TRIDIUM talk

SPECIFIER SERIES

Specifying an OT Network

TRIDIUM

Presenter

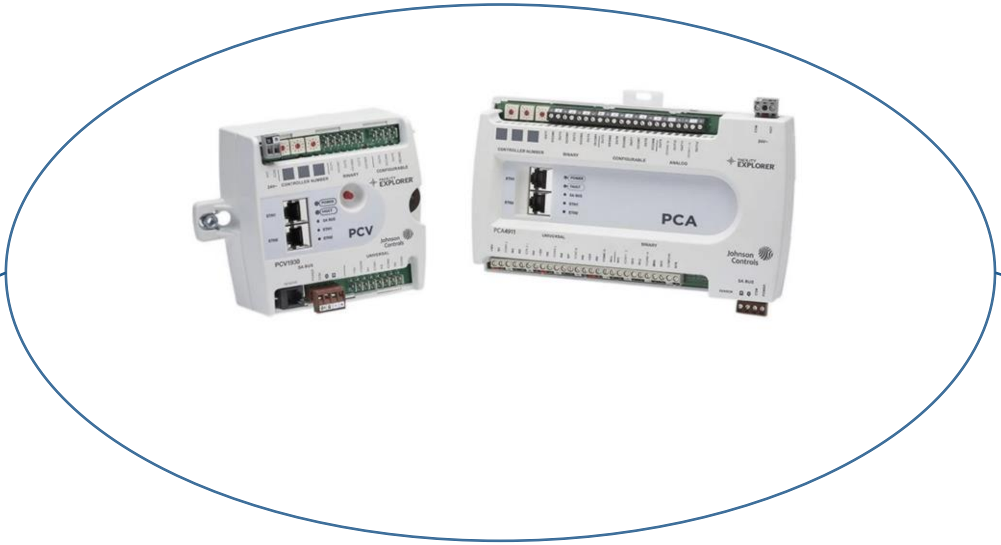
Gregory Fitzpatrick, CxA

Cochrane Supply and Engineering
BDC Engineering

WHAT ARE WE GOING TO COVER?

- IP DEVICES
- WHAT ARE OPERATIONAL TECHNOLOGY NETWORKS (OT Networks)
- CYBER SECURITY
- HOW TO SPECIFY AN OT NETWORK
- SELECTING AN OT NETWORK SOLUTION
- FUNDAMENTALS OF DESIGNING AN OT NETWORK
- EXAMPLE PROJECT

THE INDUSTRY MOVING TO IP DEVICES



ETHERNET MOVES MORE DATA

* ANALYTICS

* APPLICATIONS RUNNING AT THE CONTROLLER LEVEL

* EASIER TO SHARE DATA FROM DIFFERENT OT ON A COMMON NETWORK

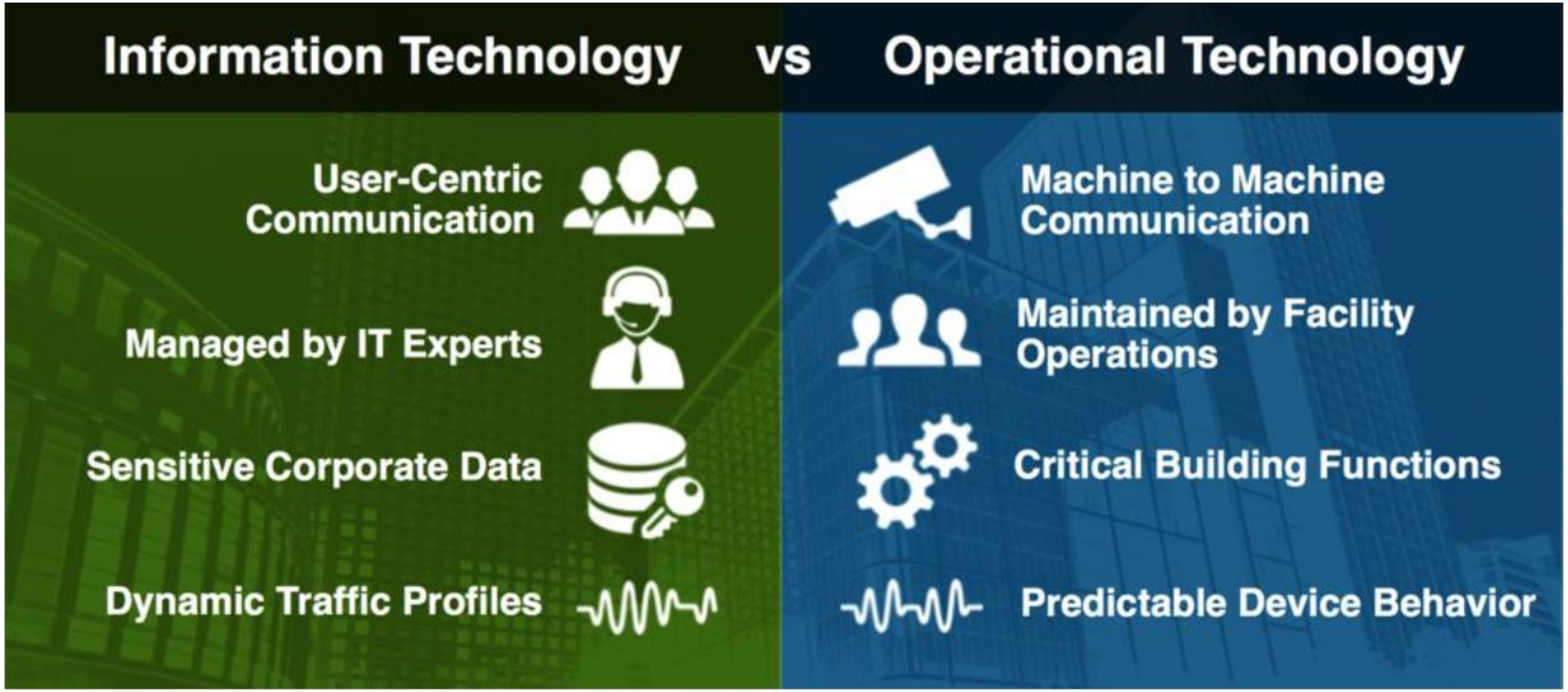
WHAT IS OT?

User-centric communication

Machine to machine communication

- OT is Operational Technology
- The OT network consists of elevators, lighting, HVAC, power meters, surveillance, access control, intercoms, and fire alarms — essentially, anything bolted to the building.

WHY SEPARATE IT FROM OT?



Information Technology	vs	Operational Technology
User-Centric Communication		Machine to Machine Communication
Managed by IT Experts		Maintained by Facility Operations
Sensitive Corporate Data		Critical Building Functions
Dynamic Traffic Profiles		Predictable Device Behavior

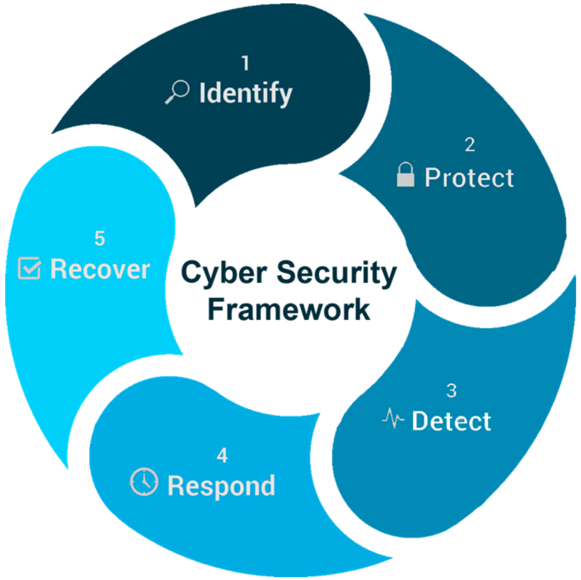
WHY IS AN OT NETWORK IMPORTANT?

- We as an industry need to be capable designers and installers of Self-contained IP Networks to accommodate the new IP devices being manufactured by the control industry.
- Cyber Security Risks due to device security.
- Consulting Engineers Can Be Partially Liable for Damages Due to security breaches on the Owner’s IT Network (Target Cyber Security breach).
- The Design Community Has No Control Over The Owner’s Network.

485= Bad

Ethernet IP= Good

CYBER SECURITY FOR OT



A BASIC APPROCH TO CYBER SECURITY FOR OT

A multi-tiered holistic approach to cyber security for OT gives designers, systems integrators, and end users a foundation for ensuring that the data on your network is safe from vulnerabilities. Cyber security **is not about making your network 100 percent** impenetrable, but if **sufficient obstacles are in place to deter a hacker**, they will likely look elsewhere for an easier mark.

There are 4 main areas that we address in our basic approach to cyber security for OT. Those areas are **Encrypted Data** at the and supervisor level device level, **Managed IP Switches**, a **Physical Firewall**, and a written **Cyber Security Policy**.

ENCRYPTED DATA

Tridium

niagara4

- Both the JACE® 8000 and Niagara Supervisor have encryption that meets the FIPS 140-2 federal standard.
- Meets encryption standards for mission-critical industries such as banking and for US government contracts.
- Data is encrypted when sent/received, as well as at rest

MANAGED IP/EDGE SWITCHES

PHYSICAL FIREWALL

- A network security system/device that monitors and controls incoming and outgoing network traffic based on security rules.
- Establishes a wall between a trusted network or data and an untrusted network.

WRITTEN CYBER SECURITY POLICY

The owner's cybersecurity policy is intended to minimize vulnerabilities while preparing your organization to manage risk on an ongoing basis including recovering from a disastrous incident.

- Authorization
- Passwords
- User Removal
- User Audit
- Administrative Users
- Internet Management
- Back Up
- Integration Platform Server Management
- Remote Communications
- Disaster Recovery

SELECTING AN OT NETWORK SOLUTION

- EASE OF DESIGN, INSTALLATION AND MANAGEMENT
- SCALABILITY
- FLEXIBLE TOPOLOGY DESIGN
- NETWORK MANAGEMENT CAPABILITIES WITH A GUI
- MANAGED SWITCHES
- PORT SECURITY
- VLAN CAPABILITIES
- BANDWIDTH MONITORING

THE FOUNDATION FOR AN OT NETWORK

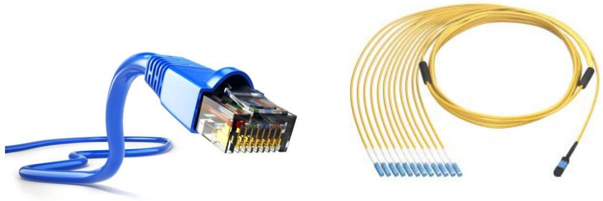
THE HARDWARE AND SOFTWARE REQUIRED TO DEVELOP A COMPLETE SOLUTION

Server Rack or Control Cabinet

On Premises Server

Integration Software

Network Management Switch



Network Media (Fiber or CAT 6)

Edge Switches

THE FOUNDATION FOR AN OT NETWORK

Physical Firewall/DNS for Cyber Security

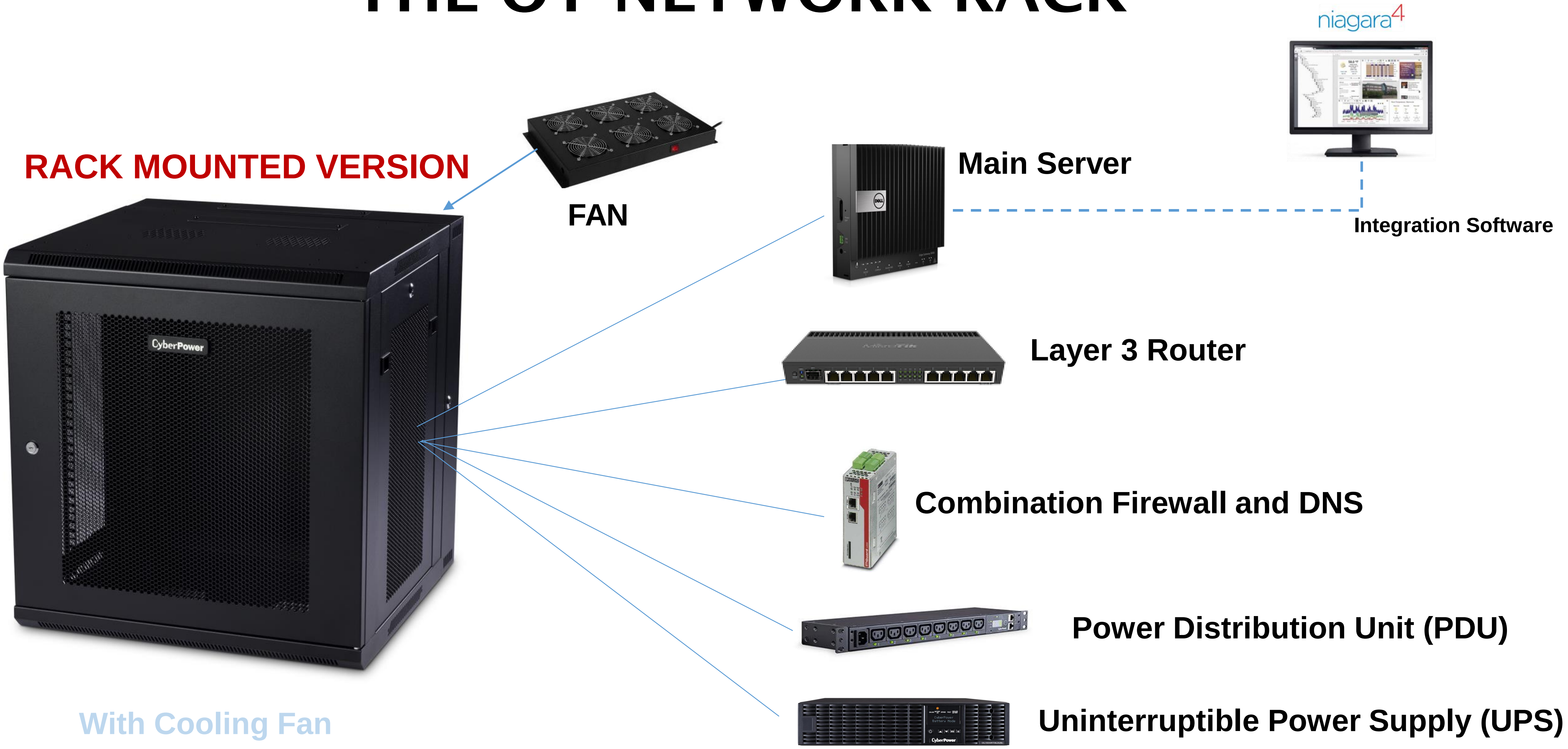
Wireless Access Point(s)

Layer 3 Router

Power Distribution Unit

UPS

THE OT NETWORK RACK



RACK MOUNTED VERSION

FAN

With Cooling Fan

niagara4

Main Server

Integration Software

Layer 3 Router

Combination Firewall and DNS

Power Distribution Unit (PDU)

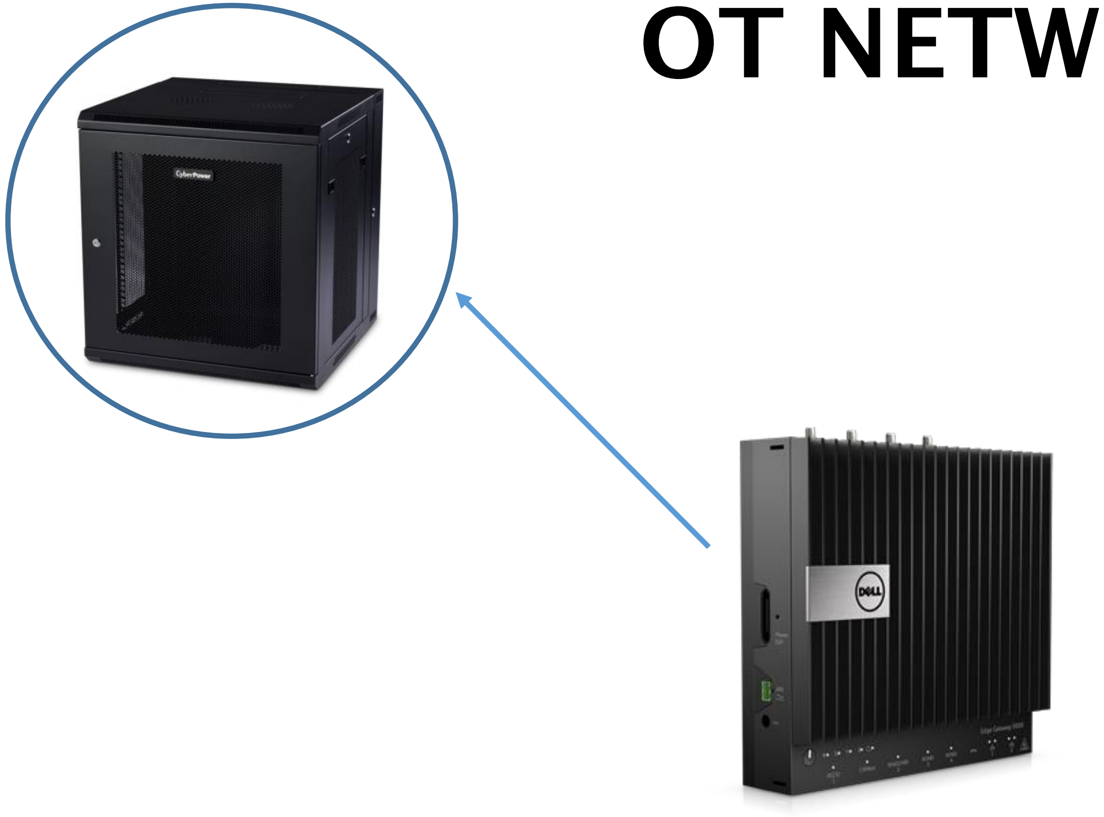
Uninterruptible Power Supply (UPS)

INTEGRATION SOFTWARE

Tridium

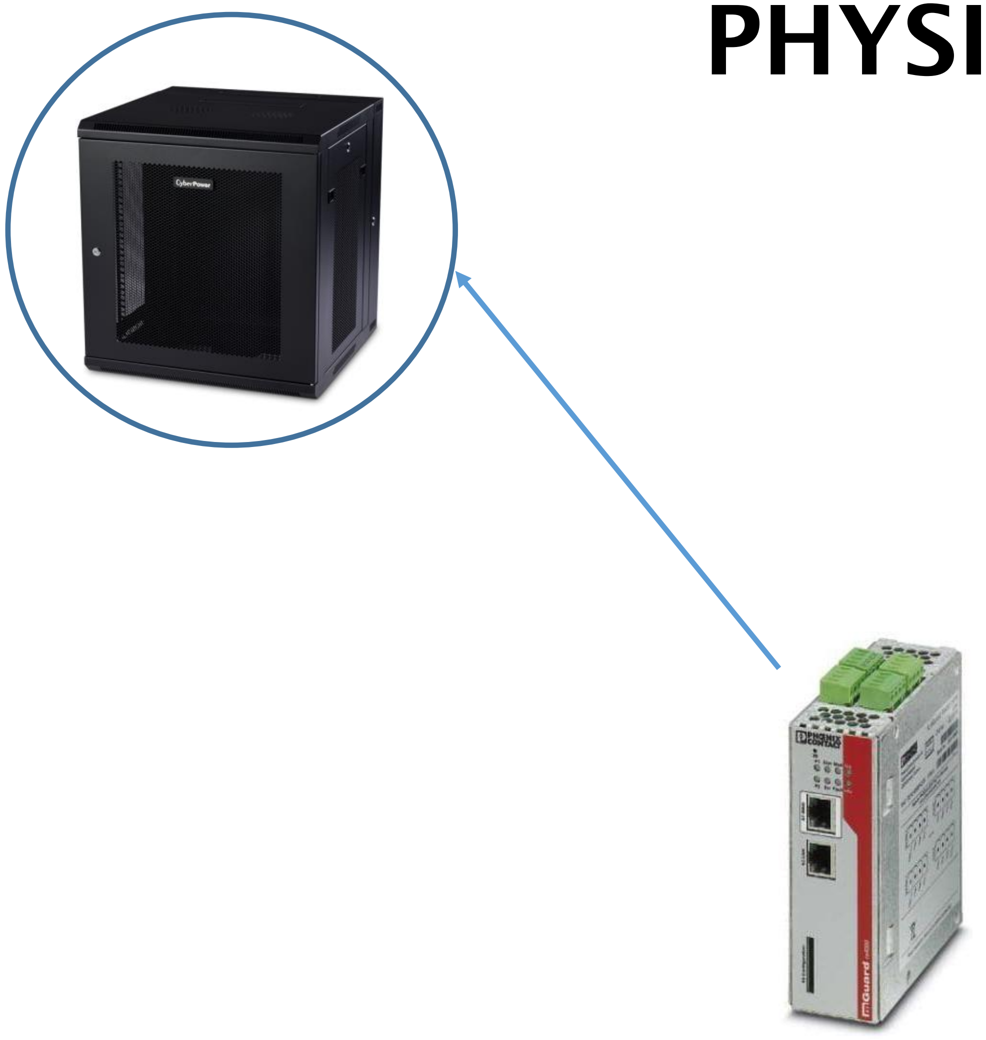
- Equipment Scheduling
- Alarms
- Trending
- Graphics for All Integrated Systems
- Dashboards
- Edge Applications
- Data Tagging

OT NETWORK SERVER



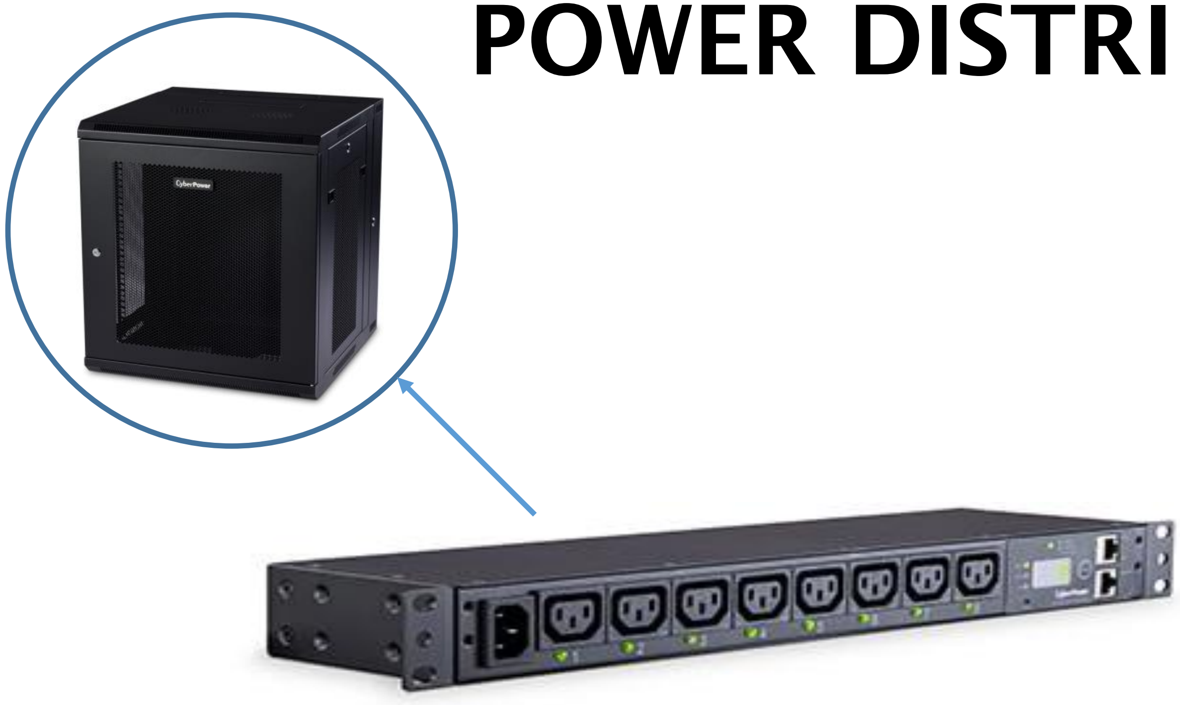
- Data Backup and Storage
- Runs Integration Software
- Runs other software for managing and programming devices
- All other software tools for devices reside on this server

PHYSICAL FIREWALL



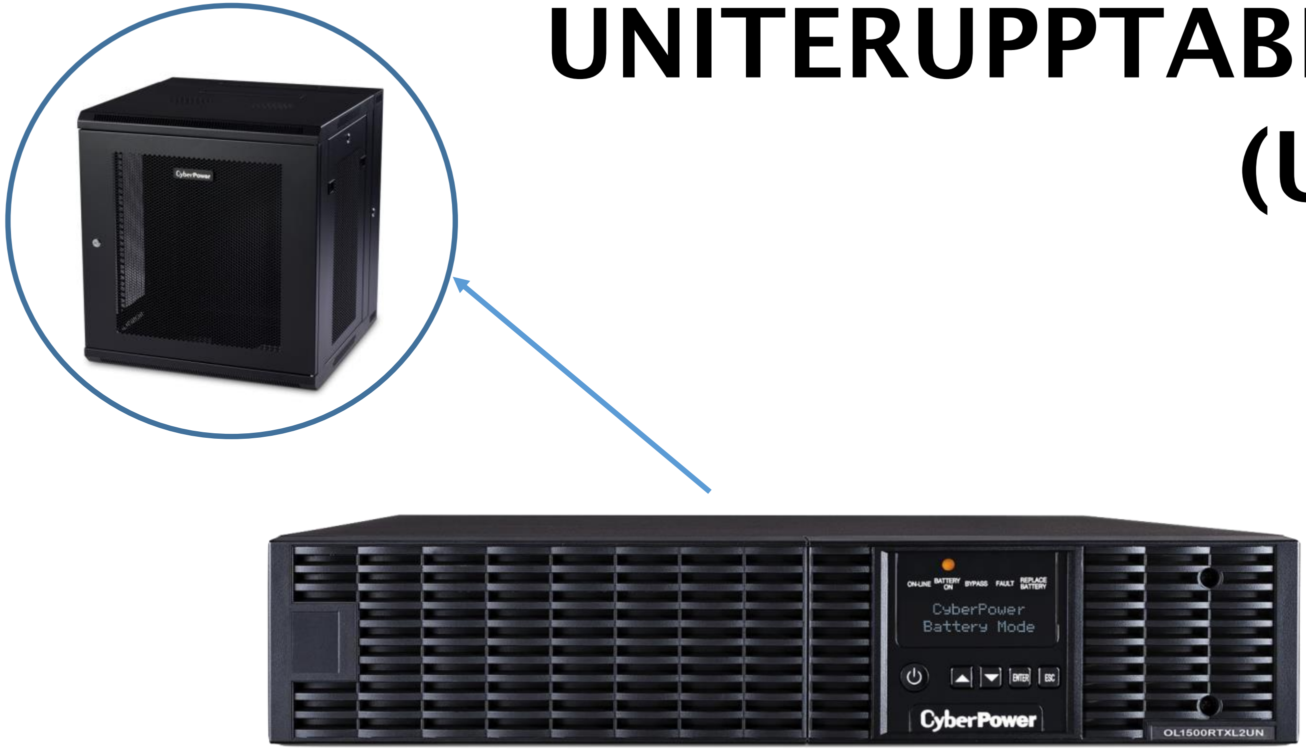
- Establish your security rules
- Provides a robust layer of defense against security risks that typically make their way into the network via the DNS.
- Directs traffic for all IP addresses on the network.
- Optional VPN and Cell Modem

POWER DISTRIBUTION UNIT (PDU)



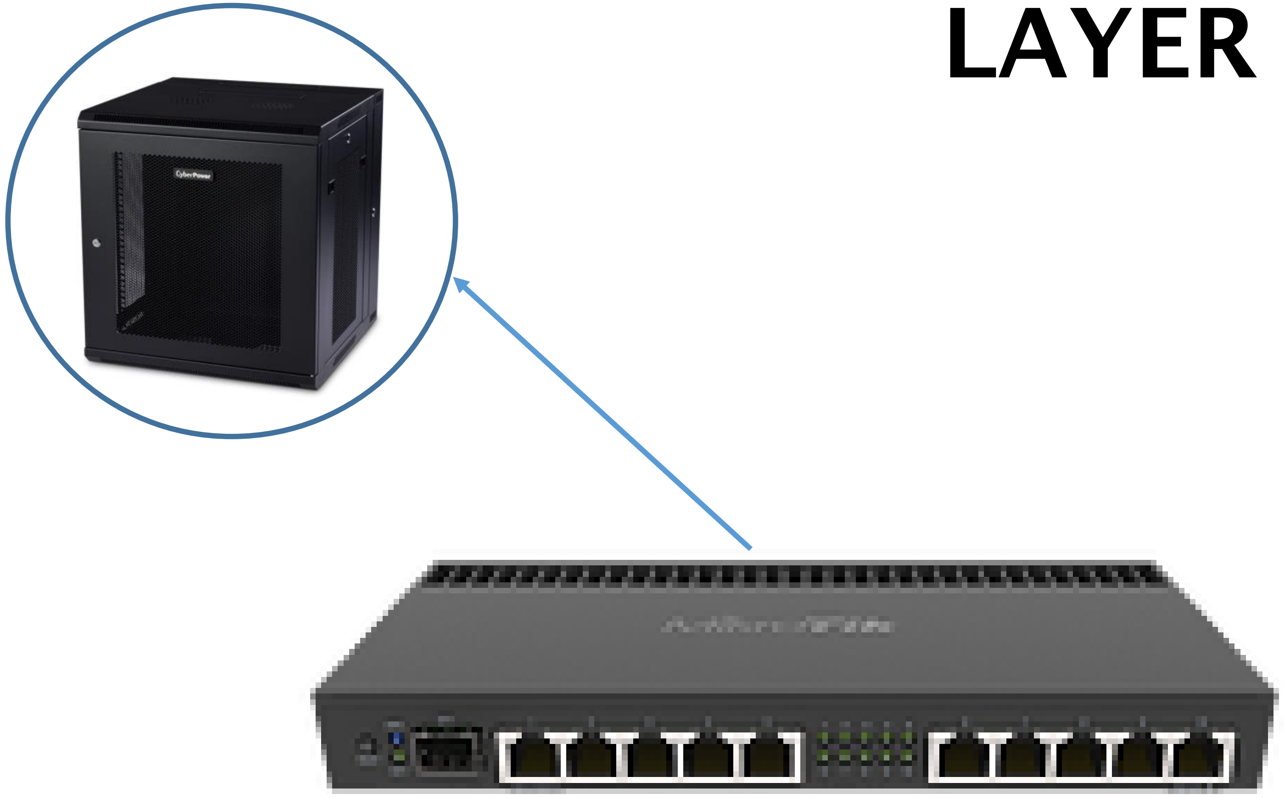
- Provides a *“Network-Grade”* power distribution to control outlets individually.
- Digital Meter for load and voltage information.
- Ethernet connection for remote control of outlets for power cycling and device re-booting.

UNITERUPPTABLE POWER SUPPLY (UPS)



- Provides uninterruptable power protection for all the components in the rack.

LAYER 3 ROUTER



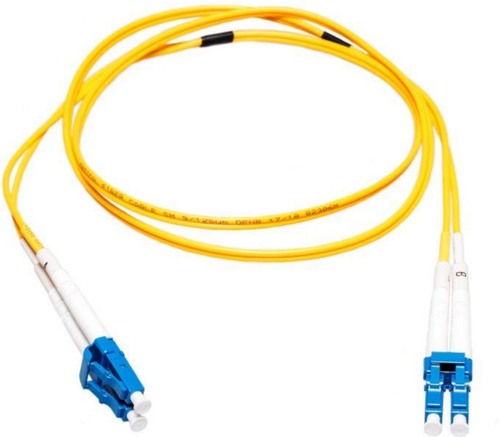
- IP Address Management
- Inter-VLAN Management
- Ability to change the data “packets and frames” on the network, without changing the message

WIRELESS ACCESS POINT

- Provides wireless access to the network

THE OT NETWROK

- Edge Switches
- Network Media (Fiber or CAT 6)
- Network Management Switch w/GUI



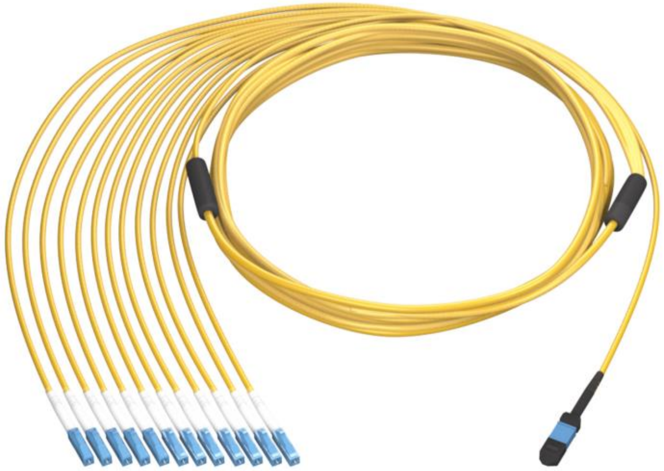
MANAGED EDGE SWITCHES

- Specifically Built for OT and priced accordingly
- 4, 8, 16 and 24 port configurations

NETWORK MEDIA

NO MORE 485!

- CAT 6
- Single Mode Fiber
- Multimode Fiber



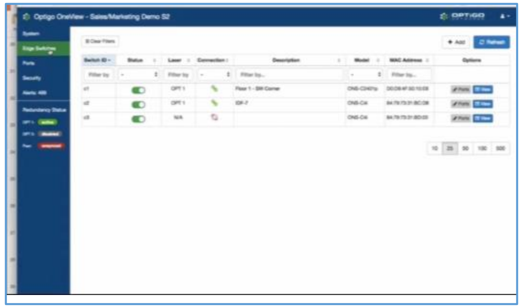
Single Mode Fiber

Multi-Mode Fiber

CAT 6 Ethernet Cable

NETWORK MANAGEMENT GUI

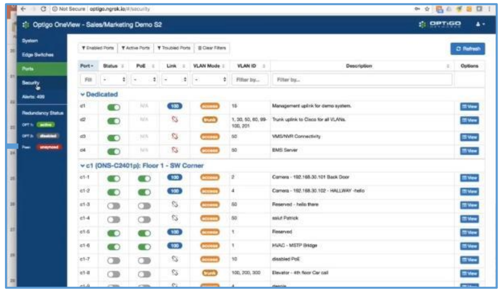
- Port Management and Security



Optigo OneView - Sales/Marketing Demo S2

Switch ID	Status	Laser	Connection	Description	Model	MAC Address	Options
Filter by	-	Filter by	-	Filter by...	-	Filter by...	
c1		OPT 1		Floor 1 - SW Corner	ONS-C2401p	D0:D9:4F:50:10:E8	Ports View
c2		OPT 1		IDF-7	ONS-C4	84:79:73:31:BC:D8	Ports View
c3		N/A			ONS-C4	84:79:73:31:BD:03	Ports View

- VLAN Capabilities

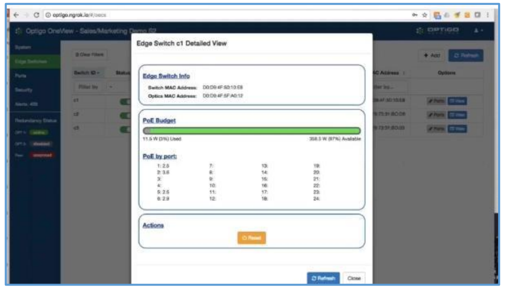


Not Secure | optigo.ngrok.io/#/security

Optigo OneView - Sales/Marketing Demo S2

Port	Status	PoE	Link	VLAN Mode	VLAN ID	Description	Options
Filt	-	-	-	-	Filter by...	Filter by...	
Dedicated							
d1		N/A	100	access	15	Management uplink for demo system.	View
d2		N/A		trunk	1, 30, 50, 60, 99-100, 201	Trunk uplink to Cisco for all VLANs.	View
d3		N/A		access	50	VMS/NVR Connectivity	View
d4		N/A		access	50	BMS Server	View
c1 (ONS-C2401p): Floor 1 - SW Corner							
c1-1			100	access	2	Camera - 192.168.30.101 Back Door	View
c1-2			100	access	4	Camera - 192.168.30.102 - HALLWAY -hello	View
c1-3				access	50	Reserved - hello there	View
c1-4				access	50	salut Patrick	View
c1-5			100	access	1	Reserved	View
c1-6			100	access	1	HVAC - MSTP Bridge	View
c1-7				access	10	disabled PoE	View
c1-8				trunk	100, 200, 300	Elevator - 4th floor Car call	View

- PoE Management



Edge Switch c1 Detailed View

Edge Switch Info

Switch MAC Address: D0:D9:4F:50:10:E8
Optics MAC Address: D0:D9:4F:5F:A0:12

PoE Budget

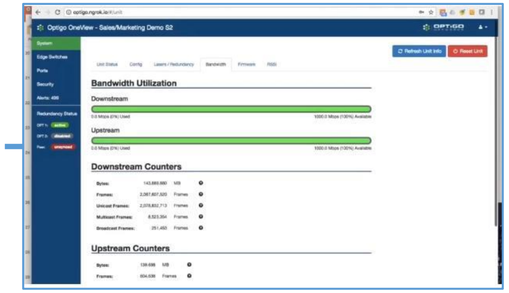
11.5 W (3%) Used — 358.5 W (97%) Available

PoE by port:

1: 2.5	7:	13:	19:
2: 3.6	8:	14:	20:
3:	9:	15:	21:
4:	10:	16:	22:
5: 2.5	11:	17:	23:
6: 2.9	12:	18:	24:

Actions

- Bandwidth Monitoring Capabilities



optigo.ngrok.io/#/unit

Optigo OneView - Sales/Marketing Demo S2

Bandwidth Utilization

Downstream

0.0 Mbps (0%) Used — 1000.0 Mbps (100%) Available

Upstream

0.0 Mbps (0%) Used — 1000.0 Mbps (100%) Available

Downstream Counters

Bytes:	143,869,880	MB
Frames:	2,087,607,520	Frames
Unicast Frames:	2,078,832,713	Frames
Multicast Frames:	8,523,354	Frames
Broadcast Frames:	251,453	Frames

Upstream Counters

Bytes:	138,698	MB
Frames:	604,638	Frames

WHERE DO I SPECIFY AN OT NETWORK

THE SPECIFICATION- DIV. 25

SECTION 25 0000 - INTEGRATED AUTOMATION AND OPERATIONAL TECHNOLOGY

GENERAL

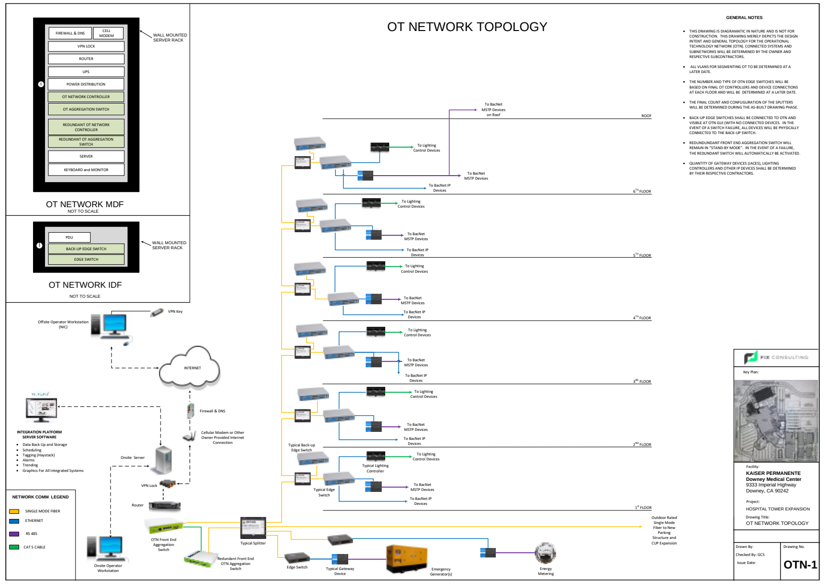
The intent of this specification is to define an IoT and Integrated Automation Topology that will successfully integrate the Facility Management and Control Systems into a common platform that will allow for a consistent graphical display of control and functionality regardless of the control system vendor in the facility.

This section defines the following 3 major systems, subsystems and components that make up the IoT and Integrated Automation Topology:

1. INTEGRATION PLATFORM
   a. Main Server Hardware
   b. Firewall and DNS
   c. Server Rack
   d. IoT Server Software Platform
   e. Uninterruptable Power Supply (UPS)

2. OPERATIONAL TECHNOLOGY NETWORK (OTN)
   a. Aggregation Switch
   b. Graphical User Interface
   c. Edge Switches
   d. Fiber Optic Cabling

3. IoT GATEWAY
   a. Java Application Control Engine (JACE)



INTEGRATION PLATFORM SERVER SOFTWARE

- Data Back Up and Storage
- Scheduling
- Tagging (Haystack)
- Alarms
- Trending
- Graphics For All Integrated Systems

NETWORK COMM LEGEND

🟨	SINGLE MODE FIBER
🟦	ETHERNET
🟪	RS 485
🟩	CAT 5 CABLE

GENERAL NOTES

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- QUANTITY OF GATEWAY DEVICES (JACES), LIGHTING CONTROLLERS AND OTHER IP DEVICES SHALL BE DETERMINED BY THEIR RESPECTIVE CONTRACTORS.

Facility:
KAISER PERMANENTE
Downey Medical Center
9333 Imperial Highway
Downey, CA 90242

Project:
HOSPITAL TOWER EXPANSION

Drawing Title:
OT NETWORK TOPOLOGY

Drawn By:
Checked By: GCS
Issue Date:

Drawing No.
OTN-1

WHY USE DIVISION 25?

Division 25 allows the engineer the opportunity to specify an “Open Integration Platform” for the owner that is specified independent of the controls and control devices associated with equipment and ancillary systems.

Division 25 also gives the engineer the opportunity to specify a “secure” “Operational Technology Network” that is totally independent of the owner’s IT network.

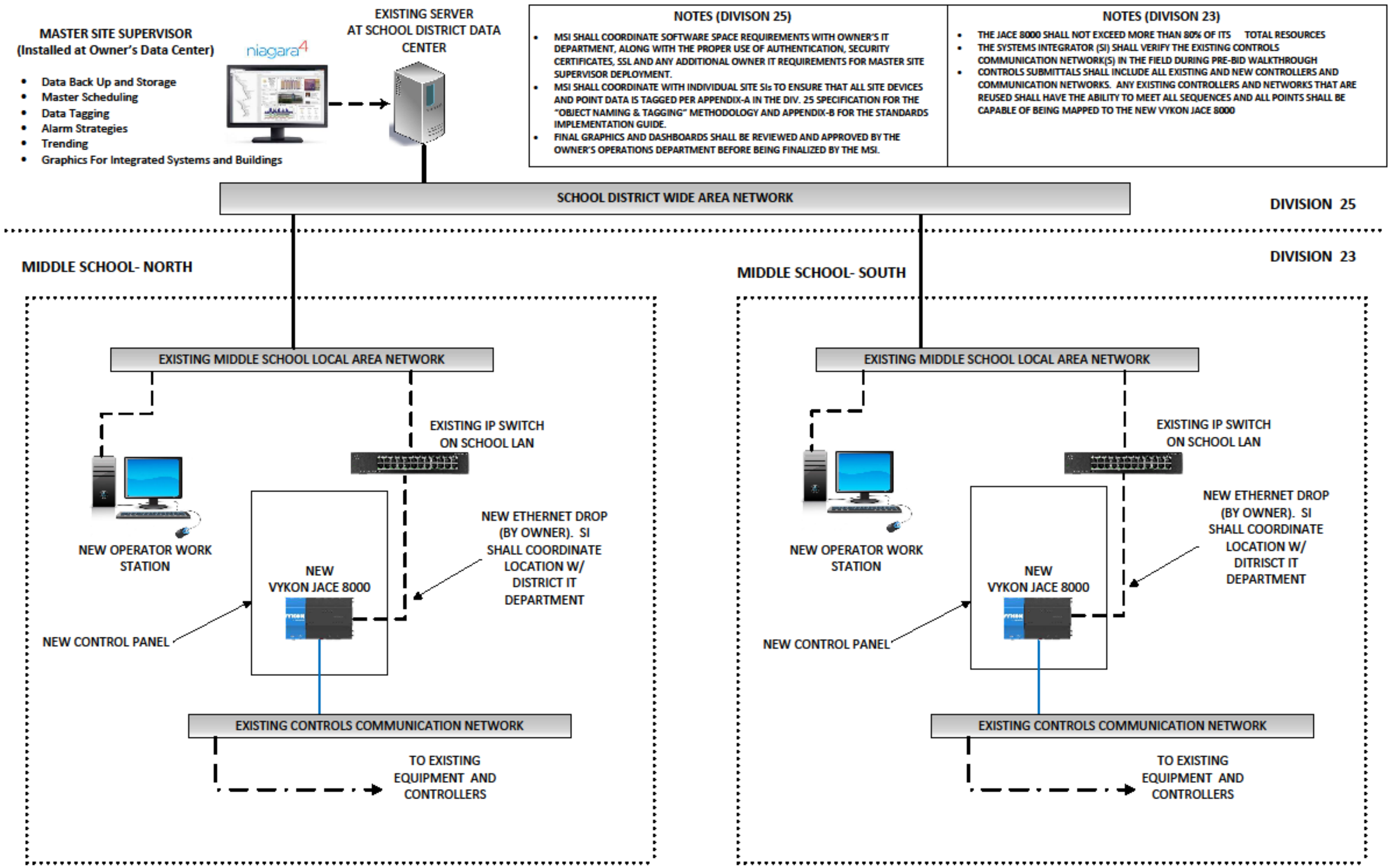
WHAT IS THE INTENT OF DIVISION 25?

Division 25 (Integrated Automation) is where the “Integration Platform” is specified, along with a clear and concise plan for technology convergence. Div. 25 also describes the systems, subsystems, hardware, software and implementation of a Platform that will seamlessly integrate different control systems and protocols into one common graphical display.

YOU CANNOT SIMPLY STATE THAT THE SYSTEM SHALL BE TRIDIUM!!

HOW DO I IMPLEMENT DIV. 25?

MSIP TOPOLOGY



MASTER SITE SUPERVISOR
(Installed at Owner's Data Center)

- Data Back Up and Storage
- Master Scheduling
- Data Tagging
- Alarm Strategies
- Trending
- Graphics For Integrated Systems and Buildings

NOTES (DIVISON 25)

- MSI SHALL COORDINATE SOFTWARE SPACE REQUIREMENTS WITH OWNER'S IT DEPARTMENT, ALONG WITH THE PROPER USE OF AUTHENTICATION, SECURITY CERTIFICATES, SSL AND ANY ADDITIONAL OWNER IT REQUIREMENTS FOR MASTER SITE SUPERVISOR DEPLOYMENT.
- MSI SHALL COORDINATE WITH INDIVIDUAL SITE SIs TO ENSURE THAT ALL SITE DEVICES AND POINT DATA IS TAGGED PER APPENDIX-A IN THE DIV. 25 SPECIFICATION FOR THE "OBJECT NAMING & TAGGING" METHODOLOGY AND APPENDIX-B FOR THE STANDARDS IMPLEMENTATION GUIDE.
- FINAL GRAPHICS AND DASHBOARDS SHALL BE REVIEWED AND APPROVED BY THE OWNER'S OPERATIONS DEPARTMENT BEFORE BEING FINALIZED BY THE MSI.

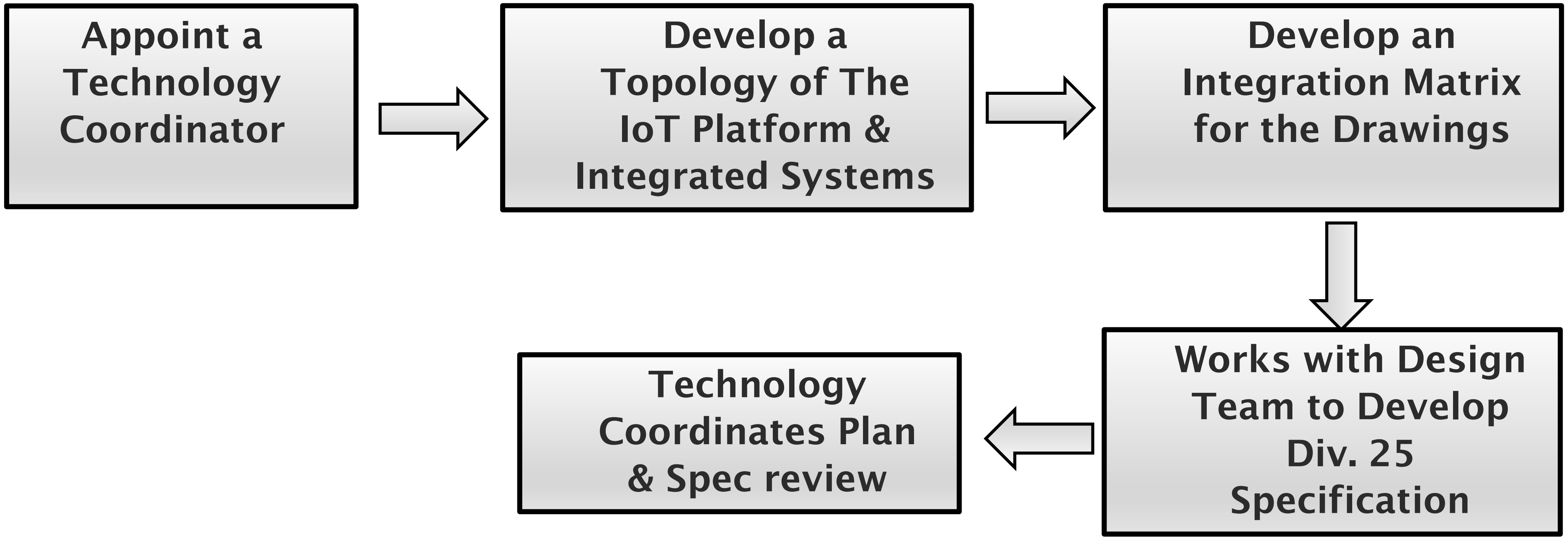
NOTES (DIVISON 23)

- THE JACE 8000 SHALL NOT EXCEED MORE THAN 80% OF ITS TOTAL RESOURCES
- THE SYSTEMS INTEGRATOR (SI) SHALL VERIFY THE EXISTING CONTROLS COMMUNICATION NETWORK(S) IN THE FIELD DURING PRE-BID WALKTHROUGH
- CONTROLS SUBMITTALS SHALL INCLUDE ALL EXISTING AND NEW CONTROLLERS AND COMMUNICATION NETWORKS. ANY EXISTING CONTROLLERS AND NETWORKS THAT ARE REUSED SHALL HAVE THE ABILITY TO MEET ALL SEQUENCES AND ALL POINTS SHALL BE CAPABLE OF BEING MAPPED TO THE NEW VYKON JACE 8000

niagara4
EXISTING SERVER AT SCHOOL DISTRICT DATA CENTER
SCHOOL DISTRICT WIDE AREA NETWORK
DIVISION 25
DIVISION 23
MIDDLE SCHOOL- NORTH
MIDDLE SCHOOL- SOUTH
EXISTING MIDDLE SCHOOL LOCAL AREA NETWORK
EXISTING IP SWITCH ON SCHOOL LAN
NEW OPERATOR WORK STATION
NEW ETHERNET DROP (BY OWNER). SI SHALL COORDINATE LOCATION W/ DISTRICT IT DEPARTMENT
NEW VYKON JACE 8000
NEW CONTROL PANEL
EXISTING CONTROLS COMMUNICATION NETWORK
TO EXISTING EQUIPMENT AND CONTROLLERS
EXISTING MIDDLE SCHOOL LOCAL AREA NETWORK
EXISTING IP SWITCH ON SCHOOL LAN
NEW OPERATOR WORK STATION
NEW ETHERNET DROP (BY OWNER). SI SHALL COORDINATE LOCATION W/ DITRISCT IT DEPARTMENT
NEW VYKON JACE 8000
NEW CONTROL PANEL
EXISTING CONTROLS COMMUNICATION NETWORK
TO EXISTING EQUIPMENT AND CONTROLLERS

HOW DO WE LAY OUT AND SPECIFY THIS CONCEPT?

🤔



Appoint a Technology Coordinator

Develop a Topology of The IoT Platform & Integrated Systems

Develop an Integration Matrix for the Drawings

Works with Design Team to Develop Div. 25 Specification

Technology Coordinates Plan & Spec review

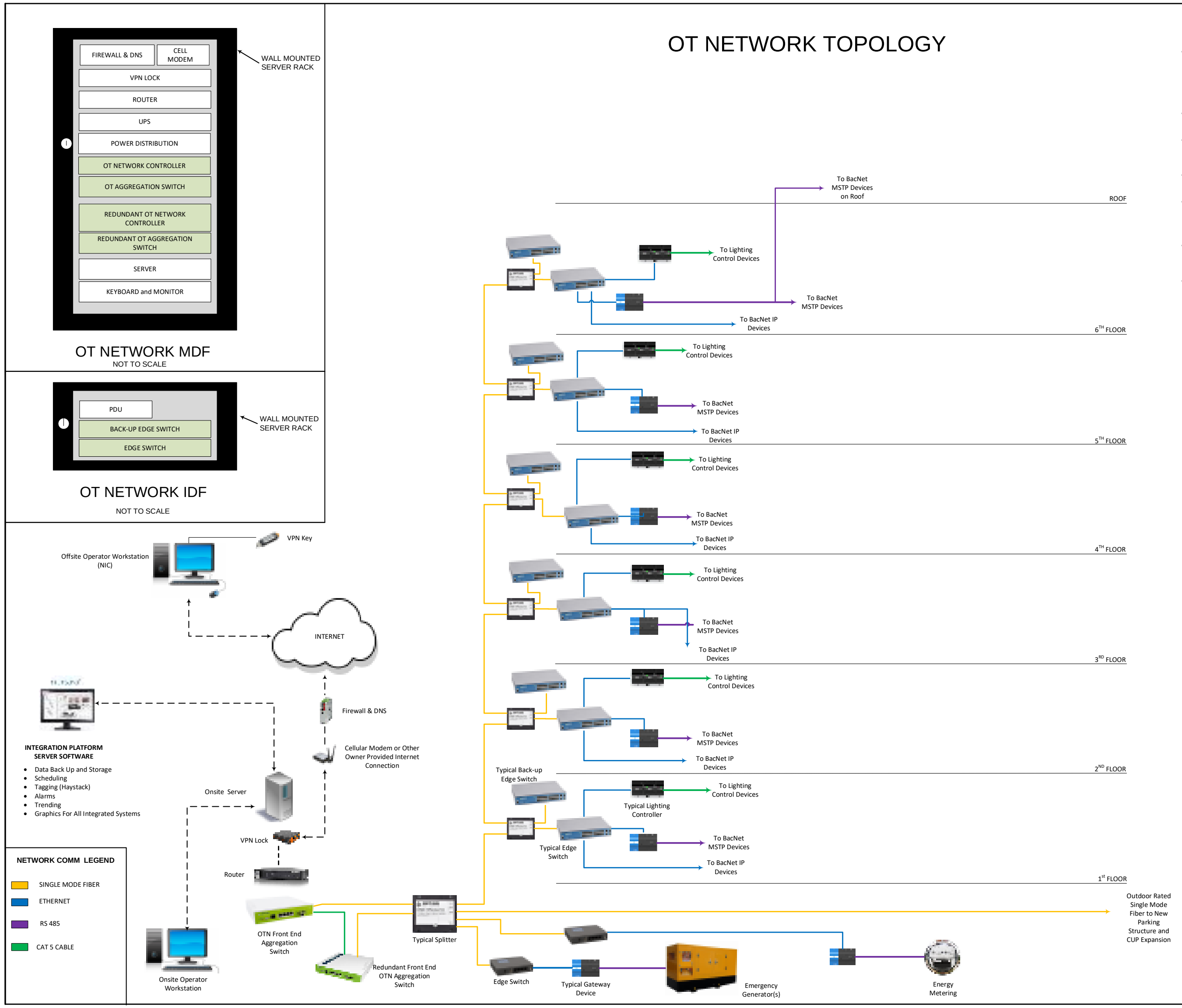
ASSIGN A TECHNOLOGY COORDINATOR

- Develops a checklist for all coordination needed
- Develops the Integration Matrix for the mechanical drawings
- Develops specification verbiage and drawing notes for all integrated divisions and points all related sections to Div. 25
- Coordinates Plan and Specification Review

INTEGRATION MATRIX

System	Spec Section Furnished By	Protocol	Master Systems Integrator Div. 25	BMS Contractor Div. 23	Electrical Contractor Div. 26	Mechanical Contractor Div. 23
Lighting Control	Division 26	BacNet IP	Integrate Lighting Controls Data into Integration Platform		Furnish, Install, Program and Connect Bus to Integration Platform. Expose BacNet Points to MSI and Provide Documentation to MSI.	Coordinate the installation of controls to equipment.
Electrical Metering	Division 26	Modbus	Integrate Utility Data into Integration Platform		Furnish, Install, Program and Connect Bus to Integration Platform. Expose all points to MSI	
Fire Alarm	Division 26	BacNet IP	Integrate Fire Alarm Data into Integration Platform		Furnish, Install, Program and Connect Bus to Integration Platform. Expose BacNet Points to MSI and Provide Documentation to MSI.	
Escalators	Division 14	Modbus	Integrate Lifting Device Data into Integration Platform		Furnish, Install, Program and Connect Bus to Integration Platform. Expose all points to MSI.	
HVAC	Division 23	BacNet MSTP, IP and BacNet IP	Integrate HVAC System Controls Data into Integration Platform	Furnish, Install, Program and Connect Bus to Integration Platform. Expose all points to MSI.		Coordinate the installation of controls to equipment.

OT NETWORK TOPOLOGY



INTEGRATION PLATFORM SERVER SOFTWARE

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- Alarms
- Trending
- Graphics For All Integrated Systems

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FIX CONSULTING

Key Plan:

Facility:
KAISER PERMANENTE
Downey Medical Center
9333 Imperial Highway
Downey, CA 90242

Project:
HOSPITAL TOWER EXPANSION

Drawing Title:
OT NETWORK TOPOLOGY

Drawn By:
Checked By: GCS
Issue Date:

Drawing No.
OTN-1

HOW DO I BEGIN MY DESIGN?

DESIGN DEVELOPMENT/DISCOVERY

- WHERE WILL MY SERVER RACK OR CABINET BE LOCATED?
- WHAT TECHNOLOGY WILL BE INTEGRATED INTO THE OT NETWORK?
- WHAT TYPE OF PROTOCOLS AND SUBNETWORKS NETWORKS WILL THESE TECHNOLOGIES USE (BACNet IP, BACNet MSTP, Modbus…RS 485) ?
- CONNECTION TO THE INTERNET REQUIRED?
- ARE THERE ANY PLANS FOR FUTURE EXPANSION?

EXAMPLE PROJECT

- HEALTHCARE FACILITY
- MULTI-STORY BUILDING (5 STORIES)
- ON PREMISES SERVER THAT WILL BE RACK MOUNTED
- INTEGRATION SOFTWARE- TRIDIUM’S NIAGARA 4
- STAND-ALONE AND AIR-GAPPED FROM THE OWNER’S IT NETWORK
- NO CONNECTION TO THE INTERNET
- INTEGRATING: HVAC, EMERGENCY GENERATORS, FIRE ALARM and LIGHTING CONTROLS

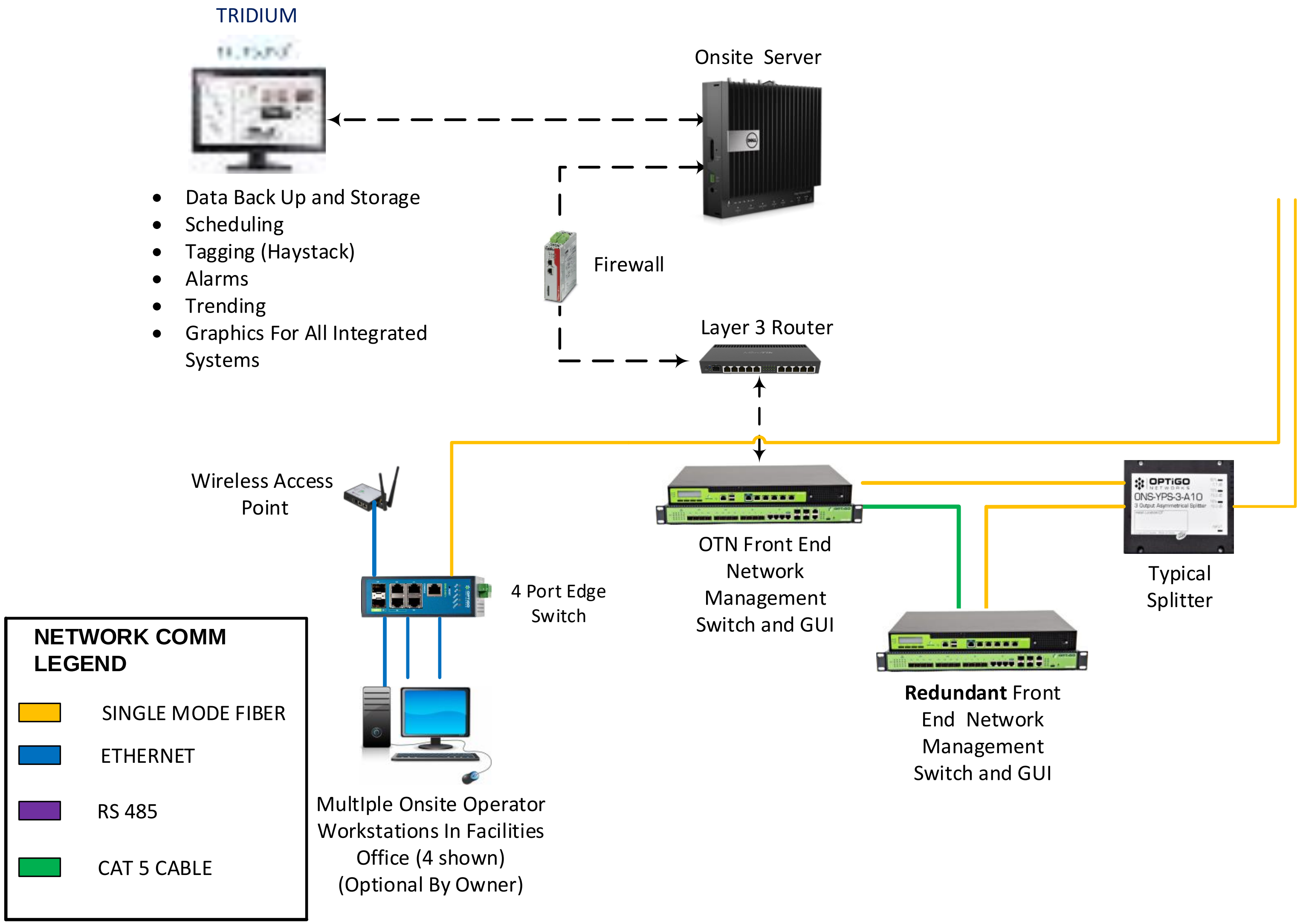
HVAC Systems

Emergency Generators

Fire Alarm

Lighting Controls

INTEGRATION PLATFORM DRAWING



TRIDIUM

- Data Back Up and Storage
- Scheduling
- Tagging (Haystack)
- Alarms
- Trending
- Graphics For All Integrated Systems

Onsite Server

Firewall

Layer 3 Router

Wireless Access Point

4 Port Edge Switch

OTN Front End Network Management Switch and GUI

Typical Splitter

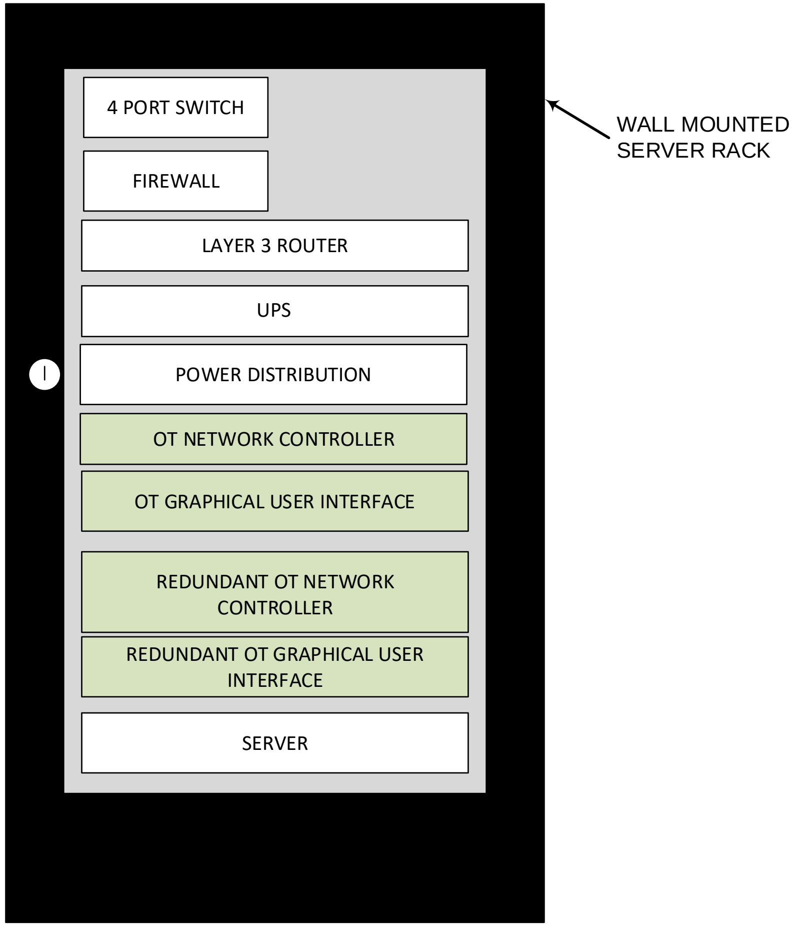
Redundant Front End Network Management Switch and GUI

Multlple Onsite Operator Workstations In Facilities Office (4 shown) (Optional By Owner)

NETWORK COMM LEGEND

🟨	SINGLE MODE FIBER
🟦	ETHERNET
🟪	RS 485
🟩	CAT 5 CABLE

SEVER RACK DIAGRAM



OT NETWORK MDF

NOT TO SCALE

DEVELOP AN INTEGRATION SCHEDULE

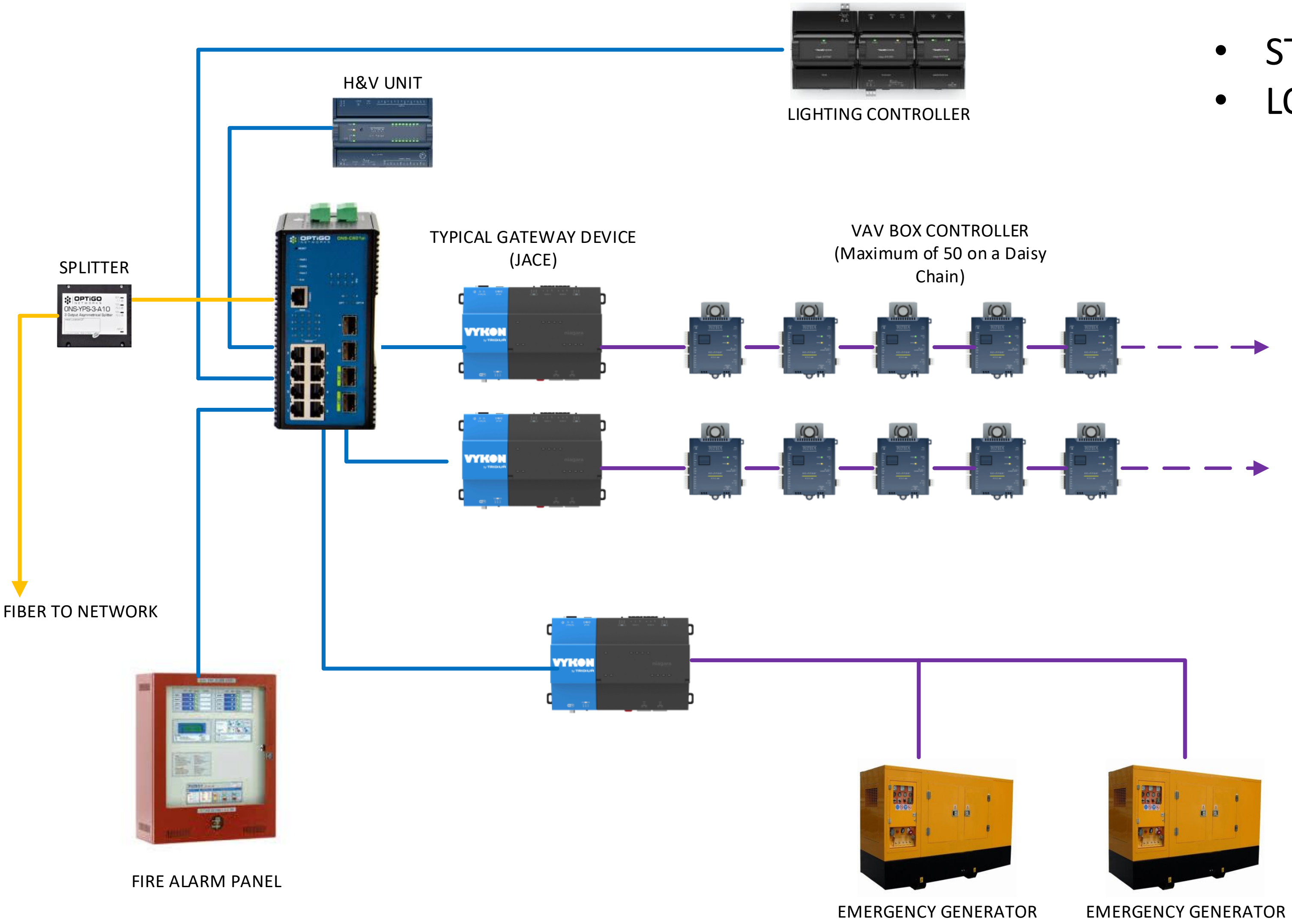
- LIST OF EQUIPMENT
- CONTOLLER LOCATIONS (AREA OR FLOOR)
- CONTROLLER COMMUNICATION PROTOCOLS
- SUBNETWORK MEDIA
- QUANTITIES

INTEGRATION SCHEDULE

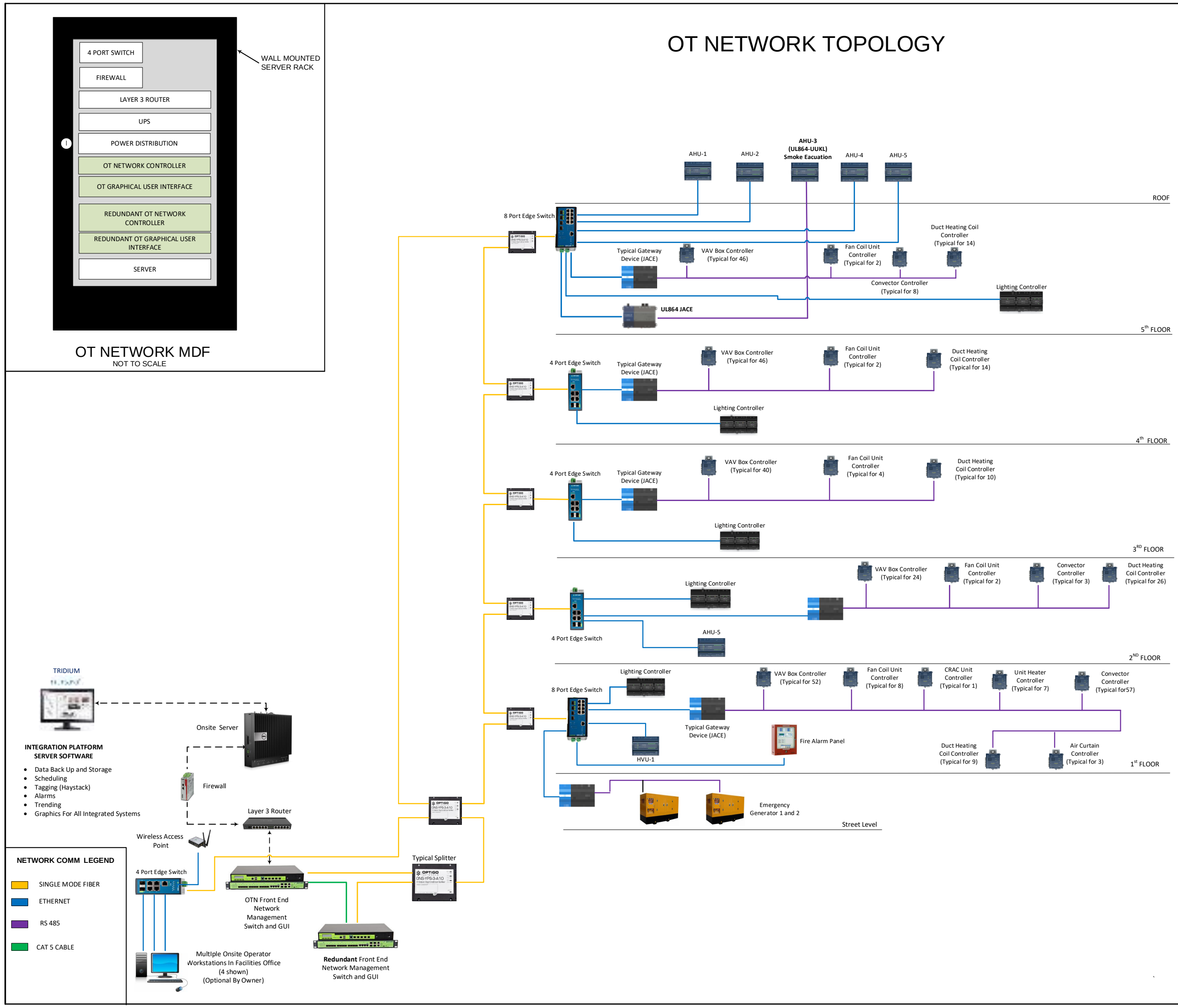
Floor	Equipment The Controller Serves	Protocol	Network Media (RS 485/ CAT6, etc.)	Controller Quantity
1st	Emergency Generators	ModBus	RS 485	2
1st	Fire Alarm Panel	BACnet/IP	CAT6	1
1st	HVU-1	BACnet/IP	CAT6	1
1st	Lighting Controller	BACnet/IP	CAT6	1
1st	VAV Boxes	BACnet/MSTP	CAT6	52
1st	Fan Coil Units	BACnet/MSTP	CAT6	8
1st	CRAC	BACnet/MSTP	CAT6	1
1st	Unit Heaters	BACnet/MSTP	CAT6	7
1st	Convectors	BACnet/MSTP	CAT6	57
1st	Duct Heaters	BACnet/MSTP	CAT6	9
1st	Air Curtains	BACnet/MSTP	CAT6	3

CONTROLS SEGMENT DRAWINGS

- STRAIGHT DAISY CHAIN
- LOOP



SYSTEMS INTEGRATION DRAWING


4 PORT SWITCH
FIREWALL
LAYER 3 ROUTER
UPS
POWER DISTRIBUTION
OT NETWORK CONTROLLER
OT GRAPHICAL USER INTERFACE
REDUNDANT OT NETWORK CONTROLLER
REDUNDANT OT GRAPHICAL USER INTERFACE
SERVER
WALL MOUNTED SERVER RACK
OT NETWORK MDF
NOT TO SCALE
OT NETWORK TOPOLOGY
AHU-1
AHU-2
AHU-3 (UL864-UUKL) Smoke Eacuation
AHU-4
AHU-5
ROOF
8 Port Edge Switch
Typical Gateway Device (JACE)
VAV Box Controller (Typical for 46)
Fan Coil Unit Controller (Typical for 2)
Duct Heating Coil Controller (Typical for 14)
Convector Controller (Typical for 8)
Lighting Controller
UL864 JACE
5th FLOOR
4 Port Edge Switch
Typical Gateway Device (JACE)
VAV Box Controller (Typical for 46)
Fan Coil Unit Controller (Typical for 2)
Duct Heating Coil Controller (Typical for 14)
Lighting Controller
4th FLOOR
4 Port Edge Switch
Typical Gateway Device (JACE)
VAV Box Controller (Typical for 40)
Fan Coil Unit Controller (Typical for 4)
Duct Heating Coil Controller (Typical for 10)
Lighting Controller
3RD FLOOR
Lighting Controller
VAV Box Controller (Typical for 24)
Fan Coil Unit Controller (Typical for 2)
Convector Controller (Typical for 3)
Duct Heating Coil Controller (Typical for 26)
4 Port Edge Switch
AHU-5
2ND FLOOR
Lighting Controller
8 Port Edge Switch
VAV Box Controller (Typical for 52)
Fan Coil Unit Controller (Typical for 8)
CRAC Unit Controller (Typical for 1)
Unit Heater Controller (Typical for 7)
Convector Controller (Typical for57)
Typical Gateway Device (JACE)
Fire Alarm Panel
HVU-1
Duct Heating Coil Controller (Typical for 9)
Air Curtain Controller (Typical for 3)
1st FLOOR
Emergency Generator 1 and 2
Street Level
TRIDIUM
Onsite Server
Firewall
Layer 3 Router
Wireless Access Point
4 Port Edge Switch
OTN Front End Network Management Switch and GUI
Typical Splitter
Redundant Front End Network Management Switch and GUI
MultIple Onsite Operator Workstations In Facilities Office (4 shown) (Optional By Owner)

INTEGRATION PLATFORM SERVER SOFTWARE

- Data Back Up and Storage
- Scheduling
- Tagging (Haystack)
- Alarms
- Trending
- Graphics For All Integrated Systems

NETWORK COMM LEGEND

🟨	SINGLE MODE FIBER
🟦	ETHERNET
🟪	RS 485
🟩	CAT 5 CABLE

GENERAL NOTES

- THIS DRAWING IS DIAGRAMATIC IN NATURE AND IS NOT FOR CONSTRUCTION. THIS DRAWING MERELY DEPICTS THE DESIGN INTENT AND GENERAL TOPOLOGY FOR THE OPERATIONAL TECHNOLOGY NETWORK (OTN). CONNECTED SYSTEMS AND SUBNETWORKS WILL BE DETERMINED BY THE OWNER AND RESPECTIVE SUBCONTRACTORS.
- ALL VLANS FOR SEGMENTING OT TO BE DETERMINED AT A LATER DATE.
- THE NUMBER AND TYPE OF OTN EDGE SWITCHES WILL BE BASED ON FINAL IP CONTROLLERS AND DEVICE CONNECTIONS AT EACH FLOOR AND WILL BE DETERMINED AT A LATER DATE.
- THE FINAL COUNT AND CONFUGURATION OF THE SPLITTERS WILL BE DETERMINED DURING THE AS-BUILT DRAWING PHASE.
- REDUNDUNDANT FRONT END AGGREGATION SWITCH WILL REMAIN IN “STAND-BY MODE”. IN THE EVENT OF A FAILURE, THE REDUNDANT SWITCH WILL AUTOMATICALLY BE ACTIVATED.
- IF IT IS DECIDED THAT OTHER OPERATIONAL TECHNOLOGY WILL RESIDE ON THIS NETWORK, THE QUANTITY OF GATEWAY DEVICES (JACES) MAY CHANGE.
- THE LOCATION OF THE SERVER RACK, FRONT END EQUIPMENT AND ETHERNET DROPS FOR NETWORK ACCESS SHALL BE DETERMINED AT A LATER DATE.
- THE FIBER FOR THE OTN (FROM BUILDING TO BUILDING) SHALL BE RUN IN THE TUNNEL.

COCHRANE SUPPLY

Key Plan:

Facility:
COCHRANE SAMPLE PROJECT

Project:
5 STORY HEALTHCARE FACILITY

Drawing Title:
OT NETWORK TOPOLOGY

Drawn By:
Checked By:
Issue Date:

Drawing No.
SI-1

HOW CAN COCHRANE HELP?

- Cochrane has developed a Division 23 and 25 Guide Spec for consulting engineers and end users to use.

- www.smartbuildingdesign.com

- Cochrane can assist with technical drawings of your System Topology, including an OT Network.

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