



# NS2022

ACCELERATING INNOVATION

BUSINESS

WED, APRIL 6 • CCC

3:30 PM - 4:30 PM  
ROOM E218

COMMISSIONING SMART  
BUILDINGS - FROM "NICE TO  
HAVE" TO "A MUST FOR SUCCESS"

**NS2022**  
ACCELERATING INNOVATION





MODERATOR - PAUL WARNES  
TRIDIUM





JAMES CURRY - Sr Associate,  
Intelligent Building Consultant  
Newcomb & Boyd



RICHARD FARMER - Mechanical Engineer  
Newcomb & Boyd



GREG FITZPATRICK  
Business Development  
Cochrane Supply & Engineering



DAVID MEYERS  
Director of Commissioning  
Burns & McDonnell

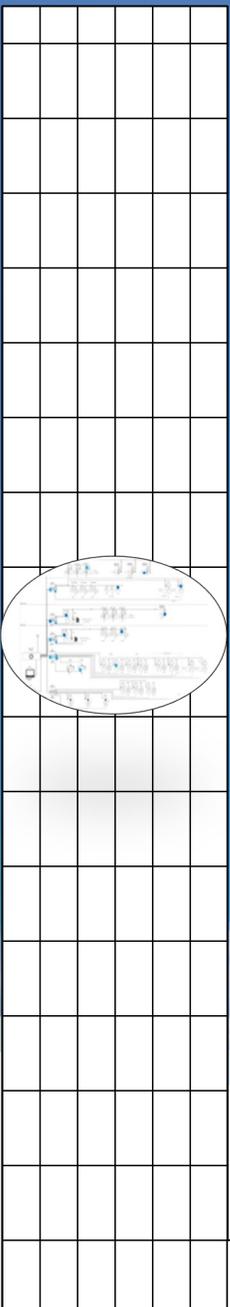


JAMES CURRY &  
RICHARD FARMER  
Newcomb & Boyd

LESSONS LEARNED



**NS2022**  
ACCELERATING INNOVATION



22-Story Tower

18 JACE 8000's

28 Plant Controllers (Used as Routers)

62 Meters

29 VFD's

785 Field Controllers

1 OT Network

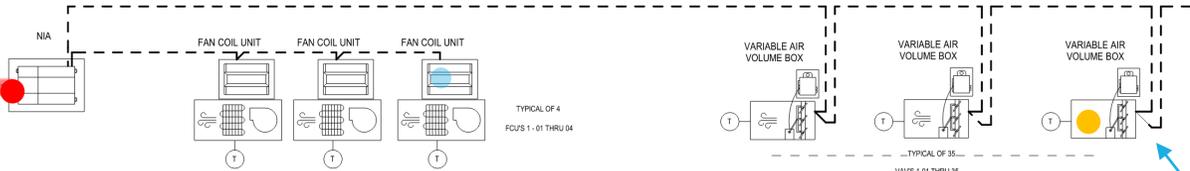
2 BACnet Broadcast Offenders



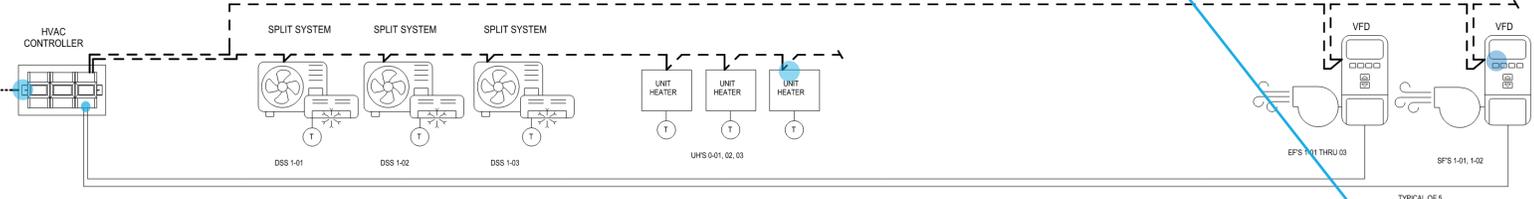
**NS2022**  
ACCELERATING INNOVATION



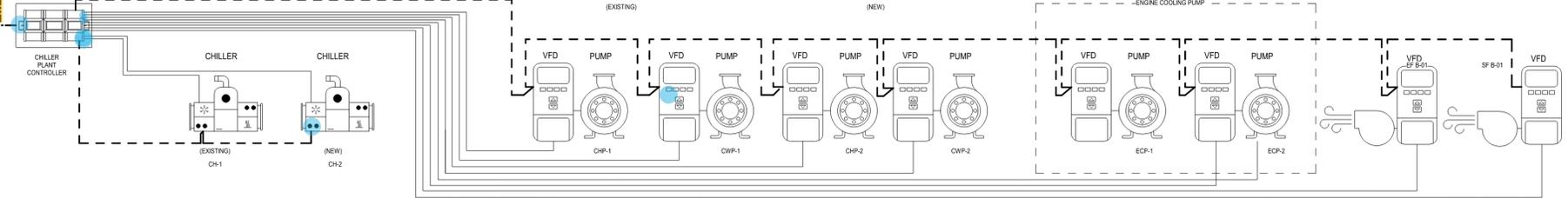
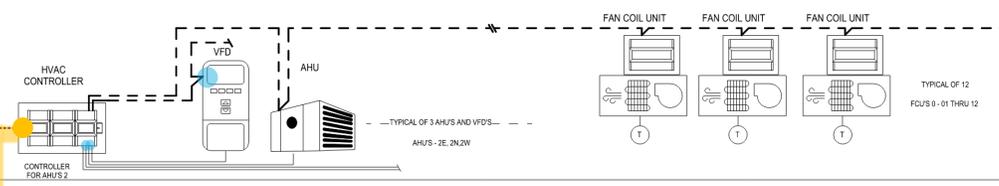
THIRD FLOOR



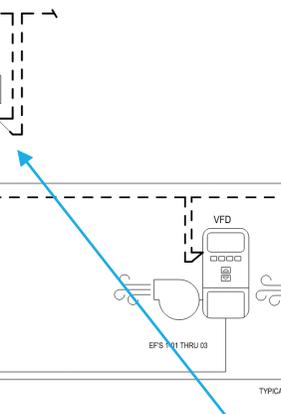
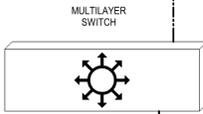
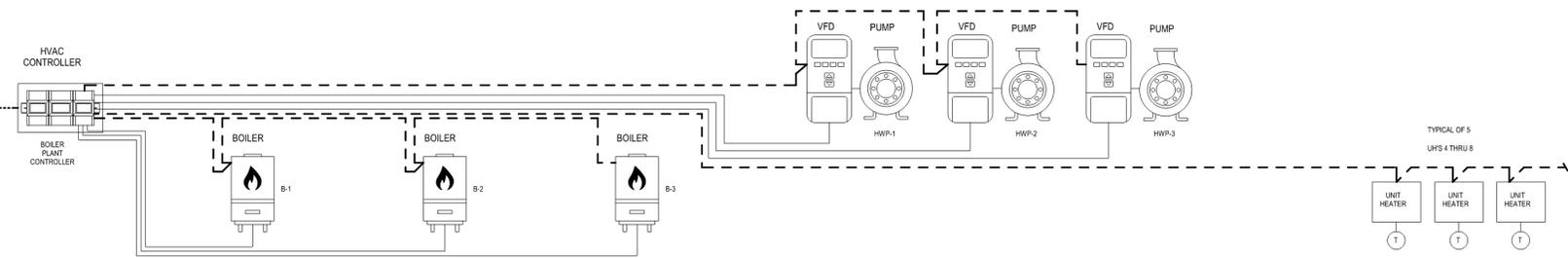
SECOND FLOOR



FIRST FLOOR



BASEMENT LEVEL



**Owner  
(PT)**



**Construction  
team  
(EDT)**



**Sprint 1 (Dev)  
Programming  
(GMT+5:30)**

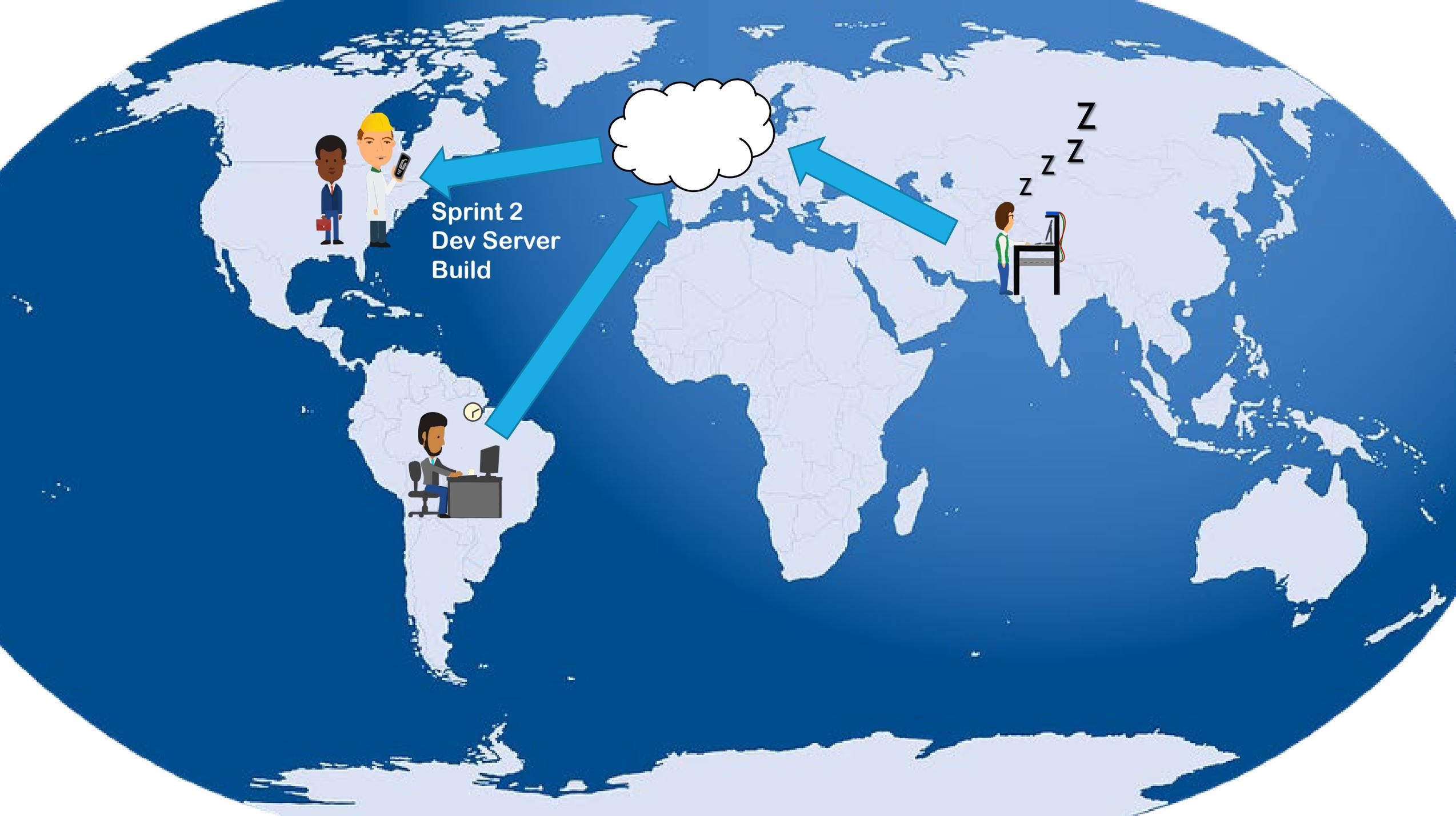
**Programmer 2**



**Programmer 1**



**Sprint 1 (Dev)  
Programming  
(GMT-3:00)**



Sprint 2  
Dev Server  
Build





Sprint 3  
On-Site

?

# ROOT CAUSE ANALYSIS

1. Commissioning team used a packet-capture tool to scan all BACnet traffic 12 times.
  2. Located Broadcast offenders (2)
  3. Located high-traffic and slow/no responders
- CONCLUSION:
    1. Inconsistent Programming Practices
    2. Mixed manufacturers on same trunk

**SYNERGY = SPEED**  
Rapid Project Delivery



### AGILE PROJECT DELIVERY

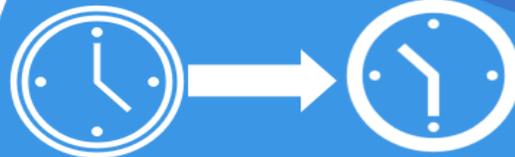
Programming in Sprints  
Dev to Prod



**SYNERGY = FLEXIBILITY**  
Project Delivery Flexibility



**STRAINED  
RESOURCES**



**GLOBAL MATRIX TEAM**  
Diversified Time Zones



**DIFFERENT PROGRAMMERS**  
Maximize Best Resources

**SYNERGY = QUALITY**  
Best Global Programmers



# LESSONS LEARNED CONTINUED

- 1.No plant controllers as routers
- 2.Don't mix manufacturers on same trunk
- 3.Don't assign blame until scans complete
- 4.Maintain core unit programming team
- 5.Introduce a Holistic OT Commissioning scope
- 6.Hire an Experienced technology OT Commissioning Authority!



# NS2022

ACCELERATING INNOVATION

GREG FITZPATRICK  
Business Development  
Cochrane Supply &  
Engineering

COMMISSIONING  
THE OT NETWORK



**NS2022**  
ACCELERATING INNOVATION



# OT NETWORK COMPONENTS

- Edge switches
- Network media (fiber or CAT 6)
- Network management switch w/GUI



# OT NETWORK COMPONENTS

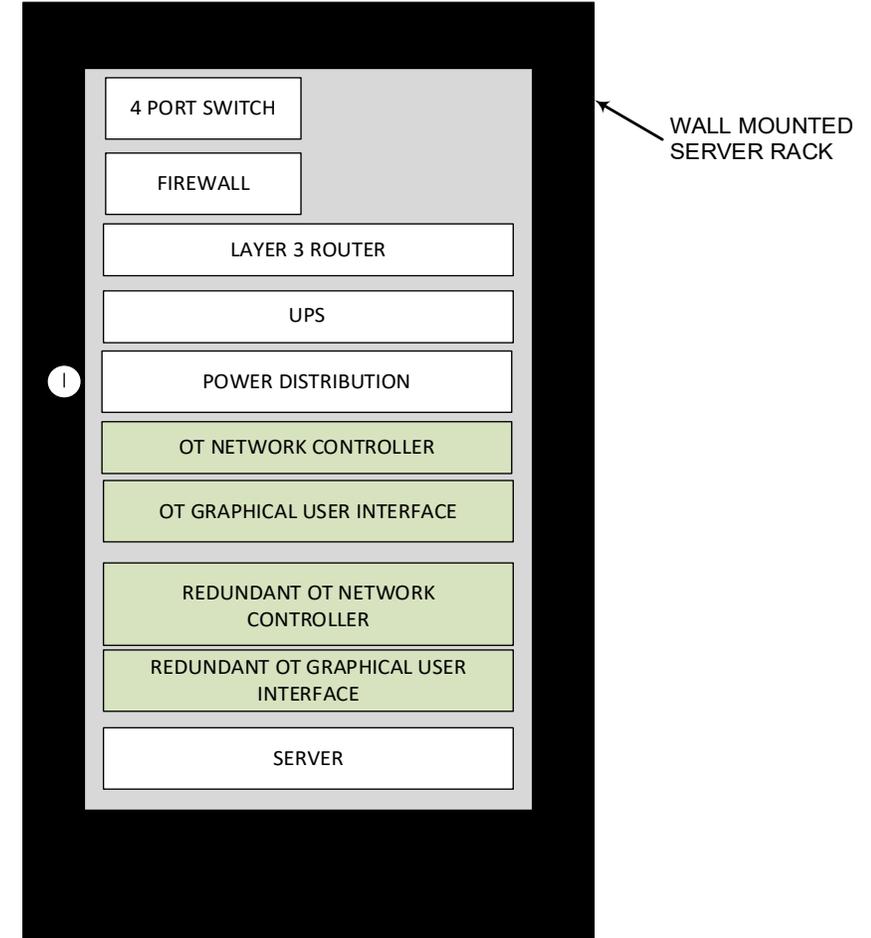
- Layer 3 router
- UPS
- Power distribution unit
- VPN/Firewall



# OT NETWORK MDF

## Pre-functional

- Coordinate approved location for OTN MDF
- Verify that all components are installed per approved submittals
- Verify components are protected (UPS)
- Verify that server rack has lock and key



OT NETWORK MDF  
NOT TO SCALE

# EDGE SWITCHES

## Pre-functional

- Verify power to switch

## Functional Test

- Verify communication w/network management switch
- Verify switch type (capacity, POE, etc.)



# NETWORK GRADE PDU

## Functional Test

- Verify remote access to PDU
- Test each outlet for device reset



# LAYER 3 ROUTER

## Functional Test

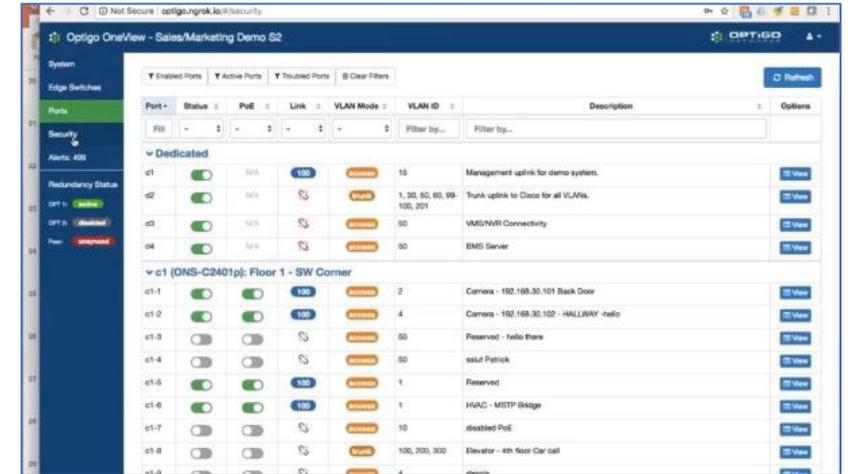
- Verify communication with network management switch
- Verify VLANs (per owner's requirements)
- Verify that IP address traffic is being routed properly back to the supervisor



# NETWORK MANAGEMENT SWITCH

## Pre-functional Test

- Verify all edge switches on the network are communicating
- Verify MAC address of connected devices to every switch



The screenshot displays the Optigo OneView interface for a 'Sales/Marketing Demo S2' environment. It shows a table of ports with columns for Port, Status, PoE, Link, VLAN Mode, VLAN ID, and Description. The table is divided into sections: 'Dedicated' and 'c1 (ONS-C2401p): Floor 1 - SW Corner'. The 'Dedicated' section lists ports e1 through e4, and the 'c1' section lists ports c1-1 through c1-8. Each port entry includes a status indicator, PoE status, link status, VLAN mode, VLAN ID, and a description of the connected device or service.

Port	Status	PoE	Link	VLAN Mode	VLAN ID	Description	Options
<b>▼ Dedicated</b>							
e1	ON	N/A	ON	Access	10	Management uplink for demo system.	View
e2	ON	N/A	ON	Trunk	1, 30, 50, 60, 99, 100, 201	Trunk uplink to Disco for all VLANs.	View
e3	ON	N/A	ON	Access	50	VMS/NVR Connectivity	View
e4	ON	N/A	ON	Access	50	BMS Server	View
<b>▼ c1 (ONS-C2401p): Floor 1 - SW Corner</b>							
c1-1	ON	ON	ON	Access	2	Camera - 192.168.30.101 Back Door	View
c1-2	ON	ON	ON	Access	4	Camera - 192.168.30.102 - HALLWAY -hello	View
c1-3	ON	ON	ON	Access	50	Reserved - hello there	View
c1-4	ON	ON	ON	Access	50	salut Patrick	View
c1-5	ON	ON	ON	Access	1	Reserved	View
c1-6	ON	ON	ON	Access	1	HVAC - METP Bldg	View
c1-7	ON	ON	ON	Access	10	disabled PoE	View
c1-8	ON	ON	ON	Access	100, 200, 300	Elevator - 4th floor Car call	View



# FIREWALL/VPN

## Functional Test

- Verify configuration
- Verify Users & Authentication





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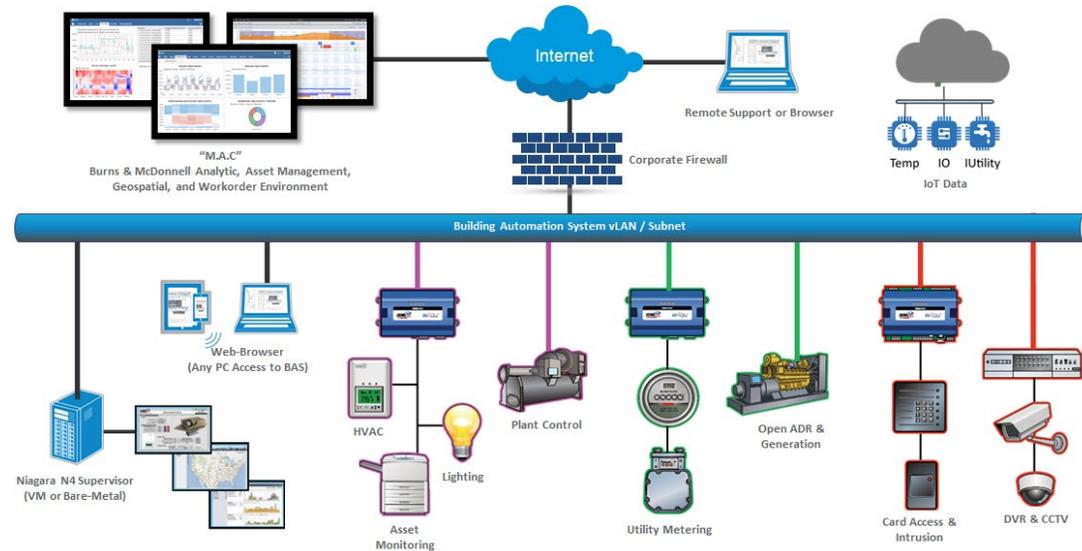
# Commissioning Agent as a Partner

*Good communication is the key  
to system coordination*



# Partnering with Commissioning

- Set up Program
- Cyber requirement
- IT requirements
- ASHRAE Guideline O Cx Vs PMI process



*Smarter buildings/facilities = more complex construction; requires proactive commissioning planning & coordination*

# Case Study - DEN Expansion

- \$2B Program
- 39 Gates
- 80 Systems
- 4 different BAS control platforms



*Smarter buildings/facilities = more complex construction; requires proactive commissioning planning & coordination*

# Airport Systems

DOMAIN	CATEGORY	SYSTEM	DESCRIPTION
COMMUNICATIONS	PREMISE WIRING	Backbone - Fiber	Structured Cabling Systems
		Horizontal - Copper	Structured Cabling Systems
	NETWORKS	Local Area Network	Switching / Routing / Firewalls
		Wireless 802.11 Network	Switching / Routing / Controllers
		IPTV	CaTV
		Cellular Networks/5G	Service Provider Connectivity
		Cellular DAS	Service Provider Connectivity
	INFRASTRUCTURE	MPOE, MDF, IDF, Service Provider Support	Rooms / Racks / Equipment
	TELEPHONY / VOICE	Airport PABX	Phones, Wiring, Headend
		Tenant & Airline PABX	Phones, Wiring, Headend
		Courtesy Phones	Phones, Wiring, Headend
		Elevator Phones	Phones, Wiring, Headend
	MISCELLANEOUS	Comm Room Monitoring	Devices, Cabling, Headend
Master Antenna TV		Distribution, Signal Splitter, Horizontal Link	
Airline Radio		Airline Operations	
PUBLIC SAFETY & SECURITY	CABLING	Elec Safety & Security	Conductors & Cables
		Fire Safety	Conductors & Cables
	SYSTEMS	Access Control	IDCs, Readers
		Video Surveillance	Cameras
		Perimeter Intrusion Detections (PIDS)	Cameras, Sensors
		Situational Awareness & PSIM	Video Displays & Software
		Fire Alarm	Strobes & Beacons
	MASS NOTIFICATION	Visual Paging & Displays	
	RADIO COMMUNICATION	Emergency Communication System (ECS)	
		Distributed Antenna Systems	Public Safety - 800 MHz
TERMINAL	PAX PROCESSING	Common-Use Terminal Equipment	
		Resource Management System	
		Airport Operational Database (AODB)	
		Queue Management System	
		Biometric Self-Boarding (Int'l Exit)	
		Digital Signage	
		TSA Security Checkpoints	
	CBP FIS Systems		
	BAG PROCESSING	Baggage Handling System(s)	
		Self-Serve Bag Drop	
		Baggage Reconciliation	
		Message Distribution System	
		TSA Checked Bag Networks & Equip	
	APRON	Baggage Operational Database (BODB)	adam barringer-esque?? :)
		Centralized Monitoring, Reporting & KPIs	
Aircraft Autodocking (AVGDS)			
	Lightning Notification		
	Ramp Information Displays (RIDS)		

DOMAIN	CATEGORY	SYSTEM	DESCRIPTION
OPERATIONS	LANDSIDE	Parking Control System	
		License Plate Recognition	
		Parking Guidance System	
		Curbside Flow Management	
		Taxi & TNC Queue Management	
	AIRSIDE	FAA Tower Communications	
		Environmental Monitoring & Weather Station	
ENTERPRISE	INFRASTRUCTURE	ON-PREMISE PHYSICAL & VIRTUAL COMPUTING	
		Cloud Services (Saas, IaaS, PaaS)	
		File Mgmt, Storage, Backups & Disaster Recovery	
		Enterprise Service Bus	
		Communication Domain	
		UPS / Power / Environmental Controls	
	SOLUTIONS	Storage Area Network	
		Finance, Accounting, Timekeeping	
		Office Suite, Teams, Sharepoint, Comm Tools	
		IT Helpdesk	ServiceNow, CA Unicenter
		Asset Management (CMMS)	Maximo, Infor EAM
		Network Monitoring System	
Project Management Control Tools	Unifier, Procore		
Procurement / Supplier Management	Supplier		

# Case Study - Utah's Department of Corrections

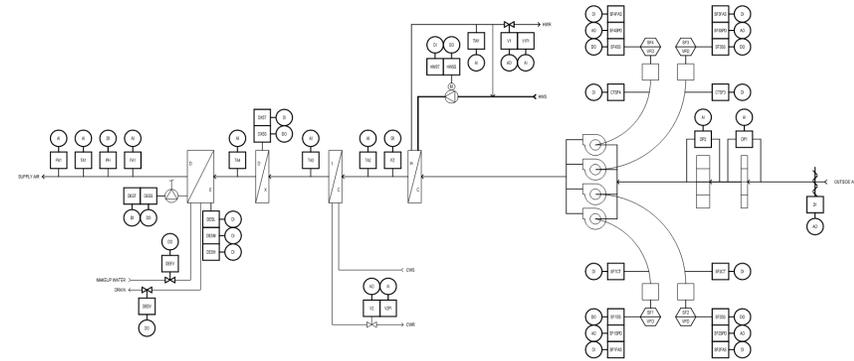
**\$1B, 31-Building Campus**  
**Totaling 1.36M SF, Niagara Controls**  
**Facilities types**

- Inmate rooms
- Medical and mental health clinic
- Administration building
- Food service building
- Offices
- Classrooms
- Kitchen
- Laundry
- Industry work areas
- Communications, data center and security electronics rooms.

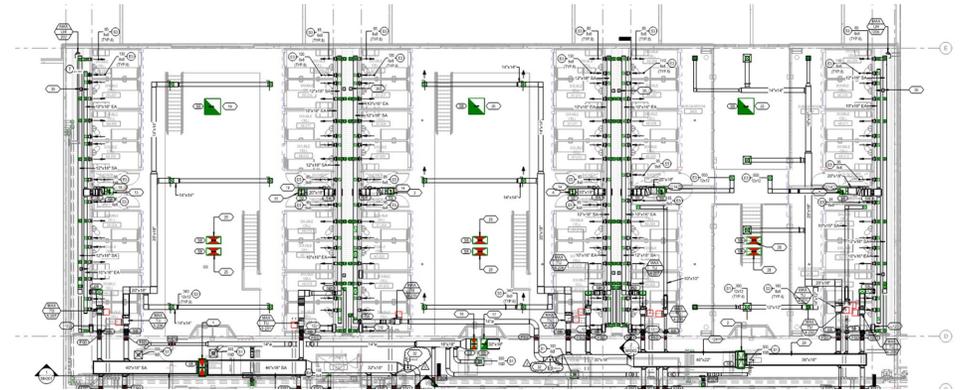


# Systems in the Campus

- Building Exterior Closure
- Conveying Equipment
- Fire Suppression
- Plumbing
- HVAC
- Electrical System
- Electronic Safety and Security



Indirect Direct Evaporative Cooling



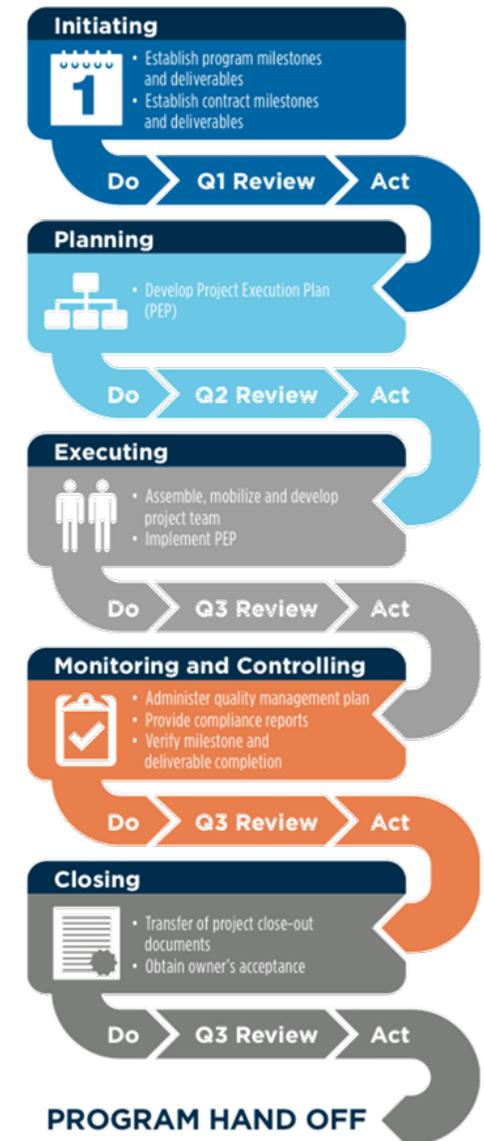
2 Tier Housing HVAC Design

# Correctional Facility Networks

System	Secured State Network	Security Network	Isolated Internal Network	Fire/Life Safety Network	Standalone
Medical/Telemedicine/TelePsych	X				
Central Phones	X				
Video Arraignments/Pardons	X				
Institutional Videos	X				
Inmate Education	X				
Detention, Monitoring, Control		X			
Video Surveillance		X			
Intercom and Paging		X			
Perimeter Intrusion/Extrusion		X			
Building Management (BAS)			X		
SCADA			X		
Inmate Reading/Library			X		
Water Management			X		
Site and Building Fire Alarm				X	
DAS Backbone. Man-Down					X
Site Lighting Control					X
Food Services					

# Commissioning Management

- Understanding stakeholder & stakeholder's needs
- Owner's Project Requirements (OPR)
- IT System Communication Protocols
- Understanding communication paths and contractual links
- Understanding project charter
- Partnering session
- Schedule



# Commissioning Management

- Create Project Execution Plan
- PM software (BIM360)
- Cx software
- FDD requirements
- Cx plan
- Cx specifications
- Specification Divisions 22,23,26,27,28
- Functional Performance tests
- Integrated Systems Test
- Communication plan
- Meeting schedule
- Cx schedule requirement integration into master program schedule
- Establishing M&V requirements
- Establishing turnover criteria
- CMMS integration
- Cyber
- O&M Training
- Control Systems



# Q&A

Thank  
You.



YOU DON'T WANT TO LIVE IN A WORLD  
WITHOUT THIRD-PARTY CERTIFICATION.