Networking Academy

Industrial Networking Essentials & Cisco Packet Tracer 9.0.0

IPD Week - May 7, 2025

Francesco Felicetta
Product Manager

Agenda

- The Problem to Solve and How
- Industrial Networking Essentials Course Deep Dive
- Discovering Cisco Packet Tracer 9.0.0 OT features

The Growing Number of Cyber Attacks on OT

Clorox says sales and profit took a big hit from cyberattack

Johnson Controls Ransomware Attack: Data Theft Confirmed,

World's Critical Infrastructure Suffered 13 Cyber Attacks Every Second in 2023

Jan 29, 2024

Cyberattacks on CNI surge by 30% in 2024, study reveals

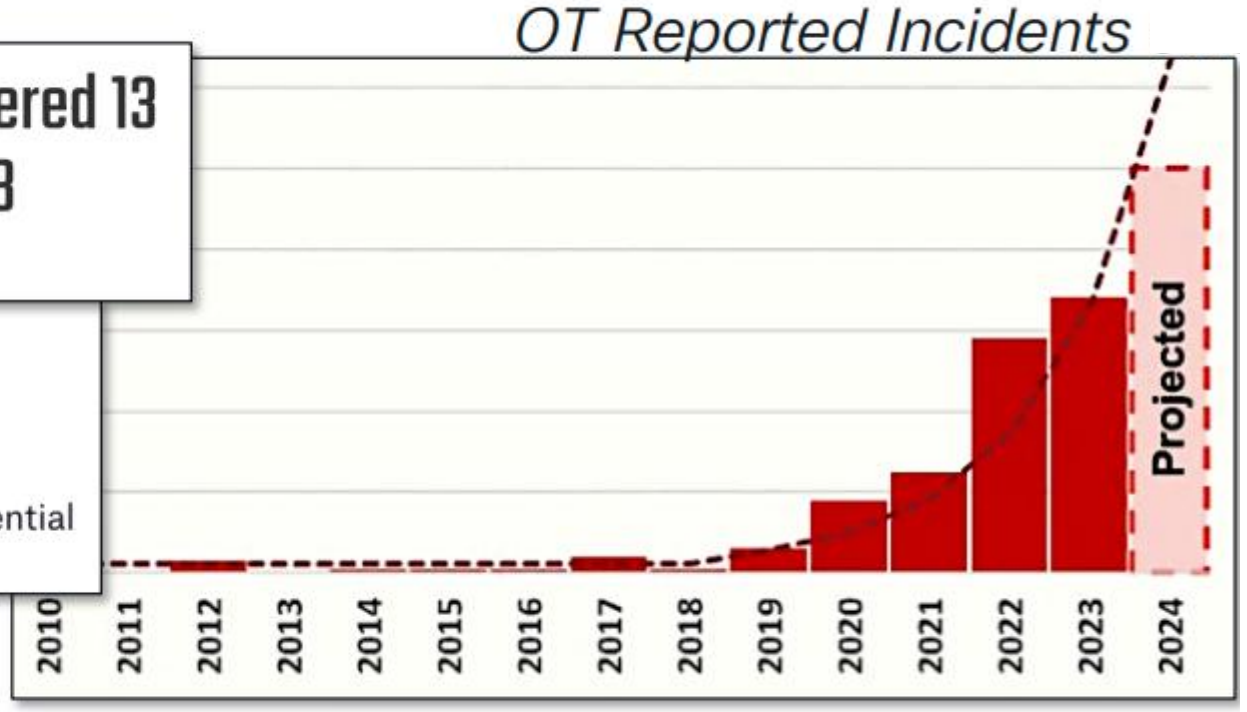
The report by KnowBe4 details the significant rise in attacks on essential sectors - with the US power grid providing especially vulnerable.

Suzuki Motorcycle India breach forces plant shutdown

Simpson Manufacturing Takes Systems Offline Following Cyberattack

Simpson Manufacturing is experiencing disruptions after taking IT systems offline following a cyberattack.

Over 50% of incidents occurred in process and discrete manufacturing in 2023



Ukraine blackouts caused by malware attacks warn against evolving cybersecurity threats to the physical world

May 17, 2024
By Emily Cerf

On a cold winter night in 2016, Ukrainians experienced the first-ever known blackout caused by malicious code (malware) designed to autonomously attack the power grid. One-fifth of Kyiv's citizens were plunged into darkness as attackers used malware to target the capital city's power grid. Six years later, in the early months of the ongoing Russia-Ukraine war, a second attack attempted to combine kinetic and cyber attacks to take down Ukraine's power grid.

Power lines in Ukraine. Photo credit: Mny-Jhee, iStock.

Malware attacks against physical infrastructure have long been a looming threat in the realm of cybersecurity, but these two in Ukraine were the

From Cisco Report on the State of Industrial Networking

Survey

- 1000+ Operation Leaders
- 17 Countries
- 20 Industries

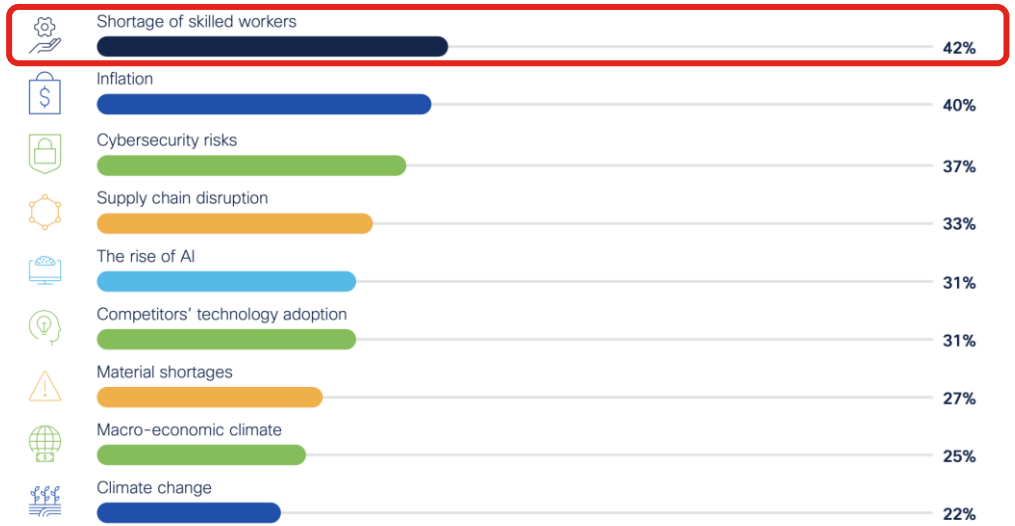
https://www.cisco.com/c/dam/m/digital/elq-cmcglobal/witb/4449635/CIS2401-2024-Cisco-Industrial-Networking-report-V4-FINAL.pdf

Cybersecurity is a top Concern

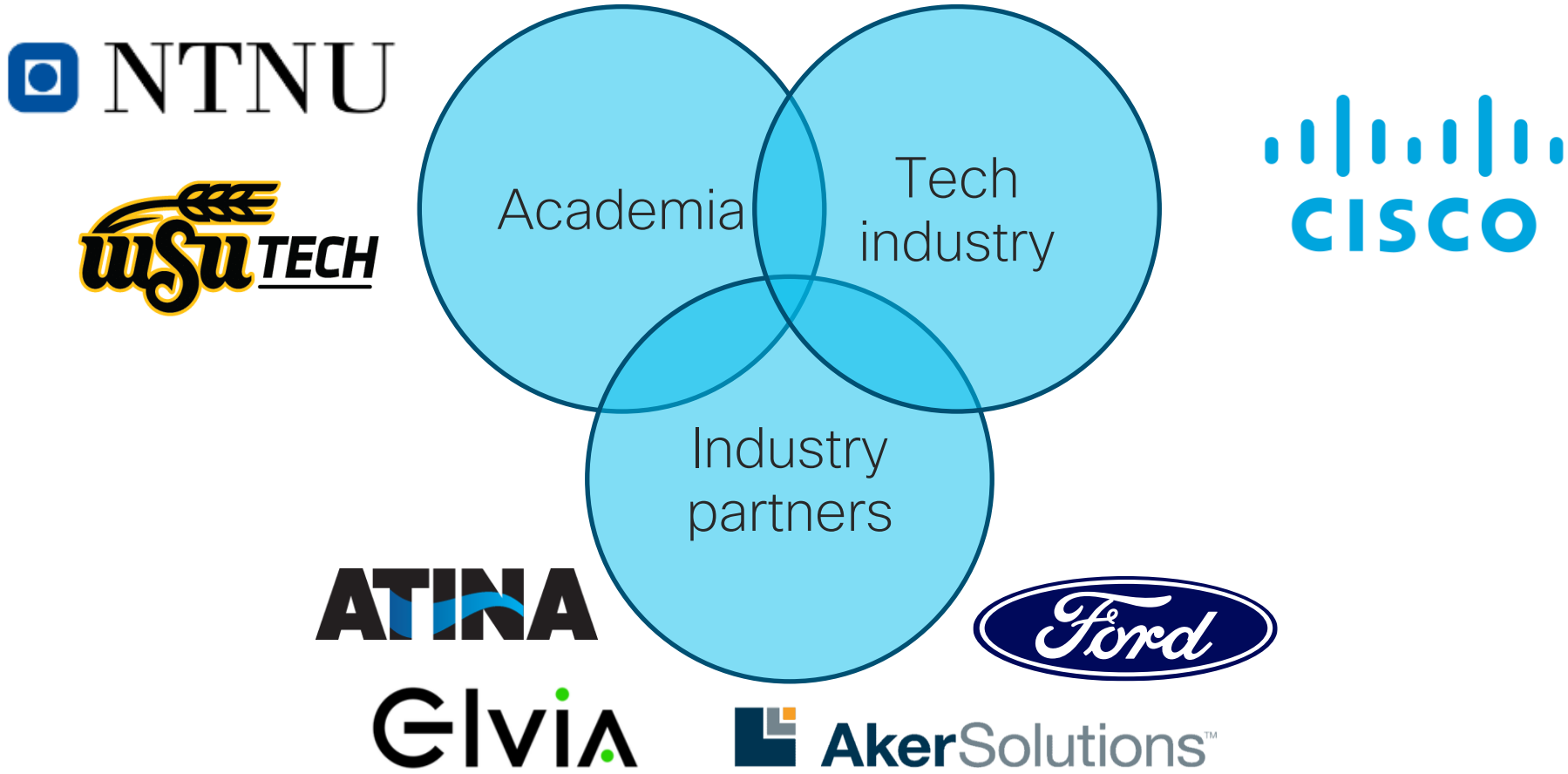
IT and OT must Become more collaborative

AI is driving infrastructure refresh cycle

Industry obstacles to growth: external



Collaboration to Address a Real Need: Skills Shortage



SUBJECT TO CHANGE

Securely Connect Operational Technology

Essential Industrial networking and cybersecurity skills for entry-level OT Jobs in two verticals: manufacturing and utility (power).

Target Audience:

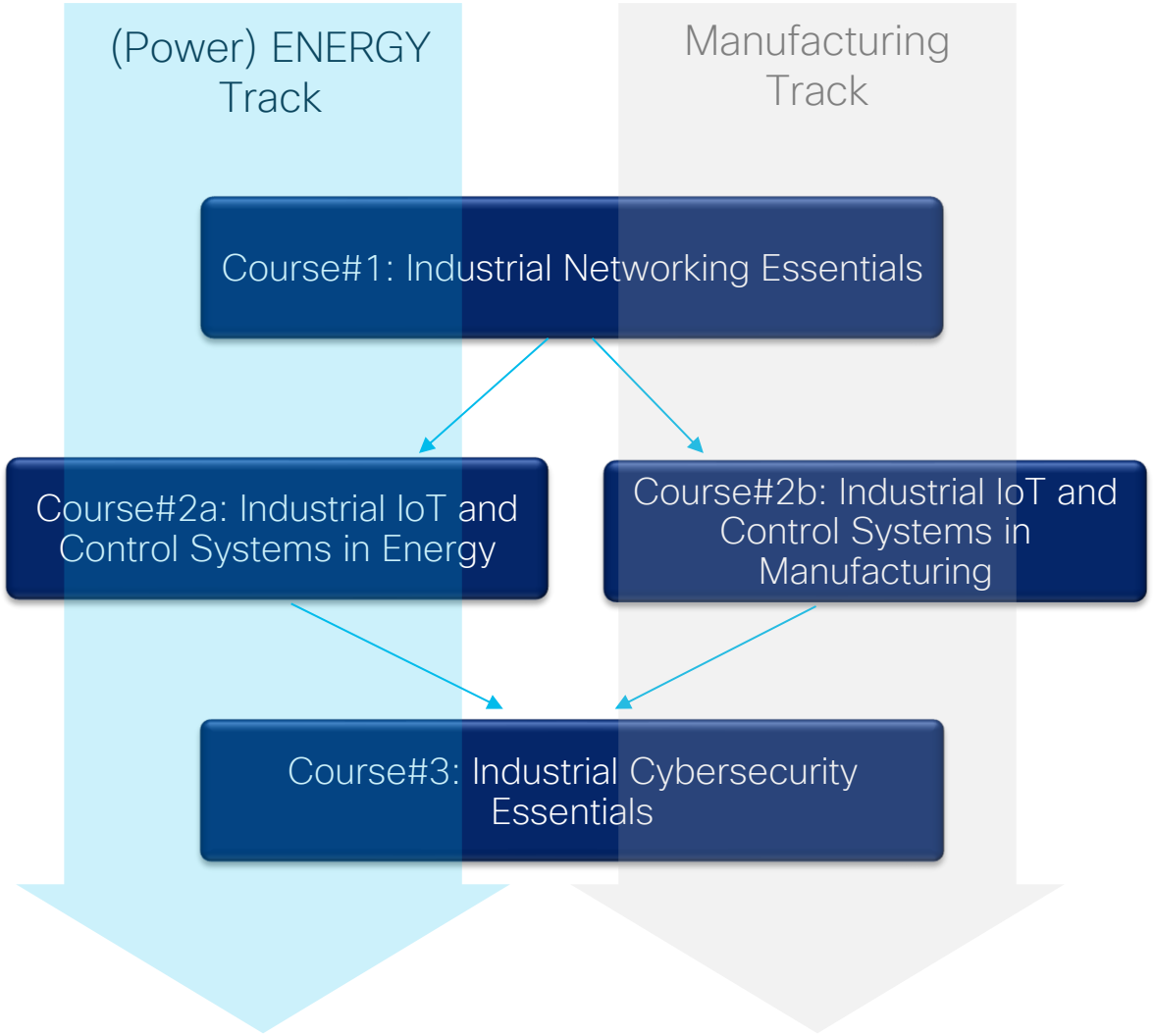
- Students in secondary and post-secondary educational Institutions in the two verticals: manufacturing, utility (Energy power)
- Adults that wants to reskill/upskill

Value proposition

- Complement the learner vertical-specific skills with Industrial Networking and Cybersecurity skills critical for operating modern converged OT infrastructures

Format:

- Learning Collection of courses available on NetAcad.com



Securely Connect OT: Courses and Modules

Estimated total duration ~ 75 hours

Industrial Networking Essentials (~35h)

1. Networking Concepts for OT
2. Network Components, Types, and Connections
3. Network Media
4. Wireless Networks in Integrated IT and OT Systems
5. Communication Principles
6. Network Design
7. The Access Layer
8. Configuring Network Devices
9. The Internet Protocol
10. IPv4 Addressing
11. Gateways to Other Networks
12. Routing Between Networks
13. Transport Layer
14. Application Layer Services
15. Application Layer Implementation in IACS and the Internet of Things
16. Build a Small IACS Network
17. Build a Simple Digital Substation Network

Industrial IoT and Control Systems in Manufacturing (~15h)*

1. Industrial Automation and Control Systems
2. Safety and Regulatory Compliance
3. High Availability Networking for OT
4. Time Sensitive Networking for OT
5. Manufacturing IACS
6. Implement a Simulated Manufacturing IACS System

Industrial IoT and Control Systems in Energy (~15h) *

1. Industrial Automation and Control Systems
2. Safety and Regulatory Compliance
3. High Availability Networking for OT
4. Time Sensitive Networking for OT
5. Smart Grid Systems
6. Implement a Simulated Smart Grid

Industrial Cybersecurity Essentials (~25h) *

1. Introduction to Industrial Cybersecurity
2. Attack Concepts and Techniques
3. Industrial Cybersecurity Frameworks and Regulations
4. Risk Assessment
5. Vulnerabilities
6. Secure Industrial Networks
7. Authentication and Authorization Controls
8. Hardening the Industrial Infrastructure
9. Frontiers in Industrial Security

° **Currently available as BETA and subject to change based on feedback from pilot testing.**

Available on Netacad.com

Cisco Networking Academy

netacad.com/catalogs/learn/networking?category=course&page=2

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Learning Catalog

Subjects

- Cybersecurity
- **Networking**
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- Programming
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Show More

Filters

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Category

- [x] Courses
- [ ] Career Paths
- [ ] Modules
- [ ] Resources

Networking

Computer networks are the brains powering the internet. Learning how they work is valuable for any career in tech!

Courses | Clear

Course | Instructor-led

Industrial Networking Essentials

Learn fundamental networking concepts for modern industrial architectures and practice with industrial devices in Cisco Packet Tracer.

35 Hours

Industrial Networking Essentials

Course Overview

Introduce foundational networking concepts essential for modern industrial infrastructures, focusing on IT and OT integration. Prepare learners for entry-level careers in operational technology (OT), with practice using Cisco Packet Tracer 9.0.0, to simulate real-world scenarios with industrial devices.

Benefits

Equip your students with the confidence and skills needed to get started in connecting industrial devices. This curriculum, co-designed with industry experts, ensures learners gain relevant skills that meet current industry demands.

- ✓ Discover the benefits and key considerations of IT and OT integration.
- ✓ Teach fundamental networking concepts tailored for industrial environments.
- ✓ Understand Ethernet network communication and IP addressing.
- ✓ Explore key industrial protocols including, Ethernet/IP, PROFINET, and Modbus.
- ✓ Build a simple, simulated Industrial Automation Control Systems (IACS) network using Cisco devices.

Course Details

Target Audience: High school, secondary and general audience

Estimated Time to Completion: 35 hours

Prerequisites: Basic computer skills, familiarity with operating systems, internet usage and a basic understanding of industrial components such as Programmable Logic Controller (PLC).

Course Delivery: Self-paced (exclusively through participating academies) and Instructor-led

Learning Component Highlights:
- 17 learning modules
- 22 Cisco Packet Tracer activities
- 3 interactive labs
- 1 per-module Glossary of Terms
- 1 final exam

Course Recognitions: Digital badge

Recommended Next Course: Additional courses coming soon.

Requirements

- ASC Alignment: Recommended
- Instructor Training: Optional
- Physical Equipment: Not Required

netacad.com

What is Operational Technology (OT)?

- OT refers to the hardware and software used to control or monitor physical equipment, processes, and events in the real world.
- This includes devices like valves, pumps, sensors, machines, robots, and industrial control systems (e.g. PLCs - Programmable Logic Controller)
- OT is essential for managing operations in industries such as manufacturing, energy (power grids), water utilities, oil and gas, and transportation.

Two worlds (IT/OT) Converging from two (very) different cultures.

Speaking the same language?

Help, my logistics software App is not working, is the firewall blocking it?

Q: Which port are you using?

A: Port 161/UDP

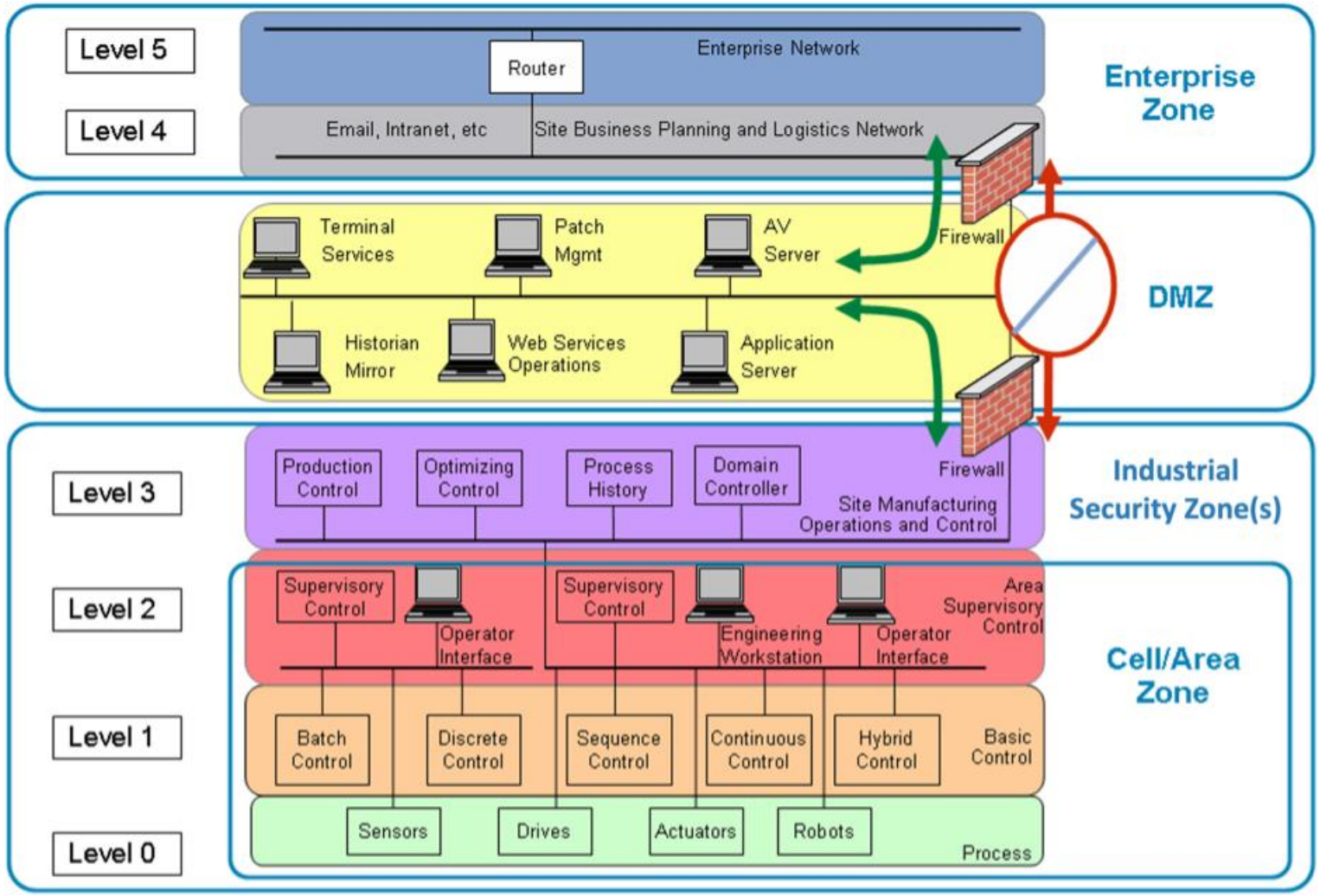
B: Switch 2, port 5

C: Serial Port

D: Rotterdam Port

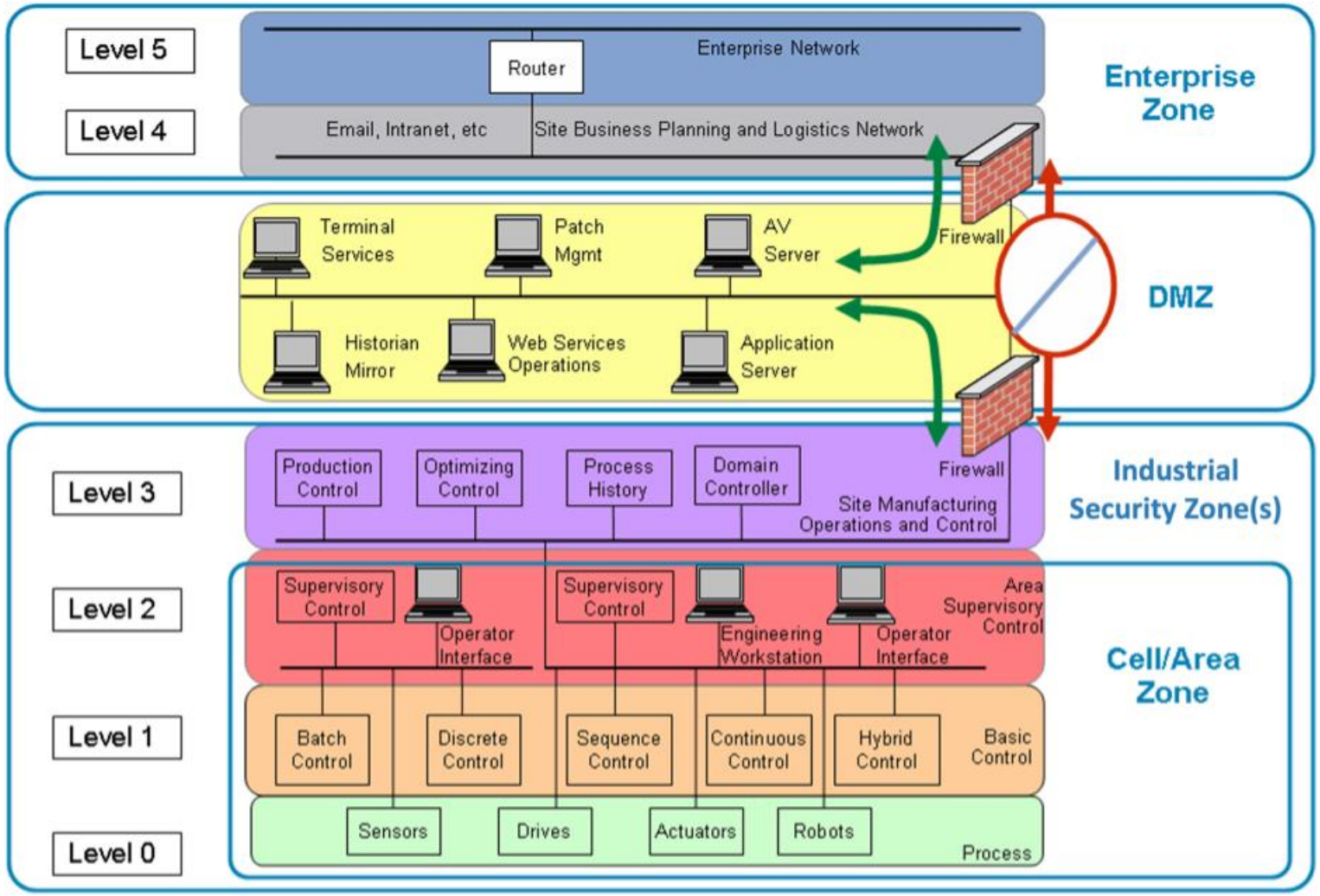
Industrial Networking Essentials:
The Perdue Model

The Purdue model is a framework for segmenting industrial control system (ICS) networks from corporate enterprise networks and organizing systems according to their roles in the industrial network



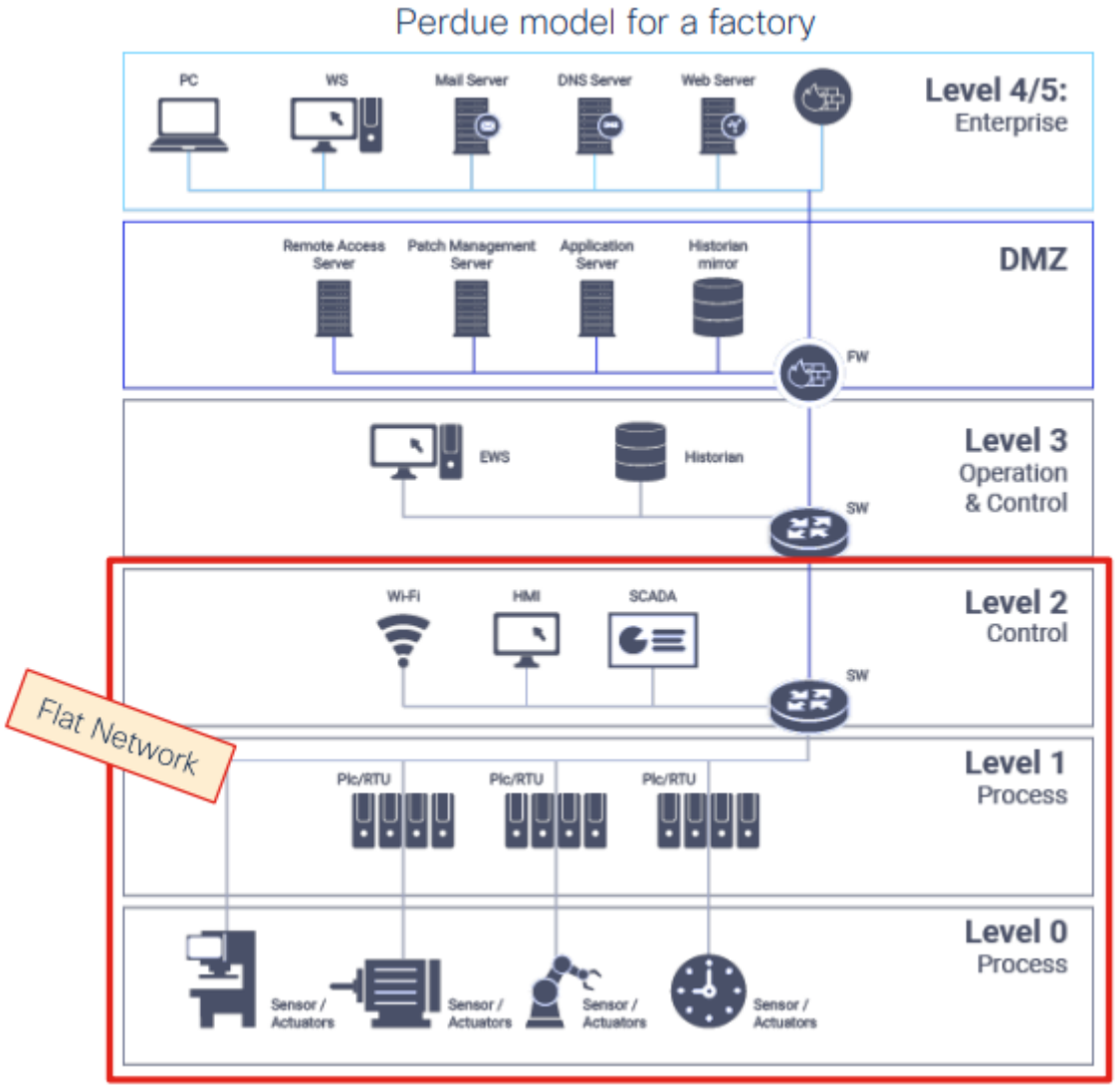
Industrial Networking Essentials:
The Perdue Model Levels

- **Levels 4 and 5** (enterprise zone): comprise the traditional IT enterprise network, where business systems such as enterprise resource planning (ERP) and email servers are located, including user computers and related functions.
- The demilitarized zone (**DMZ**) is the buffer between the critical environments or production systems and the enterprise network. All shared services between the industrial zone and the enterprise zone are at the IDMZ.
- **Level 3** (operations zone): acts like the data center of the operational network, includes *data historians*.
- **Level 2** (supervisory zone): contains systems that control and monitor the physical process, like human machine interfaces (*HMI*).
- **Level 1** (control zone): contains intelligent devices that send commands to level 0 devices; includes programmable logic controllers (*PLC*),
- **Level 0** (process zone): contains devices that interact with the physical world (*sensors, actuators, machines*).



Industrial Networking Essentials:
The risks of Flat Networks

Threats can spread unrestricted and bring down entire factory floor

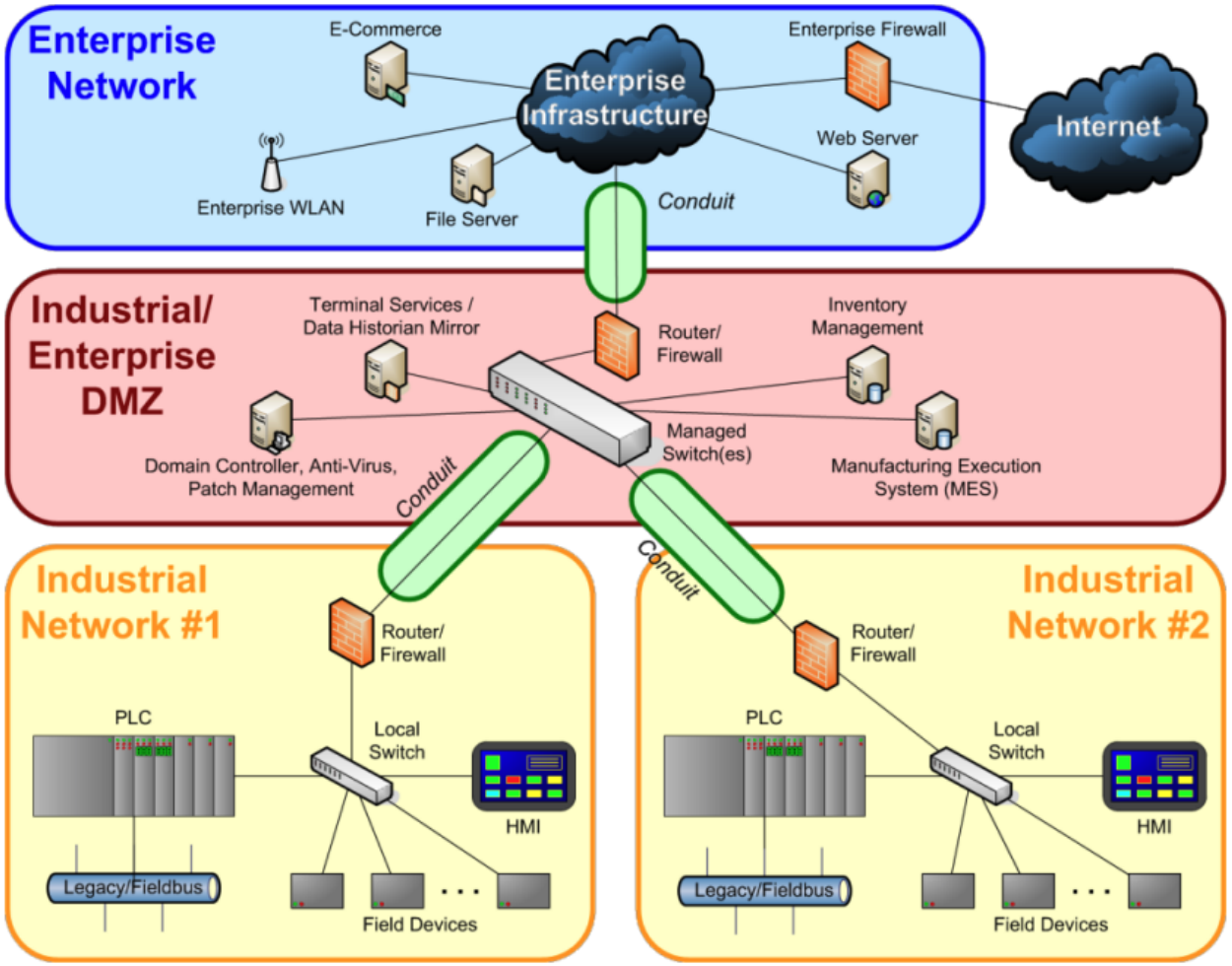


Industrial Networking Essentials:
Network Segmentation

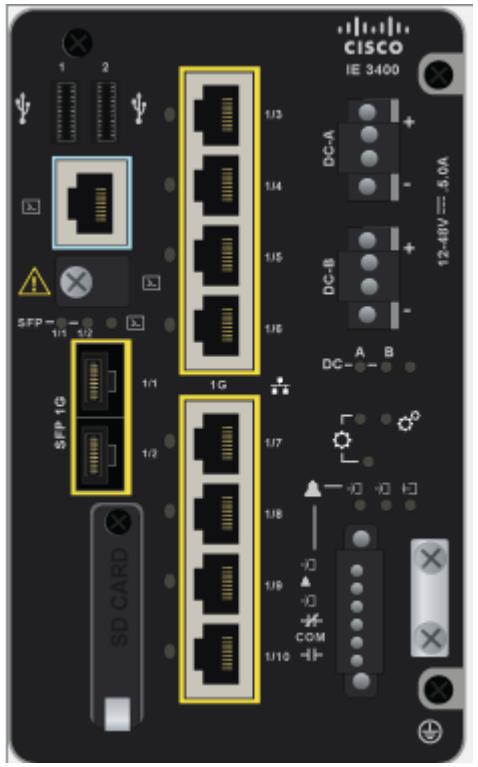
~~FLAT NETWORKS~~

VLANs Trunks

IP Address Subnet Mask



Industrial Networking Essentials:
Industrial **Devices and Protocols**



INDUSTRIAL SWITCH

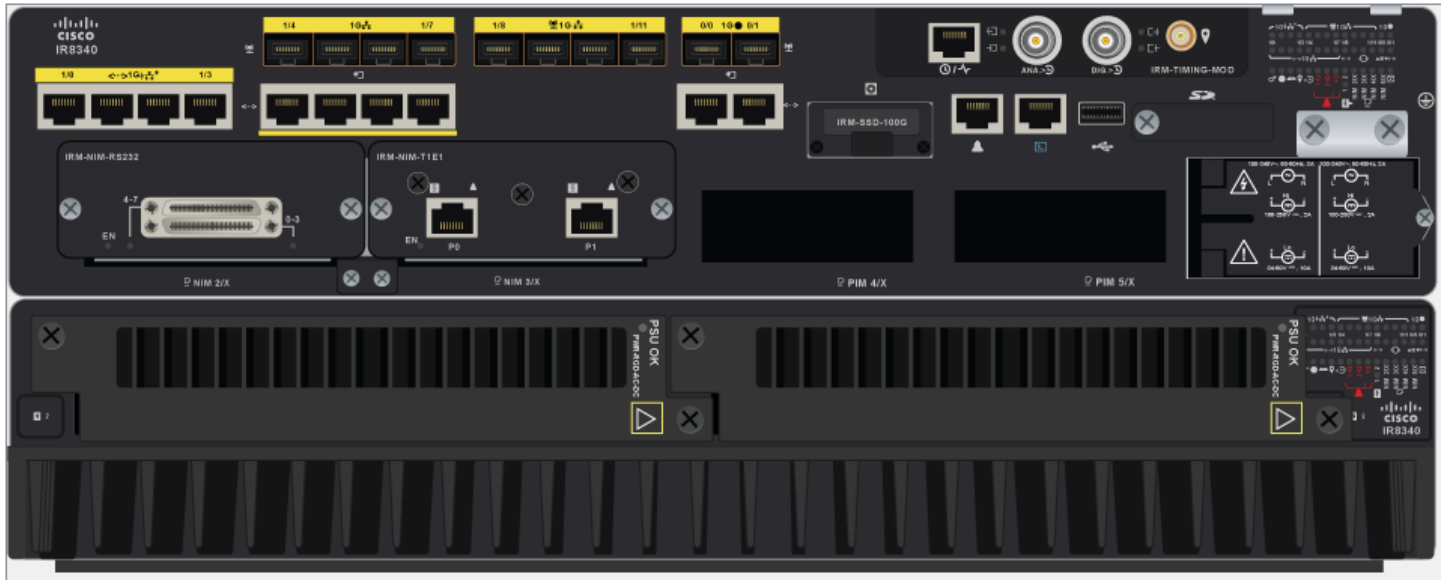
Ethernet/IP: CIP

PROFINET

IEC 61850
- Goose
- SV
- MMS

MQTT

OPC UA



INDUSTRIAL ROUTER

Importance of Practice

A key pillar of Cisco Networking Academy

Motivate students with exciting experiences that make learning very real

Accelerate and optimize each student's path to career-ready skills

Build student confidence: "I can do this!"

Cisco Packet Tracer

Virtual Machines

Cisco Packet Tracer 9.0.0

Expand on the Industrial devices, protocols and process

Cisco Packet Tracer, a leading tool for practicing ICT skills, becomes even more unique in its latest version by empowering users to practice entry-level industrial skills. It enables practice of industrial processes, device connectivity and configuration, troubleshooting, and securing, with support for industrial-specific protocols - using just a simple PC.

Securely

- Industrial Firewall (ISA3000-ASA)
- Cyber Observer (inspired by Cisco Cyber Vision)

Connect

Industrial Router
- IR8340
- IR1101

Industrial Switch
- IE9300
- IE3400

- Fiber Optics
- DIN Rail

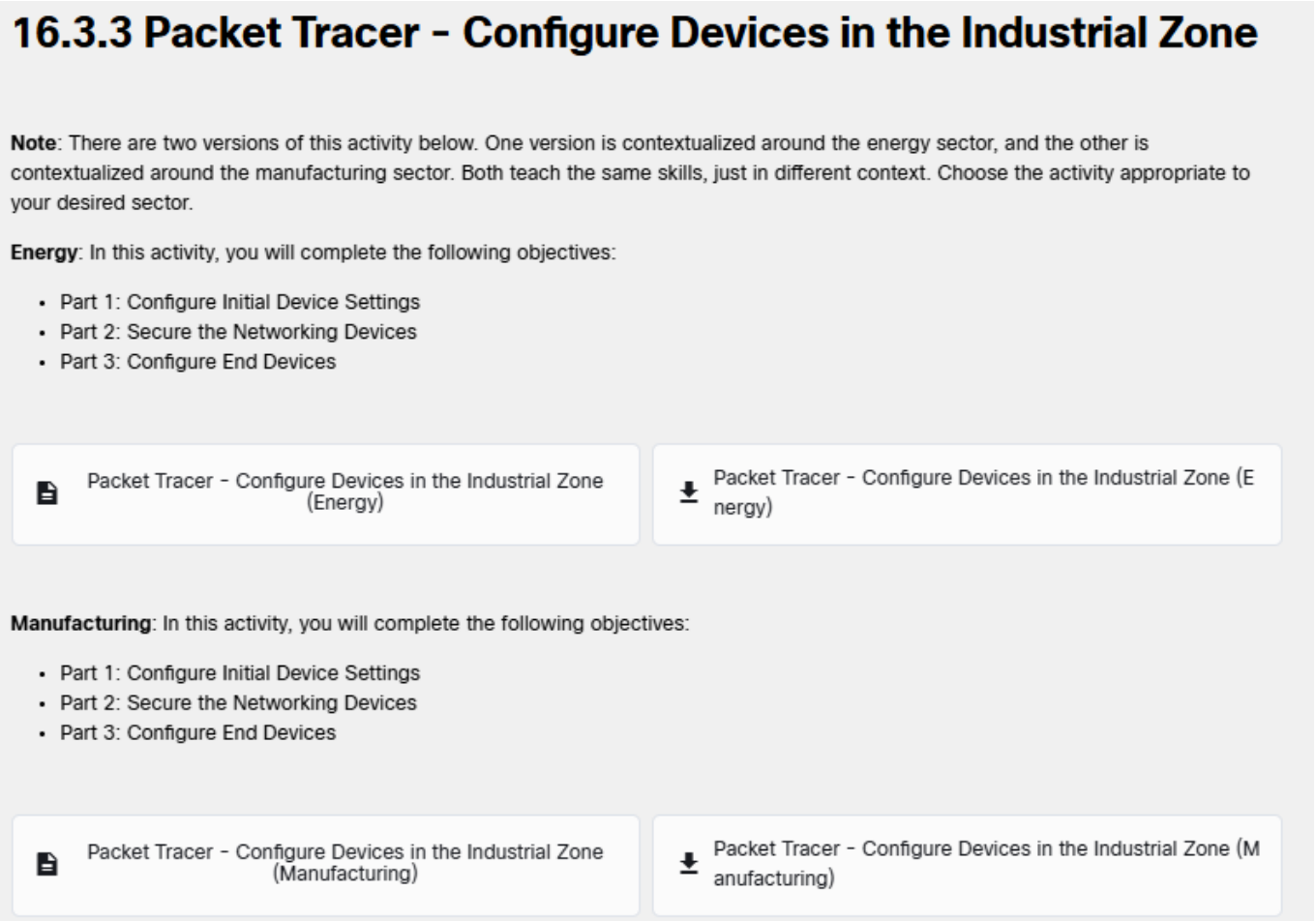
Operational Technologies

- Sensors
- Actuators
- Create your own sensor, actuator…
- PLC
- RTU
- HMI
- Data Historian
- Engineering Workstation
- Ladder Logic

- Modbus
- Profinet
- CIP: Ethernet/IP
- PTP (Power Profile)
- PRP
- IEC61850
  - Goose
  - SV
  - MMS
- OPC-UA
- 5G

Devices and protocols are modeled with simplified implementations for didactical purposes.
Features are subject to change based on feedback from the pilots

Industrial Networking Essentials:
Contextualized Packet Tracer Activities



16.3.3 Packet Tracer - Configure Devices in the Industrial Zone

Note: There are two versions of this activity below. One version is contextualized around the energy sector, and the other is contextualized around the manufacturing sector. Both teach the same skills, just in different context. Choose the activity appropriate to your desired sector.

Energy: In this activity, you will complete the following objectives:

- Part 1: Configure Initial Device Settings
- Part 2: Secure the Networking Devices
- Part 3: Configure End Devices

Packet Tracer - Configure Devices in the Industrial Zone (Energy)

Packet Tracer - Configure Devices in the Industrial Zone (Energy)

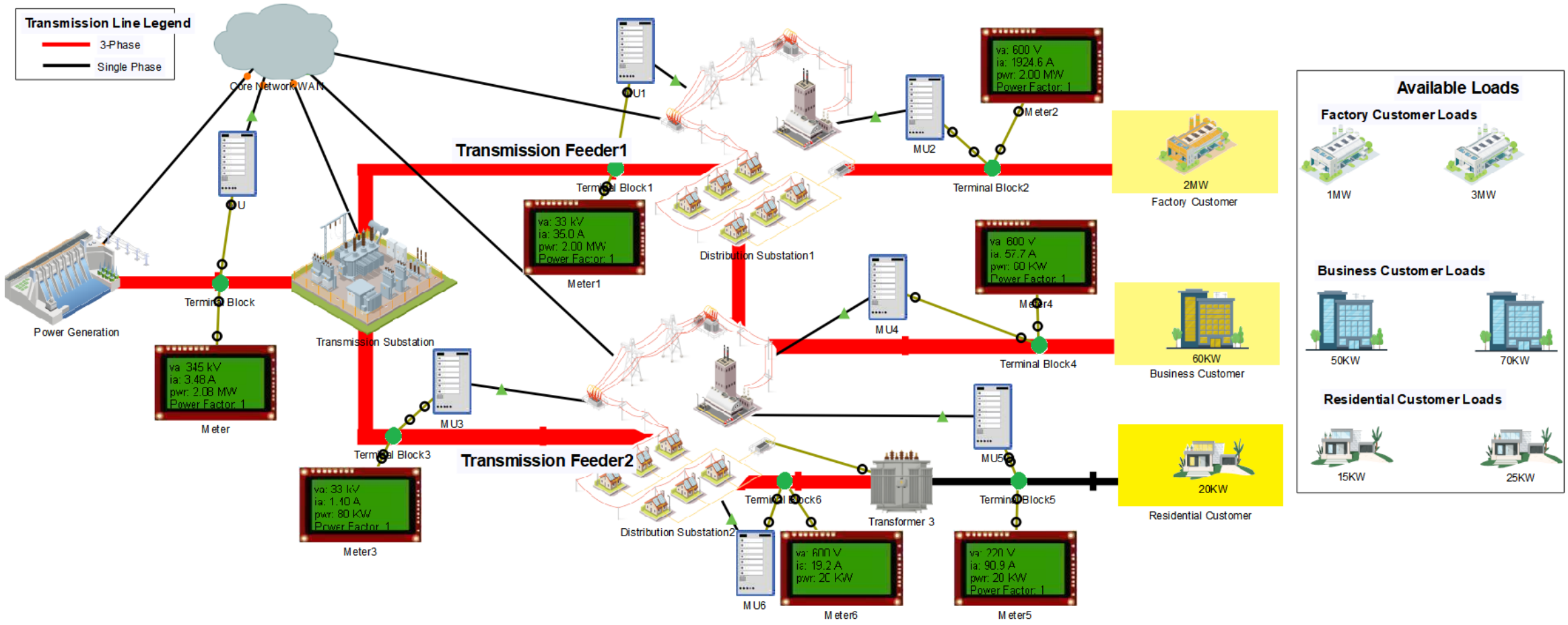
Manufacturing: In this activity, you will complete the following objectives:

- Part 1: Configure Initial Device Settings
- Part 2: Secure the Networking Devices
- Part 3: Configure End Devices

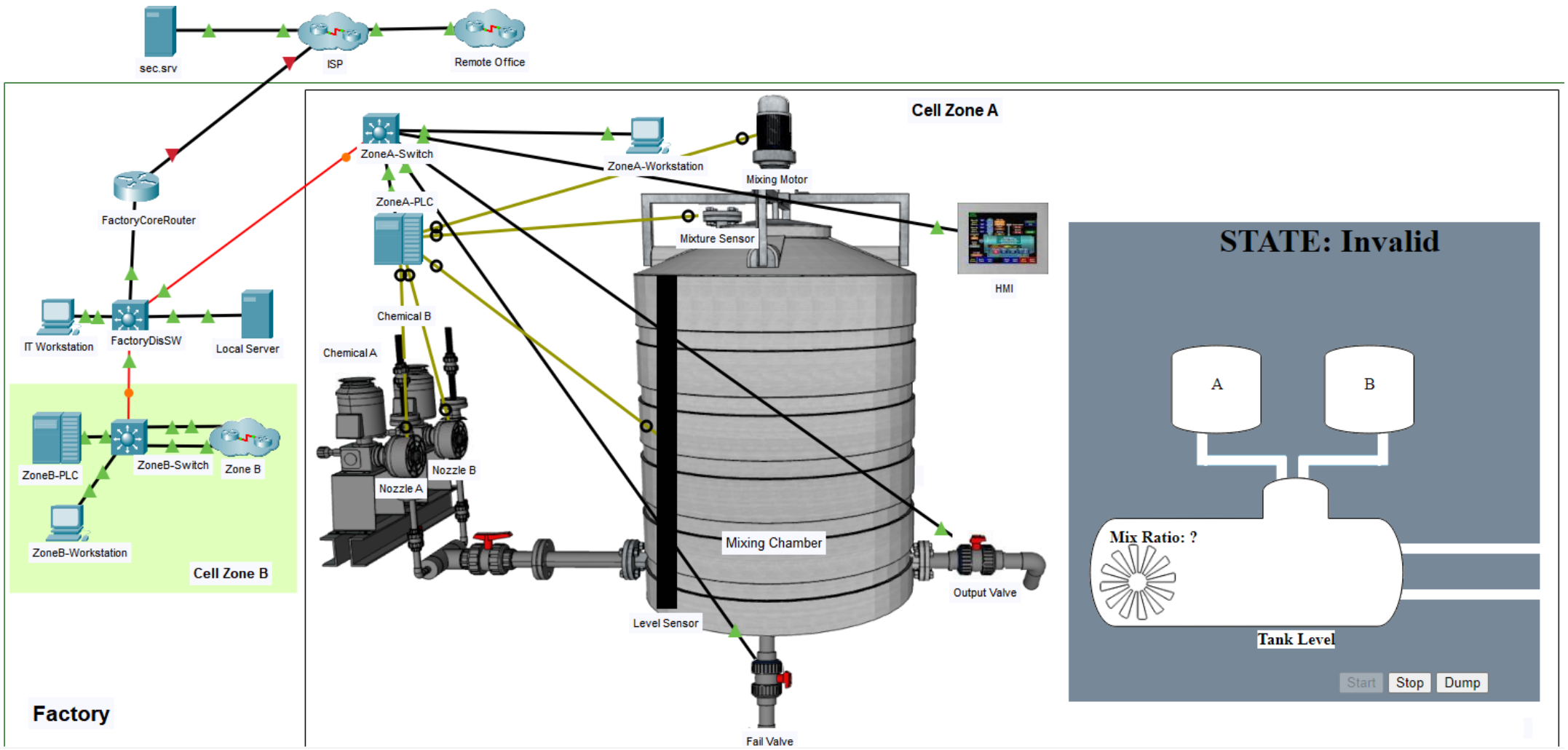
Packet Tracer - Configure Devices in the Industrial Zone (Manufacturing)

Packet Tracer - Configure Devices in the Industrial Zone (Manufacturing)

Industrial IoT in Energy:
Simulate a Smart Grid



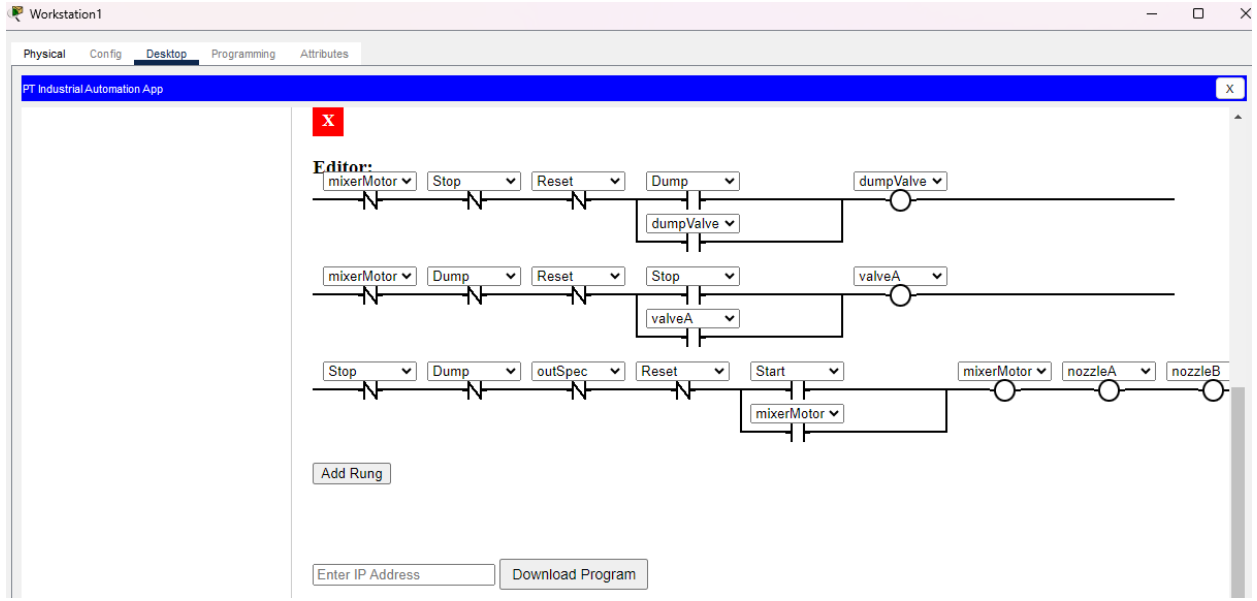
Industrial IoT in Manufacturing:
Simulate a factory for mixing raw materials

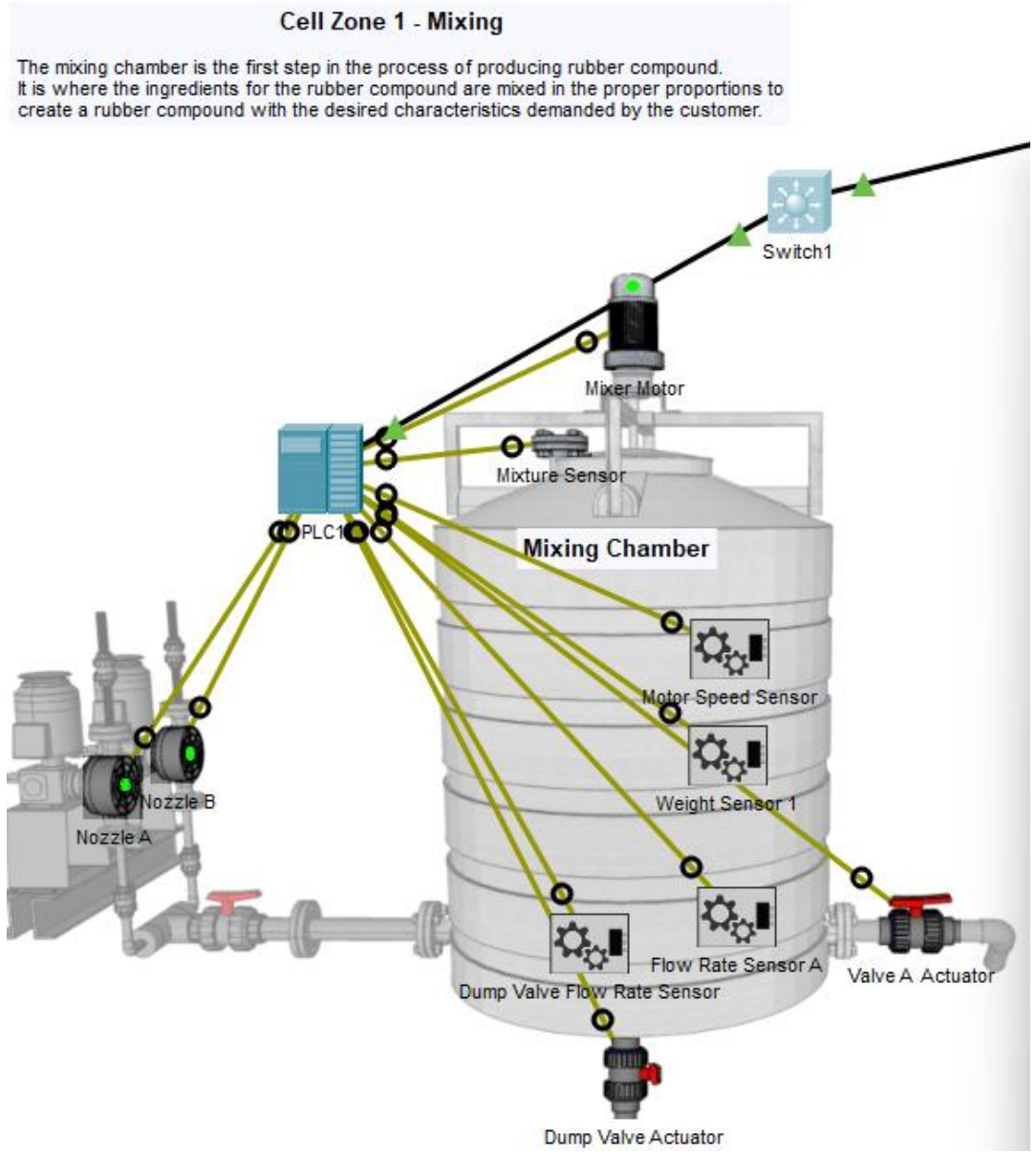


Cisco Packet Tracer 9.0.0

Practice Programming PLCs in an IACS Network

Practice ladder logic programming to control manufacturing processes.

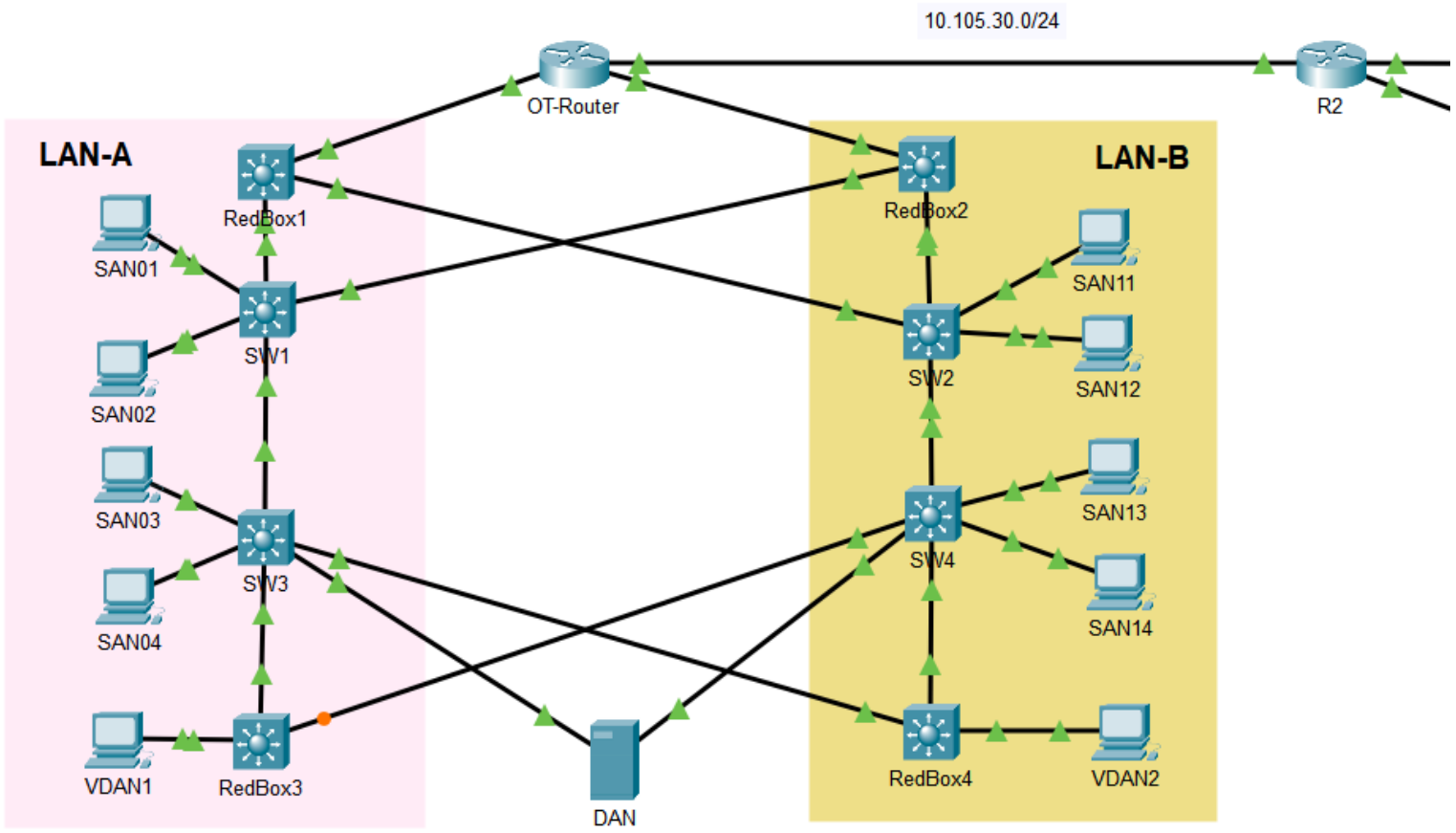




Cisco Packet Tracer 9.0.0

Implement High Availability Protocols

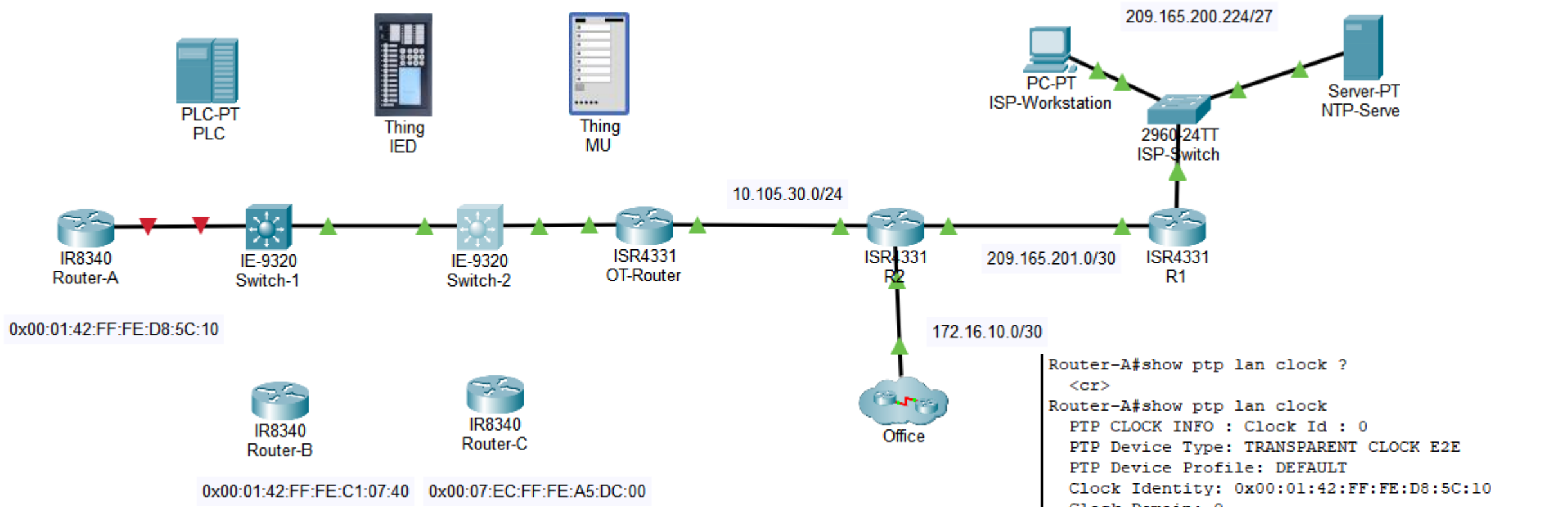
PRP (Standard IEC 62439-3) based scenario to simulate hitless redundancy (zero recovery time after failures) in Ethernet networks.



Cisco Packet Tracer 9.0.0

Implement Time Sensitive Networking (PTP)

Time synchronization at the microsecond and sub-microsecond level is achievable using the Precision Time Protocol (PTP) or IEEE 1588. This level of precision is critical for applications like fault detection ensuring the safe and efficient operation.




```
Router-A#show ptp lan clock ?
  <cr>
Router-A#show ptp lan clock
  PTP CLOCK INFO : Clock Id : 0
  PTP Device Type: TRANSPARENT CLOCK E2E
  PTP Device Profile: DEFAULT
  Clock Identity: 0x00:01:42:FF:FE:D8:5C:10
  Clock Domain: 0
  Number of PTP ports: 14
  Delay Mechanism: End to End
  Local clock time: 2024-06-21  18:05:38 UTC
Router-A#
```

Industrial Cybersecurity Essentials:
Shodan Lab

shodan.io/search?query=plc+siemens

Shodan | Maps | Images | Monitor | Developer | More...

SHODAN | Explore | Downloads | Pricing | plc siemens

TOTAL RESULTS

503

TOP COUNTRIES

Germany	**161**

View Report | View on Map | Advanced Search

Product Spotlight: Keep track of what you have connected to the Internet. Check out **Shodan Monitor**

92.241.219.135

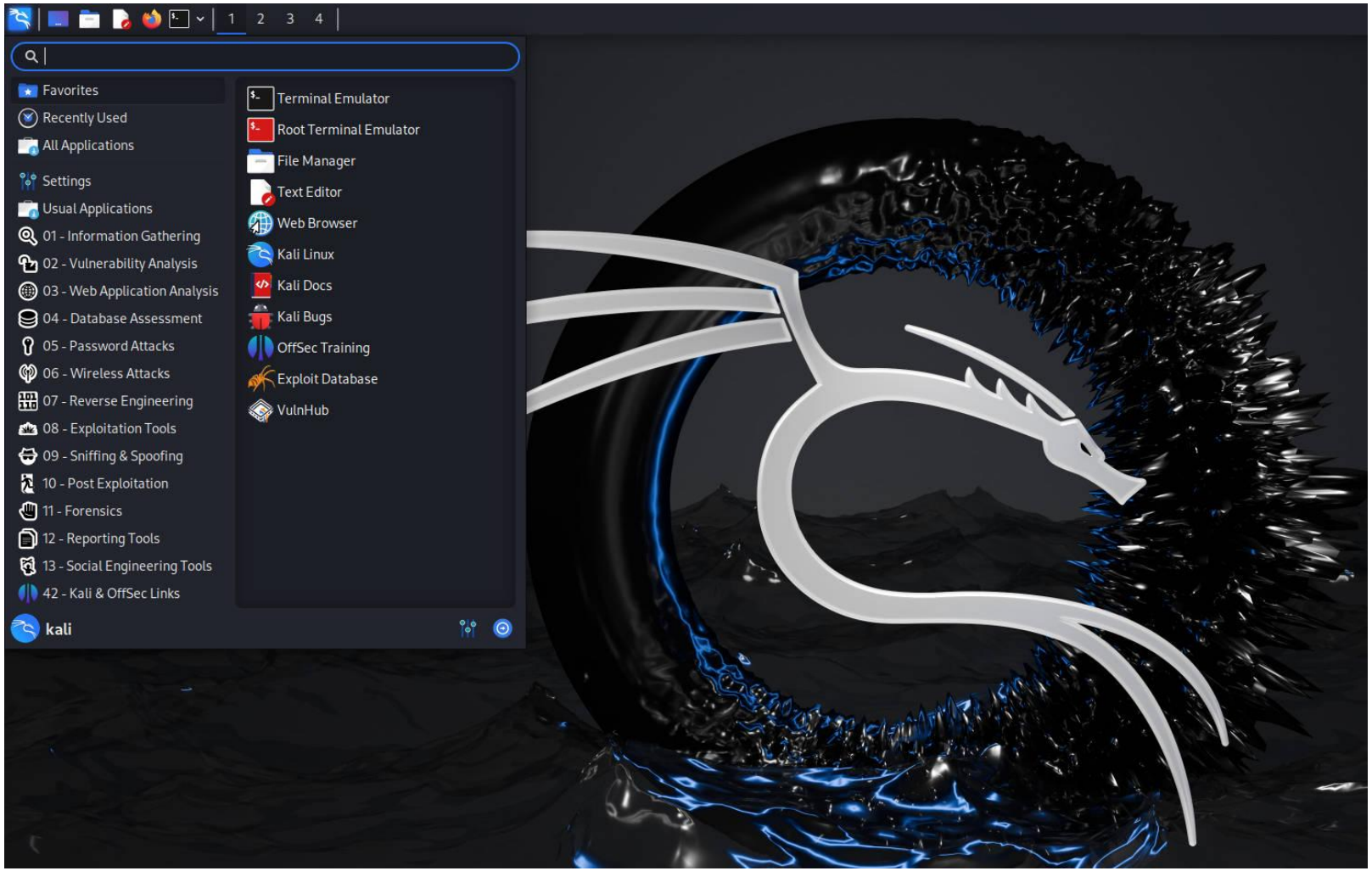
Cibicom A/S

Denmark, Copenhagen

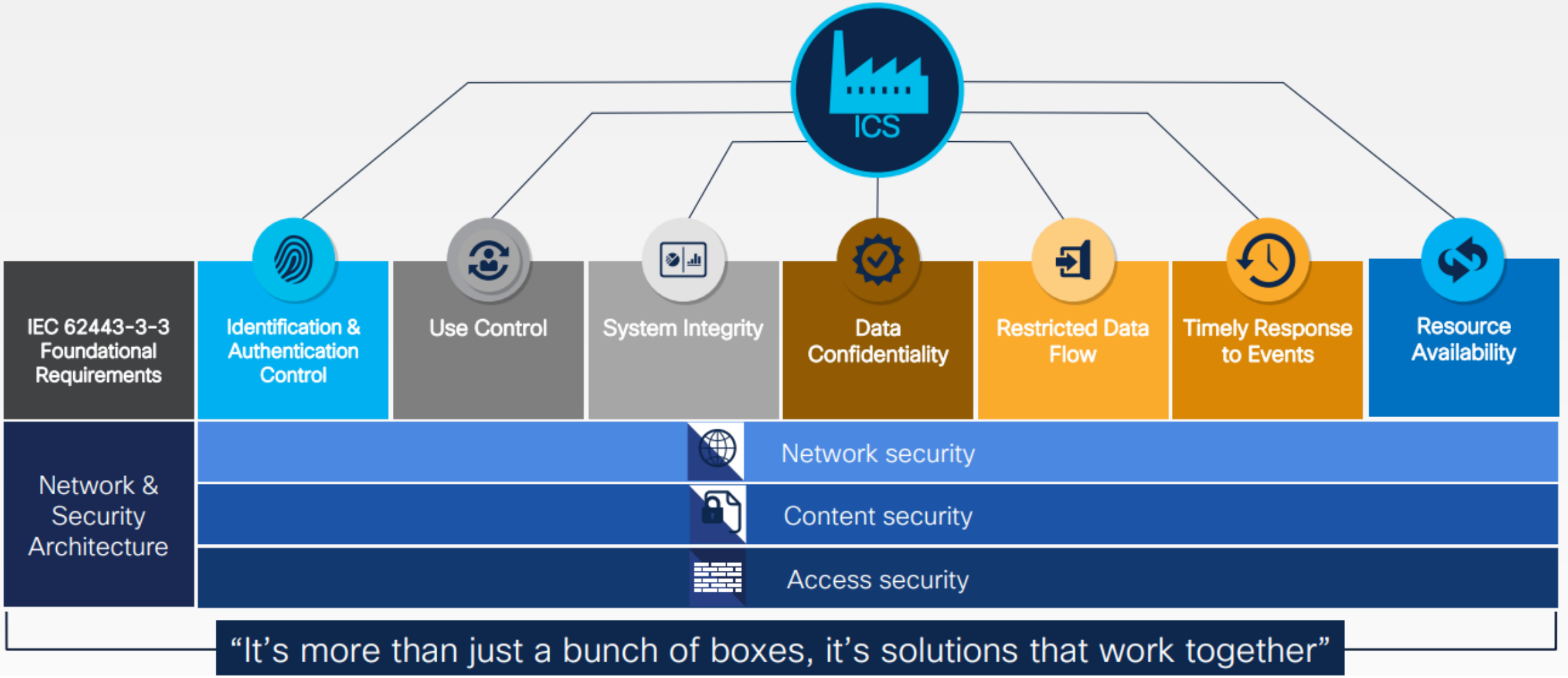
ics

```
Copyright: Original Siemens Equipment
PLC name: PLC1
Module type: IM151-8 PN/DP CPU
Unknown (129): Boot Loader          A%
Module: 6ES7 151-8AB01-0AB0  v.0.7
Basic Firmware: v.3.2.14
Module name: IM151-8 PN/DP CPU
Serial number of module: S C-K8SF91062018
Plant identification: Pumpestation PSGIL...
```

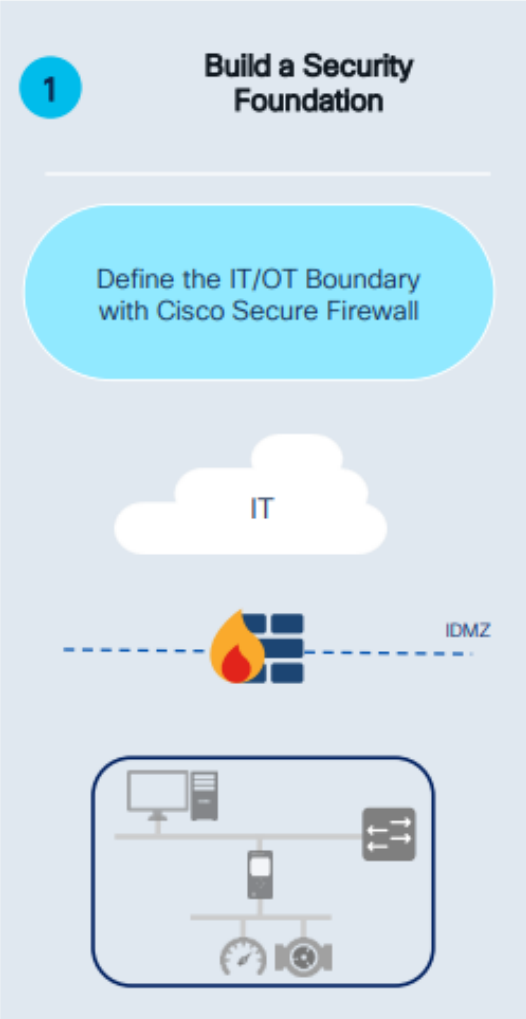
Industrial Cybersecurity Essentials:
Practice using Open-Source Tools

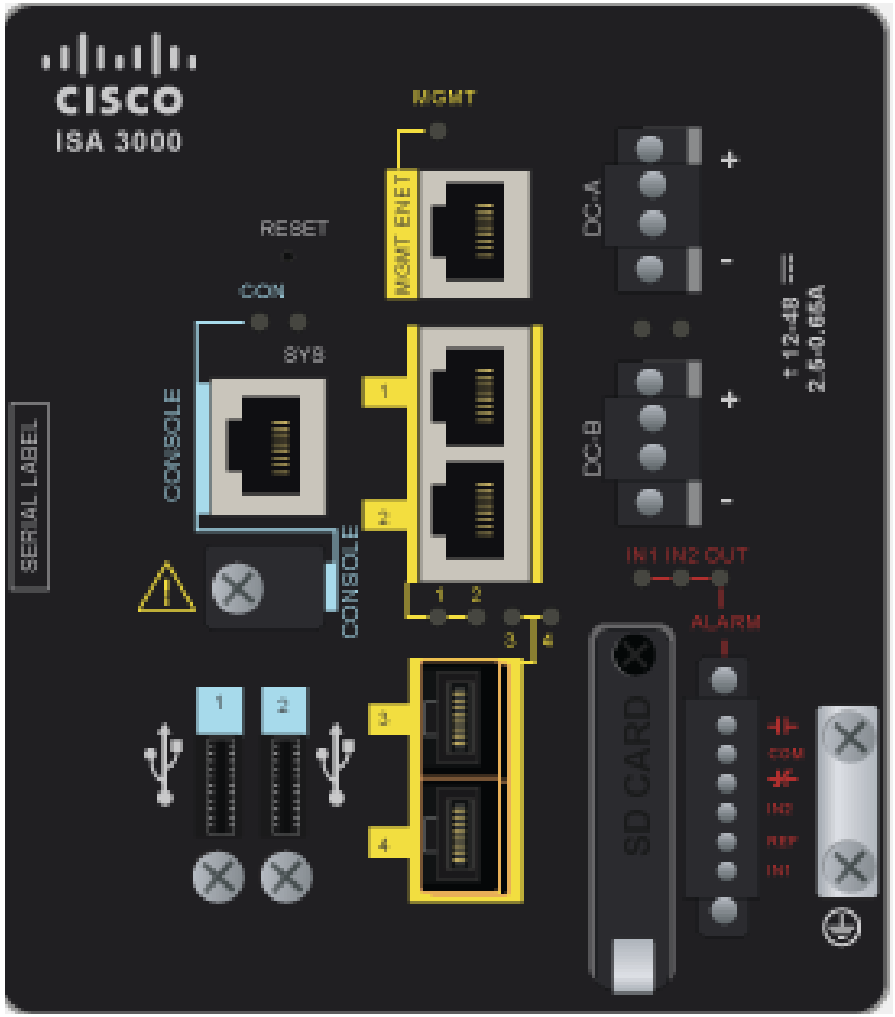


Industrial Cybersecurity Essentials:
Introducing Standards

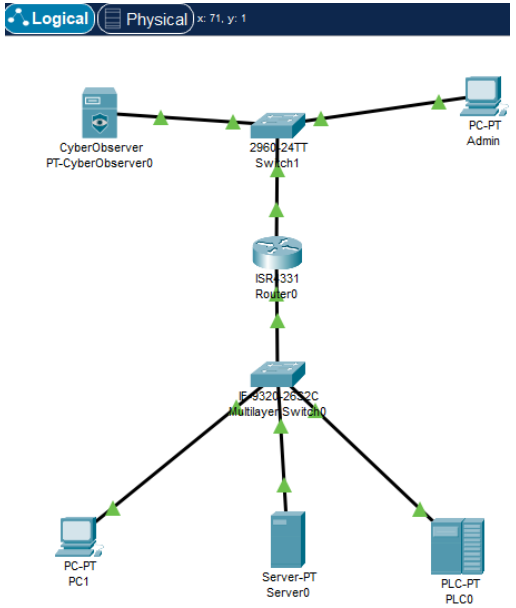


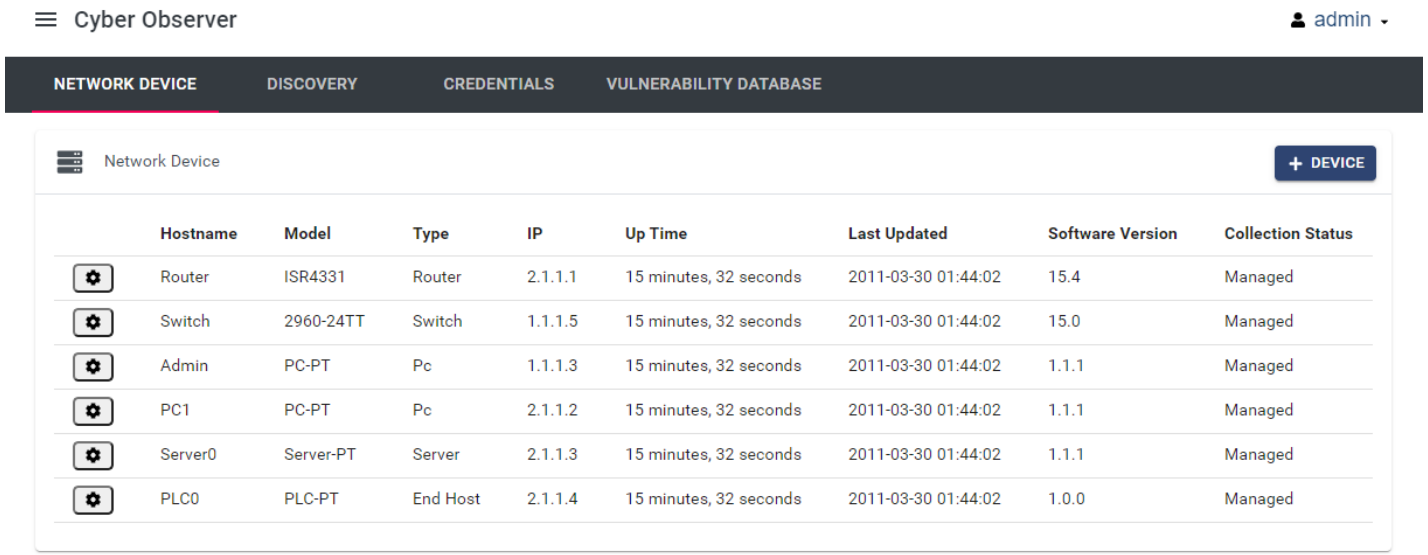
Cisco Packet Tracer 9.0.0:
Configure an IDMZ Firewall





Cisco Packet Tracer 9.0.0: CyberObserver
Inspired by Cisco Cyber Vision





	Hostname	Model	Type	IP	Up Time	Last Updated	Software Version	Collection Status
⚙	Router	ISR4331	Router	2.1.1.1	15 minutes, 32 seconds	2011-03-30 01:44:02	15.4	Managed
⚙	Switch	2960-24TT	Switch	1.1.1.5	15 minutes, 32 seconds	2011-03-30 01:44:02	15.0	Managed
⚙	Admin	PC-PT	Pc	1.1.1.3	15 minutes, 32 seconds	2011-03-30 01:44:02	1.1.1	Managed
⚙	PC1	PC-PT	Pc	2.1.1.2	15 minutes, 32 seconds	2011-03-30 01:44:02	1.1.1	Managed
⚙	Server0	Server-PT	Server	2.1.1.3	15 minutes, 32 seconds	2011-03-30 01:44:02	1.1.1	Managed
⚙	PLC0	PLC-PT	End Host	2.1.1.4	15 minutes, 32 seconds	2011-03-30 01:44:02	1.0.0	Managed

The PT CyberObsever can be used to simulate scenarios on:

1) ICS Visibility: Asset Inventory
2) Identify Industrial Asset Vulnerabilities
3) Threat Detection and Mitigation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