

OCTOBER 25, 2023

PG&E: AVEVA™ PI System™/ADMS Integration and IT/OT Convergence

Justin Bagley - PG&E

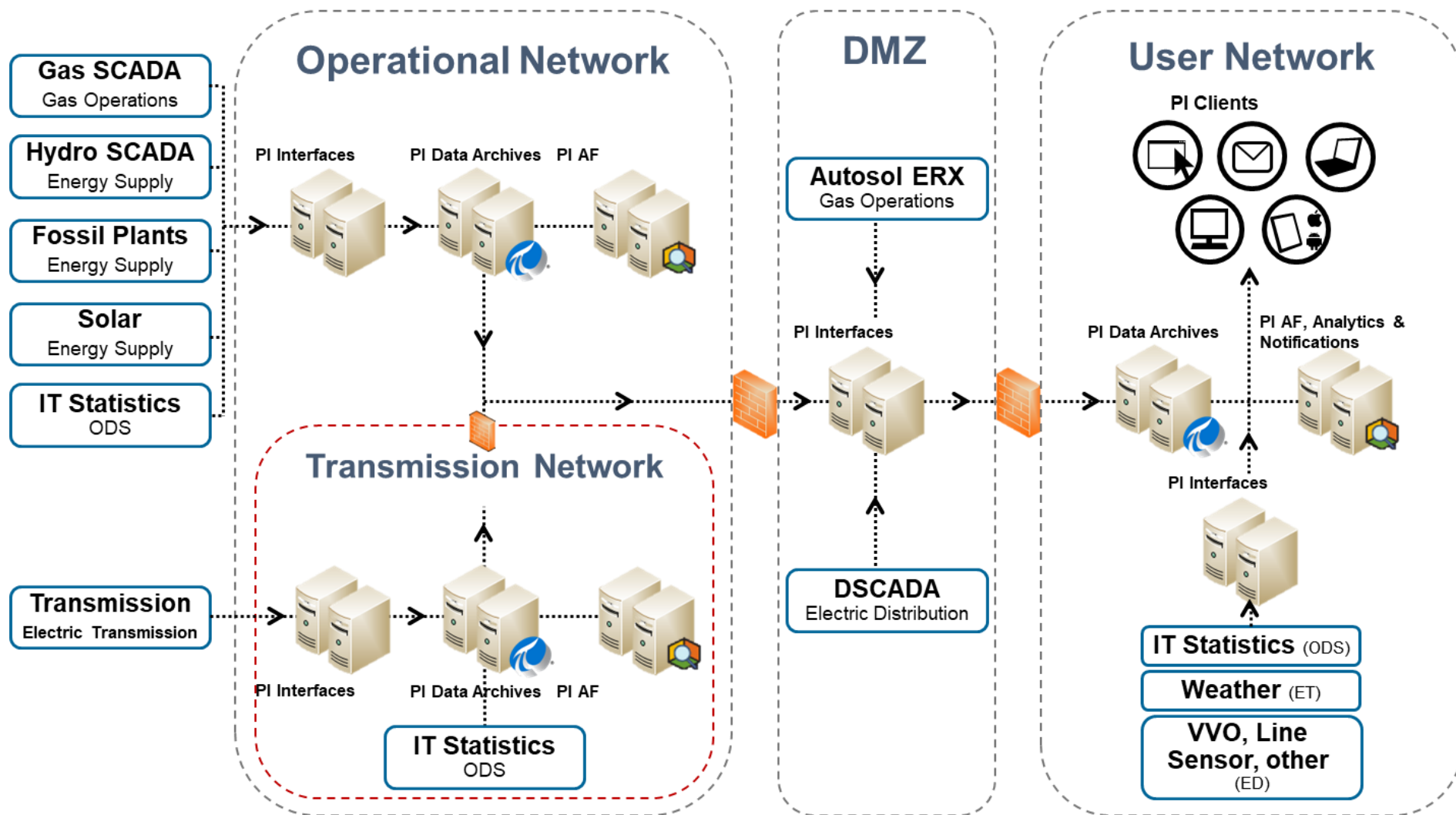
Gary Yegiazaryan - PG&E

AVEVA

About Pacific Gas and Electric Company

- Incorporated in California in 1905
- Header quarters in Oakland, California
- Approximately 23,000 employees
- 106,681 Circuit miles of Electric Distribution
- 18,466 Circuit miles of interconnected transmission lines
- 42,141 miles of natural gas distribution pipelines
- 6,438 miles of natural gas transmission pipelines
- 5.5 million electric customer accounts
- 4.5 million natural gas customer accounts

The AVEVA™ PI System™ at PG&E



- Currently 8 production PI System installations
- Before split out by area contained 20 million PI tags
- Largest system now at ~7 million tags
- Rapid growth in data
 - 2012 – less than 1TB a year
 - 2016 ~1TB
 - 2019 ~10TB
 - 2022 ~20TB
- 4 new data sources in 2022
- AF structure adoption for each area

PG&E ADMS Vision

The upgrade our Advanced Distribution Management System will improve the visibility, operability, and security of grid assets – which are critical for wildfire mitigation and daily operations



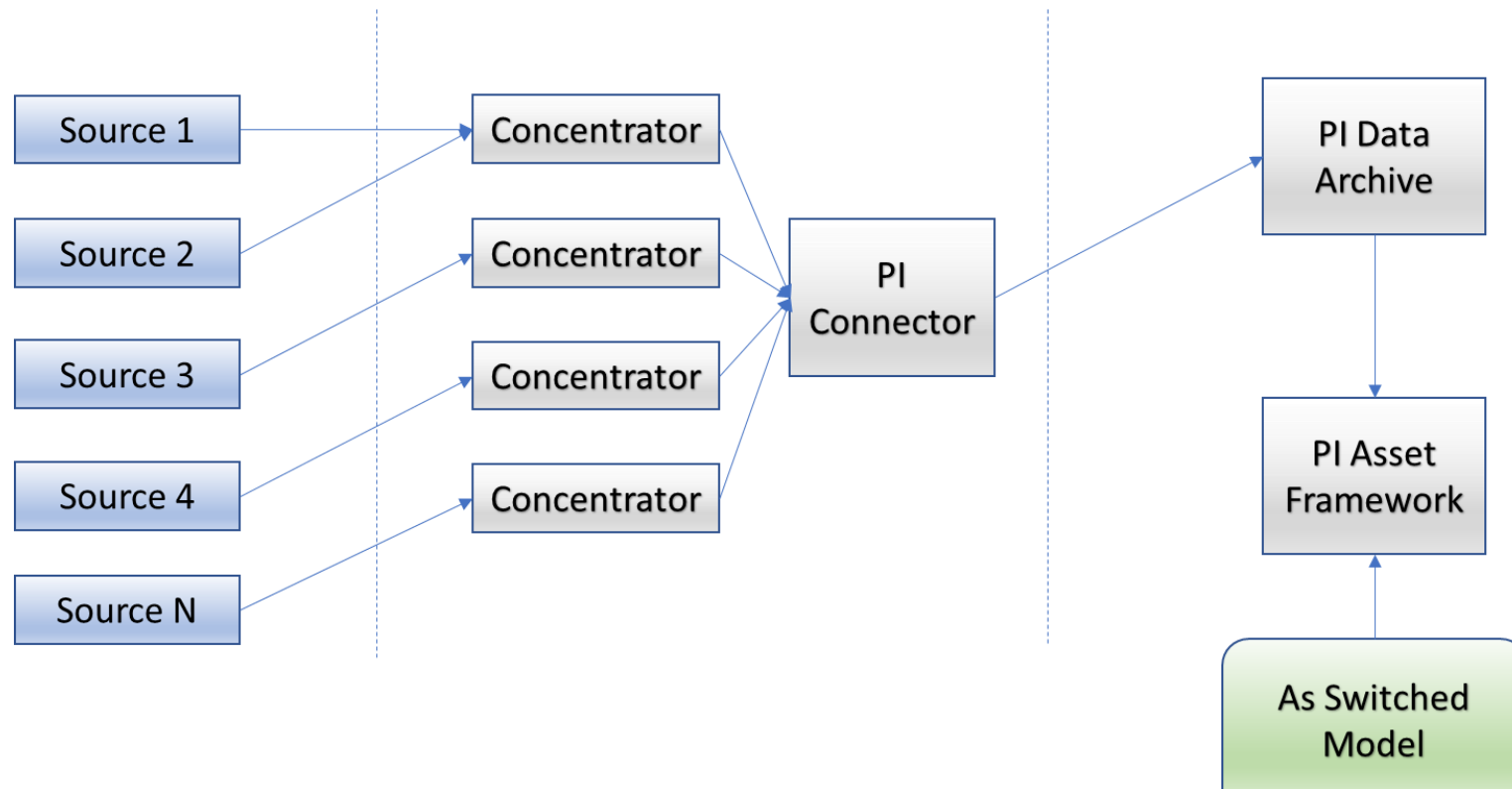
	Challenges Today	Investment Plans
SCADA	<ul style="list-style-type: none"> • 30-year-old, end-of-life application • Does not integrate with other systems, limited operational automation 	<ul style="list-style-type: none"> • Leading, integrated platform with visibility to Distributed Energy Resources • Functionality to automate operational processes during wildfire & PSPS events
DMS	<ul style="list-style-type: none"> • Not integrated with SCADA, no 'single pane of glass' view as the users have to complete manual data entry across DMS-SCADA 	<ul style="list-style-type: none"> • Consolidating 10 systems to a single, integrated user interface • Reduction in # outages-duration due to better load forecasting
Cybersecurity	<ul style="list-style-type: none"> • Lack of security controls make systems more susceptible to cyber attacks 	<ul style="list-style-type: none"> • Secure infrastructure with built-in enhanced network security controls
Network Infrastructure	<ul style="list-style-type: none"> • 20-35-year-old communications infrastructure result in unacceptable volume of truck rolls per year 	<ul style="list-style-type: none"> • Modern network assets and a new Field Area Network (FAN) which will provide resiliency, scalability, and reduce manual truck rolls

preADMS high level architecture

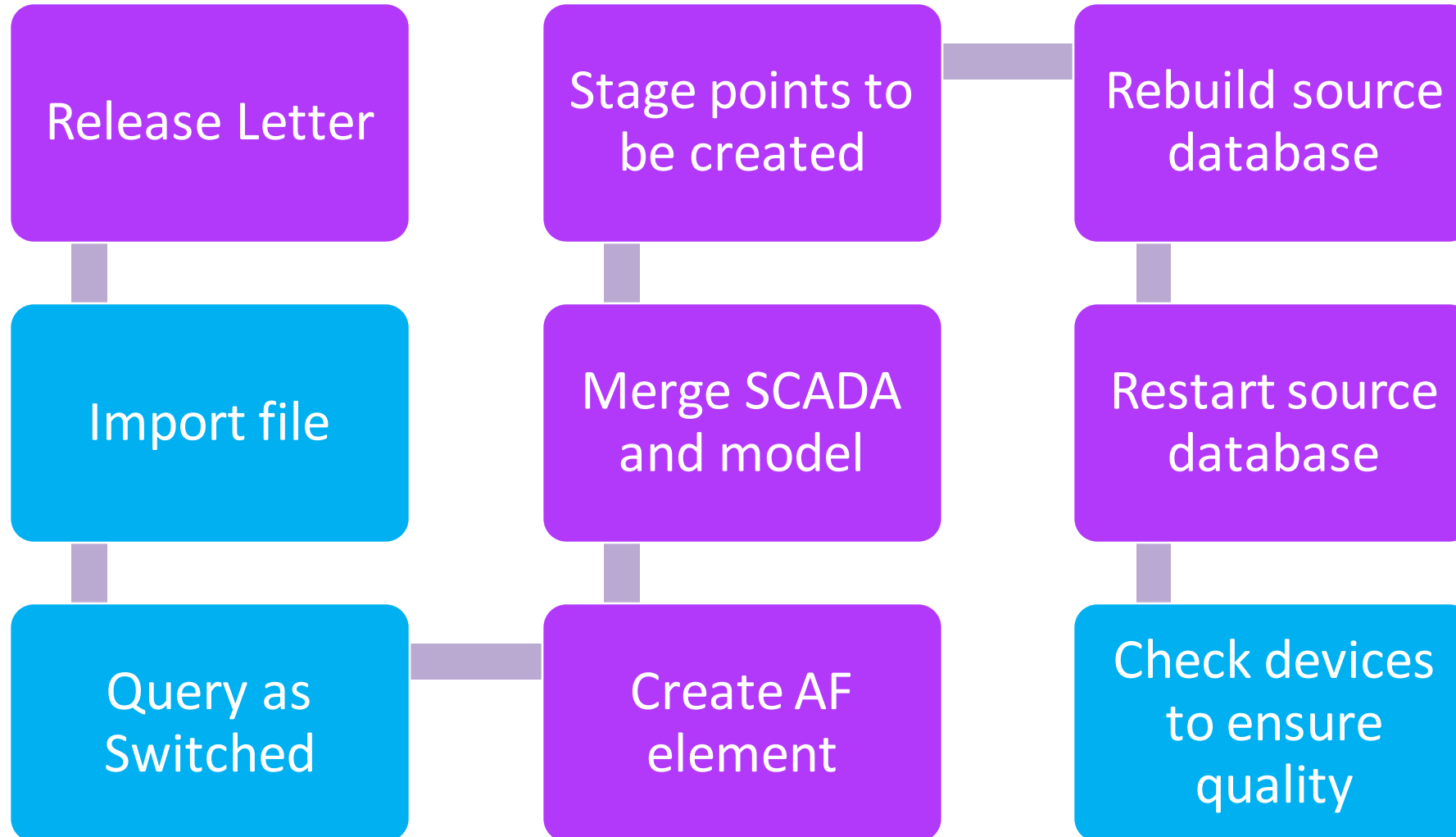
SEMI-AUTOMATED MERGING OF
AS-SWITCHED MODEL WITH SCADA
DATA

DIFFERENT DATA FEED FOR EACH
SCADA MASTER

UPDATE PROCESS CAN TAKE A
WEEK



New Device Process pre-ADMS



Merging and Staging

EDPI O&M Tools (Pretty Picture Edition)

WELCOME TO EDPI O&M TOOL SUITE.
HERE YOU'LL FIND TOOLS TO MAINTAIN ELECTRIC DISTRIBUTION ASSETS IN PI

STAGE A

SCADA

RELEASE STAGED DEVICES/REMOVE RETIRED DEVICES

UPDATE MULTIPLE AF ELEMENT'S DMS/SCADA INFORMATION

UPDATE AN AF ELEMENT'S DMS INFORMATION...

DO GUID/REPLACE_GUID UPDATES

LOAD THE DMS EXTRACT AND RTSCADA CURRENT MODEL...

CREATE PI TAGS FOR STAGED DEVICES...

WHAT TO DO TODAY? COPY PRODUCTION AF/EDP

QUIT

Stage A Field Device on DHUDPIN

Device Name Like:

Select device

Device Name	Type	ADR	Division	Substation	Frequency
REG 104K	2-150A-10%	ADR 8	Revere	GIRFFEN	50
REG 104G5	3-200A-10%	ADR 1	North Valley	GIRVAN	50
REG 104E5	3-200A-7.5%	ADR 1	North Valley	JFK	50
REG 11045	2-150A-5%	ADR 1	Sonoma	WILMITE RID	50
REG R104	3-300A E.25%	ADR 1	North Valley	WILMITE RID	50
REG REG 1104	1-110%	ADR 3	East Bay	WILMITE RID	50
REG REG 1104	1-110%	ADR 3	East Bay	WILMITE RID	50
REG REG 1104	1-110%	ADR 3	East Bay	WILMITE RID	50
REG REG 1104	1-110%	ADR 3	East Bay	WILMITE RID	50
REG REG 1104	1-110%	ADR 3	East Bay	WILMITE RID	50

Select DMS location

Select template

Review Point Mapping

Device Name	PI Tag Name	Active
Active Band Center Forward	band center forward	False
Auto Inhibit	auto inhibit	False
Automatic Status	automatic status	False
Band Center Forward	band center forward	False
Band Center Reverse	band center reverse	False
Bandwidth Forward	bandwidth forward	False
Bandwidth Reverse	bandwidth reverse	False
Block Lower Tap	block lower tap	False
Block Lower Voltage	block lower voltage	False
Block Raise Tap	block raise tap	False
Block Raise Voltage	block raise voltage	False
Control	control	False
Heartbeat Band Center Forward	heartbeat band center forward	False
Ldc Resistance Forward	ldc resistance forward	False
Ldc Resistance Reverse	ldc resistance reverse	False
Ldc Resistance Forward	ldc resistance forward	False
Ldc Resistance Reverse	ldc resistance reverse	False
Load Voltage	load voltage	False
Load Voltage Secondary	load voltage secondary	False
Neutral Count Calc	neutral count calc	False
Operation Count Calc	operation count calc	False
Power Factor	power factor	False
Power Flow Direction	power flow direction	False
Primary Current	primary current	False
Primary VA	primary va	False
Primary Wats	primary wats	False
Primary Voltage	primary voltage	False
Primary Watts	primary watts	False
Resettable Op Count Calc	resettable op count calc	False
Source Voltage Secondary	source voltage secondary	False

Verify points are realistic

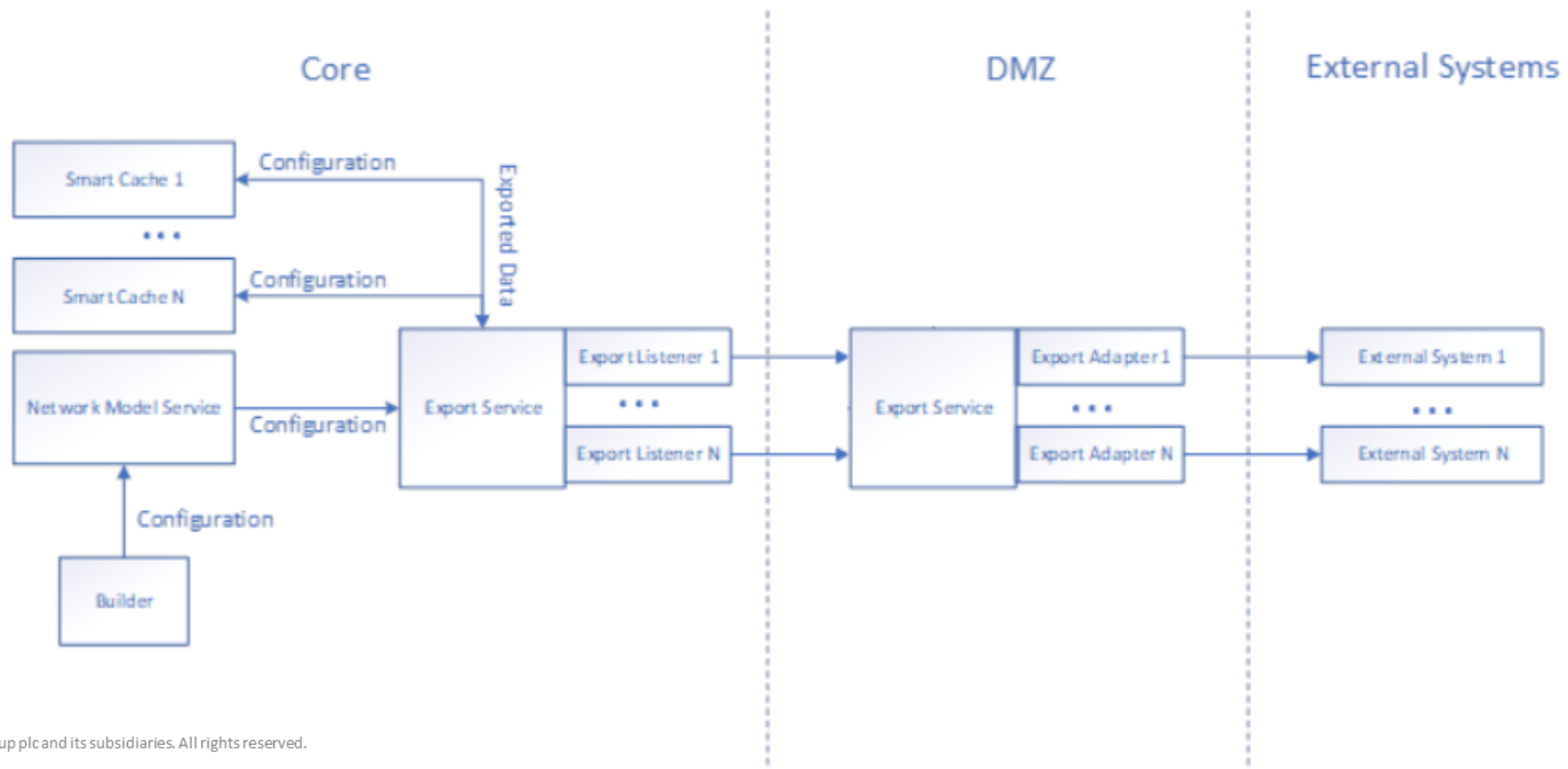
Stage It

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ADMS PI Adapter – High Level View

PI ADMS Integration

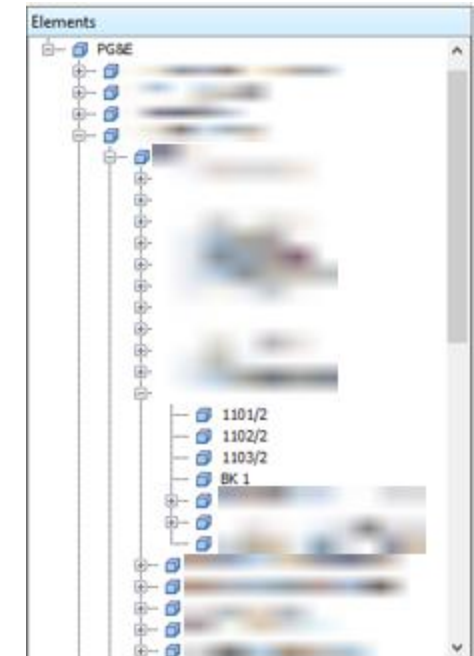
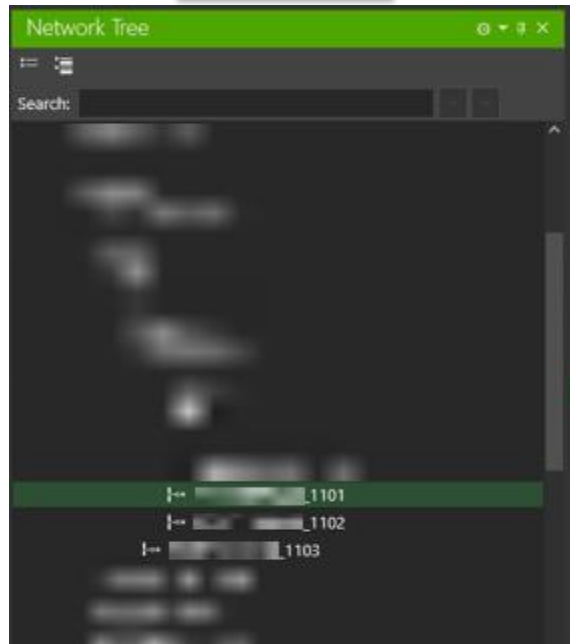
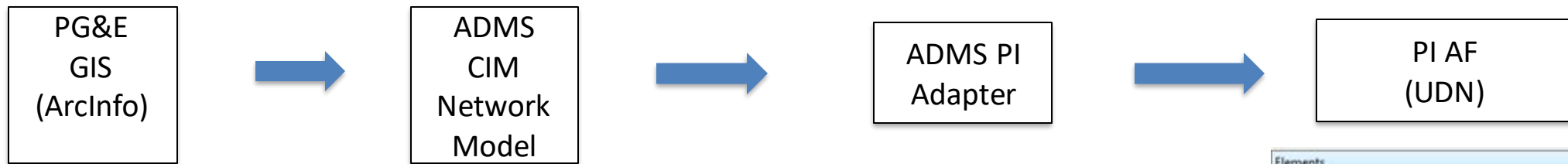
- Ability to automatically create the appropriate PI Tags and PI Asset Framework structures
- In addition to timeseries data, can transfer network model data in a form of PI AF structures
- Transfers data from caches directly and not from ADMS Historian (MS SQL) database
- Transfers timeseries data without applying historical deadbands



ADMS PI Adapter – PI AF Network Model

ADMS PI Adapter -> PI AF – Key Benefits

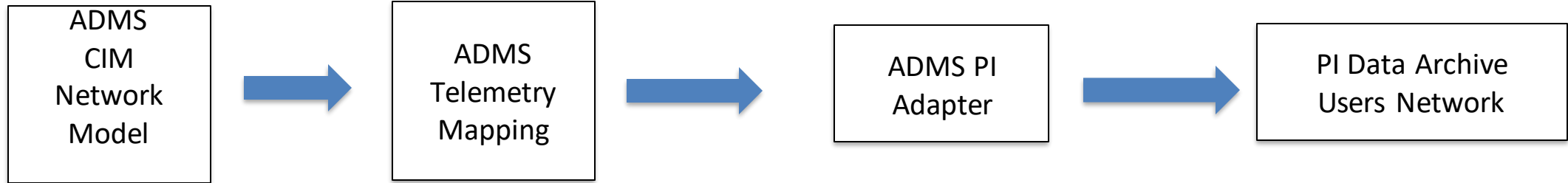
- AF model is completely synced with ADMS CIM network model
- Any update/modification/deletion of ADMS CIM model element will be automatically updated in PI AF
- Any topology change on ADMS CIM model will be reflected in PI AF



ADMS PI Adapter – PI Time-Series Tag

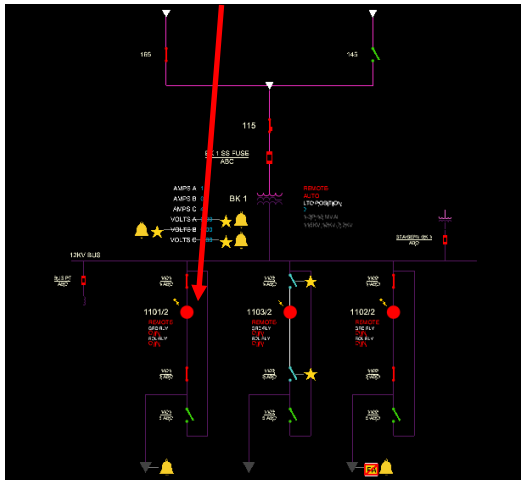
ADMS PI Adapter -> PI Data Archive – Key Benefits

- Time Series tag is either created automatically or linked to existing tag if previous tag exists
- AF attribute is automatically linked PI tag
- Any update/modification/deletion of ADMS SCADA signal will be automatically updated in PI Data Archive and PI AF
- Time series data received from field device is sent to PI in real-time (data shows in PI at the same time as ADMS HMI shows the data)



PI Tag

Network Asset
CB 1101/2



Device Signal
CB 1101/2

No.	Indicators	Signal	Signal type	DMS Value	Measurement type	Remote point type	Signal quality
1.		1101/2 TIME DC TOT ABC	Relay Trip	NORMAL	Status	Status	Good
2.		1101/2 INST DC TOT ABC	Relay Trip	NORMAL	Status	Status	Good
3.		1101/2 TOT GROUND	Relay Trip	NORMAL	Status	Status	Good
4.		1101/2 GROUND RLY ABC	Enabled	C/N	Status	Status	Good
5.		1101/2 UNDER FREQ TOT ABC	Relay Trip	NORMAL	Status	Status	Good
6.		1101/2 UNDER FREQ RLY ABC	Enabled	C/N	Status	Status	Good
7.		1101/2 RLY FAIL ABC	Custom	NORMAL	Status	Status	Good
8.		1101/2 CONTACT WEAR ALARM ABC	Custom	NORMAL	Status	Status	Good
9.		1101/2 SET A TRIP TOT ABC	Custom	NORMAL	Status	Status	Good
10.		1101/2 TRIP TOT ABC	Custom	NORMAL	Status	Status	Good
11.		1101/2 TST A	Custom	NORMAL	Status	Status	Good
12.		1101/2 TST B	Custom	NORMAL	Status	Status	Good
13.		1101/2 TST C	Custom	NORMAL	Status	Status	Good

Name	Value	Time Stamp
1101/2	1101/2	1/1/1970 12:00:00 AM
1101/2 ACTIVE SETTING GROUP ABC	0	3/7/2023 4:44:46.240 PM
1101/2 ACTIVE SETTING GROUP ABC_S	130	3/7/2023 4:44:46.240 PM
1101/2 AMPS A	0.62442 A	3/7/2023 4:44:46.240 PM
1101/2 AMPS A_S	0	3/7/2023 4:44:46.240 PM
1101/2 AMPS B	-5.7778E-05 A	3/7/2023 4:44:46.240 PM
1101/2 AMPS B_S	0	3/7/2023 4:44:46.240 PM
1101/2 AMPS C	-8.003944 A	3/7/2023 4:44:46.240 PM
1101/2 AMPS C_S	0	3/7/2023 4:44:46.240 PM
1101/2 AMPS GROUPS	-6.93462 A	3/7/2023 4:44:46.240 PM
1101/2 AMPS GROUPS_S	0	3/7/2023 4:44:46.240 PM
1101/2 BP ALARM ABC	1	3/7/2023 4:44:46.240 PM
1101/2 BP ALARM ABC_S	0	3/7/2023 4:44:46.240 PM
1101/2 CONTACT WEAR A	0 %	3/7/2023 4:44:46.240 PM
1101/2 CONTACT WEAR A_S	0	3/7/2023 4:44:46.240 PM
1101/2 CONTACT WEAR ABC	1	3/7/2023 4:44:46.240 PM

ADMS PI Cutover Requirements



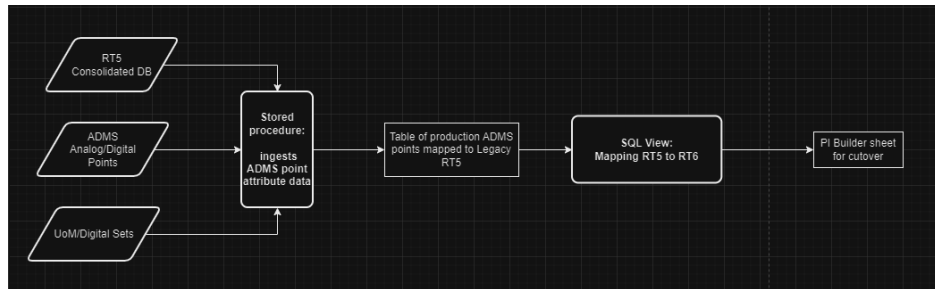
Historical trending between RTSCADA and ADMS



Existing client applications cannot be affected

RTSCADA to ADMS Cutover

How did the PG&E PI team cutover distribution data from RTSCADA to ADMS?



Select(s)	Name	ObjectType	NewName	engunits	pointtype	ptclassname	pointsource	DigitalSet	exdesc
x	ED.RT.1111.4.2057672.Value	PIPoint	FORTUNA FOR LR 686774 VOLTAGE TGT ABC		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_NOALARM	Humbolt
x	ED.RT.1111.4.2057716.Value	PIPoint	FORTUNA FOR LR 686774 TRIP TGT ABC		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_LOW	Humbolt
x	ED.RT.1111.1.1144595.Value	PIPoint	FORTUNA FOR LR 686774 TOTAL POWER FACTOR ABC		Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.3.168105.Value	PIPoint	FORTUNA FOR LR 686774 TOTAL OPERATION COUNTER		Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.1.1144590.Value	PIPoint	FORTUNA FOR LR 686774 TOTAL KW ABC	kW	Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.1.1144594.Value	PIPoint	FORTUNA FOR LR 686774 TOTAL KVAR ABC	kVAr	Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.4.2057670.Value	PIPoint	FORTUNA FOR LR 686774 TIME OC TGT ABC		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_LOW	Humbolt
x	ED.RT.1111.4.2057654.Value	PIPoint	FORTUNA FOR LR 686774 TGT GROUND		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_LOW	Humbolt
x	ED.RT.1111.3.168101.Value	PIPoint	FORTUNA FOR LR 686774 TGT COUNTER GROUND		Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.3.168104.Value	PIPoint	FORTUNA FOR LR 686774 TGT COUNTER C		Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.3.168103.Value	PIPoint	FORTUNA FOR LR 686774 TGT COUNTER B		Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.3.168102.Value	PIPoint	FORTUNA FOR LR 686774 TGT COUNTER A		Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.4.2057663.Value	PIPoint	FORTUNA FOR LR 686774 TGT C		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_LOW	Humbolt
x	ED.RT.1111.4.2057662.Value	PIPoint	FORTUNA FOR LR 686774 TGT B		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_LOW	Humbolt
x	ED.RT.1111.4.2057661.Value	PIPoint	FORTUNA FOR LR 686774 TGT A		Digital	Classic	ADMS	NORMAL_ALARM_1_NOOPEN_NOCLOSE_LOW	Humbolt
x	ED.RT.1111.1.1144626.Value	PIPoint	FORTUNA FOR LR 686774 SWITCH MODE NORMAL SGF MTT ...	A	Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.1.1144624.Value	PIPoint	FORTUNA FOR LR 686774 SWITCH MODE NORMAL PHASE M...	A	Float32	Classic	ADMS		Humbolt
x	ED.RT.1111.1.1144625.Value	PIPoint	FORTUNA FOR LR 686774 SWITCH MODE GROUND MTT AMP...	A	Float32	Classic	ADMS		Humbolt



Process:

SCADA RT5 DB consolidation

Data cleanup

Mapping data between RT5 and RT6

Creation of PI builder rename sheets

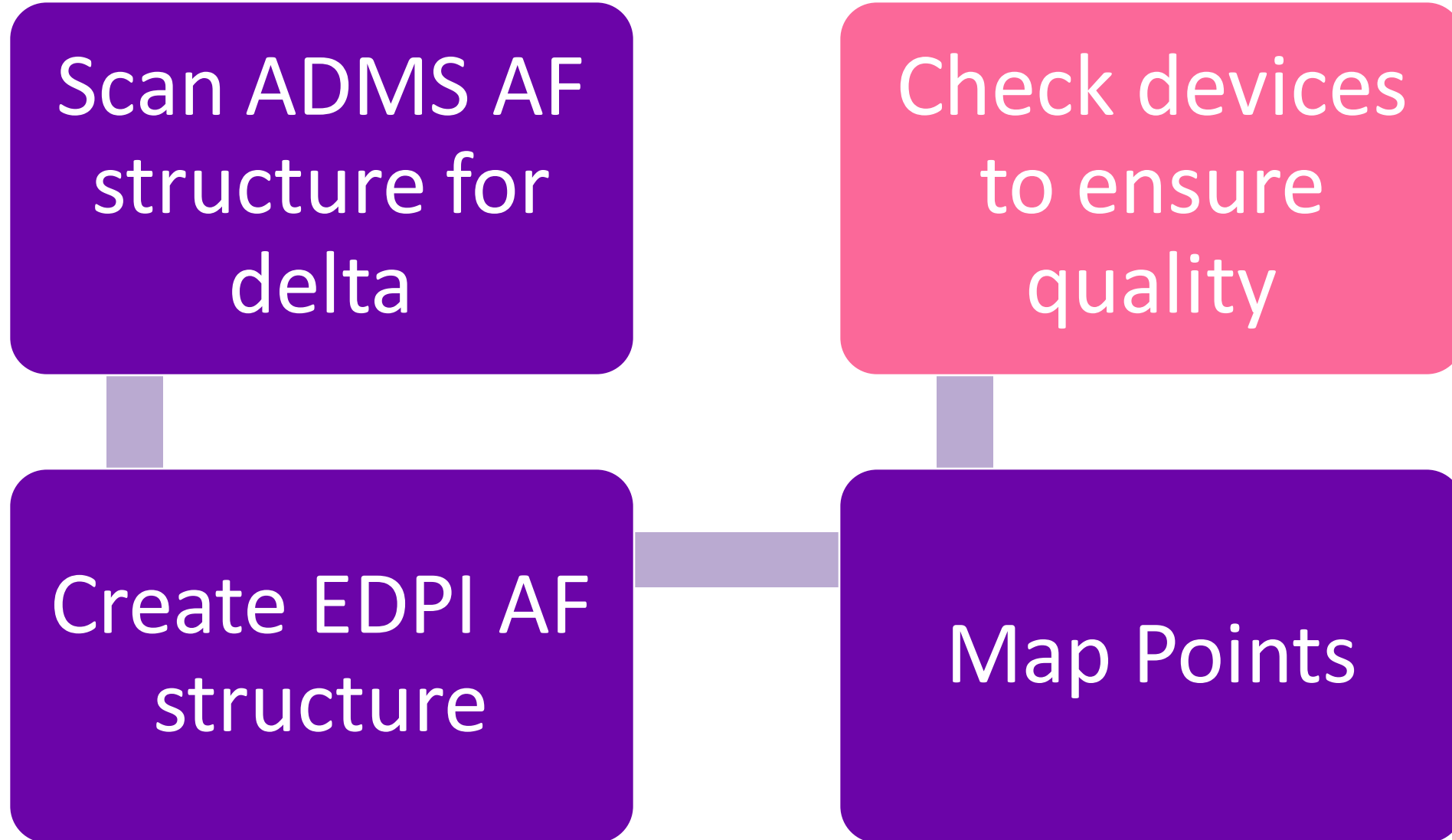


Technologies used:

SQL

PI builder

New device process from ADMS to PI System



Simplifying
Processes

Fewer Manual
Steps

Standard
access
method

Model and
Point Updates
in minutes

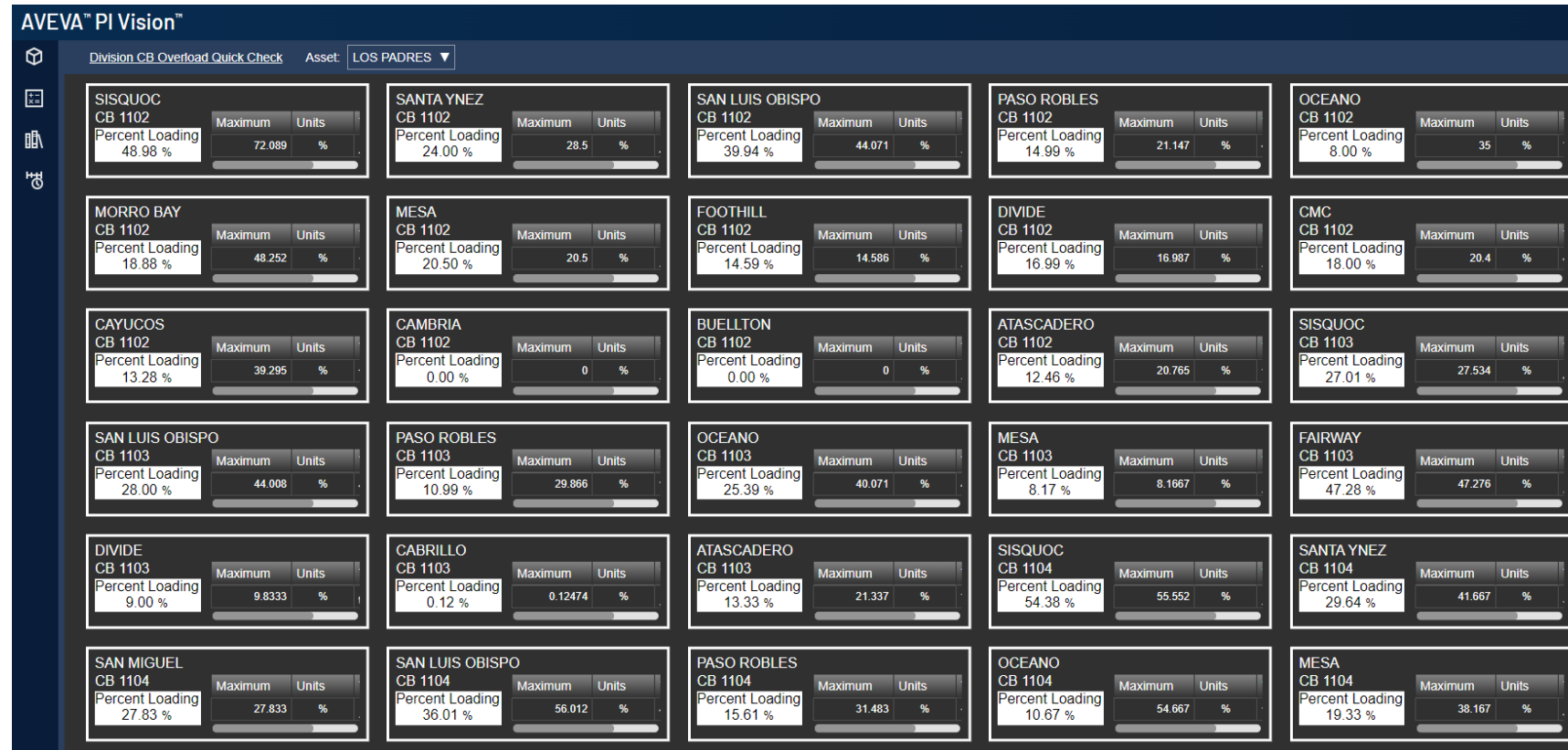
Point names
are readable

Less Custom
applications
for O&M

Using PI System for viewing ADMS data

PI System allows for user friendly access to ADMS data

- Users are familiar with the Client tools (PI Datalink, PI Vision, PI System Explorer)
- Programmatic access (PI WebAPI/AFSDK/RTQP engine)
- Ability to view RTSCADA and ADMS data all in one place
- PI AF Analyses/Notifications

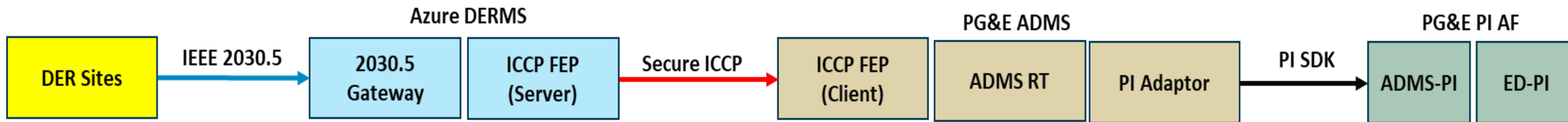


What's next for PI Integration at PG&E



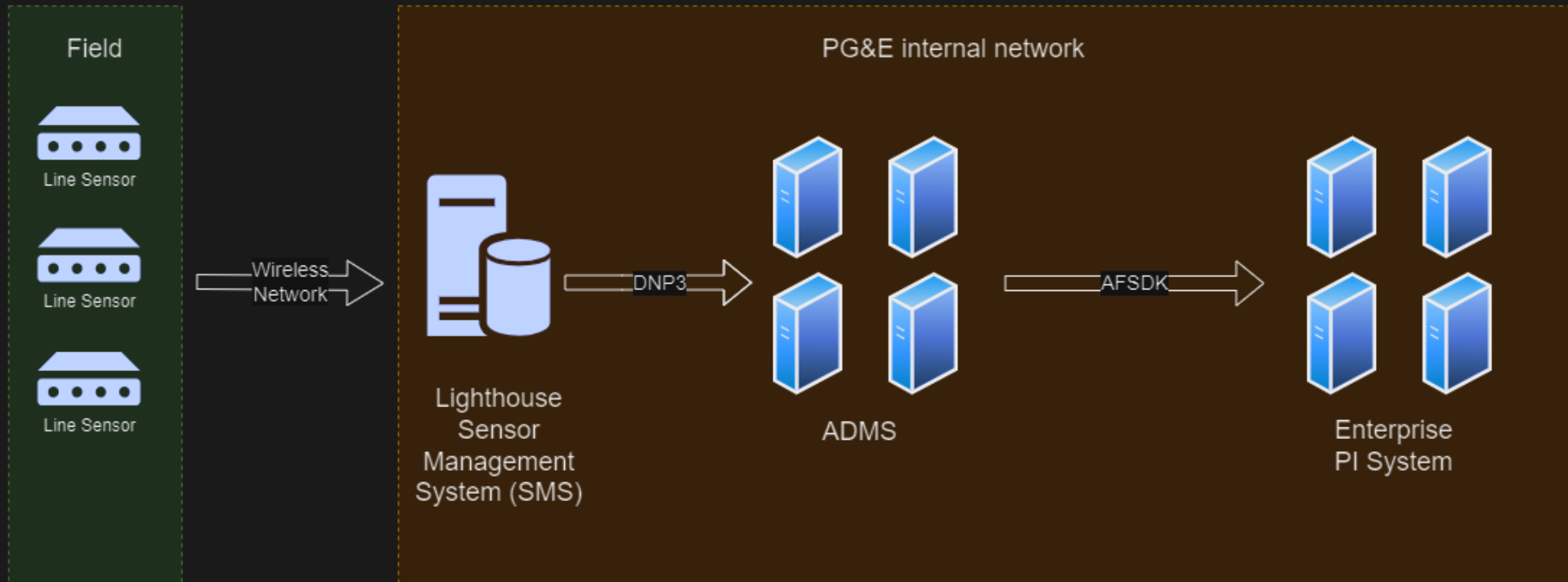
PI and DERMS Integration

- DERMS ADMS integration leverages SE Azure Cloud environment
- Consolidated data flow back to PI using SE PI adapter
- Automatic AF element creation of DERMS assets as they come online



PI System and Line Sensor Integration

High Level Overview





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Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



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