Driving Overall Equipment Effectiveness Across Your Industrial Facilities

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Agenda

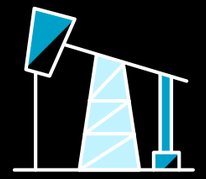
- IIoT & Industry 4.0
- Lean Manufacturing and OEE
- Introduction to AWS IoT SiteWise
- Calculating OEE in the cloud for all of your sites
- IIoT Reference Architecture
- Q&A

IoT Transforms Traditional Industrial Processes

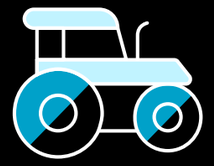
IoT brings sensors, machines, cloud computing, analytics, and people together to improve productivity and efficiency

Manufacturing

Mining



Oil & gas

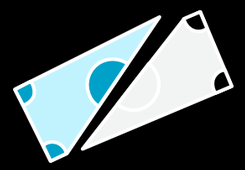


Automotive

IoT drives new industrial market trends

Convergence of business, process, and government standards like Industry 4.0 and Society 5.0

Mass production
↓
Mass customization



Buy
↓
Lease

Pay upfront
↓
Pay as you go

Manual
↓
Automatic

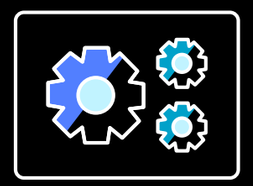
But customers face challenges

Security

Keep devices and data secure

Downtime

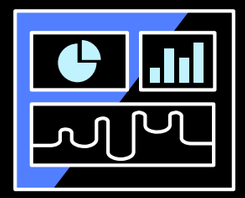
Operate at top performance even without cloud connectivity



Legacy equipment

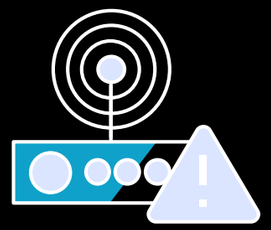
Onboard Greenfield and Brownfield devices

AWS helps you overcome challenges with software and services for key use cases



Predictive maintenance

Predictive quality



Asset condition monitoring

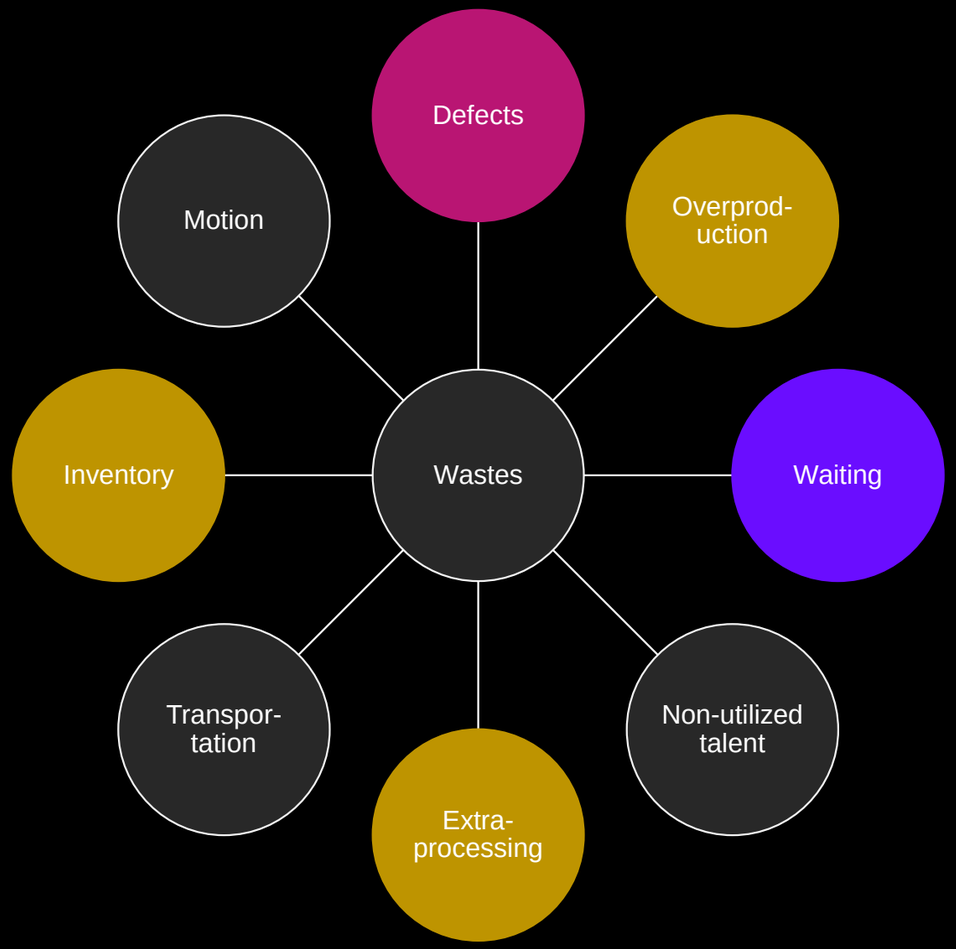
Introducing Bob

Countering waste is core goal of lean manufacturing

Defect rate can be higher in one facility than in others for the same manufacturing process

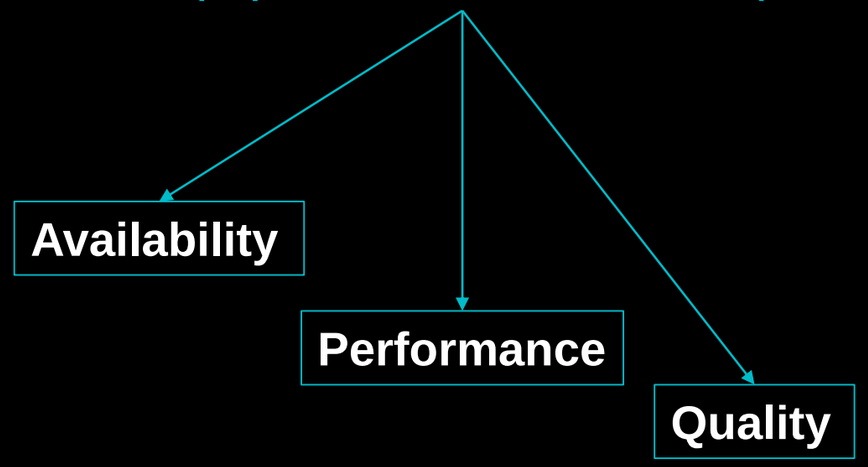
Equipment down-time can be costly for customers in competitive commodities markets such as mining and energy.

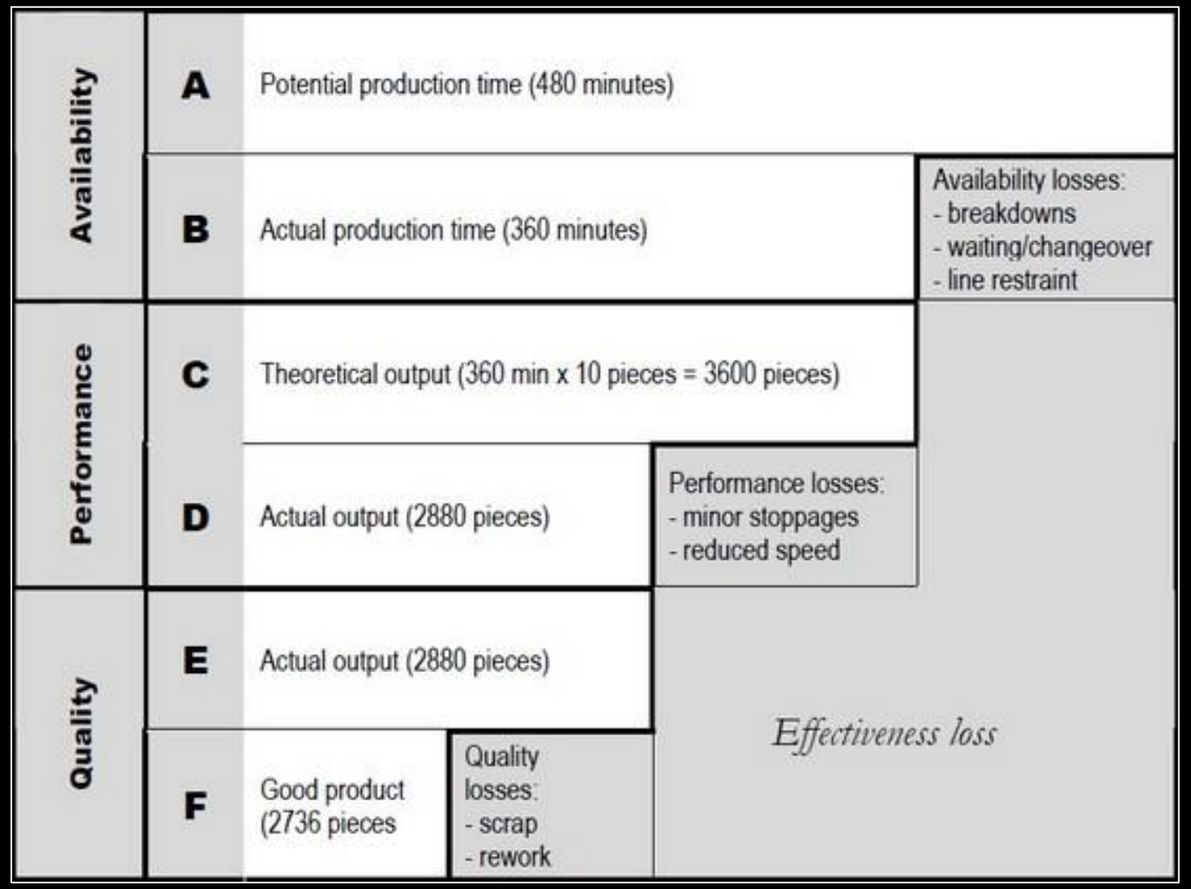
Perishable raw materials such as meat and dairy are expensive to store and handle for food and beverage producers



Equipment Metrics can help track waste

Overall Equipment Effectiveness (OEE)





Pre-requisites

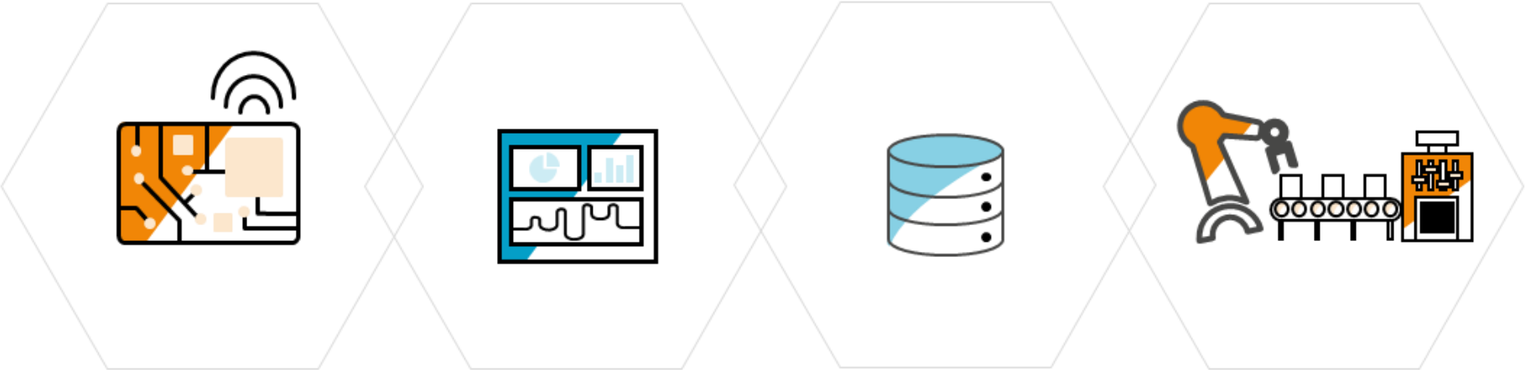
1. Data collection from facilities
2. Data labeling and organization
3. Data accessibility

AWS IoT SiteWise

Collect, structure, and consume data from industrial sites

Use **SiteWise App** and configure your gateway. See data flowing in minutes.

Create representations of your assets, processes, and facilities with **Views**



Acquire a **SiteWise Gateway** (OEM provides or Snowball Edge)

Data stored in a time-series data lake (IoT Analytics)

Configure **metrics** for assets or processes

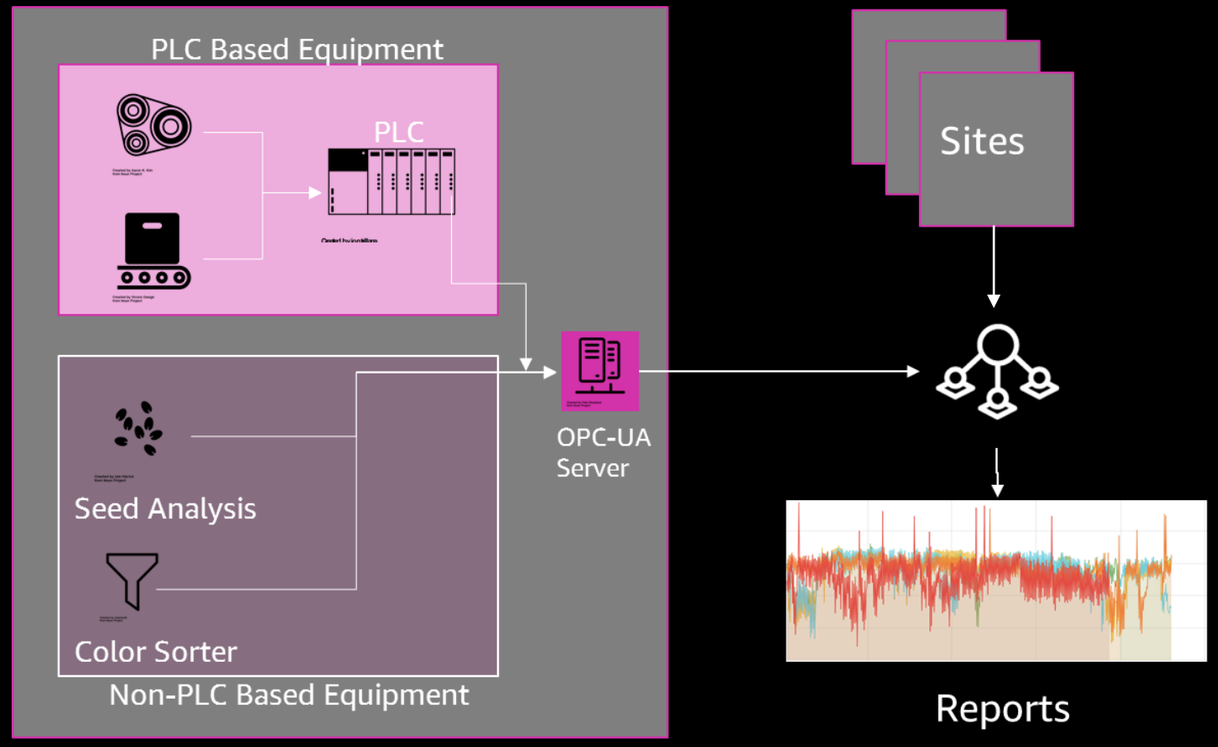
Quickly diagnose issues across sites remotely

Create monitoring dashboards for critical processes

Perform analytics, detect events, create alarm applications

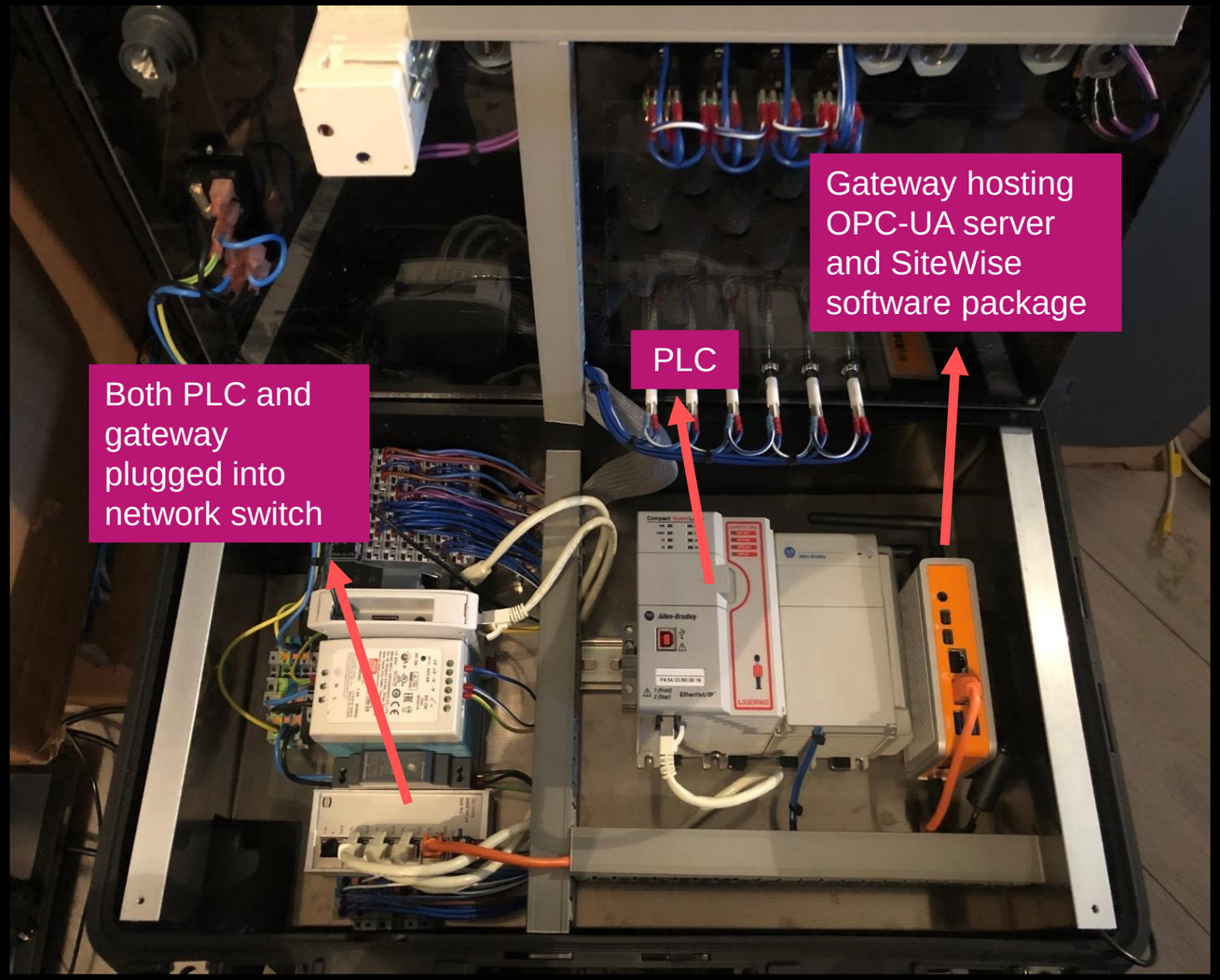
Drive efficiencies across sites

- Next level of efficiencies will come from optimizing across sites.
- Compute metrics for thousands of assets, across hundreds of sites in near real time.
- Serve to dashboards and applications across your organization.
- Enable end to end business workflows.

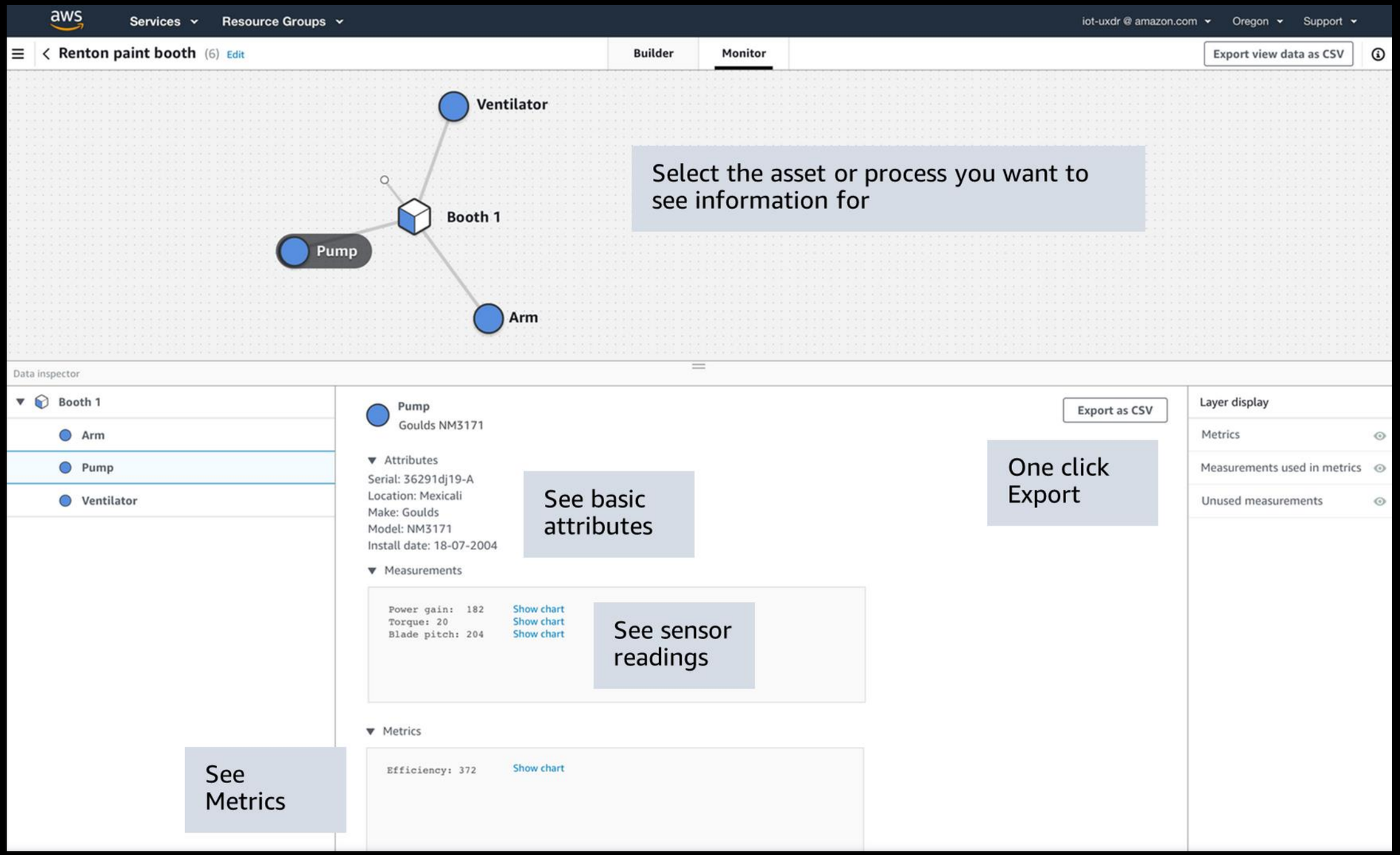


Intended site set-up

OPC-UA: Liberate data from factories

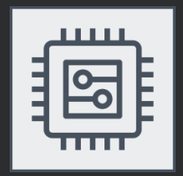


Representing your assets in SiteWise



Representing your assets

Name:	Solar Panel
Make:	Ajax
Serial Number:	PK78484
Real Power:	f(Voltage, Current)
Efficiency:	f(Real Power)
Voltage:	CA/17/260-477
Current:	CA/17/260-478

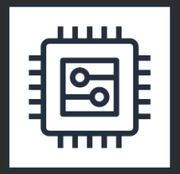


Power Meter

Representing your assets

Asset

Name:	Solar Panel
Make:	Ajax
Serial Number:	PK78484
Real Power:	f(Voltage, Current)
Efficiency:	f(Real Power)
Voltage:	CA/17/260-477
Current:	CA/17/260-478

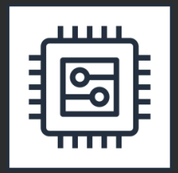


Power Meter

Representing your assets

Attributes

Name:	Solar Panel
Make:	Ajax
Serial Number:	PK78484
Real Power:	f(Voltage, Current)
Efficiency:	f(Real Power)
Voltage:	CA/17/260-477
Current:	CA/17/260-478

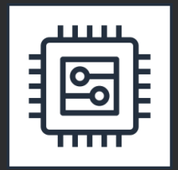


Power Meter

Representing your assets

Metric

Name:	Solar Panel
Make:	Ajax
Serial Number:	PK78484
Real Power:	f(Voltage, Current)
Efficiency:	f(Real Power)
Voltage:	CA/17/260-477
Current:	CA/17/260-478



Power Meter

Representing your assets

Name:	Solar Panel
Make:	Ajax
Serial Number:	PK78484
Real Power:	f(Voltage, Current)
Efficiency:	f(Real Power)

Power Meter

Measurements

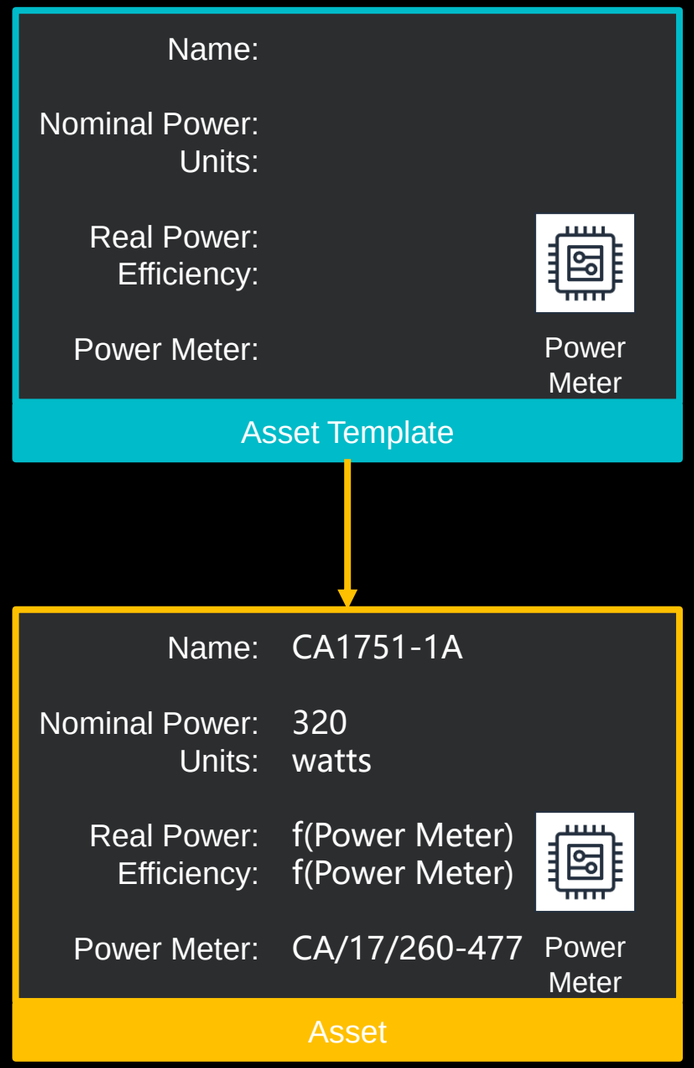
Voltage:	CA/17/260-477
Current:	CA/17/260-478

Representing your assets

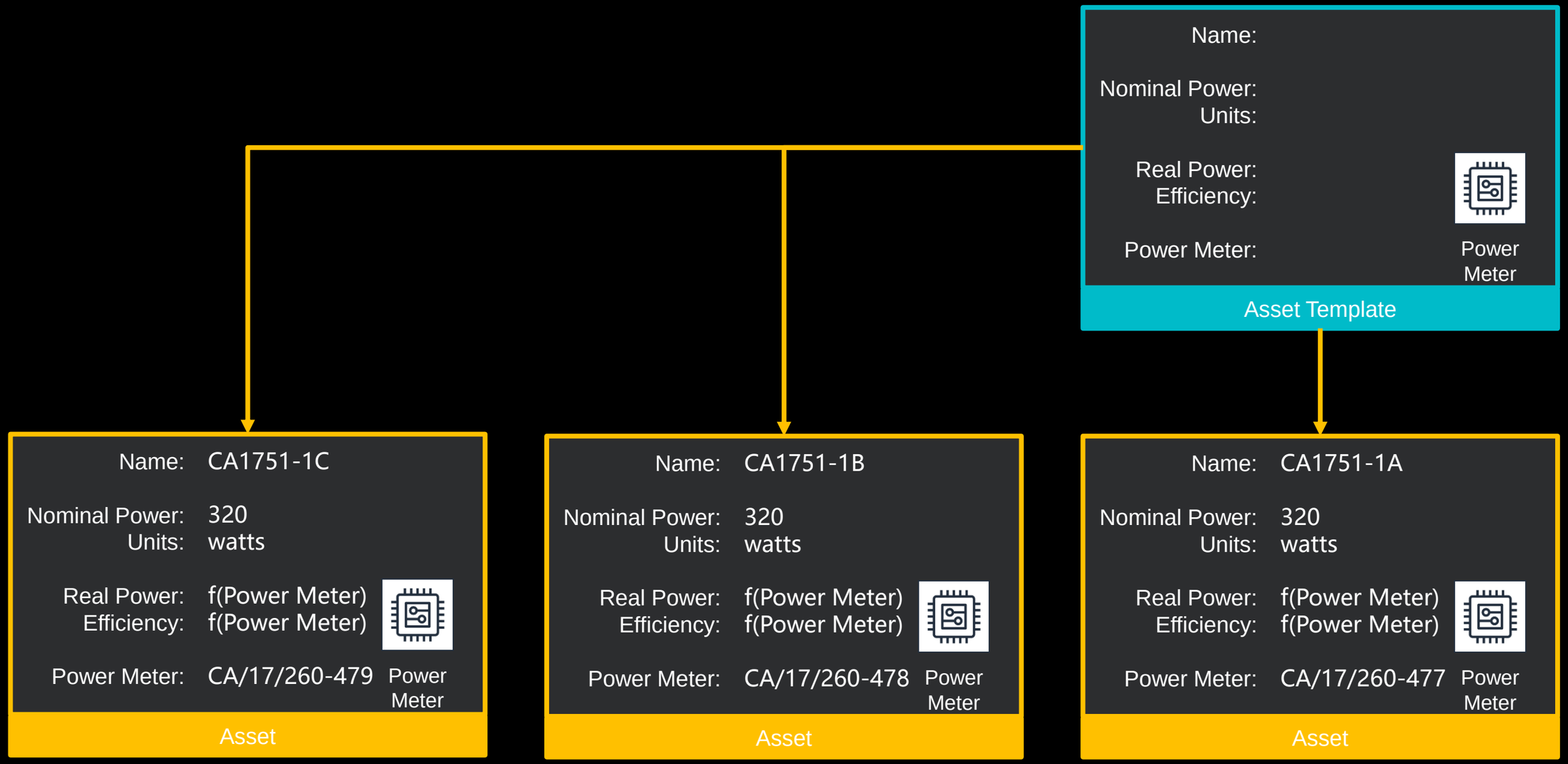
Name:	CA1751-1A	
Nominal Power:	320	
Units:	watts	
Real Power:	f(Power Meter)	
Efficiency:	f(Power Meter)	
Power Meter:	CA/17/260-477	Power Meter

Asset

Representing your assets



Representing your assets



The Recipe for OEE

Asset	Packer
Data from Equipment	Equipment_State (reported as numerical codes e.g. 1024) Good_Count Bad_Count
Equipment State Derivations (Transforms)	IDLE = EQ(Equipment_State, 1024) FAULT = EQ(Equipment_State, 1020) STOP = EQ(Equipment_State, 1000) RUNNING = EQ(Equipment_State, 1111)
Metrics (Aggregates) Interval Options: 5 min, 10 min, 15 min, 30 min, 1 hour, 1 day, 1 week.	IDLE_TIME = STATETIME(IDLE) FAULT_TIME = STATETIME(FAULT) STOP_TIME = STATETIME(STOP) RUN_TIME = STATETIME(RUNNING) DOWN_TIME = STOP_TIME + FAULT_TIME + IDLE_TIME **AVAILABILITY = RUN_TIME / (RUN_TIME + DOWN_TIME)** **QUALITY = Last(Good_Count) / Last(Good_Count) + Last(Bad_Count)** **PERFORMANCE = Last(Good_Count) / RUN_TIME * 0.2** **OEE = AVAILABILITY x QUALITY x PERFORMANCE**

Measurement definitions

Measurements are named inputs of data streams.

Name	Unit	Variable name
Equipment State	none	var_equipmentstate

Add another measurement

Derived measurement definitions

Derived measurements are derived from a single standard measurement and can be utilized in metrics calculated in the asset or later by a group

Name	Formula Enter a conditional statement for transforming values. Type down arrow to add available functions and measurements.	Unit
RUNNING	gt(Equipment State ,0.25)	none
FAULT	lt(Equipment State ,0.10)	none
IDLE	lt(Equipment State ,0)	none

Add another derived

Metric definitions

Metrics are defined by formulas and are used to gather insights into the performance of an asset. For limited preview, you will need to use the variable listed for each measurement above when writing a formula.

Name	Formula	Metric type	Variable name
FAULT TIME	statetime(FAULT)	OEE HUSKER - 15 minutes	var_faulttime
IDLE TIME	statetime(IDLE)	OEE HUSKER - 15 minutes	var_idletime
RUN TIME	statetime(RUNNING)	OEE HUSKER - 15 minutes	var_runtime
DOWN TIME	FAULT TIME + IDLE TIME + RU	OEE HUSKER - 15 minutes	var_downtime
AVAILABILITY	(RUN TIME - DOWN TIME)/ R	OEE HUSKER - 15 minutes	var_availability

Add another metric

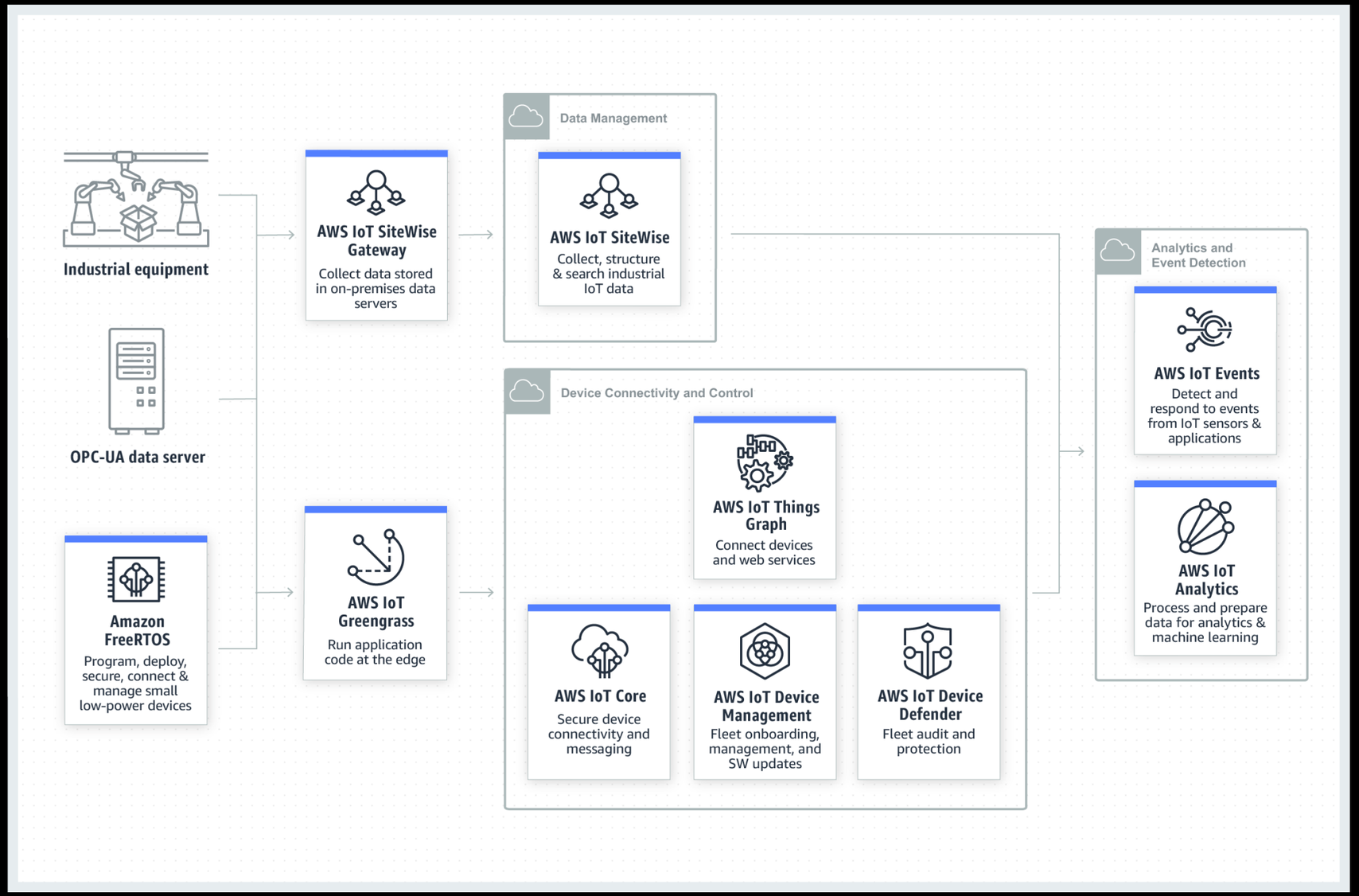
Cancel Create template

Crop Sciences

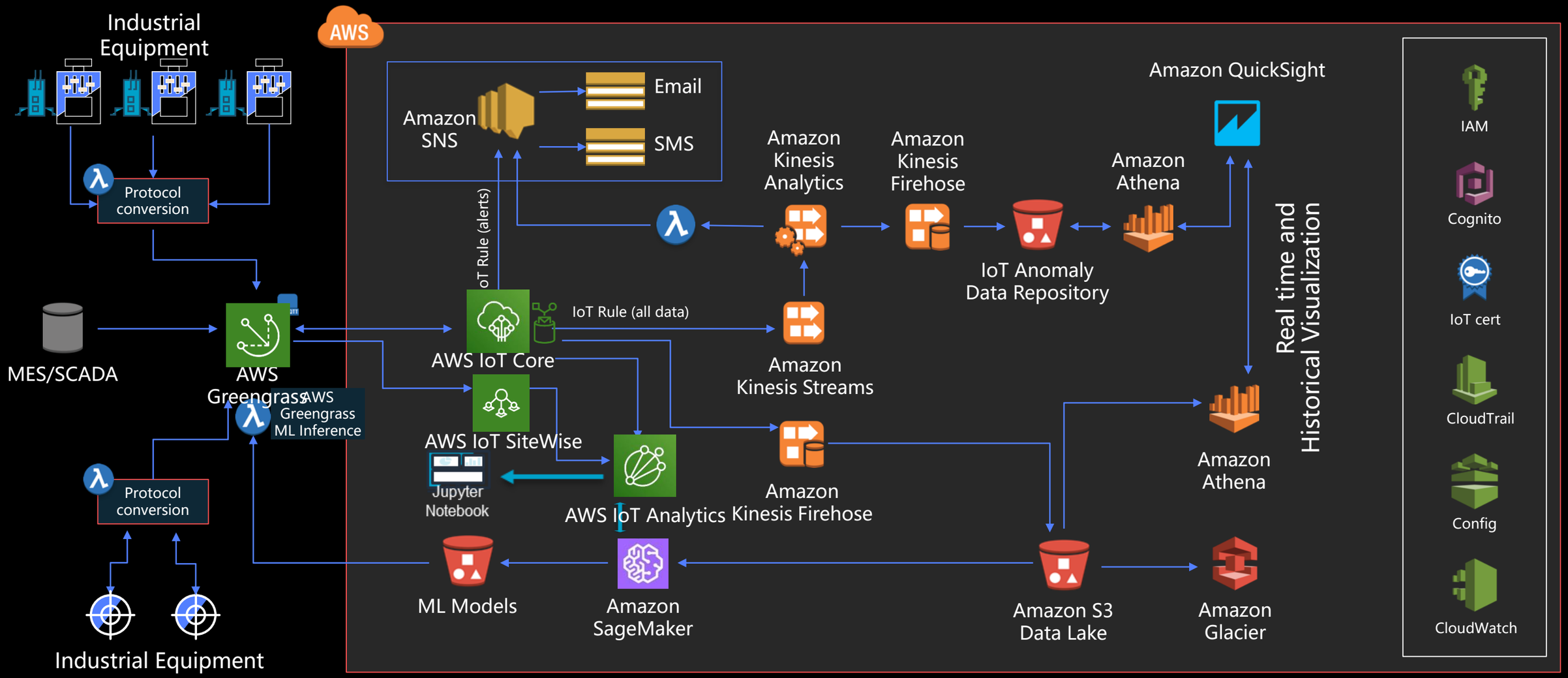
AWS IoT SiteWise

- “Digital Factory” solution
- 18% agricultural produce is lost in processing; goal to eliminate that waste
- Used SiteWise in production for 2019 Harvest Season across 9 sites; plan to expand to additional sites worldwide
- Top priority is end to end visibility

AWS IoT for industrial applications



AWS Industrial IoT reference architecture



Reliance Steel & Aluminum overview

- Fortune 500 company (ranked 305) founded in 1939, went public in 1994
- Largest metals service center companies in North America
- 300+ locations across 40 states and 13 countries
- 100,000+ metal products
- Carbon steel, stainless, alloy, aluminum
- Bar, tubing, plate, sheet, coil
- Value-added metals processing services
- 125,000+ customers
    - Manufacturing / Energy
    - Aerospace / Transportation
    - Construction

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