

Overview of Cisco 800 Series ISR Deployment

Last Updated 08/11/14



Cisco 800 series Integrated Services Routers (ISRs) provide a rich set of deployment capabilities, which help customers deploy a new router in a network. This white paper discusses these capabilities that enable the effective operations of Cisco 800 series ISRs in networks.

Zero Touch Deployment via USB

The Zero Touch Deployment (ZTD) via USB feature in Cisco 800 series ISRs is an ease-of-use feature that loads a customized configuration from a USB flash drive. This feature requires that the router has no startup configuration in its nonvolatile RAM (NVRAM). The feature also requires that a valid configuration file, with the filename extension `.cfg`, is stored in the USB flash drive. A valid configuration file can be created by saving the running configuration of a router to flash, USB flash, or to a TFTP Server.

When a router with no startup configuration boots up, it checks for a valid configuration file within the USB flash drive and loads it. This feature does not apply to Security Token (eToken).

The pre-requisites for deployment using the Zero Touch Deployment via USB feature are:

1. Boot up router with no startup-configuration
2. Cisco USB flash drive inserted in the first available USB slot
3. A valid configuration file in ASCII text with the filename extension `.cfg`

If the USB flash drive has multiple `.cfg` files, the router chooses the one with the highest index number in the USB Flash drive. In the example below, the router loads the `sample.cfg` file with the index number 5. It does not choose the latest file; say, for example, a newly-created file named `new_sample.cfg`, which has an index number that is lower than that of any other `.cfg` file present in the drive. To avoid loading an incorrect `.cfg` file, ensure that there is only one `.cfg` file in the USB flash drive.

Figure 1. Example of directory of a USB Flash drive

```
Router#dir usbflash0:
Directory of usbflash0:/

 1 -rw-   68176296   Jun 3 2014 06:06:14 +00:00  c800-universalk9-mz.SPA.153-3.M3
 2 -rw-    1927   Jun 11 2014 22:14:06 +00:00  router-config
 3 -rw-    1927   Jun 11 2014 22:14:28 +00:00  ciscortr.cfg
 4 -rw-    1980   Jun 11 2014 22:50:34 +00:00  new_sample.cfg
 5 -rw-    1982   Jun 11 2014 22:40:42 +00:00  sample.cfg

999079936 bytes total (848625664 bytes free)
Router#
```

When the router boots up with the usbflash0:sample.cfg file, it also implicitly performs the following actions:

1. Deletes any existing .cfg file in the router's NVRAM and flash.
2. Copies the usbflash0:sample.cfg file to nvram:startup-config.
3. Creates a copy of sample.cfg in nvram and flash.

Verify successful deployment by using the IOS CLI "show platform boot-record" command:

Figure 2. Example of Zero Touch Deployment verification

```
Router# show platform boot-record

Platform Config Boot Record :
=====
Configuration Register at boot time : 0x2102
Reset Button Status at Boot Time    : Not Pressed
Startup-config Backup Status at Boot: No Status
Startup-config(backup file)location : No Backup
Zero Touch Deployment              : Yes

Router#
```

AutoInstall

The Cisco IOS software includes two features that automate the configuration of Cisco devices.

- Setup is a Cisco IOS software feature that guides a user through the first-time configuration of a Cisco device.
- AutoInstall is the feature that enables remote, automatic configuration of networking devices.

AutoInstall is used to remotely set up new networking devices. You can use AutoInstall to also configure existing networking devices after you remove the configuration file from their NVRAM. The AutoInstall feature uses pre-existing configuration files that are stored on a TFTP server. However, the configuration loaded through the AutoInstall feature is not automatically saved into the router's NVRAM.

There are some prerequisites when using AutoInstall. For more details, please see these references of the AutoInstall feature: [Using AutoInstall to Remotely Configure Cisco Networking Devices](#) and [Using AutoInstall and Setup](#).

Cisco 800 series ISRs support the AutoInstall feature only through the router's Ethernet WAN interface.

Default Configuration Files

When a router has no startup configuration and does not support the Zero Touch Deployment via USB (that is, loading the xxx.cfg file from USB flash drive), the IOS software checks for the files "router-config" and "ciscortr.cfg" in the flash drive and USB flash drive and loads the valid configuration when it boots up.

The order in which the router looks for the configuration file is:

1. flash:router-config
2. flash:ciscortr.cfg
3. usbflash0:router-config
4. usbflash0:ciscortr.cfg

The configuration, however, is not saved and requires that the user manually save it to NVRAM or use the Embedded Event Manager (EEM) feature to save it. This requirement applies to the AutoInstall feature as well.

The following are two examples of the EEM applet configuration used to save router configuration:

Figure 3. Embedded Event Manager Configuration Example 1

```
event manager applet SAVE-CONFIG
event syslog pattern ".*router-config.*"
action 10 cli command "enable"
action 20 cli command "conf t"
action 30 cli command "no event manager applet SAVE-CONFIG"
action 40 cli command "end"
action 50 cli command "write memory"
```

Figure 4. Embedded Event Manager Configuration Example 1

```
event manager applet SAVE-CONFIG
event syslog pattern ".*ciscortr.cfg.*"
action 10 cli command "enable"
action 20 cli command "conf t"
action 30 cli command "no event manager applet SAVE-CONFIG"
action 40 cli command "end"
action 50 cli command "write memory"
```

Priority of Zero Touch Deployment, AutoInstall, and Default Configuration files

Because a router can support the Zero Touch Deployment via USB feature, the AutoInstall feature, and default configuration files, the IOS software applies a predefined priority for them. As a result, when there is no startup configuration in the NVRAM, the configuration file is selected during router boot up in the manner described below.

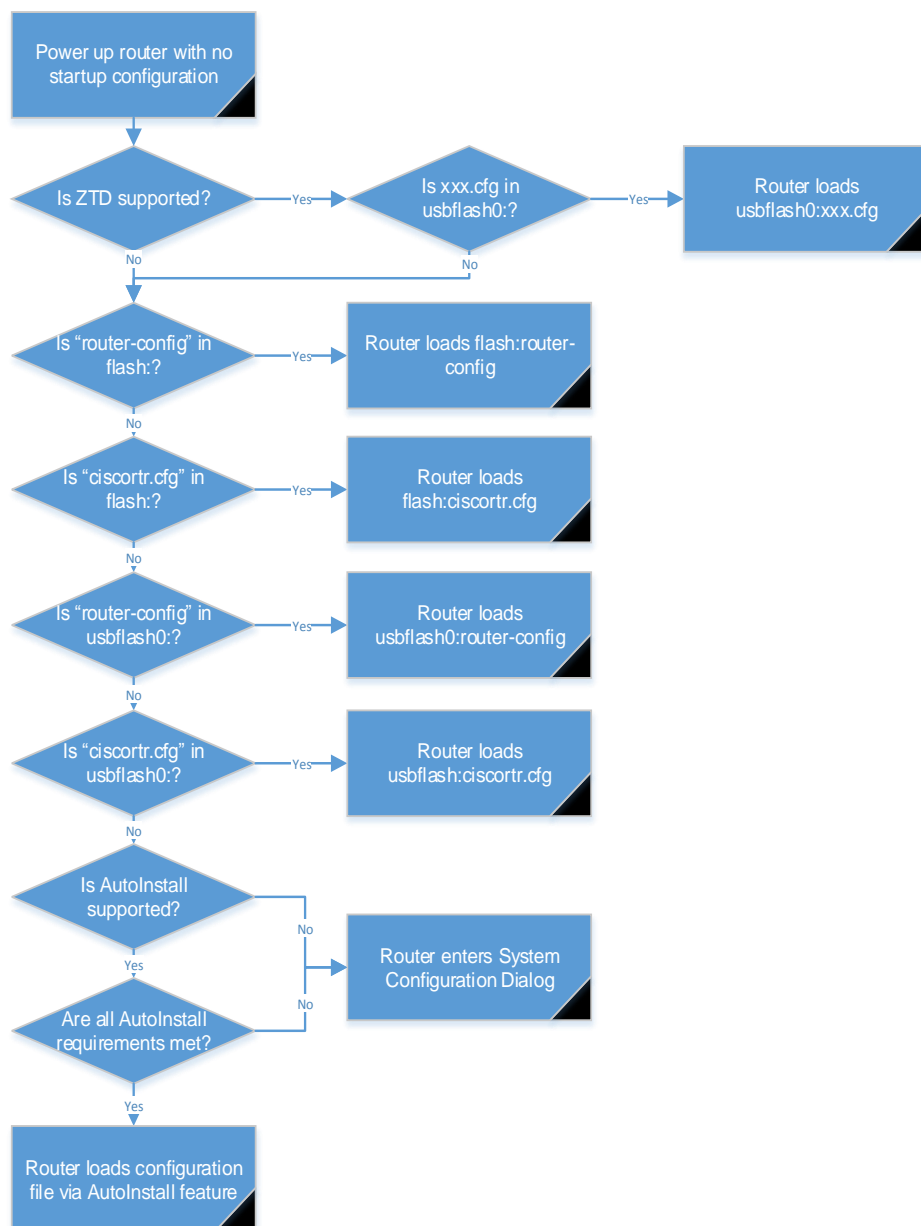
For a router that supports the Zero Touch Deployment via USB feature, the order in which configuration file is chosen and loaded is as follows:

1. Use the Zero Touch Deployment via USB feature; that is, usbflash0:anyfilename.cfg
2. Load default configuration files
 - a. flash:router-config
 - b. flash:ciscortr.cfg
 - c. usbflash0:router-config
3. Use the AutoInstall feature

For a router that does not support the Zero Touch Deployment via USB feature, the order in which configuration file is chosen and loaded is as follows:

1. Load default Configuration files
 - a. flash:router-config
 - b. flash:ciscortr.cfg
 - c. usbflash0:router-config
 - d. usbflash0:ciscortr.cfg
2. Use the AutoInstall feature

Figure 5. Flow-Chart of different deployment options



Reset Button

In order to provide more flexibility to customers during deployment or troubleshooting, most Cisco 800 series ISRs have a reset button. The reset button can be used in either of two scenarios:

1. In power up mode, when a user restores the router to the default factory settings (empty startup configuration) or load-specific configuration file.
2. In IOS mode, when a user loads a specific configuration file without accessing the router IOS prompt.

In the first scenario, where the router erases the startup-config in NVRAM, the router needs to be powered up, while the reset button is held down. The system LED blinks four times indicating that the router has accepted the reset action. Note that the CISCO860VAE & C860VAE-W routers require that the reset button is held down for over 15 seconds when powering up; in this scenario, its system LED is not designed to blink. Note that:

- When the reset button is pressed, some routers may react within 5 seconds of router power up. However, it is recommended that the reset button is held down for the stipulated time, while powering up the router.
- If the reset button is held down while powering up, and there is no valid xxx.cfg file in the NVRAM or flash memory, the router boots up with the no startup configuration and enters the System Configuration Dialog.
- With the reset button is held down while powering up and there a valid xxx.cfg is present in the NVRAM or flash memory, the router boots up with the xxx.cfg file. The xxx.cfg gets copied and overwrites the startup-config in NVRAM.

In the second scenario, where a user loads a specific configuration file from a USB flash drive or flash memory without using any IOS CLIs:

1. Check the system status LED and ensure that the IOS is up and running.
2. After the configuration is in place (on the usbflash0 or router's flash), the user needs to press and hold the reset button down until the system status LED starts flashing. This generally happens within 5 seconds. The router reloads itself after the startup configuration is replaced with the configuration. If the user releases the reset button before the system status LED starts flashing, the recovery procedure is aborted.

The configuration files on the USB flash have priority over the ones on the router flash memory. Therefore, if a valid configuration file is present on both the USB flash and the router's flash, and the reset button is pressed, the system first attempts to load the configuration present on the USB flash drive. If that fails, the system then attempts to load the file present on the router's flash file system. The order in which the system looks for configuration files is:

1. usbflash0:customer-config.SN
2. usbflash0:customer-config
3. flash:customer-config.SN
4. flash:customer-config

For CISCO860VAE and C860VAE-W routers, the priority and files are:

1. usbflash0:SN-customer-config
2. usbflash0:customer-config
3. flash:SN-customer-config
4. flash:customer-config

For C800 ISRs with WLAN AP, the description of the router's behavior when reset button is pressed is available at [Cisco 819 Integrated Services Routers Software Configuration Guide](#).

For C860VAE-W routers, the reset button is also used to load a specific WLAN AP configuration when the router is up and running. This function requires the IOS customer-config file or the SN-customer-config file is present in either the USB flash drive or router's flash. However, there is no such requirement when a user just wants to load a specific IOS configuration file from the USB flash driver or router's flash.

The priority for the configuration files in the USB flash drive and the router's flash is:

1. usbflash0:SN-ap860vae-customer-config
2. usbflash0:ap860vae-customer-config
3. flash:SN-ap860vae-customer-config
4. flash:ap860vae-customer-config

The sequence of processes involved is:

1. The SN-customer-config or customer-config file in either the USB flash driver or the router's flash replaces the startup-config in NVRAM.
2. The SN-ap860vae-customer-config or ap860vae-customer-config file replaces the ap860vae.conf in router's flash.
3. The router reloads and boots up with new configurations for both IOS and WLAN AP.

Cisco Virtual Office

Cisco Virtual Office (CVO) is a scalable solution for midsize and large organizations looking to provide teleworkers, small offices, and mobile users with office-like experiences combining voice, video, wireless, and real-time data applications in a secure environment. More information about CVO is available at [Cisco Virtual Office](#) website.

A customer has an option to pre-load a router with a CVO factory configuration at the time of ordering a Cisco router. This CVO factory configuration contains the "boot config usbflash0:CVO-BOOT.cfg" file in the startup-config; so, during boot up, the system looks for this file in the USB flash drive. Therefore, a customer who wants to deploy a specific configuration can save it as "CVO-BOOT.CFG" and power up the router with the USB flash drive containing the "CVO-BOOT.CFG" file.

This section describes the behavior of a router when loaded with the CVO factory configuration.

1. If the USB flash drive is not inserted when the router boots up, the router uses the CVO factory configuration.
2. If a USB flash drive without the CVO-BOOT.CFG file is inserted, the router boots up and copies its startup-config (CVO factory configuration) file to the USB Flash drive (usbflash0:), using the filename, CVO-BOOT.CFG.
3. If the USB flash drive containing the CVO-BOOT.CFG file is inserted when the router boots up, the router copies usbflash0:CVO-BOOT.CFG and overwrites its startup-config. The same CVO-BOOT.CFG is used as the running-config with the addition of the "boot config usbflash0:CVO-BOOT.cfg" command.
4. When the router's running-config contains the "boot config usbflash0:CVO-BOOT.CFG" command,
 - saving the configuration to NVRAM (that is, writing the memory) overwrites the usbflash0:CVO-BOOT.CFG.
 - saving the configuration as usbflash0:CVO-BOOT.CFG also overwrites the startup-config in NVRAM.
 - removing the USB flash drive causes the router to restore the original CVO factory configuration back to the startup configuration, while keeping the CVO-BOOT.CFG configuration as the running configuration.
5. When the "boot config usbflash0:CVO-BOOT.cfg" command is removed from the running configuration, the router's startup configuration reverts to its original CVO factory configuration. When we place the "boot config usbflash0:CVO-BOOT.CFG" as the running configuration, the usbflash0:CVO-BOOT.CFG replaces the startup configuration.
6. If a customer loads a specific CVO-BOOT.CFG and overwrites its original CVO factory configuration, the EEM feature is used to remove the "boot config usbflash0:CVO-BOOT.CFG" and save the new configuration in the NVRAM. To achieve this goal, this EEM applet can be added in the CVO-BOOT.CFG:

Figure 6. EEM example to remove the CVO USB boot option and save configuration

```

event manager applet REMOVE-BOOT-CONFIG-N-SAVE
event syslog pattern ".*Cisco IOS Software.*"
action 10 cli command "enable"
action 20 cli command "config t"
action 30 cli command "no boot config usbflash0:CVO-BOOT.CFG"
action 40 cli command "no event manager applet REMOVE-BOOT-CONFIG-N-SAVE"
action 50 cli command "end"
action 60 cli command "write memory"
    
```

Features Support on Cisco 800 Series ISRs

Table 1. Matrix of Supported Features on Cisco 800 Series ISRs

Product ID	Default configuration file	CVO	AutoInstall (via Ethernet WAN only)	Zero Touch Deployment via USB (ZTD)	Reset Button (empty startup-config & load xxx.cfg when power up)	Reset Button (load customer-config in IOS mode)
C819	✓	✓	✓		✓	
CISCO86X CISCO88X CISCO89X C88X (SRST, CUBE, 3G, WLAN) C892F-CUBE-K9	✓	✓	✓		✓	
CISCO860VAE C860VAE-W	✓	✓	✓		✓	✓
C88X (4G)	•		✓		✓	✓
C89X (LTE)	•		✓		✓	✓
C88X (non 4G, non WLAN)	✓	✓	✓	✓	✓	✓
C89X (non LTE)	✓	✓	✓	✓	✓	✓

- ✓ Supported
- Supported only from flash

References

- Cisco 890 Series Integrated Services Routers Data Sheet:
http://www.cisco.com/en/US/prod/collateral/routers/ps380/data_sheet_c78-519930.html
- Cisco 880 Series Integrated Services Routers Data Sheet:
http://www.cisco.com/en/US/prod/collateral/routers/ps380/data_sheet_c78_459542.html
- Cisco 860 Series Integrated Services Routers Data Sheet:
http://www.cisco.com/en/US/prod/collateral/routers/ps380/data_sheet_c78_461543.html
- Software Activation for Cisco 860 and 880 Integrated Services Routers FAQ:
http://www.cisco.com/en/US/prod/collateral/routers/ps380/qa_c67_459785.html
- EEM Configuration for Cisco Integrated Services Router Platforms:
http://www.cisco.com/c/en/us/products/collateral/ios-nx-os-software/ios-embedded-event-manager-eem/config_guide_eem_configuration_for_cisco_integrated_services_router_platforms.html