WHY BELIEVE IN SAP ASSET PERFORMANCE MANAGEMENT ?

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SAP

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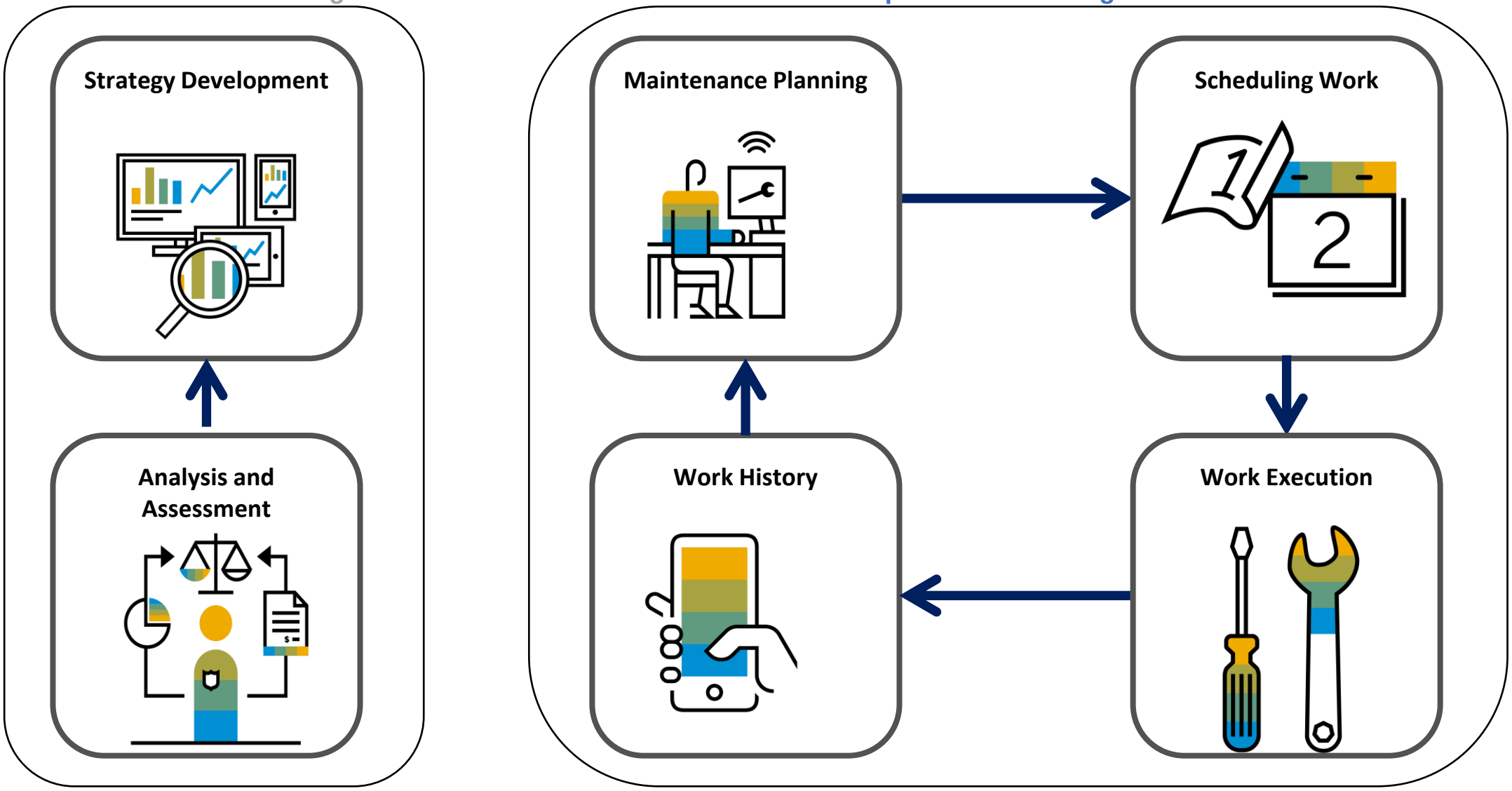
The Right Tasks

Asset Performance Management

Executed Well

Enterprise Asset Management



SAP Asset Performance Management

Closing the Loop

Capabilities to **constantly** assess and improve **asset availability and its output**, to extend asset life, including **risk** and **reliability management**, **predictive** and **prescriptive maintenance**, and asset **integrity management**.

Asset Performance Management

Enterprise Asset Management & Service

Capabilities for **managing maintenance operations** including planned and unplanned maintenance, scheduling work and resources, work order management and reporting, mobile support for maintenance technicians; it also covers solutions for asset acquisition and life cycle management, capital portfolio and project management, and environment, health and safety

Assessment to Strategy

- Segment your assets based on risk & criticality
- Develop maintenance & service strategies using standard methods

Strategy to Implementation

- Implement recommendation as schedule ready activities
- Move from traditional to more data-driven, rule-based definitions

Demand to Planning

- Overserve asset health – onsite or remote
- Manage one prescribed backlog of maintenance demand

Planning to Execution

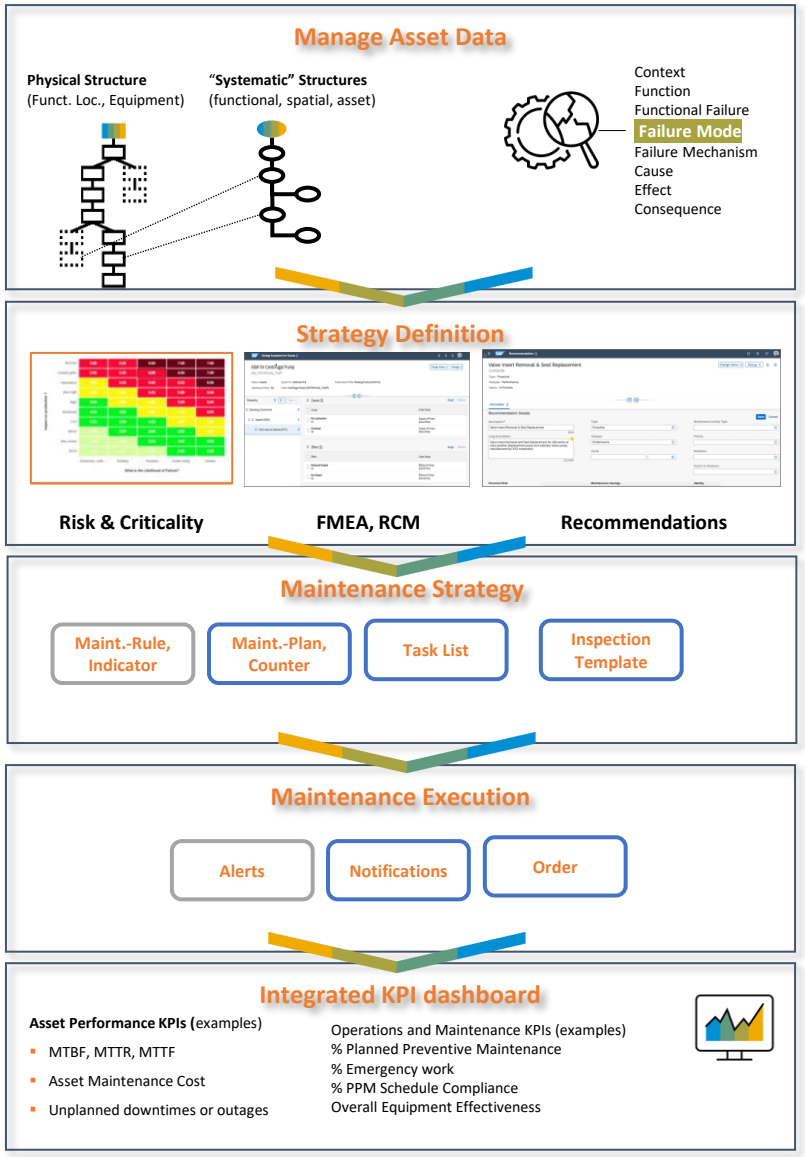
- Plan your resources to meet obligations and business targets
- Optimize capacity and schedule/dispatch your technicians

Execution to Analysis

- Perform work with all information at hand
- Report work, material, and maintenance history

Analysis to Assessment

- Supervise asset and maintenance/service performance
- Optimize strategy and subsequent the maintenance/service program



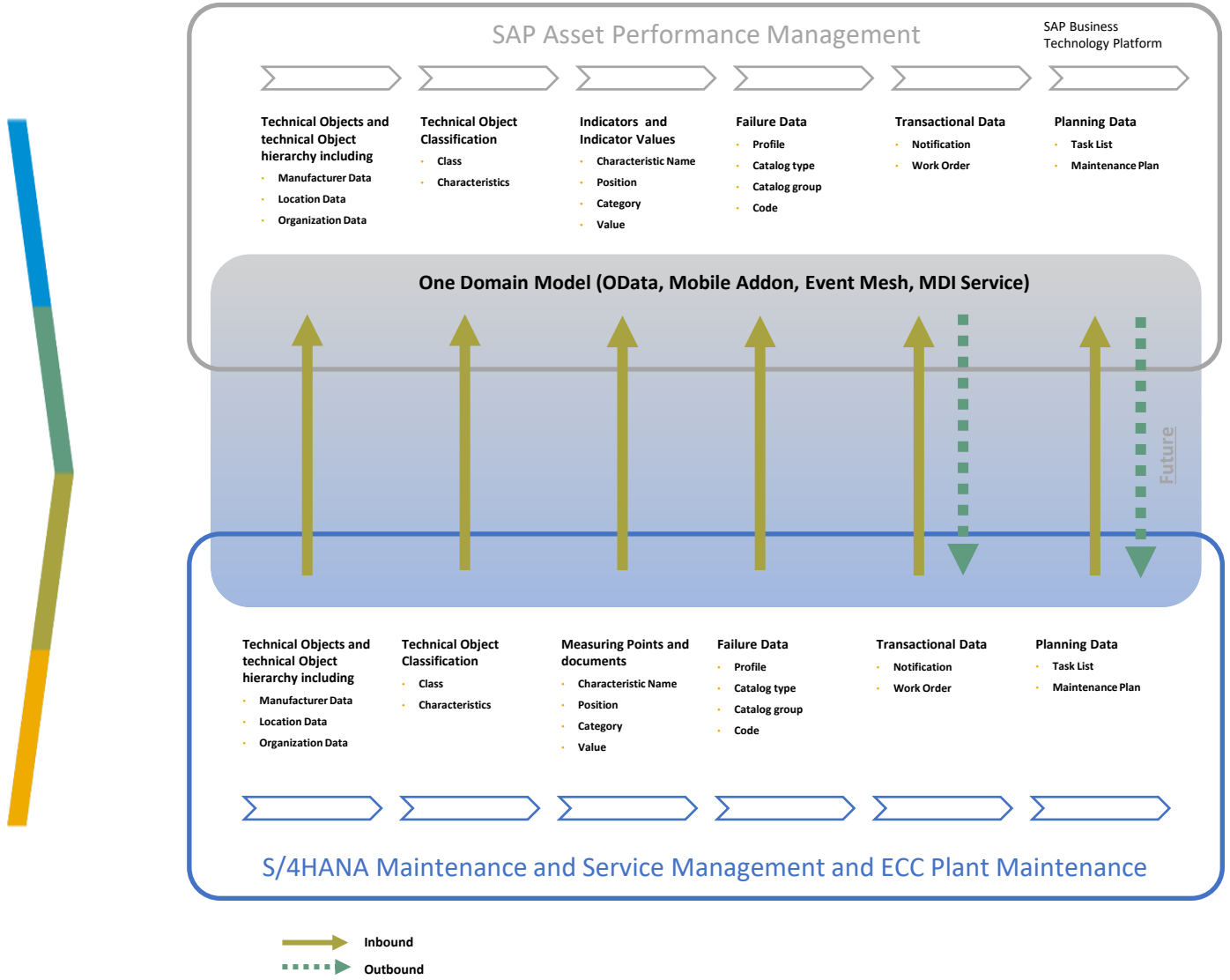
SAP Asset Performance Management

Harmonised and Aligned Asset Data

Aligned and harmonised domain model between S/4HANA Asset and Service Management, ECC Plant Maintenance and SAP Asset Performance Management

Out of the Box integration using Master Data Integration Service on SAP BTP

Inbound and Outbound integration scenarios supporting end to end process integration



SAP Asset Performance Management

Define Asset Maintenance Strategies

Risk & Criticality Assessment

Segment the assets to focus on critical equipment by applying a risk-based maintenance approach

Reliability Engineer

Maintenance Strategy Development by Assessment

Define the right maintenance & service strategy for assets considering critical failure with the help of standard reliability methodologies including Reliability Centered Maintenance

Reliability Engineer

Recommendation Management

Holistically manage failure mitigating recommendations by reviewing, consolidating and promoting them for implementation

Reliability Engineer

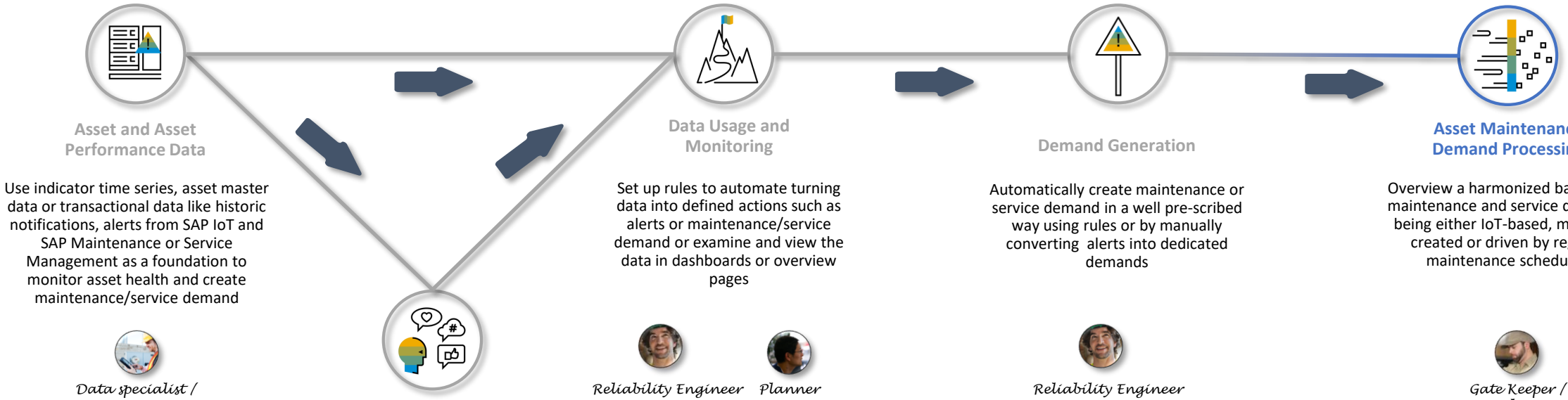
Recommendation Implementation

Use the promoted maintenance & service recommendations to bring them into execution

Planner

SAP Asset Performance Management

Monitor Asset Health and Maintenance Demand



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What does it take in SAP S/4HANA for APM?

- Master Data
- Transactional Business Process Expectations
- History Data
- Investigation Skills

FRACAS

Failure Reporting, Analysis, and Corrective Action System

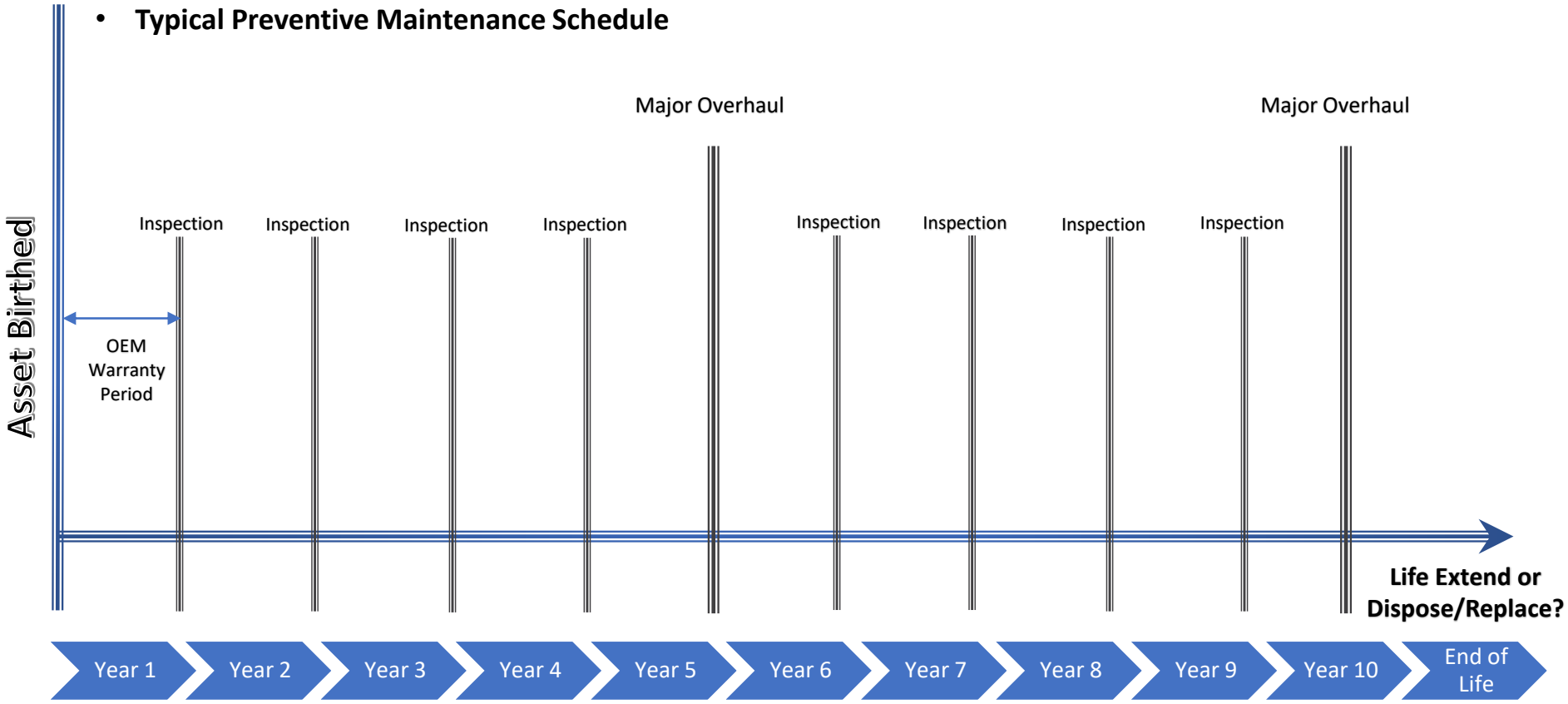
- The FRACAS method is used in many applications, such as safety/risk reduction systems, process control systems, and incident reporting systems. It provides a disciplined and aggressive closed-loop process for solving issues at the design, development, production, and deployment stages. The fundamental tasks include:
  - Recording and capturing information about failures and problems
  - Identifying, selecting, and prioritizing failures and problems
  - Identifying, implementing, and verifying corrective actions to prevent recurrence of failures
  - Providing information from failure analysis and corrective actions to support reliability data analysis
  - Providing report summaries of incident counts, and providing data used for reliability and quality metric

Asset Lifecycle (Typical)

Graph depicts no failures or downtime

- All Inspections completed as per scheduled maintenance frequencies
- Full maintenance scope of works completed as per equipment maintenance procedures
- Equipment not run outside of operating limits
- Process hasn't exceeded equipment thresholds.

- **Typical Preventive Maintenance Schedule**



Test Case - Rotating Mechanical Equipment

Average Corrective Costs & Events per year

	PMO2 WO Count	NOV TDS 11	PMO2 WO Cost	Average PMO2	Average PMO2 Cost
Country	Corrective	Equipment in Service	Corrective	Per Each Equipment	Per Each Equipment
Canada	5	2	$ 103,585.03		
US	177	55	$ 2,356,864.19		
International	32	5	$ 61,888.78		
Total	**214**	**62**	**$ 2,522,338.00**	**3.5 events per year**	**$ 40,682.87**

Why think out of the box with APM Concepts?

- What can APM Monitor that you may not have thought about?
- How can multiple data points be useful in the investigation process

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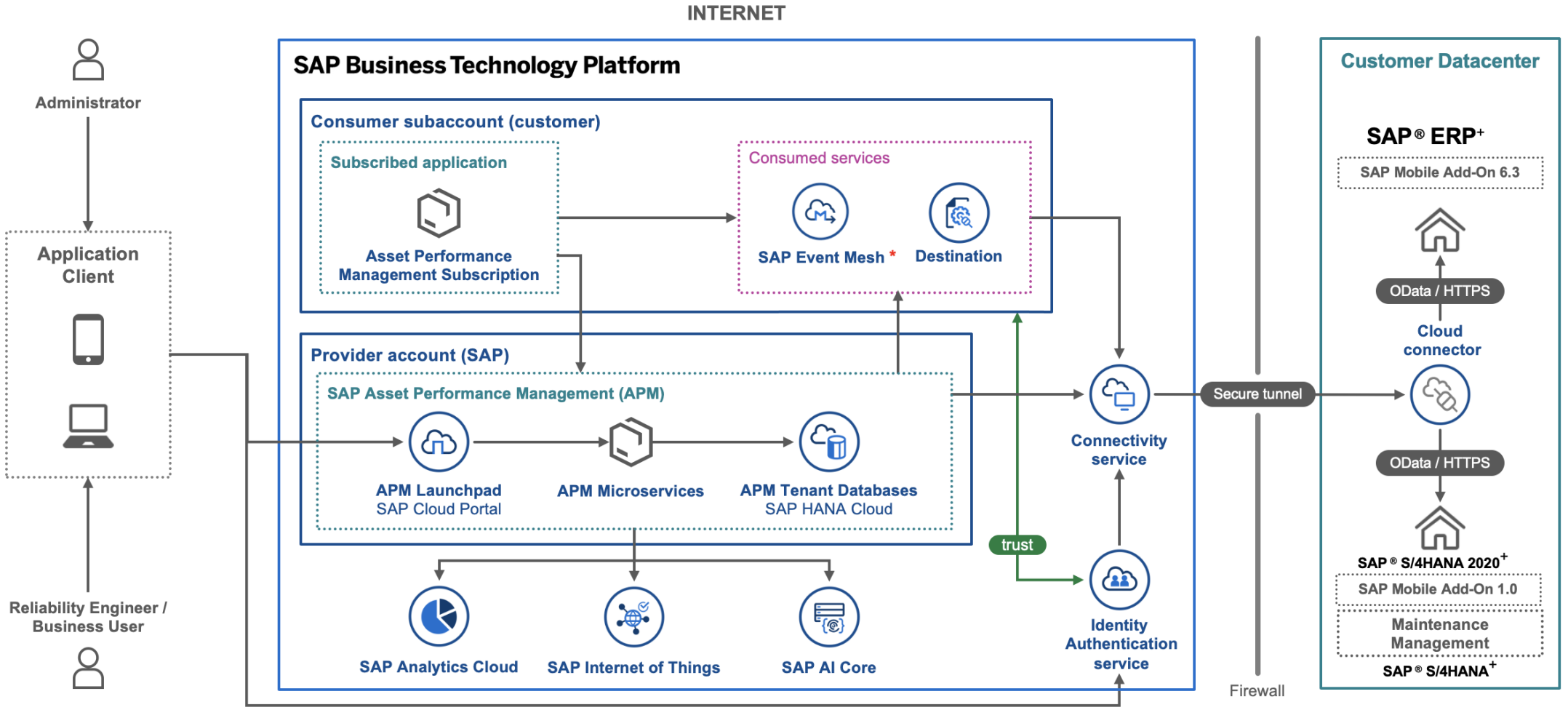
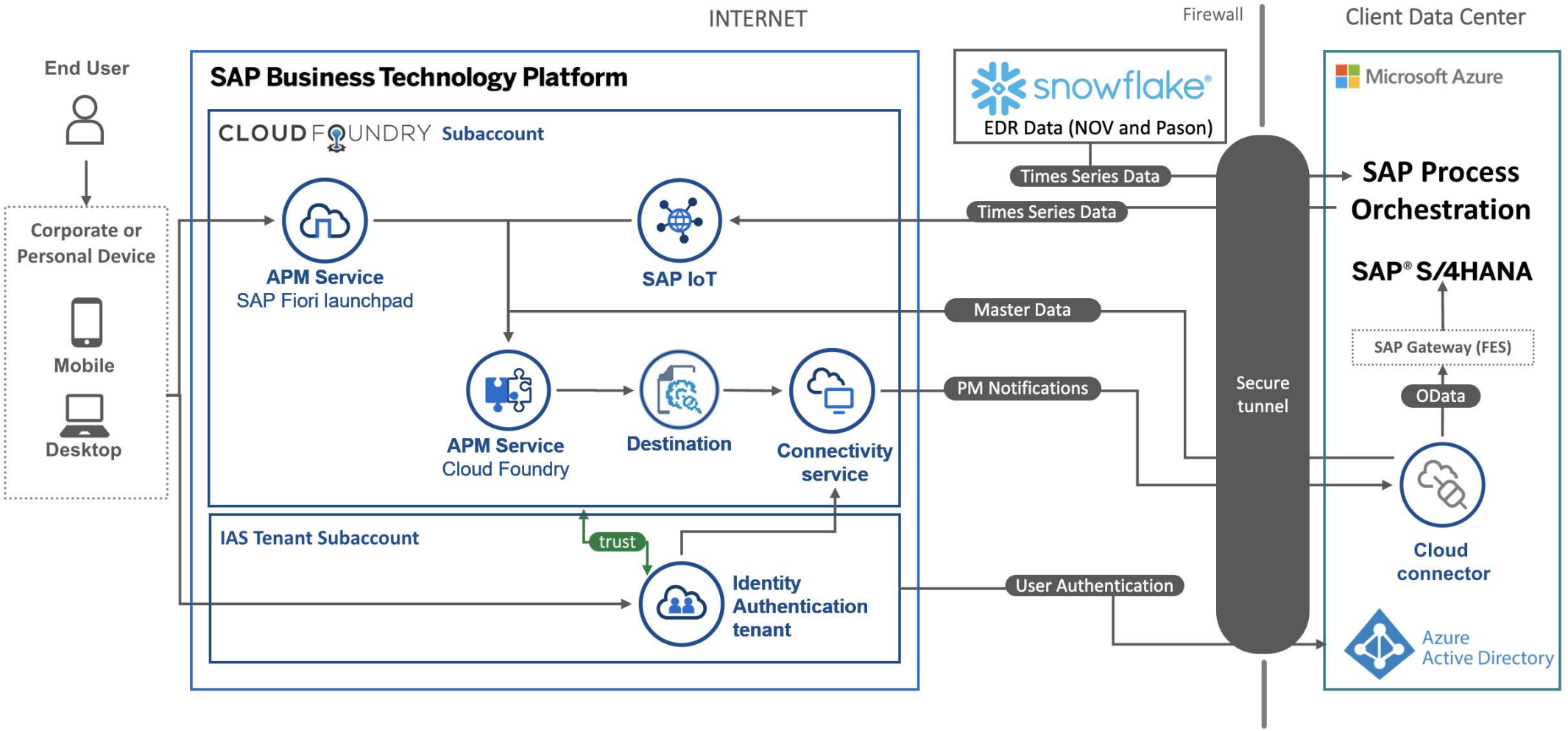
APM System Architecture Diagram - SAP



\+ *SAP ERP 6.0 & S/4HANA OP 2020 integration is supported using SAP Mobile Add-on. S/4HANA OP 2021 FPS01 onwards uses standard OData API*

* *Supported S/4HANA OP 2021 FPS01 onwards only*

APM System Architecture Diagram - Client



APM Technical Requirements – SAP Version

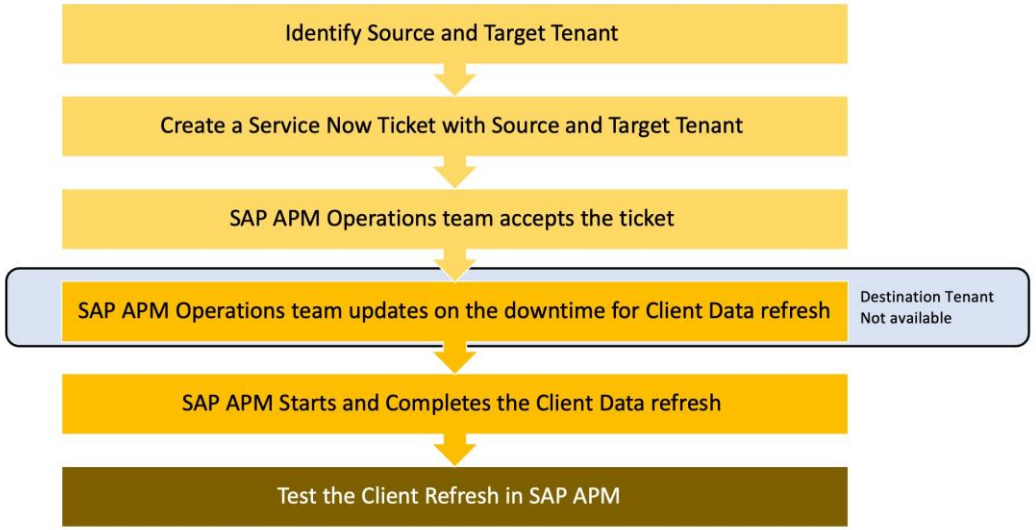
- For Cloud S/4HANA clients, release 2202 or higher is required to use all features provided by SAP APM
- For On-Premise clients
  - S/4HANA 2021 FPS01 or higher
  - S/4HANA 2020
  - SAP ERP ECC 6 EHP7 SP14 or later

APM Setup - Roles and Security

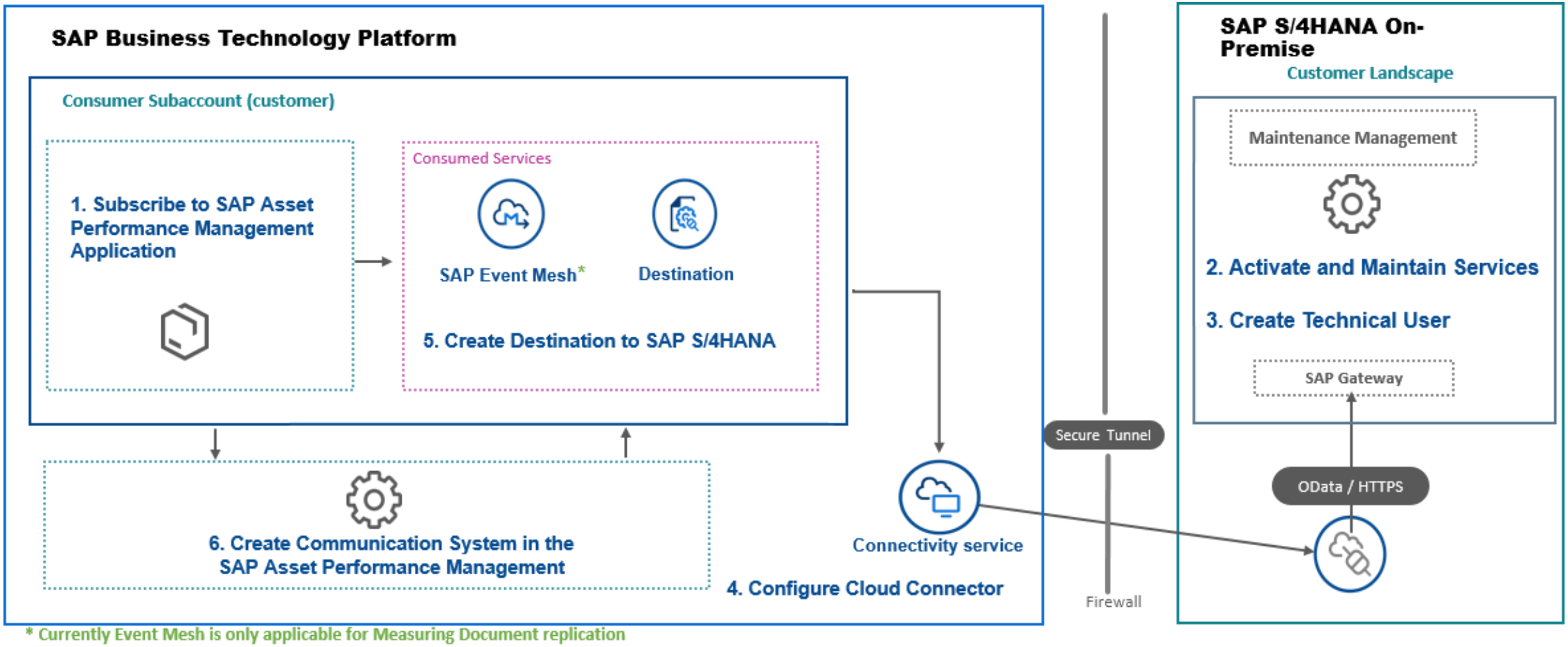
- Preset Roles
  - Reliability Engineer
    - Permission to access apps and view data
  - Administrator
    - Permission to view, create, update or delete anything within APM
- Custom Roles can be created within BTP cockpit
  - There are several hundred roles that can be individually given to specific users
  - Users can be restricted to a specific company code, maintenance plant, planning plant, authorization group, or cost center

Copy Back Support – Test Data Refresh

- Non-production APM Tenants will become out of sync with their respective SAP environment when a copy back is performed
  - Due to table structure of SAP. Tables like CABN will get out of sync
- SAP Test Data Refresh Service solves
  - One week to complete



APM Setup – BTP and SAP Overview



* Currently Event Mesh is only applicable for Measuring Document replication

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Data Integration – SAP Data

Standard Functionality

- Equipment and Floc master data sync occurs every 2 hours
  - Includes all applicable master data on equipment/floc record
  - Includes the value of any characteristics assigned to the class
- Measuring points can now be synced as indicators. Standard indicator rules apply
- Notification history data
- Work order data (limited)

Data Integration – SAP Data

Standard Functionality

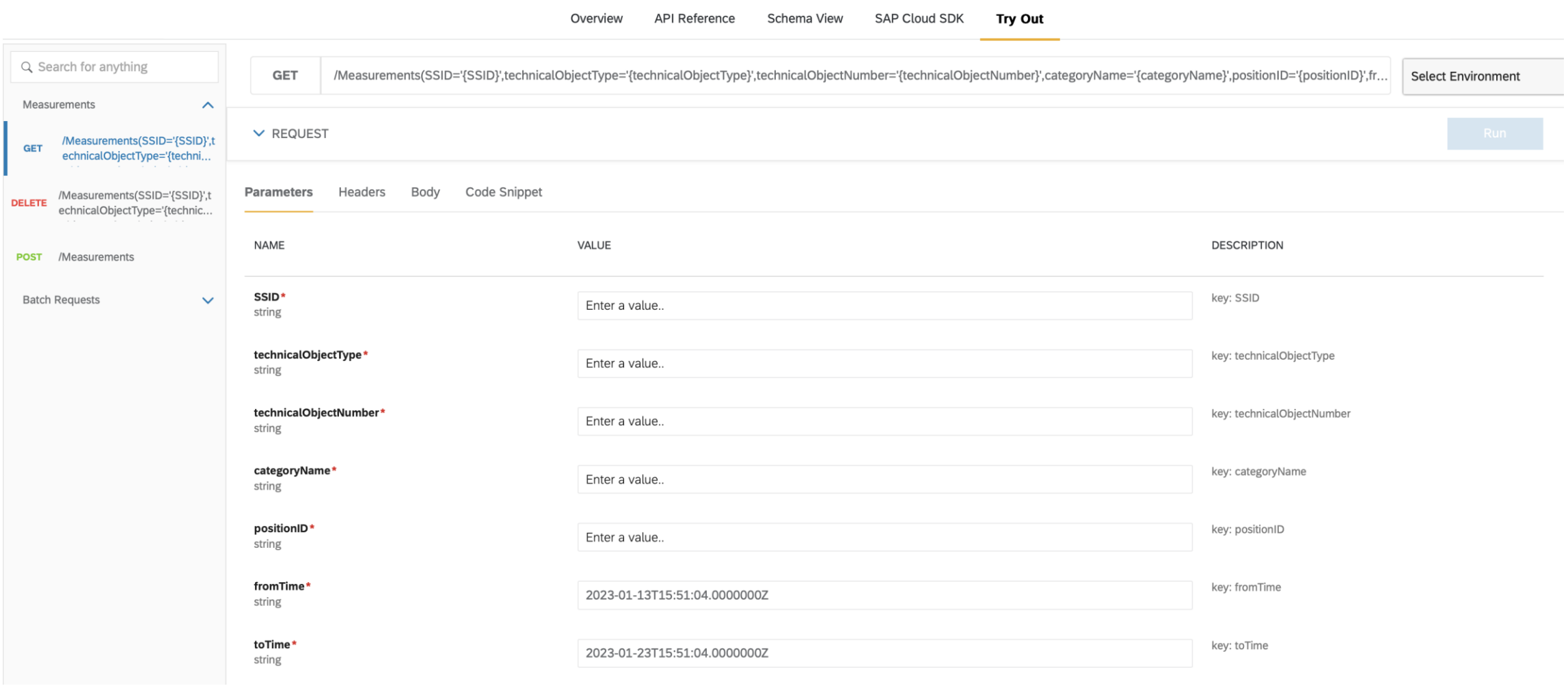
- Equipment sync can be filtered by any of the following
  - Category
  - Company Code
  - Maintenance Plant
  - Planning Plant
  - Object Type
  - Authorization Group
  - Planner Group

Data Integration – API Options

Application Programming Interface

- APM Asset Health (ODATA V4 API)
  - Indicators API (manage indicators and related entities)
  - Notification API (retrieval of notification data from APM)
  - Time Series API (create, read, and delete time series data obtained from IoT)
- APM Asset Strategy (REST and GraphQL APIs)
  - Recommendation API (read, update, and use recommendations)
  - Risk and Criticality Assessment (carry out risk and criticality assessments)
  - Strategy Assessment for Classes (define maintenance strategy)
- IoT Gateways API
  - Not APM specific but can be used to post data into APM like Time Series API

Data Integration – api.SAP.com



Data Integration – Operational Context Data

Step 1: 

- Operating data is measured by sensors on equipment and stored in Snowflake
  - Snowflake is a cloud-based SQL database
- Data for APM is calculated into hourly aggregates and placed in a table to be extracted
- Hourly aggregates are used for simplicity and to maximize space.
  - APM can accept shorter intervals (milliseconds)

Data Integration – Operational Context Data

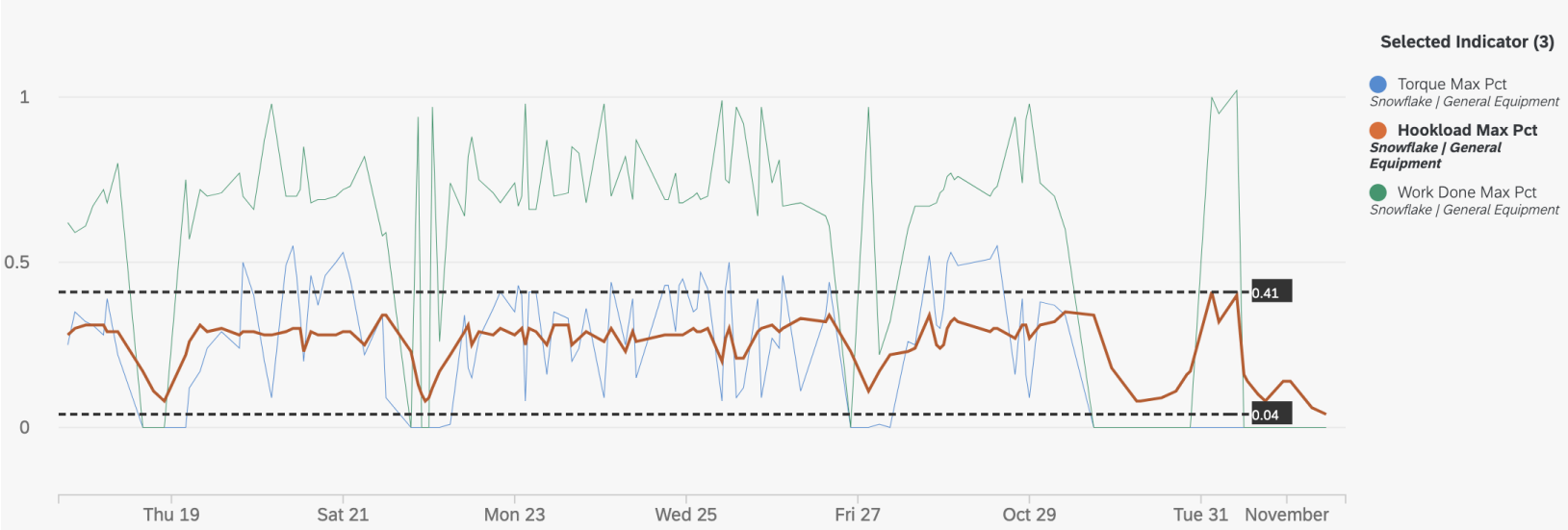
Step 2: Process Orchestration (PO)

- JDBC Channel for Data Extraction:
  - Utilizes Java Database Connectivity (JDBC) to pull data from Snowflake database tables into SAP Process Orchestration (PO).
- Data Conversion Using PO Mapping Tool:
  - Implements a mapping tool within SAP PO to transform data from Snowflake.
  - Converts data into a JavaScript Object Notation (JSON) format, preparing it for transfer.
- Data Transfer via REST Adapter:
  - Employs the REST (Representational State Transfer) Adapter in SAP PO for data transmission.
  - Facilitates the sending of JSON-formatted data to SAP APM, using the IoT Gateway's API.

Data Integration – Operational Context Data

Step 3: APM

- Data is ingested into Indicators
  - Indicators are specific, observable, and measurable data points that can be used to show the state of an Equipment or Functional Location



Data Integration – SAP Data

Custom Functionality

- Indicators are treated differently from characteristics by rules in APM
- If indicator functionality is needed for values stored in characteristics, characteristics can be ingested as indicators through a similar process
- Many solutions depending on context
  - SAP Process Orchestration
  - SAP Process Integration
  - SAP Cloud Platform Integration
  - Non-SAP software

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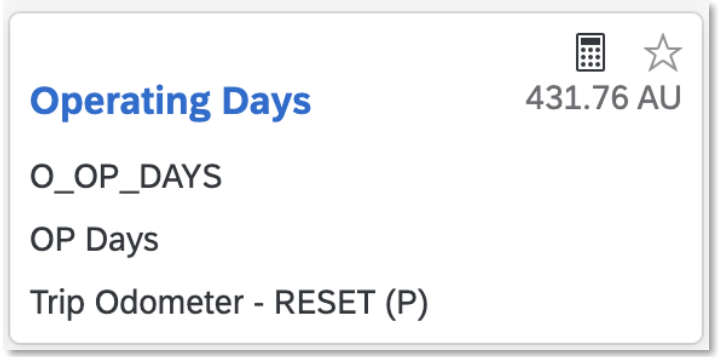
APM Functional Build – Indicators



- An indicator is a specific, observable, and measurable characteristic that can be used to show the state of an Equipment or Functional Location
- Elements
  - Characteristic (name, description, and data type are derived here)
  - Position (free text. Same-position indicators can use the same API call)
  - Category (selected from measuring point categories in SAP)
- Latest, Oldest, and Previous (1) values can be used in rules, as well as the corresponding timestamps. All previous data is stored as aggregates and can be viewed

Indicator Details

Description:
Operating Days

Characteristic:
O_OP_DAYS

Position:
OP Days

Category:
Trip Odometer - RESET (P)

Data Type:
NUM

Precision:
15

Scale:
2

Value:
431.76 AU

Unit of Measure:
Activity unit (AU)

Maximum Value:
0

Minimum Value:
0

Target Value:
0

Number of Decimal Places for Display:
2

Last Updated:
Oct 28, 2023, 8:09:09 AM

Color:

Type:
Continuous

Source:
Local Indicator

Measuring Point ID:

Measuring Point Description:

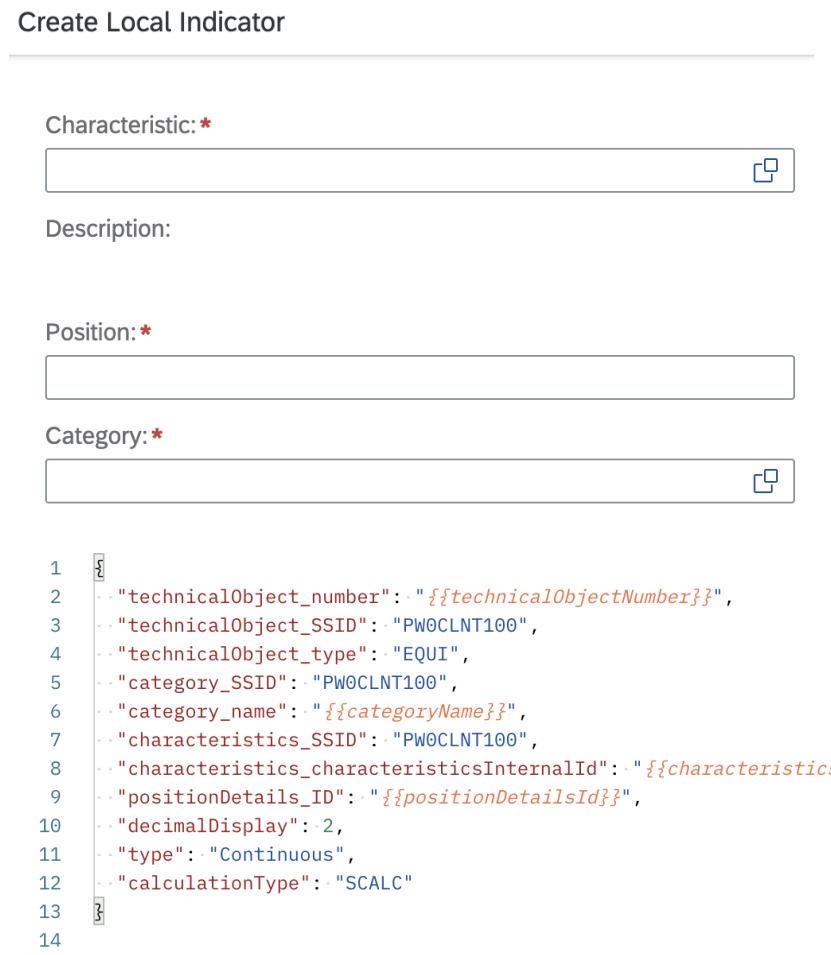
Is Counter:
No

APM Functional Build

Indicators Create

- Manually
  - Enter data manually as shown
  - 30 seconds per indicator
- Using Indicator API
  - Requires API key and setup from SAP
  - Create a load sheet and use the Postman Runner
  - <1 second per indicator

	A	B	C	D
1	technicalObjectNumber	categoryName	characteristicsId	positionDetailsId
2	30160274	G	1057	468d0cadd3d84741b5bb4910b9d0608d



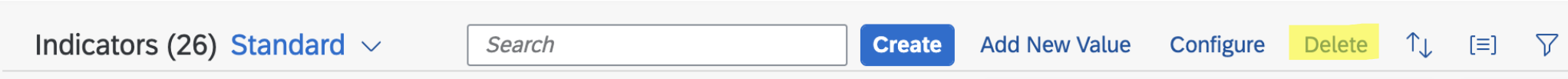
APM Functional Build

Indicators Delete

- Manually
  - Only an option if there is no time series data in the indicator
  - Delete button in APM

Using APIs

- Delete all time series data using the Timeseries Data API
  - Test version found on API.SAP.com
- Delete indicators using Delete Indicators API in Postman.
  - Only requires indicator ID, and can be retrieved en masse from Get Indicators API



APM Functional Build – Rules

Rule Types

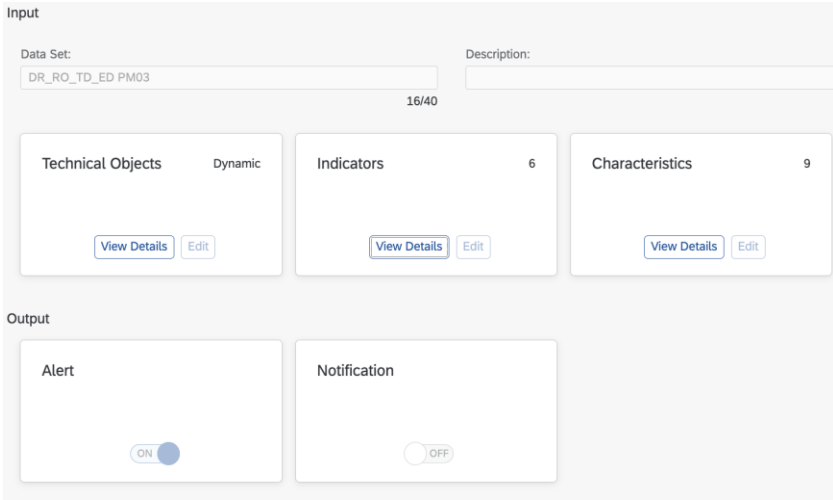
- Calculation
  - Executes whenever an input indicator (not characteristic) is refreshed.
  - Calculates a value based on a set formula, output into an indicator.
- Aggregate
  - Calculation rule specifically for calculating aggregates. Output into an indicator.
- Scheduled
  - Executes on a set schedule. Output is an alert or notification.
- Streaming
  - Executes whenever an input indicator is refreshed. Output is an alert or notification

APM Functional Build – Rules

Data Set

- Inputs
  - Technical Objects
    - Can be dynamic (all objects in a class, etc.)
    - 1 class per rule, but SAP plans to support multiple classes per rule.
  - Indicators

    Latest, Oldest, and Previous (1) values and corresponding timestamps
  - Characteristics
    - Current value from SAP only.
    - Sync is every 2 hours
- Outputs
  - Alerts
  - Notifications
  - Indicators



APM Functional Build – Rules

Rule Editor

- If, then structure
  - Else If and Else statements available
- SAP Expression Language 2.0
- Extensive SAP Help documents available for understanding and writing rules

APM Functional Build – Rules

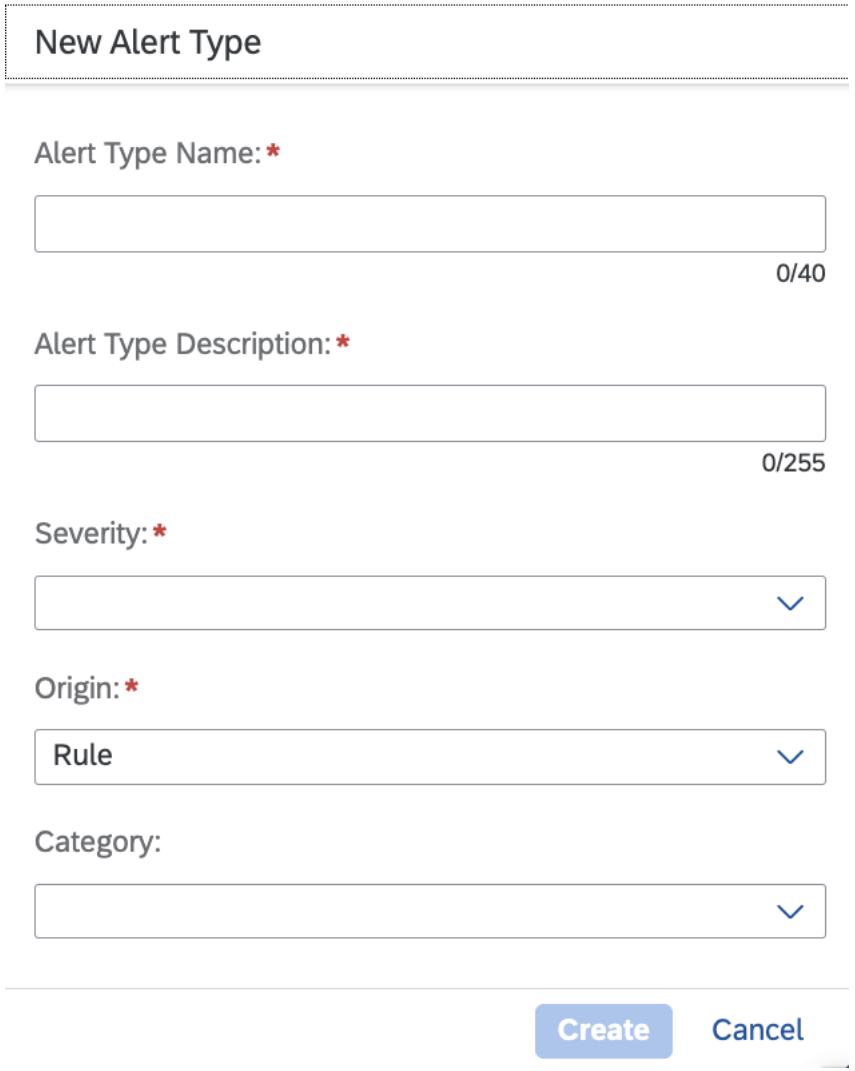
Scheduled and Streaming Outputs

- Alerts
  - Gather in the Alerts Tile in APM
  - User Selectable Status
    - New (automatically set to this)
    - In Process
    - Closed
  - Create a notification from an alert easily
  - Setup only requires an alert type

- Notifications
  - Post directly in SAP
  - Includes all of the standard functionality once in SAP, but only specific fields can be automatically posted from APM.
  - Setup requires giving APM_Admin permission in SAP to create Notifications

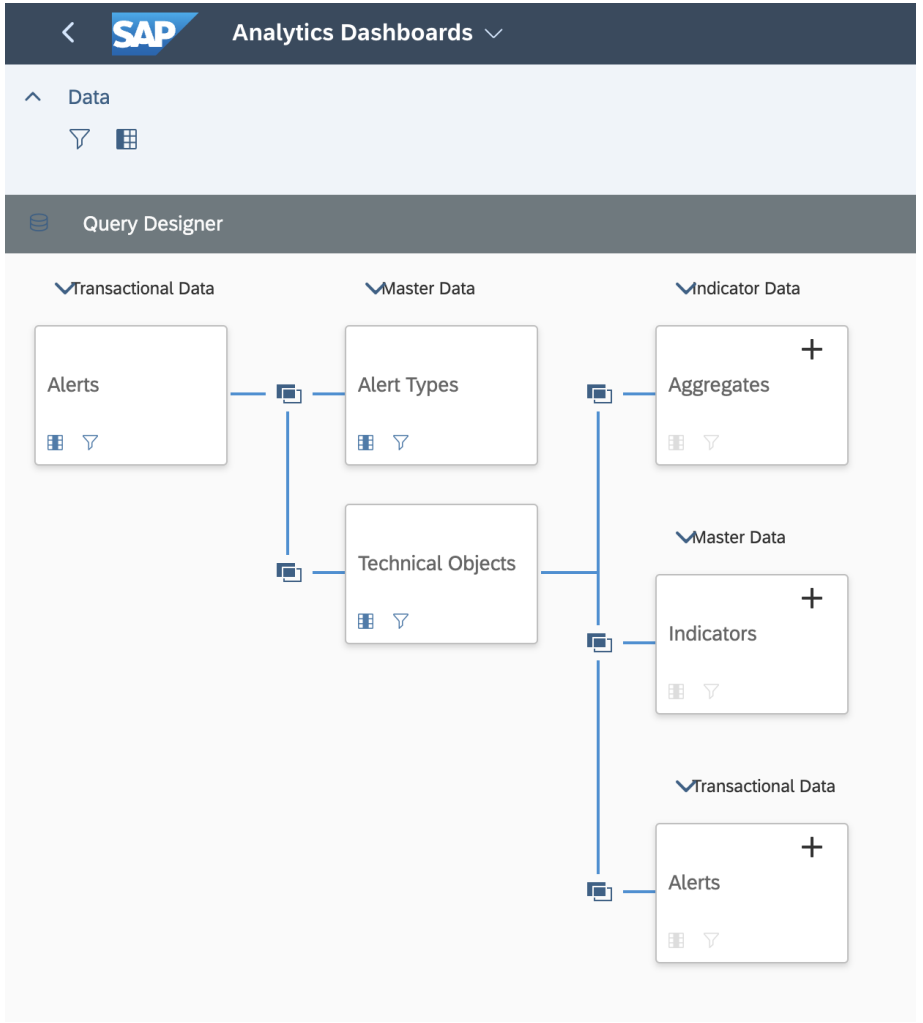
APM Functional Build – Alerts

- Alert Types
  - Simple to create and delete
  - Requires free text name and description
  - Severity
    - Information (blue)
    - Warning (orange)
    - Error (red)
  - ‘Alert Type Name’ inserted with single quotes in rules

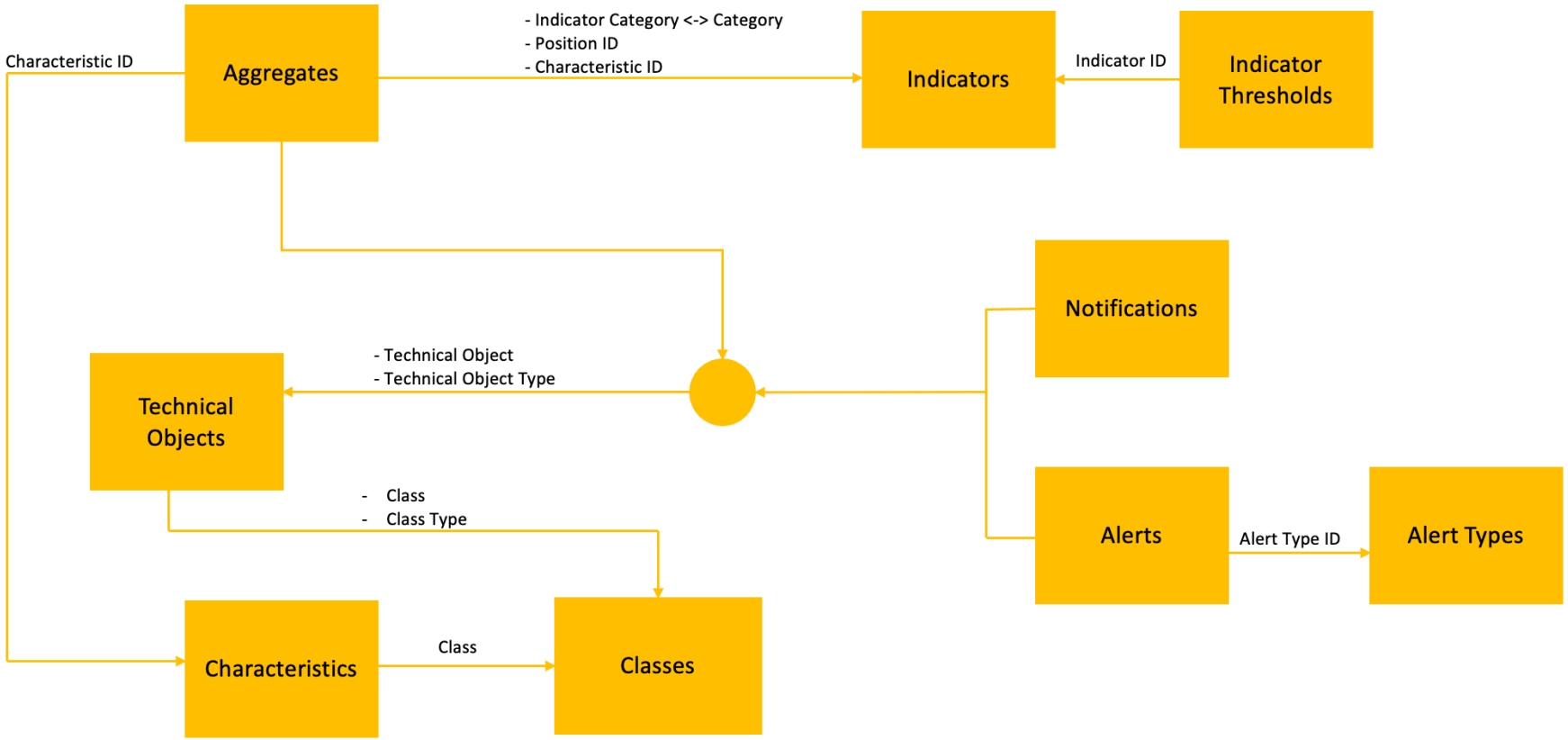


APM Functional Build – APM Analytics

- Setup: via BTP, connect SAP Analytics Cloud (SAC) to APM
- Aggregate-based analytics available in APM
- Limited to APM data. SAP has solutions that allow reporting on all data within an organization



APM Functional Build – APM Analytics Data



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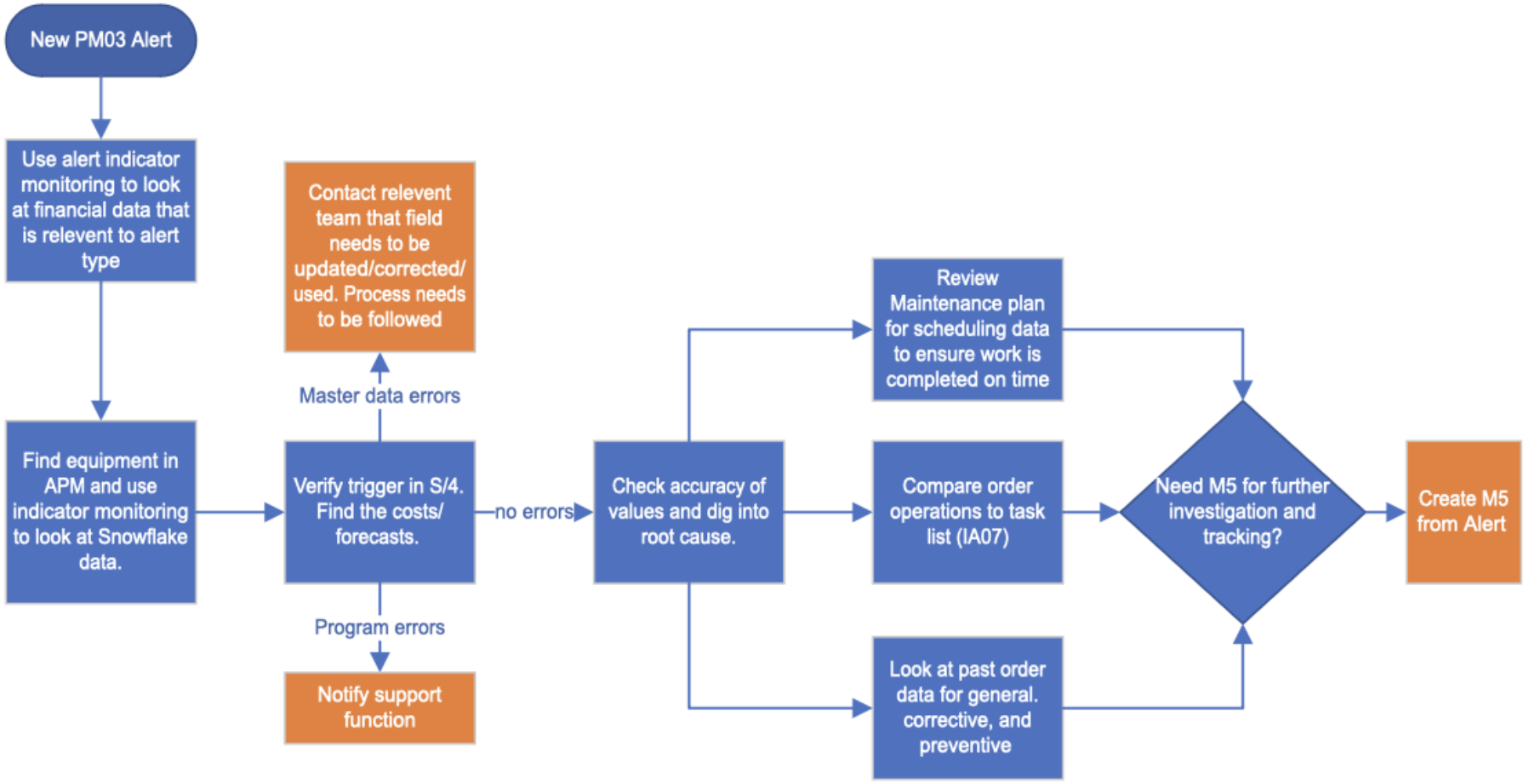
DEMO

APM Alert Investigation Process Flow



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