



Smart Grid

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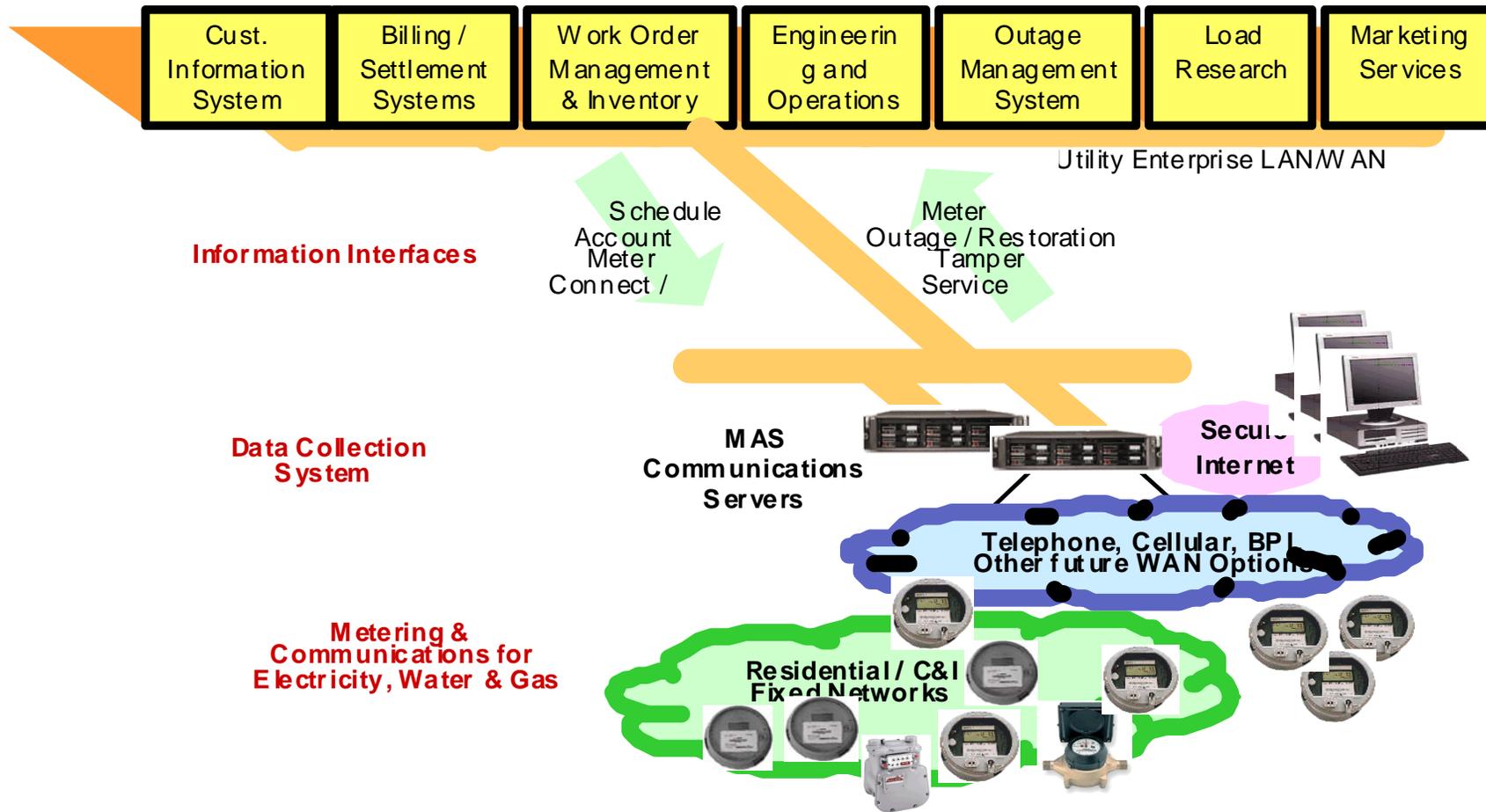
What is A Smart Grid?

- Smart Grid is a vision for electric utilities where:
 - Utilities and consumers will accrue values through the convergence of power delivery and information technologies to achieve improved reliability, reduced O&M and capital costs, maximum utilization of DER, and increased customer satisfaction.
- Applied to Distribution, Transmission, Generation and customer sectors by leveraging computer and communications infrastructure and technologies
- Not a set of shrink-wrapped solutions; the set and scope are unique to each utility, in the context of traditional capacity engineering and planning

Translated into Results

- Improved reliability
 - More visibility to the transmission and distribution system
 - Intelligent Electronic Devices (IEDs), AMI meters, Phasor Measurement Units (PMUs)
 - State estimators
 - More local intelligence and control of the system
 - Communications infrastructure (e.g., Peer-to-Peer)
 - Ability to communicate/interoperate devices
- Improved condition-based maintenance
- Optimal utilization of infrastructure capacity
- Improved usage of DER, storage & renewable forming micro-grids
- Utilization of Plug-in Hybrid Electric Vehicles (PHEVs)
- Interface with Home Area Networks (HAN)

Enterprise IT Integration



Smart Grid Business Case

- Highly critical step
- Smart Grid seems to be technology-driven, but “what value can both a utility and society accrue” is the focus
- Factors to be considered
 - What Smart Grid applications exist and are still needed?
 - What is the scope and benefit of each Smart Grid application?
 - Which Smart Grid applications are beneficial and applicable?
 - What are the barriers to implementation?
 - What combinations of technologies should be used?
 - How many legacy system resources can be used?
 - What are the ultimate costs and benefits of implementation?

The Smart Grid of The Future¹

| 20th Century Grid | 21st Century Smart Grid |
|----------------------------------|--|
| Electromechanical | Digital |
| One-way communications (if any) | Two-way communications |
| Built for centralized generation | Integrates distributed generation & renewables and supports electric vehicles or hybrids |
| Radial topology | Network topology; bidirectional power flow |
| Few sensors | Monitors and sensors throughout; High visibility |
| Manual restoration | Semi-automated restoration & decision-support systems, and, eventually, self-healing |
| Prone to failures and blackouts | Adaptive protection and islanding |
| Scheduled equipment maintenance | Condition-based maintenance |
| Limited control over power flows | Pervasive control systems; state estimator |
| Not much sustainability concern | Sustainability and Global Warming concern |
| Limited price information | Full price information to customers – RTP, CPP, etc. |

¹ Modified from the Emerging Smart Grid: Investment And Entrepreneurial Potential in the Electric Power Grid of the Future, Global Environment Fund, October 2005



Thank You

