

BUILDING

CONVERGED

PLANTWIDE

ETHERNET
ARCHITECTURES

Building Converged Plantwide Ethernet Architectures

Converged Plantwide Ethernet (CPwE) Architectures

PUBLIC

 Allen-Bradley • Rockwell Software

Rockwell
Automation

Abstract

- Learn why and how to use reference architectures to build a scalable, reliable, safe, secure and future-ready network infrastructure. This discussion provides an overview of the Cisco and Rockwell Automation® Converged Plantwide Ethernet (CPwE) architectures. Learn what defines a reference architecture, why they're important and how these architectures combined with products, services and solutions support successful deployment of The Connected Enterprise. A prior understanding of general Ethernet concepts, or attendance of the fundamentals of EtherNet/IP network technology is recommended.

Agenda

- What's Driving This?
 - Why are Reference Architectures Important?
 - OT-IT Similarities and Differences
- CPwE Architectures
 - Cisco and Rockwell Automation Alliance
 - What Makes Up CPwE
 - Convergence-Ready Network Solutions
- Additional Material
- Training Resources

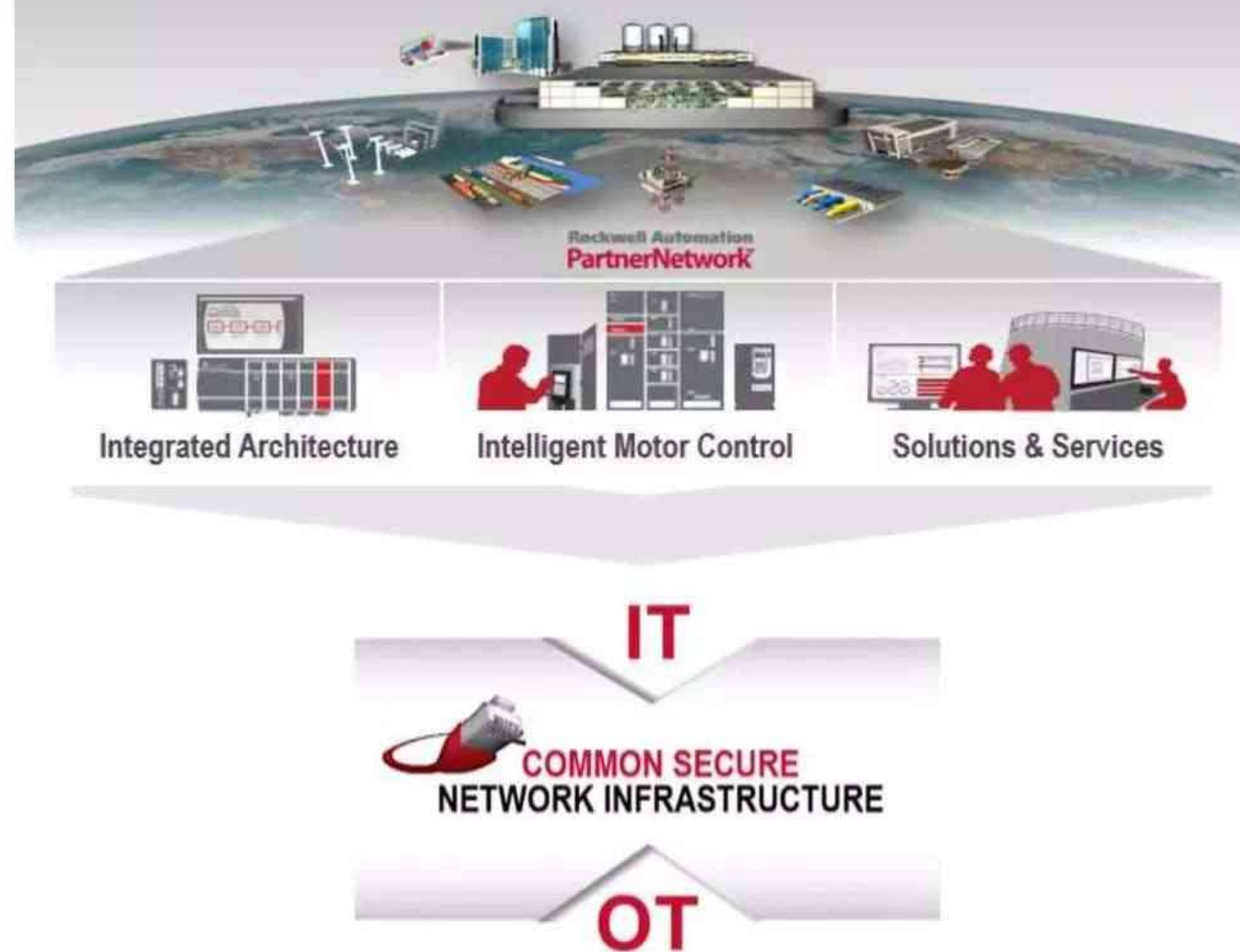
What's Driving This?

What's Driving This?

Reliable, Safe and Secure Architectures for The Connected Enterprise

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THE CONNECTED ENTERPRISE



A reliable, secure architecture is critical to building a connected enterprise

➤ Application

**Rockwell
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PartnerNetwork

➤ Software

**Rockwell
Automation**

PartnerNetwork

➤ Network

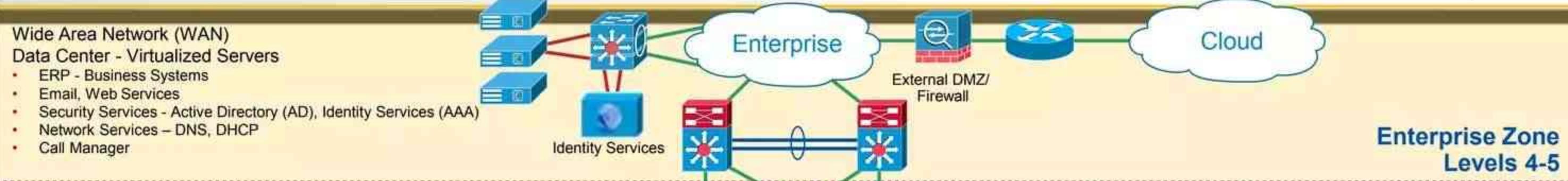
**Rockwell
Automation**

PartnerNetwork

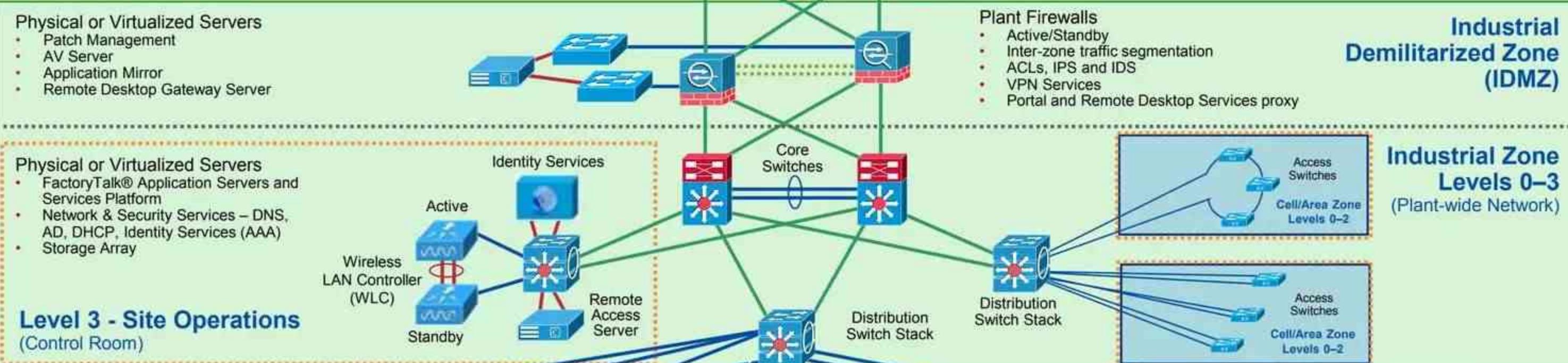
EtherNet/IP®

What's Driving This?

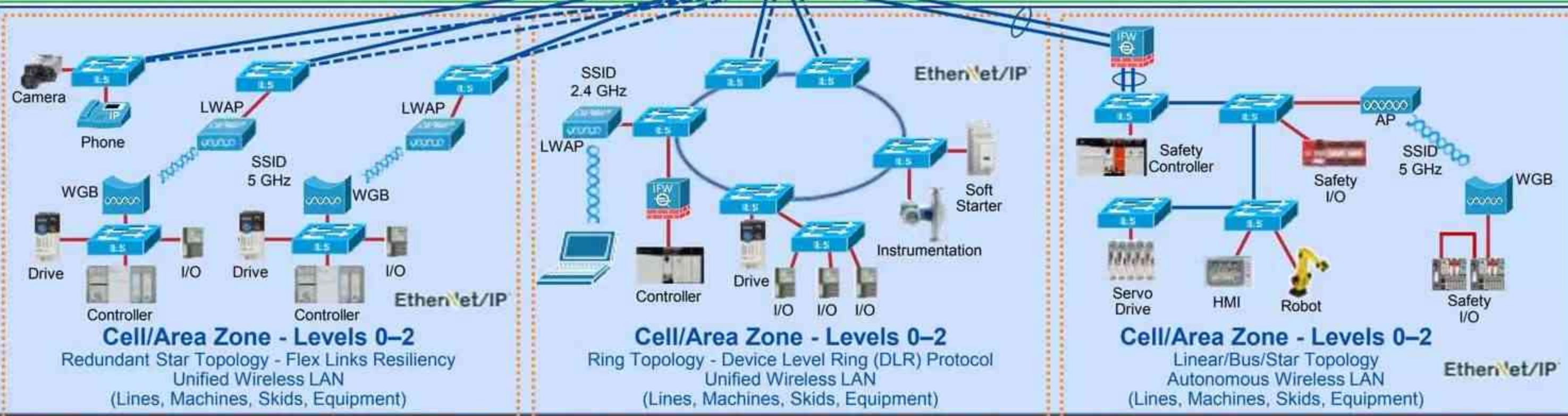
Reliable, Safe and Secure Architectures for The Connected Enterprise



Information Technology



Industrial IT



Industrial IoT Operational Technology

What's Driving This?

People Convergence

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Industrial IoT



Technology
Convergence

Network
Convergence

Organizational
Convergence

Cultural
Convergence

Ethernet and IP
Wide Deployment

Increasing Business
Pressures

- Sharing of engineering best practices between Control System Engineers (OT) and IT Network Engineers:
 - Standardization of design and technology
 - Reference architectures, reference models, industry and technology standards

What's Driving This?

Technology and Cultural Convergence - Similarities and Differences

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Criteria	Industrial OT Network	Enterprise IT Network
Environment	<ul style="list-style-type: none">• Plant-floor• Control Room• Control Panel, Industrial Distribution Frame (IDF)	<ul style="list-style-type: none">• Carpeted Space, Data Center• Data Communication or Wiring Closet, Intermediate Distribution Frame (IDF)
Switches	<ul style="list-style-type: none">• Managed and unmanaged• Layer 2 is predominant• DIN rail or panel mount is predominant	<ul style="list-style-type: none">• Managed• Layer 2 and Layer 3• Rack mount
Wireless	<ul style="list-style-type: none">• Autonomous (locally managed) – point solutions• Mobile equipment (emerging) and personnel (prevalent)	<ul style="list-style-type: none">• Unified (centrally managed) solutions• Mobile personnel – corporate provided or BYOD• Guest access
Computing	<ul style="list-style-type: none">• Industrial Hardened Panel Mount Computers and Monitors• Desktop, Notebook• 19" Rack Server• Virtualization - becoming prevalent• Hardening – Sporadic patching and white listing	<ul style="list-style-type: none">• Desktop, Notebook• Tablets• 19" Rack Server and Blade Server• Unified Computing Systems (UCS)• Virtualization – widespread• Hardening - Patching and white listing

What's Driving This?

Technology and Cultural Convergence - Similarities and Differences

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Criteria	Industrial OT Network	Enterprise IT Network
Network Technology	<ul style="list-style-type: none">Standard IEEE 802.3 Ethernet and proprietary (non-standard) versionsStandard IETF Internet Protocol (IPv4) and proprietary (non-standard) alternativesSporadic use of standard Layer 2 and Layer 3 network and security services	<ul style="list-style-type: none">Standard IEEE 802.3 EthernetStandard IETF Internet Protocol (IPv4 and IPv6)Pervasive use of standard Layer 2 and Layer 3 network and security services
Network Availability	<ul style="list-style-type: none">Switch-Level and Device-Level topologiesRing topology is predominant for both, Redundant Star for switch topologies is emergingStandard IEEE, IEC and vendor specific Layer 2 resiliency protocols	<ul style="list-style-type: none">Switch-Level topologiesRedundant star topology is predominantStandard IEEE, IETF, and vendor specific Layer 2 and Layer 3 resiliency protocols
Service level agreement (SLA)	<ul style="list-style-type: none">Mean time to recovery (MTTR) - Minutes, Hours	<ul style="list-style-type: none">Mean time to recovery (MTTR) - Hours, Days
IP Addressing	<ul style="list-style-type: none">Mostly Static	<ul style="list-style-type: none">Mostly Dynamic

What's Driving This?

Technology and Cultural Convergence - Similarities and Differences

**Rockwell
Automation**

Criteria	Industrial OT Network	Enterprise IT Network
Traffic Type	<ul style="list-style-type: none">• Primarily local – traffic between local assets• Information, control, safety, motion, time synchronization, energy management• Smaller frames for control traffic• Industrial application layer protocols: CIP, Profinet, IEC 61850, Modbus TCP, etc.	<ul style="list-style-type: none">• Primarily non-local – traffic to remote assets• Voice, Video, Data• Larger packets and frames• Standard application layer protocols: HTTP, SNMP, DNS, RTP, SSH, etc.
Performance	<ul style="list-style-type: none">• Low Latency, Low Jitter• Data Prioritization – QoS – Layer 2 & 3	<ul style="list-style-type: none">• Low Latency, Low Jitter• Data Prioritization – QoS – Layer 3
Security	<ul style="list-style-type: none">• Open by default, must secure by configuration and architecture• Industrial security standards – e.g. IEC, NIST• Inconsistent deployment of security policies• No line-of-sight to the Enterprise or to the Internet	<ul style="list-style-type: none">• Pervasive• Enterprise security best practices• Strong security policies• Line-of-sight across the Enterprise and to the Internet

What's Driving This?

Security Policies - Similarities and Differences



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Criteria	Industrial OT Network	Enterprise IT Network
Focus	24/7 operations, high OEE	Helping to protect intellectual property and company assets
Precedence of Priorities	Availability Integrity Confidentiality	Confidentiality Integrity Availability
Types of Data Traffic	Converged network of data, control, information, safety and motion	Converged network of data, voice and video
Access Control	Strict physical access Simple network device access	Strict network authentication and access policies
Implications of a Device Failure	Production is down (\$\$'s/hour ... or worse)	Workaround or wait
Threat Protection	Isolate threat but keep operating	Shut down access to detected threat
Upgrades	Scheduled during downtime	Automatically pushed during uptime

What's Driving This?

Business Outcomes – Industrial IoT / Industrial IT (Bridging OT-IT)



- Smart Devices, Smart Machines, Smart Manufacturing
- Standard Network and Security Services; Standard Network Tools
- Customer choice of best-in-class products through Industrial IoT device coexistence and interoperability
- Pervasive Asset Optimization and Utilization
 - Common infrastructure devices and tools
 - Human assets: knowledge, experience, training
- Better Analytics
 - Device/Machine, System/Plant, Enterprise
- Enables Innovative Technologies
 - Mobility – Personnel and Equipment
 - Cloud –On Premise and Off Premise

What's Driving This?

Application Requirements

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- What is secure? What is real-time? What is resilient?

	Process Automation	Discrete Automation	Loss Critical
Function	Information Integration, Slower Process Automation	Time-critical Discrete Automation	Multi-axis Motion Control
Comm. Technology	.Net, DCOM, TCP/IP	Industrial Protocols - CIP	Hardware and Software solutions, e.g. integrated motion on the EtherNet/IP network, PTP
Period	10 ms to 1 second or longer	1 ms to 100 ms	100 µs to 10 ms
Industries	Oil and gas, chemicals, energy, water	Auto, food and beverage, semiconductor, metals, pharmaceutical	Subset of Discrete automation
Applications	Pumps, compressors, mixers; monitoring of temperature, pressure, flow	Material handling, filling, labeling, palletizing, packaging; welding, stamping, cutting, metalforming, soldering, sorting	Synchronization of multiple axes: printing presses, wire drawing, web making, picking and placing

Application
dependent
Only you can
define what this
means for your
application.

Source: ARC
Advisory Group

CPwE Architectures

Key Takeaways

Converged Plantwide Ethernet (CPwE) Architectures



- Cisco – Rockwell Automation® Strategic Alliance Program
- 10 Years of Collaboration
- 10 Tested and Validated Architectures
 - Design Considerations
 - Best Practices
 - Documented Test Results
 - Documented Configurations
- Proven Architectures
 - Enables OT-IT Convergence
 - Industrial IT (bridging OT-IT)
 - Industrial IoT
 - Helps customer to reduce costs
 - Simplified Design
 - Quicker Deployment
 - Reduced risk in deploying newer technologies

Cisco and Rockwell Automation® Alliance

Technology, Network, Cultural and Organizational Convergence

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Common Technology View:

A single scalable architecture, using open and standard Ethernet and IP networking technologies, such as EtherNet/IP, enabling the Industrial Internet of Things to help achieve the flexibility, visibility and efficiency required in a competitive manufacturing environment.

Converged Plantwide Ethernet (CPwE) Architectures:

Collection of tested and validated architectures developed by subject matter authorities at Cisco and Rockwell Automation®. The content of CPwE is relevant to both Operational Technology (OT) and Information Technology (IT) disciplines and consists of documented architectures, best practices, guidance and configuration settings to help manufacturers with design and deployment of a scalable, reliable, safe, secure and future-ready plant-wide industrial network infrastructure.

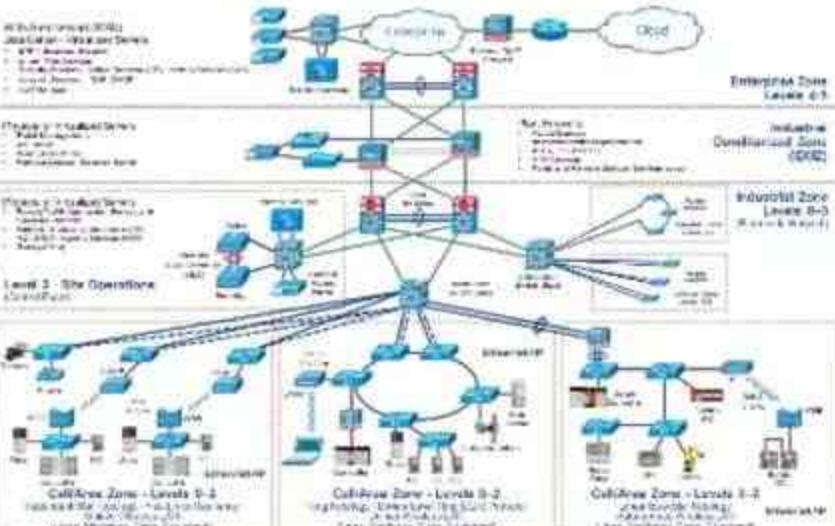
Joint Product Collaboration:

Stratix® 5900 Services Router, Stratix® 5950 Industrial Firewall, Stratix® 5100 Wireless Access Point/Workgroup Bridge, and Stratix® 5000/Stratix® 8000 families of managed industrial Ethernet switches, which combine the best of both Rockwell Automation® and Cisco.

People and Process Optimization:

Education and services to facilitate OT and IT convergence, assist with successful architecture deployment, and enable efficient operations that allow critical resources to focus on increasing innovation and productivity.

EtherNet/IP™

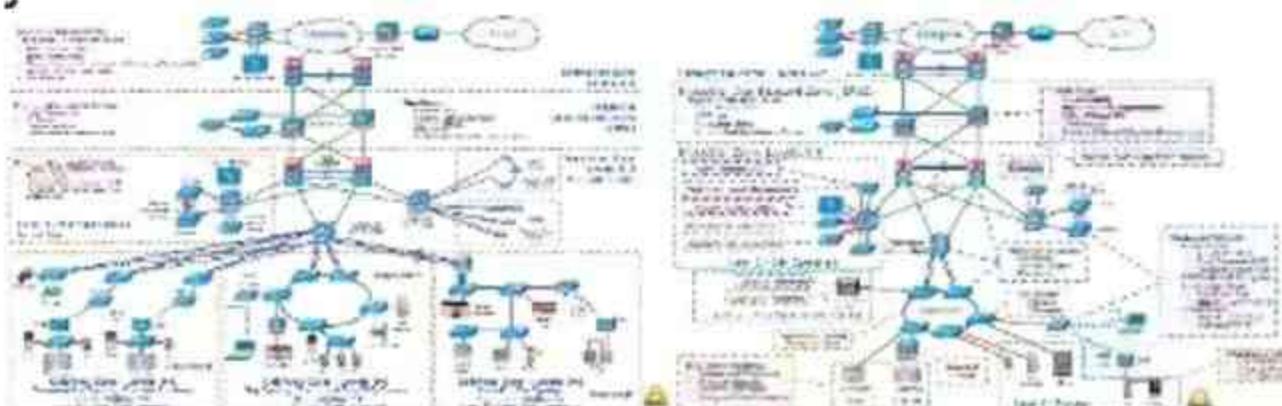


Converged Plantwide Ethernet (CPwE)

Industrial IoT / Industrial IT (Bridging OT-IT)

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- Tested, validated and documented reference architectures
 - Comprised of a collection of Cisco and Rockwell Automation® validated architectures, following the Cisco Validated Design (CVD) program
 - Developed from application and technology use cases
 - Industry neutral, one-to-many approach, customers adapt to meet their application needs
 - **Tested for performance, availability, repeatability, scalability and security** by subject matter authorities at Cisco and Rockwell Automation® CPwE test labs
- Built on technology and industry standards (IEC, IEEE, IETF)
 - “Future-ready” network and security design
 - Content relevant to both OT and IT Engineers
- Deliverables
 - [White Papers](#), [Design & Implementation Guides](#) - architectures, design considerations, best practices, documented test results with configuration settings
- **Proven architectures:**
 - Helps customers to reduce their costs by simplifying their designs, accelerating their deployments, and reducing their risk in deploying new technology



CPwE – Proven Architectures

Customer (OT-IT) Value Statements



- Valued resource
 - To help us with our own OT-IT convergence – Industrial IT
 - Proven architectures – cost reduction, risk reduction
- We've come to expect it
 - Architectural collaboration between Cisco and Rockwell Automation®
 - We adapt CPwE into our global standards
- Unique in the industry
 - No other company, organization or consortia provides the level of testing, validation and documentation that CPwE provides
- We use CPwE to help us justify network and security projects
 - Architectural Framework
 - Best practices
 - Design and Implementation Guidance

CPwE – Proven Architectures

Customer (OT-IT) Value Statements



- We have adopted 7 of the 10 CPwE tested and validated architectures into our global network design and specifications for our plants and OEMs
 - CPwE Architectures :
 - Baseline – CPwE Model/Framework, Industrial Network Security Framework
 - WLAN – Unified Architecture for Mobile Maintenance Personnel
 - NAT – Cloning of OEM Applications
 - ISE – Identity Services PAN and PSN within Plant Network – Wired and Wireless
 - IDMZ – ASA Firewall Policies between OT and IT Networks
 - Resiliency – Stratix® 5700 switch with Redundant Star (EtherChannel), Catalyst 3850, Catalyst 4500-X with VSS
 - IFW - Firewall Policies for ASA, they do not currently use Stratix® 5950 security appliance
 - We value the OT-IT collaboration between Rockwell Automation® and Cisco
 - We standardized on Stratix® industrial Ethernet switches due to CPwE

Key Requirements:

- Scalable
- Reliable
- Safe
- Secure
- Future-ready

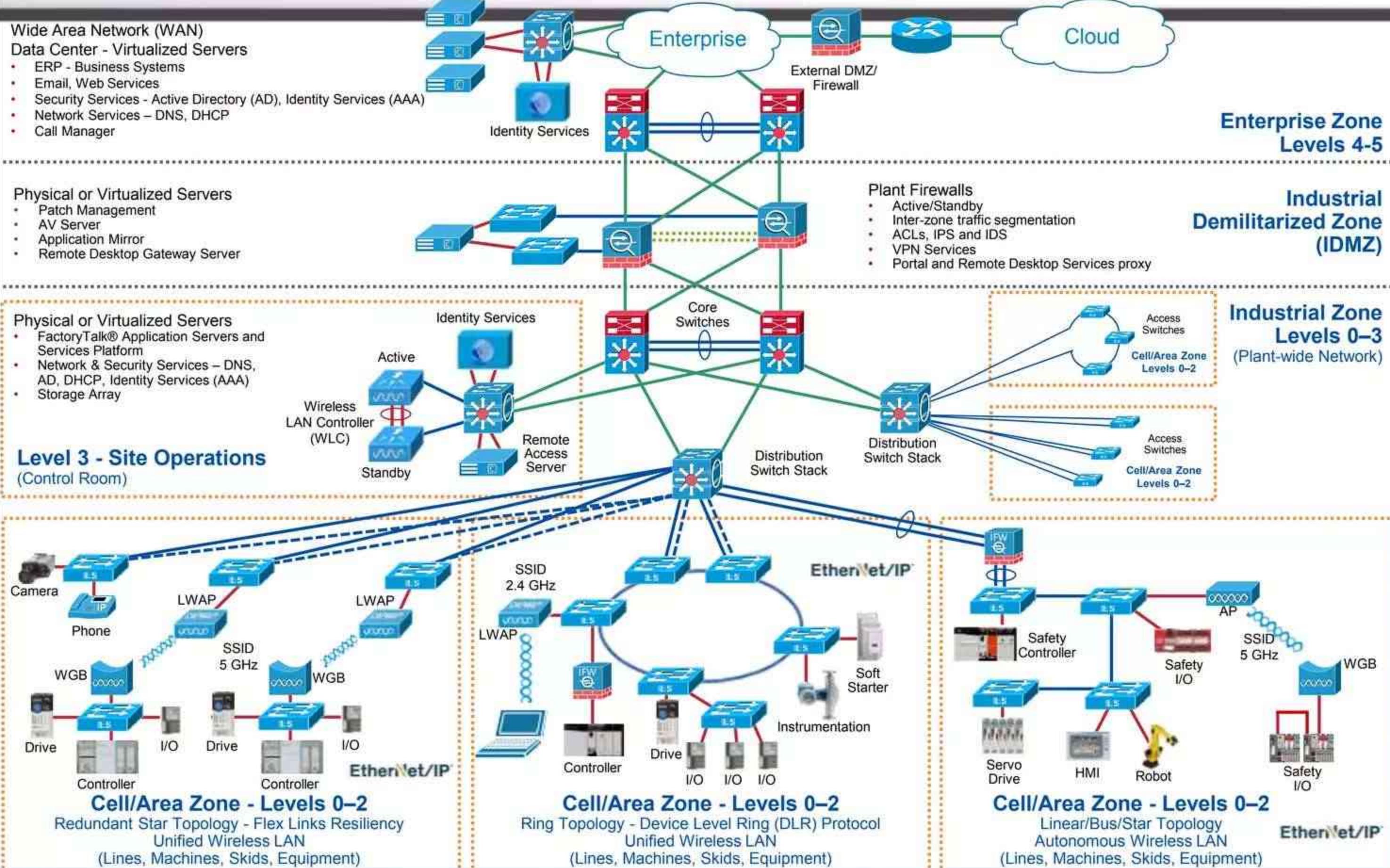
Key Tenets:

- Smart Endpoints
- Segmentation (Zoning)
- Managed Infrastructure
- Resiliency
- Time-critical Data
- Wireless - Mobility
- Holistic Defense-in-Depth Security
- Convergence-ready

CPwE Architectures

Collection of Cisco and Rockwell Automation® Tested & Validated Designs

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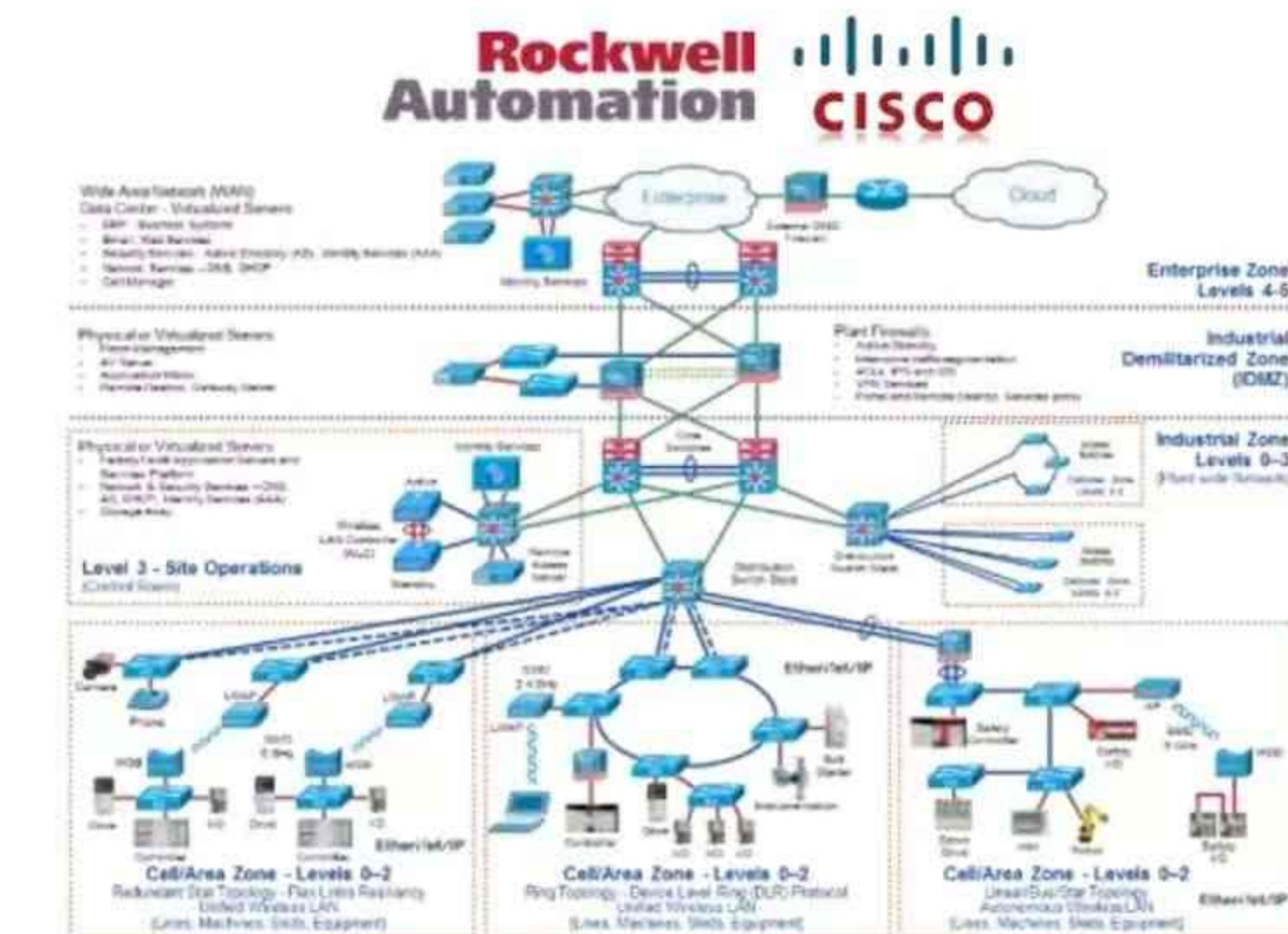
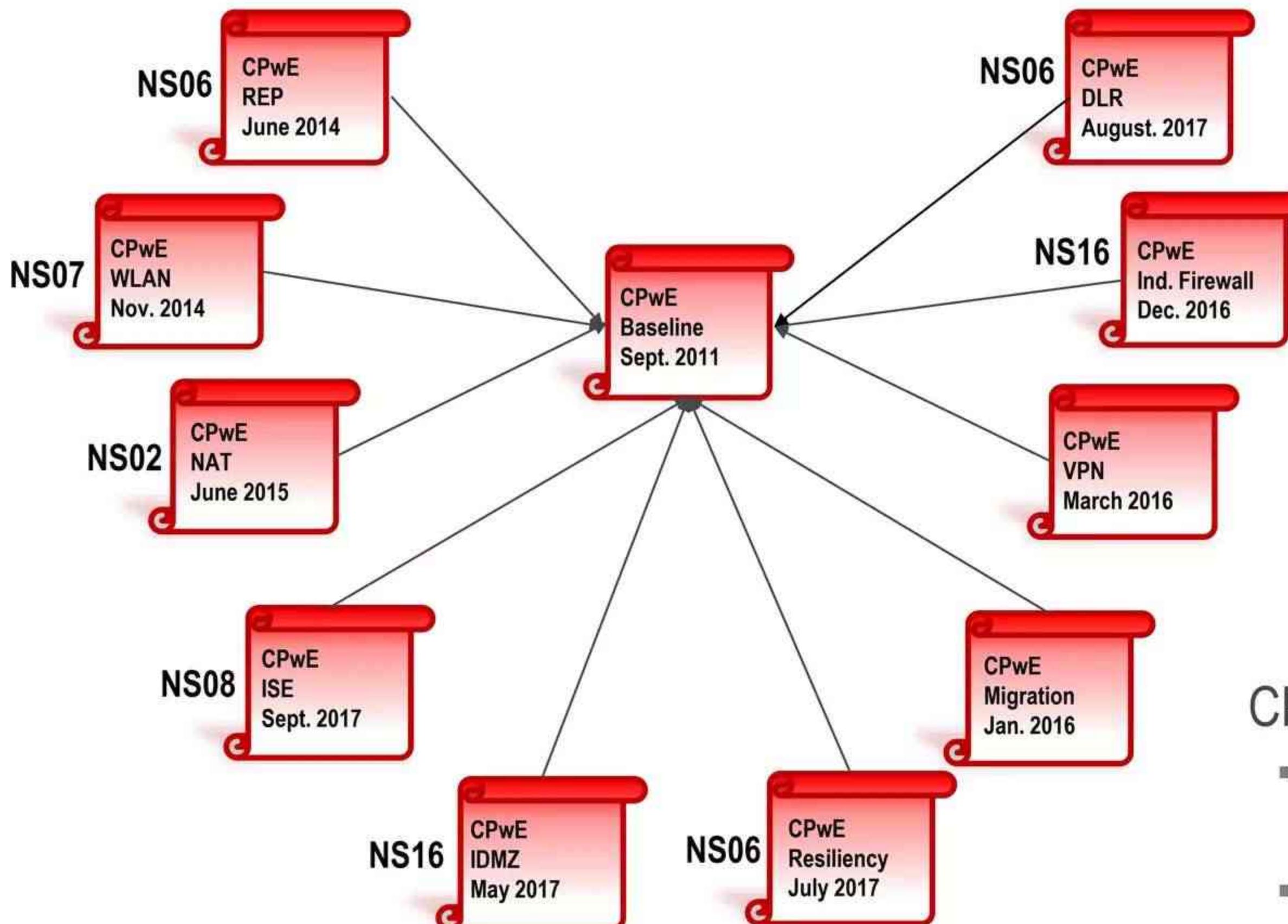
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CPwE Test Labs

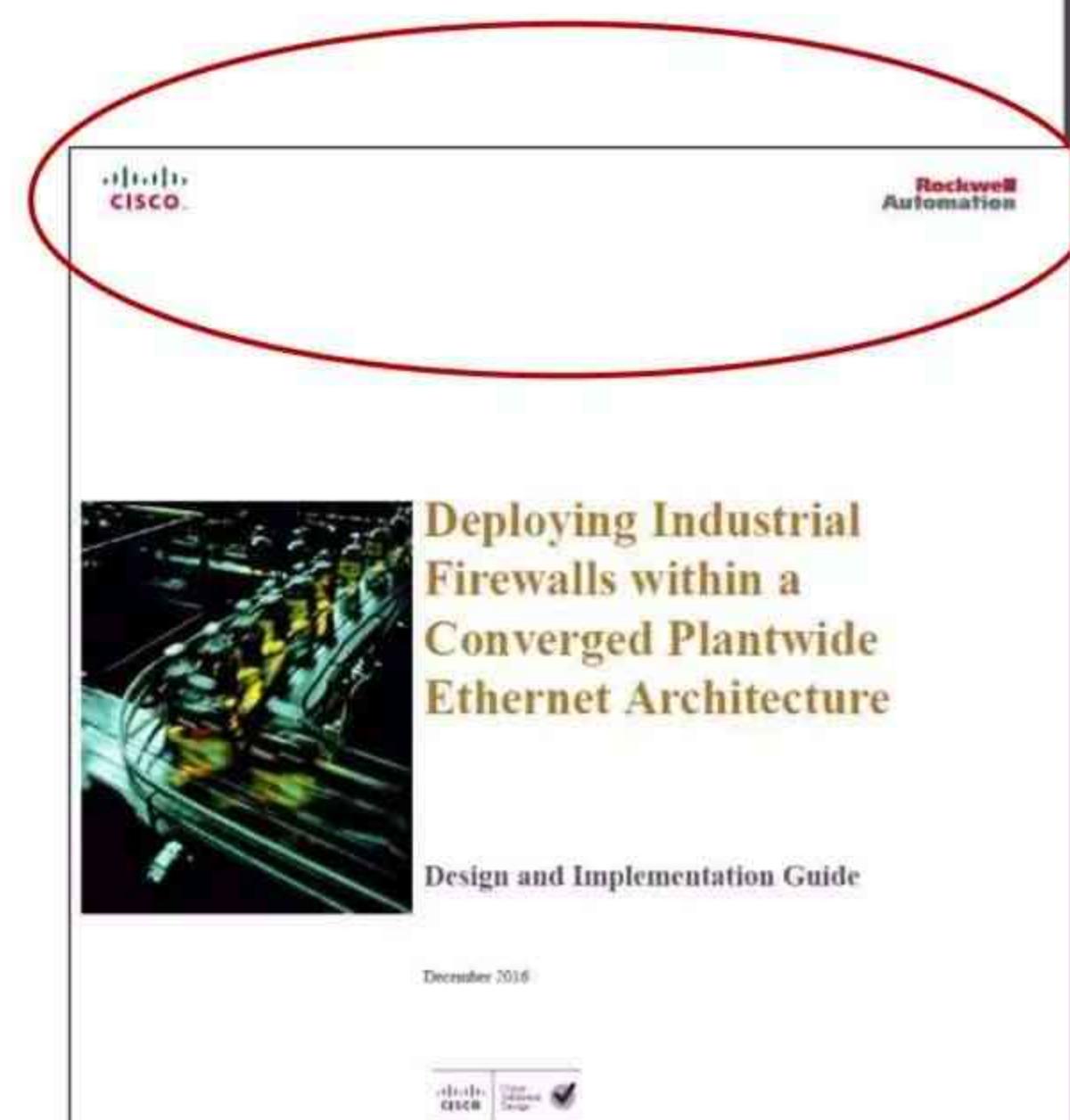
- Rockwell Automation® – Mayfield Heights, OH
- Cisco – Raleigh, NC (RTP)
- Panduit – Tinley Park, IL

CPwE Architectures

Collection of Cisco and Rockwell Automation® Tested & Validated Designs

**Rockwell
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- Converged Plantwide Ethernet (CPwE) is a collection of tested and validated architectures that are developed by subject matter authorities at Cisco and Rockwell Automation® and that follow the Cisco Validated Design (CVD) program.
- The content of CPwE, which is relevant to both Operational Technology (OT) and Informational Technology (IT) disciplines, consists of documented architectures, best practices, guidance and configuration settings to help manufacturers with design and deployment of a scalable, reliable, secure and future-ready plant-wide industrial network infrastructure.
- CPwE also helps manufacturers achieve the benefits of cost reductions using proven designs that can help lead to quicker deployment and reduced risk in deploying new technology.

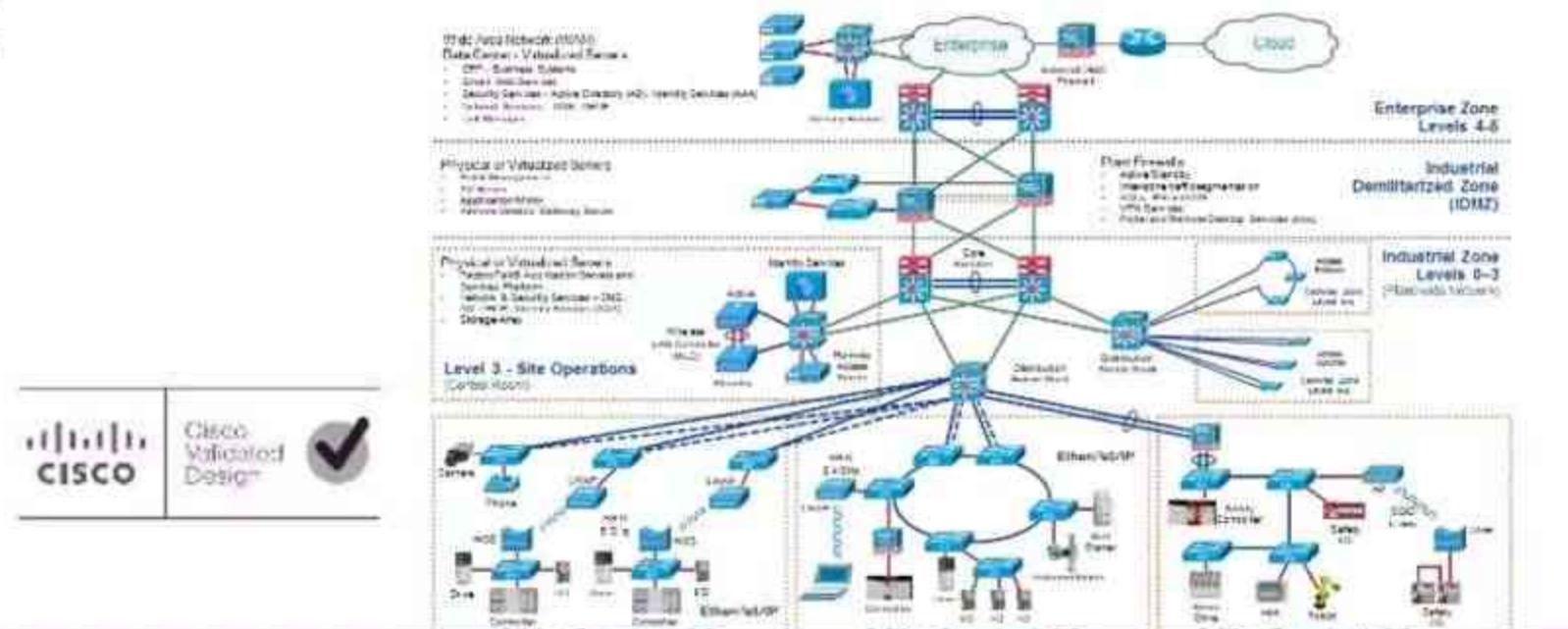


CPwE Architectures

Collection of Cisco and Rockwell Automation® Tested & Validated Designs

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- CPwE follows the Cisco Validated Design (CVD) Program
 - Provide the foundation for systems design based on common use cases or current engineering system priorities. They incorporate a broad set of technologies, features, and applications to address customer needs. Each CPwE CVD has been comprehensively tested, validated and documented by Cisco and Rockwell Automation® subject matter authorities to maintain faster, more reliable, and fully predictable deployment
- CPwE CVDs are organized by solution areas with customer collateral published using various types of documents:
 - [Design & Implementation Guides \(DIGs\)](#)
 - [White Papers](#)
 - [Application Guides](#)



OT Standards

- Operational Levels
 - ISA 95, Purdue – Levels 0-5
 - Level 0 Sensor/Actuators, Level 1 Controller, Level 2 Local Supervisor, Level 3 Site Operations, Level 4-5 Enterprise
- Functional / Security Zones
 - IEC-62443, NIST 800-82, ICS-CERT
 - Enterprise, Industrial, IDMZ
 - Industrial Subzones – Cell/Area, Site Operations

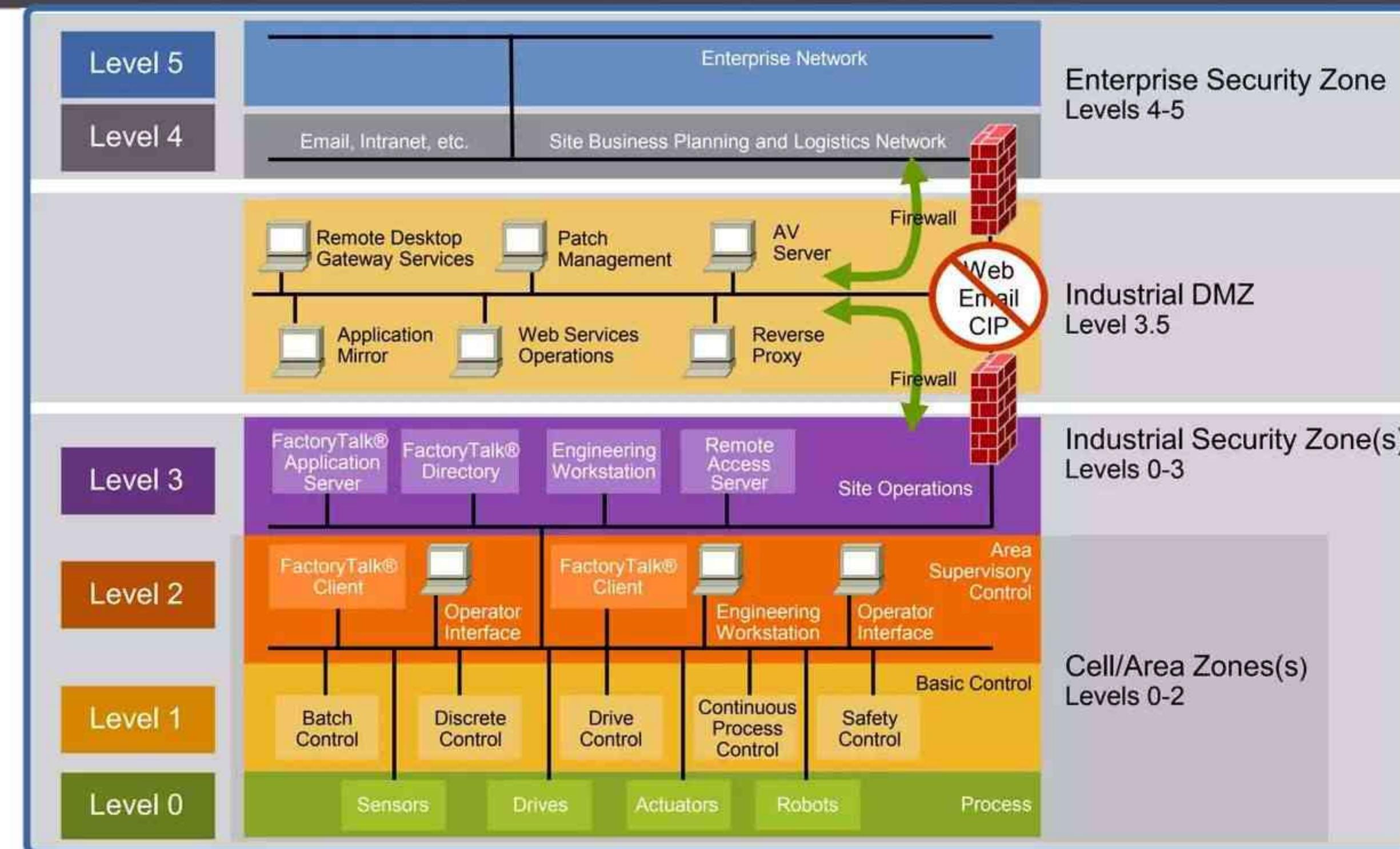
IT Standards

- Network Technology
 - OSI Reference Model – 7 Layers
 - IEEE 802.1, 802.3, 802.11
 - IETF TCP, UDP, IP
- Network Switch Hierarchy
 - Campus Network Model
 - Layer 2 Access
 - Layer 3 Distribution/Aggregation
 - Layer 3 Core

CPwE Logical Model

OT Standards - Operational Levels - Functional / Security Zones

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NIST

ICS-CERT
INDUSTRIAL CONTROL SYSTEMS-CRITICAL INFRASTRUCTURE RESPONSE TEAM



- Levels – ISA 95, Purdue Reference Model
- Zones – IEC 62443, NIST 800-82, ICS-CERT Recommended Practices

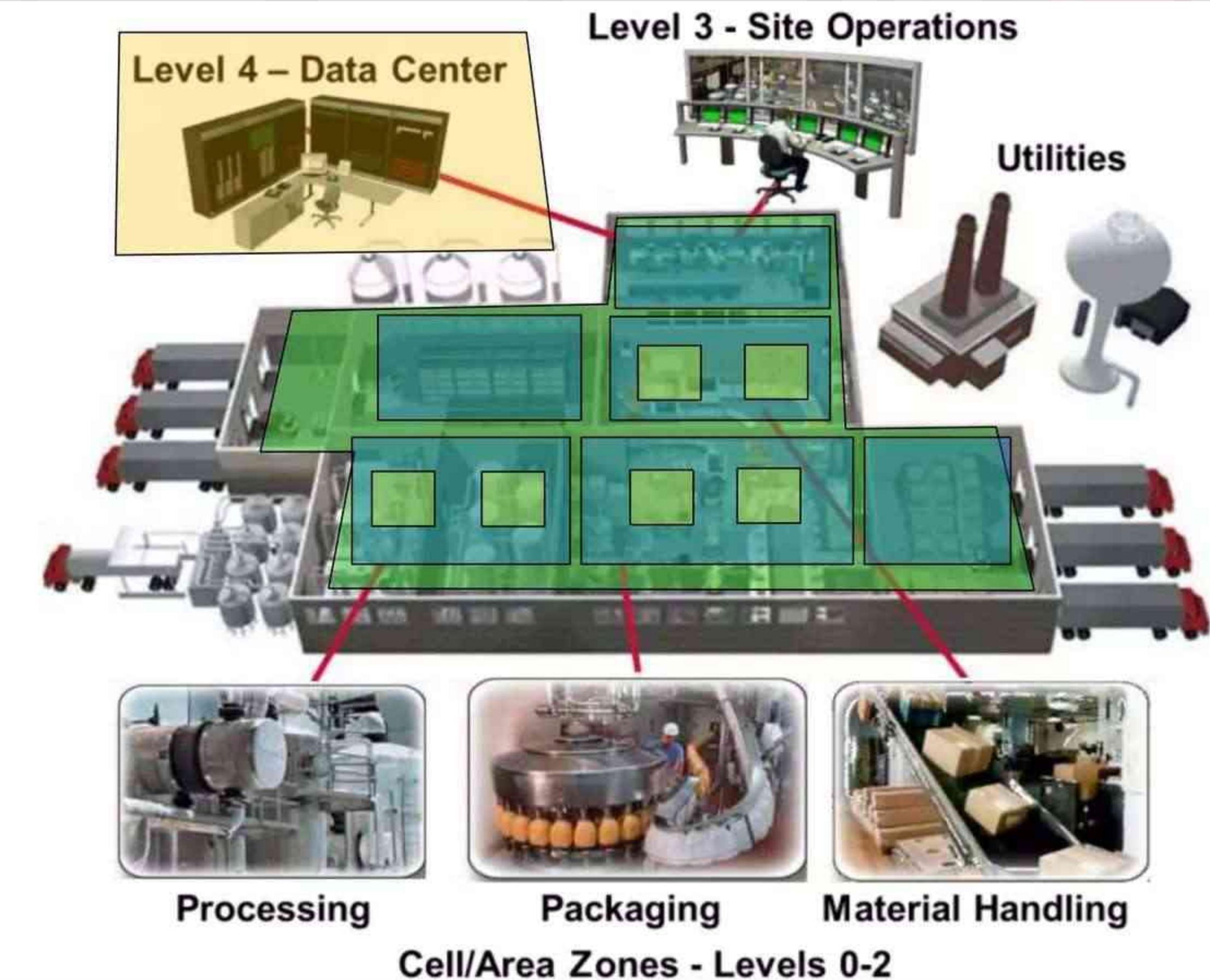
Plant-wide Zoning

OT Standards - Functional / Security Zones

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Plant-wide Zoning

- Functional / Security Areas
- Smaller Connected LANs
 - Smaller Broadcast Domains
 - Smaller Fault Domains
 - Smaller Domains of Trust
- Industrial IoT Technology
- Building Block Approach for Scalability



OSI 7-Layer Reference Model

OT-IT Standards

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Open Systems Interconnection

EtherNet/IP

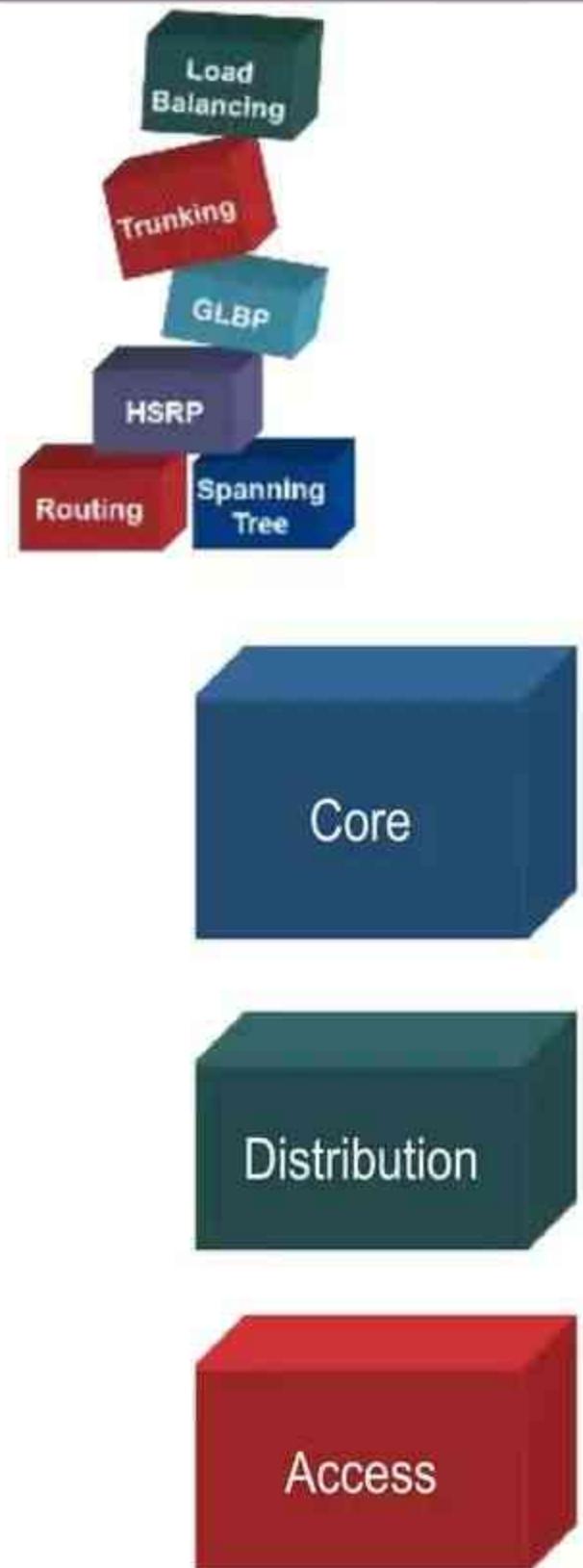
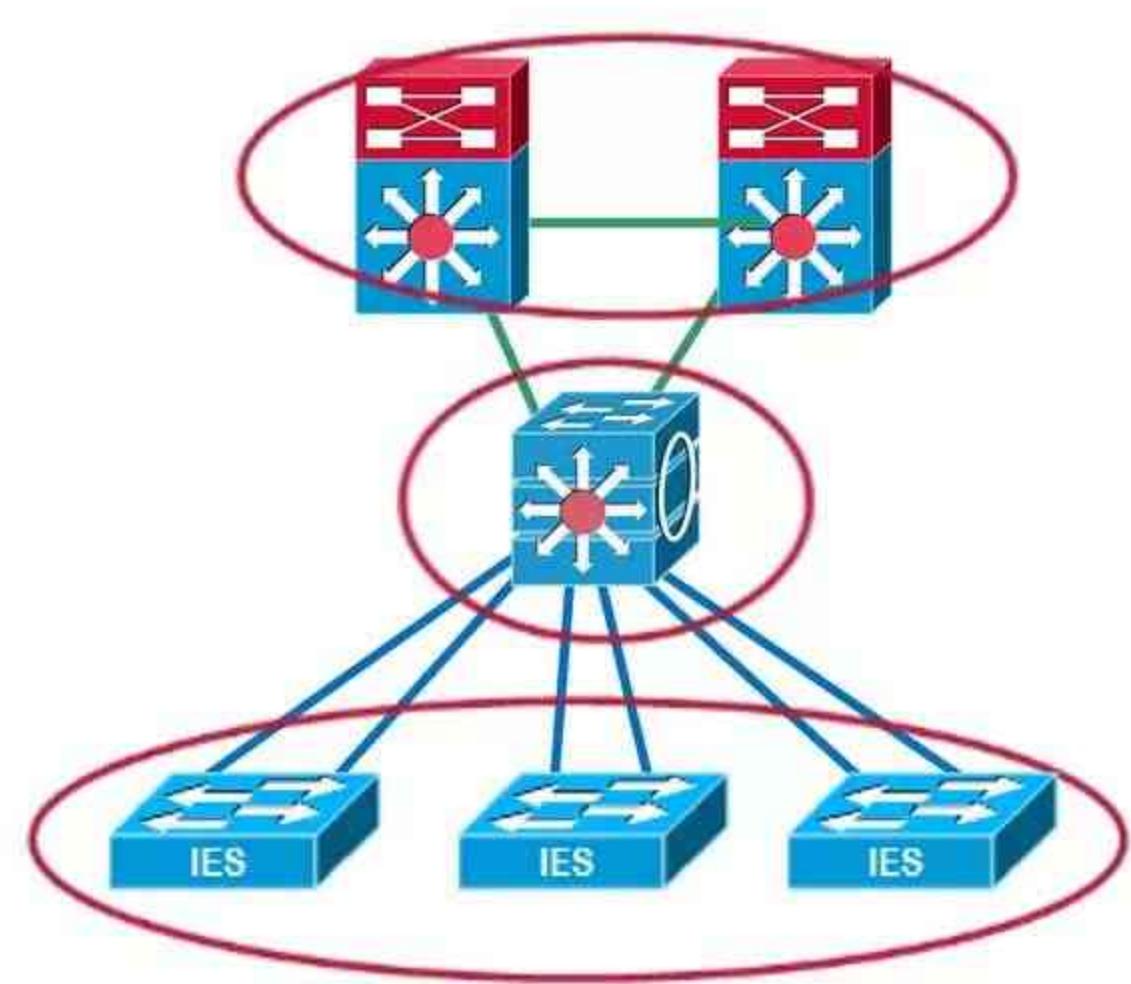
Layer No.	Layer Name	Function	Examples
Layer 7	Application	Network Services to User App	CIP - IEC 61158
Layer 6	Presentation	Encryption/Other processing	
Layer 5	Session	Manage Multiple Applications	
Layer 4	Transport	Reliable End-to-End Delivery Error Correction	IETF TCP/UDP
Layer 3	Routers A blue circular icon with a white router symbol.	Network	IETF IP
Layer 2		Data Link	IEEE 802.3/802.1/802.11
Layer 1	Physical	Signal type to transmit bits, pinouts, cable type	TIA - 1005



Campus Network Model

IT Standards – Network Switch Hierarchy

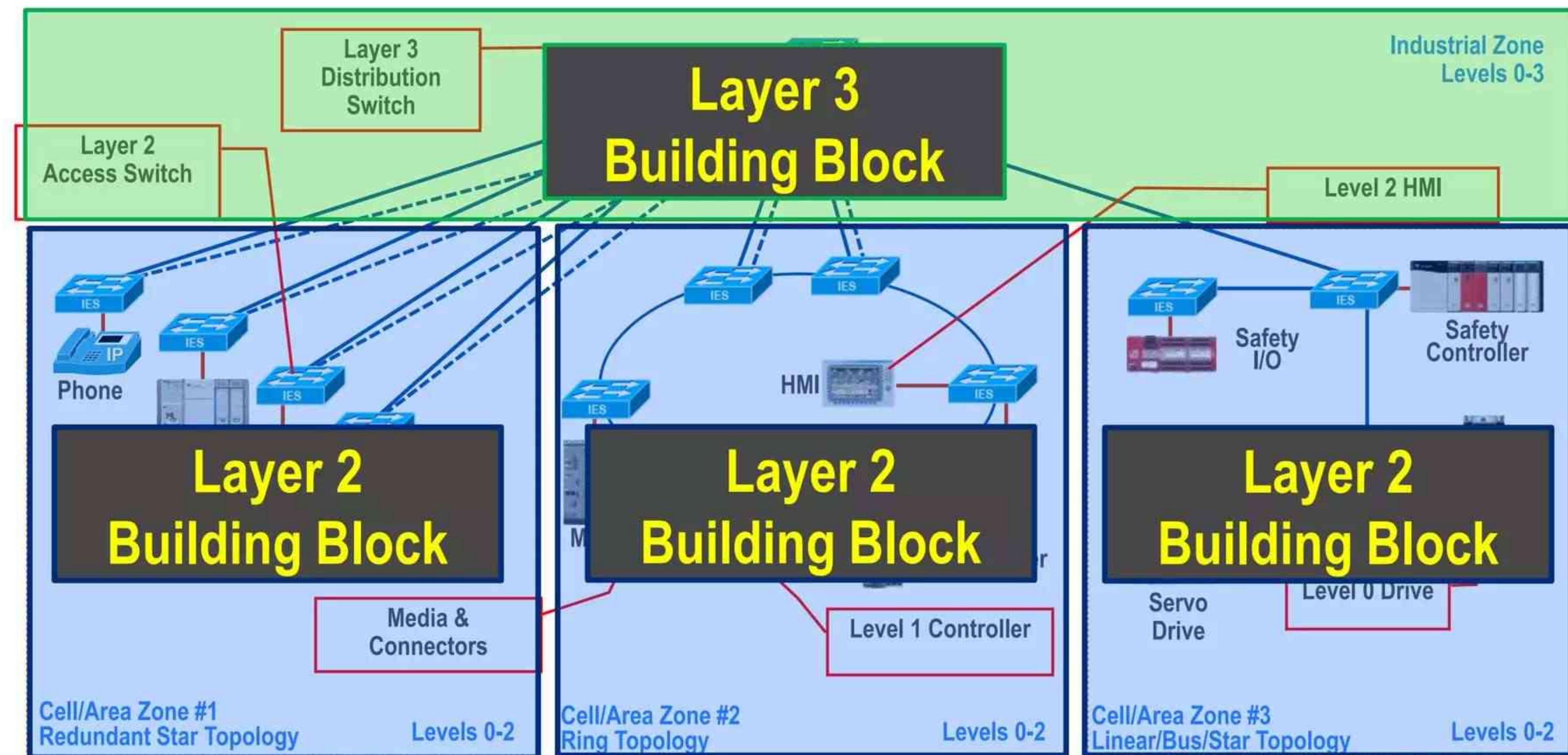
- Hierarchical, modular and scalable building blocks
- Smaller Connected LANs - clear demarcations and segmentation
 - Fault domain (e.g. Layer 2 loops), broadcast domain, domains of trust (security)
- Easier to grow, understand and troubleshoot
- Multi-tier switch model
 - Core – Layer 3
 - Aggregates distribution switches
 - Backbone of network
 - Industrial DMZ connectivity
 - Distribution / Aggregation – Layer 3
 - Aggregates access switches
 - Provides Layer 3 services
 - Access – Layer 2
 - Aggregates industrial automation and control system (IACS) devices
 - Provides Layer 2 services



Logical Zoning - Segmentation

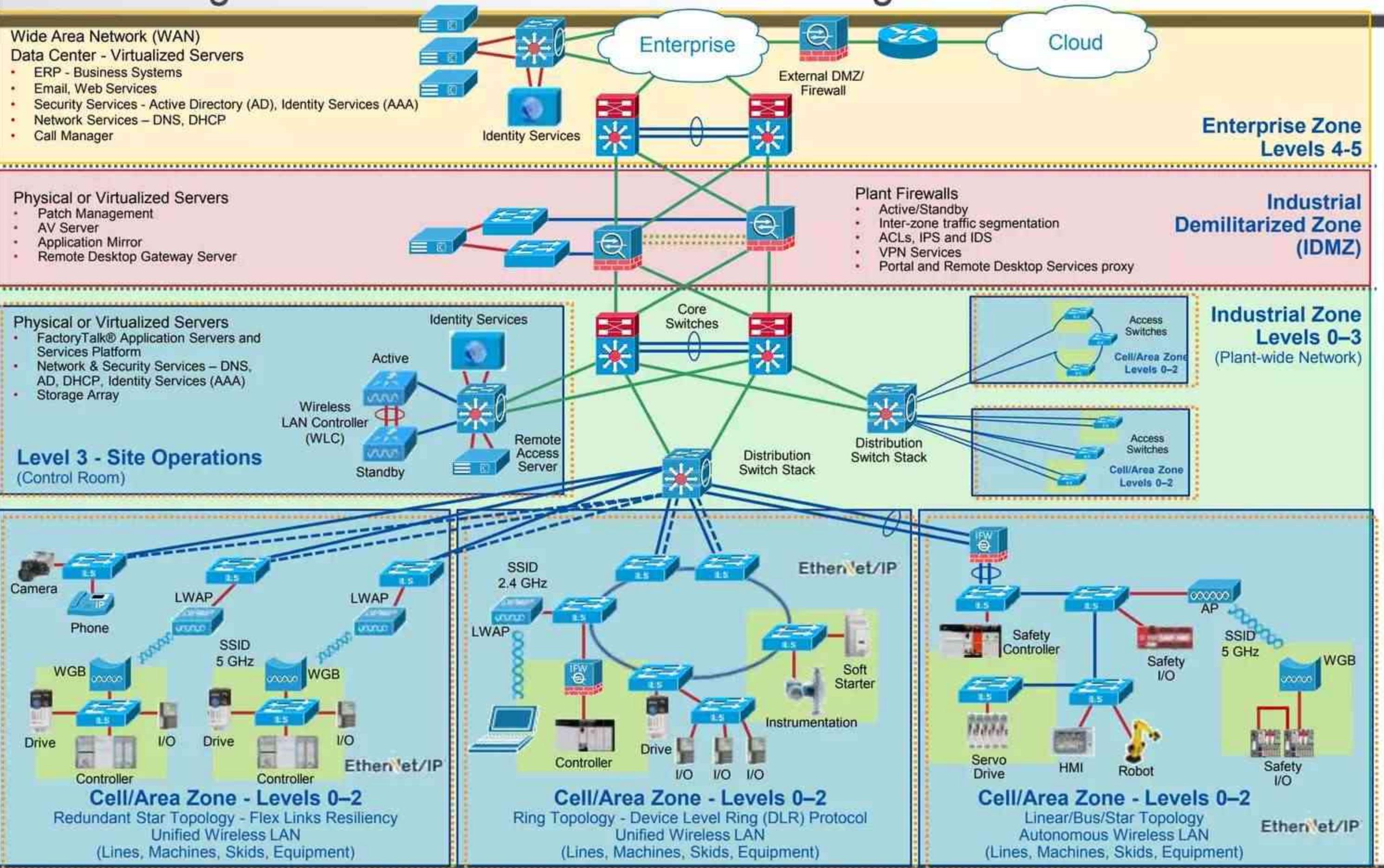
CPwE Logical Framework – Modular Building Blocks

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Logical Zoning - Segmentation

CPwE Logical Framework – Modular Building Blocks



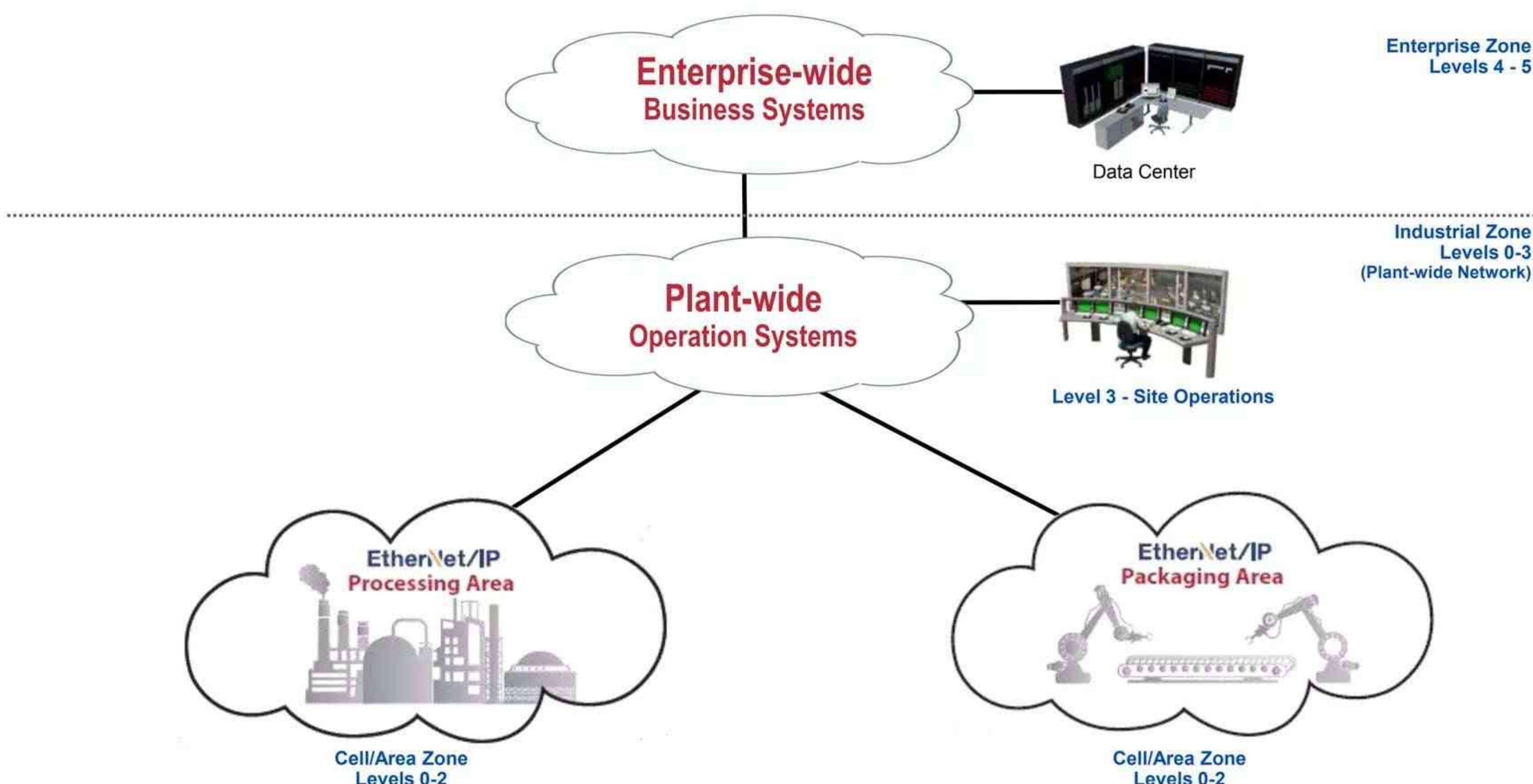
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- Wireless - Mobility
- Holistic Defense-in-Depth Security
- Convergence-ready

CPwE Architectures

Logical Model – Modular Building Blocks

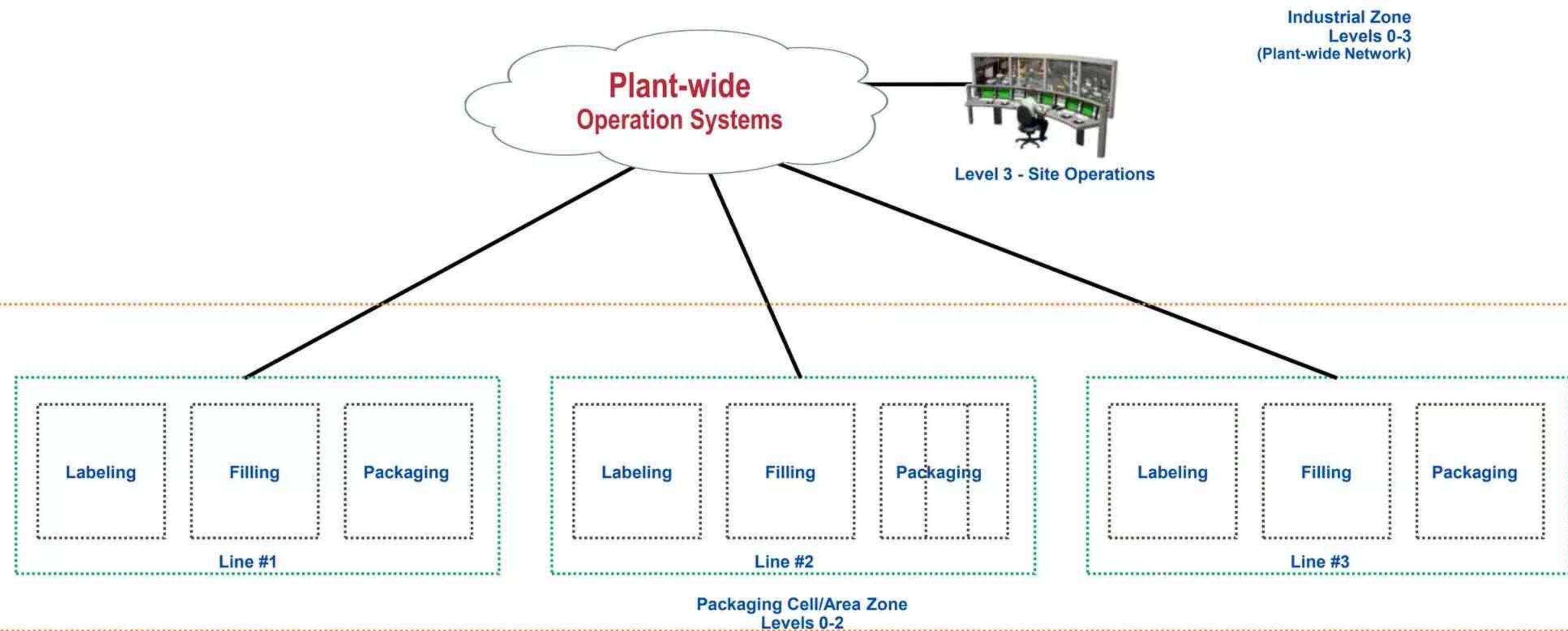
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CPwE Architectures

Logical Model – Modular Building Blocks

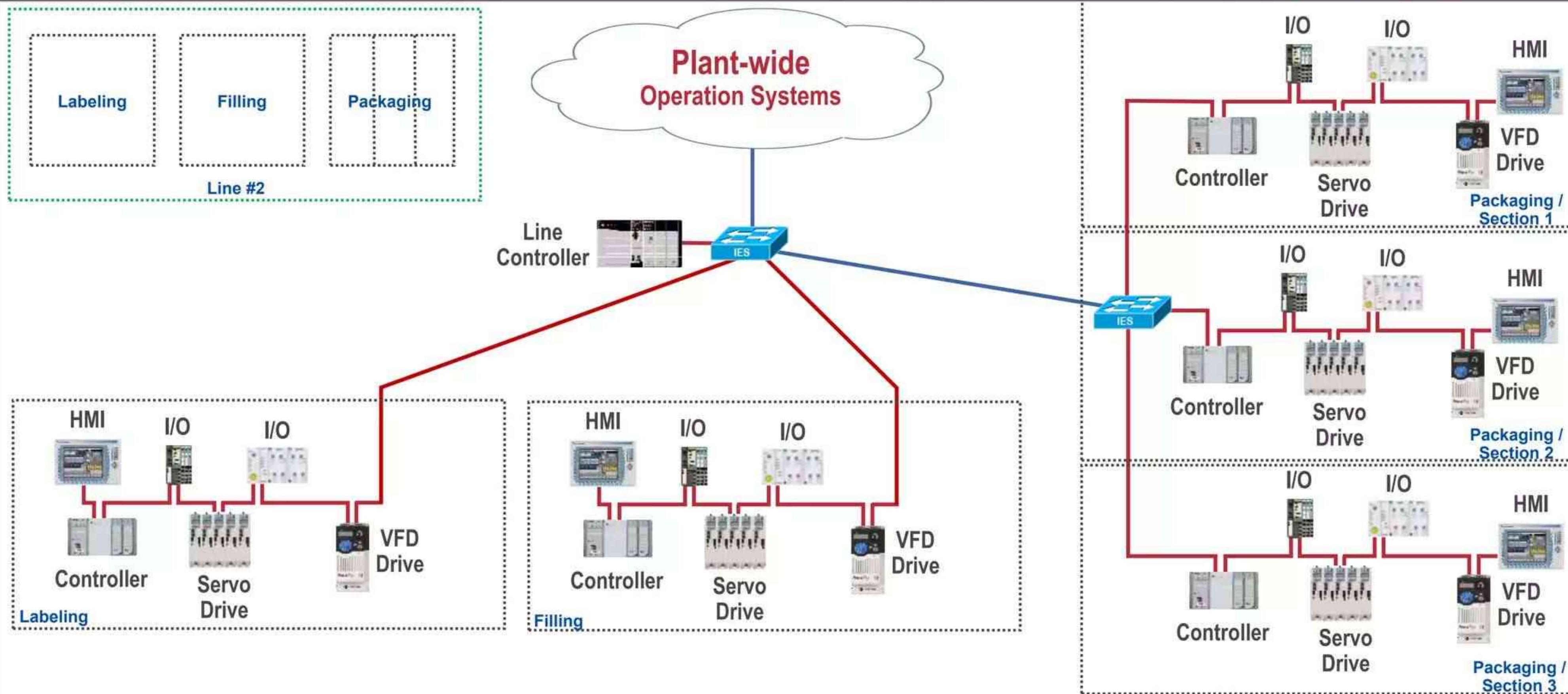
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CPwE Architectures

Logical Framework – Modular Building Blocks

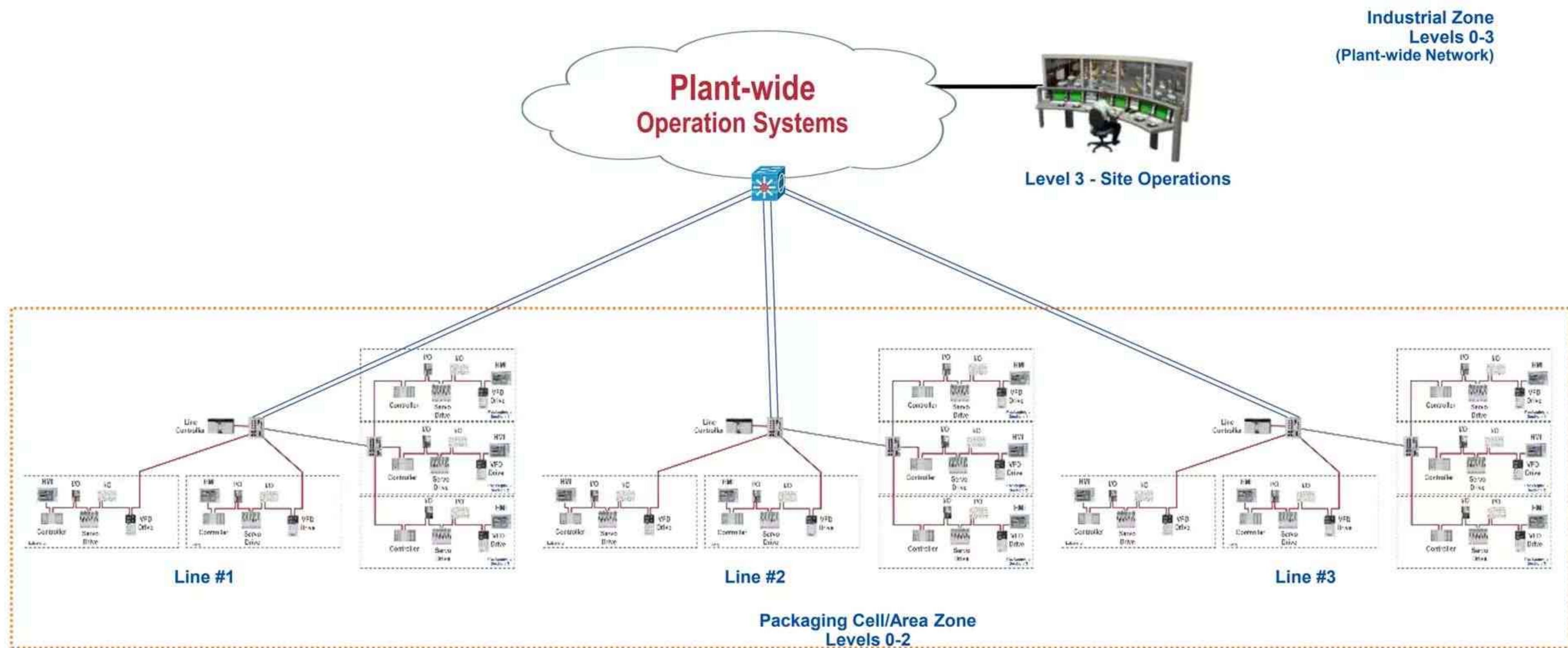
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CPwE Architectures

Logical Framework – Modular Building Blocks

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Structure and Hierarchy

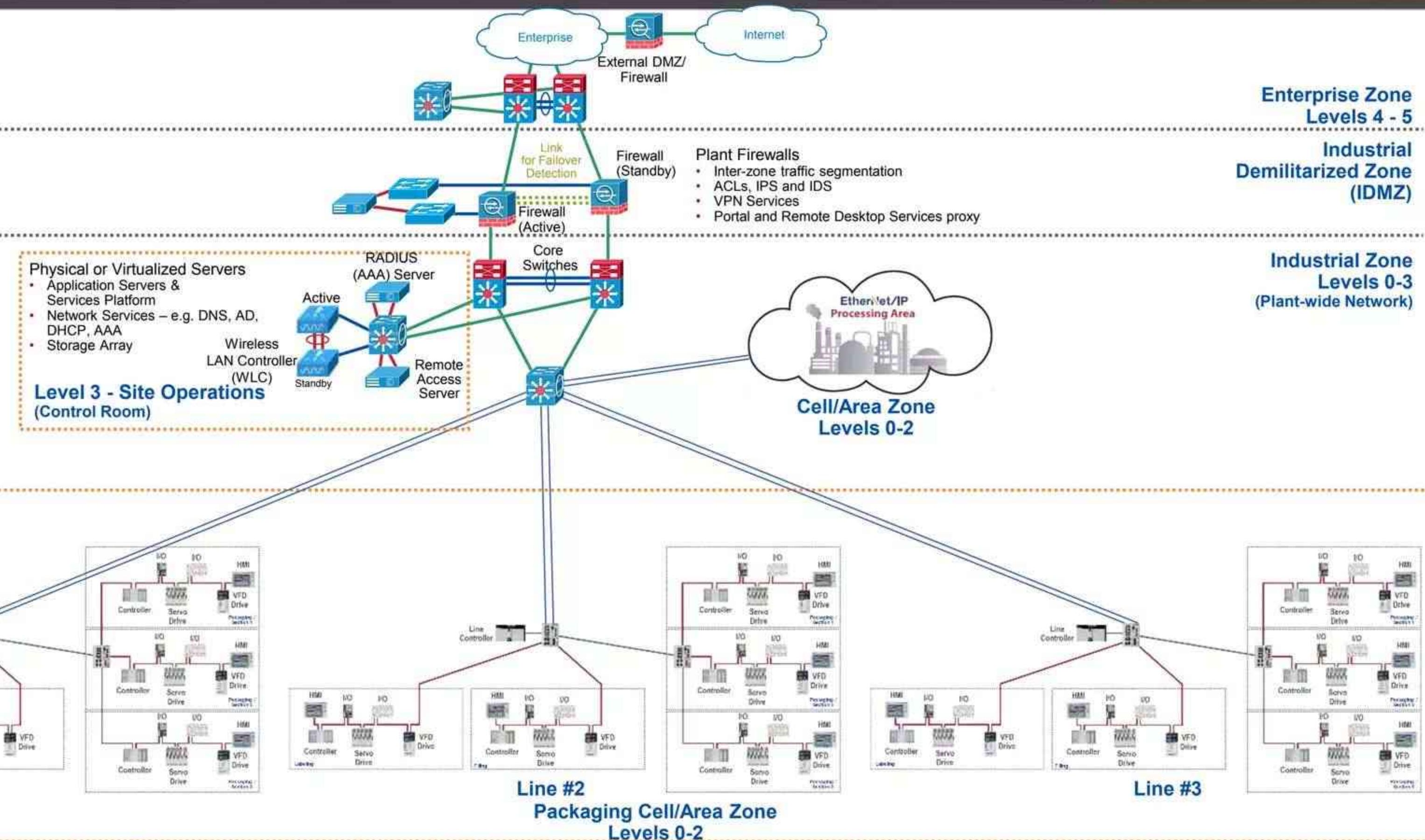
CPwE Logical Model - Modular Building Blocks

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Wide Area Network (WAN)
Physical or Virtualized Servers

- ERP, Email
- Active Directory (AD), AAA – Radius
- Call Manager

Physical or Virtualized Servers
• Patch Management
• AV Server
• Application Mirror
• Remote Desktop Gateway Server



Convergence-Ready Network Solutions

Design and Implementation Considerations

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Design and deployment considerations that a partner (e.g. OEM, SI, Contractor) has to take into account to achieve seamless integration of their solution (e.g. equipment, skid, machine) into their customers' plant-wide/site-wide network infrastructure.

**Early, open and two-way
OT-IT dialogue is critical!**

Convergence-Ready Network Solutions

Alignment with End User Stance on Safety, Security and Availability

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- Risk management policies and overall tolerance to risk
 - Business practices
 - Corporate / local standards
 - Application requirements
 - Applicable industry standards
 - e.g. NERC CIP
 - Government regulations and compliance
- Enterprise and industrial policies (safety and security), procedures, access control (avoidance of back doors) and network ownership
 - Alignment with industrial safety standards such as IEC 61508 – SIL 3 and EN 954-1 - Cat 4
 - Alignment with industrial security standards such as [IEC-62443](#) (formerly ISA99), [NIST 800-82](#) and [ICS-CERT](#)
 - Network capabilities (zone segmentation into domains of trust)

Early, open and two-way
OT-IT dialogue is critical!

“one-size-fits-all”

Convergence-Ready Network Solutions

Alignment with End User - Network Services:

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- Use of a common industrial network technology that fully uses standard Ethernet and IP networking technology as the multi-discipline industrial network infrastructure.
- IP addressing schema
 - Who manages? End User (OT/IT) or OEM?
 - Address range (class), subnet, default gateway (routability)
 - Implementation conventions – static/dynamic, hardware/software configurable, NAT/DNS
- Use Common Layer 2 and Layer 3 Network Services
 - Switches - managed vs. unmanaged, industrial vs. COTS, system vs. component approach
 - Segmentation, data prioritization
 - Topologies - switch-level, device-level, hybrid
 - Availability – loop prevention, redundant path topologies with resiliency protocols
 - Time Synchronization Services
 - IEEE 1588 Precision Time Protocol (PTP w/E2E) – first fault, SOE, Motion

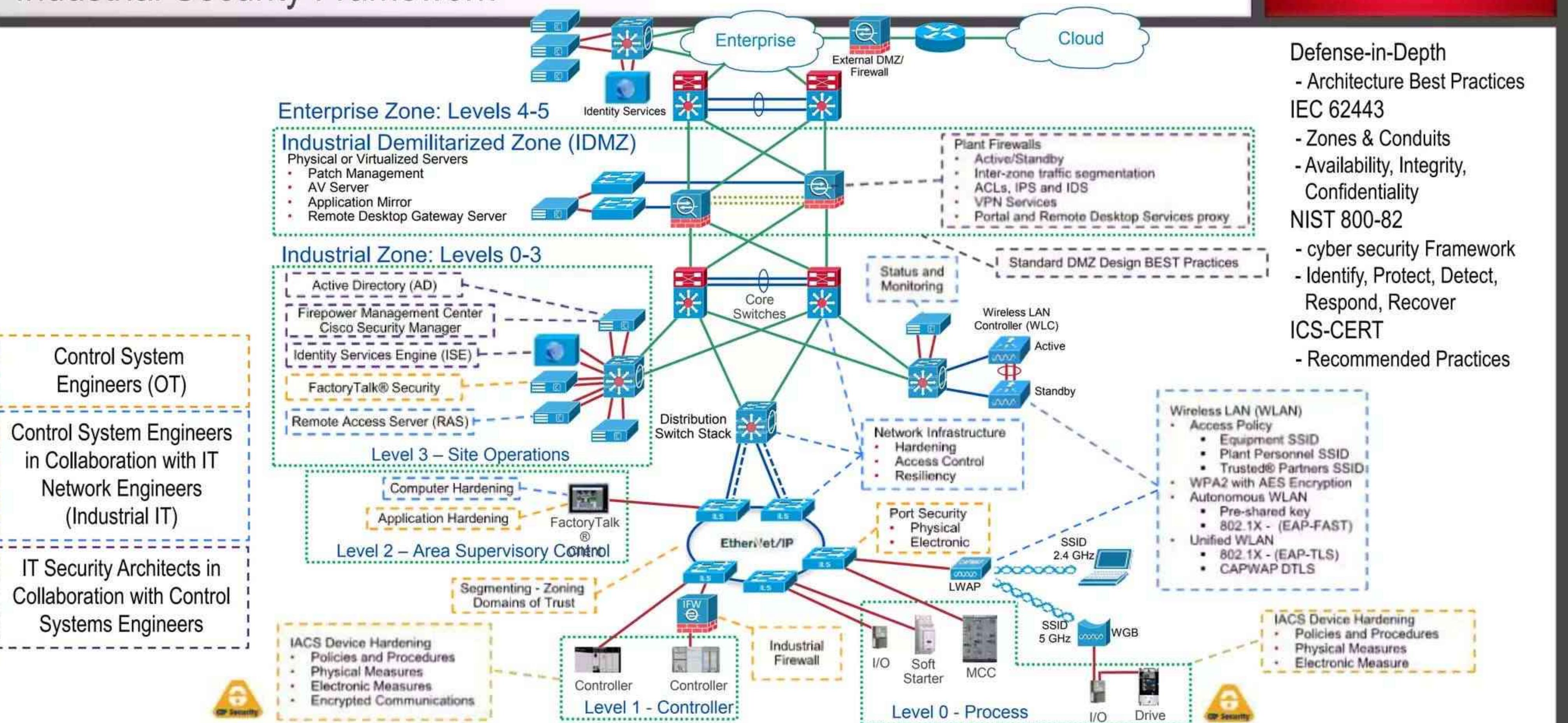
[The OEM Guide to Networking](#)

ENET-RM001_-EN-P

CPwE Architectures

Industrial Security Framework

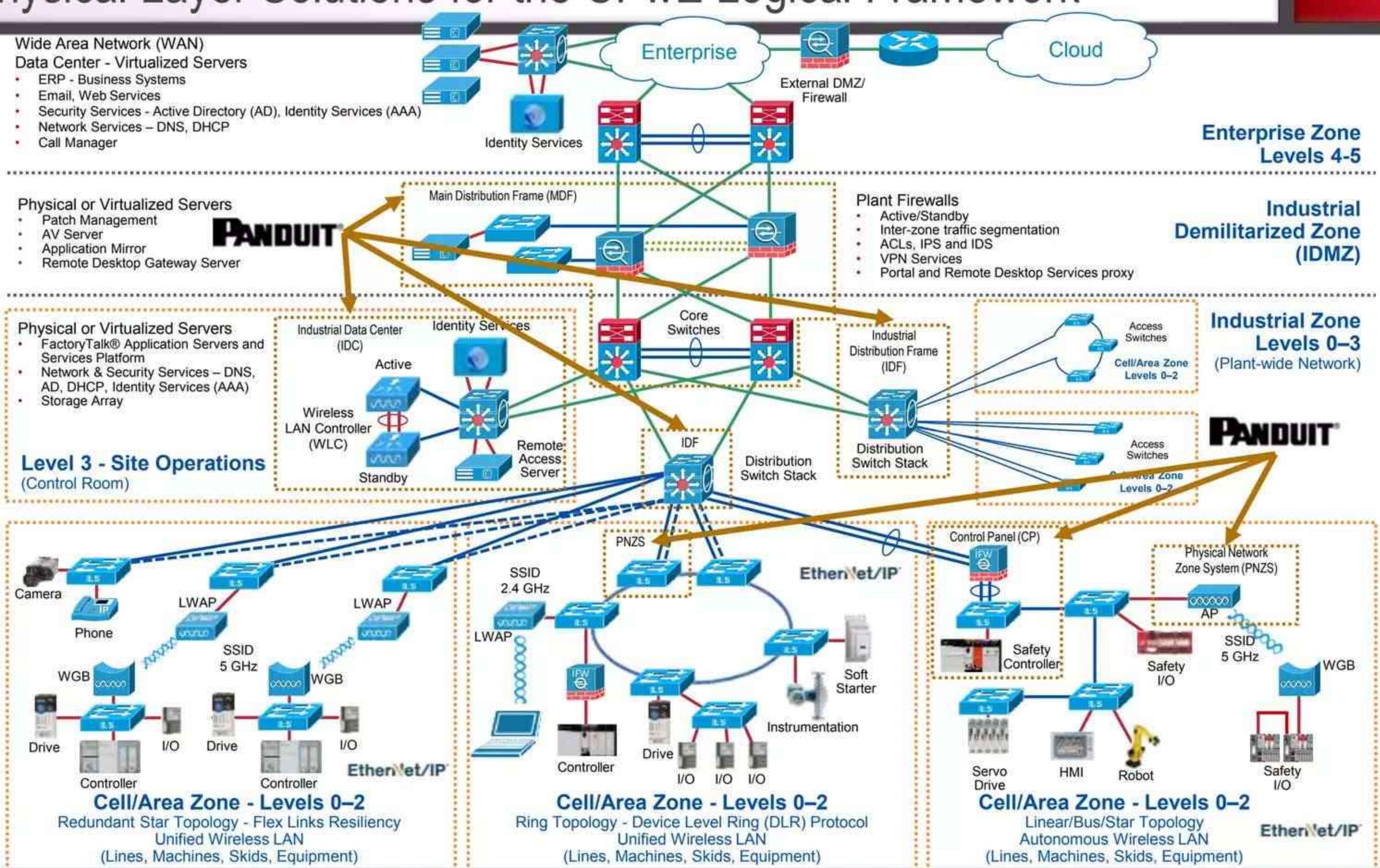
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Automation



CPwE Architectures

Panduit Physical Layer Solutions for the CPwE Logical Framework

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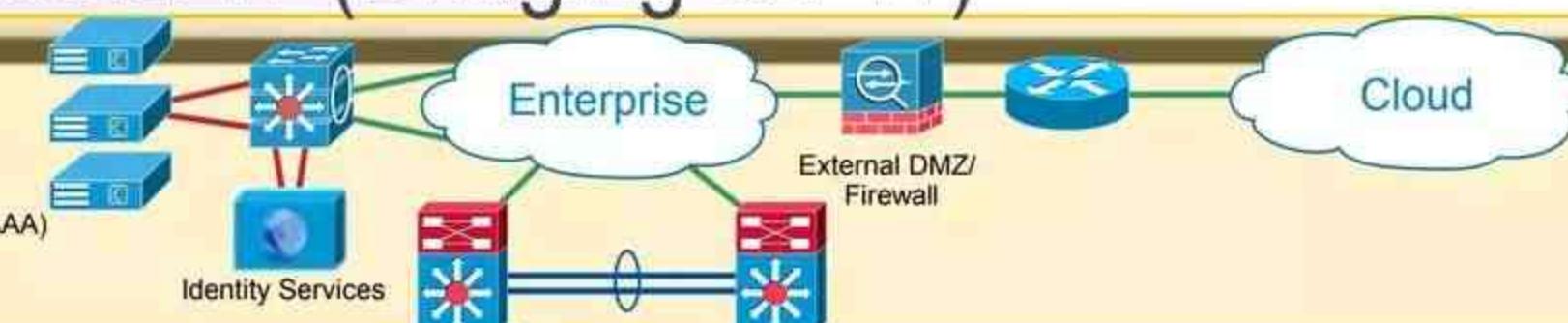
CPwE Architectures

Industrial IoT / Industrial IT (Bridging OT-IT)

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Wide Area Network (WAN)
 Data Center - Virtualized Servers

- ERP - Business Systems
- Email, Web Services
- Security Services - Active Directory (AD), Identity Services (AAA)
- Network Services – DNS, DHCP
- Call Manager



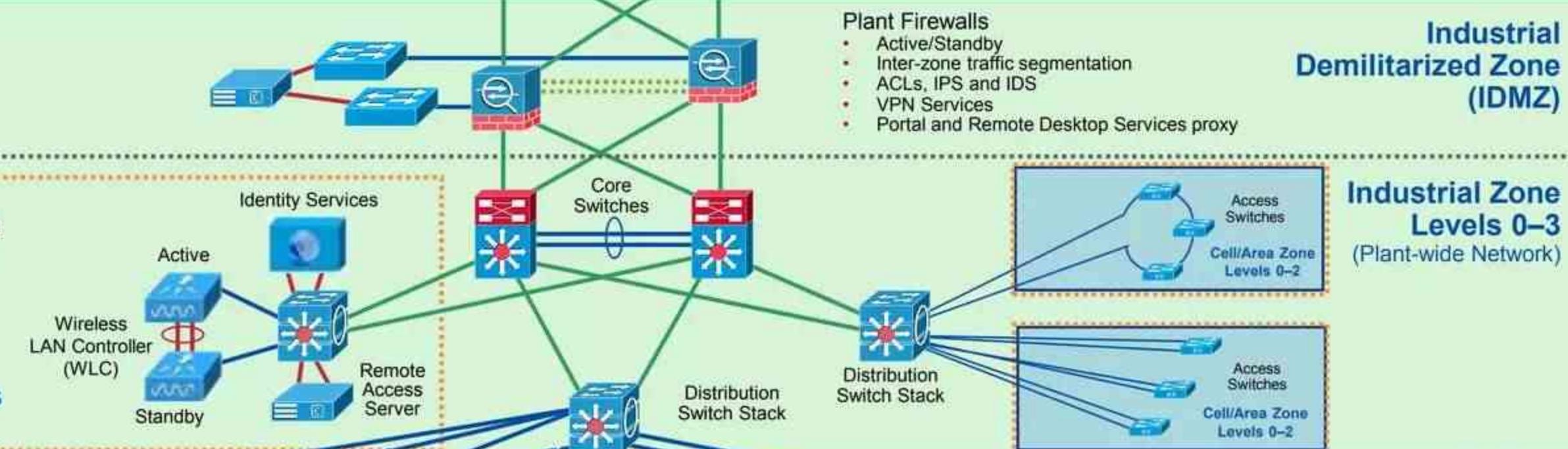
Enterprise Zone
Levels 4-5

Information Technology



Physical or Virtualized Servers

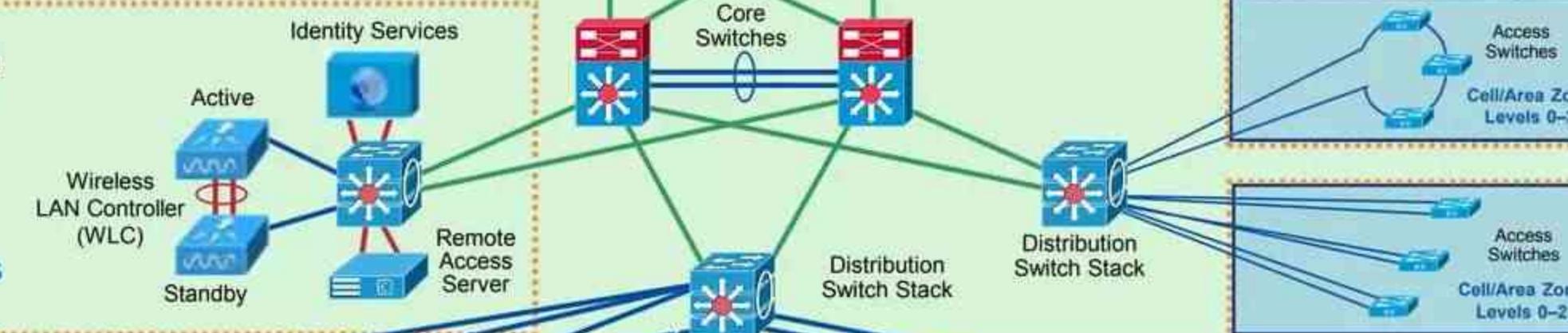
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- AV Server
- Application Mirror
- Remote Desktop Gateway Server



Industrial
Demilitarized Zone
(IDMZ)

Physical or Virtualized Servers

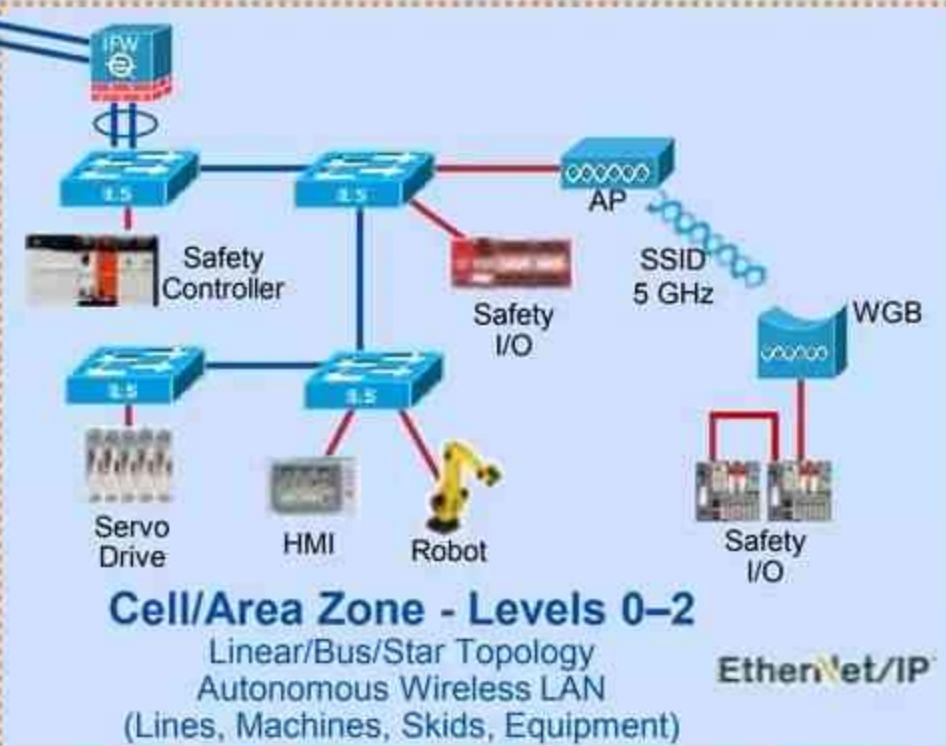
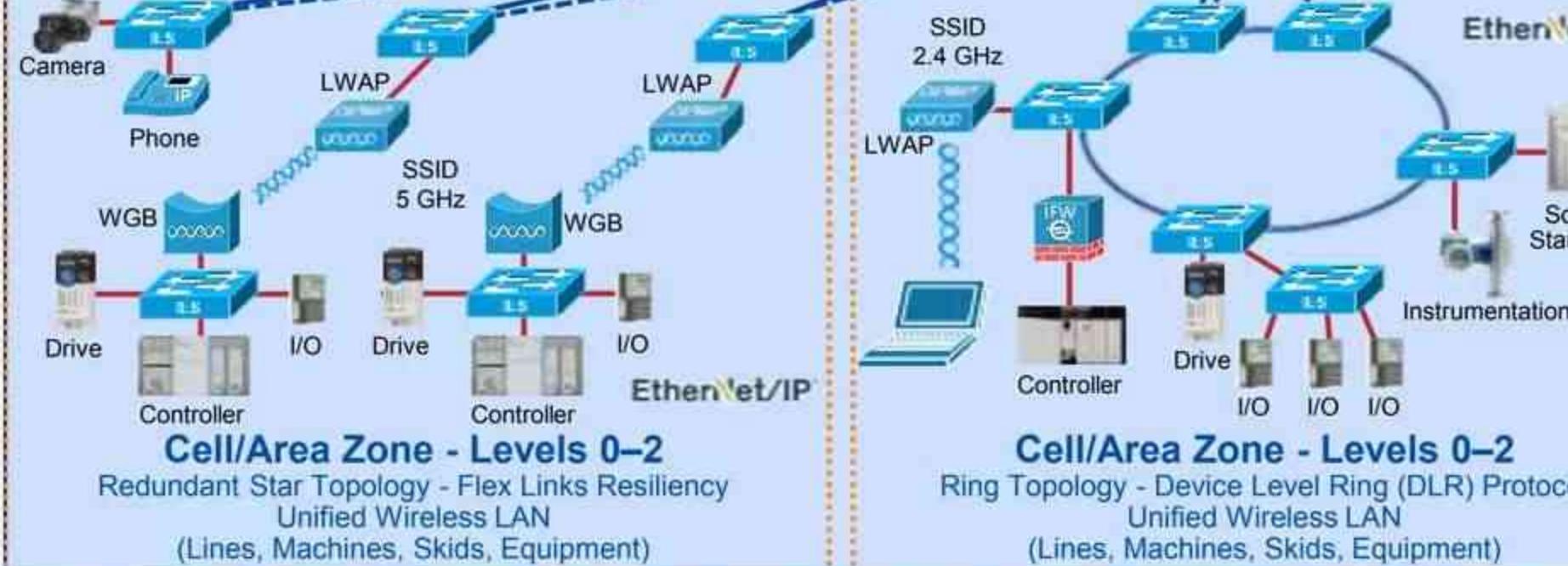
- FactoryTalk® Application Servers and Services Platform
- Network & Security Services – DNS, AD, DHCP, Identity Services (AAA)
- Storage Array



Industrial
Zone
Levels 0-3
(Plant-wide Network)

Industrial IT

**Rockwell
Automation** CISCO



Operational Technology
Industrial IoT

**Rockwell
Automation**

Lessons Learned From Your Peers

- Corporate culture change takes time
- People, Process, and Technology changes are required for Industrial IoT transformation
- The Network is foundational
- Create an OT-IT convergence plan early
- Early Engagement of Operations Staff
- Define business outcomes early in the process with KPIs to measure success
- Communicate and Celebrate Successes between locations
- A robust archiving framework and strategy is needed
- Behavior changes will be necessary to deliver success
- Good technology will be trumped by bad processes
- Good technology will be trumped by bad data
- Process experts should be engaged early
- Data Governance framework and teams must be in place before beginning
- Provide enough runway and scheduling for Knowledge Transfer
- Define out-of-scope processes and applications
- Develop a mitigation plan early

Additional Material

Additional Material

Network Architecture Icon Key

	Layer 2 Access Switch, Catalyst 2960		Firewall, Adaptive Security Appliance (ASA) 55xx
	Layer 2 Access, Industrial Ethernet Switch (IES), Stratix® 2500, Stratix® 5700, Stratix® 5400, Stratix® 8000		Industrial Firewall, Stratix® 5950
	Layer 2 IES with NAT, Stratix® 5700, Stratix® 5400		Autonomous Wireless Access Point (AP), Stratix® 5100 as Autonomous AP
	Layer 2 IES with NAT and Connected Routing, Stratix® 5700, Stratix® 5400		Wireless workgroup bridge (WGB), Stratix® 5100 as workgroup bridge (WGB)
	Multi-Layer Switch - Layer 2 and Layer 3, Stratix® 8300, Stratix® 5700, Stratix® 5400, Stratix® 5410		Unified Wireless Lightweight Access Point (LWAP), Catalyst 3602E LWAP
	Layer 3 Distribution Switch Stack, Catalyst 3750-X, Catalyst 3850		Unified Wireless LAN Controller (WLC), Cisco 5508 WLC
	Layer 3 Core Switch, Catalyst 4500, 4500-X, 6500, 6800		Unified Computing System (UCS), UCS-C series
	Layer 3 Core Switch with Virtual Switching System (VSS), Catalyst 4500-X, 6500, 6800		Identity Services Engine (ISE) for Authentication, ISE - PAN/PSN/MnT
	Layer 3 Router, Stratix® 5900		Layer 2 Access Link (EtherNet/IP Device Connectivity)
	Layer 3 Router with Zone-based Firewall, Stratix® 5900		Layer 2 Interswitch Link/802.1Q Trunk
			Layer 3 Link

Additional Material

ODVA



Rockwell
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- Website:
 - <http://www.odva.org/>
- EtherNet/IP
 - [https://www.odva.org/Technology-Standards/EtherNet-IP/OverviewSecuring EtherNet/IP Networks](https://www.odva.org/Technology-Standards/EtherNet-IP/OverviewSecuring_EtherNet/IP_Networks)
- EtherNet/IP Network Infrastructure Guide
 - [https://www.odva.org/Portals/0/Library/Publications Numbered/PUB00035R 0 Infrastructure Guide.pdf](https://www.odva.org/Portals/0/Library/Publications_Numbered/PUB00035R_0_Infrastructure_Guide.pdf)

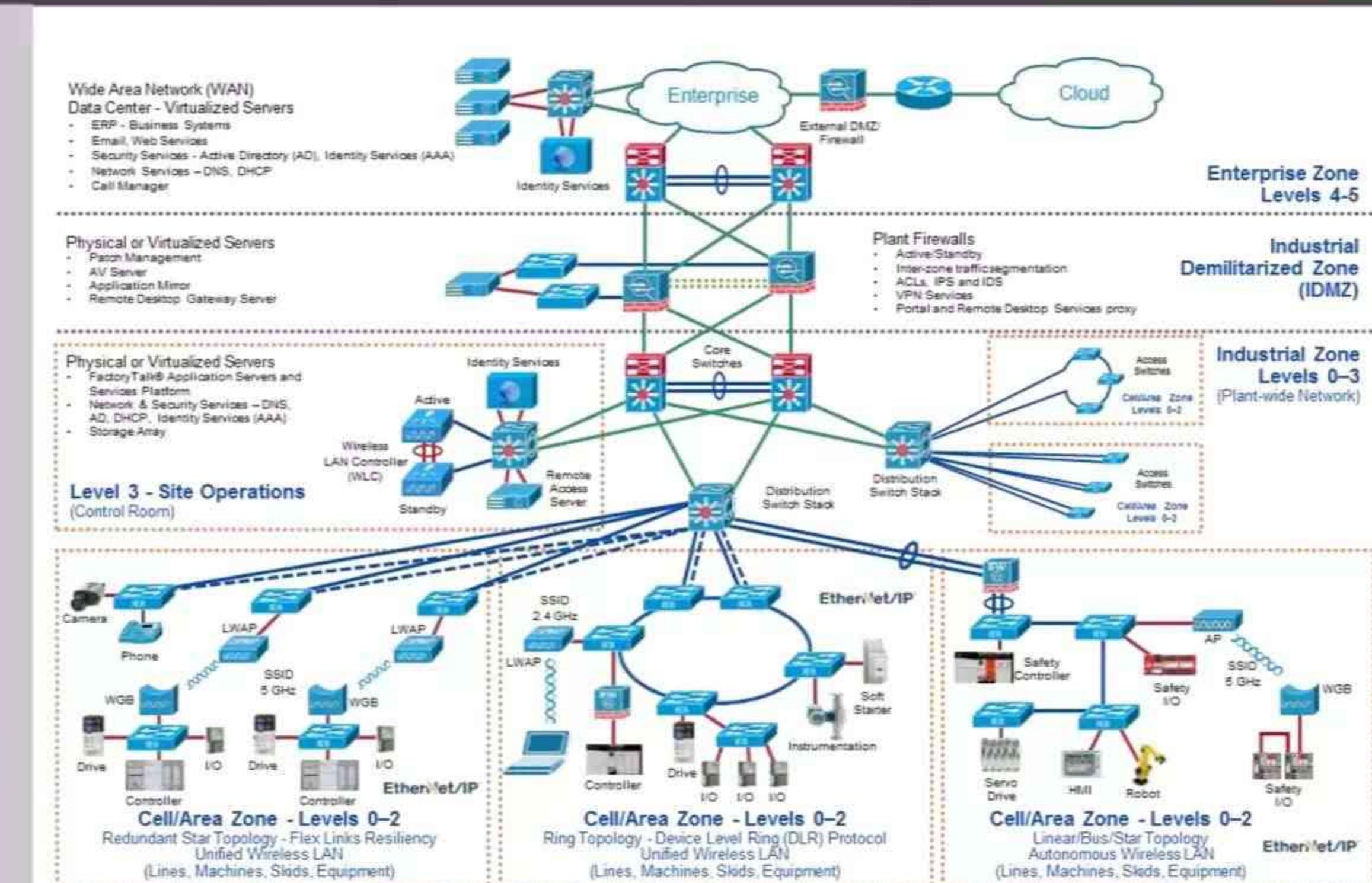
- Common Industrial Protocol (CIP)
 - <https://www.odva.org/Technology-Standards/Common-Industrial-Protocol-CIP/Overview>
- The Family of CIP Networks
 - [https://www.odva.org/Portals/0/Library/Publications Numbered/PUB00123R1 Common-Industrial Protocol and Family of CIP Networks.pdf](https://www.odva.org/Portals/0/Library/Publications_Numbered/PUB00123R1_Common-Industrial_Protocol_and_Family_of_CIP_Networks.pdf)
- CIP Security
 - <https://www.odva.org/Technology-Standards/Common-Industrial-Protocol-CIP/CIP-Security>

Additional Material

CPwE Architectures - Cisco and Rockwell Automation®

Rockwell
Automation

- [CPwE website](#)
- Overview Documents
 - [Alliance Profile](#)
 - [Top 10 Recommendations for Plant-wide EtherNet/IP Deployments](#)
 - [Design Considerations for Securing Industrial Automation and Control System Networks](#)



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Automation

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Additional Material

CPwE Architectures - Cisco and Rockwell Automation®



Topic	Design Guide	Whitepaper
Design Considerations for Securing IACS Networks	—	ENET-WP031A-EN-P
Converged Plantwide Ethernet – Baseline Document	ENET-TD001E-EN-P	—
Resilient Ethernet Protocol in a CPwE Architecture	ENET-TD005B-EN-P	ENET-WP033A-EN-P
Deploying 802.11 Wireless LAN Technology within a CPwE Architecture	ENET-TD006A-EN-P	ENET-WP034A-EN-P
Deploying Identity Services within a CPwE Architecture	ENET-TD008A-EN-P	ENET-WP037A-EN-P
Securely Traversing IACS Data Across the Industrial Demilitarized Zone (IDMZ)	ENET-TD009A-EN-P	ENET-WP038A-EN-P
Deploying Network Address Translation within a CPwE Architecture	ENET-TD007A-EN-P	ENET-WP036A-EN-P
Migrating Legacy IACS Networks to a CPwE Architecture	ENET-TD011A-EN-P	ENET-WP040A-EN-P
Deploying A Resilient Converged Plantwide Ethernet Architecture	ENET-TD010A-EN-P	ENET-WP039B-EN-P
Site-to-site VPN to a CPwE Architecture	ENET-TD012A-EN-P	—
Deploying Industrial Firewalls within a CPwE Architecture	ENET-TD002A-EN-P	ENET-WP011B-EN-P
Deploying Device Level Ring within a CPwE Architecture	ENET-TD015A-EN-P	ENET-WP016A-EN-P

Additional Material

Rockwell Automation® Reference Documents



- Ethernet Design Considerations Reference Manual
 - [ENET-RM002C-EN-P](#)
 - EtherNet/IP Overview, Ethernet Infrastructure Components, EtherNet/IP Protocol, Predict System Performance
- EtherNet/IP IntelliCENTER® Reference Manual ([MCC-RM001](#))
- The OEM Guide to Networking
 - [ENET-RM001A-EN-P](#)
 - This guide is intended to help OEMs understand relevant technologies, networking capabilities and other considerations that could impact them as they develop EtherNet/IP solutions for the machines, skids or equipment they build
- Segmentation Methods Within the Cell/Area Zone [ENET-AT004B-EN-E](#)

Additional Material

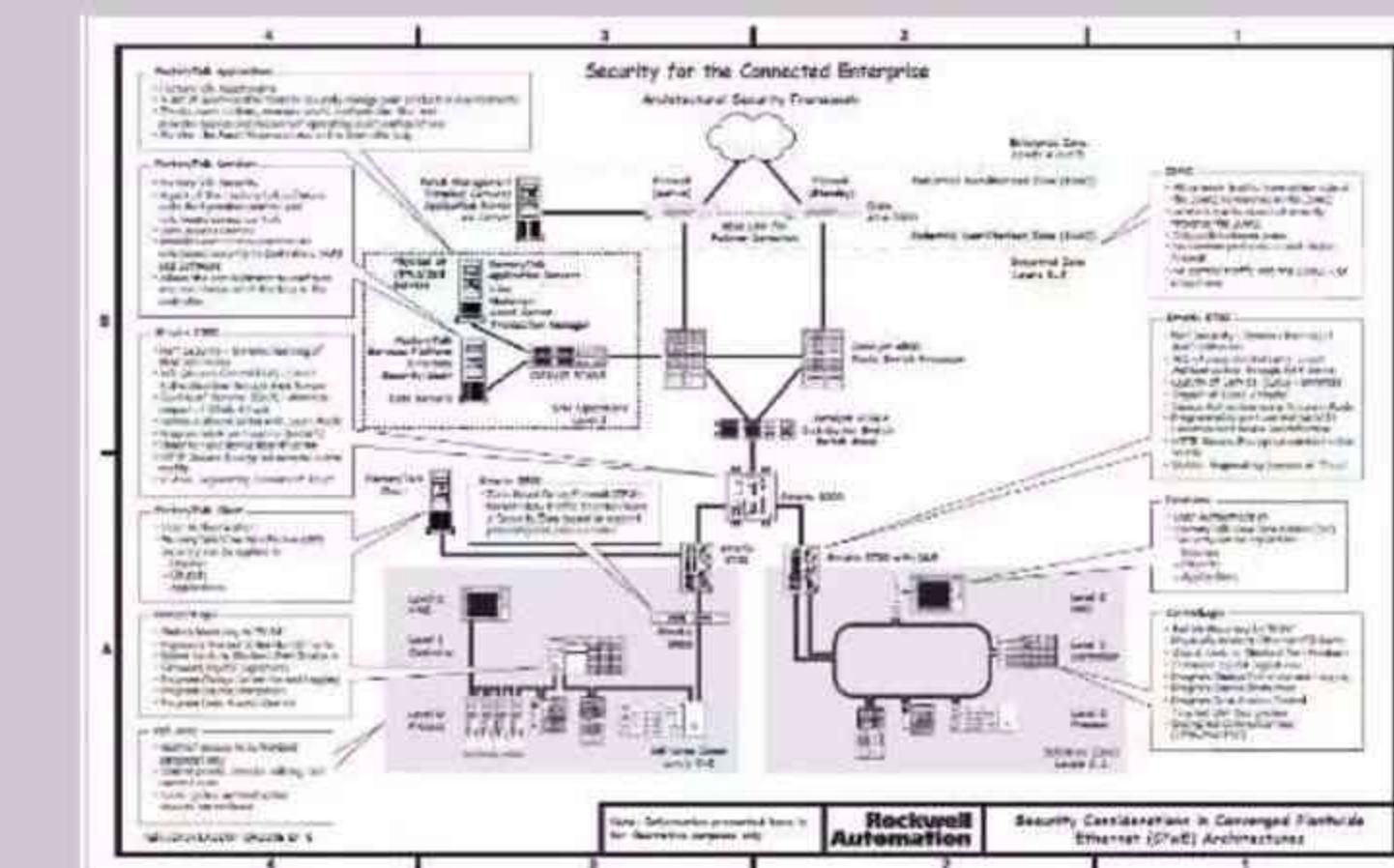
Rockwell Automation® Automaton Tools

Rockwell
Automation

- [Integrated Architecture® Builder \(IAB\)](#)
 - Updates and additions to better-reflect CPwE structure, hierarchy and best practices
 - Improved Switch Wizard for distribution (e.g. Stratix® 5410 switch) and access (e.g. Stratix® 5700 switch)
 - Easier to create a large EtherNet/IP network with many topologies
 - CIP traffic is measured per segment, not just controller scanner and adapter centric

- [EtherNet/IP Capacity Tool](#)
- [Popular Configuration Drawings \(PCDs\)](#)

- Updates and additions to better reflect CPwE recent enhancements



Training Resources

Training Resources

Education - Industrial IoT / Industrial IT (Bridging OT-IT)

**Rockwell
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Cisco
Panduit
Rockwell Automation



- A 'go-to' resource for training and educational information on standard Internet Protocol (IP), security, wireless and other emerging technologies for industrial applications
- Led by Cisco, Panduit, and Rockwell Automation®
- Receive monthly e-newsletters with articles and videos on the latest trends
- Scenario-based training on topics such as: logical topologies, protocols, switching, routing, wireless and physical cabling

Network Design eLearning course available at promotional price for TechEd Attendees!
Earn PDHs by signing up today at www.industrial-ip.org with code "EVENTS2017"

Training Resources

Education - Industrial IoT / Industrial IT (Bridging OT-IT)

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Four eLearning courses cover key aspects of implementing networked, industrial control systems. 20-30 minute interactive, scenario-based courses cover automation controls and physical infrastructure considerations.

Industrial IP ADVANTAGE
CONNECT. INFORM. TRANSFORM.

Module Objectives

Objectives

- Evolution of Network Hardware
- Managed and Unmanaged Switches
- Application Evaluation

Specifically, at the end of the module, you will be able to:

- Explain the advantages of using managed and unmanaged switches in the Cell/Area zone
- Evaluate common considerations that

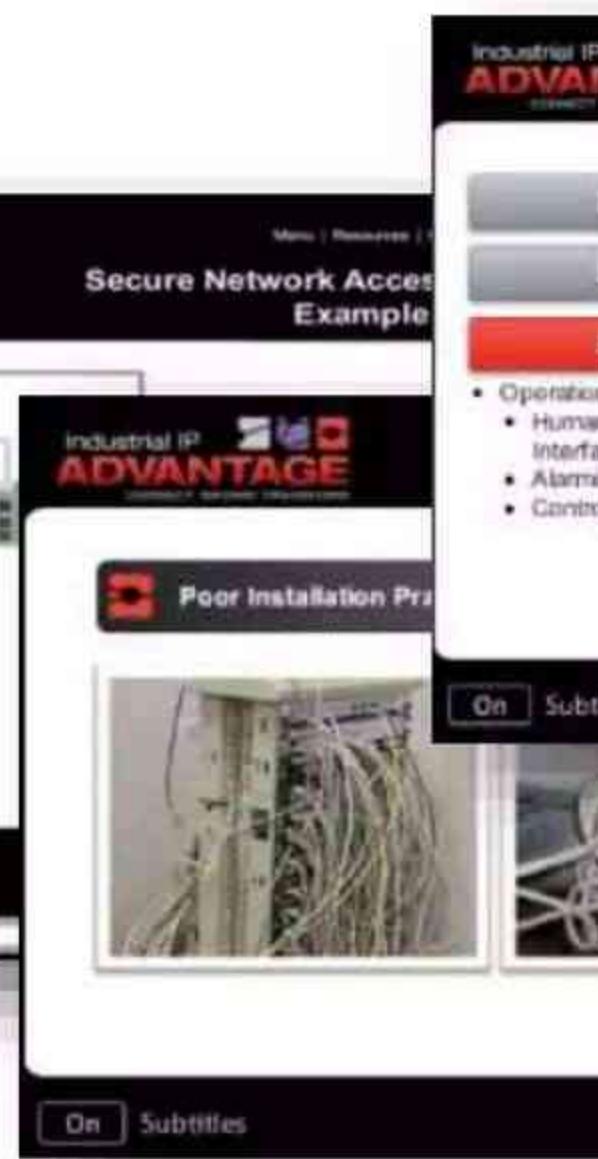
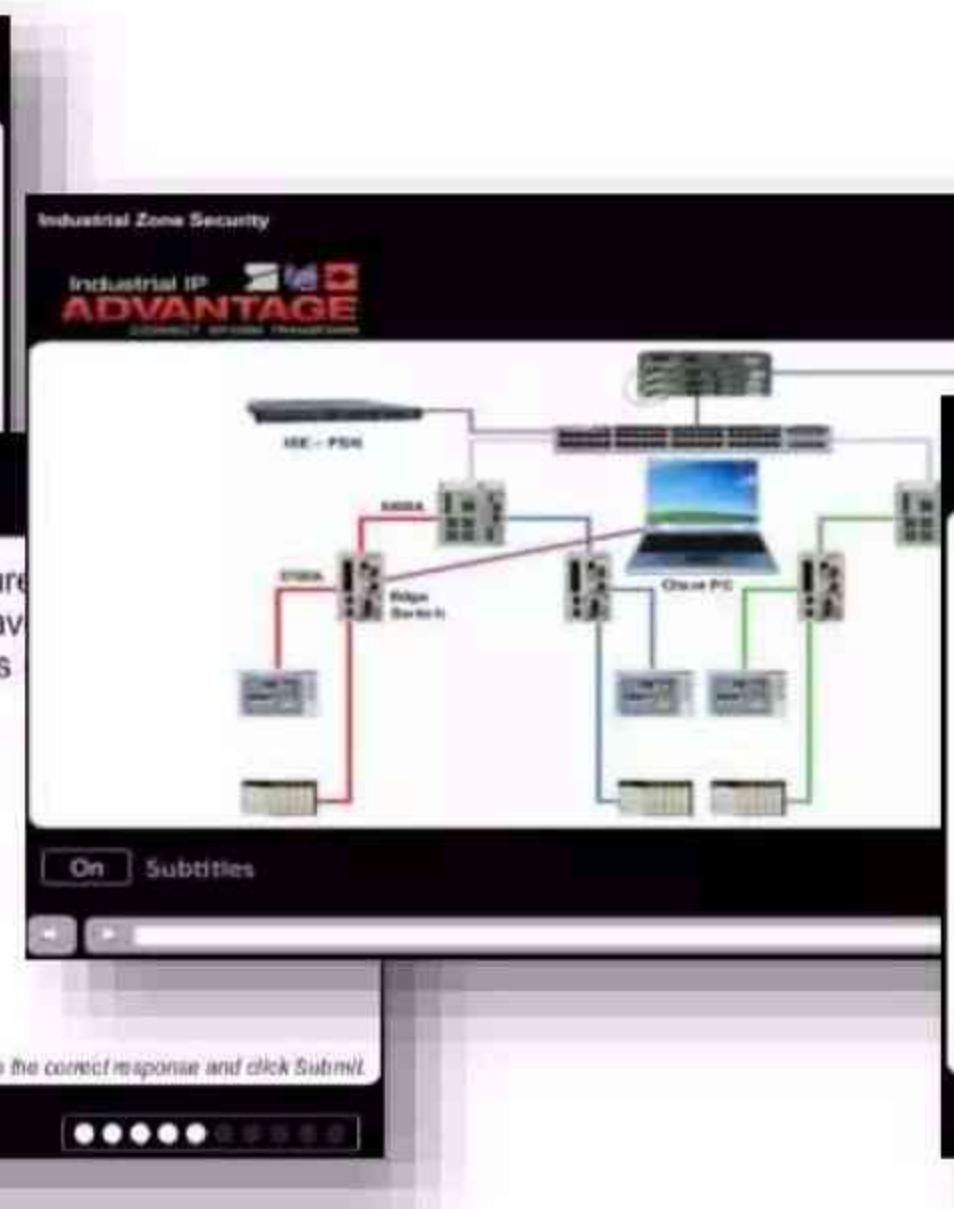
Which of the following, when configured properly, ensure Industrial Automation and Control System traffic will travel network, in a predictable manner, even if the network is

- Unmanaged Switch
- Router
- Network Hubs
- Managed Switches

Choose the correct response and click Submit.

On Subtitles

On Subtitles



Production Cells

Cell Area Zone

Level 0

Level 1

Level 2

- Operational supervision:
 - Human Machine Interfaces
 - Alarming
 - Control room operation

Level 3 Supervisory Control

Level 4 Basic Control

Level 5 Process

Click each button to learn more, or click Next to continue.

Select an image to learn more.

On Subtitles

On Subtitles

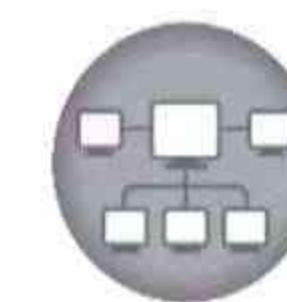
Training Resources

Education - Industrial IoT / Industrial IT (Bridging OT-IT)

- **Courses 1 and 2: Designing for the Cell/Area Zone**
 - Design secure, robust, future-ready networks for cells, machines, skids and other functional units by implementing reference architectures and standard IP.
- **Course 3: Designing for the Industrial Zone**
 - Learn design principles on line integration, high-availability networks and wireless architectures to optimize plant networks.
- **Course 4: IT/OT Integration**
 - Understand how to effectively converge a smart manufacturing facility with IT and OT stakeholders.



EtherNet/IP



Topologies



Security



Wireless



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Training Resources

Training and Certification – Industrial IoT / Industrial IT (Bridging OT-IT)

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- Cisco Industrial Networking Specialist Training and Certification
 - Classroom training
 - [Managing Industrial Networks with Cisco Networking Technologies \(IMINS\)](#)
 - Exam: [200-401 IMINS](#)
 - CPwE Design Considerations and Best Practices



- CCNA Industrial Training and Certification
 - Classroom training
 - [Managing Industrial Networks for Manufacturing with Cisco Technologies \(IMINS2\)](#)
 - Exam: [200-601 IMINS2](#)
 - CPwE Design Considerations and Best Practices



Training Resources

Training and Certification – Industrial IoT / Industrial IT (Bridging OT-IT)



Industrial Networking Specialist

Module 1	Industrial Networking Solutions and Products
Module 2	Industrial Network Documentation and Deployment Considerations
Module 3	Installing Industrial Network Switches, Routers, and Cabling
Module 4	Deploying Industrial Ethernet Devices
Module 5	Maintaining Industrial Ethernet Networks
Module 6	Troubleshooting Industrial Ethernet Networks

CCNA Industrial

Module 1	Industrial Networking Concepts and Components
Module 2	General Troubleshooting Issues
Module 3	EtherNet/IP
Module 4	Troubleshooting EtherNet/IP
Module 5	PROFINET
Module 6	Configuring PROFINET
Module 7	Troubleshooting PROFINET
Module 8	Exploring Security Concerns
Module 9	802.11 Industrial Ethernet Wireless Networking

Training Resources

Rockwell Automation® - Webinars

**Rockwell
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- [Industrial Automation Webinars](#)

- On Demand Webinars

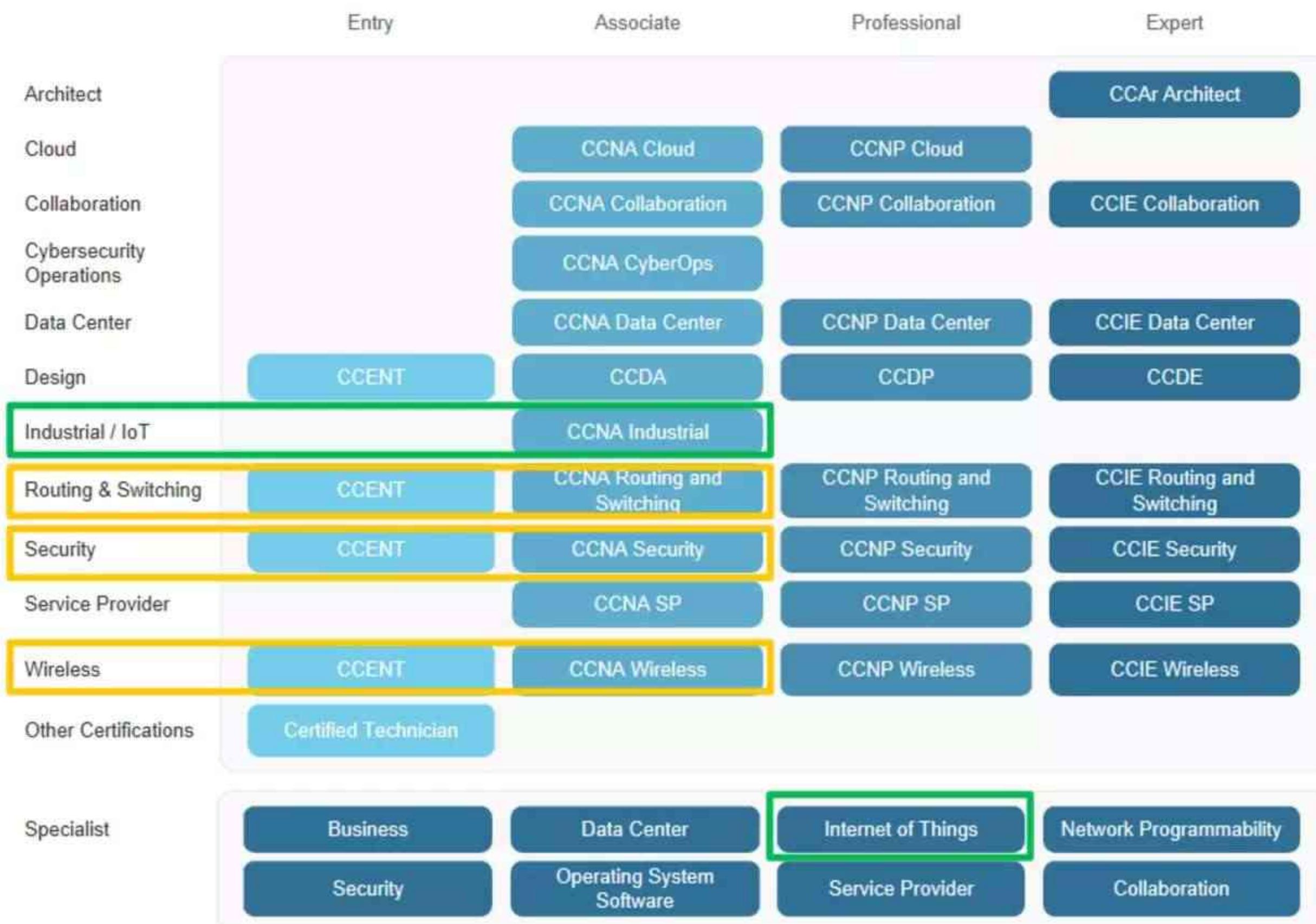
- [Introduction to Building a Robust, Secure and Future-ready Network Infrastructure](#)
- [Increase Business Agility by Converging Manufacturing and Business Systems](#)
- [The Power of Building a Secure Network Infrastructure](#)
- [Design Considerations for Building a Secure Network Infrastructure](#)



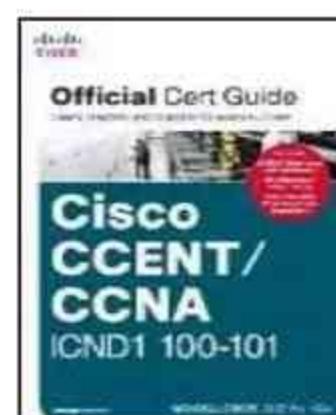
Training Resources

Cisco Training & Certifications

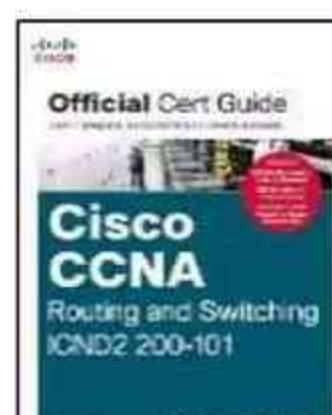
Rockwell
Automation



Cisco
Certification
Track



ICND1



ICND2

Complete A Survey

Please take a moment to complete the brief session survey on our mobile app and let us know how we're doing!

- Download the **ROKTechED** app and login:

Username: Last name

Password: Email address used to register

- Locate the session in the “Schedule”  icon
- Click on the “Survey”  icon in the lower right corner of the session details
- Complete survey & submit



Thank you!

Thank You!

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