RISK ANALYTICS APPLICATIONS AND VISION

An example of applying BIG data to mitigate an electric grid issue.

Agenda

- IBM's Smarter Analytics
- What is BIG data in the utilities industry?
- What types of problems can it help solve?
- What is the business framework in using BIG data for operational capabilities?
- An example of using BIG data to solve a grid problem.
- What are the issues and challenges that need to be solved?

The world is changing, enabling organizations to make faster, better-informed decisions

- Instrumented
- Interconnected
- Intelligent

This is an opportunity to develop a new kind of intelligence on a Smarter Planet.

Five years ago, we started working with organizations to build a smarter planet

Through thousands of client engagements, we learned that analytics is fundamental to success.

Examples of Smarter Domains

What is BIG Data?

- The collection of information from a variety of sources that can amount to terabytes of information in a short order of time.
- Examples:
  - Advanced Metering Infrastructure (AMI)
  - Phasor Measurement Units (PMU)
  - Device and Line sensors
  - Social media messages
  - Maintenance records

What is utilities risk?

- Any event that causes negative, unintended consequences, to a utilities operations, finances or image.
- Can be physical or virtual, real or imagined
- May come internally or externally; purposeful or accidental
  - But often predictable …
- It may be avoidable or not
  - But the consequences can be planned for and dealt with logically to produce the most desired outcome possible.

Examples of Utilities Risk

- Financial – Events that impact profit/loss
- Social – Perception of doing the right thing
- Workforce efficiency and effectiveness
- Operational Risk
  - Power consumption versus supply balance
  - Power quality and reliability – outages
  - Asset health
  - Environmental and safety issues

What is Operational Risk?

- Operational risk is any process, system event, outside event or natural occurrence that can effect the safety, performance and/or perceived value of a operational capability within the utility.
- It can be caused by the utility or be an act that impacts the utility, either directly or indirectly.
- It can also be an unintended consequence of utility operations or policies.

Total Risk Management Involves

- Identifying all the key elements (risk factors) that effect risk
- Determining the probability of risk (both spatial – where, and temporal – when)
- Assessing what the consequences might be
- Determining the potential size of the impacts
- Determining the possible mitigation capabilities
- Balancing all of the resources across the enterprise to achieve the best possible outcome (optimization)
- Executing and managing the risk management ecosystem (coordination/orchestration)
- Communicating that appropriate measures are being taken to all stakeholders/interested parties before, during and after an event

The solution operates at two levels

- Business Unit Level
  - Discovery, determination and execution
- Enterprise Level
  - Awareness, orchestration and support

Five processes occur at each level

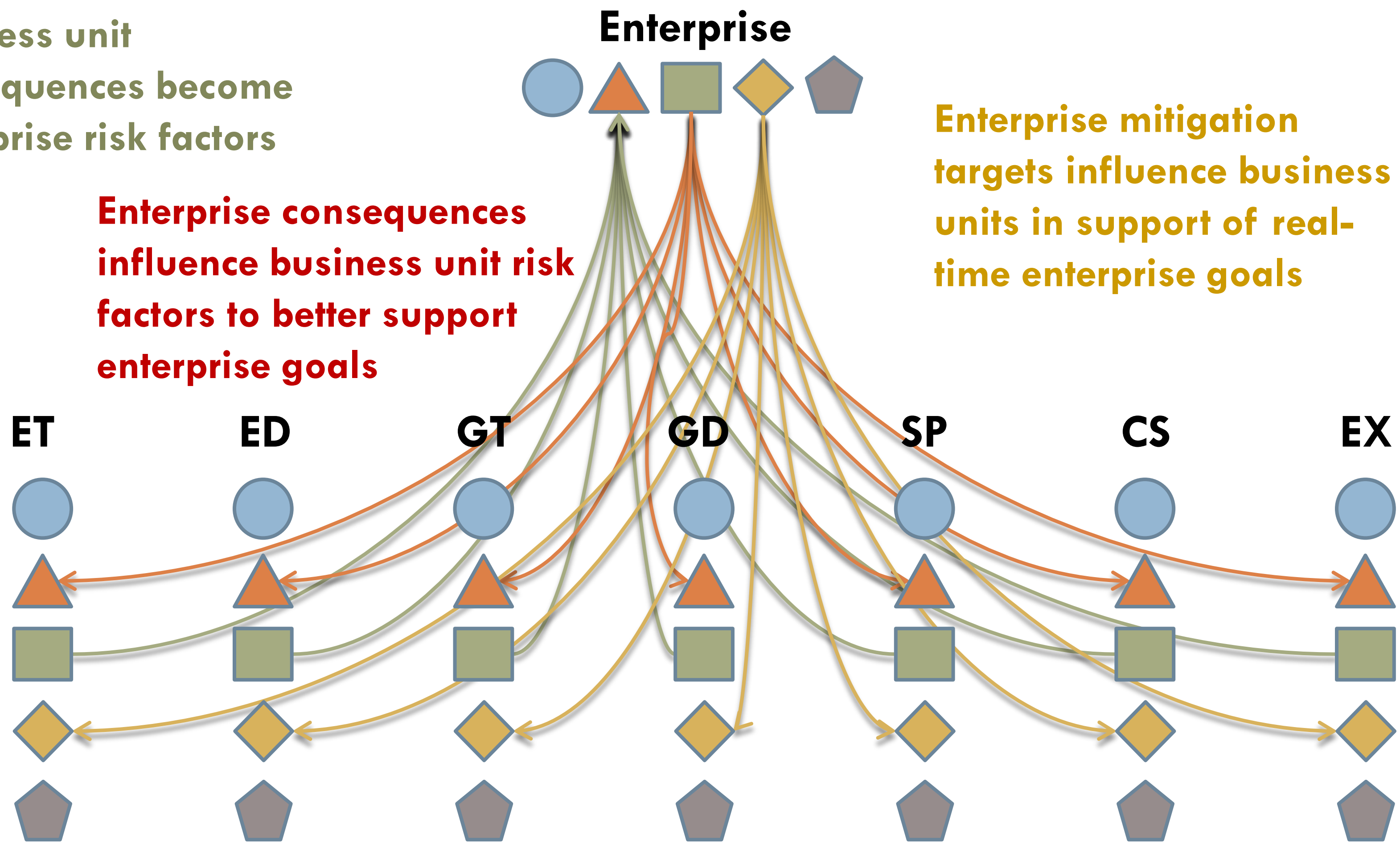
Data Preparation	• Static and real-time data
Risk Factor Determination	• What could go wrong and what certainty?
Consequence Analysis	• Would it be of interest or importance?
Mitigation & Optimization	• What should be done and how
Learning & Correction	• Automatic continuous process improvement

How the levels tie together …

Business unit consequences become enterprise risk factors

Enterprise consequences influence business unit risk factors to better support enterprise goals

Enterprise mitigation targets influence business units in support of real-time enterprise goals



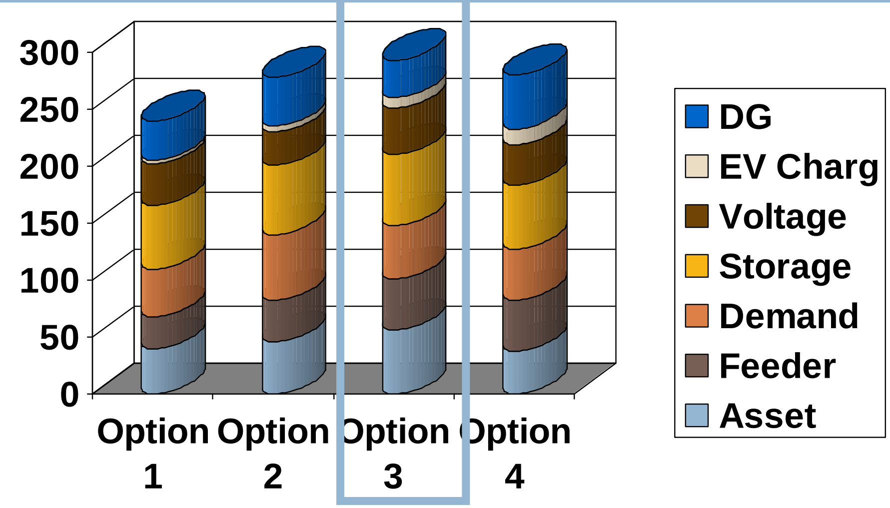
Todays Focus is on Mitigation/Optimization

- Mitigation is the process step where it all comes together to realize the value
- It is assumed that the organization understands the problem and the solution but does not understand which is the optimal path.
- Mitigation and Optimization uses BIG analytics to make the most appropriate choices.

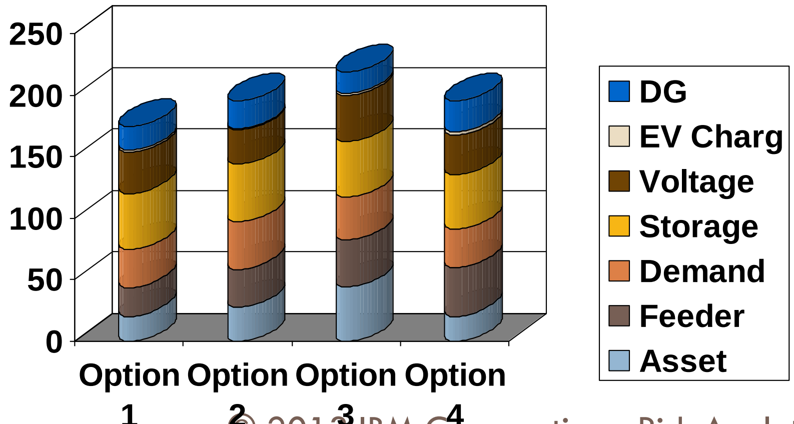
Mitigation and Optimization is all about prioritizing and coordinating options into a enterprise based balanced solution, in near real-time

- The models are evaluated within two domains
  - Financial Impacts
  - Resource Requirements and Availability Impacts
- A total quantitative score is aggregated to determine the most optimal solution

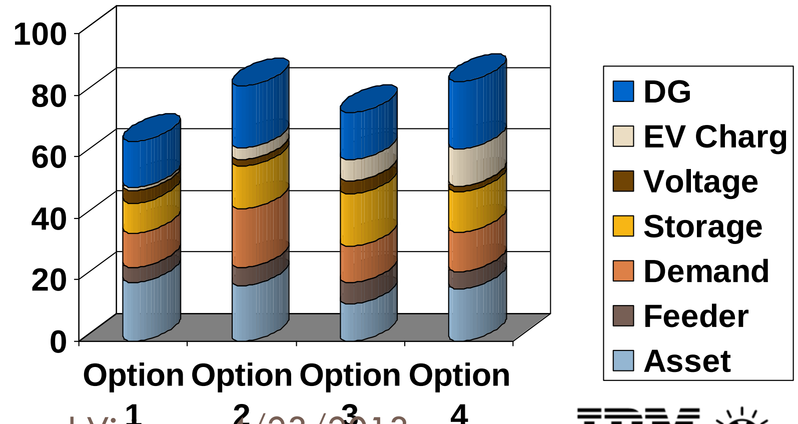
Total Optimized Value



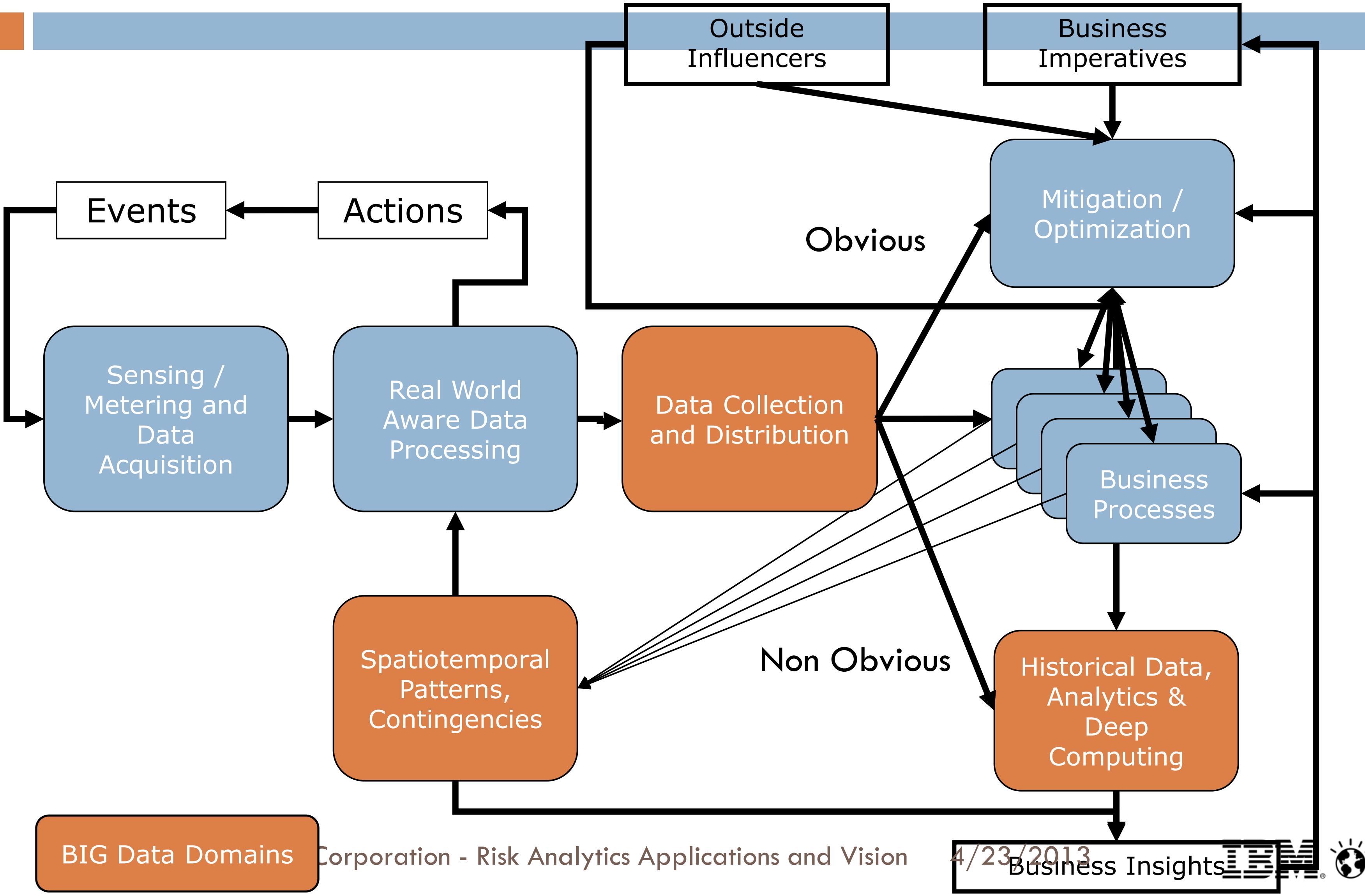
Financial Analysis



Resource Analysis

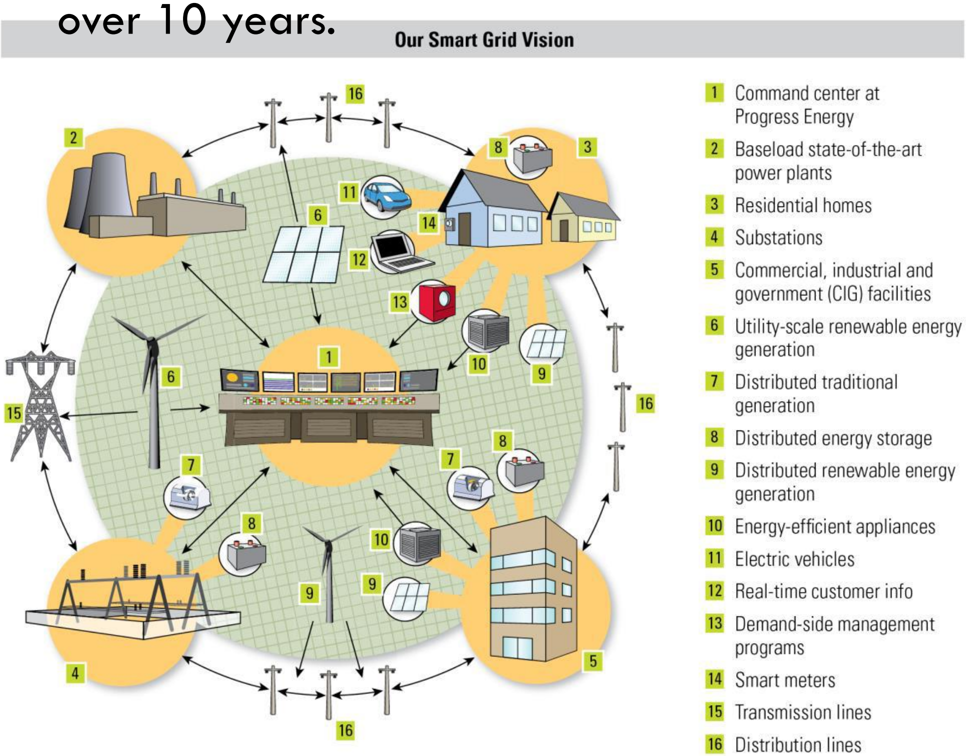


Risk Management Systems Model



Progress Energy – Optimized Energy Value Chain

The Optimized Energy Value Chain (OEVC) will build a green Smart Grid virtual power plant through conservation, efficiency and advanced load shaping technologies. By the end of 2012 the OEVC will enable nearly 1000MW of peak load reduction, growing to over 1600 MW by the end of 2015, and producing a present value of fuel savings of $127M over 10 years.



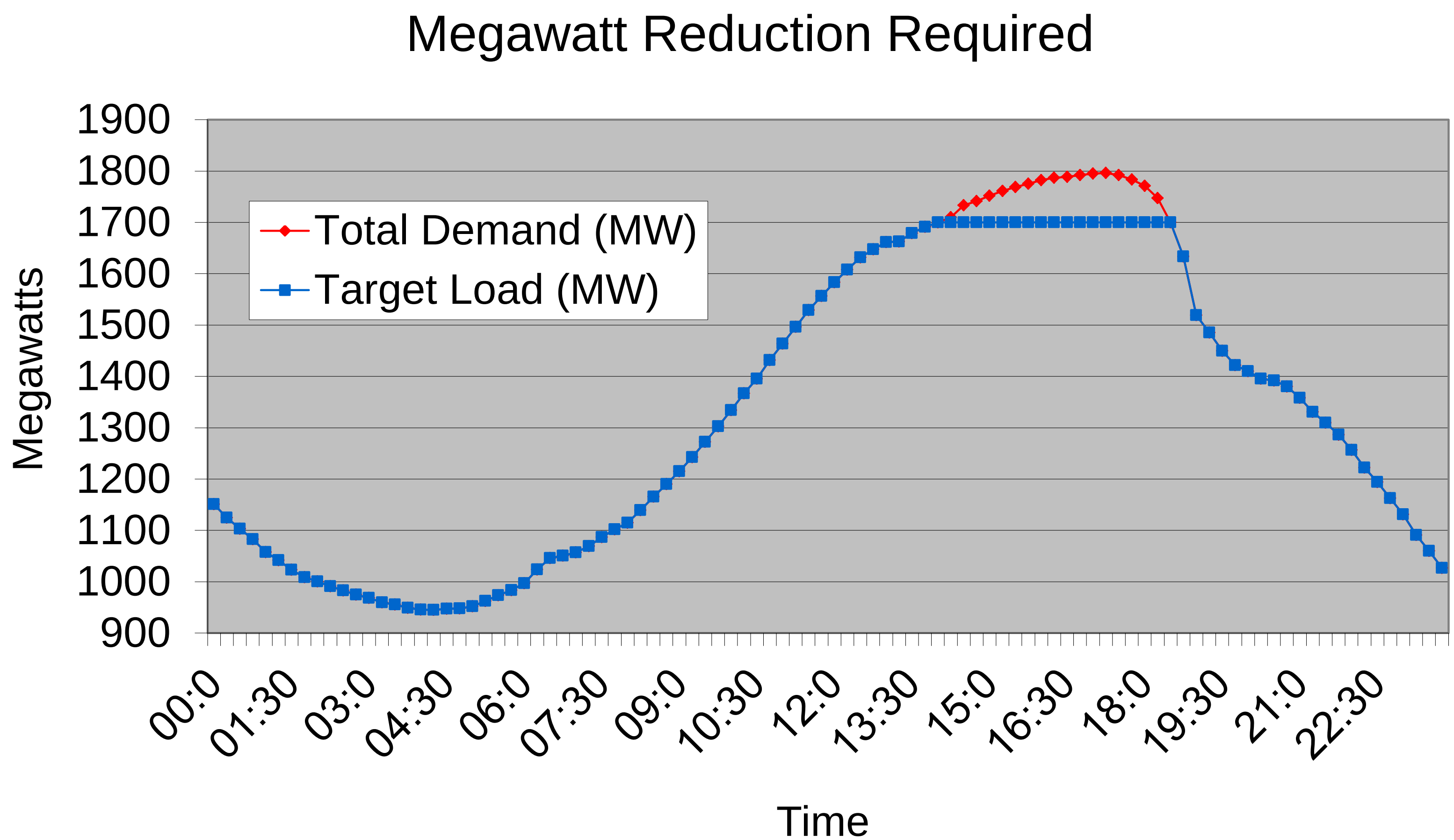
Progress Energy

- Alternative Supply
- Energy Storage
- Grid-Side Efficiency
- Condition Based Mngnt.
- Tailored Demand Response
- Wholesale Demand Response
- Customer Segmentation
- Dynamic Adaptability
- Holistic Analytics-Driven
- System Wide Optimization

An Example Scenario

- Potential transmission asset failure identified as a high current risk factor
  - An additional risk factor is the current backup transformer is down for maintenance
- Probable consequences are an asset failure and large scale outage for feeders supported by these two assets.
- Mitigation can be achieved by assembling/orchestrating enterprise solution
  - Demand management to relieve load on targeted feeders
  - Voltage/Var management to reduce load in targeted feeders
  - EV charging coordination within target area
  - Distributed storage management and coordinated charging
  - Focused social media solicitation and awareness to shave load in target feeders

Scenario Results

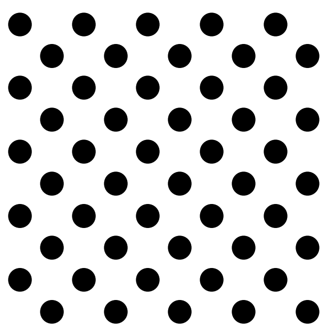


Big Data Analytics Issues and Challenges

- The data must be useful and available/accessible
  - It must be collected and cleaned up
  - Often communications is the bottleneck
- The analytics tools must be accessible
  - Focus on domain expertise versus analytical skills
- The solution needs to be scalable
  - Often it will start simple but grow in complexity
- Look at both the enterprise and business unit capabilities and value

The fourth dimension of Big Data: Veracity – handling data in doubt

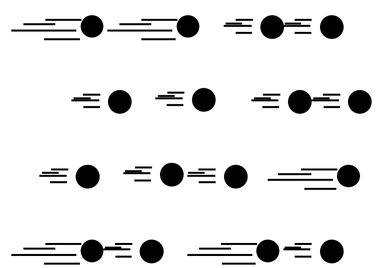
Volume



Data at Rest

Terabytes to exabytes of existing data to process

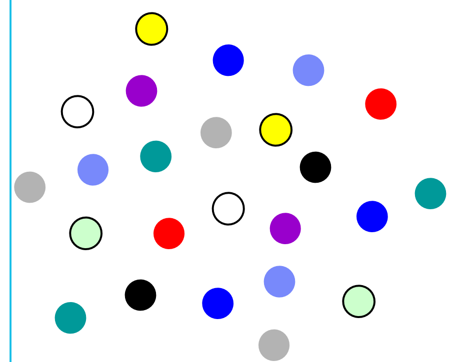
Velocity



Data in Motion

Streaming data, milliseconds to seconds to respond

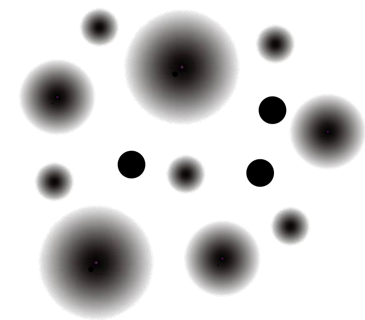
Variety



Data in Many Forms

Structured, unstructured, text, multimedia

Veracity*



Data in Doubt

Uncertainty due to data inconsistency & incompleteness, ambiguities, latency, deception, model approximations

A smarter planet is built on

Smarter Analytics

Backup Slides

IBM Smarter Analytics is a holistic approach that turns information into insight and insight into business outcomes.

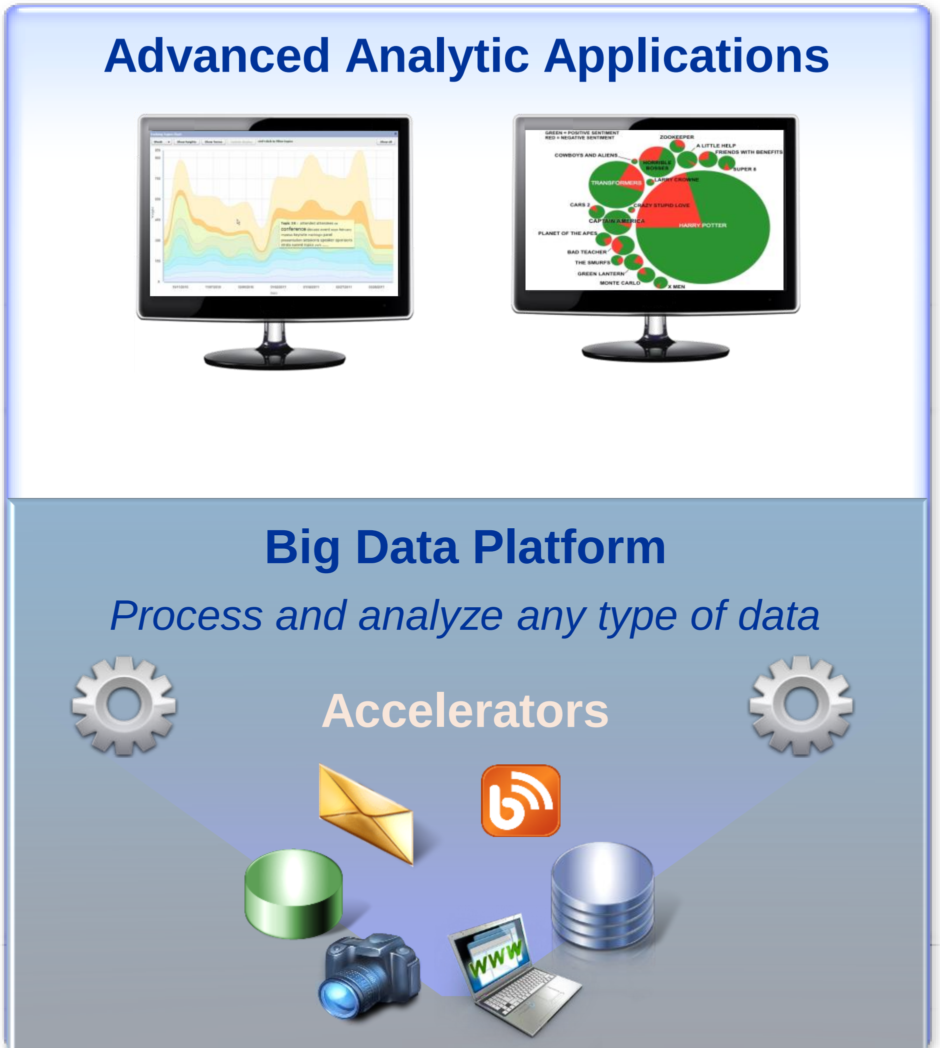
SmarterAnalytics

IBM

What are the characteristics of BIG data?

- Generally small, simple data types
  - Integers, floating point, simple text
  - In todays systems mostly digital and often tagged
  - Social media text is unstructured but short
    - Context may be difficult to determine
- Data acquisition can include numerous fields
  - From a few to tens of attributes at one read
  - Messages are usually less than a few hundred bytes
- But sampling rates can be large
  - AMI up to one read per five minutes
  - PMU up to 15 reads per cycle (1/60 sec)

New analytic applications require a BIG data platform

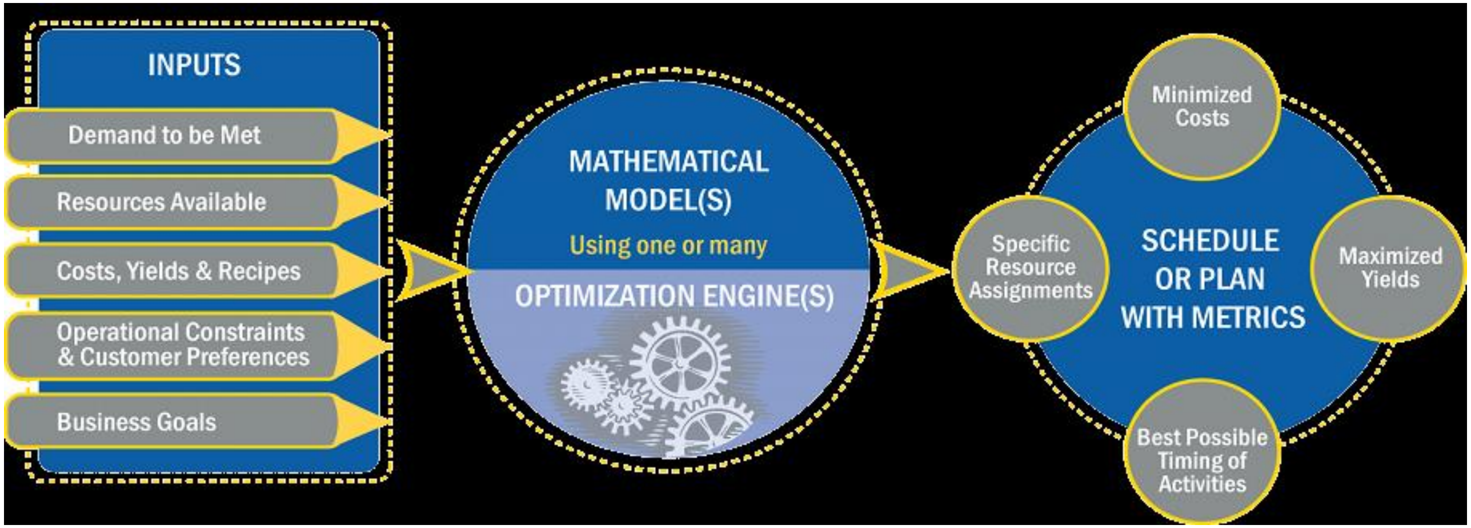


- Integrate and manage the full variety, velocity and volume of data
- Apply advanced analytics to information in its native form
- Visualize all available data for ad-hoc analysis
- Development environment for building new analytic applications
  - Electric operations risk

How Optimization Works

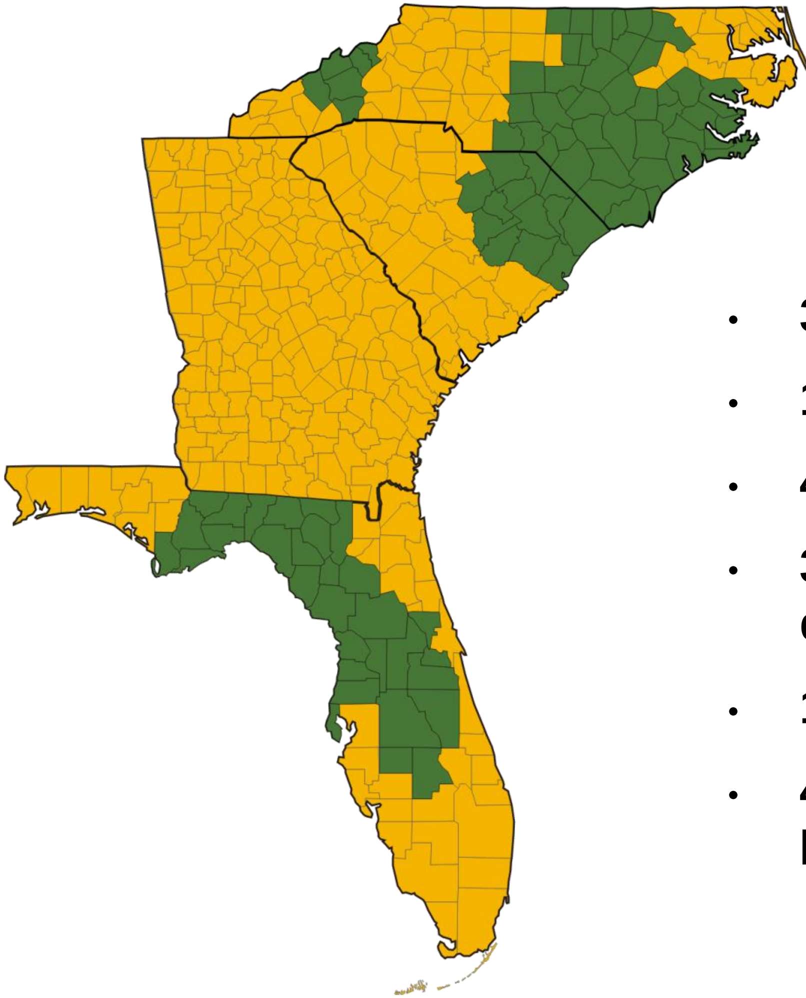
Targets & Goals
Limits
Rules
Data

Choices & Decisions
KPIs



Two kinds of decisions:
•Continuous – examples: How much to generate? How much to invest?
•Discrete – examples: Which units to commit? Which plants to build?

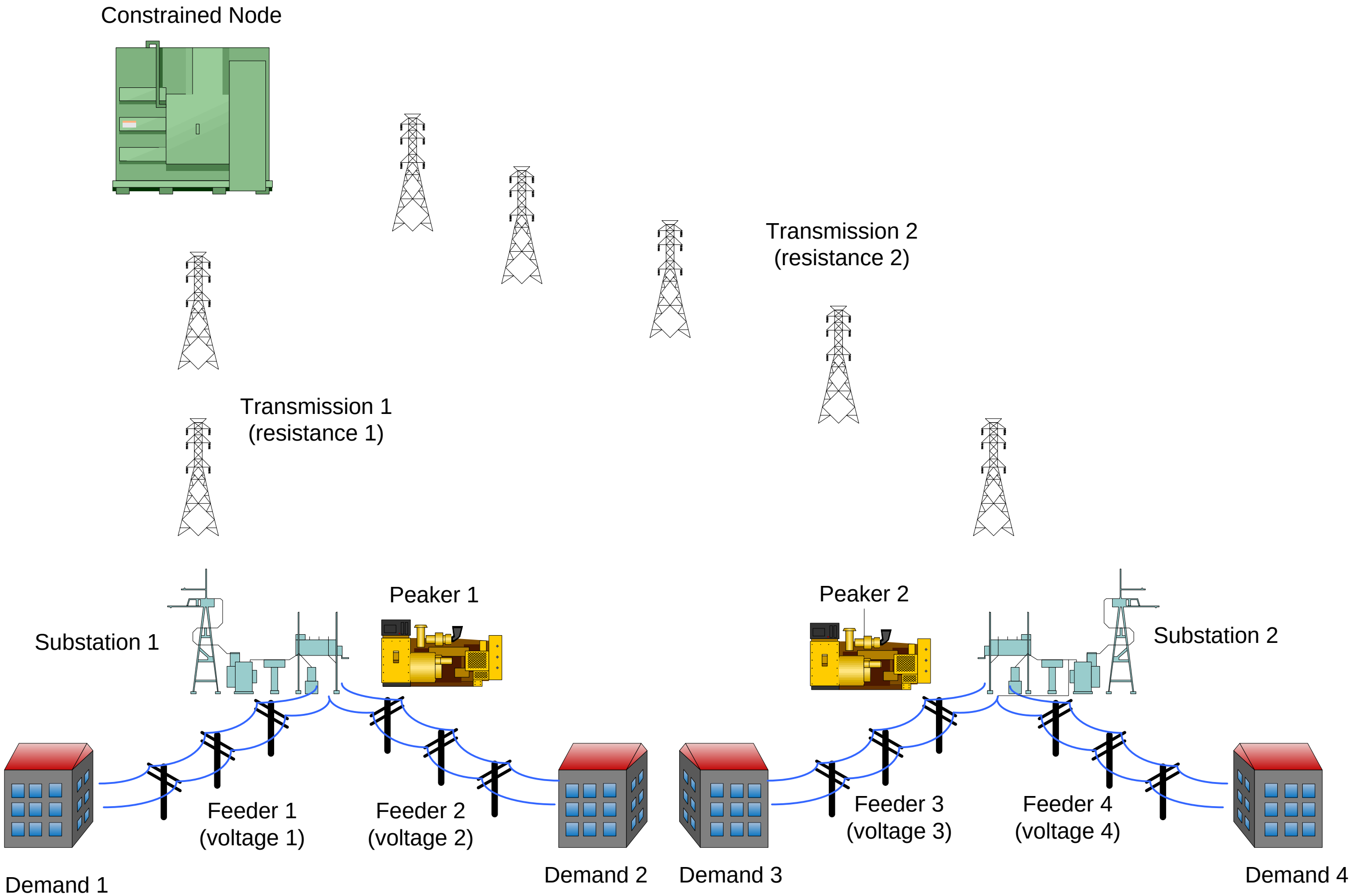
Progress Energy is implementing a dynamic voltage reduction project as a part of their Optimized Energy Value Chain - Distribution System Demand Response (DSDR)



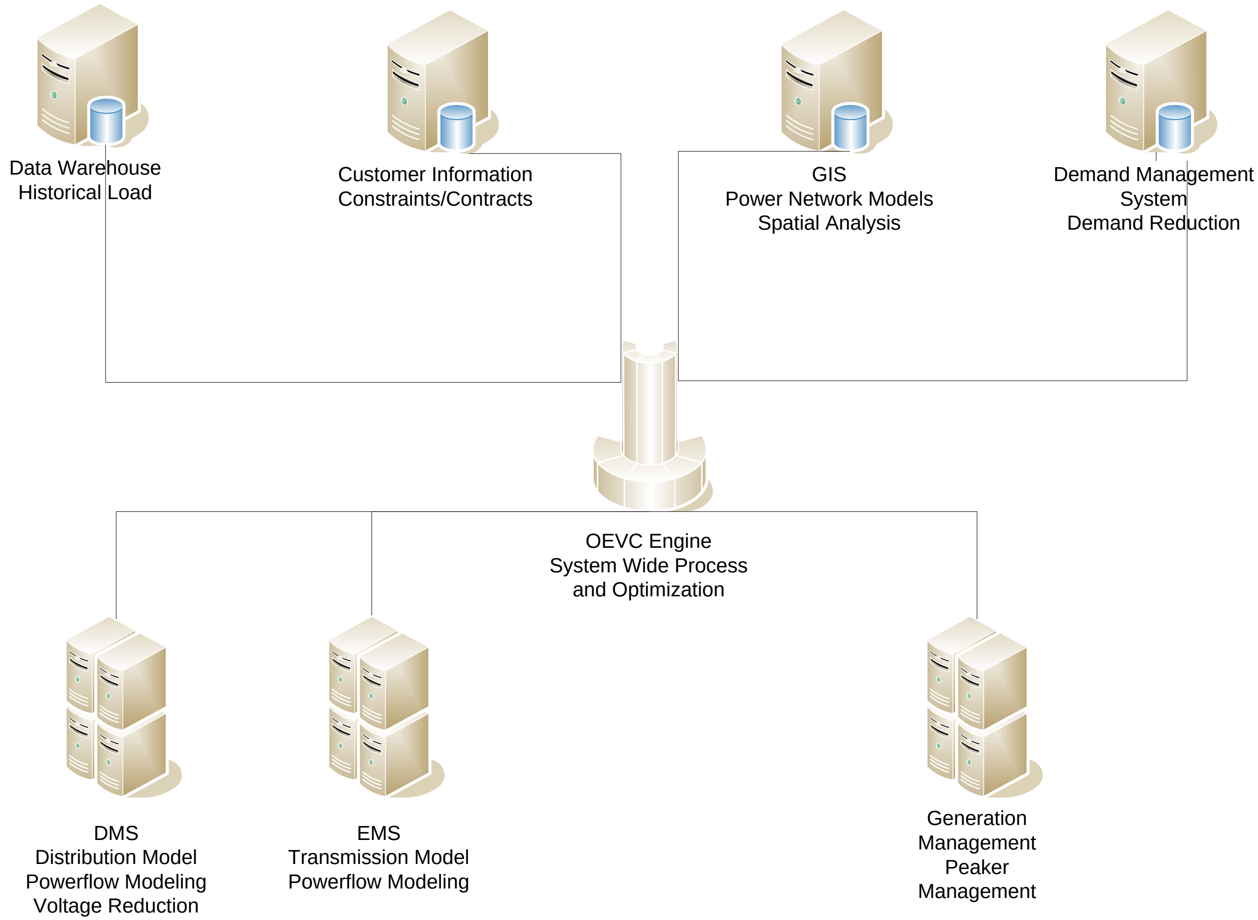
Progress Energy

- 33,000 Square Miles
- 1.4 million customers
- 47,000 miles of distribution primary
- 350+ T/D substations & 1,190+ distribution feeders
- 1,200 customers per feeder
- 41 miles average primary feeder length

Scenario – Physical View



Scenario – Systems View



Demonstration