IED System Management Solution
Universal solution for Grid IoT OT/IT Integration

Simon Rodriguez, Vice President of Business Development
SUBNET Solutions Inc

Universal solution for Grid IoT Integration

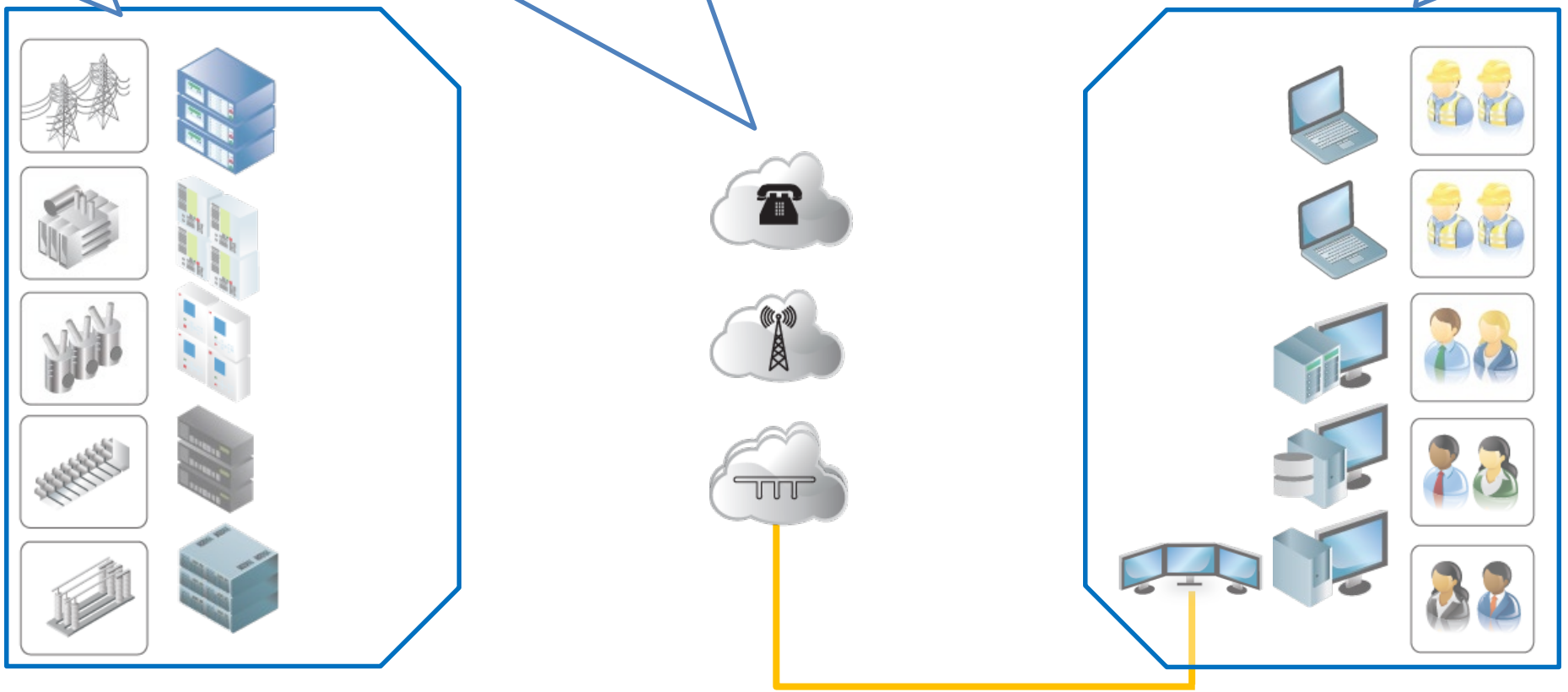
- Grid IoT Universal Solution Background
  - Historical Vendor Specific Issues and Complexity
  - Evolving List of Capabilities needed in a Universal Solution
  - Reoccurring risks and issues of Smart Grid Integration Projects
- Benefits of Universal Solution
  - Multi-Vendor, Multifunction Smart Grid Integration Standard
  - Vendor Choice = Competition, Innovation, Savings
  - Integrated Integration
  - 200% to 500%+ ROI Potential

Objectives for Universal Grid IoT Integration Solution

All Your Primary Equipment and Device Vendors

All Your Top Tier OT and IT Management Systems

All Your Various Data Communication Options

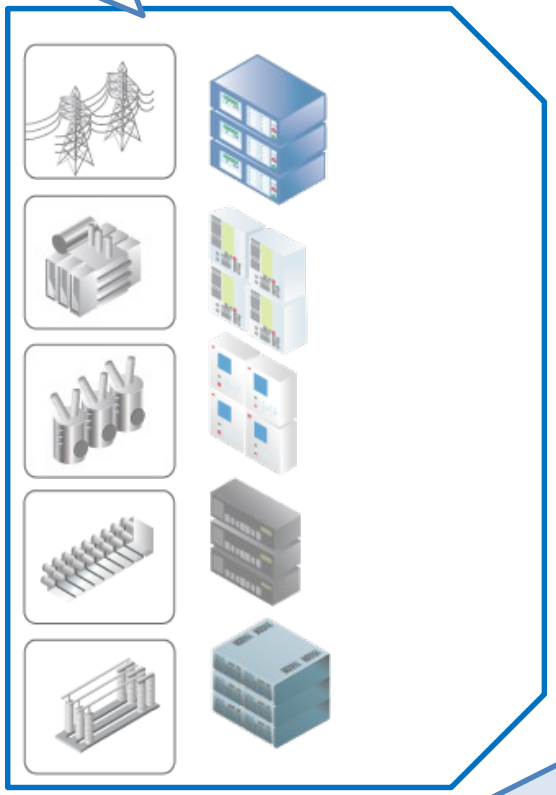


Specifically Multi-Vendor vs Vendor Specific

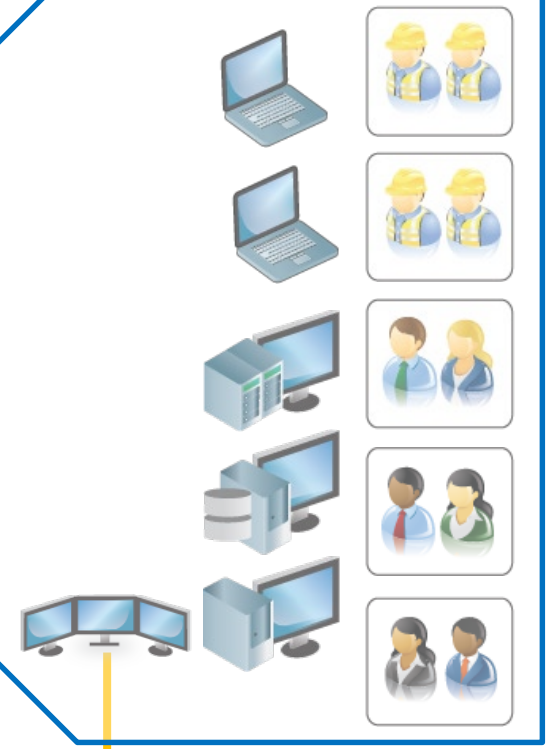
All Your Primary Equipment and Device Vendors

All Your Top Tier OT and IT Management Systems

All Your Various Data Communication Options



Universal
Grid IoT OT/IT
Integration
Solution



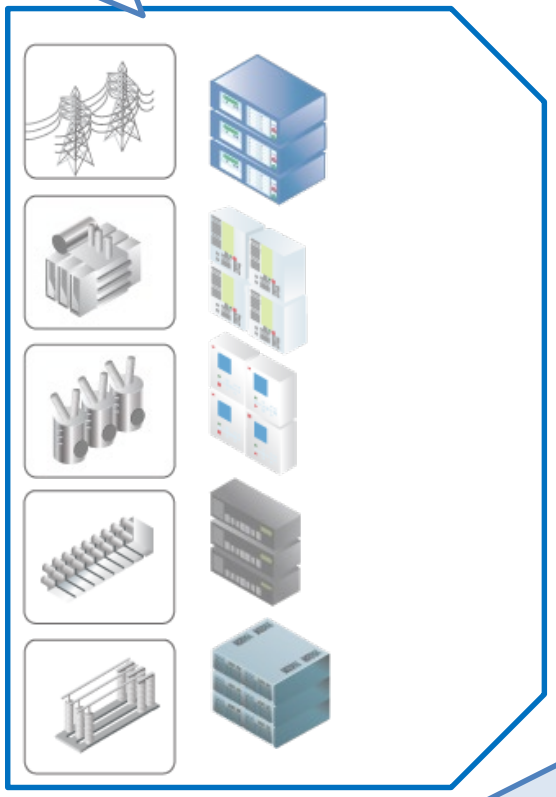
Need A Multi-Vendor, Multi-Function Integration Solution

Multi-Function Integration vs Multiple Single Function

All Your Primary Equipment and Device Vendors

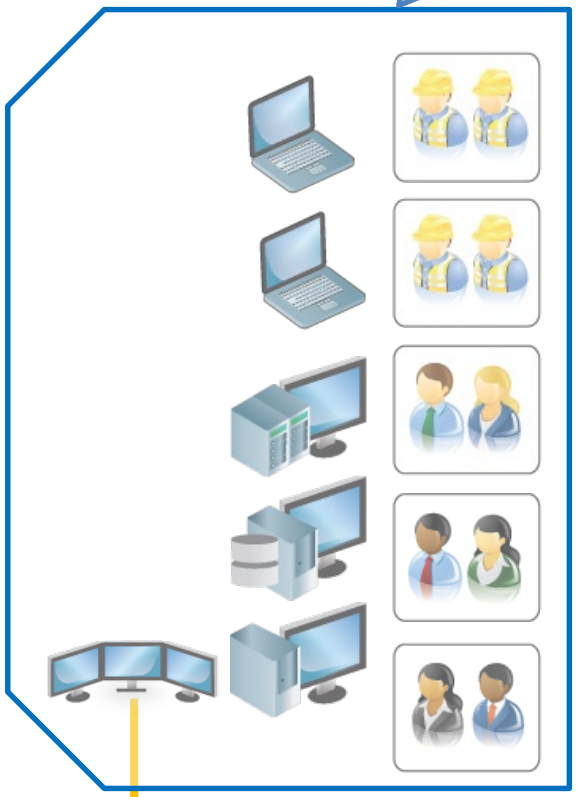
All Your Top Tier OT and IT Management Systems

All Your Various Data Communication Options



Multi-Function Integration

1. SCADA Data Collection
2. Non-SCADA Data Collection
3. Secure Remote Access
4. Password Management
5. Configuration Management
6. Firmware Management



Need A Multi-Vendor, Multi-Function Integration Solution

Unified Device Integration and Security

Grid IoT Represents that Latest Wave of Connected Grid Solutions

FLISR

IVVC

Equip Mon

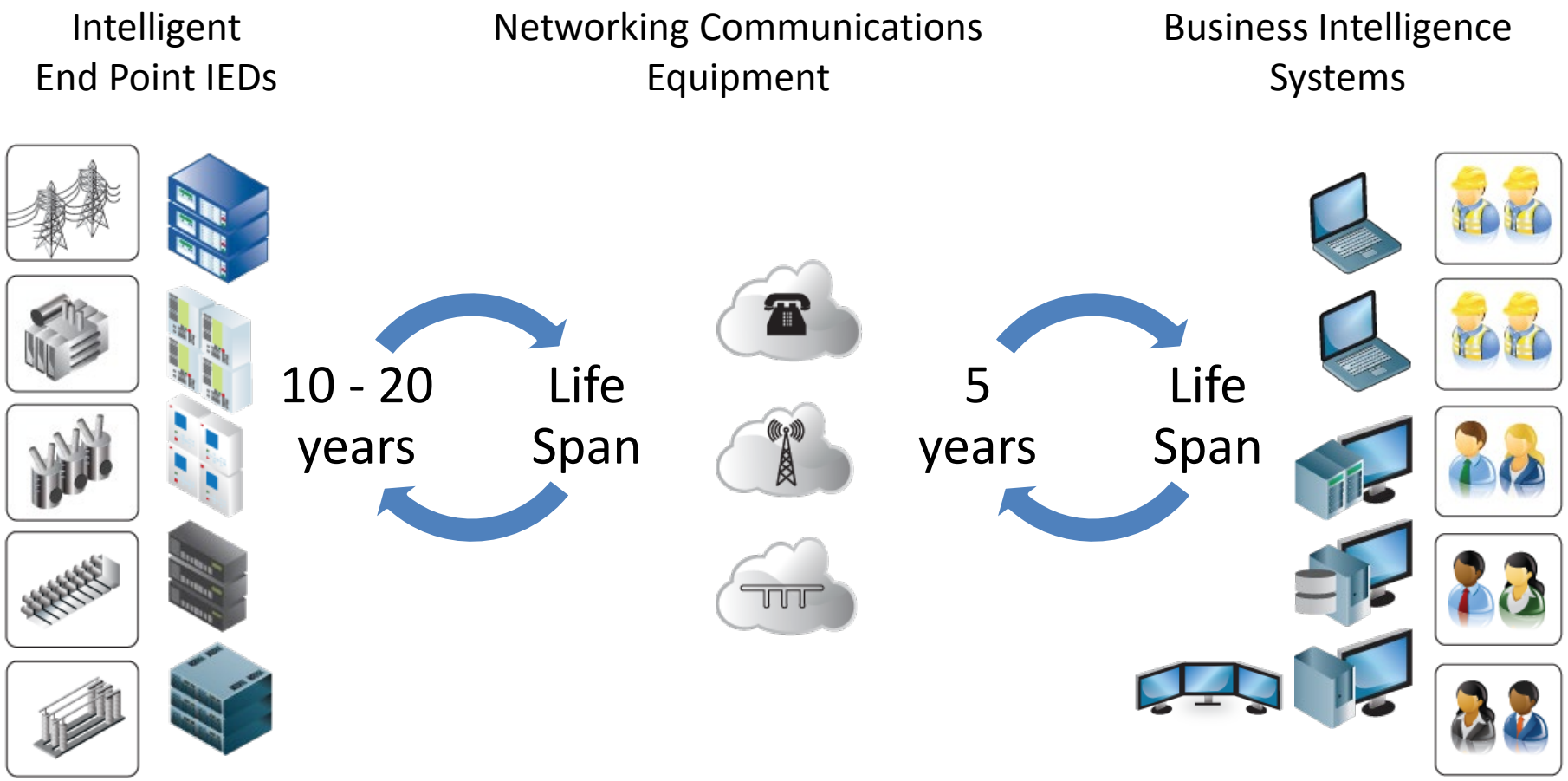
Line Monitors

Inverters

Thousands of IoT Devices being Deployed: Benefits

- Many New Smart Grid Devices
  - New Vendors entering the Market
  - New Innovative Product Offerings
- Many New Smart Grid Applications
- The Connected Grid offers many Benefits
- Large Investor-Owned Utilities (IOUs) with Budgets of 100Ms, 1B+ Grid Modernization Budgets

Can OT Devices Keep Pace with IT Technology (Evolving Security and Integration)



Lessons Learned from Connected Grid v1.0

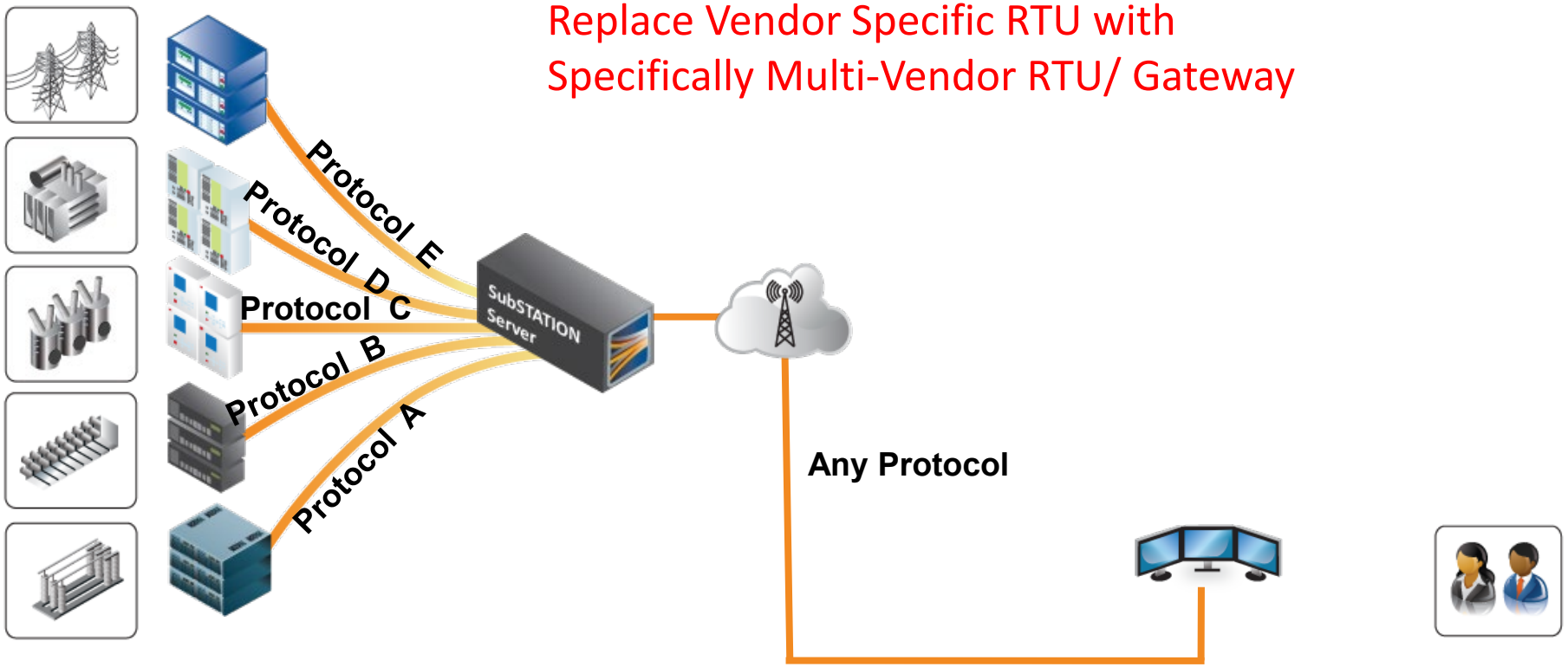
Vendor Specific Technology – A Constant Challenge

1st Connected Grid Wave SCADA – 1970+

Partial List of Vendor Specific Protocols

ABB Spa Bus
ABB RP-570
ABB RP-571
ABB Indactic 33/1
ABB Indactic 33/41
ABB Indactic 33/41 Ext.
ACS 3100
AEP Synchronous
AEP Asynchronous
ASEA ADLP 80
ASEA ADLP 180
ASW LS RTU1
Amtrak SDLC
Avista Inp 1000
Bailey MPC
Boeing SDLC
CAE Micro RTU1
CAE HDLC
CDC Type 1
CDC Type 1-12 bit adrs
CDC Type 1 ASCII
CDC Type 2
CDC Type 2 synchronous
CDC Type 2 extended
CDT Types 1, 2, 3, 4, 5
Cegelec HN Z 66 S 11/15
Compumech CD-4150
Conitel 300
Conitel 2000
Conitel 2020
Conitel 2025
Conitel 2100B
Conitel 2100H
Conitel 2100M
Conitel 3000
DYNAC DYNET
Ferranti Van Comm
Fuji
Getac/ 7020/4-BCH
Getac/Betac 7020-LP
Getac/Betac SDLC
Harris 5000/6000
Harris Micro 2
Harris Micro 3
Honeywell 7000
Modbus ASCII
Modbus RTU
Modbus TCP
Moore 9000
Newfoundland
OPC-XML DA
PG&E 2179
Pert 26/31
QEI/Quindar QPLH1
QEI/Quindar Quics II
QEI/Quindar Quics IV1
Quantum DNP 1/QDIF
RainWise Serial
Recon 1.1
Redac 70D
Redac 70H
Redsad
Rockwell 5010
Rockwell 5011 (standard)
Rockwell 5011 (PSI)
Rockwell 5012
Rockwell 5020
SCADA Consultants
Scadapac 1
Scadapac 5
SCA 2500
SCI RDACS1
SEL Fast Meter
SEL Fast Message
SEL Interleiaved
SES 92
SES 92 (GRE)
SES 92 IP (GRE)
Siemens Sinaut 8-FW/DPDM
Southern Services
Southwestern PS Co. SPS
Systems Control 5
Systems Control 5.2
SC1801 5.4.1
SC1802 5.5
SC1803 6
Systems Northwest 11.1
Systems Northwest 111
Systems Northwest Distribution
Toshiba
Telegyr BOA
Telegyr BOA Byte
Telegyr MPS9000 Async
Telegyr MPS9000 Sync
Telegyr Telegyr 800
Telegyr Telegyr 8979
TLC 11M
TRW 850
TRW 9550
TRW System 9
Valmet (Tejas) Series 3
Valmet (Tejas) Series 5
Valmet (Tejas) Series 5 extended
Westinghouse Wisp+
Westinghouse Wisp+
Weston Recon 1

Universal SCADA Data Management Solution =



Multi-Vendor IED Support Matrix

	Vendor	Protocol Matrix
1	Siemens	L&G 8979, Spa-Bus
2	ABB	RP-570, 571..
3	SEL	SEL FM, SEL ASCII..
4	GE	Harris 5000, 6000
5	Alstom	Proprietary
6	Schneider	Tejas III, V, …
7+	etc	More….

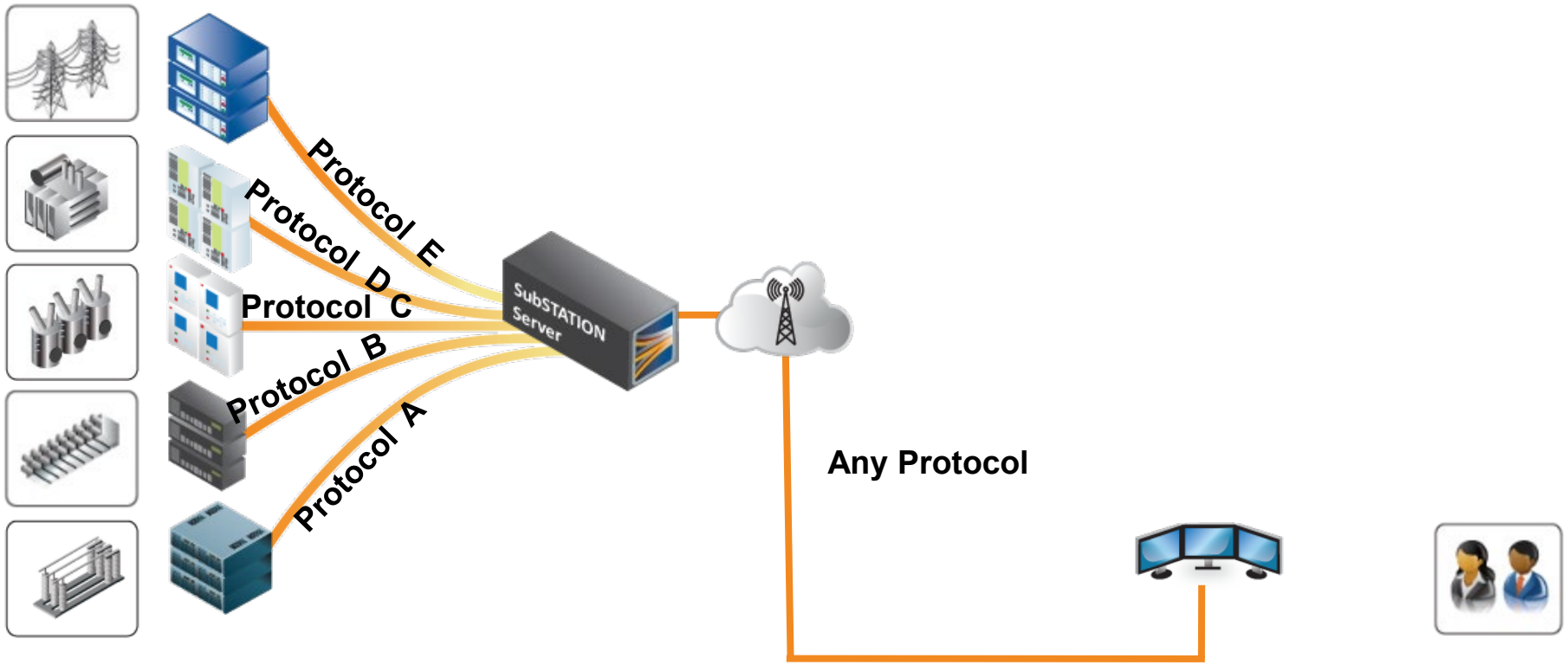
Defining Interoperability

Past Three Decades

Operational

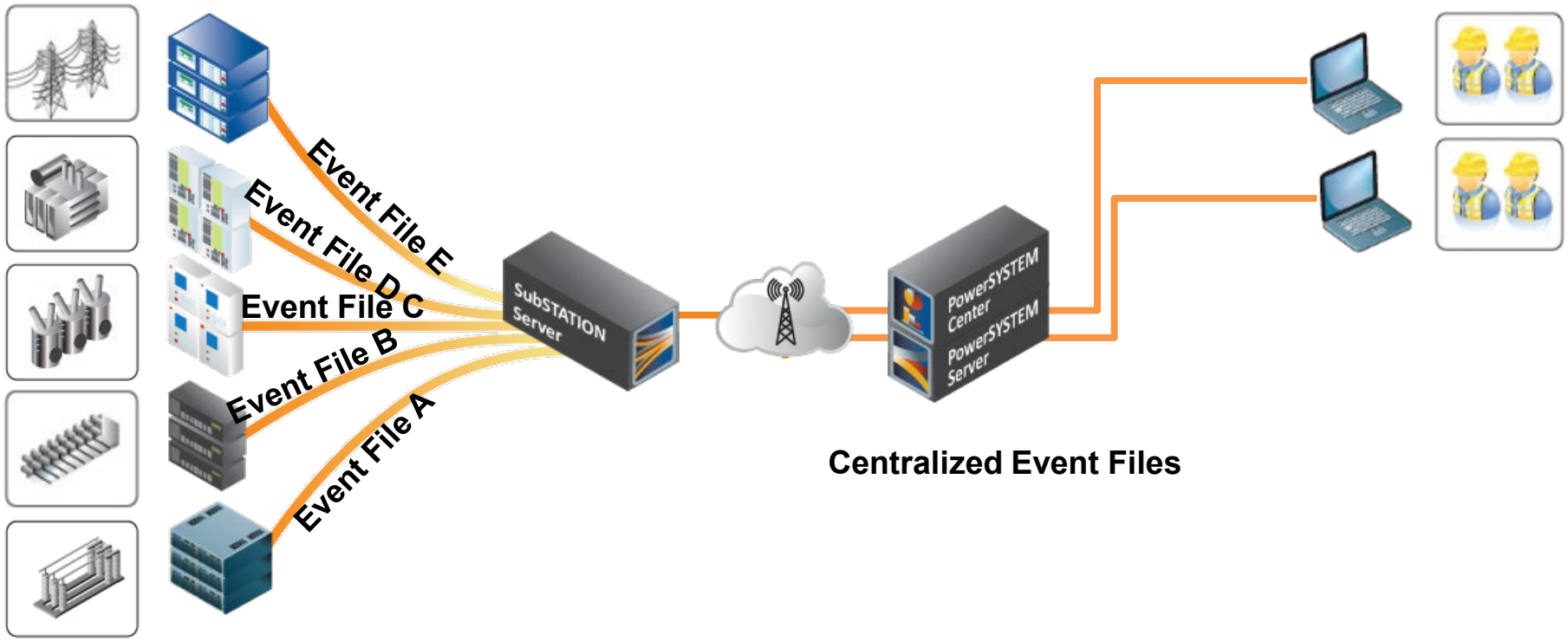
SCADA Data Collection

Total SCADA Data Management Solution =
Requires a Multi-Vendor SCADA Protocol Solution

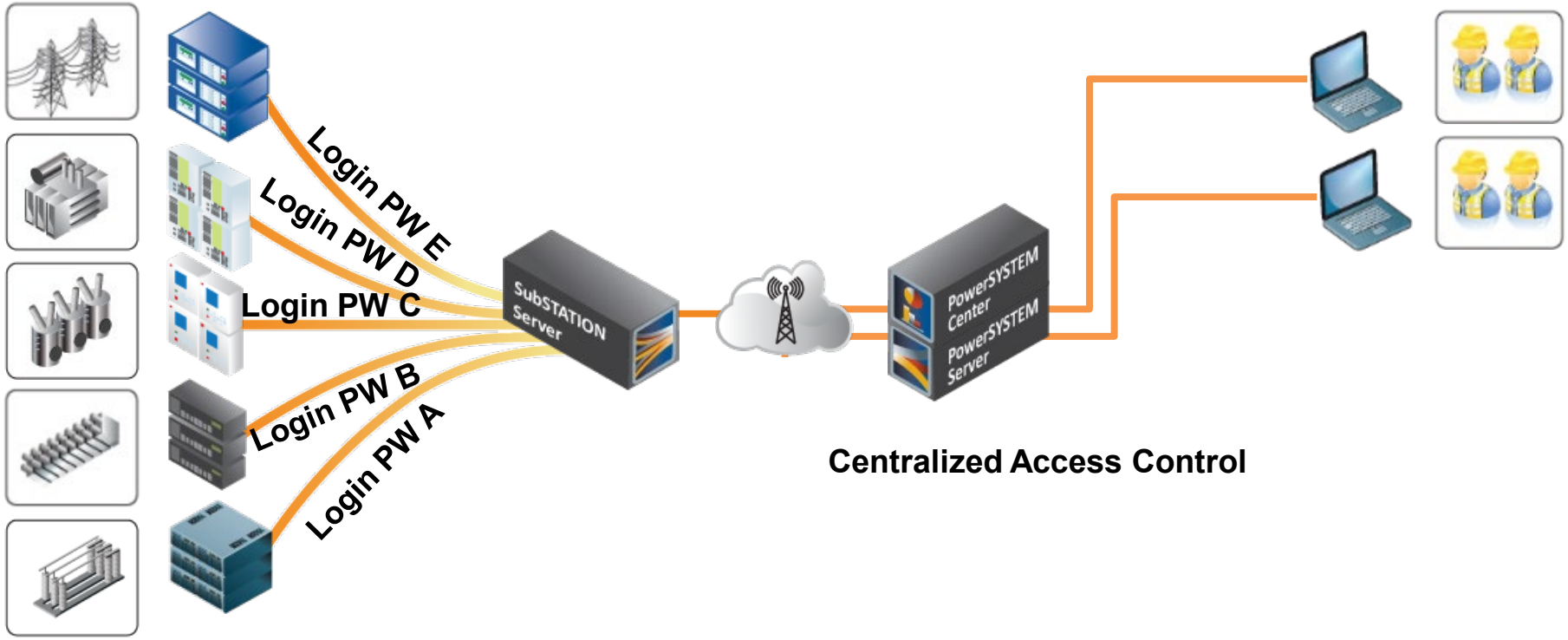


Total Device Event File Management

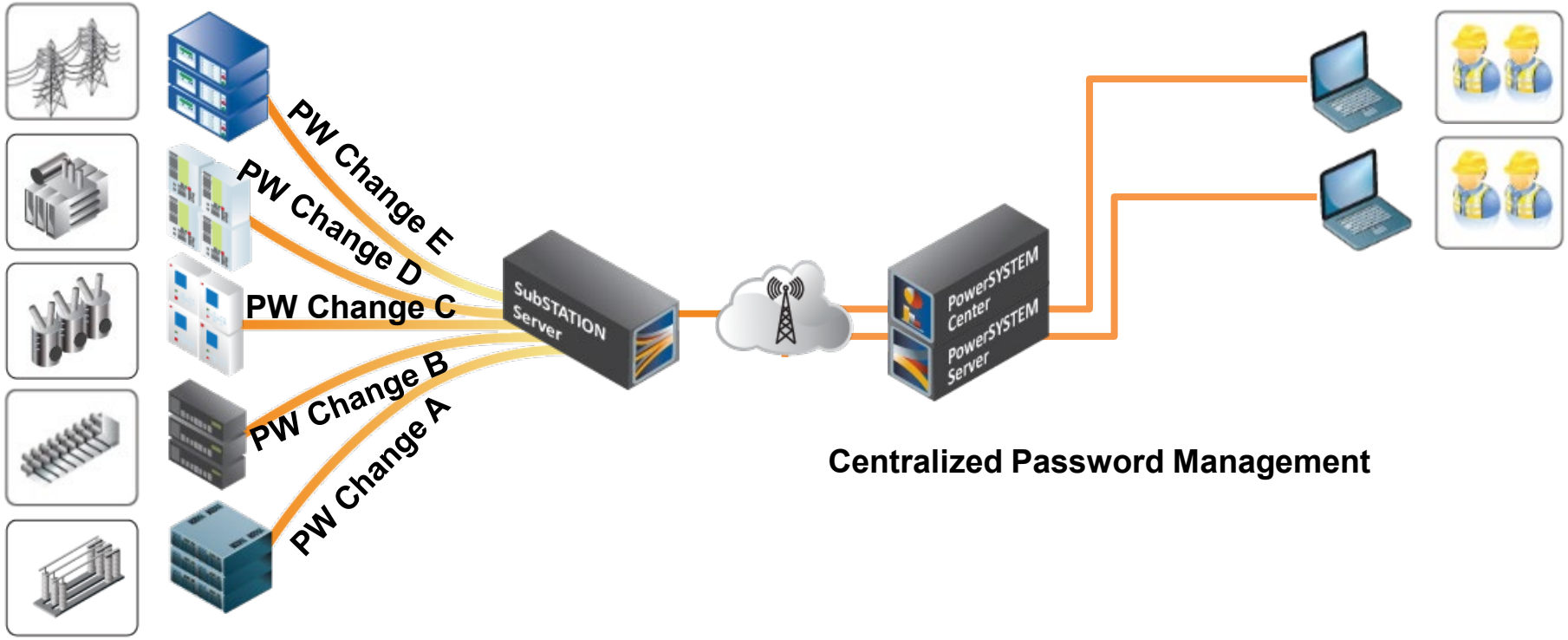
Requires a Multi-Vendor Event File Solution



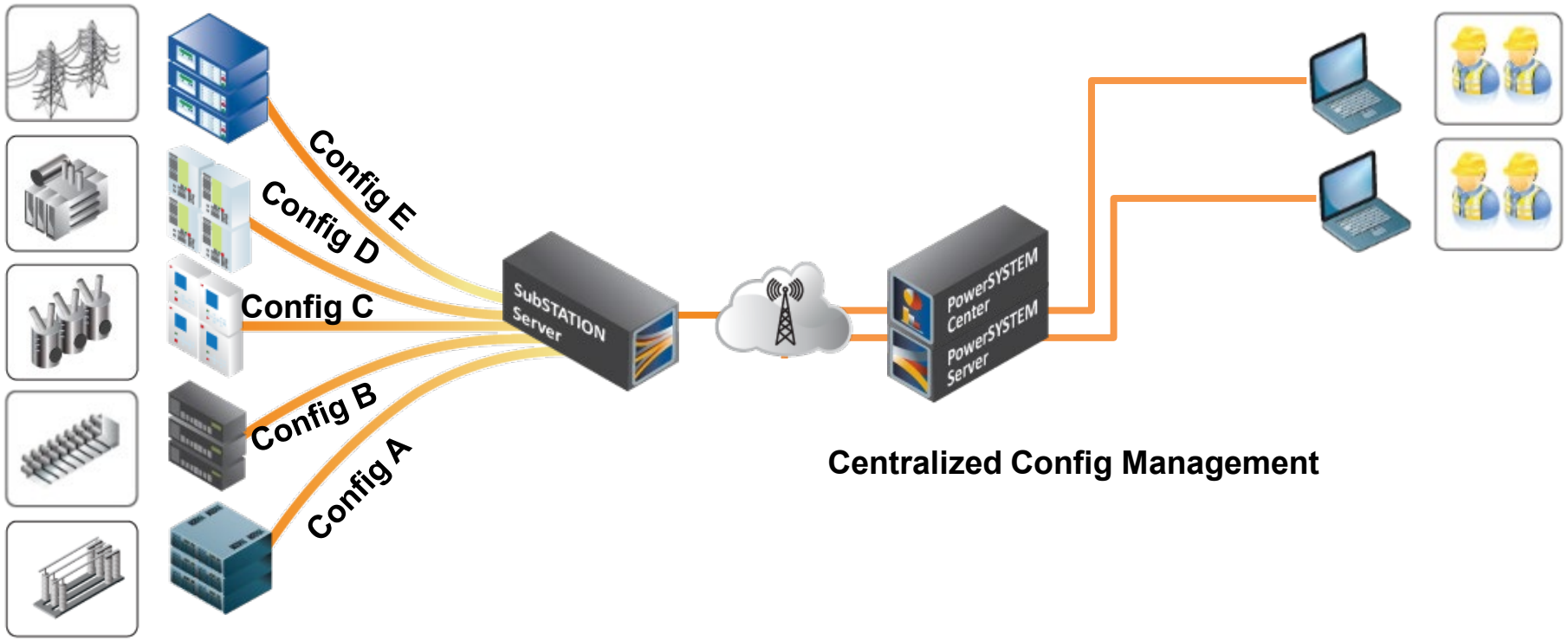
Total IED Access Control
Requires a Multi-Vendor IED Access Control Solution



Total Password Management
Requires a Multi-Vendor Password Management Solution



Total Device Configuration Management Solution =
Specifically Multi-Vendor Configuration Management



Beyond SCADA Integration. Today we need to deal with the complexity of…

- Fault File Management
- Remote Engineering Access (CIP-005, CIP-007)
- Password Change Management (CIP-005, CIP-007)
- Configuration Management (CIP-010, PRC-005)
- IED Documentation Management is even complicated

Defining Interoperability

Today

Operational

& Maintenance

+

Device

Management

SCADA Data Collection

Non SCADA Data Collection

Secure Remote Access Management

Password Change Management

Configuration File Management

Firmware Management

Multi-Vendor IED Support Matrix

	Vendor	Protocol Matrix
1	Siemens	L&G 8979, Spa-Bus
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5	Alstom	Proprietary
6	Schneider	Tejas III, V, …
7+	etc	More….

Multi-Vendor IED Support Matrix

Need IED Access, Password, Config & Firmware Management

	Vendor	Protocol Matrix	Event File Collection Mgmt	IED Access Mgmt	Password Change Mgmt	IED Config Change Mgmt	Firmware Change Mgmt
1	Siemens	L&G 8979, Spa-Bus	?	?	?	?	?
2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE	Harris 5000, 6000	?	?	?	?	?
5	Alstom	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

IED Vendors have long history of providing vendor specific solutions…

	Vendor	Protocol Matrix	Event File Collection Mgmt	IED Access Mgmt	Password Change Mgmt	IED Config Change Mgmt	Firmware Change Mgmt
1	Siemens	L&G 8979, Spa-Bus	?	?	?	?	?
2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE Alstom	Harris 5000, 6000	?	?	?	?	?
5	Eaton Cooper	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

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2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE Alstom	Harris 5000, 6000	?	?	?	?	?
5	Eaton Cooper	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

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2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE Alstom	Harris 5000, 6000	?	?	?	?	?
5	Eaton Cooper	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

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	Vendor	Protocol Matrix	Event File Collection Mgmt	IED Access Mgmt	Password Change Mgmt	IED Config Change Mgmt	Firmware Change Mgmt
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2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE Alstom	Harris 5000, 6000	?	?	?	?	?
5	Eaton Cooper	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

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2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE Alstom	Harris 5000, 6000	?	?	?	?	?
5	Eaton Cooper	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

Multi-Function IED Management

	IED Access	IED Passwords	IED Configurations	IED Firmware
Auditable Process Control Management	Control IED Access and who is authorized to access what IEDs	Control IED Passwords and who authorized to knows what passwords	Control IED Configurations and who authorized to change what configurations	Centralized IED Firmware Control
Active Monitoring & Alerting	Alert Unauthorized IED Access attempts	Monitor IED Password Changes	Monitor IED Configuration Changes	Monitor IED Firmware Changes
Automated Change Management	Updates with AD Users and Group changes	Automate IED Password Changes	Automate IED Configuration Changes	Automate IED Firmware Changes

Multi-Vendor IED Support Matrix

Need IED Access, Password, Config & Firmware Management

	Vendor	Protocol Matrix	Event File Collection Mgmt	IED Access Mgmt	Password Change Mgmt	IED Config Change Mgmt	Firmware Change Mgmt
1	Siemens	L&G 8979, Spa-Bus	?	?	?	?	?
2	ABB	RP-570, 571..	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?
4	GE Alstom	Harris 5000, 6000	?	?	?	?	?
5	Eaton Cooper	Proprietary	?	?	?	?	?
6	Schneider	Tejas III, V, …	?	?	?	?	?
7+	etc	More….	?	?	?	?	?

Multi-Vendor IED Support Matrix

Multiple Control, Monitor, Automate Use Cases

	Vendor	Protocol Matrix	Event File Collection Mgmt	IED Access Mgmt			Password Change Mgmt			IED Config Change Mgmt			Firmware Change Mgmt		
1	Siemens	L&G 8979, Spa-Bus	?	C	M	A	C	M	A	C	M	A	C	M	A
2	ABB	RP-570, 571..	?	C	M	A	C	M	A	C	M	A	C	M	A
3	SEL	SEL FM, SEL ASCII..	?	C	M	A	C	M	A	C	M	A	C	M	A
4	GE Alstom	Harris 5000, 6000	?	C	M	A	C	M	A	C	M	A	C	M	A
5	Eaton Cooper	Proprietary	?	C	M	A	C	M	A	C	M	A	C	M	A
6	Schneider	Tejas III, V, …	?	C	M	A	C	M	A	C	M	A	C	M	A
7+	etc	More….	?	C	M	A	C	M	A	C	M	A	C	M	A

One SUBNET Utility Customers' IED Support Matrix

	Vendor	Protocol Matrix	Event File Collection Support	IED Eng Access			Manual Password Change			Automated Password Change			Config Mgmt		
1	Siemens	L&G 8979, Spa-Bus	?	?	?	?	?	?	?	?	?	?	?	?	?
2	ABB	RP-570, 571..	?	?	?	?	?	?	?	?	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?	?	?	?	?	?	?	?	?
4	GE	Harris 5000, 6000	?	?	?	?	?	?	?	?	?	?	?	?	?
5	Alstom	Optimho..	?	?	?	?	?	?	?	?	?	?	?	?	?
6	Schneider	Tejas III, V, ...	?	?	?	?	?	?	?	?	?	?	?	?	?
7+	etc	More....	?	?	?	?	?	?	?	?	?	?	?	?	?

89 Different IEDs

17+ Use Cases Defined To Date

Advanced/ Automated Functions													
Login Logout		Passwords		Configurations			Firmware			Events	SOE	Logs	Discover
Automated login	Automated logout	Change Device Password in gateway	Change Password	Backup config	Restore Config	Get Config summary	Retrieve firmware version	Compare firmware	Update firmware	Retrieve new event files	Retrieve SOE files	Retrieve device logs	Discover Connected devices

Evolving SUBNET's Unified Grid Intelligence is a continual process. Always new devices, Always new use cases…

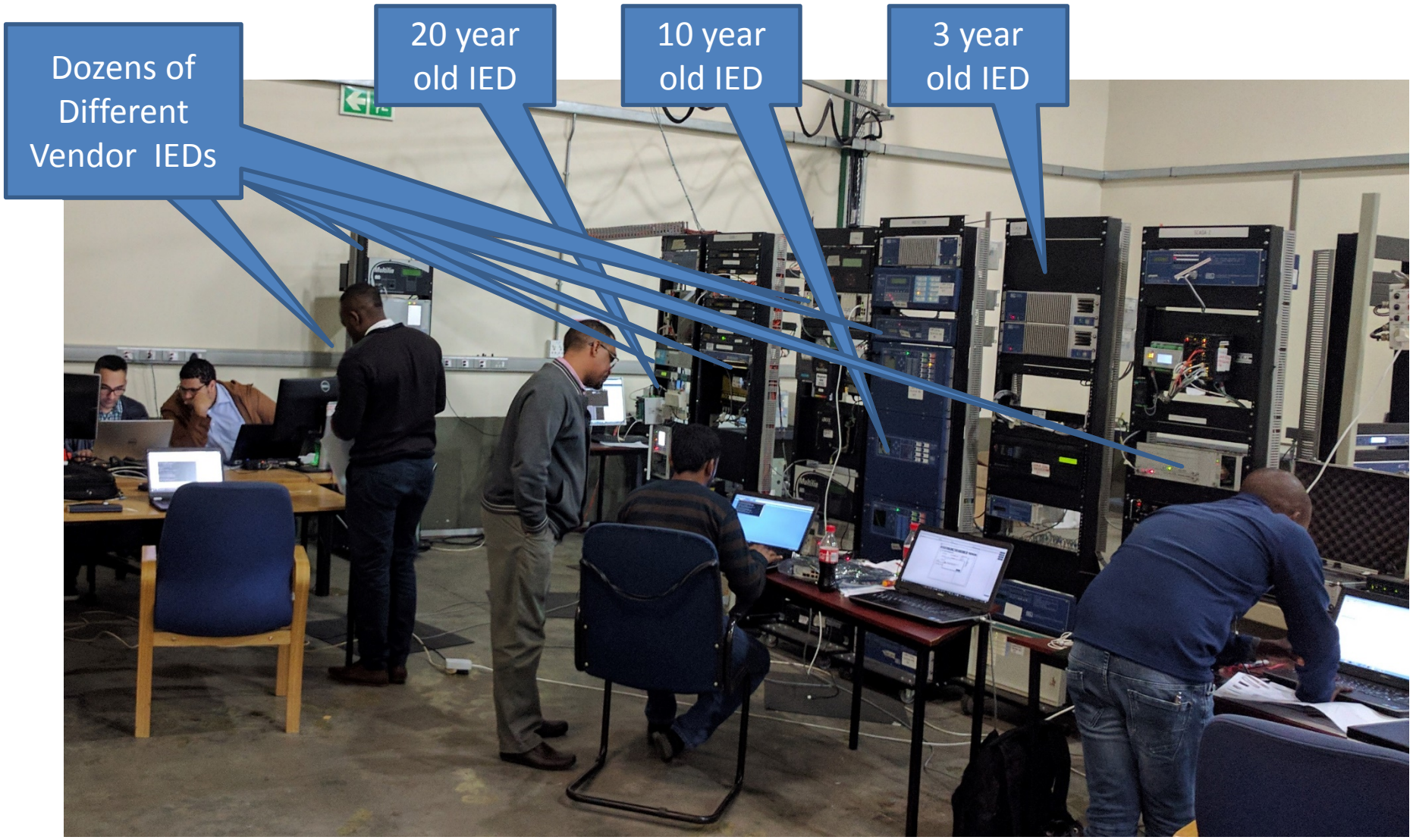
	Vendor	Protocol Matrix	Event File Collection Support	IED Eng Access			Manual Password Change			Automated Password Change			Config Mgmt		
1	Siemens	L&G 8979, Spa-Bus	?	?	?	?	?	?	?	?	?	?	?	?	?
2	ABB	RP-570, 571..	?	?	?	?	?	?	?	?	?	?	?	?	?
3	SEL	SEL FM, SEL ASCII..	?	?	?	?	?	?	?	?	?	?	?	?	?
4	GE	Harris 5000, 6000	?	?	?	?	?	?	?	?	?	?	?	?	?
5	Alstom	Optimho..	?	?	?	?	?	?	?	?	?	?	?	?	?
6	Schneider	Tejas III, V, ...	?	?	?	?	?	?	?	?	?	?	?	?	?
7+	etc	More....	?	?	?	?	?	?	?	?	?	?	?	?	?

New Use Cases every year…..

New IEDs every month

Advanced/ Automated Functions													
Login Logout		Passwords		Configurations			Firmware			Events	SOE	Logs	Discover
Automated login	Automated logout	Change Device Password in gateway	Change Password	Backup config	Restore Config	Get Config summary	Retrieve firmware version	Compare firmware	Update firmware	Retrieve new event files	Retrieve SOE files	Retrieve device logs	Discover Connected devices

Many Different IoT Devices, Old and New,



Multi-Function Integration Evolution

Multi-Function Integration Evolution

Today

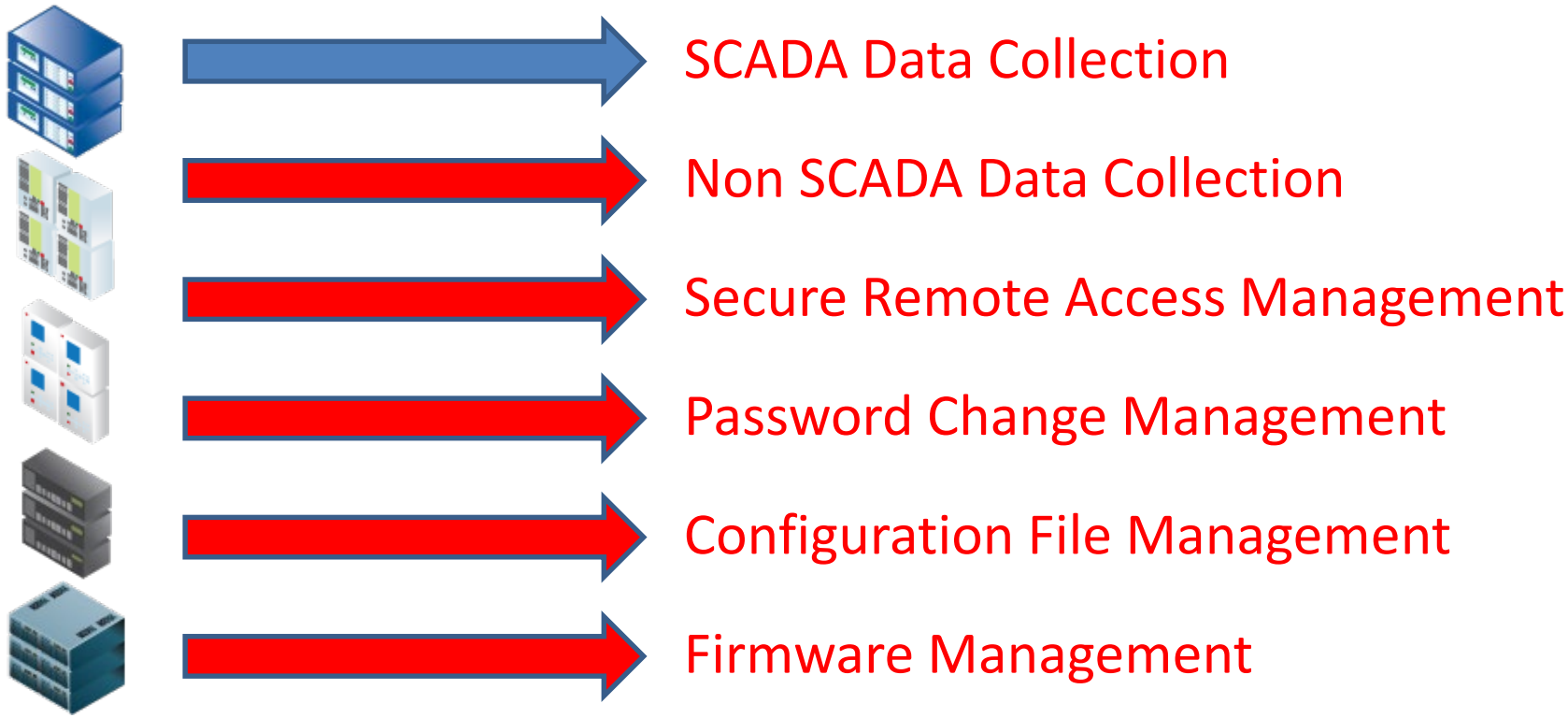
Operational

& Maintenance

+

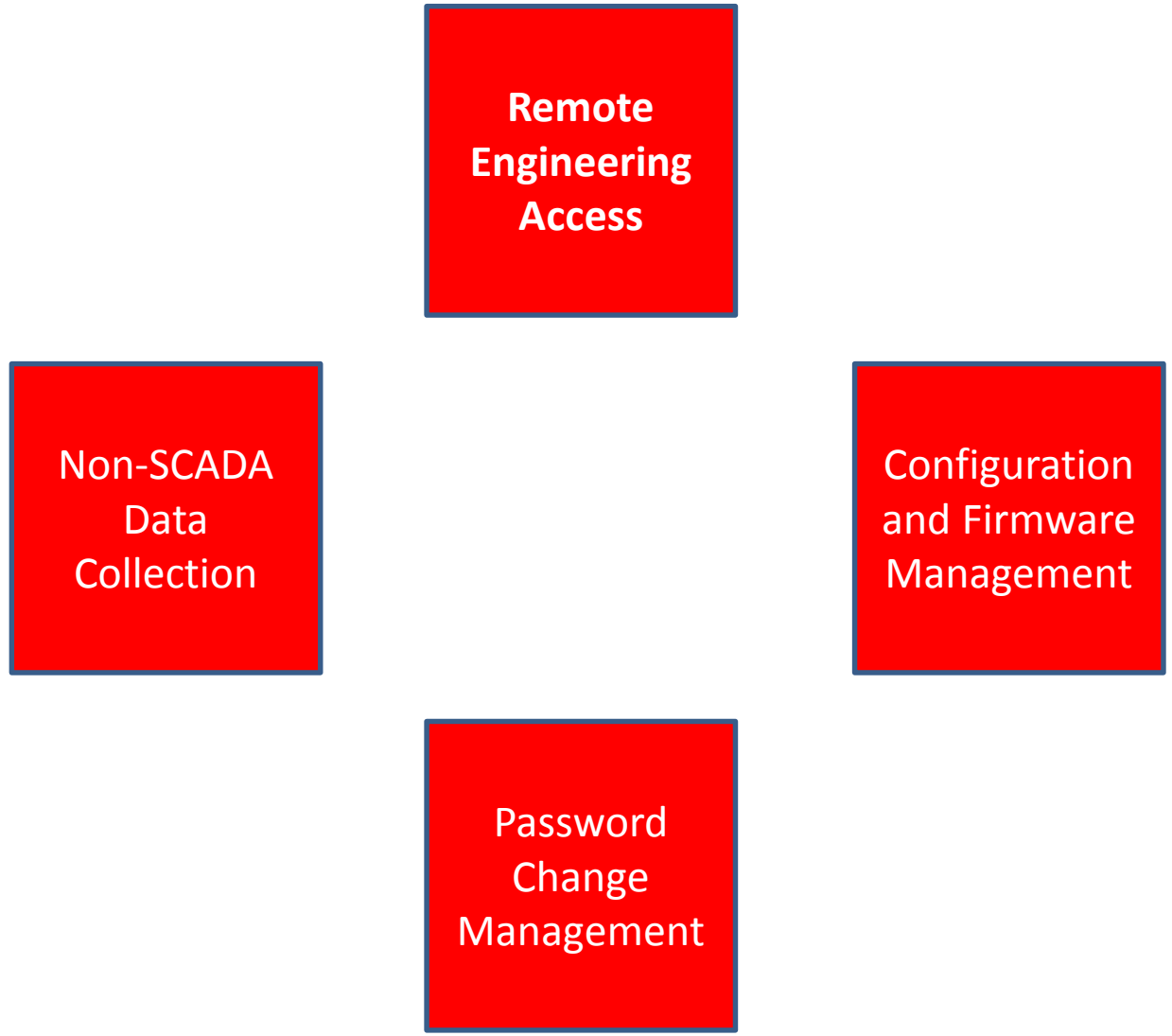
Device

Management

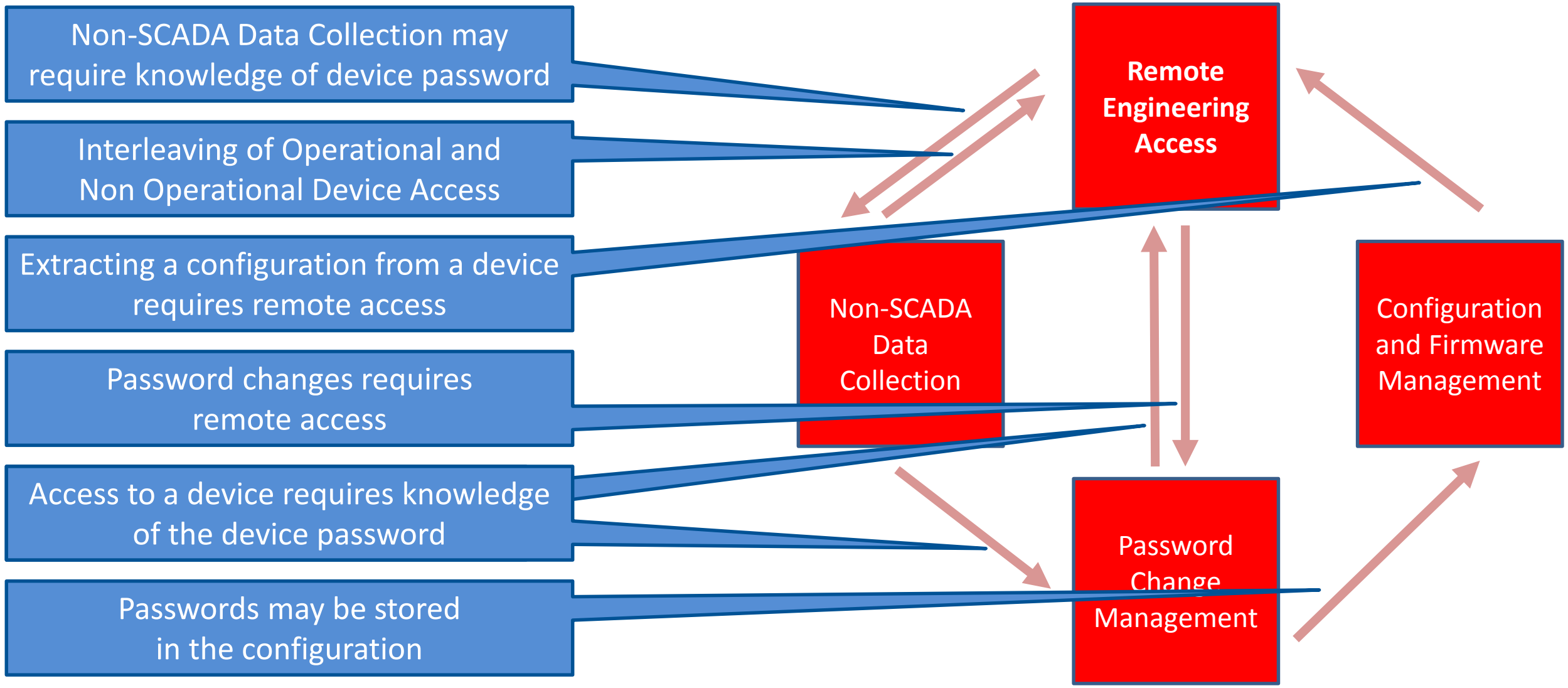


Expanding Integration Systems

- Non SCADA Data Collection
- Secure Remote Access
- Password Change Management
- Configuration Management
- Firmware Management



Interdependency of Systems



Grid IoT: Grid Integration v3.0

Typical Utility Grid IoT Execution Project Team for Each Solution

FLISR

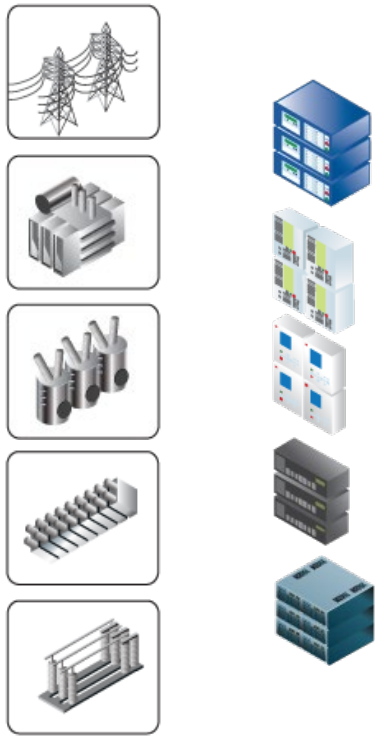
IVVC

Equip Mon

Line Monitors

Inverters

Utility Standard Typically



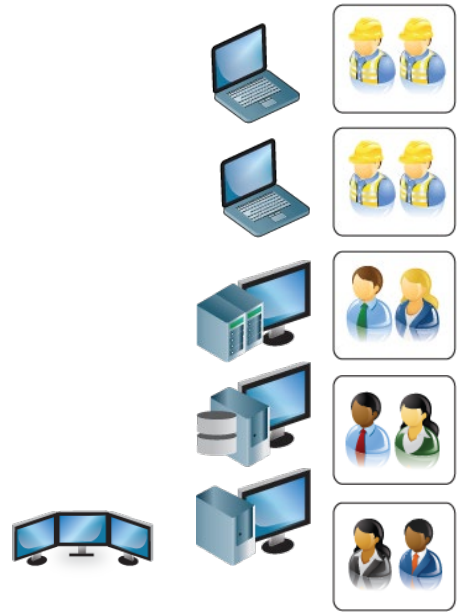
Your Utilities IED Edge Integration Standard????

Does this exist??

Or is this done in a
- Project Specific
- Vendor Specific way>

Your Utilities Comm System Standards

Your Utilities OT System Standards



SCADA Vendor

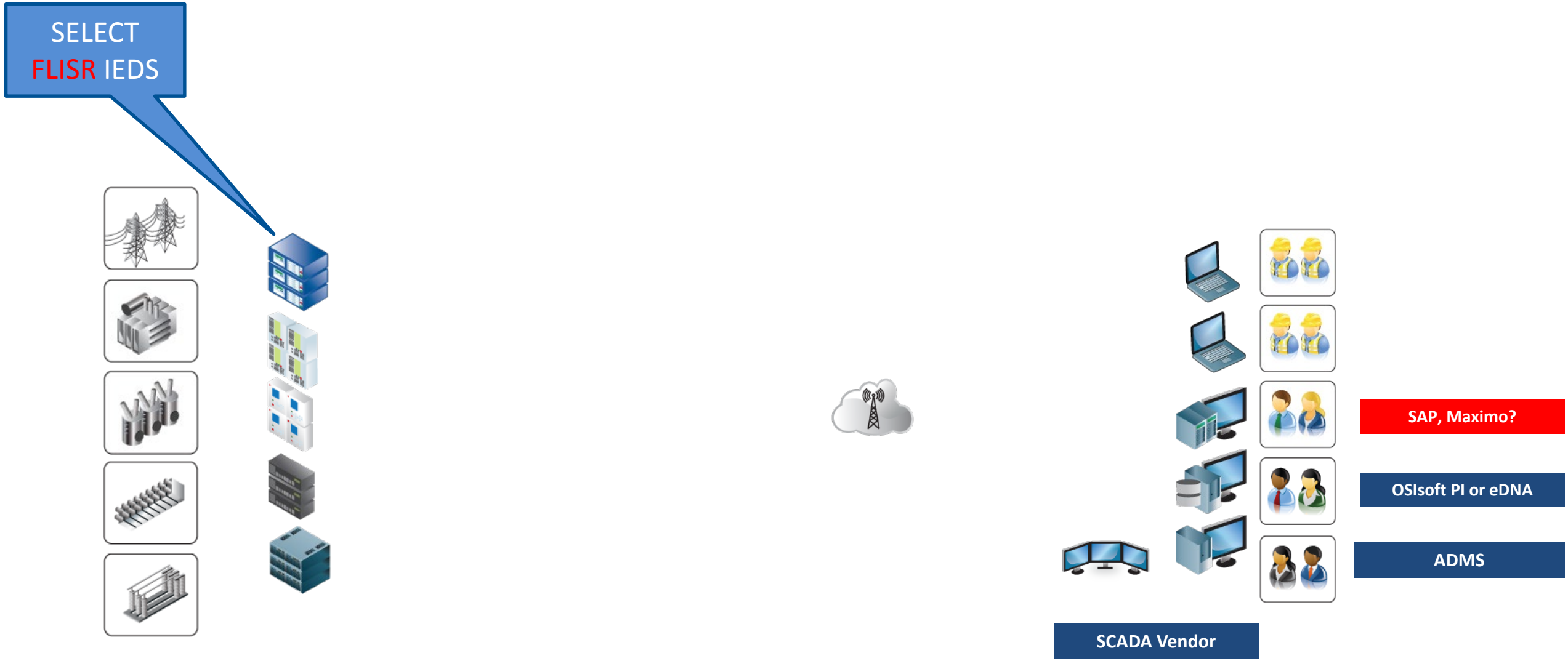
Your Utilities BI System Standards

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

The FLISR of Things: Select Edge Device



The FLISR of Things: Determine Communication Network

SELECT FLISR IEDS

Determine Comms FLISR IEDs

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

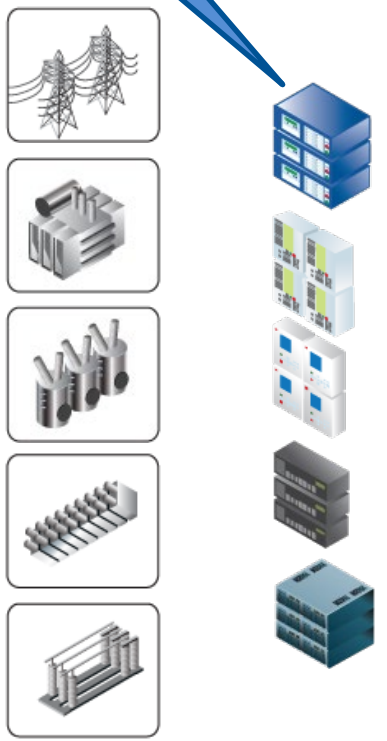
SCADA Vendor

The FLISR of Things: Determine SCADA Interface

SELECT FLISR IEDS

Determine Comms FLISR IEDs

Determine FLISR SCADA DATA Collection



SAP, Maximo?

OSIsoft PI or eDNA

ADMS

SCADA Vendor

The FLISR of Things: Determine Historian Integration

SELECT FLISR IEDS

Determine Comms FLISR IEDs

Determine FLISR SCADA DATA Collection

Determine Historian FLISR Data Collection

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

SCADA Vendor

The FLISR of Things: Determine Integration with other BI

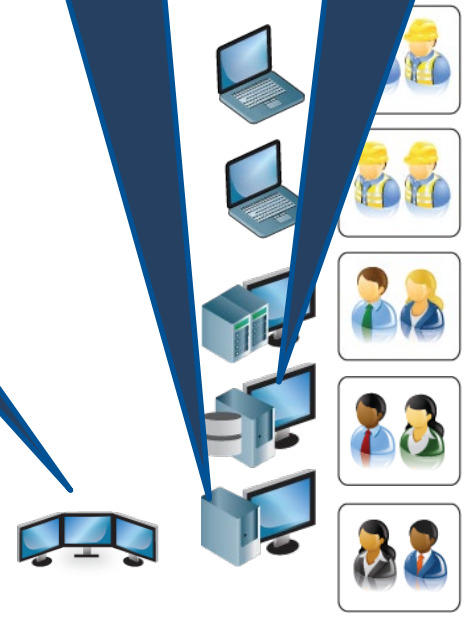
SELECT FLISR IEDS

Determine Comms FLISR IEDs

Determine FLISR SCADA DATA Collection

Determine Historian FLISR Data Collection

Integration FLISR Data to Maximo, ESRI



SCADA Vendor

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

The FLISR of Things: Determine IED Management

SELECT FLISR IEDS

Determine Comms FLISR IEDs

Determine FLISR SCADA DATA Collection

Determine Historian FLISR Data Collection

Integration FLISR Data to SAP, Maximo, ESRI

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

SCADA Vendor

Determine how to manage FLISR Devices?
IED Access Control, PW Mgmt, Config Mgmt, Firmware Mgmt

Repeat for Implementing VVC

SELECT VVC IEDS

Determine Comms VVC IEDs

Determine VVC SCADA DATA Collection

Determine Historian VVC Data Collection

Integration VVC Data to SAP, Maximo, ESRI

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

Determine how to manage VVC Devices?
IED Access Control, PW Mgmt, Config Mgmt, Firmware Mgmt

SCADA Vendor

Repeat for Implementing Fault Indication (Fault In)

SELECT FaultIn IEDS

Determine Comms FaultIn IEDs

Determine FaultIn SCADA DATA Collection

Determine Historian FaultIn Data Collection

Integration FaultIn Data to SAP, Maximo, ESRI

SAP, Maximo?

OSIsoft PI or eDNA

ADMS

Determine how to manage FaultIn Devices?
IED Access Control, PW Mgmt, Config Mgmt, Firmware Mgmt

SCADA Vendor

Repeat for Implementing Smart Inverter Integration

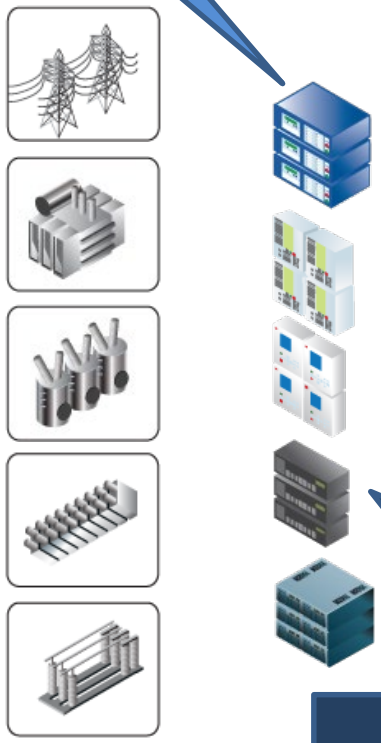
Select Inverter IEDS

Determine Comms Inverter IEDs

Determine Inverter SCADA DATA Collection

Determine Historian Inverter Data Collection

Integration Inverter Data to SAP, Maximo, ESRI



SAP, Maximo?

OSIsoft PI or eDNA

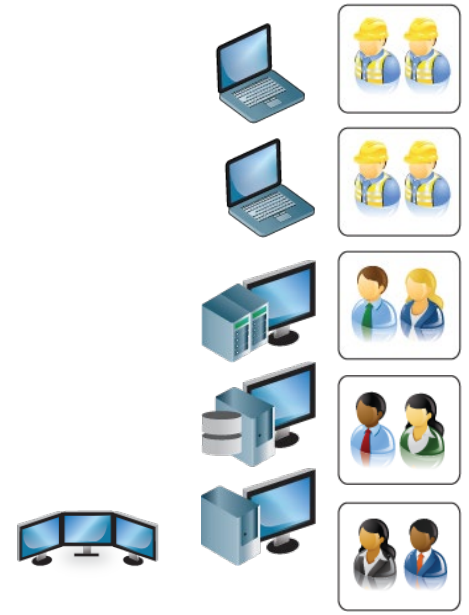
ADMS

Determine how to manage Inverter Devices?
IED Access Control, PW Mgmt, Config Mgmt, Firmware Mgmt

SCADA Vendor

Typical Result: Implemented Many Project Specific, Vendor Specific Systems

FIISR IEDS Vendor 1	FLISR DATA Collection	FLISR Data Historian	FLISR BI Integration	FLISR Device Mgmt
VVO IEDS Vendor 2	VVO DATA Collection	VVO Data Historian	VVO BI Integration	VVO Device Mgmt
CFI IEDS Vendor 3	CFI DATA Collection	CFI Data Historian	CFI BI Integration	CFI Device Mgmt
Smart Inv Vendor 4	S Inv DATA Collection	S Inv Data Historian	S Inv BI Integration	S Inv Device Mgmt
XFMR Mon Vendor 5	XFMR DATA Collection	XFMR Data Historian	XFMR BI Integration	XFMR Device Mgmt



SAP, Maximo?

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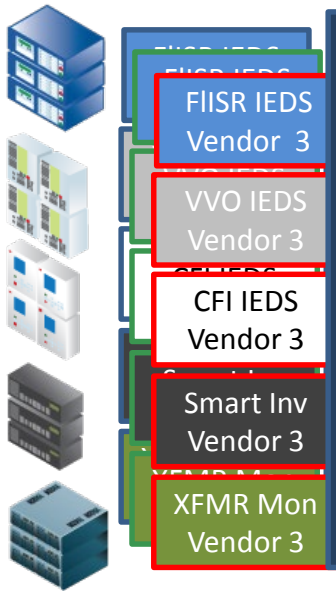
ADMS

SCADA Vendor

Extend Your Utilities Integration Standard Closer to the Edge



Your Utilities IED Edge Integration Standard??

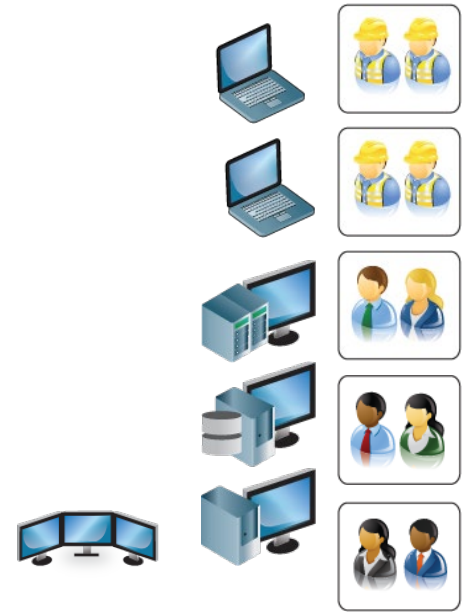
Your Utilities Comm System Standards

Your Utilities OT System Standards

Your Utilities BI System Standards

Integrated Integration

- ANY IED SCADA and Non-SCADA-DATA Collection
- ANY IED Historian Data Collection
- Any IED Integration with BI
- ANY IED Device Management
  - IED Access Control
  - Password Management
  - Configuration Management
  - Firmware Management



SCADA Vendor

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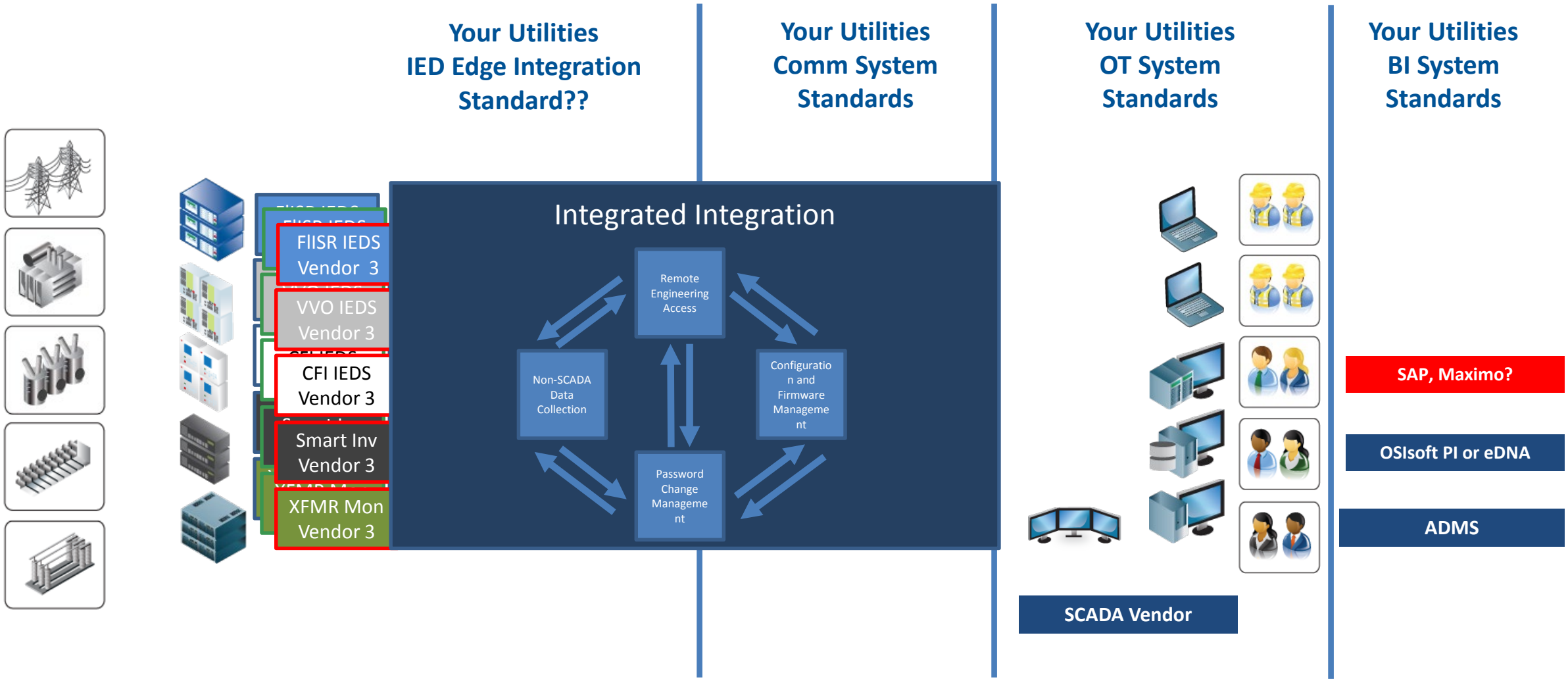
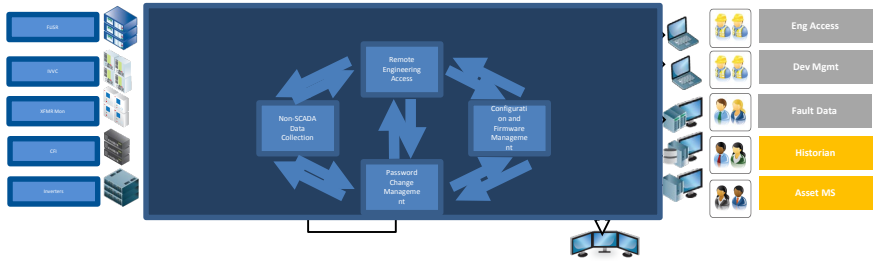


Multi-Vendor
System Level Down Approach is Key

Devices Up Integration Approach

System Level Down Integration Approach



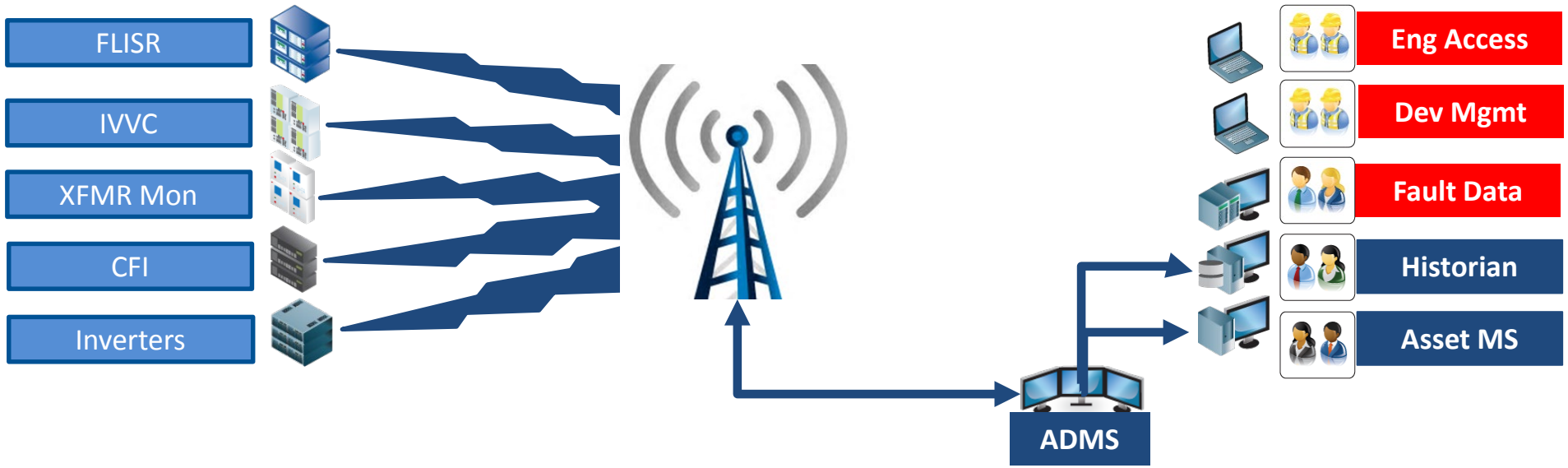
Universal Grid IoT Integration
Project Example 1

Project 1 – Electric Utility, North Eastern US
Universal Grid IoT Data Concentration

- Service Area
  - 26,000 sq. kilometer service territory
  - 80,000 kilometers of Distribution circuits
  - 12,800 kilometers of Transmission lines
  - 1.4 million meters (transitioning to Smart Meters)
- Deploying 7000 Grid IoT devices

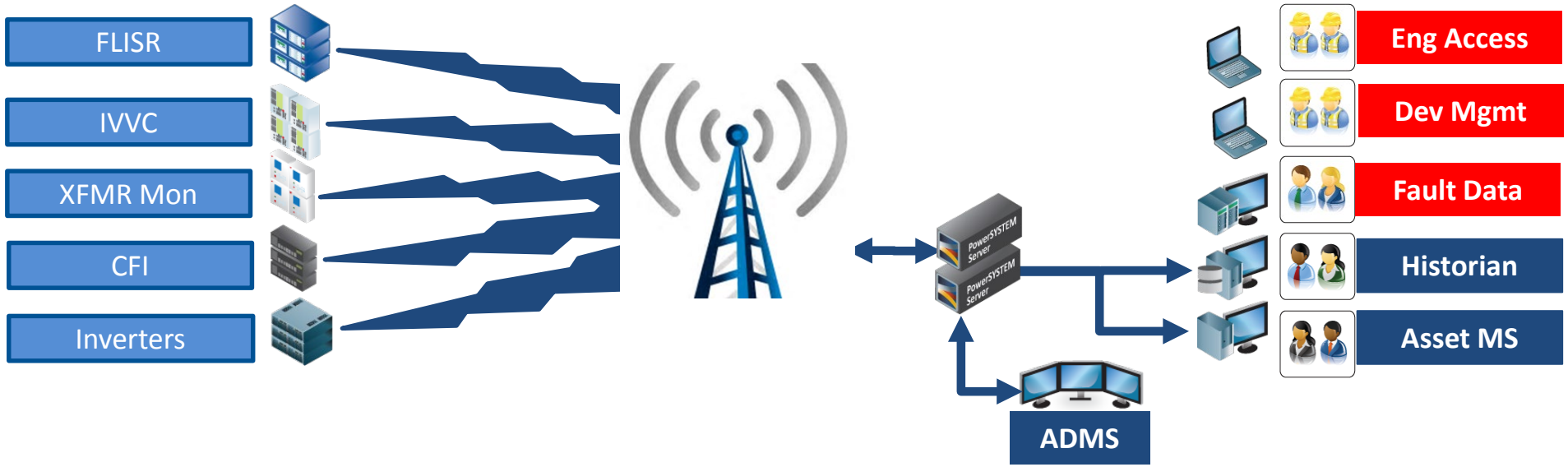
Thousands of Grid IoT Devices being Deployed

- 7000 Devices Being Deployed
- Rollout = Approximately 3 Devices added per Day
- Didn’t want ADMS to poll all 7000 (Cost, Disruptive)
- Didn’t want ADMS to be middleman for Historian (Cost, Disruptive)

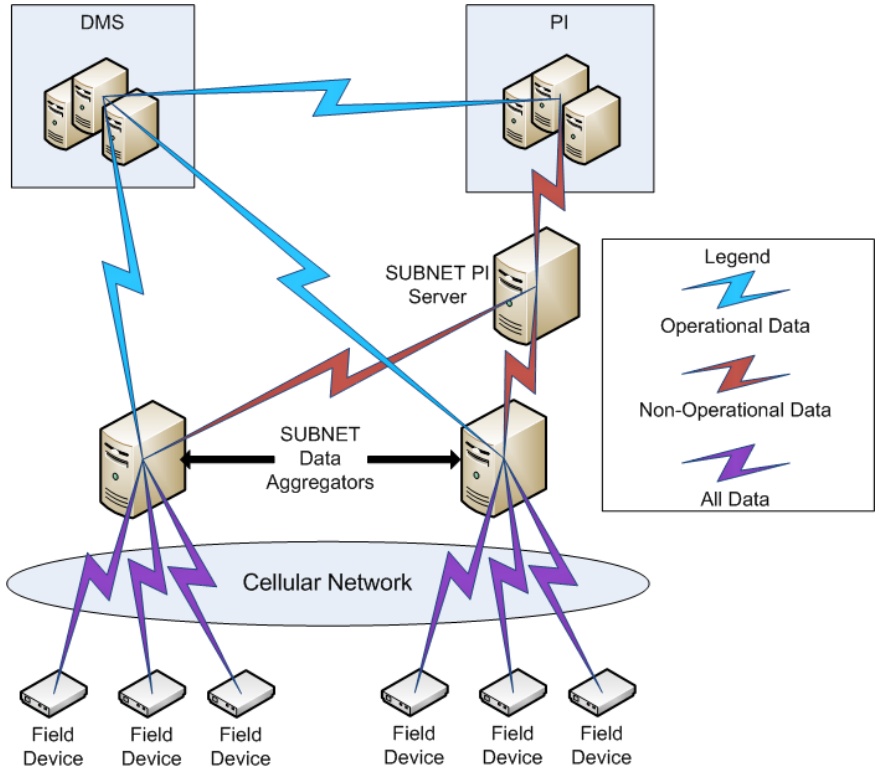


Add in Universal Grid IoT FEP for both OT (ADMS) and IT (Historian, SAP, Analytics)

1. Add in Separate IoT FEP Poll Devices
2. IoT FEP Polled for OT Data by ADMS
   70 Devices vs 7000, 5% of Data
3. IoT FEP Supplies Data Directly to Historian and Asset Management



Case Study – Electric Utility, US



- All operational SCADA data such as Volt, Amp, Status goes to DMS and displayed to System Operators.
- Telemetry not required by DMS goes directly into the PI System. Saves on licensing costs and network traffic.
- DMS also send data to PI, which is useful for calculated outputs.
- A simplified architecture reducing multiple and proprietary data collectors.

SUBNET Grid IoT Security and Integration Key Benefits

- Benefits of Universal Solution Benefits Extend Life of Current Install Base
- Multi-Vendor Competition Savings (2X to 5X+ ROI)
  - Make Primary and Edge Device Vendor Compete with Multi-Vendor Integration
  - Enable Vendor Choice, Avoid Vendor Lock In
- Ensure Maintenance of Grid IoT Infrastructure is cost effective
  - Device OT and IT Data Collection Grid IoT Devices
  - Centralized Device Management of Grid IoT Devices
  - Focus on integrating your systems not trying to multiple Integrate Systems
- Have a Security and Integration Standard for all your Smart Grid projects

Q&A Session / Contact Details

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