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Transformation of intelligent utilities with analytics, big data, and internet of things

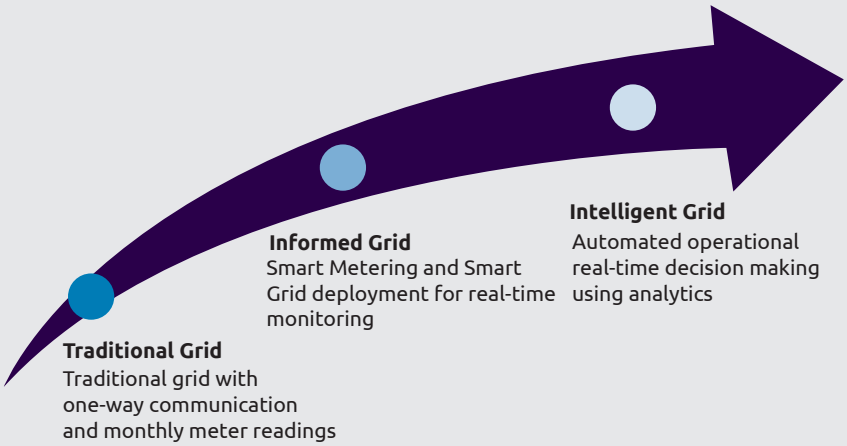
Transition to intelligent utilities

The traditional utility business model of generating and distributing energy was relatively simple: utility companies would only collect very elementary data relating to the levels of consumption on customer premises. Customer engagement only happened through one way communication of energy bills.With the digitization of the traditional grids, featuring advanced metering infrastructure (AMI) systems and intelligent supervisory control and data acquisition (SCADA) systems, came exponential increases in the data volumes. The addition of such smart infrastructure to the grid has led to progression from traditional grid with unidirectional data flow to the level of being an informed grid with enormous real-time data.

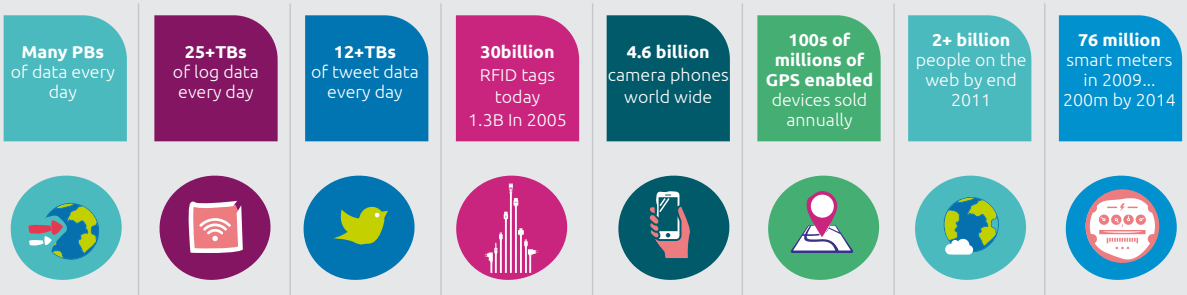
Smart grid data growth – resulting from intelligent sensors on the grid, further integrated with structured and unstructured data from social media and other third party data sources – unlocks the potential to gain additional insights for utilities. The new data sources are creating a utility Internet of Things (IoT) where utility assets are integrated with external applications and data. These business insights are derived through a combination of business analytics techniques such as data reservoirs, data acquisition and predictive and prescriptive analytics, enabling utilities to transition from an informed grid to an intelligent grid.

Further increasing expectations of digital-savvy customers due to social networks, price comparison websites, and online reviews – coupled with the additional data generated by the deployment of "smart" technologies like smart meter, smart Home, smart Grid, smart City and others – have changed the customer / utility relationship. This has created new

Transition from traditional grid to intelligent grid



An explosion in data



80% of world's date is unstructured

digital transformation opportunities for utilities to adopt in order to leverage information for competitive advantage, generate new revenue streams, and break away from the conventional model of selling energy as commodity to energy as service. Capturing customer-centric opportunities requires the ability to deal with an influx of information separating the noise from real insights that can help to increase customer satisfaction, which is becoming one of the key drivers of digital transformation.

In the past, the technology to capture, integrate, and analyze data was either not available or not cost-effective for utilities to adopt. The evolution of big data and cloud solutions are enabling utilities to transition to intelligent enterprises by leveraging new insights.

The key drivers which are pushing utilities to adopt data management & analytics:

- Changing business models with more integrated business processes at enterprise level requiring detailed understanding of cross functional impact for decision making.
- Need to prepare to deal with exponential increase in data from various sources with digitalization of grid.
- Investments in analytics (acting as the “soft investment” required to realize operational efficiency from “hard investment”) being put in for grid modernization by tapping demand-side management opportunities.
- Increasing complexity of managing both hard and soft assets (firmware) with modernization of grid.
- Real-time decision making for the grid operations to maintain grid discipline with the increasing complexity of grid due to integration of EVs and distributed the generation sources.
- Increasing market of available and affordable technologies for data management and analytics solutions.
- Increasing expectations of digital-savvy customers due to social networks, price comparison websites, and online reviews require getting real insights for utilities to capture customer centric opportunities.

Evolution from BI to Enterprise Analytics

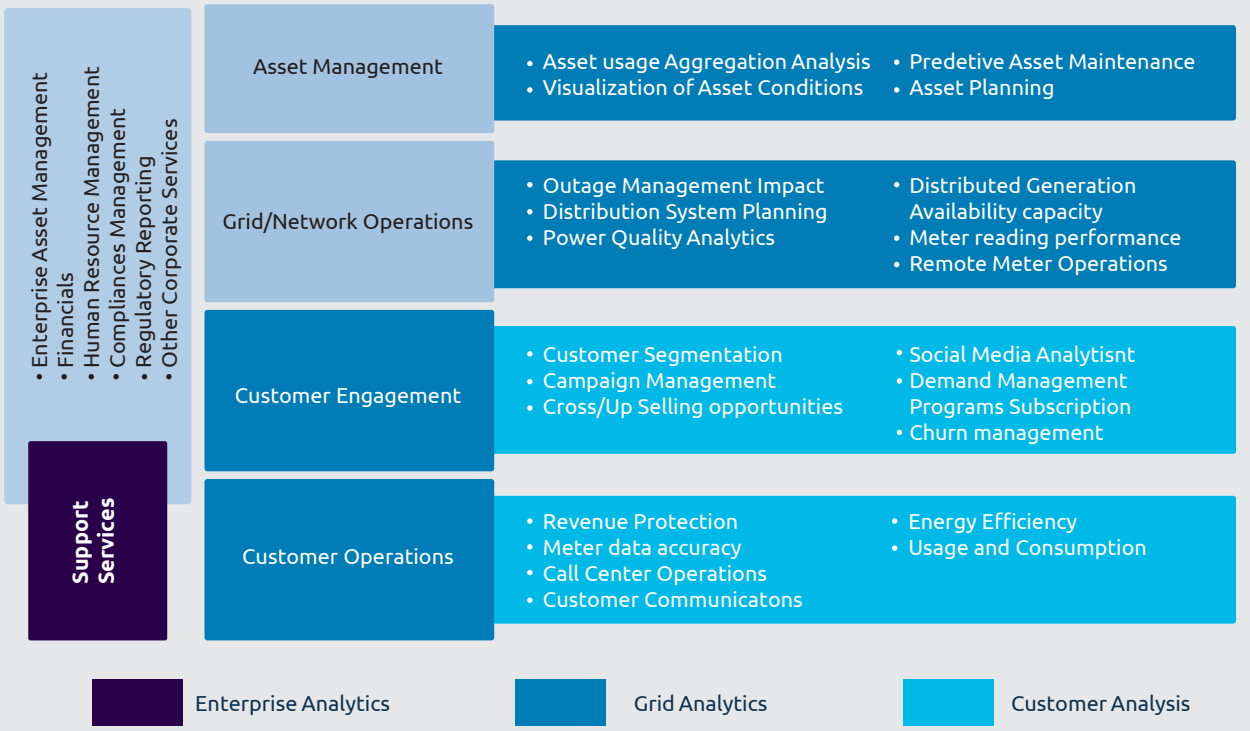
Most utilities use traditional business intelligence (BI) reporting solutions such as data warehousing, dashboards, reports and descriptive analytics. These solutions are implemented to meet regulatory requirements, ensure accurate billing and to improve operational efficiency. However, digitization of the grid, or utility IoT, requires an evolution in data management maturity to support the new data being collected – resulting in a hunger for additional analytics capabilities. For example, five million smart meters sending updates every 15 minutes result in nearly 16 terabytes of information a year, a 3,000-fold increase in the amount of data. Meter data provides a snapshot of total consumption in a home or building, but coupled with consumption captured by in-home devices, adds additional insights as well as more complexity to the solution.

The additional data volume and speed to capture data exceeds the ability of traditional solutions, resulting in new requirements for storage, integration and analytics. The ability to manage and analyze petabytes of data allows utilities to deal with clusters of information that could have an impact on the business. This requires analytical engines that can manage this highly distributed data and provide results that can be optimized to solve a business problem. Using big data technology, slicing and dicing of data collected from the grid and from customers, results in new insights for utilities leading to operational efficiencies, new products, new customer programs, and fresh revenue streams.

In order to take advantage of analytics, it is important to visualize analytics across the utility value chain as opposed to silos. The diagram below depicts the key functions of utilities in transmission & distribution, and retail business with a large opportunity for analytics to improve the decision making process.

- **Grid Analytics:** Grid Analytics determine insights from real-time monitoring of the grid using grid sensors and advanced metering infrastructure (AMI), while automating the situation analysis to achieve better operating efficiencies in order to anticipate and avoid service interruptions and

Utilities Analytics Business Area



other operating issues. Most grid algorithms were already in place in their rudimentary form but are now significantly improved with real-time and better quality data supported by big data technology.

- **Customer Analytics:** New consumer opportunities are emerging with the increased adoption of smart technology, mobile devices and the integration of social media, coupled with new digital-savvy consumers looking for more value and preferences. Customer insights from customer-related data provides opportunities in areas of revenue protection, improved load forecasting, and detailed customer segmentation – leading to increased enrollments in demand side management programs.
- **Enterprise Analytics:** Enterprise analytics provides greater visibility and insights from the utility value chain, from supply chain and energy procurement to consumption – including human resources, project management and finance. Utilities empowered with these insights are better positioned to understand how changes in one part of the value chain impact others.

The Big Data Problem: Utilities don't have a big data problem – they have a big problem with data

In order to realize the benefits of the new insights, many utilities recognize that they don't have a coherent data management strategy that includes data governance, data quality, a centralized funding vehicle for analytics, and a master data management approach. Furthermore, business users and data scientists rely on IT to test their hypotheses and have no self-service tools. Leveraging analytics for competitive advantage and generating additional revenue can be achieved by understanding the phases of a big data journey: Initial phase, some investments and proof-of-concept, and centralized investments. The following list of significant barriers to adoption of analytics in utilities should be considered:

- **Limitations of ROI models:** In utilities that are not decoupled, analytics can lead to decreased revenue by encouraging energy efficiency resulting in conflict of investment principle.
- **Regulatory Requirements:** May also pose a challenge where investments are focused on specific goals such as profitability or customer engagement, as opposed to safety and reliability.
- **Scarce skill set:** On the business side, data scientists who understand the business to create use cases as well as big data technology resources in IT, are both scarce.
- **Siloed Structure:** Mainly between grid operations and business operations, these pose a challenge for adopting analytics which requires enterprise-wide information sharing.
- **Technological complexity:** Utilities are yet to get a firm grip over the complex technical landscape with smart grid related technologies before adding a big data infrastructure for which utilities have limited expertise.
- **Data Acquisition:** Data acquisition in utilities continues to be a complex task, which poses a significant barrier due to:
  - hundreds of data silos, thousands of data files, tens of thousands of Excel workbooks
  - no data inventory, metadata, business glossary
  - poor quality, unreliable, often late data
  - often not integrated or correlated data
  - existing data acquisition processes still very manual and labor intensive

Where to Begin?

Most of the utilities are aware of benefits they could gain from analyzing the newly-available data from the grid and its customers, but may not have an idea where to begin. A business user may invest in a solution to address their use case but this may not be able to be leveraged by another organization. There may be several alternatives to begin the analytics journey based on different value propositions of analytics depending on IT structure, age of network infrastructure, supporting systems and unique challenges for which utilities need specific insights to address. That said, if a utility understands where they are in the analytics journey, they are better enabled to complete the journey.

Utilities are facing the challenge to translate the large volumes of new data into true, actionable intelligence, and to leverage the information gained from analysis to make decisions resulting in improved business performance, service reliability and customer

Phase	Characteristics	Activities
Beginner	• Have heard of big data • Understand that there is a need for analytics • AMI or Smart Grid program	• Big Data strategy • Program launch / funding • One or several POC's • Leverage cloud
Intermediate	• Big data strategy • Some investment or POC • Decentralized analytics organization	• Validate strategy • Validate analytics program • Technology solution • Governance
Advanced	• Investment in big data technology • May have organization • May have governance	• Validate investment • Operations

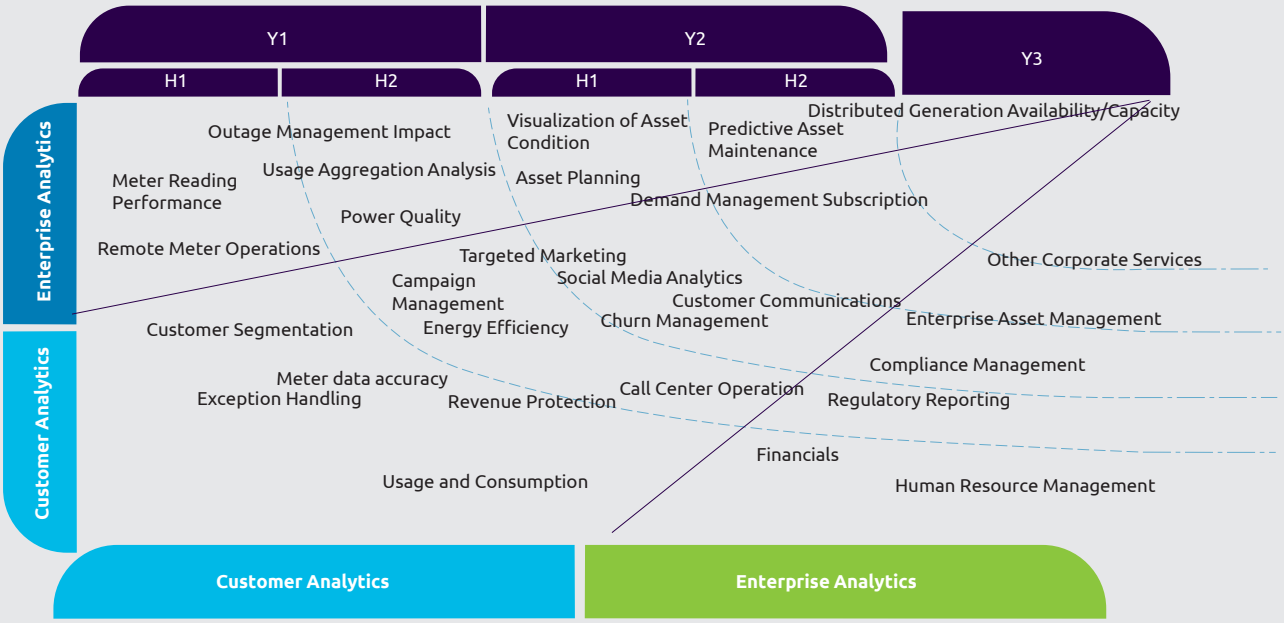
relationships. The value is there for those willing to start the journey and build the analytics capabilities as they progress through each phase.

Utilities need collaboration between the business and IT stakeholders to create a comprehensive roadmap focused on analytics with clearly defined objectives and achievable milestones by following the below steps:

- **Identifying and prioritizing business initiatives:** The first step in defining a comprehensive roadmap is to identify the use cases and related KPIs of respective business areas to provide business value that is in synch with the overall objective. Departments have different priorities when it comes to harvesting data, so IT may have different priorities than distribution. Utilities should prioritize them in order of their importance to be driven for improvements, considering the unique set of challenges for the utility.
- **Define analytics road map:** Combine use cases and technical requirements into a roadmap and prioritize based on ROI, leading practices, ease of implementation, impact on business processes, and investments in IT systems. Assemble these use cases and align funding vehicles into the roadmap classifying the opportunities along short-, mid- and long-term horizons.
- **Defining Enterprise Information Model:** An Enterprise Information Model is the foundation for the analytics solution described in the data strategy. This includes defining the data elements to be included, aligning with the business model, and identifying data sources (internal and external; structured and unstructured; static and dynamic), access methods, data availability frequency and timelines, metrics, dimensionality and instrumentation. In some cases, a data reservoir may be selected before loading the data to the data warehouse. This provides the ability to test hypotheses before loading the data to the data warehouse and may result in an update to the data model.
- **As-Is Study and Gap Analysis:** Evaluate the existing organizational data management and

Utilities Analytics Capabilities Journey

Utilities Analytics Enterprise Roadmap



technical capabilities to avoid risk of creating stranded costs from having to rework data stores, or possibly investing in a solution that does not align with the data management requirements. Measuring the gap between existing and desired future-state skills to achieve business objectives forms the basis for developing the appropriate analytics solution.

- **Data analytics solution design:** Develop a solution to support the use cases and technical requirements such as flexibility, scalability, data availability, quality and integration. This may require building out necessary architecture addressing data staging area, data management platform, master data management capabilities, business intelligence and advanced analytics platform. Utilities have an option to develop the solution in-house, invest in engineered systems, invest in an external solution, or a hybrid approach.

Conclusion

Utilities may have different catalysts to embark on a big data journey but developing a roadmap is a key activity to sharpen the executive vision and inspire the organization to adopt a new analytics vision. Once the journey has started, each step will anchor back to benefits of additional insights to improve decisions and actions. Creating these insights does not complete the journey – they need to be monitored in order to fine tune analytical models, business processes and applications. Regulatory requirements, technology, weather, demographics and other influences are continuously evolving, which means the utility environment is also continuously evolving. The analytics journey must also continue to evolve.

Capgemini's Big Data initiative can provide customers with solutions, capabilities and a platform that enables agility and innovation for the business and transformation for IT. The business imperative that we are addressing for our customers is how to create the value from the data to compete in the modern business environment. Capgemini's Big Data Strategy combines Capgemini's utilities industry knowledge, process and capability together with Big Data technology is designed to bring value across the spectrum from defining strategy to execution.

About Capgemini

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of 200,000 team members in over 40 countries. The Group reported 2016 global revenues of EUR 12.5 billion (about $13.8 billion USD at 2016 average rate).

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