

零接觸調配實施和故障排除提示

目錄

[簡介](#)

[背景資訊](#)

[Linux伺服器配置](#)

[DHCP配置](#)

[HTTP伺服器要求](#)

[疑難排解提示](#)

[使路由器能夠通過DHCP獲取IP地址](#)

[驗證HTTP伺服器是否正常工作](#)

[如何啟動ZTP?](#)

[手動啟動ZTP](#)

[使用iPXE啟動路由器](#)

[安裝後自動化](#)

[相關資訊](#)

簡介

本文檔介紹首次部署零接觸調配(ZTP)的故障排除提示。

引入ZTP是為了減少提供XR裝置的人際互動。ZTP使用預引導執行環境(iPXE)的實現。

背景資訊

ZTP可以執行：

- 自動配置更新：映像安裝後下載並應用XR配置
- 指令碼執行：下載並執行使用者定義的指令碼檔案。各種方法/函式可作為指令碼執行的一部分實現：多個包更新SMU安裝驗證eXR根據檔案中第一行的內容決定要執行的操作 如果檔案以!!開頭IOS XR表示配置檔案並執行apply_config。同樣，以#開頭的檔案!/bin/bash或#!/bin/sh 或#!/usr/bin/python表示指令碼檔案，並執行指令碼執行。eXR 6.2.2引入了對python的支援eXR iPXE支援簡單式檔案傳輸通訊協定(TFTP)、檔案傳輸通訊協定(FTP)和超文字傳輸通訊協定(HTTP)。不支援安全超文本傳輸協定(HTTPS)，因為它無法預測要驗證哪個簽名。

Linux伺服器配置

iPXE是對PXE的增強功能，它要求TFTP/FTP/HTTP進行映像/配置下載，並使用動態主機配置協定(DHCP)來獲取/提供映像和配置的資訊。

DHCP配置

在稍後的示例中，將檢查資料包捕獲以確認DHCP操作。

HTTP伺服器要求

必須可從管理乙太網介面訪問HTTP伺服器。

疑難排解提示

設定Linux伺服器後，執行DHCP/HTTP伺服器可達性和功能檢查。

在此設定中，一個Linux伺服器用作DHCP/HTTP伺服器。如果有用於這些功能的獨立伺服器，請根據需要在所有伺服器上驗證這些步驟。

```
[root@xxxxxxxxxx]# service dhcpd status
Redirecting to /bin/systemctl status dhcpd.service
dhcpd.service - DHCPv4 Server Daemon
   Loaded: loaded (/usr/lib/systemd/system/dhcpd.service; disabled; vendor preset: disabled)
   Active: active (running) since Mon 2017-05-29 10:30:59 PDT; 15h ago
     Docs: man:dhcpd(8)
           man:dhcpd.conf(5)
  Main PID: 26913 (dhcpd)
    Status: "Dispatching packets..."
   CGroup: /system.slice/dhcpd.service
           26913 /usr/sbin/dhcpd -f -cf /etc/dhcp/dhcpd.conf -user dhcpd -group dhcpd --no-pid
<SNIP>
```

提示：某些行是橢圓形，使用 `— |` 可顯示全行。

```
[root@xxxxxxxxxx]# service httpd status
Redirecting to /bin/systemctl status httpd.service
httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; vendor preset: disabled)
   Active: active (running) since Fri 2017-05-26 05:50:30 PDT; 3 days ago
     Docs: man:httpd(8)
           man:apachectl(8)
  Process: 28088 ExecStop=/bin/kill -WINCH ${MAINPID} (code=exited, status=0/SUCCESS)
  Process: 11036 ExecReload=/usr/sbin/httpd $OPTIONS -k graceful (code=exited, status=0/SUCCESS)
 Main PID: 28095 (httpd)
    Status: "Total requests: 0; Current requests/sec: 0; Current traffic: 0 B/sec"
   CGroup: /system.slice/httpd.service
           11037 /usr/sbin/httpd -DFOREGROUND
           11038 /usr/sbin/httpd -DFOREGROUND
           11039 /usr/sbin/httpd -DFOREGROUND
           11040 /usr/sbin/httpd -DFOREGROUND
           11041 /usr/sbin/httpd -DFOREGROUND
           26998 /usr/sbin/httpd -DFOREGROUND
           27426 /usr/sbin/httpd -DFOREGROUND
           27427 /usr/sbin/httpd -DFOREGROUND
           27428 /usr/sbin/httpd -DFOREGROUND
           27889 /usr/sbin/httpd -DFOREGROUND
           28095 /usr/sbin/httpd -DFOREGROUND

May 26 05:50:30 xxxxxx systemd[1]: Starting The Apache HTTP Server...
May 26 05:50:30 xxxxxx systemd[1]: Started The Apache HTTP Server.
May 27 03:16:01 xxxxxx systemd[1]: Reloaded The Apache HTTP Server.
May 28 03:37:01 xxxxxx systemd[1]: Reloaded The Apache HTTP Server.
```

使路由器能夠通過DHCP獲取IP地址

```
Interface MgmtEth 0/RP0/CPU0/0
Ipv4 address dhcp
Shut/no shut
```

驗證HTTP伺服器是否正常工作

- 測試<http://<ip-servername>>是否正常工作。
- 開啟瀏覽器以檢視IP位址/伺服器名稱。

如果DHCP或HTTP無法正常工作，則可能存在防火牆問題或可達性問題。

要檢查伺服器上的防火牆屬性，請執行以下命令或新增特定協定：

使用IP tables命令驗證防火牆規則：

```
Iptables -L -n
Chain IN_public_allow (1 references)
target      prot opt source                destination           udp dpt:67 ctstate NEW
ACCEPT      udp  --  0.0.0.0/0              0.0.0.0/0            tcp dpt:80 ctstate NEW
ACCEPT      tcp  --  0.0.0.0/0              0.0.0.0/0            tcp dpt:22 ctstate NEW
```

使用此防火牆命令列出允許的條目：

```
[root@xxxxxxxxxx ~]# firewall-cmd --list-all
public (active)
  target: default
  icmp-block-inversion: no
  interfaces: enp2s0f0
  sources:
  services: dhcp dhcpv6-client http ssh
  ports:
  protocols:
  masquerade: no
  forward-ports:
  sourceports:
  icmp-blocks:
  rich rules:
```

使用命令永久允許埠：

```
firewall-cmd --permanent --add-service=http
firewall-cmd --permanent --add-service=dhcp
```

在DHCP伺服器上啟用資料包捕獲：

```
tcpdump -i <interface id> port (bootpc & bootps & port http) -s 0(buffer size) -w <dest. File name>
```

```
ex: tcpdump -i enp2s0f0 port 67 or port 68 or port 80 -s 0 -w iPXboot.pcap
```

如何啟動ZTP?

手動啟動ZTP

使用ZTP `initiate exec` CLI命令呼叫ZTP。預設情況下，用於ZTP的介面為MGMTeth。要在其它介

面上啟動此進程，請使用此選項：

```
ZTP initiate interface <type> <number> <cr>
```

或

```
Ztp initiate <cr>
```

使用iPXE啟動路由器

1. 從Calvados啟動reload CLI命令：

此命令會導致路由器重新載入，從而啟動iPXE引導。

附註：由於Wireshark中存在錯誤，使用者類資訊被解釋為Malformed選項。

2. 路由器啟動DHCP發現，請注意iPXE選項填充了使用者類：

43	2017-05-26 04:55:24.207214	172.16.58....	172.16.58.212	DHCP	342	DHCP Offer	- Transaction ID 0xf2e1f250
44	2017-05-26 04:55:24.208101	172.16.58....	172.16.58.212	DHCP	342	DHCP ACK	- Transaction ID 0xf2e1f250
45	2017-05-26 04:56:09.890179	0.0.0.0	255.255.255....	DHCP	449	DHCP Discover	- Transaction ID 0x97c7ee55

▼ Instance of User Class: [0]
User Class Length: 105
▼ [Expert Info (Error/Protocol): User Class Information: malformed option]
[User Class Information: malformed option]
[Severity level: Error]
[Group: Protocol]

▼ Option: (55) Parameter Request List
Length: 22
Parameter Request List Item: (1) Subnet Mask
Parameter Request List Item: (3) Router
Parameter Request List Item: (6) Domain Name Server
Parameter Request List Item: (7) Log Server
Parameter Request List Item: (12) Host Name
Parameter Request List Item: (15) Domain Name
Parameter Request List Item: (17) Root Path
Parameter Request List Item: (43) Vendor-Specific Information
Parameter Request List Item: (60) Vendor class identifier
Parameter Request List Item: (66) TFTP Server Name
Parameter Request List Item: (67) Bootfile name
Parameter Request List Item: (119) Domain Search
Parameter Request List Item: (128) DOCSIS full security server IP [T0D0]

```
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....  
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....  
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....  
0110 00 00 00 00 00 00 63 82 53 63 35 01 01 39 02 05 .....C. Sc5..9..  
0120 c0 5d 02 00 09 5e 03 01 03 0a 4d 04 69 50 58 45 .]...^...M.iPXE  
0130 37 16 01 03 06 07 0c 0f 11 2b 3c 42 43 77 80 81 7.....+<BCw..  
0140 82 83 84 85 86 87 af cb af 24 b1 05 01 80 86 15 .....$.  
0150 21 eb 03 01 00 00 17 01 01 24 01 01 13 01 01 2a !.....$.....*  
0160 01 01 27 01 01 20 01 01 15 01 01 26 01 01 3d 0b !.....&..=..  
0170 46 4f 43 32 30 32 36 52 33 38 5a 3c 30 50 58 45 FOC2026R 38Z<0PXE  
0180 43 6c 69 65 6e 74 3a 41 72 63 68 3a 30 30 30 30 Client:A rch:0000  
0190 39 3a 55 4e 44 49 3a 30 30 33 30 31 30 3a 50 49 9:UNDI:0 03010:PI  
01a0 44 3a 4e 43 53 2d 35 35 30 32 2d 53 45 61 11 00 D:NCS-55 02-SEa..  
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....  
01c0 ff .
```

3. 來自伺服器的DHCP提供包括選項67中的引導檔名：

No.	Time	Source	Destination	Protocol	Length	Info
46	2017-05-26 04:56:09.890388	172.16.58.115	172.16.58.110	DHCP	342	DHCP Offer - Transaction ID 0x97c7ee55
47	2017-05-26 04:56:10.889556	0.0.0.0	255.255.255...	DHCP	449	DHCP Discover - Transaction ID 0x97c7ee55
48	2017-05-26 04:56:10.889765	172.16.58.115	172.16.58.110	DHCP	342	DHCP Offer - Transaction ID 0x97c7ee55

```

Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0x97c7ee55
Seconds elapsed: 4
  ▶ Bootp flags: 0x0000 (Unicast)
Client IP address: 0.0.0.0
Your (client) IP address: 172.16.58.110
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Cisco_1c:a5:1a (00:62:ec:1c:a5:1a)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name: http://172.16.58.115/images/ncs5500-mini-x.iso-6.1.2
Magic cookie: DHCP
  ▶ Option: (53) DHCP Message Type (Offer)
  ▶ Option: (54) DHCP Server Identifier
  ▶ Option: (51) IP Address Lease Time
  ▶ Option: (1) Subnet Mask
  ▶ Option: (3) Router
  ▶ Option: (6) Domain Name Server

```

0000	00 62 ec 1c a5 1a cc 46 d6 f8 8f 86 08 00 45 10	.b.....F.....E.
0010	01 48 00 00 00 00 80 11 6c 93 ac 10 3a 73 ac 10	.H.....l...:s..
0020	3a 6e 00 43 00 44 01 34 5d 97 02 01 06 00 97 c7	:n.C.D.4 }.....
0030	ee 55 00 04 00 00 00 00 00 00 ac 10 3a 6e 00 00	.U.....:n..
0040	00 00 00 00 00 00 00 62 ec 1c a5 1a 00 00 00 00	.....b.....
0050	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
0060	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
0070	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
0080	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
0090	00 00 00 00 00 00 68 74 74 70 3a 2f 2f 31 37 32	.....ht tp://172
00a0	2e 31 36 2e 35 38 2e 31 31 35 2f 69 6d 61 67 65	.16.58.1 15/image
00b0	73 2f 6e 63 73 35 35 30 30 2d 6d 69 6e 69 2d 78	s/ncs550 0-mini-x
00c0	2e 69 73 6f 2d 36 2e 31 2e 32 00 00 00 00 00 00	.iso-6.1 .2.....
00d0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
00e0	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....

DHCP Server -> NCS5K

Server responds with Boot file information

4. 路由器啟動映像下載：

No.	Time	Source	Destination	Protocol	Length	Info
46	2017-05-26 04:56:09.890388	172.16.58.115	172.16.58.110	DHCP	342	DHCP Offer - Transaction ID 0x97c7ee55
47	2017-05-26 04:56:10.889556	0.0.0.0	255.255.255...	DHCP	449	DHCP Discover - Transaction ID 0x97c7ee55
48	2017-05-26 04:56:10.889765	172.16.58.115	172.16.58.110	DHCP	342	DHCP Offer - Transaction ID 0x97c7ee55
49	2017-05-26 04:56:12.888299	0.0.0.0	255.255.255...	DHCP	461	DHCP Request - Transaction ID 0x97c7ee55
50	2017-05-26 04:56:12.888506	172.16.58.115	172.16.58.110	DHCP	342	DHCP ACK - Transaction ID 0x97c7ee55
51	2017-05-26 04:56:25.659940	172.16.58.110	172.16.58.115	TCP	74	36332 -> 80 [SYN] Seq=0 Win=65532 Len=0 TSval=36...
52	2017-05-26 04:56:25.660031	172.16.58.115	172.16.58.110	TCP	74	80 -> 36332 [SYN, ACK] Seq=0 Ack=1 Win=28960 Len...
53	2017-05-26 04:56:25.660153	172.16.58.110	172.16.58.115	HTTP	168	GET /images/ncs5500-mini-x.iso-6.1.2 HTTP/1.1
54	2017-05-26 04:56:25.660206	172.16.58.115	172.16.58.110	TCP	66	80 -> 36332 [ACK] Seq=1 Ack=103 Win=29056 Len=0 ...
55	2017-05-26 04:56:25.661660	172.16.58.115	172.16.58.110	TCP	14546	[TCP segment of a reassembled PDU]
56	2017-05-26 04:56:25.661864	172.16.58.110	172.16.58.115	TCP	66	36332 -> 80 [ACK] Seq=103 Ack=4345 Win=262144 Le...
57	2017-05-26 04:56:25.661918	172.16.58.115	172.16.58.110	TCP	8754	[TCP segment of a reassembled PDU]

```

  ▶ Frame 53: 168 bytes on wire (1344 bits), 168 bytes captured (1344 bits)
  ▶ Ethernet II, Src: Cisco_1c:a5:1a (00:62:ec:1c:a5:1a), Dst: Cisco_f8:8f:86 (cc:46:d6:f8:8f:86)
  ▶ Internet Protocol Version 4, Src: 172.16.58.110, Dst: 172.16.58.115
  ▼ Transmission Control Protocol, Src Port: 36332, Dst Port: 80, Seq: 1, Ack: 1, Len: 102
    Source Port: 36332
    Destination Port: 80
    [Stream index: 0]
    [TCP Segment Len: 102]
    Sequence number: 1 (relative sequence number)
    [Next sequence number: 103 (relative sequence number)]
    Acknowledgment number: 1 (relative ack number)
    Header Length: 32 bytes
    Flags: 0x018 (PSH, ACK)

```

0000	cc 46 d6 f8 8f 86 00 62 ec 1c a5 1a 08 00 45 00	.F.....b.....E.
0010	00 9a 09 b3 00 00 40 06 a3 a9 ac 10 3a 6e ac 10	.....@.....:n..
0020	3a 73 8d ec 00 50 30 83 ab 5e 7a d3 a4 16 80 18	:s...P0. ^z.....
0030	02 00 25 b4 00 00 01 01 08 0a 02 25 c3 af 94 c7	%......%.....
0040	56 00 47 45 54 20 2f 69 6d 61 67 65 73 2f 6e 63	V.GET /i mages/nc
0050	73 35 35 30 30 2d 6d 69 6e 69 2d 78 2e 69 73 6f	s5500-mi ni-x.iso
0060	2d 36 2e 31 2e 32 20 48 54 54 50 2f 31 2e 31 0d	-6.1.2 H TTP/1.1.
0070	0a 55 73 65 72 2d 41 67 65 6e 74 3a 20 69 50 58	.User-Ag ent: iPX
0080	45 2f 31 2e 30 2e 30 2b 20 28 65 32 39 31 29 0d	E/1.0.0+ (e291).
0090	0a 48 6f 73 74 3a 20 31 37 32 2e 31 36 2e 35 38	.Host: 1 72.16.58
00a0	2e 31 31 35 0d 0a 0d 0a	.115....

NCS5K initiates download of ISO image

5. 映像成功下載後，開始在裝置上安裝映像。

6. 路由器使用下載的映像成功啟動後，會啟動另一個DHCP請求：

No.	Time	Source	Destination	Protocol	Length	Info
418654	2017-05-26 05:04:12.051436	172.16.58.115	172.16.58.212	DHCP	342	DHCP Offer - Transaction ID 0xd...
418655	2017-05-26 05:04:12.052378	172.16.58.115	172.16.58.212	DHCP	342	DHCP ACK - Transaction ID 0xd...
418656	2017-05-26 05:06:52.778102	0.0.0.0	255.255.255...	DHCP	367	DHCP Discover - Transaction ID 0x5...
418657	2017-05-26 05:06:52.778327	172.16.58.115	172.16.58.110	DHCP	342	DHCP Offer - Transaction ID 0x5...
418658	2017-05-26 05:06:52.778626	0.0.0.0	255.255.255...	DHCP	379	DHCP Request - Transaction ID 0x5...

```

Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Cisco_1c:a5:1a (00:62:ec:1c:a5:1a)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
  ▶ Option: (53) DHCP Message Type (Discover)
  ▶ Option: (55) Parameter Request List
  ▼ Option: (60) Vendor class identifier
    Length: 45
    Vendor class identifier: PXEClient:Arch:00009:UNDI:003010:PID:NCS-5500
  ▶ Option: (61) Client identifier
  ▼ Option: (77) User Class Information
    Length: 10
    ▶ Instance of User Class: [0]
  ▼ Option: (255) End
    Option End: 255
  
```

0080	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0090	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00a0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00b0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00c0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00d0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00e0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00f0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0100	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0110	00 00 00 00 00 63 82	53 63 35 01 01 37 07 01	.....c. Sc5..7..
0120	1c 02 03 0f 06 0c 3c 2d	50 58 45 43 6c 69 65 6e	.....<- PXEClie
0130	74 3a 41 72 63 68 3a 30	30 30 30 39 3a 55 4e 44	t:Arch:0 0009:UND
0140	49 3a 30 30 33 30 31 30	3a 50 49 44 3a 4e 43 53	I:003010 :PID:NCS
0150	2d 35 35 30 30 3d 0b 46	4f 43 32 30 32 3e 52 33	-5500=.F 0C2026R3
0160	38 5a 4d 0a 65 78 72 2d	63 6f 6e 66 69 67 ff	8ZM.exr- config.

NCS5K-> DHCP Server

NCS user-class has info on "exr-config"

在此發現中，請注意user-class info includes *.exr-config。因為DHCP配置為返回Config file或Script(即etc/dhcp/dhcpd.conf)中的Else語句。

7. DHCP伺服器返回選項67中所需的檔案資訊：

No.	Time	Source	Destination	Protocol	Length	Info
418654	2017-05-26 05:04:12.051436	172.16.58.115	172.16.58.212	DHCP	342	DHCP Offer - Transaction ID 0xd...
418655	2017-05-26 05:04:12.052378	172.16.58.115	172.16.58.212	DHCP	342	DHCP ACK - Transaction ID 0xd...
418656	2017-05-26 05:06:52.778102	0.0.0.0	255.255.255...	DHCP	367	DHCP Discover - Transaction ID 0x5...
418657	2017-05-26 05:06:52.778327	172.16.58.115	172.16.58.110	DHCP	342	DHCP Offer - Transaction ID 0x5...
418658	2017-05-26 05:06:52.778626	0.0.0.0	255.255.255...	DHCP	379	DHCP Request - Transaction ID 0x5...

```

Seconds elapsed: 36
  ▶ Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0
  Your (client) IP address: 172.16.58.110
  Next server IP address: 0.0.0.0
  Relay agent IP address: 0.0.0.0
  Client MAC address: Cisco_1c:a5:1a (00:62:ec:1c:a5:1a)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name: http://172.16.58.115/images/NCS-5502-A.cfg
  Magic cookie: DHCP
  ▼ Option: (53) DHCP Message Type (Offer)
    Length: 1
    DHCP: Offer (2)
  ▼ Option: (54) DHCP Server Identifier
    Length: 4
    DHCP Server Identifier: 172.16.58.115
  ▼ Option: (51) IP Address Lease Time
    Length: 4
    IP Address Lease Time: (600s) 10 minutes
  
```

0070	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0080	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0090	00 00 00 00 00 00 68 74	74 70 3a 2f 2f 31 37 32	.....ht tp://172
00a0	2e 31 36 2e 35 38 2e 31	31 35 2f 69 6d 61 67 65	..16.58.1 15/image
00b0	73 2f 4e 43 53 2d 35 35	30 32 2d 41 2e 63 66 67	s/NCS-55 02-A.cfg
00c0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00d0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00e0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
00f0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0100	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00	.....
0110	00 00 00 00 00 63 82	53 63 35 01 02 36 04 ac	.....c. Sc5..6..
0120	10 3a 73 33 04 00 00 02	58 01 04 ff ff ff 00 1c	..s3.....X.....
0130	04 ac 10 3a ff 03 04 ac	10 3a 01 0f 09 63 69 73	.....:..:..cis
0140	63 6f 2e 63 6f 6d 06 04	ab 46 a8 b7 ff 00 00 00	co.com...F.....
0150	00 00 00 00 00 00		.....

DHCP Server -> NCS5K

Server responds with config info

8. 路由器下載配置：

Apply a display filter ... <36/>

No.	Time	Source	Destination	Protocol	Length	Info
418660	2017-05-26 05:06:56.981542	172.16.58.110	172.16.58.115	TCP	74	36775 → 80 [SYN] Seq=0 Win=42746 L...
418661	2017-05-26 05:06:56.981642	172.16.58.115	172.16.58.110	TCP	74	80 → 36775 [SYN, ACK] Seq=0 Ack=1 ...
418662	2017-05-26 05:06:56.981779	172.16.58.110	172.16.58.115	TCP	66	36775 → 80 [ACK] Seq=1 Ack=1 Win=4...
418663	2017-05-26 05:06:56.981852	172.16.58.110	172.16.58.115	HTTP	268	HEAD /images/NCS-5502-A.cfg HTTP/1...
418664	2017-05-26 05:06:56.981900	172.16.58.115	172.16.58.110	TCP	66	80 → 36775 [ACK] Seq=1 Ack=203 Win...

[Stream index: 1]
[TCP Segment Len: 202]
Sequence number: 1 (relative sequence number)
[Next sequence number: 203 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
Header Length: 32 bytes
Flags: 0x018 (PSH, ACK)
Window size value: 21
[Calculated window size: 43008]
[Window size scaling factor: 2048]
Checksum: 0x0502 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
Options: (12 bytes), No-Operation (NOP), No-Operation (NOP), Timestamps
▶ No-Operation (NOP)
▶ No-Operation (NOP)
▶ Timestamps: TSval 4294963862, TSecr 2496722970
▶ [SEQ/ACK analysis]

Hypertext Transfer Protocol

```
0020 3a 73 8f a7 00 50 a9 0f 07 af 8d 06 14 b1 80 18 :S...P.. .....
```

NCS5K initiates config download using HTTP

指令碼可以作為DHCP伺服器的響應包括在內，並讓它們複製映像/配置。這也可以用作安裝後指令碼，如下例所示。

安裝後自動化

在eXR軟體的安裝後可執行各種自動化。

在本例中，此指令碼安裝所有必需的包並應用配置。這是經過微幅修改的ztp_helper.sh版本。此指令碼從xr-linux-shell呼叫：

```
RP/0/RP0/CPU0:NCS-5502-A#more disk0:/ztp/ztp_helper_file.sh
Wed May 31 00:55:54.529 UTC
#!/bin/bash
#####
# Install config and additional packages
#####

source /disk0:/ztp/ztp_helper.sh

export HTTP_SERVER=http://10.10.10.10
export RPM_PATH=images
export CONFIG_PATH=images
#Config
export INITIAL_CONFIG=NCS-5502-A.cfg
export FINAL_CONFIG=NCS-5502-A.cfg

#Packages
K9SEC_RPM=ncs5500-k9sec-2.2.0.0-r612.x86_64.rpm
```

```
MCAST_RPM=ncs5500-mcast-2.0.0.0-r612.x86_64.rpm
ISIS_RPM=ncs5500-isis-1.1.0.0-r612.x86_64.rpm
OSPF_RPM=ncs5500-ospf-1.1.0.0-r612.x86_64.rpm
MGBL_RPM=ncs5500-mgbl-3.0.0.0-r612.x86_64.rpm
MPLS_RPM=ncs5500-mpls-2.1.0.0-r612.x86_64.rpm
MPLSTE_RPM=ncs5500-mpls-te-rsvp-2.2.0.0-r612.x86_64.rpm
```

```
function download_config(){
    ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${CONFIG_PATH}/${FINAL_CONFIG} -O
/harddisk:/new-config 2>&1
    if [[ "$?" != 0 ]]; then
        printf "### Error downloading system configuration ###"
    else
        printf "### Downloading system configuration complete ###";
    fi
}
```

```
function apply_config(){
    # Applies initial configuration
    printf "### Applying initial system configuration ###";
    xrapply_with_reason "Initial ZTP configuration" /harddisk:/new-config 2>&1;
    printf "### Checking for errors ###";
    local config_status=$(xrcmd "show configuration failed");
    if [[ $config_status ]]; then
        echo $config_status
        printf "!!! Error encounter applying configuration file, review the log !!!!";
    fi
    printf "### Applying system configuration complete ###";
}
```

```
function install_pkg(){
    #Download packages
    printf "Downloading Packages"
    ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${K9SEC_RPM} -O
/harddisk:/${K9SEC_RPM} 2>&1
    if [[ "$?" != 0 ]]; then
        printf "### Error downloading $K9SEC_RPM ###"
    else
        printf "### Downloading $K9SEC_PKG complete ###";
    fi

    printf "Downloading Packages"
    ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${MCAST_RPM} -O
/harddisk:/${MCAST_RPM} 2>&1
    if [[ "$?" != 0 ]]; then
        printf "### Error downloading $MCAST_RPM ###"
    else
        printf "### Downloading $MCAST_RPM complete ###";
    fi

    printf "Downloading Packages"
    ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${ISIS_RPM} -O
/harddisk:/${ISIS_RPM} 2>&1
    if [[ "$?" != 0 ]]; then
        printf "### Error downloading $ISIS_RPM ###"
    else
        printf "### Downloading $ISIS_RPM complete ###";
    fi

    printf "Downloading Packages"
    ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${OSPF_RPM} -O
/harddisk:/${OSPF_RPM} 2>&1
    if [[ "$?" != 0 ]]; then
        printf "### Error downloading $OSPF_RPM ###"
    fi
}
```



```

else
    printf "### Downloading $OSPF_RPM complete ###";
fi
printf "Downloading Packages"
ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${MGBL_RPM} -O
/harddisk:/$MGBL_RPM 2>&1
if [[ "$?" != 0 ]]; then
    printf "### Error downloading $MGBL_RPM ###"
else
    printf "### Downloading $MGBL_RPM complete ###";
fi

printf "Downloading Packages"
ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${MPLS_RPM} -O
/harddisk:/$MPLS_RPM 2>&1
if [[ "$?" != 0 ]]; then
    printf "### Error downloading $MPLS_RPM ###"
else
    printf "### Downloading $MPLS_RPM complete ###";
fi

printf "Downloading Packages"
ip netns exec tpnns /usr/bin/wget ${HTTP_SERVER}/${RPM_PATH}/${MPLSTE_RPM} -O
/harddisk:/$MPLSTE_RPM 2>&1
if [[ "$?" != 0 ]]; then
    printf "### Error downloading $MPLSTE_RPM ###"
else
    printf "### Downloading $MPLSTE_RPM complete ###";
fi

xrcmd "install update source /harddisk:/ $K9SEC_RPM $MCAST_RPM $ISIS_RPM $OSPF_RPM $MGBL_RPM
$MPLS_RPM $MPLSTE_RPM" 2>&1
local complete=0
while [ "$complete" = 0 ]; do
    complete=`xrcmd "show install active" | grep k9sec | head -n1 | wc -l`
    printf "Waiting for k9sec package to be activated"
    sleep 5
done
rm -f /harddisk:/$K9SEC_RPM /harddisk:/$MCAST_RPM /harddisk:/$MCAST_RPM /harddisk:/$ISIS_RPM
/harddisk:/$OSPF_RPM /harddisk:/$MGBL_RPM /harddisk:/$MPLSTE_RPM /harddisk:/$MPLS_RPM
printf "### XR PACKAGE INSTALL COMPLETE ###"
}

printf "Start Auto provision"
install_pkg;
download_config;
apply_config;

```

相關資訊

- <https://xrdocs.github.io/software-management/tutorials/2016-08-26-working-with-ztp/>
- <https://xrdocs.github.io/software-management/tutorials/2016-07-27-ipxe-deep-dive/>
- <https://xrdocs.github.io/software-management/blogs/2016-10-14-ios-xr-packages-and-security/>