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

Introduction

Stratix® 5700 Familiarization

Loading Stratix® Switch Configuration

EtherNet/IP devices and Stratix® switches in Studio 5000® Logix Editor

Stratix® 5700 Diagnostic Faceplate

Device Level Ring (DLR) Topology

Stratix® 5700 DLR DHCP Functionality
EtherNet/IP Technology

- The same Ethernet technology…
  - as email, voice, video, the Internet, web pages
  - as the corporate network
  - known by IT professionals
  - on your home and office computers

- Running Common Industrial Protocol (CIP™):
  - The most widely used standard, application layer industrial protocol globally
  - Standardized through IEC, ISO, ODVA, and others
  - Same technology as DeviceNet and ControlNet
  - Rockwell Automation® and Cisco and other major vendors like Schneider, Omron, Bosch-Rexroth & 300+
Trend – Technology Convergence

Convergence of Operational Technology (OT) with Information Technology (IT)
Reference Architectures
Converged Plantwide Ethernet (CPwE)

- Validated and documented reference architectures
  - Developed from customer use cases
  - Tested for performance, availability, scalability and security
    - “Future-ready” network design
- Content relevant to both OT and IT Engineers
  - Recommendations and best practices
  - Design and implementation guidance
  - Test results and configuration settings
- Simplified design, quicker deployment, reduced risk in deploying new technology
Cell Area Zone Within CPwE

Cell/Area Zone
Traditional Cell/Area Zone Network Architecture

- Controller can be accessed from the local or enterprise network
- Studio 5000® software access
- HMI and data collection access
- Use of diagnostic tools and web page
Traditional Cell/Area Zone Network Architecture

- I/O network is isolated
Traditional Cell/Area Zone Network Architecture

- Device access is limited by the backplane to CIP™ traffic only
Converged Cell/Area Zone Network Architecture

- Stratix® Switch can be a part of the I/O network
Converged Cell/Area Zone Network Architecture

- Allows full device access bypassing the controller
The following lab will demonstrate how EtherNet/IP and Stratix® managed switches improve reliability, manageability and overall ease of use through simplified integration.
Lab Agenda

- 6 Short Labs, 5–10 minutes each
  - Stratix 5700 hardware familiarization and commissioning
  - EtherNet/IP I/O and Stratix® 5700 in Studio 5000® environment
  - Stratix® Diagnostic faceplates
  - Device Level Ring (DLR) topology, configuration and diagnostic tools.
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Stratix® 5700

- 4 base platforms that offer 25 configurations
  - 6, 10, 18 and 20-port base units
  - 2 Gig port option
- SFP slots support multi- and singlemode fiber
  - Wide variety of SFPs available
- SecureDigital update card (optional)
  - Stores configuration and IOS of switch
- Power over Ethernet (PoE)
  - 4 ports PoE and PoE+ (port configurable)
- Two software packages
  - Lite and Full software versions
- Advanced feature set
  - Integrated DLR (on select versions)
  - Integrated NAT functionality (selected versions)
  - Connected and static routing

*Combo ports can be either copper or SFP
SD card for back-up
Manual pages 8–9
Network Switch Product Overview

- Stratix® 2000
- Stratix® 2500
- Stratix® 6000
- Stratix® 5700/ArmorStratix™ 5700
- Stratix® 8000/Stratix® 8300
- Stratix® 5400
- Stratix® 5410

**Categories:**
- **UNMANAGED**
- **LIGHTLY MANAGED**
- **FULLY MANAGED**
- **HIGH PERFORMANCE MANAGED**

- 100M/1G
- 10M
- 100M/1G
- 1G/10G
Network & Security Portfolio

Unmanaged Lightly Managed Stratix®
- Low-cost, compact solutions
- Automatically negotiates speed and duplex settings
- No configuration required, or can be configured to support security, resiliency and bandwidth optimization

Managed Switches Stratix®
- Access switches & distribution switches
- High-Performance switching up to 10 GB
- Integrated Network Address Translation
- Integrated DLR with three ring support
- IT and OT configuration and support tools

Wireless Technology Stratix®
- Connect hard-to-reach and remote areas
- Mobile access to equipment and key business systems
- Minimizes hardware and wiring

Security Appliances Stratix®
- Secure real-time control communication
- Intrusion prevention using Deep Packet Inspection capabilities
- Routing and firewall capabilities
- Access control lists

Communication Modules 1756
- Communication links between devices and ControlLogix® controller
- Can use EtherNet/IP, ControlNet, and DeviceNet network protocols
- Supports real-time I/O & exchange messaging

Embedded Switch & Linking Devices
- Connects control networks to device level networks
- Leverages existing network structures for migrations
Agenda

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**Loading Stratix® Switch Configuration**

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Stratix® 5700 DLR DHCP Functionality
Loading Stratix® Switch Configuration

- 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.
Loading Stratix® Switch Configuration

- Click the Stratix® icon located in the Desktop
- Security Certificate window will come up. Select “Continue to this website…”
- Use blank user name and password rockwell (low case)
- Select Admin -> Load/Save
- Click Browse and navigate to This PC > Desktop > Lab Files > Switch Configs
- Select the config.text file then click Upload
- Select the vlan.dat file then click Upload
- Cycle box power
Manual pages 10–13
Other Backup/Restore Options

- SD Card
- Back up and Restore Switch configuration using Add-on Profile
  - **Save/Restore** tab
- Command Line Interface (CLI)
- Cisco tools
  - Cisco network Assistant
  - Cisco Prime
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EtherNet/IP Devices and Stratix® Switches in Studio 5000® Logix Editor

- Import I/O modules - new way to manage I/O
  - Studio 5000® software version 30
  - Import predefined I/O modules and complete chassis into the project
  - Allows quick migration from project to project.

- In this lab, you will use **Import** functionality to add Compact I/O™ rack into the project.

- Then you explore the Stratix® 5700 Add-on Profile navigation and functionality it adds.
EtherNet/IP Devices and Stratix® Switches in Studio 5000® Logix Editor

- Common Industrial Protocol (CIP™) is implemented all Stratix® managed switch product families

- Allows retrieval of switch and network diagnostic data directly from the switch via its Add-On Profiles (AOPs) into the controller

- Additional information can be obtained via CIP™ Messaging

- Helps user make informed decisions when troubleshooting a problem to minimize the downtime
EtherNet/IP Devices and Stratix® Switches in Studio 5000® Logix Editor

- Must have steps in any Stratix® Switch configuration
  - Express Setup
  - Enable CIP™
  - Set Smartports
EtherNet/IP Devices and Stratix® Switches in Studio 5000® Logix Editor

- Connection Type “Data”
  - Configure switch parameters
  - Use Output tags to control switch functionality
- Default Connection Type: “Input Data”
  - Read-only information
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What Is FactoryTalk® View Faceplate?

- Faceplate is a pre-configured set of screens for FactoryTalk® View SE or ME
  - Interfaces with a specific device of feature
  - Provide HMI functionality and integration
- Can be added to a new or existing FactoryTalk® View application
- Provides real time data from a device on a single screen in an organized manner.
- Faceplate allows users to use preconfigured elements
  - Status
  - Control
  - Alarms
What Is FactoryTalk® View Faceplate?

- Typically a Faceplate consists of
  - An Add-On Instruction that brings device data into the Logix environment
  - A pre-configured screen displayed in FactoryTalk® View SE or FactoryTalk® View ME that interfaces with the Add-On Instruction
  - Implementation instructions and display overview manual
Faceplate Implementation - Logix

- Import Logix Rung
  - Customize Tag names during import process
  - Point Add-On Instruction path to the Switch
Faceplate Implementation – FactoryTalk® View

- Import FactoryTalk® View Components
  - Images
  - Global Objects
  - Faceplate and Help Displays
- Point OPC Topic to the Controller
- Link Parameters tag with FactoryTalk® View
Manual pages 21–26
How to Get Stratix® Faceplates?

- 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
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Stratix® 5700 DLR DHCP Functionality
Device-level Topology - Linear

- Comfort level with traditional field bus topology
- Eliminate cost of additional switches
- Simplify network cabling
- Applicable for certain applications that physically have a linear layout
  - Conveyor applications
  - Material handling application
Device-level Topology - Ring

- Making the Linear topology into a ring provides single fault tolerance
  - Network still functions if there is a (single) break
  - Better fault tolerance over normal Star topology
- A resiliency protocol is needed to:
  - Keep packets from circling the ring forever
  - Reconfigure to Linear topology in event of a fault
  - Detect ring restoration and reconfigure to ring mode
Device Level Ring Topology
Device Level Ring Protocol

- ODVA - open standard
- Support for ring and Linear topologies, fiber and copper implementations
- Single fault tolerant network
- Designed for 1-3 ms convergence for simple device networks
Device Level Ring Topology
Device Level Ring Protocol

- **Ring Supervisor**
  - Supervises the ring, one or more
  - Normally a scanner, controller or a dedicated supervisor

- **Ring Node, Beacon-based**
  - Member of the ring
  - Normally an adapter
  - Usually a hardware assisted solution

- **Ring Node, Announce-based**
  - Member of the ring
  - Normally an adapter
  - Software implementation based on a commercial switch
Device Level Ring Topology
Device Level Ring Protocol

- Supervisor blocks traffic on one port
- Sends Beacon frames on both ports to detect break in the ring
- Supervisor hears beacon on both ports indicating the normal ring mode
Device Level Ring Topology
Device Level Ring Protocol

- All faults that are detectable at physical layer
- Physical layer failure detected by protocol-aware node
- Status message sent by ring node and received by ring supervisor
Device Level Ring Topology
Device Level Ring Protocol

- After failure detection, ring supervisor unblocks blocked port
- Network configuration is now a Linear topology
- Fault location is readily available via diagnostics
Once ring is restored, supervisor hears beacon on both ports, and transitions to normal ring mode, blocking one port.
Device Level Ring (DLR) Topology
Manual pages 27–35
Device Level Ring (DLR) Topology

- What Stratix® switches support DLR functionality?
  - All Stratix® 5400 switches (up to three rings)
  - Stratix® 5700 switches
    - All 20-Port models
    - All 18 Port Models
    - Two 10-port models (catalog numbers ending with GP or GN)
  - ArmorStratix™ 5700 switches
    - All 10 Port Models
    - All 18 Port Models
Device Level Ring (DLR) Topology

- What is the difference between DLR Tool and DLR faceplate?
  - DLR Tool is Windows application that requires RSLinx® only
  - DLR Faceplate is an HMI display component to be used with FactoryTalk View SE or ME
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Stratix® 5700 DLR DHCP Functionality
What Is DHCP?

- Dynamic Host Configuration Protocol (DHCP) is a protocol for assigning dynamic IP addresses to devices on a network.
- **DHCP Server** functionality assigns IP address from a pool of available addresses to the devices (**DHCP Clients**)
- If a device leaves and then rejoins the network, it may not get the same address.
- **DHCP Persistence** can be used to assign specific IP addresses.
DHCP in Stratix® 5700 Switches

- Can function as a DHCP server on the network
- Supports DHCP Persistency
  - Per port
  - Based on device location on DLR network
Device Level Ring and DHCP

- Provides assignment of fixed IP addresses to devices on the ring
- DHCP configuration table is defined in active supervisor
  - Table does not have to include all devices on the ring
  - Configuration table “Index” increments around the ring using the lowest switch ring port number as the starting point
- Switch creates reference table by combining configuration table and DLR participant table

<table>
<thead>
<tr>
<th>Index</th>
<th>IP address</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>192.168.1.102</td>
</tr>
<tr>
<td>3</td>
<td>192.168.1.103</td>
</tr>
<tr>
<td>5</td>
<td>192.168.1.105</td>
</tr>
<tr>
<td>6</td>
<td>192.168.1.107</td>
</tr>
</tbody>
</table>
Stratix® 5700 DLR DHCP Functionality

- Will assign IP address to the Armor Block module using DLR DHCP functionality
Stratix® 5700 DLR DHCP Functionality

- Steps to follow:
  - Set Stratix® 5700 as a Primary Supervisor
  - Specify IP address for Armor Block in the Node table
  - Enable DLR DHCP
Manual pages 36–41
Conclusion

- Stratix® managed switches
  - Improve manageability
  - Ease of use
  - Simplified integration
  - Improve reliability
Thank You!