IBM and Smart Utilities

12 May 2011; Istanbul
Agenda

- E&U Value Chain
  - SAFE Architecture

- T&D Operations
  - Asset and Work Management

- Intelligent Utility Network
  - Smart Meter Deployment
An information value chain has emerged where meters are the gateway and infrastructure for enabling deeper customer engagement.

**Traditional electricity value chain**

- Power generation and trading
- Power transmission
- Power distribution
- Energy service (retail)
- Electric devices and appliances

**Emerging electricity value chain**

- Power generation and trading
- Power transmission
- Power distribution
- Energy service (retail)
- Electric devices and appliances
- Distributed resources (generation, storage, electric vehicles)

**While the traditional value chain stopped at the meter to the premises, the new value chain will integrate devices beyond the meter and the actions of customers themselves.**
In the expanded value chain, the customer has more to offer power providers and other participants than just payment for energy.

Traditional industry value model:

Value to customers (continuous)
- Power
- Reliability
- Universal service

Reciprocal value from customers (intermittent)

At the same time, customers are becoming more demanding; they actually have much more to offer in reciprocal value to energy and other product/service providers.

Emerging industry value model:

Value to customers (continuous)
- Power
- Reliability
- Universal service
- Environmental impact reduction
- Cost saving
- Personalization
- Information
- Services
- Revenue

Third-party product/service providers
- Information
- Services
- Environmental impact reduction
- Revenue

Reciprocal value from customers (intermittent)
IBM’s Energy and Utility Solution Portfolio addresses a utility’s business and technology needs across the full energy value chain.

IBM’s Energy and Utility Solution Portfolio

- **POWER GENERATION OPTIMIZATION (PGO)**
  - Plant Operations
  - Fleet Optimization
  - Supply Expansion

- **TRANSMISSION & DISTRIBUTION OPERATIONS**
  - Mobile Workforce Mgmt
  - Asset Lifecycle Mgmt
  - Supply Chain Mgmt

- **CUSTOMER OPERATIONS TRANSFORMATION (COT)**
  - Customer Care
  - Customer Management
  - Customer Systems

- **INTELLIGENT UTILITY NETWORK (IUN)**
  - Smart Metering & Beyond
  - Grid Operations
  - Emerging Areas

- **CORPORATE SUPPORT SERVICES**
  - Human Resources
  - Accounting
  - Payroll

**DELIVERY OPTIONS**

- **PHYSICAL AND CYBER SECURITY**
  - Solution Architecture for Energy & Utilities Framework (SAFE)

- **INFRASTRUCTURE**
  - Servers, storage, communications network and equipment and associated services
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Business Challenges to Distributed Utility

Today’s Environment
- Below Ground Assets
- Above Ground Assets
- Support Infrastructure

Strategic Imperatives
- Carbon Footprint
- Public Safety
- Customer Affordability
- Regulatory Compliance
- CAPEX and OPEX spend

Desired Outcomes
- Accurate and complete Regulatory review
- Improved OPEX management
- Reduction in Emergencies
- Reduced outage
- No Fines
- Improved Customer Service

Pain Points
- Ageing Assets
- Regulatory Reviews
- Multiple asset and work types

Enablers
- Intelligent Meters / Sensors / Assets
- Condition based error detection
- Specialist WAMS system
- Lean work processes
- SOA Model – componentised systems

A greener, sustainable, profitable business
The Concept

Optimise resources

Meet response times

Asset Investment

Standard Business Process; Key Performance Indicators; Regulatory Data Readiness; Customer Experience
IBM Maximo in Utilities

300+ IBM Maximo for Utilities Clients worldwide

Growing market share in all sectors

17 of 30 Fortune 1000 Utility Companies

Key Utility Sectors

- **Fossil/Hydro Generation** – 45% North American Fossil Generation and 55% of North American Hydro Power Generation (160)

- **Nuclear Power** – 11 Customers, 42 Units
  WW Presence. Marketshare: 10% World, 24% NA

- **Distributed Utilities**: High Voltage Transmission & Substation Maintenance (38) Distribution (22)
  Gas Pipeline & Distribution (24), Water & Waste Water (120) - Collection and Distribution,
  Water Treatment, Facilities and Vehicles

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Recent Success

Top Reasons for Selecting Maximo for Utilities

1. **Consolidation of asset management solutions** – for Power Generation, Electric & Gas T&D, Water & Waste Water, Facilities, Vehicles, & IT assets

2. **Technology** – J2EE Certified, Service Oriented Architecture (SOA) platform –
   standardization, scalability, usability, security

3. **Capabilities** – Functionality & ease of configuration to customer processes

4. **Convergence of OT & IT** – IT systems are leveraging the utilities ability to stay competitive

5. **Leadership Position** – In both the Gartner MQ and the Energy insight's Short List

6. **People** – Dedicated development teams for IBM Maximo for Utilities
Maximo for Utilities

Vision

Enhance Maximo to support Transmission and Distribution utility work process in Electric, Gas and Water.

Support the design, construction, and accounting for new utility infrastructure.

Further development is now focused on supporting IUN/Smart Grid features for a smarter planet, future development will extend capabilities to gas and water segments as well as electric to maximize business operations with advancing technology

The Integration Framework supports the customer ecosystem of software products that support distribution management (OMS, DMS) and utility operations (GIS, CIS)

Only vendor in the leader’s quadrant in Gartner’s Analysis of Enterprise Asset Management for Delivery Utilities Transmission and Distribution

History

IBM developed & marketed Maximo CUE for Maximo v4

Maximo for Utilities v5.2 was released in 2004 providing Compatible Unit Estimating CUE and Crew Management was added in 2005 for v 6

Maximo for Utilities 6.1 added GIS integration to ESRI ArcGIS server supporting geo-spatial management capabilities in an asset/work management system

Maximo for Utilities 7.1.1 adding CPM for Crews and the Service Address application for premise geo-coding

7.1.2 released in Nov. 2010 supporting Revenue Meter Asset Management and task work dependencies

7.x Crew support scheduler 7.1.1 & NERC/CIP support

Maximo for Utilities Supports DB2, Oracle, SQL Server.

Utility clients / development partners

- Duke Energy
- BGE
- Lakeland Electric
- Portland General Electric
- SRP
- DTE Energy
- Colorado Springs Utilities

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Magic Quadrant for Delivery Utility Enterprise Asset Management

Source: Gartner (September 2010)

Service Management Resource Center Links (for clients)
Gartner Magic Quadrant for Delivery Utility Enterprise Asset Management
Gartner Magic Quadrant for Power Generation Enterprise Asset Management Software
Maximo Enterprise Adaptor for SAP

- Chart of Accounts
- Transactions
- Items
- Inventory
- Material Reservations
- Material Issues
- Purchase Requisitions
- Purchase Orders
- Receipts
- Invoices
- Companies
- Work Orders
- Labor
- Labor Hours
- Cost Objects / Assets / GLs / WBS
- FI GL Postings
- MM Material
- MM Storeroom
- Material Reservations
- Material Issues
- Purchase Requisitions
- Purchase Orders
- Receipts
- Invoices
- Vendors
- CO Internal Orders
- Employee / Activity Codes
- CATS
- CO Actual Postings
Crew Forecasting in Scheduler
# Maximo Spatial - Features and Benefits

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Accurately define work locations</td>
<td>When a new service request is created, either manually or through a call center, having access to a map of the region to determine the location of the problem leads to a more efficient resolution.</td>
</tr>
<tr>
<td>Plan and schedule work by area</td>
<td>Ability to look at a number of open work orders and create a project or work package using a map view. Query work order by status, work type or craft requirements to find related work.</td>
</tr>
<tr>
<td>Query a map by Address</td>
<td>When trying to locate an asset or work order users can query the map by a specific address.</td>
</tr>
<tr>
<td>Optimize technicians travel time</td>
<td>By having a work orders location accurately specified, there is less time spent on travel trying to find the correct address or location, and less time traveling between work locations inefficiently.</td>
</tr>
<tr>
<td>Advanced analytics</td>
<td>Ability to overlay information on a map like traffic or weather information, asset failure history or population to prioritize work, schedule outages or plan future maintenance projects.</td>
</tr>
</tbody>
</table>
IBM Maximo Spatial Asset Management

The core of the SAFE architecture software stack, spatially-enabled with ESRI ArcGIS®

GIS digital infrastructure data is the System-of-Record

IBM Maximo® with ESRI ArcGIS® Server for service management

Perform asset editing and work orders spatially—e.g., workforce routing, geo-spatial processing.
Maximo for Utilities is Smart Grid Ready

IBM passed the first interoperability test for part 6 by creating a web service to receive a request in the CIM format. This web service creates a work order and responds with the new work order number. The web service also supports work order updates.

This work and the instructions to deploy it will be made available on Service Management (ISM)


Support for Common Information Model CIM 61968 part 6
More and more customers request CIM Support
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The IBM Smart metering and beyond offering includes:

<table>
<thead>
<tr>
<th>Offering components</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Metering Systems Integration</td>
<td>Complete end-to-end smart meter implementation and program management including project planning and justification, management of meter deployment and communication networks, installation of Meter Data Management Systems and integration to utility back-office systems</td>
</tr>
<tr>
<td>Centralized Meter Data Services</td>
<td>Planning, development, connecting and integrating meter data from multiple utilities into an aggregated business model</td>
</tr>
<tr>
<td>Meter Data Analytics</td>
<td>Applying business analytics to data collected from smart meters and other devices to gain insights into site interactions, smart meter infrastructure and grid enterprise participants.</td>
</tr>
<tr>
<td>Smart Meter Operations</td>
<td>Designing, building, and providing application management and hosting support and services to optimize the support of the smart meter infrastructure and related applications.</td>
</tr>
<tr>
<td>Metering Innovation</td>
<td>Identification, design, and incorporation of emerging metering capabilities as part of a smart grid deployment that needs to integrate with home area networks, electric vehicles, smarter buildings, renewable energy resources, microgrids and other new grid enterprise participants.</td>
</tr>
</tbody>
</table>
Smart metering and beyond SWG offering components

SAFE Framework for Asset Lifecycle Management

Solution Architecture for Energy and Utilities Framework

Third-party Access Domain

Utility Business Domain

Power Generation
- Plant Operations
- Fleet Management
- Supply Expansion

Regulatory, Risk and Compliance Management
- Mobile Workforce Management
- Asset Lifecycle Management
- Supply Chain Management

Transmission & Distribution
- Smart Meter & Beyond
- Grid Operations
- Security
- Communications Network
- Plug-In vehicle/Distributed Energy Resources

Improved Customer Experience

Customer Operations
- Customer Management
- Customer Care
- Customer Systems

Corporate Support Services
- Human Resources
- Accounting
- Payroll

Informative Decision Making

Business Process Automation

Business and infrastructure integration layer (Service Oriented Architecture)

Communications network domain

Device domain

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Larger smart meter deployments are driving change across the smart meter infrastructure and in the end-to-end network.

**Home Energy Management System:** Standards and architectures emerging.

**Load control devices**

**Displays**

**Meters**

**Backhaul Network**

**Office Network**

**Neighborhood Network**

**WAN**

**Data center – NMS and MDMS**

**Data center – legacy apps**

**Customers and other stakeholders**

**Retailers**

**Web**

**Customer**

**External data provision**

**Network protocols:** Standards for the smart meter network layer are evolving toward Internet Protocol (IP).

**Meter communications:** Standards are evolving.

**Data Collection Systems**

**Integration with existing distributor systems**

**CIS**

**OMS**

**ERP**

**GIS**

**Smart Metering and Beyond offering from IBM**
Smart Metering Opportunity: Data Processing & Management

Solution Partners (FIT-FOR-PURPOSE)

Smart Metering Solutions Network

- Smart Meters
- Software
- Head End and Meter Data Management Operations

Source: Pike Research

~ $19.5 Billion
250 million meters

2010 - 2015

Smart Metering Solutions

Device

Network

Best Hardware, Software, Services

IBM

2010 – 2015 and Beyond

Smart Metering Servers
Systems Software

Meter Data Backup and Recovery
Storage & Archival

Data Tsunami

Storage case over 3 years

Solution Partners

Smart Meters

2010 - 2015

Meter Installation Penetration Rate:
- 55% North America
- 40% Europe
- 7% SE Asia

IBM => Support, Technology, Testing, Marketing programs, Delivery options, Differentiation, Analytics, & more

Additional Business Value

- Data Strategy
- Communication
- IT Skills/Education
- IT Management
- Agility
- Risk Management
- Customer Focus
- Modular Design
- Integrated Solution
- Scalability
- Apps. Performance
- Data Intelligence

Longer Term Benefits

2010 - 2025

Energy Retail

Intelligent Utility Network

- Customer Management
- Transmission & Distribution
- Power Generation
- Impact

Partners + IBM (HW, SW, Services) = SCALABLE, Integrated, Global Solution
Netcool for Utilities Solution

- **Network Visualization**
  - Command & Control through graphics
  - Topology based root cause
  - E2E Event & Visual Consolidation

- **Probe Library**
  - Sensor Specific Probes
  - Existing Generic Probes

- **Event Correlation**
  - Root Cause Analysis
  - Service Level Management

- **Multi-Protocol, Multi-vendor**
  - Sensors
  - IT
  - Transmission
  - NGN

- **Knowledge Base**
  - Reduces repair time
  - Centralized repository of knowledge
  - Launch in alarm context

- **Scalable**
  - Centralized or Distributed Management
Maximo 7.1.2 New Features to support Smart Meters

– Improve receiving rotating assets in bulk
– Improve issues and transfers by pallet number
– Store meter test results
– Define meter sampling templates
– Define meter sampling groups
– Create random sampling work orders
– Automate administrative functions that prevent dispatching of work orders
Benefits realization is immature, but examples demonstrate value in key areas

Revenue enhancement
- Cash flow
  - Fewer estimated bills
  - Shorter billing cycles
- Loss Identification
  - Tamper alarms
  - Load balancing
  - Move-in detection
- Loss response
  - Load limiting
  - Remote and virtual disconnect

  ▪ Smart meter data indicated more electricity theft “than anticipated.”¹
  ▪ Electricity theft arrests double and $1.6 billion in electricity payments recouped sooner over a two year period³

Demand management
- Time-based pricing (TOU, CPP)
- Energy profiling and analysis
- Online energy audits / analysis
- Load control extensions

  ▪ Estimation rate reduced over 85% from the non-smart meter estimation rate:
    - Non-smart meter estimation rate => 1.75%:
      Smart meter estimation rate => 0.25%²

Distribution operations / reliability
- Outage detection and restoration
  - Identifying “single-light-out” situations
- Asset optimization
  - Asset loading
- Emergency response
  - Emergency load shedding

  ▪ Reduced truck rolls to confirm service after outages.
  ▪ Avoiding 2,000 truck rolls per storm, which was not in the original business case.¹

Customer service
- Better customer information for Customer Service Representatives
- Reduced customer call volumes

  ▪ Reconnect time – 36 minutes, 05 seconds²

Sources:
¹ IBM Analysis for 1 million meter deployment;
² Smart Grid News, Sept 17, 2010;
³ Jacksonville Electric Authority (JEA), smartmeters Research Store, Dec 7, 2010

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## IBM’s smart meter experience

<table>
<thead>
<tr>
<th>Offering components</th>
<th>Key client references</th>
</tr>
</thead>
</table>
| **Smart Metering Systems Integration** | CenterPoint  
Enemalta  
ESB  
Hydro Ottawa  
IESO  
Oncor  |
|  | Oxxio  
Pacific Gas & Electric  
Pepco Holdings (PHI)  
Southern California Edison  |
| **Centralized Metering Data Services** | IESO  
Smart Meter Texas  |
|  | Oncor  
Oxxio  
Pacific Gas & Electric  
Southern California Edison  |
| **Meter Data Analytics** | A2A  
American Electric Power  
FirstEnergy  
npower  
NV Energy  |
| **Smart Meter Operations** | Oxxio  
IESO  
Smart Meter Texas  |
| **Metering Innovation** | Powermatch  
Oncor  |
|  | CenterPoint  |
IBM smart metering engagements span the globe

**North America:**
- American Electric Power
- Austin Energy
- BC Hydro
- BELCO
- CenterPoint Energy
- Con Edison
- Consumers Energy
- CPFL Energia
- Entergy
- First Energy
- Florida Power & Light
- Hydro One
- Hydro Ottawa
- IESO (Ontario)
- London Hydro
- NV Energy
- Oncor
- Ontario Energy Board
- Pacific Gas & Electric
- Pacific Northwest National Laboratory
- PECO
- Pepco Holdings Inc
- Progress Energy
- Smart Meter Texas
- Southern California Edison
- Toronto Hydro

**Europe:**
- A2A - AEM Torino
- A2A - ASM Brescia
- Alliander
- EDF (France)
- EDF Energy (UK)
- EnBW
- Endesa
- Enemalta
- EDF
- ESB Networks
- Göteborg Energi
- MVV Energie AG
- Nuon
- Oxxio
- RWE npower
- Scottish & Southern Energy
- 30 Italian distributors

**Australia:**
- Country Energy
- Energy Australia
- Western Power