Data Infrastructure

Operational data management for Data Infrastructure

Presented by: PI Presales engineer
Byeongchul Yun

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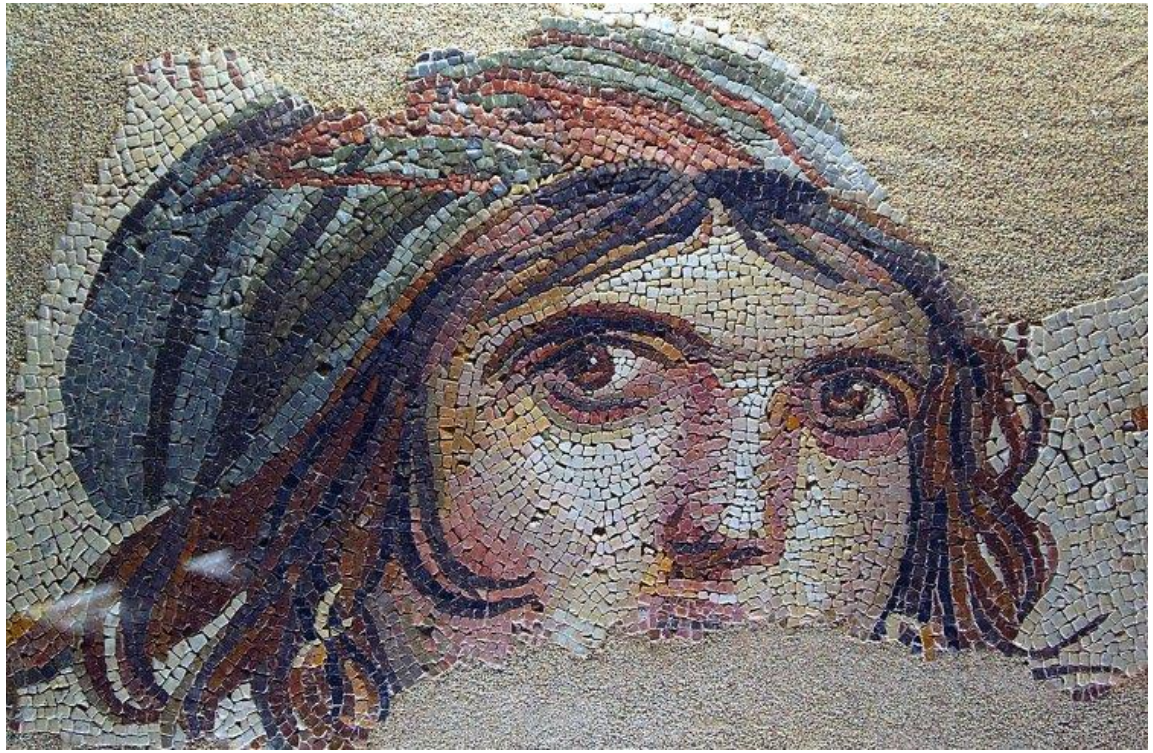
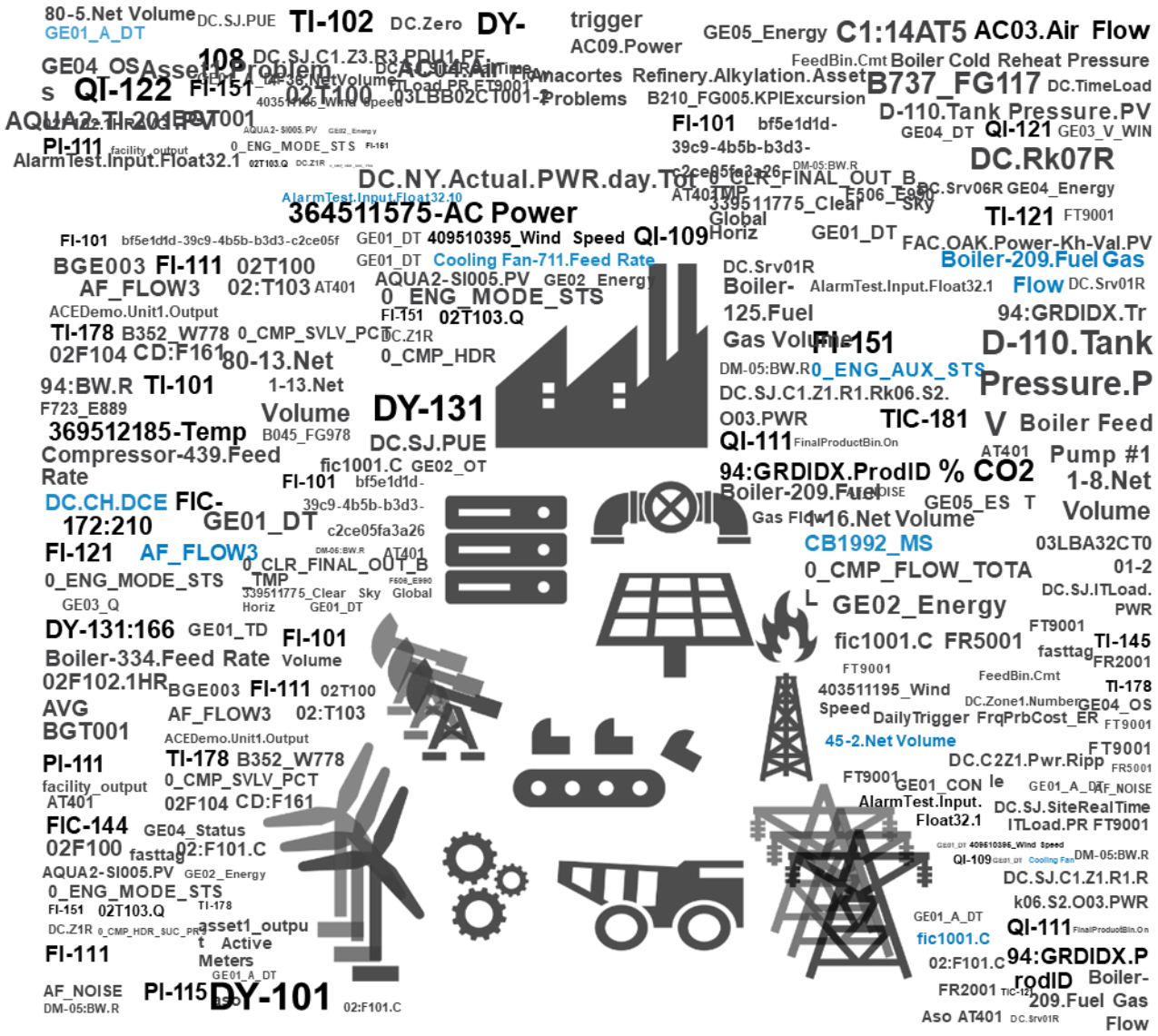
So, what can **we** do?

Structure Makes All the Difference



Can You Make Sense of Your Data?



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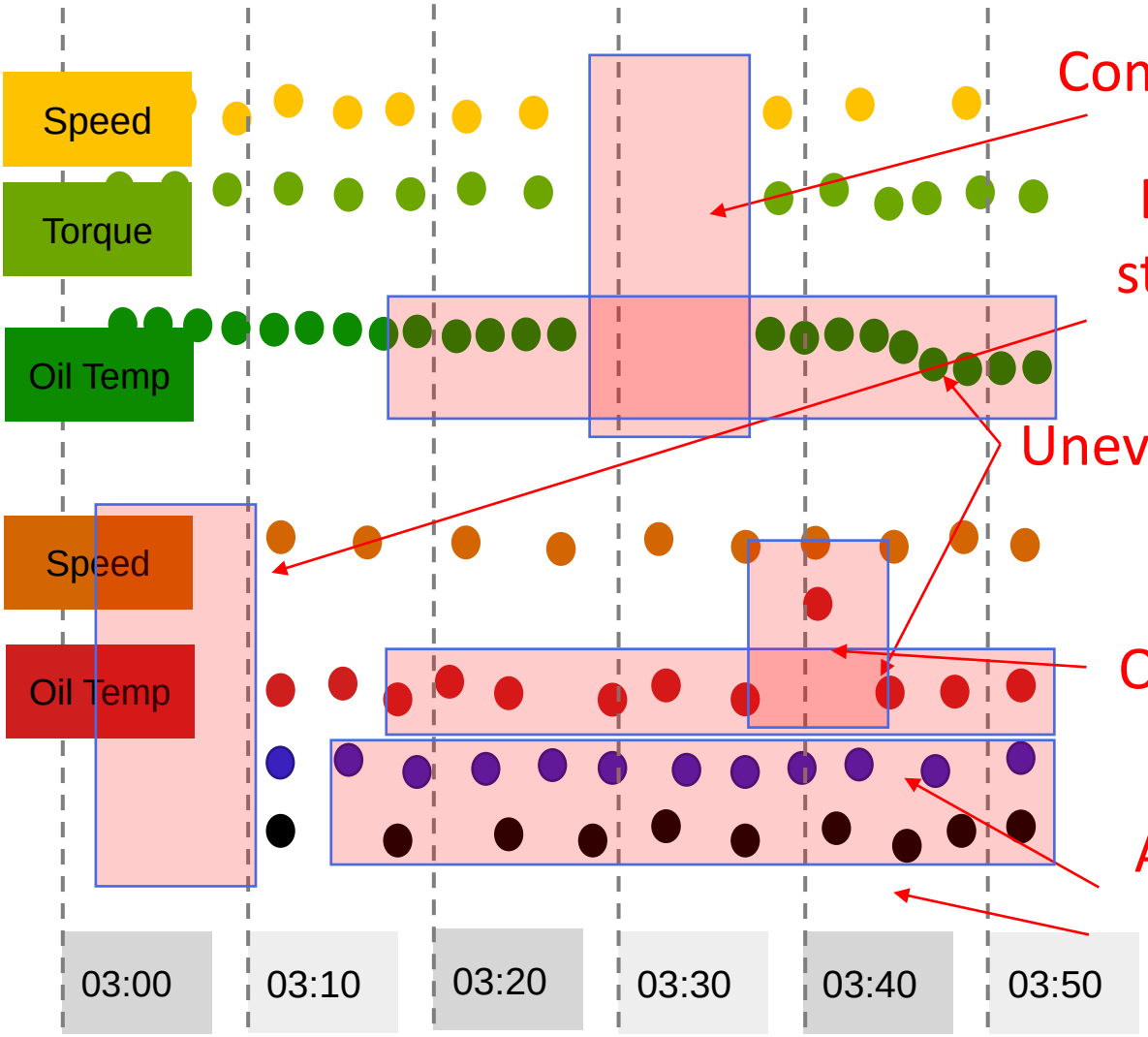
Time to Tables is Hard



Comm Failure

Different start times

Uneven Spacing

Spike / Out of Range

Additional Measure

	Speed	Torque	Oil Temp	Speed	Oil Temp
03:00	9.8	25	50	✗	✗
03:10	10	24	50	10.0	60
03:20	10	25	50	10.2	60
03:30	✗	✗	✗	9.8	60
03:40	9.9	25	50	10.0	120
03:50	9.9	25	45	10.1	60

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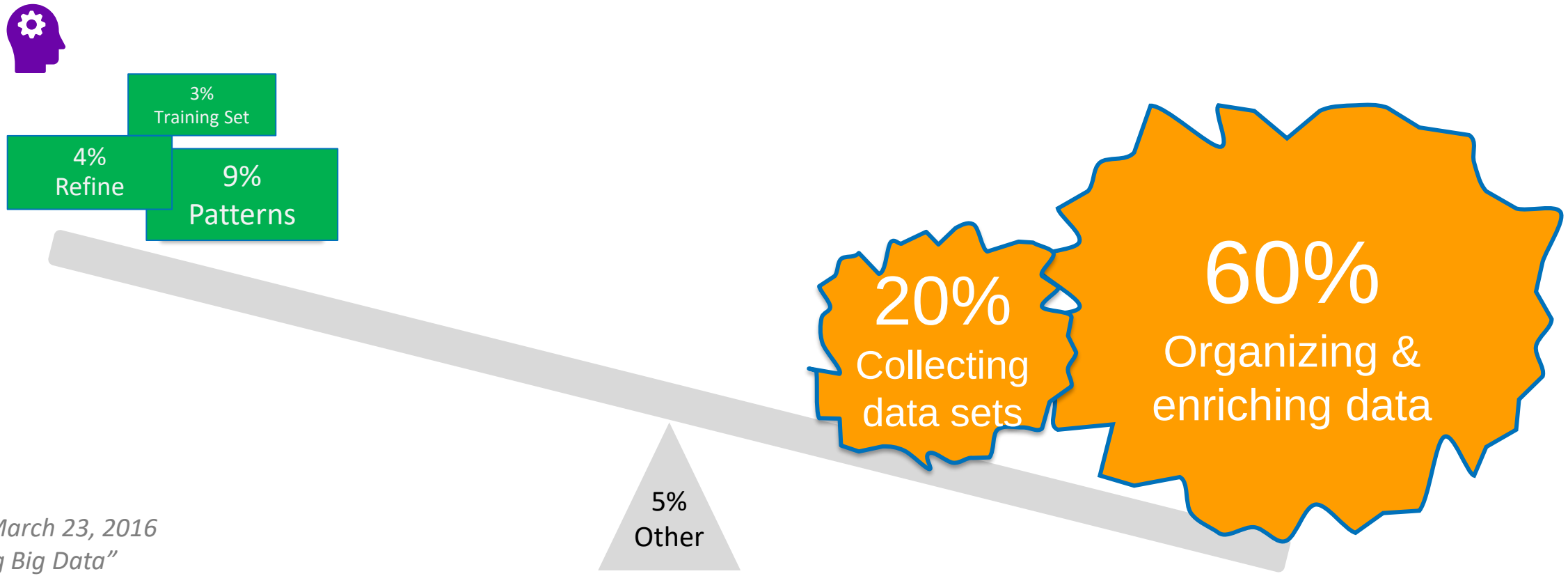
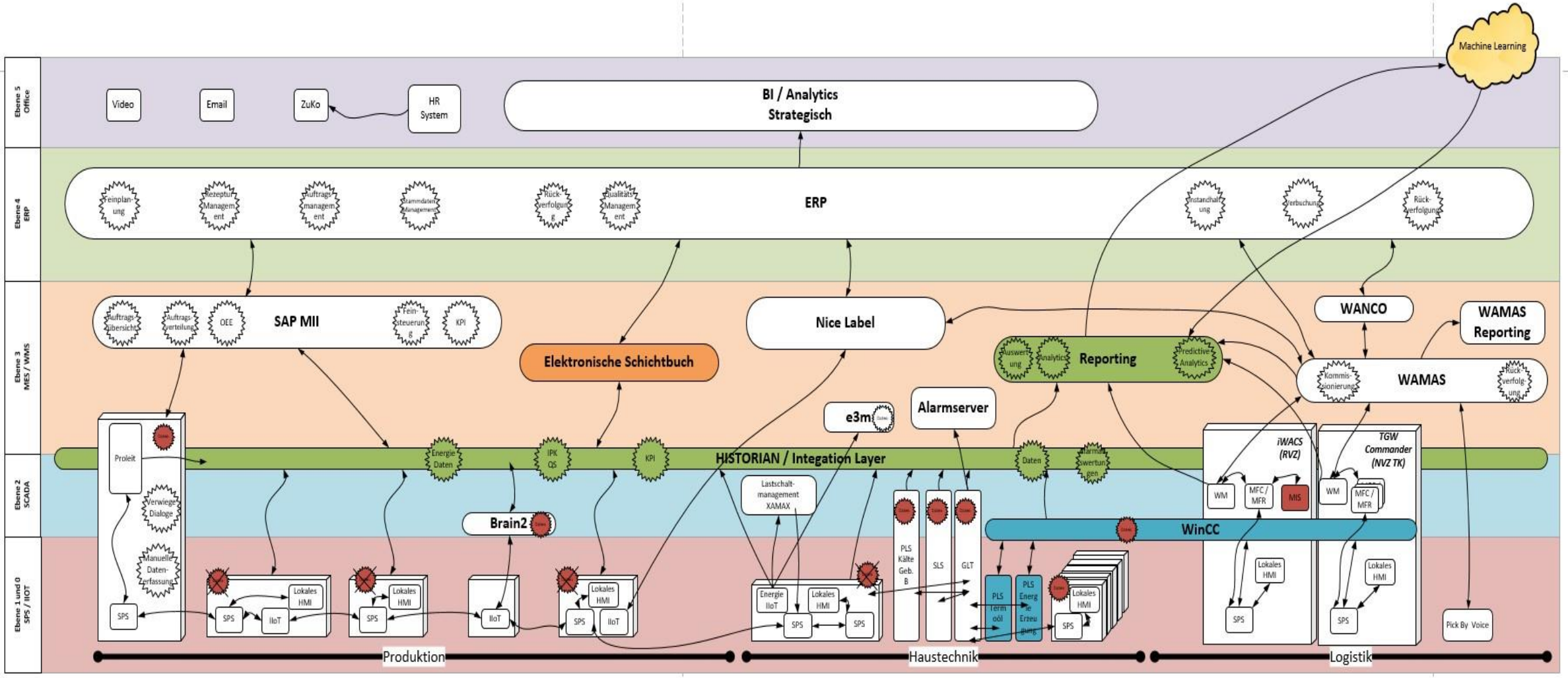
80% of Investment Lost to Data Preparation that could be automated



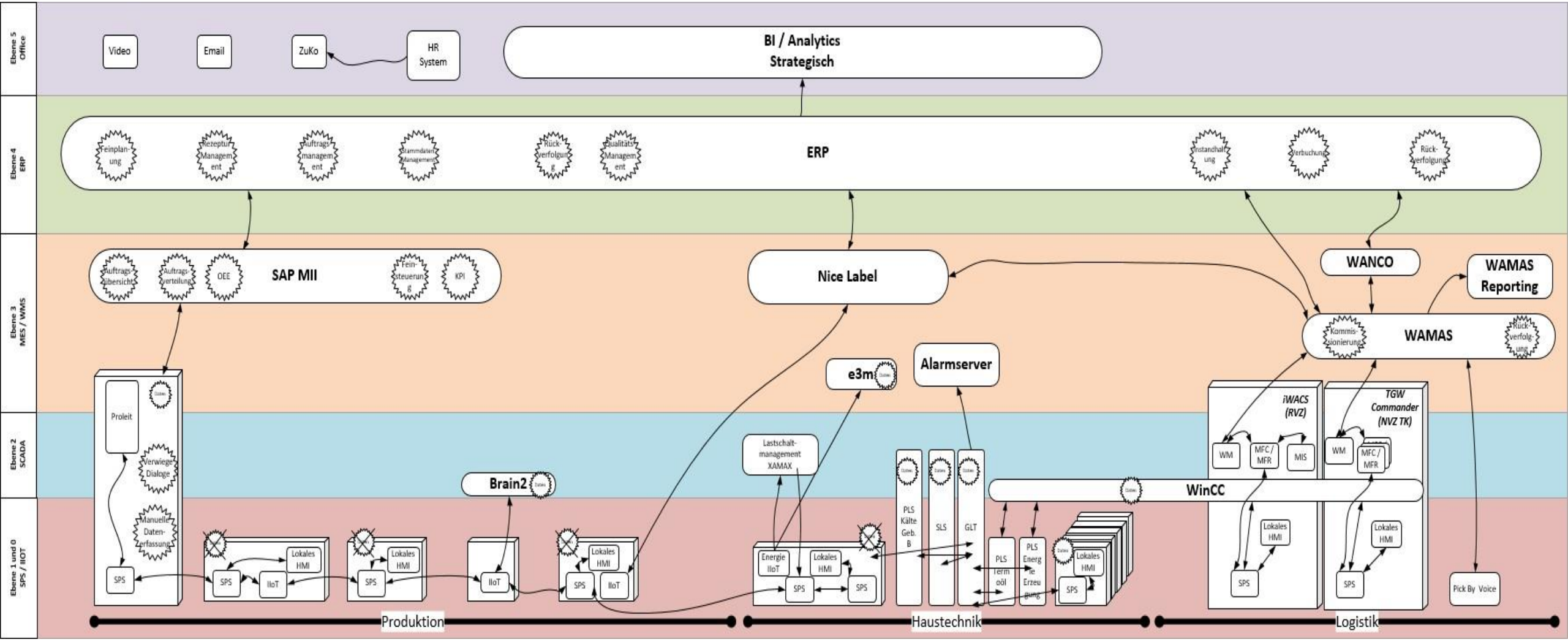
Forbes, March 23, 2016
"Cleaning Big Data"

“It should be easy…..**shouldn’t it?**”

where you want to be

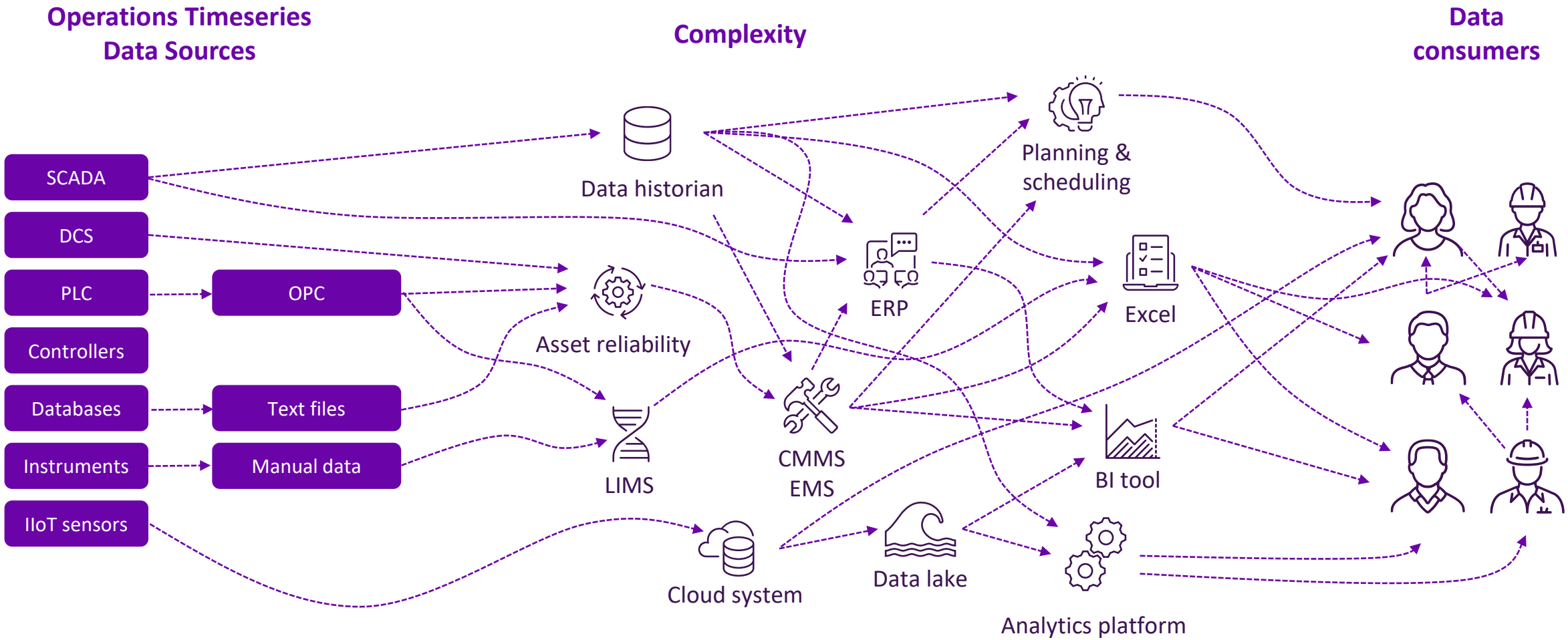


where you are…



“Let us think one by one...”

Managing Operations Data is Complex



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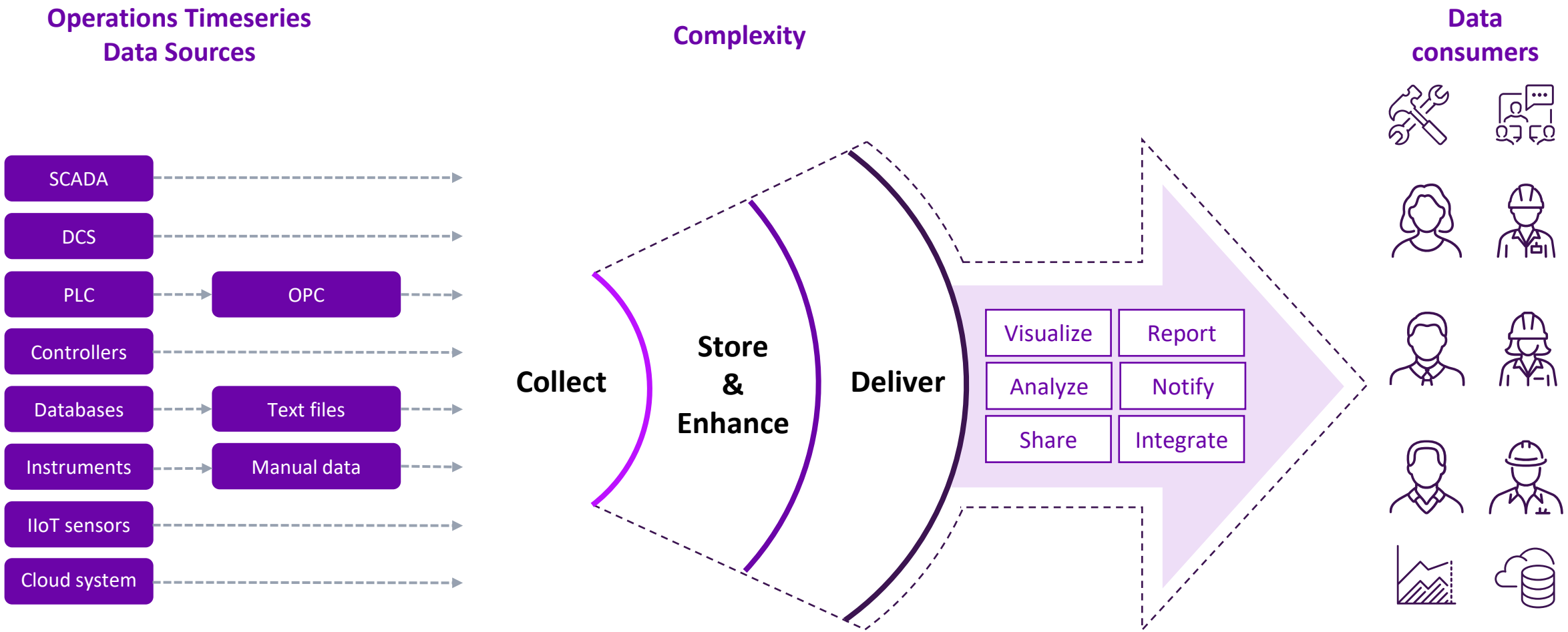
Taking the Data Infrastructure Approach



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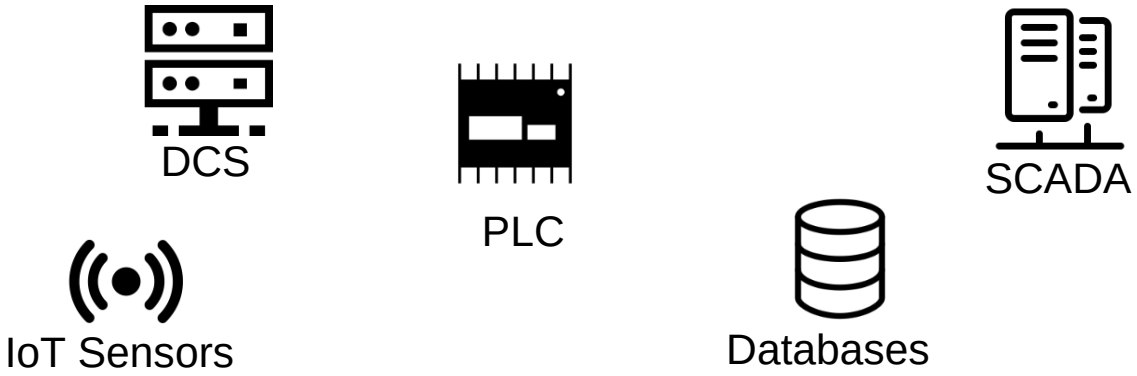
PI Connectors, PI Interfaces, PI Adapters

High performance

Secure architecture

225+ standard interfaces

Collects **time-series** and **meta-data** from any source



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PI Manual Logger

- **PI Manual Logger PC**
  - Configure tours
  - Enter, review, edit, or approve the data

- **PI Manual Logger Web**
  - Collect data from equipment with a mobile device
  - Barcode to identify tags and/or enter data (Inateck BCST-10, Motorola CS3070)

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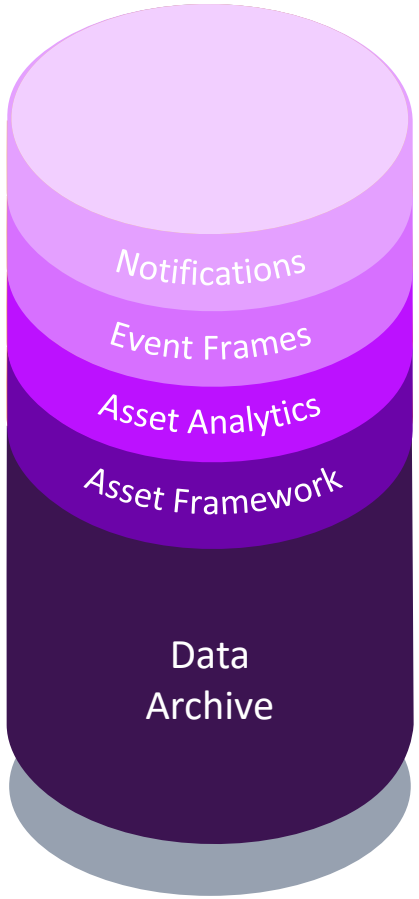
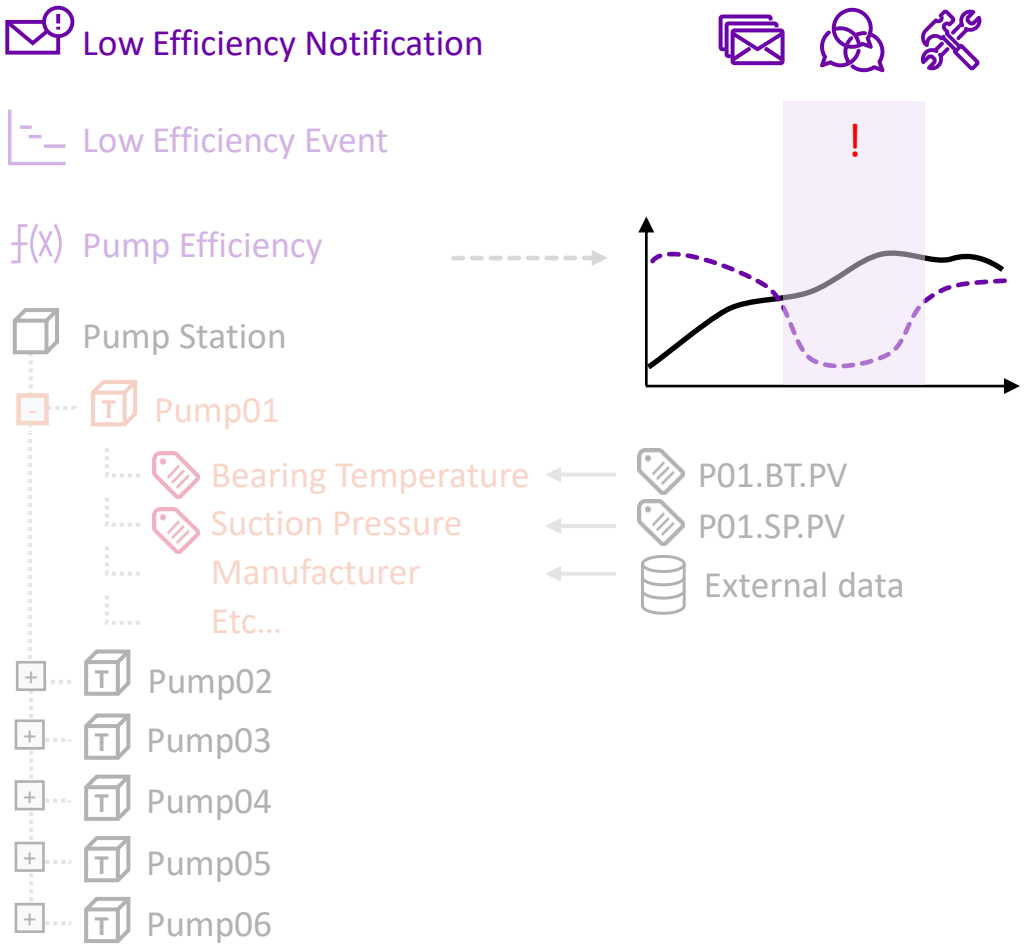
Store and Enhance



PI Server



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PI Asset Framework Maturity Levels

"Start Simple but Simply Start" Kevin Milliman, DCP Midstream

SAP PM,
IBM Maximo,
Lab Data,
Linked Tables,
Financial Data,
Etc.

Level 1

Data Directory (tag mapping)
Abstraction (std. Lexicon)
Normalization (UOM, time zones)
Organization (Dynamic Hierarchy)

Level 2

Metadata Integration - add **context** via Data References and Linked Tables

Simple calculations (data quality, totals, averages)

Level 3

Complex Calculations (CBM, OEE, rollups)

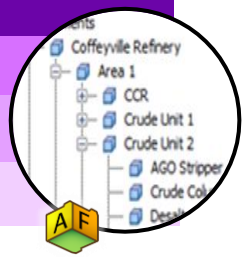
Use of **Event Frames** (downtime, startups, shifts tracking)

Notifications (emails, work order generation via web service)

Level 4

Real Time Analytics (predictive, equation-based: Stoner equation etc.)

Fine-tuning based on Actual vs Predicted



PI Data Archive

- Tag-based, **High Fidelity** historical data ingress/egress
- **"Rich" Time Series Data** created by PI AF analytics & calculations (health index, efficiency etc.)
- **Future** Data (forecasts, projections etc.)

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PI Vision

An easy to use, self-service, scalable visualization solution

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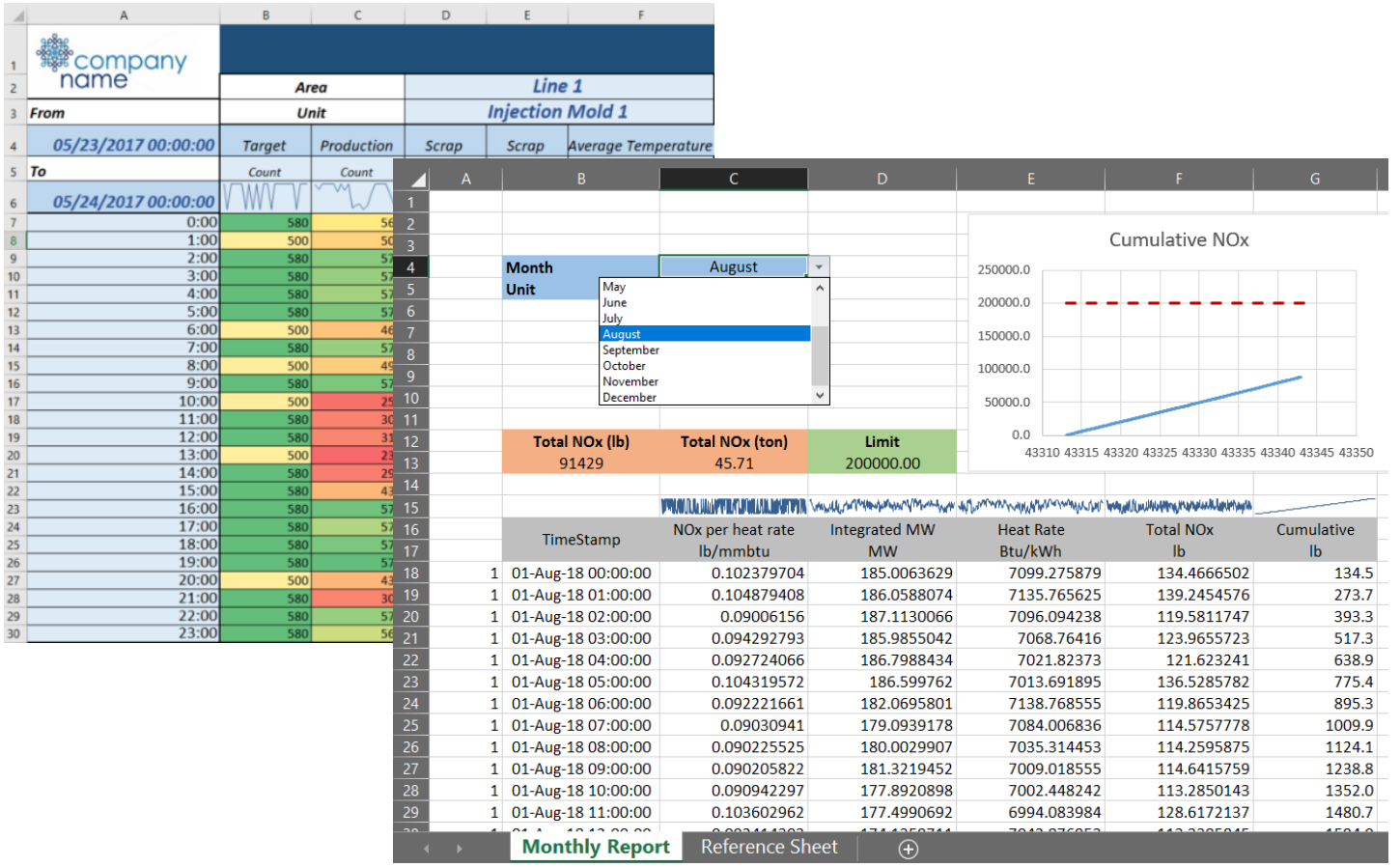
Collect

Store and enhance

Deliver

PI Datalink

Delivering PI System Data into Microsoft Excel



company name					
	Area		Line 1		
From	Unit		Injection Mold 1		
05/23/2017 00:00:00	Target	Production	Scrap	Scrap	Average Temperature
To	Count	Count			
05/24/2017 00:00:00					
0:00	580	56			
1:00	500	50			
2:00	580	57			
3:00	580	57			
4:00	580	57			
5:00	580	57			
6:00	500	46			
7:00	580	57			
8:00	500	49			
9:00	580	57			
10:00	500	25			
11:00	580	30			
12:00	580	31			
13:00	500	23			
14:00	580	25			
15:00	580	43			
16:00	580	57			
17:00	580	57			
18:00	580	57			
19:00	580	57			
20:00	500	43			
21:00	580	30			
22:00	580	57			
23:00	580	56			

Month: August

Unit

May
June
July
August
September
October
November
December

Cumulative NOx

250000.0
200000.0
150000.0
100000.0
50000.0
0.0
43310 43315 43320 43325 43330 43335 43340 43345 43350

Total NOx (lb)	Total NOx (ton)	Limit
91429	45.71	200000.00

	TimeStamp	NOx per heat rate lb/mmbtu	Integrated MW MW	Heat Rate Btu/kWh	Total NOx lb	Cumulative lb
1	01-Aug-18 00:00:00	0.102379704	185.0063629	7099.275879	134.4666502	134.5
1	01-Aug-18 01:00:00	0.104879408	186.0588074	7135.765625	139.2454576	273.7
1	01-Aug-18 02:00:00	0.09006156	187.1130066	7096.094238	119.5811747	393.3
1	01-Aug-18 03:00:00	0.094292793	185.9855042	7068.76416	123.9655723	517.3
1	01-Aug-18 04:00:00	0.092724066	186.7988434	7021.82373	121.623241	638.9
1	01-Aug-18 05:00:00	0.104319572	186.599762	7013.691895	136.5285782	775.4
1	01-Aug-18 06:00:00	0.092221661	182.0695801	7138.768555	119.8653425	895.3
1	01-Aug-18 07:00:00	0.09030941	179.0939178	7084.006836	114.5757778	1009.9
1	01-Aug-18 08:00:00	0.090225525	180.0029907	7035.314453	114.2595875	1124.1
1	01-Aug-18 09:00:00	0.090205822	181.3219452	7009.018555	114.6415759	1238.8
1	01-Aug-18 10:00:00	0.090942297	177.8920898	7002.448242	113.2850143	1352.0
1	01-Aug-18 11:00:00	0.103602962	177.4990692	6994.083984	128.6172137	1480.7

Monthly Report | Reference Sheet

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PI Integrators

Prepare, clean and deliver PI System data to external systems

Business Analytics

- Connect to any BI platform
- Develop machine learning models
- Available for **Streaming** and **Batch**

SAP HANA, Microsoft SQL Server, hadoop, Google Cloud Platform, Apache kafka, Azure, Power BI, aws, TIBCO The Power of Now

ArcGIS

See your real-time data on a map

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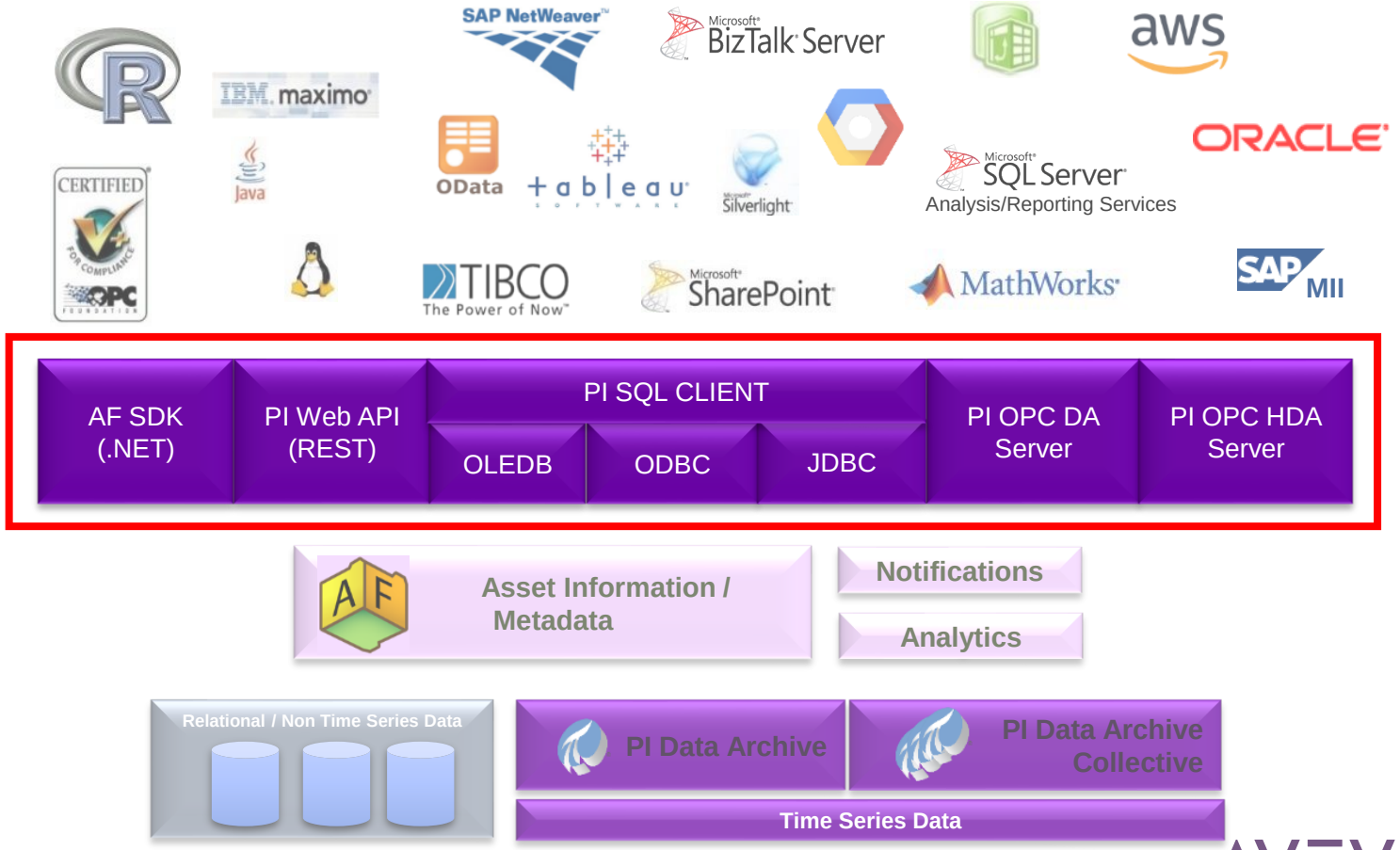
PI System Access

A **developer technologies suite** to build custom applications or integrate PI with other systems



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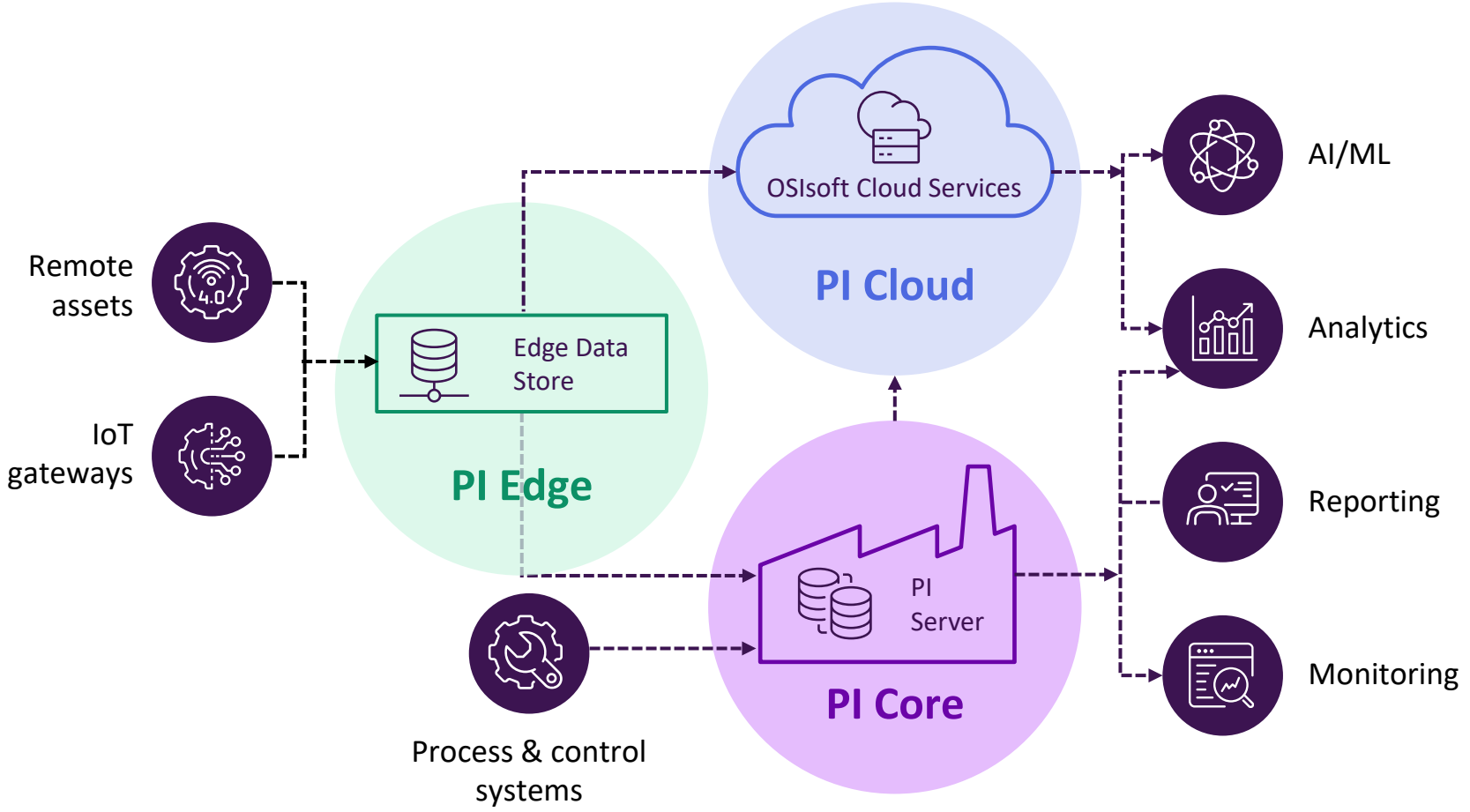
PI System

PI System
enables edge-to-cloud visibility and intelligence



Secure access to **structured** and **cleansed** operational data from its source to whomever and wherever it's needed

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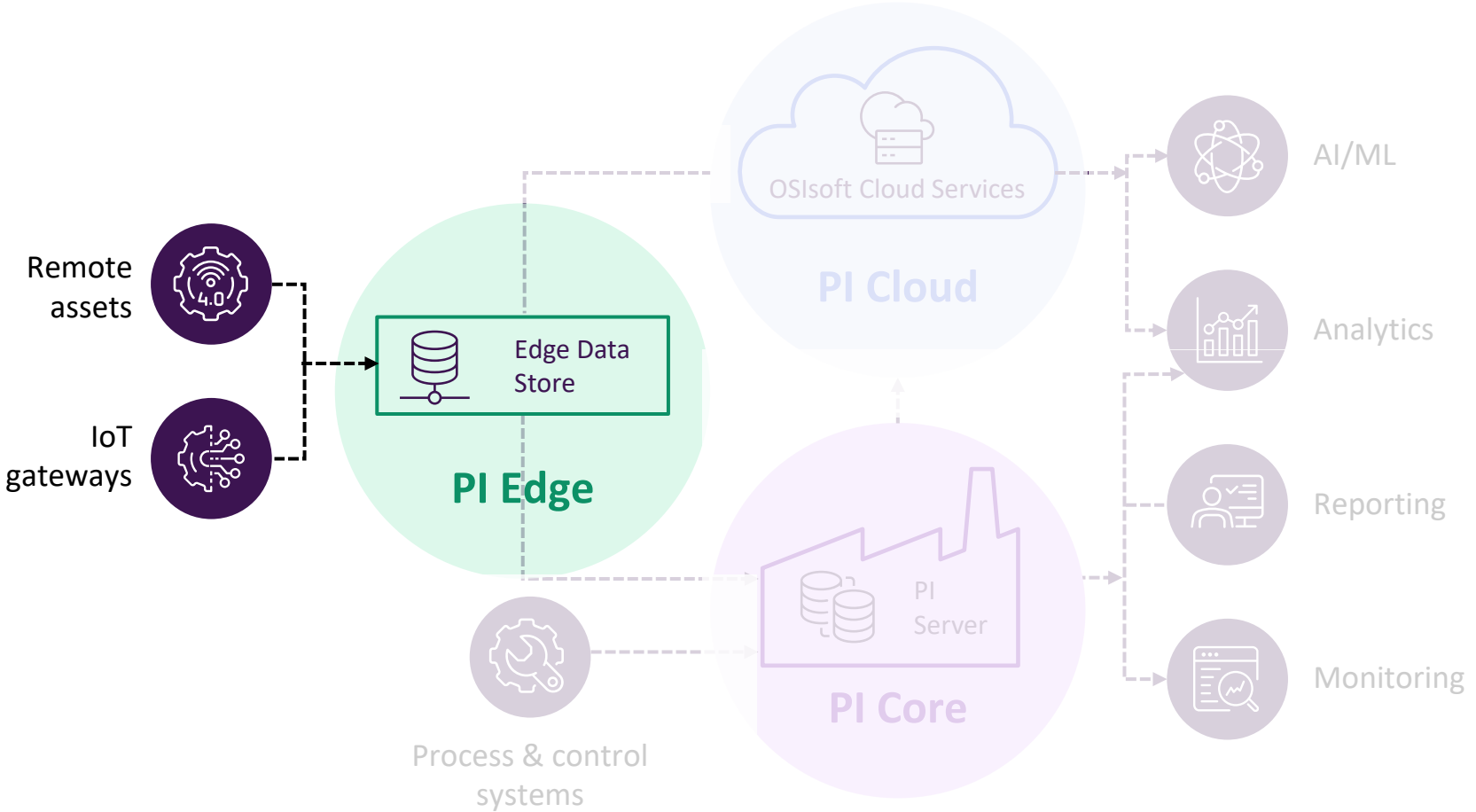
“Beyond On-premise, edge-to-cloud...”

PI Edge

Support edge IIoT patterns

Lightweight software supported on rugged devices

- Configuration options to optimize bandwidth
- Empower users in the field, beyond the four walls
- Enable high speed edge analytics



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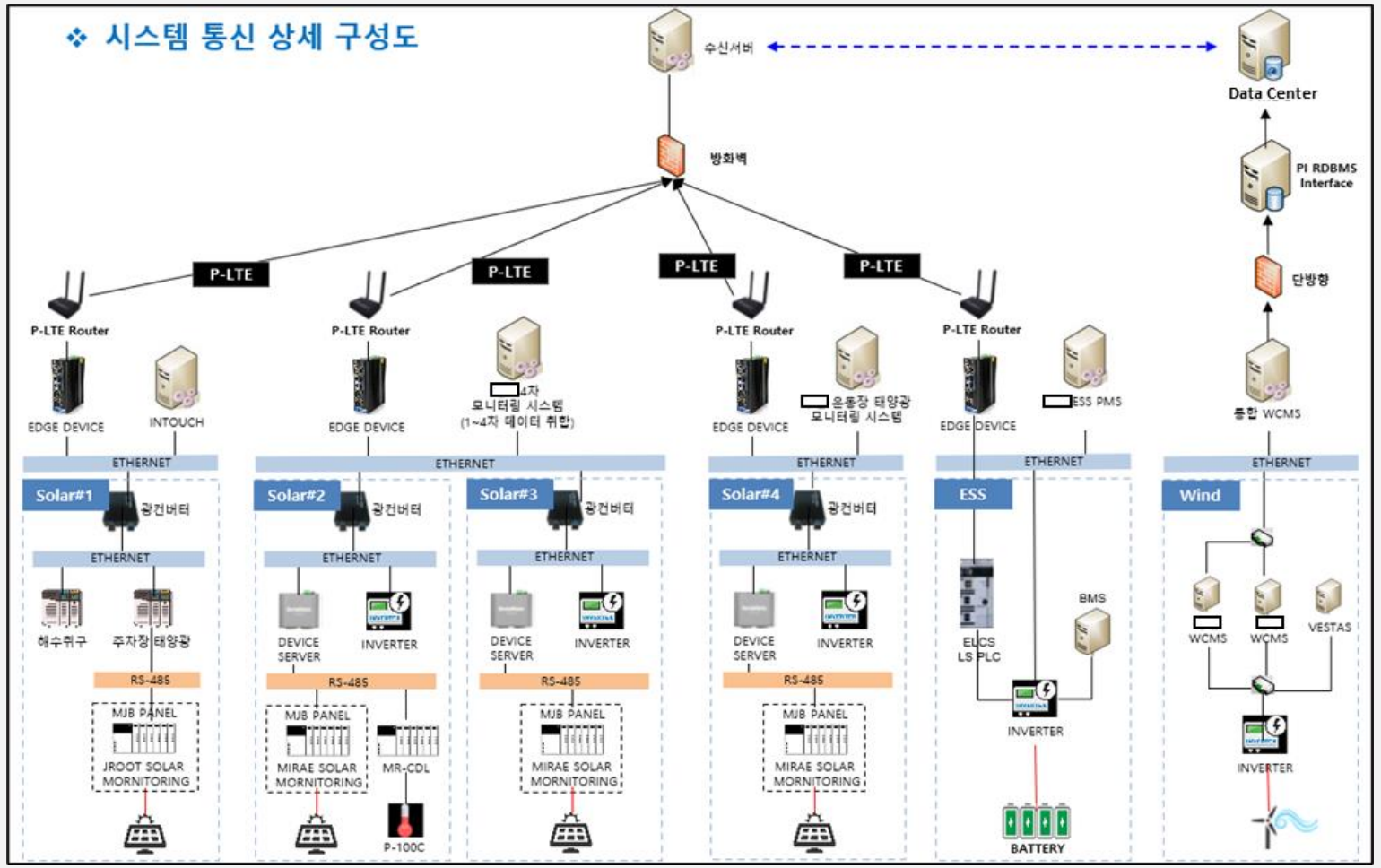
PI Edge Reference



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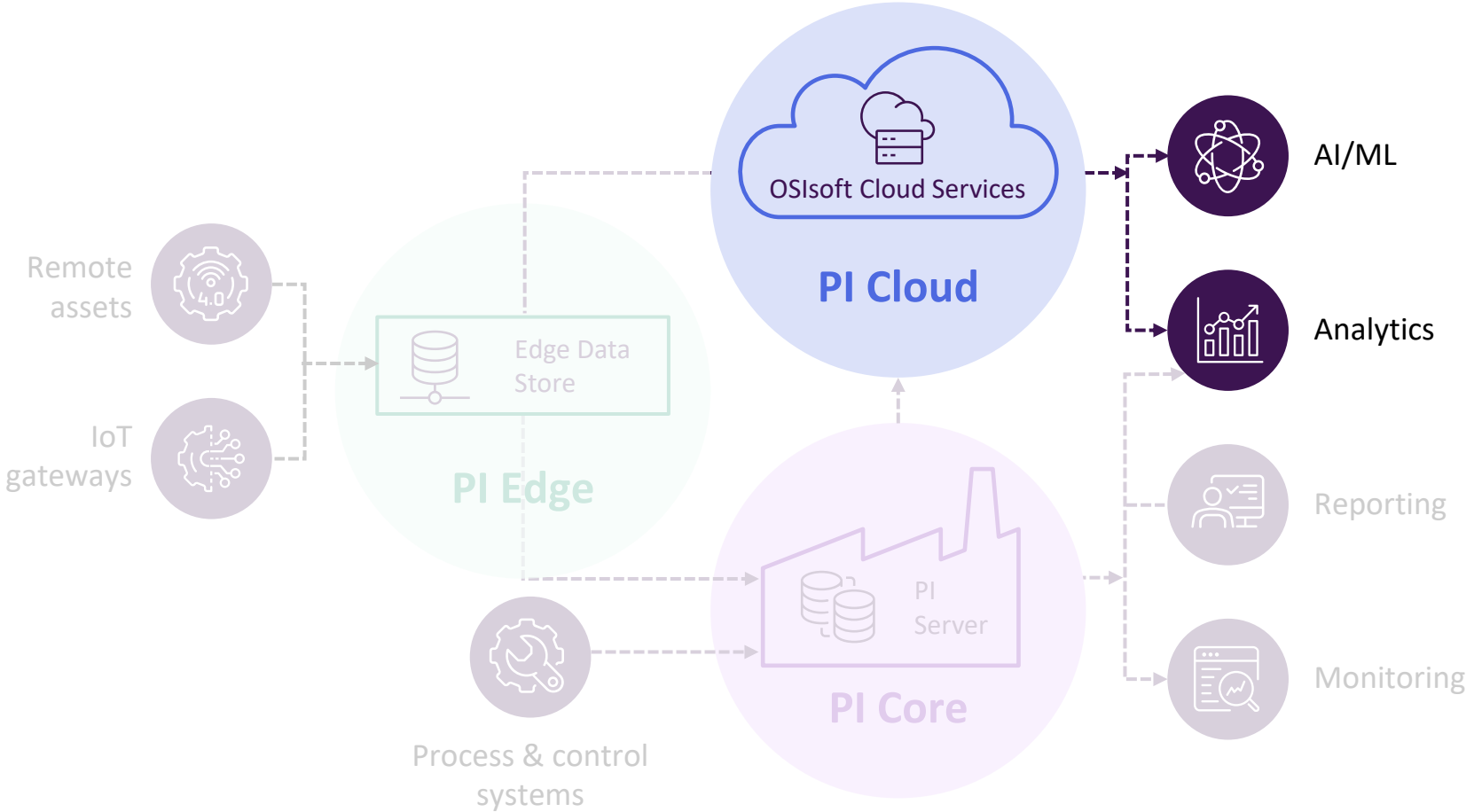
PI Cloud

Analytics and data sharing at scale

Cloud-native Managed Service built for elasticity and resiliency

- Supports scalable cloud workloads for advanced analytics
- Data sharing creates new value networks



Secure access to **structured** and **cleansed** operational data from its source to whomever and wherever it's needed

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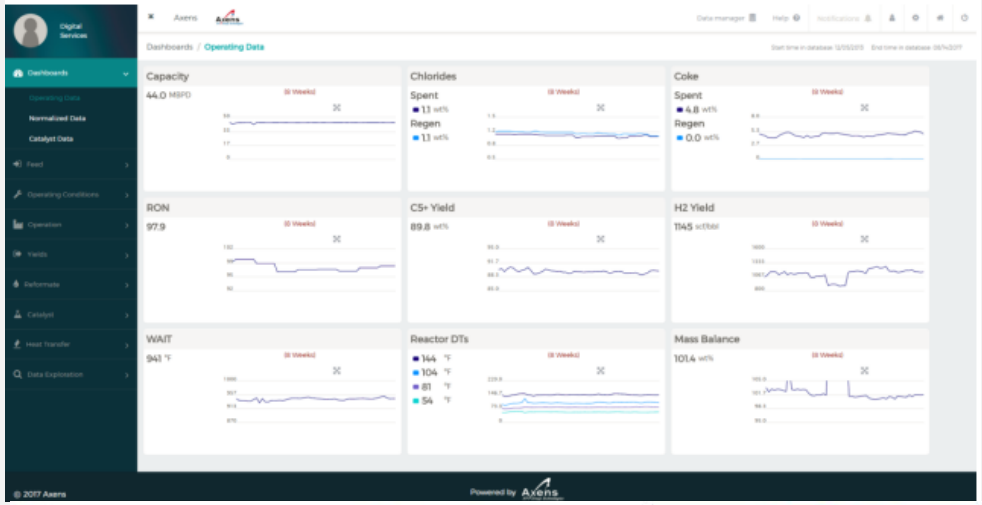
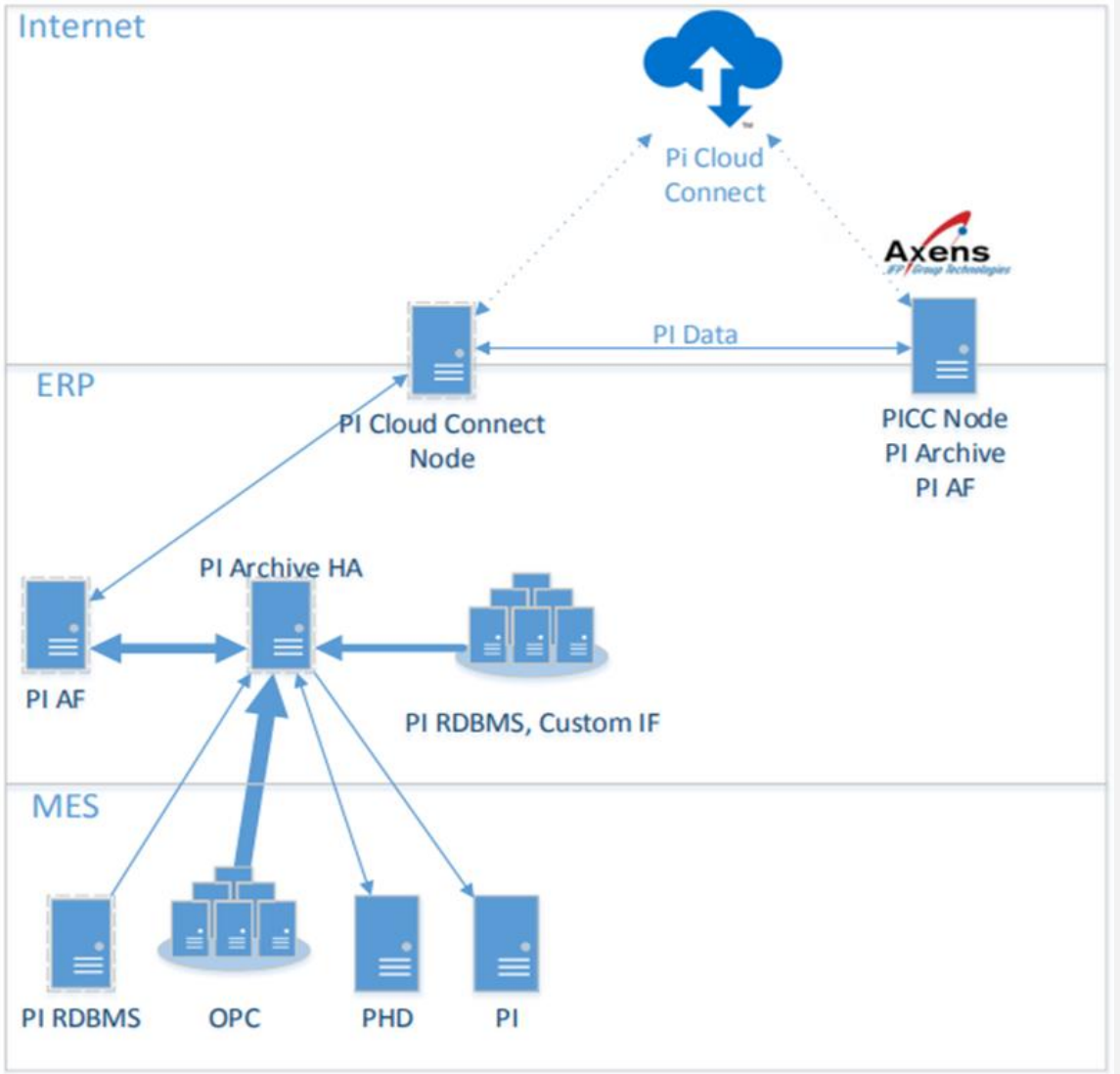
PI Cloud Reference





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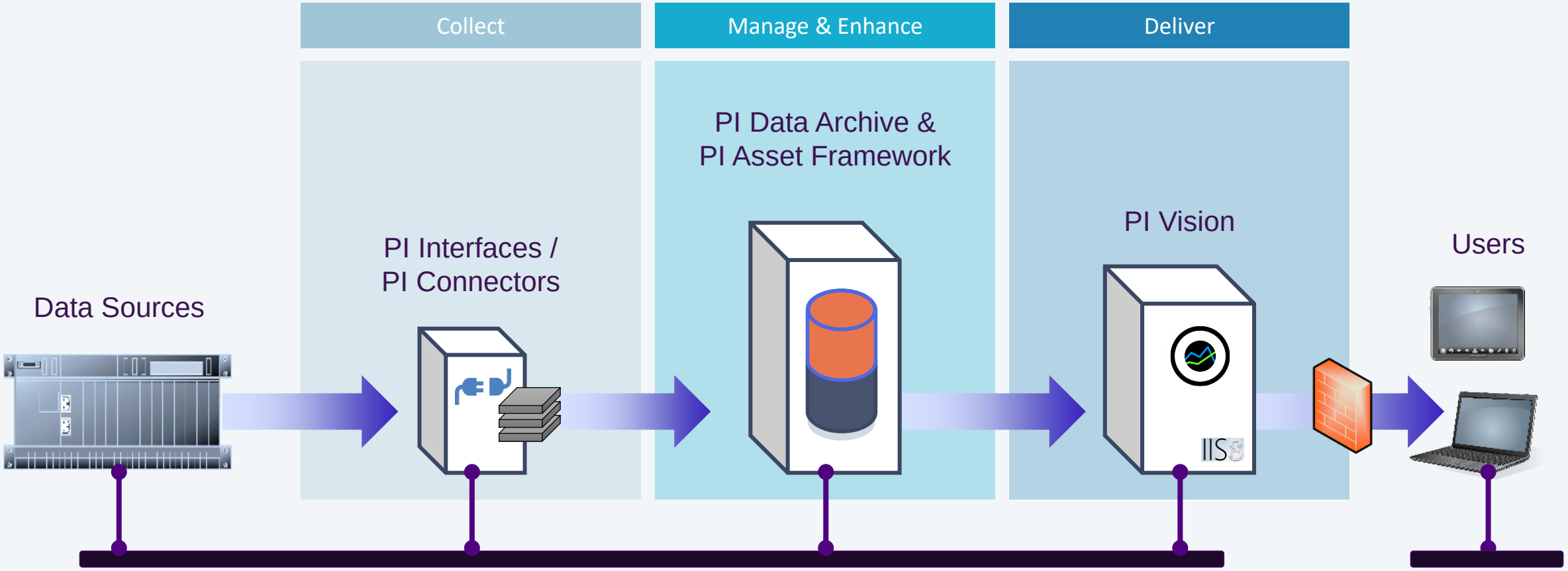
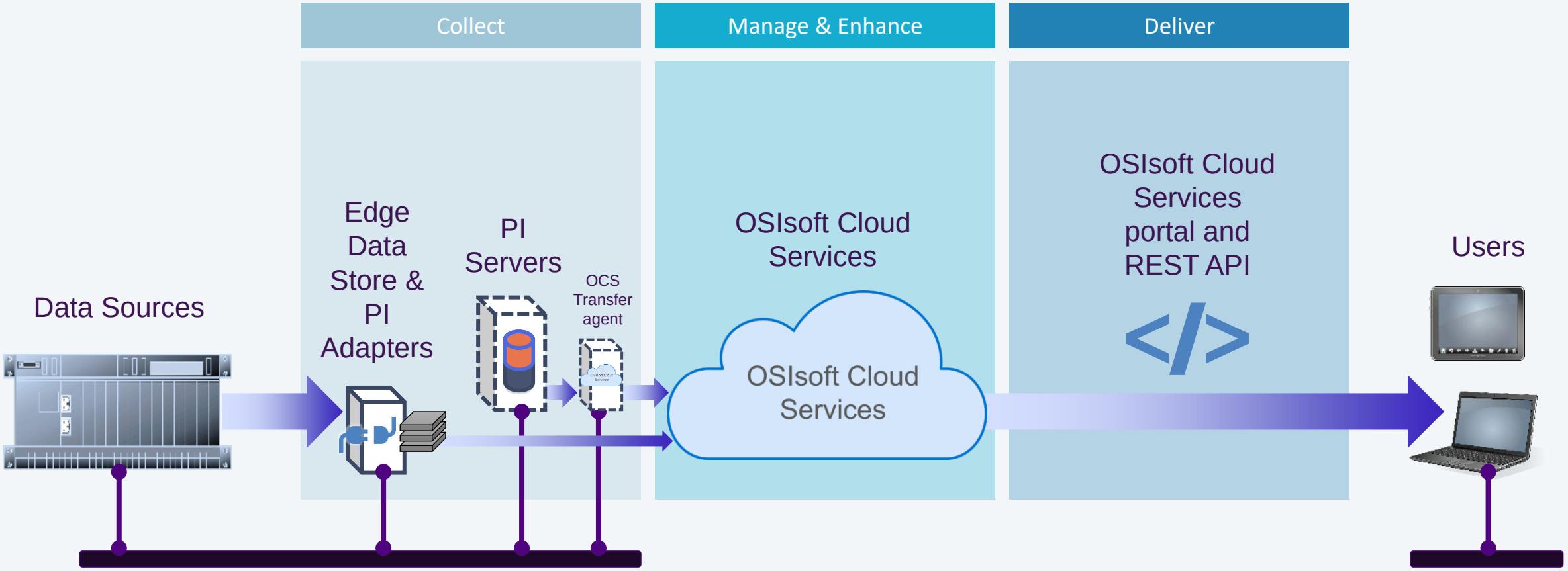
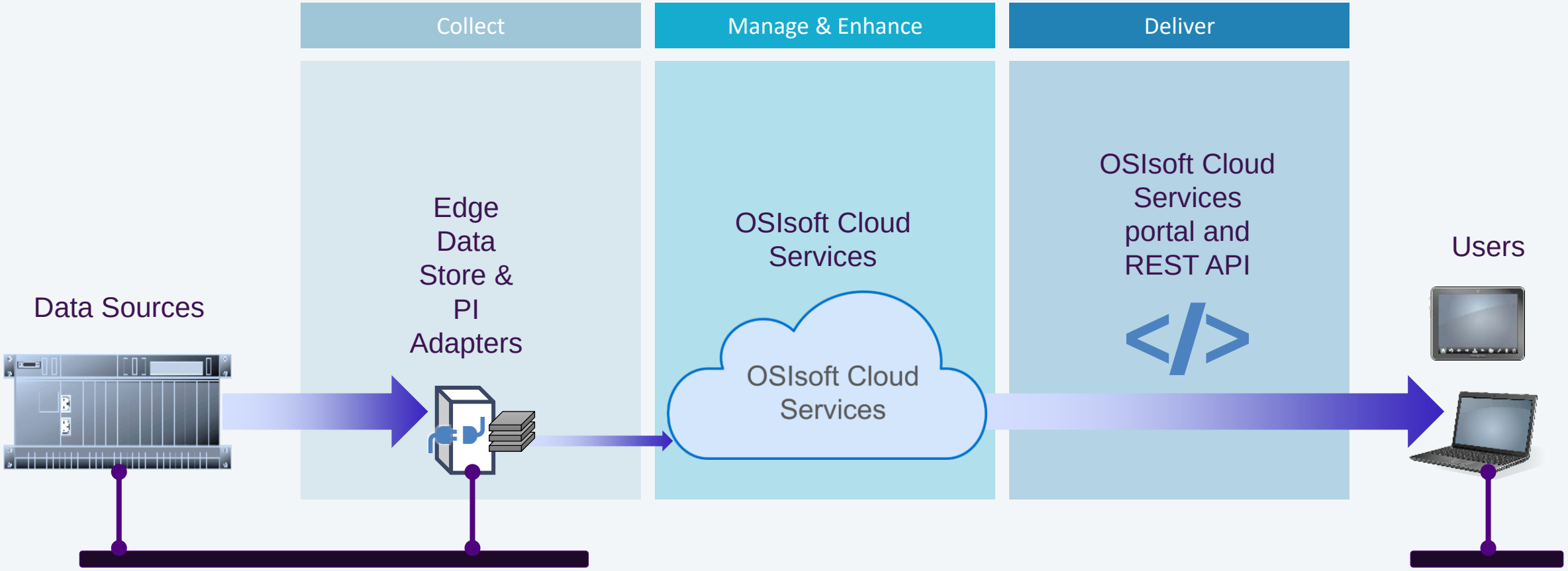
The PI Server provides a key component of the hybrid cloud



A complete hybrid on-prem and cloud architecture



PI Edge enriches the hybrid cloud with direct edge-to-cloud



“Better data. Better business outcomes”

Rapid Time to Value

Data flowing, monitored, visualized across initial assets (on-premises and edge)

Deliver first use case: Define initial asset hierarchy and key metrics (uptime, total energy use etc.)

Payback from initial use case funds additional use cases, additional deployments etc.

Share data with business users, data analysts etc.

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Our Proven Success - Industry Agnostic

Equipment efficiency optimization & cost reduction

Saved $20-25M in first year

dcp Midstream

+

Minimize energy usage by leveraging real-time data

Achieved 10x ROI from operational savings in first 8 months

Air Liquide

+

Maximizing production & product quality

$120M additional revenue by shipping 26M tons

ArcelorMittal

+

Saving costs while saving the planet

Speed up response time by 13 hours and saved local oysters

Taswater

+

Improving transparency and quality with right data

Postponed $8M capital upgrade

Deschutes Brewery

+

Increase ability to react to volatile market

Operated over 3,452 days without lost-time accidents

Qatar Power

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PI Server: trusted by essential industries for over 40 years

Oil & Gas

85%

of the top oil and gas companies

Power & Utilities

1000+

utilities worldwide

Mining & Metals

9

of the top 10 Mining companies

Pharma & Life Sciences

24

of the top 25 Pharmaceutical companies

Chemicals

9

of the top 10 Chemical companies

Manufacturing

6

of the World Economic Forum's Factories of the Future

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