

UG0V4953

S1920 _RGOS11.4(1)B19

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↓ և ↓ <http://www.ruijie.com.cn/>

↓ և ի <http://webchat.ruijie.com.cn>

↓ և ↓ ռ և <http://www.ruijie.com.cn/service.aspx>

7×24 ռ ի 4008-111-000

↓ և <http://bbs.ruijie.com.cn/portal.php>

<http://www.ruijie.com.cn/service/know.aspx>

↓ և լ և ր

[illegible]



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1

1.1

מבנה המערכת מיושם באמצעות שרת הנתונים, שרת הנתונים מיושם באמצעות שרת הנתונים, שרת הנתונים מיושם באמצעות שרת הנתונים.

מבנה המערכת מיושם באמצעות שרת הנתונים.

1.2

שם המערכת	מבנה המערכת
שרת הנתונים	שרת הנתונים מיושם באמצעות שרת הנתונים

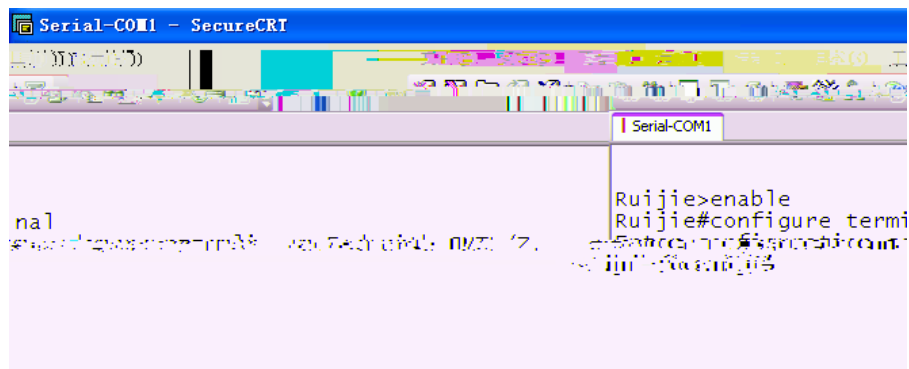
1.2.1 CLI

המערכת מיושמת באמצעות שרת הנתונים, שרת הנתונים מיושם באמצעות שרת הנתונים, שרת הנתונים מיושם באמצעות שרת הנתונים.



המערכת מיושמת באמצעות שרת הנתונים.

המערכת מיושמת באמצעות שרת הנתונים, שרת הנתונים מיושם באמצעות שרת הנתונים, שרת הנתונים מיושם באמצעות שרת הנתונים.



1.3

1 1 0

$\tau \sim \wedge \overset{\text{OBS}}{\text{u}} \text{ 7}$

✕

 $\approx \text{W} \tilde{\text{A}} \varepsilon$ $\text{W} \tilde{\text{A}} \zeta \quad \acute{\text{W}} \text{ 9}$ $\approx$ $\text{W} \tilde{\text{A}} \text{H} \text{q}$ $\approx$ $\text{W} \tilde{\text{A}} \overset{\text{OBS}}{\text{A}} \text{ 7 9} \approx$

J W Ā	卩 ρ J W Ā ĩ 7 vlan <i>vlan_id</i> u 卩 W Ā		† = W Ā end u 卩 ā 7 † † ρ J W Ā exit u 卩	7 W Ā J v "Q
-------	---	--	---	--

1.3.3

7 "A 卩 u 卩 00 7 1 Q 卩 ĩ "A Ā 卩 7 7 W 7

卩 Y W Ā 00 u 卩 ō ~ 7 ĩ N ε ? ζ , E u 卩 W Ā 7 H Y 00 u 卩 3 卩 ō 卩 7 7 W 卩



```
Ruijie(config)#interface vlan ?
```

```
<1-4094> Vlan port number
```

```

    p      j H Q u n      È º      N ε ? ζ      ' Q , Q È † Å~ A ω u n      È
    b x

```

```
Ruijie#d?
```

```
debug delete diagnostic dir disable disconnect
```

```

    p      j H Q u n      È º      b '      È º / x      ' Q      † ã H Q      È
    b x

```

```
Ruijie# show conf<Tab>
```

```
Ruijie# show configuration
```

```

    p      u n w Å ï      ' Q      help u n      n w ' √ / Å ï      Å ω      U
    b x

```

```
Ruijie(config)#help
```

Help may be requested at any point in a command by entering a question mark '?'. If nothing matches, the help list will be empty and you must backup until entering a '?' shows the available options.

Two styles of help are provided:

1. Full help is available when you are ready to enter a command argument (e.g. 'show ?') and describes each possible argument.
2. Partial help is provided when an abbreviated argument is entered and you want to know what arguments match the input (e.g. 'show pr?'.)

1.3.4

```

b ' u n 58      ý v      u n      E      u n      È A      ' È †      ' È †      z      x      A u n      È o †
    b      i Æ      j w Å u n      p interface gigabitEthernet 0/1 b ' Q v      ã x

```

```
Ruijie(config)#int g0/1
```

```
Ruijie(config-if-GigabitEthernet 0/1)#
```

J u ɲ z ʌ ɔ̃ **default** u ɲ^[06J] **default** N u ɲ^[06J] J ʔ ʰ ɰ ɰ ɰ z ʌ ʔ u ɲ^[06J] ʔ ʰ ɰ ɰ ɰ ɰ % ɰ
 ʌ ʔ ʔ **default** ^[06J] ʔ ɰ **no** ʔ ʰ a^[06J] ɰ ʔ ʰ u ɲ^[06J] ʔ ʔ ɰ ɰ ʔ ʔ ʔ **default** ɰ
no ^[06J] ʔ ʔ ʔ ʔ^[06J] ʔ **H default** ɰ ʔ ʔ ɰ ʔ ʔ ʔ ʔ J ɰ ɰ ^[06J] ʔ ʔ

no default

У	g Θ	b n w '
	ɾʰA ≡ ω z ^[OBS] E ɿ ɹ ʌ t ŋ x ^[OBS] u ɲ	A u ɲ ɹ i' ʌ i ʈ θ ^[OBS] D N i i' ^[OBS] È N Ĩ~, ↑
	ɾʰA ≡ ω u ɲ ^[OBS] ɸ ^[OBS] È ǎ ǎ ψ vʱŋ	A u ɲ wɪ W N i i' ^[OBS] È ǎ ǎ ψ vʱŋ N Ĩ~, ↑
	ɾʰA u ɲ ɿ N ε ζʰY" f i ^[OBS] D ^[OBS] H ɹ	pʰA p s u ɲ wʰ ã ω~ ɿ i N wʰ ã ^[OBS] u ɲ ^[OBS] È N Ĩ~, ↑

“H	J
ǎ i A b	p u K u b f i u b k w [00] i e Ñ D u t “H l w ~ E[00] e
ǎ i A b	p t ǎ i A b “H a t “H p u K u b t ~ [00] i u b u t “H l w ~ [00] e

ı ĭ	τΥ ð à	"
p ʌ √ ʊ ✕ %	ı ʌ ʙ ǎ	✕ % √ ı È √

	L A b ǎ	*% V L È y
		*% V u n b
		*% V u n b P
È y		*% t È y
		*% L È y
, H R W • u ǎ		p Ĩ~ k`H t + N , k b i • u Ĩ~ ĩ
		k p , k`J`H t
		p Ĩ~ k`H t V t N , k b i • u Ĩ~ ĩ
		k p , k`J`H t

E 1 *% i L q`H u n b Ź b t v u È y u n b ' y N e z n w i w t` Y
ǎ ò à N *% V È y ǎ ǎ t u n b

b J W Ā u n b access-list I ĩ R W K y E *% V K i P`H u n b Ź b t v u È y
u n b ' y N e z n w 1/2 K i L q`H b t v u È y y

```
access-list 199 permit ip host 192.168.180.220 host
$ost 192.168.180.220 host 202.101.99.12
$0.220 host 202.101.99.12 time-range tr
```

i w ò à t u n b H u n b P N y N e z n w

```
access-list 199 permit ip host 192.168.180.220 host 202.101.99.$
```



1.3.9 show

p show u n b , U ĩ Y ĥ k i w t w i u n b X

u n b	t
show any-command begin regular-expression	p show u n b , k ĩ Y ĥ k N V g k w z w a U ,



show



p show u n b , U Y ĥ k i w t w i u n b X

u n b	t
show any-command exclude regular-expression	p show u n b , k Y ĥ k w u , T U k
show any-command include regular-expression	p u n b , k Y ĥ k T U N

p show u n b , k ĩ = w 1 y N e y 1 z p 1 È y a i w "Ų ĩ = w
p ĩ = w k e È y ǎ È y z X ĩ = w k n` z n X

```
Ruijie#show running-config | include interface
interface GigabitEthernet 0/0
interface GigabitEthernet 0/1
interface GigabitEthernet 0/2
interface GigabitEthernet 0/3
interface GigabitEthernet 0/4
interface GigabitEthernet 0/5
interface GigabitEthernet 0/6
interface GigabitEthernet 0/7
interface Mgmt 0
```

1.3.10

1 "A 1 Q"Y h Y D 11 u b 11 e 1 1 u b 11 11 11

D 11 11 11 u b

b x N o **ip route** 0.0.0.0 0.0.0.0 192.1.1.1 b 1 e D b "E u b E D b o 1

D 11 11 11 u b 11 11 W a 11

b x N o **ip address** b 1 e D b "E 11 11 11 11 11 11 W "Y h 11 11 11 11

J'A | p p J'WÄ i J u 7 e d b 7 ' J d **ip route 0.0.0.0 0.0.0.0 192.168.1.1 b**

```
Ruijie#configure terminal
```

```
Ruijie(config)#alias config ir ip route 0.0.0.0 0.0.0.0 192.168.1.1
```

5 A | ● **show alias**† ~ e i e J ä I

```
Ruijie(config)#show alias
```

```
Exec mode alias:
```

h	help
p	ping
s	show
u	undebug
un	undebug

```
Global configuration mode alias:
```

ir	ip route 0.0.0.0 0.0.0.0 192.168.1.1
----	--------------------------------------

● i J B e "E u 7 **show running-config**† ~ i e J ä I

```
Ruijie(config)#ir
```

```
Ruijie(config)#show running-config
```

```
Building configuration...
```

```
!
```

```
alias config ir ip route 0.0.0.0 0.0.0.0 192.168.1.1 // J e
```

```
...
```

```
ip route 0.0.0.0 0.0.0.0 192.168.1.1 // e d ir b 00J J J '
```

```
!
```

J'A | p p J'WÄ i J u 7 e d b 7 ' J 00J d **ip route b**

```
Ruijie#configure terminal
```

```
Ruijie(config)#alias config ir ip route
```

5 A | ● **show alias**† ~ e i e J ä I

```
Ruijie(config)#show alias
```

```
Exec mode alias:
```

h	help
---	------

p	ping
s	show
u	undebug
un	undebug

Ruijie(config-if)#ip address



2

2.1

הגדרת המונחים: $\mathbb{K}$ הוא שדה, $\mathbb{A}$ הוא רשת של $\mathbb{K}$ ו- $\mathbb{B}$ הוא רשת של $\mathbb{A}$. $\mathbb{A}$ ו- $\mathbb{B}$ הם רשתות של $\mathbb{K}$.

ה

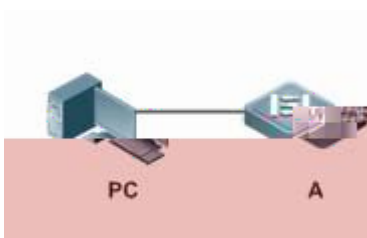
2.2

הגדרה	הערות
$\mathbb{A}$ ו- $\mathbb{B}$ הם רשתות של $\mathbb{K}$	ה"א" ו-ה"ב" הם רשתות של $\mathbb{K}$ ו- $\mathbb{A}$ ו- $\mathbb{B}$ הם רשתות של $\mathbb{K}$.

2.2.1

ה"א" ו-ה"ב" הם רשתות של $\mathbb{K}$ ו- $\mathbb{A}$ ו- $\mathbb{B}$ הם רשתות של $\mathbb{K}$. $\mathbb{A}$ ו- $\mathbb{B}$ הם רשתות של $\mathbb{K}$.

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2.3

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j "A

л'Оп н

У D ă

OBJ

AAA

ε

2.3.1

7 AE 15 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042 1043 1044 1045 1046 1047

[illegible]

Æ ƿ ʿ 𐌺

0 On ε α ש ת "A"ΩΩז זר ׃ Ω ת "A" = ל ת "A"1 ת 1 ת I İ v
ד"ר יע

ת username ןב ד ת ש = α ם N ן ן ת "A" ל ן ז I ם ן

ת login local ןב ן 'H י ם e 'H ש ת "A
ז ן % ן י ן

AAA

ע Ä ן ת ת default A |
ת login authentication ןב ן י י ד ם A |
ד ן ת ש A | 'H ד

ד ן 'H ן
ת exec-timeout ןב ד י 'H'H ע I י P י ן "Yñ" 'H ≡ ō 'H Ñ Ä% י
ן à ä י~ י ן e 'H ז"ע % ד Ω

λ ≡ ω ½ ħ ~

τ **banner motd** J ½ ħ ~ U

½ ħ ~ M" A ω i J 7 t [06J] τ " A E τ " A ~ e J 7 t " H ~ π U N × Ĩ ~ p 7 7 i τ ½ ħ ~ I
Q 7 t 7 t [06J] π U ε ½ b 7 7 7 o N 7 7 ζ 7 t " A

λ ≡ ω ~ e %

τ **banner login** u 7 J ~ e % τ ω W [06J] ~ e ω ~ U

τ **speed** u 7 J 7 7 t [06J] '

λ [06J] ' Ĩ

2.3.4

τ ~ 7 7 J U ǰ ú τ ~ 7 7 * p [06J] J U Q 3 τ ~ è p ε τ, ó è π è 7 ζ i t [06J]
J 7

7 7 * p [06J] J U o Ĩ 7 7 i " A ω [06J] 7 W e E [06J] J [06J] Ō = τ ω ħ " H ó [06J] s e p Ĩ ~ [06J] H
ö × b " A ω [06J] 7 θ ǻ J X J ħ [06J] 7 ħ 7 t a Ĩ ~ 7 t " A * t 7 t ħ ħ " H ó [06J] s e E ω [06J] 7
é ' Ĩ ω % J U b ' 7 ' τ j Ĩ ~ τ J ~ p 7 7 k u 7 7 7 k [06J] 7 7 j 7 ħ ↑
ō ù Ĩ " A ó [06J] 7 7 J ō ħ [06J] I à b p • " H 7 ó [06J] U 7 • 7 [06J] J 7 " H a W ó
ō ō

è p ε τ, ó è π è 7 ζ i t [06J] J o 7 t k u " H " E [06J] J p 7 7 7 A k u a N
M ǻ 7 t A [06J] J τ ~ ↔ J [06J] 7 ō Ĩ n t i [06J] ǻ U X Ĩ ~

"E **show running-config interface interface** u 7 Ĩ ~ 7 7 * p [06J] J U ǻ • i 7 t Ĩ [06J] J U

"E **show startup-config** u 7 Ĩ ~ t [06J] k u J U

2.3.5 Telnet

$$R \sim [\text{OBJ}] Z \dot{\tau} P \quad \check{E} N_s \quad \downarrow N \omega \quad Y^{\sim} e = O M Y \quad I \acute{I} [\text{OBJ}]_{\text{vh}}$$

[illegible]

at



↗ reload ↖ ⌂ ↵ ⌂ ↵

τ u n i $@Y\ddot{h}$ t p $"Y\ddot{h}$ OBJ H k U A γn

p ʌ l ɿ t ɔ̃ h ö ʌ [Q6] ɹ u bɹ̥ ɰ x M • i ʔ [Q6] ɿ t ħ [Q6] h ě k ˇ
 ǎ ɸ ɕ b ˈ n̩ i ʔ [Q6] ɹ u bɹ̥ Y ɹ l ɔ̃ p ŋ ɽ t ǎ p ɹ h ˈE ŋ ɽ t ǎ
 ø ˈ w N̥ [Q6] ɹ ɹ ħ ⅜



ᠰᠤ ᠨᠢ ᠭᠡ ᠶ᠋ᠣᠵᠤ ᠬᠡ ᠲᠦ ᠪᠦᠴᠦᠳᠦ

7 u n l @ n H ä • l i ^ j u n OB J V 7 "A"H

[illegible]

$\text{b} \cdot \dot{\text{y}} \sim \wedge \text{á} \text{ 1}$ $\text{í} \bullet \text{í} \text{ u } \text{b}$ $\text{í} \text{ Q } \dot{\text{N}} \text{ u } \text{b}$ J $\text{H} \text{í} \text{ "A 1}$ $\psi \check{\alpha} \text{b} \cdot \dot{\text{y}} \text{ u } \text{b}$ $\text{í} \text{ u } \text{b}$ $\text{b} \text{ n}$
 $\text{í} \text{ Q } \dot{\text{N}} \text{ u } \text{b}$ J $\text{í} \text{ "A 1}$

/

$\text{J} \text{ J} \sim \text{e} \text{ J} \text{ N}$ $\text{í} \text{ "A}$ $\text{í} \text{ Q}$ $\dot{\omega} \psi \text{E}$ $\text{í} \text{ "A 1}$ Q $\text{j} \text{ a 1}$ $\text{u } \text{b}$
 $\text{í} \text{ enable}$ disable $\text{u } \text{b}$ $\text{H} \text{í} \text{ "A 1}$

line

í J M $\text{í} \sim \text{e} \text{ e } \text{b}$ ζ $\text{Æ} \text{b}$ J line $\text{Æ} \text{b}$ í
 $\text{Z} \times$ í **password 0 7 line** $\text{u } \text{b}$ J line 1 $\text{Æ} \text{b}$ í a "E **login** $\text{u } \text{b}$ $\text{k} \text{ u } \text{Æ} \text{b}$ í



line

$\text{í} \text{ Q}$ í **show privilege** $\text{u } \text{b}$ $\sim \text{E}$ $\text{í} \text{ "A 1}$
 $\text{í} \text{ Q}$ í **show running-config** $\text{u } \text{b}$ $\sim$ J

password

$\text{u } \text{b}$ $\check{\text{A}}$ **enable password level level password 0 7 encrypted-password**
 v "Q " $\text{level} \chi \text{ í} \text{ "A}$
 $\text{password} \chi \text{ í} \text{ "A}$ $\neq$ J P $\text{Æ} \text{b}$
 $0 \chi \sim$ $\text{Æ} \text{b}$ $\text{È} \text{ í}$ $\text{Æ} \text{"}$ $\check{\alpha} \text{È} \text{ í}$
 $7 \chi \sim$ $\text{Æ} \text{b}$ $\text{È} \text{ í}$ $\text{Æ} \text{[}$ $\check{\alpha} \text{È} \text{ í}$
 $\text{encrypted-password} \chi \text{Æ} \text{b}$ $\check{\alpha}$ q g $\text{z} \text{ n}$ $\text{È} \text{ \%} = \text{"QÈÈ} \text{ í}$



$\text{u } \text{b}$ ~~W~~ $\check{\text{A}}$ í

v"Q " -
JwÄ line JwÄ

p ä ä 1~ 3 4 ẽ'H 'H Z"E % J

I J

E i T J ä 1^[00] p"Yh'H ≡ ω U Ñ ÄE i 1 J 1^[00] X Õ^u J 1^[00]
 M † ð

p ä ä 1~ 3 4 ẽ'H 'H Z"E % J

I J p T ä 1 a 'H" Ä t'H p t i"E h i í
 † h i í p J w Ä i k † H J 1^[00] i í X p' Z J 1^[00] w Ä i † lock
 u b H J 1

† **show running-config** u b I Q† ~ J

p 'H J s † "A Q^a X p 1 i J † s † "A`    e`HÑó~ † "A^v ⊃ Æ b
 a é u b 7

p ẽ Ä'H J s † "A^a X p ẽ A | "Yh' † s 'A | † "A`    e`HÑó~ † "A^v ⊃ Æ
 b a é u b 7

T J`    e            u    b    7            ẽ † "A    I Q    † **show user** u    b    I    ~    E    ` e ẽ † "A U

p s t i Ä k a † "A I Q † j "A 1 i s t

† "A p H^[00] 7 i † a ó~ Æ b E ð Æ b b "A J^[00] 1 é J 1

† **show sessions** u b I Q† ~ T J ä 1^[00] h ẽ 1/8 h U

u b I Ä **username** *name*


```

/source:"Y ħ      ĭ "A 1  ĭ [06J] ◇   ǎ ǎ ◇ ĭ Ǽ
ip A.B.C.D X"Y ħ      ĭ "A 1  ĭ [06J] ◇   S X
interface interface-name X"Y ħ      ĭ "A 1  ĭ [06J] ◇ ĭ Ǽ
u ƚ W Ā
 ĭ "Y Ė

```

Telnet Client

```

u ƚ Ā
v"Q " -
u ƚ W Ā
 ĭ "Y Ė      u ƚ ĭ Ō ʘ ĭ ĭ ĩ ǎ 1 [06J]      ĭ Ǽ ĭ telnet u ƚ ʌ      ĭ Ĥ
 ĭ Ǫ ĭ ʃ Ǽ      ĭ ʀ Ĥ ,      ĭ ƚ ' Ō ʘ ĭ ĭ Ǫ ĭ <1-99> u ƚ Ō ʘ a Ĥ
 ƚ ' ĭ ĩ ǎ 1 ĭ Ǫ ĭ show sessions u ƚ ĭ ~ ĩ ǎ 1 [06J] ĭ Ǫ

```

Telnet Client

```

u ƚ Ā      disconnect session-id
v"Q "      session-id X"Y [06J]      ĭ N
u ƚ W Ā      " ĭ "A W Ā
 ĭ "Y Ė      "Y ħ [06J]      ĭ N ǎ ǎ "Y ħ [06J]      ĭ

```

Telnet Server

```

u ƚ Ā      enable service telnet-server
v"Q "      -
 ĭ W Ā      ʀ W Ā
 ĭ "Y Ė      Ǽ ǎ      Ō n

```

```

u ƚ Ā      exec-timeout minutes seconds
v"Q "      minutes X"Y ħ [06J] Ĥ Ĥ [06J] "Q
      seconds X"Y ħ [06J] Ĥ Ĥ [06J] 1"Q
u ƚ W Ā      ĭ W Ā
 ĭ "Y Ė      ĭ ĭ ĭ ĩ ʀ ĭ [06J] Ĥ Ĥ Ǽ ĭ Ĥ ≡ Ǫ      Ĥ Ĥ ǎ % ĭ
 ʀ      ĭ W Ā ĭ ĭ no exec-timeout u ƚ n ʃ      ĭ ĭ [06J] Ĥ ĭ

```

```

u ƚ Ā      session-timeout minutes output
v"Q "      minutes X"Y ħ [06J] Ĥ Ĥ [06J] "Q
      output X ĭ Ǽ Ĥ , "Q Ǫ ʃ      ĭ ǎ ĭ Ǽ Ĥ
u ƚ W Ā      ĭ W Ā
 ĭ "Y Ė      ĭ ĭ ĭ 1 ĭ [06J] Ĥ Ĥ ʀ "Y ħ Ĥ      ≡ Ǫ      Ĥ Ĥ ǎ %

```

在配置文件中配置 `no session-timeout` 命令，防止用户因长时间未操作而被强制退出。

line

```

line 1
password cipher 12345678
lockable
line 2
password cipher 12345678
lockable
line 3
password cipher 12345678
lockable

```

line

```

line 1
password cipher 12345678
lock
line 2
password cipher 12345678
lock
line 3
password cipher 12345678
lock

```

Telnet

- 在配置文件中配置 `telnet` 命令，防止用户因长时间未操作而被强制退出。
- 在配置文件中配置 `telnet` 命令，防止用户因长时间未操作而被强制退出。

```

Ruijie# telnet 192.168.65.119
Trying 192.168.65.119 ... Open
User Access Verification
Password:
Ruijie(config)# do telnet 2AAA:BBBB::CCCC
Trying 2AAA:BBBB::CCCC ... Open
User Access Verification
Password:
Ruijie# telnet 2AAA:BBBB::CCCC
Trying 2AAA:BBBB::CCCC ... Open
User Access Verification
Password:

```

- 在配置文件中配置 `telnet` 命令，防止用户因长时间未操作而被强制退出。

5 A | ● p ≈ ~~W~~Ä i i **show clock** u 7b i ~ v l`H U

```
Ruijie# show clock          //  ÷ v l`H  i  7
clock: 2003-6-20 10:10:54
```

J A | ● i 7 7 v 1/8 7 ~ 777ä U 77

```
Ruijie(config)# banner motd #// Ä D´ 7 v
Enter TEXT message. End with the character '#'.
Notice: system will shutdown on July 6th.# // J ´ 7 v
Ruijie(config)#
```

5 A | ● i **show running-config** u 7b i ~ J

● i i´ J ä i 7 t u 7b 7 HN i´ 1/8 7 ~ U

```
C:\>telnet 192.168.65.236
Notice: system will shutdown on July 6th.
Access for authorized users only. Please enter your password.
User Access Verification
Password:
```

J A | ● i 7 7 v 7 e% 777ä 77

```
Ruijie(config)# banner login #// Ä D´ 7 v
Enter TEXT message. End with the character '#'.
Access for authorized users only. Please enter your password.
#                               // J ´ 7 v
Ruijie(config)#
```

5 A | ● i **show running-config** u 7b i ~

i v 7 x

5 A |

● r show u B | ~

```

Ruijie# show line console 0      / 7 ~ i ' j j
CON      Type      speed      Overruns
* 0      CON      57600      0
Line 0, Location: "", Type: "vt100"
Length: 25 lines, Width: 80 columns
Special Chars: Escape Disconnect Activation
               ^^x      none      ^M
Timeouts:      Idle EXEC      Idle Session
               never      never
History is enabled, history size is 10.
Total input: 22 bytes
Total output: 115 bytes
Data overflow: 0 bytes
stop rx interrupt: 0 times
Modem: READY

```

ñ

2.4.4

p v l Y i Q u õ s 7 Q v l "A ó 000 On é Å 7 "Yñ 000 On ε
ζ

SNMP Server / SSH Server / Telnet Server

i j p r On H E % j


```

# show running-config
# show services

```

SSH-Server/telnet-server/snmp-agent

```

# enable service ssh-server telnet-server snmp-agent
# ssh-server
# telnet-server
# snmp-agent

```

SSH Server

```

# Ruijie# configure terminal
# Ruijie(config)#enable service ssh-server

```

```

# show running-config
# show ip ssh

```

2.4.5

第 2 章

~ 7 o k t 7 "A 7 Q p = ~~W~~Ä 7 ' i reload u 7 b7 k 7 7 7

reload at hh:mm:ss month day year

"Y h 7 7 p N7 • `H 7 k 7 H 7 o 7 7 N7 • `H 7 v "Q 7 7 7 7 b ' 7 "A ≡ ω
7 7 7 7 H 7 w φ 7 7



at



-

u 7 b7 Ä

ן

execute

ן

	т ~ è p ε ʔ, ó è n è н ζ i t 08J У
	т ~ ʋ / 08J ʋ
	Ї ~ Т ʋ á ʋ ʋ 08J 1/8 ʋ ʋ

3.2.2 VTY



$\vdash$ $\text{אם } \neg A \rightarrow B \text{ אז } A \vee B$
 $\vdash$ $A \vee \neg A$

א נ ת ת 1 = א ת [06] א נ ת א נ י ר "A p א נ ת ת i j "A א ε b ζ ר ã
י א נ ת i X u פ ה מ א נ ת א = א ת

3.3

CTY

1 1 3 "Y[0] i' J Y AE E Z z ^ "Q L N t T W i' J Y AE r A l Q r i' J A Y
Y AE S M l

VTY

$$1 \quad 1 \quad 3 \quad \tilde{t} \quad 'O \quad \mathcal{M} \quad \mathcal{V} \quad 1 \quad X \equiv \tilde{\omega} \mathcal{L} \quad \acute{M} \mathcal{Z}_{\text{OBJ}} \quad 'O \quad \mathcal{M} \quad \mathcal{V} \quad 1 \quad \tau \quad \tilde{\alpha} \quad i$$

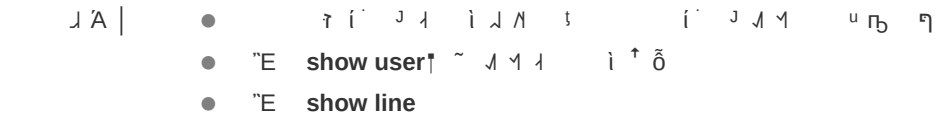
$I \cap J \neq \emptyset$	τ
$g \quad I \cap J$	$\mathcal{M} \cap \mathcal{N} \quad \mathcal{I} \sim \quad \mathcal{M} \cap \mathcal{N} \quad \mathcal{I} \cup \mathcal{N}$

3.3.1

ñ

р р УА İ ı line u n l @ "Y h 00 l v УА

↓ 1 2 3 4



```

Ruijie#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)#line vty 35
Ruijie(config-line)#
*Oct 31 18:56:43: %SYS-5-CONFIG_I: Configured from console by console

```

- 5 A |
- **show line** 显示当前设备上的所有线路配置信息
 - **show running-config** 显示当前设备的运行配置

A

```

Ruijie#show line vty ?
  <0-35>  Line number

Ruijie#show running-config

Building configuration...
Current configuration : 761 bytes

version 11.0(1C2B1)(10/16/13 04:23:54 CST -ngcf78)
ip tcp not-send-rst
vlan 1
!
interface GigabitEthernet 0/0
!
interface GigabitEthernet 0/1
  ip address 192.168.23.164 255.255.255.0
!
interface GigabitEthernet 0/2
!
interface GigabitEthernet 0/3
!
interface GigabitEthernet 0/4
!
interface GigabitEthernet 0/5
!
interface GigabitEthernet 0/6
!
interface GigabitEthernet 0/7
!
interface Mgmt 0
!
line con 0

```

```
line vty 0 35
 login
 !
end
```

`absolute-timeout`

p[~] e X ✱ 71 4 1 'H ' 0 : 7Ω p 4 i 7 **activation-character** u 7b 4

Mã ã º AE [08] J M i r A I Q p i i r % J J u P S U " E [08]" H

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```

1  Q p      1  i      7  exec-character-bits  u  15  xu5pt0x3G0x242(ecL)H0Xf0xi(5p0s*3G0Uf0zuUf0i

```

Terminal will be login out after 20 second

7 "YM b ' E 1 1 5 0 "O autoselect 1 1 M Z [OBJ] ☀ 7 1 1 [OBJ] 🎵 È 1 0 n 1 1 1 é ð ð

autocommand W Z r i r A Q J V A A ã l E Ъ + H á V i o W **autocommand**

"Y h [0B] u Ъ Y e "Y h ž i á ä **autocommand** u Ъ ê "Y h [0B] g Z r [0B] J V O n i í

ṭ "YĠM ḏ H [08J] ā l i t b ā l Æ Æ v v p ll ~~W~~ Ā ī f i V > [06J] "Q̣ΩH b ' > f i
 ö "Yġ "Q̣ΩH 𐤇 b ' ≡ ō f i > ö "Yġ "Q̣ΩH 𐤇 "Q̣ΩH 𐤇 ă ä [06J] ù E ō p ă [06J] t i
 é ō Z ṭ X J W j ṭ

(EXEC)

$$u \quad \Pi_{\mathbb{D}}^{\tau} \quad \tilde{A}$$

flowcontrol ¶ Ħ ℓ í Ě ž ſ M ℓ í ∕ ∕ ¿ ☒ ∕ Đ Ъ k Ѯ È † Š
ĥ = Ħ ∕ ∕ Ó ° П stop-character

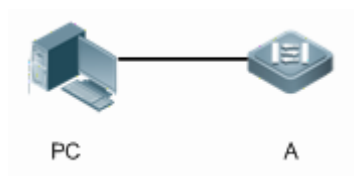
start-character ¶ Ј Ě

u	$\bar{u}$	$\bar{\bar{u}}$	parity	even		none		odd
v	$\bar{v}$	$\bar{\bar{v}}$	even	>				
			none	$\bar{v}$	>		odd	$\bar{v}$ >

u r̄ W Ā J W Ā
r̄ Y M r̄ • t b ā l Æ i · J Æ v [OBJ] H ö W θ J τ [OBJ] > y

v o s

g,



1 A |

- `↑` `í` `j` `i` `l` `n` `t` `í` `j` `i` `u` `p` `q`
- `ó` `j` `w` `a` `j` `i` `[06]` `L` `'` `"` `Q` `Ω` `y` `>` `y` `ß` `y`
- "E **show line console** `↑` `~` `í` `j` `i` `↑` `õ`

A

```
version 11.0(1C2B1)(10/16/13 04:23:54 CST -ngcf78)
ip tcp not-send-rst
vlan 1
!
interface GigabitEthernet 0/0
!
interface GigabitEthernet 0/1
  ip address 192.168.23.164 255.255.255.0
!
interface GigabitEthernet 0/2
!
interface GigabitEthernet 0/3
!
interface GigabitEthernet 0/4
!
interface GigabitEthernet 0/5
!
interface GigabitEthernet 0/6
!
interface GigabitEthernet 0/7
!
interface Mgmt 0
!
line con 0
  parity even
  stopbits 1
  speed 115200
line vty 0 35
  login
!
end
```

ñ

3.4.3

l Q p E J Y i r **terminal terminal-type** u n J

r **show line** u n r ~ i [00] J U

u n r Å **terminal databits** *bit*
 v "Q " *bit* $\chi \frac{1}{8}$ È y [00] "Q " H n u b h h
 u n r Å ≈ r "A Å
 r "Y M

(EXEC)

u n r Å **terminal exec-character-bits** 7 | 8
 v "Q " 7 "O y È y T h u n J n [00] È y T
 8 "O y È y T h u n J n [00] È y T
 u n r Å ≈ r "A Å
 r "Y M b ' p u n J È ã ã ĭ ~ J È g, è ã ã τ Ě f È y o . J **terminal**
exec-character-bits 8

u n r Å **terminal flowcontrol** hardware | none | software
 v "Q " **hardware** ll í Å h ll í
none ll í Å h ĩ ll í
software ll í Å h ll í
 u n r Å ≈ r "A Å
 r "Y M

u n r Å **terminal parity** even | none | odd
 v "Q " **even** >
none ĩ >
odd ~ >
 u n r Å J Å
 r "Y M r • t b ã l Æ í J Æ y [00] H ö W ð J τ [00] > y

u n r Å **terminal start-character** *ascii-value*

v "Q " *ascii-value* x à l l [0B] L [0B] k u È v M Z [0B] n v b k
 u P W A = i "A W A
 i "Y M

u P A A **terminal stop-character** *ascii-value*
 v "Q " *ascii-value* x à l l [0B] L [0B] A B È v M Z [0B] n v b k
 u P W A = i "A W A
 i "Y M

u P A A **terminal stopbits** 1 | 2
 v "Q " 1 B H
 2 B H
 u P W A = i "A W A
 i "Y M

u P A A **terminal terminal-type** *terminal-type-string*
 v "Q " *terminal-type-string* x A 1 1 3 ó È v b v v
 u P W A = i "A W A
 i "Y M

1 A v L
 g



- i i j l i A t i j A u P q
- = i "A W A j E A 1 [0B] A 1 1 3 = L = '

A Ruijie#terminal terminal-type ansi
 Ruijie#terminal speed 115200

5 A | • "E **show line console** i ~ i j l i ð
 A Ruijie#show line console 0

CON	Type	speed	Overruns

```
* 0      CON      115200  0
Line 0, Location: "", Type: "ansi"
Length: 24 lines, Width: 79 columns
Special Chars: Escape Disconnect Activation
              ^^x      none
Timeouts:      Idle EXEC      Idle Session
              00:10:00      never
History is enabled, history size is 10.
Total input: 858 bytes
Total output: 57371 bytes
Data overflow: 0 bytes
stop rx interrupt: 0 times
```

4 TIME RANGE

4.1

ĩ ħ í ' On Ē ó ʎ • Z ħ ħ í b b ' ý p Ĩ Q • ħ ʎ Ĩ
 ' Q J X = , Ĩ

4.2

ʎ M ħ ħ Ĩ "Y ' Q ħ J D ħ Q z J ħ ħ ħ ħ E ʒ ʎ M ħ ħ ħ b w ó Ĩ X
 w ó Ĩ X Z ħ Ĩ ª ' Q p ħ ħ • Ĩ Ĩ ħ

~ Q ħ Ĩ "Y ' Q ħ J ~ Q ó ħ E ʒ ~ Q ħ b o ½ ~ X ½ ~ X b
 Z ħ Ĩ ª ' Q ~ Q ó s p ½ ~ ½ ~ • Ĩ Ĩ ħ

Ĩ Ĩ ª Ó	ħ
ħ ʎ M ħ ħ ħ	J ʎ M ħ ħ ħ Z ħ p ʎ M ħ ħ ħ • Ĩ Ĩ Ĩ
ħ ~ Q ħ	J ~ Q ħ Z ħ p • ~ Q ó ħ • Ĩ Ĩ Ĩ

4.2.1

g Ĩ Z ħ p Ĩ k • Ĩ Ĩ Ĩ Ĩ E Ĩ Ĩ Ĩ ʎ M ħ ħ ħ b ' p ħ ' Q Ĩ p E
 ħ Ĩ Ĩ Ĩ p E ħ j Ĩ

4.2.2

g Ț Ț p Ā k • ı İ`H      Ā E Ț`H ı̇ ε J ~ Q`H      b ' p Ț    ı Q    ı İ p E `H
ı Ț ă ă p E `H j ı Ț

4.3

J	J ā ı u Ț
	
	time-range <i>time-range-name</i> Â
	
	absolute star <i>time date</i> end <i>time date</i> ı̇ Â
	periodic <i>day-of-the-week</i> <i>time</i> to Â <i>day-of-the-week</i> <i>time</i>

4.3.1 time range

J J Ț Ț M`H    Ț    ā ~ Q`H Q Ț Ț p M Ț`H Ț • ı İ ı Ț

İ

time range

Q J p Ț Ț Ț ı J

u Ț Ā **time-range** *time-range-name*

v`Q    "    *time-range-name* χ    ā Ț      Ț`E

J J ≡ Ț J

u Ț W Ā p W Ā

Ț`YM    Ț Ț ε    b    Ț ı İ g `H Ț b p ı Q Ț`H •    `H Ț ı Ț Ț Ț

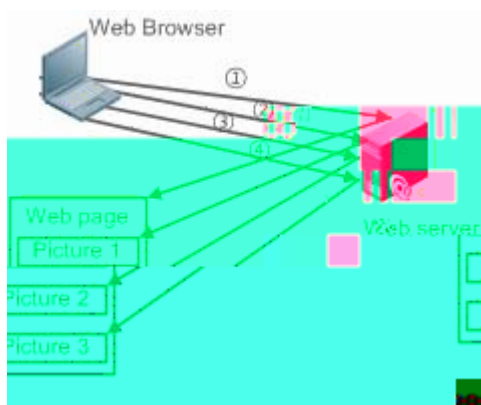
Ț Q Ț J ā H Ț ı Q p W Ā J' Ț`H ı

ı J

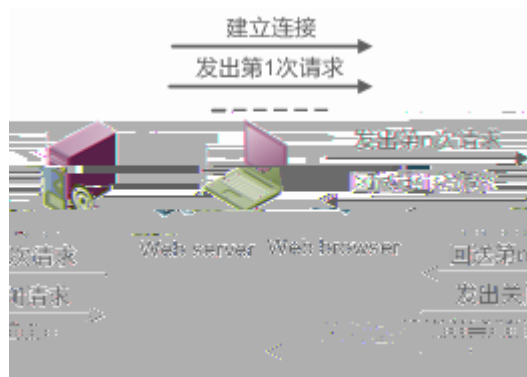
$$t \vdash \text{"A p"} \vdash_H \chi \vdash_{\text{OBJ}} \S x \vdash t$$

HTTP

g₂



g₇


$$\dot{\alpha} + \tau H' Y = \tau \gamma + v$$

HTTP

Ş 1'H t 18 'On H r'A f H t N 1[08]ă i t h x t i ă [08]
1

I Ĩ ≠ Ó	ĩ
<u>On</u>	ĩ "A ъ † л љ ʀ т
<u>s 1'On</u>	N ʀ ^[OB] ǎ i † h x † i ǎ [OB] ʀ

5.3.1 HTTP

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[06] ᠭᠢᠨ ᠤ ᠵᠡ᠋ᠶ᠋ᠠᠳᠤ ᠣᠨ ᠬᠡ ᠠᠨ ᠣᠨ ᠰᠢᠵᠡᠱᠡᠸᠦᠷ ᠣᠨ ᠬᠡᠸᠡᠸᠡ ᠵᠡᠶ᠋ᠠᠳᠤ ᠰᠢᠩ ᠭᠢᠨ ᠵᠡᠶ᠋ᠠᠳᠤ

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i. d.

$$J \cup \Gamma \vdash A \quad A \vdash J \text{OBJ} \vdash A \text{ v} = \bar{\Gamma} \quad \varepsilon \quad \dot{\Gamma} \quad \sim$$

;

[illegible]
$$\mathfrak{t} \quad \mathfrak{H} \quad \text{'On H} \quad \mathfrak{r} \text{'A} \quad \mathfrak{F} \quad \mathfrak{H} \sim \quad \mathfrak{t} \quad \dot{\mathfrak{N}} \quad 1 \boxed{\text{OBJ}} \check{\alpha} \quad \varepsilon \quad \mathfrak{U} \text{'I} \quad \zeta \text{'i} \quad \mathfrak{t} \quad \check{\alpha} \quad \check{\alpha}' \quad \mathfrak{i}$$

5.4

J	J á " u n
<u>J `O n</u>	
	enable service web-server í `O n
	webmaster level J U
	http port J `O n 1Æ
<u>J s 1</u>	
	upgrade web 1 t è ð
	upgrade web download s u k`O n H i i Xs u 1

5.4.1 HTTP

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HTTP

o J

Y ñ = e ð Z p 1/8 J à t i í `O n e `O n j l

HTTP

ù i T J J r'A e M Z L i

Y ñ = e ð r'A l Q r [r'A e ~ i f H f ~ A U p b ' ' r
 "A è p G Ú t k ñ | á ^ ð l Q n t J U v

HTTP

b ' ð ð p `O n 1Æ o J `O n 1Æ

Y ñ = e ð l Q r [`O n 1Æ

r'A p f H i X t X `O n 1Æ f H i e

HTTP

```

u rBj Å enable service web-server http all
v "Q " http all x ě Å Z[0B]On http ĩ ě Å On
u rB WÅ p WÅ
r "YM b ' "E u rB H a j È å å all ~ a `H ě Å On ψ b ' http È ~
E ě Å On
r no enable service web-server å å default enable service web-server r ' Z[0B] On

```

HTTP

```

    u nB f Å
v "Q "
webmaster level privilege-level username name password password 0 | 7 encrypted-password
privilege-level χ τ "A √ ħ
name χ τ "A v
password χ τ "A Æ nB
0 | 7 χ Æ nB [6] τ [̄ 1 z ĩ τ [̄ √ D τ [̄ j ℥
encrypted-password χ Æ nB ā
u nB W Å
p τ [6] H ö ~ é í τ u nB j ~ [6] τ "A
v = [̄
"E no webmaster level privilege-level "Y ħ √ 1 [6] "A ō τ "A v lb [̄
"E no webmaster level privilege-level username name "Y ħ τ "A v = [̄

```



HTTP

$\cup \Gamma_{\mathcal{I}}^{\mathcal{A}}$ **http** port *port-number*
 $\vee \mathcal{Q}$ *port-number* χ $\downarrow$ $\mathcal{O} \cap \mathcal{I} \in \Pi$ $\mathcal{I} \in \mathcal{I}$
 $\cup \Gamma_{\mathcal{I}}^{\mathcal{A}}$ $\rho \mathcal{A}$
 $\mathcal{I} \mathcal{Y} \mathcal{M}$ $\mathcal{I} \cup \Gamma_{\mathcal{I}}^{\mathcal{A}}$ $\mathcal{O} \cap \mathcal{I} \in \mathcal{I}$

Web

Web

7 J [OBJ] U e

g₇

```
A A#configure terminal
A(config)# enable service web-server
A(config)# http port 8080
```

```
5 A |  ~  U
A A# show web-server status
http server status: enabled
http server port: 8080
```

$\mathfrak{p} \mid \mathfrak{p}'$ $\mathcal{O}_n \cap \mathcal{A} = j \cdot \tilde{I}$ $\boxed{\text{OBJ}}$ $\mathfrak{L}$ $\mathfrak{r} \mathcal{A} \mathfrak{p} \mid \mathfrak{F}$ $\mathfrak{H}$ $\mathfrak{q}$ $\mathcal{J} \boxed{\text{OBJ}} \mathfrak{r}$ $\mathcal{O}_n \cap \mathcal{A} = \varepsilon$ $\mathfrak{r} \mathfrak{h} \mid$ $\mathfrak{t}$

5.4.2 HTTP

$$\tau \text{ "A" } \vdash \quad \vdash \quad \text{H} \quad \tilde{\alpha} \quad \bar{\alpha} \quad \text{u} \quad \text{p}_b \quad 1$$
[illegible]

1. 配置 Web 服务器

TFTP

Web

1. 配置 Web 服务器

2. 配置 TFTP 服务器

3. 配置 Web 服务器

4. 配置 TFTP 服务器

5. 配置 Web 服务器

Web

1. 配置 Web 服务器

2. 配置 TFTP 服务器

3. 配置 Web 服务器

4. 配置 TFTP 服务器

5. 配置 Web 服务器

Web

Web

1. 配置 Web 服务器



- 1. 配置 Web 服务器
- 2. 配置 TFTP 服务器
- 3. 配置 Web 服务器
- 4. 配置 TFTP 服务器
- 5. 配置 Web 服务器

A

```

A#configure terminal
A(config)# vlan 1
A(config-vlan)# exit
A(config)# interface vlan 1
A(config-VLAN 1)# ip address 10.10.10.131 255.255.255.0
A(config-VLAN 1)# exit
A(config)# enable service web-server
    
```

1. 配置 Web 服务器

1. 配置 Web 服务器

УЧЕ
г



- ЛБ С ' [08] СХ Ы П / т J a J [08] СХ
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A

```

A#configure terminal
A(config)# vlan 1
A(config-vlan)# exit
A(config)# interface vlan 1
A(config-VLAN 1)# ip address 10.10.10.131 255.255.255.0
A(config-VLAN 1)# end
A#upgrade web download tftp:// 10.10.10.13/web.upd
Press Ctrl+C to quit
!!!!!!!
download 3896704 bytes
Begin to upgrade the web package...
Web package upgrade successfully.
    
```

5 A | р A ~ Ы Э Ы ~ Ѡ A [08]

upgrade web WEB

УЧЕ
г



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- Э Æ Он н

A

```

A#configure terminal
A(config)# vlan 1
A(config-vlan)# exit
A(config)# interface vlan 1
A(config-VLAN 1)# ip address 10.10.10.131 255.255.255.0
A(config-VLAN 1)# end
A#copy tftp://10.10.10.13/web.upd flash:/web.upd
Press Ctrl+C to quit
!!!!!!!
Accessing tftp:// 10.10.10.13/web.upd finished, 3896704 bytes prepared
Flushing data to flash:/web.upd...
    
```



```
Flush data done
A #upgrade web flash:/web.upd
Web package upgrade successfully.
A #
```

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5.5

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ĩ ~ On J U = ↑ ð	show web-server status

6

6.1

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6.2.2

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6.3

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	η`H	Π Ε Μ Ζ <sup>[00]</sup> η`H`Q
	‘	Π Ε Μ Ζ ^[00] `Q
	γ	Π Ε Μ Ζ γ`Q
	← γ	Π Ε Μ Ζ ^[00] ← γ`Q ε υ ζ
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È J e ι ᾱ ħ Ő^[00] ι ρ γ ħ Ő`O n H % ħ Ő κ υ ž Λ ι

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 Ő γ `A γ È J 1<sup>[00]</sup> ħ Ő γ ω ι ħ ≡ ω `A γ È J

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ε J _ v`Q n ζ

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 γ ≡ ω v`Q γ ρ ι È ι γ γ ι γ 1/8 v`Q γ^[00] Æ ħ χ

[SD_ID@enterpriseID PARAM-NAME=PARAM-VALUE]

R v`Q È J<sup>[00]</sup> " b ħ `A~ χ

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æ b		æ b ‘ Λ ħ ᾱ ι ^[00] æ b N d ħ ħ ι ω J 1 ι χ http://www.iana.org/assignments/enterprise-numbers
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J L ħ Ő U J	τ J L L ħ Ő Æ R A b v"Q U
J L ħ Ő U I ħ J	τ J L L ħ Ő U I ħ v"Q U
J L ħ Ő i I ħ J	τ J L L ħ Ő i I ħ v"Q U
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6.3.1

τ J L L ħ Ő I ħ Ő Ä Æ ž ú X ħ Ő Ä ħ Ő U L I ħ Ä

J ħ ħ ħ Ő Ä ħ Ä

τ **logging on** u p p p J W Ä ħ Ä ħ Ő Ä Ä ħ Ő Ä a J L F I ħ Ő U Ä ħ R , A b , X
τ ħ J L Ő ħ

J ħ ħ ħ Ő U L I ħ ħ

τ **logging count** u p p p J W Ä ħ ħ Ő U L I ħ Ä ħ Ő U L I ħ a J L N e R W e f I ħ Ő
U K"Q Q z ω a f I % ħ Ő U H v

6.3.2

τ J L L ħ Ő Ő ħ Ä ž ú X ħ Ő Ä ħ Ő H A ħ Ä ħ Ő J L e y ħ Ő ž N y

RFC5424

J ħ ħ ħ ħ Ő Ä ħ

' "Ω ä ħ Ő Ä a ħ ħ Ő Ä Ő u p **service sequence-numbers** äservice sysname äservice timestamps ä
service private-syslog ä **service standard-syslog** N , Ő X é

p A ħ ħ Ő Ä "Ω a **show logging** = **show logging config** u p Ő ħ ħ k Ő A ψ

Ĵ ù ĩ √ √ ŋ Ō ɹ 000 Ā 𐌹 ĩ Ā Ĥ Aĭ Ā ≡ ō Ȧ V w ɹ ← ʎ Ȯ

↳ logging synchronous

```

└─ logging rate-limit number all number console number all number except severity u n p p J W Å i
└─ h Ō U ' ' I Ĩ ' ⅛ \ , OBJ ħ Ō U

```

7 u 5 logging console level u 5 p p W Å i J p í j i Ĩ [08] ĩ Ő Ū 1

terminal monitor

logging monitor level

```
 logging buffered buffer-size level u p r W A i J h O [06] è ¸ t [06] v "Q ε ù ¸ t z n ħ
```

```

↑ logging server ip-address      udp-port port  u  5  9  0  1  W  Å  i  1  9  Ö  Λ  È  "  Y  h  0  8  1  9  Ö  0  n  H

```

ṭ u ɲ logging trap level u ɲ p p ́ J W Ǻ i J ʌ È ń Ồ Ồ n H Ồ ń Ồ Ụ 1

logging filter direction all buffer | file server | terminal

logging filter type contains-only filter-only

logging filter rule exact-match module module-name mnemonic mnemonic-name level level

logging filter rule single-match level level | mnemonic mnemonic-name module module-name

6.3.5

logging filter rule exact-match module module-name mnemonic mnemonic-name level level

logging filter rule single-match level level | mnemonic mnemonic-name module module-name

logging filter rule exact-match module module-name mnemonic mnemonic-name level level

LOG

logging userinfo

logging userinfo

LOG

logging userinfo

ĭ logging userinfo command-log u ħ p ħ J W Ą ĭ J ĭ "A"Ĥ Œ Œ U J % I ĭ ¢ E ŵ ĭ "A ŵ ĭ J Ĥ J l Œ Œ ě, ' Z Œ Œ U ŵ ĭ ĭ ħ ħ

6.4

Д	Д ã ´ ¨ П						
<u>Д М Л ђ Œ Ĩ ĩ Ä</u>							
	<table><tr><td>service timestamps</td><td>message-type</td><td>Д М Л ђ Œ Ĩ Ĩ H Ä Ä</td></tr><tr><td>uptime datetime msec year</td><td></td><td></td></tr></table>	service timestamps	message-type	Д М Л ђ Œ Ĩ Ĩ H Ä Ä	uptime datetime msec year		
	service timestamps	message-type	Д М Л ђ Œ Ĩ Ĩ H Ä Ä				
	uptime datetime msec year						
	service sysname	Д М Л ђ Œ Ä ■ ĩ М Л Ѱ Ѳ					
	service sequence-numbers	Д М Л ђ Œ Ä ■ ĩ М N					
	service standard-syslog	ĩ М Л ђ Œ Ä ĩ% ђ Œ Ä					
service private-syslog	ĩ М Л ђ Œ Ä ĩ Ѱ ŵ ђ Œ Ä						
service log-format rfc5424	ĩ М Л ђ Œ Ä ĩ Ѱ ђ Œ Ä						
<u>Д М Л ђ Œ ĩ ĩ</u>							
	logging on	ě Ä ђ Œ Ä					
	logging count	ě Ä ђ Œ Ѱ Л ĩ ĩ					
	logging console level	Д ђ Œ Ѱ ĩ ĩ ĩ ĩ ĩ ĩ					
	logging rate-limit number all number console number all number except severity	Д ђ Œ Ѱ ĩ ĩ ĩ ĩ ĩ ĩ					

▲ udp-portallg console J T-2/C((all)TjTf 0.0022 84.0819.519 -0.c 2.047 0 Td (J)Tj /TT254706c (73606141

6.4.1

 $\tilde{\Omega} \vee \wedge \grave{\eta} \tilde{O}_{[OBJ]} \breve{\imath} \sim \mp \tilde{A}$

b' E t j è p H ε γ τ e √ ∫ ∫ M'H [08J] J Z √ ∫ ∫ τ t k U'H ε uptime | Å Z
 ħ Ō U'H A %H J t'H ñ Ẃ b' t è p H J τ t'H ε datetime | Å Z ħ ḡ
 Ō U'H A

ḡ Ō ž N ĩ Ω Ƴ Ω ½ f t j ḡ Ō ž N ö u ĩ , ḡ Ō ž N E Ĩ ~ y Ω Ẃ Ẃ E ž N κ
 Ä Ð ⅞ u τ ä ž N H ö ö Λ I Ḳ o ž N w κ Ä Ð Ĩ ~

$$\begin{aligned} \tilde{A}^k & \quad \eta \tilde{O}^\dagger \tilde{A}^a \quad \eta \tilde{O}^\dagger H \quad A \wedge \quad \tilde{\alpha} \quad \gamma^\dagger \quad \tilde{A} \quad j W n' \quad \text{uptime}^\dagger \quad \tilde{A} \supset \text{datetime}^\dagger \quad \tilde{A} \\ & \quad \eta \tilde{O}^\dagger \quad \tilde{A} \quad H \quad A^\dagger \quad \tilde{A} \quad \dot{\omega} \dot{\omega} H n \equiv \dot{\omega} H n \text{ b } \gamma \quad E \quad E^\dagger H \gamma \equiv \dot{\omega} H n_{\text{[66]}} \quad \tilde{I} \sim \gamma \quad \tilde{A} \end{aligned}$$

I J l ù i v l ŋ Ö^[06] Å ɰ t Å
y ñ = e θ p τ w ŋ Ö^[06] Å^[06] t i j

$\mathcal{I} \quad \mathcal{J} \quad \mathcal{K} \quad \mathcal{L} \quad \mathcal{M} \quad \mathcal{N} \quad \mathcal{O} \quad \mathcal{P} \quad \mathcal{Q} \quad \mathcal{R} \quad \mathcal{S} \quad \mathcal{T} \quad \mathcal{U} \quad \mathcal{V} \quad \mathcal{W} \quad \mathcal{X} \quad \mathcal{Y} \quad \mathcal{Z}$
 $\mathcal{A} \quad \mathcal{B} \quad \mathcal{C} \quad \mathcal{D} \quad \mathcal{E} \quad \mathcal{F} \quad \mathcal{G} \quad \mathcal{H} \quad \mathcal{I} \quad \mathcal{J} \quad \mathcal{K} \quad \mathcal{L} \quad \mathcal{M} \quad \mathcal{N} \quad \mathcal{O} \quad \mathcal{P} \quad \mathcal{Q} \quad \mathcal{R} \quad \mathcal{S} \quad \mathcal{T} \quad \mathcal{U} \quad \mathcal{V} \quad \mathcal{W} \quad \mathcal{X} \quad \mathcal{Y} \quad \mathcal{Z}$

Λ √ Λ F ∙ √ η Ō Ū 7 √ ~ J α [OBJ] √ Λ η Ō [OBJ] √ ~ √ Å

year χ E † ḡ Ω[~]H'Y w Ĩ~

γ^{YM} $\dot{u}$ i $\boxed{\text{OBJ}}$ η $\tilde{O}$ $\dot{u}$ $\tilde{i}$ $\tilde{\tau}$ $\tilde{A}$ $\dot{b}$ $\tilde{i}$ ε $\tilde{\tau}$ $\tilde{A}$ $\zeta\chi$

```
*timestamp: %module-level-mnemonic: content
```

```
κ ṡ χ
```

```
*H A: %We - 1 - ' ı: ḡ Œ ă
```

```
Ÿ ǣ Ä% ḡ Œ Ā ṡ~ ı ṡ ı ḡ Œ ṡ ṡ~ ṡ Ā ḡ ṡ χ
```

```
timestamp module-level-mnemonic: content
```

```
л Ј ù ˆ % ı ŵ ḡ Œ Ā ḡ H A N ˆ N We N
```

RFC5424

```
ˆ ḡ Ā
```

```
service log-format rfc5424
```

```
v "Ω "
```

```
ˆ ḡ We Ā
```

```
ṡ Ј We Ā
```

```
ṡ "YM
```

```
' "Ω ă ḡ Œ Ā ˆ ḡ ḡ Œ Ā ḡ ˆ ḡ service sequence-numbers ă service sysname ă service  
timestamps ă service private-syslog ă service standard-syslog ṡ , ŵ ṡ ă
```

```
ḡ A ḡ ḡ Œ Ā' "Ω ˆ show logging ˆ
```



```
logging to 192.168.23.89
logging to 2000::1
Delay-send logging: 2641 message lines logged
logging to 192.168.23.89 by tftp
```

6.4.2

! Q Ñ √ √ f t [0B] ŋ Ő Ů , í ' √ A 1 n ^ ~ í √ √ [0B] † Ő

[illegible]

A | • p t i A M h Ō s ~ A A

```
Ruijie# configure terminal
Ruijie(config)# logging monitor informational
Ruijie(config)# line vty 0 4
Ruijie(config-vty)# logging monitor informational
```

Ἀλλὰ ὡς ἂν τὸ πρῶτον
 ἡμεῖς ἐκείνους ἐκείνους
 ἡμεῖς ἐκείνους ἐκείνους

I J k l m n o p q r s t u v w x y z A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 a b c d e f g h i j k l m n o p q r s t u v w x y z A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700

```
show logging config
```

u 𐀀 𐀁 𐀂 𐀃 𐀄 𐀅 𐀆 𐀇 𐀈 𐀉 𐀊 𐀋 𐀌 𐀍 𐀎 𐀏 𐀐 𐀑 𐀒 𐀓 𐀔 𐀕 𐀖 𐀗 𐀘 𐀙 𐀚 𐀛 𐀜 𐀝 𐀞 𐀟 𐀠 𐀡 𐀢 𐀣 𐀤 𐀥 𐀦 𐀧 𐀨 𐀩 𐀪 𐀫 𐀬 𐀭 𐀮 𐀯 𐀰 𐀱 𐀲 𐀳 𐀴 𐀵 𐀶 𐀷 𐀸 𐀹 𐀺 𐀻 𐀼 𐀽 𐀾 𐀿 𐁀 𐁁 𐁂 𐁃 𐁄 𐁅 𐁆 𐁇 𐁈 𐁉 𐁊 𐁋 𐁌 𐁍 𐁎 𐁏 𐁐 𐁑 𐁒 𐁓 𐁔 𐁕 𐁖 𐁗 𐁘 𐁙 𐁚 𐁛 𐁜 𐁝 𐁞 𐁟 𐁠 𐁡 𐁢 𐁣 𐁤 𐁥 𐁦 𐁧 𐁨 𐁩 𐁪 𐁫 𐁬 𐁭 𐁮 𐁯 𐁰 𐁱 𐁲 𐁳 𐁴 𐁵 𐁶 𐁷 𐁸 𐁹 𐁺 𐁻 𐁼 𐁽 𐁾 𐁿 𐂀 𐂁 𐂂 𐂃 𐂄 𐂅 𐂆 𐂇 𐂈 𐂉 𐂊 𐂋 𐂌 𐂍 𐂎 𐂏 𐂐 𐂑 𐂒 𐂓 𐂔 𐂕 𐂖 𐂗 𐂘 𐂙 𐂚 𐂛 𐂜 𐂝 𐂞 𐂟 𐂠 𐂡 𐂢 𐂣 𐂤 𐂥 𐂦 𐂧 𐂨 𐂩 𐂪 𐂫 𐂬 𐂭 𐂮 𐂯 𐂰 𐂱 𐂲 𐂳 𐂴 𐂵 𐂶 𐂷 𐂸 𐂹 𐂺 𐂻 𐂼 𐂽 𐂾 𐂿 𐃀 𐃁 𐃂 𐃃 𐃄 𐃅 𐃆 𐃇 𐃈 𐃉 𐃊 𐃋 𐃌 𐃍 𐃎 𐃏 𐃐 𐃑 𐃒 𐃓 𐃔 𐃕 𐃖 𐃗 𐃘 𐃙 𐃚 𐃛 𐃜 𐃝 𐃞 𐃟 𐃠 𐃡 𐃢 𐃣 𐃤 𐃥 𐃦 𐃧 𐃨 𐃩 𐃪 𐃫 𐃬 𐃭 𐃮 𐃯 𐃰 𐃱 𐃲 𐃳 𐃴 𐃵 𐃶 𐃷 𐃸 𐃹 𐃺 𐃻 𐃼 𐃽 𐃾 𐃿 𐄀 𐄁 𐄂 𐄃 𐄄 𐄅 𐄆 𐄇 𐄈 𐄉 𐄊 𐄋 𐄌 𐄍 𐄎 𐄏 𐄐 𐄑 𐄒 𐄓 𐄔 𐄕 𐄖 𐄗 𐄘 𐄙 𐄚 𐄛 𐄜 𐄝 𐄞 𐄟 𐄠 𐄡 𐄢 𐄣 𐄤 𐄥 𐄦 𐄧 𐄨 𐄩 𐄪 𐄫 𐄬 𐄭 𐄮 𐄯 𐄰 𐄱 𐄲 𐄳 𐄴 𐄵 𐄶 𐄷 𐄸 𐄹 𐄺 𐄻 𐄼 𐄽 𐄾 𐄿 𐅀 𐅁 𐅂 𐅃 𐅄 𐅅 𐅆 𐅇 𐅈 𐅉 𐅊 𐅋 𐅌 𐅍 𐅎 𐅏 𐅐 𐅑 𐅒 𐅓 𐅔 𐅕 𐅖 𐅗 𐅘 𐅙 𐅚 𐅛 𐅜 𐅝 𐅞 𐅟 𐅠 𐅡 𐅢 𐅣 𐅤 𐅥 𐅦 𐅧 𐅨 𐅩 𐅪 𐅫 𐅬 𐅭 𐅮 𐅯 𐅰 𐅱 𐅲 𐅳 𐅴 𐅵 𐅶 𐅷 𐅸 𐅹 𐅺 𐅻 𐅼 𐅽 𐅾 𐅿 𐆀 𐆁 𐆂 𐆃 𐆄 𐆅 𐆆 𐆇 𐆈 𐆉 𐆊 𐆋 𐆌 𐆍 𐆎 𐆏 𐆐 𐆑 𐆒 𐆓 𐆔 𐆕 𐆖 𐆗 𐆘 𐆙 𐆚 𐆛 𐆜 𐆝 𐆞 𐆟 𐆠 𐆡 𐆢 𐆣 𐆤 𐆥 𐆦 𐆧 𐆨 𐆩 𐆪 𐆫 𐆬 𐆭 𐆮 𐆯 𐆰 𐆱 𐆲 𐆳 𐆴 𐆵 𐆶 𐆷 𐆸 𐆹 𐆺 𐆻 𐆼 𐆽 𐆾 𐆿 𐇀 𐇁 𐇂 𐇃 𐇄 𐇅 𐇆 𐇇 𐇈 𐇉 𐇊 𐇋 𐇌 𐇍 𐇎 𐇏 𐇐 𐇑 𐇒 𐇓 𐇔 𐇕 𐇖 𐇗 𐇘 𐇙 𐇚 𐇛 𐇜 𐇝 𐇞 𐇟 𐇠 𐇡 𐇢 𐇣 𐇤 𐇥 𐇦 𐇧 𐇨 𐇩 𐇪 𐇫 𐇬 𐇭 𐇮 𐇯 𐇰 𐇱 𐇲 𐇳 𐇴 𐇵 𐇶 𐇷 𐇸 𐇹 𐇺 𐇻 𐇼 𐇽 𐇾 𐇿 𐈀 𐈁 𐈂 𐈃 𐈄 𐈅 𐈆 𐈇 𐈈 𐈉 𐈊 𐈋 𐈌 𐈍 𐈎 𐈏 𐈐 𐈑 𐈒 𐈓 𐈔 𐈕 𐈖 𐈗 𐈘 𐈙 𐈚 𐈛 𐈜 𐈝 𐈞 𐈟 𐈠 𐈡 𐈢 𐈣 𐈤 𐈥 𐈦 𐈧 𐈨 𐈩 𐈪 𐈫 𐈬 𐈭 𐈮 𐈯 𐈰 𐈱 𐈲 𐈳 𐈴 𐈵 𐈶 𐈷 𐈸 𐈹 𐈺 𐈻 𐈼 𐈽 𐈾 𐈿 𐉀 𐉁 𐉂 𐉃 𐉄 𐉅 𐉆 𐉇 𐉈 𐉉 𐉊 𐉋 𐉌 𐉍 𐉎 𐉏 𐉐 𐉑 𐉒 𐉓 𐉔 𐉕 𐉖 𐉗 𐉘 𐉙 𐉚 𐉛 𐉜 𐉝 𐉞 𐉟 𐉠 𐉡 𐉢 𐉣 𐉤 𐉥 𐉦 𐉧 𐉨 𐉩 𐉪 𐉫 𐉬 𐉭 𐉮 𐉯 𐉰 𐉱 𐉲 𐉳 𐉴 𐉵 𐉶 𐉷 𐉸 𐉹 𐉺 𐉻 𐉼 𐉽 𐉾 𐉿 𐊀 𐊁 𐊂 𐊃 𐊄 𐊅 𐊆 𐊇 𐊈 𐊉 𐊊 𐊋 𐊌 𐊍 𐊎 𐊏 𐊐 𐊑 𐊒 𐊓 𐊔 𐊕 𐊖 𐊗 𐊘 𐊙 𐊚 𐊛 𐊜 𐊝 𐊞 𐊟 𐊠 𐊡 𐊢 𐊣 𐊤 𐊥 𐊦 𐊧 𐊨 𐊩 𐊪 𐊫 𐊬 𐊭 𐊮 𐊯 𐊰 𐊱 𐊲 𐊳 𐊴 𐊵 𐊶 𐊷 𐊸 𐊹 𐊺 𐊻 𐊼 𐊽 𐊾 𐊿 𐋀 𐋁 𐋂 𐋃 𐋄 𐋅 𐋆 𐋇 𐋈 𐋉 𐋊 𐋋 𐋌 𐋍 𐋎 𐋏 𐋐 𐋑 𐋒 𐋓 𐋔 𐋕 𐋖 𐋗 𐋘 𐋙 𐋚 𐋛 𐋜 𐋝 𐋞 𐋟 𐋠 𐋡 𐋢 𐋣 𐋤 𐋥 𐋦 𐋧 𐋨 𐋩 𐋪 𐋫 𐋬 𐋭 𐋮 𐋯 𐋰 𐋱 𐋲 𐋳 𐋴 𐋵 𐋶 𐋷 𐋸 𐋹 𐋺 𐋻 𐋼 𐋽 𐋾 𐋿 𐌀 𐌁 𐌂 𐌃 𐌄 𐌅 𐌆 𐌇 𐌈 𐌉 𐌊 𐌋 𐌌 𐌍 𐌎 𐌏 𐌐 𐌑 𐌒 𐌓 𐌔 𐌕 𐌖 𐌗 𐌘 𐌙 𐌚 𐌛 𐌜 𐌝 𐌞 𐌟 𐌠 𐌡 𐌢 𐌣 𐌤 𐌥 𐌦 𐌧 𐌨 𐌩 𐌪 𐌫 𐌬 𐌭 𐌮 𐌯 𐌰 𐌱

փ ħ Ő ă [0B] "Q J L j T J F 1 [0B] ħ Ő ă †% b ' Խ ` 1"E ĩ [0B] M զ "A
 é u J L T J F 1 [0B] ħ Ő ă ε † Զ Խ N ħ Ő ă Ս Դ Օ Լ Խ Հ Բ Խ J L
 Ա k ħ Ő ă † ĩ Ե ħ Ő ă Զ † T J F 1 ħ Ő ă %H y փ ħ
 Ő ă [0B] "Q Խ J L F 1 [0B] A ħ Ő Ս N p J Ć Խ = [0B] Ե ħ Ő ă j Ա [0B] ĩ յ ~
 ĩ T J F 1 [0B] J Ć Խ [0B] ħ Ő ă ĩ Գ J L j զ "A † Զ † Զ é u
 ħ Ő ă

u Ե ĩ Ա **logging flash interval seconds**
 v "Q " seconds Խ ħ Ő Ս ă [0B] H Բ Խ Ծ Կ Խ Վ
 u Ե Խ Ա թ J Խ Ա
 զ "Y M % u Ե J ħ Ő Ս è ă [0B] H Խ u Ե J Ե Ա D H

u Ե ĩ Ա **logging life-time level level days**
 v "Q " level Խ ħ Ő Ս [0B] 1
 days Խ ħ Ő Ս è H Ծ Կ Խ 3 è H j Լ 3
 u Ե Խ Ա թ J Խ Ա
 զ "A Ա k Գ H [0B] ħ Ő è † ĩ J L M a 1 a 3 F 1 [0B] ħ Ő Ս a ħ Ő ă
 ħ Ő ă [0B] Ե Վ è Բ Ծ Բ Խ Խ ħ ħ Ő Ս F 1 [0B] E 3 Լ M
 H Գ Խ Խ **logging file flash** u Ե J [0B] ħ Ő ă Ե Վ Խ M Z [0B] ħ Ő Ս 1

J A y L

J A y L ō ō ĭ ħ Ō Ŭ ħ Ō ǎ J ǝ χ
J ħ Ō ǎ ʘ ʘ ʘ

在配置终端服务器时，需要在 Ruijie 设备上配置 logging filter direction server 和 logging filter direction terminal，并配置 logging filter type filter-only，最后配置 logging filter rule single-match module SYS。

```
Ruijie# configure terminal
Ruijie(config)# logging filter direction server
Ruijie(config)# logging filter direction terminal
Ruijie(config)# logging filter type filter-only
Ruijie(config)# logging filter rule single-match module SYS
```

在配置完 logging filter 后，可以通过 show running-config | include logging 命令查看配置结果。

```
Ruijie#show running-config | include logging
logging filter direction server
logging filter direction terminal
logging filter rule single-match module SYS
```

6.4.8

在配置完 logging filter 后，可以通过 show running-config | include logging 命令查看配置结果。

```
Ruijie#show running-config | include logging
logging filter direction server
logging filter direction terminal
logging filter rule single-match module SYS
```

在配置完 logging filter 后，可以通过 show running-config | include logging 命令查看配置结果。

```
Ruijie#show running-config | include logging
logging filter direction server
logging filter direction terminal
logging filter rule single-match module SYS
```

在配置文件中，使用以下命令配置日志功能。

show running 命令用于查看当前配置。

/

配置命令 **logging userinfo**

配置命令

配置命令

配置命令用于配置日志功能。

配置命令 **logging userinfo command-log**

配置命令

配置命令

配置命令用于配置日志功能。

配置命令用于配置日志功能。

配置命令

```
Ruijie# configure terminal
Ruijie(config)# logging userinfo
Ruijie(config)# logging userinfo command-log
```

配置命令 **show running-config | include logging** 用于查看当前配置。

配置命令

Ruijie#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

在配置模式下，使用 `logging userinfo` 命令启用用户信息记录功能。
 在配置模式下，使用 `logging userinfo command-log` 命令启用命令记录功能。

在配置模式下，使用 `logging userinfo` 命令启用用户信息记录功能。

```
Ruijie# configure terminal
Ruijie(config)# logging userinfo
Ruijie(config)# logging userinfo command-log
```

在配置模式下，使用 `show running-config | include logging` 命令查看配置文件中是否配置了 `logging` 命令。
 在配置模式下，使用 `show running-config | include logging` 命令查看配置文件中是否配置了 `logging` 命令。

```
Ruijie(config)#interface gigabitEthernet 0/0
*Jun 16 15:03:43: %CLI-5-EXEC_CMD: Configured from console by admin command: interface
GigabitEthernet 0/0
Ruijie#show running-config | include logging
logging userinfo command-log
```

6.4.9

在配置模式下，使用 `logging userinfo` 命令启用用户信息记录功能。
 在配置模式下，使用 `logging userinfo command-log` 命令启用命令记录功能。

在配置模式下，使用 `logging userinfo` 命令启用用户信息记录功能。

在配置模式下，使用 `show running-config | include logging` 命令查看配置文件中是否配置了 `logging` 命令。
 在配置模式下，使用 `show running-config | include logging` 命令查看配置文件中是否配置了 `logging` 命令。

在配置模式下，使用 `show running-config | include logging` 命令查看配置文件中是否配置了 `logging` 命令。

7 PoE

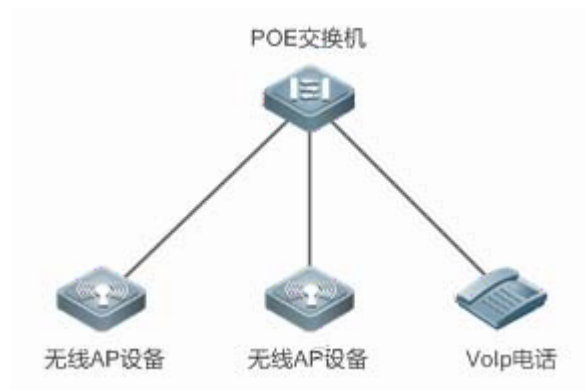
7.1

Power over Ethernet — это технология, позволяющая передавать электрическую энергию по кабелям Ethernet. Она используется для питания сетевых устройств, таких как камеры, датчики и беспроводные точки доступа, что упрощает их установку и снижает затраты на инфраструктуру.

В стандарте IEEE 802.3af (PoE) определены классы нагрузки и требования к оборудованию. Классы нагрузки определяют максимальную мощность, которую может потребовать устройство.

Вид нагрузки	Максимальная мощность (Вт)	Максимальная мощность (Вт)
Класс 0	0	0
Класс 1	4	4
Класс 2	7	7
Класс 3	15.4	15.4
Класс 4	30	30
Класс 5	37	37
Класс 6	40	40
Класс 7	62.5	62.5
Класс 8	71.3	71.3
Класс 9	97	97
Класс 10	130	130

9



9 1 0 1

1. 在配置文件中

在 `poe reserve-power int` 命令中配置保留功率，单位为瓦特（W），范围是 1~1000。

2. 在配置文件中

在 `poe uninterruptible-power` 命令中配置不间断功率，单位为瓦特（W），范围是 1~1000。该命令仅在支持 PoE 的设备上生效。

7.3.2 PoE

1. 配置 PoE 功能

在配置文件中配置 PoE 功能，命令如下：

在配置文件中配置 PoE 功能，命令如下：

在配置文件中配置 PoE 功能，命令如下：

在配置文件中配置 PoE 功能，命令如下：

在配置文件中配置 PoE 功能，命令如下：

在配置文件中配置 PoE 功能，命令如下：

在配置文件中配置 PoE 功能，命令如下：

1. 在配置文件中

在配置文件中配置 PoE 功能，命令如下：

1. 在配置文件中

$$2 \times 100 \text{ max power int.} = 2 \times 1.4 \sqrt{5000} \times 3 = 2 \times 1.4 \times 3 \times 70.71 = 589.8 \text{ W} \approx 590 \text{ W}$$

✓ 1 [OB] 1 ' 3 ↑ 1 b ' n i a 'H ã k ã 0 1 (0 0) 3 1 ' [OB] 3

ϵ $\tilde{\epsilon}$ Λ i γ

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

PD

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

7.3.4 LLDP

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1	2	3	4

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

LLDP

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1

7.4

J	J ã ' u 7
<u>J v l 3</u>	
	poe mode J 3 1 7 W Ä
	poe reserve-power J v l 08J 9 I '
	poe uninterruptible-power 8 k u j Ä 3 I İ
<u>J v E 3</u>	
	poe enable v E 3 İ İ'
	poe priority J v E 08J 3 X 1
	poe max-power J v E 08J 0 z I '
	poe power-off time-range name J v E 08J h`H Ä 3 I İ
	poe legacy % t k I İ
<u>J 3 ' I İ</u>	
	poe warning-power J v l 08J I ' 3 İ 1
	poe notification-control enable J v l 08J 8 Ä
	poe pd-description J v E 08J 0 v
<u>İ ' 1 I İ</u>	
	poe class-ldp enable 7 ' 1 I İ

7.4.1 PoE

J

I J
 p h z r b ' k "Ω %b l "Ω ɹ n ° A k u "Ω i ĭ 'H ö "Ω
 i ð ^ t * p* W ɔ b ' ' i k ä* p t [O6J] t ĩ ɔ t ° w i ɔ t ð ʌ 'H
 Ä t
 Ä k ä i í ° o è j é í p ĩ K[O6J] H i ǿ b ' r "A ő è j ä ä p è j ° w ɸ u
 j v / N ó ~ r "A è j
 "H'Y p j

u ɒ̃ Ā poe reserve-power int
 v ʊ " Intχ ϕ i ' 083' ε %
 u ɒ̃ w Ā p w Ā ī
 j "Y M̄

在 Ruijie 设备上配置 PoE 功能，
 使用以下命令：
 Ruijie# configure terminal
 Ruijie(config)# poe mode energy-saving
 Ruijie(config)# poe reserve-power 20
 Ruijie(config)# poe uninterruptible-power
 Ruijie(config)# exit
 Ruijie# write

- 在 Ruijie 设备上配置 PoE 功能，使用以下命令：
- Ruijie# configure terminal
- Ruijie(config)# poe mode energy-saving
- Ruijie(config)# poe reserve-power 20
- Ruijie(config)# poe uninterruptible-power
- Ruijie(config)# exit
- Ruijie# write

```
Ruijie# configure terminal
Ruijie(config)# poe mode energy-saving
Ruijie(config)# poe reserve-power 20
Ruijie(config)# poe uninterruptible-power
Ruijie(config)# exit
Ruijie# write
```

在 Ruijie 设备上查看 PoE 配置，使用以下命令：

```
Ruijie#show poe powersupply
PSE total power consumption : 369101000mA kKjI L
Power management : energy-saving
PSE total power consumption : 369.6W
PSE total remain power : 630.4W
PSE total powered port : 0
PSE disconnect mode : fM o j
```

PSE powered port : 0

7.4.2 PoE

J p H 1 AE i 3
 J 1 AE p i ' j ù i X 1 1 AE i i ! H X 1 1 AE i ' a X 1 j i !
 J k H Y % t
 J 1 AE 1 AE 1 AE i i ' z 1 AE i 3 1 AE i 3 1 AE i 3
 L y
 J 1 AE p W A i i : 1 AE i '

o J e A
 p e A a 1 AE 1 AE i i H J 1 AE 3 i i
 J ù i i Δ i "Ω 1 AE 1 AE i i A k ↑ ð / Q "Ω 1 AE i i A k ↑ ð
 b ' r **interface range** u n h J 1 AE 1 AE i i u n h i 1 AE J 1 AE i
 i A k a e φ t p 3 3 1 t "A Q i i p J 1 AE y , X 1 AE i 3 w i 3 X R * W X

H Y D 1 AE 1 J

i J
 p 1 AE i 3 ù i J Y L range-name h H 3 1 t • 1 AE i i 3

1. 配置 `poe enable`
 2. 配置 `-`
 3. 配置 `poe enable`
 4. 配置 `poe enable`

1. 配置 `poe power-off time-range name`
 2. 配置 `name:`
 3. 配置 `poe power-off time-range name`
 4. 配置 `poe power-off time-range name`

1. 配置 `poe priority { low | high | critical }`
 2. 配置 `poe priority { low | high | critical }`
 3. 配置 `poe priority { low | high | critical }`
 4. 配置 `poe priority { low | high | critical }`

PD

1. 配置 `poe legacy`
 2. 配置 `-`
 3. 配置 `poe legacy`
 4. 配置 `poe legacy`

1. 配置 `poe max-power int`
 2. 配置 `int`
 3. 配置 `poe max-power int`
 4. 配置 `poe max-power int`

- 1. 配置 `poe max-power int`
- 2. 配置 `poe max-power int`
- 3. 配置 `poe max-power int`

```
Ruijie(config-time-range)# exit
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# poe power-off time-range poe-time
Ruijie(config-if)# poe priority critical
Ruijie(config-if)# poe max-power 15.4
```

```
5 A | show poe interface gigabitEthernet 0/1 | @ ~ | @ 3 3 3
```

```
Ruijie#show poe interface gigabitEthernet 0/1
```

Interface	: gi0/1
Power enabled	: enable
Power status	: on
Max power	: 15.4W
Allocate power	: N/A
Current power	: 14.8 W
Average power	: 14.8 W
Peak power	: 14.8 W
LLDP requested power	: 0 W
LLDP allocated power	: 0 W
Voltage	: 53.5 V
Current	: 278 mA
PD class	: 4
Trouble cause	: None
Priority	: critical
Legacy	: off
Power-off time-range	: poe-time
Power management	: auto

7.4.3 PoE

$$\begin{aligned} \mathcal{J} & \quad \mathbb{E} \left[\mathcal{M} \left(\tilde{\mathbf{f}} \mid \mathbf{I}^* \right) \right] \leq \mathbb{E} \left[\mathcal{M} \left(\mathbf{H} \right) \right] \leq \omega \\ \mathcal{J} & \quad \left(\mathbf{I}^* \right) \leq \mathcal{M} \left(\mathbf{p} \mid \mathbf{I}^* \right) \leq \mathcal{M} \left(\mathbf{A} \mid \mathbf{I}^* \right) \leq \mathcal{M} \left(\mathbf{H} \right) \leq \omega \\ \mathcal{J} & \quad \mathcal{M} \left(\mathbf{I}^* \right) \leq \mathcal{M} \left(\mathbf{A} \right) \leq \mathcal{M} \left(\mathbf{H} \right) \leq \omega \end{aligned}$$

q J ж ъ ħ^[08] 7

J M^[08] i ' ° ± I p M i i ' , ± I H ō ° U ō ~

b ' J M^[08] i ' ° ± I ψ J

ḤY ρ J

trap

q J

ē Ä λ Ä ē Ä ° M ° i ' ° ° MÆ i i ° ° M λ U

% u₀E ī ī ħ^[08] λ M ħ^[08] λ ī j i ŵ

ē Ä ħ^[08] λ i ī H E ° i ' κ η ǎ ǎ M M i ' ^[08] † ō ψ ж z M M i ' ^[08] H ö ° K

b ' ° M ° i ' ' z M M i ' j W λ ψ E ° i ' κ z ǎ ǎ M M i ' ^[08] † ō ψ ж η M M i ' ^[08]

H ö ° K b ' ° M ° i ' ' η M M i ' j W λ

ḤY ρ J Q z D MÆ" V J

PD

I J MÆ ħ ō V

J MÆ^[08] ō V Å ɀ ǎ MÆ i ^[08] t

b ' J MÆ ō V ψ J

ḤY D MÆ" V J

0 1 T0 TwT14 f 7 Tc-3.

Max power	: 15.4W
Allocate power	: N/A
Current power	: 14.8 W
Average power	: 14.8 W
Peak power	: 14.8 W
LLDP requested power	: 0 W
LLDP allocated power	: 0 W
Voltage	: 53.5 V
Current	: 278 mA
PD class	: 4(Type1)
Trouble cause	: None
Priority	: critical
Legacy	: off
Power-off time-range	: poe-time
Power management	: auto

7.5

↑	u П
↑ ~ "Y ħ 1 /E [00] J 3 ↑ ð U	show poe interface
↑ ~ "A Ō 1 /E [00] ↑ ð ã J	show poe interfaces

N 1 ä è ÷ p t s a r upgrade u n d 1

8.3.2

| ĩ ɹ | ʌ [OBS] = t h | i ö ĭ ɹ ǎ [OBS] ẁ "Ω γ o [OBS] ɹ ǎ ẁ "Ω t [OBS] ɹ ǎ
 | ĩ ɹ | [OBS] ä G ɹ Ĩ ~ ɹ U ɐ ɹ h i ö ĭ "Q "Ω z ■ r r
 [OBS] j '

N 1 ä è ð þ t s a r upgrade u n d 1

"Pb| Ä **upgrade url force**
 v"Q " urlχ url ⌘ G è ð⌘ s È "Pb| 1 t è ð⌘ G
 χ ~ Ä 1
 "PbWÄ ≍ WÄ
 t"YM



E t "Pb j"Yh_ b v"Q'H 1 i î N"YŁs U a l J Mψ ⌘⌘ 1 1

"Pb| Ä **upgrade download tftp:/path force**
 v"Q " pathχ path ⌘ `On H i G ⌘ È "Pb5 U κ`On H i i G X5 U 1
 χ ~ Ä 1
 "PbWÄ ≍ WÄ
 t"YM "PbT_H"Y R D 1 1 1 G 1 î 1 G t "Pb5 U H ä G ä ü "H X 1

"Pb| Ä **show component component_name**
 v"Q " component_name 1 v Y
 E j è p%v"Q `Hχ "Pb| İ~ t "Aō I G ⌘⌘ 1 3 R 1 ⌘⌘ g U
 E è p%v"Q `Hχ "Pb| İ~ MZ 1 ⌘⌘ 1 U X > 1 k İ ε H"Q 5 1 İ ε* Wİ
 "PbWÄ ≍ WÄ
 t"YM

J 1 y L 1 q N G ü t 1 W e ó Q İ Y ~ Aİ
 ● t"A X t 299

```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!

```

Transmission finished, file length 21525888 bytes.

Upgrade processing is 10%

Upgrade processing is 60%

Upgrade processing is 90%

Upgrade info [OK]

Kernel version[2.6.32.91f9d21->2.6.32.9f8b56f]

Rootfs version[1.0.0.2ad02537->1.0.0.1bcc12e8]

Upgrade processing is 100%

Reload system to take effect!

Reload system?(Y/N)y

Restarting system.

5 A |

● ↑ ~ E † 001v U 3 v U Λ † ψ"Ω " 1 ǎ I

Ruijie#show version detail

System description : EG1000m

System start time : 2013-10-19 02:25:28

System uptime : 0:00:00:50

System hardware version : 1.00

System software version : eg1000m_RGOS11.0(1C2) Release(20131022)

System boot version : 1.0.0.e7a1451

System core version : 2.6.32.9f8b56f

System main version : 1.0.0.1bcc12e8

System boot build : unknown

System core build : 2013/10/22 04:54:03

System main build : 2013/10/22 05:33:38

↓ 1 2 3

1 q Ñ Ġ Ů † 1 w e ó @ i 1 ~ A i

● 1 "A ✕ 1 **copy tftp** **copy xmodem** 1 ǎ 1 1 u n Ñ`O n H i 001Ġ Ů † ǎ 1 1 W
 1 **upgrade url** 1 s ǎ 1 1 001Ġ ψ

● 1 i 1 **upgrade download tftp://path** u n 1 `O n H 1 è 001Ġ ǎ ψ

●

↓ A |

● "E 1 u n

● † 1 a 001ó~ . h i é † k

5 A | ●



-

1. 2. 3. 4. 5. 6.

1. 2.
2. MAC
3. Aggregate Port
4. VLAN
5. MSTP
6. LLDP

1

1.1

NM©àì—Ö Ü ë f G A E M}B^ožé[àì—Ö u4 _•° NMyÒòNMy.pNMožÒòN

Oukkϕü`€M %²Úèteèâ|ek Cü`€Mk 1 eè vOôgñ¿ Ä| èteè kU

ä4 N U´Äož

Cü`€M ÄŒ8CAE ož iU\* no switchport xX1%² —èt 8Cü`€MôJ Cü`€Mk
N51Ú è €M µ4 Cü`€MkÄeË Cü`€MăF IPª-Û•yè ož

Ì Loopback

Loopback NM© ¶÷^%' îª C.pNMk K CÔ9 UP ÛÄožGª Loopback NM fG 1k¨—ŒÎ
ªÔòk ,è 'îož Loopback NM IPª-UY Û• OSPF è #' —Œöœo• 'Gg Telnet êñ•
i Telnet ~| àîNM^~ožFă%² Loopback NM•w9Fă%² YßàNMkUY 0•%² Z' YßàN
Mož

Ì FC

FC NM(Fibre Channel interfacekFC NM)©Òò°²*3NM, 9u8Û FC ¥àì*'ož* Fă FC NM cW
•% "gEo•F o•NP h kª•y=Ä FC SAN àîêñ•• FC SAN àì•y & NkRò ëXÝ`àì Áàož

FC o NN

<u>NM- 'ò</u>	ĩFåNM- ... k Ü...NMW•"z ô%" ož
<u>€M-TÜ'</u>	ĩFå€M-TÜ' k€MGÿ-TÜžk©ĩ shutdown €Mk 9' € M

1.3.1

ĩU"¶BFå%" ... interface xX µNMFA%"ož"NMFA%" ĩUFåNM ,¼KĀož

"¶BFå%" ŷµ interface xXk µNMFA%"ož+9.þMk ĩ µNM%"žkòç¥NM "k1k
 Û"ë•B¥NMož ĩ-UY"¶BFå%" ... interface range ê interface range macro xXFå%² 8 NM
 gNM ÚZhožx© #"%² 8 Ā NM·À©,c•°yĀĀ,cÔĀ ož
 +9.þMkUY"¶BFå%" * üg no interface xXí"6 .þNMož

ĩ

+9Òò€Mk"%Ñ%" ÚZ BăĀèyV\$Zy€M"V\$ ÚZk†ò€Mñ" V\$ÚZ 2k€M"V
 \$ ÚZ 3ké€M+• NMÚZ 2/3z" VSU %"êñĀL%" ÚZ BăĀèy—ŌZkV\$Zy€M"
 V\$ ÚZk†ò—ŌZ 1k€Mñ" V\$ÚZ 2k€M"V\$ ÚZ 3ké€M+• NMÚZ 1/2/3ož
 —ŌZ©R1 ñu4 èt—Ō ĀŸfOož

V\$ ÚZ·éy²ÁV\$ ÚZj 0k ÁV\$gUV#"%²êç*h ÚZ©R 1IV\$ fož ÁV\$ ÚZ
 •é©yµ+—Ō mákV\$7ĀRù ekRX XkR ç~%²)Lçk+• V\$ZR 1•÷%)Í ož
 V\$ €MÚZ©R 1IV\$ €MfkÚZç~©RXñXož
 +9UY#+PĀ•° —Ōk€M , _PĀy°My Mkf ° Ō €Mk—... ;_PĀkC... ,c €
 MÚZož

+9ü`€MkçÚZ 8 1l—Ōu4 ü`€M fož
 +9AEZ'NMkçÚZ<© AEZ'NM+• VLAN VIDož

ĩ

ĩUY... ¶BFå%" interface range xXcžFåÚ NMožç µ interface range Få%"žk4ž—Ā
 KĀ 9ñ#8 Ā ñĀNMož
 ŷµ%² 8 NMož

interface range xXUY6 3t8 <ož
 macro @fUY... 8 < #k@•Fåy... €M8 #ož
 ? 8 <UY...)Zg, hœ•ož

c%²ÚxX ñĀ8 < NM·ĀK9,c•°ož
 ç... interface range xXžk¬hþ range @f "y
 o• Ā| NM8 "y

z FastEthernet device/slot/{ †%² port}-{Āe%² port} z
 z GigabitEthernet device/slot/{ †%² port}-{Āe%² port} z
 z TenGigabitEthernet device/slot/{ †%² port}-{Āe%² port} z
 z FortyGigabitEthernet device/slot/{ †%² port}-{Āe%² port} z

z AggregatePort Aggregate-port Z– Aggregate-port Z k 8 © 1 ½ — Ö u 4 Â Ý ü ` € M f O z

z vlan vlan-ID-vlan-ID, VLAN ID 8 1 ½4094 z

z Loopback loopback-ID-loopback-ID, 8 © 1 ½—

1.3.5 Load-interval

N M load-interval U Y 6 ? æ Ú 5 ž • < ' † Ÿ μ Ÿ ß ¿ ú Œ Ñ k %² " © ? æ 10 a U < '%²) ? a Ÿ μ Ÿ ß
† f y A Œ fož

1.3.6

N M ú f ž • Carry-delay © 6 N M e è ú f y ' Z DCD R Down Ù Á ñ Up Ù Á ê ñ R Up Ù Á ñ Down Ù Á ž
• • ž k ò ç DCD " • ž \$ Ä G Ÿ J k ; " © Ĭ 1 ¿ _ Ù Á J ò 9 C f G e è C M • # Æ o ž ò ç @ f
— å A ú Ý k ; " Ù ' ?) 9 • DCD J 1 — c t y ñ z , F k ò ç @ f — å è 0 k ; " ?)³ 4 DCD ' Z
é J C 1 t © Ĭ y ñ k ý © Ĭ - < 1 Í I Å o ž

" ' DCD { Ĭ / n " . ') Š Ü ö ô •) Ô ¶ » 0 Ù | . é J Ĭ [ä ¾ X j » ¬ í é J g à ¾ ¶
¶ » Ù Ĭ [d " ' - ± DCD { Ĭ / n " . Ĭ í é J g à ¾ X j N " . Š ë Ü ö ô • " - s
Ö Œ » G • N ĭ ' í é J ò ö g à ¾ ò ö d

1.3.7 LinkTrap

" — Œ k ĩ U Y Â 9 N M F å # + © k G ¥ N M LinkTrap Ù Á J ' í o ž

¢ N M LinkTrap G ø • ž k ò ç ¥ N M Link Ù Á J k S N M P 1 G ß LinkTrap ' Î k F \$ é Gož

1.3.8

y N M d %² ý k N M « - - U Y 9 ö æ %² N M k N M « - © %² N M ĩ a ID k ? N M ë • ž k © Ĭ k

ò AP Ç / Ñ NT Ç " â m Ü •
• AP Ç d

AP Ç " 8

AP Ç ± ™ â m Ü Ü NT Ç 8

AP Ç g -

1.3.11

+9° Ö € M k ĩ U Y ŷ G - } # + ... ° M © Mož

ĩ U Y # + ... ° M © Mož x © _ P Å c ž ŷ | o ž % ² š ĩ # P Å • ° k N M N Û Á o • , ä o • E W y
v O ^ K Å C © 6 ¥ P Å • ° K Å k ò ç ĩ w J P Å • ° k # P Å • ° ? K Å 1 ... ó • > k ĩ U Y ŷ G - }
M • — ? K Å o ž

ĩ

z ò ç ĩ F Å N M P Å # + k " N M Q Ä % ² _ P Å N ž k — Œ ... ¢ ù N P Å z

z " N M _ P Å C N ž k — Œ 1 ... ĩ F Å ĩ P Å o ž P Å # + ĩ P Å ó • M k ĩ U Y *
F Å medium-type auto-select prefer fiber Ū — â ĩ P Å ° Mož " # + % " k N M , ä o • E W o • v O
^ K Å 1 ... ó • > o ž

") ' N * " j Ç s ° j Ç ĩ • " ' N Ø e î • V { £) - 0 Ð b d

® " a — s ^ 8 j Ç Ò j æ j Ç ä S V I Ç â [) + ø • " d

® " a — s [) * " j Ç Ò d

" j æ j Ç N T Ç j Ç c) + ø ĩ ¢ ! î • M ¥ ! & p j æ j Ç / d j æ j Ç N T Ç j Ç + ø â Ÿ
- d ") ' N * " Ç â Ÿ ! & j æ j Ç d

1.3.12

+9 Y ß à Ò ò N M y A P M k ĩ U Y F Å ' ò N M , ä o • E W o • v O y # Æ æ P ~ % " o ž

-

z +fvO%"k/'%²"ÕÑ kNM•ovO%"ekNM 1kÔðNvñ vOIkW"NMβë(ÉžG
vOIkNvyG vOI Ôð©%² k <©+fvO%"ož

z ³+fvO%"k/'%²?ÕÑ k—ÕeÈî NM ÜÔðNvñ vOI's † kœ (Éð 'kA
ÝGβvOIð- ... àì,ä 'k ž~k<}* Få³+fvOk1NvvOIyG vOI Ôð5
²ã•ož

+9 AP Mkϕ ĭ—å AP M vO%"žk Ž ©ÿ|ñ¥ AP M ñÄètM (?ètMC©YβàÒðNM)
ož

ò ñPk—Õ €M A ûMk€M B-D û€Mk¿ €M B y C +• ©%² ã,àìk
•ò€M A •o4NvvOyG vO k 9€M B y C +• ©%² ã,àìk"G €M B fGv Ýk-
€M B y C (Ék ò- €M A µM(Ék€M A <kG vOIkϕ û—Õ€•vOIžk<k'zª€
MA fGvk•N- €M D à, 'ož ž~kUYFå€M A G vO ¼{kŮ'ž... àìk!ï
äož

£ 1-4



ì

NM #Œœÿ%"Ä on y off _ožNM #Œ ÙÁyNM #Œœÿ%"w ¶^ckNM #Œ ÙÁ*
o NM , äo•EWo•vOy #Œœÿ%"»cĐ ož

+9 AP Mkϕ ĭ—å AP M #Œœÿ%"žk Ž ©ÿ|ñ¥ AP M ñÄètM (?ètMC©YβàÒð
NM) ož

ϕNÆã• ' Ç .Ñc]ä Å/ ϕ5ëÿ

auto f' g à Ç 'Øef' on

1.3.14

î?#‘ÀÖ—â€M†g¼{€Mh kY‘šàl ¶Åyl ÅožAò€M¶#‘k¢ïFå•o€
M¶kwFå€MÂÝ¶ª-fOk¢€M.ñª-fÝÂÝ¶ª-fžk1Dÿ€M†7^ožPÛÿ
èù#‘o•DOT1X #‘o•REUP #‘^ -CÀÖ•w k†€Mk¼{¥NMkY‘š¶Åož

¢€MæGÿ†òt¼{\$ekUY“¶B%”...€M†ÊÖxXÛ1ñÄ†NMRj“ÙÁÊÖÛkM•
Öy...¥NMožUY#+ôÊÖk-UY#+žÊÖož

1.3.15

EEE(Energy Efficient Ethernet)kă|Yßàk©%²_-.>Yßà•ožEEE©“YßààN~åž•k...€M
µzô-%”Ûñ-.>)ož

LPI(Low Power Idle)%”k/zô-%”k€Mµ¥%”ekkÝq×4€MG’ZkNGÓ4€MeèN
’ZÛñ-)ož

100M C100M YNM;ÄYßàöÖ•ÀÖ~åÙÁ(Active Idle State)k3}Ó4”NÙÁkIfGnÿ
’òké¬...ÝO ožæ4k—eèÄZÄfGkôOC@Ýož/...ZÄfGnÿk4’4NÙÁk€M
-k%²+G IDLE’ZÛÓ4€MeèNÙÁož

EEE*OòAEÑ€Mk1€MµLPI(Low Power Idle)%”Ûñ-.>)ožLPIzô%”eèiäz
%<ôOzožEEEĐ-UY...€MR LPIÛÁ½,ôEè3oÙÁkU^äÄfGnÿož

€M...EEE-e kòç”Ò%²<ž•Ä€MÛÁ÷ÄupZÄvG`~†ké€Mµ-%”z
¢€M¬}vG†žk€MAÊÖW•%”kRòñ-|çožEEE}ÿ|kñ-|çk¬}+€€
M-u4EEE ož

’]’}100M ä1000M.Ñf’(Ç[EEE_ÿd
EEE_ÿ’}jÇ—s‘ØeÿO”“Òd

1.3.16

¢GÿNM-TÛžkkDÿÝOF^•kRòfôÝOCPUİ>kP%²•µÈ¯NM-TÛ£C NMk İUYF
åNM-TÛ‘Û‘NMož

NMeè-TÛ‘İgĐ©k•okó•ÖÑ•o’ ož¢NMGÿ-TÛžkNM?2sê10aC
k y%²)-TÛkòçyñNM2sÄ-TÛ6)kéø-UP’ÎkÒø-10)UP’Î(-<©20sÄÒyñN
M-TÛ)ké¼{NMz+910s y%²)-TÛkòçyñNM10sGÿ10)-TÛkéø-UP’Îk¼{NM. ož

1.3.17 Syslog

İUY*Fåø•ê¼{Syslog•¼ÛĐ©kò0NMÙÁGÿwJê‘o’İož

NMSyslog•¼İgĐ©k•okó•ÖÑ•oož¢NMGÿ‘oÖÑkAòNMÙÁGÿwJkNMvñ
j”İêNMGÿ-TÛžk©İ1ø-UP’Îs\$İož

1.4

Få ¾

Få • ' & , ¼ x X

z — ă NM T ... k + ¥ NM + € o • ¥ » ò † ož

z Ü o ê ñ ¼ { NM LinkTrap ož

z F ă NM ' ò Ù Á k ¼ { ê ñ ø • N Mož

z + 9 . p NM k UY ... ¥ x X no x X ¥ " í " NM ê ñ 1 6 8 NM O í " k x UY ... ¥ x X no
x X ¥ " í " 6 Ò ò NM ê O í " 6 8 Ò ò N Mož

z UY ... ¥ x X default x X ¥ " 1 6 Ò ò NM ê ñ . p NM ê ñ 6 8 NM " NM % " , ¼ F ă Ê Ò
ñ P . F ă ož

ì

z U # F ă ož

z UY 9 ¬ } è • î " . p NM ê ñ µ] Æ " Ò ò NM y . p NM NM F ă % " Y g NM , ¼
F ă ž k ¬ } F ă ¥ x Xož

o ¬ x X " o- interface interface-type interface-number

o ¬ @ f ^ ¢ o- interface-type interface-number y / NM • ° y NM Ú Z k UY © Y ß à Ò ò N Mo • AP Mo • SVI Mo •
Loopback M ^ ož

o ¬ P . F ă o- —

o ¬ x X % " o- ¶ B F ă % "

o ¬ ... 6 - o- + 9 . p NM k ò ç ¥ NM ì t è • k é Ù ¯ è • ß ¥ NM w µ NM F ă % " ož
+ 9 Ò ò NM ê ñ] Æ è • . p NM k + N µ ¥ NM F ă % " ož
... no x X ¥ " í " 6 . p N Mož
... default x X ¥ " 1 ¥ NM NM % " F ă Ê Ò ñ P . F ă ož

ì

z U # F ă ož

z UY 9 ¬ } O è • " . p NM ê ñ µ] Æ " Ò ò NM y . p NM NM O F ă % " Y g NM ,
¼ F ă ž k ¬ } F ă ¥ x Xož

o ¬ x X " o- interface range { port-range | macro macro_name }

o ¬ @ f ^ ¢ o- port-range y / O q • NM • ° y NM Ú Z 8 k UY © Y ß à Ò ò N Mo • AP Mo • SVI Mo • Loopback
M ^ ož

macro_name y / % 2 8 NM • ° # dož

o ¬ P . F ă o- —

o ¬ x X % " o- ¶ B F ă % "

o ¬ ... 6 - o- + 9 . p NM k ò ç NM ì t è • k é Ù ¯ è • ß NM Æ e Ç µ NM O F ă % " ož
+ 9 Ò ò NM ê ñ] Æ è • . p NM k + N µ NM O F ă % " ož
... default x X ¥ " O 1 NM % " F ă Ê Ò ñ P . F ă ož
... # ž ~ k ¬ } " ¶ B F ă % " k ¯ 1 % 2 8 NM • ° * define interface-range
x X g # è macro_name k Æ e Ç * interface range macro macro_name g NM
O F ă ' ò ož

ì

z U # F å ož

z U Y 9 ¬ } ' 4 N M « – “ © ĭ M o ù e %² ž ... ož

o ¬ x X " o-

z "¶BFÅ%" FÅxXkò physical-port dither protectož #+%² Òò€MkÈ¯V#à¿%'€MGÿ-TÙ
 ŌÑk"OòV UY0ñ©İø-€MGÿ-TÙ 'ÎkÆ Òø-3t)\$ek©İkUP€M I 1
 shutdown N Mož

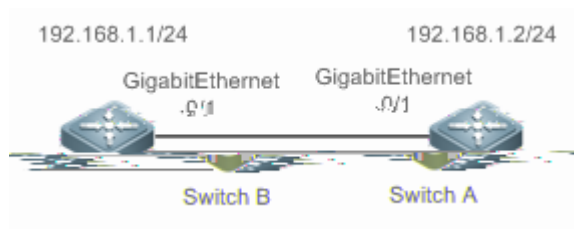
İ Syslog

z "¶BFÅ%" FÅxXkò logging link-updown ò0NMÙÁ'İož #+%² Òò€MkV#à¿kNM1Gÿ
)ÙÁwJk İUY"OòV 0ñNM link ÙÁR up J down 'ÎkAR down J up 'ÎzFÅ no
 logging link-updown ekÇ)V#à¿kOòV 0ñ'Îkª¢¥ ©3o ož

İ

o→àİêĚo-

£ 1-5



o→FÅ•co-

12V—Ō* AE€M g Nož

ãďĚ2V—ŌFÅ%² SVI MkwFÅ,cà< IPª-ož

"2V—ŌãďFÅNM«-K! ož

"2V—Ōãďo LinkTrap ožöž

M o — Ö e k N M GigabitEthernet 0/1 N M « - > © k y M o ù %²

A

```
A# show interfaces gigabitEthernet 0/1
Index(dec):1 (hex):1
GigabitEthernet 0/1 is administratively down , line protocol is DOWN
Hardware is GigabitEthernet, address is 00d0.f865.de9b (bia 00d0.f865.de9b)
Interface address is: no ip address
  MTU 1500 bytes, BW 1000000 Kbit
  Encapsulation protocol is Bridge, loopback not set
  Keepalive interval is 10 sec , set
  Carrier delay is 2 sec
  Rxload is 1/255, Txload is 1/255
  Queue      Transmitted packets      Transmitted bytes      Dropped packets      Dropped
bytes
    0          0                  0                      0                      0
0
    1          0                  0                      0                      0
0
    2          0                  0                      0                      0
0
    3          0                  0                      0                      0
0
    4          0                  0                      0                      0
0
    5          0                  0                      0                      0
0
    6          0                  0                      0                      0
0
    7          4                  440                    0                      0
0
  Switchport attributes:
    interface's description: ""
    lastchange time:0 Day:20 Hour:15 Minute:22 Second
    Priority is 0
    admin medium-type is Copper, oper medium-type is Copper    admin duplex mode is AUTO, oper
duplex is Unknown
    admin speed is AUTO, oper speed is Unknown
    flow control admin status is OFF, flow control oper status is Unknown
    admin negotiation mode is OFF, oper negotiation state is ON
    Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF
  Port-type: access
  Vlan id: 1
  10 seconds input rate 0 bits/sec, 0 packets/sec
  10 seconds output rate 0 bits/sec, 0 packets/sec
  4 packets input, 408 bytes, 0 no buffer, 0 dropped
  Received 0 broadcasts, 0 runts, 0 giants
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
  4 packets output, 408 bytes, 0 underruns , 0 dropped
  0 output errors, 0 collisions, 0 interface resets
A# show interfaces vlan 1
Index(dec):4097 (hex):1001
VLAN 1 is UP , line protocol is DOWN
Hardware is VLAN, address is 00d0.f822.33af (bia 00d0.f822.33af)
Interface address is: 192.168.1.1/24
ARP type: ARPA, ARP Timeout: 3600 seconds
  MTU 1500 bytes, BW 1000000 Kbit
  Encapsulation protocol is Ethernet-II, loopback not set
  Keepalive interval is 10 sec , set
  Carrier delay is 2 sec
  Rxload is 0/255, Txload is 0/255
```

B

```

B# show interfaces gigabitEthernet 0/1
Index(dec):1 (hex):1
GigabitEthernet 0/1 is administratively down , line protocol is DOWN
Hardware is GigabitEthernet
Interface address is: no ip address, address is 00d0.f865.de9b (bia 00d0.f865.de9b)
MTU 1500 bytes, BW 1000000 Kbit
Encapsulation protocol is Bridge, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Rxload is 1/255, Txload is 1/255

```

Queue	Transmitted packets	Transmitted bytes	Dropped packets	Dropped bytes
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	4	440	0	0

```

Switchport attributes:
  interface's description: ""
  lastchange time:0 Day:20 Hour:15 Minute:22 Second
  Priority is 0
  admin medium-type is Copper, oper medium-type is Copper
  admin duplex mode is AUTO, oper duplex is Unknown
  admin speed is AUTO, oper speed is Unknown
  flow control admin status is OFF, flow control oper status is Unknown
  admin negotiation mode is OFF, oper negotiation state is ON
  Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF
Port-type: access
  Vlan id: 1
  10 seconds input rate 0 bits/sec, 0 packets/sec
  10 seconds output rate 0 bits/sec, 0 packets/sec
  4 packets input, 408 bytes, 0 no buffer, 0 dropped
  Received 0 broadcasts, 0 runts, 0 giants
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
  4 packets output, 408 bytes, 0 underruns , 0 dropped
  0 output errors, 0 collisions, 0 interface resets
B# show interfaces vlan 1
Index(dec):4097 (hex):1001
VLAN 1 is UP , line protocol is DOWN
Hardware is VLAN, address is 00d0.f822.33af (bia 00d0.f822.33af)
Interface address is: 192.168.1.2/24
ARP type: ARPA, ARP Timeout: 3600 seconds
MTU 1500 bytes, BW 1000000 Kbit
Encapsulation protocol is Ethernet-II, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Rxload is 0/255, Txload is 0/255

```

z —ož

1.4.2

z 1— Œ* A E € M ê ñ è € M g N y f G* 'ož

z " — Œ ã ð² ... __ N M K Å ož

z —ož

ì

z U # F Å ož

z U Y 9 ¬ } 1 N M ô E C è M ž ... ož

z F Å è C è M e 1 ... ¥ N M g 8 C # ' â | ož

z u 4 8 C A E M F Å ož

o¬ x X "o- no switchport

o¬ @ fª ¢o- "

o¬ Ð . F Å o-

o¬ x X V"o-

o¬ ... g6113 At6 C è M ô E è C A E M ž

z F Å € M v O % " J ž k U k – Ü € M -TÙož
 z u 4 Y ß à Ò ò € M C ü ` M F åž
 o x X "o- flowcontrol { auto | off | on }
 o @ f a ¢o- auto y # Ć v O O òož
 off y ¼ { v O O òož
 on y ø • v O O òož
 o p . F åo- p . Ő Ń k N M v O %² " © off % " k / N M v O p . © ¼ {
 o x X % "o- N M F å % "
 o ... 6 -o- -

ì

z U # F åž
 z F Å € M # Ć œ y J ž k U k – Ü € M -TÙož
 z u 4 Y ß à Ò ò € M C ü ` M F åž
 o x X "o- negotiation mode { on | off }
 o @ f a ¢o- on y # Ć œ y % " on % "ož
 off y # Ć œ y % " off % "ož
 o p . F åo- p . Ő Ń k N M # Ć œ y off % "
 o x X % "o- N M F å % "
 o ... 6 -o- -

ì

MTU

z U # F åž
 z U Y * — å € M MTU Û O ò € M a • v G Â Ý I xož
 z u 4 Y ß à Ò ò € M C S V I M — åž
 o x X "o- mtu num
 o @ f a ¢o- num y64 l9216
 o p . F åo- p . Ő Ń k N M MTU > %² " 1500 -
 o x X % "o- N M % "
 o ... 6 -o- — å N M ñ u 4 MTU k / e è C f G B ã Â Ý x tož) ù Q u 4 — å Ò ò € M y m è t M AP M
 MTUož

ì

z U # F åž
 z %² " Ő Ń k N M k ! > y N M u 4 , ä > , což
 o x X "o- bandwidth kilobits
 o @ f a ¢o- kilobits y Y Y ? a K A Ô % y k 8 1 ñ 2147483647ož
 o p . F åo- p . Ő Ń k N M k ! > %² " y N M • ° , F k A ò + 9 ® Y ß à Ò ò € M k ¥ N M p . k ! >
 1000000 k ® Y ß à Ò ò € M é 10000000
 o x X % "o- N M F å % "
 o ... 6 -o- -

ì

z U # F åž

z F å ú f ž • ž • û x ž k N M Ò ò Ù Á J ž k û ® – Û # ' Ù Á J k 3 F å 0 a ž k N M Ò ò Ù Á J
 é y ö – Û # ' Ù Á J ož
 o¬ x X "o- carrier-delay {[milliseconds] num | up [milliseconds] num }
 o¬ @ f ª ¢o- num y ó • Y a % y k 8 0 ½60 aož
 milliseconds y F å Y D a % y ú f • k 8 0~60000 D aož
 Up y — å ú f y ' Z DCD R Down Ù Á ñ Up Ù Á ž • • žož
 o¬ Þ . F åo- Þ . Œ Ñ k N M Carry-delay › 2 a
 o¬ x X % "o- N M F å % " Œ ú Å W € € € i F ü " ó l ‡ gg4 lbÜ t € ' Ù Ç l ú f • y ' Z

o x X % "o-

Ô Ó % "

o ... 6 -o-

ò ç @ f k é^a P N M Â î' î

o x X J Po-

SwitchA#show interfaces GigabitEthernet 0/1

Index(dec):1 (hex):1

GigabitEthernet 0/1 is DOWN , line protocol is DOWN

Hardware is Broadcom 5464 GigabitEthernet, address is 00d0.f865.de9b (bia 00d0.f865.de9b)

Interface address is: no ip address

MTU 1500 bytes, BW 1000000 Kbit

Encapsulation protocol is Ethernet-II, loopback not set

Keepalive interval is 10 sec , set

Carrier delay is 2 sec

Ethernet attributes:

Last link state& î

s

s

s

s

s

s

Oper Status	Ž ý Û Á
Trouble Cause	€ M EEE Û Á 3 o = œ

2 y^a P ñ Ä N M EEE Û Á 'î ož

Ruijie#show eee interface status

Interface	EEE Support	Admin Status	Oper Status	Remote Status	Trouble Cause
-----------	-------------	--------------	-------------	---------------	---------------

Gi0/1	Yes	Enable	Disable	Disable	Remote Disable
Gi0/2	Yes	Enable	Disable	Unknown	None
Gi0/3	Yes	Enable	Enable	Enable	None
Gi0/4	Yes	Enable	Enable	Enable	None
Gi0/5	Yes	Enable	Enable	Enable	None
Gi0/6	Yes	Enable	Enable	Enable	None
Gi0/7	Yes	Enable	Enable	Enable	None
Gi0/8	Yes	Enable	Enable	Enable	None
Gi0/9	Yes	Enable	Enable	Enable	None
Gi0/10	Yes	Enable	Enable	Enable	None

ì

o- à ì ê Ëo-

£ 1-6



o- F ă • co-

.. Switch A F ă GigabitEthernet 0/1 Access % " A E € M k P . VLAN ID 1 k F ă SVI 1 k w SVI1 F ă IP Y C ñ Switch D è ož

.. Switch B F ă GigabitEthernet 0/1 y GigabitEthernet 0/2 Trunk % " A E € M k Native VLAN ID 1 kw F ă SVI 1 kw SVI 1 F ă IP k F ă GigabitEthernet 0/3 è M w ¥ € M F ă P %² à < IP ož

.. Switch C F ă GigabitEthernet 0/1 Access % " A E € M k P . VLAN ID 1 k F ă SVI 1 k w SVI 1 F ă IP ož

.. Switch D F ă GigabitEthernet 0/1 è € M k w ¥ € M F ă IP Y C ñ Switch A è ož

A

```
A# configure terminal
A(config)# interface GigabitEthernet 0/1
A(config-if-GigabitEthernet 0/1)# switchport mode access
A(config-if-GigabitEthernet 0/1)# switchport access vlan 1
A(config-if-GigabitEthernet 0/1)# exit
A(config)# interface vlan 1
A(config-if-VLAN 1)# ip address 192.168.1.1 255.255.255.0
A(config-if-VLAN 1)# exit
A(config)# ip route 192.168.2.0 255.255.255.0 VLAN 1 192.168.1.2
```

B

```
B# configure terminal
```



```

B(config)# interface GigabitEthernet 0/1
B(config-if-GigabitEthernet 0/1)# switchport mode trunk
B(config-if-GigabitEthernet 0/1)# exit
B(config)# interface GigabitEthernet 0/2
B(config-if-GigabitEthernet 0/2)# switchport mode trunk
B(config-if-GigabitEthernet 0/2)# exit
B(config)# interface vlan 1
B(config-if-VLAN 1)# ip address 192.168.1.2 255.255.255.0
B(config-if-VLAN 1)# exit
B(config)# interface GigabitEthernet 0/3
B(config-if-GigabitEthernet 0/3)# no switchport
B(config-if-GigabitEthernet 0/3)# ip address 192.168.2.2 255.255.255.0
B(config-if-GigabitEthernet 0/3)# exit

```

C

```

C# configure terminal
C(config)# interface GigabitEthernet 0/1
C(config-if-GigabitEthernet 0/1)# port-group 1
C(config-if-GigabitEthernet 0/1)# exit
C(config)# interface aggregateport 1
C(config-if-AggregatePort 1)# switchport mode access
C(config-if-AggregatePort 1)# switchport access vlan 1
C(config-if-AggregatePort 1)# exit
C(config)# interface vlan 1
C(config-if-VLAN 1)# ip address 192.168.1.3 255.255.255.0
C(config-if-VLAN 1)# exit

```

D

```

D# configure terminal
D(config)# interface GigabitEthernet 0/1
D(config-if-GigabitEthernet 0/1)# no switchport
D(config-if-GigabitEthernet 0/1)# ip address 192.168.2.1 255.255.255.0
D(config-if-GigabitEthernet 0/1)# exit
A(config)# ip route 192.168.1.0 255.255.255.0 GigabitEthernet 0/1 192.168.2.2

```

o- à • co- " Ao•Bo•C o•D š V — Œ ã ð g ò à y
A Ping Ć 3 V k- Œ \$ NUM , ; ~ | ož

B y D ;Ping *ož

ò N M Û Á © k 3 Gož

A

```

A# show interfaces gigabitEthernet 0/1
Index(dec):1 (hex):1
GigabitEthernet 0/1 is UP , line protocol is UP
Hardware is GigabitEthernet, address is 00d0.f865.de90 (bia 00d0.f865.de90)
Interface address is: no ip address
MTU 1500 bytes, BW 100000 Kbit
Encapsulation protocol is Ethernet-II, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Ethernet attributes:

Last link state change time: 2012-12-22 14:00:48
Time duration since last link state change: 3 days, 2 hours, 50 minutes, 50 seconds
Priority is 0
Admin medium-type is Copper, oper medium-type is Copper
Admin duplex mode is AUTO, oper duplex is Full
Admin speed is AUTO, oper speed is 100M
Flow control admin status is OFF, flow control oper status is OFF
Admin negotiation mode is OFF, oper negotiation state is ON
Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF
Bridge attributes:
Port-type: access
Vlan id: 1

```

```

Rxload is 1/255, Txload is 1/255
10 seconds input rate 0 bits/sec, 0 packets/sec
10 seconds output rate 67 bits/sec, 0 packets/sec
 362 packets input, 87760 bytes, 0 no buffer, 0 dropped
Received 0 broadcasts, 0 runts, 0 giants
 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
 363 packets output, 82260 bytes, 0 underruns , 0 dropped
 0 output errors, 0 collisions, 0 interface resets

```

B

```

B# show interfaces gigabitEthernet 0/1
Index(dec):1 (hex):1
GigabitEthernet 0/1 is UP , line protocol is UP
Hardware is GigabitEthernet, address is 00d0.f865.de91 (bia 00d0.f865.de91)
Interface address is: no ip address
MTU 1500 bytes, BW 100000 Kbit
Encapsulation protocol is Ethernet-II, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Ethernet attributes:

  Last link state change time: 2012-12-22 14:00:48

  Time duration since last link state change: 3 days, 2 hours, 50 minutes, 50 seconds

  Priority is 0
  Admin medium-type is Copper, oper medium-type is Copper
  Admin duplex mode is AUTO, oper duplex is Full
  Admin speed is AUTO, oper speed is 100M
  Flow control admin status is OFF, flow control oper status is OFF
  Admin negotiation mode is OFF, oper negotiation state is ON
  Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF

Bridge attributes:

  Port-type: trunk
  Native vlan: 1
  Allowed vlan lists: 1-4094
  Active vlan lists: 1

Rxload is 1/255, Txload is 1/255
10 seconds input rate 0 bits/sec, 0 packets/sec
10 seconds output rate 67 bits/sec, 0 packets/sec
 362 packets input, 87760 bytes, 0 no buffer, 0 dropped
Received 0 broadcasts, 0 runts, 0 giants
 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
 363 packets output, 82260 bytes, 0 underruns , 0 dropped
 0 output errors, 0 collisions, 0 interface resets

```

C

```

C# show interfaces gigabitEthernet 0/1
Index(dec):1 (hex):1
GigabitEthernet 0/1 is UP , line protocol is UP
Hardware is GigabitEthernet, address is 00d0.f865.de92 (bia 00d0.f865.de92)
Interface address is: no ip address
MTU 1500 bytes, BW 100000 Kbit
Encapsulation protocol is Ethernet-II, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Ethernet attributes:

  Last link state change time: 2012-12-22 14:00:48

  Time duration since last link state change: 3 days, 2 hours, 50 minutes, 50 seconds

  Priority is 0
  Admin medium-type is Copper, oper medium-type is Copper
  Admin duplex mode is AUTO, oper duplex is Full
  Admin speed is AUTO, oper speed is 100M

```

D

```

Flow control admin status is OFF, flow control oper status is OFF
Admin negotiation mode is OFF, oper negotiation state is ON
Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF
Rxload is 1/255, Txload is 1/255
10 seconds input rate 0 bits/sec, 0 packets/sec
10 seconds output rate 67 bits/sec, 0 packets/sec
362 packets input, 87760 bytes, 0 no buffer, 0 dropped
Received 0 broadcasts, 0 runts, 0 giants
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
363 packets output, 82260 bytes, 0 underruns , 0 dropped
0 output errors, 0 collisions, 0 interface resets

D# show interfaces gigabitEthernet 0/1
Index(dec):1 (hex):1
GigabitEthernet 0/1 is UP , line protocol is UP
Hardware is GigabitEthernet, address is 00d0.f865.de93 (bia 00d0.f865.de93)
Interface address is: 192.168.2.1/24
MTU 1500 bytes, BW 100000 Kbit
Encapsulation protocol is Ethernet-II, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Ethernet attributes:

Last link state change time: 2012-12-22 14:00:48
Time duration since last link state change: 3 days, 2 hours, 50 minutes, 50 seconds
Priority is 0
Admin medium-type is Copper, oper medium-type is Copper
Admin duplex mode is AUTO, oper duplex is Full
Admin speed is AUTO, oper speed is 100M
Flow control admin status is OFF, flow control oper status is OFF
Admin negotiation mode is OFF, oper negotiation state is ON
Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF
Rxload is 1/255, Txload is 1/255
10 seconds input rate 0 bits/sec, 0 packets/sec
10 seconds output rate 67 bits/sec, 0 packets/sec
362 packets input, 87760 bytes, 0 no buffer, 0 dropped
Received 0 broadcasts, 0 runts, 0 giants
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
363 packets output, 82260 bytes, 0 underruns , 0 dropped
0 output errors, 0 collisions, 0 interface resets

```

z —ož

1.5



}••nû¶Q/ û clear a— ¶ÿÙ 7'đo|ž—ý!æ`/nd

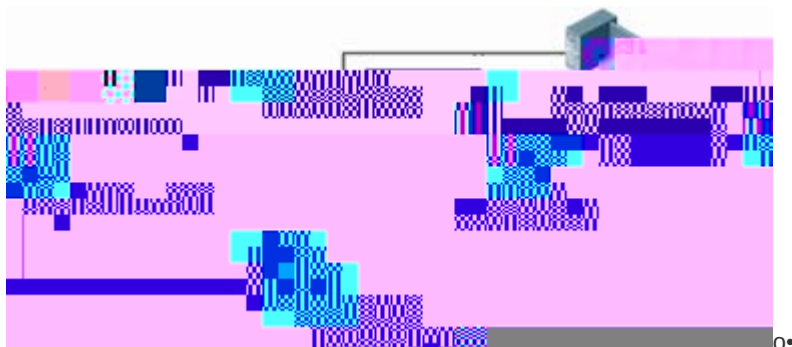
•	x X
Ž"NM Ĩ< >ož	clear counters [interface-type interface-number]
NMF^Öyož	clear interface interface-type interface-number

İ

•	x X
^a P 6 N M ¶ B Ù Á y F å ' îož	show interfaces [interface-type interface-number]
^a P N M Ù Áož	show interfaces [interface-type interface-number] status
^a P N M † Ù Áož	show interfaces [interface-type interface-number] status err-disable
ò 0 € M e è Ù Á J ž • y) fož	show interfaces [interface-type interface-number] link-state-change statistics
^a P U A E N M g ³ è N M h administrative y operational Ù Á ' îož	show interfaces [interface-type interface-number] switchport
^a P 6 N M T F å y N M Ù Áož	show interfaces [interface-type interface-number] description

UserB vñ †e1>• †* — Ö €M GigabitEthernet 0/3 G UserA k4ž — Ö MAC^a-n] " UserA
 MAC^a-kñY †tY%n •"ôGñ GigabitEthernet 0/2 €Mkcž — Ö 1 . UserB MAC^a-k 5â 1
 ñ c © UserC 4žNv ñ UserB G Ě UserA †ož

£ 2-3 Á^a- .5â8



£ 2-4 — ÖMAC^a-n 8

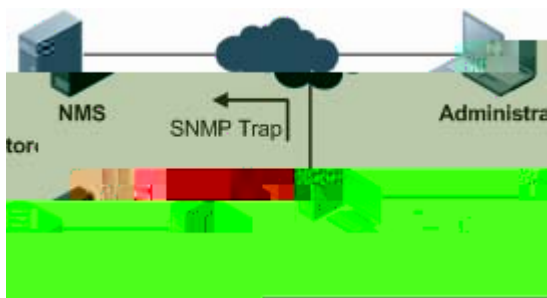
* UserA UserB %2)A; iek— Ö .ñ4 UserA UserB > MAC^a-k\$e UserA UserB \$•
 †A;éJ %n •" gôGk4e UserC 1 ÇNvñ UserA UserB \$• A; †ož

z 8CAE— Ö* Á^a- .k ë †%nôGk×5zn †k×ùàì .} ¿>ož

2.2.2 MAC

— Ö MAC^a-*= * àì'òW•{g NMS h #• àì'òU^4!Oàì— Ö ĭJ Ñòož

£ 2-5 MAC^a-*=



ø• MAC^a-*= ek¢— Ö .ñ%2 • MAC^a-êĭ J%2] .ñ MAC^a-žk%2 F¥ MAC^a
 -J *= 'Î<kDÿkwY SNMP Trap •"1*='ÎG Ě6 NMS(àì'òW•{)ož
 ¢%2 MAC^a-Í *= Dÿk<UY=3%2 4 MAC^a-öœ • ĭ•÷... àìk¢%2 MAC^a-í"
 *= DÿkénP%2 ĭ"á-ĭ ž•ĂZĂ• †G k*oUY• 4 ĭ]Æ 2... àì4ož

2.4

F ¼	F • '&, ¼ x X	
F Á a-	 * "d ¬ £ N _ 0 } d	
	mac-address-learning	F Á B ê N M MAC a- .
	mac-address-table aging-time	F Á Á a- ĭ ž •
F ² Á a-	 * "d ^ G • • • î • • MAC 0 j Ç ' , d	
	mac-address-table static	F ² Á a-
F ĭ a-	 * "d ĭ Ò q 3 d	
	mac-address-table filtering	F ĭ a-
F MAC a- J * =	 * "d ³ Á î • • • - \$ d	
	mac-address-table notification	F Á B MAC a- J * =
	snmp trap mac-notification	F Á N M MAC a- J * =

2.4.1

ě Á a- . k † 3 o % n ô Gož

ĭ MAC

z U # F ă ož

z ò ç ¬ } ¼ { ĭ B MAC a- . k é • ¥ ù g 4 F ă ¼ ož

z A E Ñ — Œ F ă ož

o ¬ x X "o- mac-address-learning { enable | disable }

o ¬ @ f ^ ¢ o- enable y • o ĭ B MAC a- .

disable y ¼ { ĭ B MAC a- .

o ¬ Ɔ . F ă o- ĭ B a- . • o

o ¬ x X % "o- ĭ B % "

o ¬ ... 6 -o- -

æ e MAC 0 } Ÿ O ĭ ~ — s d ò æ e MAC 0 } Ÿ O ' ž " æ e M ¥) û MAC 0 } " ò æ e MAC 0 } Ÿ O — s " j Ç MAC 0 } Ÿ O " Ò d

ĭ MAC

z U # F ă ož ož

z ò ç ¬ } ¼ { N M MAC a- . k é • ¥ ù g 4 F ă ¼ ož

z A E Ñ — Œ F ă ož

o ¬ x X "o- mac-address-learning

o ¬ @ f ^ ¢ o- -

o ¬ Ɔ . F ă o- a- . • o

o ¬ x X % "o- N M % "

o- ... 6-o- NM · Ä © 8 C N M k , A E M o · A P Mož

MAC 0}Ÿ O i ~ — s " ' j Ç h " t DOT1X IP SOURCE GUARD ^ G j Ç æ _ Ÿ j Ç 0}
Ÿ O â Ÿ — s " ½ , ' ž j Ç 0 } Ÿ O j Ç â Ÿ — s & Å % _ Ÿ d

l

z U # F ä ož

z ò ç ¬ } " w Á a - i ž • k é • ¥ ü g 4 F ä ¾ ož

z A E Ñ — Ō F ä ož

o- x X "o- mac-address-table aging-time value

o- @ f a Ç o- value y i ž • ož H > 8 { 0 | 10 l1000000 } k P . > 300 a ož

o- P . F ä o- P . > © 300 a

o- x X % "o- ¶ B % "

o- ... 6-o- Ç — ä ¥ > 0 ž k a - i 1 t ¼ { k . ñ a - 1 k t i ož

¶ ¬ • \$ " · V 0 • G É } Ç G * i â V 1 ¶ • G 2 • d

z ò — Ō © k 3 o . Á a - ož

z * show mac-address-table dynamic c x X ò 0 Á a - ' i ož

z * show mac-address-table aging-time x X ò 0 Á a - i ž • ož

o- x X "o- show mac-address-table dynamic [address mac-address] [interface interface-id] [vlan vlan-id]

o- @ f a Ç o- address mac-address y ò 0 — Ō Ō Á MAC a - ' i ož
interface interface-id y 6 Ō ò N M ê © Aggregate Portož
vlan vlan-id y ò 0 Ō VLAN Á a - ož

o- x X % "o- Ō Ó % " k ¶ B % " k N M % "

o- ... 6-o- -

o- x X J P o-

```
Ruijie# show mac-address-table dynamic
Vlan      MAC Address      Type      Interface
-----
1         0000.0000.0001   DYNAMIC   GigabitEthernet 1/1
1         0001.960c.a740   DYNAMIC   GigabitEthernet 1/1
1         0007.95c7.dff9   DYNAMIC   GigabitEthernet 1/1
1         0007.95cf.eee0   DYNAMIC   GigabitEthernet 1/1
1         0007.95cf.f41f   DYNAMIC   GigabitEthernet 1/1
1         0009.b715.d400   DYNAMIC   GigabitEthernet 1/1
1         0050.bade.63c4   DYNAMIC   GigabitEthernet 1/1
```

< † K y

<	a Ç
Vlan	MAC a - ñ " VLAN
MAC Address	MAC a -
Type	MAC a - • o
Interface	MAC a - ñ " N M

o- x X "o- show mac-address-table aging-time

o- @ f a Ç o- -

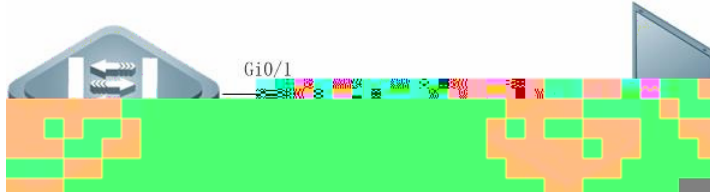
o- x X % "o- Ō Ó % " k ¶ B % " k N M % "

o- ... 6-o- -

o x X J Po- Ruijie# show mac-address-table aging-time
Aging time : 300

i

o à i è Ëo-
£ 2-6



o F Å • co- ø • N M MAC a - .
F Å Á a - i ž • 180 a
í " N M GigabitEthernet 0/1 VLAN 1 ñ Ä Á a -

```
Ruijie# configure terminal
Ruijie(config-if-GigabitEthernet 0/1)# mac-address-learning
Ruijie(config-if-GigabitEthernet 0/1)# exit
Ruijie(config)# mac aging-time 180
Ruijie# clear mac-address-table dynamic interface GigabitEthernet 0/1 vlan 1
```

o à • co- ò 0 N M MAC a - .
ò □ Á a - i ž •
ò 0 N M GigabitEthernet 0/1 VLAN 1 ñ Ä Á a -

```
Ruijie# show mac-address-learning
GigabitEthernet 0/1 learning ability: enable
Ruijie# show mac aging-time
Aging time : 180 seconds
Ruijie# show mac-address-table dynamic interface GigabitEthernet 0/1 vlan 1
```

Vlan	MAC Address	Type	Interface
1	00d0.f800.1001	STATIC	GigabitEthernet 1/1

F Å N M a - . ž k N M Z Ä F Å è 8 C N M k , A E Mo • AP Mož

2.4.2

z F Å ² Á a - k Ç — Ö N à l — Ö MAC a - € M ¼ © ož

i

z U # F Å ožož
z ò ç - } Ç — Ö N à l — Ö MAC a - € M ¼ © k é • ¥ ü g 4 F Å ¼ ož
z A E Ñ — Ö F Å ož
o x X " o- mac-address-table static

```

interface interface-id y 6   Aggregate Portož
P . Z Ä — ä ` ~ 2 Ä a -
P B % "
P ... 6 -0-   P — Ö " vlan-id 6   VLAN   N v ñ Y   mac- address   ) a -   † ž k   † 1 t ô G ñ
interface-id ñ 6   N M ož

```

```

z * x X   show mac-address-table static   a P 2 Ä a - ' î © k 3 Gož
P x X "o-   show mac-address-table static   [ address mac-address ] [interface interface-id ] [ vlan vlan-id ]
P @ f a P o-   address mac-address y ò 0 — Ö   Ö 2 Ä   MAC a - ' î ož
interface interface-id y 6   Aggregate Portož
vlan vlan-id y ò 0 Ö   VLAN   2 Ä a - ož
P x X % "o-   Ö Ó % " k P B % " k N M % "
P ... 6 -0-   -
P x X J Po-

```

```

Ruijie#show mac-address-table static
Vlan    MAC Address    Type    Interface
-----
1       00d0.f800.1001  STATIC  GigabitEthernet 1/1
1       00d0.f800.1002  STATIC  GigabitEthernet 1/1
1       00d0.f800.1003  STATIC  GigabitEthernet 1/1

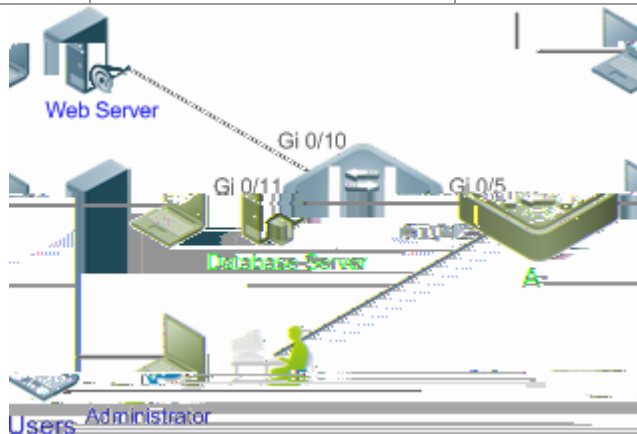
```

ì

î † MAC a - c VLANo• N M + • ¼ © ò n ñ P y

...)	MAC a -	VLAN ID	N M ID
Web Æ ~	00d0.3232.0001	VLAN2	Gi0/10
'î Æ ~	00d0.3232.0002	VLAN2	Gi0/11
à ì ' ò t	00d0.3232.1000	VLAN2	Gi0/12

P à ì ê Eo-
£ 2-7



P F Å • co- 6 n ¾ + •) MAC a - g Mac-address h
6 ¥ a - ñ K VLAN g vlan-id h
N M ID g interface-id h

A

```

A# configure terminal
A(config)# mac-address-table static 00d0.f800.3232.0001 vlan 2 interface gigabitEthernet 0/10
A(config)# mac-address-table static 00d0.f800.3232.0002 vlan 2 interface gigabitEthernet 0/11
A(config)# mac-address-table static 00d0.f800.3232.1000 vlan 2 interface gigabitEthernet 0/12

```

o- à • co-
A

“ A E Ñ ò 0 F å ² Á MAC a -

A# show mac-address-table static

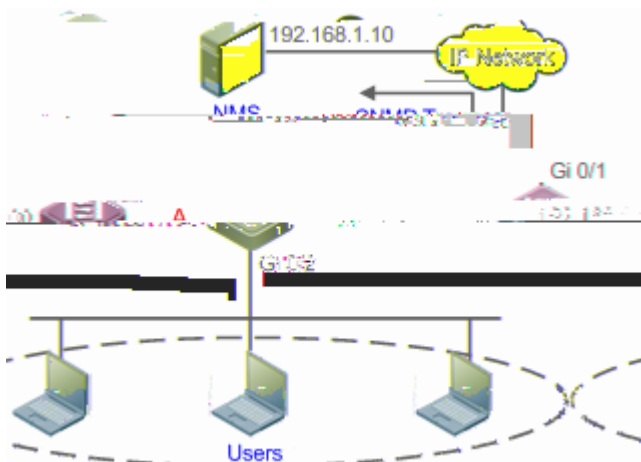
Vlimac-addre AdLe stat/

l

Vlimac-w

Maximum History Size	MAC a - * s 7 W " £ n Â Ý n ¾ f
Current History Size	£ ù " £ Ú) f

o- à ì ê Ëo-
£ 2-8



£ î c Ä B à ì P ð £ ož û î *

Gi0/2 M N ñ A E Ñ ož

4 Ž 9 ' ò t + û î ... à ì Ñ Ñ ' î K O k e È * F ă ñ Y) y

£ A E Ñ û î N M . ñ %² • MAC a - ê î J %²] . ñ a - ž k 1 a - J ' ,

î " £ ñ MAC a - * = 7 W " £ n k ' ' ò t 4 † Â MAC a - J ' î ož

c ž k A E Ñ 1 MAC a - J * = Y SNMP Trap • " 1 * = ' î G Ě 6 NMS(à ì ' ,

ò W • { }

£ A E Ñ û î û Ú ž k @ O 9 ² ? ž • Ä D ý Ý O MAC a - J ' î k × ù à ì ě ož

o- F ă • co-

ø • A E Ñ ¶ B MAC a - * = • ¼ k " Gi0/2 N M F ă MAC a - * = ož

F ă NMS Ñ a - k ... A E Ñ G SNMP Trap * = ož A E Ñ ñ NMS g à ì ' ò W • { h

è U ož

— ă A E Ñ G MAC a - * = ž • • œ 300 a g ó • ž • • œ 1 a h ož

A

```
Ruijie# configure terminal
Ruijie(config)# mac-address-table notification
Ruijie(config)# interface gigabitEthernet 0/2
Ruijie(config-if-GigabitEthernet 0/2)# snmp trap mac-notification added
Ruijie(config-if-GigabitEthernet 0/2)# snmp trap mac-notification removed
Ruijie(config-if-GigabitEthernet 0/2)# exit
Ruijie(config)# snmp-server host 192.168.1.10 traps version 2c comefrom2
Ruijie(config)# snmp-server enable traps
Ruijie(config)# mac-address-table notification interval 300
```

o- à • co-

ò 0 MAC a - * = ¶ B F ă ' î ož

ò 0 N M MAC a - J * = ... Ù Ñ ož

ò 0 N M MAC a - n k w clear mac-address-table dynamic x X % ' Á a - ' î ož

ò 0 MAC a - * = ¶ B F ă ' î ož

ò 0 MAC a - J * = ' î 7 W " £ n ož

A

```
Ruijie# show mac-address-table notification
MAC Notification Feature : Enabled
Interval(Sec): 300
Maximum History Size : 50
Current History Size : 0
Ruijie# show mac-address-table notification interface GigabitEthernet 0/2
```

```

Interface          MAC Added Trap    MAC Removed Trap
-----
GigabitEthernet 0/2  Enabled          Enabled
Ruijie# show mac-address-table interface GigabitEthernet 0/2
Vlan      MAC Address      Type      Interface
-----
1         00d0.3232.0001      DYNAMIC   GigabitEthernet 0/2
Ruijie# show mac-address-table notification
MAC Notification Feature : Enabled
Interval(Sec): 300
Maximum History Size : 50
Current History Size : 1
Ruijie# show mac-address-table notification history
History Index : 0
Entry Timestamp: 221683
MAC Changed Message :
Operation:DEL Vlan:1 MAC Addr: 00d0.3232.0003 GigabitEthernet 0/2

```

—ož

2.5



3 Aggregate Port

o→ h Ko- -

LACP NTjÇjæ jÇ híěÿÜý!½jæ|• cPjÇ™M¥)û

LACP jæ^G d



,<s , NTÇ|&gàÜ{
AP /Ü{d

AP _ÿ jÇ âÿÜjÇ|&A_

AP g à LACP AP g à ¶A_ AP g à LACP

ì AP

9©Ĭ È ètMfOÄ'òk©ĬÈu4ètMf

¸ Ó

3.3.1

AP eèü`•"ã \_k%²\_©\* ôWFåk/²Á AP z P%²\_©\* LACP #' Áü`ož
z ²Á AP
²Á AP ë•%kïQ}16 Òò€M* FåxX μñc%² ü`Á AP k<UY ëÚÚÒòeè ü`ož
èt€M%²š μü`Áek/U@ AP ü`Á fGvG kw@ ü`Á vO®kož
z Á

z > MAC ê) MAC^a -

z > MAC+) MAC^a -

z > IP

	aggregateport member linktrap	ø•G AP è t M LinkTrap *s ož
FåvOuk%	 ¶* "d G ò•jæ]¾ h^ùf'd	
	aggregateport load-balance	—åAP ¶B ê % AP M v O u k 'což

3.4.1 AP

z * ôW• AP Mèt k1Ú Ò ò€MÇ kY ëëëü`ož

z ü`e .peèk!©èteèk! Èyož

z ¢AP %²Úèteè••žk©İk1¥èteè vO ¢ăFñ AP ğ Ä|èteè ož

z QÄÒ ò€M ðª• μ AP Mož

z cPĀ•°êñ c€M•° NM ¢• μ c%² AP Mož

z 8C€MQ μ8C APk C€MQ μ C APz mètM AP M ¢•wJ8C/ C KĀož

z %² €M μ APk€M KĀ1t AP KĀñHWož

z %² €MR AP í"ké€M KĀ1ÊÖ μ AP ù KĀož

ò¢QjÇ|& AP jÇ ëÿÜÝ AP Ç ëÿ N»¢NÆă•â m } AP NTÇh)û " g àÜ
 "æ_“Òþ AP NTÇh d i¢Ôrô a—gà_Ÿ " shutdown ä no shutdown "a—ăÔ ö¶
 » [{} AP NTÇh " —"Ÿ“ÒdN» }° AP NTÇ " 'TIn~_Ÿ‘Đÿ òG¾î
 [æ_] AP NTÇh“Ò É)ûþ ò "d

```

o~ @ f ^ ċo- port-group ap-number: AP N M Ú Z
o~ Ɔ . F ăo- Y Ɔ à € M K 9 ` ~ ^ Á AP è t M
o~ x X % "o- Y Ɔ à N M F ă % "
o~ ... 6 -o- " N M % " k ĩ U Y * port-group F ă x X g AP M • è t Mož " N M F ă % " ... no
port-group x X 1 4 è t M Ɔ APož

```

```

I ] ¾ j æ _ Ÿ Ɔ ( } ] ¾ f j • • h ' s K " A _ AP N T Ć d
Ü T 1 j Ć | & v Q AP Ć ò j Ć | ± ¶ AP Ć Ü { " T 1 j Ć h P • - ' " ¶ Ÿ V K ĩ ~ " d
â ½ _ Ÿ s AP Ć N T P " % 8 ° ' N â ½ Ü ® Ü Đ } j Ć ¶ AP Ć Ü { è ĩ É ò j Ć " d
AP N T j Ć ¶ AP Ć Ü { - N T 1 j Ć j Ć V „ shutdown » ½ { £ , ¾ 9 • ' } ò é J M Ó
( | } Ć f ' • ũ no shutdown a — 7 í ° Ÿ Ć d
I ] ¾ j æ _ Ÿ Ɔ ( } ] ¾ f j • • h ' s K " FC A _ AP N T Ć d

```

İ AP AP

```

z ñ U # F ăož
z ò Ć ~ } o AP M C è ^ k A ò ~ } " AP M F ă IP ^ - k ê ñ F ă ^ Á è n ¾ ^ k ~ } ^ 1 8 C
AP M ô C AP M k Ć " C AP M o è ^ ož
z ¥ U " C A E Ñ ê ñ — Ć AC ^ u 4 8 o • C y AP — Ō F ăož
o~ x X "o- no switchport
o~ @ f ^ ċo- -
o~ Ɔ . F ăo- " u 4 8 o • C y N M 8 o • C ô E — Ō k AP M Ɔ . 8 C Mož
o~ x X % "o- AP N M F ă % "
o~ ... 6 -o- L 3 AP © C — Ō ð u 4 k ñ Ä 8 C — Ō ® u 4 ož
s 8 • • " ' • • â [ • _ Ÿ AP Ć „ — Ü " • ¾ Ć Q 8 AP Ć î • AP Ć „ — Ü " ¾ Ć Q •
AP Ć d

```

İ AP

```

z U # F ăož
z ò Ć — Ō u 4 F ă Ÿ N M k é - c ž u 4 " AP M * interface aggregateport sub-ap-number è • , •
Ÿ N Mož
z ¥ U " C A E Ñ ^ u 4 C y AP — Ō F ăož
o~ x X "o- interface aggregateport sub-ap-number
o~ @ f ^ ċo- sub-ap-number: AP Ÿ N M Ú Z
o~ Ɔ . F ăo- Ɔ . AP M Z Ä ` ~ Ÿ N Mož
o~ x X % "o- AP N M F ă % "
o~ ... 6 -o- " u 4 8 o • C y N M 8 o • C ô E — Ō k AP M N M ~ } ^ ô E C M k õ ^ a • ¥ AP
M N M è • Ÿ N Mož

```

```

z * show running x X ò 0 , • F ăož
z * show aggregateport summary x X ò 0 AP M F ă Ō Ñ ož
o~ x X "o- show aggregateport aggregate-port-number [ load-balance | summary ]
o~ @ f ^ ċo- aggregate-port-number AP N M Z
load-balance ^ P AP v O u k ' c

```

summary aP AP ?Úeè d}'Î
 o- x X % "o- _ % " @ U ü g
 o- ... 6 -o- ò ç Z Ä 6 AP NM Z k é ñ Ä AP 'Î 1 t a P ß Ü
 o- x X J Po-

Ruijie# show aggregateport 1 summary

AggregatePort	MaxPorts	SwitchPort	Mode	Load balance	Ports
Ag18	Enabled	ACCESS	dst-mac	Gi0/2	

1 AP

o- à î ê Ëo-
 £ 3-3



o- F å • co- 1 SwitchA € M GigabitEthernet 1/1 y GigabitEthernet 1/2 μ ñ ² Á AP 3 ož
 1 SwitchB € M GigabitEthernet 2/1 y GigabitEthernet 2/2 μ ñ ² Á AP 3 ož

SwitchA SwitchA#configure terminal
 SwitchA(config)#interface range GigabitEthernet 1/1-2
 SwitchA(config-if-range)# port-group 3

SwitchB SwitchB#configure terminal
 SwitchB(config)#interface range GigabitEthernet 2/1-2
 SwitchB(config-if-range)# port-group 3

o- à • co- * show aggregateport summary ò 0 AP M y è t M + • ¼ © © k 3 Gož
 SwitchA SwitchA#show aggregateport summary

AggregatePort	MaxPorts	SwitchPort	Mode	Ports
Ag3	8	Enabled	ACCESS	Gi1/1,Gi1/2

SwitchB SwitchB#show aggregateport summary

AggregatePort	MaxPorts	SwitchPort	Mode	Ports
Ag3	8	Enabled	ACCESS	Gi2/1,Gi2/2

3.4.2 LACP

z , — Ö ÿ G LACP # Æ k Á ü ` e è ož

z ü ` e . pe è k ! © è te è k ! È yož

z ¢ AP %² Ú è te è • • ž k © Ĭ k 1 ¥ è te è v O a ā F ñ AP ç Ä | è te è ož

z x Ý ž % " ž k e è { ž e 90 a ò ß = ñ z F å ? Ý ž % " ž k 3 a U < ß = ñ ož

z 1⁻*€M μî LACP AP Mek¢¥€M Ç)R LACP AP M ßžk⁻*€M =⁻,¼ F ă U kÊÖ
 p. F ă ož c + LACP AP M èt =Ă F ă Ô ò•"Ă ñ ckœ4•'€MR LACP AP M ß
 ek•ò0wG•€M F ă ož

z wJ LACP ©İi⁻'U -Ü LACP èt€M ßëtü`Ç ü`è »ož

z wJ LACP ètM €Mi⁻'U -Ü¥ LACP ètM+• ü`Ă ñĂ€M ßëtü`Ç ü`è »ož

İ LACP

z .Ă F ă ož

z 16 Ô ò€M F ă LACP ètMož"u4 LACP — Ő F ă ož ... LACP ž-}F ă +• LACP
 ètMož

o→ x X "o- port-group key-numbermode { active | passive }

o→ @ f^a ¢o- Key-number : ü`Ă 'ò key kKey-number H>8 ÿG cD}u4 ü`Ă fO còJk
 Key-number ><©+• LACP AP M €M Zož
 active: nP€MY %" μ Ă ü`Ă
 passive: %" nP€MY t %" μ ü`Ă

o→ p. F ă o- Ô ò€M K9`~ LACP ètM

o→ x X % "o- Ô òNM F ă % "

o→ ... 6-o- "NM %" k İUY* μ F ă xXg LACP AP M • ètMož
 I LACP _Ÿp(}]¾fj ••h 'sK " LACP NTÇd

İ LACP . "I

z ñ U# F ă ož

z "→}²...¥— Ő©İ ID i⁻'ž gF ă kF ă >p4k©İ ID i⁻'p ă k©İ ID i⁻'ă — Ői⁻#+ü
 `€Mož

z U"u4 LACP — Ő F ă ¥ ož

o→ x X "o- lacp system-priority system-priority

o→ @ f^a ¢o- system-priority yLACP ©İ i⁻'kU#8 0-65535 k ó•i⁻ 32768ož

o→ p. F ă o- LACP ©İ i⁻ 32768à Ô òNM F ă % "
 tĐZEtàTĐ,Pi@@€6°•i@@•s Æ€đ ĐUPZ€wPs@ LACP%Uđ€Cp%ADIPESUü4

0- x X % "0- Ò ò N M F å % "
0- ... 6-0- "¶ B % " k ĭ U Y * µ F å x X F å LACP © ĭ i ´ o ž " N M F å % " ... no lacp
port-priority x X 1 LACP © ĭ i ´ Ê Ö ñ þ . o ž

- ✓ LACP

z U # F aož

z "¬}¾ žβ=eè{ž «° k¬}Fǎè?Ýž% "ožFǎ?Ýž%"žk€M 3 a v ÝžkxÝž%"k
€M 90 a v Ýžož

z U"u4 LACP — Õ Få¥ kAòAEÑD}^oż

o- x X "o- lacp short-timeout

$$0 \neg @ f^a \text{ } \text{ } 0 -$$

o- p . F åo- LACP è t M € M Ý ž % " x Ý ž

0- x X % "0- N M F å % "

0- ... 6 -0- N " Ò ò M u 4ož
" N M F å % " ... no lacp short-timeout x X 1 LACP Ý ž % " Ê Ö þ . xož

z * show running x X ò 0 , • F a o ž

```
z * show lacp summary x X 0 LACP e è Ù Áóž
```

o- x X "o- show lacp summary [key-number]

```
0- @ f a 0- key-name y 6 LACP AP N M Z
```

0-1 X X % "0- _ % " ® U ü g

0- ... 6 -0- ò ç Z Ä 6 key-number k é ñ Ä LACP AP e è ü ` Ù Á ' î 1 t ^a P ß Û ož

0- x X J P0-

```
Ruijie(config)#show
System Id:32768, 0. . 3fb.. . -
F      / Š           ĩ       eēue m τ Usy l'
F      Š            : equē m ACN1 yō t Ö-
A      Š            n    Y m τ H l M x A ē l Ō / Š     $     $   evice is    1 /   sive mode.

Ag reg   ep d t   :
L yal    lf rmati n:

LACN          $         r    $        D m / $         I'
P   D m / $     g / $                $      ε              $      Š y    $      ϕ κ κ               e

-----

Gi /1SAbndl    960x 0x M0x3d
Gi /2SAbndl    960x 0x M0x3d


P   tner inf   m   i   n:
    $     $     $     $     Š
P   D m / $     g / $             ri f / $     Š     $     $     $     $     $     $     $     š or
                                          / $     $     $     f / $     $     Tate

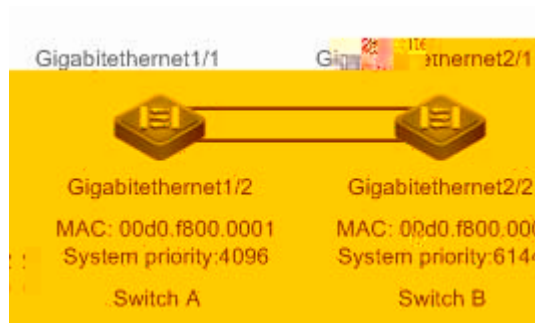
-----

Gi0/1         r SA          $     6 4 0         r 0.d..f 0...00x3d         x3 $         x1 $

Gi0/3         r SA          $     6 4 0         r 0.d..f 0...0.1 M         x3 $         x3 $         0x d
```

i LACP

o- à l'ê Eo-
£ 3-4



o- F 5 • co-

```

SwitchA -> LACP system-priority 4096
SwitchA # M GigabitEthernet1/1 y GigabitEthernet1/2 o Á e è ü ` # ' k1 ¿ μ
ñ LACP 3 ož
SwitchB -> LACP system-priority 61440
SwitchB # M GigabitEthernet2/1 y GigabitEthernet2/2 o Á e è ü ` # ' k1 ¿ μ
LACP 3 ož

```

SwitchA

```

SwitchA# configure terminal
SwitchA(config)# lacp system-priority 4096
SwitchA(config)# interface range GigabitEthernet 1/1-2
SwitchA(config-if-range)# port-group 3 mode active
SwitchA(config-if-range)# end

```

SwitchB

```

SwitchB# configure terminal
SwitchB(config)# lacp system-priority 61440
SwitchB(config)# interface range GigabitEthernet 2/1-2
SwitchB(config-if-range)# port-group 3 mode active
SwitchB(config-if-range)# end

```

o- à • co-

```

* show lacp summary 3 0 LACP y è t M + • ¼ © © k 3 Gož

```

SwitchA

```

SwitchA#show LACP summary 3
System Id:32768, 00d0.f8fb.0001
Flags: S - Device is requesting Slow LACPDUs
       F - Device is requesting Fast LACPDUs.
       A - Device is in active mode.           P - Device is in passive mode.
Aggregate port 3:
Local information:
LACP port      Oper   Port   Port
Port   Flags   State   Priority   Key   Number State
-----
Gi1/1   SA      bndl    32768     0x3   0x10x3d
Gi1/2   SA      bndl    32768     0x3   0x20x3d
Partner information:
Port   Flags   LACP port   Dev ID   Oper   Port   Port
      Priority   ID       Key   NumberState
-----
Gi1/1   SA      32768     00d0.f800.0002  0x3   0x1   0x3d
Gi1/2   SA      32768     00d0.f800.0002  0x3   0x2   0x3d

```

SwitchB

Gi2/1	SA	bndl	32768	0x3	0x10x3d
Gi2/2	SA	bndl	32768	0x3	0x20x3d
Partner information:					
Port	Flags	LACP port Priority	Dev ID	Oper Key	Port NumberState
Gi2/1	SA	32768	00d0.f800.0001	0x3	0x1 0x3d
Gi2/2	SA	32768	00d0.f800.0001	0x3	0x2 0x3d

3.4.3 AP LinkTrap

č ü ` e è G ŷ J ž k © ĭ k G ß , • LinkTrap * s .

AP LinkTrap

z "NM%" F ă ož U # F ă ož AP M LinkTrap * s ó • • o k " 4 Ő Ń k AP M e è Û Á ê ñ # ' Û Á
G ŷ J ž k — Ő k G ß LinkTrap * s z č ĩ } } ¥ AP M LinkTrap * s ž k F ă ¼ { ¥ ož
z U " ñ Ä u 4 AP — Ő F ă ¥ ož
o ĩ x X " o- snmp trap link-status
o ĩ @ f ^ č o- -
o ĩ P . F ă o- LinkTrap * s ó • • o
o ĩ x X % " o- AP N M F ă % "
o ĩ ... 6 - o- "NM%" k ĩ U Y + 6 AP M — ă © k G LinkTrap * s ož č ¥ ø • k AP M G ŷ Link
Û Á J ž 1 G ß LinkTrap * s k F \$ é Gož P . Ő Ń k ¥ © ø • ož ĩ U Y " 6 AP M
NM%" k * F ă no snmp trap link-status x X ¼ { 6 AP M LinkTrap * s ož
AP è t M u 4 " € M % " ø • LinkTrap * s ož ĩ } * μ F ă k / " ¶ B % " F ă
aggregateport member linktrap x X Ū ø • AP è t M LinkTrap * s ož

AP LinkTrap

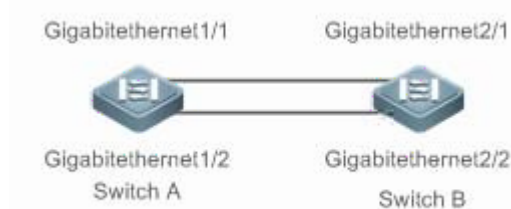
z U # F ă ož è t M LinkTrap ó • ¼ { k č ĩ } ... è t M LinkTrap * s ž k F ă • ož
z U " ñ Ä u 4 AP — Ő F ă ¥ ož
o ĩ x X " o- . C i s ĩ v ` t ă o p ` Ő " ă H @ 0 Ā o ĩ x X Ū Ő Ő ă q = ă P 7 6 - o- F ò Ő Ő Ā H P • s ` b Ő Ő Ā F \$ é G 0 D U P Z € o | @ < g Ū { k č 0 D U P € n % Ā

z * show running x X 0 , • F ăž

Z • LinkTrap * s Ō Ń k * MIB ÷ ^ U Y ! O Ń AP M ê è t M LinkTrap * sož

ĭ AP LinkTrap Ȳ

o→ à ĭ ê Ěo-
£ 3-5



o→ F ă • co- 1 SwitchA € M GigabitEthernet 1/1 y GigabitEthernet 1/2 μ ñ ² Á AP 3 ož

1 SwitchB € M GigabitEthernet 2/1 y GigabitEthernet 2/2 μ ñ ² Á AP 3 ož

.. SwitchA F ă Ź AP 3 LinkTrap Ȳ ~ * ✓ LinkTrap Ȳ ož

.. SwitchB F ă Ź AP 3 LinkTrap Ȳ ~ * ✓ LinkTrap Ȳ ož

SwitchA

```

SwitchA# configure terminal
SwitchA(config)#interface range GigabitEthernet 1/1-2
SwitchA(config-if-range)# port-group 3
SwitchA(config-if-range)# exit
SwitchA(config)#aggregateport member linktrap
SwitchA(config)#interface Aggregateport3
SwitchA(config-if-AggregatePort 3)#nosnmp trap link-status
  
```

SwitchB

```

SwitchB# configure terminal
SwitchB(config)#interface range GigabitEthernet 2/1-2
SwitchB(config-if-range)# port-group 3
SwitchB(config-if-range)# exit
SwitchB(config)#aggregateport member linktrap
SwitchB(config)#interface Aggregateport3
SwitchB(config-if-AggregatePort 3)#nosnmp trap link-status
  
```

o→ à • co- * show running 0 0 AP v O ® k ' c F ă © k 3 Gož

SwitchA

```

SwitchA#show run | include AggregatePort 3
  
```

```

&XU UHQW FRQILJXUDWLRQ DÀ ¼!dq<ÖSjö
  
```

3.4.4

© Ĩ k Ÿ G 6 v O u k ' c k + Ÿ μ † g v O ã F o ž c % 2 † v 1 j * c % 2 Ú e è Ÿ ß k c † v 1 u @ ã
F ñ _ e è o ž " Í % " k — Œ Ĩ Ĩ • G † • ° k Æ e Ÿ G 6 † < g v O @ k o ž

ì AP

z U # F ă k € - } w J AP v O u k ' c Y è ¾ ñ v O @ k ž k - } F ă ¥ o ž

z U " ñ Ä u 4 AP — Œ F ă ¥ o ž

o - x X " o - aggregateport load-balance {dst-mac | src-mac | src-dst-mac | dst-ip | src-ip | src-dst-ip | src-l4port | dst-l4port | src-dst-l4port }

o - @ f ^ € o - dst-mac y Ÿ G Ÿ μ †) MAC ^ a - g v O ã F o ž

src-mac y Ÿ G Ÿ μ † > MAC ^ a - g v O ã F o ž

src-dst-ip y Ÿ G > IP) IP g v O ã F o ž

dst-ip y Ÿ G Ÿ μ †) IP ^ a - g v O ã F o ž

src-ip y Ÿ G Ÿ μ † > IP ^ a - g v O ã F o ž

src-dst-mac y Ÿ G > MAC) MAC g v O ã F o ž

src-l4port y Ÿ G L 4 C > € M Z g v O ã F o ž

dst-l4port y Ÿ G L 4 C) € M Z g v O ã F o ž

src-dst-l4port y Ÿ G L 4 C > € M Z L 4 C) € M Z g v O ã F o ž

o - Ɔ . F ă o - AP v O @ k % " Â 9 > y) MAC (ò A E Ñ D } © ç) ê ñ Â 9 > y) IP (ò à ¼ D } © ç) v
O @ k • " o ž

o - x X % " o - ¶ B F ă % "

o - ... 6 - o - } 1 AP v O u k — â Ê Œ ñ Ɔ . > k U Y " ¶ B F ă % " ... no aggregateport load-balance x
X o ž

" Ĩ ? u 4 Â 9 6 AP M F ă v O u k ' c D } k v O u k ' c F ă x X - U Y μ AP M

N M % " g F ă k F ă Ÿ | e k ¥ AP M < k Y • F ă v O u k ' c g W • o ž c ý k "

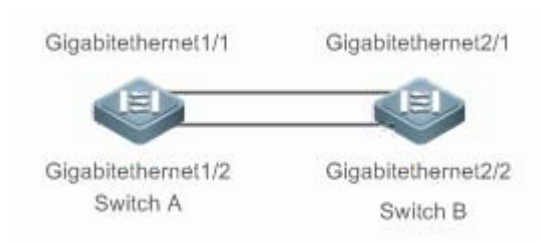
? D } μ k Ĩ U Y " AP M N M % " ... no aggregateport load-balance x X ... ¥ AP M F

ă v O u k ' c â | k ò Ÿ | € ù — Œ Ÿ | AP ¶ B v O u k ' c o ž

} [n AP Ç " h ^ ù ! 6 h aggregateport load-balance . [} AP Ç Ç f ' •
) û " d

ì

o - à ì ê Ë o -
£ 3-6



o→ F 6 • co- 1 SwitchA € M GigabitEthernet 1/1 y GigabitEthernet 1/2 μ ñ ² Á AP 3 ož
 1 SwitchB € M GigabitEthernet 2/1 y GigabitEthernet 2/2 μ ñ ² Á AP 3 ož
 " SwitchA F 6 ¶ B AP v O ® k % " Â 9 > MAC ^a - v O ® k • "ož
 " SwitchB F 6 ¶ B AP v O ® k % " Â 9) MAC ^a - v O ® k • "ož

SwitchA SwitchA# configure terminal
 SwitchA(config)#interface range GigabitEthernet 1/1-2
 SwitchA(config-if-range)# port-group 3
 SwitchA(config-if-range)# exit
 SwitchA(config)# aggregateport load-balance src-mac

SwitchB SwitchB# configure terminal
 SwitchB(config)#interface range GigabitEthernet 2/1-2
 SwitchB(config-if-range)# port-group 3
 SwitchB(config-if-range)# exit
 SwitchB(config)# aggregateport load-balance dst-mac

o→ à • co- * show aggregateport load-balance ò 0 AP v O ® k ' c F 6 © k 3 Gož

SwitchA SwitchA#show aggregatePort load-balance

Load-balance : **Source MAC**

SwitchB SwitchB#show aggregatePort load-balance

Load-balance : **Destination MAC**

3.4.5 AP

z w J ¢ ù © Ĩ u 4 Â Ý U é ĩ ũ Â Â%0ÚÂ TQfX P A~Pz•V°f0é ĩ ũP <"S EX ù © Ĩ u 4 èT E 4`žPz•V°f0"vùâ ÂÀ1 t Â10 \$ù € kðA

```

z      *      show running  x X ò 0 , • F åž
z      *      show aggregateport capacity  x X ò 0 ¢ ù  AP  O % " Y C  AP M  O ...  Œ Œž
o¬ x X "o-      show aggregateport capacity
o¬ @ f ¢ o-      -
o¬ x X % "o-      _ % " ® U ù g
o¬ ... 6 -o-      -
o¬ x X J Po-

```


Available Capacity Mode ' 256*64.
 Total Number : 256, Used: 1, Available: 255.

3.5

•	x X
ò 0 LACP e è ü ` Ù Á kU 6 a P Ô ü ` Á ' î k @ f key-numebr n P LACP ü ` Á IDož	show lacp summary [key-numebr]
a P AP M d } ' î ê v O u k ' což	show aggregateport [ap-number] { load-balance summary }



4 VLAN

4.1

VLAN © Z' B ž à gVirtual Local Area Network h • f k © "%² Ò ò à ì æ ã ß Ů . p à lož à ì + • 9

ISO % ° † 8 C à lož

VLAN Ä 5 y ¯ * Ò ò à ì c ý K Å k " 4 Z Ä Ò ò y ä ' ò k y ¯ * B ž à %² ý ož † 8 C % n o • z n y Ů ì "

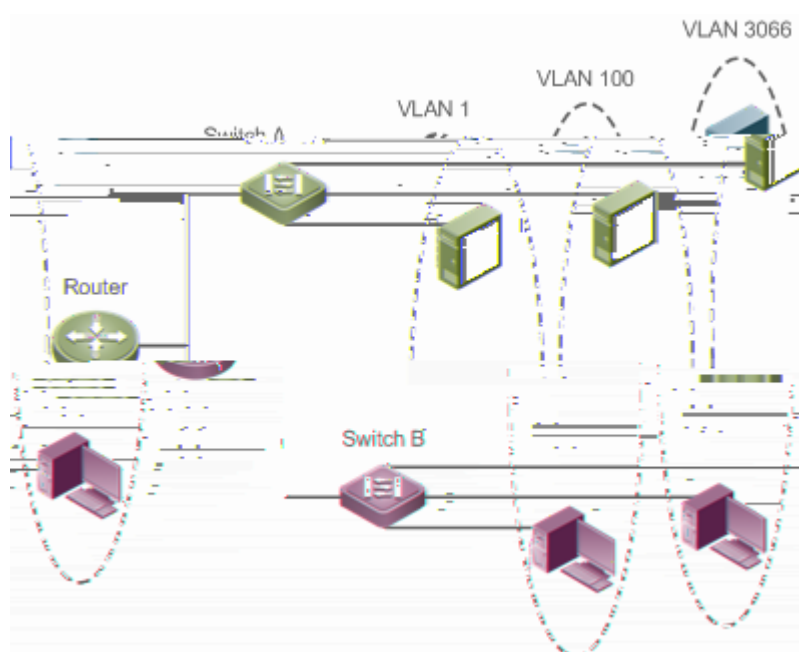
%² VLAN Ä ô G o • ý • k ò k + N μ ž U VLAN \$ ož

U Y %² € M # %² VLAN è t k ñ Ä N ñ Ô € M Ä € C © Z ' à ì %² B ä k w ... à ì U Y u

4 Ů VLAN ož ¢ " VLAN í o • í " y " w ï ž ~ k • R Ò ò ² ... à ì F ä ož VLAN \$ • * ' • Ä * C

— Ō k • £ ož

£ 4-1

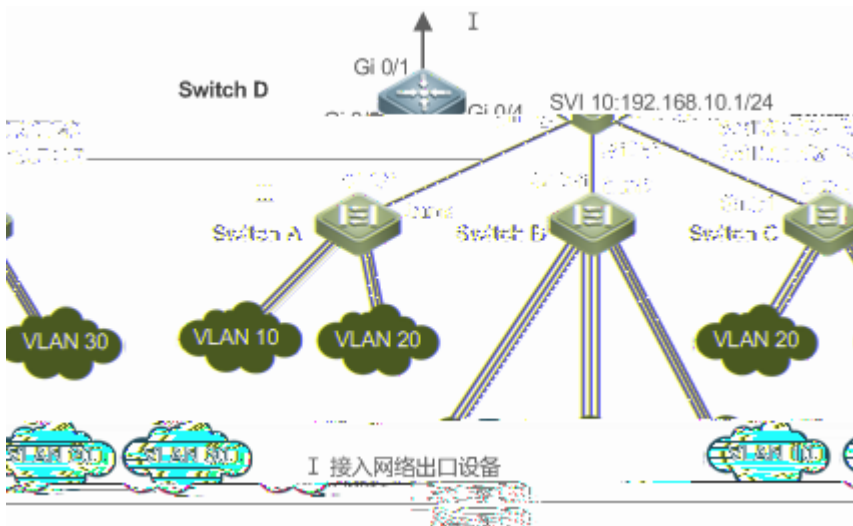


z IEEE 802.1Q

4.2

Á ° •	« ° T
<u>< 2 ' 4 • 8 C æ Y o • C ;</u>	ĩ Ä à t æ ã Ů VLAN k ë , ; • 2 C æ Y k VLAN • * 3 C p ¶ A E Ñ IP ô G ë ÿ à ; ož

4.2.1 VLAN



o- h Ko- Switch A o•Switch B o•Switch C N μ A E Ñ ož

“ p ¶ A E Ñ F ă 3 VLAN k F ă N μ A E Ñ € M trunk M k w 6 • U vlan ç n k ë 2 C œ Y z

“ p ¶ A E Ñ F ă 3 SVI M k ă đ • 3 VLAN + • IP ý à à ¼ N M k F ă + • IP a - z

ă đ “ 3 V N μ A E Ñ ë • VLAN k _ VLAN ă F Access M k 6 p ¶ A E Ñ trunk Mož

z “ Intranet * æ ă Ű VLAN k ë VLAN • 8 C œ Yož

z C A E — Ő F ă SVI N M k ë VLAN \$ • C * ' ož

4.3

1 VLAN

VLAN © Z ' B ĺ à g Virtual Local Area Network h • f k © "%² Ò ò à ĩ æ ă ß Ű . p à lož

VLAN Ä 5 y ¯

* Ò ò à ĩ c ý K Å k " 4 Z Ä Ò ò y ă ' ò k y ¯ * B ĺ à %² ý ož † 8 C % n o • z n y Ű n l " %²

VLAN Ä

ô Go • ý • k ò k + N μ ĺ U VLAN \$ ož

! 6 [VLAN @ 6 IEEE802.1Q ³ y « • [4094 Q VLAN(VLAN ID 1-4094) c/ VLAN 1 ¾ â ¶ W , o
VLAN d

¶ " VLAN ID ³ 1-4094 d

ò ÷ Ñ ‡ W â Æ ă • , Ä Ű ² M — Û VLAN ž G đ o d

1 VLAN

U Y * F ă %² € M VLAN è t • ° k Ű G € M * Ä ý I k Y C € M U Y K 9 Ű 5

VLAN ož ¼ 9

VLAN è t • ° ĩ Ä a ç k - 0 n y

€ M • °	•
Access € M	%² Access € M k Q K 9 %² VLAN k w © * ô W — ă 6 VLAN ož
Trunk € M g 802.1Q h	%² Trunk M k " p . Ő Ñ © K 9 ĩ — Ő ñ Ä VLAN k Ű ô G ñ Ä VLAN I k - U Y * — ă • U VLAN ç n (Allowed-VLANs) Ű Y ' ò ož
Uplink € M	%² Uplink M k " p . Ő Ñ © K 9 ĩ — Ő ñ Ä VLAN k Ű ô G ñ Ä VLAN I k w Y tag • " ô G native-vlan lož

4.4.1 VLAN

```

z  %2 VLAN © Y VLAN ID Ũ ö æ ož " — Œ k Ó U Y • o • í " o • " w VLAN2-4094 k ò VLAN 1 © — Œ è
• k w U t í " ož U Y " N M F å % " F å %2 € M VLAN è t • ° ê µ o • g ß %2 VLAN ož

```

```

z  —

```

```

|      vlan

```

```

z  . À F åž
z  ¢ F ^ Ĭ > á Œ Ñ k © Ĭ 1 > è • < 2 ' 4 â Â ' Ĭ ož
z  ... vlan vlan-id x X • %2 • VLAN è ñ µ VLAN % " ož
z  A E Ñ — Œ F åž
o- x X "o-      vlan vlan-id
o- @ f ^ ¢ o-      vlan-id: VLAN vid k 8
o- Þ . F å o-      VLAN 1 — Œ è • k w U t í "
o- x X % "o-      ¶ B F å % "
o- ... 6 -o-      ò ç Ÿ µ © %2 • VLAN ID k é — Œ k è • %2 VLAN k ò ç Ÿ µ © ] Æ " VLAN ID k é " w ,
• VLAN ož ... novlan vlan-id x X U Y í " vlan k ç " a • í " < 2 ' 4 Ä y ó • < 2 ' 4 o • F å 9 < /
< 2 ' 4 o • 9 ; ( < 2 ' 4 ^ ož

```

```

|      vlan

```

```

z  U # F åž
z  Ĭ 1 < 2 ' 4 M x d ç U < 2 ' 4 Þ . d ož
z  A E Ñ — Œ F åž
o- x X "o-      name vlan-name
o- @ f ^ ¢ o-      vlan-name y } M • x X VLAN d
o- Þ . F å o-      Þ . Œ Ñ k VLAN d f ¥ VLAN VLAN ID ož A ò k VLAN 0004 < © VLAN 4 Þ . d ož
o- x X % "o-      VLAN F å % "
o- ... 6 -o-      ò ç Ý VLAN d w > Þ . d k Q ñ Ÿ µ no name x X / U

```

```

|      ACCESS      VLAN

```

```

z  U # F å d
z  * switchport mode access x X 6 8 C N M g switch port h % " access Mož
z  * switchport access vlan vlan-id x X 1 %2 access port µ 6 VLAN k U n Ÿ ¥ VLAN v O ož
z  A E Ñ — Œ F åž
o- x X "o-      switchport mode access
o- @ f ^ ¢ o-      -
o- Þ . F å o-      switch port Þ . % " access
o- x X % "o-      N M F å % "
o- ... 6 -o-      -
o- x X "o-      switchport access vlan vlan-id
o- @ f ^ ¢ o-      vlan-id: VLAN vid y
o- Þ . F å o-      Access M Þ . N µ VLAN 1
o- x X % "o-      N M F å % "
o- ... 6 -o-      ò ç %2 N M å F Ě %2 " VLAN k ; " VLAN 1 t è • ož

```

1 VLAN ACCESS

```

z U # F ăoż
z ¥xXQ + 'I IKYY M Ä | k < 2'4 • 'I IKYY M e k N M U n ŷ ¥ < 2'4 f Goż
z A E Ñ — Ö F ăoż
o→ x X "o- addinterface{ interface-id | range interface-range}
o→ @ f ^ 0- interface-id y % N M
interface-range y Ú N M
o→ p . F ăo- p . Ö Ñ k ñ Ä 8 C Y ß à M C K 9 VLAN1
o→ x X % "o- VLAN F ă % "
o→ ... 6 -o- " VLAN F ă % " k 1 6 Access M µ ¥ VLAN oż ¥ x X F ă | ğ c " N M % " 6 ¥ N M ñ K
VLAN x X g / switchport access vlan vlan-id h | ğ %² oż

s f 5 ù ´ Ğ ! & VLAN a — " " Ö P • ¾ " a — " • K " a —

```

```

z ^ ACCESS M G untag † k † " ¥ VLAN Ä z noż
z ... x X showvlan showinterfaceswitchport ò 0 F ă ^ P © k ŷ | oż
o→ x X "o- show vlan [ id vlan-id ]
o→ @ f ^ 0- vlan-id VLAN ID Z
o→ x X % "o- ñ Ä % "
o→ ... 6 -o- -
o→ x X J Po-

```

```

Ruijie(config-vlan)#show vlan id 20
VLAN Name                Status    Ports
-----
20 VLAN0020              STATIC    Gi0/1

```

1 VLAN access

```

» • " h H ' u VLAN - ' " d
o→ F ă • co- ë • %² • VLAN k w M x d
1 %² ACCESS M µ µ VLAN k _ • " oż
Ruijie# configure terminal
Ruijie(config)# vlan 888
Ruijie(config-vlan)# name test888
Ruijie# configure terminal
Ruijie(config)# interface GigabitEthernet 0/3
Ruijie(config-if-GigabitEthernet 0/3)# switchport mode access
Ruijie(config-if-GigabitEthernet 0/3)# switchport access vlan 20
ê ñ ò • " y Access M (GigabitEthernet 0/3) • ñ VLAN 20 y

```

```

Ruijie# configure terminal
SwitchA(config)#vlan 20
SwitchA(config-vlan)#add interface GigabitEthernet0/3

```

```

o→ à • co- show ^ P © k 3 G

```

```

Ruijie(config-vlan)#show vlan
VLAN Name                Status    Ports
-----
1 VLAN0001              STATIC
20 VLAN0020             STATIC    Gi0/3
888 test888             STATIC
Ruijie(config-vlan)#

```

```
Ruijie#show interfaceGigabitEthernet0/3 switchport
```

Interface	Switchport	Mode	Access	Native	Protected	VLAN lists
GigabitEthernet 0/3	enabled	ACCESS	20	1	Disabled	ALL

4.4.2 TRUNK

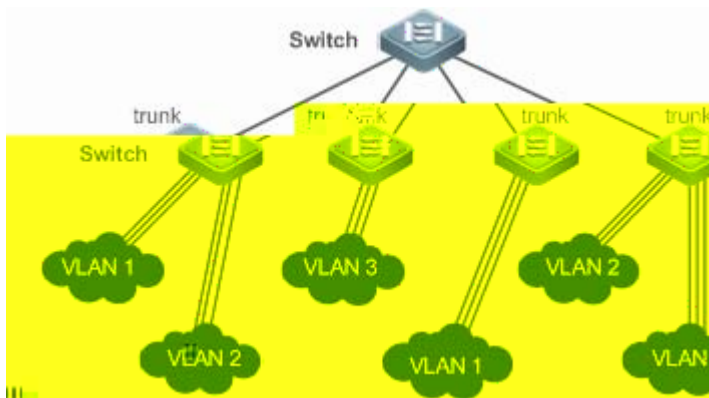
%2 Trunk ©1%2 ê Ú Y ß à A E N M y ç U à Ì — Ö g ò è ~ ê A E Ñ h g N μ + μ e è k %2 Ú

Trunk

e è U Y n ÿ K 9 Ú VLAN v O o ž

i H — Ö Trunk J 802.1Q ö Ö / x o ž £ ª P 4 %2 J Trunk N à ò ž

£ 4-3



Ó U Y %2 — * Y ß à € M k ê ñ %2 Aggregate Port — %2 Trunk M g ¼ 9 Aggregate Port ¡ Â ª ç k ¬ • F

å Aggregate Port ho ž

· À Trunk M 6 %2 Native VLAN ð ž ñ μ Native VLAN k < © 6 ¨ N M v G UNTAG † k C t • © K 9

VLAN o ž ª À k N M Þ . VLAN ID g / IEEE 802.1Q PVID h < © Native VLAN VLAN ID o ž c ž k ¨ Trunk

G K 9 Native VLAN I k é · À J UNTAG • ¨ o ž ? Trunk M Þ . Native VLAN © VLAN 1 o ž

¨ F å Trunk e è ž k ¬ G • N e è € Trunk M ... , c Native VLAN o ž

1 TRUNK

z · À F å d

z 1 N M F å è Z X [T Q U n ÿ Ú < 2 ' 4 v O d

z A E Ñ — Ö F å d

o ¬ x X " o- switchport mode trunk

o ¬ @ f ª ç o- -

o ¬ Þ . F å o- Þ . % " © ACCESS % " k U F å è TRUNK % "

o ¬ x X % " o- N M F å % "

o ¬ ... 6 - o- ò ç Ý %2 Trunk M ñ Ä Trunk , ¼ K Å C Ö y è Þ . > k ¬ ... no switchport mode F å x X o ž

1 Trunk VLAN

z U # F å d

z %2 Trunk M Þ . U Y n ÿ Î — Ö u 4 ñ Ä VLAN g 1 I 4094 h v O o ž - U Y * — å Trunk M • U VLAN ç

n Û ' ò î ? VLAN v O * Trunk Mo ž

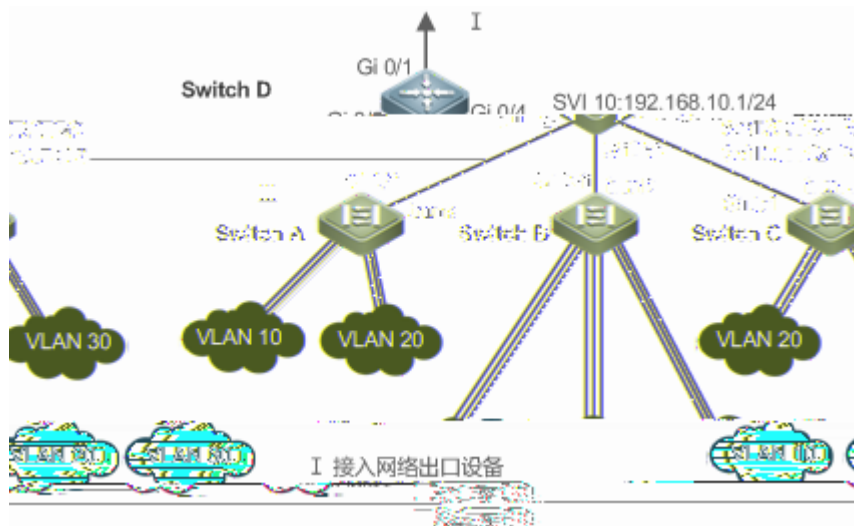
z A E Ñ — Ö F å o ž

o ¬ x X " o- switchport trunk allowed vlan {all | [add | remove | except | only]} vlan-list

```

o- @ f ^ ¢o-    @ f vlan-list U Y ©%² VLAN k - U Y ©%² © ¢ VLAN kVLAN ID 7 ¸ ~ L ¸ k • - Z Nož ò y
10-20ož
all m # © • U VLAN ¸ n m ñ Ä u 4 VLAN z
add n P 1 6 VLAN ¸ n µ • U VLAN ¸ n z
remove n P 1 6 VLAN ¸ n R • U VLAN ¸ n í " z
except n P 1 " ¸ ß VLAN ¸ n Ù ñ Ä VLAN µ • U VLAN ¸ n z
only n P 1 ¸ ß VLAN ¸ n µ • U VLAN ¸ n k ¸ U VLAN R • U ¸ n í ";
o- P . F ăo-    trunk M y uplink M K 9 ñ Ä VLAN
o- x X % "o-    N M F ă % "
m ñ , • 6wĐŦŸ , "Aql m # # ( `ĐTĐ

```

o→ Fåå•co-

Áà¬L

ò £ñP kî ïÄ àtæã

VLAN 10o•VLAN 20o•VLAN 30 k Y ë , ; •

2 CæY z3 VLAN

+• IP ýàãð 192.168.10.0/24o•192.168.20.0/24o•192.168.30.0/24 k3

VLAN * 3 Cþ¶AE

Ñ IP ôG ëÿà; ož

Få}µ

Î†Yþ¶AEÑy 1 VNµAEÑ †ª¢Få iož}µò y

"þ¶AEÑFå 3 VLANKFå NµAEÑ €M

trunk Mkw6 •U vlan çnk ë 2

CæYz

"þ¶AEÑFå 3 SVI Mkãð• 3 VLAN +• IP ýà à¼NMkFå+• IP º-z

ãð" 3 VNµAEÑë• VLANK _ VLAN ãF Access Mk6 þ¶AEÑ trunk MožÎ†

YNµAEÑ Switch A †ª¢Få5ãož

D

D#configure terminal

D(config)#vlan10

ig)#vlan10

```

A(config-vlan)#exit
A(config)#interface range GigabitEthernet 0/2-12
A(config-if-range)#switchport mode access
A(config-if-range)#switchport access vlan 10
A(config-if-range)#interface range GigabitEthernet 0/13-24
A(config-if-range)#switchport mode access
A(config-if-range)#switchport access vlan 20
A(config-if-range)#exit
A(config)#interface GigabitEthernet 0/1
A(config-if-GigabitEthernet 0/1)#switchport mode trunk

```

o- à • co-

```

" p ¶ A E Ñ ò 0   vlan F å
    ò 0 vlan ' î k ,   vlan ido• d fo• Ù Áo• ,   € M
    ò 0 € M Gi 0/2o•Gi 0/3o•Gi 0/4   vlan Ù Á

```

D

```

D#show vlan
VLANName    Status    Ports
-----
 1 VLAN0001  STATIC   Gi0/1, Gi0/5, Gi0/6, Gi0/7
                                Gi0/8, Gi0/9, Gi0/10, Gi0/11
                                Gi0/12, Gi0/13, Gi0/14, Gi0/15
                                Gi0/16, Gi0/17, Gi0/18, Gi0/19
                                Gi0/20, Gi0/21, Gi0/22, Gi0/23
Gi0/24
10 VLAN0010  STATIC   Gi0/2, Gi0/3
20 VLAN0020  STATIC   Gi0/2, Gi0/3, Gi0/4
30 VLAN0030  STATIC   Gi0/3, Gi0/4
D#show interface GigabitEthernet 0/2 switchport
Interface          Switchport Mode      Access Native Protected VLAN lists
-----
GigabitEthernet 0/2    enabled  TRUNK 1      1      Disabled 10,20
D#show interface GigabitEthernet 0/3 switchport
Interface          Switchport Mode      Access Native Protected VLAN lists
-----
GigabitEthernet 0/3    enabled  TRUNK 1      1      Disabled 10,20,30
D#show interface GigabitEthernet 0/4 switchport
Interface          Switchport Mode      Access Native Protected VLAN lists
-----
GigabitEthernet 0/4    enabled  TRUNK 1      1      Disabled 20,30

```

z —

4.4.3 UPLINK

z UPLINK € M%² " 9 QinQ g ß ö Ö

o- p . F 6- p . % " © ACCESS % " k U F 6 è ACCESS % " UPLINK % "
 o- x X % "o- N M F 6 % "
 o- ... 6 -o- 6 ç Ý %² UPLINK M ñ Ä UPLINK , ¼ K Ä C Ö y è p . > k - ... no switchport mode F 6 x Xož

UPLINK VLAN

z U # F 6 d
 z U Y * — 6 UPLINK M • U VLAN ç n Ů ' ò î ? VLAN v O * UPLINK Mož
 z A E Ñ — Ů F 6 ož
 o- x X "o- switchport trunk allowed vlan {all | [add | remove | except | only]} vlan-list
 o- @ f 6 6 o- @ f vlan-list U Y © %² VLAN k - U Y © %² © ç VLAN k VLAN ID 7 ç ~ L ç k • - Z Nož ò y
 10–20 ož
 all m # © • U VLAN ç n m ñ Ä u 4 VLAN z
 add n P 1 6 VLAN ç n µ • U VLAN ç n z
 remove n P 1 6 VLAN ç n R • U VLAN ç n í " z
 except n P 1 " ç ß VLAN ç n Ů ñ Ä VLAN µ • U VLAN ç n z
 only n P 1 ç ß VLAN ç n µ • U VLAN ç n k ç U VLAN R • U ç n í ";
 o- x X % "o- N M F 6 % "
 o- ... 6 -o- 6 ç Ý UPLINK • U VLAN ç n w p . • U ñ Ä VLAN Ù Á k - ... no switchport trunk allowed
 vlan N M F 6 x X

Native VLAN

z U # F 6 d
 z 6 ç %² I k Ä Native VLAN VLAN ID k " * UPLINK M ô G ž k k t ü > TAG ož TRUNK , Fož
 z A E Ñ — Ů F 6 ož
 o- x X "o- switchport trunk native vlan vlan-id
 o- @ f 6 6 o- vlan-id: VLAN vid
 o- x X % "o- N M F 6 % "
 o- ... 6 -o- 6 ç Ý UPLINK Native VLAN ç n w > p . VLAN 1 k - ...

F ă x Xož

```

z   a HYBRID M G tag   t k   t " 6   VLAN   Ā z nož
z   ... x X showvlan   showinterfaceswitchport   ò 0 F ă a P © k Ÿ |ož
o→ x X "o-   show vlan [ id vlan-id ]
o→ @ f a 0o-   vlan-id   AP VLAN ID Z
o→ x X % "o-   ñ Ā % "
o→ ... 6 -o-   -
o→ x X J Po-

```

```

Ruijie(config-vlan)#show vlan id 20
VLAN Name                Status    Ports
-----
20 VLAN0020              STATIC    Gi0/1

```

1 hybrid

» • "h H ' u HYBRID - ' " d

o→ F ă • co- μ © %² € M Gi0/1 ¼ 9 HYBRID F ă t Ÿ y

```

Ruijie#configure terminal
Ruijie(config)#interface gigabitEthernet0/1
Ruijie(config-if-GigabitEthernet 0/1)#switchport mode hybrid
Ruijie(config-if-GigabitEthernet 0/1)#switchport hybrid native vlan 3
Ruijie(config-if-GigabitEthernet 0/1)#switchport hybrid allowed vlan untagged 20-30
Ruijie(config-if-GigabitEthernet 0/1)#end

```

o→ à • co- show run a P © k 3 G

```

Ruijie(config-if-GigabitEthernet 0/1)#show run interface gigabitEthernet 0/1

Building configuration...
Current configuration : 166 bytes

interface GigabitEthernet 0/1
 switchport
 switchport mode hybrid
 switchport hybrid native vlan 3
 switchport hybrid allowed vlan add untagged 20-30

```

4.5

•	x X
ò 0 < 2 ' 4 F ă	show vlan
ò 0 A E M F ă	showinterfaceswitchport

» { 8 Ě ð o V ½ , Ā ‡ W d ° ũ ~ Ě K ‡ ' ž 8 Ě — ' d

•	x X
ø • VLAN ² j • ¼ ož	debug bridge vlan

5 MSTP

5.1

ÿ è ù # ' © %² _ 8 C ' ò # ' k * # + Åª Š É à Ì É • e è Û f " 8 C ê è k c ž À Õ e è Õ a ož

h Ú # ' G J i %² ý k ÿ è ù # ' - © š 5 à Ì G J ò • ¾ • k R Â Ì STP gSpanning Tree Protocol k ÿ

è ù # ' Ĥ RSTP gRapid Spanning Tree Protocol Ĥ½, ÿ è ù # ' Ĥ Ć Ĥ Ĥ Ĥ • MSTP gMultiple Spanning Tree Protocol k

Ú ÿ è ù # ' hož

+ 8 C Y ß à Ûª k LAN • Q Ä %² Ú t 5 * è k k é < k D ÿ z n Îª ož x © 4 %² B Ć à U´ Ä k

• y É • e è A © · } k Ć %² ? * è · À Õ 9 Õ a Û Á k ò Ć Ć à Ì G ÿ { ž k P %² Ú e è â | ž k É • e è < · Ä

t U t Û Ä ož ô W O ò ý iª Ä © %² ¾ª³ o (4 W • k STP # ' <ª è ¾ W • ož ... %² B Ć

à — Õ Û Y • y

z G ě w o B Ć à %² Äª ùª"; È ã ož

z G ě { ž w š \$ g Ê Õ k ¾ª · à Ì"; È ã k ... " ~ ž ~ C # + 4 U Äª ùª È ã ož

B Ć à "; È ã © ÿ G ' ò t —ª %² Á à F ä @ f g < ' ož ... ? @ f Û ÿ è Ä Ĥ %² <ª"; ù ož Q Ä

F ä ± Ć k õ ± Ĥ Äª • ož

RSTP # ' ¶ g Ä 802.1D STP # ' k " 4 y n Ĭ STP # ' %² ý Ä Ä 9² > è o • U ^ É • e è Û k Ä }

Ô µ < © " ½ª ož ò Ć %² B Ć à Ä à C u 4 RSTP # ' ' ò t F ä ± Ć Ĥ %² š à Ì"; w J ò } M • ÿ è"; ù Q

¬ } Ý 1 a ž • g n Ĭ STP ¬ } Ý³ 50 a hož

STP y RSTP " á y

z STP ½, g k / ... © " µ + µ e è ê Û € M k - - Ä ^ - • Forward Delay ž • • k € M õ g

ñ ô G Û Ä ož

z RSTP U Y ½, v • k x y STP %² ý " ò ð ~ y 9 B Ć à Ä Ĥ Ä VLAN C » F %² <ª ÿ è ù k æ 4 Ĥ Ä VLAN

† C _ <ª ÿ è ù g ô G k 7 VLAN Š É É • e è k - — c" VLAN • ě f G v O Ć ú @ kož

MSTP (Multiple Spanning Tree Protocol k Û ÿ è ù # ') k IEEE ò 802.1s ò Õ # k U Y š m STP o • RSTP

ð ~ k ~ U Y ½, v • k - ... c VLAN v O _ _ è ò G k R ò É • e è Û ^ 4 ¾ Ĥ Ć ú ä Ĥ ò ož

• %ªª k STP / RSTP © Ä 9 € M k MSTP © Ä 9 † ož Ĥ µ † < © Û VLAN %² ¨ª k * Û VLAN ? Ć

ñ %² † • c U Y - . * ' • f y Ĭ >) ä ož

Î — Õ ~ u 4 STP # ' k - u 4 RSTP # ' MSTP # ' k 8² IEEE 802.1D o • IEEE 802.1w C IEEE 802.1s ò Õ ož

• 3' u MSTP - ' • d

I BPDUs Bridge Protocol Data Units

ž ý è %² I ù °"; à ì ñ } % ' Y «^a y

z ? à (Ä Š %² ID gBridge ID h k i ' y Mac^a - Á ` ò è ož

z à ñ ý è ñ 0 Ě gRoot Path Cost h k Y • f ý è ñ 0 Ě ož

z ? € M ID gPort ID h k € M i ' y € M Z Á ` ò è ož

à \$ • * A E BPDUGBridge Protocol Data Units kà # ' f G % « h l Ů B ± • y Ä „ ù ¥ "; È ã ñ ñ } ' Ě ož
? I Y Á n^a - 01-80-C2-00-00-00 g¹ ò h)^a - ož

? BPDUs Y ? }^a Á è y

z Root Bridge ID g Ĥ à ñ • ý ID hož

z Root Path Cost g Ĥ à ý è ñ 0 Ě hož

z Bridge ID g Ĥ à ID hož

z Message Age g †] t ž • h

z Port ID g G ¥ † € M ID hož

Forward-Delay Timeo•Hello Timeo•Max-Age Time # ' • ž • @ f ož

¿ U %² ? - ò n P G ě à ì "; J o • Ĥ € M Ů Á ö ° y ož

¢ à %² € M v ñ ä i ' BPDUs g ¾ 4 Bridge ID k ¾ 4 Root Path Cost ^ h k < " ¥ € M ' ? ' Ĥ k c

ž g ñ Ä € M ¾ • w n n ? ' Ě ož ò ç v ñ A \ z i ' BPDUs k à < ' ¥ ' Ě ož

ý Ñ ò < ... ä i ' ' Ĥ " ... à ì n n • k BPDUs A v < Ä 4 μ Ě ç y

z à ì # + 4 %² à ý gRoot Bridg e hož

z " ý Ů ? à C Ä %² ý M gRoot Port h k / U ^ Ä ? è ñ Root Bridge € Mož

z ? à C < ' ß 4 ñ ý gRoot Bridge h Ä ? è ñ ož

z ? LAN C Ä 4 6 u à gDesignated Bridge h k y 9 ¥ LAN ý \$ • Ä ? è ñ ož 6 u à y LAN , €
M f 6 u € M gDesignated Port hož

z ý M gRoot port h y 6 u € M gDesignated Port h μ Forwarding Ů Á ož

I Bridge ID

7 IEEE 802.1W Root

6	32
5	16
4	8
3	4
2	2
1	1

Spanning-Tree Timers

Y T S € ñ ... ÿ è ù Å ž ~ ož

z Hello timer y ž G BPDU † ž • • œ ož

z Forward-Delay timer y € M Ù Á w J ž • • œ ož ¢ RSTP # ' Y Ā STP # ' % " g ž k € M R Listening ô J g Learning k ê ñ R Learning ô g Forwarding Ù Á ž • • œ ož

z Max-Age timer y BPDU † f î ÿ Ā x ž • ož ¢ Ý ß ž • k † f î 1 t ' ož

Port Roles and Port States

? € M C " à ĩ Ā ĩ %² ...) gPort Role h k Ū } è " à ĩ "; c • ož

z Root port y U ^ Ā ? è ñ ÿ gRoot Bridge h € Mož

z Designated port y ? LAN * ¥ Ā M N ñ ÿ ož

z Alternate port y y Ā Ā E Ā k %² š y Ā â | k ¥ Ā < y ¥ Ê y Ā ož

z Backup port y Designated Port Ō a Ā k ¢ %² à Ā € M C M " %² LAN k ; " ä i " ' € M Designated Port k z i " ' € M Backup Portož

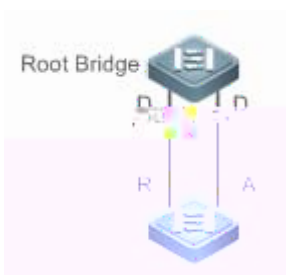
z Disable port y ¢ ù Ō 9 t Ù Á Ā k / Operation State Down € M C t ã F 4 ...) ož

Y _ € M ...) P ð £ 10•20•3 y

R = RootPort D = Designated Port A = AlternatePort B = BackupPort

" Z Ā Ō ð " ¢ Ō Ñ k € M i " ' R X ñ X ' × ož

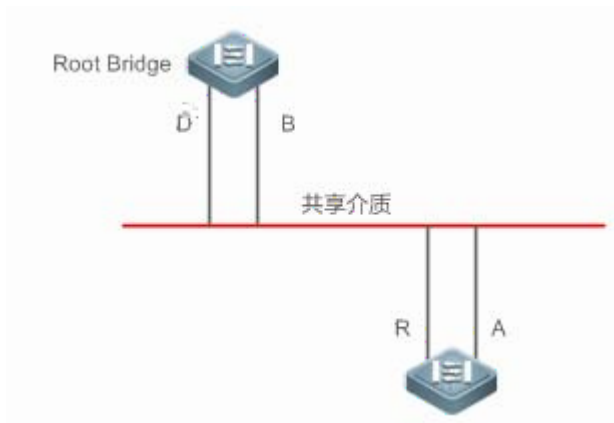
£ 5-1



£ 5-2



£ 5-3



? € M Ä Û Á gPort State h Ū n P © k ô G f G k R ò O ò 5 ... ÿ è ù "; È ã őž

z Discarding y ~ + v ñ l g ô G k - g > Mac ^a - .ož

z Learning y + v ñ l g ô G k x g > Mac ^a - .k © ' Û Á őž

z Forwarding y ~ + v ñ l g ô G k - g > Mac ^a - .ož

+%²]Æ l à ì "; kQ Ä Root Port y Designated Port ò k μ Forwarding Û Á k ĸ € M C Q Ô 9 Discarding Û Á őž

Ī Hop Count

IST y MSTI]Æ Message Age y Max Age Ū < ' BPDU ' Ī © k Ý ž k ò © • w 9 IP † TTL Ñ ò Ū < ' k < © Hop Count őž

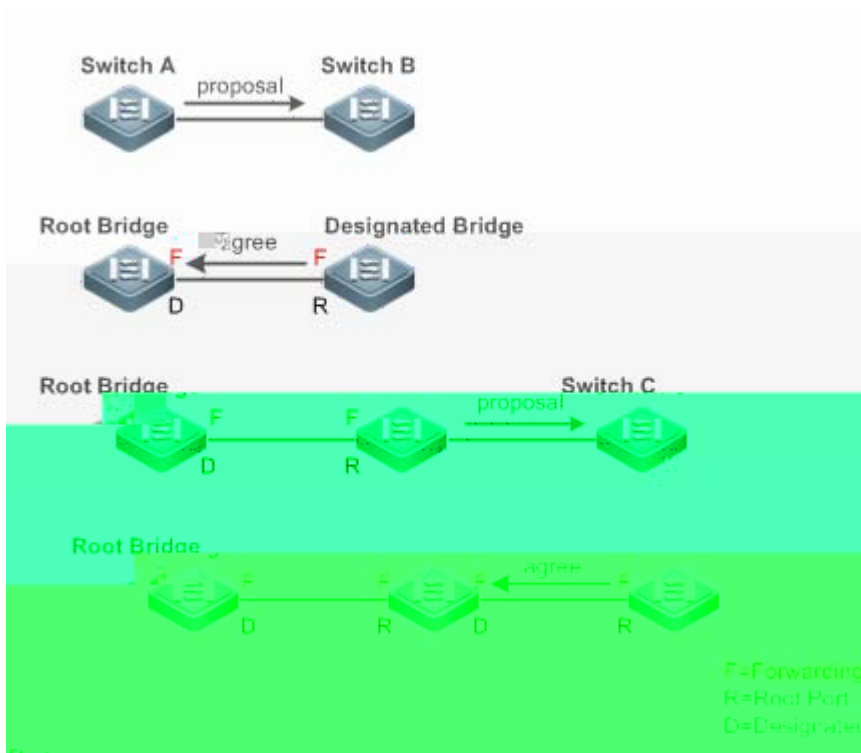
U Y spanning-tree max-hops ¶ B F å x X Ū — ã őž " Region Ä k R Region Root Bridge • ÷ k ? Æ %² — Ő k Hop Count < k × 1 k + ñ 0 é n P ¥ BPDU ' Ī Ý ž k — Ő v ñ Hops > 0 BPDU < } ' őž

4 y Region Û STP • RSTP MSTP Message Age y Max Age Ñ ò őž

Ô Ä	•
STP # ' 	STP Spanning Tree Protocol ~ ~ ~ IEEE ⁸ 802.1D ñ Ĥ ȳ
RSTP	RSTP Rapid Spanning Tree Protocol ~ ~ ~ IEEE ⁸ 802.1w ñ Ĥ
MSTP	MSTP Multiple Spanning Tree Protocol ~ ~ ~ IEEE ⁸ 802.1s ñ Ĥ

z G ě w o B ĺ à %² Â „ ù ° "; È ã ož

z



»h “DÍ”¶Q¼ “Ñ \¼jÇ·i ¼
 Ò «Úâ'°••· Ä\$ s\$U d

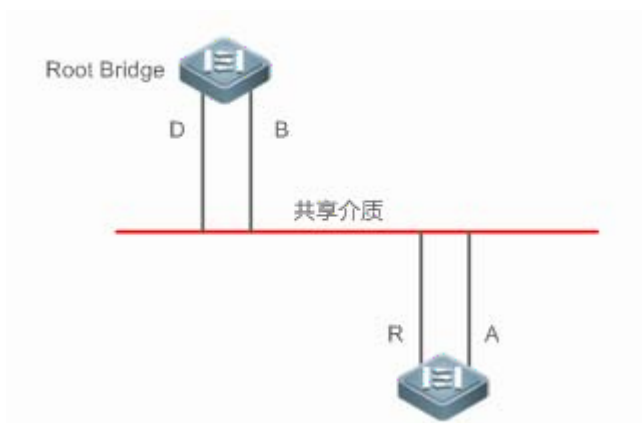
“Point-to-point Connect \$ s\$U

"d tþ••ÿH«Ö _

Y çß4“³µ+µ N” 8†£ož

³µ+µ N8†y

£ 5-5



£ 5-6



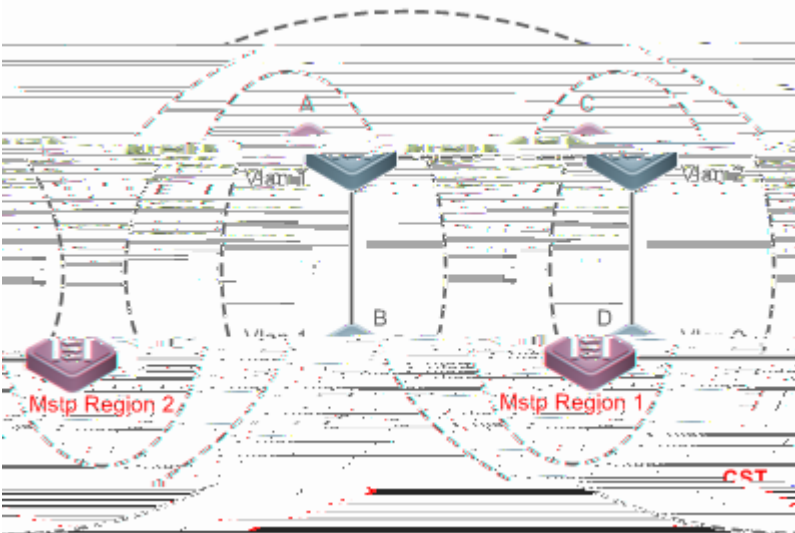
Protocol Migration

... clear spanning-tree detected-protocols [interface interface-id] x X U Y • ¥ € M ò g Í Î ò ož , ¼ ¢ ¬ @
 0 RSTP STP Ā ož

5.2.3 MSTP

4†Đ |Êk MSTP <Dÿ4k UY %²V—Ö %² êÚ Vlan æã %² Instance kÄ5,c Instance Få
 —Ö<Áè%² ĺgMST Region hk gÞy ÿèùg ÄB ÿèùf IST k Internal Spanning-tree hz
 MST region Á`<,¢9%² Ý —Ö...}k ĺU MST Region Ç gÿèù'c 'k±ß%² ...} ÿèùkf
 CST gCommon Spanning Tree hož

7 _'ckY àì<UY" MSTP 'c ¥è£ 16 ";y—Ö AyBC" MSTP Region 1 ÄkMSTP Region 1
 Z èèDÿkñYZÄeè DISCARDING kcò MSTP Region 2 ŐÑ-©%²ý ožÀe Region 1 y Region 2 <ã
 ð,¢9 Ý —Ök V"—Ö"•Äèèkœ4ÿG,¼Få#+%²Úeè DISCARDINGož
 £ 5-12



ýk~9²4èè Dÿk- •,c Vlan • *' lš€ož

İ MSTP Region

ÿGY T @¢ª}• MSTP Dÿ•Ä • ÌÜ<}<`òªæã MSTP Region kc MSTP Region Ä —Ö“MST
 Få'î"%² },což

MST Få'î ,y

z MST FådfgName hyÂxU 32 -x ... Ūöœ MSTP Regionož

z MST Revision Number y %² 16bit x “3>Ūöœ MSTP Regionož

z MST Instance—vlan +•ny?V—ÖCÂÚUYë• 64 Instancegid R1ñ64hkInstance0 ©ò" k
 ñY©İÄÚUYu4 65 Instanceož ĩ UY7¬}ãF 1-4094 Vlan K9 c Instanceg0l64 hkìã
 F Vlan Þ.<K9 Instance0ož ýk? MSTI gMST Instance h<©%² “Vlan Á”kÿG BPDU L MSTI '
 Îg MSTI ÄB ÿèù'ck l CIST yĺU MSTI š€ož

U" spanning-tree mst configuration ¶BFåxX µ“MST Få%” FåY 'İož

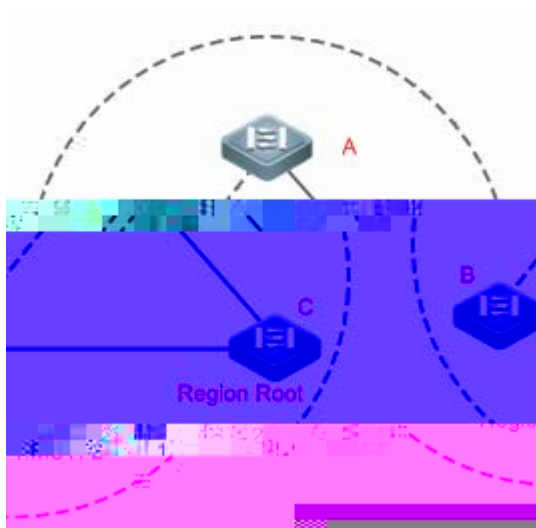
MSTP BPDU L•kY 'İk ò¢%²V—Övñ BPDU L MST Få'îy ĩ %²ýk<k• ¥€M 5 —
 Őy]©K9c%² MST Region kké<• ©RP Û%² Region Ū ož

ŪĐ}'ž MSTP f' " Instance—vlan sě¶ "Ú|Ö— MSTP »l îéR 7Gäì[d

İ IST MSTP region

æ ã ñ MSTP Region e k? Region L < 7 _ Instance ñ — å Bridge PriorityoPort Priority ^ @ f # ß _ Instance
 Þ y Root Bridge

£ 5-15



ï" L}hþ ©

MSTP # 'îï ¼ ¶%² € M K 9 „

Vlan kñ Y ï • ¥ ÿ G ž

Vlan

c ž k CIST Regional Root Root Port + MSTI Ů ª Ä 4 • Port Role k "Master port" k• ñ Ä Instance + Û " ß
M" k + ñ Ä Instance C © FORWARDING ož 4 ..."; ¾ l k é [• ' ? Region + CST Root " ß M" @ O Q
" ¥ Region %² V — Ő !

Ì MSTP RSTP STP

+ STP # ' Ů ª k MSTP k | RSTP ; ý G STP BPDU Ů Ä k | Ä Ő Ñ ¬ @ đ " RSTP STP Ä " ~ - Ä ož
ò + RSTP # ' Ů ª k î ĩ k Ô ò MSTP BPDU CIST B ä k œ 4 MSTP · y G RSTP BPDU Y Ä ož
? V g STP ê RSTP # ' — Ő C © % Þ %² Region k ` ~ %² — Ő Á è c %² Region ož

Ì STP

Þ . Ő Ñ k STP % " © MSTPož

... spanning-tree mode [stp | rstp | mstp] à X UX UX UX UX V È Ô Mà1 1A ñ Î ò) @ — • 4 Ä pu @ 1 " ! • j (4 á ì

Error-disabled Ù Á k Y P F 5 j " z c ž ... € M t ¼ { k n P à Ì U t ³ c ř í 4 % ² V à Ì — Œ k ... à Ì ";

G ý w Jož

- U Y " Interface F 5 % " spanning-tree bpduguard enable x X Ů 0 • % Interface BPDU Guardg ¥ € M ©
k 0 • Port Fast — ¼ hož " Œ Œ ò ç ¥ Interface v ň 4 BPDU k < µ Error-disabled Ù Á ož

BPDU Filter

BPDU Filter ~ ¶ B enable k - S + % Interface g enable ož ň Ä ? Ä 4 [dož

U Y " ¶ B % " spanning-tree portfast bpduguard default x X 0 • ¶ B BPDU Filter enabled Ù Á k " _ Ù Á k
Port Fast enabled Interface 1 ~ v BPDU k - G BPDU k ý k + Port Fast enabled € M Œ < v ň BPDU ož
ò ò ç Port Fast enabled Interface œ v ň BPDU ò ... Port Fast Operational Ù Á disabled Ì BPDU Filter - < â jož

- U Y " Interface F 5 % " spanning-tree bpduguard enable x X — 5 4 % Interface BPDU Filter enableg ¥ €
M © k 0 • Port Fast — ¼ hož " Œ Œ ¥ Interface ~ v BPDU k - G BPDU k w © + N Forwarding ož

TC-protection

TC-BPDU † © 6 ` k TC 0 ° BPDU † k A E Œ v ň • † n P à Ì " ÷ G ý 4 J k k g MAC a - n í
" q • k + C A E Œ k k - G ½ 0 % ² M • 0 * q • k w w J ARP n ¾ € M Ù Á ož 9 ² A E Œ Ì ñ q - TC-BPDU
† Ð Þ x à ž È ¯ g Y q • k ¿ > M k š € à Ì Ì k U Y ... TC-protection g ' ož

Tc-protection Q ¶ B 0 • y ¼ { k Þ . Œ Œ ¼ { 4 ož

" 0 • , • ž k v ň TC-BPDU † e % ² ž • Ä g % ² " 4 a h k Q g % ²) í " q • k c ž ! O ¥ ž • < Ä © k
v ň TC-BPDU † ož ò ç " ¥ ž • < Ä v ň 4 TC-BPDU † k é — Œ " ¥ ž • Ý ž e Ç g % ²) í " q • ož ý U Y 9
² È ¯ í " MAC a - n ¾ y ARP n ¾ ož

TC Guard

Tc-Protection U Y ' š à Ì D ý Ý O tc † ž × 5 Á MAC a - y ARP í " k x " 1 ň TC † x à ž ~ ©
k D ý © Ů í " q • k w TC † © U ý • k 1 š € ... à lož ... TC Guard k é [a • ř " ¶ B ê ñ € M
W 2 TC † ý • ož 0 % ² € M v ň TC † ž ~ k ò ç ¶ B F 5 4 TC Guard ê ñ © € M F 5 4 TC Guard k é
¥ € M 1 Ì U J ¥ € M N v ê ñ © \ D ý TC † k ... ± TC † k ý • ñ ¿ € M k ý Ä | O ò à Ì U
" TC x à k ' 4 à Ì Ì k ; ¿ © " C — Œ k ¥ Ä | 9 ² N µ C — Œ 7 | T Ù - Ü Þ ¶ è • | Ê ož

⚠ Ð b ° tc-guard _ Ý V ° î . 1 ? / n d

⚠ Ù Ð } ò î ò / Ä ¥ tc q 3 ^ Ì Æ ä • | Œ — ® _ Ý d

⚠ Œ — æ e tc-guard , • N j Ç [â V s ó ò ; tc q 3 d Á } K & • • h — s d

⚠ Œ — Ç tc-guard , • s Ç ! " é J - \$ » f Ì Þ tc q 3 Ü â ¿ c Q j Ç ô ; d Á æ } h j Ç c ¾
X j â ĩ j Ç — s _ Ý d

TC

F 5 TC Guard k € M 1 ý • TC † ň ĭ — Œ ¿ @ ý è ù < ' € M k L ý • , 4 _ Œ Œ y % ² _
© € M v ň TC † ý • k % ² _ © € M \ D ý TC † ý • ož € M \ D ý TC † © 6 € € M ô G Ù Á G ý
J ž († ò R block ň forwarding ô J) k € M k D ý TC † k n P " ÷ U G ý 4 J ož

ý k U - G | Ê ž k 9 TC Guard Š 2 4 TC † ý • k - € G ý " ÷ J ž ~ k — Œ Z Ä ž " , • € M
MAC a - k ô G f g ß jož

œ 4 k - µ 4 TC j " ¾ ož TC j © 6 + 9 € M v ň TC † Œ ò k ò 3 o " ÷ J Œ Œ k Ü Œ ò ož ý k
† Ð 4 Ì F 5 Portfast € M È ¯ a UP/DOWN - Ü ž a - y Þ ¶ è • | Ê k A ' š G ý " ÷ J ž k Þ ¶ è
n ¾ Ü ± ñ C ž a ¾ • ož

⚠ TC ¶ Œ Ò _ Ý ĭ ~ ' ž d

BPDU MAC

BPDU > MAC ò© 4...2* K G BPDU †ÛĐÞxàAEÑò... MSTP W• 3oož¢G 4î€Mµ+
µeè+€, AEÑŽKJ* Få BPDU > MAC òÛ ñQNv+€AEÑG BPDU |k'ñĂ¿ U BPDU



MSTP) Q 7 s • j Ç) & , ¾ l block q _ — MSTP) Q 7 s " j Ç ö ì â p BPDU • j Ç
 Ü g - N ê Ç É) & forward q _ d Û ® Û Ð } 7 s MSTP) Q • ç j Ç) & , ¾ l block q _ P Û
 É f " ... ¥ G) Q 7 s " N î é J ö { £ Ó (d

BPDU

IEEE 802.1Q ö Ö kBPDU) MAC ¢ - 01-80-C2-00-00-00 © • ¢ ¢ a - ... k / 8 º IEEE 802.1Q ö Ö
 — Ö k + 9 N v ñ BPDU l © ô G ož À ò • a ¢ , à • ž œ Ä f ž ` A ¢ 6 ° U P ¢ ° Ä \$ Ð © p] P ¢ j Ä w P s @ º P F à BPDU lož † ò
 — Ö ì • o STP # ' ž k - } % n BPDU l k ... ± \$; — Ö \$ • ý è ù < ' 3 oož



BPDU É Ž o ' ž d



BPDU É Ž _ Ÿ } STP Ø Ð ' ž " ì s ' d ò STP Ø Ð Ö — " • • â É Ž BPDU d

Portfast

Port Fast • ¼ © ¼ { ož

¶ B F å % " k ... spanning-tree portfast default qE€UPE•o€i o |@tàTÐ'• Portfast • ¼ z ... no spanning-tree
 portfast default qE€KÀ•°o |@tàTÐ'• portfast • ¼ ož

N M F å % " ... spanning-tree portfast qE€ U Y ø • î tàTÐ Portfast • ¼ z ... spanning-tree
 portfastdisabled qE€KÀ•°~à tàTÐ'• portfast • ¼ ož

BPDU guard

BPDU guard • ¼ © ¼ { ož

¶ B F å % " k ... spanning-tree portfast bpduguard default qE€UPE•o€i o |@tàTÐ'• BPDU guard • ¼ z ... {ožn00%"}Bj

mstp yMultiple spanning tree protocol(IEEE 802.1s)

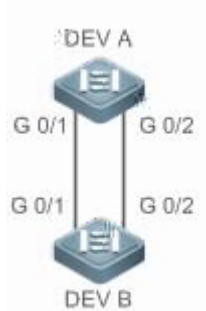
o→ x X % "o- ¶ B F ă % "

o→ ... 6 -o- Ă ? D E D } ¶ 7 ö Ö ë k U k - %² ? Ă ă | Ê ož " ' ò t G ë ĺ U 4 — Ö î — Ö
Ă ž k ... 4 x X U Y ä E ñ z í î Spanning Tree % " k Y Ă \$ ož

I

Spanning Tree

o→ à î ê Ě o-
£ 5-18



o→ F ă • co-

— Ö • o ý è ù # ' k c ž F ă ý è ù # ' % "

STP # 'ož

F ă ý DEV A ž ~ @ f yHello Time=4s

kMax Age=25s kForward Delay=18s ož

DEV A

† %² 5 k • o ý è ù # ' k c ž F ă ý è ù # ' % "

STP # 'ož

```
Ruijie#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)#spanning-tree
Ruijie(config)#spanning-treemode stp
```

† 8 5 k F ă ý DEV A ž ~ @ f

```
Ruijie(config)#spanning-treehello-time 4
Ruijie(config)#spanning-treemax-age 25
Ruijie(config)#spanning-treeforward-time 18
```

DEV B

† %² 5 k • o ý è ù # ' k c ž F ă ý è ù # ' % "

STP # 'ož

```
Ruijie#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)#spanning-tree
Ruijie(config)#spanning-treemode stp
```

o→ à • co-

* show spanning-tree summary ò 0 ý è ù " ÷ y # ' F ă @ fož

DEV A

```
Ruijie#show spanning-tree summary
```

Spanning tree enabled protocol stp

```
Root ID    Priority    0
Address    00d0.f822.3344
this bridge is root
Hello Time  4 sec Forward Delay 18 sec Max Age 25 sec
```

```
Bridge ID  Priority    0
Address    00d0.f822.3344
Hello Time  4 sec Forward Delay 18 sec Max Age 25 sec
```

Interface	Role	Sts	Cost	Prio	OperEdge	Type
Gi0/2	Desg	FWD	20000	128	False	P2p
Gi0/1	Desg	FWD	20000	128	False	P2p

DEV B

Ruijie#show spanning-tree summary

Spanning tree enabled protocol stp

Root ID Priority 0
 Address 00d0.f822.3344
 this bridge is root
 Hello Time 4 sec Forward Delay 18 sec Max Age 25 sec

Bridge ID Priority 32768
 Address 001a.a917.78cc
 Hello Time 2 sec Forward Delay 15 sec Max Age 20 sec

Interface	Role	Sts	Cost	Prio	OperEdge	Type
Gi0/2	Altn	BLK	20000	128	False	P2p Bound(STP)
Gi0/1	Root	FWD	20000	128	False	P2p Bound(STP)

z Fåÿèù# ' ž~,¼@ f k Q Ä"—Œ# ÿèù ÿ ž õ Ü • ož /³ÿ ž~@ f © Y ÿ
 ž~@ f Œož

5.3.2

z FåNM Ä Å%"kUY ë ĸ DŒ\$• ; ož

z FåProtocol Migration g ò í î ò k § € RSTP STP Ä ož

z FåNM Ä Å%"kUY ...¥€MG BPDU žÿG ĸ ù € M K Ä Ä # + `k c MSTI 'îkY ë
 ĸ DŒ\$• ; ož

ì

z U#Få

ì

Protocol Migration

z U#Få

z 'òtGë+€—ŒUu4 RSTP #'žkU1î—Œ—å ò í î ò k ò +N—Œ g RSTP #'ož

z ªP à šož

ì

o¬ x X "o- spanning-tree compatible enable

o¬ @ f ª ĸ o-

o¬ x X % "o- N M % "

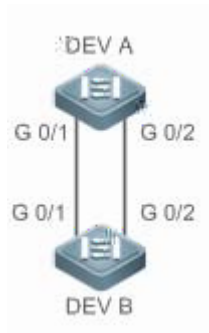
o→ ... 6 -o- ø • NM Ą % " k U Y ... ¢ ù € M NM K Ą ' ĩ Ą # + Ą ` k MSTI ' ĩ g G k Y ě
 ı D Ą \$ • ; ož

İ Protocol Migration

o→ x X "o- clear spanning-tree detected-protocols [interface interface-id]
 o→ @ f ^ ¢o- interface interface-id y + • NM
 o→ x X % "o- Ō Ō % "
 o→ ... 6 -o- 4 x X Ū ò NM G RSTP BPDU l k + BPDU l ũ g ò ò ož

İ Spanning Tree

o→ à ĩ ê Ěo-
 £ 5-19



o→ F ă • co- — ŌA kB F ă † 1 k2 ož † 1 ¼ ũ VLAN 10 k † 2 ¼ ũ VLAN 20 ož
 € M gi 0/1 K 9 VLAN 10 kgi 0/2 K 9 VLAN 20 k F ă € M ÿ è ù Ą % " ož
 DEV A † % 2 5 k ě • † 1 k2 ož † 1 ¼ ũ VLAN 10 k † 2 ¼ ũ VLAN 20 ož

```
Ruijie#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)#spanning-tree mst configuration
Ruijie(config-mst)#instance 1 vlan 10
Ruijie(config-mst)#instance 2 vlan 20
```

† 8 5 k F ă € M ñ K VLAN k c ž • o € M ÿ è ù Ą % " ož

```
Ruijie(config)#int gi 0/1
Ruijie(config-if-GigabitEthernet 0/1)#switchport access vlan 10
Ruijie(config-if-GigabitEthernet 0/1)#spanning-tree compatible enable
Ruijie(config-if-GigabitEthernet 0/1)#int gi 0/2
Ruijie(config-if-GigabitEthernet 0/2)#switchport access vlan 20
Ruijie(config-if-GigabitEthernet 0/2)#spanning-tree compatible enable
```

DEV B
 c DEV A ož

o→ à • co- * show spanning-tree summary ò 0 ŷ è ù " ÷ < ' © k 3 Gož
 DEV A Ruijie#show spanning-tree summary

```
Spanning tree enabled protocol mstp
MST 0 vlans map : 1-9, 11-19, 21-4094
  Root ID    Priority    32768
            Address      001a.a917.78cc
            this bridge is root
            Hello Time  2 sec Forward Delay 15 sec Max Age 20 sec

  Bridge ID  Priority    32768
```

DEV B

```
Address      001a.a917.78cc
Hello Time   2 sec Forward Delay 15 sec Max Age 20 sec

Interface    Role Sts Cost      Prio    OperEdge Type
-----
Gi0/2        Desg FWD 20000    128     False   P2p
Gi0/1        Desg FWD 20000    128     False   P2p

MST 1 vlans map : 10
  Region Root Priority 32768
    Address 001a.a917.78cc
    this bridge is region root

  Bridge ID Priority 32768
    Address 001a.a917.78cc

Interface    Role Sts Cost      Prio    OperEdge Type
-----
Gi0/1        Desg FWD 20000    128     False   P2p

MST 2 vlans map : 20
  Region Root Priority 32768
    Address 001a.a917.78cc
    this bridge is region root

  Bridge ID Priority 32768
    Address 001a.a917.78cc

Interface    Role Sts Cost      Prio    OperEdge Type
-----
Gi0/2        Desg FWD 20000    128     False   P2p
Ruijie#show spanning-tree summary

Spanning tree enabled protocol mstp
MST 0 vlans map : 1-9, 11-19, 21-4094
  Address 001a.a917.78cc
  this bridge is root
  Hello Time 2 sec Forward Delay 15 sec Max Age 20 sec

  Bridge ID Priority 32768
```

```

Gi0/1          Root FWD 20000      128      False   P2p

```

```

MST 2 vlans map : 20

```

```

  Region Root Priority   32768
        Address      001a.a917.78cc
        this bridge is region root

```

```

  Bridge ID Priority   32768
        Address      00d0.f822.3344

```

```

Interface      Role Sts Cost      Prio      OperEdge Type
-----

```

```

Gi0/2          Root FWD 20000      128      False   P2p

```

z Få € M Å % " k - } ¼ h € M VLAN v ÿ ' ð ø • ' e è € € M VLAN ç n F å %² øž

5.3.3 MSTP Region

z Få MSTP Region U Y w J „ ? — Õ Ô 9 c %² MSTP Regin Ä k R ò § € à ì " ÷ øž

z } • Ú V — Õ Ô 9 c %² MSTP Region k < } • Û V — Õ Ä , c d f gName ho • , c Revision Number • , c Instance—Vlan + • nož

z U Y F å 0 I64 Z Instance m „ ? Vlan k p Vlan < ã F Ě Instance 0 ož %² Vlan Q K 9 %² Instance ož

z • ' Ó `` ¼ { STP % " Få Instance—Vlan + • n k F å ñ e Ç ø • MSTP k Y ' š à ì " ; l y v • øž

1 MSTP Region

z U # F å

z } • Ú V — Õ Ô 9 c %² MSTP Region ž F åž

z * instance instance-id vlan vlan-range x X F å MST Instance Vlan + • ¼ © øž

z * name name x X F å MST d fož

z * 2.78 0 Td [<036B>62<0B4609E5 1 9]TJ f 884609E50>]TJ0A9A

1 MST Instance Vlan

```

o~ x X "o- Instance instance-id vlan vlan-range
o~ @ f^ ¢o- instance-id yMST Instance ID k 8 0 l64 ož
              vlan-range yVLAN ID k 8 1 l4094 ož
o~ x X % "o- MST F Å % "
o~ ... 6 -o- vlan Á • ñ%² MST instance ... 4 x Xož
              † Ů^y
              instance 1 vlan 2-200 < vñ 2 ñ vlan 200 C • ñ instance 1 ož
              instance 1 vlan 2,20,200 < vñ 20-vlan 20 kvlan 200 • ñ instance 1 ož
              c ý k Ó U Y no x X vlan R instance í " k í " vlan ô µ instance 0ož

```

1 MST

```

o~ x X "o- name name
o~ @ f^ ¢o- name yMST F Å d f k ¥ ... Å Ů U Y Ä 32 -ož
o~ x X % "o- MST F Å % "
o~ ... 6 -o- -

```

1 MST

```

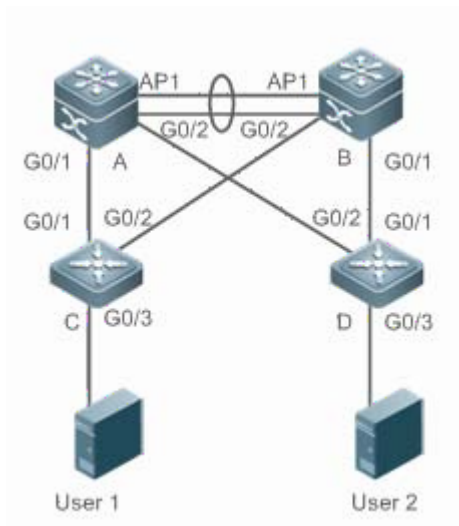
o~ x X "o- revision version
o~ @ f^ ¢o- version y 6 MST revision number k 8 0 l65535 ož P . > 0
o~ x X % "o- MST F Å % "
o~ ... 6 -o- -

```

» • " h H ' u 0 MSTP ä VRRP - ' " d

1 MSTP+VRRP MSTP VLAN

o~ à ì ê Ěo-
£ 5-20



```

o~ F Å • co- " A E Ñ A k B k C k D k ø • MSTP # ' k ë • † 1 k 2ož
              F Å A E Ñ A MSTP † 0 y 1 ý k A E Ñ B † 2 ý ož
              F Å A E Ñ A VLAN 1 k 10 VRRP Master — Ů k A E Ñ B VLAN 20 VRRP Master
              — Ůož

```

A

```

†%² 5 k F å  VLAN 10,20 k c ž — Œ ; û € M F å è   Trunk M
A(config)#vlan 10
A(config-vlan)#vlan 20
A(config-vlan)#exit
A(config)#int range gi 0/1-2
A(config-if-range)#switchport mode trunk
A(config-if-range)#int ag 1
A(config-if-AggregatePort 1)# switchport mode trunk

† 8 5 k ø •   MSTP k c ž è • †   1 k2
A(config)#spanning-tree
A(config)# spanning-tree mst configuration
A(config-mst)#instance 1 vlan 10
A(config-mst)#instance 2 vlan 20
A(config-mst)#exit

† 5 k F å — Œ   A   †   0 y 1  ÿ
A(config)#spanning-tree mst 0 priority 4096
A(config)#spanning-tree mst 1 priority 4096
A(config)#spanning-tree mst 2 priority 8192

† š 5 k F å   VRRP   i ´ k ... — Œ   A   VLAN 10   VRRP Master — Œ k c ž F å   VRRP Z à ¼ IP a -
A(config)#interface vlan 10
A(config-if-VLAN 10)ip address 192.168.10.2 255.255.255.0
A(config-if-VLAN 10) vrrp 1 priority 120
A(config-if-VLAN 10) vrrp 1 ip 192.168.10.1

† < 5 k VRRP   ó • i ´   100 k ... — Œ A   VLAN 20   VRRP Backup — Œ
A(config)#interface vlan 20
A(config-if-VLAN 20)ip address 192.168.20.2 255.255.255.0
A(config-if-VLAN 20)vrrp 1 ip 192.168.20.1

```

B

```

†%² 5 k F å  VLAN 10,20 k c ž — Œ ; û € M F å è   Trunk M
B(config)#vlan 10
B(config-vlan)#vlan 20
B(config-vlan)#exit
B(config)#int range gi 0/1-2
B(config-if-range)#switchport mode trunk
B(config-if-range)#int ag 1
B(config-if-AggregatePort 1)#switchport mode trunk

† 8 5 k ø •   MSTP k c ž è • †   1 k2
B(config)#spanning-tree
B(config)#spanning-tree mst configuration
B(config-mst)#instance 1 vlan 10
B(config-mst)#instance 2 vlan 20
B(config-mst)#exit

† 5 k F å — Œ   A   †   2  ÿ
B(config)#spanning-tree mst 0 priority 8192
B(config)#spanning-tree mst 1 priority 8192
B(config)#spanning-tree mst 2 priority 4096

† š 5 k F å   VRRP Z à ¼ IP a -
B(config)#interface vlan 10
B(config-if-VLAN 10)ip address 192.168.10- f 10- f 10- f 10B   d

```

C

```

† < 5 k F å VRRP i ¯ ´ 120 k ... — ŒB VLAN 20 VRRP Master — Œ
B(config)#interface vlan 20
B(config-if-VLAN 20)vrrp 1 priority 120
B(config-if-VLAN 20)ip address 192.168.20.3 255.255.255.0
B(config-if-VLAN 20)vrrp 1 ip 192.168.20.1

```

```

† % 2 5 k F å VLAN 10,20 k c ž — Œ ; û € M F å è Trunk M
C(config)#vlan 10
C(config-vlan)#vlan 20
C(config-vlan)#exit
C(config)#int range gi 0/1-2
C(config-if-range)#switchport mode trunk

```

```

† 8 5 k ø • MSTP k c ž è • † 1 k 2
C(config)#spanning-tree
C(config)#spanning-tree mst configuration
C(config-mst)#instance 1 vlan 10
C(config-mst)#instance 2 vlan 20
C(config-mst)#exit

```

```

† 5 k F å — Œ C + N ĩ € M Portfast M k c ž o BPDU Guard ož
C(config)#int gi 0/3
C(config-if-GigabitEthernet 0/3)#spanning-tree portfast
C(config-if-GigabitEthernet 0/3)#spanning-tree bpduguard enable

```

D

```

c — Œ Což

```

Gi0/1	Desg FWD	200000	128	False	P2p
Gi0/2	Desg FWD	200000	128	False	P2p

MST 2 vlans map : 20

Region Root	Priority	4096
Address	001a.a917.78cc	
this bridge is region root		

Bridge ID	Priority	8192
-----------	----------	------

C

```

Ag1          Desg FWD 19000    128    False    P2p
Gi0/1        Desg FWD 200000    128    False    P2p
Gi0/2        Desg FWD 200000    128    False    P2p

Ruijie#show spanning-tree summary

Spanning tree enabled protocol mstp
MST 0 vlans map : 1-9, 11-19, 21-4094
  Root ID    Priority    4096
              Address    00d0.f822.3344
              this bridge is root
  Hello Time  4 sec    Forward Delay 18 sec    Max Age 25 sec

  Bridge ID   Priority    32768
              Address    001a.a979.00ea
              Hello Time  2 sec    Forward Delay 15 sec    Max Age 20 sec

Interface      Role Sts Cost        Prio    Type OperEdge
-----
Fa0/2          Altn BLK 200000    128     P2p    False
Fa0/1          Root FWD 200000    128     P2p    False

MST 1 vlans map : 10
  Region Root Priority    4096
              Address    00d0.f822.3344
              this bridge is region root

  Bridge ID   Priority    32768
              Address    001a.a979.00ea

Interface      Role Sts Cost        Prio    Type OperEdge
-----
Fa0/2          Altn BLK 200000    128     P2p    False
Fa0/1          Root FWD 200000    128     P2p    False

MST 2 vlans map : 20
  Region Root Priority    4096
              Address    001a.a917.78cc
              this bridge is region root

  Bridge ID   Priority    32768
              Address    001a.a979.00ea

Interface      Role Sts Cost        Prio    Type OperEdge
-----
Fa0/2          Root FWD 200000    128     P2p    False
Fa0/1          Altn BLK 200000    128     P2p    False

```

D

z MSTP "÷ kMST ı Få•'Få%² ož

z Få †y VLAN ¥0¼©ž kVLAN Z Ä ë•ož

z " MSTP+VRRP "÷ k— Ō ò ç g STP ê RSTP # 'ké¥— Ō © 7 Á c MST ı 'c gÿ è ù ‹ ož

5.3.4 RSTP

z F 5 link-type ¼ © ñ RSTP © k ½, v • ož

z F 5 ¥ € M N • ° © © “ μ + μ N ” k %² μ ¼ © ñ RSTP © k ½, v • ož ¬ @ Á RSTP ½, v • ož
 ¢ Ó — å ¥ › ž k — Œ k Ÿ G € M “ E W” Û Á Û — å k ¶ E W € M < — link type point-to-point k ! E W
 < — shared ož Ó - U Y ò — å link type Û Ð € M N © © “ μ + μ N” ož

ì link-type

z U # F 5

z a P à š ož

z ... show spanning-tree [mst instance-id] interface interface-id x X ò 0 Ÿ è ù N M F 5 ' Ÿ ož

ì link-type

o ¬ x X ” o- spanning-tree link-type [point-to-point | shared]
 o ¬ @ f a ¢ o- point-to-point y ò — å ¥ N M N • ° point-to-point
 shared y ò — å ¥ N M N • ° shared
 o ¬ x X % ” o- N M F 5 % ”
 o ¬ ... 6 -o- F 5 ¥ € M N • ° © © “ μ + μ N ” k %² μ ¼ © ñ RSTP © k ½, v • ož ¢ ï — å ¥ ›
 ž k — Œ k Ÿ G € M “ E W” Û Á Û — å ož

ì RSTP

o ¬ F 5 • co- F 5 € M N • ° μ + μ à Ÿ ož
 Ruijie(config)#int gi 0/1
 Ruijie(config-if-GigabitEthernet 0/1)#spanning-tree link-type point-to-point

o ¬ à • co- z * show spanning-tree summary ò 0 € M N • ° ož

```
Ruijie#show spanning-tree summary

Spanning tree enabled protocol mstp
MST 0 vlans map : ALL
  Root ID    Priority    32768
            Address      001a.a917.78cc
            this bridge is root
            Hello Time   2 sec   Forward Delay 15 sec   Max Age 20 sec

  Bridge ID   Priority    32768
            Address      00d0.f822.3344
            Hello Time   2 sec   Forward Delay 15 sec   Max Age 20 sec

Interface    Role Sts Cost        Prio    OperEdge Type
-----
Gi0/1        Root FWD 20000        128     False    P2p
```

z € M N • ° y , ä o • E W Ä ¼ ož ò ç © ! E W k é N • ° sharedož

5.3.5

z — ä — Ö i ¯ ' gSwitch Priority h ¼ © 5 ñ , „ — Ö ... à ì ý k c ž - ¼ © ñ ... à ì "; È ä ož

z — ä € M i ¯ ' gPort Priority h ¼ © 5 ñ , „ € M μ Forwarding Ù Á ož

z • ' ' ò t p ¶ — Ö i ¯ ' — ± ä ? g f > 4 h k ý Ä ï 9 ... à ì l ož U Y Ë c Instance ä F c
 — Ö i ¯ ' k _ Instance U ÿ G ? > g Þ y ÿ è ù # ' ož + 9 c Region • — Ö k [Q ¼ ¶ CIST
 gInstance 0 h i ¯ ' ož ò Bridge ID ñ " k i ¯ ' — ä > Ä 16 k C 4096 • f k ä ð © 0 k 4096 k 8192 k
 12288 k 16384 k 20480 k 24576 k 28672 k 32768 k 36864 k 40960 k 45056 k 49152 k 53248 k 57344 k 61440 ož Þ .
 > 32768 ož

z ¢ Ä € M C ° %² » F P Ä k — Ö k # + %² ä i ¯ ' g f > 4 h € M μ Forwarding Ù Á k z i ¯ ' g f
 > Ý h € M μ Discarding Ù Á ož ò ç € M i ¯ ' %² ý k < # € M Z 4 ; μ Forwarding Ù Á ož Ó U
 Y ° %² € M Ë c Instance ä F c € M i ¯ ' k _ Instance U ÿ G ? > g Þ y ÿ è ù # ' ož

z € M i ¯ ' y — Ö i ¯ ' %² ý k U F ä i ¯ ' > - Ä 16 Y • @ 0 O p F • k

i

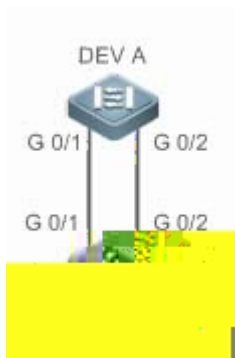
```

o- x X "o- spanning-tree [ mst instance-id]port-priority priority
o- @ f a 0- mst instance-id yInstance Z k 8 0 l64 ož
port-priority priority y € M i ' k U # 0 k 16 k 32 k48 k 64 k 80 k96 k 112 k 128 k144 k160 k176 k
192 k 208 k224 k240 k » 16 ... f k @ 16 • f ož
o- x X % "o- N M F å % "
o- ... 6 -o- " Region Ä ¥ è ê è ž k i ' # + ä i ' € M Ô 9 G Û Á ož i ' , c ž k Y # N M Z û 4
€ Mož
... 4 x X k 1 $ € ñ Region Ä ¥ è ê è „ € M k Ô 9 G Û Á ož

```

i

o- à l ê Ëo-
£ 5-21



```

o- F å • co- z F å à i ' k ... DEV A ý è ù ý ož
z F å DEV A € M gi 0/2 € M i ' 16 k ... DEV B € M gi 0/2 # ý € Mož
DEV A † % 2 5 k ø • ý è ù # ' k F å à i ' ož
Ruijie(config)#spanning-tree
Ruijie(config)#spanning-tree mst 0 priority 0
† 8 5 k F å € M Gi 0/2 € M i ' ož
Ruijie(config)# int gi 0/2
Ruijie(config-if-GigabitEthernet 0/2)#spanning-tree mst 0 port-priority 16
DEV B
o- € à • co- z * show spanning-tree summary ò 0 ý è ù " ÷ < ' È çož
DEV A

```

```

Spanning tree enabled protocol mstp
MST 0 vlans map : ALL
  Root ID    Priority    0
            Address    00d0.f822.3344
            this bridge is root
            Hello Time  2 sec  Forward Delay 15 sec  Max Age 20 sec

  Bridge ID  Priority    0
            Address    00d0.f822.3344
            Hello Time  2 sec  Forward Delay 15 sec  Max Age 20 sec

Interface    Role Sts Cost        Prio    OperEdge Type
-----
Gi0/2        Desg FWD 20000       16      False    P2p
Gi0/1        Desg FWD 20000       128     False    P2p

```

DEV B

```

Ruijie#show spanning-tree summary

Spanning tree enabled protocol mstp
MST 0 vlans map : ALL
  Root ID    Priority    0
            Address    00d0.f822.3344
            this bridge is root
            Hello Time  2 sec Forward Delay 15 sec Max Age 20 sec

  Bridge ID  Priority    32768
            Address    001a.a917.78cc
            Hello Time  2 sec Forward Delay 15 sec Max Age 20 sec

Interface          Role Sts Cost          Prio    OperEdge Type
-----
Gi0/2              Root FWD 20000         128     False    P2p
Gi0/1              Altn BLK 20000         128     False    P2p

```

o•j

z € M i - ' Q Ä " 6 u € M " w ö Ü • ož

5.3.6

z € M è - 0 Ě gPath Cost h k \$ € € M ô G Û Á k C \$ € ... à ì " ÷ Ě ã ož

z € ĩ € M Path Cost P . > ž k F Å è - 0 Ě < ' • c k \$ € € M è - 0 Ě < ' Ě ç ož

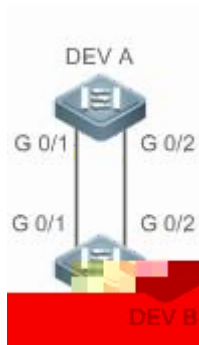
z — Ō © ŷ G „ € M ñ ŷ gRoot Bridge h Path Cost Ě y Â 4 ò # Root Port k œ 4 Port Path Cost — å
¼ © ñ Î — Ō Root Portož P . > © 7 Interface e è , ä gThe Media Speed h < ' k , ä ä 0 Ě 4 k
ò ç ' ò t Z Ä Ō ð - } U · ¾ w kœ ý ' ß Path Cost Â ` ož Ō U Y " %² € M S + c Instance
ã F c è - 0 Ě k _ Instance U ŷ G ? > g P y ŷ è ù # ' ož

z € ¥ € M Path Cost P . > ž k — Ō k ŷ G € M , ä < ' ß ¥ € M Path Costžx IEEE 802.1d-1998 y IEEE
802.1t + , c e è , ä • 4 c Path Cost > k 802.1d-1998 H > 8 © ? ... ° gshort hg1—65535 hk802.1t
H > 8 © x ... ° glong h(1—200,000,000) ož ĺ + 9 AP Cost > Ä • y é [\ Ä • j Ō ò M
Cost > * 95% z ò Ō P < • 20,000,000,000/(AP Ž e è k !) k ĺ AP Ž e è k ! è t M k !
*UP è t M fož - ' ò t %² } ĩ %² ñ ... à ì Ä Path Cost ö Ō ož P . % " \ Ä x ... ° % " ož

z n ç ß _ • c + c e è , ä — å Path Cost ož

€ M , ä	Interface	IEEE 802.1d gshort h	IEEE 802.1t glong h	IEEE 802.1t glong standard h
10M	— * € M	100	2000000	2000000
	Aggregate Link	95	1900000	2000000 , linkupcnt
100M	— * € M	19	200000	200000
	Aggregate Link	18	190000	200000 , linkupcnt
1000M	— * € M	4	20000	20000
	Aggregate Link	3	19000	20000 , linkupcnt
10000M	— * € M	2	2000	2000
	Aggregate Link	1	1900	20000 , linkupcnt

o- à l'ê Ëo-
£ 5-22



o- Få • co-

z Få à i' k ... DEV A ý è ù ý ož
z Få DEV B € M gi 0/2 € M è - 0 Ě 1 € M

z "w€Mè¬0ËkQÄ"Nv€MFåöÜ•ož

5.3.7 BPDU

z Få BPDU I ÂÝéf gMaximum-Hop Count hkk§€ BPDU ýxÊkRò§€àì"÷ož

z BPDU I ÂÝéf ɓ.›© 20k%²"¬} g"wož

ì Maximum-Hop Count

z U#Fãožòçàì"÷•%ûÝk...± BPDU I n'Ý 4ó• 20 éké•'¼w max-hops Fãož

z ^aP à šož

ì


```
##### mst 0 vlans map : ALL
BridgeAddr : 00d0.f822.3344
Priority: 0
TimeSinceTopologyChange : 2d:0h:46m:4s
TopologyChanges : 25
DesignatedRoot : 0.001a.a917.78cc
RootCost : 0
RootPort : GigabitEthernet 0/1
CistRegionRoot : 0.001a.a917.78cc
CistPathCost : 20000
```

5.3.8 port fast

- z • Port Fast e € M k + N Forwardingož x k œ v ñ BPDU ò ... Port Fast Operational State disabled kR ò 3 o @ STP ' c ò Forwardingož
- z € M • BPDU Guard e k ò ç " € M v ñ BPDU k é k µ Error-disabled Ù Áož
- z • BPDU Filter e k , • € M k ~ G k - v BPDUož

- z • î N M portfast k ¶ B BPDU guard F å õ ý jož
- z • ¶ B BPDU Filter enabled Ù Á kPort Fast enabled Interface 1 ~ v BPDU k - G BPDU k ý k + Port Fast enabled € M Ñ < v ñ BPDUož ò ç Port Fast enabled Interface œ v ñ BPDU ò ... Port Fast Operational Ù Á disabled kBPDU Filter - < â jož
- z • î N M portfast k ¶ B BPDU filter F å õ ý jož

1 port fast

- z U # F å
- z ò ç — Œ € M + 5 à ì Ä € k ; " < U Y — å € M Port Fastož

1 BPDU Guard

- z U # F å
- z ò ç — Œ € M + 5 à ì Ä € k 4 ... 2 l ñ BPDU x à - ý è ù " ÷ G ý ' o k U Y " ? € M F å BPDU Guard ož • o BPDU Guard € M v ñ BPDU k € M k µ Error-disabled Ù Áož
- z ò ç — Œ € M + 5 à ì Ä € k 4 ... 2 € M ß è è k - U Y F å BPDU Guard ... 2 è è ož • % Ó — Œ g A ò HUB h Ü ô G BPDU lož

1 BPDU Filter

- z U # F å
- z 4 ... 2 ' o BPDU † + ý è ù " ÷ § € k U Y " € M F å BPDU Filter j J ? ' o BPDUož

z a P à šož

z ... show spanning-tree [mst instance-id] interface interface-id x X ò 0 ÿ è ù N M F ă ' îož

İ

Port Fast

o¬ x X "o- spanning-tree portfast

o¬ @ f a ¢o- -

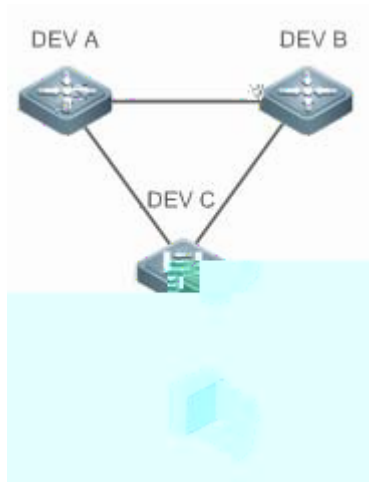
o¬ x X % "o- N M F ă % "

o¬ ... 6 -o- ø • Port Fast e ¥ € M k + N Forwardingož x k œ v ñ BPDU ò ... Port Fast Operational State disabled k R ò 3 o @ STP ' c ò Forwarding

o 0 -

o¬ x X % "o-

o-àlêĚo-
£ 5-23



o- F ă • co-

DEV C

z F ă DEV C € M gi 0/3 Port Fast € M k c ž • o BPDU Guard ož

```
Ruijie(config)# int gi 0/3
Ruijie(config-if-GigabitEthernet 0/3)# spanning-tree portfast
%Warning: portfast should only be enabled on ports connected to a single
host. Connecting hubs, switches, bridges to this interface when portfast is
enabled, can cause temporary loops.
Ruijie(config-if-GigabitEthernet 0/3)#spanning-tree bpduguard enable
```

o- à • co-

DEV C

z * show spanning-tree interface x X ò 0 € M F ă ' Ń ož

```
Ruijie#show spanning-tree int gi 0/3

PortAdminPortFast : Enabled
PortOperPortFast : Enabled
PortAdminAutoEdge : Enabled
PortOperAutoEdge : Enabled
PortAdminLinkType : auto
PortOperLinkType : point-to-point
PortBPDUGuard : Enabled
PortBPDUFilter : Disabled
PortGuardmode : None

##### MST 0 vlans mapped :ALL
PortState : forwarding
PortPriority : 128
PortDesignatedRoot : 0.00d0.f822.3344
PortDesignatedCost : 0
PortDesignatedBridge :0.00d0.f822.3344
PortDesignatedPortPriority : 128
PortDesignatedPort : 4
PortForwardTransitions : 1
PortAdminPathCost : 20000
PortOperPathCost : 20000
Inconsistent states : normal
PortRole : designatedPort
```

5.3.9 TC

z • TC Protection ž kv ň TC-BPDU † e %² ž • Ä g %² " 4 a h k Q g %²) í " q • o ž ý U Y 9
² È ¯ í " MAC ª - n ¾ y ARP n ¾ o ž

z • TC Guard e k ¢ %² € M v ň TC TC

1 tcguard

```
o x X "o- spanning-tree tc-guard
o @ f a o- -
o x X % "o- N M F a % "
o ... 6 -o- o tc-guard k ... 2 tc t y ož
```

1 tc

```
o x X "o- spanning-tree ignore tc
o @ f a o- -
o x X % "o- N M F a % "
o ... 6 -o- o tc i k e M v ñ TC t 1 O ò ož
```

1 TC Guard

```
o F a • co- F a M TC Guard
Ruijie(config)#int gi 0/1
Ruijie(config-if-GigabitEthernet 0/1)#spanning-tree tc-guard
o à • co- z * show run interface x X ò 0 M TC Guard F a ož
Ruijie#show run int gi 0/1
Building configuration...
Current configuration : 134 bytes
interface GigabitEthernet 0/1
switchport mode trunk
spanning-tree tc-guard
```

```
z j " a F a TC Guard ê TC i k U k- à l — Ō t ô G B jož A ò " ÷ G ŷ J Ō Ñ k Z Ä C
ž Ž " MAC a - - t ô G B jož
```

5.3.10 BPDU MAC

```
z ø • BPDU > MAC ò • ¼ k 1 Q N I > MAC a - 6 MAC BPDU I k i J ě ñ Ä N v BPDU lož
```

```
z ¢ G 4 î € M μ + μ e è + €, A E Ñ ž W Y F a BPDU > MAC ò Ū ñ Q N v + € A E Ñ G BPDU
lož
```

1 BPDU MAC

```
z U # F a
z P . © ¼ { ož
z 4 ... 2 Ð P BPDU x à k U Y F a BPDU > MAC ò ož
```

z^a P à šož

I bpdu mac

o→ x X "o- bpdu src-mac-check H.H.H

o→ @ f^a ¢o- H.H.H y n P Q N v > mac^a - ¥^a - bpdu lož

o→ x X % "o- N M % "

o→ ... 6 -o- ... BPDU > MAC ò © 4 ... 2 * K G BPDU † Û Ð Þ x à A E Ñ ò ... MSTP W • 3 oož

¢ G 4 î € M µ + µ e è + €, A E Ñ ž k U * F å BPDU > MAC ò Û ñ Q N v + € A E

Ñ G BPDU l k ' ñ Ä ¿ U BPDU l k R ò ñ ... 2 Ð Þ x àož

U Y " interface % " Û Ô € M F å , • BPDU > MAC ò MAC^a - k %² € M Q^a • F

å %² i MAC^a - ož

I BPDU MAC

o→ F å • co- F å € M BPDU > MAC ò

z P . © Ø • ož

z ^a P à Šož

ì

o→ x X "o- spanning-tree autoedge

o→ @ f ^a Øo- -

o→ x X % "o- N M % "

o→ ... 6 -o- 6 u M "%² ž • 8 Ä(3 a) k ò ç v ñ • € M G BPDU k é • ¥ € M , © %² V à
 Ì — Œ k R ò — á ¥ € M Ů € M k + N μ Forwarding Û Á ož ö œ Ů M € M œ v ñ BPDU
 ò œ ð ³ Ů Mož
 U Y * spanning-tree autoedge disabled x X H f Ů M œ ð ož

ì

Auto Edge

o→ F Å • co- ¼ { € M Auto Edge

```
Ruijie(config)#int gi 0/1
```

```
Ruijie(config-if-GigabitEthernet 0/1)#spanning-tree autoedge disabled
```

o→ à • co- z * show spanning-tree interface x X ò 0 € M Spanning Tree F Å ož

```
Ruijie#show spanning-tree interface gi 0/1
```

```
PortAdminPortFast : Disabled
```

```
PortOperPortFast : Disabled
```

```
PortAdminAutoEdge : Disabled
```

```
PortOperAutoEdge : Disabled
```

```
PortAdminLinkType : point-to-point
```

```
PortOperLinkType : point-to-point
```

```
PortBPDUGuard : Disabled
```

```
PortBPDUFilter : Disabled
```

```
PortGuardmode : None
```

```
##### MST 0 vlans mapped :ALL
```

```
PortState : forwarding
```

```
PortPriority : 128
```

```
PortDesignatedRoot : 0.00d0.f822.3344
```

```
PortDesignatedCost : 0
```

```
PortDesignatedBridge :0.00d0.f822.3344
```

```
PortDesignatedPortPriority : 128
```

```
PortDesignatedPort : 2
```

```
PortForwardTransitions : 6
```

```
PortAdminPathCost : 20000
```

```
PortOperPathCost : 20000
```

```
Inconsistent states : normal
```

```
PortRole : designatedPort
```

z Ů € M œ ð k ó • 6 u M 3 a Ä Ì N v ñ BPDU < 1 € M œ ð è Ů € M w y / Forwardož ò ç à Ì è
 Ě " ê v G † • ë » k • ' 1 € M œ ð ¼ { ož

5.3.12

z N M ø • Root Guard ž k ò ě "ň Ä † € M ...) 6 € M №² Š ¥ € M v ň i ´ ¼ ä F å ' î ž k
Root Guard k 1 ¥ N M å root-inconsistent (blocked) Û Á, " á Ü x ž • Ä Z Ä v ň ¾ i F å ' î ž k € M
k Ê Ö è = Û 3 o Û Á őž

z 9 % g e è { ž k ý M ê Œ a m 9 v ň B P D U k J è 6 u M µ ô G Û Á k R ò - 4 à ì ê è D ý k
LOOP Guard ... 2 4 _ Œ Ñ G Ÿ ö ž

z	€ M	ROOT Guard	y	LOOP Guard	c% ²	ž	ö	Q	Ä% ²	ÿ	lož
---	-----	------------	---	------------	-----------------	---	---	---	-----------------	---	-----

o¬ x X "o- spanning-tree guard loop
 o¬ @ f ^a ¢o- -
 o¬ x X % "o- N M F å % "
 o¬ ... 6 -o- o loop guard k ... 2 ŷ € M ê Õ a M œ v ñ bpdu ò D ŷ U ê è ož
 ì guard
 o¬ x X "o- spanning-tree guard none
 o¬ @ f ^a ¢o- -
 o¬ x X % "o- N M F å % "
 o¬ ... 6 -o- ℙ . © ¼ { guard ož

 ì

```
PortDesignatedRoot : 0.001a.a917.78cc
PortDesignatedCost : 0
PortDesignatedBridge :0.001a.a917.78cc
PortDesignatedPortPriority : 128
PortDesignatedPort : 17
PortForwardTransitions : 1
PortAdminPathCost : 20000
PortOperPathCost : 20000
Inconsistent states : normal
PortRole : rootPort
```

```
Ruijie#show spanning-tree int gi 0/2
```

```
PortAdminPortFast : Disabled
PortOperPortFast : Disabled
PortAdminAutoEdge : Enabled
PortOperAutoEdge : Disabled
PortAdminLinkType : auto
PortOperLinkType : point-to-point
PortBPDUGuard : Disabled
PortBPDUFilter : Disabled
PortGuardmode : Guard loop
```

```
##### MST 0 vlans mapped :ALL
PortState : discarding
PortPriority : 128
PortDesignatedRoot : 0.001a.a917.78cc
PortDesignatedCost : 0
PortDesignatedBridge :0.001a.a917.78cc
PortDesignatedPortPriority : 128
```

z a P à šož

BPDU

bridge-frame forwarding protocol bpdu

IEEE 802.1Q ö Ö k BPDU) MAC a- 01-80-C2-00-00-00 © • ' a-... K 8² IEEE 802.1Q ö Ö — Ö k + 9 N v ñ BPDU l © ô G ož Ä ò k " Ž à ì b æ k U ñ } — Ö Ü u 4 % n BPDU lož † ò k — Ö ì • o STP # ' ž k ñ } % n BPDU l k ... ± \$; — Ö \$ • ÿ è ù < ' 3 oož

BPDU % n Q " STP # ' ¼ { ž ò o • ož ¢ STP # ' ø • ž k — Ö % n BPDU lož

BPDU

à ì ê Ë-
£ 5-25



DEVA kC • o ÿ è ù # ' kDEV B ì • o ÿ è ù # ' ož

F Å • co- z DEV B F Å BPDU % n k ... ± DEV A kC \$ • STP # ' Ü 3 G < ' ož

DEV B

Ruijie(config)#bridge-frame forwarding protocol bpdu

à • co-

z * show run ò 0 BPDU % n © k • oož

DEV B

Ruijie#show run

Building configuration...
Current configuration : 694 bytes
bridge-frame forwarding protocol bpdu

5.4

! } • • n û ¶ Q / û clear a — ¶ Ÿ Û 7 ' ð o l ž — ý ! æ ` / n d

•	x X
Ž " € M v G ĭ < ' î	clear spanning-tree counters [interface interface-id]
Ž " STP " ÷ w J ' î	clear spanning-tree mst instance-id topochange record

• x X

<code>^P MSTP _ 3/4 @ f 'Î C ÿ è ù " ÷ 'Î</code>	<code>show spanning-tree</code>
<code>^P MSTP v G Î < 'Î</code>	<code>show spanning-tree counters [interface interface-id]</code>
<code>^P MSTP _ instance 'Î C ç € M ô G Ù Á 'Î</code>	<code>show spanning-tree summary</code>
<code>^P æ ÿ ' ê ê è ' ò block € M</code>	<code>show spanning-tree inconsistentports</code>
<code>^P MST ç F å 'Î</code>	<code>show spanning-tree mstconfiguration</code>
<code>^P ¥ instance MSTP 'Î</code>	<code>show spanning-tree mst instance-id</code>
<code>^P 6 interface + • instance MSTP 'Î</code>	<code>show spanning-tree mst instance-id interface interface-id</code>
<code>^P 6 † N M " ÷ w J 'Î</code>	<code>show spanning-tree mst instance-id topochange record</code>
<code>^P 6 interface ñ Ä instance MSTP 'Î</code>	<code>show spanning-tree interface interface-id</code>
<code>^P forward-time</code>	<code>show spanning-tree forward-time</code>
<code>^P Hello time</code>	<code>show spanning-tree hello time</code>
<code>^P max-hops</code>	<code>show spanning-tree max-hops</code>
<code>^P tx-hold-count</code>	<code>show spanning-tree tx-hold-count</code>
<code>^P pathcost method</code>	<code>show spanning-tree pathcost method</code>



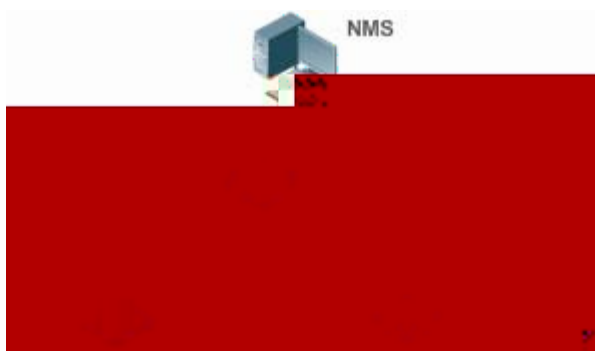
Û { 8 Ë ð o V 1/2 , Ä ‡ W d ° û ~ È K ‡ ' ž 8 Ë — ' d

•	x X
<code>ø • ÿ è ù ñ Ä ² j • 1/4</code>	<code>debug mstp all</code>
<code>ø • ÿ è ù GR ² j • 1/4</code>	<code>debug mstp gr</code>
<code>ø • N v BPDU † ² j • 1/4</code>	<code>debug mstp rx</code>
<code>ø • G BPDU † ² j • 1/4</code>	<code>debug mstp tx</code>
<code>ø • ÿ è ù 7 ^ ² j • 1/4</code>	<code>debug mstp event</code>
<code>ø • ÿ è ù Loop Guard Ô Å ² j • 1/4</code>	<code>debug mstp loopguard</code>
<code>ø • ÿ è ù Root Guard Ô Å ² j • 1/4</code>	<code>debug mstp rootguard</code>
<code>ø • Bridge Detect Ù Á Ñ ² j • 1/4</code>	<code>debug mstp bridgedetect</code>

6 LLDP

6.1

LLDP gLink Layer Discovery Protocol k e è C G ë # ' h © IEEE 802.1AB # %²_e è C G ë # ' ož * LLDP #
 ' Ü g " ÷ G ë C K W " ÷ J Ō ŃžLLDP 1 — Ō îª' î Á Ā è TLV " gType/Length/Value k • %/
 x †/ > † x " LLDPDUgLLDP data unit k e è C G ë # ' f G % « h G Ě > D — Ō k ž 1 > D — Ō G LLDPDU
 Y MIB gManagement Information Base k ' ò ' î € h ¥ " ¥ Ü Ů k U ^ Ě à ì ' ò © î ~ jož
 * LLDP k à ì ' ò © î U Y K W " ÷ N Ō Ń k A ò — Ō „ ? € M ¿ — Ō , N k e è N (> hnC9 65 218E4 /TD0 1 T-4<06F7 Tf 0 Tc 1.7





č y

z M n P © j TLVož

z " LLDPDU k Chassis ID TLVo•Port ID TLVo•Time To Live TLV y End Of LLDPDU TLV © · Ä`k kò č •
 ° TLV © U #`kož

LLDP

LLDP † u 4 _/x " yEthernet II y SNAP gSubnetwork Access Protocols k ŷ à ~ | # ' hož

č Ethernet II "/x LLDP † ò £ ñ P y

£ 6-4 Ethernet II "/x LLDP †

Destination Address	Source Address	Ethertype	LLDPDU	FCS
---------------------	----------------	-----------	--------	-----

č y

z Destination Address y) MAC a - k LLDP Á n a - 01-80-C2-00-00-0Eož

z Source Address y> MAC a - k — Œ € M MAC a -ož

z Ethertype y Y ß à • ° k 0x88CCož

z LLDPDU yLLDP # ' f G % «ož

z FCS y l û à ~ çož

SNAP "/x LLDP † ò £ ñ P y

£ 6-5 SNAP "/x LLDP †

č y

z Destination Address y) MAC a - k LLDP Á n a - 01-80-C2-00-00-0Eož

z Source Address y> MAC a - k — Œ € M MAC a -ož

z SNAP-encoded Ethertype ySNAP /x Y ß à • ° k AA-AA-03-00-00-00-88-CC.ož

z LLDPDU yLLDP # ' f G % «ož

z FCS y l û à ~ çož

TLV

LLDPDU /x TLV U Y ä è 8 Ý • y

z Ä î ' ò TLV

z Ä Ä # TLV

Ä î ' ò TLV © %² Á 9 à î ' ò Ä E TLV □ `ož Ä Ä # TLV © ö Œ Ä Ä y č Ñ ä # TLV ka ò IEEE 802.1
 Ä Ä • IEEE 802.3 Ä Ä ä ð # 4 _ TLV □ `ož

1. TLV

Ä î ' ò TLV □ ` m 4 _ • ° TLV y TLV y U # TLVož TLV © 6 ¥ TLV ' î • Ä m " LLDPDU G b k
 U # TLV © 6 ŷ G ¬ } G TLV © k m " LLDPDU G bož

TLV °	TLV °
LLDP-MED Capabilities TLV	— Ö © k u 4 LLDP-MED ° LLDPDU / x LLDP-MED TLV ° Y C ¢ ù — Ö ° g à ì N — Ö ê Ä € h
Network Policy TLV	* s € M VLAN F å ° u 4 • ° g ò § ° ê , È ho • 8 C i ¯ ' î ^
Location Identification TLV	y ö æ Ä € — Ö ož " à ì " ÷ v ¢ ^ • Ü ¢ G ^ y ß Ä € — Ö
Extended Power-via-MDI TLV	U ^ 4 ¾ ä ' ^ ' ò
Inventory – Hardware Revision TLV	MED — Ö F ^ í î
Inventory – Firmware Revision TLV	MED — Ö j ^ í î
Inventory – Software Revision TLV	MED — Ö ÷ ^ í î
Inventory – Serial Number TLV	MED — Ö ~ ç Z
Inventory – Manufacturer Name TLV	MED — Ö ò - Æ d f
Inventory – Model Name TLV	MED — Ö % ^ d f
Inventory – Asset ID TLV	MED — Ö ï D ö æ ... k 9) £ ' ò y ï D æ í

, ì 0 o , y ! 6 LLDP Ø Ð [LLDP-MED G ì TLV Ÿ ã d

Ô Å	•
LLDP W • % "	F å LLDP † v G % " ož
LLDP † n Ÿ Ñ	+ u 4 LLDP # ' A E Ñ — Ö U G LLDP † Ě + • ož
ò	
LLDP † N v Ñ	+ u 4 LLDP # ' A E Ñ — Ö U N v + • G LLDP † ož
ò	

6.3.1 LLDP

F å LLDP W • % " k Ü ... A E Ñ v G LLDP † • " G Ÿ J ož

LLDP U ^ 4 _ W • % " y

z TxRx y ~ G - N v LLDPDU ož

z Rx Only y Q N v G LLDPDU ož

z Tx Only y Q G N v LLDPDU ož

¢ € M LLDP W • % " G Ÿ J ž k € M 1 + # ' Ü Á Ñ g ì ÷ q • k * F å € M ì ÷ • ž • k U Y 9 ^

9 W • % " È ¯ w J ò - € M • ^ g ì ÷ q • ož

ì LLDP

Þ . Ö Ñ k N M W • % " TxRx ož

... lldp mode x X U Y w J N M W • % " ož

· À " N M F å W • % " TxRx ö ... LLDP # ' † v G 3 ož 3 N M W • % " F å

N v LLDP † k x — c G LLDP † ž 3 N M W • % " F å Tx Only k " — Ö Q G LLDP † k x — c N v LLDP

† ž 3 ™ M W • % " ¼ { k 1 Ç v G LLDP † ož

İ LLDP

ᐁ. Œ Ñ kLLDP ½, G † f 3 ož

... lldp fast-count x X U Y w J LLDP ½, G † fož

w J ½, G Ñ ò ½, G † fož

0054Axy/TT1002hy00825Dw/61247 0 Td [(LL)-6(DE)P0 7H/C2_0 1 TLD074E>819007<074 567705407J /C2Tj /TT11 Tf DTT5/TT5 n 0.81-h 300T

LLDP † N v PÜ G ë > D — Œ `` Y C ~ ž • ¥ ĩ > D ' ĩ ož 54 616.64 11 1 1 T1 1 4.98 3 re



¶ * "d "

TTL P ô ä LLDP q 3 Ÿ "" . . O d

	no { country state county city division neighborhood street-group leading-street-dir trailing-street-suffix street-suffix number street-number-suffix landmark additional-location-information name postal-code building unit floor room type-of-place postal-community-name post-office-box additional-code } ca-word	í" — Ö ¯ * a _ ' î
<u>Få — Ö ¯ Ä ¢ Z A ' î</u>	 ¶ * " d " • • % „ (% Ü ò ð o d	
	lldp location elin identifier id elin-location tel-number	Få — Ö ¯ Ä ¢ Z A ' î
	no lldp location elin identifier id	í" — Ö ¯ Ä ¢ Z A ' î

6.4.1 LLDP

z ø • ê ¼ { LLDP ož

z ò ç } L N M LLDP

1 LLDP

o F 6' co- ¼ { B LLDP ož

```
Ruijie(config)#no lldp enable
```

o à 6' co- a P LLDP B Û Á ' ťož

```
Ruijie(config)#show lldp status
Global status of LLDP: Disable
```

z NM] 6' o LLDP k x © B Z Ä 6' o LLDP k 4 ž NM LLDP © ŷ | ož

z € M . ñ > D f ' ò " 5 k / € M Â Ú Q . ñ 5 > D ož

z ò ç > D — Œ u 4 LLDP k x © > D — Œ — Œ u 4 LLDP k 9 > D — Œ U k ô G LLDP † k ý k €
M U k . ñ 3 + — Œ ' ťož

6.4.2 LLDP

z F 6' NM LLDP W 6' % " TxRx k é ¥ NM U G y N v † ož

z F 6' NM LLDP W 6' % " Tx k é ¥ NM Q G † k N v † ož

z F 6' NM LLDP W 6' % " Rx k é ¥ NM Q N v † k G † ož

z ¼ { NM LLDP W 6' % " k é ¥ NM N v y G † ož

z LLDP g " Ž Ò ò NM g + 9 AP M k é Ž © g " AP è t M hož Ä L M k V S L M u 4 LLDP ož

U # F 6' ož

z ĩ U ŷ G Ž - } 1 W 6' % " " w Tx ê Rx % " ož

a P NM LLDP Û Á ' ťož

z ò NM LLDP W 6' % " © k y F 6' , což

1 LLDP

o x X " o- lldp mode { rx | tx | txrx }

o @ f a 6' o- rx y n P Q N v G LLDPDU

tx y n P Q G N v LLDPDU

txrx y n P / G A N v LLDPDU

o x X % " o- N M % "

o ... 6 - o- N M LLDP ŷ | ù U © B ... 4 LLDP N M LLDP W 6' % " Ô 9 txo•rx ê txrx ož

1 LLDP

```

o~ x X "o- no lldp mode
o~ @ f a 0o- -
o~ x X % "o- N M % "
o~ ... 6 -o- ¼{ N M LLDP W • % " k 4 ž N M Ç G y N v LLDP tož

```

LLDP

```

o~ F ă • co- N M F ă LLDP W • % " Tx % "ož
Ruijie(config)#interface gigabitethernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)#lldp mode tx

```

```

o~ à • co- a P LLDP " N M ù Á 'lož
Ruijie(config-if-GigabitEthernet 0/1)#show lldp status interface gigabitethernet 0/1
Port [GigabitEthernet 0/1]
Port status of LLDP          : Enable
Port state                   : UP
Port encapsulation           : Ethernet II
Operational mode              : TxOnly
Notification enable          : NO
Error detect enable          : YES
Number of neighbors          : 0
Number of MED neighbors      : 0

```

6.4.3 TLV

z ĩ U Y * F ă g G b TLV • ° k ... G LLDP † LLDPDU Ā w Jož

z F ă Â ĩ ' ò TLVo • IEEE 802.1 Á Ā # TLVo • IEEE 802.3 Á Ā # TLV ž k ò ç 6 all @ f k 1 G b ¥ • ° ĩ Ā U # TLVož

z F ă LLDP-MED TLV ž k ò ç 6 all @ f k 1 G b " Location Identification TLV \$ ù ĩ Ā • ° LLDP-MED TLVož

z F ă a • G b LLDP-MED Capability TLV ž k } ~ F ă a • G b LLDP 802.3 MAC/PHY TLV ž f G b LLDP 802.3 MAC/PHY TLV ž k } ~ H f G b LLDP-MED Capability TLV

F ă LLDP-MED TLV ž k • Ā F ă a • G b LLDP-MED Capability TLV k ò U Y F ă a • G b LLDP-MED ĩ • ° TLVož H f G b LLDP-MED TLV k • Ā ~ H f G b LLDP-MED ĩ • ° TLV k ò a • H f G b LLDP-MED Capability TLVož ¢ — Ō ũ IP ¢ k 3 IP ¢ u 4 LLDP-MED ké U Y * F ă network policy TLV Ą Ě IP ¢ ò ç — Ō ħ . u 4 DCBX k ħ . Ō ĩ € a • G b IEEE 802.3 TLV C LLDP-MED TLV

U # F ă ož

z ĩ U ŷ G ž ~ } ~ ĩ N F ă a • G b TLV • ° ož

TLV F 10

TLV 2

LLDP TLV

no lldp tlv-enable { basic-tlv { all | port-description | system-capability | system-description | system-name } | dot1-tlv { all | port-vlan-id | protocol-vlan-id [vlan-id] | vlan-name [vlan-id] } | dot3-tlv { all | link-aggregation | mac-physic | max-frame-size | power } | med-tlv { all | capability | inventory | location { civic-location | elin } identifier id | network-policy profile [profile-num] | power-over-ethernet } }

basic-tlv y 1 TLV

port-description y n P Port Description TLV

system-capability y n P System Capabilities TLV

system-description y n P System Description TLV

system-name y n P System Name TLV

dot1-tlv y802.1 1 TLV

port-vlan-id y n P Port VLAN ID TLV

protocol-vlan-id y n P Port And Protocol VLAN ID TLV

vlan-id y n P 1 VLAN ID k F 8 y1-4094

vlan-name y n P VLAN Name TLV

vlan-id y n P 6 VLAN d f + • VLAN ID k F 8 y1-4094

dot3-tlv y802.3 1 TLV

link-aggregation y n P Link Aggregation TLV

mac-physic y n P MAC/PHY Configuration/Status TLV

7x-frame-size y n P Maximum Frame Size TLV

power y n P Power Via MDI TLV

med-tlv y LLDP MED TLV

capability y n P LLDP-MED Capabilities TLV

inventory y n P 1 TLV k , F 10 j ^ 10 ÷ ^ 10 ~ 20 - D d fo % 2 d f y D ö ... ^

location y n P Location Identification TLV

civic-location y n P / x à 1 N — Ö * a - ' ^

elin y n P / x - Ä 2 A ' ^

id y n P F 1 ID k F 8 y1-1024

network-policy y n P Network Policy TLV

profile-num y Network Policy 1 ID k F 8 y1-1024

power-over-ethernet y n P Extended Power-via-MDI TLV

N M % "



TLV

no lldp tlv-enable { basic-tlv { all | port-description | system-capability | system-description | system-name } | dot1-tlv { all | port-vlan-id | protocol-vlan-id | vlan-name } | dot3-tlv { all | link-aggregation | mac-physic | max-frame-size | power } | med-tlv { all | capability | inventory | location { civic-location | elin } identifier id | network-policy profile [profile-num] | power-over-ethernet } }

o- @ f^a ¢o- basic-tlv y Â Î ' ò TLV

port-description y n P Port Description TLV

system-capability y n P System Capabilities TLV

system-description y n P System Description TLV

system-name y n P System Name TLV

dot1-tlv y802.1 Á Ã # TLV

port-vlan-id y n P Port VLAN ID TLV

protocol-vlan-id y n P Port And Protocol VLAN ID TLV

vlan-name y n P VLAN Name TLV

dot3-tlv y802.3 Á Ã # TLV

link-aggregation y n P Link Aggregation TLV

mac-physic y n P MAC/PHY Configuration/Status TLV

max-frame-size y n P Maximum Frame Size TLV

power y n P Power Via MDI TLV

med-tlv y LLDP MED TLV

capability y n P LLDP-MED Capabilities TLV

inventory y n P) £ ' ò TLV k , F ^ Í Îo• ÷ ^ Í Îo• ~ ¸ Zo• ò - D Æ d fo• %² d
f y Î D ö œ ... ^

location y n P Location Identification TLV

civic-location y n P / x à Ì N — Ö ¯ * a - ' Î

elin y n P / x ¬ Ä ¢ Z A ' Î

id y n P F å Æ ID k F å 8 y1-1024

network-policy y n P Network Policy TLV

profile-num y Network Policy Æ ID k F å 8 y1-1024

power-over-ethernet y n P Extended Power-via-MDI TLV _ E ‡ b À ú Ö Ì b Æ P ð

Port And Protocol VLAN ID TLV	NO	YES
VLAN Name TLV	YES	YES
IEEE 802.3 extend TLV:		
MAC-Physic TLV	YES	YES
Power via MDI TLV	YES	YES
Link Aggregation TLV	YES	YES
Maximum Frame Size TLV	YES	YES
LLDP-MED extend TLV:		
Capabilities TLV	YES	YES
Network Policy TLV	YES	YES
Location Identification TLV	NO	NO
Extended Power via MDI TLV	YES	YES
Inventory TLV	YES	YES

-

6.4.4 LLDP

z F 6 NM LLDP † G b ' 0 a - k U ... ' 0 a - TLV G ý w Jož

z H f ' 0 a - G b 1 ... LLDP † ' 0 a - 7 p . Ů Ň # Hož

z LLDP g " Ž Ò 0 NM g + 9 AP M k é Ž © g " AP è t M hož Ě L M k VSL M u 4 LLDPož

U # F 6 ož

z " NM F 6 LLDP † G b ' 0 a - ož

a P î a — Ů NM LLDP ' î ož

z ò î a — Ů NM LLDP ' î © k y F 6 , což

ì LLDP

o ↯ x X "o- lldp management-address-tlv [ip-address]

o ↯ @ f a 0o- ip-address y LLDP † G b ' 0 a -

o ↯ x X % "o- NM % "

o ↯ ... 6 -o- p . Ů Ň k LLDP † G b ' 0 a - ož G b ' 0 a - € M a • * Ě 4 VLAN IPv4 a - k 0 ç
¥ VLAN î F 6 IPv4 a - k é Ð Ò 0 % 2 a • * Ě 4 VLAN k + ň ň IPv4 a - 2ož

ì

o ↯ x X "o- no lldp management-address-tlv

o ↯ @ f a 0o- -

o ↯ x X % "o- NM % "

o- ... 6-o- P. Õ Ñ k LLDP † G b ' ò a - ož G b ' ò a - € M a • * Â 4 VLAN IPv4 a - k ò ç
 ¥ VLAN Ì F å IPv4 a - k é Ð Ò ò %2 a • * Â 4 VLAN k + ñ ñ IPv4 a - 2ož

Ì LLDP

o- F å • co- " NM F å LLDP † G b ' ò a - 192.168.1.1

```
Ruijie(config)#interface gigabitethernet 0/1
```

```
Ruijie(config-if-GigabitEthernet 0/1)#lldp management-address-tlv 192.168.1.1
```

o- à • co- ò 0 + • NM , • F å ' Î

```
Ruijie(config-if-GigabitEthernet 0/1)#show lldp local-information interface GigabitEthernet 0/1
```

Lldp local-information of port [GigabitEthernet 0/1]

Port ID type	: Interface name
Port id	: GigabitEthernet 0/1
Port description	: GigabitEthernet 0/1

Management address subtype	: ipv4
Management address	: 192.168.1.1
Interface numbering subtype	: ifIndex
Interface number	: 1
Object identifier	:

802.1 organizationally information

Port VLAN ID	: 1
Port and protocol VLAN ID(PPVID)	: 1
PPVID Supported	: YES
PPVID Enabled	: NO
VLAN name of VLAN 1	: VLAN0001
Protocol Identity	:

802.3 organizationally information

Auto-negotiation supported	: YES
Auto-negotiation enabled	: YES
PMD auto-negotiation advertised	: 1000BASE-T full duplex mode, 100BASE-TX full duplex mode, 100BASE-TX half duplex mode, 10BASE-T full duplex mode, 10BASE-T half duplex mode
Operational MAU type	: speed(100)/duplex(Full)
PoE support	: NO
Link aggregation supported	: YES
Link aggregation enabled	: NO
Aggregation port ID	: 0
Maximum frame Size	: 1500

LLDP-MED organizationally information

Power-via-MDI device type	: PD
Power-via-MDI power source	: Local
Power-via-MDI power priority	:
Power-via-MDI power value	:
Model name	: Model name

6.4.5 LLDP

z w J ½, G Ñ ò LLDP † G fož

z -

U # F ă ož

z " ¶ B F ă % " F ă ½, G LLDP † fož

^a P ¶ B LLDP ù Á ' î ož

z ò LLDP ½, G f © k y F ă , což

ì 0¬ x U % " 0- LLDP

b b D P X " 0-9 • é é ož

6.4.6 TTL LLDP

z w J TTL + f > ož

z w J LLDP † G ž • • œ ož

-

U # F å ož

z ¶ B F å % " g F å ož

^a P N M LLDP Û Á ' ſ ož

z ò N M LLDP W • % " © k y F å , což

Ì TTL

o x X "o- lldp hold-multiplier value

o @ f ^a ¢o- value yTTL + f k Ð . 4 k F å 8 2-10

o x X % "o- ¶ B % "

o ... 6 -o- LLDP † Time To Live TLV >=TTL + f ~ † G ž • • œ +1 ož œ 4 k * ² ... TTL + f U Y O
ò î — Õ ' î " > D — Õ t ž • ož

Ì TTL

o x X "o- no lldp hold-multiplier

o @ f ^a ¢o- -

o x X % "o- ¶ B % "

o ... 6 -o- LLDP † Time To Live TLV >=TTL + f ~ † G ž • • œ +1 ož œ 4 k * ² ... TTL + f U Y O
ò î — Õ ' î " > D — Õ t ž • ož

Ì LLDP

o x X "o- lldp timer tx-interval seconds

o @ f ^a ¢o- seconds yLLDP † G ž • • œ k U F å 8 5-32768

o x X % "o- ¶ B % "

o ... 6 -o- -

Ì LLDP

o x X "o- no lldp timer tx-interval

o @ f ^a ¢o- -

o x X % "o- ¶ B % "

o ... 6 -o- -

1 LLDP

```
o- F Å • co- F Å TTL + f 3 kLLDP † G • æ 20 a k 4 ž kîª—Ö'îˆ>D—Ö tž• 61 a
Ruijie(config)#lldp hold-multiplier 3
Ruijie(config)#lldp timer tx-interval 20
```

```
o- à • co- ª P ¶ B LLDP Ù Á'îož
Ruijie(config)#lldp hold-multiplier 3
Ruijie(config)#lldp timer tx-interval 20
Ruijie(config)#show lldp status
Global status of LLDP : Enable
Neighbor information last changed time :
Transmit interval : 20s
Hold multiplier : 3
Reinit delay : 2s
Transmit delay : 2s
Notification interval : 5s
Fast start counts : 3
```

-

6.4.7 LLDP

0→xX% "0- ¶B % "

0→... 6 -0- ¶îª·îĠÿJ žkk y /g>D—ŒG LLDP †ož 49²îª·îÈ¬J -Ü È¬ªG

LLDP †kUYFå LLDP †G ·ž·Ů'ò LLDP †È¬G ož

i LLDP

```

0- F a • co-      F a G   LLDP  † • ž•      3 a
Ruijie(config)#lldp timer tx-delay 3

```

```

0- à • co-      0 0 1 B LLDP Û Á 'Î
Ruijie(config)#show lldp status
Global status of LLDP                               : Enable
Neighbor information last changed time :
Transmit interval                                     : 30s
Hold multiplier                                       : 4
Reinit delay                                          : 2s
Transmit delay                                        : 3s
Notification interval                                : 5s
Fast start counts                                     : 3

```

6.4.8

$$z \quad w \quad J \in M \div \quad \bullet \quad \check{z} \bullet o\check{z}$$
$$Z =$$

U # F àož

z ĩ U ŷ G Ž ¬ } + € M Ù Á Ñ ì ÷ • ž • g F ã ő ž

^a P B LLDP Ù Á ' îož

z ò ¶ B LLDP € M ì ÷ • ž • © k y F å , což

1

0-x X "0-	lldp timer reinit-delay	seconds	
0- @ f ^ 0-	seconds y € M ÷	• ž • k F å 8	1-10 a
0-x X % "0-	¶ B % "		
0- ... 6-0-	4 9 2 € M W • % "	È - J - Ü È - a ÷	Ù Á Ñ k U Y F å € M ÷ • ž • ož

1

o¬ x X "o- no lldp timer reinit-delay

o¬ @ f^a ¢o- -

o¬ x X % "o- ¶ B % "

o¬ ... 6 -o- 4 9² € M W • % " È⁻ J - Ü È⁻ a i ÷ Ù Á Ñ k U Y F å € M i ÷ • ž • ož

ì

o¬ F å • co- F å € M i ÷ • ž • 3 a k w^a P LLDP Ù Á ' Î⁻ a i ÷ a k sÂ ò I làš" —xI% ¼b`T (Åd 2M6 0±Q%õc ...BE

LLDP Trap

```

0- x X "0- lldp notification remote-change enable
0- @ f a 0- -
0- x X % "0- N M % "
0- ... 6 -0- * F å Trap k U Y 1 îª— Œ LLDP 'îg†òGë•>Do• yñ >D *'eè{ž^
'îhG Ěà'Æ ~k'òtU Y ŷ G 4'î!Oàì g Ù Ñož

```

LLDP Trap

```

0- x X "0- no lldp notification remote-change enable
0- @ f a 0- -
0- x X % "0- N M % "
0- ... 6 -0- * F å Trap k U Y 1 îª— Œ LLDP 'îg†òGë•>Do• yñ >D *'eè{ž^
'îhG Ěà'Æ ~k'òtU Y ŷ G 4'î!Oàì g Ù Ñož

```

LLDP Trap

```

0- x X "0- lldp timer notification-interval seconds
0- @ f a 0-

```

Port state	: UP
Port encapsulation	: Ethernet II
Operational mode	: RxAndTx
Notification enable	: YES
Error detect enable	: YES
Number of neighbors	: 0
Number of MED neighbors	: 0

-

6.4.10 LLDP

z LLDP j" y ø•k¢ LLDP yñj"žk1ø- LOG 'ÎUP'òtož

z Få LLDP j" y kj" y ,eè € VLAN Få yo•€MÙÁ yo•€Mü`Få yo• MTU Få
yCêè y

-

U#Fåož

z ĪUÿG Ž¬}“NM%” gFåkø•ê¼{ LLDP j" y ož

ªPNM LLDP ÙÁ'îož

z òNM LLDP j" y ©ø• ©¼{k ŽFå©k%² ož

Ì LLDP

o¬xX "o- lldp error-detect

o¬@fª¢o- -

o¬xX% "o- NM%”

o¬... 6-o- LLDP j" y ©%´eè € —ÖA; LLDP † Ô TLV 'Î g k 4's y
3G gk¬}—ÖGb3G TLV 'îož

Ì LLDP

o¬xX "o- no lldp error-detect

o¬@fª¢o- -

o¬xX% "o- NM%”

o¬... 6-o- LLDP j" y ©%´eè € —ÖA; LLDP † Ô TLV 'Î g k 4's y
3G gk¬}—ÖGb3G TLV 'îož

Ì LLDP

o F 6 • co- ø • LLDP " NM GI 0/1 j" y ož

```
Ruijie(config)#interface gigabitethernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)#lldp error-detect
```

o à • co- a P LLDP " NM ù Á' ňož

```
Ruijie(config-if-GigabitEthernet 0/1)#show lldp status interface gigabitethernet 0/1
Port [GigabitEthernet 0/1]
Port status of LLDP          : Enable
Port state                   : UP
Port encapsulation           : Ethernet II
Operational mode             : RxAndTx
Notification enable          : NO
Error detect enable          : YES
Number of neighbors          : 0
Number of MED neighbors      : 0
```

6.4.11 LLDP

z w J LLDP † / x "ož

U # F 6ož

z Ĩ U Ÿ G Ž } " NM w J LLDP † / x "ož

a P N M LLDP ù Á' ňož

z ò N M LLDP † / x " © k y F 6 , což

Ì LLDP SNAP

o x X "o- lldp encapsulation snap

o @ f a 0o- -

o x X % "o- N M % "

o ... 6 -o-  t l ‡ • ä f b • p (1 ð ' Ü LLDP q 3 " N - ½ ß m L ´ d

Ì LLDP Ethernet II

o x X "o- no lldp encapsulation snap

o @ f a 0o- -

o x X % "o- N M % "

o ... 6 -o-  t l ‡ • ä f b • p (1 ð ' Ü LLDP q 3 " N - ½ ß m L ´ d



```

o- x X "o- lldp network-policy profile profile-num
o- @ f a o- profile-num y LLDP network-policy e o e k 8 y1-1024
o- x X % "o- ¶ B % "
o- ... 6 -o- ... 4 x X µ LLDP network-policy F å % " k ... 4 x X ž - } 6 e IDož
µ LLDP network-policy F å % " e k U ... { voice | voice-signaling } vlan x X F å À }
network-policy e ož

```

LLDP Network Profile

```

o- x X "o- no lldp network-policy profile profile-num
o- @ f a o- profile-num y LLDP network-policy e o e k 8 y1-1024
o- x X % "o- N M % "
o- ... 6 -o- ... 4 x X µ LLDP network-policy F å % " k ... 4 x X ž - } 6 e IDož
µ LLDP network-policy F å % " e k U ... { voice | voice-signaling } vlan x X F å À }
network-policy e ož

```

LLDP Network Profile

```

o- F å • co- F å N M 1 G b LLDP † Network Policy TLV e 1 yvoice • • ° vlan id © 3 kcos © 4 k
dscp © 6ož

```

```

Ruijie#config
Ruijie(config)#lldp network-policy profile 1
Ruijie(config-lldp-network-policy)# voice vlan 3 cos 4
Ruijie(config-lldp-network-policy)# voice vlan 3 dscp 6
Ruijie(config-lldp-network-policy)#exit
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)# lldp tlv-enable med-tlv network-policy profile 1

```

```

o- à • co- a P î a — Œ LLDP network-policy F å e ' î ož

```

```

network-policy information:
-----
network policy profile :1
voice vlan 3 cos 4
voice vlan 3 dscp 6

```

-

6.4.13

```

z — Œ a - ' î G ŷ J ož

```

-

U # F å ož

```

z ĩ U ŷ G ž - } F å — Œ - * a - ' î ož

```

a P î a — Ō LLDP ⁻ * a - ' î ož

z ò LLDP ⁻ * a - ' î © k y F å , což

ì

o→ x X "o- F å LLDP ⁻ * a - ' î ož ï U Y ... no # ¾ í " a - ' î ož

{ country | state | county | city | division | neighborhood | street-group | leading-street-dir |
trailing-street-suffix | street-suffix | number | street-number-suffix | landmark |
additional-location-information | name | postal-code | building | unit | floor | room | type-of-place |
postal-community-name | post-office-box | additional-code } ca-word

o→ @ f a ¢o- country y ¢ W A k2 ...ožchina yCH

state y a - ' î CA • ° 1

county yCA • ° 2

city yCA • ° 3

division yCA • ° 4

neighborhood yCA • ° 5

street-group yCA • ° 6

leading-street-dir yCA • ° 16

trailing-street-suffix yCA • ° 17

street-suffix yCA • ° 18

number yCA • ° 19

street-number-suffix yCA • ° 20

landmark yCA • ° 21

additional-location-information yCA • ° 22

name yCA • ° 23

postal-code yCA • ° 24

building yCA • ° 25

unit yCA • ° 26

floor yCA • ° 27

room yCA • ° 28

type-of-place yCA • ° 29

postal-community-name yCA • ° 30

post-office-box yCA • ° 31

031 71.5474J-TJ 2 0 4J |-(locTT018(i))TJan-na)4(m) Tf0.A-4 -17.44 -1379>Tj /TT0 41E>T28.1-0.0022{3.113 -1.713

o ... 6-o- μ LLDP Civic Address F % " e k F LLDP * a - ' ŏž

!

o x X "o- device-type device-type

o @ f a o- device-type y — Ő • ° k p . 1 k H > 8 0-2

0 n P — Ő • ° DHCP Server

1 n P — Ő • ° Switch

2 n P — Ő • ° LLDP MED Ä €

o x X % "o- LLDP Civic Address F % "

o ... 6-o- μ LLDP Civic Address F % " e k F LLDP * a - — Ő • ° ' ŏž

!

o x X "o- no device-type

o @ f a o- -

o x X % "o- LLDP Civic Address F % "

o ... 6-o- μ LLDP Civic Address F % " e k Ê Ő LLDP * a - — Ő • ° ' ŏž

!

o F • co- F — Ő N M1 a - y A E Ő — Ő k a - © ¢ yCH k ½ a yFuzhou k = Ú y350000ož

Ruijie#config

Ruijie(config)#lldp location civic-location identifier 1

Ruijie(config-lldp-civic)# country CH

Ruijie(config-lldp-civic)# city Fuzhou

Ruijie(config-lldp-civic)# postal-code 350000

o à • co- a P — Ő N M1 LLDP * a - ' ŏž

civic location information:

Identifier :1

country :CH

device type :1

city :Fuzhou

postal-code :350000

-

6.4.14

z ¾ w — Ő — Ä ¢ Z A ' ŏž

-

U # F ŏž

z ĩUÿG Ž¬}Få—Ö ¬Ä ¢ZA'İož

aPÎª—Ö ¬Ä ¢ZA'İož

z òÎª—Ö ¬Ä ¢ZA'Î©kyFå ,což

İ

o¬xX "o- lldp location elin identifier id elin-location tel-number

o¬@fª¢o- idynP¬Ä ¢ZA'Î FåöæZk8 y1-1024

tel-number y n P ¬ Ä ¢ Z A k 8 y10 – 25 -

o¬xX% "o- ¶B%"

o¬... 6-o- ... 4xXÛFå¬Ä ¢ZA'İož

İ

o¬xX "o- no lldp location elin identifier id

o¬@fª¢o- idynP¬Ä ¢ZA'Î FåöæZk8 y1-1024

o¬xX% "o- ¶B%"

o¬... 6-o- -

İ

o¬Få•co- Få—ÖNM1 ¬Ä ¢ZA y085285555556ož

Ruijie#config

Ruijie(config)#lldp location elin identifier 1 elin-location 085283671111

o¬à•co- aP—ÖNM1 ¬Ä ¢ZA'İož

elin location information:

Identifier :1

elin number :085283671111

-

6.5

⚠ }••nû¶Q/ û clear a— ¶ÿÛ 7'ðoİž—ý!æ`/nd

•	xX
Ž" LLDP İ<'İož	clear lldp statistics [interface interface-name]
Ž" LLDP >D'İož	clear lldp table [interface interface-name]

•

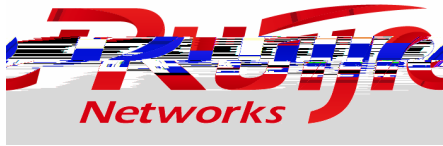
xX

show lldp local-information [global interface interface-name]	show lldp local-information [global interface interface-name]
show lldp location { civic-location elin-location } { identifier id interface interface-name static }	show lldp location { civic-location elin-location } { identifier id interface interface-name static }
show lldp neighbors [interface interface-name] [detail]	show lldp neighbors [interface interface-name] [detail]
show lldp network-policy { profile [profile-num] interface interface-name }	show lldp network-policy { profile [profile-num] interface interface-name }
show lldp statistics [global interface interface-name]	show lldp statistics [global interface interface-name]
show lldp status [interface interface-name]	show lldp status [interface interface-name]
show lldp tlv-config [interface interface-name]	show lldp tlv-config [interface interface-name]



Û { 8 Ë ð o V ½ , Ä ± W d ° û ~ È K ± ' ž 8 Ë — ' d

•	x X
debug lldp error	debug lldp error
debug lldp event	debug lldp event
debug lldp ha	debug lldp ha
debug lldp packet	debug lldp packet
debug lldp stm	debug lldp stm



G5B0-IP 50

IP

1. IP
2. DNS
- 3.
4. TCP
5. IPv4

1 IP

1.1

Ōă# g Internet Protocol k IP h . pZ' " > 1 G R G æ) k / IP " > o □ àl C k Ł Ō
IP " > Ł G ôGo



IPv4

RFC 1918 y Address Allocation for Private Internets

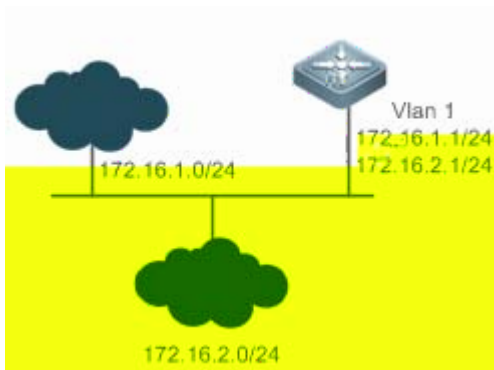
RFC 1166 y Internet Numbers

1.2

˘ " « ° T	
F ă / 6 " > *	àl c%† A E Ñ M g *

1.2.1 IP

A E Ñ N%† B ĩ àk B ĩ àª à< y 172.16.1.0/24 y 172.16.2.0/24o } L à< ÑC U Y * A E Ñy
Ōă* k w à< Ñ\$ U Y ; , * o
£ 1-1 IP " > F ă8



□ vlan1 M F 6 ip " > k%† ip " > k%† R ip " > o
 □ 172.16.1.0/24 à< Ñ F 6à... 172.16.1.1 k □ 172.16.2.0/24 à< Ñ F 6à... 172.16.2.10

1.3

IP

IP " > 32 y 8 ò`Ł k 4 0° y T k%†" òn Po òn P k<sup>a</sup> `k?` 8 y k 8 R 0~255 k
 ` \$. Z k A ò 192.168.1.1 <' òn P IP " > o
 IP " > `d^# k À IP C # ; " > o 32 y IP " > B<sup>a</sup> `Ł y1 h à Ì B^a z2 h ĸ " " > B^a o ÿ G à
 Ì B^a a Ò A Ô y k) ø IP " > U Y æ Ł Ý o
 A " > k' ä A Ô y 0 k ~ 7 A Ô y n P à Ì Z k 24 A Ô y n P ĸ " " > o ý" » ~ 128 A à ò
 £ 1-2

B " > k ø ´ ä A Ô y 10 k ~ 14 A Ô y n P à Ì Z k 16 A Ô y n P ĸ " " > o ý" » ~ 16,348 B
 à ò
 £ 1-3

C " > k ø ´ ä A Ô y 110 k ~ 21 A Ô y n P à Ì Z k 8 A Ô y n P ĸ " " > o ý" » ~ 2,097,152 C
 à ò
 £ 1-4

D " > k ø ´ ä A Ô y 1110 k ĸ A Ô y `n " > o
 £ 1-5

□ ài i k g IP " > æk%† }ÿG ài -- g IP " > ^aFo òç ài < } ; ß à N k
 Ø < } æ , Ñ ^aF IP " > o ç " U Y g ç ; ß à , ¶ gCNNIC h < k ç ` IP " > ^aF ~ Ñ^a
 ç ; ß à ù ^aF , [gICANN, Internet Corporation for Assigned Names and Numbers ho òç ài ~ B
 \ ~ ài k < < } < IP " > k x ' - ^aF k ' æ ^aF y \ ~ ài " > o
 n U " > ç n y

đ	" > q	Ù
A ài	0.0.0.0~0.255.255.255	
	1.0.0.0~126.255.255.255	U
	127.0.0.0~127.255.255.255	
B ài	128.0.0.0~191.254.255.255	U
	191.255.0.0~191.255.255.255	
C ài	192.0.0.0~192.0.0.255	
	192.0.1.0~223.255.254.255	U
	223.255.255.0~223.255.255.255	
D ài	224.0.0.0~239.255.255.255	` n " >
E ài	240.0.0.0~255.255.255.254	
	255.255.255.255	z n " >

ç y ~ " > † U , \ ~ ài k ? " > ' k □ ; ß à k òç ^aF 4 ? " > ài < } N ; ß à k Ø
 < } 1 ? IP " > ò E Ł ~ | ; ß à " > o n \ ~ ài " > q k \ ~ ài " >

RFC 1918 # y

đ	" > q	Ù
A ài	10.0.0.0~10.255.255.255	1 A ài
B ài	172.16.0.0~172.31.255.255	16 B ài
C ài	192.168.0.0~192.168.255.255	256 C ài

... 9 IP " > o TCP/UDP M C ç Ú ^aF Ñ k < @ đ RFC 1166 o

ài Q A - '%† 32 A Ô k ö 5 ¥ IP " > ù A Ô ài B ^ao ài Q A k "1" A Ô† IP " > A
 Ô y < ' ài B ^ak "0" A Ô† IP " > A Ô y < ' Ñ > B ^ao ò A ài + ài Q A "255.0.0.0" o Ó
 Y i ài Q A +%† ài g y à æ k y à æ < ' 1 Ñ > B ^a %† ? A Ô y - ài B ^ak Y 4 Ñ O k ~
 ài O k ài Q A < f y à Q A o

z n ' 6) ö " > î Ò ài æ ~ Ñ G o i H D } u 4 _ " z n y A Ô y ¶ 1 h g z n k ' 6 G N
 v æ %† 6 ài æ ~ Ñ k) ö " > Ñ B ^a ¶ 1 z 2 h A ! Z z n k ' 6 G I 2 N v æ æ ~ ài Ñ k) ö

TTL

TTL gTime-To-Live h kÿ o 6 G tŁ \$ø“ * à< Oo ' IP # %† k s
 à\ k G ¢ à\ ' k ßx ò t o

Õ

[/ 6 “ >](#)

9 F ấN M IP “ > k ¥ N M I “ g IP # o

Ú àl' '9 8 C N àl kZ~ g yà æo) IP " > U Y ¥ àl fi £ · æ' 9 IP C
 Ł àlo +9? yàk ŒCF&† IP " >o
 † àl yà t P ù † àl Y k U Y ° † t Y àl yàk * F å IP " > k 1 Y ÿ
 à N Ů Ů † yà ¢ Œ Œ Y N M ß °



IP

IP

IP

IP

IP

PPP

IP



* 4 F åk µ+ µ N M U Y * PPP # N I + \ ¢ F IP " >o

IP

æ µ IP " > k' 6 † N M Z ~ F å IP " > k x 4 ¥ N M 3 o k < g c † Œ Œ ~ IP " > N M
 † IP " >o



IP

IP



IP

IP



IP



IP

IP

IP

IP

p. Œ N M Z ~ F å IP " >o

* **ip address** x X F å N M IP " >o

F å æ y G ~ s y / U ¥ IP " > g * o

* **ip address** ¢ **secondary** U Y F å Ů) IP " >o

1.3.2

tŒ Y =

z n ¢ _ k ¶ z n k / IP " >

òç IP àì ŒôGA!Zzn g%t"6)ö IP " > ¶ 1 zn hkU k Üàì Ýç æk M§ àì
 gk _Œñf znç"o ŒU 4%t? c Ü1znç" òæç" àìk 2ç —Œýo x+9 yAEÑ´
 98C àì Œk1ôGynnznç"o
 —znç"´æ c<'ç? àì6 %t zn">k <' gznk }L zn IP # @U
 gznò 'A!Zzn g Gnno
 ...9zn|° f´T k<@ RFC 919 y RFC 922o
 IP gzn '6)ö" > î IP ýàzn"> IP kò)ö"> 172.16.16.255 <f gzn o
 x'Dÿ¥ -µA ')öyà Łto
 Z~)öyà+ ŒNvæ IP gzn kæG%n %týŒŒ gzn oç gzn æ + ¥ÿ
 à Œek Œ1 gzn ôE A!Zzn g%t"6)ö IP " > ¶ 1 zn hkÀeYeŁCzn
 G ,)öyà æ~ Œ

IP

p. ŒñNM IP zn"> 255.255.255.255o
 òç<} #ç "> zn kUY¤NM Få **ip broadcast-address** xXo

p. ŒñNM " ôG gzn o
 ÿUY¤6 NM k* **ip directed-broadcast** xXFåNM" ôG gznk ý¥NM<UYôGæ+
 àì gzn4o ¥xXQ§ gzn ¢)öyà nÿkò § ç gzn 3oôGo
 ¢NM k ÿUY* # |Oòçn ŒŒòôGî? gzn oç #4 |çn kQ~ ' |çn #
 gznıktôGo

1.3.3 ICMP

4 2!~ xàk+ ICMP [j G ,ä g òkJ Xç co
 òç IP <}aìkx' IP ÒB Uaìyt å4k Œkg IP ">G ÚZ 4 ICMP) U k
 _ICMP [j } ('Ł< MTU G° 4 2ç ICMP [j ßÚ G ßÚZ 4 ICMP) U
 kRò- Ł< MTU G° â|k+ÚZ 4 ICMP) U yç ICMP [j ađ ,o

IP

ICMP

p., ä' 100 D a 10 o

U * ip icmp error-interval DF F åG , ä

ICMP

p., ä' 100 D a 10 o

U * ip icmp error-interval F åG , ä

1.3.4 IP TTL

IP G R ">g) ">~ Ł nnk å†

TTL k? %† Ł

TTL < *%†k D*%°QQ KSD

1.4

Få¾¼	Få & , ... x X	
FåNM / 6 "›	 ip IP	
	ip address	ôW FåNM IP "›
Fåzn Ôð	 IP	
	ip broadcast-address	Få IP zn "›
	ip directed-broadcast	" ôG gz n
Få/)36 [j G , ä		
	ip icmp error-interval DF	Få IP ÛB Uªÿ G ICMP) U G ,ä
	ip icmp error-interval	Få¿ ICMP [j y ICMP M g G ,ä
å/6 ::2	 TTL	
	ip ttl	å TTL
Få/6 Ł		
	ip source-route	o IP Ł

1.4.1 IP

* FåNM IP "› ° IP àì* o

-

IP

• ÅF å

▣ CNM% Få

IP

U # F åk ~ ? ĩ Ñ U Q 0.0.0.0 z n “ > k 4 < } F å N M z n “ > 0.0.0.0o

▣ C N M % F å

U # F åkg Ô %† z n ċ ¶ B Ñ GU Z n k æ F å w Ô z n ċ ~ k 4 < } F å“ ô G — < ð P p — \ “ T “ S — ▣ C N M % F å ó fl q ð sh

IP

o < x X o > **ip broadcast-address** ¶

o < @ “ ¢ o > ¶ y IP à ĩ z n “ > ð 91e-RC OS % ^ u N * M B O D @ ð G - o >) ð P z n) ö “ > %† “ ¶ ð æ D kn P 255.255.25

z n k ò U Y c N v ¶ æ ´ æ S Y C \ B 0 g v à Q V ø à

o < x X o >

```
0< F å co>      □ Õ M      gigabitEthernet 0/1 F å IP z n      ) ö“ >      0.0.0.0 k o      g z n ôGo
```

```
Ruijie#configure terminal
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)# no switchport
Ruijie(config-if-GigabitEthernet 0/1)# ip broadcast-address 0.0.0.0
Ruijie(config-if-GigabitEthernet 0/1)# ip directed-broadcast
```

```
0< à co> show ip interface U Y 0 æ N M GigabitEthernet 0/1 F åŁ
```

```
Ruijie#show running-config interface gigabitEthernet 0/1
ip directed-broadcast
ip broadcast-address 0.0.0.0
```

1.4.3 ICMP

Få ICMP [j] G , ä

—

IP

ICMP

U # F ∅

□ ¶ B % F ∞

ICMP

U # F $\mathfrak{A}$

□ ¶ B % F ∅

Üg show rhT0105F4000indigc 0rw 870td6 Tm130F605E6057T0jTT02 1 CTf0rjCS0s 031 051 041 scnC22 1 Tf105 0105 56.7468m

o< x X o> **ip icmp error-interval DF** []
 o< @ " ¢o> y X , ó u ° k H 8 0~2147483647 k ¢. 100 k % y D ao H 0 k n
 P ò ICMP [j G ,ă

1.4.4 IP TTL

w N M IP TTL o

-

U # F 6

□ C N M % F 6

* **show run-config** U Y 0 æ F 6|

IP TTL

o< x X o> **ip ttl** 6

o< @ “ 0> 6 yTTL k H 8 ' 0~255o

o< x X % o> ¶ B %

o< 6 -o> -

o< F 6 co> F 6 ÑG % n P. TTL 100o

Ruijie#configure terminal

Ruijie(config)#ip ttl 100

o< à co> * **show run-config** U Y 0 æ F 6|

Ruijie#show running-config

ip ttl 100

1.4.5 IP

o CE ... { IP

1.5

-

	x X
“ P N M IP ˆ	show ip interface [brief]

2 DNS

2.1

DNS g Domain Name System k ç d ' ~ h k Ôà ç d y IP “ > , ; ¥ 0 % † ª b G k Ü ï ¾
 | ; ß à k ò > { Ü Ñ + N fl H IP o * Ñ d k ´ ~ – æ ¥ Ñ d + IP “ > i R ç d
 ä g Æ Ñ d ä ho



DNS

RFC1034 y DOMAIN NAMES - CONCEPTS AND FACILITIES

RFC1035 y DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION

2.2

“ ”	« ° T
† ` ç d ä	+ N ¢ ¸ Õ ý G ~ ç d /IP + n g ç d ä
` ç d ä	R à ì DNS ~ ` B H ç d + “ >

2.2.1

¤ Õ ~ å ç d y IP + n
 Õ % † ? g A ò Ping k Telnet h g ç d q k + N ¢ Õ < ä æ ~ IP k < æ à ì ~
 o

¤ Õ ~ å ç d y IP + ... '

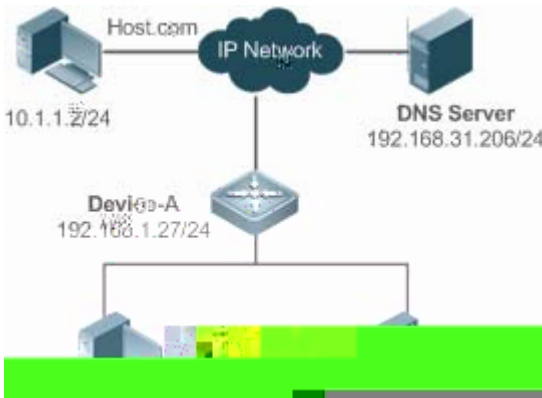
2.2.2

DNS Server B æ àì k + Ù ÿ d ~

host.com B æ àì k ÿ d (host.com) + Ù ÿ

Device-A" Õ6 DNS Server DNS ~ k R DNS Server B H æ host.com" " >

£ 2-1 ` ÿ d äF å` à£



1 DNS Server B æ "Device-A" DNS ~

2.3

DNS

DNS ä y ÿ d ~ ` ÿ o ÿ d ~ '6 ~ àì æ ~ Ñ ÿ d y
ô ~ o DNS TCP y UDP M Z C'

IP "> + ...'kwU 1 ÿ d y IP ;

†`ç d äk<' i□ Õ~fl åæç d y IP + ...'kϕ i î? (Aò Pingo Telnet) g ç d
q k'~R, Õ äßç d+ IP kò <}æ àì DNS ~ B H ç d+ IPo

`ç d äk<'ϕ i î? g ç d q k'~ DNS ä ò ÙB DNS ~ k B H æ ç d+ IPo
`ç d ä i y

1. i (Ping o Telnet) g'~ DNS ä <L ç d+ IP
2. '~ DNS ä fl ò `Ù k òç `Ù ç d i °∅ , i~
3. òç □ i ° ç d k DNS ä g ÙB DNS ~ G Ùç d ô IP <L
4. DNS ä N v æ DNS ~ k Ù w ô G , i~

p. Õ~k Õ o ç d ä o

* **ip domain-lookup** xX o ç d ä o

IP

p. Õ~k Z~ç d/IP †`F å

* **ip host** xX 6 ç d+ IPv4 ">

p. Õ~k Ì F åç d~ o

* **ip name-server** xX F åç d~ o

2.4

Få¾	Få & , ... xX	
Få†`ç d ä		
	ip domain-lookup	o ç d ä
	ip host	F åç d+ IPv4 ">
Få`ç d ä		
	ip domain-lookup	o ç d ä
	ip name-server	F åç d~

2.4.1

' ä R Õ " ä d + IPo

P.] o d ä

òç... {¥ k t` d ä y|o

IPv4

• ÄF åk i æ d • ÄF å+ IPo

* **show run** ò0 F å o

* **show hosts** ø ø d y IP + ...'

IPv4

o< x X o> **ip host**

o< @ " øo> y d

y + IPv4 ">

o< x X % o> ¶ B %

o< 6 -o> -

o< F å co> □ Õ t` F å d www.test.com

IP d

Name servers are:

Host	type	Address	TTL(sec)
www.test.com	static	192.168.1.1	---

2.4.2

' ä R DNS ä d + IP

P.] o d ä

òç... {¥ k ` d ä y|o

DNS

• ÄF åk ` d ä • ÄF åÜB DNS o

* **show run** ò0 F å

```

o< x X o> ip name-server {
o< @ " ¢o> y DNS IPv4 ">
o< x X % o> ¶ B %
o< 6 -o> -

```

o< àl Æ ,o>
£ 2-2



DEVICE y R àl DNS ~ (192.168.10.1) ä¿ d
¤ Ö F 5 DNS ~ “> 192.168.10.1

o< F 5 co>

```

DEVICE#configure terminal
DEVICE(config)# ip name-server 192.168.10.1
DEVICE(config)# exit
  
```

o< à co>

* **show hosts** ò0'k F 56 DNS ~

```
Ruijie(config)#show hosts
```

Name servers are:

192.168.10.1 static

Host	type	Address	TTL(sec)
------	------	---------	----------

2.5

x X

3.2.2

£ 3-2 àì Õ A)ö Ñ B C N □ IP àì o
 àì Õ)ö Ñ C N □ IP àì k Ñ Ì ò<' î
)ö Ñ* o ' àì Õ ì k w * o àì Õ □ c%†

IP □ 8 æ \$ n ý k o } < } ~ Ú 5 à... g Ł h o
 IP à<o



* □ àì Õ g Traceroute o

3.3

Õ	
Ping * _ y i	y 6 IPv4 “>' k U k w ý ß, ... ı o
Traceroute * _ y i	“ P IPv4 G R “>æ) “>æ ~ à...o

3.3.1 Ping

PING W À g) ö IP “> G %† ICMP < L g ICMP Request h G k } L + %† ICMP Õ g ICMP Echo T f 0.0002 T c 9 0 0 9

3.3.2 Traceroute

Traceroute WÀ ICMP CIP aB TTL gTime To Live h <o ùl k àl Ö Traceroute WÀ ß%† TTL '

1 ICMP Request æ) Ñk¢ £< %† £ v æ k 1 TTL × 1o 4 TTL J 0 4 k æ Y ¥ £

k 1 4 k w %† ICMP Ý gICMP time exceeded h , kTraceroute WÀ v æ , e k = 3 £

¤ 9 £< Ñ5´ ßP%† TTL ' 2 kG ° 2 £ o Traceroute WÀ?) 1 ß TTL

1 ÛG ° P%† £ k M Ö %† + 4 Öæ î G æ) Ñ¢ æ) Ñe Ñ Ñ k ICMP

time exceeded , k ò' ICMP Echo kTraceroute WÀ` ØM y w " P R àl Öæ) Ñ £< , o

* **traceroute** xX g Få

3.4

Få¾	Få & , ... xX	
Ping *-y i	IPv4	
	ping	g Ping o
Traceroute *-y i	IPv4	
	traceroute	g Traceroute o

3.4.1 Ping

¤ àl Ö J Ping *-y i k U Y – = ¥ àl Öy) Ñ\$ 'k 4 *k 'k U Y ¤ àl Öy)

Ñ\$ n ÿo

ü g PING q àl Ö ï<} Få IP ">o

òç<} y IPv4 ">'k U k U * Ping IPv4 x Xo


```

Reply from 192.168.21.26: bytes=100 time=4ms TTL=64
Reply from 192.168.21.26: bytes=100 time=3ms TTL=64
Reply from 192.168.21.26: bytes=100 time=1ms TTL=64
Reply from 192.168.21.26: bytes=100 time=1ms TTL=64
Reply from 192.168.21.26: bytes=100 time=1ms TTL=64

```

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms.

o< à co> P. 1 5 G < x 100Byte G G æ 6 IP "> k æ 6 g P. 2 a h ~ k " P ,
 My k ´ e y ð % † ~ , o

Ping

o< F å co> æ Ó % ÿ µ Ping IPv4 "> 192.168.21.26 k w 6 G G x o o Ý o

```

o   ping
Ruijie# ping 192.168.21.26 length 1500 ntimes 100 data ffff source 192.168.21.99 timeout 3
Sending 100, 1500-byte ICMP Echoes to 192.168.21.26, timeout is 3 seconds:
   < press Ctrl+C to break >
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!
Success rate is 100 percent (100/100), round-trip min/avg/max = 2/2/3 ms
"P detail   ping
ping 192.168.21.26 length 1500 ntimes 20 data ffff source 192.168.21.99 timeout 3 detail
Sending 20, 1500-byte ICMP Echoes to 192.168.21.26, timeout is 3 seconds:
   < press Ctrl+C to break >
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=2ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
Reply from 192.168.21.26: bytes=1500 time=3ms TTL=64

```

```
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
```

```
Reply from 192.168.21.26: bytes=1500 time=1ms TTL=64
```

```
Success rate is 100 percent (20/20), round-trip min/avg/max = 1/1/3 ms.
```

```
o< à co> 1 20 x 1500Byte G G æ 6 IP "> k æ 6 g3 a h~k òç~ k"P,
My , k' e ÿ%† ~ ,o
```

3.4.2 Traceroute

```
àl Õ J Traceroute * y i kU Y - = ¥ àl Õy) Ñ$ Ł " ÷ , k R àl Õæ) Ñ
~ 4 Ů à...o
```

```
üg Traceroute q àl Õ i < } F å IP ">o
```

```
òç<} æ IPv4 G æ ) Ñ ? à... k U * F å Traceroute IPv4 x X
```

```
ÿµ traceroute x X k / U □ CLI µ"P, ... ,o
```

Traceroute IPv4

```
o< x X o> traceroute [ip] [ d [ probe h ] [ source e ] [ timeout d ] [ ttl h ]
[ out-interface interface ]]
```

```
o< @ " ¢o> d y 6 ) IPv4 "> Æ ç do
h y 6 G My O k 8 y1~255o
e y 6 IPv4 "> Æ N Mo ç k Æ N M "> g ò 127.0.0.1 h " ">
d y 6 Ý k 8 y1~10 g a ho
h y 6 ' 4 y' Ý TTL k 8 y1~255o
interface y 6 G G ß M N Mo
```

```
o< x X % o> □ fl * i % k Q g' , traceroute z □ Ō Ō i % k U Y g traceroute ýJ
```

o

o< 6 -o> **Traceroute** x X } 9 òàl *⁻kw □ àl{ G ÿ k ŒG y{ G ÿ y ă } ħ
 d k Ø } fl F ă ċ d ~ k À} F ă< @ đ DNS F ăB ăo

Traceroute

o< F ă co> □ ŒŒ% k ŷµ Traceroute IPv4 "> 61.154.22.36o

```
Ruijie# traceroute 61.154.22.36
```

```
< press Ctrl+C to break >
```

```
Tracing the route to 61.154.22.36
```

1	192.168.12.1	0 msec	0 msec	0 msec
2	192.168.9.2	4 msec	4 msec	4 msec
3	192.168.9.1	8 msec	8 msec	4 msec
4	192.168.0.10	4 msec	28 msec	12 msec
5	202.101.143.130	4 msec	16 msec	8 msec
6	202.101.143.154	12 msec	8 msec	24 msec
7	61.154.22.36	12 msec	8 msec	22 msec

R µ " çU Y " 0 æ k R "> } | IP "> 61.154.22.36 Ñk àl G C ~ 4 ? à
 ... g1l6 h k c , ß4 æ ¥ à... æ 0 , o

Traceroute

o< F ă co> □ ŒŒ% k ŷµ Traceroute IPv4 "> 202.108.37.42o

```
Ruijie# traceroute 202.108.37.42
```

```
< press Ctrl+C to break >
```

```
Tracing the route to 202.108.37.42
```

```

1      192.168.12.1      0 msec  0 msec  0 msec
2      192.168.9.2       0 msec  4 msec  4 msec
3      192.168.110.1    16 msec 12 msec 16 msec
4      * * *
5      61.154.8.129     12 msec 28 msec 12 msec
6      61.154.8.17      8 msec 12 msec 16 msec
7      61.154.8.250     12 msec 12 msec 12 msec
8      218.85.157.222   12 msec 12 msec 12 msec
9      218.85.157.130   16 msec 16 msec 16 msec
10     218.85.157.77    16 msec 48 msec 16 msec
11     202.97.40.65     76 msec 24 msec 24 msec
12     202.97.37.65     32 msec 24 msec 24 msec
13     202.97.38.162    52 msec 52 msec 224 msec
14     202.96.12.38     84 msec 52 msec 52 msec
15     202.106.192.226   88 msec 52 msec 52 msec
16     202.106.192.174   52 msec 52 msec 88 msec
17     210.74.176.158   100 msec 52 msec 84 msec
18     202.108.37.42    48 msec 48 msec 52 msec
```

```

R  μ  "çUY  "0ækR  "> } |          IP ">  202.108.37.42  Ñk àì G C ~ 4 ?
à... g1 l17 h k w  à...  4 ßº 4 { o
```

4 TCP

4.1

TCP # C U 4%† U · o ~ N ´9 IP nÿC# o

Cg TCP CG 9 à nÿo 8 y - nP GvkÀe TCP G v^a Ł ¢x < k' Ý^a < Ý
 4g MSS h* o I ¥ Ñ N à ì Ge Ł C ´ Ýn % « gMTU h ò \$ e TCP n, IP C k Û*
 à ì 1 n , N v } TCP Co

TCP 4 G ÿ k < , ? - %† ~ Z k c ~ Z - 4 n æ N v } 7 ~ N v o À e N v } +
] Ł v æ - G %† , G (ACK) z ò ç G } ¢ ' ò " (RTT) ~ ì v æ G k ; " + Gg
 â 4 h 1 k t M n o

- G 3 G ¯ ' c ¯ kTCP %† ß à y Æ Û à G ' k ~ j ¢ k ¢ G y N v C } ß à y z c U Y
 MD5 + G g ß à
- U · ¯ k J Ý M n y 7 ´ k G Ñ

4.2.1 TCP

Y £ kA y D y TCP N kA y B \$ eŁ MTU ' 1500 -kB y C \$ eŁ MTU ' 1300 -kC y D
\$ eŁ MTU ' 1500 -k 4 TCP nŷ æ'ik<}9† TCP ▯ Ō B y Ō C a\o

□ Õ A o TCP t o

4.3

TCP

Source Port ' M k16 yo

Destination Port ') M k16 yo

Sequence Number ' ~ çZ k32 yo

Acknowledgment Number 'G ~çZ k32 yo

Data Offset ' G g k4 y k ¥ < ' TCP ÛB g , # ¾h x Y 4o

ö"yy 6 y kURG n P Urgent Pointer <~þ#k ACK n P Acknowledgment Number <~þ#k PSH n P Push
k RST n P Öy TCP N k SYN n P SYN g ¢ y TCP N hk FIN n P G Z~ G < } G
4 g ¢ ... { TCP N ho

Window n P N v Ûr q ~ q k16 y k Ûs TCP N+ \ ÛN v ´Ý G x o

Checksum ' ß ày k16 yo

Urgent Pointers ' < ~6 S k 16 y k Q~ URG ö"y t å ¥ < i ~þ#k n P < ~ G , + ~ çZ gSequence
Number < h go

□ G Ü G SYN e k SYN+ACK k x G Ü · Ö ACK k - k%† + M n + æ Ý %†
M n) Æ Ý o gSYN x àk ß° _ Ö h

TCP SYN

TCP SYN Ý Þ. ' 20 ao

ï U Y □ ¶ B F å% **ip tcp synwait-time** ð x X å SYN Ý k H 8 ' 5 æ300 k % y
' ao

òçàì □ SYN x àk ×5 SYN Ý U Y 2%† ? ~ ôk x + Ò SYN x à æ | ø □ Ö
Û < L y N k ×5 SYN Ý U Y ×5 ï > k ò telneto òçàì A ß [- U Y ø ~ Ý
o

4.3.2

TCP N v Û Û R + N v æ G k ? G e Ç k t i ~ fl Ho %† " Ö Ñ kTCP v M F ¥ N v Û
~ q ~ q Ý4o + 9 k ! A ß ö ~ Ý O G N k ~ Ý v M U Y " K U ä TCP n ÿ - o

ï U Y □ ¶ B F å% **ip tcp window-size** ð x X å v M Ý4 k % y ' - k H 8 ' 128 æ(65535<<
14) k Þ. ' 65535o òçv M Ý9 65535 - k o v M ý Ý o
* s , + v M Ý4 ' R F å v M Ý4 y N v Û þ q H ß 4 o

4.3.3

reset

TCP # □ ¢ G TCP , i ~ k òç æ ¥ æ K TCP N k Ö %† reset Y ~ 2 + TCP
No x àæ U ï Ý O M U TCP + Ö g x àð

(3) TCP * ä¥ ICMP [j k U = TCP Ł < ¢ ø´4 MTU k / Ł < MTUo

(4) e Ò TCP G G < x Ý MSS kMSS | Ł < MTU IIP ª B x ITCP ª B x o

MTU

TCP Þ. ... { Ł < MTU G ° o

İ U Y ¢ ¶ B F å% **ip tcp path-mtu-discovery** x X o Ł < MTU G ° o

4.3.6 TCP

òç TCP e ¨ = 3 + 'k ¢ 3 o W k U Y o t o ¢ TCP + ¢ % † < ~ g f q ~ h Z ~ G
 , . k ¢ ÷ G t k Ò G 3 t) k ò ç Z ~ v æ % † k < + o k ... { TCP No

TCP Þ. ... { t o

İ U Y ¢ ¶ B F å% **ip tcp keepalive** [interval 0] [times 0] **idle-period 0**] x X o t
 o interval ' k ó ' 75 a z times ' G t ´ Ý k ó ' 6) z idle-period ' q ~ k
 ó ' 15 ª Uo



TCP

4.4

Få¾	Få & , ... x X
:)6 ⁻ i	TCP
	ip tcp synwait-time Få y TCP N Ý o
	ip tcp window-size Få TCP v M Ý4o
	ip tcp send-reset Få v æ M U TCP 'k G reset o
	ip tcp mss Få TCP N MSSo ip tcp path-mtvTT2 1 Tf0 Tf Få

-

SYN

0< X X 0> **ip tcp synwait-time** 0
 0< @ " 0> 0 ySYN Ý o %y a k H 8 ' 5 æ300 k B. ' 20o
 0< X X % 0> ¶ B %
 0< 6 -0> 0çàì 0 SYN x àk ×5 SYN Ý U Y 2%† ? ~ ôk x + Ò SYN x à æ | ø
 0 Õ Û < L y N k ×5 SYN Ý U Y ×5 ï > k ò telneto 0çàì A B [
 - U Y 0 ~ Ý o

TCP

0< X X 0> **ip tcp window-size** 0
 0< @ " 0> 0 y % y ' - k H 8 ' 128 æ(65535 << 14) k B. ' 65535o
 0< X X % 0> ¶ B %
 0< 6 -0> -

reset

0< X X 0> **ip tcp send-reset**
 0< @ " 0> -
 0< X X % 0> ¶ B %
 0< 6 -0> v æ M U TCP k ó G reset o

MSS

0< X X 0> **ip tcp mss** 0
 0< @ " 0> 0 yMSS o %y - k H 8 ' 68 æ10000 k ó ýG MTU - æ
 MSSo
 0< X X % 0> ¶ B %
 0< 6 -0> **ip tcp mss** <' ò/1 y TCP N MSS ' Ý o ' ~ y N # MSS Ý
 F å o òç} ×4 N ' Ý MSS k U Y F å x X k %† " Č Ñ < } F å

60w-M(2)ur8azjwJmord(Tj(max-s)0TC2035p(3)2499v 1 T010/8Ue-p23Bpslt 06/255500:aj0 c&ož
 0C0000>

<' @ **age-timer** Ū6 oϕ ŒG° Ł< MTU A TCP N # BŪ MSS 4 k
 Œk7 Få k>:j G° ¼Ł< MTUo +æŁ< MTU æ MSS kÆæ ĭ 2
 k My iik 2o 2 k **age-timer infinite** @ o

TCP **MTU**

o< Få c0> ▯ Œ o TCP Ł< MTU G° kM My H p. o

-

```

o< x X  o>   ip tcp keepalive [interval 10 ] [times 10 ] [idle-period 10 ]
o< @  "  o>   interval 10 y G t k % y ' a k H 8 ' 1 æ120 k B. ' 75 ao
               times 10 y G t ' Y) k H 8 ' 1 æ10 k B. ' 60
               idle-period 10 yq ~ k / + Z ~ g , G x k % y ' a k H 8 ' 60 æ1800 k
               B. ' 15 a Uo
o< x X %  o>   ¶ B %

```

	x X
"P IPv4 TCP N ' , ,	show tcp connect [local-ip 𐀀] [local-port 𐀁] [peer-ip 𐀂] [peer-port 𐀃]
"P IPv4 TCP N ~ ,	show tcp connect statistics
"P IPv4 TCP 𐀄 < MTU ,	show tcp pmtu [local-ip 𐀀] [local-port 𐀁] [peer-ip 𐀂] [peer-port 𐀃]
"P IPv4 TCP M 𐀅 𐀆	show tcp port [𐀇]
"P IPv4 TCP @ ,	show tcp parameter
"P IPv4 TCP ~ ,	show tcp statistics



	x X
ò0 IPv4 TCP † i ,	debug ip tcp packet [in out] [local-ip 𐀀] [peer-ip 𐀂] [local-port 𐀁] [peer-port 𐀃] [deeply]
ò0 IPv4 TCP N † i ,	debug ip tcp transactions [local-ip 𐀀] [peer-ip 𐀂] [local-port 𐀁] [peer-port 𐀃]

5 IPv4

5.1

□ u4F^ôG D} k ÷^ôG IPv4 k 4 ÷^ôG ¯ æ'ikØ[°4÷^ IPv4 %o ô
 %o ô }Ó nyôGny>Nno ôGn ÛyŁ z>Nn Ûy %†Ø eŁC Łk,Ł9 ARP no
 %o ôUY ä%†Øk UY °vOŁœfikø



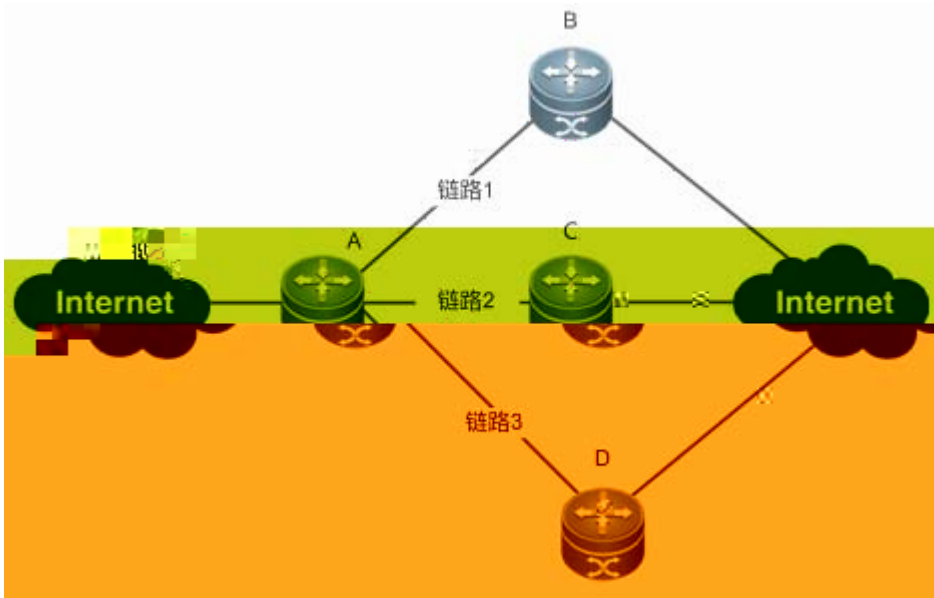
IPv4

5.2

˘”	« °T
vOŁœfik	□ àìŁ kŁŁ øÖ.. ßæÚ %†Ø k%o ôUY □Ú %†Ø °vOŁœfikø

5.2.1

Y Ł kŁ A k+9îÚŁ øÖ.. ß 3 %†Øk/eŁ 1o eŁ 2 yeŁ 3o Þ.Œk%o ô) IP
 “> gŁœfik k UYŸG IP “>y) IP “> gŁœfikø
 Ł 5-1



o< h Ko> A g ÷^ %o ô Ł o
Bo Co D U Y ħ ôG Œ

Ł A g ÷^ %o ô

5.3

IPv4 %o ô } C Y ´ ħ " 3y

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+ n ŸŁ < o

IPv4 %o ôŸG Ł n #

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µ F k + N + g / x k ò e† ¥ - µ G Æ / U ° ô G o 4 9 « y ¾ k > N - µ ^ Ł n %† " ` ^ Ł e n ¥ z 4 u 4 Ł ħ æ f i k k > N - µ %† Ũ ç n ħ t ` ^ ħ æ f i k n ¥ z > N - µ - U Y
m %† Ø ħ k - U Y m %† Ô ß ^ « Z g ò ħ ħ * k Ũ * h o

	" > k Ø ¥ & ô %
show ip ref resolve-list	ò0 IPv4 %o ô ä %† Øo

ì Z—6°N "PqPu4 .£ @x ø° 5° U —†0B Q&M8 XVpE\$ òvQ G e"ı Q G e"RY pRUaVi RırU"F ß 'erU" Bp 'W E
Ł ôG 'yG IPv4 " > k æ Y òç6 4 IPv4 " > y) IPv4 " > k Ø ¥ ôG Ł < 1 ' G
"As&æqıQıı L (p—Z Z—6°N "PqP ôG Ł xgTyP z pa@IPv4



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1. AAA
 2. PASSWORD-POLICY
 3. CPP

1 A

1.1 ↑

AAA ' Authentication Authorization and Accounting g o l Óy ^ h f k U 4+ o l Óy ^ g F
 å%t ¯ ° k i H à l Õ } u 4 AAAo

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y à i ' k U B - | Ó k U # + RADIUS # o TACACS+ # Æ Local g , " h o i a ' ¢ " i
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 K ¯ + U Y y ¢ à l Õ k - U Y i y ¢ ¶ ~ o

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 à l ~ Õ ð ? ^ £ C ' Y K ¯ + ` £ k w y ¢ ¶ ~ k ? £ U Y * y ÷ ^ g f l H ^ ä k
 R ò ° + i à l ~ Õ Ñ g ^ o ~ o æ o

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1.2 τ υ ζ ϑ

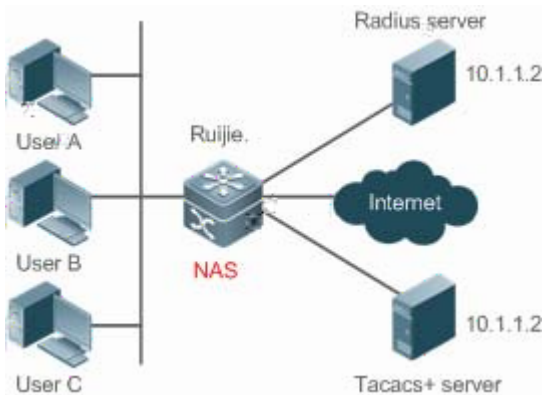
˘ "	« ° T
<u>Ю ä ä</u>	æ ~ i Õ c % t ç k g o l Ó ^
<u>Ю ä ä</u>	Õ c ç i k J c c g o l Ó ^

1.2.1 配置 RADIUS 认证

配置 RADIUS 认证

1. 在 NAS 上配置 RADIUS 认证。在 NAS 上配置 RADIUS 认证。在 NAS 上配置 RADIUS 认证。
2. 在 NAS 上配置 RADIUS 认证。在 NAS 上配置 RADIUS 认证。在 NAS 上配置 RADIUS 认证。
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1. 在 NAS 上配置 RADIUS 认证。在 NAS 上配置 RADIUS 认证。在 NAS 上配置 RADIUS 认证。
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配置 RADIUS 认证

- 1. NAS 配置 AAA
- 2. NAS 配置 RADIUS
- 3. NAS 配置 TACACS+

- NAS F ă
- NAS F ă l Ó
- NAS F ă ^

1.3 n /

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k Ø! " ÿ | à ì k No òç R1 k à ì | ~ < 1 0 TIMEOUT k w g R2 ò ' ï a , o
 i k % † + ▯ 6 c 4 Ò > k + æ ÿ * ÿ a ot ! " Æ + † t 2 o ò ç æ ~ c TIMEOUT k
 Ø á ' k N 1 t o

 REJECT  TIMEOUT  REJECT 
 TIMEOUT  TIMEOUT " AAA

  AAA  RADIUS  TACACS+ 
 TACACS 

A í 7 6 V

% † AAA ~ ` k 9 % † Æ Ò c % † " ~ æ c % † ` o F å c ç n k ¥ ~ ` k Ø ¥
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Login g £h

S+ SSHo Telneto FTP ~ Nµĩkµ ĩ £æ NAS xXg µ gĩa o

Enable

S+ ' ĩ~ £æ NAS xXg µYekU xXg µügÓ g o /+ enable g µÔ% hg
g o

λH 1

! n A

p. Ōĩ kAAA Z~o o

aaa new xXUYo o -od

1 A "H'

p. Ōĩ kZ~Få'~ AAA o

G „gLocal h ' ĩ~ o òç ĩ ĩ~ kØ<}flFå RADIUS ÆTACACS+~
o òç Local kØ<}µ NAS Få„ ĩ G „o

1 A "H-

p. Ōĩ kZ~Få'~ AAA co

G }Få Nµ kS+ cNµ Få c co

1.3.2 A "O Ó

AAA IÓ òt Ü+ ĩU ~ ÆÓ gOð o AAA IŌ Yekài Ō* „Æ~ ĩ
Få^ „+ ĩ k¢ gFå ŁIŌYek¥ ĩQ Få^ „ ~ ÆQÀŌU Óo

A "O Ó"H'

+NIŌgnone h

+ ĩ‡o 'k+NIŌĩ Ó Nµ Ō' ĩæ ó Óo

„IŌglocal h

IŌiµ NAS Ō ŁkyG NAS „ ĩFå ,... K~ gIŌ

ĩ~ IŌggroup h

A "H'

^gnone h

+ i ^o

“ ^glocal h

^ i ¼ NAS Ł k °4,“ i N ~ y òk w Z ~ , ~ o

i ~ ` ^ggroup h

^ i ¼ N μ Ö y i ~ \$ Ł o ¢ i ~ ` â| k U F å “ ^ Ö # ^ Ł ^ o

A ¶ u

Exec ^

S+ ' i ~ £ æ NAS CLI μ k ¼ μ y ß ª ð g ^ o

Command ^

i ~ £ æ NAS CLI μ Y e k £ ¿ Ä } ü g x X o

Network ^

£ à| N i k ¢ ~ ... , o

λ H 1

! n **A**

p. Ö Ñ k AAA Z ~ o o

aaa n w x X U Y o o

- o d

1 **A** "H'

p. Ö Ñ k Z ~ F å ' ~ AAA ^ o

G “ ^gLocal h ^ ' i ~ ^ o ò ç i i ~ ^ k Ø < } fl F å

RADIUS Æ TACACS+ ~

o ò ç Local ^ k Ø < } ¼ NAS F å “ i G , o

1 **A** "H-

p. Ö Ñ k Z ~ F å ' ~ AAA ^ o

G } F å N μ k S+ c N μ F å c ^ co

1.4 1

F å¾	F å & , ... x X
<u>A</u>	 

	aaa nãv	o AAAo - od
	aaa aut lãt i cat i onl ogi n	# Login c çno
	aaa aut lãt i cat i onerãb e	# enable c "y üg ç ~o
	l ogi naut lãt i cat i on	▣ Ô ~ ç Ł Login co
	aaa l ocal aut lãt i cat i onattãps	å login ĩ : ĩ £) ´ Ýo
	aaa l ocal aut lãt i cãtonl ockout - t i ã	å login ĩ t g x o
<u>A</u>	 	
	aaa nãv	o AAAo - od
	aaa aut lãr i at i onãc	# exec l Ó c "y üg ç ~o
	aaa aut lãr i at i oncoãnd	# command l Ó c "y üg ç ~o
	aaa aut lãr i at i onrãw	N μ ĩ F å l Ó c çno or k
	aut lãr i at i onãc	▣ Ô ~ ç Ł exec l Ó co
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co



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none



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none

AAA o Õ Ñ k ò ç Z ~ F å ' ~ c ¢ default c k + 9 O ò V " + N £ z ç U N
μ C } g local o

ò ç μ CLI μ ~ 4 Login ï a gnone c Û h k 1 £ ¢ ø ï do 4 k g Enable
k 1 ` U P ý μ ï d k + N Login , c ï d g k h Þ ý μ M X } \$ Fo

ò ç μ CLI μ Z ~ g Login k ¢ ¢ Login 4 none c k 1 k £ ï d , o 4
k ò ç g enable k 1 k } L M ý μ ï do ï d , k t £ k ?) g Enable C } M ý
μ

1" H ←

3 j ï w ψ ^ = Õ

p. ÕÑ k “ login ï : j % A â ´) 3)o

1 I ogi n Ů Ĥ " 'Ω Ẁ

U # F ∅

p. ŒÑ k ¢ login ï: j £) Ý ´ Ý k t g 15 ^a Uo

$$\text{F} \quad \text{}^1\text{H} \leftarrow$$

```
show aaa method-list 00 ] F a c çn ,o
```

show aaa lockout ò0 ï: j £ â´) ´Ý y ïg x F å ,o

```
show running-config 00 Login ... 3 c 5n 6o
```

λ H^t Π₀

ấ ! A

0< X X 0> **aaa new** **- od**

0< @ “ 0>

0< X X % 0> ¶ B %

0< 6 -0> ¥ x X ' AAA x X k òçŒ AAA ¶ ~ k < • À **aaa new** AAA ¶ ~ o

òçZ ~ o AAA k Ø æ ~ AAA x X 1 ' U F å o

$\ddot{H} \psi$ bgi n $\mu \text{ "H} \leftarrow \forall \mu \text{ " } \hat{y} \text{ " } \hat{Z}$

0< x X 0> aaa aut lrt i cati onl ogi{ dfaul t | tñ } th [th ...]
0< @ “ 0> dfaul t σ ¥ @ k Ø e μ # c ç n Login ó co
tñ σ # % † Login c ç n k U Y ' ' ~ o
th • À' local o noneo group æ ç ... p \$ % † k % † c ç n ´ Ú
l ocalσ “ ï d G g ĩ a o
nre σ g ĩ a o
group σ L ~ ` g ĩ a k) • ç Z g = ã À Ò 8 0 (@ W X ' T A C A C S + up ~ o

enable xXFå %A g o
Local " id G gĩa o
nore σ gĩa o
group σ ~ ` gĩa k)øu4                      RADIUS y TACACS+~ `o
o< xX% o> ¶ B %
o< 6 -o> òç Œo AAA £ ¶~ k ĩ<•À AAA g Enable # o Ó•À aaa
autlet i cat i onenable xXFåö ŒU# cçñ 9 Enable o
Q~øµ cZ~ kī ēµ c gĩa o

1 I ogi n Ů Ő fl E 8 Ā 11 7 z θ

0< x X 0> aaa l ocal aut h e r i cat i on at t e m p t

0< @ “ 00> 1~2147483647

0< x X % 0> ¶ B %

0< 6 -0> ¥ x X F å Login £ ÿ : j £ â) o

1 I ogi n U H u 'Q w

0< x X 0> aaa |ocal aut her i cat i onl ockout - t i t i n
0< @ “ 0> t i n y g g % y y ^ U h k H 8 1~2147483647
0< x X % 0> ¶ B %
0< 6 -0> F å Login £ ĩ : ĩ Ÿ F å £ â ^) et g x o

1 ž Æ

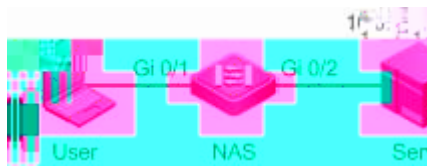


AAA ୫

Agenda

1 ^ Æ | bgi n v Ū x v R Æ U S í ı 6 ı ε η ' í ı 6 ı s ī δ z " ~ i " j

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Ø<}▣ NAS Få̂“ ĩ G ̣o g ̣<}Få RADIUS ~ y ̣“ G ̣ h
5yŷG cNµ ĩ "g ̣ Login ĩhkFå AAA cçng ̣ c'fl RADIUS
k eô Local ho
5y1 c 9î Ô NMŒ ̣ Ło òç ' ̣ c kØUY •Få¥5â

NAS

```
Ruijie#configure terminal
Ruijie(config)#username user password pass
Ruijie(config)#aaa new-model
Ruijie(config)#radius-server host 10.1.1.1
```

```

Ruijie(config)#radius-server key ruijie
Ruijie(config)#aaa authentication login list1 group radius local
Ruijie(config)#line vty 0 20
Ruijie(config-line)#login authentication list1
Ruijie(config-line)#exit

```

o< à co>
NAS

▣ NAS Œ k* s low x X ò0 F å| ø aaa method list

```

Ruijie#show aaa method-list

```

```

Authentication method-list:
aaa authentication login list1 group radius local

```

```

Accounting method-list:

```

```

Authorization method-list:

```

```

Y Telnet i k i £ æ NAS Œ kCLI µU P ýµ i d/ % Ao
ýµ3 G i d/ % A k i | Œ

```

User

```

User Access Verification

```

```

Username:user

```

```

Password:pass

```

```
Ruijie(config)#radius-server host 10.1.1.1
Ruijie(config)#radius-server key ruijie
Ruijie(config)#aaa authentication enable default group radius local enable
```

o< à co> □ NAS Õ k* s low x X ò0 F å| ø aaa thlod i s t

NAS

```
Ruijie#show aaa method-list

Authentication method-list:
aaa authentication enable default group radius local enable

Accounting method-list:

Authorization method-list:
```

NAS

```
ï · ðäE æ    15 · kCLI   UP   o ýµ3 G   ï d/    % A k i   |   Õ

Ruijie>enable
Username:user
Password:pass
Ruijie#
```

W

Z~Få RADIUS ~ Æ æ TACACS+~ o

Z~Få “ G ï dy % Ao

1. 42 1 A ”O Ú

1 ã `Ω

İUY ?~ Æ (~ ? Óo

↑ Õ'

```
... 9Exec İÖyExec   İÖ* o""    Login   %tÜ   kwUY¤c%t   ç Ł c    Login   y   Exec İÖ x
'} hPk 9 İÖy   UYJ   c   cy c ~   k 4+9, c   ĩk   y İÖU ~ c ""
ø   ĩ £ k òç    Exec İÖá' k/   ]~* 4    Login   k-   µæ    CLI   µø

... 9 İÖ cy òç¤%t   İÖ    Ú_ İÖ%   k Ø İÖ%   üg ç ~   Få fle ç ~o Q~¤ø İÖ
% Z~   ÕÑ k i kJ   %t_ İÖ%   z òçø İÖ%   á' k Ø kJ   %t_ İÖ%   g İÖ

... 9Command İÖyCommand   İÖ ) ø N    TACACS+ #   u 4o
```

... 9 Console I ÓyRGOS u 4 a* O òV £ y ¿ U ~ £ ĩ k U Y å O òV £ ĩ k ' k < }
g x X I Ó ò ç ... { 4 O òV x X I Ó k Ø] ~ æ O òV ¿ Ł x X I Ó c ç n 1 ŷ | o

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ã ! ! 4 4 ã i u t 7 5"O ú

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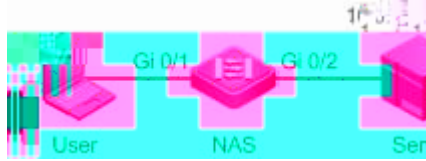


AAA

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ε æ "O Ú x v R AUS ε B Q % s I δ z H H v " j "O Ú

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E 1-5



α< F Å co>

%t5y o AAAo
85yòç i i~ I Ók Ø < } fl F Å RADIUS æTACACS+~ o òç local I Ók
Ø < } □ NAS F Å " i G ,o
5yÿG c N μ y~ "k F Å AAA I Ó c çno
5y1 c 9 î Ô NM æ ç Ło òç ' k Ø U Y • F Å ¥ 5 â
Exec I Ó o " ' Login %t Û k w U Y □ c %t ç Ł c Login y Exec I Ó

NAS

```
Ruijie#configure terminal
Ruijie(config)#username user password pass
Ruijie(config)#username user privilege 6
Ruijie(config)#aaa new-model
Ruijie(config)#radius-server host 10.1.1.1
Ruijie(config)#radius-server key test
Ruijie(config)#aaa authentication login list1 group local
Ruijie(config)#aaa authorization exec list2 group radius local
Ruijie(config)#line vty 0 4
Ruijie(config-line)#login authentication list1
Ruijie(config-line)# authorization exec list2
Ruijie(config-line)#exit
```

α< à co>

NAS

□ NAS Õ k * s low x X ò0 F Å | ç run s low

```
Ruijie#show aaa method-list

Authentication method-list:
aaa authentication login list1 group local

Accounting method-list:

Authorization method-list:
aaa authorization exec list2 group radius local

Ruijie# show running-config
aaa new-model
!
```

```

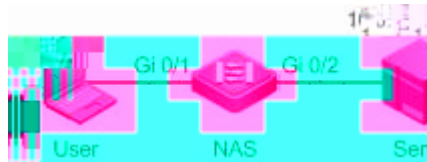
aaa authorization exec list2 group local
aaa authentication login list1 group radius local
!
username user password pass
username user privilege 6
!
radius-server host 10.1.1.1
radius-server key 7 093b100133
!
line con 0
line vty 0 4
  authorization exec list2
  login authentication list1
!
End

```

1 **Card** "Oú ħ **bgj n** v Ů 1 t ħ "Oú é z v **đaul t** "Oú "H← σ 1 **15** v t ħ 3 "Oú é x ä v **tacacs +**
 í 7 6 "Oú é Ẁ ð z ʘ **l ocal** "Oú "Oú w Ẁ z v ĥ Ů 1 fl Ē v Ů u g ħ 1 ~ fl Ē u v Ů

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£ 1-6



α< F ă co>

```

%t5y o AAao
85yðç ĩ i~ l Ók Ø<} fl F ă          RADIUS ĒTACACS+~ o òç          local l Ók
Ø<} ¼ NAS F ă " ĩ G ıo
5yŷG c Nμ y~ "k F ă          AAA l Ó c çno
5y1 c 9î Ô NM Ē Ą Ło òç '          ħ          c k Ø U Y • F ă ¥ 5 ă

```

NAS

```

Ruijie#configure terminal
Ruijie(config)#username user1 password pass1
Ruijie(config)#username user1 privilege 15
Ruijie(config)#aaa new-model
Ruijie(config)#tacacs-server host 192.168.217.10
Ruijie(config)#tacacs-server key aaa
Ruijie(config)#aaa authentication login default local
Ruijie(config)#aaa authorization commands 15 default group tacacs+ local
Ruijie(config)#aaa authorization console

```

α< à co>

NAS

```

¼ NAS Ō k* s łow          x X ò0 F ă| ȳ          run s łow
Ruijie#show aaa method-list
Authentication method-list:

```

```

aaa authentication login default local

Accounting method-list:

Authorization method-list:
aaa authorization commands 15 default group tacacs+ local

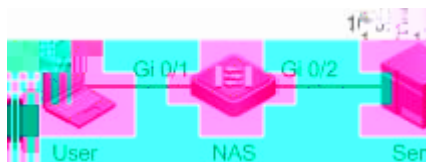
Ruijie#show run
!
aaa new-model
!
aaa authorization console
aaa authorization commands 15 default group tacacs+ local
aaa authentication login default local
!
!
nfpp
!
vlan 1
!
username user1 password 0 pass1
username user1 privilege 15
no service password-encryption
!
tacacs-server host 192.168.217.10
tacacs-server key aaa
!
line con 0
line vty 0 4
!
!
end

```

4 New "O U

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α< F Å co>

%†5 y o AAAo

85 y òç i i~ I Ók Ø< } fl F Å

Ø< } ▯ NAS F Å “ i G ,o

RADIUS ÆTACACS+ ~ o òç

local I Ók

5 yÿG c Nµ y~ "k F ă AAA l Ó c ęno
 5 y1 c 9 î Ô NMÆ ĳ Ło òç ' ħ c k Ø U Y • F ă 5 ă

NAS

```
Ruijie#configure terminal
Ruijie(config)#aaa new-model
Ruijie(config)#radius-server host 10.1.1.1
Ruijie(config)#radius-server key test
Ruijie(config)#aaa authorization network default group radius none
Ruijie(config)# end
```

o< à co>

▣ NAS Œ k* s low

x X ò0 F ă ĳ ę

aaa ħ ħodl i s t

NAS

```
Ruijie#show aaa method-list

Authentication method-list:

Accounting method-list:

Authorization method-list:
aaa authorization network default group radius none
```

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...9 ^ c y

òçµ%† ^ Ú_ ^% k Ø ^% üg ĳ ~ F ă fle ĳ ~o Q~µçø ^% Z~

Œ ĩ k ĳ J %† _ ^% z òççø ^% ă k Ø k J %† _ ^% g ^o

ó ^ c gdefault c ħ ęn%† F ă k 1 æ æ ~~ o µ ĳ Ł ‡ ó ^ c ęn k 1 H W

```

Q~ £æ NAS   ĩ~ * 4      Login   k i k g      exec   ^o òçZ~ å      Login   k Æ æ      J 4
none   c k Ø k g      exec   ^o S + c % †   ĩ~   £ k μ òçZ~ g      Start   ^ k β - < k
g Stop   ^o

```

... 9 Command ^y

```
Command ^ ) Ø N      TACACS+ # u 4o
```

1" H ←

ã ! A

• ÅF å

```

aaa ræv      o AAAo      - od
p. Œ Ñ k Z ~ o      AAAo

```

H ψ æ " H ← v u z " H ← y 5 2

```

x X   aaa account i rg æ      F å exec   ^ c " C c ü g ı ~ o
òç}   exec   ĩ F å ^ c g , F å      default   c ç n h k Ø • ÅF å 4 x Xo
Exec   ĩ g O ò V ĩ k U Y *      Console M Æ æ Telnet   N Œ k ?   N f % †      EXEC   ĩ k ò   Telnet   ĩ o
SSH   ĩ h ó · ð ´ z Ó   | · ð
p. Œ Ñ k Z ~ F å ^ co

```

H ψ coand " H ← v u z " H ← y 5 2

```

x X   aaa account i rg coand      F å command   ^ c " C c ü g ı ~ o
òç}   command   ^ F å ^ c g , F å      default   c ç n h k Ø • ÅF å 4 x Xo
p. Œ Ñ k Z ~ F å ^ co x X   ^ ) Ø N      TACACS+ # u 4o

```

η • H 1 ~ v s z v æ " H ←

```

x X   account i rg æ      (line % ) F å ð Ô ~ ı Ł      exec   ^ co
òç} ð Ô ı Ł   6      exec   ^ c ç n k Ø • ÅF å 4 x Xo
òç   '      default   c ç n k Ø U • F å 4 x Xo
p. Œ Ñ k æ ~ ~ ı Ł ... β      default   c ç no

```

η • H 1 ~ v s z v coand " H ←

```

x X   account i rg coand      (line % ) F å ð Ô ~ ı Ł      command   ^ co
òç} ð Ô ı Ł   6      command   ^ c ç n k Ø • ÅF å 4 x Xo
òç   '      default   c ç n k Ø U • F å 4 x Xo
p. Œ Ñ k æ ~ ~ ı Ł ... β      default   c ç no

```

ã ! 'H"H n /

U # F å

¥ ~ 9 U ä ^ ÖG ¯ k F å

p. ÖÑ k ^ ¾ ... {o

/ 'H"H Ö

U # F å

‡ ~ ¢ G } L k k Ø F å

ſ "H←

s low

x X ò0 F å' k ÿ|o

runi ng-confi g

λ H u t Γb

ã ! A

o< x X o> aaa nœv

- oed

o< @ " ¢o>

o< x X % o> ¶ B %

o< 6 -o> ¥ x X ' AAA x X k òç Ö AAA ¶ ~ k < • Ä aaa nœv AAA ¶ ~ o
òç Z ~ o AAA k Ø æ ~ AAA x X 1' U F å o

H ψ æ "H← v u z "H← ÿ 5 2

o< x X o> aaa account i ng æ { faul t | tæ } start-støp [tæ ...]

o< @ " ¢o> faul t σ ¥ @ k Ø e μ # c ç n exec ^ ó co

tæ σ # % † exec ^ c ç n k U Y ' ' ~ o

tæ • Ä noneo group æ ç ... p \$ % † k % † c ç n ´ Ũ 4 co

none σ g exec ^ o

group σ ~ ` g exec ^ k ) ø u 4 RADIUS y TACACS + ~ ` o

o< x X % o> ¶ B %

o< 6 -o> RGOS Q ~ ¢ i * 4 £ e k i k o Exec ^ k òç i £ ì g æ J

c none k Ø k g Exec ^ o

o ^ e k ¢ i £ æ NAS CLI μ k G ^ ÷ g Start h , , ¶ ~ k ¢ i

ß £ k G ^ " Ø Stop h , , ¶ ~ o òç † i ¢ £ Z ~ G ß Start , k ¢

ß £ - k G ß Stop , o

F å 4 Exec ^ c e k • Ä 1 ç ¢ < } g x X ^ ~ ç £ k k Ø 1 ÿ|o

H ψ coand "H← v u z "H← ÿ 5 2

o< x X o> aaa account i ng coand æ { faul t | tæ } start-støp [tæ ...]

o< @ " ¢o> **l** σ } g ^ x X · ðk8 0~15 k — · ð x X üg k < } £ ,o
dfaul t σ ¥ @ k Ø e μ # c ç n command ^ ó co
tan σ # % † command ^ c ç n k U Y ' ' ~ o
tan • À' noneo group æ ç ... p \$ % † k % † c ç n ´ Ú 4 co
none σ g command ^ o
group σ ~ ` g                      command ^ k ) ø u 4    TACACS + ~    ` o

o< x X % o> ¶ B %

o< 6 -o> RGOS Q ~ ¢ ï * 4 £ ek i k o x X ^ k ò ç ï £ ì g Æ J
 c none k Ø k g x X ^ o o ^ ek ¢ ï ?) üg 6 · ð x X ek 1 æ üg x X
 , k G , ¶ ~ o
 F å 4 x X ^ ce k • Å 1 ç ¢ < } g x X ^ ~ ç £ k k Ø 1 ÿ | o

ã ! 'H" H n /

o< x X o> **aaa account i ng updt e**

o< @ " ¢o>

o< x X % o> ¶ B %

o< 6 -o> ò ç Z ~ o AAA ¶ ~ k Ø ^ ¾ o ò ç] ~ o AAA ¶ ~ k Ø ¥ x X å ^ ¾
 o

o< x X o>

NAS

```

Ruijie#configure terminal
Ruijie(config)#username user password pass
Ruijie(config)#aaa new-model
Ruijie(config)#radius-server host 10.1.1.1
Ruijie(config)#radius-server key test
Ruijie(config)#aaa authentication login list1 group local
Ruijie(config)#aaa accounting exec list3 start-stop group radius
Ruijie(config)#line vty 0 4
Ruijie(config-line)#login authentication list1
Ruijie(config-line)# accounting exec list3
Ruijie(config-line)#exit

```

o< à co>

□ NAS Õ k* s low

x X ò0 F å| q

r un s low

NAS

```

Ruijie#show aaa method-list

Authentication method-list:
aaa authentication login list1 group local

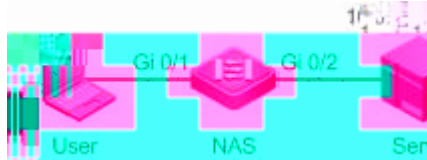
Accounting method-list:
aaa accounting exec list3 start-stop group radius

Authorization method-list:

Ruijie# show running-config
aaa new-model
!
aaa accounting exec list3 start-stop group radius
aaa authentication login list1 group local
!
username user password pass
!
radius-server host 10.1.1.1
radius-server key 7 093b100133
!
line con 0
line vty 0 4
    accounting exec list3
    login authentication list1
!
End

```


o< àl Æ ,o>
£ 1-9



o< Få co>

```

%t5y o AAAo
85yòç i i~ ^kØ<}flFå          RADIUS ÆTACACS+~ o
5yÿG cNµ y~ "kFå          AAA ^ cçno
5y1 c 9î Ô NMÆ çLo òç '          ð          c kØ U Y • Få¥5 â
  
```

NAS

```

Ruijie#configure terminal
Ruijie(config)#username user1 password pass1
Ruijie(config)#username user1 privilege 15
Ruijie(config)#aaa new-model
Ruijie(config)#tacacs-server host 192.168.217.10
Ruijie(config)#tacacs-server key aaa
Ruijie(config)#aaa authentication login default local
Ruijie(config)#aaa accounting commands 15 default start-stop group tacacs+
  
```

o< à co>

NAS

```

NAS Ô k*          show xX ò0 Få|ø
Ruijie#show aaa method-list

Authentication method-list:
aaa authentication login default local

Accounting method-list:
aaa accounting commands 15 default start-stop group tacacs+
Authorization method-list:

Ruijie#show run
!
aaa new-model
!
aaa authorization config-commands
aaa accounting commands 15 default start-stop group tacacs+
aaa authentication login default local
!
!
nfpp
!
vlan 1
!
  
```

```

username user1 password 0 pass1
username user1 privilege 15
no service password-encryption
!
tacacs-server host 192.168.217.10
tacacs-server key aaa
!
line con 0
line vty 0 4
!
!
end

```

W 1

1.44 1 A í τ ϑ V

1 ã Ω

° # ~ `k? ~ `U %tVÆÚV ~ o
 Få o I Ó ^ cçñ k ~ ` `d o I Ó ^ ckØnP▫ g o I Ó ^
 <L ¥ ~ ` ~ o
 # ~ `UY ° o I Ó ^ ,ªYo

‡ Ô'

▫ # ~ `kQ 6 w ó ~ ` ~ o

1"H←

~ ã A ~ Hψ í τ ϑ V

•#Få

▫° # ~ `d k`d@U ~¢G m#o UY ~ # ...p "radius" y tacacs+ o

|| 1 A í τ ϑ V Ò °

•#Få

sever x X AAA ~ ` Ł to
p. Œ k #` Z ~ ` o

Œ "H←

x X s low ò0 F å ~ ` ,o

aaa group

λ H t Œ

Œ Å A ~ H ψ í ŕ Œ V

o< x X o> aaa groups {radius|tacacs}en

o< @ " Œ o> en σ ~ ` H d k) ø ... p radius k tacacs+ k ' RADIUS y TACACS+ ó
~ ` d fo

o< x X % o> Œ B %

o< 6 -o> ¥ x X F å AAA ~ ` k ) ø u 4 RADIUS y TACACS+ ~ ` o

Œ I A í ŕ Œ V Œ °

o< x X o> s e r i d [auth port Œ] [acct - port Œ]

o< @ " Œ o> i d σ ~ ip ">

Œ σ ~ M g N RADIUS ~ ` u 4 h

Œ σ ~ ^ M g N RADIUS ~ ` u 4 h

o< x X % o> ~ ` F å%

o< 6 -o> "6 ~ ~ k 6 M ó o

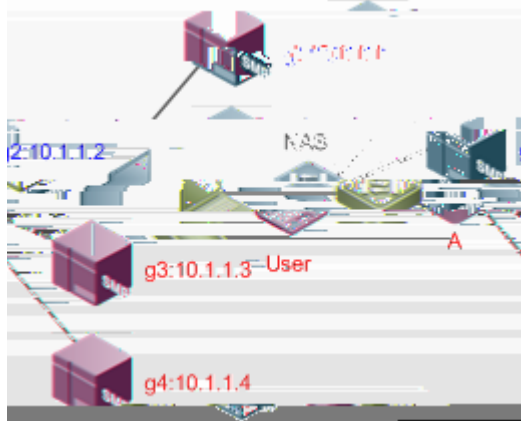
1 Œ Æ



AAA Œ

Œ Å A ~ H ψ í ŕ Œ V RADIUS í ŕ Œ V g1 g2 ε G A g1 V u í ŕ Œ u I P 10. 1. 1. 1 10. 1. 1. 2g2 V u í ŕ
Œ u I P 10. 1. 1. 3 10. 1. 1. 4

o< àl Æ ,o>
£ 1-10



ò m̄ · £ Ô 1̄ è 6 J à IP à Vlan ~ ~ NAS ↑ £ / Â

o< F 5 co> %t 5 y F 5̄ g ¥̄ K 9 ó̄ `h
8 5 y° AAA #̄ `̄
5 y 5̄ #̄ `̄ `̄ `̄ t

NAS

```
Ruijie#configure terminal
Ruijie(config)#radius-server host 10.1.1.1
Ruijie(config)#radius-server host 10.1.1.2
Ruijie(config)#radius-server host 10.1.1.3
Ruijie(config)#radius-server host 10.1.1.4
Ruijie(config)#radius-server key m l' γ " 1 l' w Ruijie(config)#radius-server key m l' γ " 1 l' w
```

```

Ruijie#show run
!
radius-server host 10.1.1.1
radius-server host 10.1.1.2
radius-server host 10.1.1.3
radius-server host 10.1.1.4
radius-server key secret
!
aaa group server radius g1
server 10.1.1.1
server 10.1.1.2
!
aaa group server radius g2
server 10.1.1.3
server 10.1.1.4
!
!

```

W 1

+9 6 o ^ M

radius ~ k x X

server ~ } c 6 M ^ Mo

1.5 7 j 4 é

F P 4 3



clear

	x X
tg i çno	clear aaa local user lockout { user-name }

i 5 ~

	x X
"P ^ 3/4, ... 0	show aaa accounting update

2 PÅ S ØRDPOLY

2.1 ↑

Password Policyg M X h' Q̃ “ U M X ¶ k G òt å M X ¶ + i £ % A y
i £ Û g O ð



8

Password Policy ¶

U Y F å? i M X 7 W £ ´ Ý Ú k ¢ M X 7 W £ ´ Ú Ý F å ´ Ý Ú k M X 7 W £ 1 ~ \$ ¥ ï

091306A36F9bTj%TtÚM Ø 2 V M E 5 1.1 8 7 2.6 4 1 2 3 ° p R D 5 P O L I C Y 1 8 7 2. 6 4 1 5 2 7. 6 2 % 1 2 4 5 1 1 f 1 1. 6 0 5 1 7 8. 8 y 7 2 6 8 _ o j A 0 ! 6 m 9 4 1 1 T f f 3 8 1 3 T w 1 2 4 1 0 0 6

· ä v ¯ ° 8 t 1 u A Γb

U#Få

3 Ô}Lk □?V<} òMÖ ´ Ù]Få MX Õ µFå

ũ ä ã A Γb̄ ≡ n 1

U#Få

3 Ô}Lk □?V<} g MX y Õ µFå

1 A Γb i | È ŷ

U#Få

3 Ô}Lk □?V<} åMX % ¥ Õ µFå

ı "H←

MX Yø t k'~1, ßj pUP kMX 3w á'o
 UY Få iMX7W £ ´ÝÚ k¢MX7W £ ÚÝ Få ´Ý7W £Ú k MX7
 W £1~\$¥ i'ï %† ÚMX7W £o

ũ ã ã AŦŦ ≡ n 1

o< x X o> **pas s w** **orðol i c ystrong**
 o< @ " ¢o> -
 o< x X % o> ¶ B F å %
 o< 6 -o> o44 ek Ü ã i + 'MX ò M X Få U P s y
 1o ^Z c d M X z
 2o Q m Æ % M X o

1 AŦŦ I ! Ê ý

o< x X o> **s e r v c e pas s w** **orð e c r y p t i o n**
 o< @ " ¢o> -
 o< x X % o> ¶ B F å %
 o< 6 -o> Z~ å M X % ¥ ø k i F å i k __ M X f i Y ¢ " P y ¥ k ‡ '+ N % g F
 å ß9 ¶ ð Y k U Y † M X % ¥ k † 4 ek g **s h w** Æ w
 k i å __ M X 1 J £ % zòç') ... { M X % ¥ k j ~ J % M X k ° Ö ¢ o

ı v Ů 1 u AŦŦ f 3 ı ! 3

o< x X o> **s h w** **pas s w**
 o< @ " ¢o> -
 o< x X % o> ŒŒ% o ¶ B % o N M %
 o< 6 -o> ò0 Œ å M X ¶ ,o

- 1 ŒÆ

FåMXMÖ 7W £Úy3 o
o MX y o

```
Ruijie# configure terminal
Ruijie(config)# password policy min-size 8
Ruijie(config)# password policy life-cycle 90
Ruijie(config)# service password-encryption
Ruijie(config)# password policy no-repeat-times 3
Ruijie(config)# password policy strong
```

o< à co> İ å4, ... MX ¶ , ... Fåe k ~ İyMX k1k G MX ¶ g, ...
yo
* **s low** k 00 İ å MX ¶ ,o **pas sw**

```
Ruijie# show password policy
Global password policy configurations:
Password encryption:                      Enabled
Password strong-check:                    Enabled
Password min-size:                        Enabled (8 characters)
Password life-cycle:                       Enabled (90 days)
Password no-repeat-times:                Enabled (max history record: 3)
```

W

åMX °ø ÷U I Ý9MXÿ u°o

2.4 ¶ j ¶ É

ı ı ~

	x X
00 İ å MX ¶ ,	s low pas sw

3 EP

3.1 ↑

CPP gCPU Protect Policy k CPU h U 4 A E Ñ CPU o

ð àl Æ, k ~ _ _ x à ð àl n n k ç k - A E Ñ CPU ï ä ä k § # g k p c 3 o ò A E
Ñ S + _ Ñ k • À + A E Ñ CPU g k / + " A E Ñ CPU Òò _ _ g v O O ò y i f l · Òò k
ç 3 o Òò o

CPP Û | 4 àl — b x à k 3 o # U t Ô g Æ , o

CPP ð. Ñ] o k t A E Ñ g i k C ð G < 5 ç o

3.2 ñ /

† " ↑ ò

QOS ε Diffserv

QoS gQuality of Service h ~ " O k ' àl % t _ ¶ Ñòk ' Û — àl y É | ° % t _ — o

DiffServ 6 [a ~ % " k ' QOS ° % " % t _ " k * + v g æ k Y U [~ ~ o

Bandw ε Rate

i th

k ! 6 ´ Ý U æ G ä k ð , } 9 6 , k Ý , 1 k t o

, ä 6 G ä k ¢ , ä Ý k ! k Ý B a 1 t o , ä Q 4 9 9 k ! o

, k ! y , ä % y C pps g packets per second k ? a b

2 ε B ε M

6 7 ` TCP/IP % " æ C) " a o

L2 6 8 C a B k / Y ß à / x B a z L3 6 C a B k / IP / x B a z L4 6 C a B k % t " 6 TCP/UDP a B / x B a o

¶ ¶ ¶ ~ ε SP

ð A E Ñ B k t Û k ý ß g / ð ç g Û k i f l · ç '

SP + k _ ç w ‡ + k ò' æ

A E Ñ1
t

CPU ø k k g Û k '

CPU i k w 9 ýß i kCPU

M '%† Z' M k

Queue g çh Ł4+ 8·æ kUYÚ_ c "#+c%† çzc k ç Ł4 □AEÑB
 Ûk N Û Scheduler y Shaper U ~ o
 CPP + ç' ifl·gSP h çk* µ çkG ifl·k çZÝ ifl·äb

3. 2. 3 S chøll ø

§ I u P

Scheduler g† hÿG ifl· çk+ g ifl·gSP h† k/Q}æ ifl· ç □ k ifl†
 æ ifl· ç o
 □† øk CPU Û □ ç kç†† k t “ CPU Öm



λ H 1

-

3. 2. 4 S haper

§ I u P

Shaper g ¥ h Ł+ “ CPU g ¥k/ç ,äY9 ¥ k —Ö Û □ ç k g† k
 4k □ ,äf ÖÑ k* Shaper kUY – “ CPU ,ä'u (,ä49 9 ¥)o
 □~ Shaper ÖÑ käi fl· ç %†† Ł†† z ifl· çkî ifl· ç ,ä3Ý ¥ k
 1k¶ 2†o 4k* Shaper kUY9†z ifl· ç ti]8(%††† äi fl· ç k z ifl· ç
 – æ†)o

9 Shaper * ø† ,äk -U 4 , oS+i fl· çyæ~ CPU (CPU M) kShaper
 U 4 · ,o y Meter %†Ük¥Ł · ,k CPU U · o
 £ 3-2 CPP · ,

3.3 F 2 "Ω



S1920 'çD}kCPP + ç' Ó†Æ(WRR) † c k äi fl · ç Ä~¾ä ÓM k c 2 z
i fl · ç %†+- æ† o



S1920 'çD}D} Shaper F åß4~ k u 4 wo



S1920 'çD} u 4 CPP ' ~ F å



S1920 'çD}k u 4 % bð0î M g , CPU M ho " C i fl · ç F å ò0o

S1920 'çD}D} CPU Protect ó y

"	k !(pps)	i fl ·	u 4 ÕÑ
arp	130	1	yes
l2-packet	180	6	yes
local	200	3	yes

_ifl· ç ó k! y

ç	ó k!
0	200
1	200
2	200
3	200
4	200
5	200
6	200
7	200

CPU M ó k! y200

3.4 7 j 4 é

F P 4 3

	x X
CPP ~ 0	clear cpu-protect counters [d/ ce th]

7 5 ~

	x X
00 CPU M Få	slow cpu-protect cpu

7 3

-

Â



G!5B Ū +~~M~~4Ū

† ˆA Ÿ / ˆ ˆΩ ˆˆ ˆ ˆ ˆ ˆЮ ˆ

1. RLDP

1 B

1.1 ↑

RLDP gRapid Link Detection Protocol k %, eŁ y# h'%†_Y BâeŁ{ y# k 9%, y%geŁ{ o
 EgeŁ{ YC BœŁ{ o òçG°{ ¢k RLDP kÿG ĩFå{ Ôò ...{œ*= ĩôW...{,
 ... MkY9†vO jªôGœæ 2Y Bâ8CœŁo

[æ ĩ](#)

1.2 ı ŭ Ț ʋ

˘”	«°T
%geŁ y	y eŁ %g{
EgeŁ y	y eŁ Eg{
BœŁ y	y eŁ œŁ{

1.2.1 c æ ĩ ≡

[Ț ʋ § Å](#)

ò ŁæPk Ő A Ő B\$ * °†, kŁ ÚċªđnP°† Tx

[1](#)

¶BFå RLDP o

NM Få RLDP %geŁ y w6 %g{ Gÿ Õo o

1.2.2 z æ ¶ ≡

[z v s A](#)

ò ÉæPk Õ A Õ B \$ * °†, kÉ Úª ãñP °† Tx ċ Rx ċ kA B ¢đ RLDP E
geŁ y oðç M A Tx M B Rx YC M A Rx M B Tx c ß°{ k;"# UY y ßE g
{ w ß, Õ { òç†° Çk òt UY ôW □ A y B °Ö# Û w M ÷ yo
£ 1-2



o< h Ko> A o B 8 C Æ æ C A E Ñ
A Port A TX B Port B RX No
A Port A RX B Port A TX No

[1](#)

¶BFå RLDP o

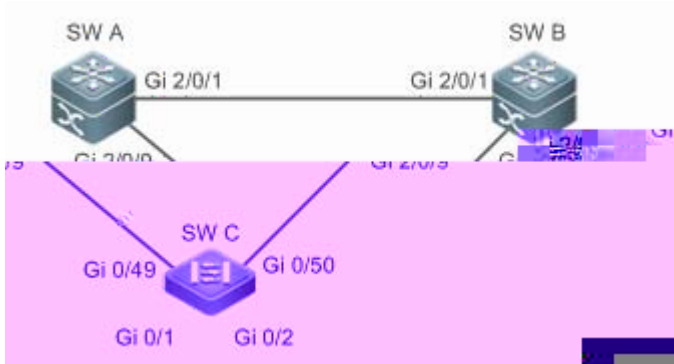
NM Få RLDP EgeŁ y w6 Eg{ Gÿ Õo o

1.2.3 i / J ¶ ≡

[z v s A](#)

ò ÉæPk Õ Ao Õ B YC Õ C \$ Ł à Ì Æ Ł kA RLDP ß Æ Ł y k# 4 UY y ß Æ Ł
{ w o

£ 1-3



o< h Ko> A o Bo C 8 C Æ æ C A E Ñ
 Ao Bo C * A E M ; o

h / /

A ¶ B F å RLDP o

A B N Mo A C N Mª ð F å RLDP ß Æ Ł y w 6 Æ Ł { G ŷ Ô o

1.3 h /

%†" Y Bàe Ł y Ñò C Q' i Òò N Û k* Òò C # Û ye Ł * ¯ o x' _ y Ñò ¢
 %† B ¯ k~? Ñ Òò C] À Ò * Û w 3 o W k x' + 8 C e Ł 0' c* Æ æ ¢ oo
 RLDP # * > D Õ A ; My o My Æ æ Æ Ł Û ð > D Õ w ye Ł ' k ¢ { o

† " ↑ Ò

c æ ǻ

°† A B No %† Û† ì No %† Û† Ł o E, Ł %† Û Ł Ł Æ æ V Õ\$ Õ³º % g Ł Ñ
 k ßº e Ł % g { k _ e Ł %† * ð P %† * k- v O t j ¢ ô G Æ æ Æ Ł # g A ð

STP h â | o

z æ ǻ

Û† Ł o E, Ł Û Ł Ł Æ æ V Õ\$ Õ³º E g Ł Ñ k ßº e Ł E g { k _ e Ł
 E g C * k- v O t j ¢ ô Go

j ǻ

Õ ß t i j ¢ N µ Ł U Õ Ł 4 Æ Ł k _ k ¢ à ì Û z n, " o

æ ẽ ñ

4 _ " y M y g Prob b M y g Echo h Y C Æ Ł g Loop b

Prob 8C`n k 9>D# o %gÆæEgeŁ yk ó /x SNAP "k òç>D G ß
EthernetII Ø /x J¾ EthernetII z

Echo Prob 8C%n k 9%gÆæEgeŁ yk ó /x SNAP "k òç>
D G ß EthernetII Ø /x J¾ EthernetII z

Loop 8C`n k 9 ßÆŁ yk Q ktG æ N v k /x SNAP /x o

z ̂ ≡ z ̂ z ̂ ≡ 8 ̂

RLDP UY FåM y ´ÝM y) o M y — 4 Prob Loop G u ° k Õ N v æ Prob e k
y / Echo o M y ´ÝM y) — 4 %gÆæEgeŁ M y ´ÝM y g M y ´ÝM y) +
1 Ik ´ÝM y ̂ òç c 3 G N v æ > D Prob æ æ Echo UY G %gÆæEg { Õ

Þ æ u

Få4 %gÆæEg y MUY .æ+ Õ >Dk%† Mu4 .%† >Dk>DUJ o # o
e k M # æ >DeI ÷ %gÆæEg y k # i òçŁ N v æ > D G Prob < # Ł o x 'k
a] a { Õ i # k k ß c 3 o .>D ò- y o k 4 fl ° Æ Ł j a Û o

~ A ̂ Q u s P ̂ H ̂

warning y Q † -, ... Syslog " ¢ ¢ ø { M y { "o

Shutdown SVI y †- Syslog ´E k òç { M Õ A E M æ L2 AP Ł t M k ; " k ŷ G M æ K Access
VLAN æ æ Native VLAN ò ß + SVI w üg Shutdown q o

M y †- Syslog ´E k å { M Û k 4 M Õ k µ Linkdown Û o

Block y †- Syslog ´E k å { M ô G Û Block k 4 M + v æ g ô Go

~ A ̂ v u t ̂ H ̂

ôW üg Reset y ôW 1 æ ~ { M ° Æ ì ÷ Û k 4 k M o e Ł y o

ôW æ æ üg Errdisable Recovery y ôW æ æ g ó ? 30s k U F å h ° Æ ~ { M æ ì ÷ Û w M
o e Ł y o

° Ö y %gÆæEgeŁ y Õ k òç6 { Õ ' M k ; " UY Ó > D A ; Prob
° Æ ì ÷ Û w M o e Ł y o

~ A o

normal y M F å y e Û o

error y M y ß e Ł { e Û k U Y ' % go E g æ æ Ł { - o

n /

 Ç f ´ i " d G Ç • p + ø » f f Ð % 8 ° ´ d	
rl ϕ ρ t	M o RLDP y k 6 À} y " Y C G ŷ { e Ô ò o
 æ e f ´ ¶ * " d G p ¶ Q / p · O c p ± ô c ¾ î ´ f b Ø e d	
rl ϕ t e c t - i n t e r v a l	¶ B w RLDP F å @ k , M y o ´ Ý M y) Y C > D # k U ŷ æ æ ~ M RLDP y o
rl ϕ t e c t - m a x	
rl ϕ n e i g b o n e p i a t i o	
 < ã f ´ ¶ * " d	
rl ϕ r e s e t	Ó ° Œ M Û k U ŷ æ æ ~ M RLDP y o

1.4.1 ¶ B † " ñ /

¶ Œ Ω

o RLDP % go E g Œ æ ß Œ Ł y k 9 G ° % go E g Œ æ Œ Ł { o

Σ

¶ B % F åk F åe _ M y U Y o o

Ƴ P 1 P ææ

U # F å

¶ B % F åk F åe _ M y o Ó > D # Ł o

Ƴ P 1 Ü ≡

U # F å

¶ B % F åk U Y 6 À } o

Ƴ P 1 ˘ z Ü ≡ 8 Ȧ

U # F å

¶ B % F å

U Y 6 À } ´ Ý M y) o

Ü A i 1 ¶ ≡ n 1

• À F å

N M % F å

▯ N M F å RLDP k U Y # + % go E g Æ æ ß Æ Ł y " k c 6 + { Ô ò o

• Ó i 1 † Ú Ȧ Ȧ ~ A o

U # F å

Ó % F åk F åe U Y ° Ö æ ~ { Û M k M o yo

¶ "H←

ò0 Õ RLDP ˘ k , ¶ Bo M Y C > D , ... ˘ o

λ H t Γ

Ƴ P ä 1 B ¶ ≡ n 1

α < x X o> r l φ enabl e

α < @ " φ o> -

α < x X % o> ¶ B % o

```

C(config)#interface GigabitEthernet 0/1
C(config-if-GigabitEthernet 0/1)# rldp port loop-detect shutdown-port
C(config-if-GigabitEthernet 0/1)#exit
C(config)#interface GigabitEthernet 0/2
C(config-if-GigabitEthernet 0/2)# rldp port loop-detect shutdown-port
C(config-if-GigabitEthernet 0/2)#exit

```

o< à co>

```

    ò Ao Bo C   Õ   RLDP Û   k Y   A   o

```

A

```

A#show rldp
rldp state      : enable
rldp hello interval: 3
rldp max hello   : 2
rldp local bridge : 00d0.f822.33aa
-----

```

```

Interface GigabitEthernet 2/0/1

```

```

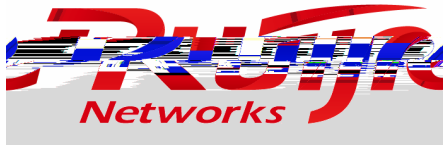
port st  3'      Π m ò ò ò   un  Z   w      ı l ı̇ y x k æ   Mk ı ÔR   MÔM ı A  D

```

```

-----
unidirection detect information: un  Z   w      ı l ı̇ y x k æ   Mk ı ÔR   MÔM ı A  D

```

G!5B Ů +5%1u ` ,¥ {

Ů ` Ÿ4;5%1u ` ,¥ {G!5B Ů +, Ì G Y • È Ů À ¹ ß0´8V Ö

1. SNMP
2. NTP

1 SNMP

1.1 é

SNMP © Simple Network Management Protocol g • % à ì ' ò # ' h Ý Ê k " 1988 v 8 Ã < è %² à ì ' ò ö Ö
RFC1157 ož ñ) ù k œ h Ú 4 + ¥ # ' u 4 kSNMP] è 7 à ' ö Ö k ` 9 " Ú 4 © Ĭ ; ê Ě ... ož
i SNMP # ' k à ì ' ò t U Y + à ì - μ g ' î < P ž à ì - å ž ç { - G™ à æ k O • i k à ì ' ! O y' ò ö 19MP5(PTJ /C2_0 1 Tf 0 Tc 4.-51.9 0 .733 Td

1.2 À¹€Đ

Á°•	« ° T
* SNMP 'ò à Ì— Œ	* SNMP à Ì' ò ~+ à Ì— Œ g' ò y! Oož

1.2.1 ù Ú SNMP a Â ¯ > f Ô

€ Đ ¢

Y £ † k ĩ* SNMP à Ì' ò ~k Ū+ à Ì— Œ A g' ò y! Oož
£ 1-1

o ħ Ko- A ħ } t' ò à Ì— Œ ož
PC à Ì' ò { ož

×

à Ì' ò { y t' ò à Ì— Œ* à Ì N k ĩ" à Ì' ò { k* SNMP à Ì' ò ~k ~| à Ì— Œ ' ò' ĩ
f G € k Y C N v Ū à Ì— Œ G B f ĩ k Ū+ à Ì— Œ g' ò y! Oož

1.3 × u U

Á ¯ ½

SNMP ©%² • C # ' k ĩ Ñ / Æ ~% " k , B ä y

Z SNMP à Ì' ò ~

Z SNMP W ò

Z MIB ' ò' ĩ €

£ 1-2 5%4°1u)Ú0- Æ IMS Å â5%1u ·)Ú Ä Agent Å, X G2 ĩ Ò

- z Get-request q • y NMS R Agent U H%² ê Ú @ f > ož
- z Get-next-request q • yNMS R Agent U H%² ê Ú @ f %² @ f > ož
- z Get-bulk q • yNMS R Agent U H O @ f > z
- z Set-request q • y NMS — åAgent %² ê Ú @ f > ož
- z Get-response q • yAgent > %² ê Ú @ f > k © Agent + NMS ù µ 3 q • € • q • ož
- z Trap q • yAgent

1.3.1 SNMP Á⁻ x

V € < Â

Ì v € Ú 8

SNMP # ' A ; © • < " g † A ; @ • £ 1-4 SNMP † • ° ložNSM g Agent G Ü ¬ L k ,Get-request o•
Get-next-requesto•Get-bulk y Set-request k Agent N v ¬ L w è q • e YGet-response • • < ož Agent Ä ž ~ - k gNSM
G BTrap yInform f î k ç Trap f î ¬ } • < k òInform f î é ¬ }NSM > %² Inform-response • < k n P v ñ f
î k k éAgent 1 k M GInform f î ož

ü » ´

Ì H \$ Ě » J SNMP V Â

Ð . ž o SNMP ož

... no snmp-server x X I U SNMP W ò ož

ü g no enable service snmp-agent x X k + N ¼ { SNMP ñ Ä Æ ož

Ì f ´ SNMP Á⁻ ? d

Ð . ž © Ĩ û © • " o • ~ ç Z Ð . > © 60FF60 z Ð . Ä Ý f G † x † 1572 - z Ð . SNMP Æ UDP € M Z © 161ož

... snmp-server contact x X F å ê í " © Ĩ û © • " ož

... snmp-server location x X F å ê í " © Ĩ y å ož

... snmp-server chassis-id x X F å © Ĩ ~ ç A ê Ê Ö Ð . > ož

... snmp-server packetsize x X F å W ò Ä Ý f G † x † ê Ê Ö Ð . > ož

... snmp-server udp-port x X — å SNMP Æ UDP € M Z ê Ê Ö Ð . > ož

Ì ´ SNMP ² © ¬

Ð . Ö Ñ k Z Ä SNMP Ñ ož

... snmp-server host x X F å Agent G f î NMS Ñ^a - ê í " 6 SNMP Ñ^a - ož Ě Ñ f î U Y Ç

SNMP Í î • N v € Mo • • š d ê ï ož ¥ x X snmp-server enable traps x X %² Ü ... k Ě NMS G Trap
f î ož

Ì f ´ Trap d54 ? d

Ð . Ö Ñ k W 2 SNMP g NMS G Trap f î z ø • N M G Link Trap z ¼ { G © Ĩ M o Trap ož

Ð . ž kSNMP † R „ N M ß > k < ... „ N M IP^a - • >^a - ož

Ð . ž Trap f î † „ ç x † 10 k G Trap f î ž • • œ 30 aož

... snmp-server enable traps x X F å Agent ê W 2 g NMS G Trap f î ož

1.3.3 SNMPv3

SNMPv3 M• #4 SNMP ëãk1\$ù SNMPv1 y SNMPv2 -¹μñ SNMPv3 }© ož

V€<Â

àì'ò©ĭ (NMS hy SNMP WògSNMP Agent hCf SNMP }ož" SNMPv3 ëã k SNMP }ã -ry•
 ÝBãkž SNMP -r 9G yNv'îo•R y %'îYC+'ò+» Oò~|ož SNMP • 6 © SNMP Ä
 B • i~kĩ SNMP -rU^ Æ gW•ož

SNMPv3 ÍÎ... Â9 ĩ ¶%°gUSM hÛRđ©kÄÓ... MIB +»ož 4 Ü'ò—Ökàì'ò©ĭ (NMS)
 ĩy ¶'đ·Äc—Ö # î SNMP ĩ%² ož

SNMPv3 ÍÎ• NSM "'ò—Ö ž~kÀ±=—Ö SNMP Agent -röœož SNMPv3 #4 Discover y Report
 q•ÑòkNSM " =3 Agent -röœ ÖÑ kUY¬g Agent G Discover †kò Agent Y Report €•kw"€
 • † `k4-röœ'îož4ekNSM y Agent \$• 'òq•·Ä`k¥-röœož

ì μ

z SNMPv3 * ¶%°YC ¶'đÛG +fGJ „_ ¶Ñò gÔòož)ùU ¶%°Ä _•đy
 SNMPv1o•SNMPv2Co•SNMPv3ožSNMPv3 1 SNMPv1 y SNMPv2C -¹μñ ¶%° ož

SNMPv1 C SNMPv2C ¶%°y'đ

¶%°	¶'đ	Rđ	%	a¢
SNMPv1	noAuthNoPriv	•šd	—	* •šdG•fG`cÅ
SNMPv2c	noAuthNoPriv	•šd	—	* •šdG•fG`cÅ

SNMPv3 ➔ŠG"&msg's/R5s/.pD@S& n2òšD G nf 65~RÅ(9 aV5~ RpD9 AVi° œ!GŸ•pD9BðD'K`P[a¢ %

z 1 y e μ 4 - ©%² l p v 4 ª - o ž

z 3 y e μ 6 - ©%² M A C ª - o ž

z 4 y † î k Â x 27 - k 4 Ē g # o ž

z 5 y 16 ò > k Â x 27 - k 4 Ē g # o ž

z 6-127 y ' o ž

z 128-255 y 4 Ē Ô " o ž

Ü » ´

İ ´ M I B Q ĸ x •

▷ . F ă %² default , £ k ª • ~ | ñ Ä M I B + » o ž

▷ . Z Ä F ă ĩ Á o ž

... snmp-server view x X F ă ê í " , £ z ... snmp-server group x X F ă ê í " ĩ Á o ž

U Y F ă %² Ú ê ñ Ú Ú 6 X k Ů 6 Ú c » c } d f k ... ± à ì — Œ U Y ^ c Ó ' N M S ' ò o ž

İ ´ S N M P Ð Ð

▷ . Z Ä F ă ĩ o ž

F ă snmp-server user x X F ă ê í " ĩ o ž

N M S Q Ä ... ` c ĩ õ c W ò g * ' o ž

+ 9 S N M P v 3 ĩ k U Y 6 ¶ ´ ð g © k ¬ } g • š o • © k ¬ } g % ^ b • • š ' c g M D 5 ê S H A b • • š M X o •
% ' c g) ù Q Ä D E S h y % M X o ž

1.4 ´ u U

F ă ¾	F ă • ' & , ¼ x X	
F ă S N M P Ä Î	▲ i " d ° ¶ » ¹ ¶ N M S À 9 A g e n t d	
	enable service snmp-agent	o A g e n t o ž
	snmp-server community	F ă • š d y ~ Ó ' o ž
	snmp-server user	F ă S N M P ĩ ' î o ž
	snmp-server view	F ă S N M P , £ o ž
	snmp-server group	F ă S N M P ĩ Á o ž
	snmp-server enable secret-dectionaty-check	F ă + community y user % A Á X ò o ž

[o T r a p](#)

¶ * " d ° A g e n t V N Ć N M S

	snmp-server host	Få NMS Ñª-ož
	snmp-server enable traps	Agent g NMS G

İ ı'icxgK'a

z ı#Fãož

z ... SNMPv1 y SNMPv2C 'òàì—Œ·À" agent —Œ —â•š dož

İ ı' SNMP ĐĐ'54

z ı#Fãož

z ... SNMPv3 'òàì—Œ·À—â ıož

İ n Agent x

z U#Fãož

z ó••o Agent k" Agent ¼{e¬}Ç)•ož kÀ ... 4xXož

İ Û• SNMP YßTõóZ x

z U#Fãož

z ó•¼{9436xà... y k"¬}...2ĐPxàžk" GMKTZ ... ¥Fâ¾ož

İ f'• community x user á6\$ ÀóÓ

z U#Fãož

z ó• + IUSS[TOZ_ y [YKX g%A Á òkòç eĚ•}dy ıdß•%ò £tD†kUYo +
IUSS[TOZ_ y [YKX g%A Á òk¥Fâ¬} ¶BFâxX VGY Y]UXJ VUROI_%²Ü ... ož

ó¯qD

... show snmp xXò0—Œ snmp ož

Û»wW

İ ı' SNMP Q¢

o¬xX "o- snmp-server view view-name oid-tree { include | exclude }

o¬@fª¢o- view-name y ,£ dož

oid-tree y ,£¼û MIB +»k©%²<• MIB ÿùož

include uö¢¥ MIB +»ÿùt m",£\$Ăož

exclude uö¢¥ MIB +»ÿùtL"" ,£\$Ùož

o¬xX% "o- ¶BFâ%"

o¬... 6-o- 6 ,£ dfk 9Â9,£ 'òož

İ ı' SNMP ĐĐ•


```

o- x X "o-      snmp-server group groupname { v1 | v2c | v3 { auth | noauth | priv } } [ read readview ] [ write writeview ]
[ access { aclnum | aclname } ]

o- @ f a o-      v1 | v2c | v3 u 6 6 SNMP í î ő
auth u 6 Á   ĩ n ŷ f î - } à š x f G - - } ' % k Q +          v3 Ä | ož
noauth u 6 Á   ĩ n ŷ f î - } à š f G - - } ' % k Q +          v3 Ä | ož
priv u 6 Á   ĩ n ŷ f î - } à š c ž n ŷ f G - - } ' % k Q +          v3 Ä | ož
readview

```

Wož

priv u 6 © k ... ' %oždes56 6 ¢ ... 56 y DES % # 'ož

priv-password y % M X ... g Ý 32 ... bž © Ĭ 1 M X ô E è , • % % Wož

aclnum y ~ | ċ n ~ ċ Z k ¼ û 6 ~ | ċ n k 6 ~ | MIB ipv4 NMS ^a - 8 ož

aclname y ~ | ċ n d f k ¼ û 6 ~ | ċ n k 6 ~ | MIB ipv4 NMS ^a - 8 ož

o x X % "o- ¶ B F å % "

o ... 6 -o- F å Ĭ ' Ĭ k Y ... NMS ... ` c Ĭ c W ò g * 'ož

+ 9 SNMPv3 Ĭ k U Y 6 ¶ ' ð o • • š ' c gMD5 ê SHA b • • š M Xo • % ' c g) ù Q Ä DES h

y % M Xož

İ n Agent x

o x X "o- enable service snmp-agent

o @ f ^a ¢ o-

o F å % "o- ¶ B % "

o ... 6 -o- ¥ x X 9 o — Œ SNMP W ò ož

İ f ' *

o- à ì ê Ëo-
£ 1-5

z à ì W • {gNMS hÂ 9 ĭ • š % % " + à ì — ŒgAgent h g ' ò ož† ò y... ĭ d user1 k
• š • " MD5 k • š % A 123 k % ' c DES56 k % % A 321 ož

z à ì — Œ Ü Ö ò ĭ ~ | MIB + » q • Ó ' ož† ò y ĭ user1 U Y + System g1.3.6.1.2.1.1 h
- μ MIB + » g ¯ q • k Ć Q + SysContact g1.3.6.1.2.1.1.4.0 h - μ MIB + » g Ê
q • ož

z à ì — Œ Ü g à ' W • {G à š % f î ož

o- F Å • co-

† %² 5 k F Å MIB , £ y Á ož ě • %² MIB , £ view1 k m ¼ û MIB + » g 1.3.6.1.2.1.1 hz Ç
ě • %² MIB , £ view2 k m ¼ û MIB + » g1.3.6.1.2.1.1.4.0 bž ě • %² Á g1 k # + Í Î
Z v3 k F Å ħ ' ð • š % % " priv k w U ¯ , £ view1 k U Ê , £ view2 ož
† 8 5 k F Å SNMP ĭ ož ě • ĭ d user1 k K 9 Á g1 k # + Í Î Z v3 k F Å • š • "
md5 k • š % A 123 k % • " DES56 k % % A 321 ož
† 5 k F Å SNMP Ñ ª - ož F Å Ñ ª - 192.168.3.2 k # + Í Î Z 3 k F Å ħ ' ð •
š % % " priv k ¼ û + • ĭ d user1 ož ... Agent g NMS G Trap f î ož
† š 5 k F Å Agent IP ª - ož F Å Gi0/1 N M ª - 192.168.3.1/24 ož

Agent

5XLMLH FRQILJ	VQPS VHUYHU YLHZ YLHZ	LQFOXGH
5XLMLH FRQILJ	VQPS VHUYHU YLHZ YLHZ	LQFOXGH
5XLMLH FRQILJ	VQPS VHUYHU JURXS J Y S ULY UH D G Y L H Z Z U L W H Y L I	
5XLMLH FRQILJ	VQPS VHUYHU X V H U X V H U J Y D X W K P G S U L Y G H V	
5XLMLH FRQILJ	VQPS VHUYHU K R V W W U D S V Y H U V L R Q S U L Y X	
5XLMLH FRQILJ	VQPS VHUYHU H Q D E O H W U D S V	
5XLMLH FRQILJ	L Q W H U I D F H J L J D E L W (W K H U Q H W	
5XLMLH FRQILJ	L I J L J D E L W (W K H U Q H W L S D G G U H V V	
5XLMLH FRQILJ	L I J L J D E L W (W K H U Q H W H [L W	

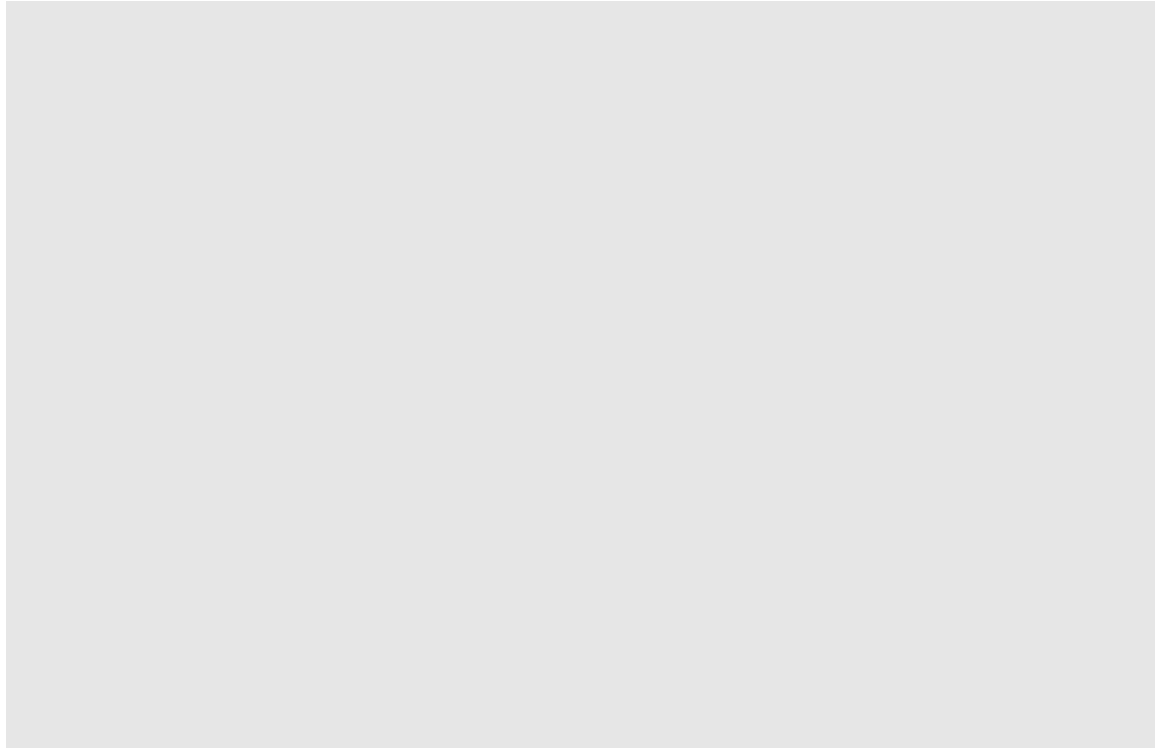
o- à • co-

† %² 5 k * show running-config x X ò 0 — Œ F Å ' î ož
† 8 5 k * show snmp user x X ò 0 SNMP ĭ ož
† 5 k * show snmp view x X ò 0 SNMP , £ ož
† š 5 k * show snmp group x X ò 0 SNMP Á ož
† < 5 k * show snmp host x X ò 0 ĭ F Å Ñ ' î ož
† ¹ 5 k H I x X B \ » U ï h x X ª @ ð % Á P ,) = 3 ¥ â w q & % • C € C • V V Ů Â 1 ù ~ v , 9 v 5 X L M L H F S U h U I E

QR LS SUR[\ DUS
LS DGGUHV

VQPS VHUYHU YLHZ YLHZ LQFOXGH
VQPS VHUYHU YLHZ YLHZ LQFOXGH
VQPS VHUYHU XVHU XVHU J Y HQFU\SWHG DXWK PG (%' \$ ' ((&
' &(\$%%) \$% ('
VQPS VHUYHU JURXS J Y SULY UHGD YLHZ ZULWH YLHZ
VQPS VHUYHU KRVW WUDSV YHUVLRQ SULY XVHU
VQPS VHUYHU HQDEOH WUDSV

5XLMLH VKRZ VQPS XVHU
8VHU QDPH XVHU
(QJLQH , ' •&ø' [[\$



n N 9 w

-

1.4.2 n ÐTrap ×

´]È

...Agent g NMS G Trap f îož

l ħ 6 •

-

´ q D

ì ´ snmp ² © ¬

z U # F åož

z ¬} Agent G f îž ¬} F å NWS Ñ^a -ož

ì Agent f NMS F î Trap d54

z U # F ă ož

z ɸ ɳ } agent g NMS G Trap f î ž k ɳ " agent F ă 4 ¾ ož

Ì Û • / L F î Link Trap x

z U # F ă ož

z ɸ ɳ } N M G link trap ž k ɳ " agent F ă N M ø • 4 ¾ ož

Ì Û • F î x ž n Trap x

z U # F ă ož

z ɸ e È RGOS © Ĩ " — Œ reload /reboot Y ù Ě NMS G Trap f î * = © Ĩ M o ž k ɳ " agent F ă 4 ¾ ož

Ì F î Trap d54 é | © ɳ

z U # F ă ož

z ɸ e È ĭ ... %² îª IPª - • SNMP >ª - Y Ž 9 ' ò ž k ɳ " agent F ă 4 ¾ ož

ó ¯ q D

* show snmp x Xª P SNMP Û Á ' î ož

* show running-config x X ò 0 — Œ F ă ' î ož

Û » w W

Ì ¸ NMS ² © ɳ

o ɳ x X "o- snmp-server host { host-addr } [traps | inrorms] [version { 1 | 2c | 3 { auth | noauth | priv }]
community-string [udp-port port-num] [notification-type]

o ɳ @ fª ɸo- host-addr ySNMP Ñª -ož

```

o~ x X "o-      snmp-server enable traps [ notification-type ]
o~ @ f ^ ¢o-    notification-type : o + • 7 ^      Trap * = k Ä Y • ° y
                snmp: o   SNMP 7 ^      TRAP * = z
                bridge: o   BRIDGE 7 ^      TRAP * = z
                mac-notification: o   MAC 7 ^      TRAP * = z
                urpf: o   URPF 7 ^      TRAP * = z

```

•{G fîož

o→ Få•co- †%²5kFå Agent g NMS G fîožFå SNMP Ńª- 192.168.3.2kfî " Version
 2ck•šd user1 ož... Agent G Trap fîož
 †85kFå Agent IPª-ožFå Gi0/1 NMª- 192.168.3.1/24ož

Agent 5XLMLH FRQILJ VQPS VHUYHU KRVW WUDSV YHUVLRQ F XVHU
 5XLMLH FRQILJ VQPS VHUYHU HQDEOH WUDSV
 5XLMLH FRQILJ LQWHUIDFH JLJDELW(WKHUQHW
 5XLMLH FRQILJ LI JLJDELW(WKHUQHW LS DGGUHV
 5XLMLH FRQILJ LI JLJDELW(WKHUQHW H[LW

o→ à•co- * show running-config xXò0—Ŏ Få'îož
 * show snmp xXªP SNMP ÙÁ'îož

Agent 5XLMLH VKRZ UXQQLQJ FRQILJ
 LS DFFHVV OLVW VWDQGDUG D
 SHUPLW KRVW
 LQWHUIDFH JLJDELW(WKHUQHW
 QR LS SUR[\ DUS
 LS DGGUHV
 VQPS VHUYHU YLHZ Y LQFOXGH
 VQPS VHUYHU ORFDWLRQ IX]KRX
 VQPS VHUYHU KRVW WUDSV YHUVLRQ F XVHU
 VQPS VHUYHU HQDEOH WUDSV
 VQPS VHUYHU FRQWDFW UXLMLH FRP FQ
 VQPS VHUYHU FRPPXQLW\ XVHU YLHZ Y UZ D
 VQPS VHUYHU FKDVVLV LG
 5XLMLH VKRZ VQPS
 &KDVVLV
 6103 SDFNHWV LQSWX
 %DG 6103 YHUVLRQ HUURUV
 8QNQRZQ FRPPXQLW\ QDPH
 ,OOHJDO RSHUDWLRQ IRU FRPPXQLW\ QDPH VXSSOLHG
 (QFRGLQJ HUURUV
 1XPEHU RI UHTXHVWHG YDULDEOHV
 1XPEHU RI DOWHUHG YDULDEOHV
 *HW UHTXHVW 3'8V
 *HW QH[W 3'8V
 6HW UHTXHVW 3'8V
 6103 SDFNHWV RXWSX
 7RR ELJ HUURUV 0D[LPXP SDFNHW VL]H
 1R VXFK QDPH HUURUV


```
%DG YDOXHV HUURUV
*HQHUDO HUURUV
5HVSQRVH 3'8V
7UDS 3'8V
6103 JOREDO WUDS HQDEOHG
6103 ORJJLQJ GLVDEOHG
6103 DJHQW HQDEOHG
```

n N 9 w

-

1.4.3 x H \$Agent x

´]È

“ ¬} Agent Æ ž~kIU Agent ož

l ĸ 6•

z ü g no snmp-server xXkUY“ ¬}Wò Æ ž~kIU SNMP Wò ož

z c9IUxXkü g no enable service snmp-agent xXkk+N¼{ snmp ñ Ä Æ g/ snmp Wò tW 4k
Nv †• G €• †C trap lk kIUWò F Å'îož

´qD

ì ´H\$fÔ SNMP V Â

z U#F åož

z ¬}IUñ Ä SNMP Wò Æ F ÅžkU# 4¼F åož

ì ´»JfÔ SNMP V Â

z U#F åož

z ¬}+N¼{ ñ Ä Æ žk•# 4F Å¼ož

ó ¯ qD

* show services xXò0 snmp Æ •¼ Ù Á'îož

* show snmp xXªP SNMP Ù Á'îož

* show running-config x X ò 0 — Ö F å ' îož

ü » w W

ì ´H\$fÔ SNMP v Â x

o¬ x X "o- no snmp-server

VQPS DJHQW	HQDEOHG
VVK VHUYHU	GLVDEOHG
WHOQHW VHUYHU	HQDEOHG

n N 9 w

-

1.4.4 f'SNMP 0 ñ ? d

]È

z U#Fåož

z ¢¬} "w SNMP Æ UDP € M Z ž k ¬ " agent Få 4 ¼ož

o x X "o- snmp-server packetsize byte-count

ì ' SNMP V Å £ Ü d (ö g G ...

o x X "o- snmp-server packetsize byte-count

o @ f ª ¢o- byte-count y f G Ý 4 k R 484 - ñ 17876 -ož

o F Å % "o- ¶ B % "

o x X "o- snmp-server packetsize byte-count

ì ' SNMP § UDP O L Y

o x X "o- snmp-server udp-port port-num

o @ f ª ¢o- port-num y 6 SNMP Æ UDP € M Z k / N v SNMP † # ' € M Zož

o F Å % "o- ¶ B % "

o x X "o- snmp-server udp-port port-num

ì ' Trap d54 ö g é S æ G ...

o x X "o- snmp-server queue-length length

o @ f ª ¢o- length y „ ç x † k Ý 4 R 1 ñ 1000ož

o F Å % "o- ¶ B F Å % "

o x X "o- snmp-server queue-length length

ì ' F î Trap d54 é • N N k

o x X "o- snmp-server trap-timeout seconds

o @ f ª ¢o- seconds y • æ ž • k % y a k H > 8 y1 – 1000 ož

o F Å % "o- ¶ B F Å % "

o x X "o- snmp-server trap-timeout seconds

ì ' SNMP W 0

o x X "o- snmp-server flow-control pps [count]

o @ f ª ¢o- count u ? a Ô ò SNMP ¬ L † f O k 8 <50-65535> ož

o x X % "o- ¶ B F Å % "

o x X % "o- ¶ B F Å % "

ì ' ...

ì f ' SNMP é 0 ñ ? d

o¬ à ì ê Ëo-
£ 1-8

z à 'W • {gNMS h Â 9 » c } • š % " + à ì — Œ gAgent h g 'ò k à 'W • { Ü B H — Œ
Â î © ï ' î k ò © ï û © • " o • y å o • ~ ç Aož

o¬ F å • co-

† %² 5 k F å SNMP W ò @ fož F å © ï ñ Ô y å o • û © • " o • ~ ç Aož
† 8 5 k F å Agent IP º - ož F å Gi 0/1 NM º - 192.168.3.1/24ož

Agent

5XLMLH FRQILJ VQPS VHUYHU ORFDWLRQ IX]KRX
5XLMLH FRQILJ VQPS VHUYHU FRQWDFW UXLMLH FRP FQ
5XLMLH FRQILJ VQPS VHUYHU FKDVVLV LG
5XLMLH FRQILJ LQWHUIDFH J LJDELW(WKHUQHW
5XLMLH FRQILJ LI J LJDELW(WKHUQHW H[LW

o¬ à • co-

† %² 5 k ò 0 — Œ F å ' î ož
fož @ P € À Ð ¥ 0 05¬ " ž X o J á • Å º Q !! L JJ á • Å º Q !! L JJ á o¼* C 0 p 0 0 ` € € p ° € P • v„ Q 84W5

```

UHDGYLHZ Y
ZULWHYLAZ Y
QRWLI\YLAZ
JURXSQDPH XVHU
VHFXULW\0RGHO Y F
VHFXULW\HYHO QR$XWK1R3ULY
UHDGYLHZ Y
ZULWHYLAZ Y
QRWLI\YLAZ

```

nN9w

-

1.5 ñQ ¢õ

oc^l'54

-

Ó Ü65ŠĐ

•	xX
aP SNMP ùÁ'î	show snmp [mib user view group host]

2 NTP

2.1 é

NTP g Network Time Protocol k à ì ž • # ' Ĥ Ů ... à ì — Œ ž • c 5 %² _ • C # ' ož UY ... à ì — Œ + ĺ Æ
 ~ ê ž U › Ÿ c 5 k U ^ ä ¢ Œ † ž • Ů 3 g LAN ö Œ ž • [4 9 1 D a k WAN Û D a Ĥ U ... % G •
 • " Ů ... 2 x àož

) ù é [— Œ u 4 NTP ĭ € Æ ~ k / — Œ ~ U Y R ž • Æ ~ c 5 ž • k - Ů • ž • Æ ~ + ĺ U — Œ
 g ž • c 5 ož " • Æ ~ W • ž — Œ N u 4 % n Server % " ož

"`P

z RFC 1305 y Network Time Protocol (Version 3)

2.2 À¹ € Đ

Á ° •	« ° T
Â 9 Û B ž U @ đ › c 5 ž •	— Œ / • ĭ € R Û B ž U › c 5 ž • k c 5 è e A • Æ ~ g ĺ U — Œ U ^ ž • c 5 Æ ož

2.2.1 Á 8 Ø • \$? ĺ | b • N

€ Đ ^a ‘

ò £ ñ P y

z DEVICE-A • U ' @ đ ž U › + Û U ^ ž • c 5 Æ

z DEVICE-B 6 DEVICE-A NTP Æ ~ k R DEVICE-A c 5 ž • ož

z DEVICE-B c 5 è e g DEVICE-C U ^ ž • c 5 Æ ož

£ 2-1

1 DEVICE-B Få NTP Û B ž U @ š % "

2.3 × u U

Á⁻ ½

Ì NTP ö g

ÿ G RFC1305 # kNTP J UDP † g n ÿ kUDP € M Z 123ož

NTP ž • c 5 † " ò £ 2-2

£ 2-2 NTP ž • c 5 † "

z Leap Indicator gLI hy2 A Ô kř a ö °ož

 00- M > A š o 01- h ¢ Ó 2 61 P 10- h ¢ Ó 2 59 P 11- " 2 # ½ ä

z Version Number gVN hy3 A Ô kNTP Í Î Z k ¢ ù Í Î Z 3ož

z Mode y3 A Ô kNTP W • % "ož

 0- # G Ì 1- V N s ~ 2- „ N s ~ 3- ° j 4- û ` v 5- æ Ì 6- Å % š o 7- l •

z Stratum y8 A Ô k Î^a ž U C f g0- Ì # 1- @ š ž U > ċ > -) @ š ž U > bž

z Poll Interval y8 y ... f k ö ¢ ž • g a f h

z Precision y8 y ... f k Î^a ž U ž • ¢ † g a f h

z Root Delay y32 y ... f k ñ @ š ž U > ^a ž •

z Root Dispersion y32 y ... f k , + 9 S @ š ž U > Â Ý " [

z Reference Clock Identifier y32 A Ô k @ š ž U > ö æ

- z Reference Timestamp y64 yž•íkÂe%²)t—âêñtû3 ž•
- z Originate Timestamp y64 yž•íkž•c5¬L†Y•ĩ€îªž•
- z Receive Timestamp y64 yž•íkž•c5¬L†ñÆ~îªž•
- z Transmit Timestamp y64 yž•íkž•c5€•†Y•Æ~îªž•
- z Autherticator gU#hyàš'î

ì NTP ÐO

—Œ• NTP ĩ€Ràì NTP Æ~c5ž•ož

ì B d cstratum d

NTP ... Cf gstratum h "¼ÛT —ŒåYÓúžU> é fghops 10ž%² Cf 1 ž•Æ~•¢Ä +
 =ÿUê fUzCf 2 ž•Æ~<RCf 1 Æ~BHž•zCf 3 Æ~<RCf 2 BHž•
 ò4'Požœ4žUCff>¼z žU>/t• (Ä¼ä žU□tož

ì]•\$

F^žUÿG—Œ @6³}7!TÛ~ÈäW•k —Œ P ċ^ k—Œ¼ÑeF^žU‰À gož"—Œo gek
 kRF^žU¯Hž•'îk• —Œ ÷^ž•ož

DEVICE-B g μ•f B h• NTP @đžU>kDEVICE-A g μ•f A h• NTP ĩ€R DEVICE-B c5ž•k"î
 %²žöA îªžU 19:00:00 kB îªžU 19:30:20 y

4. A GßNTP ¬L †k †Y• A îªž•gT0 h 19:00:00 kÊ-"" Originate Timestamp
5. Æ 2 a àì•žkB vñ¬L † îªž•gT1 h 19:30:23 kÊ-"" Receive Timestamp
6. B ÔòNTP ¬L k 1 ae€• NTP †k †Y• B îªž•gT2 h 19:30:24 kÊ-"" Transmit Timestamp
7. Æ 2 a àì•žkA N vñ€• †k€• †ñ A îªž•gT3 h 19:00:06
 ž•c5 À} 'cò y

z A * , " ((T1-T0)+(T2-T3))/2 < 'ß B y A ž•[30 ã 20 a

z A * , "(T3-T0)-(T2-T1) < 'ß A y B †ª •ž 4 a

ì NTP V€ "

z ÙBžU@đ%"

"¥%" k—Œ/-¢Æ ~A-¢ ĩ€kòçvñÛ ĭ ĩ€Gß ž•c5¬Lk·À¬R6 Æ ~c5ž•k
 c5è eđUYgĭ ĩ€U^ž•c5Æ ož

ü» ' "

ì ' NTP § —

z Þ.ŒÑ kNTP ¼{ož

z * ntp server xX6 NTP Æ ~g/ÙBžU@đ>ĥ/U•o NTP ož

z Fåe—ŒÔ9ÙBžU@đ%"ož

ì •b

z Þ.ŒÑ k—Œ?œ 64 a g%²)ž•c5ož

ì Ÿp]•\$

z p. Ů Ň k— Ů c5 ž•e k ž•¼•ñ F^ž Uož

z F å ntp update-calendar x X U Y ... — Ů ?) ž•c5 è ž k ¼•F^ž Uož

Få NTP ¶•š	no ntp	¼{ ñ Ä NTP k Ž q NTP F åž
	ntp disable	W 2 N v 6 N M NTP †
	 ¶ * " ½ Ä ¶ ¬ " 2 W s • •) û " . ½ ä \$ d	
	ntp authenticate	• o ¶ • š Ñ ò
	ntp authentication-key	— å ¶ • š ¶ B % W
	ntp trusted-key	F å ž • c 5 Æ U ' % W
	ntp server	F å Û B @ ð ž U > U ' % W

2.4.1 'NTP Á[−] ×

¶] È

ì ø • \$? ¿ " "

z — Õ • ĩ € k R Û B @ ð ž U > c 5 ž • ñ î ª ž U

z ž • c 5 è e k — Õ U • ž • c 5 Æ ~ k + Û U ^ ž • c 5 Æ

l ¿ 6 •

z ĩ € / Æ ~ % " k — Õ Q Ä R Û B U ' ž U > c 5 è e k ð • ž • c 5 Æ ~ + Û U ^ Æ o ž

¶ q D

ì ¶ NTP

ó⁻ q D

```
* show ntp status
```

z * show clock ò 0 © k è ž • c 5

ü » w W

i NTP § —

```
ntp server { ip-addr | domain | ip domain } [ version version ] [ source if-name ] [ key keyid ] [ prefer ]
```

0- @ f a 0- ip-addr y @ đ ž U › IPv4 a -

domain y @ ě ž U › IPv4 ě d

version yNTP í î Z k H › 1-3ož

if-name y N M • ° k , AggregatePorto•Dialer GigabitEtherneto•Loopbacko•Multilinko•Nulllo•Tunnelo•

Virtual-pppo•Virtual-template o•Vlan • °ož

keyid y c @ ě ž U › * ' J % W(1-4294967295)

prefer u @ ě ž U > © k ä i -'

0- x X % "0- ¶ B % "

0-... 6-0- "p.ŮŇ kZÄFå NTP Æ ~ožih i€©ïu4ÂÚcž 20 NTP Æ ~A;K999D05B9DeT?%² D C²

0... 6-0- -

2.4.2 'NTP μ\i

'jÈ

-

l¿6•

ï€yÆ ~ •š%W·À%² ož

'qD

ì ' NTP μA μ\i²ñ

z ·ÀFå

z ó•ÕÑ —Õ •o ¶•šÑòož

ì ' NTP μA\i\$&

z ·ÀFå

z ó•ÕÑ —ÕZÄ•š%Wož

ì ' NTP μA'_\$& ID

z U#Få

z ÈU'—ÕU^ž•c5Æ k·À* %W ID 6 U'•š%Wož

z Qª•Få%² ``%Wkñ6 •š%W·ÀyU'—Õ%² ož

ì 'Ø?¿•\$|é\i\$& ID

z U#Få

z RU'@đžU>c5ž•k·À* %W ID 6 U'•š%Wož

z ? U'@đžU>ãđ+•%² •š%Wk•š%W·ÀyU'@đžU>%W%² ož

ó⁻qD

z * show run ò0Få©k3G

z * show clock ò0©QkRU'—Õc5ž•

ü » w W

ì • n μ \ i² ñ

```
o¬ x X "o-      ntp authenticate
o¬ @ fª ¢o-      -
o¬ x X % "o-      ¶ B % "
o¬ ... 6 -o-      Ð. Õ Ñ k ï € ... ¶ B ¶ æ ð Ñ ò ø ž ò ç ì ... ¶ æ ð Ñ ò é + * ' g % Ô ò ø x © N N
— å 4 ¶ B ¶ ö ° kw W n %² J 4 % • " è Æ ~ ï € * ' k · À è ¿ U ¶ B % W F
å w — å Æ ~ % % W ð U G Ü y Æ ~ % * ' ø ž
```

ì f´ μ A \ i \$ &

```
o¬ x X "o-      ntp authentication-key key-id md5 key-string [enc-type]
o¬ @ fª ¢o-      key-id y • š % W ¶ B ID g1-4294967295 bž
key-string y % W ... ø ž
enc-type y U # ø ž ÿ μ % W © k % g0 n P — % k7 n P • % % k ó • — % bž
o¬ x X % "o-      ¶ B % "
o¬ ... 6 -o-      -
```

ì f´ NTP § é T ' \$ &

```
o¬ x X "o-      ntp trusted-key key-id
o¬ @ fª ¢o-      key-id y • š % W ¶ B ID g1-4294967295 bž
o¬ x X % "o-      ¶ B % "
o¬ ... 6 -o-      -
```

ì f´ Ø ? ¿ • \$ | é T ' \$ &

@ ð [Få4:6Æ ~](#)

...

ì μ \ i

o¬ à ì ê Æ o-
£ 2-4

```
DEVICE-B y F å NTP ï € / Æ ~ % " k Ě DEVICE-C U ^ ¬ } ¶ • š NTP Æ k • š % W
abcd
DEVICE-A y • DEVICE-B @ ð ž U ›
DEVICE-C y R DEVICE-B c 5 ž •
o¬ F å • co- DEVICE-B F å DEVICE-A @ ð ž U ›
```



```

DEVICE-C Få DEVICE-B @ðžU>
DEVICE-B % FRQILJXUH WHUPLQDO
          % FRQILJ  QWS DXWKHQWLFDWLRQ NH\  PG  DEFG
          % FRQILJ  QWS WUXVWHG NH\
          % FRQILJ  QWS VHUYHU
          % FRQILJ  H[LW
DEVICE-C & FRQILJXUH WHUPLQDO
          & FRQILJ  QWS DXWKHQWLFDWLRQ NH\  PG  DEFG
          & FRQILJ  QWS VHUYHU              NH\
          & FRQILJ  H[LW
o- à•co-      DEVICE-B kg 192.168.1.1 G ž•c5 †k`k•š'îkR      DEVICE-A c5ž•ož
          " DEVICE-B *      show clock xXò0ž•©kè c5ož

```

...

2.5 ñQ ¢õ

Ó Ü 65ŠĐ

•	xX
show ntp status	^a P ¢ù NTP 'î

Ó •p '54

 Ü{8Ěđo V½ ,Ă±Wd° û~ ĚK±'ž8Ě—'d

•	xX
debug ntp	ø•²j ož
no debug ntp	¼{²j ož