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Asset Health Center 3.0

Connected Asset Lifecycle Management™ and ABB Ability™

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Asset Health Center 3.0

Speaker

Ansis Silde
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Enterprise Software
ABB AG, Power Grids Grid Automation

ABB's Enterprise Software product group

Worldwide presence

ABB

- 135,000 employees
- $35B revenue

ABB Power Grids

- 39,000 employees
- $12.6B revenue
- 80 countries

ABB Grid Automation

- 6,000 employees

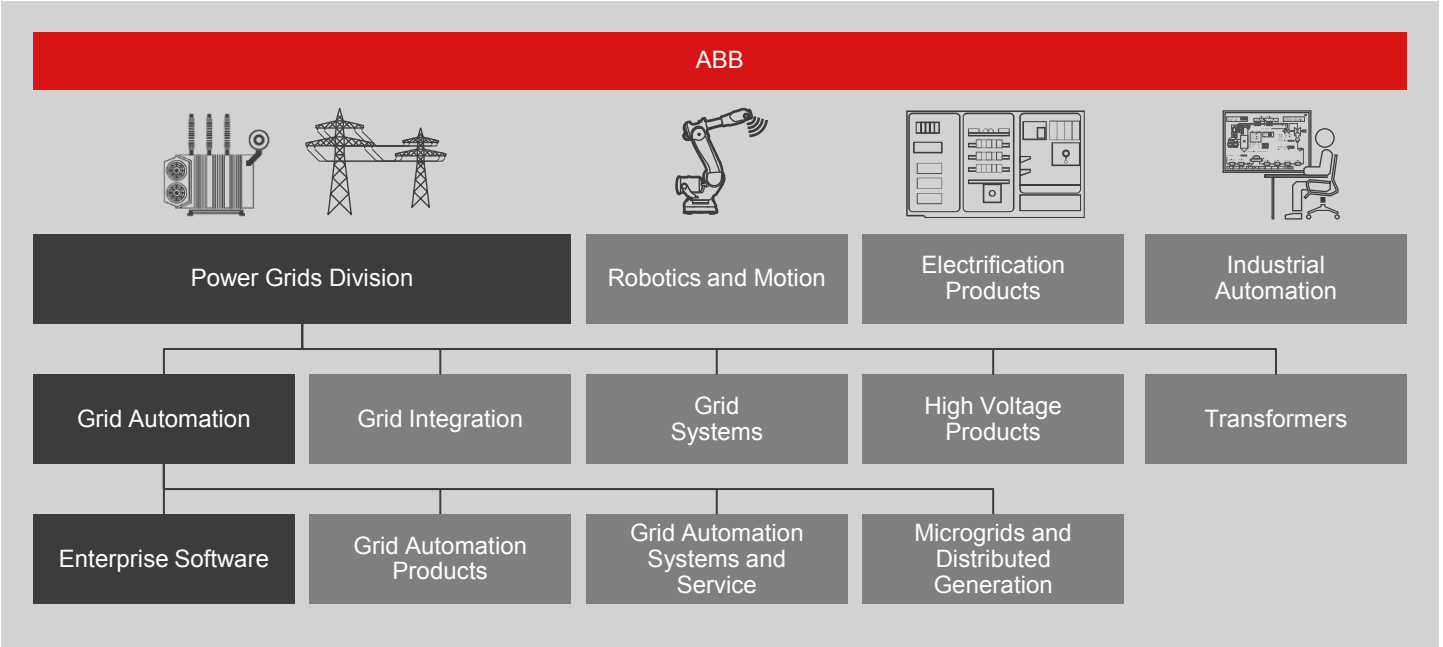


ABB Power Grid Division

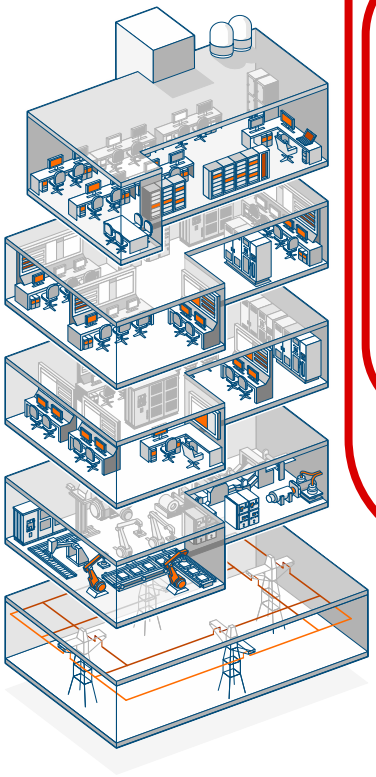


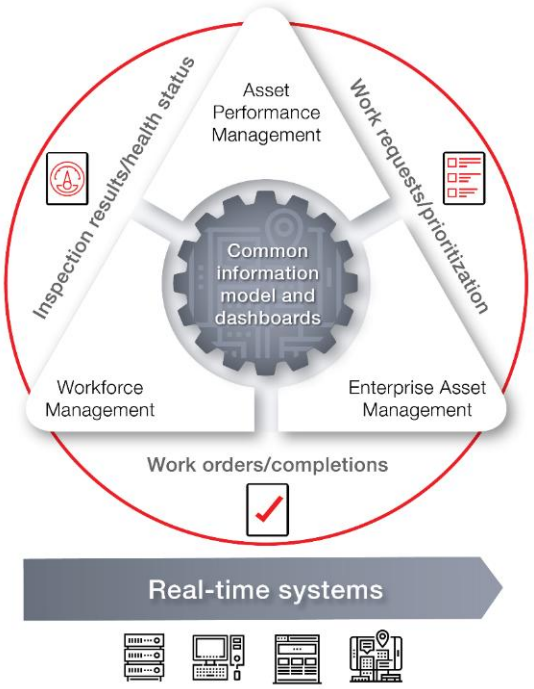
ABB Grid Automation

ABB Enterprise Software

Headquarters	ENERGY PORTFOLIO MANAGEMENT
Operations Center	ASSET MANAGEMENT SOLUTIONS
Control Center	NETWORK MANAGEMENT/SCADA
Substations	PROTECTION, CONTROL, MICROSCADA
Field Assets	PRIMARY EQUIPMENT

Connected Asset Lifecycle Management™

Next generation asset management

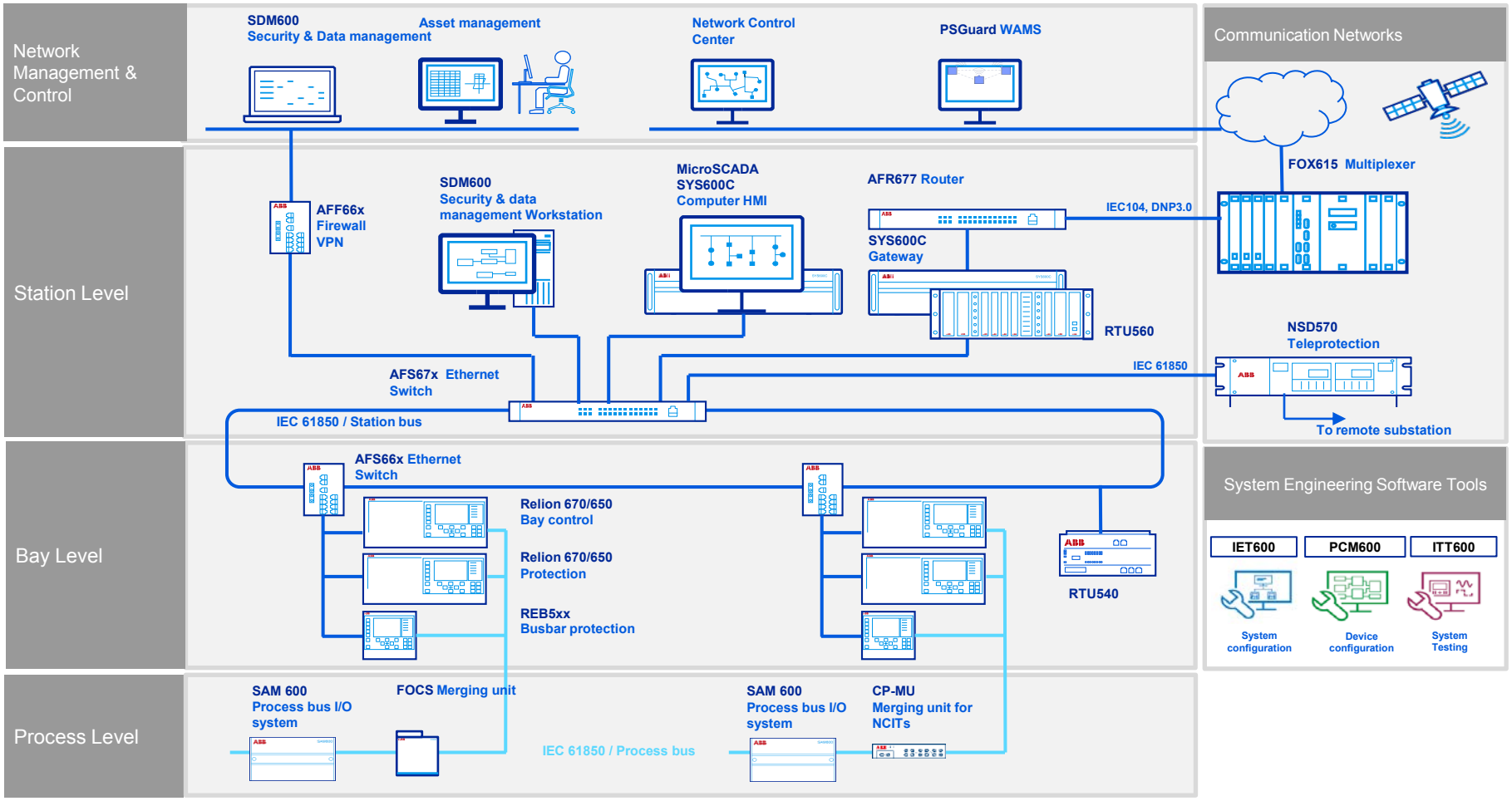


Integration for comprehensive asset management

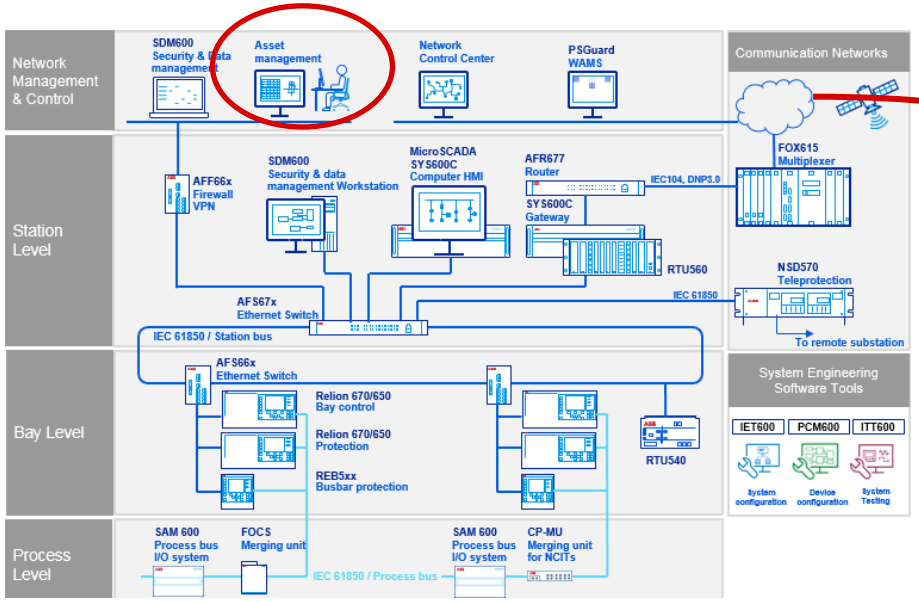
- Connecting engineering, operations and maintenance
- Connecting disparate data sources via common information model
- Connecting insight and action via advanced analytics
- Connecting real-time control to enterprise application software

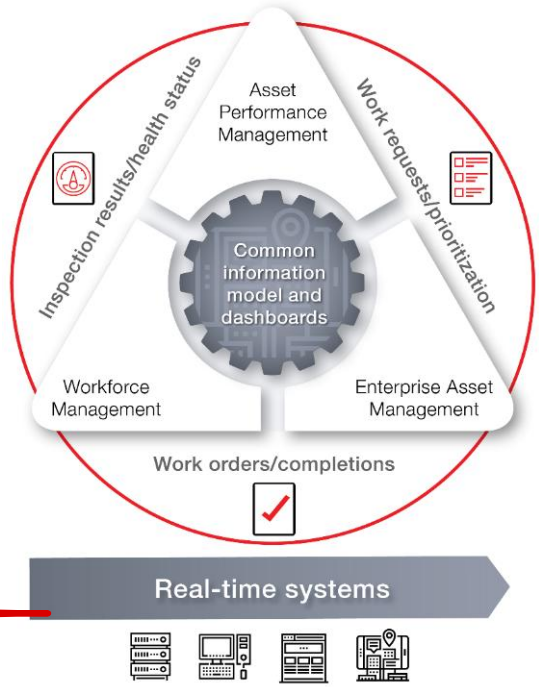
Digital Substation

Portfolio & architecture



What do we mean by Asset Management in the Digital Substation?





Challenges and changes utilities face

Aging infrastructure

Nearly 70% of the transformers in the US are more than 25 years old[1]

Cyber security

Through 2018, 50% of IoT device manufacturers will not be able to address threats from weak authentication practices[7]

Reliability

Up to 55% reduction in unexpected failures with predictive maintenance solutions[2]

Aging workforce

40% of the workforce at America's electric and natural gas utilities will be eligible for retirement in the next five years[6]

Asset information everywhere

25 billion devices (not counting smartphones, tablets or computers) will be connected to the IoT by 2020[3]

Spending justification

Companies investing in IoT-based operational sensing and cognitive-based situational awareness will see 30% improvements in the cycle times of impacted critical processes[5]

Distributed energy

By 2020, 2.5 GW of electricity will be generated by 20% of Fortune 500 companies, which will wholesale their distributed energy resource excess power through utility-independent subsidiaries[4]

1 Harris Williams & Co. | 2 ARC Advisory Group, November 2014 | 3 Gartner. Predicts 2016: Unexpected Implications Arising From the Internet of Things. December 2015 | 4 IDC FutureScape: Worldwide Utilities 2017 Predictions | 5 IDC Energy IDC FutureScape: Worldwide Digital Transformation 2017 Predictions | 6 APPA | 7 Gartner. Predicts 2016: Unexpected Implications Arising From the Internet of Things. December 2015

Asset Health Center

Why do customers need Asset Health?

Challenges

Information challenges

Aging workforce

Aging infrastructure

Pressure for higher reliability

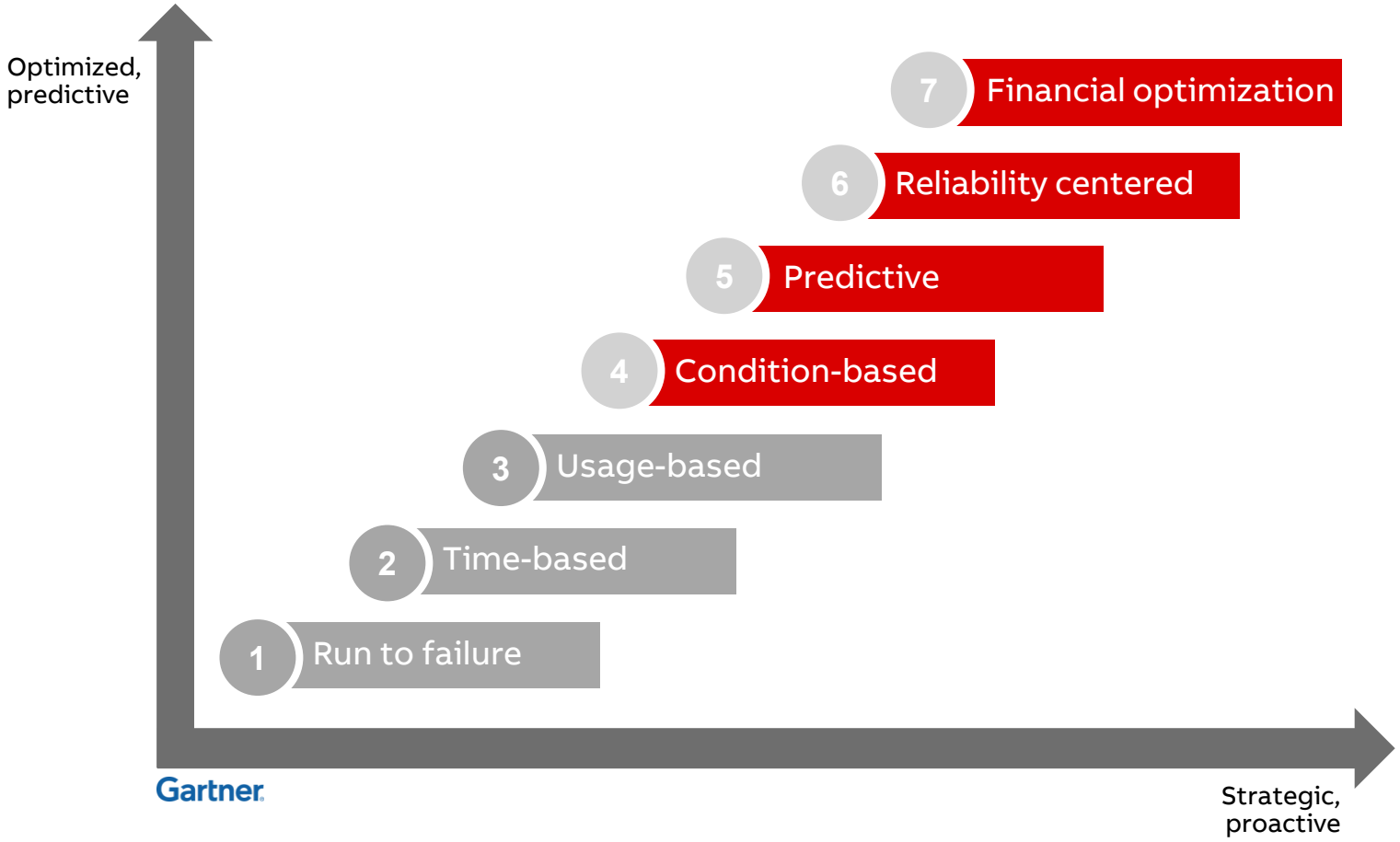
ISO 55000/PAS55

Defer or control capital expense

Flat O&M budgets

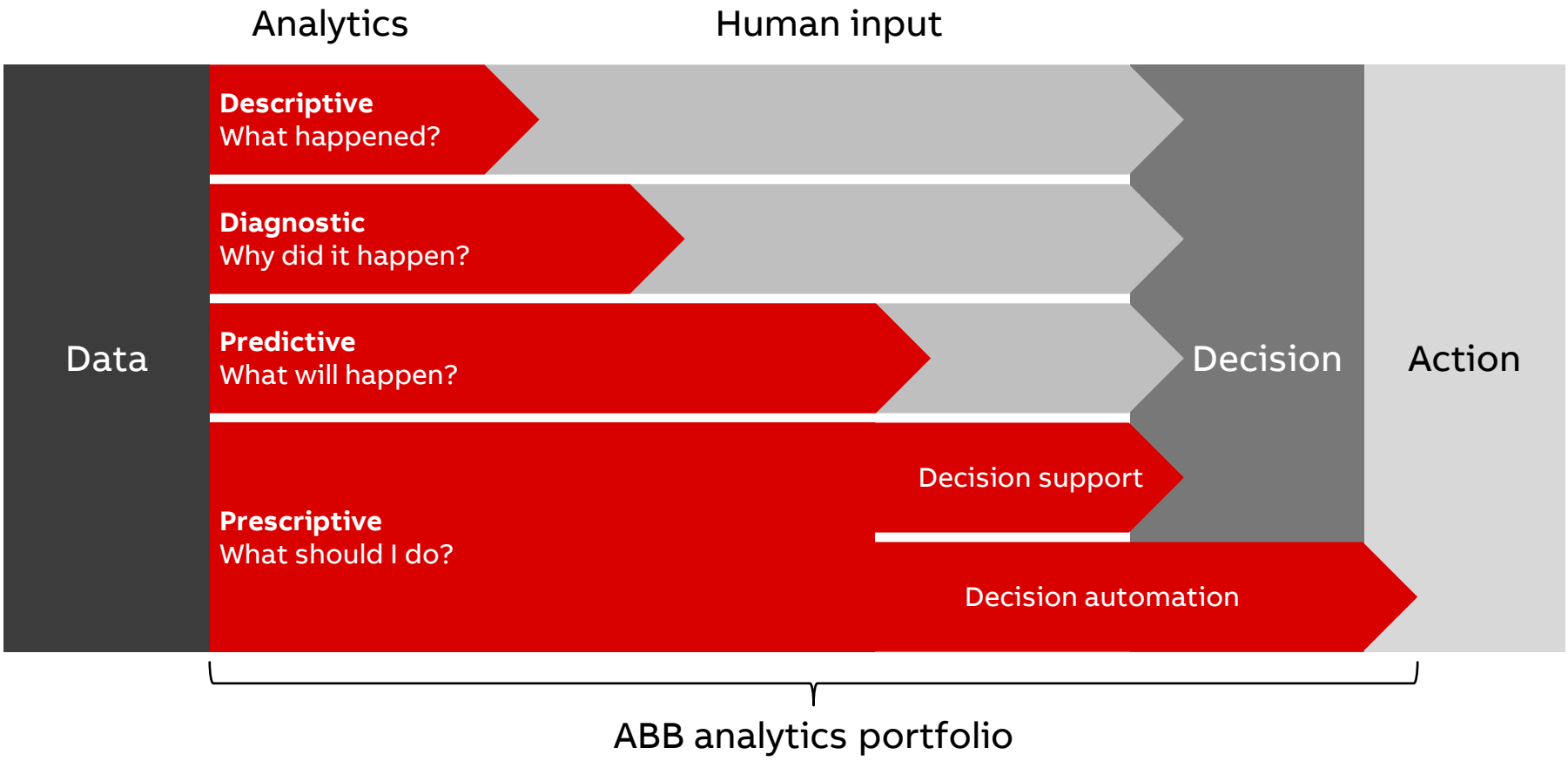
Asset Health Center

Asset management maturity



Evolution of digital business and analytics

Need for operational improvement steers analytics from descriptive to predictive



Source: Gartner (February 2015)

Adoption of predictive maintenance

Time for phases vary

Keys to adoption

- Executive champion
- Start with a business case
- Data specialist helpful
- In-house skills or easy-to-use solutions

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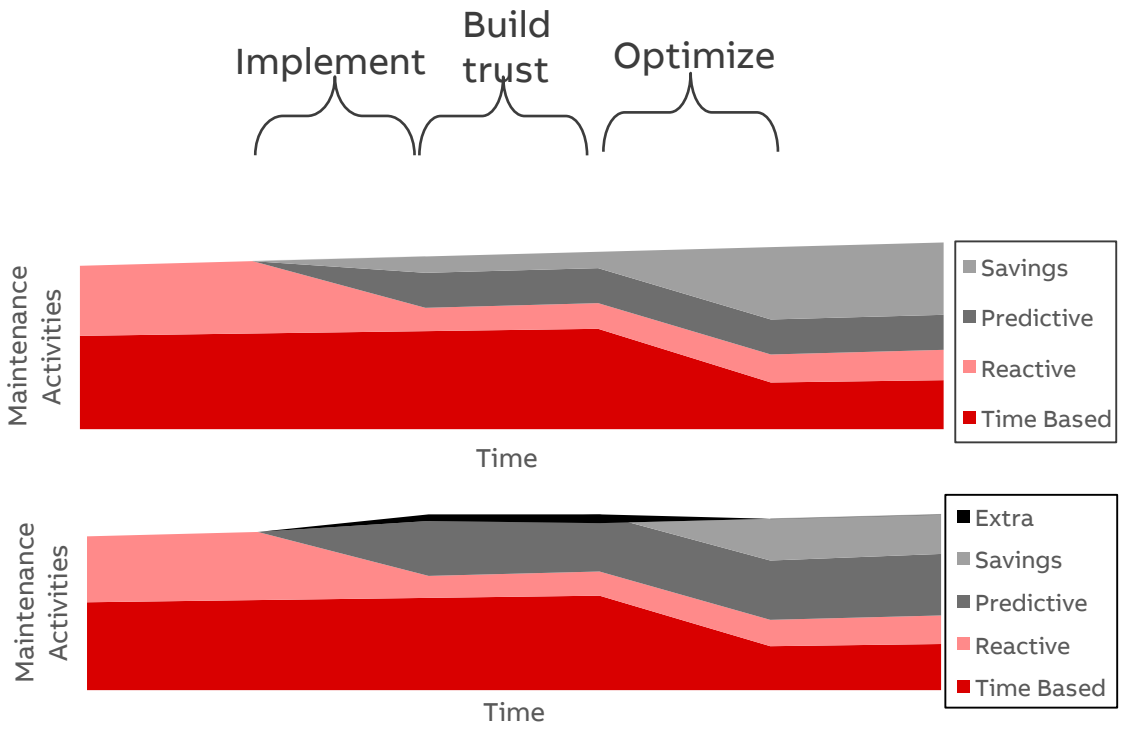
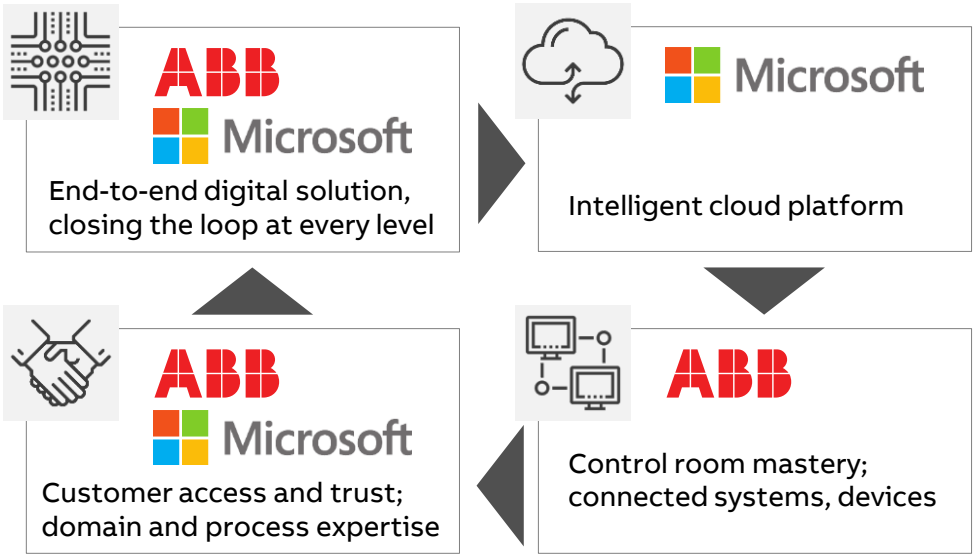


ABB and Microsoft partner for world's largest industrial cloud platform

ABB Ability™



Creating real business value

ABB Ability™ brings together **all of ABB's digital products and services**, connecting our customers to the power of the Industrial Internet of Things and turning data insights into the direct action that generates customer value in the physical world.

Global reach and reliability

- **Azure** is generally available in **32 regions** around the world, with plans for 6 more.
- Microsoft complies with both **international and industry-specific compliance standards** and participates in rigorous third-party audits, which verify security controls.

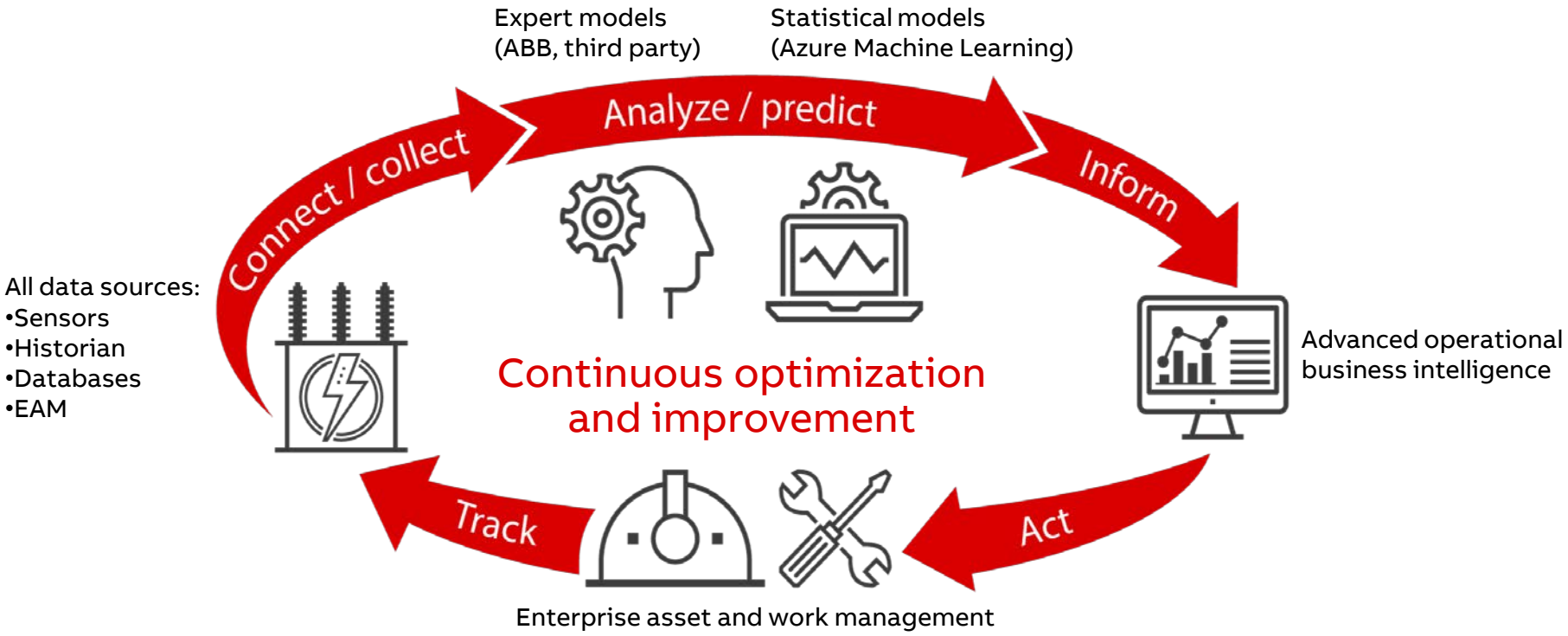
Independent analyst recognition for partners' strengths

2016 Asset Performance Management Leaderboard (Navigant Research)

2016 Magic Quadrant for Business Intelligence and Analytics Platforms (Gartner)

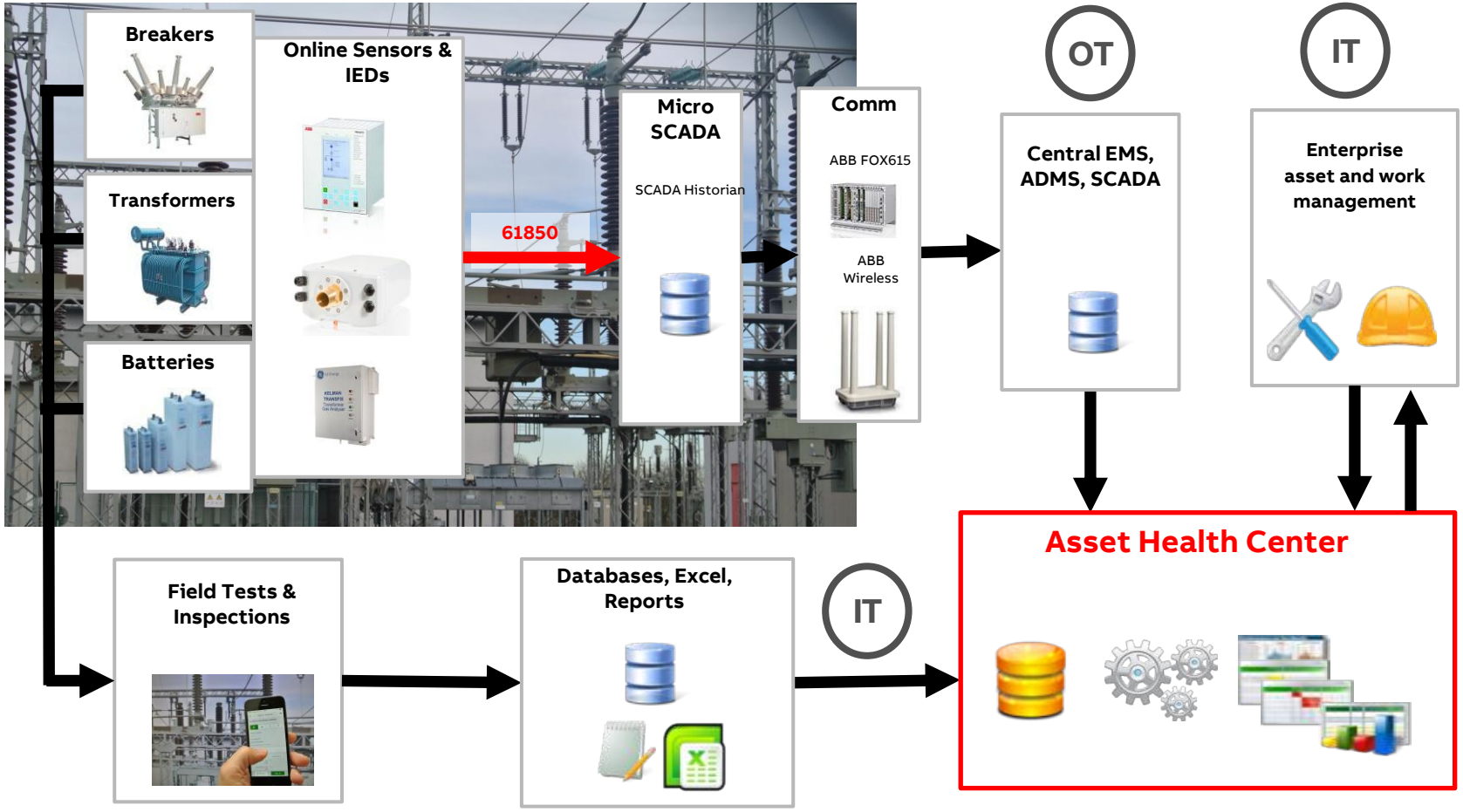
Asset Health Center

Improves process through continuous risk-based optimization

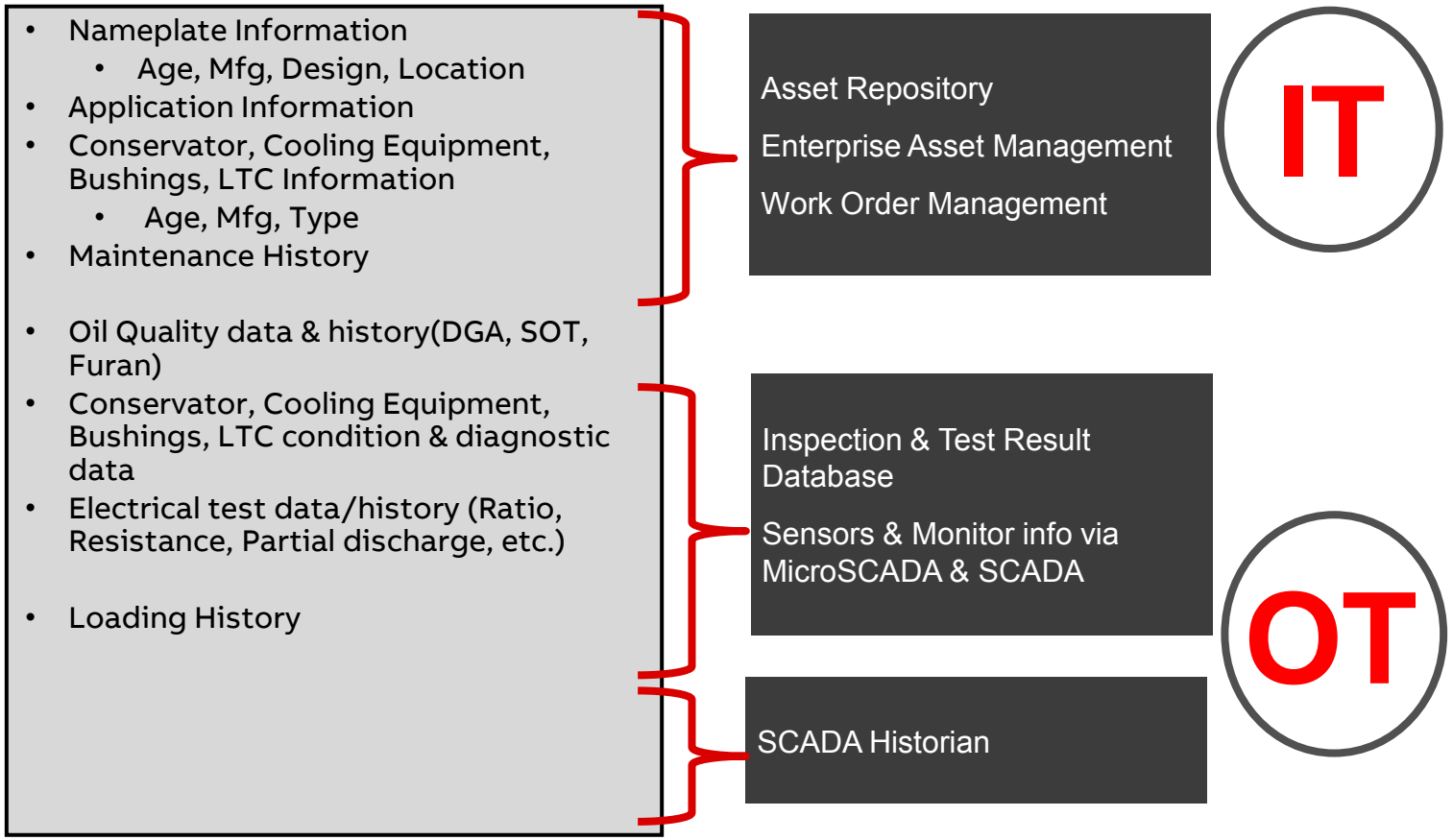


Asset Health Center

Prescriptive analytics for Utilities



Sample Input Parameters for HV Transformer Analysis



Types of Health Algorithms

Sample Asset Types

Expert Models

Algorithms based on deep technical knowledge of assets and failures(FMECA). Sometime a Health Index is good enough

ABB Algorithms for:

- Transformers
- Breakers: Gas Insulated (GIS) & Air Insulated Switchgear(AIS)
- Substation Batteries
- Relays / IED's (mit ABB SDM 600) *

Partner und Customer Indices for:

- Cables*
- Transmission Lines*
- Capacitors*
- CCVT (voltage transformers)*

Statistical & Machine Learning Models

Analysis of statistical input data based on healthy operation to identify normal correlations of data and thereby identify out-of-normal conditions

Microsoft Cortana Machine Learning for:

- Distribution Feeders/Circuits*
- Rotating Equipmnet

*in progress

Transformer Analysis

ABB Mature Transformer Maintenance Program

Transformer Algorithms

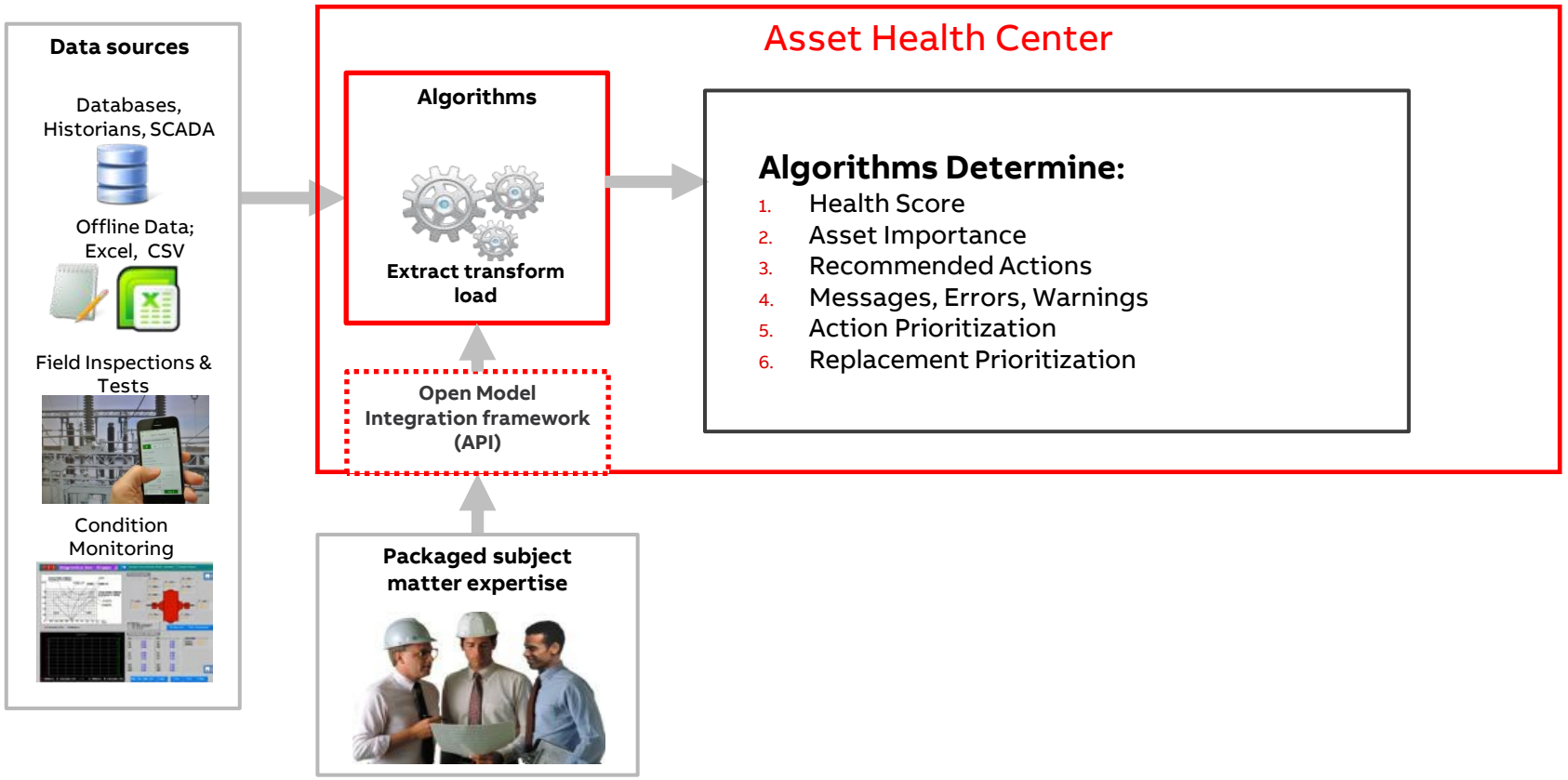
- Standard Oil Tests
- Dissolved Gas Analysis (DGA)
- Duval Triangle, IEC60599-3, Rogers Ratio
- Furan Analysis
- Oil Particle Count Analysis
- Partial Discharge
- Tap Changer (LTC)
- Bushing Analysis
- Cooling System Analysis
- Thermal Aging
- GIC

Sample output Messages from ABB Transformer Algorithms

Duval Triangle 1 and 4 analyses indicate C (thermal fault between 300°C and 700°C with paper carbonization). Possible causes include defective contacts at bolted connections (especially bus bar); connections within tap changer; connections between cables and draw rod of bushings;; circulating currents between yoke clamps and bolts; clamps and laminations; in ground wiring; bad welds or clamps in magnetic shields;; abraded insulation between adjacent parallel conductors in windings.
Recommended actions include thoroughly verifying the cooling system (fans; valves; pumps; radiators; coolers; oil preservation system; etc.); checking the leads and LTC connections; and determining if a recent DETC change caused a connection issue. An infrared camera may show hot spots on tank walls; oil ducts; radiators; and so forth. If performing an internal inspection; look for lead and LTC connection issues as well as circulating core currents and blocked oil channels. If no external issue identified; then consider degassing. Missing data for DGA and/or dynamic load is preventing accurate calculation of correlation between DGA and dynamic load. To achieve correlation; operate the transformer for some time at reduced load. Stable or diminishing gas levels indicate correlation with load. If positive correlation consider load shedding to mitigate risk as required. The data shows no statistical correlation between Acetylene, Carbon Monoxide, Ethane, Ethylene, and Methane and top oil temperature (r is at most 0.310).
Recommended actions should be taken within a year.
High Acetylene level indicates likely occurrence of arcing or high temperature faults.
DFR test may confirm presence of carbonization. Must plan internal inspection to localize fault.
Recommended actions should be taken as soon as possible.
Oil acidity is above acceptable level although interfacial tension is still within limits. This is still an indication of an aged oil which may need reclaiming soon. Elevated acidity favors accelerated aging of solid insulation whose breakdown also forms water; thus increasing operational risk of the transformer.
Bringing the oil back to acceptable conditions through processing/reclamation is highly recommended. Before addressing the oil quality itself; take another sample to assess Furan levels in order to help determine the condition of the solid insulation.

Asset Health Center

Performance models generate more than Health Scores



Thank You!