IBM Data Model for Energy and Utilities Positioning with IBM Insights Foundation for Energy

Industry Challenges

Traditional electricity utilities are faced with a landscape that is subject to significant change, which is driven by a combination of evolving regulations, different customer behavior, and expectations and competition from traditional and non-traditional sources. These challenges can be summarized as follows:

The rise of viable substitutes

The availability of viable energy substitutes to traditional utilities introduces business and technical challenges of intermittency, dispatchability, and disintermediation. The advent of alternative energy providers, specifically with renewables and storage becoming mainstream, means that these sources now provide a viable substitute. This is forcing these utilities to evolve from their traditional role of an energy supplier to that of an energy integrator, in order for them to stay relevant.

The change to the customer engagement model

Electrical utilities are not immune to the need to react to the radical changes in consumer expectations when it comes to how organizations interact with them. A growing proportion of most utilities client base now expects and demands a much richer and personalized user experience including the need for instant interaction that is delivered by social and mobile apps. Per capita demand is rising but energy intensity is sinking and prosumer supply is expanding driving a more sophisticated and economically challenging customer interaction. This requires the need for utilities to focus on the customer 360-degree experience as delivered across a range of technologies.

Core traditional expectations remain

While the customers of electrical utilities are looking for both new energy substitutes and enhanced interaction experiences, they (and the appropriate regulator) still require the continued delivery of safe, reliable, and low-cost energy with embedded sustainability. And to do this in a more efficient manner given the increased competition from new entrants in this space.

Analytics is key

The role of enhanced analytics is critical in terms of providing electrical utilities with the means to both use their current extensive infrastructure in a more efficient and cost effective way, and to also provide the ability to extend their traditional business to meet the needs to the different landscape. The necessary evolution of the analytics can be seen in a number of different possible phases.

The initial convergence of the many different sources of information that exist across the existing and evolving network into a single consolidated collection of repositories. Taking such a holistic approach to the full range of information across the enterprise enables an initial consistent and coherent view of the network. This allows for the use of advanced analytics both to get a better understanding of the existing network, but also puts in place an extensible infrastructure for use in subsequent phases.

The second phase consists of the expansion of the overall analytics infrastructure to accommodate more components in the network, in the case of incorporating more energy providers into the network but also in the case of allowing the addition of new capabilities as demanded by a growing and changing customer base. This would include the use of Analytics to provide meaningful and near real-time data to clients on their network usage as well as providing key information back to other providers to the network.

Finally, there is the use of analytics to enable a more proactive approach to be taken to the use of the network to identify areas of further improvement and efficiency.

Figure 1 shows this overall progression across these phases.

Until recently, power grid operators have relied on costly traditional scheduled asset maintenance to ensure the highest availability and reliability of power transmission because they could not plan maintenance around actual asset conditions.

Using a cloud-based big data and analytics solution, one utility created a 360-degree view of its assets from the transformer level to the entire grid. Predictive modeling and advanced analytics provided not only near-real-time asset status, but also long-term projections of maintenance requirements, helping the company plan future preventive maintenance. This means that the company can now plan maintenance for each asset on an as-needed basis, rather than scheduling simultaneous maintenance for all assets of that type, adding to cost reductions.

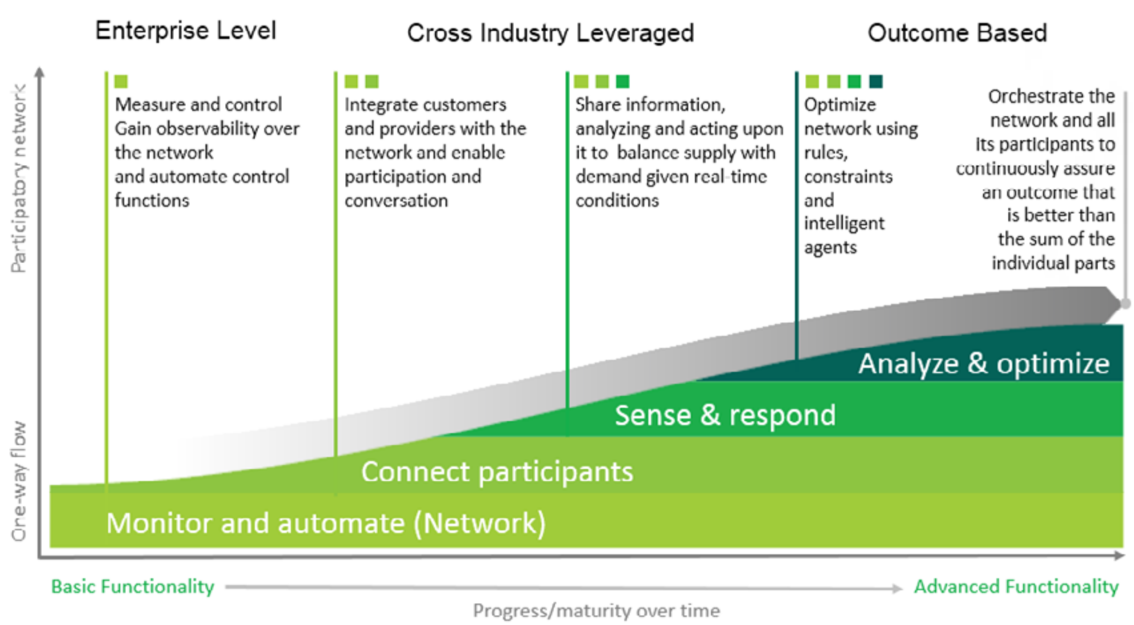

Figure 1. Evolution of analytics

Impact on IT systems

It is clear that this set of different demands are going to result in a significant change to the way utilities approach building out new analytics platforms. Some of the key business and technical imperatives that are driving a change in the approach to analytics in Figure 2.

A key question is how a utility begins the evolution towards such a phased deployment. How can they ensure that they begin the build out of such an extensive infrastructure in a way that can be extensible both in terms of the technology components it uses as well as in terms of its growing coverage of the different business areas? How does it build out the new technical components that are required to support the increased and varied analytics that are needed by these increased business demands?

Finally, are such analytical capabilities built out in a phased approach, ensuring extensibility in terms of governance, scalability, and cross-enterprise reuse of any analytical assets?

Figure 2 shows some considerations that are intended to be addressed by this new enhanced landscape are as follows:

Figure 3 shows some of the possible requirements and considerations that need to be considered when building an advanced analytics framework.

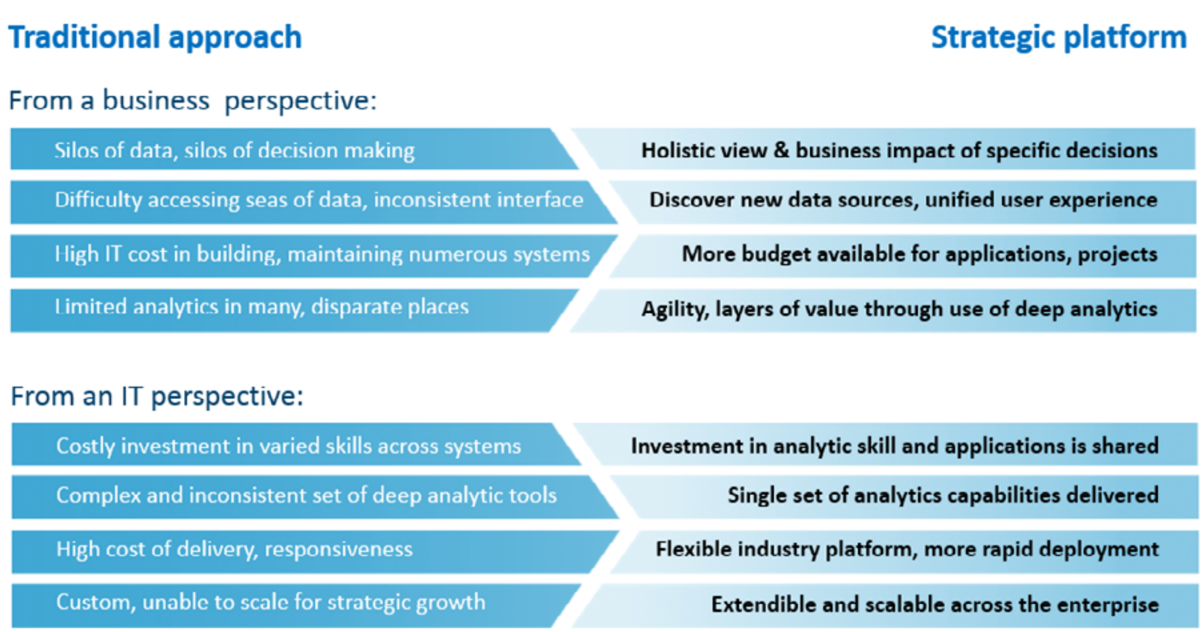

Figure 2. Considerations of the new analytics landscape

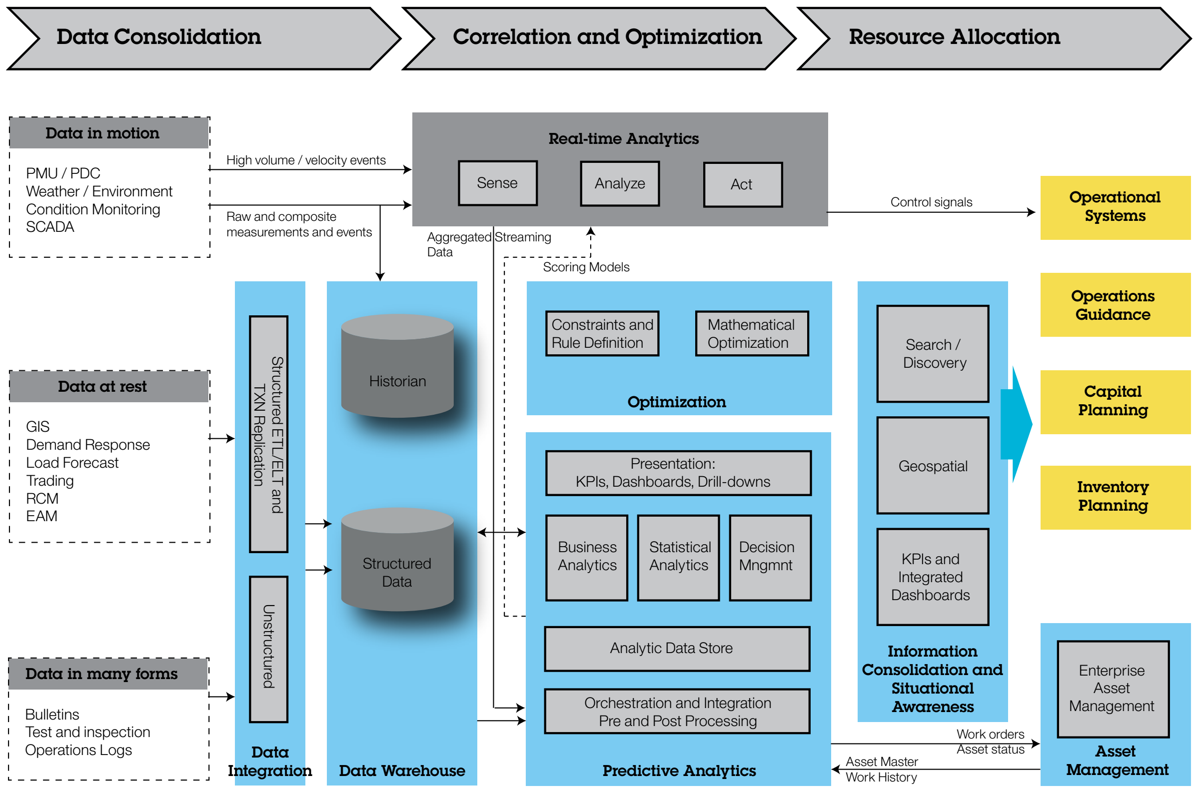

Figure 3. An advanced analytics framework

New data sources and new types of data

The new analytics platform needs to accommodate a range of new data. Whether it is the ability to handle real-time or near real time data (data in motion), or new types of data beyond the traditional structured data inputs (data in many forms). Even the traditional more conventional data (data at rest) is changing in terms of the sheer volumes and types of such data to be managed as part of this landscape.

The storage of NOSQL as well as relational data

Any new architecture being defined for an analytics platform should meet the needs of handling the storage, integration, and exploitation of data such as that stored in Hadoop stores. The characteristics of such new data stores are different and complementary to those traditional relational data warehouses and any analytics platform needs to manage both in a coherent and consist way.

The incorporation of advanced analytics

The new analytics platform now needs to support a range of more advanced analytical capabilities either in terms of predictive analytics, discovery, and exploration and support for decision management. These new capabilities need to be accommodated in addition to the traditional reporting capabilities in a coherent and integrated manner.

IBM is focused on defining a number of the key components that are needed for such a coherent integrated analytics platform specifically for energy utilities.

Solution overview

IBM has a number of integrated components that provide utilities with both the overall analytics framework as well as the underlying cross-enterprise definition of data structures and meaning, specifically IBM Insights Foundation for Energy and IBM Data Model for Energy and Utilities.

IBM Insights Foundation for Energy

IBM Insights Foundation for Energy represents a new paradigm of analytics platforms. It is a data management, visualization, and analytics software solution that includes a broad range of pre-integrated analytic technologies, which create the foundation for an ecosystem of new analytic applications. This new foundation:

- Unifies existing operation systems and business processes with data integration from multiple proprietary and open sources (sensors, SCADA, video, weather, and so on).
- Delivers complex contextual awareness by correlating, analyzing and visualizing data within and across systems and processes.
- Advances operational insights that optimize business process outcomes.
- Provides a single view of analytics across the enterprise
- Contains pre-built applications in areas such as situational awareness, predictive maintenance, and asset health and risk.
- Is a configurable and extensible solution, as the foundation for an enterprise-wide analytic strategy, forming the basis for rapid innovation, and offering the ability to add applications over time across the energy value chain.
- Contains services, APIs, connectors, user interface, workflow, and so on.

Built from IBM software technology, IBM Insights Foundation for Energy brings together in one solution a core set of functions that are both immediately usable capabilities as well as

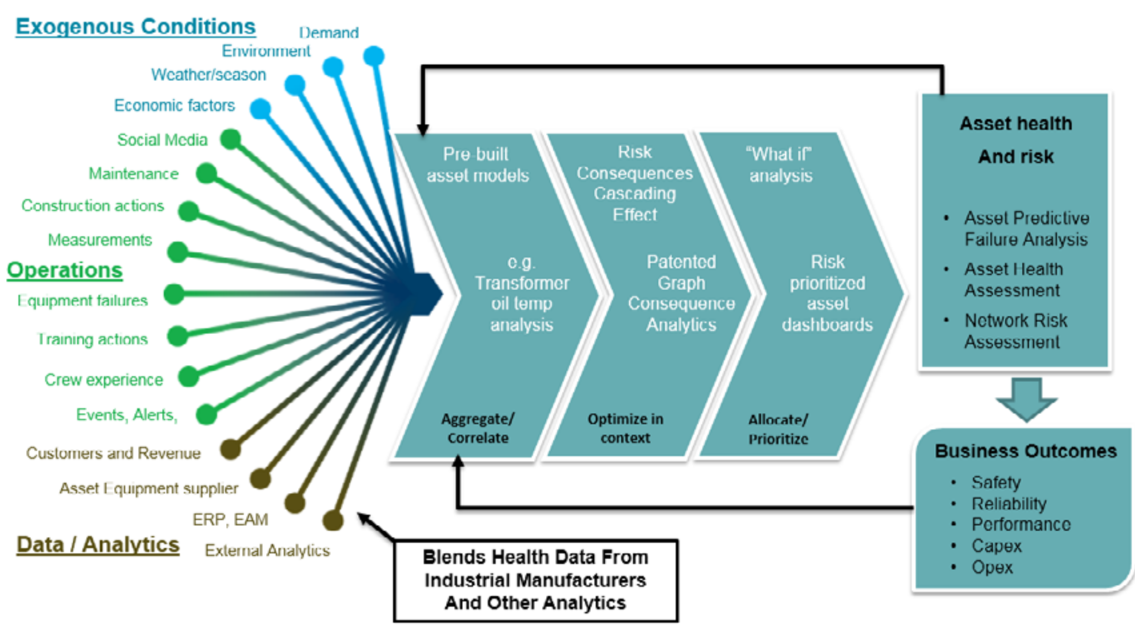

Figure 4. IBM Insights Foundation for Energy

building blocks for analytic applications, as well as a predictive analytic, maintenance application that helps utilities avoid costly downtime and reduce maintenance costs.

Use IBM Insights Foundation for Energy, a configurable and extensible solution, as the foundation for an enterprise-wide analytic strategy. Add applications over time and across the energy value chain to help key business areas deliver operational excellence while reducing asset failures, optimizing network availability, decreasing loss of service, and reducing costs.

IBM Data Model for Energy and Utilities

IBM Data Model for Energy and Utilities (DMEU) provides the necessary integrated model content to cover the main aspects of a typical model-driven business intelligence development ranging from definitions of business requirements, to centralized analysis, and to the design of specific business intelligence/data warehouse physical artifacts

Business Terms

Business Terms are the centralized cross-enterprise definitions of business terminology. This provides the basis for standardization of business terms both across the different aspects of the business but also between business and IT. This consistent terminology across the enterprise can reduce confusion and delays.

The Business Terms are fully defined, grouped into business-relevant enterprise-wide categories, and the individual terms have pre-defined relationships both with other terms and with the relevant associated data warehouse model entities and attributes.

The Business Terms form a key part of the overall business vocabulary and are deployed in IBM InfoSphere Governance Catalog.

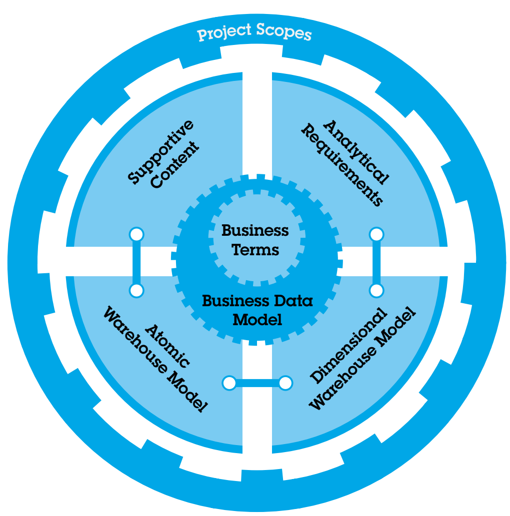

Figure 5. IBM Data Model for Energy and Utilities

Analytical Requirements

Analytical Requirements are a set of Key Performance Indicators or reporting models that provide predefined collections of business terms that are considered relevant to a specific business issue. These models provide a quick start to assist business users and analysts to define reporting requirements and identify appropriate data model structures to be used for a particular business issue.

The Analytical Requirements are fully defined, grouped into business-relevant categories pertaining to specific business issues, and the individual terms in the Analytical Requirements have pre-defined relationships both with other terms and with the relevant associated data model entities and attributes. The Analytical Requirements form a part of the overall business vocabulary and are deployed in IBM InfoSphere Governance Catalog.

Supportive Terms

Supportive Terms are where any additional supporting business specifications or taxonomies are located. The Supportive Terms are not seen as part of the core set of business terms but are needed for inclusion in the set of models to provide full visibility and support to various other structures external to the model such as other IBM solutions, regulatory reports/taxonomies, industry standards, vendor interfaces, or legacy source systems.

The definition and grouping of the Supportive Terms is dependent on the level of definition or categorization in the external structure being represented. However, these terms would have detailed mappings to both the core set of Business Terms and the relevant data models.

The main purpose of these Supportive Terms is to provide a view of the mappings, gaps, and overlaps between these external structures and the core set of models. The Supportive Terms form a part of the overall business vocabulary and will be deployed in IBM InfoSphere Governance Catalog.

Business Data Model

The Business Data Model is the design-independent enterprise-wide high level entity-relationship representation of the fundamental business structures, relationships and hierarchies. It is designed to provide the standard structures to support business analysis across the enterprise and forms the high level basis for potentially many downstream design-specific models.

The Business Data Model is a fully defined normalized (usually to 3NF) entity-relationship data model and all of its entities and attributes are fully defined and grouped into technical packages/diagrams and reflects cross-enterprise data subject areas. The entities and attributes of the Business Data Model have mappings to both the terms in the components of the business vocabulary as well as mappings to the downstream design-level data models. The Business Data Model is a data model and is deployed in IBM InfoSphere Data Architect.

Atomic Warehouse Model

The Atomic Warehouse Model is a design-level model and provides the basis for designing an enterprise wide data warehouse database structure. This model enables the creation of a flexible, extendible and data-warehouse-specific physical database. The Atomic Warehouse Model helps create a business Intelligence infrastructure supporting multiple lines of business and analytical functions and is designed to accommodate the storage of high volumes of transactional data and supports historical analysis.

The Atomic Warehouse Model is a fully defined appropriately normalized (3NF but addresses the specific Atomic Warehouse design needs) entity relationship data model. All of its entities and attributes are fully defined and grouped into technical packages/diagrams and reflect cross-enterprise data subject areas of importance for an atomic warehouse. The Atomic Warehouse Model also has mappings to the business vocabulary, to the Business Data Model and to the Dimensional Warehouse Model.

The Atomic Warehouse Model is a data model and is deployed in IBM InfoSphere Data Architect.

Dimensional Warehouse Model

The Dimensional Warehouse Model is a design-level model and provides the basis for designing either data marts to support specific business issues or to provide the basis for designing a cross-enterprise dimensional warehouse.

The Dimensional Warehouse Model is a data model that is compliant with the Kimball method for designing dimensional structures and is represented in dimensional notation. All of the associated fact and dimension entities and associated attributes are fully defined and grouped into packages and diagrams to reflect both the cross enterprise “conformed” role as well as being able to support specific business issues.

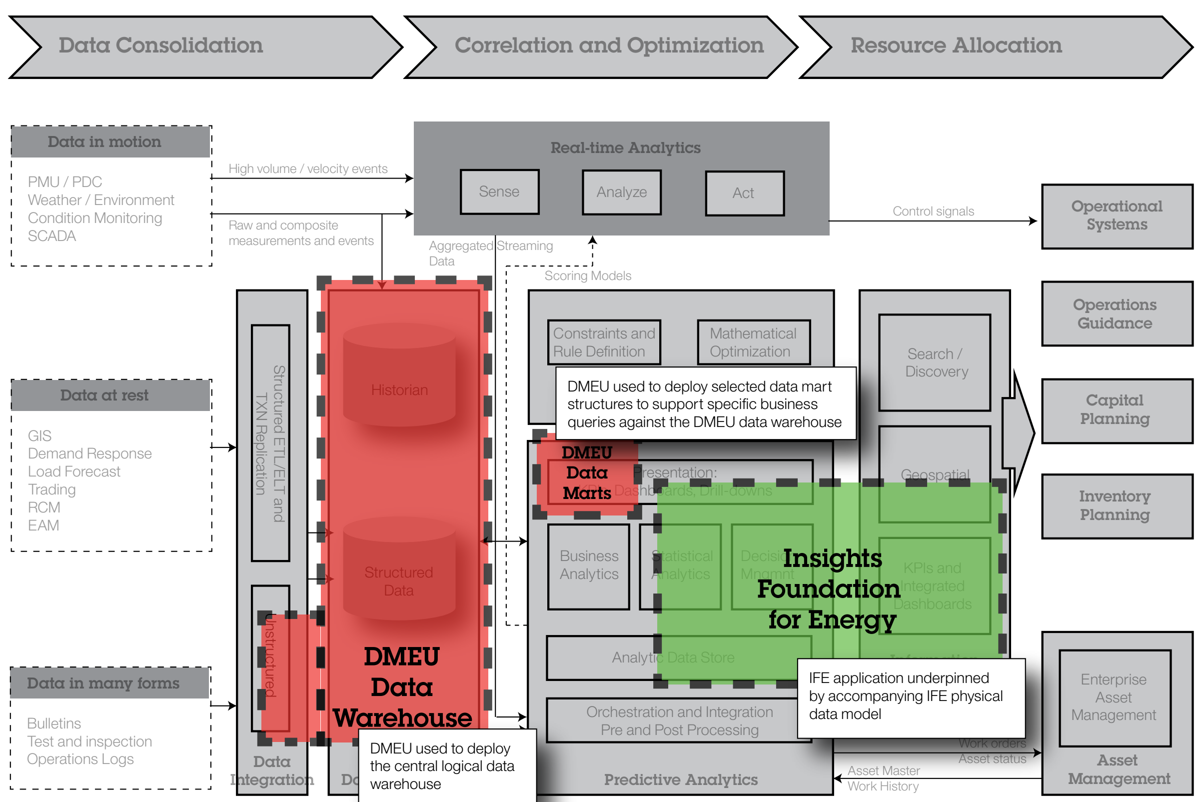

Figure 6. Integrated analytics framework

The Dimensional Warehouse Model can be used on its own to support a pure Kimball dimensional warehouse or can be used to provide a data mart layer to support an atomic warehouse.

The Dimensional Warehouse Model has mappings to all of the other data models as well as to the business vocabulary. The Dimensional Warehouse Model is a data model and is deployed in IBM InfoSphere Data Architect.

An integrated analytics framework for energy and utilities

IFE and DMEU are designed to work together to address key components of the new overall analytics landscape.

DMEU is designed to provide the basis for the data warehouse component that provides the central consolidation point for the different types of data coming into this new analytics landscape. DMEU is designed to address the definition both of traditional data warehouses as well as additional unstructured stores, both of which need to be managed in a consistent fashion. DMEU is also designed to provide the basis for business issue-specific data marts. IFE provides the downstream integrated platform for the management of the various advanced analytical needs.

The role of the DMEU-derived data warehouse as the central consolidation point for data for use across this analytics platform is very complementary with the specific IFE focus on the delivery of advanced analytical insights into that data. In many cases the data stored centrally in the DMEU-derived data warehouse would be used as input to the IFE application and likewise many of the metrics created by IFE can be stored in the DMEU-derived data warehouse for use by other applications.

The ability to leverage an extensive repository such as a DMEU-derived data warehouse:

- Massively increases IFEs view of the enterprise's data.
- Allows the IFE platform to draw from a rich data set derived from multiple disparate sources to enrich the platform's analytic capabilities.
- Provides a structure to capture point-in-time IFE insights to enrich analytics and decision making throughout the organization.

In addition to providing a data warehouse infrastructure, DMEU also provides the basis for the set of canonical models. These can be used in conjunction with IFE underpinning aspects such as governance and management.

Specific product support

Figure 7 represents a subset of the typical packets of data and how they might flow across a DMEU and IFE application landscape. It is important to note that these flows are intended to be samples. In some cases an energy utility might have data flowing in a different way through the landscape, and this outlines only a subset of possible data flows.

Asset Outage History

Building up an extensive history of details of the various asset outages is an important foundation for any set of reporting and analytics around asset health. This data could be stored in the data warehouse for overall use across the analytics platform, and could be provided to IFE as needed for specific predictive analytical calculations.

Asset Monitoring Data

The ongoing monitoring of assets in realtime may be something that does not flow into the data warehouse but may in some circumstances be used directly as an input to IFE.

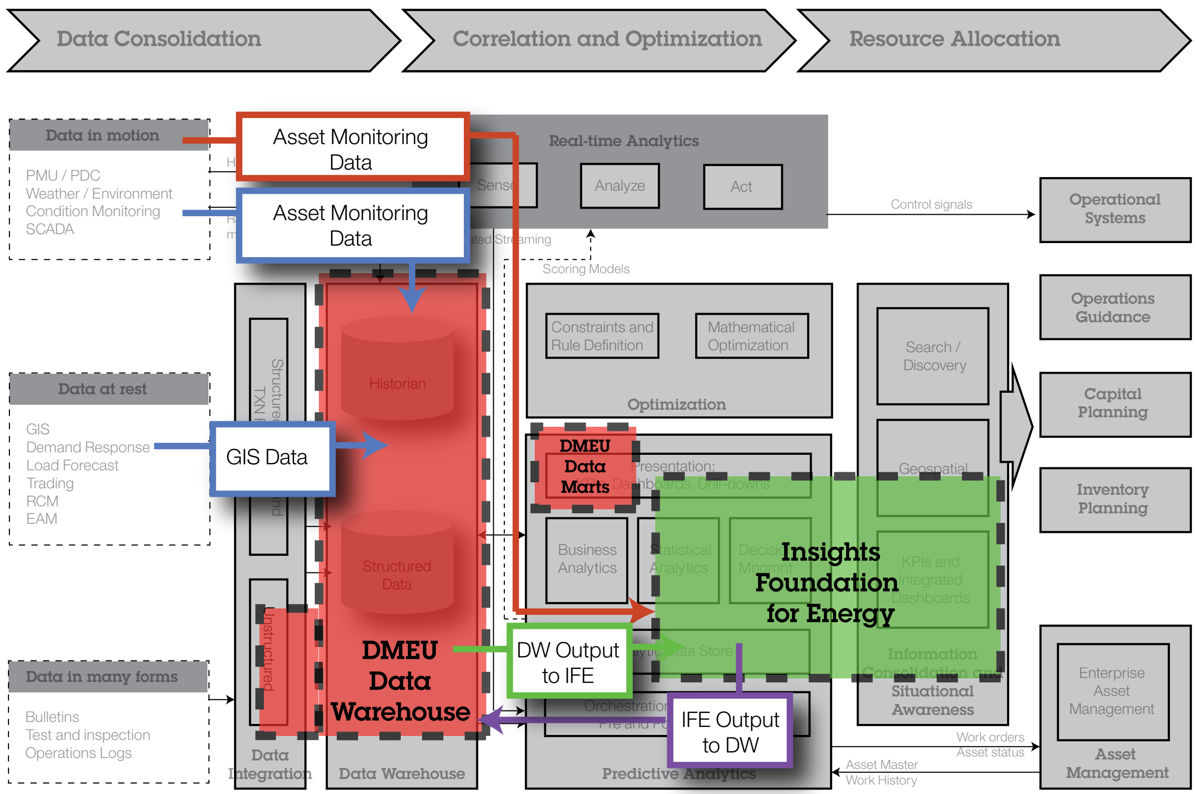

Figure 7. Subset of possible data flows across DMEU and IFE

GIS Data

GIS data may be transformed into the extended central data warehouse (in some combination of structured and unstructured forms). Some of this data, may subsequently be used as input to IFE.

Asset Maintenance Records

Coming from an Asset Management system, such records may also be stored in the central data warehouse, available for use with IFE as required.

The key point from these sample flows is the combination of the DMEU-derived data warehouse and the IFE application working in concert focusing on the respective tasks of central cross-enterprise data storage and the calculation of advanced asset analytics.

Conclusion

IBM Data Model for Energy and Utilities and IBM Insights Foundation for Energy together provide a critical set of components needed to address the current and future needs of the analytics landscape for energy and utilities organizations in the areas of data consolidation and advanced analytics. A model-driven, extensible data warehouse enables the managed and governed storage of data and provides a source data for IFE, as the statement of record for advanced analytics. It also acts as a location for the storage of any critical metrics created by IFE for use by other applications across the enterprise.

The use of a data model designed to engage the business user during the initial development phases and the business-focused run-time analytical capabilities of IFE enables the likelihood of an extensible analytics infrastructure that truly meets the needs of the business.

IBM Corporation
Software Group
Route 100
Somers, NY 10589

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