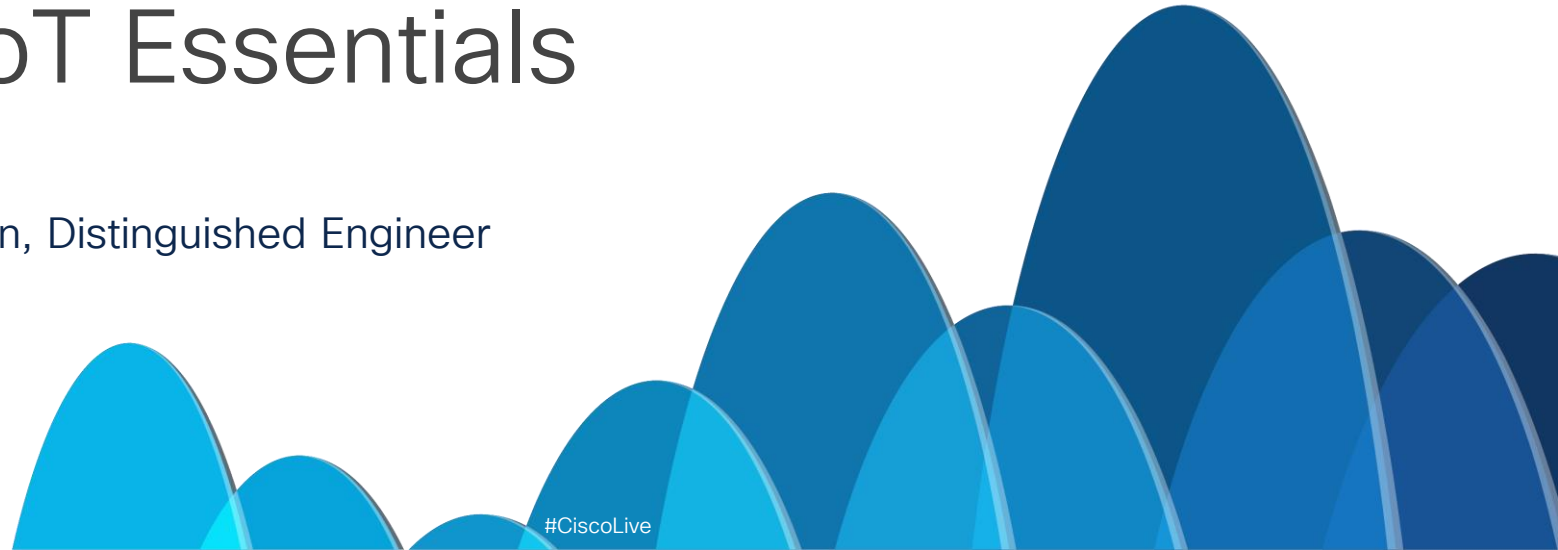
The bridge to possible

Unlocking the Future: Cisco Industrial Networking and IoT Essentials

Robert Barton, Distinguished Engineer

BRKIOT-1006



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Cisco Webex App

https://ciscolive.ciscoevents.com/ciscolivebot/#BRKIOT-1006

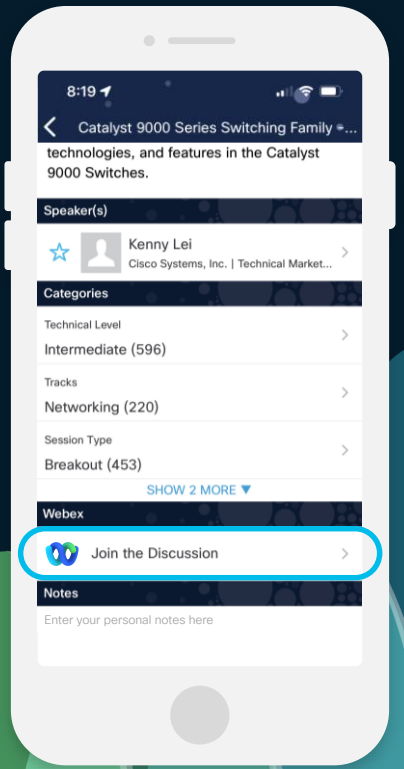
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

1. Find this session in the Cisco Live Mobile App
2. Click “Join the Discussion”
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space

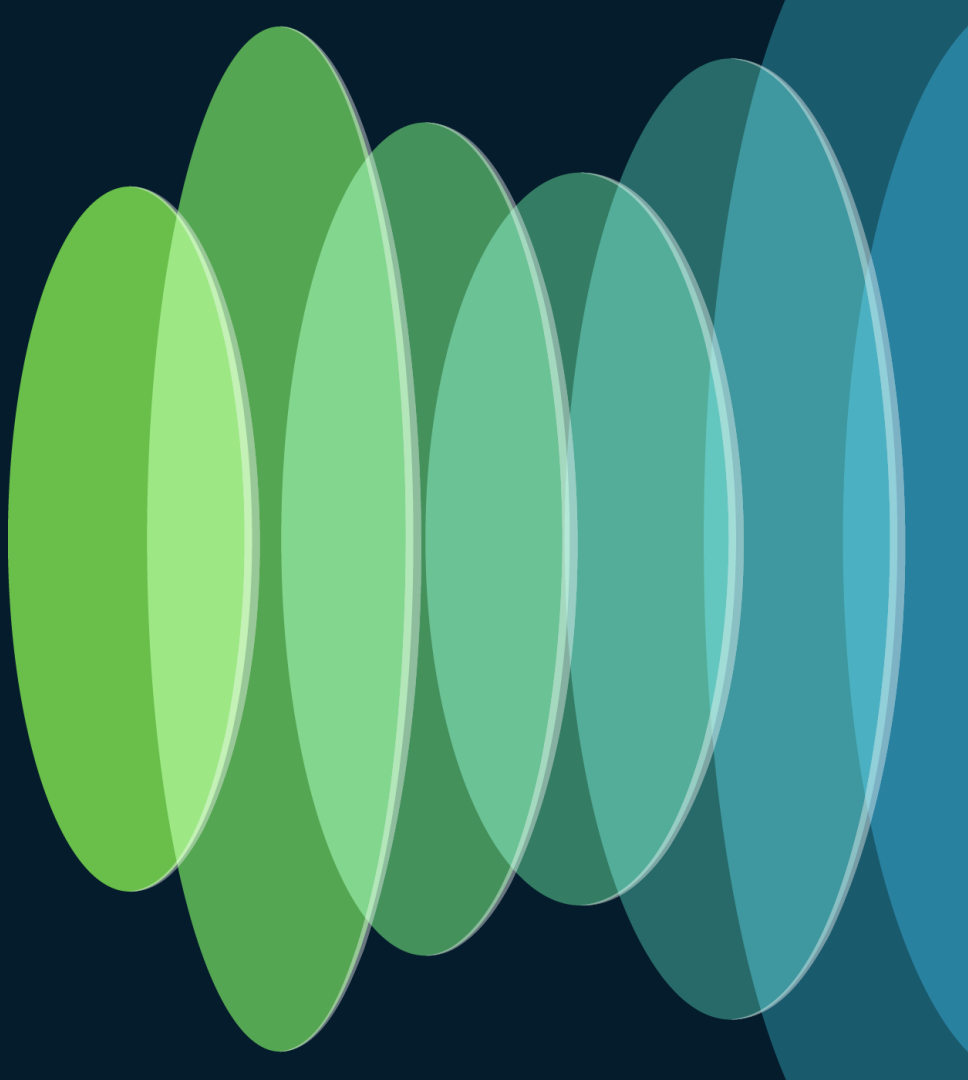
Webex spaces will be moderated by the speaker until June 7, 2024.



Agenda

- Introduction
- IT/OT Requirments
- Industrial Networking Technologies
- IoT Messaging
- Edge Compute

An Introduction to IoT Architectures



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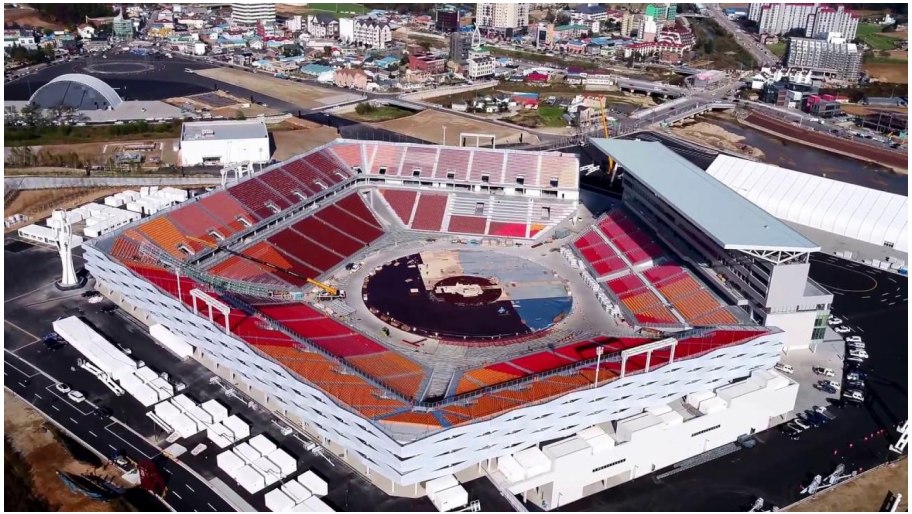
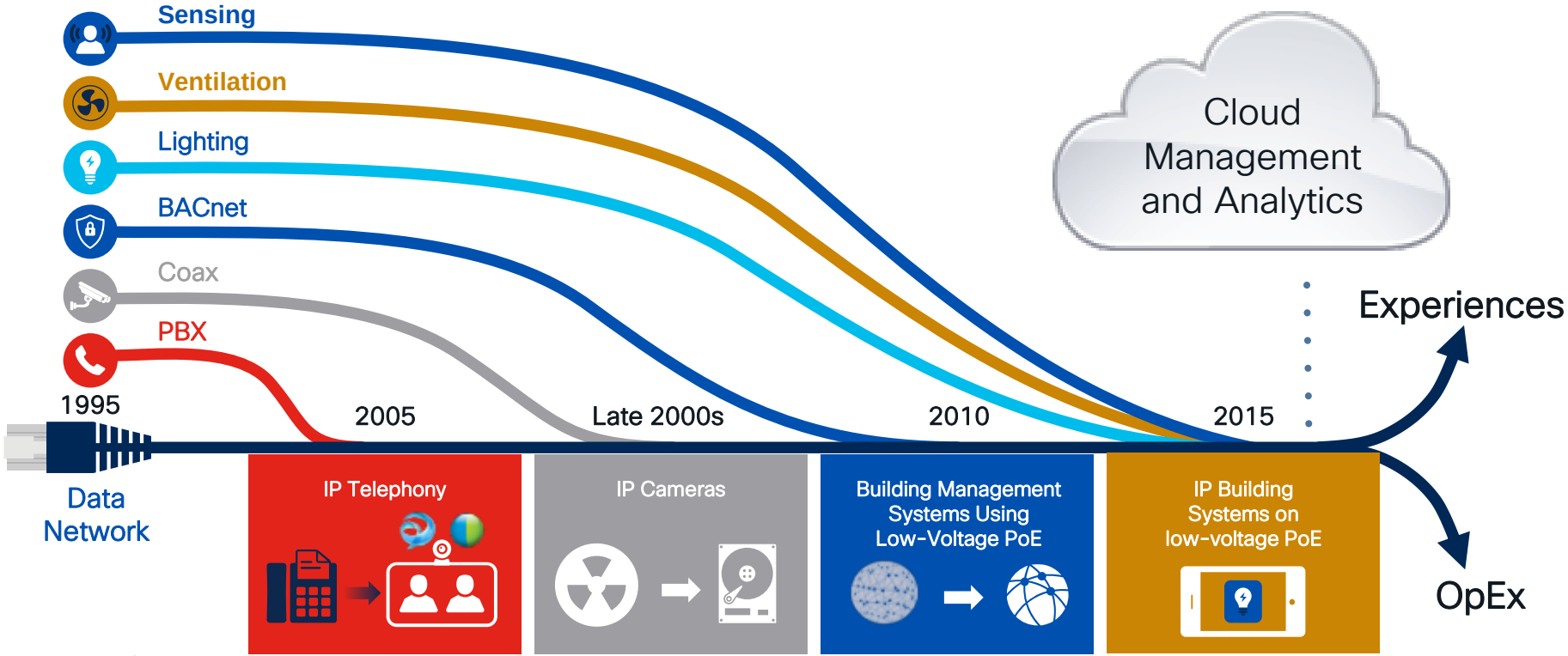
The Importance of Architecture

(These different buildings require different architectures and skills to build)



IT and OT Are Converging Towards IP



802.3bt UPoE+ Pushing New IoT Use Cases

802.3bt 90W per port

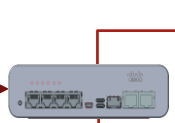
Catalyst 9300 1G UPOE+© 90W Switch

Catalyst 9400 1G UPOE+© 90W Switch

UPOE+/802.3bt

USB-C
Power + Data

UPOE
Passthrough



PoE+ PoE+

1 **USB-C power**
(laptop charging + data)

2 **UPOE Pass-through**
(for extended reach 60W)

3 **Daisy-chaining**
(Cost saving with 90W)

Revolutionizing Workspaces with 90W UPOE+

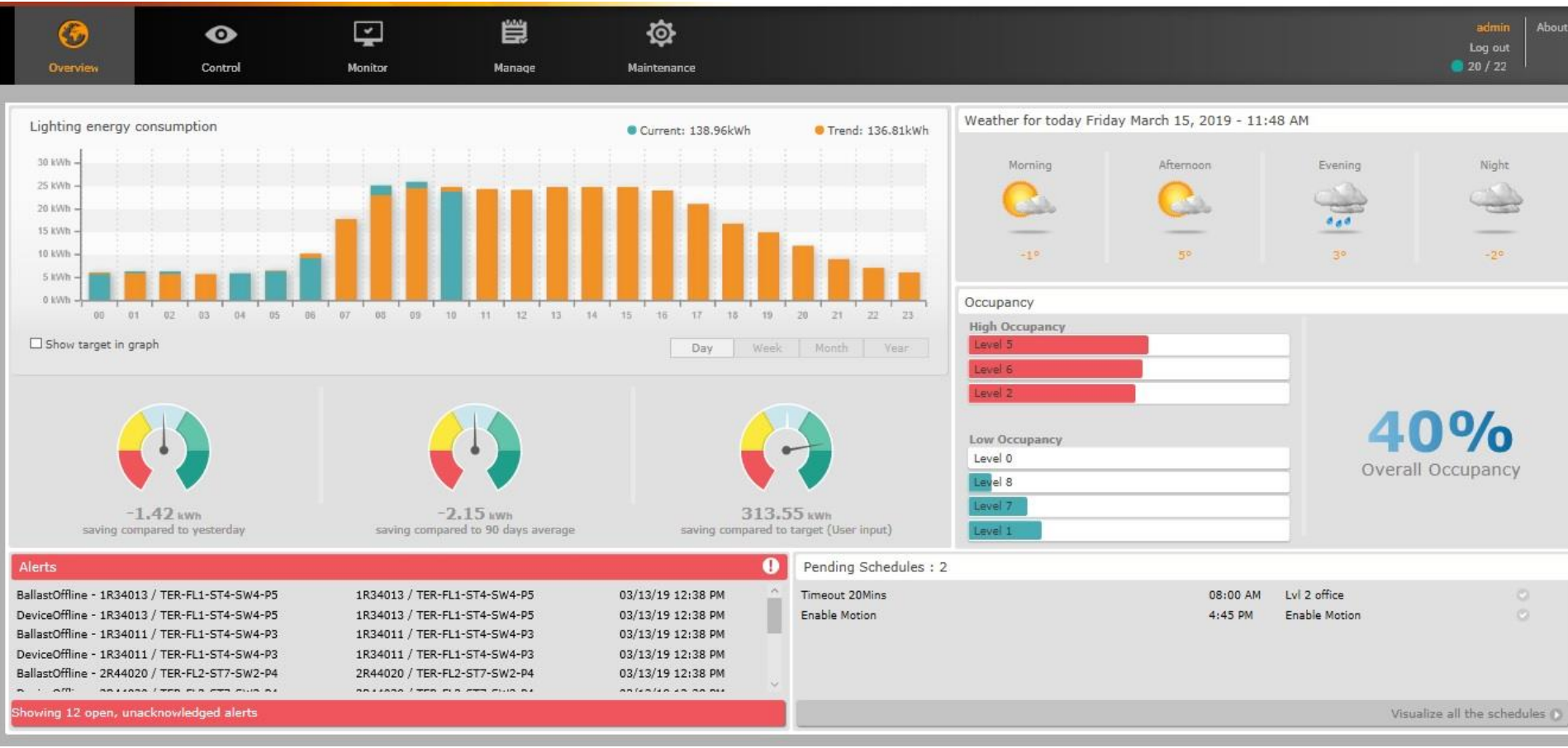
Before

Today : Workspace Powered by 90W UPOE+/802.3bt

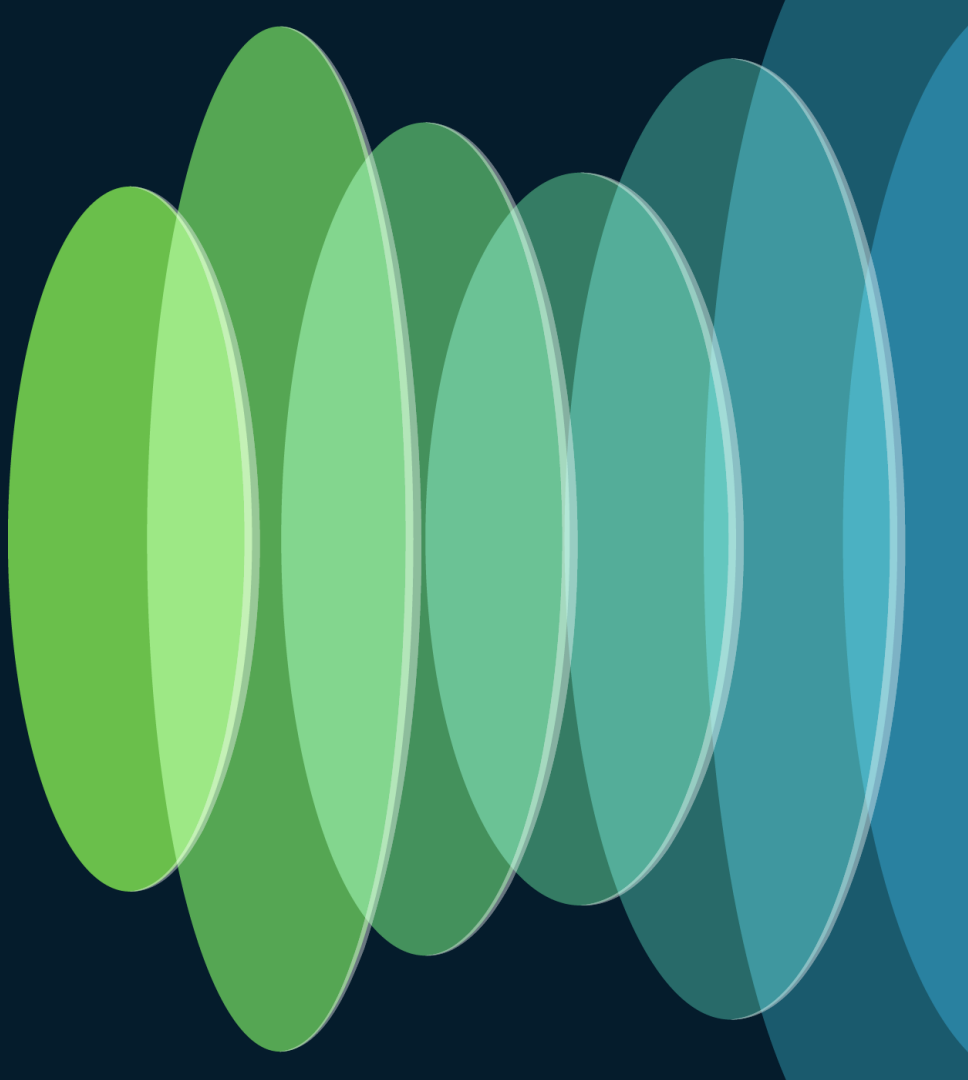
PoE Powered Workspaces

- Automated eight adjustable desk
- PoE powered desktop switch
- All-in-one computers / Displays
- Daisy-chained PoE Lights
- IP phones
- Ethernet to USB-C for Laptops/Tablets/Phones

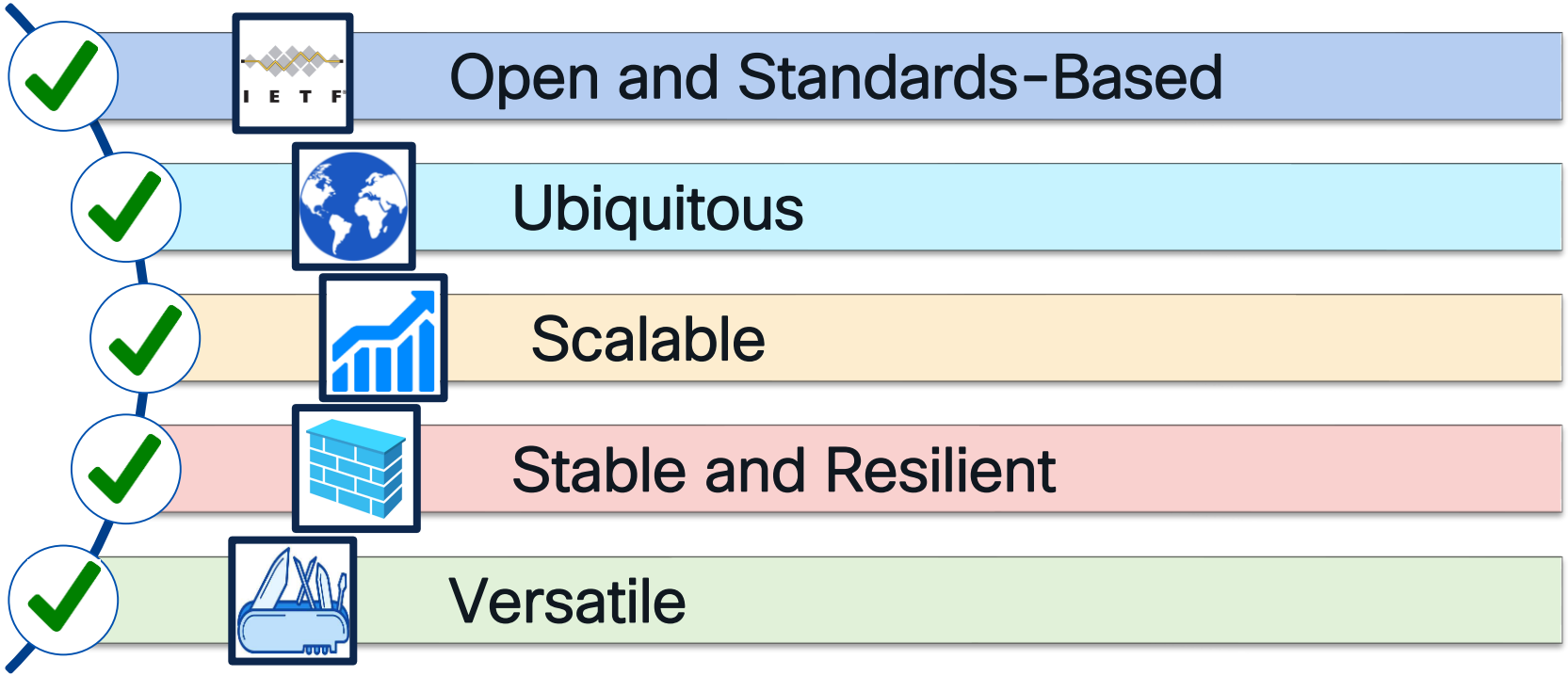
PoE White Noise Generation Unit



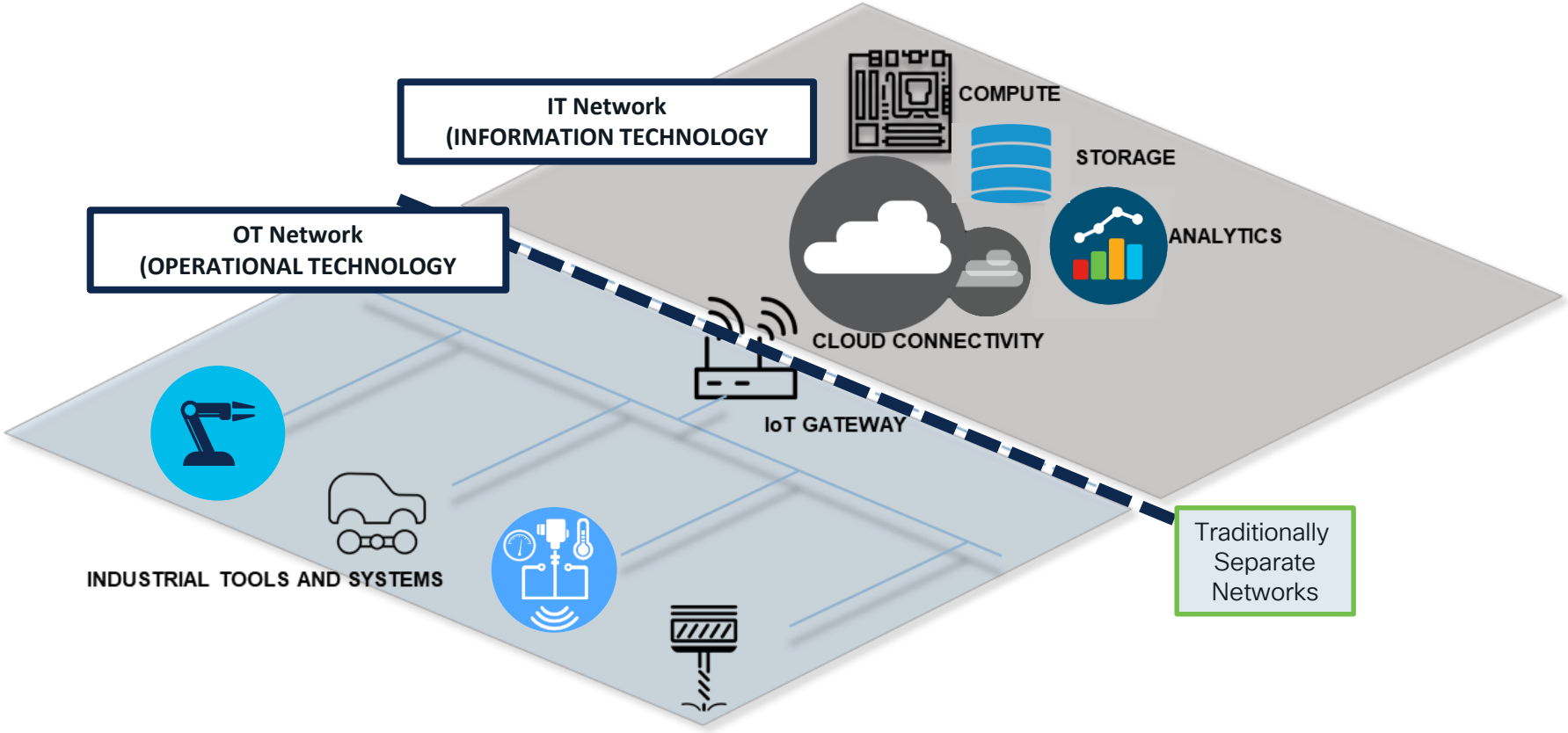
IT/OT Requirements



IoT / OT Network Requirements



IT and OT (Operational Technology)



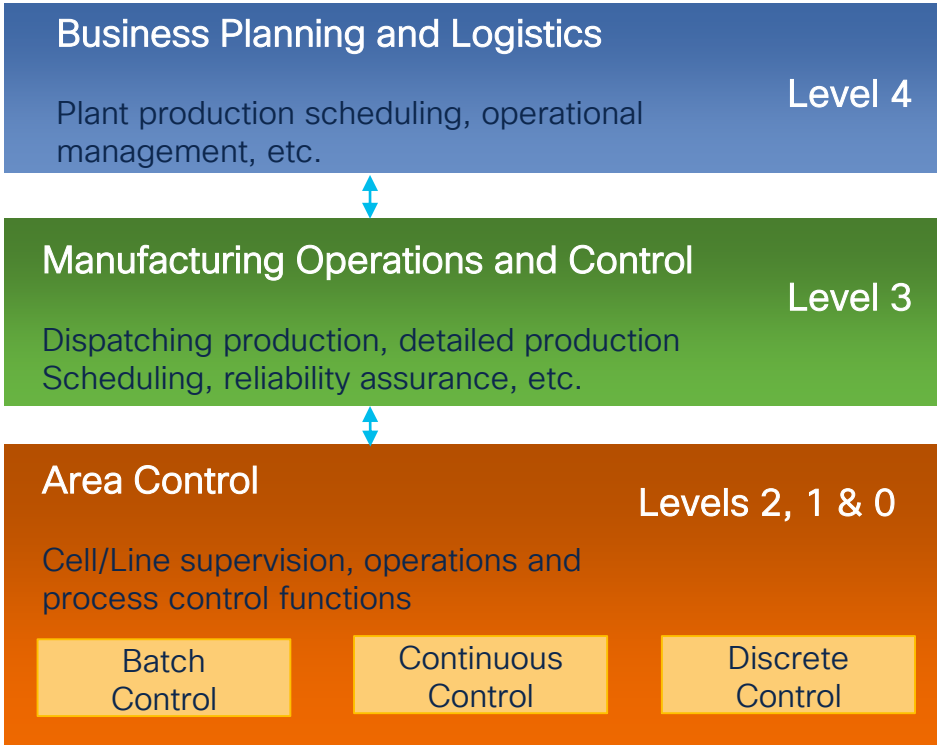
IT/OT Priorities (hint . . . the priorities are inverted)

Security Policies	IT Network	OT Network
Focus	Protecting Intellectual Property and Company Assets	24/7 Operations, High OEE, Safety, and Ease of Use
Priorities	1. Confidentiality 2. Integrity 3. Availability	***1. Availability*** ***2. Integrity*** **3. Confidentiality**
Types of Data Traffic	Converged Network of Data, Voice and Video (Hierarchical)	Converged Network of Data, Control Protocols, Information, Safety and Motion (P2P & Hierarchical)
Access Control	Strict Network Authentication and Access Policies	Strict Physical Access Simple Network Device Access
Implications of a Device Failure	Continues to Operate	Could Stop Processes, Impact Markets, Physical Harm
Threat Protection	Shut Down Access to Detected Threat and Remediate	Potentially Keep Operating with a Detected Threat
Upgrades and Patch Mgmt	ASAP During Uptime	Scheduled During Downtime

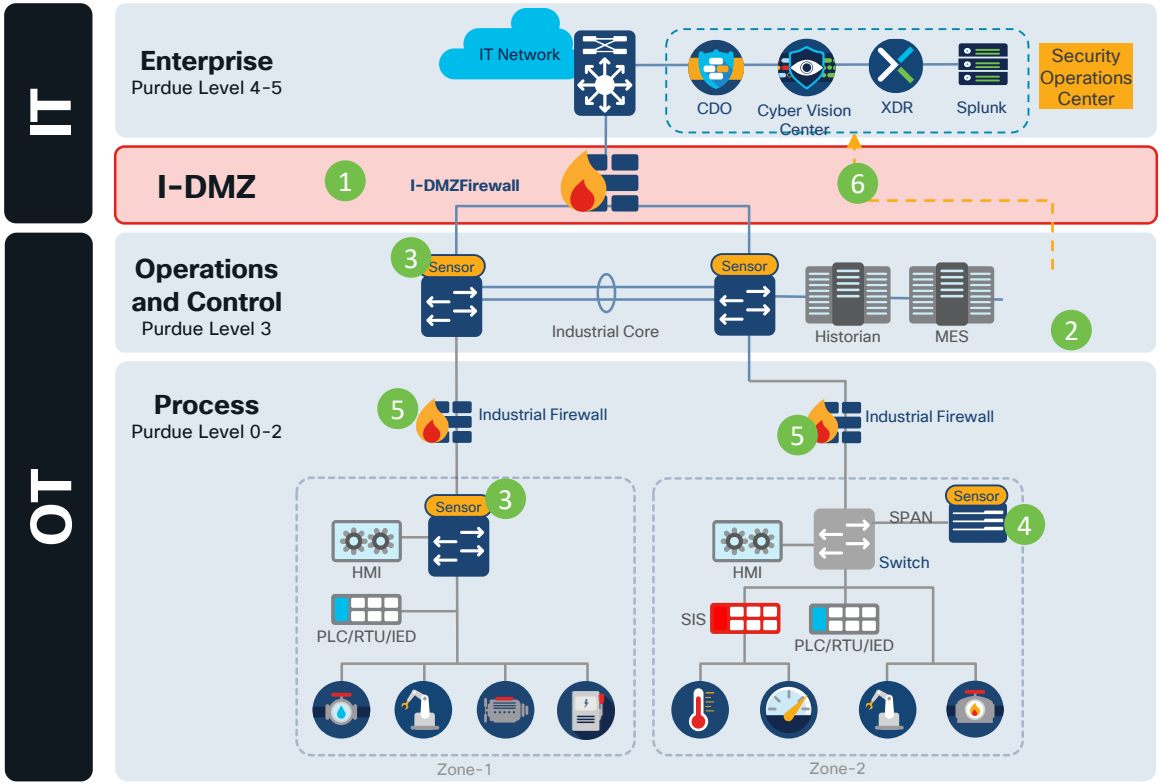
Purdue Enterprise Reference Architecture

International Electrotechnical Organization (IEC) 62664/ISA-95*

- Developed by Theodore J. Williams and members of the Industry-Purdue University Consortium
- The Purdue Model is a reference model for enterprise architecture created in the 1990s that defines levels of infrastructure and how to secure them
- Defines interfaces between Levels



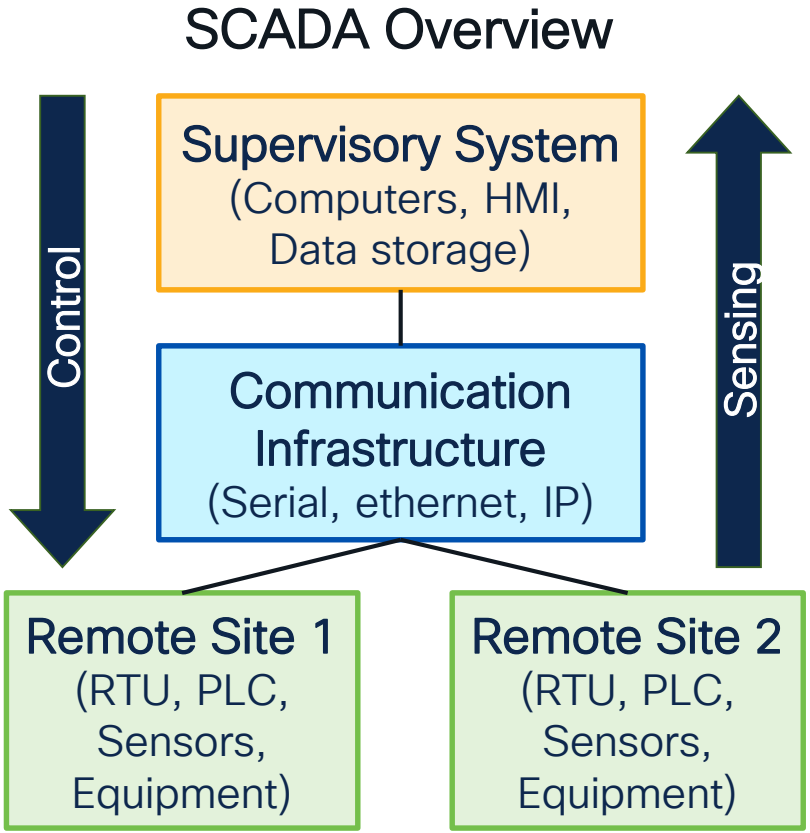
IEC 62443 Foundational OT Security Architecture
(closely associated with the Purdue Model for control hierarchy)



1. Isolate IT and OT by installing an industrial DMZ firewall
2. Secure software systems responsible for the OT network need
3. Access control on the Level-3 aggregation network
4. Segment lower layers by cell/area zones with controlled access and security sensors
5. Deploy on OT firewall, such as the Cisco Secure ISA3000 to isolate production zones
6. Share details of OT vulnerabilities and events with SOC to build informed security policies and investigate threats across domains

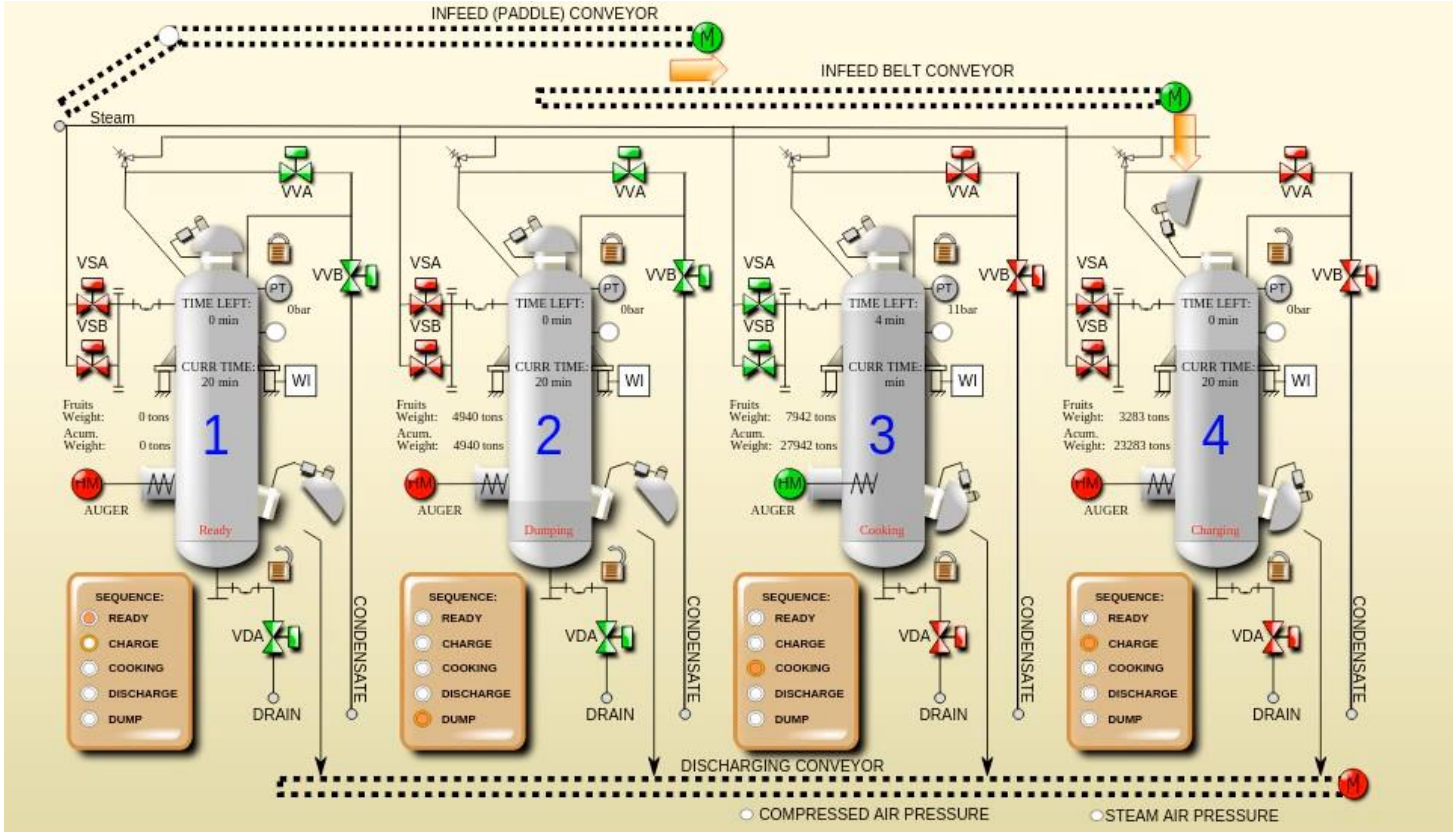
Supervisory Control and Acquisition of Data (SCADA)

- Created in the 1960s to carry data using L2 protocols over serial (e.g. RS-232 and RS-485)
- Evolved to support IP
- Controller/agent relationship
- Commonly deployed with vertical-specific protocols like:
  - Modbus
  - DNP3
  - IEC 60870-5-101 (Europe)



Source: http://www.integraxor.com/screens.html

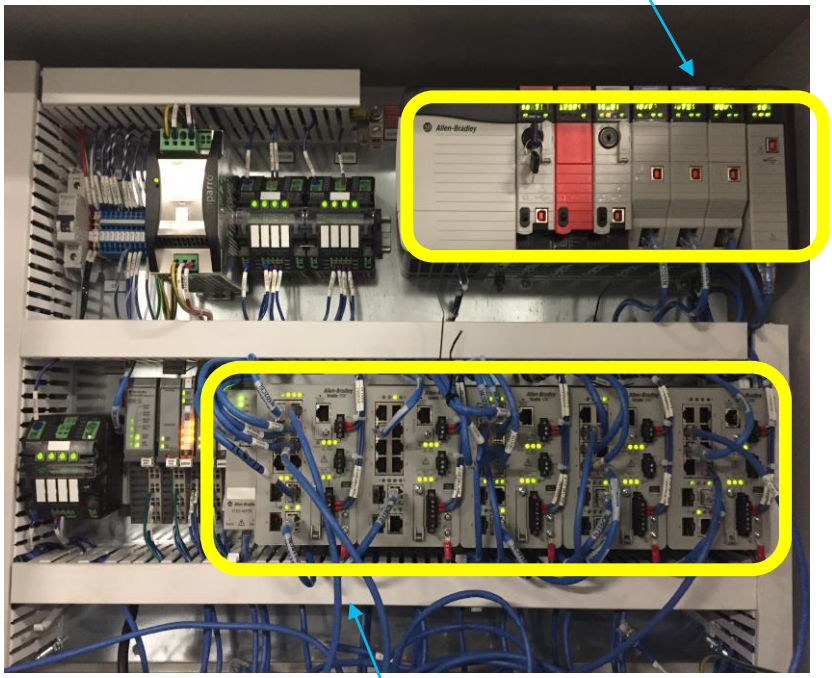
SCADA Example



Which Devices are in an OT Network?

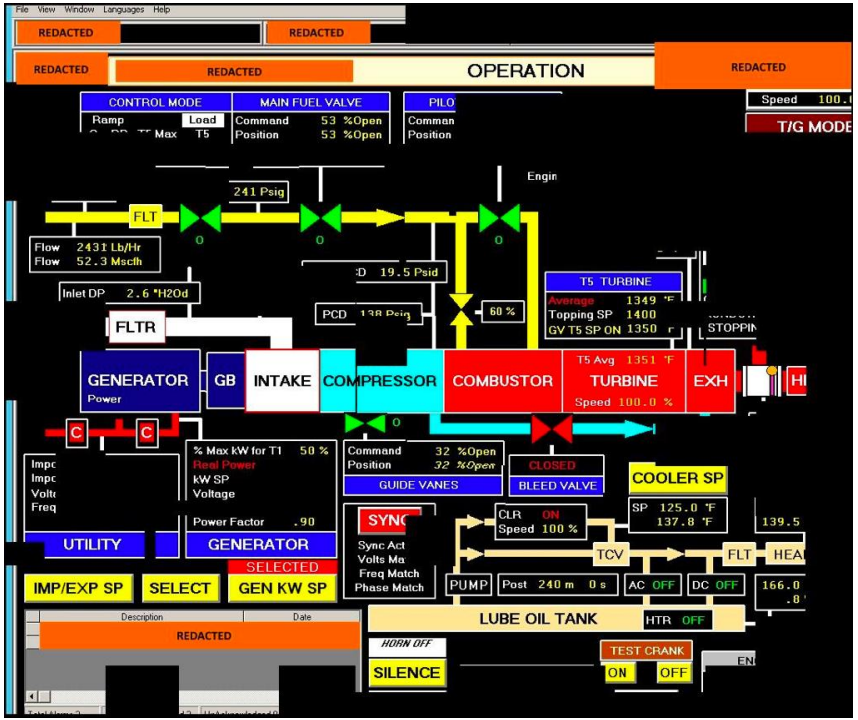
Small industrial computers with I/O ports connecting to field devices, such as . . .

- Programmable Logic Controller (PLC): Runs processes by sending orders to industrial devices



OT Components
Human Machine Interfaces (HMIs)

- HMIs are a computer visualization of the OT process
- HMIs allows control of various components, including PLCs and other SCADA systems
- Typically deployed on Microsoft Windows terminals



Securing OT:
Case Study of the Ukraine Grid Attack – Chronology of Events

Spear phishing to gain business network access

Theft of Credentials

Remote operation of ICS Systems

KillDisk to erase MBR and delete targeted logs

Keylogger, screenshots

BlackEnergy 3 malware installed

Use of VPNs to access ICS network

Attack Substation

S2E devices compromised at firmware level

Remote telephonic DOS

Power Outage

Ukraine Grid Attack – The ICS Kill Chain

Spear phishing to gain business network access

Theft of Credentials

Remote operation of ICS Systems

KillDisk to erase MBR and delete targeted logs

Attack on IT Domain

Attack on OT Domain

BlackEnergy 3 malware installed

Use of VPNs to access ICS network

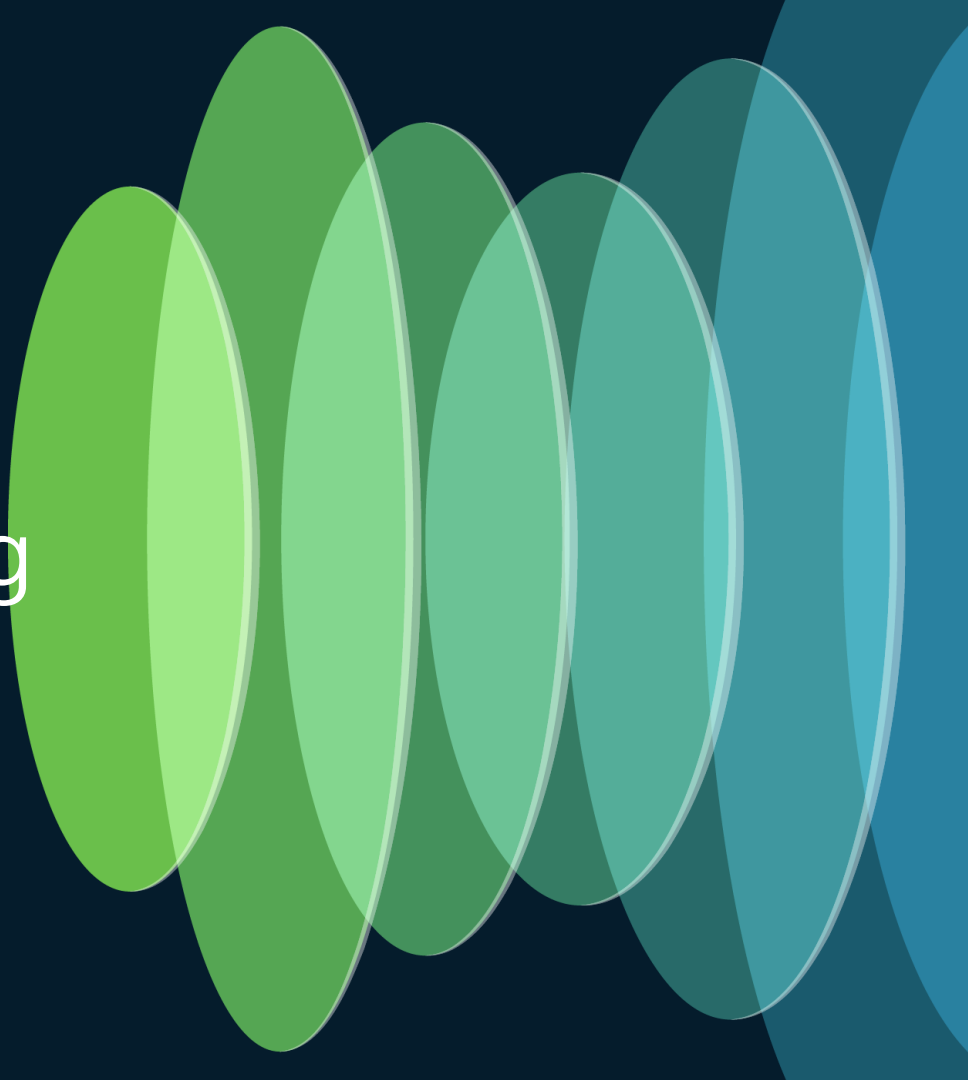
S2E devices compromised at firmware level

Power Outage

Lessons Learned
How and Why OT Systems Are Vulnerable

1. IT/OT separation (a'la IEC 62443 / Purdue) is important, but more is needed
2. Poor Internet (front door) security led to a fatal attack
3. Poor security controls between IT and OT (Zero Trust / MFA)
4. Little visibility to behavior of IEDs and SCADA in the grid
5. No control over Industrial protocols
6. Lack of a recovery plan

Meeting the Challenge – Industrial Networking Technologies



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Industrial Network Device Requirements
Switches and Routers

Ruggedized

Protection from harsh environments including extreme temperatures, humidity, dust, vibrations, etc.

High Availability

Support for redundancy protocols like PRP (Parallel Redundancy Protocol), MRP (Media Redundancy Protocol), and HSR (High-availability Seamless Redundancy)

Precision Timing

Support for clocking protocols such as PTP (Precision Time Protocol) and TSN (Time Sensitive Networking)

Industrial Protocols

Support for OT network protocols and capabilities including Profinet, CIP (Common Industrial Protocol), Ethernet/IP, and protocol translation

Industrial IoT Networking Portfolio

Industrial Switching
1K, 2K, 3100, 3200, 3300, 3400, 3400H, 4K, 5K, 9K

Industrial Routing
IR1101, IR1800, IR8100, IR8300

LoRaWAN
Long-Range IoT Sensor Networks

Industrial Wireless
Cisco Ultra-Reliable Wireless Backhaul, IW9167E, IW6300, IW3702, IR5XX, IXM Gateway

Industrial Cybersecurity
Cyber Vision, ISA3000 Firewall

Ruggedized for Harsh Environments

Extreme operating temperatures from 167˚F/75˚C down to -58˚F/-50˚C

High MTBF (Mean Time Between Failure) can exceed 40 years

Protection from dust, vibrations, humidity, and EMI

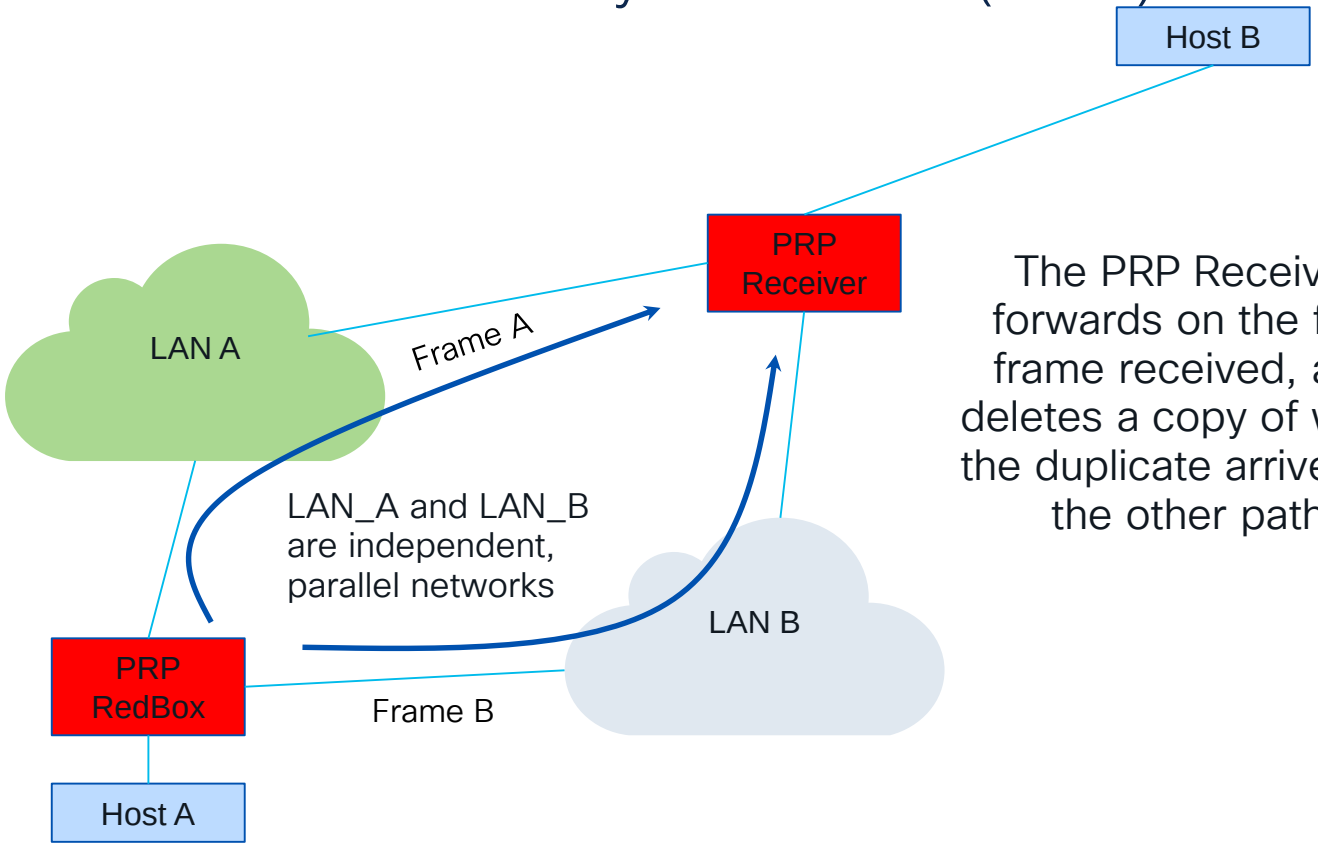
IP67 Certification (IEC 60529 Ingress Protection Code) specifies solid particle and liquid compliancy

M12 Connectors (defined by IEC) for connections in harsh conditions

OT Has Specialized Redundancy Requirements

Protocol	Industry Standard	Topology	Convergence Time
RSTP (Rapid Spanning Tree Protocol)	Yes (IEEE 802.1D-2004)	Ring/Star	> 250ms, worst-case is >2s
MRP (Media Redundancy Protocol)	Yes (IEC 62439-2), most common with Profinet	Ring	10ms, 30ms, 200ms, 500ms, configuration dependent
REP (Resilient Ethernet Protocol)	No (Cisco proprietary)	Ring	50-150ms
PRP (Parallel Redundancy Protocol)	Yes (IEC 62439-3)	Any	0ms
HSR (High-availability Seamless Redundancy)	Yes (IEC 62439-3)	Ring	0ms

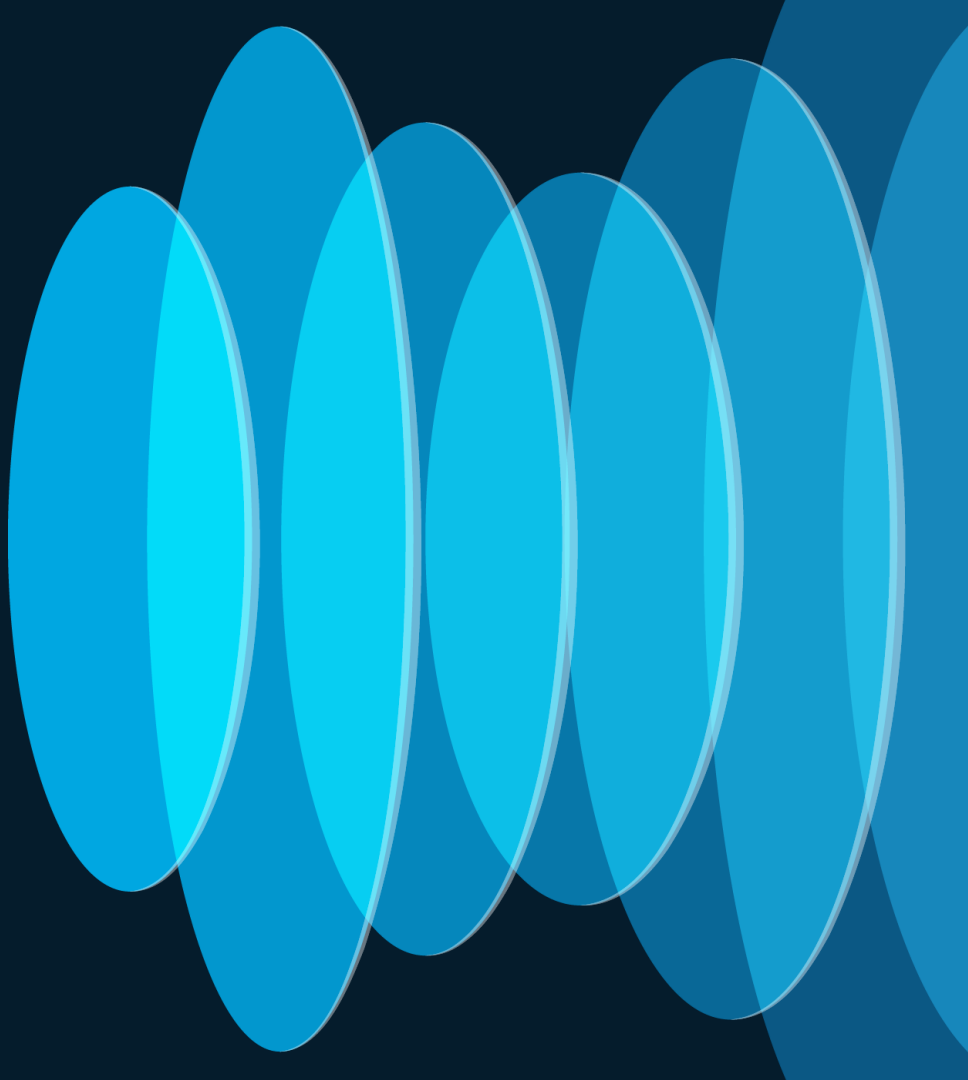
Example: Parallel Redundancy Protocol (PRP)



A RedBox (Redundancy Box) is used to replicate frames on two paths of a network

The PRP Receiver forwards on the first frame received, and deletes a copy of when the duplicate arrives on the other path

Network Essentials
OT Devices



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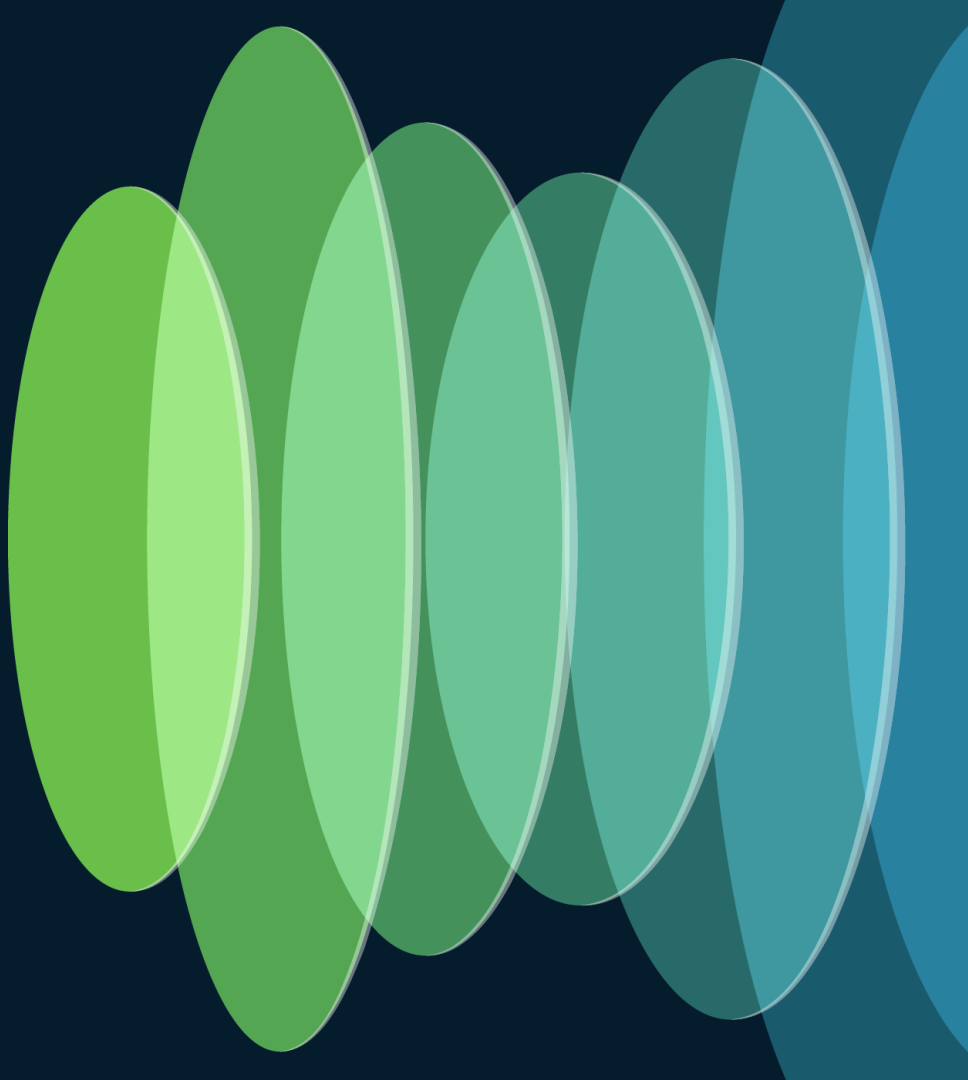
Cisco's Evolving Wireless Portfolio for Multi-access Needs

LTE and 5G | Wi-Fi 5 and 6 | Sub-GHz ISM

Wide Mobility and High Throughput		Local Mobility and Highest Throughput		Massive Scale and Broad Coverage	
IoT Gateways	Industrial Routing	Industrial Wi-Fi	CURBW (fluidmesh)	Resilient Mesh	LoRaWAN
					
819-MNA, IR807, IR809, IR829, IR1101	CGR 1000, CGR 2000	IW3702 IW6300, ESW6300		IR500	Gateway and Partner's NS

SP Public Network and Enterprise Private Network

Comparing IoT Wireless Access: Wi-Fi vs. 5G



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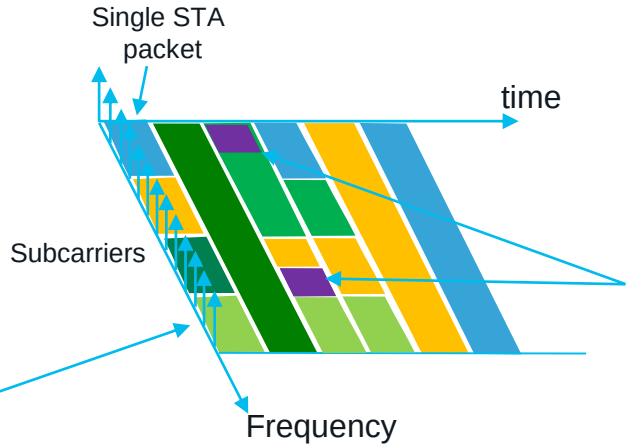
Wi-Fi Pros and Cons for IoT

- Pros:
  - High throughput if needed
  - “Large” number of clients if needed
  - Wi-Fi is unlicensed, accessible, and and cheap!
- Cons:
  - Range – 100m / 300 feet
  - Keepalives needed
  - Not optimal for battery-powered devices
  - IoT prefers simple modulation to complex and high throughput
  - 802.11ax (Wi-Fi 6) may change the landscape

IoT Improvements in Wi-Fi 6 (802.11ax)



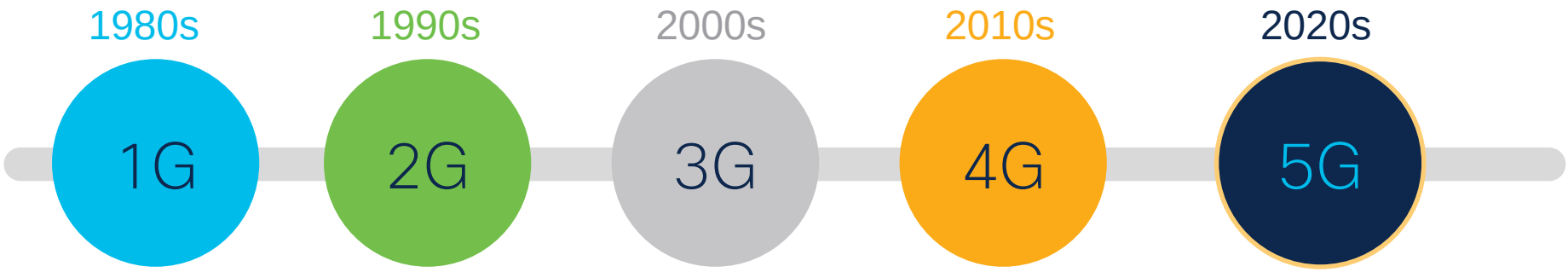
OFDMA, with 2MHz RU, 375 Kbps (3 DBm)

Dual Sub-Carrier Modulation (DCM)

Target Wake Time (TWT) with long sleep time (up to 5 years)

Long Sleep allowed (up to 5 years)

The Maturing World of Cellular Technology



Voice	TXT	Video?	Internet	Everything
	TDM Voice Limited Data Capabilities Network Appliances	TDM Voice Packet Data Capable Network Appliances	All Packet Virtualised Infra.	All Packet Containerized Infra

The Bold Vision of 5G
Solving a Host of IoT / OT Problems

~1ms
Latency

10+Gb/s
Data Rate

100x
Quicker Download

99.999%
Availability/Reliability

1,000,000
Devices per km²

500km/h
Service Support

Enterprise 5G – 3 Core Building Blocks

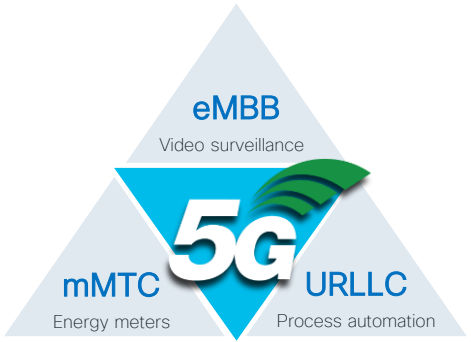
Low latency services will drive maximum 5G demand in the near-future

5G services are optimized for latency, capacity and density

URLLC and eMBB are most relevant in Enterprise

Mobile Broadband

High data rates, High traffic volumes



Massive IoT

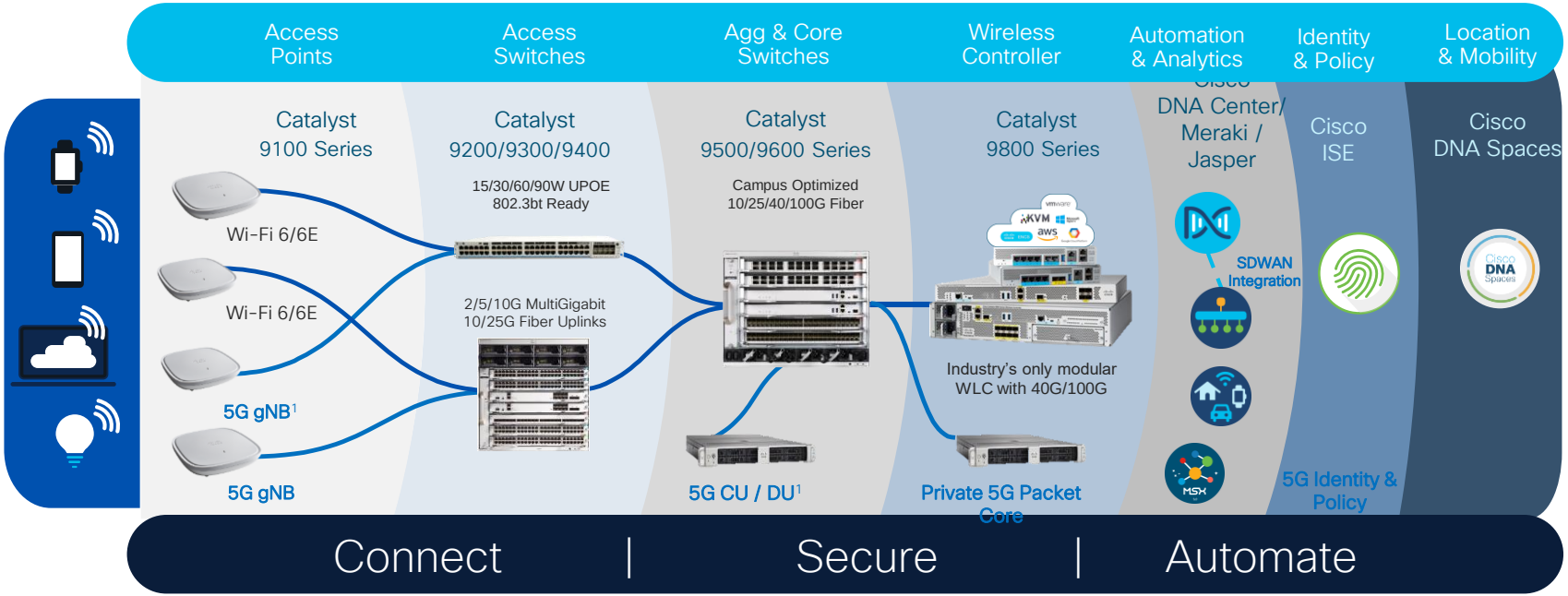
Massive number of small devices, low energy

Low Latency

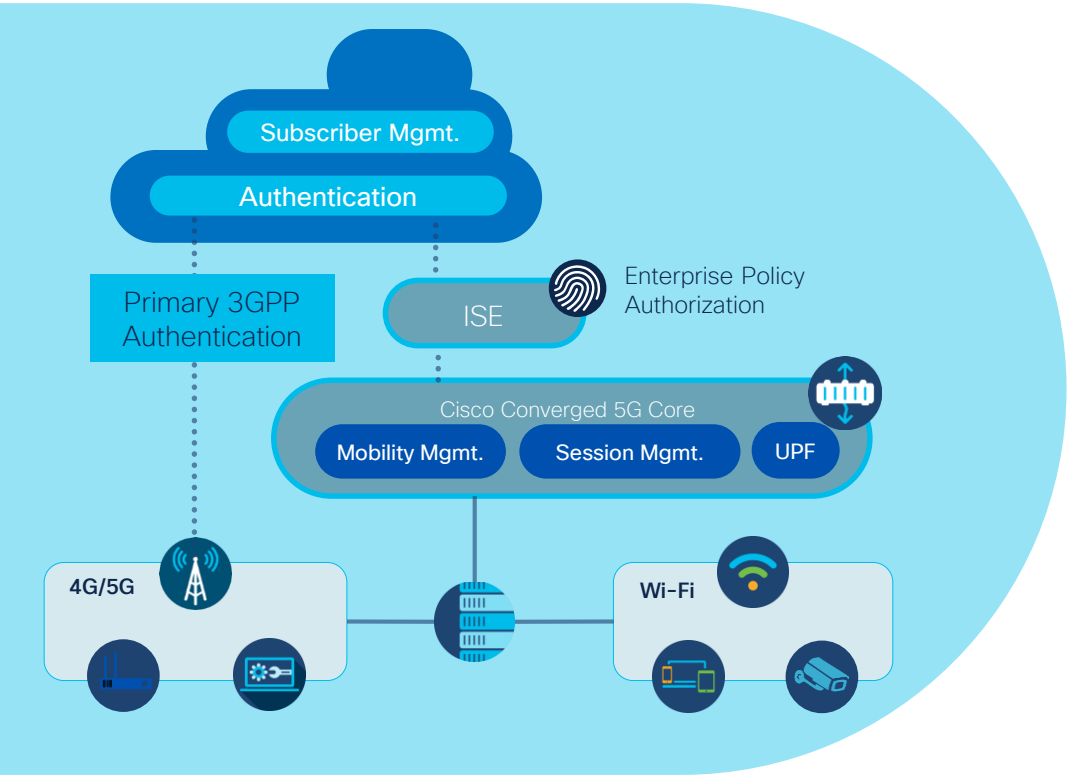
Ultra-high reliability & Ultra-low latency

	uRLLC	eMBB	mMTC
Use Cases	Manufacturing, Industrial, Warehouses	High Bandwidth for Real Time Video, Carpeted Enterprise	Super High Density for Smart Cities, Sensors
Requirement	Optimized for Latency: 1ms Latency, 99.999 Aval.	Optimized for Capacity: 10Gbps or more	Optimized for Density of devices: 1M Per km2
N/W Needs	Timing, QoS, UPF flexibility	Bandwidth, UPF flexibility	Timing, Bandwidth

Cisco Enterprise Stack Vision
Unified intent-based infrastructure for IT/OT



[1]Partner RAN Components

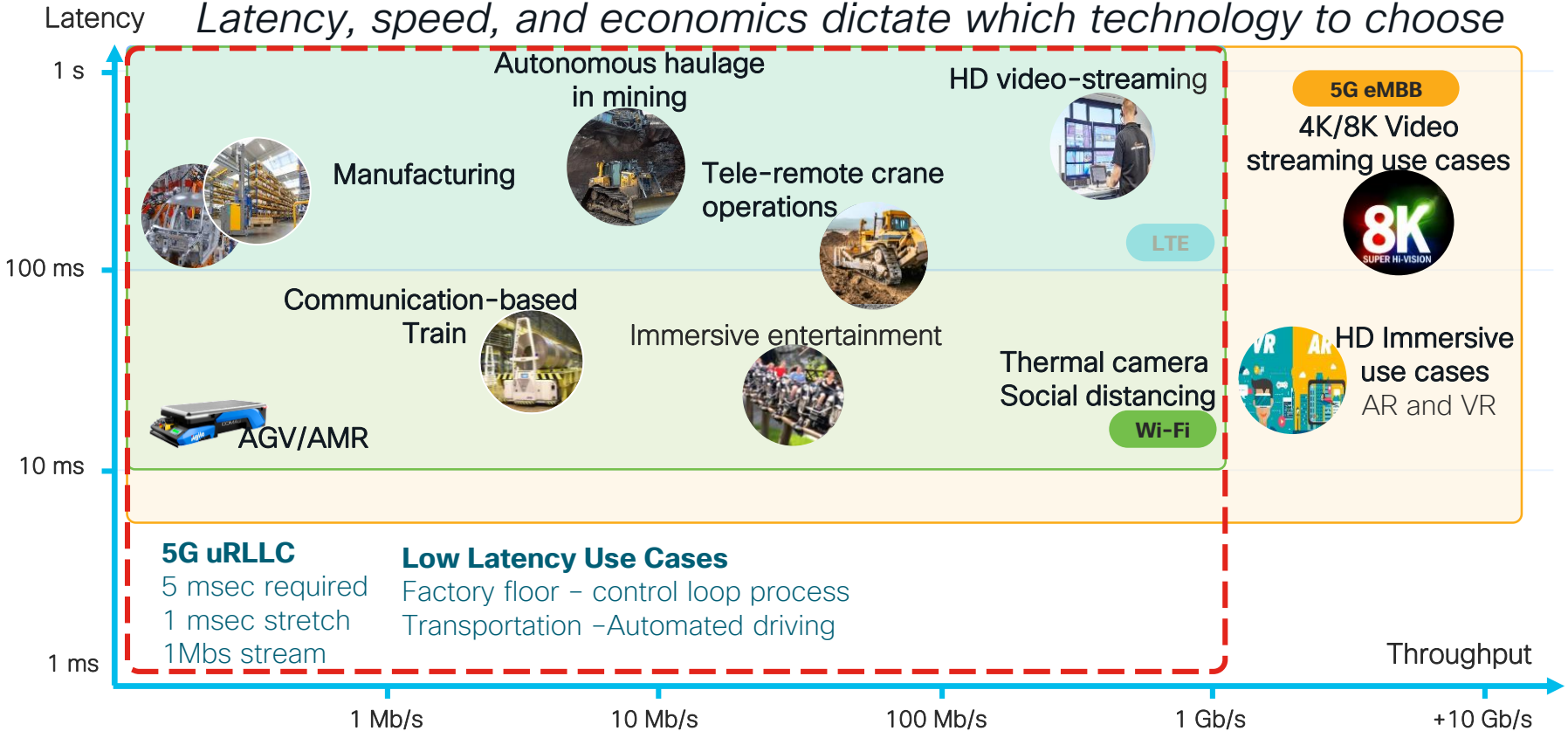


Single Point for Identity-Based Enterprise Policies

For Private 5G, Wi-Fi & Wired Networks

Use cases dictate Technology's requirements

Latency, speed, and economics dictate which technology to choose



Wi-Fi 5 & 4G (Cat. 18 1.2Gbs downstream, 150Mbs upstream) → Wi-Fi 6 & 5G →

5G Backhaul / UE Options For Industrial Networks

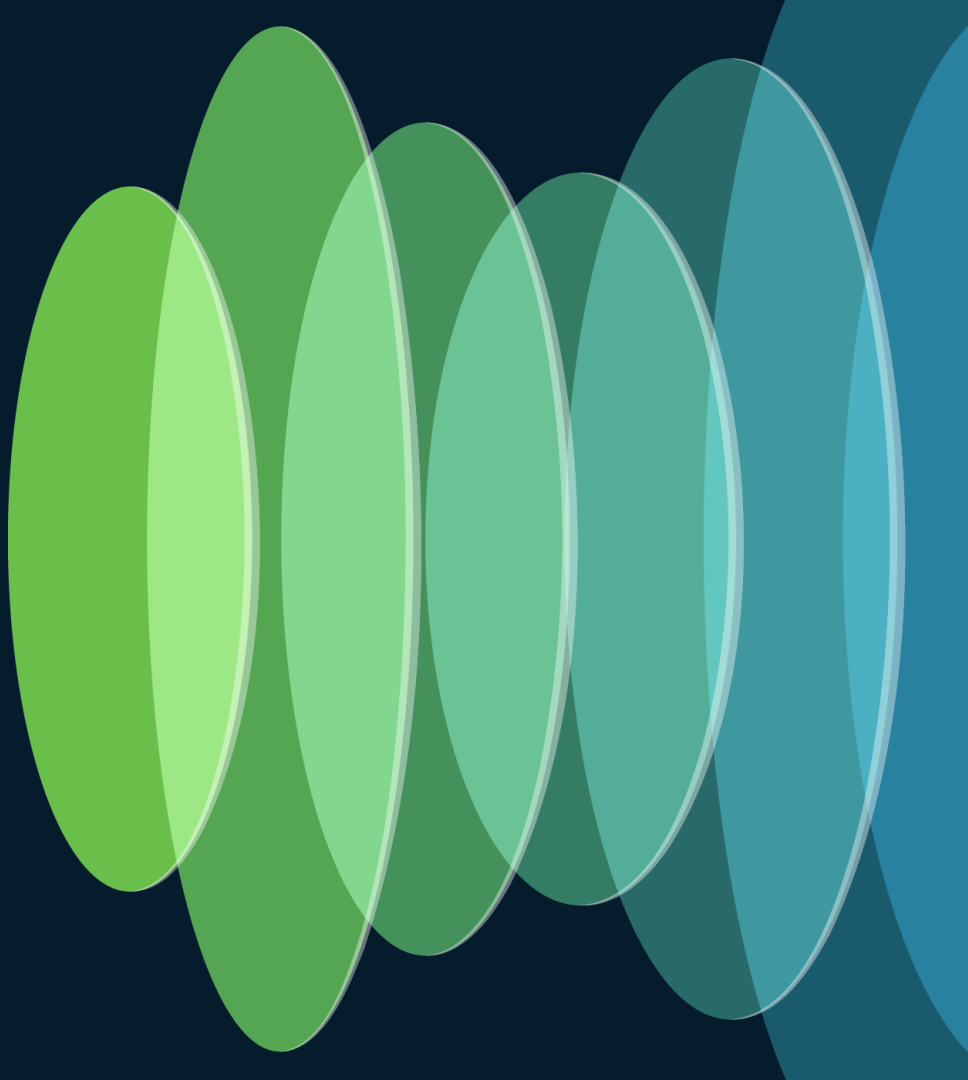
ATMs, low voltage substations, roadside traffic cabinets

Remote monitoring, streetlights, intersections

Fleet, first-responders, pipelines

Factory, high voltage substations

IEEE 802.15.4

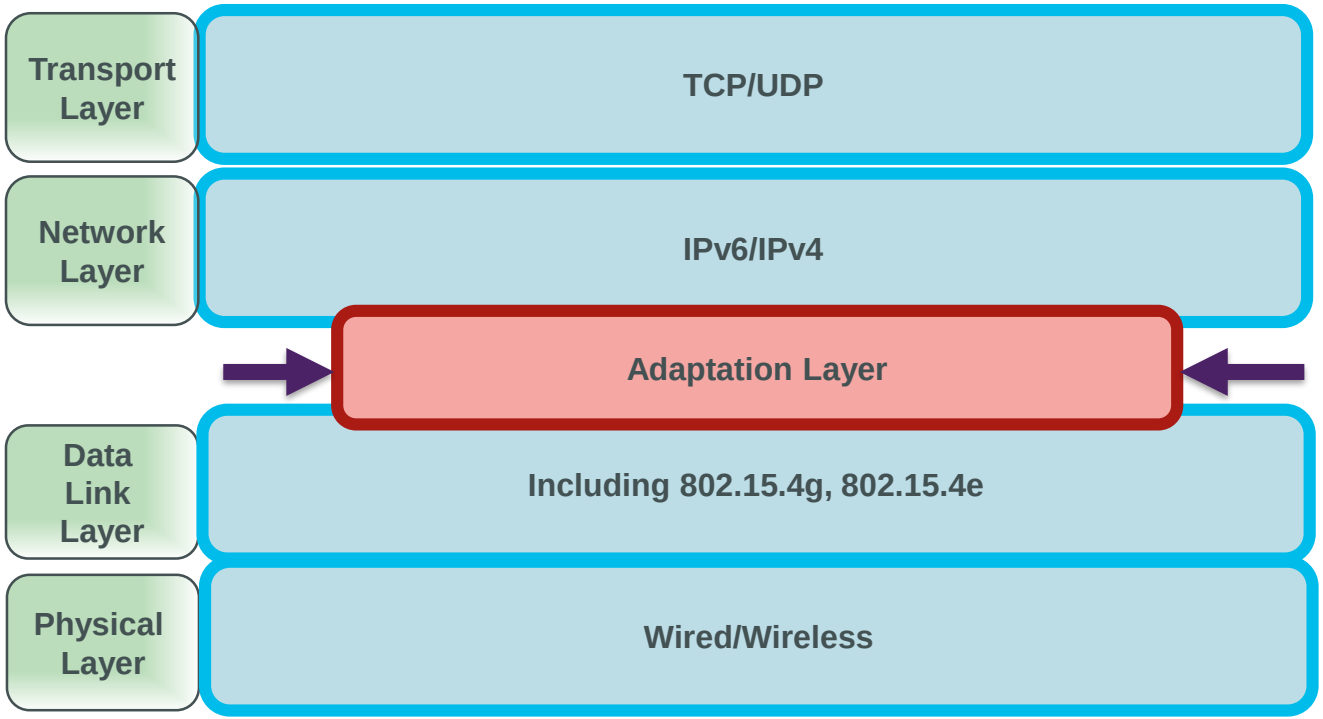


IEEE 802.15.4 – An Overview

IEEE 802.15.4 defines low data rate, low BW mesh networks

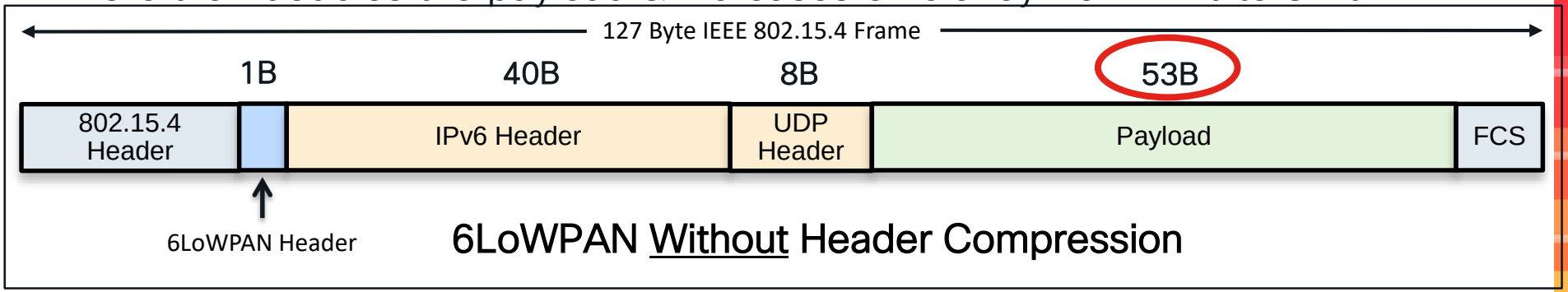
- Operates in unlicensed spectrum (900 MHz in N. America)
- ~1Mbps over 1Km distance
- Supports very high-density mesh (5,000 devices per cell)
- Uses Frequency Hopping Spread Spectrum (FHSS) – making it resilient to interference
- Very cost effective – used extensively in smart grid and buildings

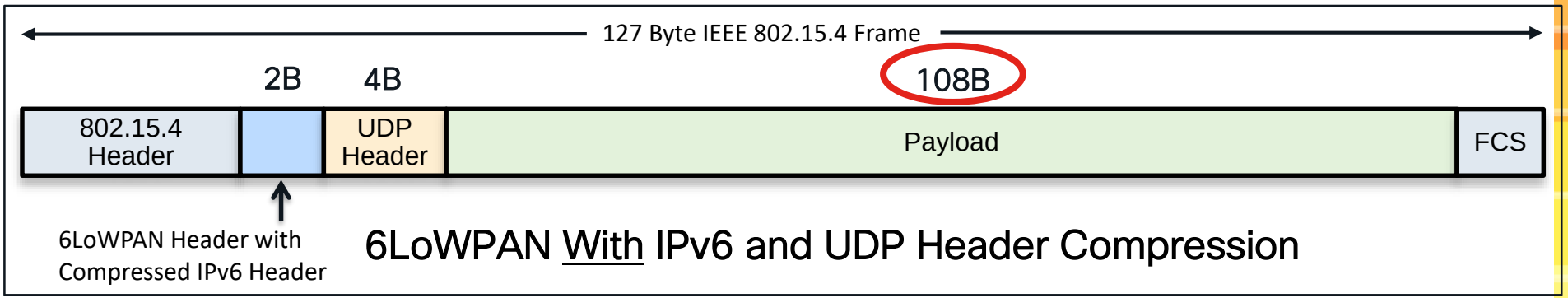
Supports an IPv6 Adaptation Layer



6LoWPAN Header Compression

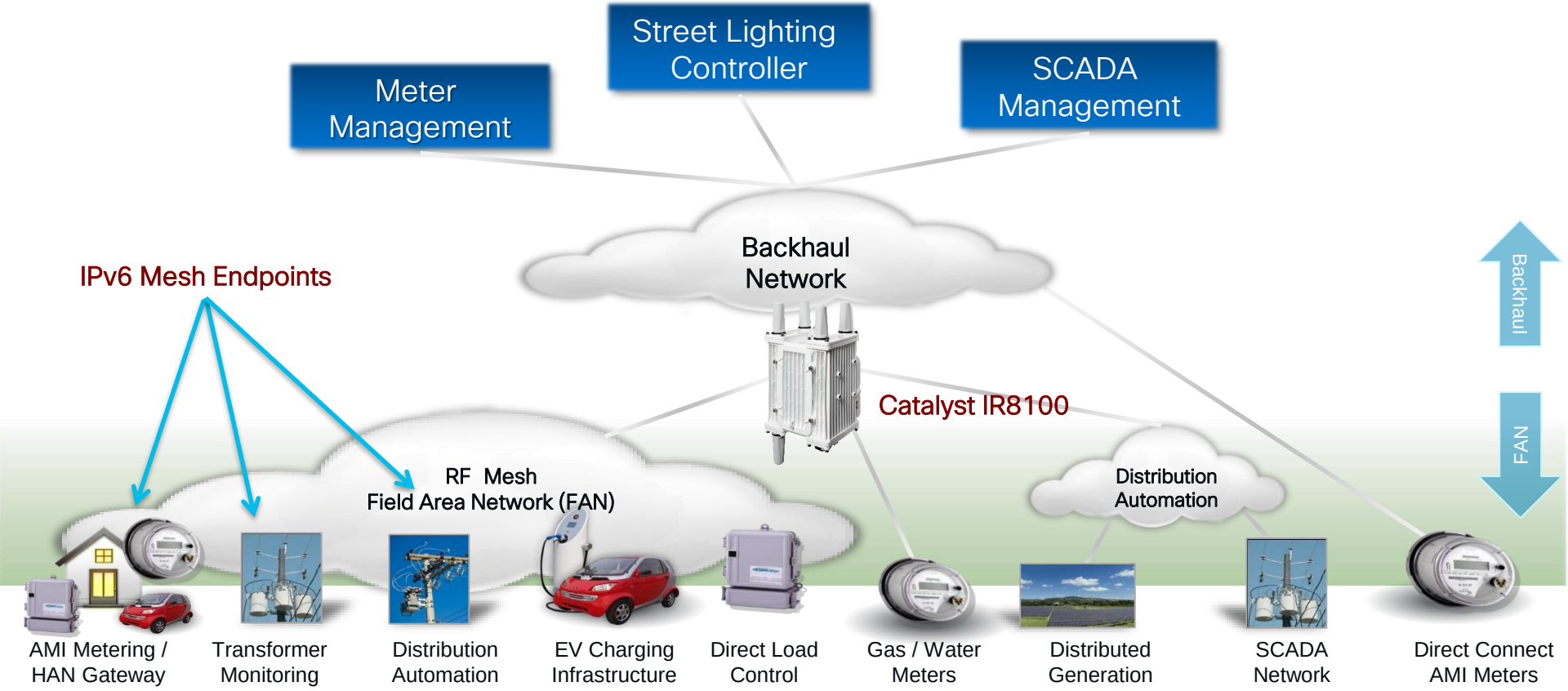
- More than doubles the payload & increases efficiency from 41% to 84%





802.15.4 Example – BC Hydro

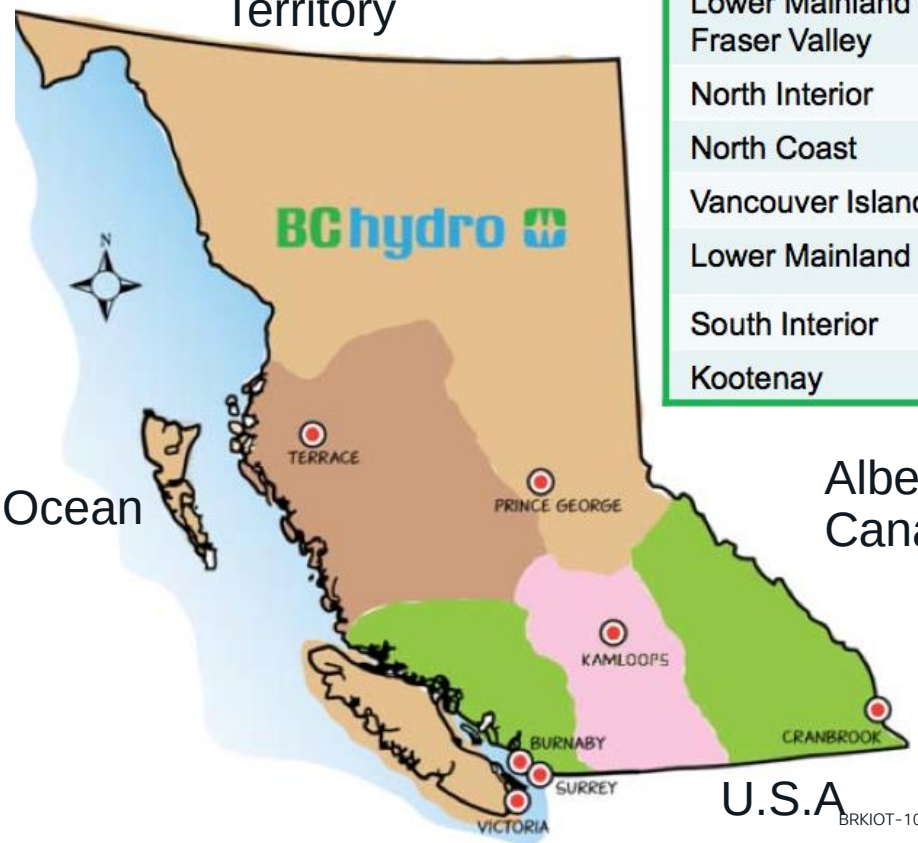
The Multi-Service Grid Network Architecture



Smart Meter Program Scope

Alaska, U.S,A

Yukon Territory



Pacific Ocean

Alberta, Canada

U.S.A

Area	Cross-Dock	Total
Lower Mainland South – Fraser Valley	Surrey	444,224
North Interior	Prince George	104,362
North Coast	Terrace	42,430
Vancouver Island	Victoria	387,898
Lower Mainland Metro	Burnaby	623,627
South Interior	Kamloops	191,965
Kootenay	Cranbrook	54,433

TOTAL 1,848,939

Meter farm in an underground concrete vault

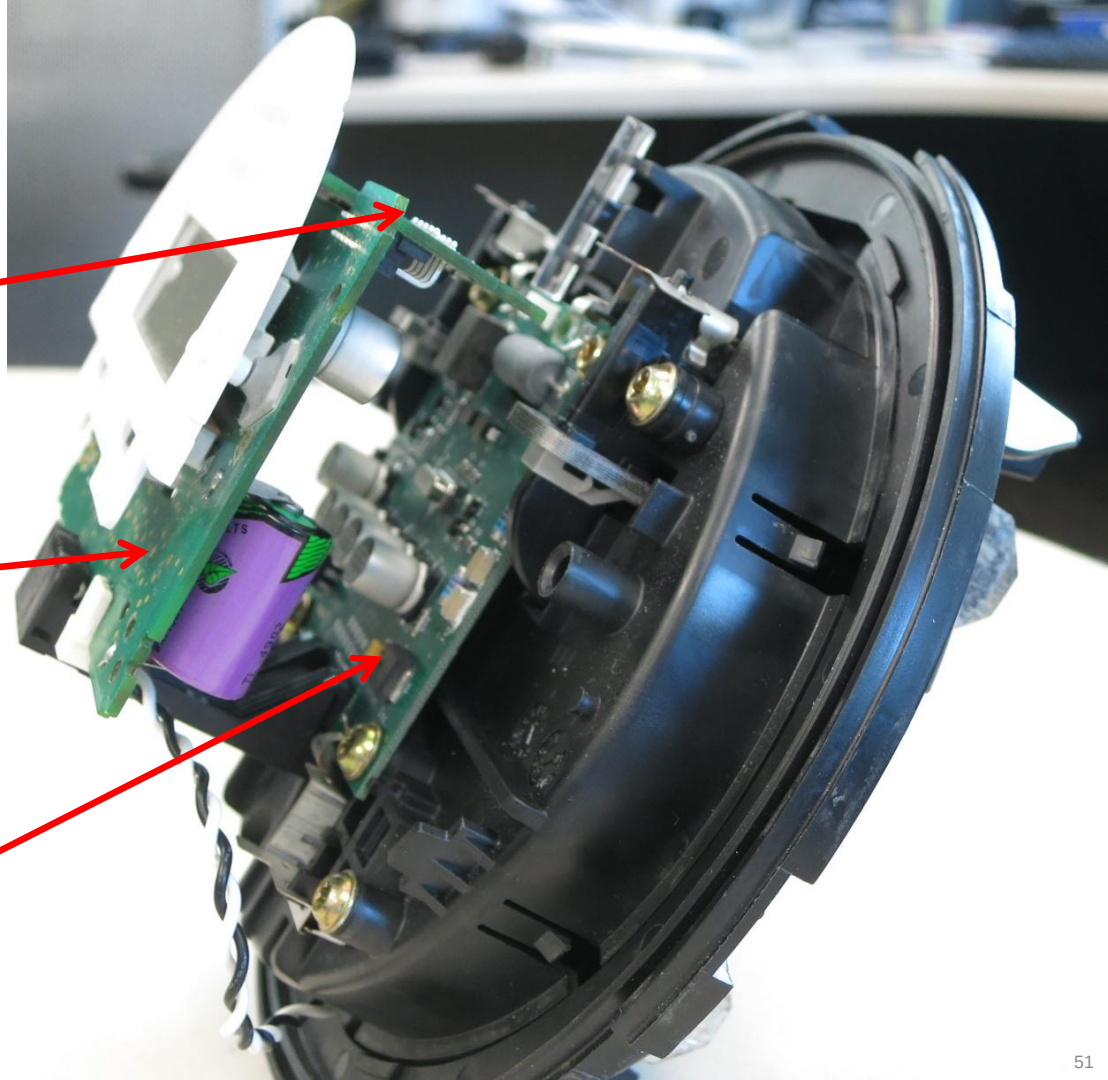
Every meter is a Cisco router running IPv6 with 802.15

Anatomy of a Smart Meter

Communications Board with FAN radio

Register board: registers voltage/energy usage, stores load/voltage profile and contains ZigBee radio for HAN

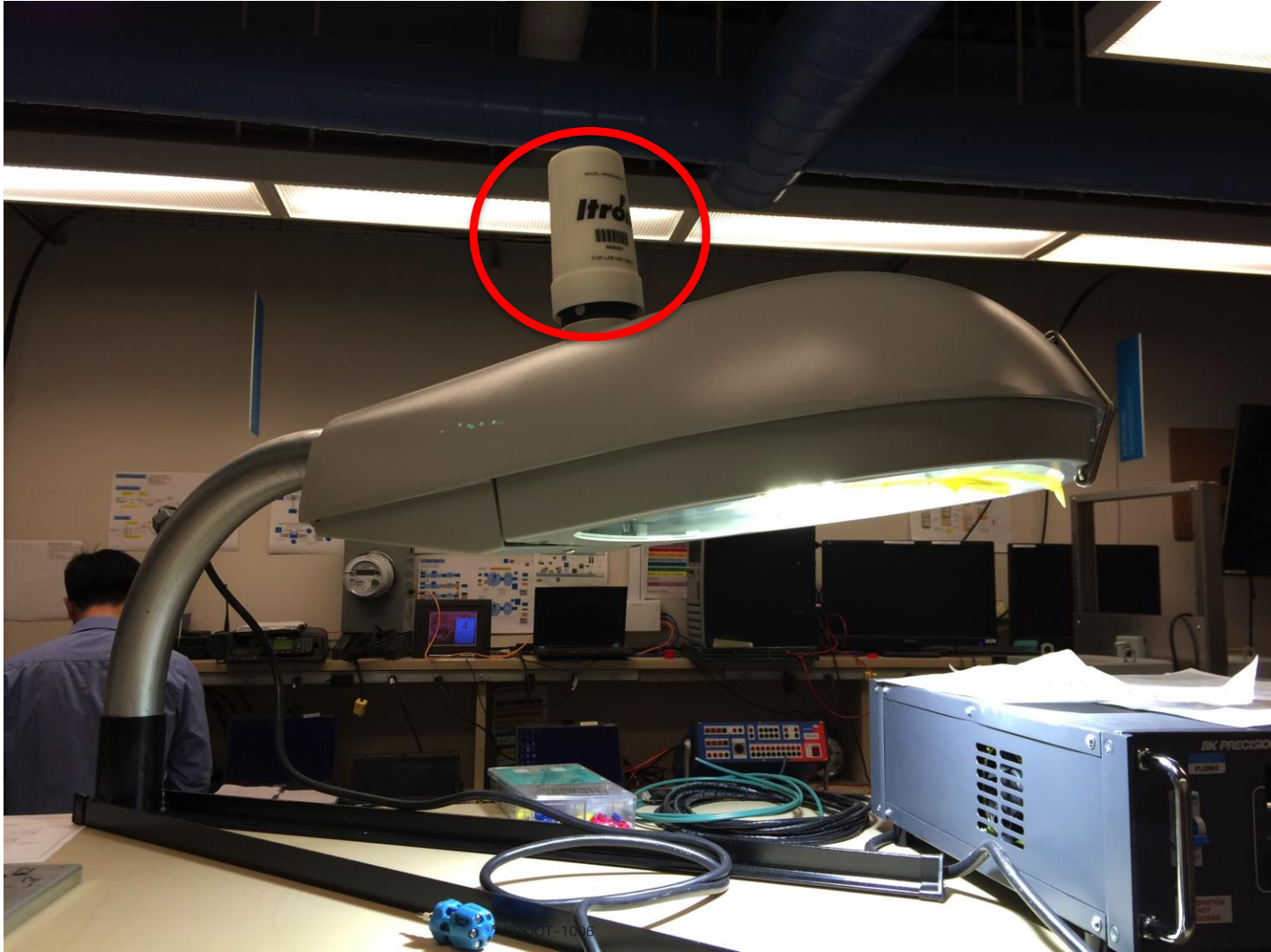
Metrology board: processes voltage and current measurements and converts them to pulses



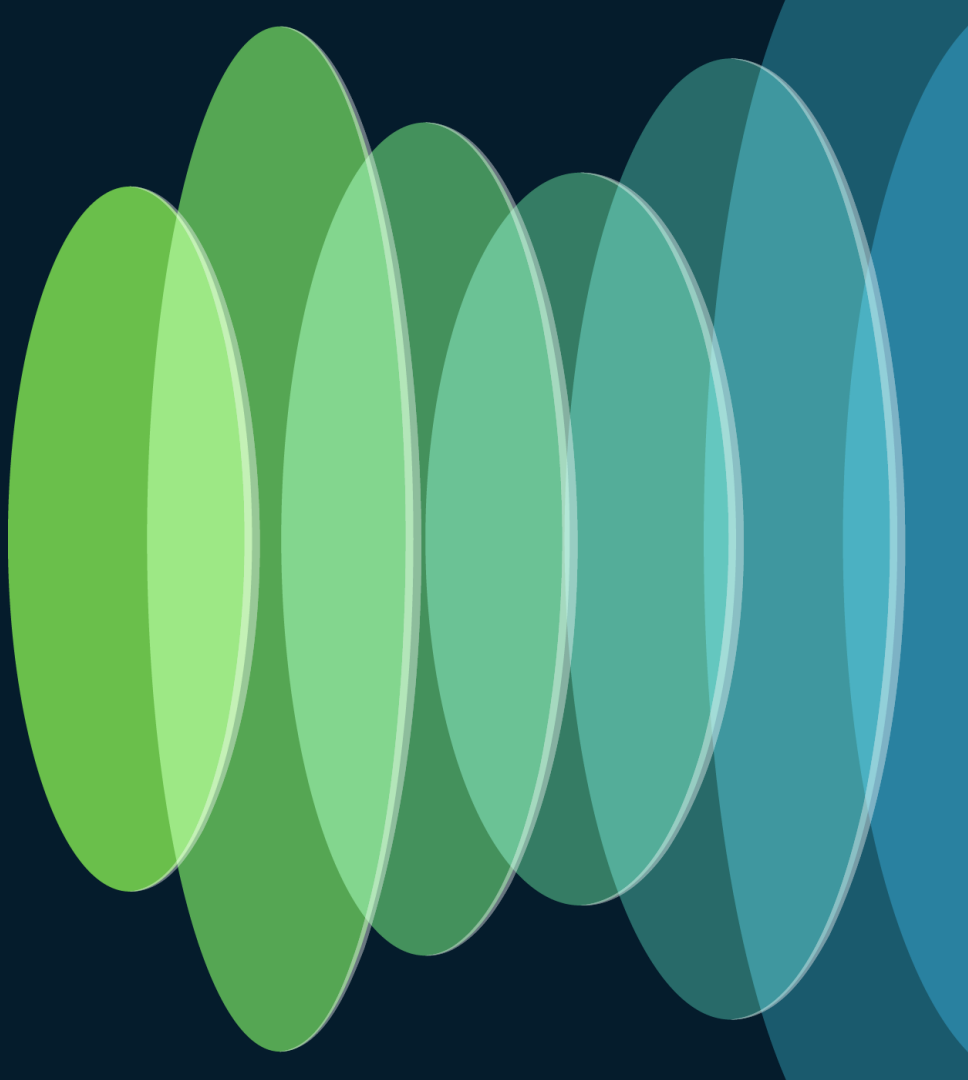
Demand Response (DR) Load Controller

- Power generation and consumption must always be kept in balance
- During periods of high power draw (peaking), energy consumption needs to be reduced to avoid brownouts
- Demand Response allows control of high energy consumption devices on the grid
- The DR device connected to water heater is connected to the 802.15.4 mesh (e.g. the meter on the home)

802.15.4 Street Light



Cisco Ultra-Reliable Wireless Backhaul



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Cisco Ultra-Reliable Wireless Backhaul (CURWB)
Supporting Ultra Reliable Communications Today

Industrial devices

Reliable Network

Cisco Ultra-Reliable Wireless Backhaul

Fixed and mobile wireless backhaul

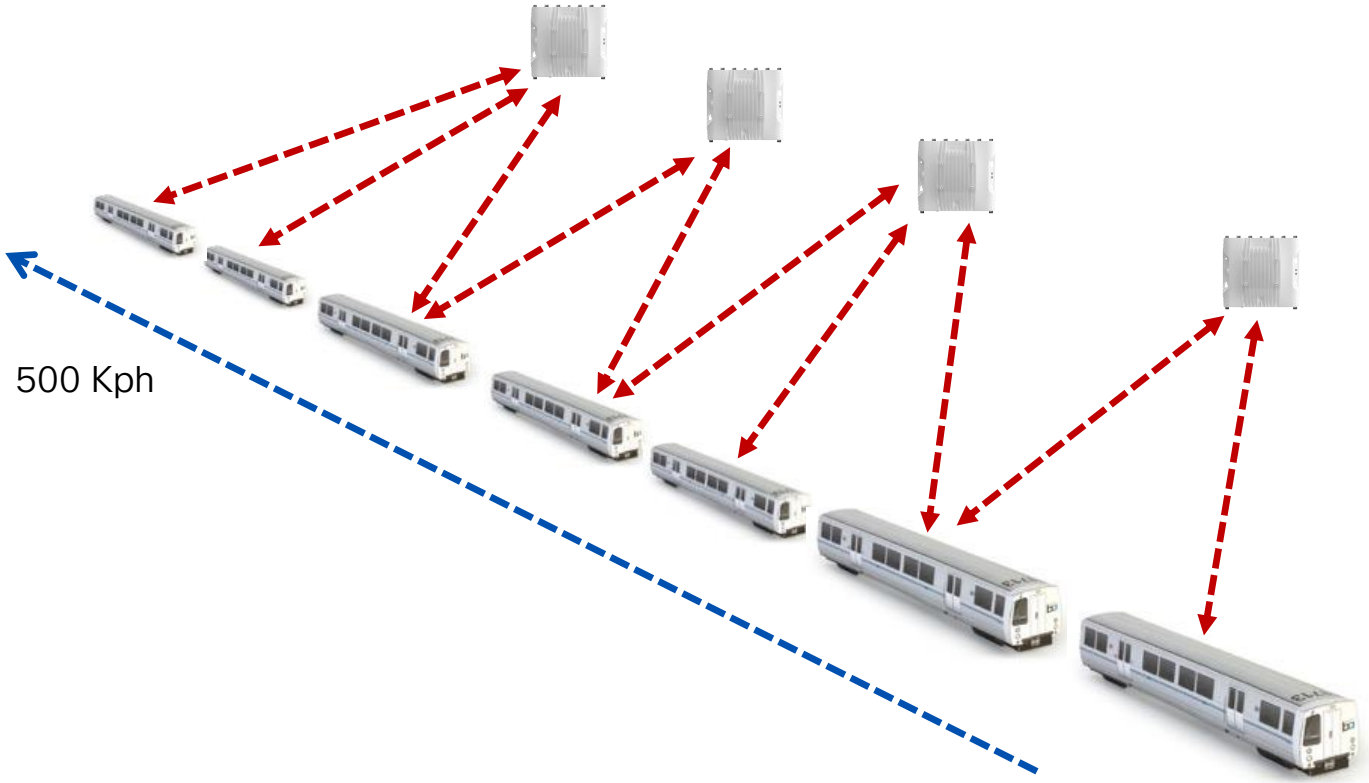
Ultra-low latency
Ultra reliable
High bandwidth
Fast mobility
Easy to deploy
Custom to your needs

Critical applications

Autonomous vehicles control
Tele-remote machine operations
Communications-based train control
Train-to-ground communications
Terminal operations systems (TOS)
Live HD video-surveillance
Emergency response systems

The bridge between moving devices and business-critical applications

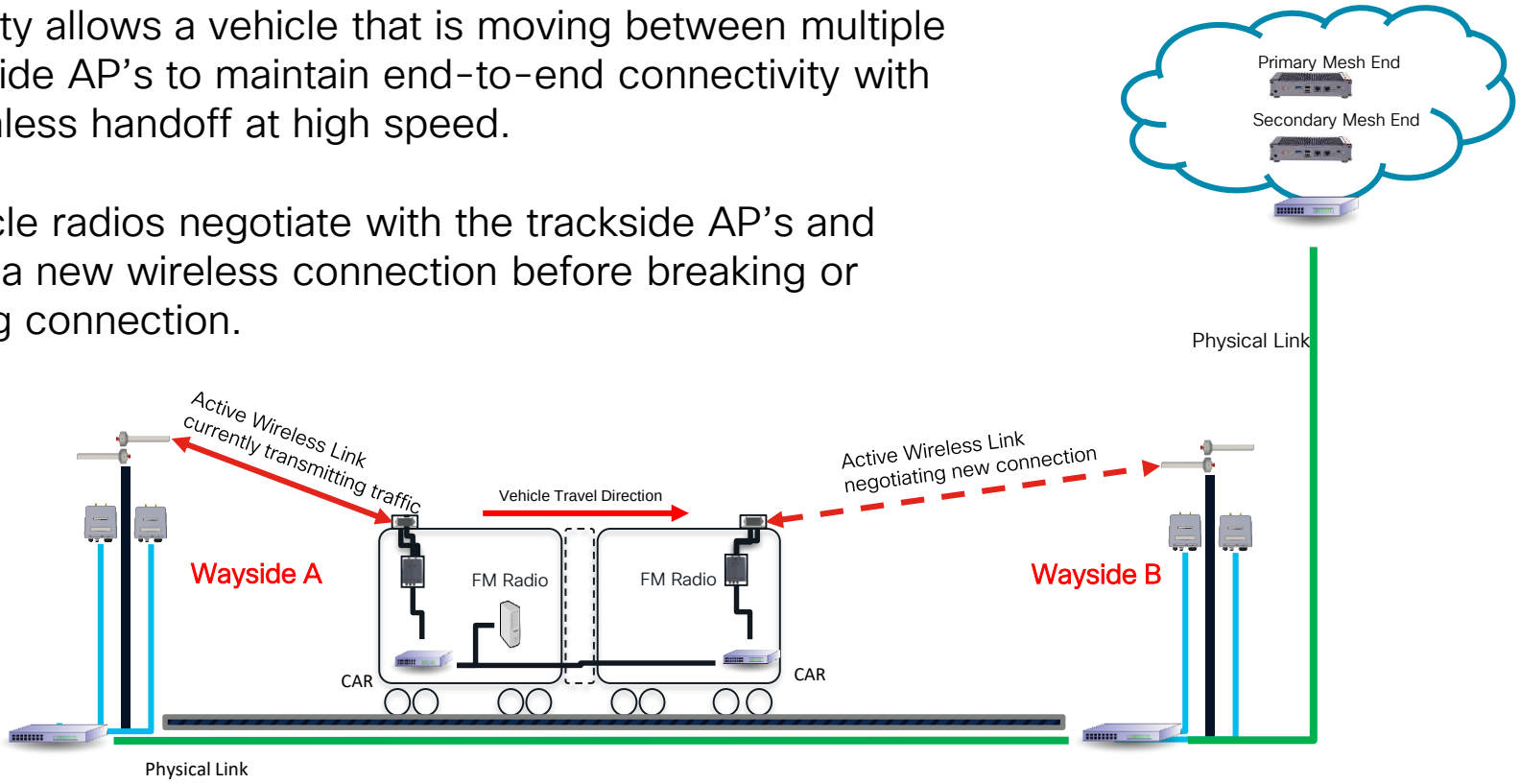
Ultra Fast Roaming is Difficult



Fluidity

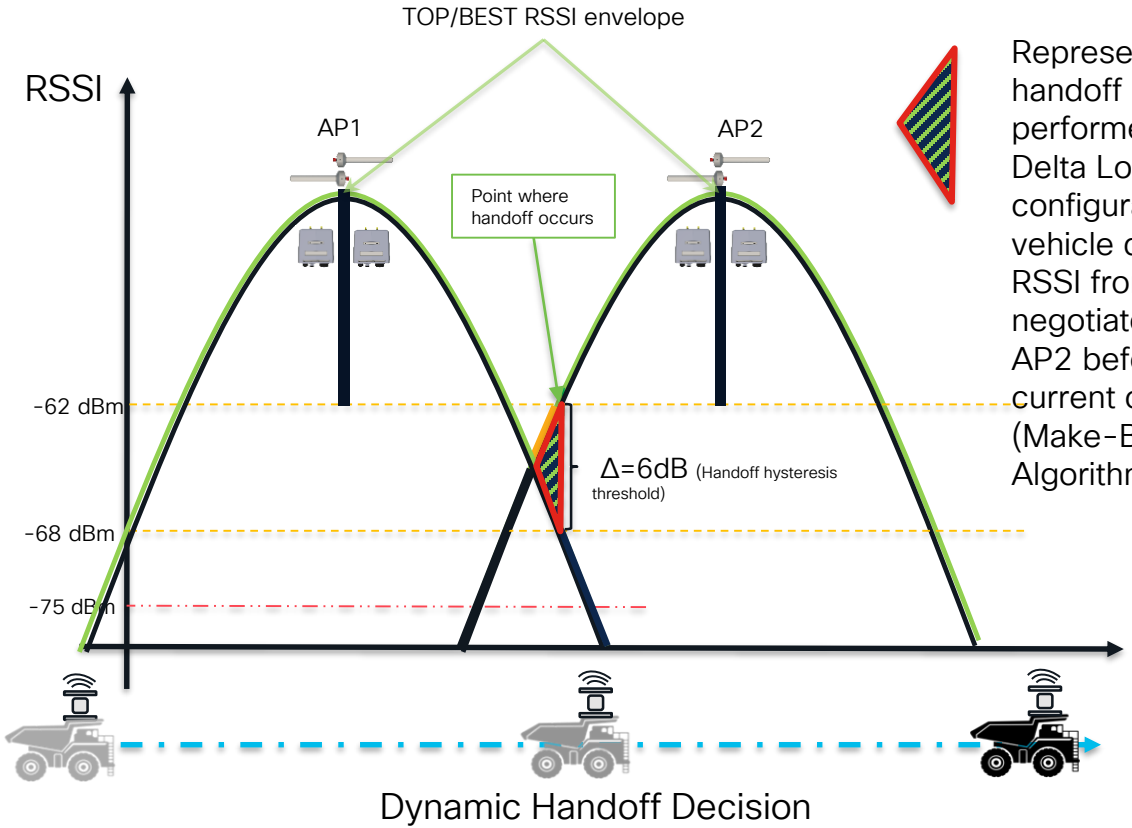
- Fluidity allows a vehicle that is moving between multiple wayside AP's to maintain end-to-end connectivity with seamless handoff at high speed.

- Vehicle radios negotiate with the trackside AP's and form a new wireless connection before breaking or losing connection.



Fluidity Seamless Handoff – How it Works

Radios always operate on the top line (RSSI Envelope), handing over to the next available AP as soon as the RSSI level is better than a designated delta value (Hysteresis Threshold).



Represents area where handoff to a new AP is performed according to the Delta Low and Hi configuration. Radio on the vehicle detects an increase in RSSI from AP2, where it negotiates a connection with AP2 before breaking the current connection with AP1 (Make-Before-Break Algorithm).

CURBW Use Case Examples

Example: Dark Rides
Wireless for Amusement Park Autonomous Rides

Type 1 System:

- On-board PLC for Vehicle Control (Safety Protocol)

Type 2 System:

- Ride Control Protocol
- Show Control (audio/visual sync with vehicle movement)
- On-board Video Surveillance

Cisco Catalyst IW9167 Series
One hardware, two wireless technologies

Industrial and outdoor
Wi-Fi 6E access point

OR

Cisco Ultra-Reliable Wireless Backhaul
Improved data rate: up to 7.8Gpbs
Improved availability: up to 99.999%

- IP67, shock/vibration, extreme temperatures
- Cisco secure
- Flexible and sustainable

Tri-radio
2.4 GHz, 5GHz, 5/6GHz

4x4
4 spatial streams

Multigigabit
RJ45, M12 or SFP+

PoE and DC power

GNSS, BLE, Scanning Radio

Learn more, see product and demo at the WoS

Catalyst IW9165E Rugged AP and Wireless Client

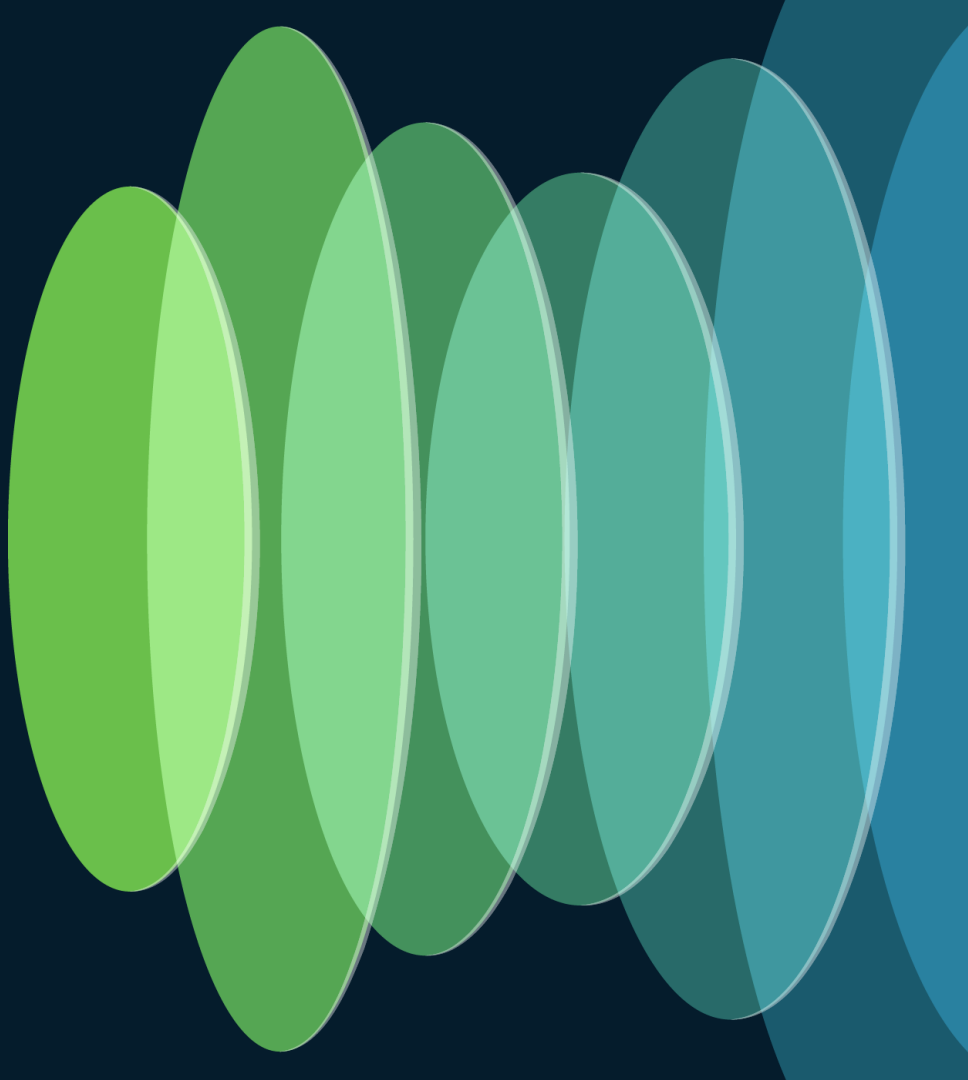
Wireless client that connects mobile industrial assets

Autonomous robots and vehicles for manufacturing, ports, logistics

Rail and light-rail rolling stock

Ultra-reliable broadband wireless connectivity for moving machines and vehicles

LoRaWAN



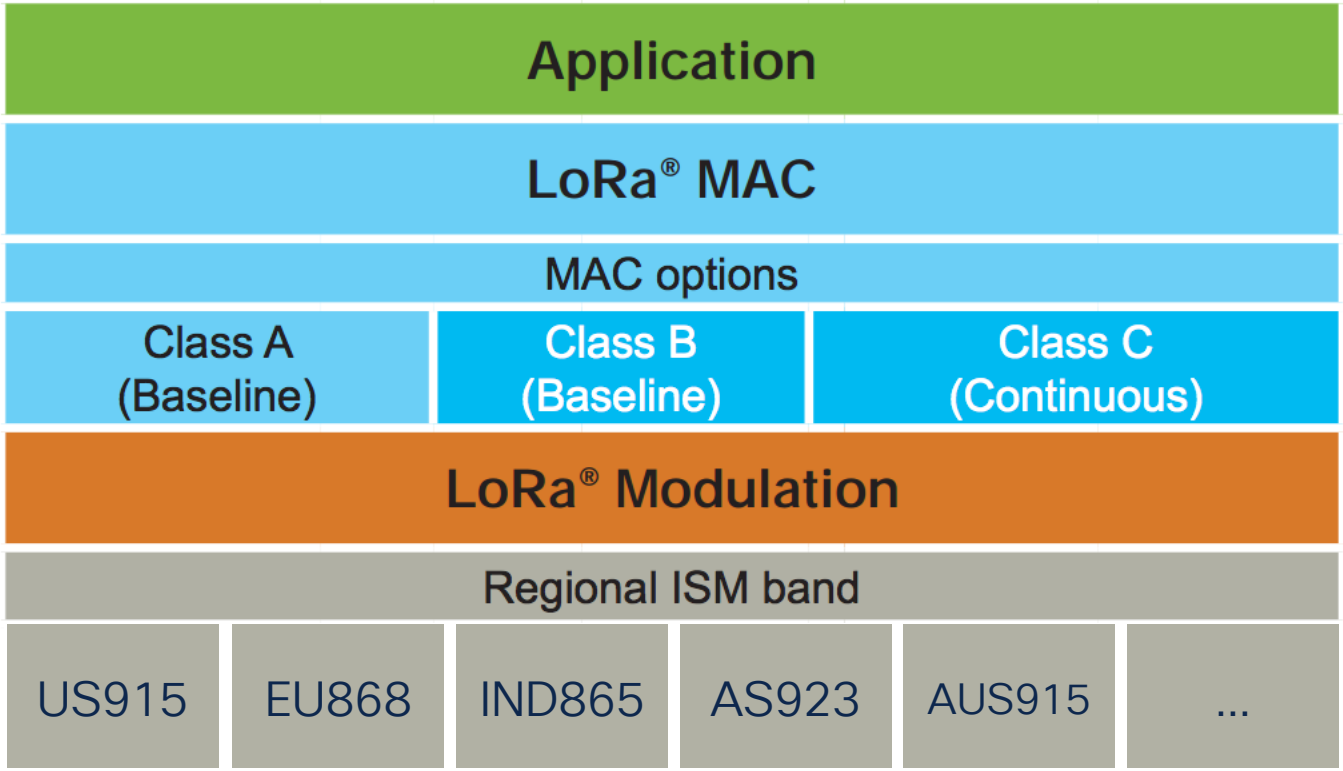
The LoRa Alliance (https://www.lora-alliance.org)

- An open, nonprofit association of members that believes the Internet of Things era is now
- Mission: To standardize LPWA networks being deployed around the world to enable Internet of Things (IoT), Machine-to-Machine (M2M), Smart City, and industrial applications
- Cisco is a founding member and serves on the Board of Directors as well as in the Technical Committee
- LoRa Alliance specifies the LoRaWAN protocol above the physical layer and network architecture, and assures interoperability between devices and operators in one open global standard

Introducing Semtech LoRa (Long Range)

- Semtech is a leading supplier of high-quality analog and mixed-signal semiconductor products, and owner of LoRa chipset / modulation technology
- LoRa modulation scheme is owned by Semtech. Based on spread spectrum modulation techniques and a variation of Chirp Spread Spread spectrum (CSS) along with FEC
  - LoRa Protocol supports 125 KHz and 500KHz channels
  - The link budget, typically given in decibels (dB), is the primary factor in determining the range in a given environment
  - 19.5 dBm demodulation below noise floor
  - Low data rates between 0.3 Kbps and 22 Kbps
  - Dynamically trades data rate against range and density of sensors

The LoRa Protocol Stack

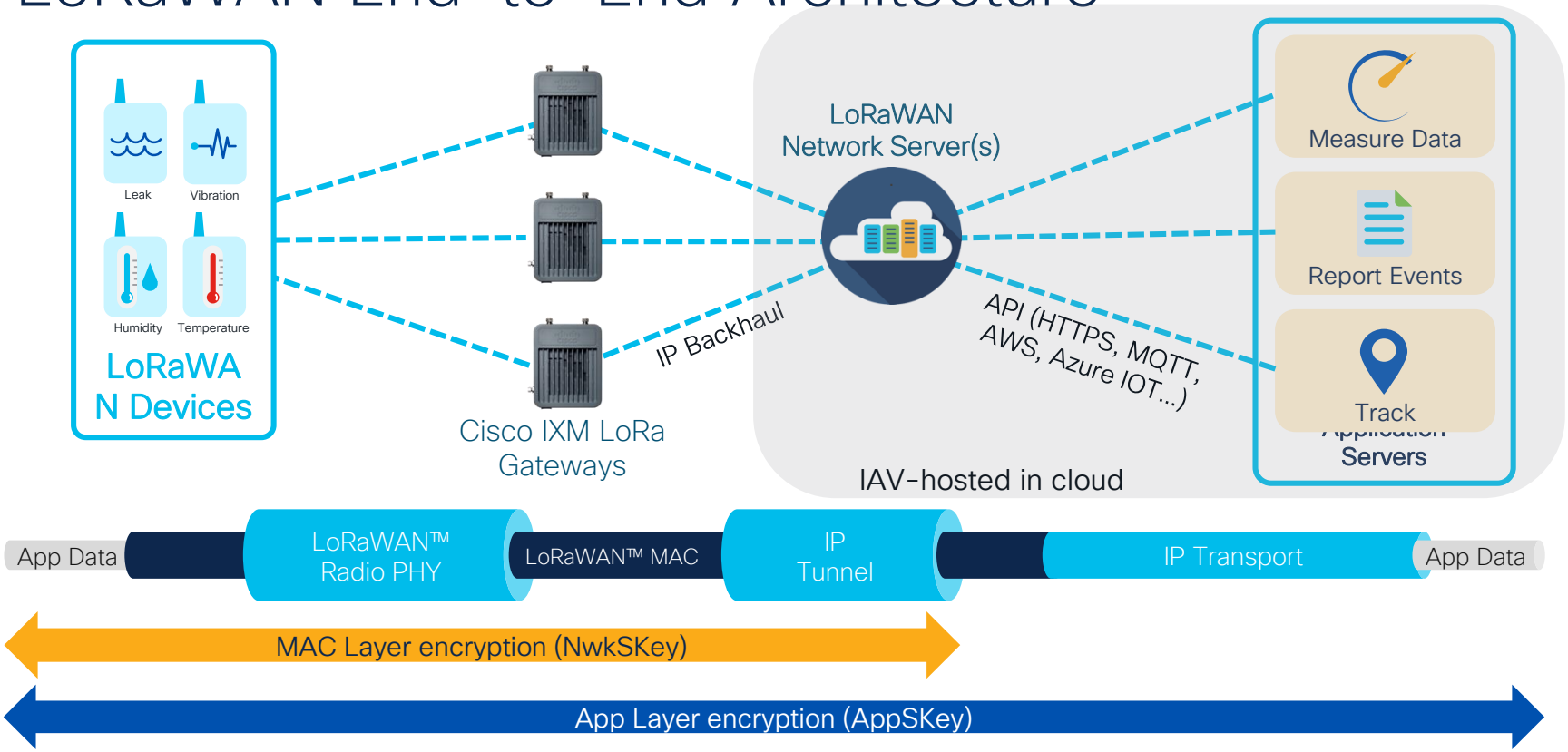


LoRa Alliance Specifications

Semtech modulation

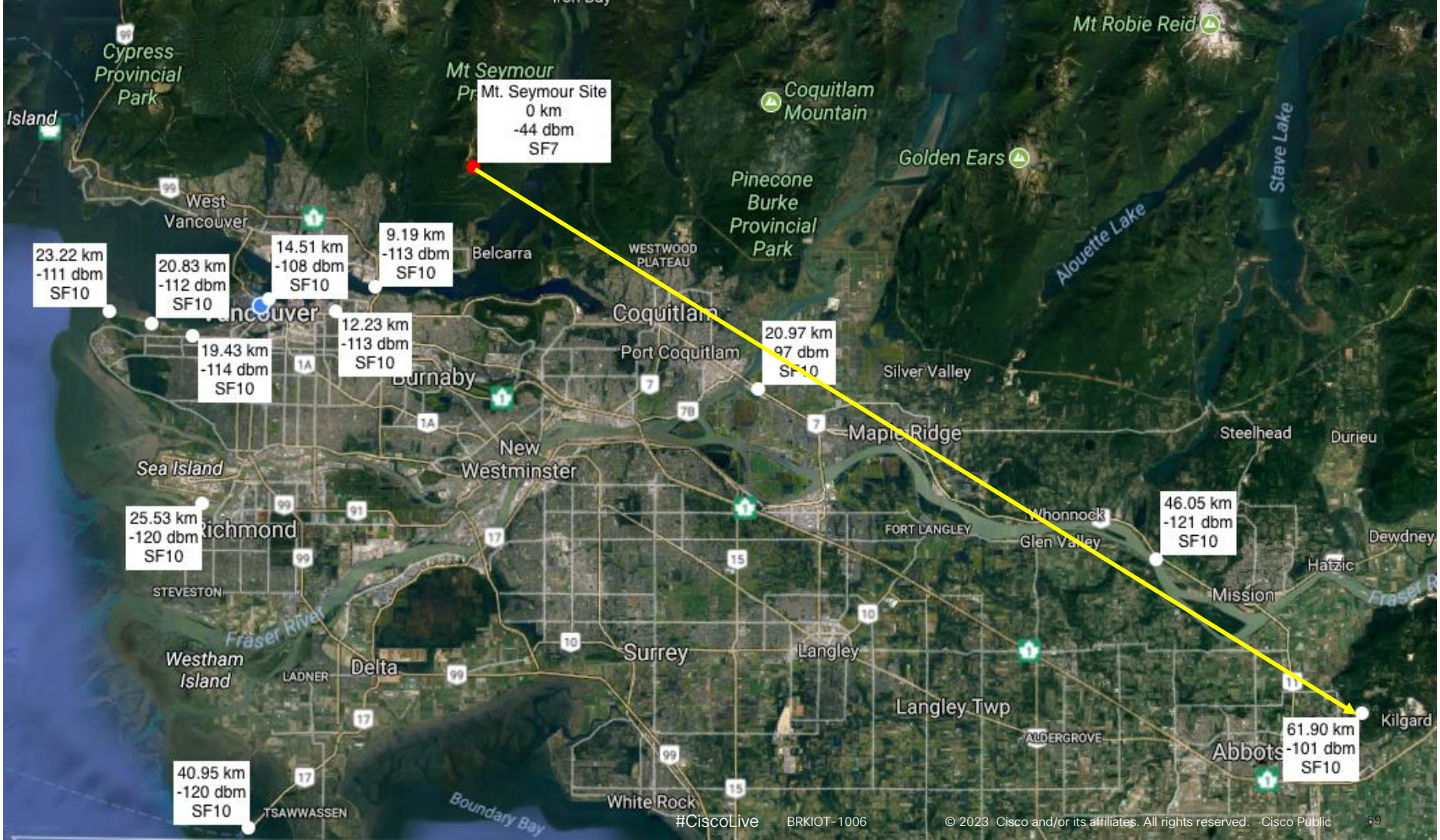
LoRa Alliance Regional Profiles

LoRaWAN End-to-End Architecture



Comparing LoRa Data Rates

SF	LoRa BW (KHz)	Coding Rate	Data Rate (bps)	Sensitivity (dBm)
7	125	4/5	5,469	-125
8	125	4/5	3,125	-127.5
9	125	4/5	1,758	-130
10	125	4/5	977	-132.5
11	125	4/5	537	-135
12	125	4/5	293	-137.5
7	500	4/5	21,875	-119
8	500	4/5	12,500	-121.5
9	500	4/5	7,031	-124
10	500	4/5	3,906	-126.5
11	500	4/5	2,148	-129
12	500	4/5	1,172	-131.5



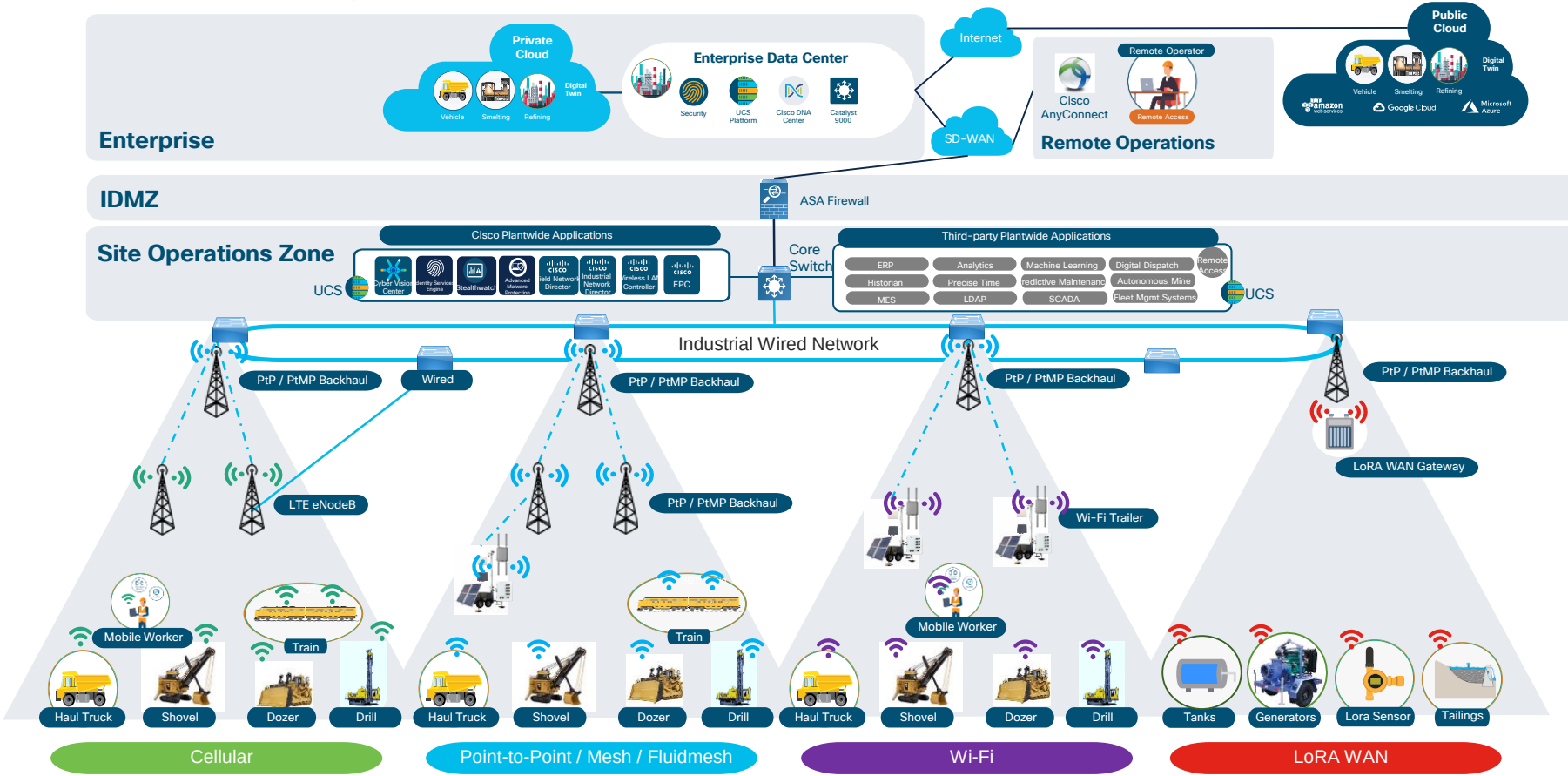
Example: Water Management

Water Resources Management

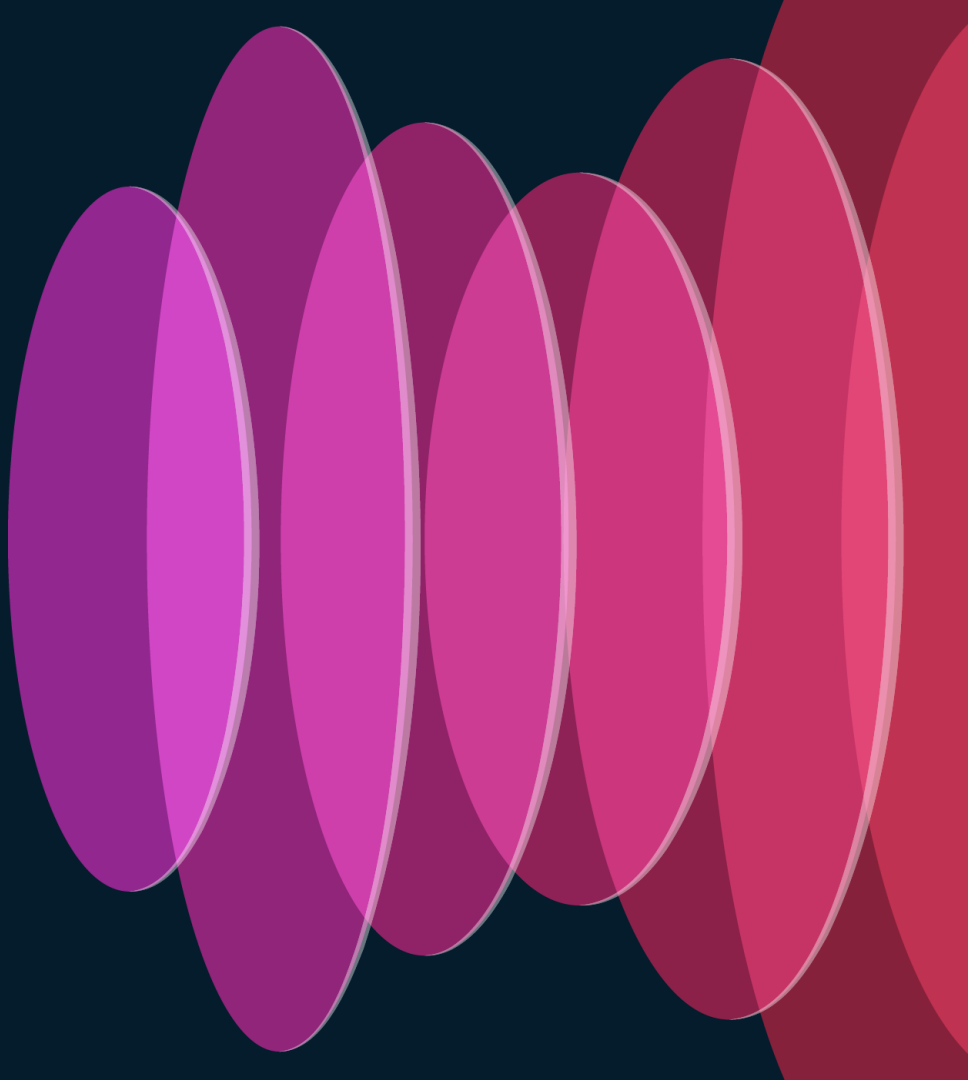
Use Cases and Benefits

- Smart water meters management and operations
- Water infrastructure leak detection
- Water resources management – dams, tank levels
- Smart Agriculture – Irrigation, leak detection…

In Summary: different problems, different solutions



IoT Messaging to Industrial Devices



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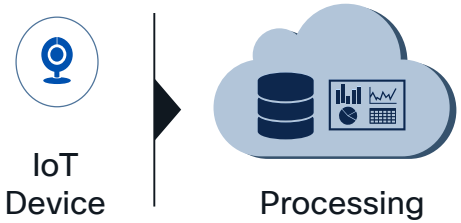
A Different Approach is Needed for IoT

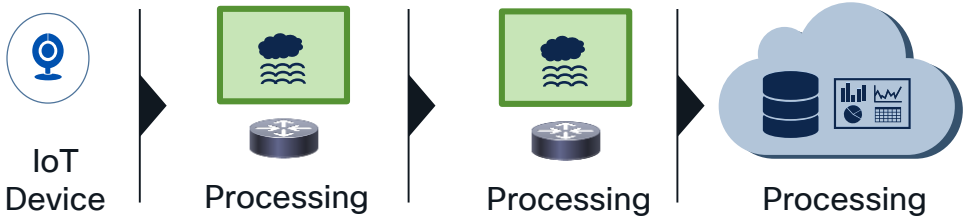
Traditional Approach

Take Data to the Processing



Approach for IoT

Take Processing to the Data



Communicating with IoT Things

- You need a language to exchange with the IoT object

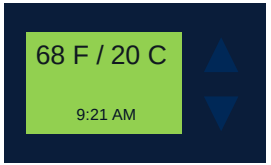
tell me the temperature (read, ‘get’)

turn HVAC off (write, ‘put’)

update firmware, etc.

save new profile (write, ‘post’)

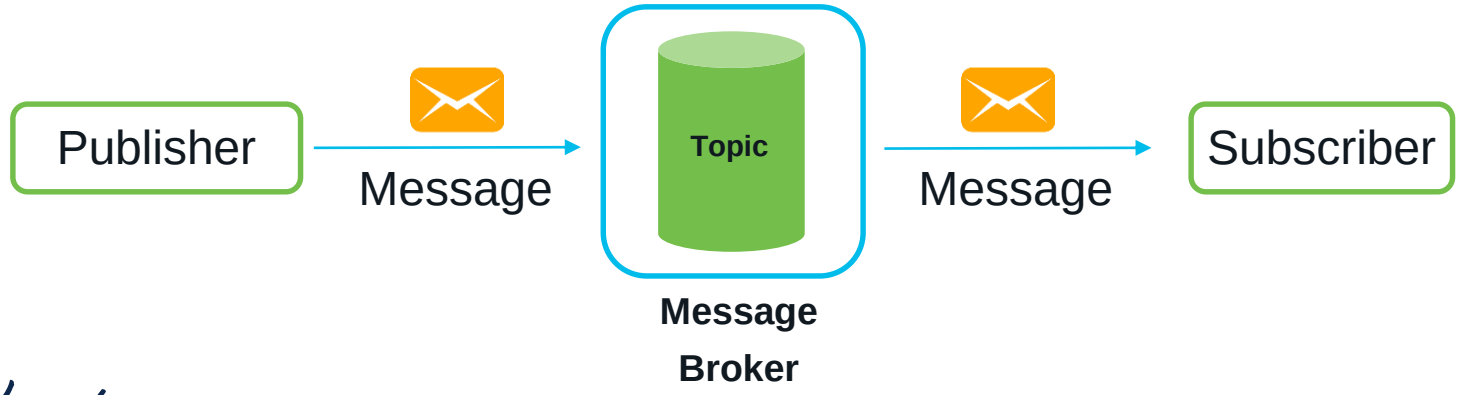
delete profile (write, ‘delete’)



- Machine may be simple or complex
  - There may be a few or many instructions
  - Instructions are variations of 4 basic operations

Message Brokers: Publishers and Subscribers

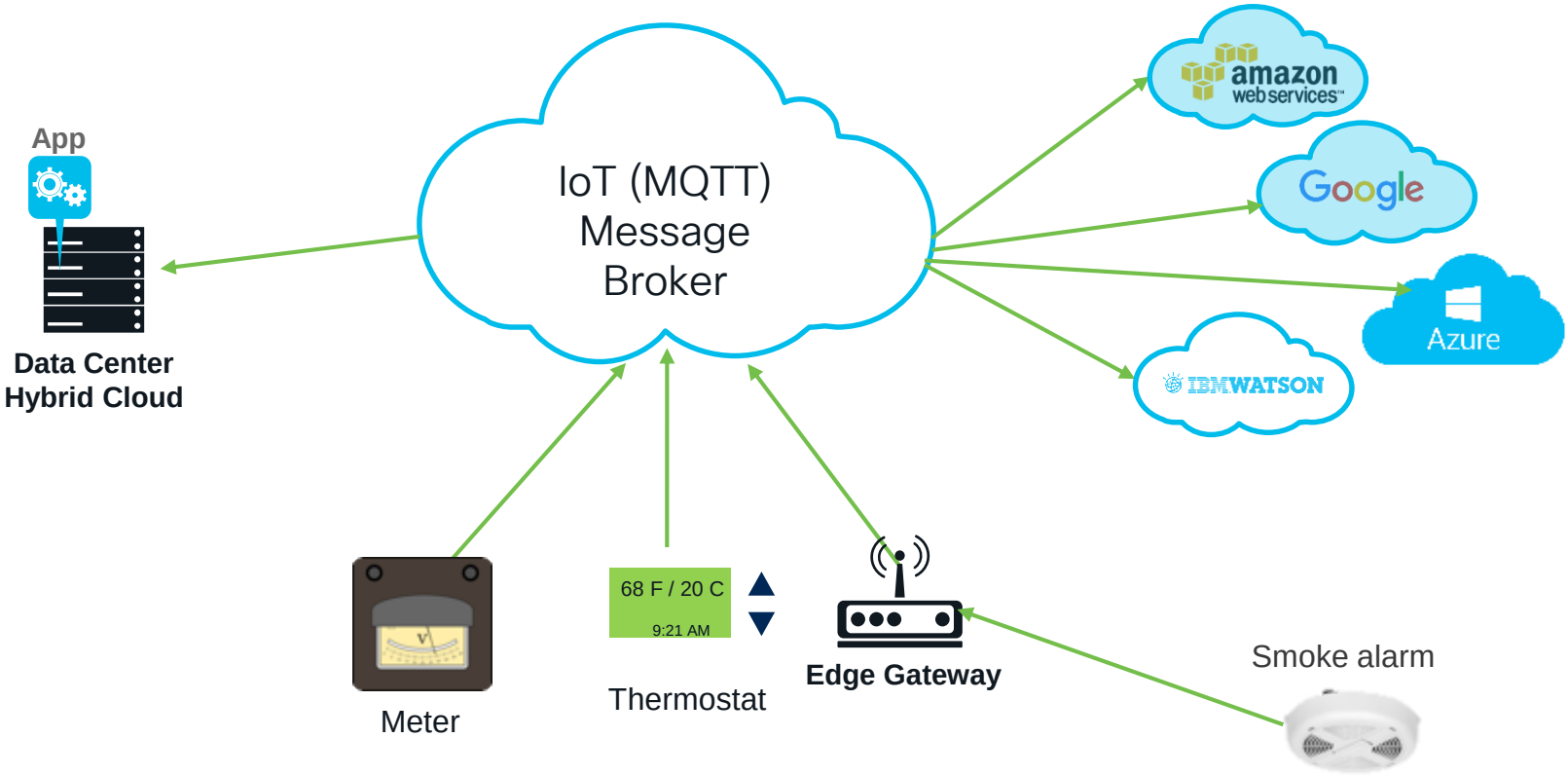
- Messaging almost always goes through a broker
- Clients Subscribe to topics to publish and receive messages
- Broker receives subscriptions from client topics.
- Broker receives messages from clients and forwards to interested subscribers (e.g. analytics engines, Big Data system, etc.)



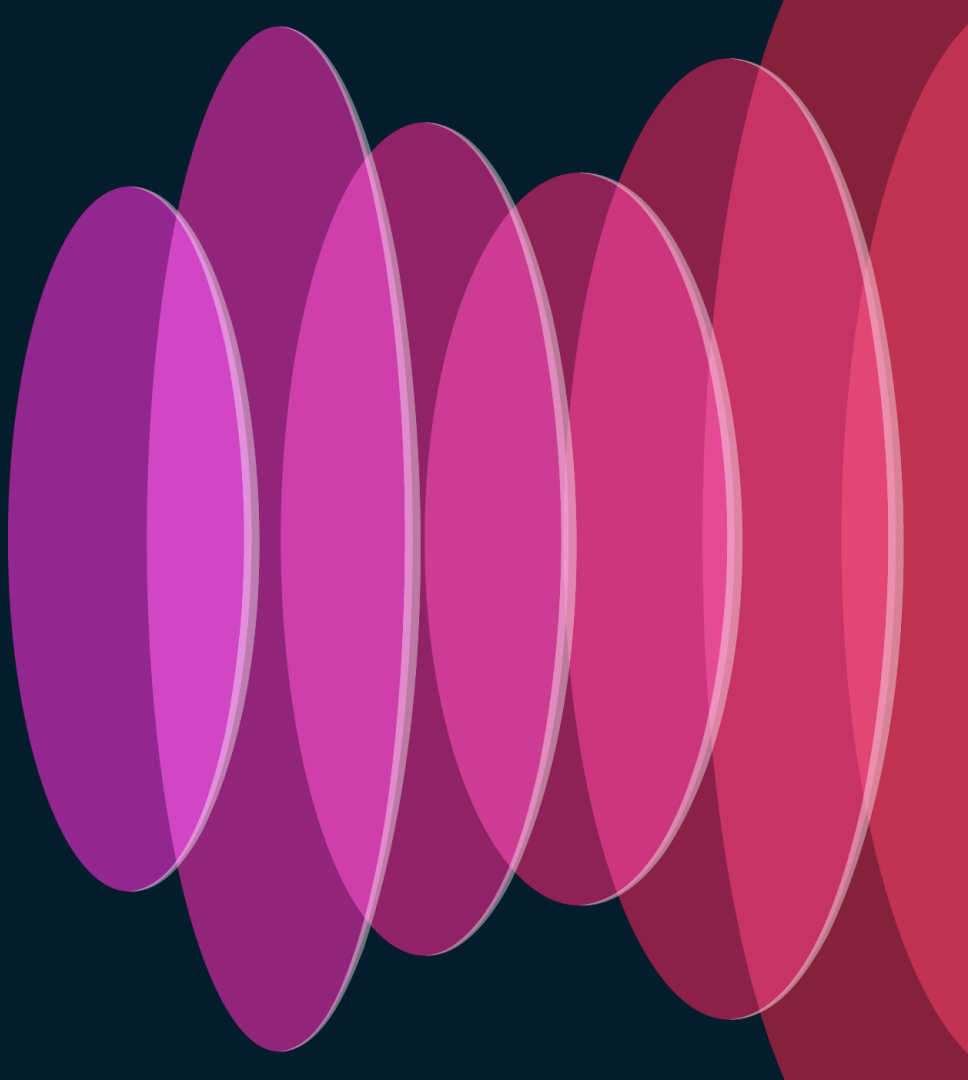
MQTT Overview

- Message Queue Telemetry Transport (MQTT)
  - Created in 1999, and is intended to be a publish-subscribe based "lightweight" messaging protocol for IoT and M2M
  - TCP Based
  - Based on the idea that TCP and HTTP are good protocols (just need to be a little lighter):
  - Sensor publishes information (MQTT Publisher)
    - Information is published as an address
  - The application that needs to receive the information can be set as the MQTT subscriber

Example: Cloud-Based Message Brokers



Running Applications at the Edge

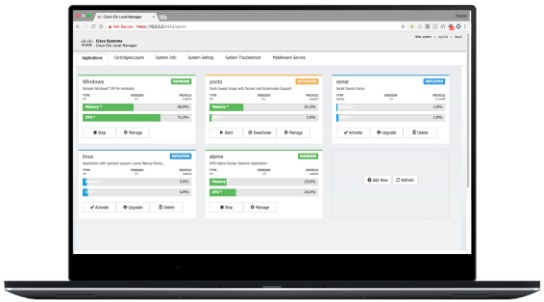


Cisco IOx – Run Applications at the Edge

Three components of IOx

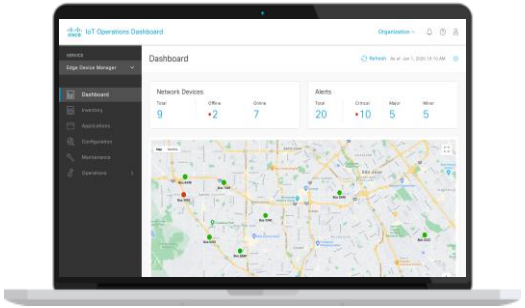
IOx-enabled devices

Developer tool



- Execute container or Virtual Machine concurrently
- Run Windows or Linux applications
- Easily-consumable System Services

IoT Operations Dashboard

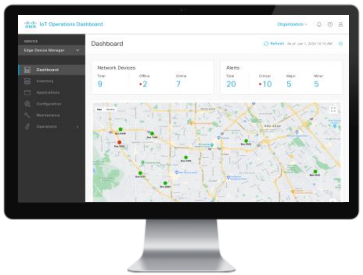


- Zero touch deployment of devices
- Centralized device and application life-cycle management at scale
- End-to-End security

Cisco IoT Operations Dashboard

A cloud platform of OT services to connect, maintain and secure industrial assets, and gain insights

IoT Operations Dashboard



IW service
Deploy and monitor IW devices in Cisco URWB mode

Secure Equipment Access
Secure remote access to industrial assets

Cyber Vision
Visibility of asset inventory and security posture

Edge Intelligence
Collect, process and control transfer of data

Application Management
Manage applications across the network

Industrial networks

Wireless backhaul

Industrial routing

LoRaWAN

Roadway intersections

Transportation

Solar panels

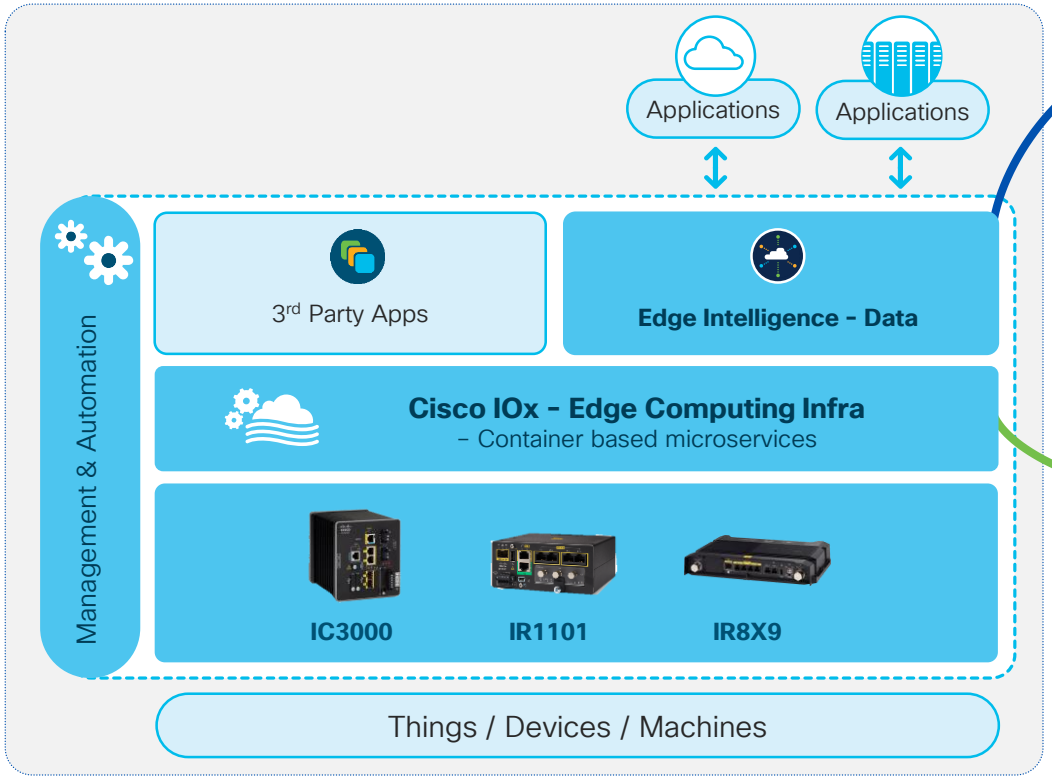
EV chargers

Connected signage

Wind farms

Connected machines

Applications at the OT Network Edge



Get Started Fast

Using Cisco Edge Intelligence for edge data processing is the fastest and easiest way to process and send data from the edge

{Or Build}

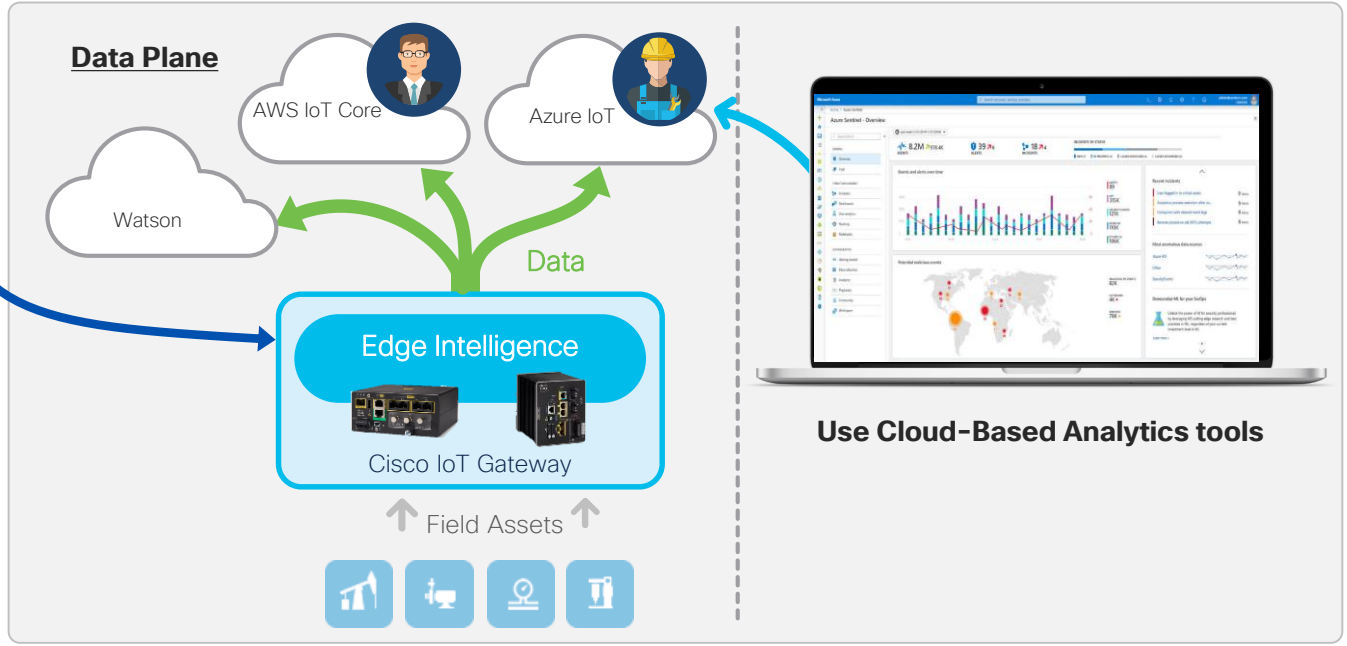
Your Own App

Using Cisco IOx compute infrastructure and development environment you can build your own Docker app that runs at the edge. Allowing you unlimited potential to enable edge processing

Cisco Edge Intelligence – How it Works

Simplify data acquisition, transformation and provisioning from edge to multi-cloud destinations - fully integrated with Cisco IoT hardware and IOS

The Control Plane Pushes data models to the gateway device to correctly ingest and prepare incoming data



Edge Intelligence – Managing Data Models

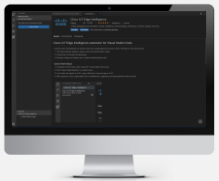
Extract
Pre-Integrated with Solution

Transform
Converting raw data to intelligence

Govern
Control flow of raw and transformed data

Deliver
Pre-integrated for secure delivery

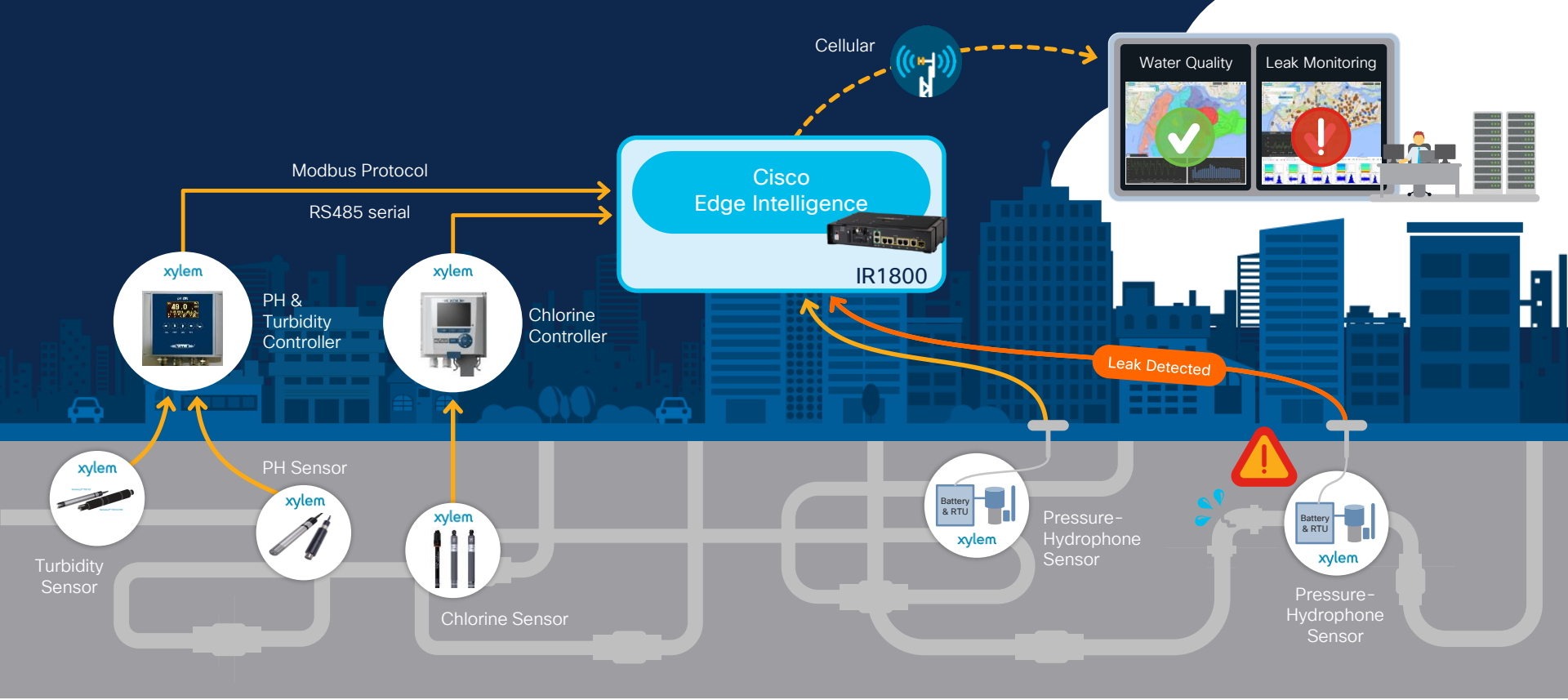
Modbus
OPC UA
MQTT
...



Built on industry's well accepted & developer-friendly tools

Policy control at device and attribute level on raw or transformed data

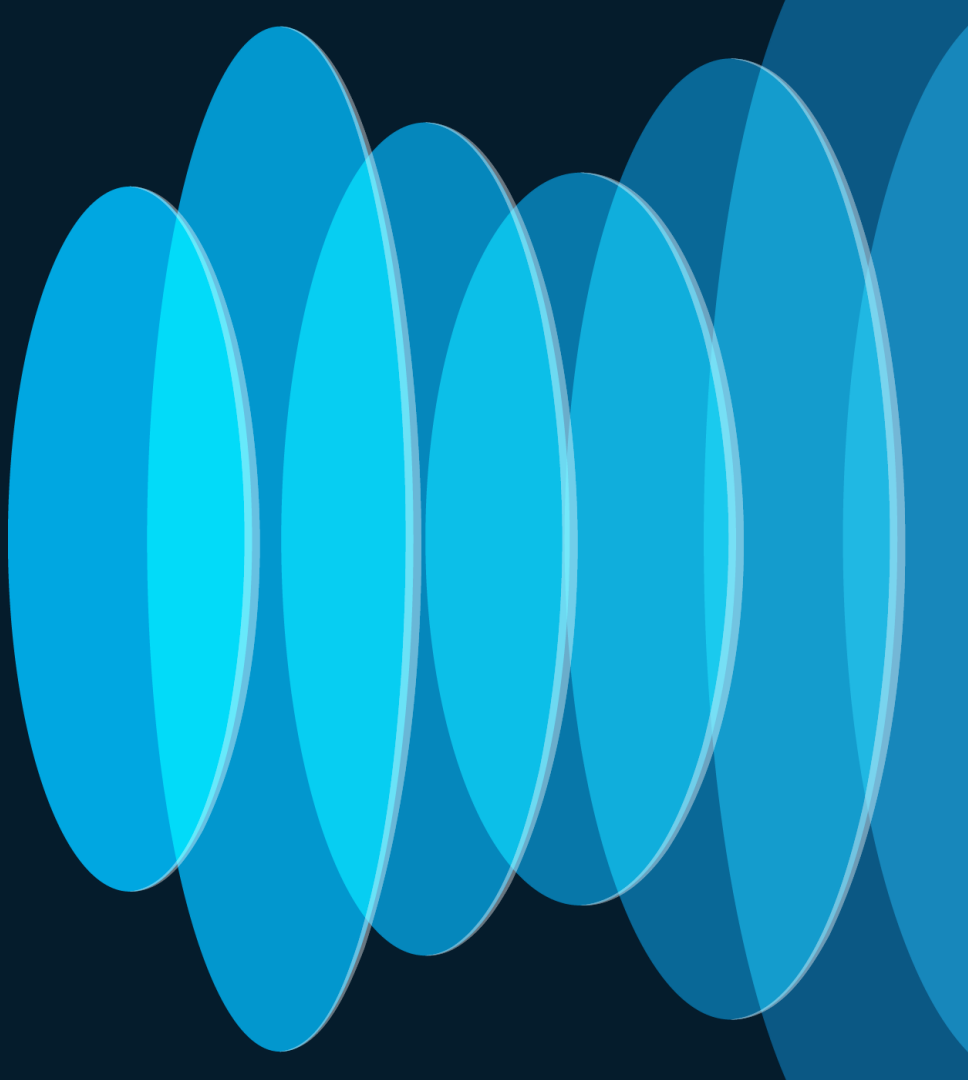
aws
Microsoft Azure
software AG
Freedom as a Service
MQTT
...



Use Case
Water Distribution

- Water quality monitoring
- Real-time water leakage detection

Summary



What Have we Learned?

- IoT is massive scale and demands a different architectural paradigm
- IoT systems are predominantly wireless – understand key capabilities and use cases of Wi-Fi, 802.15.4, LoRaWAN, 5G, and CURBW
- Industrial IoT networks generally follow the IEC 62443 / Purdue model and support a variety of unique requirements
  - Timing
  - Resiliency
  - Security
  - Management
- IoT messaging requires a distributed and intelligent framework with edge intelligence
- IoT (and OT in general) security relies on a comprehensive set of capabilities that understand the OT protocols, such as SCADA

Complete Your Session Evaluations

Complete a minimum of 4 session surveys and the Overall Event Survey to be entered in a drawing to **win 1 of 5 full conference passes** to Cisco Live 2025.

Earn 100 points per survey completed and compete on the Cisco Live Challenge leaderboard.

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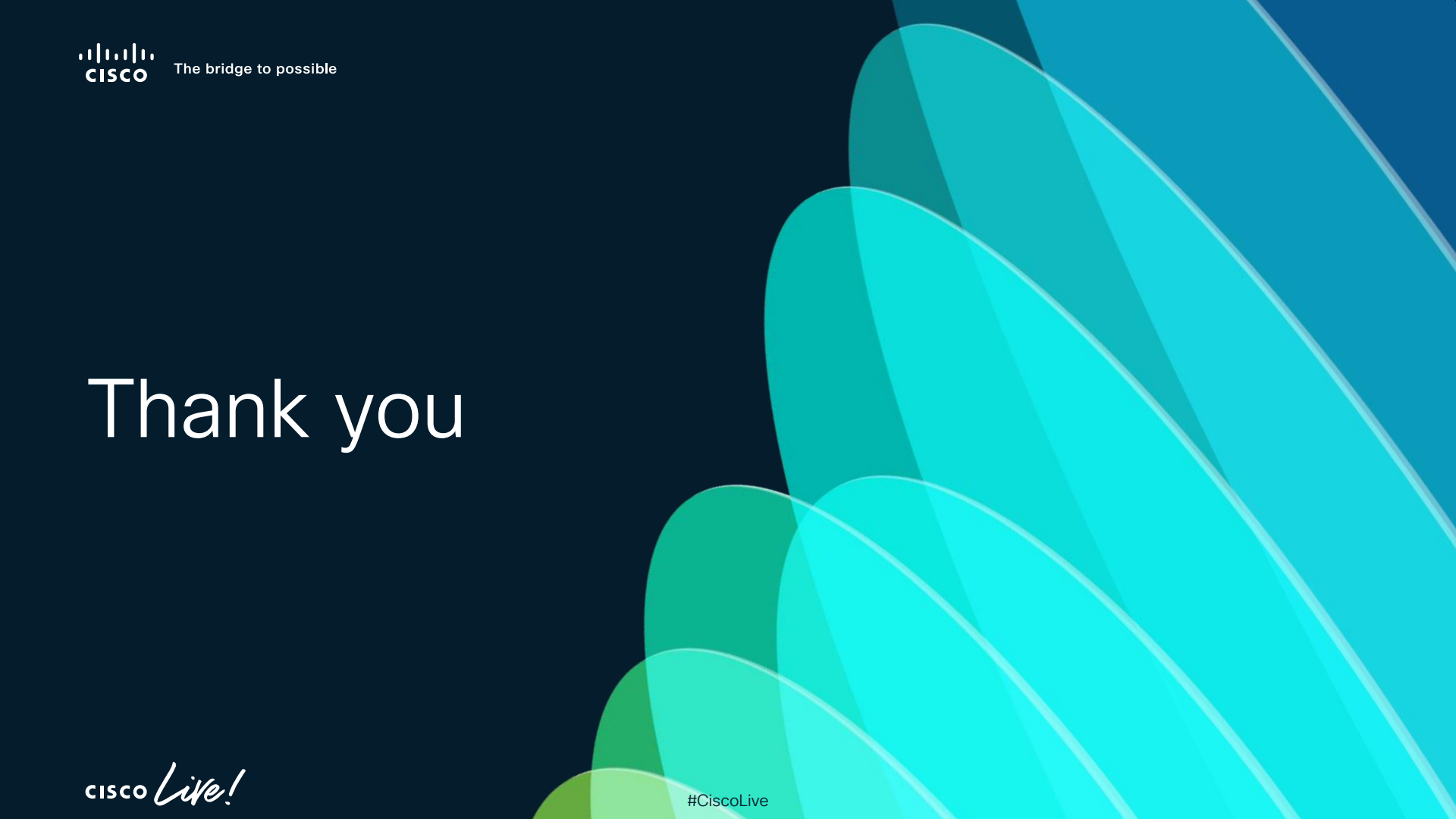
- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

Contact me at: Insert preferred comms method


The bridge to possible
Thank you
cisco Live!
#CiscoLive

Monday, June 3

Palm D

8 Tips for Deploying Indoor Wireless Mobility with Cisco Industrial Wireless

DJ Cole

- **10:30-Noon - BRKIOT-2018** - Mariners AB

  Journey to Innovation: Paving the Way with Smart Architectures and Insights from the Department of Transportation's Pioneers

  Andrew Nolan, Pete Kavanagh, Jeremy Sanders

- **1:00-2:30 - BRKIOT-2720** - Surf EF

  Revolutionizing Manufacturing: The Dawn of Industry 4.0 and Smart Factory Integration

  Arun Siddeswaran, Paul Didier, Kevin Wood

- **2:30-3:30 - BRKIOT-2016** - Palm D

  Streamline Your Success: Automating OT Services with Cisco Catalyst Center Best Practices

Tuesday, June 4

- **10:30-Noon - BRKIOT-1006** - Mariners AB

  Unlocking the Future: Introducing Cisco's Industrial Networking and IoT Essentials

  Rob Barton

- **1:00-2:00 - BRKIOT-1527** - South Seas A

  Securing Industrial Networks - A look at ISA/IEC-62443 and How Cisco Can Help Secure the IIoT Network

  Flemming Andreasen

- **3:00-4:30 - BRKIOT-2265** - Surf EF

  Let's Get Physical with IIoT Wireless

  Igor Moiseev

Wednesday, June 5

- **10:30-11:30 - BRKIOT-2116** - South Seas A

  Using Cyber Vision for OT Asset Visibility and Securing the Industrial Network

  Kevin Holcomb

- **1:00-2:00 - IBOIOT-2101** - Lagoon C

  Revolutionizing Industrial Operations: Unveiling the Power of AI in IIoT with Cisco Solutions and Emerging Industry Trends

  Casca Kwok, Kevin Wood

- **2:30-4:00 - BRKIOT-2882** - Mariners AB

  Implementing Segmentation in Industrial Networks

  Erika Franco, Andrew McPhee

- **4:00-5:00 - BRKIOT-1126** - South Seas A

  Connecting Moving Assets with Cisco IoT Solutions

  Emmanuel Tychon

Thursday, June 6

Enable Zero Trust Network Access for Industrial Networks with Cisco Secure Equipment Access

Andrew McPhee, Emmanuel Tychon

- **10:30-12:00 - BRKIOT-2017** - Mariners AB

  Streamline Your Industry: Dynamic SD-WAN Use Cases for Enhanced Industrial Performance

  Pete Kavanaugh, Dan Madey,

- **11:00-12:00 -BRKIOT-2015** - Lagoon EF

  The New Digital Substation: More Efficient, More Secure, and Ready for Demanding Modern Grid Applications

  Marcus Smith

- **1:00-2:00 - IBOIOT-2100** - Lagoon C

  Cut Through the Complexity: Navigating LAN Redundancy Options with Ease