Embedding Security into Smart Grid Application Architecture

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Agenda

• Smart Grid Opportunities and Challenges

• Open SmartGrid Application Platform

• Applying Cyber Security to SmartGrid

• Summary and Questions
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Trends That Are Transforming The Utility Industry

1. Smart Grid Investment
2. Consumer Interaction and Home Area Networks
3. Electric Vehicle Adoption
4. Intermittent Renewables and Electricity Storage
5. Aging Assets
6. Aging Workforce
7. Smart Grid Device Management
8. Business Intelligence and Analytics
9. Introducing Oracle’s Smart Utility Platform
Smart Grid – Transforming the Energy Value Chain

**Regulatory**
- Must demonstrate customer value
- Investment pay-back
- On-going customer benefits and societal benefits

**Customer Expectations**
- Information to engage customers and keep them engaged
- Impact of Choice and Smart Grid
- Expectation of improved performance – “I have options now”

**Changing Business**
- New entrants into consumer energy – Google, Microsoft, etc.
- Speed of decision making
- Media focus

**Operational Issues**
- Customer program management
- Grid impacts
- Media Hype – Higher bills, EMF, who do you trust?
Leverage Smart Grid Information To Drive Business Performance…

The more you expose people to the data the more value they can derive

- How do you manage the 600x increase in data?
- How do you manage the new smart devices to ensure security and timelines of updates, with new applications and analytics requirements?
- How do you build applications that enable immediate customer benefit in a future that is yet to be defined?

Source: EPRI - IntelliGrid
Start with the end in mind …

Premises
- Home Appliances
- Meters
- Distributed Generation
- VDUs
- HAN - Gateways
- Communication
- Micro Generation

Field Work
- Mobile Workforce
- Real Time Scheduler
- Work & Asset Management
- Transport Management
- GIS

Networks
- Automation
- SCADA
- EV Charging Infrastructure
- Distribution Management
- Outage Management

Markets
- Markets

Customers
- Customers
- Load Analysis
- Complex Billing
- Transactions
- Load Profile & Settlement
- Portfolio Management
- Forecasting
- Distribution Management
- Demand response
- Quotations Management
- Rate Design
- Customer Care & Billing

- Self-Service
- Customer Attention & relationship
- Home Appliances
- Distributed Generation
- HAN - Gateways
- VDUs
- Micro Generation

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SmartGrid Information Management Challenge

- Information Management is key to Advanced SmartGrid Processes
- This takes time and must focus on solving immediate business problems
- Each incremental DMS initiative must include Enterprise Information Management

- Beyond-the-meter customer resources: DG, Storage, DSM, EVs
- ADMS Network Impedance Model
- OMS Customer Connectivity
- SCADA Model
- Distribution SCADA
- OMS
- ADMS Grid Optimization
- RT Customer-Grid Optimization

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Smart Grid needs an Information Architecture

- Much more data, many more events need to be handled much more quickly
- New and existing business processes need to be integrated reliably, securely, and inexpensively
- Operators, customers, managers expect increased visibility and control
- IT must respond with a flexible, secure, scalable infrastructure
Enterprise Information Management

Asset Data Synchronization Example

AIA Oracle Service Bus + Process Integration Pack (CIM)

1. GIS Operator Creates New Line Extension

2. CIM Data Mapping

3. Message is validated

4. X-Ref & Rules

5. Applications updated with new facility information
Oracle Member in Industry Standards Groups
Delivering CIM Foundation for Utilities Integration

- **OBJECTIVE** – Provide a leading integration platform and fully integrated Oracle Utilities Suite of applications on top of that platform.

- **APPROACH** – Leverage and expand AIA Utilities Foundation Pack to include CIM and MultiSpeak compliant object definitions and message structures.

- **BENEFIT** - Oracle Utilities Foundation Pack (Reference Process Models and Common Objects) will deliver integrations based on Oracle’s leading Fusion Middleware and comprehensive industry domain coverage.
Oracle’s Smart Connect
Gateway Makes it Possible

INNOVATION FOR ALL SMART DEVICES:
• Simplifies the interaction between business processes and smart devices
• Reduces cost and time to add more intelligence to your operational infrastructure
• Enables near real time analysis and incident prevention
Oracle’s Smart Grid Gateway

The link between mission-critical systems and the equipment that powers them

Customer → Smart Meter → Meter Data → Smart Device → Smart Grid Sensor → Grid
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The Utility Business is Rapidly Evolving

100 years ago: Simple, one-directional business model
The Utility Business is Rapidly Evolving

Today’s Utilities are power companies but tomorrow they will become power and information management companies.

100 years ago: Simple, one-directional business model

~7 years ago: Online customer accounts

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The Utility Business is Rapidly Evolving

100 years ago: Simple, one-directional business model

~7 years ago: Online customer accounts

Now: Smart devices

Today’s Utilities are power companies but tomorrow they will become power and information management companies.

This new, bi-directional data exchange brings with it new complexities, new processes, new relationships and new risks.
## Smarter Metering & Smarter Grids…
New Opportunities and Risks to be Evaluated?

### Benefits for Consumers
- Information portal
- Taking Ownership of usage trends
- Intelligent Appliances
- Optimise your tariffs
- Self-service
  - Budget Visibility
  - New Home Services
  - Ease of supplier switching
  - Carbon footprint tracking

### Benefits for Network Managers
- Theft Detection
  - Technical losses Reduction
  - Network Reliability
  - Quality of service
  - Distributed/Micro Generation integration
- Advanced Mobile Workforce
- Advanced Outage Management
- Asset Maintenance & Optimisation

### Benefits for Suppliers
- No more ‘Estimates’
- Improved Customer relations
- Innovative Tariffs - DR & Dynamic Pricing
- Improved Customer Enrolment
- New Services
- Improved Energy Sourcing Operations
- Enhanced Self-Service
- New Generation Prepayment

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Smart Grid and Smart Metering
Security Reference Architecture

Customers

AMI

Meter Data Management

Customer Interactions

Operational & Core Business Functions

Customer Operations

- Self-Services
- Pricing & Quoting
- Customer Call Center
- Billing
- Customer Care
- Rate Analysis

Market Operations

- Demand Forecasting
- Settlements
- Balance Management
- Portfolio Management

Network Operations

- Work Management
- Outage Management
- Mobile Workforce
- Distribution Operations
- Systems Planning
- Revenue Protection

Heads-up

Smart Meters

Display

Usage & Tariffs

Reading & Status

Connect Disconnect

Micro-Generation

- Wind
- Solar
- Hydro
- Other

Home Energy Management

- Heating
- Appliances

Smart Grid and Smart Metering

Security Reference Architecture

Communications Systems

Devices

- Meter Data Management
  - Billing Determinants
  - Validation, Estimation, Editing
  - Meter Asset Management

Head-end

LAN/WAN

SOA & BPM

Application Grid

Portals

BI

Middleware

Identity, Access & Risk Mgmt

Data Management

Summaries & Aggregates

- Meter Data Repository
- Asset Data
- Customer Information
- GIS Data
- Operational Data

Infrastructure

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Oracle Cyber Security for Smart Grid
Above and beyond NERC CIP and SOX...

Industry-Leading Set of Centralized Security Services for Utilities

- **Centrally Manage Security Risks and Controls** - at the Enterprise-Level
  - Document Risks, Controls for multiple regulations, track remediation, store/retain, etc
- **Centrally Manage User and Device Explosion!**
  - Employees, Contractors, Customers, Badges...Meters, Intelligent Devices...
  - Create and Manage User Roles
  - Create, Modify and Remove user accounts and passwords
- **Centrally Control Access to Applications**
  - Control Access to Front and Back-Office Applications, Services, Physical locations, etc
  - Provides “Real Time” control of resources at both Coarse- & Fine-grained levels
  - Provides “Real Time” Fraud Prevention and “Risk-Based” Decisioning
- **Securely Manage Data and Information Explosion!**
  - Information from smart meters, grid operations, applications, etc
  - Provide controls to ensure sensitive data remains private from any user (including the DBA)
  - Secure data inside & outside databases, On Extranet Portals, Custom Apps, etc
- **Centrally Monitor and Manage System Configuration**
Tomorrow’s Portal with Smart Metering
Who should be the “Face to the Consumer?”

Utility Portal
(Secure, Analytics-Driven, Actionable)

Utility Network
(Read-Only)

Energy Monitoring Dashboards
(View and Control)
Smart Metering
Who should be the “Face to the Consumer?”

Utility Portal
(Secure, Analytics-Driven, Actionable)

3rd Party (Read-Only Views)

Energy Monitoring Dashboards
(View and Control)
Smarter Outage Management Notification
Who should be the “Face to the Consumer?”

Utility Portal
(Secure, Analytics-Driven, Actionable)
Today’s Consumer Portals – Basic Web Security

Unable to prevent ID Theft and Fraud

Security logic embedded within applications is hard to change and audit

Need to propagate User IDs across web service tiers

Access to sensitive user and financial database data is not controlled

Unable to prevent ID Theft and Fraud

Lack of detailed forensic data regarding user, device, etc

Not able to support Fine-Grained Authorization

Not currently supporting User Federation

Users and important attributes spread across directories and databases

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Conclusion: Smart Utility Roadmap

Summary Bills
Automated Meter Reading
Demand Response
Distribution Automation
Time of Use Pricing
Advanced Metering Infrastructure
Critical Peak Pricing
Smart Meters
Advanced Distribution Management Systems
Electric Meters
Electricity Storage
Home Automation Networks
Smart Appliances
Distributed Generation
Electric Vehicles
MicroGrid Balancing
Real-Time Pricing

10-years ago
Now
10-years

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Conclusion: Standards-based strategy

- CIM enabled Application Platform for Utilities

**Oracle Enterprise Information Management Strategy**

- Add Current Stds.
- Oracle EBOs
- Utility EBOs
- IEC CIM Objects
- Open SG
- MultiSpeak

**AIA Foundation Pack Canonical Model Library**

**Oracle Enterprise Information Management Strategy**

- SOA Suite, AIA (ESB + FP for CIM and MultiSpeak)

**End-to-End SmartGrid Security Strategy**

- Infrastructure Security
- Database Security
- Identity Management
- Information Rights Mgmt.
Areas of Focus for Cyber Security Platform

- Reduce Risks associated Theft and Fraud
- Meter Data Security, Storage and Analysis
- Streamline User/Role/Password Management
- Securing Next-Gen Consumer Energy Portals
- Improve speed and reduce the cost of Compliance
- Agility to comply with NERC-CIP, SOX, New Mandates
Utility Solution Paradigm

Complete: Comprehensive Industry Portfolio

Open: Standards-Based Architecture

Integrated: Designed to Work Together

More Value, Less Complexity

More Choice, Less Risk

More Flexibility, Less Cost
Q&A

Oracle is ready to partner with you on your Smart Grid journey.

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Process: Top to Bottom Support for Utilities

Leading Enterprise Software Vendor
- #1 in CRM, HCM, EPM, Middleware, and more
- Most scalable, reliable, secure infrastructure
- Most complete range of on-demand and on-premise deployment options

Built-In Utilities Capabilities
- Interval based pricing (real time, TOI, CPP, event)
- Industry Standard VEE
- Integration with smart devices
- Self Healing Grid
- Field workforce optimization

Largest Software Assistance Team
- 64,500 development, support, and services professionals
- 145 countries
ORACLE UTILITIES
Appendix

Oracle in the Utility Industry
Oracle Corporation

Scale
- $24.2B in TTM revenue for Oracle
- #1 in 50 product or industry categories
- 370,000 customers in 145 countries
- 30,000 partners
- $40B on 60+ acquisitions, since 2005
- 106,000 employees
- 10 million developers in Oracle online communities

Innovation and Investment
- 29,000 developers and engineers
- 15,500 customer support specialists, speaking 27 languages
- 20,000 implementation consultants
- 1 million students supported
- 870 independent Oracle user groups with 355,000 members

Revenue represents March 1, 2009 – February 28, 2010
Oracle in the Utilities Industry
Did You Know?

**Experience:** 30 years of Technology, Innovation and Growth

**Customer Base:** Best Solutions Running at 2,600+ Electric, Gas, Water Utilities Worldwide

**Dedicated to the Industry:** Oracle Utilities Global Business Unit with 1,000+ Worldwide

**20 of the Top 20 Utilities:** Get Results with Oracle Solutions
Oracle Utilities Global Business Unit

Dedicated Utilities Team
• 1,500+ employees focused solely on utilities
• Define, develop, and offer mission-critical applications specifically for utilities
• Global organization and reach

Industry Leading Utilities Capabilities
• Smart grid software
• Customer care and billing
• Meter data management
• Mobile workforce management
• Network management and load analysis
• Work and asset management
• Self-service billing, payment, and support

Leveraging the Capabilities of the #1 Enterprise Software Vendor
• ERP, CRM, HR and more
• Most scalable, reliable, secure infrastructure
• Most complete range of on-demand and on-premise deployment options
The Challenges We’re Hearing

Ageing Infrastructure and Changing / Ageing Workforce:
How can we optimize capital and ensure the best use of our people and our assets?

“They have neglected their infrastructure for too long… We are sick and tired of them and they had better change.” After downtown Chicago black outs.

– Mayor Richard Dailey, Chicago

Managing a complex energy portfolio:
How do we turn the data deluge into information that used throughout the business?

“A Smart Grid is characterized by the ability to use real-time information to anticipate, detect, and respond to system problems”.

– Michael R. Peevey, President California Public Utilities Commission
The Challenges We’re Hearing

Maintaining Safe, Secure, Reliable Supply:
How do we incorporate renewables, comply with regulations and standards, and meet greenhouse targets?

“I strongly believe that the energy industry needs to help shape the future of carbon regulation”.

– Jim Rogers, CEO Duke Energy

Meeting the Changing Customer Expectations:
How do we engage with the customers as they get fully involved with distributed generation, electric vehicles and a need for information?

“Electric Utilities are evolving to become energy advisors to their customers. Electricity today does more than light homes and businesses. We see a future where success in our industry will be measured by companies offering new, innovative approaches to achieving these expectations”.

– Joe Rigby, CEO PEPCo.
The need for utilities to transform

Around the world, utilities are under pressure.

- Citizens demand energy and water that don't undermine environmental quality.

- Regulators seek action on smart grid and smart metering initiatives that add intelligence to infrastructure.

- Customers seek choice and convenience, but without additional costs.
Oracle can help you on your journey

- We offer utility experts, mission-critical software applications, a rock-solid operational software suite, and world-leading middleware and technology.

- We understand the complexity around smart grid initiatives, implementations, and the unknown.

- We provide flexible, innovative technology and interoperable applications that increase efficiency, improve stakeholder satisfaction, future-proof your organization, and turn information into power.
A Closer Look…

Maintaining Safe, Secure, Reliable Supply

Protecting today’s resources for the next generation

• Moving to distributed generation and micro grids while satisfying rising demand requires new systems and process to ensure supply is safe and secure

• Incorporation of intermittent power sources will need more accurate forecasting, more robust sensing equipment and more real time monitoring

• Management of smart equipment requires new processes to ensure accuracy and reliability in the field with the need to move towards distributed system management
A Closer Look…

Ageing Infrastructure and Changing / Ageing Workforce

Optimizing the risk and return of your assets

- The balancing of costs and reliability require new risk profiles to be managed for all assets in the field to ensure minimal disruption to service.
- 40-50% of the utility workforce is eligible for retirement in the next 5 years so technology must be used to automate previous manual processes.
- Being able to schedule resources to the right place at the right time with the right skills and equipment will become key to managing the new network.
A Closer Look…

Meeting the Changing Customer Expectations

Interacting with consumers in new ways

- The engagement model for consumer is proactive enabling them to make decisions about energy and water usage through a variety of channels
- The need for more product choice and bundling capability, engaging the customer in the value chain for programs such as green energy or demand side management
- The need to have efficient and cost effective customer care processes while dealing with a change to real time information and increased options
A Closer Look…

Managing a complex application portfolio

The more you expose people to the data the more excited they get

- How do you build applications and give customers access for a future that is yet to be defined?
- How do you manage the 600x increase in data, while minimizing the duplication across the organization, ensure all functions have the data they need in a timely manner?
- How do you manage the new smart devices to ensure security and timelines of updates, with new applications and analytics requirements?
Oracle’s Solution Strategy

- More Value, Less Complexity
- More Flexibility, Less Cost
- More Choice, Less Risk

Standards-Based Architecture

Complete

Integrated

Designed to Work Together

Comprehensive Industry Portfolio
Architecture for the Transformational Utility

Interoperable applications on a smart platform…

Enabling new consumer models with Self Service and BI…

…leveraging open standards technology for integration…

…running on the world’s best hardware

Oracle Utilities “Smart Grid” Appliance: Powered by Exadata

Utilities Integration Platform: Powered by Oracle Fusion Middleware 11g

Spatial and Utilities Analytics: Powered by OBIEE

Utility Customer Management Portals and Apps
Open SmartGrid Platform

Enabling the EnergyCloud

Innovative Spatial visualization and mash-ups

Business Intelligence
Real-time Decisioning

MDM

CC&B

Mobile

Common Technology

Common Integration Platform
Powered by SOA & Industry Standards
Architecture for the Transformational Utility

Enabling new consumer models with Self Service and BI...

Interoperable applications on a smart platform...

...leveraging open standards technology for integration...

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Utility Customer Management Portals and Apps: Powered By Web Center

Spatial and Utilities Analytics: Powered by OBIEE

Utilities Integration Platform: Powered by Fusion Middleware

Oracle Utilities “Smart Grid” Appliance: Powered by Exadata

Oracle Utilities Cyber Security Platform

Interoperable applications on a smart platform...

Smart Grid Gateway

Metering

Customer

Supervisory Control System

Network Management

MicroGrid

Energy Advisor

Advanced Energy Management

Oracle Utilities  Cyber Security Platform
Oracle Member in Industry Standards Groups

AMI/HAN Research Group
EPRI - Electric Power Research Institute
IEC TC 57 - IEC Technical Committee
National Institute of Standards and Technology
OASIS
MultiSpeak
Smart Energy Alliance
OpenSG Users Group
UCA International Users Group
Peak Load Management Alliance
ZigBee Alliance
American Water Works Association
American Gas Association
Edison Electric Institute
Deliver Foundation for Utilities Integration

**OBJECTIVE** – Provide a leading integration platform and fully integrated Oracle Utilities Suite of applications on top of that platform.

**APPROACH** – Leverage and expand AIA Utilities Foundation Pack to include CIM and MultiSpeak compliant object definitions and message structures.

**BENEFIT** - Oracle Utilities Foundation Pack (Reference Process Models and Common Objects) will deliver integrations based on Oracle’s leading Fusion Middleware and comprehensive industry domain coverage.
The Oracle Smart Grid Suite

Oracle Utilities
- Network Management
- Customer Care and Billing
- Load Analysis
- Work and Asset Management
- Mobile Workforce Management
- Meter Data Management
- Meter Event Management

Oracle Hyperion
- AutoVue
- Governance, Compliance & Regulation

Oracle AIA and Fusion Middleware / Smart Grid SOA
- Primavera
- Database
- Spatial
- Business Intelligence

Communications Systems
- Smart Meters
- Consumer Energy Technologies

Network sensors & controls

Oracle Utilities

Communications Systems
## Oracle for Utilities Solution Footprint

### BUSINESS INTELLIGENCE
- Financial
- Operational
- Transactional

### BUSINESS OPERATIONS
- Metering
- Field Service
- Assets & Work
- Projects
- Networks
- Supply

### CORPORATE ADMINISTRATION
- Financials
- Procurement
- Facilities
- Human Resources
- Supply Chain
- …More

### INFRASTRUCTURE
- Middleware: Integration, Business Process Design, Orchestration and Monitoring
- Technology: Spatial, Database

### CUSTOMERS
- Customer Relations
- Billing
Oracle Utilities Footprint
Process: Top to Bottom Support for Utilities

Leading Enterprise Software Vendor
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- Industry Standard VEE
- Integration with smart devices
- Self Healing Grid
- Field workforce optimization

Largest Software Assistance Team
- 64,500 development, support, and services professionals
- 145 countries
Oracle Utilities
A Global Business Unit of Oracle Corporation

Objective
- Definition of Utilities Strategy
- Global and Central point of INDUSTRY- Contact
- Defines, develops, and offers utility Industry applications
- Ensures entire Oracle stack meets utility needs
- Engagement with Partners and SI’s
- Over 1800+ Utility experts globally

Richest Utility Application set

Best-in-Class Applications:
Complete – Open - Integrated

Best in Class:
- HRMS

- Billing
- Customer Info
- Asset
- Outage

Best in Class:
- Customer Mgmt

• Analytics,
• Consumer
• Insight

• Smart Grid
• Profile Management
• Complex Billing
• Meter Data Mgmt
• Quotation Mgmt
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