ASSET INFORMATION MANAGEMENT SYSTEMS

Introduction

Transmission companies face a variety of pressures and technical challenges regarding their assets. To address these, many companies are adopting formal asset management approaches. Asset management is defined as: A structured, integrated series of processes to align all decisions with business goals and values and designed to maximize the life cycle benefits of asset ownership, while providing the required service performance and risk exposure levels and sustaining the system going forward. It enables the establishment and execution of a series of interrelated processes that assure that all decisions related to the allocation of resources are evaluated against, aligned with and made to optimize the achievement of the organization's goals for financial and operational performance and tolerance for risk exposure. Some key characteristics are:

- Policy, goals and objectives designed to drive performance
- Documented programs, decisions on resource allocation and application based on those policy, goals and objectives
- A longer term, proactive perspective of cost and performance and future risk exposure

Effective asset management processes require the best available, current, and accurate information on assets and asset performance, well developed decision support analyses for evaluating trade-offs and prioritizing actions and effective management systems.

In order to make informed asset management decisions it is vital that utilities have a holistic view of their assets. Utilities may be able to realize this goal through well-defined processes and technologies for data collection, integration and visualization. Asset information management systems aspire to bridge this gap.

Industry Challenge

Asset information management system implementations in the electric utility sector are challenging. Organizational boundaries, inadequate asset and cost data, a multiplicity of software decision tools and schedule delays and overruns in enabling enterprise systems, and a changing business environment have all inhibited asset management implementations.

Contents

What are Asset Information Management Systems?

Asset Information Management Systems commonly include the following components:

Maintenance Management System. These systems typically include asset inventory, work order management and history, and equipment failure and repair information. The asset inventory is the critical source of basic asset information. Also, has schedules of major maintenance activities that are useful for project prioritization and investment.

Operations Data Historians and Condition Assessment Systems. Condition assessment information, e.g., thermal monitoring, operation counts, run hours, etc., may be integrated into the EAM system and used to trigger maintenance. Condition assessment and operations data may also be mined or accessed by an operations data monitoring system available in conjunction with a data historian.

Geographic Information Systems (GIS). Since much of a utility's asset information can be tied to a geographic location, another significant element of an asset management system is a CADD or GIS-based map of fixed assets and related data. The GIS may also identify compatible units, or other logical groups of assets, that can or should be evaluated together.

Asset Health Analytics. These tools aid in the development and implementation of asset health assessment algorithms and risk mitigation strategies.

Engineering and design tools. These tools may be a part of the EAM system. These tools, or related project management tools, will contain project descriptions, costs, and schedules for both projects and alternatives.

Operational excellence tools. Operator logs and tag-out records may identify outage times for planned maintenance and forced outages. Outage times can be important for understanding and managing planned exposure to risk, i.e., when a level of redundancy/contingency is voluntarily removed, and risk levels become much higher. Forced outage times are also an indicator of possible need for action to improve operations, maintenance, or design of an asset.

Finance Databases and Models. These databases may include billing, accounts receivable, accounts payable, tax data, budgeting and forecasting, valuations, and debt management. Often, because of security issues, special arrangements, such as data dumps, must be made in order to provide this information to asset management.

Capital Planning Data. Most utilities have some type of database related to their facility capital improvement projects.

Business Processes. Individual functional groups within a utility often maintain some information related to their key business processes and standard operating procedures. Sometimes performance measures or targets may also be included.

Asset Information Management Systems help utilities in collecting asset component and sub-system field performance data, organize this information in centralized management systems (maintenance management, historian etc.) and make this data available to algorithms and processes that consume data and provide actionable insights.

Considerations When Selecting a Vendor Solution

Several vendors are developing asset information management systems. However, the lack of well-defined standards and guidelines is creating challenges when utilities try to specify requirements to help them evaluate and select a suitable asset health system.

Several categories should be considered:

1. Analytics
   a. Is the system flexible enough to allow the utility in selecting and implementing analytics from different sources?
   b. Is the utility able to implement analytical tools that it receives from third parties in the system?
   c. Does the system implement third party analytical packages from an Application Programming Interface (API) via a Dynamic Link Library (DLL) or similar technologies?
   d. Does the system support open source programming languages such as Python and R?

e. What is the analytical capability of the system?

  i. Does it come equipped with proprietary algorithms?

  ii. Are the analytics methodology viewable?

  iii. Does the platform offer advanced analytical capabilities such as machine learning?

  iv. What is the underlying basis and validation for the approach?

2. Data Sources

  a. Can the system query from multiple data sources such as Oracle, SQL Server, MySQL or similar technologies?

  b. Can the system communicate with existing data sources?

3. Data Protocols

  a. What are the specific data transport protocols supported by the system such as DNP3, Modbus or similar technologies?

  b. Is the system capable of accommodating any changes to the communication protocols and data exchange methods from one monitor version to another?

4. New Data Streams

  a. What accommodations does the system have for new data streams from advanced technologies like Unmanned Aircraft Systems (UAS), robotics or other new data streams which may emerge?

5. Nontraditional Data Sources

  a. Can the system aggregate data from nontraditional sources such as digital relays, digital fault recorders, archiving voltage and current waveforms from SCADA and associate them with underlying asset?

6. Data Schemes

  a. Does the system data aggregation functionality have the flexibility to model underlying data tables and schemas using industry guidelines?

7. Data Ownership

  a. What approach is the system taking to store the utility's aggregated data?

    i. Does the system store this data on or off premises?

  b. Once the data is in the vendor's environment, who owns the data?

  c. What is the data usage rights?

  d. What can the vendor do with the utility's data in a non-attributable format?

Asset Information Management Systems: Industry Developments

With advances in computing power, data and information transport protocols and data storage technologies many vendors are developing and piloting asset information management systems at transmission utilities across the globe.

Examples of vendors developing and piloting/demonstrating asset information management systems at transmission utilities:

- Ventyx Asset Health Center from ABB
- Asset Risk Management Systems (ARMSTM) from Doble
- Command and Control Approach for Asset Health from mPrest
- Grid Asset Performance Management from GE.
- VueForge Asset Health Platform from Altran
- Asset Health Platform from KEMA
- Condition Based Risk Management from KEMA
- Using Data Science Techniques for Predicting Lightning Performance from TROVE
- Advanced Statistical Machine Learning and Artificial Intelligence in Internet of Things (IoT) Applications from Oracle

These solutions can be placed into two broad categories:

1. Vendor provides an end to end solution which includes:

  a. Propriety asset health algorithms

  b. May integrate 3rd party algorithms

Table 1. Examples of how utilities are adopting asset information management systems.

Utility	Visualization	Asset; Periodic and Corrective Maintenance Data	Periodic Test Data	Algorithms
A	SAP HANA	SAP	TOA, DTA, Historian	EPRI, Industry
B	Tableau	Cascade	TOA, DTA, Historian	EPRI, Industry & developed by internal SME's
C	mPrest	Maximo	TOA, DTA, Historian	EPRI, Industry
D	Internally developed web portal	Cascade	TOA, DTA, Historian	EPRI, Industry & developed by internal SME's
E	ABB Asset Health Center	Maximo		EPRI, Industry, ABB's MTMP and Kinectrics Battery Health
G	Internally developed web portal	Maximo	LIMS, Historian	EPRI, Industry & developed by internal SME's
H	Tools from Copper Leaf Consulting	Cascade	TOA, DTA, Historian	EPRI, Industry
I	Internally developed web portal	Cascade	TOA, DTA, Historian	EPRI, Industry
J	Asset Analytics (internal development)	Maximo	Historian, DTA and internally developed	EPRI, Kinectrics, Industry and internally developed

c. Data storage and transport

d. Data Visualization

e. Reporting

f. Examples of this type of solution include:

i. ABB

ii. Doble

iii. GE

iv. EA Technology

v. Oracle

2. Vendor provides an open platform which includes:

a. Open source programming environment for asset health algorithm development

i. Vendor may aid in algorithm development

b. Data Visualization

c. Reporting

d. Examples of this type of solution include:

i. c3 IOT

ii. Trove

iii. mPrest

Asset Information Management Systems: What is EPRI doing?

To help utilities in making better informed decisions regarding selection and implementation of asset information management systems EPRI has the following efforts underway:

- Asset health systems interest group to
  - Exchange information, experiences, and lessons learned

- Identify knowledge gaps, needed capabilities
- Learn about new and emerging tools for improving analytics and methodologies for developing and implementing enhanced asset health indices

- Subject Matter Experts from EPRI's Transmission Asset (T&S) and Information, Communication and Cyber Security (ICCS) areas have teamed up to develop guidelines that could help utilities in developing specification requirements, review vendor proposals and inform selection process. The guidelines could also inform vendors regarding utility needs that need to be incorporated in future system architecture and design. Topics such as the following may be addressed in the guide:
  - Mechanisms for accessing and integrating existing data sources
  - Data requirements for different analytics
  - Communication approaches
  - Dashboards and visualization
  - Asset health system implementation use cases

Conclusion

In order to make informed asset management decisions it is vital that utilities have a holistic view of the health of their assets. Utilities may be able to realize this goal through well-defined processes and technologies for data collection, integration and visualization. Several vendors are developing asset health systems with this goal in mind. However, the lack of well-defined standards and guidelines is creating challenges when utilities try to specify requirements to help them evaluate and select a suitable asset health system.

References

Standard Based Integration Specification: Common Information Model Framework for Asset Health Data Exchange. EPRI, Palo Alto, CA: 2014. 3002002586.

Standard Based Integration Specification: Common Information Model Framework for Asset Health Data Exchange. EPRI, Palo Alto, CA: 2014. 3002002586.

IEC standard 61970-301 a semantic model that describes the components of a power system at an electrical level and the relationships between each component.

IEC 61968-11 extends power system component semantic model to cover the other aspects of power system software data exchange such as asset tracking, work scheduling and customer billing.

IEC 61970-301 and 61968-11 are collectively known as the Common Information Model (CIM) for power systems (they facilitate the exchange of power system network data between companies; and to allow the exchange of data between applications within a company).

Note

For further information about EPRI, call the EPRI Customer Assistance Cen- ter at 800.313.3774 or e-mail askepri@epri.com.

The Electric Power Research Institute, Inc. (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI also provides technology, policy and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI members represent 90% of the electricity generated and delivered in the United States with international participation extending to nearly 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; Dallas, Texas; Lenox, Mass.; and Washington, D.C.

Together . . . Shaping the Future of Electricity

Technical Contact

Bhavin Desai at 704.595.2739, bdesai@epri.com

3002019783

August 2020

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA • 800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com