Efacec Asset Performance Management Solutions

Grid Asset Management 2019

efacec

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Strategic Asset Management

actionable loop

Planning

Health and Performance Management

Maintenance

Source: ISO 55000, IDC

The Key Drivers

need to balance benefit and cost, assess risk and prioritize implementation

Drivers

1. Improve asset utilization

ex: reducing downtime, enabling controlled overloading, securely extending asset life, enabling dynamic ratings

2. Reduce maintenance costs

ex: automating routine activities, minimizing (planned) operations and related materials, improving information access and flow.

3. Lower CAPEX expenditure and working capital

ex: minimize catastrophic failures and related collateral costs and emergency repair costs, better investment planning.

4. Increase power system reliability

ex: reducing downtime, enabling predictive protection and control.

5. Corporate drivers

ex: reduced exposure to safety and environmental issues, reputation, liability, standards compliance and regulation, competition

The business value of each driver is different between organizations as is each asset base and company strategy

Digital Asset Management Components

key digital solution elements

Drivers

Solutions

Master Data Management

Positions, identification and nameplate, features and capabilities, components, lifecycle status, documentation, etc.

Asset Sensing and RT Monitoring

Sensors, communications and data capture (live field data), online analytics

Asset Health and Performance Management

Condition assessment (health), diagnostics (cause), predictive (health evolution/ time-to-fail), prescriptive (action recommendation, asset optimization)

Maintenance and Workforce Management

Work order tracking, crew management, record-keeping (inspections, operations, asset data)
Connected workforce, powerful visualization and VR/AR

Asset Planning

Enterprise asset view including financial and accounting views, warranty management, investment planning

Autonomous Operations

Robotics, drones, automation

Managing Secondary Assets

key drivers and digital solutions

Drivers

1. Availability

Keep Automation System Operational

2. Cybersecurity

Protection and Compliance

3. Remote Management

Optimize O&M

Solutions

System and Device Monitoring

Online status and fault monitoring, logging and reporting (IDS), cybersecurity testing

Fault and Performance Management

Real-time diagnostics, predictive analytics, prescriptive

Power System Data Management

Manage COMTRADE, COMFEDE, PQDIF data
Events and P&C system response

Version Management

Version and patch management

Configuration Management

Backup and recovery, active settings
Centralized historical storage of system settings

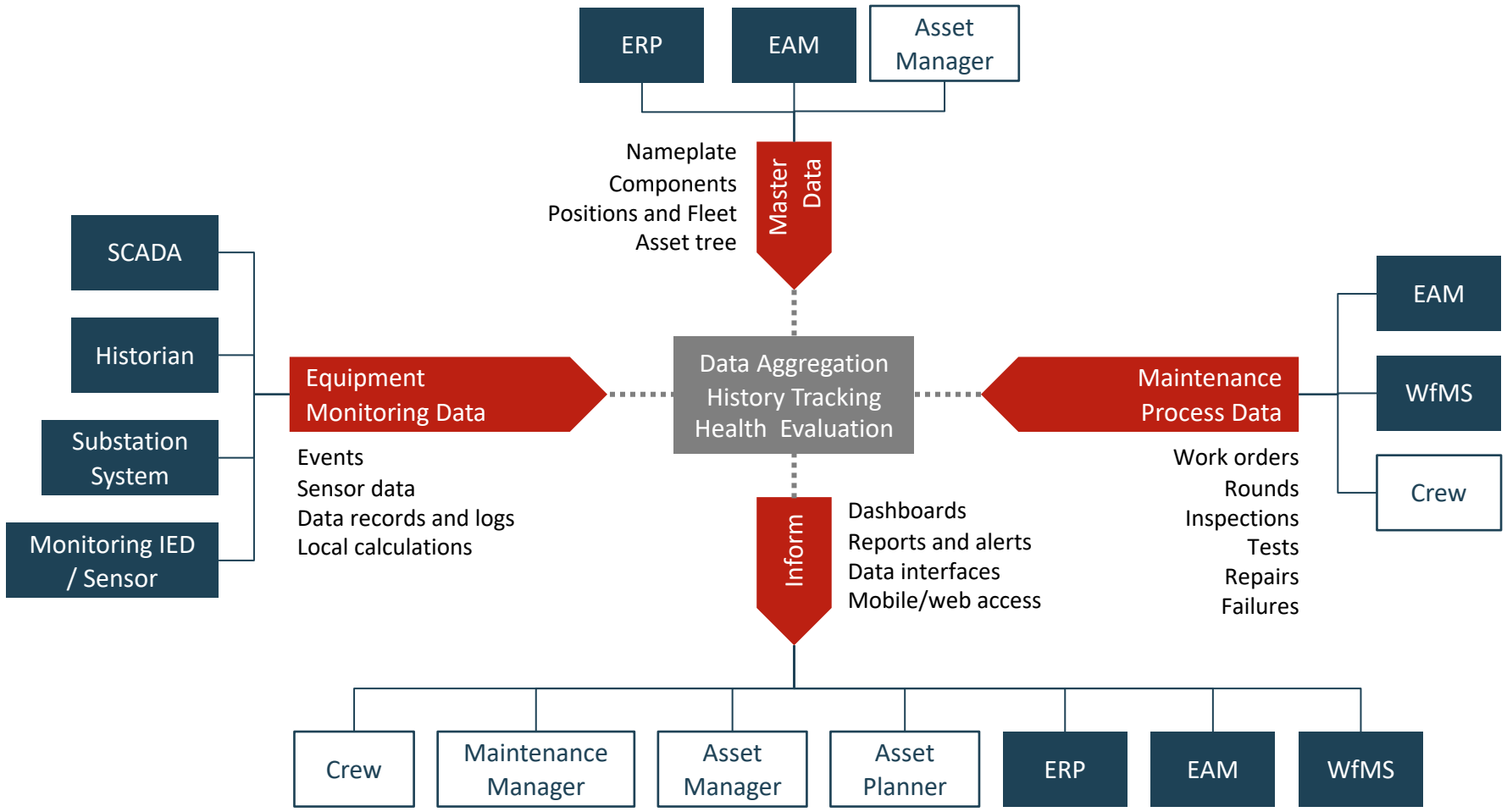
Protection Settings

Online supervision, control and management of active settings

User Management

Centralized RBAC

Data and Information are Key



And Also Standards

IEC 61850, CIM and ISO/PAS 55000

IEC 61850 Power Transformer Model Objects

- YPTR Power Transformer
- SPTR Power Transformer Supervision
- SIML Insulation Medium Supervision
- CCGR Cooling Group Control
- MMXU Electrical Measurement
- ZBSH Bushing
- SPDC Partial Discharge Monitoring
- YLTC Tap Changer
- SLTC Tap Changer Supervision

CIM (IEC 61968)

- Enterprise integration
- AMI, DMS, OMS, GIS, CIS, Asset management, Work management

IEC 61850

- Online/ connectivity
- Information modeling
- Systems engineering interoperability

ISO 55000

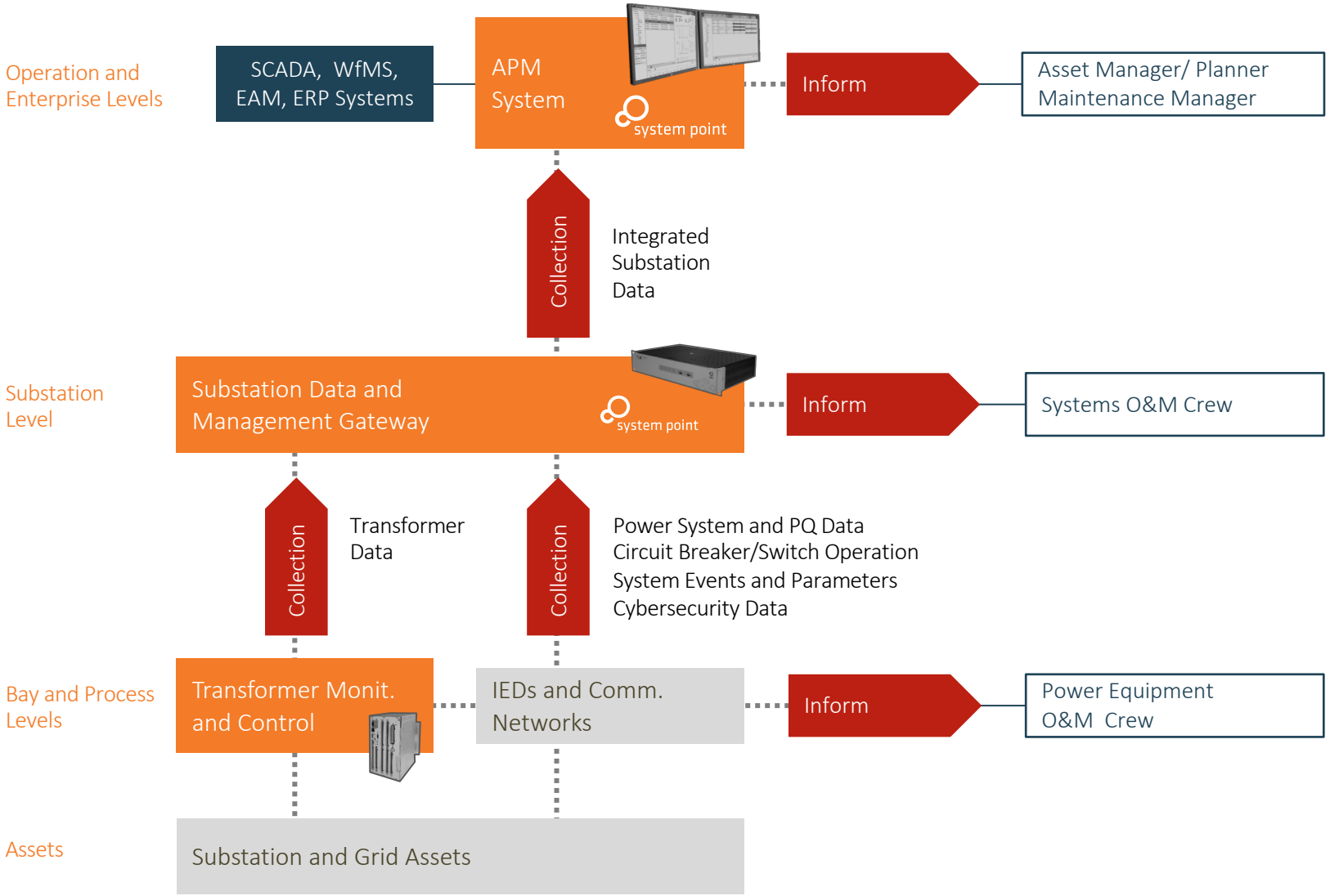
- Strategic asset management
- (Corporate) asset management systems

Other

- SNMP, syslog, LDAP, COMTRADE, etc.
- IEEE C57–104, IEC 60599, CIGRE, etc.

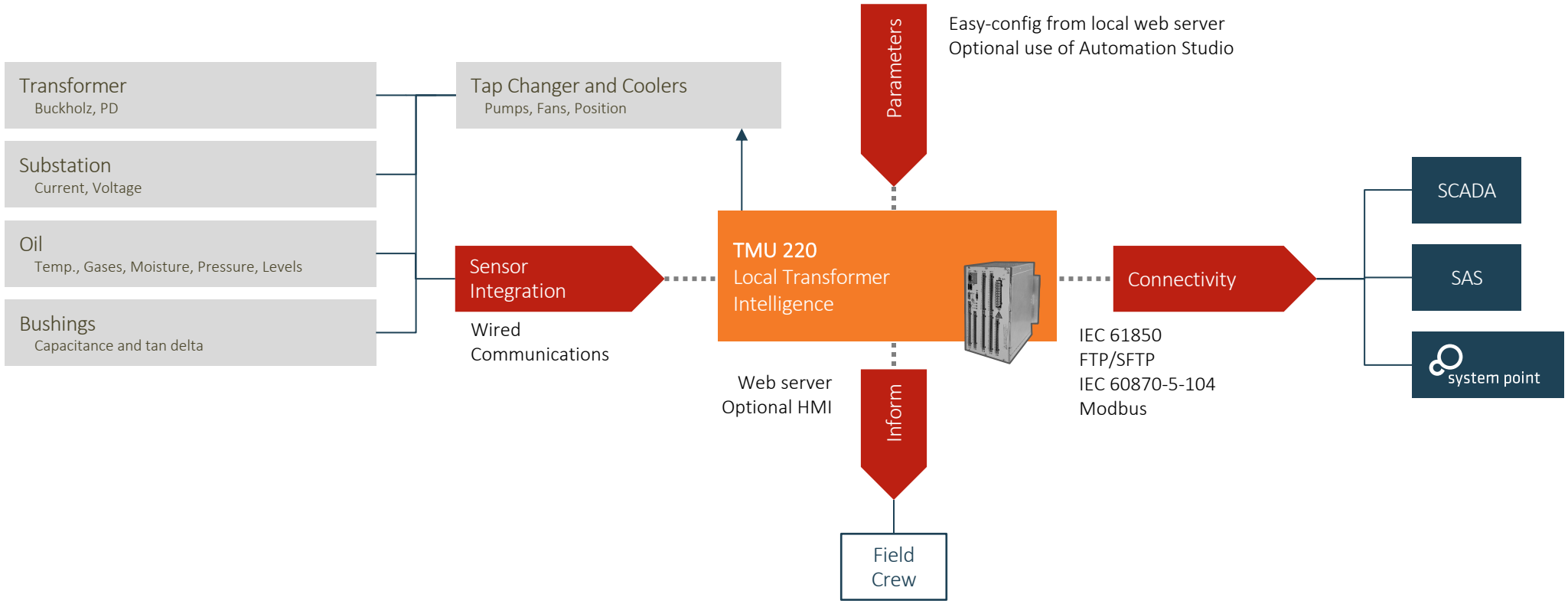
Efacec Technical Architecture

SGAM mapping



Efacec Technical Architecture

power transformer



Efacec Technical Architecture

power transformer

system point

TMU 220
Local Transformer Intelligence

YPTR	Power Transformer
SPTR	Aging and Temperature Supervision
HPTmpClc	Calculated winding hotspot temperature
ToTmp	Top oil temperature
SIML	Oil Supervision
H2O	Relative saturation of moisture in insulating liquid.
ZBSH	Bushing Supervision
CCGR	Colling System Supervision
EnvTmp	Environment temperature
CEMod	Cooling equipment operation mode
YLTC	On-Load Tap Changer Supervision

Remaining Life Time — IEC 60076-7

Paper Polymerization

$$DP_i = \frac{1}{\frac{1}{DP_{i-1}} - \frac{A_i * (t_i - t_{i-1})}{3600 * e^{E_A/[8.314(HPTmpClc_i + 273.15)]}}}$$

Percentual Remaining Life

$$perLife = 1 - \frac{\frac{1}{DP_i} - \frac{1}{DP_{start}}}{\frac{1}{DP_{end}} - \frac{1}{DP_{start}}}$$

Overload Capacity — IEC 60076-7

Allowed time based on required power factor

$$time = -log\left\{\left[1 - \frac{LimToTemp - ToTemp}{dTor * \left(\frac{1 + R * Knec^2}{1 + R}\right) - ToTemp + EnvTemp}\right]\right\} * k11 * Tau0$$

Allowed power factor based on required time

$$pf = \sqrt{\frac{1}{R}\left\{\left[\frac{LimToTemp - ToTemp}{1 - e^{-tnec/k11 * Tau0}} + ToTemp - EnvTemp\right] * \frac{1 + R}{dTor} - 1\right\}}$$

Equations are simplified and do not represent the complete algorithms

Efacec Technical Architecture

power transformer

system point

Health Index

$$HI = 60\% \times \frac{\sum_{j=1}^{21} K_j HIF_j}{\sum_{j=1}^{21} 4K_j} + 40\% \times \frac{\sum_{j=22}^{24} K_j HIF_j}{\sum_{j=22}^{21} 4K_j}$$

1	DGA
2	Load History
3	Power Factor
4	Infra-red
5	Oil Quality
6	Overall Condition
7	Furan or Age
8	Turn Ratio

9	Leakage Reactance
10	Winding Resistance
11	Core to Ground
12	Bushing Condition
13	Main Tank Corrosion
14	Cooling Equipment
15	Oil Tank Corrosion
16	Foundation

17	Grounding
18	Gaskets, Seals
19	Connectors
20	Oil Leaks
21	Oil Quality
22	Oil Level
23	DGA of OLTC
24	OLTC Oil Quality

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WfMS
Workforce Management System

	Work Orders
	Rounds
	Inspections
	Tests

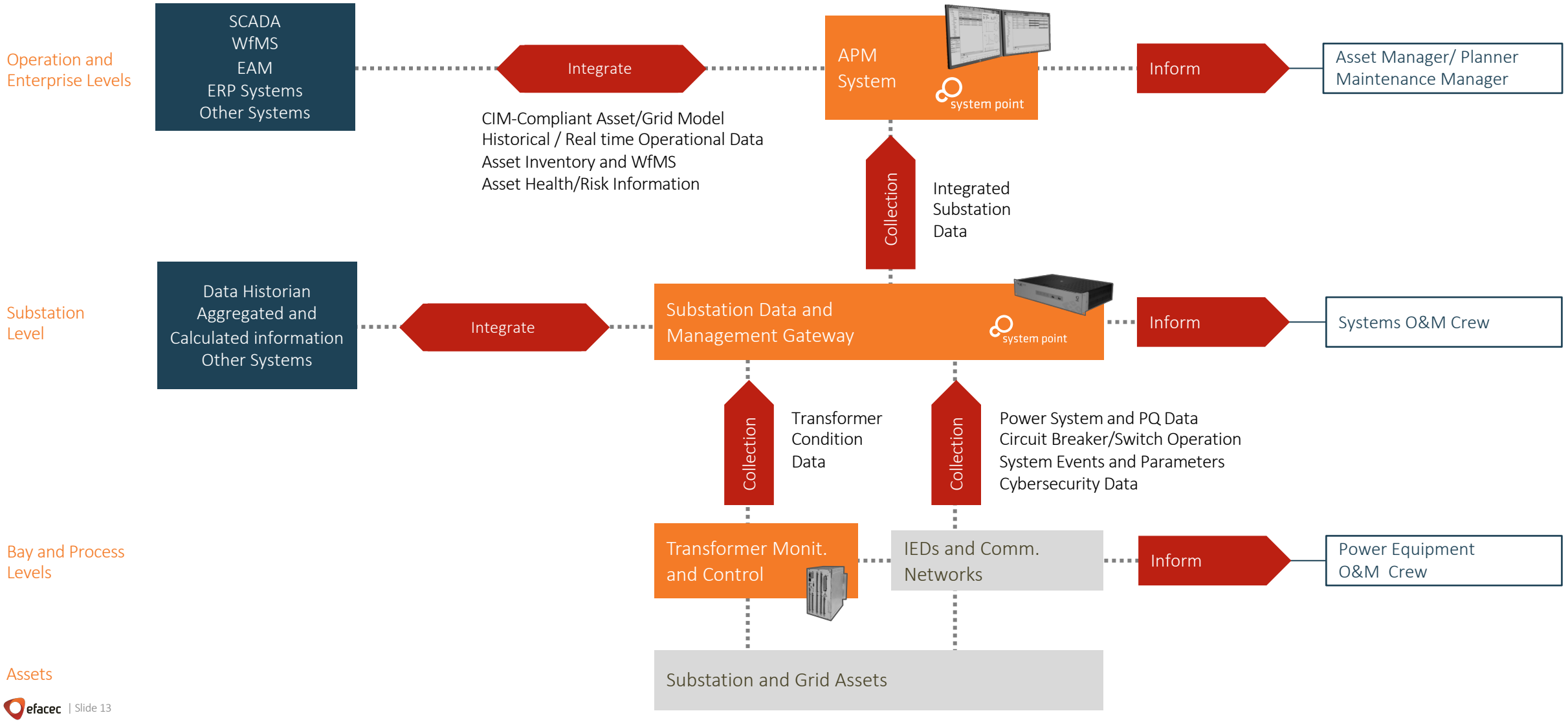
EAM
Enterprise Asset management

	Nameplate
	Components
	Repairs
	Failures

Equations are simplified and do not represent the complete algorithms

Efacec Technical Architecture

data integration and normalization



Asset Management

Coordinated activity of an **organization**
to realize value from assets.

Asset management enables an organization to examine the **need** for, and **performance** of, assets and asset systems at different levels.

Additionally, it enables the application of **analytical approaches** towards managing an asset over the **different stages of its life cycle**.

Thank you

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