



A Resilient Converged Plantwide Ethernet Architecture

Rockwell Automation and Cisco Four Key Initiatives:

- **Common Technology View:**
A single system architecture, using open, industry standard networking technologies, such as Ethernet and IP, is paramount for achieving the flexibility, visibility and efficiency required in a competitive manufacturing environment.
- **Converged Plantwide Ethernet Architectures:**
These manufacturing focused reference architectures, comprised of the Rockwell Automation Integrated Architecture® and Cisco's Ethernet to the Factory, provide users with the foundation for success to deploy the latest technology by addressing topics relevant to both engineering and IT professionals.
- **Joint Product and Solution Collaboration:**
Stratix 5700™, Stratix 5400™ and Stratix 5410™ Industrial Ethernet switches incorporating the best of Cisco and the best of Rockwell Automation.
- **People and Process Optimization:**
Education and services to facilitate Operational Technology (OT) and Information Technology (IT) convergence and allow successful architecture deployment and efficient operations allowing critical resources to focus on increasing innovation and productivity.

White Paper

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Business practices, corporate standards, industry standards, policies and tolerance to risk are key factors in determining the degree of resiliency and application availability required within a plant-wide architecture. A resilient network architecture within an Industrial Automation and Control System (IACS) application plays a pivotal role in helping to minimize the risk of application shutdowns while helping to maximize overall plant uptime.

An IACS is deployed in a wide variety of industries such as automotive, pharmaceuticals, consumer goods, pulp and paper, oil and gas, mining and energy. IACS applications are made up of multiple control and information disciplines such as continuous process, batch, discrete and hybrid combinations. A resilient network architecture can help to increase overall equipment effectiveness (OEE) of the IACS by reducing the impact of a failure and speed recovery from an outage which lowers mean-time-to-repair (MTTR).

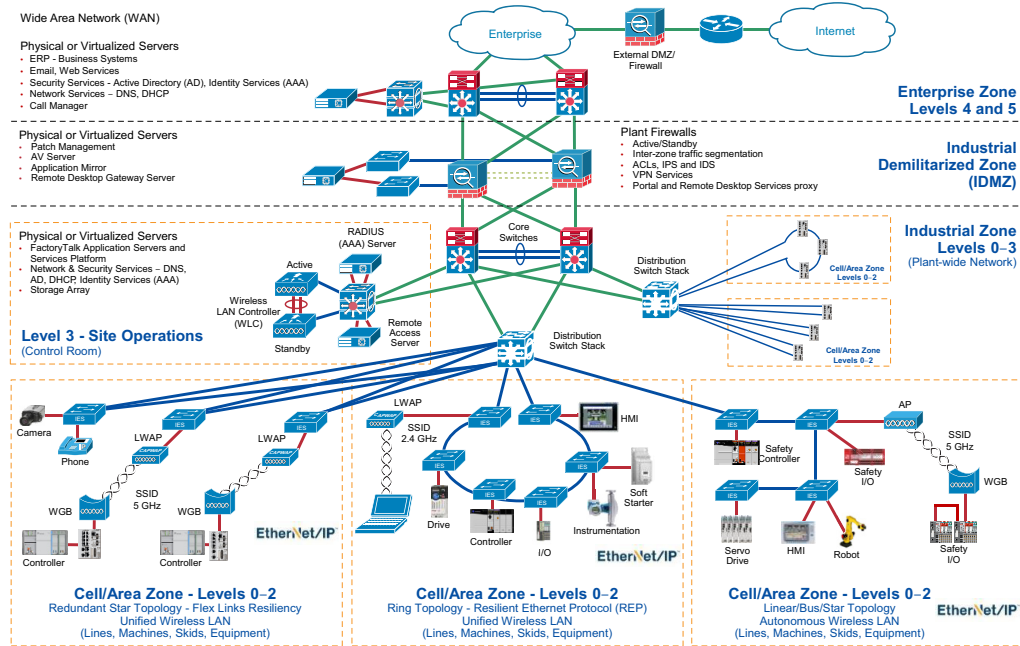
A holistic resilient plant-wide network architecture is made up of multiple technologies (logical and physical) deployed at different levels within the plant:

- Robust physical infrastructure
- Topologies and protocols
- Switching and routing
- Wireless LAN Controllers (WLC)
- Firewalls
- Network and device management

Converged Plantwide Ethernet (CPwE) is the underlying architecture that provides standard network services for control and information disciplines, devices and equipment found in modern IACS applications. The CPwE architecture ([Figure 1](#)) provides design and implementation guidance to achieve the real-time communication, reliability, scalability, security and resiliency requirements of the IACS.

CPwE Resiliency for IACS applications is brought to market through a strategic alliance between Cisco Systems® and Rockwell Automation.

Figure 1 CPwE Architectures



Converged Plantwide Ethernet Resiliency

The CPwE Resiliency Cisco Validated Design (CVD) outlines key requirements and design considerations to help with successfully designing and deploying a holistic resilient plant-wide network architecture.

- **Industrial Zone:**
 - Core Switching
 - Aggregation/Distribution Switching
 - Active/Standby Wireless LAN Controllers (WLC)
 - Prime Infrastructure Network Management
 - Robust Physical Infrastructure
- **Cell/Area Zone:**
 - Redundant Path Topology with Resiliency Protocol
 - Industrial Ethernet Switching
 - Robust Physical Infrastructure
- **Level 3 Site Operations:**
 - Virtual Servers
 - Security and Network Services
 - Robust Physical Infrastructure
- **Industrial Demilitarized Zone (IDMZ):**
 - Active/Standby Firewalls
 - Robust Physical Infrastructure

**Note**

This release of the CPwE architecture focuses on EtherNet/IP™, which is driven by the ODVA Common Industrial Protocol (CIP™).

CPwE Resiliency Use Cases

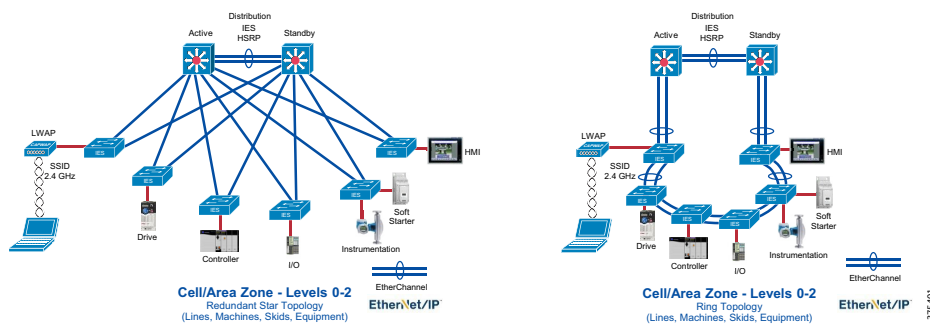
The CPwE architecture supports scalability which includes the degree of resiliency applied to a plant-wide network architecture. Scalable resiliency comes in many forms; that is, technology choices in topology and distribution switch. For the CPwE Resiliency CVD, the following represents a portion of the use cases that were tested, validated and documented by Cisco and Rockwell Automation.

Allen-Bradley® Stratix™ and Cisco Industrial Ethernet Switches (IES)

Refer to [Figure 2](#).

- Form factor:
 - DIN rail / panel mount
 - 1 RU (rack unit)
- Hot Standby Routing Protocol (HSRP) first hop redundancy protocol
- Redundant star switch-level topology:
 - Flex Links resiliency protocol
 - MSTP resiliency protocol
- Ring switch-level topology:
 - Resilient Ethernet Protocol (REP)
 - Multiple Spanning Tree Protocol (MSTP) resiliency protocol
 - Single and dual fiber ring

Figure 2 IES Aggregation/Distribution Switch

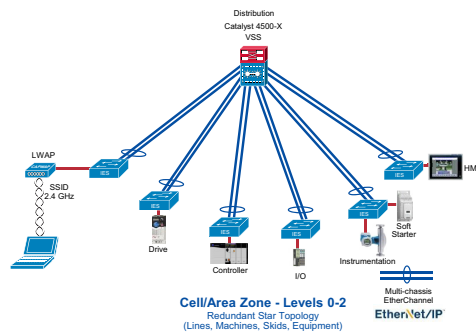


Catalyst 4500-X Aggregation/Distribution Switches

Refer to [Figure 3](#).

- Virtual Switching System (VSS) virtualization technology that pools multiple physical switch chassis into one virtual switch, with Stateful Switch Over (SSO)
- Redundant star switch-level topology:
 - Multi-chassis EtherChannel (MEC) port aggregation
 - Flex Links resiliency protocol
 - MSTP resiliency protocol
- Ring switch-level topology:
 - Resilient Ethernet Protocol (REP)
 - Multiple Spanning Tree Protocol (MSTP) resiliency protocol
 - Single and dual fiber ring
- Prime Infrastructure Network Management

Figure 3 Catalyst 4500-X Aggregation/Distribution Switch

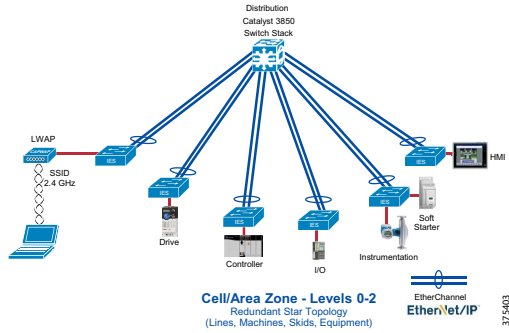


Catalyst 3850 StackWise Aggregation/Distribution Switch

Refer to [Figure 4](#).

- Switch stack, which is a set of up to nine stacking-capable switches, connected through their StackWise Plus or StackWise ports, and united to form a logical unit
- Redundant star switch-level topology:
 - EtherChannel port aggregation
 - Flex Links resiliency protocol
 - MSTP resiliency protocol
- Ring switch-level topology:
 - Resilient Ethernet Protocol (REP)
 - Multiple Spanning Tree Protocol (MSTP) resiliency protocol
 - Single and dual fiber ring
- Prime Infrastructure Network Management

Figure 4 Catalyst 3850 Aggregation/Distribution Switch

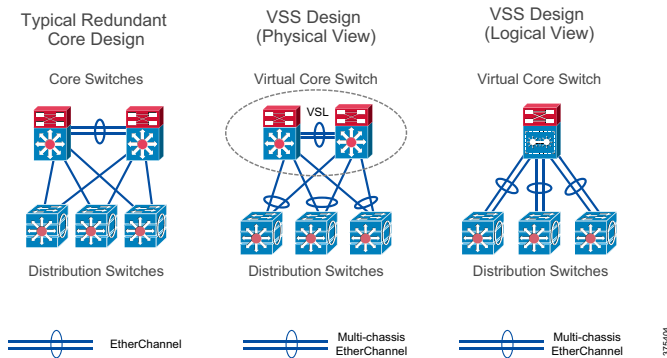


Catalyst 6800/6500-E Core Switches

Refer to [Figure 5](#).

- VSS virtualization technology that pools multiple physical switch chassis into one virtual switch, with SSO
- Prime Infrastructure Network Management

Figure 5 Core Switches - Traditional vs. VSS Design

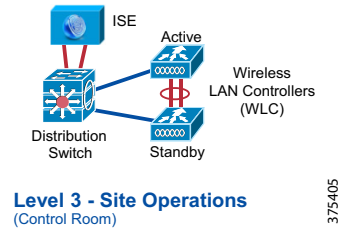


5508 Wireless LAN Controller (WLC)

Refer to [Figure 6](#).

- Unified WLC, which supports the SSO of Access Points and Clients (AP and Client SSO). AP establishes a Control And Provisioning of Wireless Access Points (CAPWAP) tunnel with the Active WLC and shares a mirror copy of the AP database with the Standby WLC.
- Prime Infrastructure Network Management

Figure 6 Active/Standby Wireless LAN Controllers (WLC)

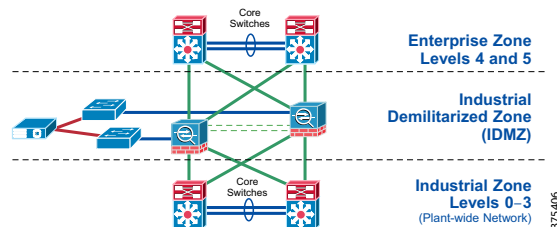


Adaptive Security Appliance 5500-X Firewalls with FirePOWER

Refer to [Figure 7](#).

- Active/Standby stateful failover mechanism enabling a standby Adaptive Security Appliance (ASA) to take over the functionality of a failed unit. When the active unit fails, it changes to the standby state while the standby unit changes to the active state.
- Adaptive Security Device Manager (ADSM)

Figure 7 Active/Standby Firewalls



Robust Physical Infrastructure

Refer to [Figure 8](#). For this CPwE Resiliency CVD, the following use cases were documented by Panduit®:

- Robust physical infrastructure design considerations and best practices
- Control Panel:
 - Electromagnetic interference (EMI) noise mitigation through bonding, shielding and grounding
 - IES deployment within the Cell/Area Zone
- Physical Network Zone System:
 - IES and AP deployment within the Cell/Area Zone
- Cable distribution across the Industrial Zone
- Industrial Distribution Frame (IDF):
 - Industrial aggregation/distribution switch deployment within the Industrial Zone
- Industrial Data Center (IDC):
 - Physical design and deployment of the Level 3 Site Operations

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