L01 - Basic Stratix® Switch and EtherNet/IP Features in Converged Plantwide Ethernet (CPwE) Architectures

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**IMPORTANT**

Identifies information that is critical for successful application and understanding of the product.

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• avoid a hazard
• recognize the consequence

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**BURN HAZARD**

Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.
Basic Stratix® Switch and EtherNet/IP Features in Converged Plantwide Ethernet (CPwE) Architectures

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Before you begin

About this Lab

Welcome to the “Basic Stratix® Switch and EtherNet/IP Features in Converged Plantwide Ethernet (CPwE) Architectures” Lab. In this lab we will explore the Cell Area Zone network as a part of the CPwE.

The Stratix switches are the core of the Cell Area Zone networking. These switches offer the best of Rockwell Automation and of Cisco, and are designed to help ease deployment of your Ethernet networks on machines and the plant floor.

The Stratix switches use the Cisco Catalyst switch architecture and feature set, along with powerful configuration tools, helping to provide secure integration with the enterprise network and making IT professionals feel at home.

Stratix Switches allow for easy setup and comprehensive diagnostics from within the Rockwell Automation Integrated Architecture. These switches can be configured using Studio 5000 Logix Editor programming software. They also automatically generate Logix tags for integrated diagnostics and include FactoryTalk View faceplates for status monitoring and alarming. Together these features provide for an easy integration of networking devices into control and automation architectures.

Labs 1 and 2 will introduce the Stratix 5700 functionality and commissioning process, which includes loading a predefined configuration.

In Lab 3 user will explore newly released methods of adding EtherNet/IP Adapters and I/O modules and explore Stratix Add-On profile (AOP) functionality.

Lab 4 will introduce Stratix Diagnostic Faceplates for FactoryTalk View SE and use of predefined Stratix AOP tags.

Lab 5 and 6 will take you through the process of configuring a Device Level Ring (DLR) Topology and introduces the newly released DLR DHCP functionality of the Stratix 5700 switches.

The entire lab set is expected to take 90 minutes to complete.

Tools & Prerequisites

- PC with Microsoft Internet Explorer V11 or Mozilla Firefox, Studio 5000 v30, FactoryTalk View Studio 9
- Stratix 5700 with FW IOS 15.2(5).EA preloaded
- Stratix Add On Profile (AOP) v14 or higher for integration into Studio 5000
- Stratix Faceplate Library V10.00.01.
- Stratix DLR Faceplate V3.02
**Lab Hardware**

This hands-on lab uses the following hardware:

- ENET 21 Demo Box version 2017.

Lab **will not work** on older revisions of the Demo box without Compact I/O and 1756-L85E controller

- A computer running VMWare Workstation or Player version 11 or higher.
Connecting Your Lab Station

Look at the lab diagram below. This system includes ControlLogix Controller chassis, Compact I/O, Stratix 5700, Point I/O, ETAP, Armor Block I/O and a Computer.

We have already made the connections for you. Verify and trace all the cables. Note that the numbers on the cables in the demo box may not match numbers on the diagram.

Please do not connect the Yellow Cable to the EN2TR Slot 1, Port 2. This will be done during the lab.

Blue Cable 1756-L85E Stratix port Fa1/2
White Cable 1756-EN2TR Port 1 Compact I/O Port 1
Yellow Cable Point I/O Port 1 Disconnected from 1756-EN2TR Port 2
Orange Cable Point I/O Port 2 1783-ETAP Port 1
Red Cable 1783-ETAP Port 2 Armor Block Port 2
Violet Cable Armor Block Port 1 Stratix port Fa1/8
Ivory Cable Stratix port Fa1/7 Compact I/O Port 2
Green Cable Computer Stratix port Gi1/1
Lab 1: Stratix 5700 Familiarization.

About this Lab

In this lab, we will introduce you to the Stratix 5700 Managed Ethernet switch with Cisco technology.

Stratix 5700 Managed Ethernet Switch

1. Look at the front of the Stratix 5700 switch.

The Stratix 5700 Managed Ethernet Switch (1783-BMS10CGN) is equipped with eight Fast Ethernet copper ports (Item 1) plus two combo Gigabit (copper or SFP) ports (Items 2-3). This particular model includes the full software feature set and has Network Address Translation (NAT) capability. The combo slots support SFP modules for multi and single mode fiber. Rockwell Automation approved (Gigabit or 100 Mbps) SFP modules can be used to establish fiber-optic connections to other switches.

SFPs (Small Form factor Pluggable) are small modules that allow you to select from a variety of fiber optic transceivers for the switch. You will need to select a particular SFP depending on the speed and type of fiber you are planning to use.

2. The Express Setup button (Item 4) is located on the top. Express Setup allows you to easily configure the switch for EtherNet/IP networks.
3. The Console port (item 5) on the top is a serial connection available on all Cisco hardware. The console port allows direct access to the switch via Cisco’s Command Line Interface (CLI). The Stratix 5700 can be also managed via the Device Manager Web interface for configuration, troubleshooting and monitoring. Using this software, real-time information can be viewed. In addition to Device Manager, the switch can also be managed via the Studio 5000 environment after completing Express Setup.

4. There are two power connectors on the top right of the switch (item 6). You can connect the switch to two separate power sources for redundancy.

5. The Secure Digital (SD) card slot (item 7) is located on the bottom middle of the front panel. The optional SD card allows you to simplify device replacement by storing switch configuration and firmware and quickly loading saved files to a replacement.

6. Additional connectors on the bottom right provide hardwired contacts for major and minor alarms (item 8).

Stratix 5700 Port Numbering

The Stratix 5700 uses Cisco’s standard port naming convention. Each port name includes:

- **A port ID** that consists of port type:
  - Gigabit Ethernet for Gigabit-capable ports (abbreviated as Gi), and
  - Fast Ethernet for 10/100 Mbps ports (abbreviated as Fa)

- **Unit number** (always 1 for the 5700 platform), and

- **Port number** (1-2 for Gigabit ports, 1-18 for all others, depending on catalog numbers)

This specific 10-port model of the Stratix switch uses the following port names:

\[ \text{Gi1/1 – Gi1/2, Fa1/1-Fa1/8} \]
Lab 2: Loading Switch Configuration using Stratix 5700 Device Manager Web Interface

About This Lab
In this lab we will use the Stratix 5700 Device Manager Web page to load pre-defined switch configurations. This feature can be used when it's necessary to replace a switch or duplicate a known good configuration into the new application. Device Manager is just one way to accomplish this task – we will explore a few more later on.

Restore Switch Configuration using Device Manager

1. Click on the Stratix icon located in the Desktop. This will open the Internet Explorer browser with shortcut to the Stratix 5700 switch located at the IP address 192.168.1.1.

2. Security Certificate window will come up.
   Select “Continue to this website…”

3. On the Login screen, leave the username field blank, enter the password “rockwell”, and click Log In.
Note: In this case, we are only using a password to log in to the switch. The Stratix 5700 can also be configured to use individual usernames and passwords for enhanced security. Users can be assigned different privilege levels (for example, read-only).

4. You will see a variation of the figure shown below.

5. From the top menu select **Admin -> Load/Save**
6. Click the **Browse** button

   ![Screen shot of Browse button](image)

   *Configuration file must be named 'config.text' to replace the existing file.*

7. Dialog should be pointing to **This PC > Desktop > Lab Files > Switch Configs.**
   Click on **config.text** file.

   ![Folder with config.text highlighted](image)

8. Click the **Upload** button.

   ![Screen shot of Upload button](image)

   *Configuration file must be named 'config.text' to replace the existing file.*

9. Observe messages on the right side of the screen and wait for the file upload to be completed.

   ![File upload messages](image)
10. Repeat steps 6-9 for the *vlan.dat* file

**Note:** Any newly uploaded configurations will not be active until you reload or reboot the switch. All changes made and saved before reload will override the uploaded file. Do not save the running configuration. It's recommended to reload (reboot) the switch as soon as the new configuration files uploaded to the switch.

11. Close the Internet Explorer window and cycle box power using the power switch located at the right bottom corner of the Demo box. Be sure to wait until the switch LEDs cycle off prior to reapplying power.

The new Stratix 5700 switch configuration is now loaded.

Reboot/reload will take few minutes, but you don’t have to wait and can continue with the next Lab while the switch is reloading.
Lab 3: Configuring EtherNet/IP devices and Stratix switches in Studio 5000 Logix Editor

About This Lab

Now, after we prepared our switch, we can prepare and download Project file to the controller.

In the past, a Control Engineer would have inserted Ethernet modules and Remote I/O devices in the I/O Configuration Tree of Studio 5000 and operated with little regard to the health or status of the network and switches until there was a problem. As a part of Premier Integration, Rockwell Automation has implemented the Common Industrial Protocol (CIP) in a variety of its Stratix switch product families. This creates a more user friendly experience and allows retrieval of switch and network diagnostic data directly from the switch via its Add-On Profiles (AOPs) into the controller so we can make informed decisions when troubleshooting a problem instead of guessing where the problem might be.

In addition to that, starting with Studio 5000 version 30, users can import predefined I/O modules and even complete chassis into the project. This allows quick migration from project to project.

In this lab you will use **Import** functionality to add Compact I/O rack into the project. Rack include 5069-AENTR adapter with two I/O modules.

Then you explore the Stratix 5700 AOP navigation and functionality it adds.

### Adding the Compact I/O rack to the I/O Configuration Tree of Studio 5000 using Import Module functionality.

1. Click on the **LOGIX** shortcut Icon located on the Windows Desktop.

   Scroll Controller Organizer down to the I/O Configuration.

As you can see, we already have Stratix 5700 and Point I/O added to the Ethernet network under the Local Ethernet communication card in slot 1 of the controller chassis.
2. Now, let's add the Compact I/O rack that consists of 5069-AENTR EtherNet/IP Adapter and two I/O modules. As we mentioned earlier we will be using recently introduced feature called Import Module. For the purpose of this lab we have prepared the rack configuration in a different project and performed the export. Right Click on the “Ethernet” and select Import Module.

![Image of Ethernet configuration](image1)

3. Under Import Module Dialog select `AENTR_5069.L5X` file. If you don't see this file then verify that you are pointing to the folder path: `This PC > Desktop > Lab Files > Logix Projects > Modules`.

![Image of Import Module dialog](image2)

This file contains full information about Compact I/O rack: 5069-AENTR and two I/O modules.

4. Under Import Configuration dialog highlight Child Modules to verify that both I/O modules are in this configuration.

![Image of Child Modules](image3)

Then click OK.

5. Now you should see 5069-AENTR with two I/O modules in I/O Configuration tree.

![Image of I/O Configuration tree](image4)
6. Click Verify Controller to make sure Project has no errors.

7. Next, let's verify that AENTR IP address is configured correctly. In the real application the export file will contain an IP address that was used in the old project. It may be necessary to change it to match your current application. Right-Click on 5069-AENTR and select Properties.

8. Verify that IP address is set to 192.168.1.11. This is the address we will be using in our application.

Then click OK to close Dialog.

9. Save the application.

10. Click the Who Active button on the toolbar located in the upper section of the taskbar.
11. Using the AB_ETHIP-1 driver, select the 1756-L85E at address 192.168.1.5 (do not expand or drill down to the backplane), click once to Highlight, then click **Download**.

Click **Download** once more.
12. Wait for download to finish and click **Yes** to put controller in **Remote Run Mode**.

13. If the Remote Run window did not pop up, then click the drop-down in the online toolbar and select **Run Mode**.

14. When the I/O OK indicator is solid green, this means you are connected to all devices in the I/O tree. If you see a blinking I/O light or warnings in the I/O tree, then you must verify physical connections and IP address settings for any device(s) indicated.

15. Let's verify Compact I/O functionality
   - Locate hardwired buttons on the right side of the Demo Box.
   - Push the top left button. You can see scrolling LEDs on the 5069-OB16F module, indicating that we module Import was successful.
   - Release left button, then press and release the Top Right button – you can see that LED scrolling stopped.
Stratix 5700 Add-On profile

16. Locate Stratix 5700 under I/O configuration and double click on it

17. Module AOP will open.
   On the General screen, notice the Connection format listed as Data. This allows not just to monitor and configure the switch, it also allows to control some Switch features using Logix program. We will explore these a little later.

18. Select Smartports and VLANs settings.
This page allows you to assign Smartport roles and VLANs to the ports. Smartports are port configurations that have been optimized by Rockwell Automation and Cisco for EtherNet/IP networks and are strongly recommended for use in your network implementations. The following Smartports are currently available:

- Automation Device
- Desktop for Automation
- Switch for Automation
- Router for Automation
- Phone for Automation
- Wireless for Automation
- Multiport Automation Device
- Virtual Desktop for Automation

Several of the Smartports have built-in MAC address security. When a device is connected to the port the switch will add the MAC address to the security table. When the device is disconnected, i.e. replaced, the switch will automatically learn the new MAC address and add it to the table. The switch will limit the number of MAC addresses that are allowed on the port (1 for Automation Device and Desktop for Automation, 2 for Virtual Desktop for Automation).

You will notice that ports have already been configured for this lab. For example:

Port Fa1/2 = Automation Device (i.e. 1756-L85E)

Ports Fa1/7 and Fa1/8 = Multiport Automation Device. This is a requirement for the Device Level Ring.

You can explore other AOP screens if time allows.
Lab 4: Stratix 5700 Diagnostic Faceplate

About This Lab

The Stratix Faceplate is a simple graphic display which can be added into a new or existing FactoryTalk View application which provides real time data from the Stratix switches on a single screen in an organized manner.

Stratix Faceplates allow you to easily use preconfigured status, control and diagnostic displays. The Stratix Faceplate is a pre-configured set of screens displayed in FactoryTalk View SE or FactoryTalk View ME that interfaces with the Stratix Add-On Instruction (AOI) to provide HMI functionality and integration.

Using the AOI and faceplate, you can easily monitor switch status, port status and alarms.

The Stratix Faceplate Library supports all versions of the Stratix 2500, 5400, 5410, 5700, 8000 and ArmorStratix 5700 families of products.

Stratix Faceplate Library is available as a Web Download from the Rockwell Automation Sample Code Library: http://www.rockwellautomation.com/global/sample-code/overview.page

The Stratix Faceplate consists of two separate parts:
- Add-On instruction in Studio 5000 application
- Graphic Display in Factory Talk SE (or ME) application

In the following steps we will explored both of them.

Stratix 5700 Add-On Instruction

1. Stratix Add-On instruction come with code and messages already preconfigured. All you need is to import the ladder Rung and point path to the IP address of the switch. To save time, we already did import for you. Let’s verify the path and make sure that we are not getting any errors.

2. In Studio 5000 application Online, expand Main Task, Faceplates program and double click on the Faceplates routine.
3. Scroll down to the Rung 3. This is Stratix 5700 Add-On instruction

4. Verify that EN output is ON and ER output is OFF. This is state indicates that instruction is working and communicating with a switch.

5. Hover your mouse over **Stratix_5700_Path** tag, wait for tool tip window to come up, then verify that it’s pointing to the IP address of our switch 192.168.1.1.
Stratix Faceplate in FT View Studio SE

1. Minimize Studio 5000 window to get to Windows Desktop, then click on HMI icon on Windows display.

2. After HMI Starts, the simplified Network Diagram will open. It represents the current state of our network with Logix Controller, Stratix switch and Computer.

3. Click on Stratix 5700 image to open Stratix 5700 Faceplate. The Home Page of the Stratix 5700 Faceplate will open.
This screen provides detailed switch status. You can see the basic switch information, status overview of each port, status of the SD card, status of Alarm signals some LEDs and the power connections. Port layout automatically represents the actual switch.

4. As you can see, green port indicators on ports Fa1/2, 7, 8 and Gi1/1 indicate connected cables. Disconnect cable from the port Fa1/8 and observe that Faceplate indicator changes color to Gray that represent unconnected port. Reconnect cable when finished and verify that Faceplate port 8 indicator is green again.

5. Click on Port 7 Indicator

Port 7 information display will come up.

You can see detailed port status:
- Link is active and port is running at 100MB with Full Duplex
- Smartport is configured as a multiport Automation Device (like we saw earlier) and belongs to VLAN 10.
6. Click twice on the right port selector arrow

This will bring up the information about port Gi1/1, where we have our computer connected.

As you can see, this Smartport is configured as a **Virtual Desktop for Automation**.
These settings are optimized for the virtual machines that we are using in this class.
Please note that depending on the computer network card used, you may see that port is running at 100Mb or 1000Mb (1Gb) speeds.

7. Click on the Home Page Icon to get back to the main switch view.

8. Next, on your Demo Box press the 3-rd Left button, labeled 1756 SOE and observe that its light comes on.

Now take a look at the faceplate again:
As you see port 3 changed color to Brown that indicated “Disabled”.

_How we did it?_ We used controller tags that are associated with the Add-On profile.
Return back to Studio 5000 by clicking the icon on the Windows taskbar at the bottom of the screen.

Double Click on Controller Tags in Controller Organizer.

Select **Monitor Tags** tab, then scroll down and expand Stratix_5700:O tags.
As you can see Port FA1_3 Disable tag is On (set to 1). This was done through the ladder code. Now Press the Right button on the 3rd row (next to the illuminated): Light will go Off, “Port Disable” tag will become 0 and Faceplate Port 3 indicator will become Gray again.

This functionality can be used to prevent un-authorized access to unused ports by shutting them down via the PLC program.

9. Expand Stratix_5700:I Tags

As you see **Connected** tags represent the actual ports that have cable connections.

10. Disconnect cable from port 8. And observe the tag FA1_8Connected state change from 1 to 0. You can use these bits in your program to monitor cable connections. Reconnect the Port 8 cable and verify that tag is 1 again.
Lab 5: Device Level Ring (DLR) Topology

About this Lab

In this lab we will introduce you to products with dual port embedded Ethernet switch technology. These embedded switch products can be placed in a Device Level Ring, or DLR, network topology.

A Device Level Ring is created when you connect dual port devices together, similar to a daisy-chain topology. When the final Ethernet cable is connected from the end DLR device back to the first DLR device, a Linear Topology becomes a Ring Topology.

An advantage of using a Device Level Ring instead of Linear/Star Topology is that it provides network resiliency by giving Ethernet traffic two paths in which to travel. If there is a failure somewhere in the ring, Ethernet packets will travel the opposite direction. With an assigned Ring Supervisor configured, you will know that a failure occurred and between which two DLR Devices it happened.

As seen below, some of the DLR Devices are the 1756-EN2TR, 1734-AENTR and 5069-AENTR. For devices that do not have the Dual Port Embedded switches, like the Power Flex Drives or Switches the 1783-ETAP can be used to connect those devices to the DLR ring. The latest Stratix 5700 (select models) and Stratix 5400 firmware allows direct DLR connection as well.
Our DLR Ring consists of a 1756-EN2TR, 5069-AENTR, Stratix 5700 switch, 1783-ETAP, Armor Block and a 1734-AENTR as seen below. The Yellow Ethernet cable connected to Port 2 of the EN2TR module in slot 1 will remain disconnected until we enable the DLR Supervisor of the Network in a later step.

Enabling the DLR Ring Supervisor

Before physically building a Device Level Ring:

At least one node on the network must be enabled as a ring supervisor before physically connecting up a Device Level Ring. Without a ring supervisor, the ring is essentially an unmanaged loop, where broadcast traffic can quickly replicate, overload and take down the network.

A ring supervisor is an important component of a Device Level Ring network. It has two key functions:

- It manages the traffic on the ring and sends out heartbeats to monitor the health of the network.
- It keeps the diagnostic information of the network and makes it available to users (i.e.: ring health status, location of wire break).

The 1756-EN2TR, Stratix 5700 and 1783-ETAP are supervisor-capable devices. The Supervisor Function is Disabled setting is the default out-of-box setting for these devices. Users can enable the supervisor function by utilizing the Studio 5000 Add-On Profile (AOP) for 1756-EN2TR, Startix 5700 and 1783-ETAP, or via RSLinx Classic.
1. Referring back to the I/O Configuration Tree. Double Click the 1756-EN2TR

![I/O Configuration Tree](image1)

2. Click on the Network Tab.

![Network Tab](image2)

You will notice that the **Network Topology** is registering that there is a **Linear/Star** topology and the **Network Status** is registering **Normal**. This status is an indication that the network is indeed a star/linear topology and a Ring Supervisor has not been enabled yet (Check Box unchecked)

3. Check the **Enable Supervisor Mode Box**, and watch the status change. Now you see that the Network Topology is registering Ring and the Network Status is registering a Ring Fault. This is because we have not physically attached the final Ethernet cable that will convert this linear topology into a ring topology yet.

![Network Status](image3)

4. Switch window to the HMI screen using the icon on Windows Task Bar.

![Switch to HMI](image4)

Close Stratix 5700 Faceplate if still open.
5. As you can see, network is represented by the Ring, but Yellow cable is blinking indicating a fault.

6. Reconnect the Yellow cable to the port 2 of 1756-EN2TR. Network is now healthy.
7. Now refer back to the EN2TR’s module properties in Studio 5000 and click on the Refresh Communication Link then the Reset Counters button. This will update the window with current data and clear all faults. Now you should see that the Network Status is Normal.

DLR Diagnostic Faceplate for FactoryTalk SE and ME

This portion of the lab will review the DLR Diagnostic Faceplate using FT View SE version. The Faceplate enables a user to visualize, diagnose and interact with Device Level Ring network from the FT View application. This faceplate is available from the Rockwell Sample Code Library (search keyword “DLR”). DLR Faceplate installation is similar to the Stratix 5700 faceplate. To save time we already have it implemented in this Demo.

8. Switch back to the FT View Client screen and click on “Device level Ring Diagnostic Faceplate” button

9. DLR Faceplate will open showing all six DLR participant nodes.

10. As you see, 1756-EN2TR is the DLR supervisor.

You can also see that one of the DLR nodes does not have an IP address, but the DLR Faceplate displayed its MAC address. It’s important to know that a device does not need to have an IP address to participate in a DLR Group. But for management purposes, it’s recommended to have an IP address for every device. We will assign the IP address in the next lab.
11. Select the **Ring Tab**.
This tab has a detailed information about the DLR network and the current DLR Supervisor and its capabilities.

12. Select the **Node Tab**.
Use the right and left arrow buttons to scroll through each network node and view detailed node information.
13. Select the **Alarm Tab**.
Here you can view the fault count of your DLR ring. The Ring Fault Count may not be 0 on your station.

![Image of Network Status](image1)

14. Disconnect the Ethernet cable from the bottom connector of the Point I/O Adapter.
Now the **Alarm Tab** indicates that the DLR has a fault and provides the fault location information.

![Image of Network Status with Fault](image2)

15. Select the **Home Tab**. You can see the blinking red line at the place where the network fault occurred.

![Image of Home Tab](image3)
16. Restore the DLR network connection, verify that DLR has no faults and then close the DLR Faceplate.

DLR Faceplate is available as a Web Download from the Rockwell Automation Sample Code Library:
http://www.rockwellautomation.com/global/sample-code/overview.page

DLR Diagnostic Tool

The Rockwell DLR Tool is another tool that enables a user to visualize, diagnose and interact with Device Level Ring network using a Windows-based computer.

17. Click on the DLR Tool Button located on the FT View screen.

18. Click Connect Icon.

19. Highlight 1756-EN2TR at the address 192.168.1.10 and click Select.
20. A graphical representation of the network will come up with 6 devices in the ring. Click on different nodes to explore device and DLR information.

![Graphical representation of the network](image)

21. Now let’s simulate a fault. Disconnect the cable from the Port 7 of Stratix 5700 switch and watch the DLR Tool screen. You should see that there is a Ring Fault with a Network Alert.

   A key advantage to using a DLR Ring over a Linear/Star Topology is that you have single fault tolerance capabilities. The DLR is capable of recovery time of under 3 milliseconds, which is fast enough not to cause an I/O connection timeout.

22. Once finished, reconnect the cable to the port 7, then click on “Disconnect” icon in the top left corner of the DLR Tool.

   ![DLR Tool](image)

   The DLR Tool is available from the Product Compatibility and Download Site under Studio 5000 tools: http://compatibility.rockwellautomation.com/Pages/MultiProductDownload.aspx?crumb=112
Lab 6: DLR DHCP Functionality of the Stratix 5700 Switch Family

About this lab
In this lab we will introduce a newly released feature of Stratix 5700 switch called DLR Dynamic Host Configuration Protocol or DLR DHCP.

Every device in an IP-based network must have a unique IP address. **DHCP Server** functionality in the Stratix family of switches assigns IP address information from a pool of available addresses to the devices (DHCP Clients) connected to switch ports. If a device leaves and then rejoins the network, the device receives the next available IP address, which is not necessarily the same address that it had before. **DHCP Persistence** can be used to assign specific IP addresses to specific switch port numbers.

**DLR DHCP** is an extension of **DHCP Server** functionality. It allows you to configure DHCP to assign IP addresses to devices connected to a ring based on their positions in the ring. This feature makes sure that a replaced device receives the assigned IP address:

- A ring supervisor functions as the active ring DHCP server to assign IP addresses to the participating nodes through two DLR ports.
- If enabled, a backup ring DHCP server runs on the backup ring supervisor and obtains its reference table automatically from the active ring DHCP server on the active ring supervisor. There can be multiple backup ring DHCP servers in the ring.
- If the active ring DHCP server in the ring fails, the backup ring supervisor becomes the active supervisor. The backup ring DHCP server on the backup ring supervisor becomes the active ring DHCP server and takes over IP assignment and renewal for the ring until one of the following happens:
  - The original active ring DHCP server is restored.
  - A new active ring DHCP server is manually configured.

In this Lab we will use DLR DHCP to assign an IP address to the **1732E Armor Block**.

This process includes steps that must be completed in the order described in the following sequence.

**Verify Global DHCP Server Settings.**

1. From the HMI screen, open the Stratix 5700 Device Manager Web interface. Acknowledge security warnings (if any), and type password ‘**rockwell**’ if prompted.
2. Select **DHCP** from the **Configure** menu.
3. Verify that **Enable DHCP** and **DHCP Snooping** are checked.

DHCP snooping prevents DHCP address assignments from going beyond an active ring DHCP server and the devices within the ring. DHCP requests from another server cannot enter the ring, and DHCP requests from the active ring DHCP server cannot leave the ring.

4. Now verify that we have a DHCP pool available for use with DLR network:
   Select the **DLR** row then click **Edit**.

5. As you see, we have pre-configured 5 addresses to be assigned to the DLR devices if requested.

Click **OK** to close the window.
Configure Stratix 5700 as the Active DLR Supervisor.

6. To use Stratix DLR DHCP service, we need to force the Stratix 5700 to be the **Primary DLR Supervisor**. Select DLR from the **Configure** menu.
   
   Set Mode from Node to Supervisor, then change its Role (Precedence) to Primary and then click **Submit**.
   
   Acknowledge warnings (if any), then click **Submit**.

![Supervisor Configuration](image)

7. Switch back to the DLR Tool and click the **Connect** Icon.

8. Now you can see in DLR Tool that Stratix 5700 became the **Active DLR Supervisor**.
Configure switch DLR DHCP parameters.

9. In device manager, click the Config DHCP tab, then change Role to Primary and click Submit.

![Config DHCP](image)

10. Click Refresh button at the top right corner of the webpage.

11. Set the Number of Devices to 6 and click Submit again.

![Number of Devices](image)

12. Now you should see the list of 5 nodes with Index range from 2 to 6 that represent devices on the network.

![Device List](image)

The DLR Index is defined by the order of the devices on the DLR network starting with the lower numbered port of the Active DLR Supervisor. The Active DLR Supervisor is always at the Index 1.
13. Looking at the **DLR Tool**: In this Demo the lowest port of the Stratix Switch is **Fa1/7** and we have 5069-AENTR connected to it at the Index 2. Then we have the 1756-EN2TR is at the Index 3, following by the 1734-AENTR at the Index 4, 1783-ETAP at the Index 5 and Armor Block at the Index 6.

14. Go back to the Device Manager Web interface, highlight **Index 6** and click **Edit**.

15. We will assign IP address **192.168.1.13** to the Armor Block using pre-configured DLR pool:
16. Click **Ok** when finished. Now you can see this entry in the **DLR DHCP** table.

17. Check the **Ring DHCP Server Enable** Box.

![Check box for Ring DHCP Server Enable]

18. Click the **Submit** button (you may need to use scroll bars to locate it).

19. Now switch to the DLR Tool. You should see that Armor Block now has the IP address.

20. If you still see a **Question Mark “?”** instead of the icon you may need to restart the **DLR Tool**.

![Image of ARMOR Block]

Now all DLR devices have IP addresses.

This concludes the lab.
# Lab Configuration and Setup Guide

## Lab Information

<table>
<thead>
<tr>
<th>Lab Name</th>
<th>Basic Stratix® Switch and EtherNet/IP Features in Converged Plantwide Ethernet (CPwE) Architectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Description</td>
<td>This hands-on lab will cover a variety of techniques, best practices, software and products using EtherNet/IP. This lab will provide Stratix 5700 hardware familiarization, Stratix 5700 AOP and controller tags as well as using Stratix FactoryTalk View faceplates for diagnostics. Students will get introduction to the Device Level Ring Topology configuration and troubleshooting.</td>
</tr>
<tr>
<td>Lab Created by</td>
<td>Arkady Nabutovsky – Sr. Commercial Engineer</td>
</tr>
<tr>
<td>Date Created</td>
<td>09/22/2017</td>
</tr>
<tr>
<td>Last Updated by</td>
<td></td>
</tr>
<tr>
<td>Date Updated</td>
<td></td>
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</table>

## Hardware Configuration

<table>
<thead>
<tr>
<th>Qty</th>
<th>Demo Cat.# / Description</th>
<th>Slot</th>
<th>IP Address</th>
<th>Firmware</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ENET-21 Demo Box rev 2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ControlLogix Chassis</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>1756-L85E</td>
<td>Slot 0</td>
<td>192.168.1.5</td>
<td>V30.011</td>
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<tr>
<td></td>
<td>1756-EN2TR/C</td>
<td>Slot 1</td>
<td>192.168.1.10</td>
<td>V10.010</td>
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<tr>
<td></td>
<td>1756-IB16ISOE</td>
<td>Slot 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1756-OB16IEF</td>
<td>Slot 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5069 Chassis</td>
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<td></td>
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<tr>
<td></td>
<td>5069-AENTR</td>
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<td>192.168.1.11</td>
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<tr>
<td></td>
<td>5069-IB16F</td>
<td>Slot 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1756-OB16F</td>
<td>Slot 2</td>
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<tr>
<td></td>
<td>Stratix 5700 Ethernet Switch</td>
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<td></td>
<td>1734-IB8</td>
<td>Slot 1</td>
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<td>V3.022</td>
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<td>1734-OE2V</td>
<td>Slot 3</td>
<td></td>
<td>V3.005</td>
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<td></td>
<td>1732E-IB16M12SOEDR</td>
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<td>192.168.1.13 (DHCP)</td>
<td>V1.007</td>
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## Computer/Host Settings

<table>
<thead>
<tr>
<th>Location</th>
<th>Files</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Address</td>
<td>192.168.1.30</td>
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<tr>
<td>Operating System</td>
<td>Windows 10</td>
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### Application Versions

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Software</th>
<th>Version</th>
<th>Service Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA</td>
<td>Studio 5000</td>
<td>V30.00</td>
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</tr>
<tr>
<td>RA</td>
<td>RSLinx</td>
<td>V3.90</td>
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<tr>
<td>RA</td>
<td>FTViewSE</td>
<td>V9.00</td>
<td></td>
</tr>
</tbody>
</table>

### Demo Box Picture

This hands-on lab uses the ENET21 Demo Box with 2017 modifications. This system is comprised of Control Logix controller, Stratix 5700 Switch, Compact I/O rack, Point I/O rack, Armor Block module, and ETAP.

Note: The same demo box is used for other labs. The switch configuration and cabling for some of the devices may be different between the labs. Please make sure that correct reset steps are followed since the box may be configured for a different lab.
Lab Reset and Startup Procedures

This section describes how to reset the hardware and verify proper configuration when setting up the lab for the first time only. There is no need to reset lab between sessions as it will be done by the students.

Please read through all steps one time before hooking, and starting, up the lab.

1. Wire up all Ethernet devices to the corresponding Ethernet ports as seen below.

![Diagram of Lab Setup]

Verify the cabling for other devices according to the diagram. Note that these connections will not change during the normal lab steps. Restart the Basic EtherNet/IP lab VM image on the PC. The IP address of the VM is set to 192.168.1.30.

a. Blue Cable 1756-L85E Stratix port Fa1/2
b. White Cable 1756-EN2TR Port 1 Compact I/O Port 1
c. Yellow Cable Point I/O Port 1 Disconnected from 1756-EN2TR Port 2
d. Orange Cable Point I/O Port 2 1783-ETAP Port 1
e. Red Cable 1783-ETAP Port 2 Armor Block Port 2
f. Violet Cable Armor Block Port 1 Stratix port Fa1/8
g. Ivory Cable Stratix port Fa1/7 Compact I/O Port 2
h. Green Cable Computer Stratix port Gi1/1

**Important:** Please do not connect Yellow cable to the EN2TR Port 2. This will be done during the lab.
2. **There is no need to reset the Stratix 5700 switch.** The configuration will be reloaded by students as a part of the Lab 2 exercise. But you must verify that switch IP address is set to **192.168.1.1**.

3. Verify IP address assignment for the EN2TR modules via the LED display and in the RSLinx Classic.
   If addresses are not correct, verify rotary switches settings, then cycle demo box power.
   - a. L85E slot 0 – 192.168.1.5 static (Static IP mode using RSLINX)
   - b. EN2TR slot 1 - 192.168.1.10 (Static IP mode using rotary switches)
   - c. 5069-AENTR - 192.168.1.11 (Static IP mode using rotary switches)
   - d. 1734-AENTR - 192.168.1.12 (Static IP mode using rotary switches)
   - e. 1783-ETAP - 192.168.1.14 (Static IP mode using RSLINX)
   - f. 1732 Armor Block – DHCP, switches at 999

4. Make sure that DLR Supervisor mode is **disabled** on EN2TR modules 192.168.1.10

5. Make sure that the cable to the "**EN2TR Slot 1, Port 2** is **disconnected**.

6. It is recommended to run through the lab on all stations before the event starts.