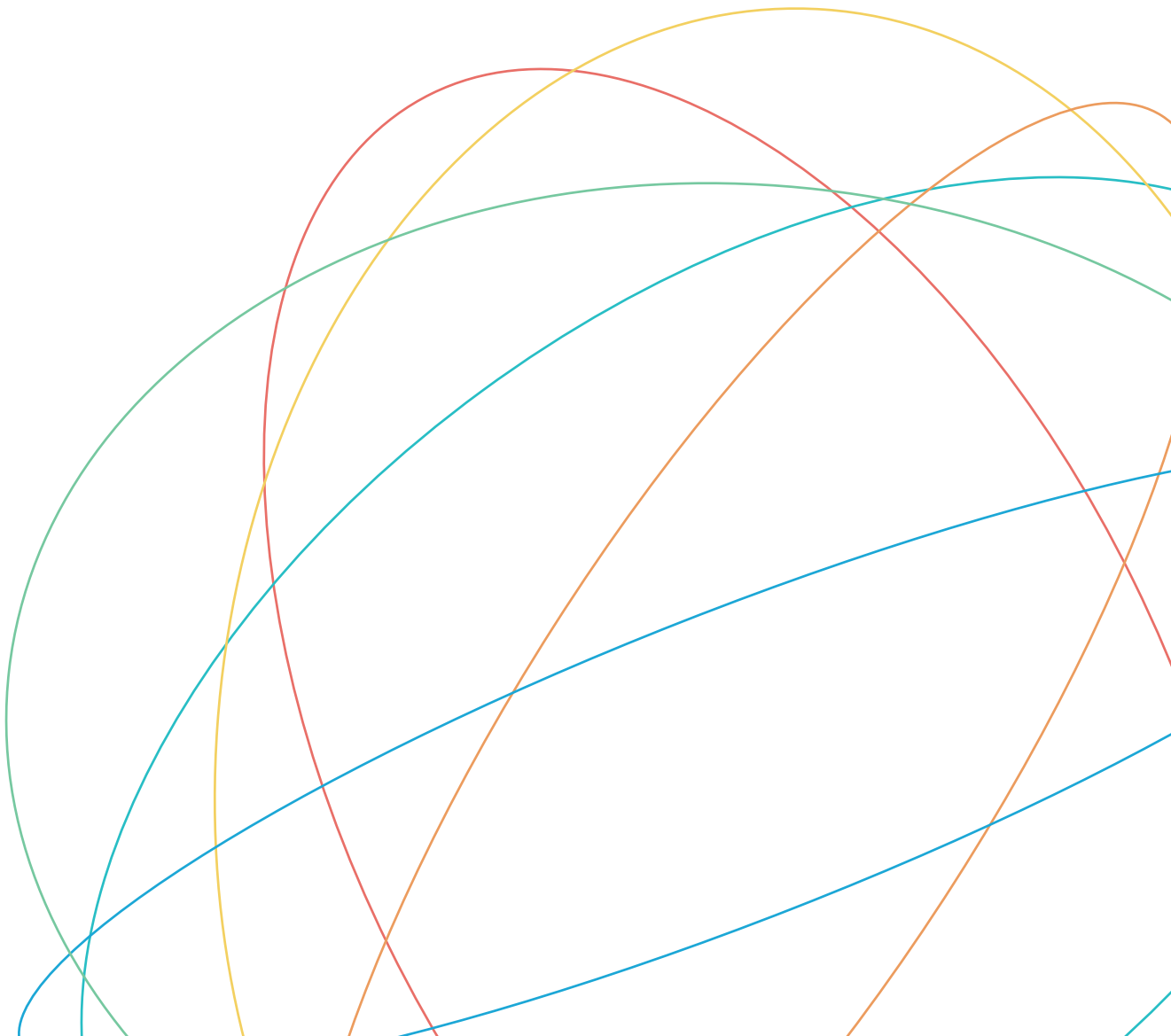


Huawei Agile Campus Solution Technology White Paper - EasyDeploy



1 EasyDeploy Overview

1.1 Background

As network technologies develop fast and networks keep expanding, Internet service providers (ISPs) and large-sized enterprises need to manage and maintain a large number of devices. Facing the huge workloads in hardware installation, software upgrade, fault location, and device replacement, customers have an urgent demand on technologies to simplify network device management. IT departments of enterprises are facing a big challenge: manage network devices in batches and automatically.

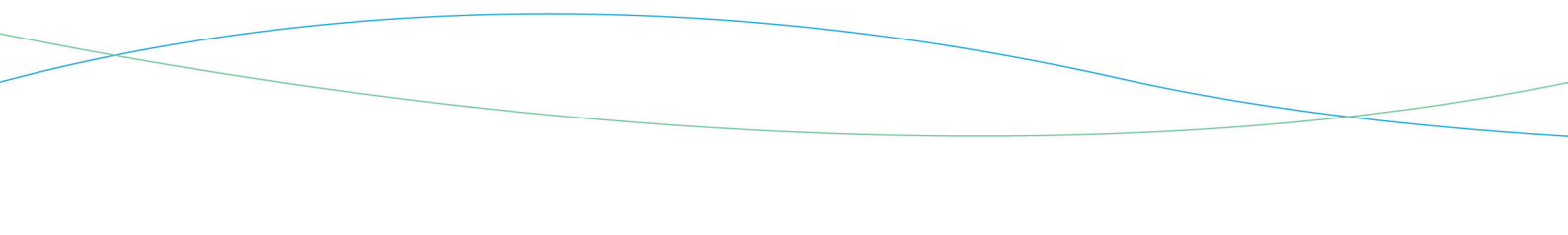
To relieve maintenance personnel from the heavy and repeated maintenance work, Huawei provides the EasyDeploy solution to simplify network deployment and reduce maintenance cost, helping lowering the TCO.

EasyDeploy makes new network devices plug-and-play and manages all devices running on a network. It includes the following features:

- Zero-Touch deployment, a function that enables new network devices to automatically load version software, configuration file, and patch file
- Device batch upgrade
- Batch configuration delivery
- Quick device replacement

1.2 Benefits to Customers

The EasyDeploy solution brings the following benefits to customers:

- **Simplified network deployment:** The EasyDeploy solution is deployed during network planning. Devices do not need to be configured when they are added to the network. After the system software, configuration files, and patch files of the access devices are configured on the management node, access devices are plug-and-play. Therefore, the network administrators can be relieved from heavy manual work.
 - **Lower configuration error probability:** No manual operation is required in the EasyDeploy process, so configuration errors are reduced.
 - **Simplified maintenance and operation:** In addition to automatic deployment, EasyDeploy allows a single device or a series of devices to be upgraded through one-key operation, and supports batch configuration delivery. This reduces the maintenance workloads.
- 

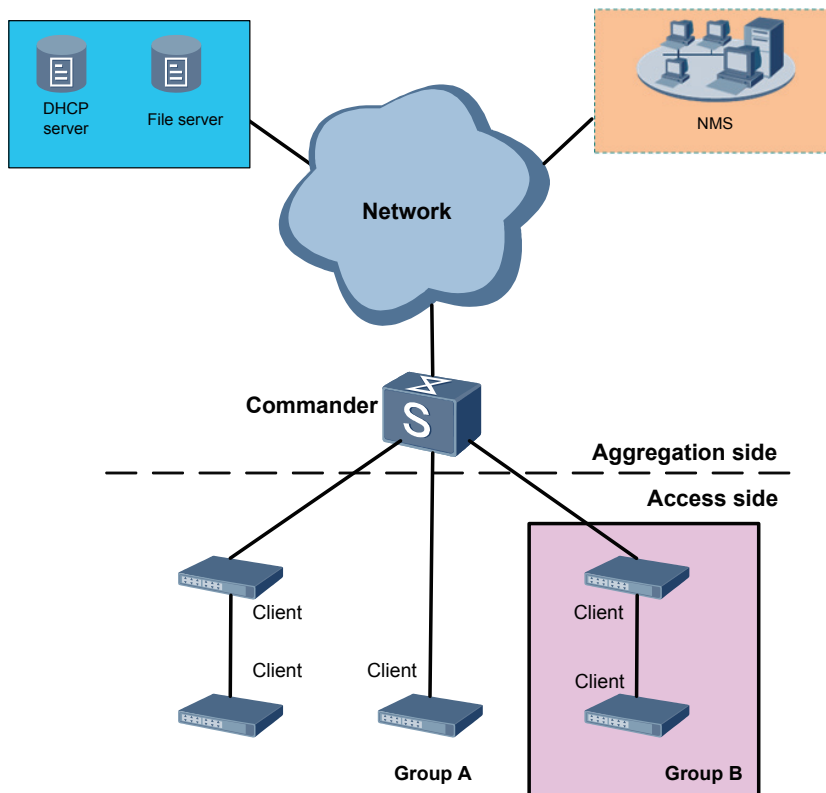
- Simplified device replacement: When a device is faulty, a new device can replace the faulty one by inheriting all the configurations on the faulty one. Even a non-technical person can complete the device replacement.
- Lower labor costs: EasyDeploy provides the plug-and-play feature and one-key operations for new device deployment, maintenance, and device replacement. The operators do not need to have high skills. Therefore, labor cost in network management is reduced and efficiency is improved.

2 Technology Description

2.1 Roles in EasyDeploy Solution

The EasyDeploy solution adopts the Client/Server model. The topology consists of the following roles: Commander, client, group, file server, DHCP server, and network management station (NMS).

Figure 2-1 EasyDeploy topology



2.1.2 Commander

A Commander is the management device in the EasyDeploy solution, that is, the server in the Client/Server model. The Commander has the following functions:

- Collects information about all clients, and maintains the database and topology relationship.
- Specifies file information and file server for clients.
- Delivers the upgrade and configuration instructions in batches.

These models can be used as Commander: S5700-SI, S5700-EI, S5700-HI, S6700, and chassis switches.

2.1.3 Client

A client is a managed device in the EasyDeploy solution. It obtains the names of system software and configuration file from the Commander, obtains the files from the file server, and reports its own working status to the Commander.

- A client runs EasyDeploy only when it connects to the network with empty configuration. If the client has a configuration file, it starts with the configuration file, and does not run EasyDeploy.
- These models can be used as client: S2750-EI, S5700-LI, S5700-SI, S5700-EI, S5700-HI, S6700, and chassis switches.

2.1.4 Group

A group contains the devices with the same attributes. The use of groups simplifies device configuration and implement batch operations on devices.

Groups are classified into built-in groups and customized groups.

- A built-in group contains the devices of the same model, for example, S5700-EI or S5700-HI.
- Customized groups are created based on multiple factors, for example, MAC address, ESN, model, and product type. Devices of a new product type can be grouped.

If multiple types of groups are configured, the clients match the groups in the following sequence: MAC address-based group > ESN-based group > model-based group > product type-based group > built-in group.

2.1.5 File Server

A file server can be a TFTP, SFTP, or FTP server that stores the files of all clients, including version, configuration, patch, web, license, and user-defined files.

- The file server is mandatory in the EasyDeploy solution. The Commander can also function as a file server.
- The file server can be a TFTP, SFTP, or FTP server.

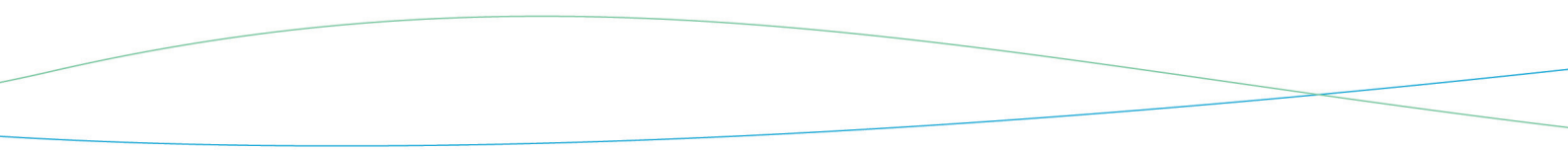
2.1.6 DHCP Server

A DHCP server dynamically allocates IP addresses to clients.

- A DHCP server is mandatory in the EasyDeploy solution. It allocates IP addresses to clients and notifies clients of the Commander's IP address through the Option 148 field. The Commander's IP address can also be manually configured on clients. The priority of manually configured IP address is higher than priority of the IP address carried in Option 148.
- The Commander can also function as a DHCP server.

2.1.7 NMS

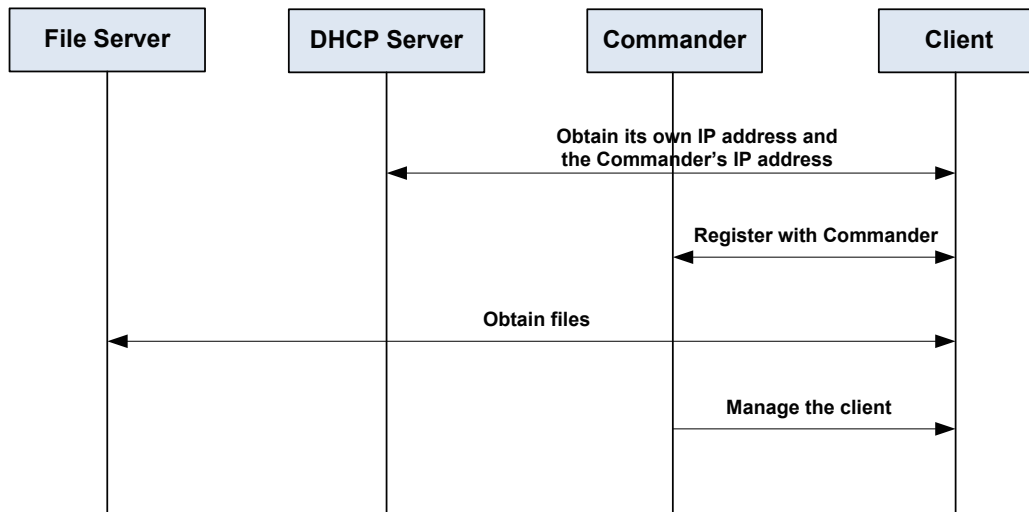
The network management station (NMS) is optional in the EasyDeploy solution. It provides visual, user-friendly configuration process and topology views.



2.2 Working Mechanism

EasyDeploy solution simplifies network deployment and makes clients plug-and-play because the files required by clients are pre-configured on the Commander by the administrator. The clients automatically obtain these files after connecting to the network. Figure 2-2 shows the EasyDeploy workflow.

Figure 2-2 EasyDeploy workflow



1.The client obtains the Commander's IP address.

The client connects to the network with empty configuration. The DHCP server notifies the client of the Commander's IP address through Option 148 and allocates an IP address to the client.

2.The client registers with the Commander.

The client requests to register with the Commander. The Commander verifies the MAC address or ESN of the client. If the client is valid, the Commander delivers the pre-configured file information, file server address, and access method (user name and password) to the client.

3.The client obtains files from the file server.

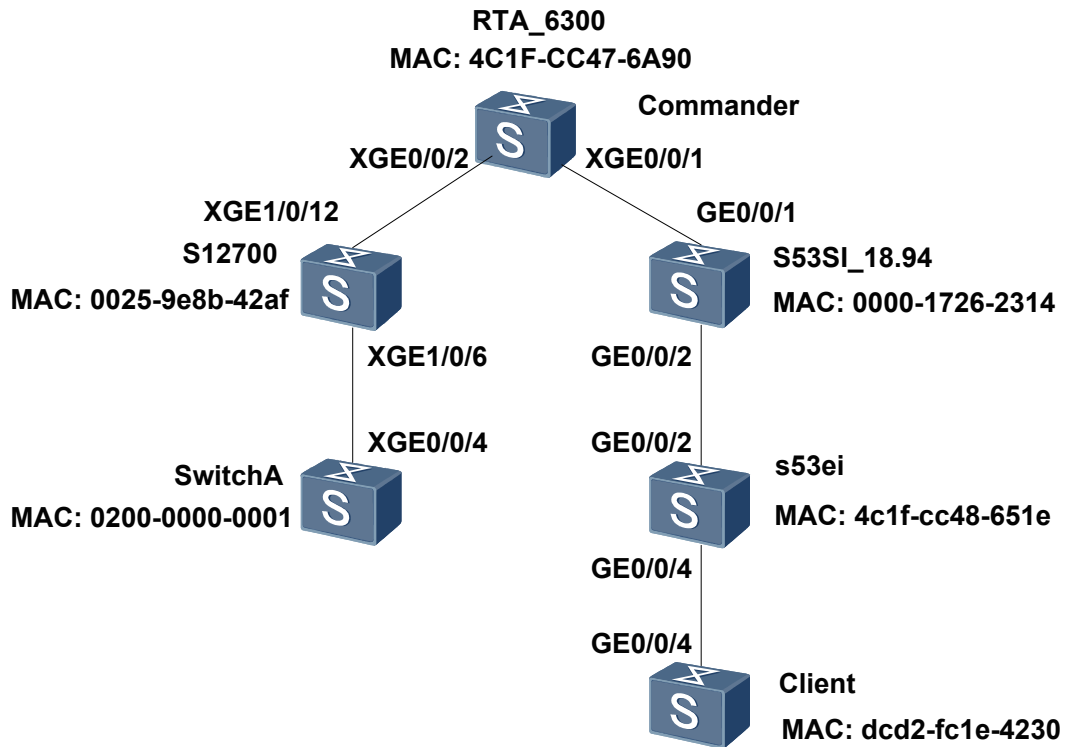
The client downloads files from the file server according to the information obtained from the Commander and runs the files.

4.The Commander manages the client.

After the registration is complete, the Commander starts to manage the client, including collecting information about the client, topology, file downloading status, and running status. The running status of the client can be displayed on the Commander.

The Commander can display the topology shown in Figure 2-3. With the Commander as the root, a maximum of 7-level structure can be displayed.

Figure 2-3 EasyDeploy topology



The Commander displays the following information:

```

<-->:normal device    <??>:lost device

Total topology node number: 6

-----

[RTA_6300: 4C1F-CC47-6A90](Commander)
|-(XGE0/0/2)<-->(XGE1/0/12)[S12700: 0025-9e8b-42af](Client 1)
||-(XGE1/0/6)<-->(XGE0/0/4)[Switch A: 0200-0000-0001](Client 6)
|-(XGE0/0/1)<-->(GE0/0/1)[S53SI_18.94: 0000-1726-2314](Client 3)
||-(GE0/0/2)<-->(GE0/0/2)[s53ei: 4c1f-cc48-651e](Client 4)
|||-(GE0/0/4)<-->(GE0/0/4)[Client: dcd2-fc1e-4230](Client 5)

-|- indicates that the device directly connects to the Commander, that is, level-1 topology. ||- indicates the level-2 topology.

-In (XGE0/0/2)<-->(XGE1/0/12), (XGE1/0/12) indicates the port on the local device connecting to the upper-level device, and (XGE0/0/2) indicates the port on the upper-level device connecting to the local device.
  
```

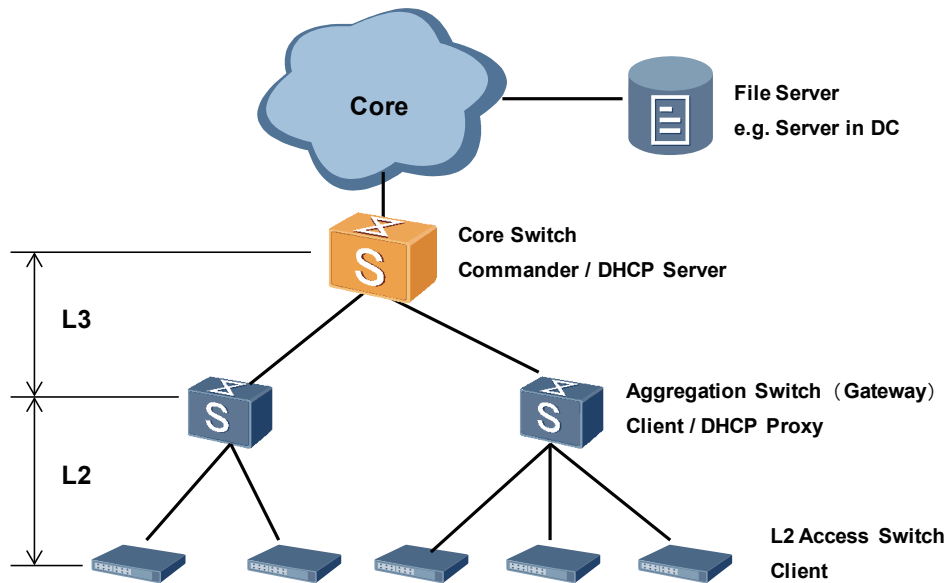
3 Typical Networking and Application

3.1 Typical Networking

3.1.1 Typical Campus Network Structure

Figure 3-1 shows the structure of a typical campus network.

Figure 3-1 Typical campus network structure



On a typical campus network, a Layer 2 network is below the aggregation switches and a Layer 3 network is above the aggregation switches. The aggregation switches functions as the gateway. Important file servers are located in the data center.

The device at the core layer is the Commander, and all devices at the aggregation and access layers are the clients.

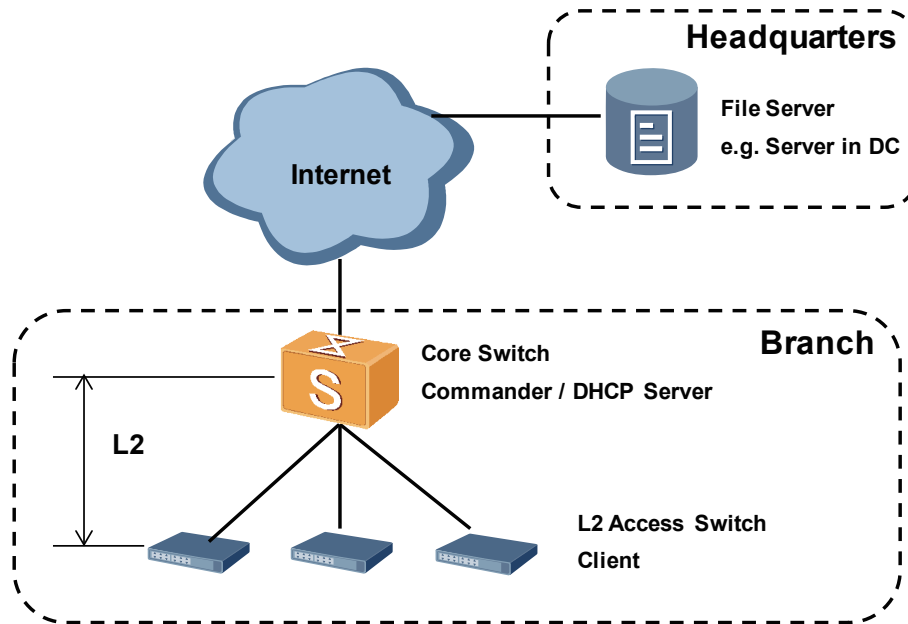
The Commander functions as the DHCP server to allocate IP addresses to clients and delivers its own IP address to clients through Option 148. Clients are distributed on different network segments, so the DHCP proxy function must be enabled on the gateway. The access devices and Commander are connected through aggregation devices; therefore, the network should be deployed from upper layers to lower layers.

The Commander can function as the file server; however, it is recommended that an independent file server be deployed in the data center.

3.1.2 Branch Network of a Large-Sized Campus Network

Figure 3-2 shows the structure of the branch in a large-sized campus network.

Figure 3-2 Branch network of a large-sized campus network



A branch network has a small size and usually uses a two-layer network structure. The access switches directly connect to the core switch, and Layer 2 service is deployed on the entire network. Files are stored on the servers in the headquarters' data center.

The core device functions as the Commander and access devices function as clients.

The Commander functions as the DHCP server to allocate IP addresses to clients and delivers its own IP address to clients through Option 148.

3.1.3 Small-Sized Campus Network

A small-sized campus network has its own file servers. It is recommended that one file server be connected to the core switch when more than 10 clients exist. The other devices are deployed in the same way as the device deployment on a campus branch network.

NOTE

- There must be reachable routes between clients and Commander and between clients and file servers.
- The clients, Commander, and file servers must be able to access each other no matter whether the clients directly connect to the Commander or whether the file servers are located locally or remotely.

3.2 Zero-Touch Deployment

The Zero-Touch function is applicable to the network deployment stage.

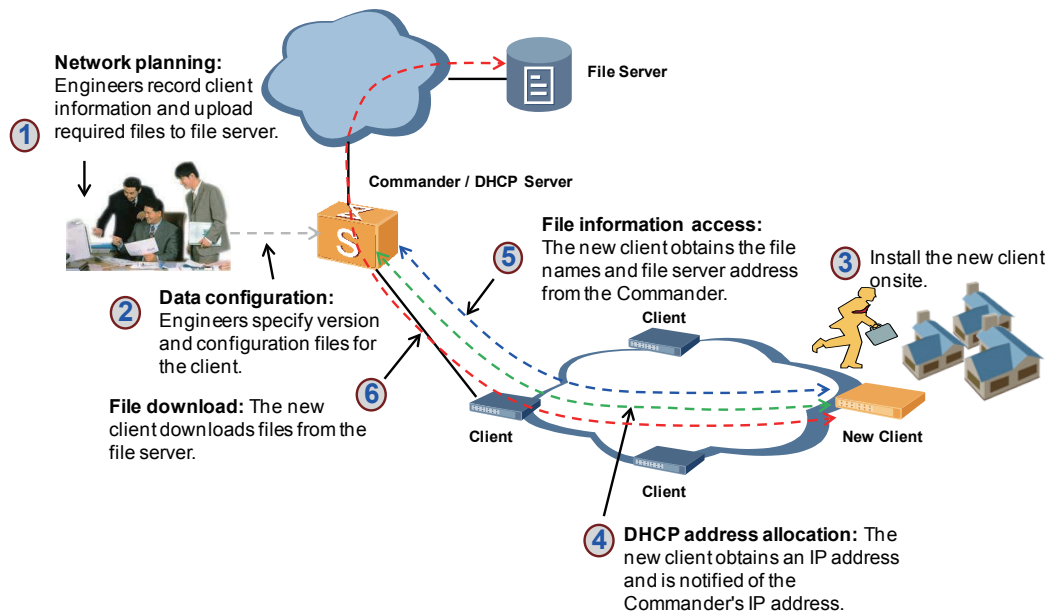
3.2.1 Overview

When EasyDeploy is not configured, engineers install and manually configure new devices or load configuration files to the devices. The workloads are heavy when there are a large number of new devices.

The Zero-Touch function relieves the engineers from heavy workloads. Before a new device is added to a network, the MAC address or ESN of the device is configured on the Commander and the files required by the device are stored on the file server, for example, software, patch, license, and web files. Alternatively, the files names can be imported to the web NMS from an Excel file and delivered to the Commander. After client connects to an upstream device and is powered on, the client automatically obtains files from the Commander. No manual operation is required on the client.

3.2.2 Process

Figure 3-3 Zero-Touch process



1. Engineers add the MAC address or ESN of the new client to the Commander and upload the software, configuration, and patch files required by the client to the file server.

2. Engineers configure client information on the Commander through command line interface (CLI) or NMS. A client is identified by its MAC address or ESN. In addition, the engineers specify software, configuration, patch, web, license files, and user-defined files for the client. To facilitate configuration, engineers can group the clients and specify files for each group. Among the previously mentioned files, only the configuration file is mandatory.

3. The new client with empty configuration is connected to an upstream device through a service port and is powered on.

4. The new client requests an IP address from the DHCP server. The DHCP server allocates an IP address to the client and returns the Commander's IP address through the Option 148 field.

5. The client requests file information from the Commander. The Commander returns the file names, file server address, user name, and password to the client. The interaction packets carry a password, so the response packet sent by the Commander is encrypted through RSA.

6. The client downloads files from the file server according to the information obtained from the Commander. If the downloaded files contain a system software package, the client needs to be reset.

7. After downloading files, the client works properly. In the entire deployment process, engineers only need to configure the Commander. The clients are plug-and-play.

NOTE

You cannot log in to the clients running EasyDeploy through their console ports.

Configure DHCP on the Commander.

```
<HUAWEI> system-view
[HUAWEI] sysname DHCP Server
[DHCP Server] dhcp enable
[DHCP Server] interface vlanif 20
[DHCP Server-Vlanif20] dhcp select global
[DHCP Server-Vlanif20] quit
[DHCP Server] ip pool easy-operation
[DHCP Server-ip-pool-easy-operation] network 192.168.1.0 mask 255.255.255.0
[DHCP Server-ip-pool-easy-operation] gateway-list 192.168.1.6
[DHCP Server-ip-pool-easy-operation] option 148 ascii ipaddr=192.168.1.6;
[DHCP Server-ip-pool-easy-operation] quit
```

Configure basic functions of the Commander.

```
[Commander] easy-operation commander ip-address 192.168.1.6
[Commander] easy-operation commander enable
[Commander] easy-operation
[Commander-easyoperation] sftp-server 192.168.10.100 username admin password easydeplo
```

Specify file information for the client.

```
[Commander-easyoperation] client 3 mac-address 5489-9875-edff
[Commander-easyoperation] client 3 configuration-file s5700-si.cfg custom-file header2.txt
[Commander-easyoperation] quit
```

3.3 Client Batch Upgrade

When new functions need to be added to a running network, the clients are upgraded.

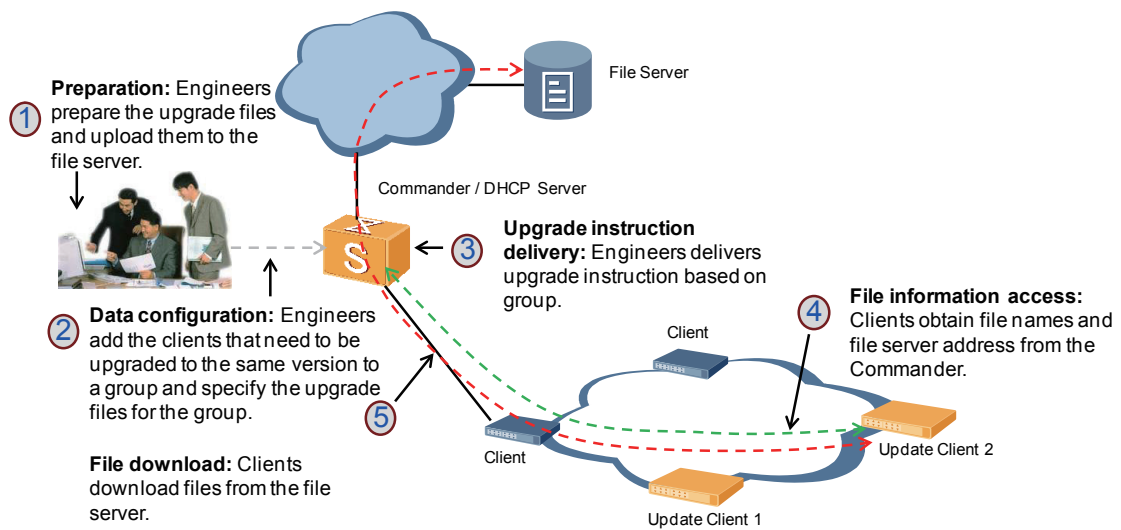
3.3.1 Overview

When no EasyDeploy is configured, Huawei engineers must load files to the clients one by one and run commands to upgrade the software. The workloads are heavy when a large number of devices need to be upgraded.

The client batch upgrade function relieves the engineers from heavy workloads. The clients that need to be upgraded to the same version are added to the same group. Huawei engineers only need to specify the upgrade version and required information for the group, and perform one-key upgrade on the Commander through CLI or NMS.

3.3.2 Process

Figure 3-4 Client batch upgrade process



1. Engineers prepare upgrade files and upload the files to the file server.
2. Engineers add the clients that need to be upgraded to the same version to a group and specify upgrade files for the group, including version, configuration, patch, web, user-defined, and license files. All the previously mentioned files are optional.
3. Engineers run commands on the Commander to upgrade the clients in the group.
4. Clients request file information from the Commander according to the locally saved Commander's IP address. The Commander returns the file names, file server address, user name, and password to the clients. The interaction packets carry a password, so the response packet sent by the Commander is encrypted through RSA.
5. The clients download files from the file server according to the information obtained from the Commander. If the downloaded files contain a system software package, the clients need to be reset.
6. After downloading files, the clients work properly. In the entire upgrade process, engineers only need to configure the Commander. All the clients are upgraded through one-key operation.

NOTE

If too many clients restart at the same time, services may be affected. Therefore, the Commander delivers upgrade instruction to a maximum of 50 clients each time.

3.3.3 Configuration Procedure

Configure basic functions of the Commander.

```
[Commander] easy-operation commander ip-address 192.168.1.6
```

```
[Commander] easy-operation commander enable
```

```
[Commander] easy-operation
```

```
[Commander-easyoperation] sftp-server 192.168.10.100 username admin password easydeploy
```

Configure a group based on the IP address of client 1, and specify the files to be loaded and file activation mode for the group.

```
[Commander-easyoperation] group custom g1 ip-address
[Commander-easyoperation-group-custom-g1] match ip-address 172.31.1.100 24
[Commander-easyoperation-group-custom-g1] system-software s7700.cc V200R005C00
[Commander-easyoperation-group-custom-g1] license license.dat
[Commander-easyoperation-group-custom-g1] custom-file header1.txt
```

Configure a group based on the MAC address of client 2, and specify the files to be loaded and file activation mode for the group.

```
[Commander-easyoperation] group custom g2 mac-address
[Commander-easyoperation-group-custom-g2] match mac-address 5489-9875-ea12
[Commander-easyoperation-group-custom-g2] web-file web_1.web.7z
[Commander-easyoperation-group-custom-g2] custom-file header.txt
```

Check group configuration on the Commander.

```
[Commander] display easy-operation group
The total number of group configured is : 2
The number of build-in group is: 0
The number of custom group is: 2
-----
Groupname      Type   MatchType
-----
g1             custom ip-address
g2             custom mac-address
-----
```

Start the batch upgrade process.

```
[Commander] easy-operation
[Commander-easyoperation] upgrade group
Warning: This command will start the upgrade processing of all groups. Continue? [Y/N]:y
```

3.4 Client Batch Configuration

When the configurations on a running network need to be modified, the clients are configured in batches.

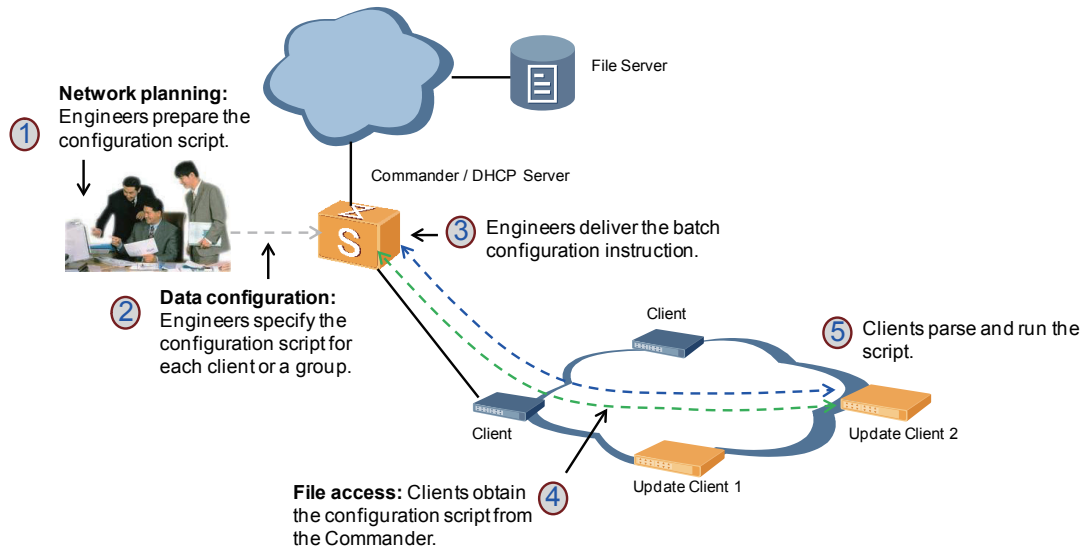
3.4.1 Overview

When EasyDeploy is not configured, engineers must log in to each client through Telnet. The workloads are heavy if a large number of clients need to be configured.

The client batch configuration function relieves the engineers from heavy workloads. Engineers only need to configure the script on the Commander and deliver instructions to clients or a group. The clients automatically run the script.

3.4.2 Process

Figure 3-5 Client batch upgrade process



1. Engineers prepare the configuration script.

2. Engineers add the clients on which the same configurations will be performed to a group, configure the script on the Commander, and associate the script with the clients or a group.

3. Engineers deliver the batch configuration instruction to a client or group.

4. The clients request the configuration script from the Commander. The script delivered by Commander is encrypted through RSA.

5. The clients decrypt and run the script. After running the script, the clients work properly. In the entire configuration process, engineers only need to configure the Commander. All the clients are configured through one-key operation.

3.4.3 Configuration Procedure

NOTE

If too many clients restart at the same time, services may be affected. Therefore, the Commander delivers configuration instruction to a maximum of 50 clients each time.

Configure basic functions of the Commander.

```
[Commander] easy-operation commander ip-address 192.168.1.6
[Commander] easy-operation commander enable
[Commander] easy-operation
[Commander-easyoperation] sftp-server 192.168.10.100 username admin password easydeploy
```

Add client 1 and client 2 to the same group.

```
[Commander-easyoperation] group custom g1 mac-address
[Commander-easyoperation-group-custom-g1] match mac-address 5489-9875-ea12
[Commander-easyoperation-group-custom-g1] match mac-address 2382-820f-6810
```

Configure the script on the Commander.

```
[Commander] easy-operation
[Commander-easyoperation] batch-cmd begin
vlan batch 100 to 200
dhcp enable
stp bpdu-protection
```

Deliver the script from the Commander to clients in batches.

```
[Commander] easy-operation
[Commander-easyoperation] execute to group g1
Warning: The command will be sent to the group. Continue? [Y/N]:y
```

3.5 Client Replacement

When a client on a running network encounters a hardware fault or is damaged, the client needs to be replaced.

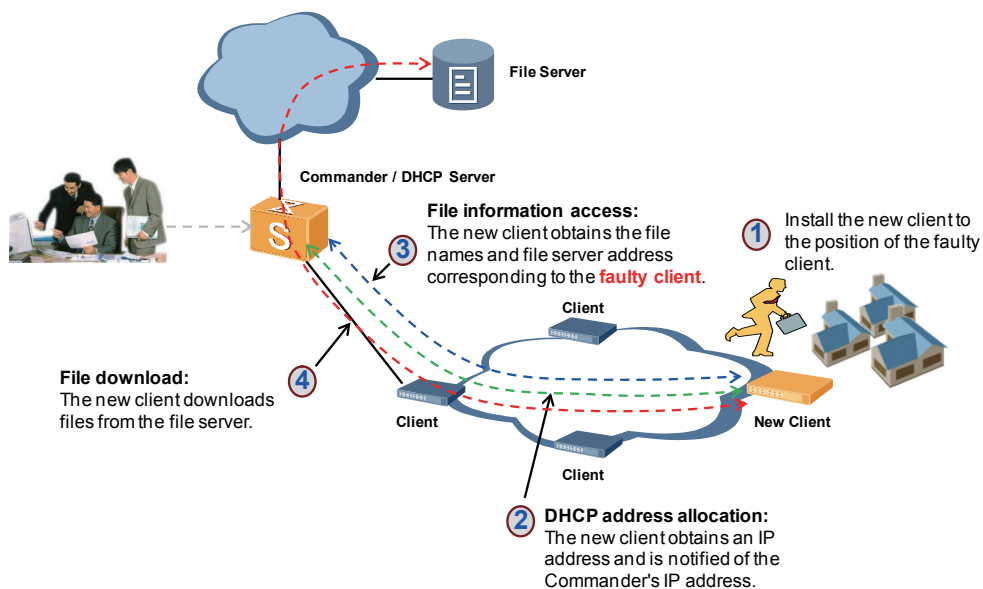
3.5.1 Overview

When EasyDeploy is not configured, Huawei engineers must replace the device onsite, and then import the version files and configurations of the faulty device to the new device.

The client replacement function relieves the engineers from heavy workloads. Engineers only need to locate the new client at the position of the faulty one (connect to the same port on the upstream device). The Commander identifies the new client according to the topology information and delivers the configurations of the faulty client to the new one. No manual operation is required.

3.5.2 Process

Figure 3-6 Client replacement process



Engineers only need to connect the new client to the network. Then the new client automatically downloads files. The file downloading process in client replacement is the same as the Zero-Touch deployment process except that the new client downloads the files of the faulty client, but not the files specified by administrator.

 **NOTE**

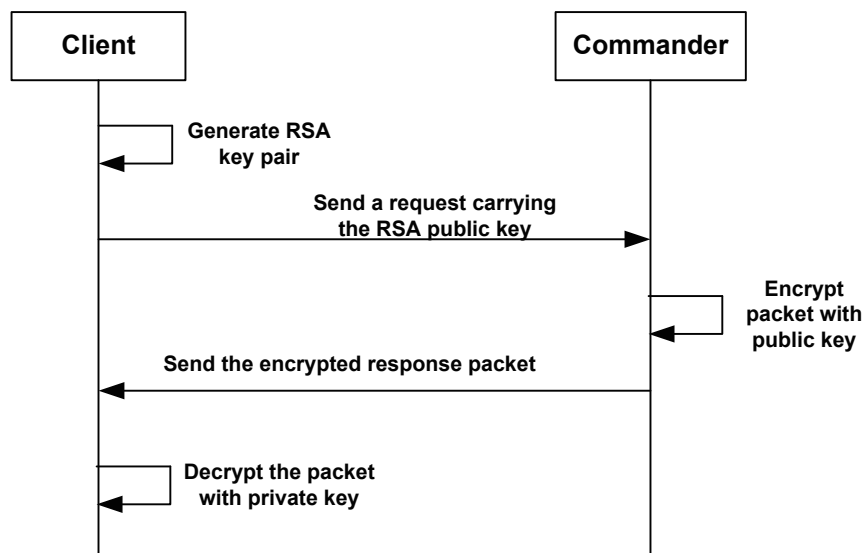
- The new client must be connected to the network in the same way as the faulty client; otherwise, the Commander cannot identify the new client.
- The new client must be of the same type as the faulty client; otherwise, the client replacement function cannot take effect.
- The new client inherits all the configurations of the faulty one. If other configurations need to be added to the new client, the engineers must specify the files on the Commander.

4 EasyDeploy Highlights

4.1 Secure Information Transmission

The IP address, user name, and password of TFTP/FTP/SFTP server are confidential and the password may be delivered in batches. Huawei EasyDeploy supports encryption for the information delivered from Commander to clients.

Figure 4-1 RSA encryption and decryption process



1.The client generates an RSA key pair when requesting to download files or script from the Commander. The client keeps the private key, and sends the public key in the request packet to the Commander.

2.The Commander encrypts the user name, password, and configuration script with the public key and sends the encrypted information to the client.

3.The client decrypts the information with the private key.

NOTE

A new RSA key pair is generated every time the client sends a request to the Commander; therefore, the keys in different request packets are different.

4.2 Configuration File Backup

If the modified configurations on clients cannot be saved timely, some configurations may be lost after client replacement. In the EasyDeploy solution, clients periodically upload the local configuration file to the specified file server.

Huawei EasyDeploy supports flexible backup methods: overwrite and save as a copy:

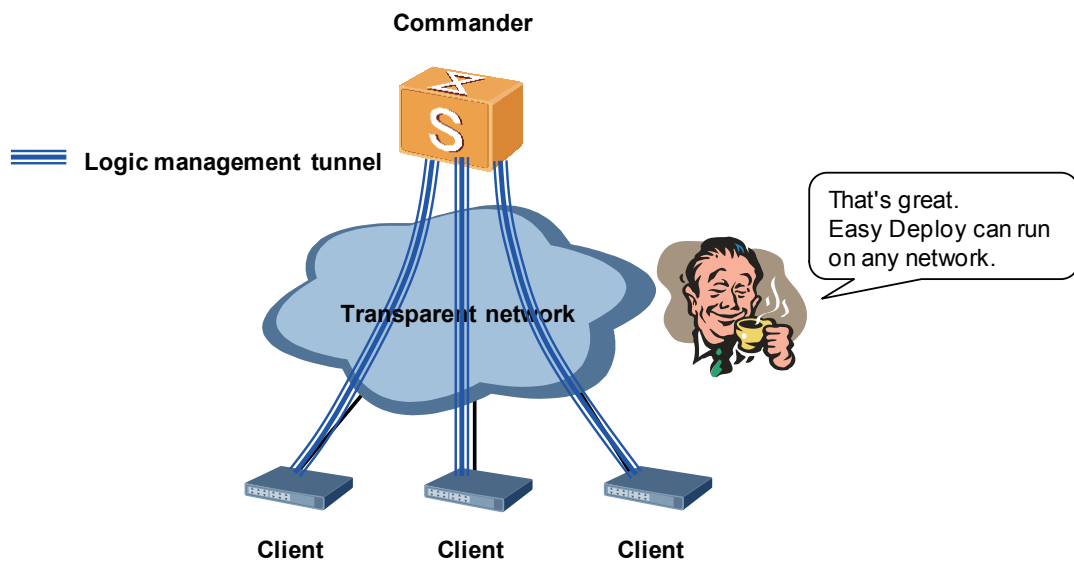
- Overwrite: The new configuration file overwrites the old one. Each client has only one configuration file on the file server. This method conserves memory on the file server.
- Save as a copy: The new configuration file does not overwrite the old one. Each client may have multiple configuration files on the file server. This method protects configuration files if incorrect operations are performed on them.
- Customers can select a backup method according to actual needs:
- If the customer rarely modifies configurations, or modifies configurations only after confirming with agents or Huawei engineers, the overwrite method is recommended.
- If the customer frequently modifies configurations for the purpose of study (for example, in a college), the save as a copy method is recommended. However, the file servers need to be cleaned up periodically.

4.3 Multi-Vendor

The Commander communicates with clients through logic management tunnels. The tunnels are set up based on IP network, and can be set up between Huawei and non-Huawei devices. In the EasyDeploy solution, the Commander and clients must be Huawei devices and have reachable routes to each other. The intermediate devices can be non-Huawei devices.

This feature makes EasyDeploy adapt to network reconstruction or expansion and has a minimum impact on original network.

Figure 4-2 Multi-vendor network



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HUAWEI TECHNOLOGIES CO.,LTD.
Huawei Industrial Base
Bantian Longgang
Shenzhen 518129,P.R.China
Tel:+86 755 28780808

www.huawei.com