



Crestron Virtual Control for Ubuntu® OS Server-Based Control System

Installation Guide
Crestron Electronics, Inc.

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Contents

- Introduction 1**
- Assumptions..... 2**
- Installation 3**
 - Prepare the Linux Platform 3
 - Install the Crestron Virtual Control Package..... 4
 - Update the Crestron Virtual Control Service 7
 - Manage Licenses with XiO Cloud® Service 9
 - Set Custom TCP Keepalives..... 9
 - Detect Device Disconnects 10
- Appendix A: Enable System Logging..... 11**
 - Local System Logging 11
 - Remote System Logging..... 12
- Appendix B: Open Server Ports..... 14**
- Appendix C: Scalable System Requirements 15**
- Appendix D: Troubleshoot Room Addresses 16**
- Appendix E: Connect Devices with Older Firmware across Subnets 17**

Crestron Virtual Control: Server-Based Control System

Introduction

The Crestron Virtual Control server-based control system provides a scalable solution for deploying programs, rooms, and devices across an enterprise. The Crestron® control system infrastructure resides entirely on a remote server, which is installed and configured using supported Linux® operating system platforms.

This guide provides the installation procedures needed to install the Crestron Virtual Control package on an Ubuntu® server platform, as well as procedures for configuring various Crestron Virtual Control features.

For more information on securely deploying the Crestron Virtual Control server, refer to the Crestron Virtual Control for Ubuntu OS Deployment Guide (Doc. 8272) at www.crestron.com/manuals.

For more information on integrating the Crestron Virtual Control server in an existing intranet site using the secure REST API platform, refer to the Crestron Virtual Control REST API Programming Guide (Doc. 8314) at www.crestron.com/manuals.

Assumptions

This guide is written with the following assumptions:

- The IT administrator (installer) has a working knowledge of Linux platforms and commands.
- The IT administrator is responsible for the following tasks:
 - Keeping the server up to date
 - Setting the security of the server
 - Integrating the server in the corporate authentication provider (LDAP, Active Directory® software, OAuth, and others)
 - Configuring user access to the server
 - Configuring the web servers, including the rights to the path of the Crestron Virtual Control web user interface pages.
- The following Linux platform is installed on a physical or virtual machine:

NOTE: The virtualization agnostic is recommended.

- Ubuntu® Server 16.04.3 LTS software (64-bit version)
- The server meets the following requirements after the Linux platform has been installed:
 - CPU: 4 Cores or higher¹
 - RAM: 4GB or higher¹
 - Disk space: 500GB or higher
- The server should be dedicated to run the Crestron Virtual Control service only.
- The server has a dependency to run the Apache® 2.4.28 (or later) web server, which is installed as part of the Crestron Virtual Control installation package.
- The server is able to run in a virtualized environment.

¹ The required number of CPU cores and amount of RAM varies depending on the number rooms and devices added to the server. For more information, refer to "Appendix C: Scalable System Requirements" on page 14.

Installation

Use the following procedures to install the Crestron Virtual Control package onto the Linux platform.

NOTE: These procedures assume that the Ubuntu server platform has already been installed and meets or exceeds the specifications described on page 2.

Prepare the Linux Platform

To prepare the Linux platform for the Crestron Virtual Control installation:

1. Log into an account with sudo privileges on the Linux platform where Crestron Virtual Control package will be installed.
2. Open a new terminal window.
3. Install the required Perl modules by issuing the following command:

```
sudo apt-get install libperl5.22:i386
```

4. The installation fails because it is not able to delete the `/usr/share/doc/libperl5.22/changelog.Debian.gz` file. Delete the file manually by issuing the following command:

```
sudo rm /usr/share/doc/libperl5.22/changelog.Debian.gz
```

NOTE: Depending on the version of the Perl modules package, the `Debian.gz` file may not be located in the same directory. To determine the correct `Debian.gz` file path, note the file path shown in the error message that displays when the installation fails. Then, replace the file path in the command above with the file path from the error message. Refer to the example below.

```
dpkg: error processing archive  
/var/cache/apt/archives/libperl5.22_5.22.1-9ubuntu0.3_i386.deb  
(--unpack): trying to overwrite shared  
'/usr/share/doc/libperl5.22/changelog.Debian.gz'
```

5. Reissue the `sudo apt-get install libperl5.22:i386` command.
6. After the Perl modules are installed, issue the following commands:

```
sudo apt-get install -f
```

```
sudo apt-get update
```

7. (Optional) To install OpenSSH, issue the following command:

```
sudo apt-get install openssh-server
```

Install the Crestron Virtual Control Package

To install the Crestron Virtual Control package onto the Linux platform:

1. Download the Crestron Virtual Control file package from the Software & Firmware resource page at www.crestron.com/Support.
2. Log into an account with sudo privileges on the Linux platform where Crestron Virtual Control package will be installed.
3. Extract the contents of the Crestron Virtual Control zip file (crestron.key and crestron.list), and move them into a local folder on the Linux platform (such as /tmp/).
4. Add Crestron Virtual Control to the Ubuntu repository:
 - a. Move the crestron.list file to the /etc/apt/sources.list.d/ directory by issuing the following command, where [directory] is the local folder where the file was copied:

```
sudo mv [directory]/crestron.list /etc/apt/sources.list.d/
```

- b. Install the crestron.key file by issuing the following command, where [directory] is the local folder where the file was copied:

```
sudo apt-key add [directory]/crestron.key
```

5. Issue the following commands to begin the Crestron Virtual Control package installation:

```
sudo apt-get update

sudo apt-get install virtualcontrol
```

6. Enter `y` when prompted to confirm the installation.
7. When prompted, configure any LDAP and Kerberos authentication settings as required by the corporate authentication provider.

NOTE: If LDAP or Kerberos settings are not required for the Crestron Virtual Control deployment, press enter on each screen without modifying any values.

8. When prompted, set the directory where Crestron Virtual Control applications will be installed. Press enter to use the default directory (/opt/crestron).

9. Enter the root account password when prompted to have the Crestron Virtual Control installer check whether the MariaDB® database server is installed. The MariaDB database server is installed automatically if it is not already.

NOTE: The MariaDB is a scalable database server used by Virtual Control server to turn data into structured information. For more information, refer to <https://mariadb.org/about/>.

10. Enter a name to use for the Crestron Virtual Control database. Press enter to use the default database name (`VirtualControl`).
11. Enter a username to use for the Crestron Virtual Control account. Press enter to use the default username (`virtualcontrol`).
12. Enter a password for the Crestron Virtual Control account. Press enter to use the default password (random string).

NOTE: To avoid seeing a "Warning: Failed to connect to the agentx master agent ([NIL]) SNMP" message, navigate to, `/etc/snmp/`, open the `snmpd.conf` file in a text editing program, and uncomment the last line (`agentXSocket tcp:localhost:705`). Then, restart the SNMPD process by issuing the `sudo systemctl restart snmpd` command.

Once the installation is complete, the Crestron Virtual Control service starts automatically within 2 to 3 minutes.

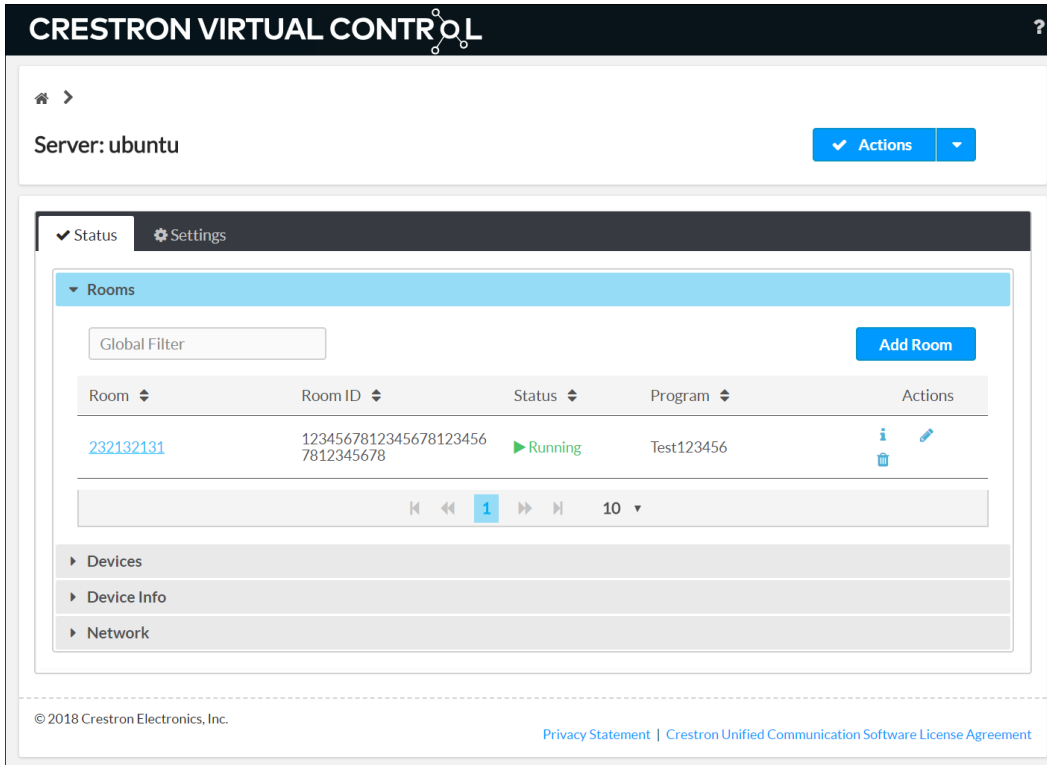
To access the Crestron Virtual Control web user interface after installation, enter "`http://[ServerURL]/VirtualControl/config/settings/`" into a supported web browser, where `[ServerURL]` is the IP address or hostname of the Linux platform.

The Crestron Virtual Control user interface supports the following browsers:

- Chrome® browser
- Firefox® browser
- Internet Explorer® browser
- Microsoft Edge® browser
- Safari® browser

The **Status > Rooms** page displays by default.

Crestron Virtual Control Web User Interface



The following commands may be issued while the Crestron Virtual Control service is running to perform various functions:

- To check the status of the Crestron Virtual Control service while it is running, issue the `sudo systemctl status virtualcontrol` command.
- To restart the Crestron Virtual Control service, issue the `sudo systemctl restart virtualcontrol` command.

NOTE: After a restart, wait 2 to 3 minutes for the service to initialize before attempting to access the web configuration interface.

- To stop the Crestron Virtual Control service, issue the `sudo systemctl stop virtualcontrol` command.

Update the Crestron Virtual Control Service

When a new version of the Crestron Virtual Control service is available, a notification is displayed on the top of the web user interface.

Web User Interface - Update Notification



CAUTION: Ensure that all custom configuration files are backed up prior to updating the Crestron Virtual Control service, as any previous configurations will be overwritten.

To update the Crestron Virtual Control service from the Linux platform:

1. Log into an account with sudo privileges on the Linux platform where Crestron Virtual Control package is installed.
2. Open a new terminal window.
3. Check that the installed Perl modules package is up to date.
 - a. Issue the following commands:

```
sudo apt-get update

sudo apt-get install libperl5.22:i386
```

- b. If the installed Perl modules package is reported to be the newest version, proceed to step 4.
 - c. If the installed Perl modules package is not up to date, the latest package begins to install. To complete the installation, refer to steps 4–5 in Prepare the Linux Platform on page 3.
4. Issue the following command to update the Crestron Virtual Control service:

```
sudo apt-get install virtualcontrol
```

5. Enter `y` when prompted to confirm the update.

The update may take up to 15 minutes to complete. Once the update has completed, the Crestron Virtual Control service starts automatically within 2 to 3 minutes.

NOTE: During an update, the following warnings may be displayed:

```
The directory '/home/crestron/.cache/pip/http' or its parent directory is not
owned by the current user and the cache has been disabled. Please check the
permissions and owner of that directory. If executing pip with sudo, you may
want sudo's -H flag.
```

```
The directory '/home/crestron/.cache/pip' or its parent directory is not owned
by the current user and caching wheels has been disabled. check the permissions
and owner of that directory. If executing pip with sudo, you may want sudo's -H
flag.
```

There is no need to take any action. These messages are displayed typically because the Crestron Virtual Control service was installed using `sudo -H`, which causes pip to install its cache folder under the user's home folder. For more information, run `man sudo` on the target machine.

Manage Licenses with XiO Cloud® Service

The number of rooms that may be run on the Crestron Virtual Control server is based on the number of purchased licenses. The Crestron Virtual Control server has an initial 90-day grace period, during which a maximum number of 500 rooms may be run. After the grace period expires, existing rooms may no longer be run, and new rooms may not be added to the server until the appropriate licenses are purchased.

Purchased Crestron Virtual Control licenses are managed through the XiO Cloud® service portal. For detailed instructions on managing licenses with the XiO Cloud portal, refer to the XiO Cloud Service User Guide (Doc. 8214) at www.crestron.com/manuals.

Set Custom TCP Keepalives

Custom TCP keepalives must be set to run the Crestron Virtual Control server. The default TCP keepalive timeout for a Linux system is two hours, but this duration must be reduced to 30 seconds.

NOTE: The TCP keepalive timeout duration may be increased to 60 seconds if desired.

To set custom TCP keepalives for the Crestron Virtual Control server:

1. Open a new terminal window.
2. Issue the following command to create a new keepalive time .conf file in the /etc/sysctl.d directory:

```
sudo vi /etc/sysctl.d/tcp_keepalive_time.conf
```

3. Type "net.ipv4.tcp_keepalive_time = 30" on the first line.
4. Save and exit the file.
5. Issue the following command to create a new keepalive interval .conf file in the /etc/sysctl.d directory:

```
sudo vi /etc/sysctl.d/tcp_keepalive_intvl.conf
```

6. Type "net.ipv4.tcp_keepalive_intvl = 30" on the first line.
7. Save and exit the file.
8. Restart the Crestron Virtual Control service by issuing the following command.

```
sudo systemctl restart virtualcontrol
```

Detect Device Disconnects

If a device connected to the Crestron Virtual Control server becomes disconnected because its Ethernet cable is disconnected and then plugged back in, the server may take up to 15 minutes to detect that the device has gone offline and to attempt to reestablish communications.

To reduce the time it takes to detect device disconnects in this scenario, reduce the TCP retry timeout for the Ubuntu server.

To reduce the TCP retry timeout:

1. Open a new terminal window.
2. Issue the following command to open the `sysctl.conf` file in the `/etc/` directory:

```
sudo vi /etc/sysctl.conf
```

3. Type `net.ipv4.tcp_retries2 = 8` on a new line.
4. Save and exit the file.
5. Reboot the Ubuntu server.

Following the reboot, the server will recognize that unplugged devices have disconnected within 2 to 3 minutes and will attempt to reestablish communications.

Appendix A: Enable System Logging

The Crestron Virtual Control service provides support for local and remote system logging. Sample syslog.conf files are provided in the installation package that may be modified as needed.

To access the sample .conf files, navigate to [VirtualControlHome]/samples/conf_files, where [VirtualControlHome] is the home directory set during the Crestron Virtual Control package installation.

Local System Logging

To enable local system logging for the Crestron Virtual Control server:

NOTE: Local Crestron log files are created in the /var/log/crestron/ directory.

1. Move the 50-default.conf file from [VirtualControlHome]/samples/conf_files to the /etc/rsyslog.d/ directory.
2. Open the 50-default.conf file.
3. Configure local logging settings by commenting, uncommenting, or modifying the appropriate lines as follows:

- a. Use the template below to create a customized log format for Crestron logs:

```
$template crestron_template,"<%syslogseverity-text%> %timegenerated%  
%HOSTNAME% %syslogtag% %msg%\n"
```

- b. Use the template below to create a customized log file name per application (Use if a separate log file is needed for the application instead of a common log file.):

```
$template CUSTOM_LOGS,"/var/log/crestron/%syslogtag:F,58:1%.log"
```

NOTE: In the above log file format, "F" is the FromChar field, "58" is the ASCII value of the delimiter, and "1" is the first field before the delimiter.

- c. Use the template below to create a single log file for all applications:

```
$template SINGLE_LOG,"/var/log/crestron/crestron.log"
```

- d. Comment any filters between lines 33–68 to send the commented item to the system log instead of the single log (shown on line 25).

NOTE: Comment all filters to send all items to the system log.

- e. Configure any other Linux syslog settings as needed.

4. Save and exit the file.

5. Issue the following commands to restart the system logging service:

```
sudo cd /etc/rsyslog.d/  
sudo service rsyslog restart
```

Remote System Logging

To enable remote system logging for the Crestron Virtual Control server:

NOTE: This procedure assumes that a remote log server account has already been created for use with the Crestron Virtual Control server. The procedure for configuring the Crestron Virtual Control server with a Loggly.com account is provided as an example.

1. Copy the remote server certificate (logs-01.loggly.com_sha12.crt) to the /etc/rsyslog.d/keys/ca.d/ directory.
2. Move the 49-default.conf file from [VirtualControlHome]/samples/conf_files to the /etc/rsyslog.d/ directory.
3. Open the 49-default.conf file.
4. Uncomment any filters between lines 22–28 to set up disk-assisted queues.
5. Update the certificate name in the following configuration for \$DefaultNetstreamDriverCAFile:

```
$DefaultNetstreamDriverCAFile /etc/rsyslog.d/keys/ca.d/  
logs-01.loggly.com_sha12.crt
```
6. Update the name= value to match the Loggly token in the following configuration for the template:

```
template(name="LogglyFormat" type="string"
```
7. Uncomment "& stop" from any filters between lines 41–75 to send the filtered items to the remote system log only. Otherwise, these items are sent to both the local and remote system logs.
8. Use the following configuration to use a remote server in TCP format:

```
@@<Remote-Server IP>:<TCP PORT>
```
9. Use the following configuration to use a remote server in UDP format, and then uncomment the filters between lines 84–95 as needed.

```
@<Remote-Server IP>:<UDP PORT>
```
10. Save and exit the file.

11. Issue the following commands to restart the system logging service:

```
sudo cd /etc/rsyslog.d/  
sudo service rsyslog restart
```

Appendix B: Open Server Ports

The Crestron Virtual Control server requires the following external and internal ports to be open while the server is running.

Open External Server Ports

PORT NUMBER	SERVICE	NOTES
80 / 443	HTTP/HTTP(S) (TCP)	
161 / 163	UDP for SNMP	
843	Flash® technology policy server (TCP)	This port may be disabled if a Flash policy server is not used. For more information, refer to the Crestron Virtual Control for Ubuntu OS Deployment Guide (Doc. 8272) at www.crestron.com/manuals .
5671	XiO Cloud service (TCP)	
41794	CIP communication (TCP and UDP)	
41796	Secure CIP communication (TCP)	

Open Internal Server Ports

PORT NUMBER	SERVICE	NOTES
1025	Listening port for Flash policy server (TCP)	This port may be disabled if a Flash policy server is not used. This port may also be changed in the Flash policy server configuration file. For more information, refer to the Crestron Virtual Control for Ubuntu OS Deployment Guide (Doc. 8272) at www.crestron.com/manuals .
3306	MySQL (TCP)	
5000	WebApp listening messages (TCP)	WebApp is the Crestron Virtual Control interface into the web server.
6379	Redis (TCP)	
50051	DBApp listening messages (TCP)	DBApp is the Crestron Virtual Control interface into the MariaDB database.

For any outbound connections made from the Crestron Virtual Control server, such as connections to Crestron Fusion® software or to XiO Cloud, the appropriate ports must be opened.

The Crestron Virtual Control server must also be configured to allow the following services to run:

- DNS Client
- Active Directory
- SNTP (Simple Network Time Protocol)

Appendix C: Scalable System Requirements

The number of CPU cores and the amount of RAM that is required to run the Crestron Virtual Control server varies depending on the number of rooms and the average number of devices per room that will be added to the server.

Use the tables below to determine how many CPU cores and how much RAM is required for operation based on the size of the deployment. If a row and column is grayed out, Crestron Virtual Control does not support the average devices per room for that room size at this time.

CPU Cores Required

ROOMS	AVERAGE DEVICES PER ROOM																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
50	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	8	8	8	
100	4	4	4	4	4	4	4	4	8	8	8	8	8	8	8	8	8	8	8	16	16
200	4	4	4	4	8	8	8	8	8	16											
300	4	4	8	8	8	8															
400	4	4	8	8	16																
500	4	8	8	16																	

RAM Required

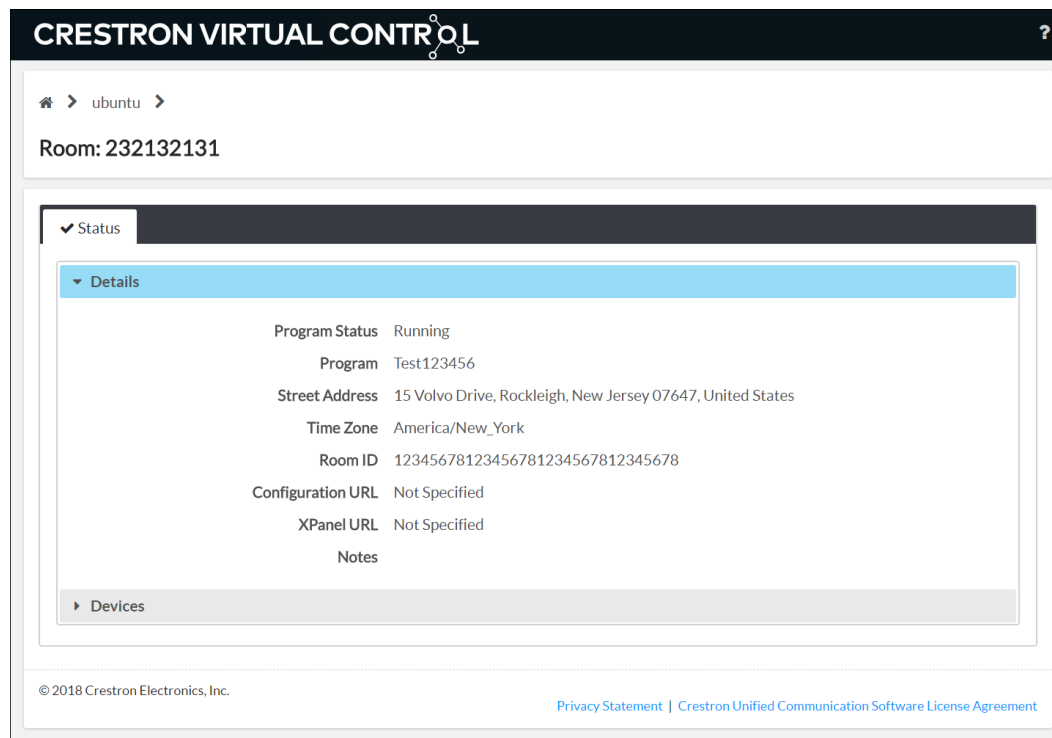
ROOMS	AVERAGE DEVICES PER ROOM																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
50	4	4	8	8	8	16	16	16	16	16	32	32	32	32	32	32	32	32	32	32	
100	4	8	16	16	16	32	32	32	32	32	32	64	64	64	64	64	64	64	64	64	
200	8	16	32	32	32	64	64	64	64	64											
300	16	32	32	64	64	64															
400	16	32	64	64	64																
500	16	32	64	64																	

Appendix D: Troubleshoot Room Addresses

When a room is added to the Crestron Virtual Control server, a street address may be entered to return a time zone for the room automatically. Programs use time zones to ensure that programmatic events are started and stopped at the correct time based on the location of the associated room.

For more information, refer to the embedded help files for the Crestron Virtual Control web interface by clicking the help icon on the top right of the page (?).

Status Page - Details Tab



Addresses are checked against the Microsoft® Azure® service's Geolocation API. If the Geolocation API recognizes the address, the time zone associated with the address is returned for the room. If the Geolocation API does not recognize the address, the default "America/New_York" value is returned as the **Time Zone** status for the room.

If a street address does not return the correct time zone, the following solutions may be attempted:

- Confirm that the address is typed and formatted correctly.
- Enter a city-level address instead of a street-level address (for example, "Minsk, Belarus").
- Enter the latitude, longitude, and time zone of the location manually. The **Address sets location data** switch must be toggled to **Off** to use these fields.

Appendix E: Connect Devices with Older Firmware across Subnets

Crestron devices with newer firmware use the Connect Request method (which specifies a Room ID) to connect automatically to rooms in the Crestron Virtual Control server. Devices with older firmware must be associated manually with a room, but if a device with older firmware is not on the same subnet as the server, it cannot be discovered.

As a workaround, the admin may create a "device_resolution.cfg" file that contains the FQDN (fully qualified domain name), MAC address, and device type for any cross-subnet devices with older firmware. The Crestron Virtual Control service reads this file on startup and then once every hour while the service is running. Each time the file is read, the server attempts to resolve the listed FQDN(s) via DNS. If the FQDN of a device is resolved, the device IP address is made available to the server, which provides the rest of the information required to make a connection. The device may then be associated manually with a room.

To connect to cross-subnet devices using a device_resolution.cfg file:

1. Log into an account with sudo privileges on the Linux platform where Crestron Virtual Control package is installed.
2. Navigate to [VirtualControlHome]/samples/deviceresolution, where [VirtualControlHome] is the Virtual Control home directory set during installation (the default is /opt/crestron/virtualcontrol).
3. Copy the device_resolution.cfg file to the [VirtualControlHome]/conf directory.
4. Open the copied device_resolution.cfg file in a text editing program.
5. Enter the following information for each cross-subnet device on one line of text, separated by commas (with no spaces):
 - a. The fully qualified domain name ("tsw-760-1.yourdomain.com")
 - b. The MAC address, using periods or colons ("11.22.33.44.55.66" or "11:22:33:44:55:66")
 - c. The device type ("TSW-760")

Example: tsw-760-1.yourdomain.com,11.22.33.44.55.66,TSW-760
tsw-760-2.yourdomain.com,00.11.22.33.44.55.66,TSW-760

6. Save and exit the file.

NOTE: If attempting to map a cross-subnet device that uses "local" in the domain name, multicast DNS must be disabled on the Ubuntu server. For more information, refer to <https://askubuntu.com/questions/81797/nslookup-finds-ip-but-ping-doesnt>.

Crestron Virtual Control begins to read the file once every hour. To have the service read the file immediately (on startup), issue `sudo systemctl restart virtualcontrol`.

