

IEEE PES General Meeting

Panel Session

The use of CIM Standards in Managing Big Utility Data

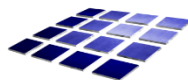
CIM-based Utility Data Model Solution for Enterprise Analytics

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National Harbor, Maryland

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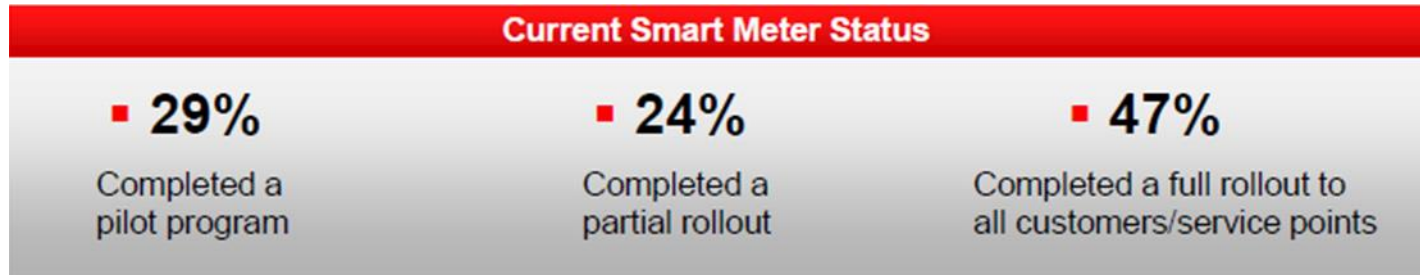


Topics Covered

- Utilities and Big Data 2013 Survey
- Importance of a Utility Data Model
- Role of IEC CIM on Utility Data Model
- Design Considerations
- Scope of Business Areas Included
- Sample BI Reports

North America Utilities Survey

- 151 North America utilities surveyed (April & May 2013)



- Less than half of utilities are using smart grid data to **improve customer service** today
- Big opportunities also remain in **operational analytics** to improve asset performance, reduce operations costs, and improve network reliability

- Source: Oracle Utilities and Big Data: Accelerating the Drive to Value, July 23, 2013

Survey on Predictive Analytics

- 70% - Expect predictive analytics to improve revenue protection
- 61% - Expect predictive analytics to reduce asset maintenance costs

- Source: Oracle Utilities and Big Data: Accelerating the Drive to Value, July 23, 2013

Utilities are Improving, but Underprepared

- While almost twice as many utilities say they are completely prepared for smart grid data today vs. one year ago, **the majority still say they are underprepared**. Utilities report slight improvements in information sharing and strategic decision making

How would you **grade your utility's preparedness** to manage the smart grid/smart meter data influx?

Percentage who said completely prepared:¹

2012 – 9%

2013 – 17%

How effective is your utility in handling the data influx?

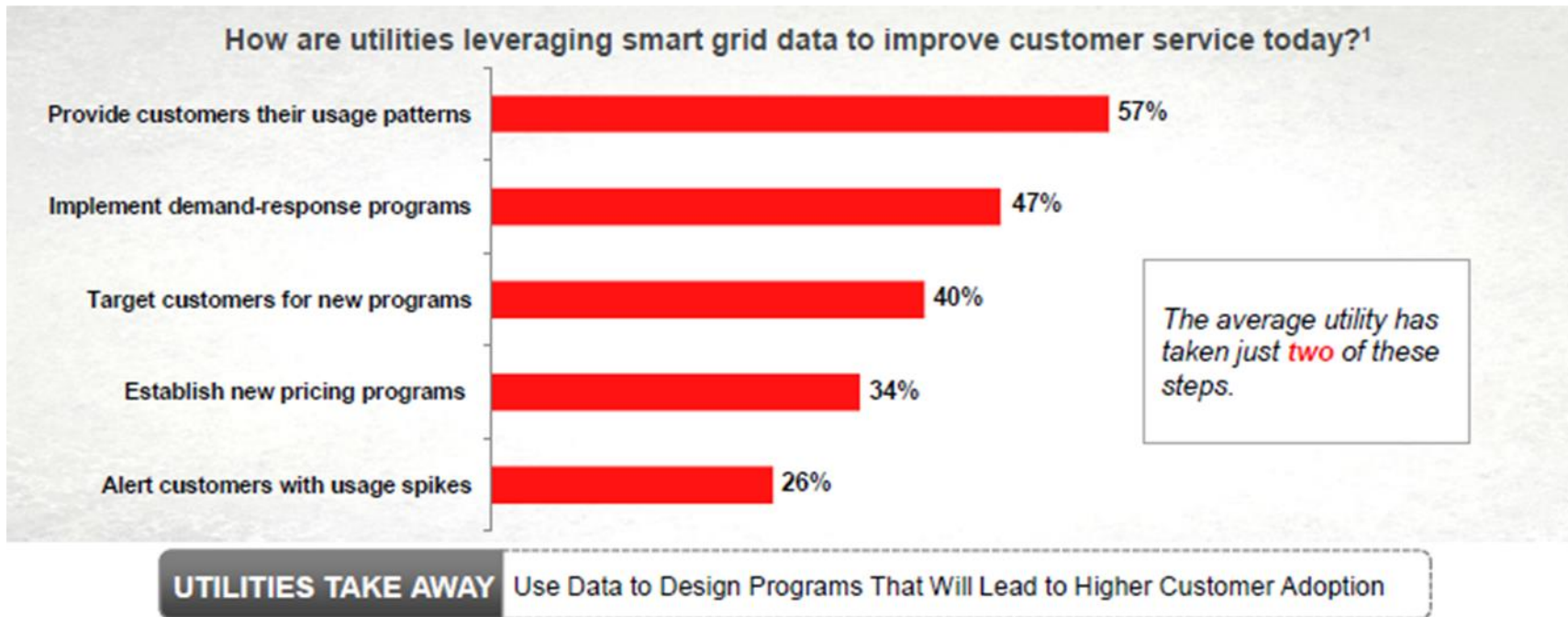
Percentage doing an excellent job: ¹	2012	2013
Putting timely information into the hands of people who need it most	8%	20%
Making strategic decisions based on the information	4%	11%

UTILITIES TAKE AWAY More Aggressive Analytics Approaches are Needed to Drive Significant Value

- Source: Oracle Utilities and Big Data: Accelerating the Drive to Value, July 23, 2013

Opportunities to Drive Greater Customer Value

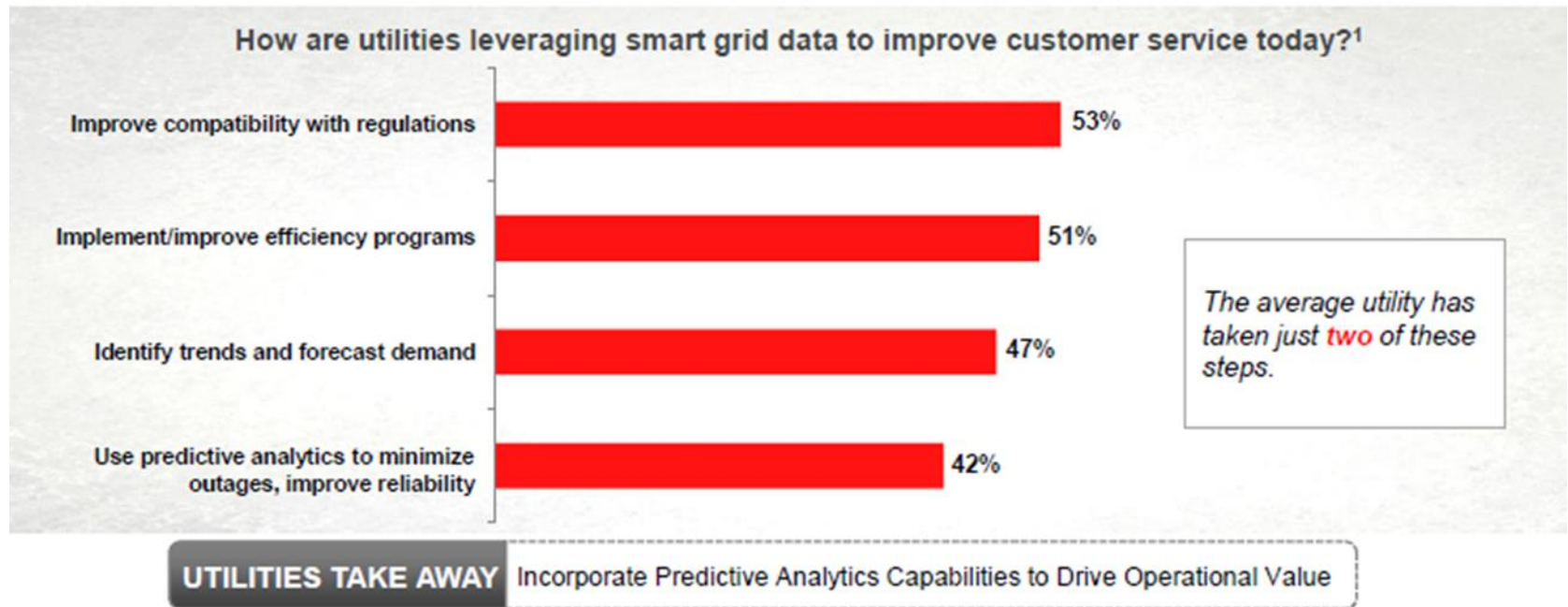
- Fewer than half of utilities today use smart grid data to provide alerts or make other direct customer service improvements



- Source: Oracle Utilities and Big Data: Accelerating the Drive to Value, July 23, 2013

Opportunities to Drive Greater Operational Value

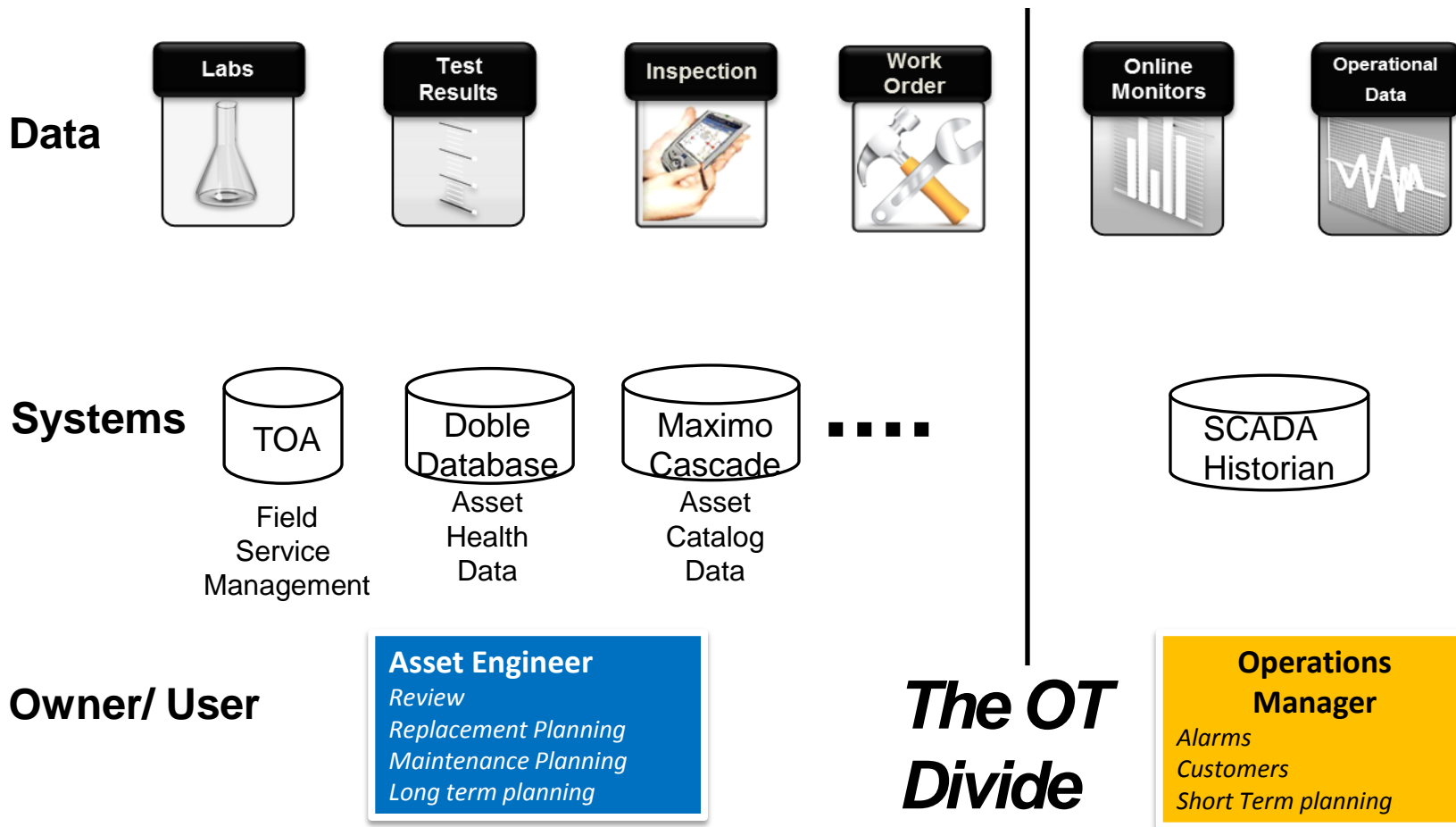
- Currently, just half of utilities are fully leveraging smart grid data to improve customer service through forecasting, demand management and improved reliability



- Source: Oracle Utilities and Big Data: Accelerating the Drive to Value, July 23, 2013

Data Aggregation Challenge

- Example on Asset Health Data

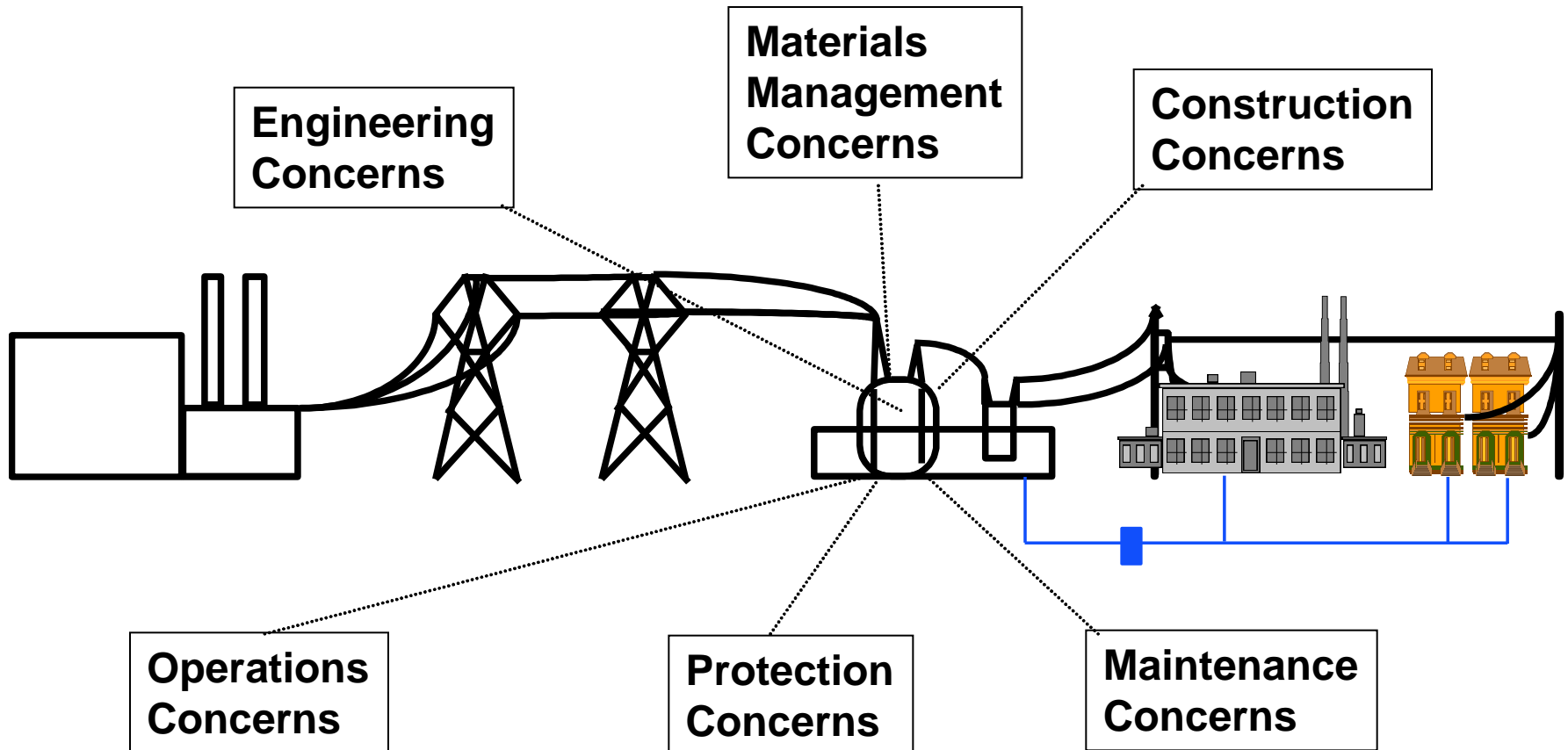


Challenging to bring the data together

What is a Utility Data Model (UDM) Exactly?

- UDM is a pre-built, standards-based data warehouse solution
- UDM provides the following features:
 - Query and reporting for information
 - Provides extraction of detailed and summary data
 - On-Line Analytical Processing (OLAP) for answering multi-dimensional analytical (MDA) queries swiftly
 - Provides summaries, trends, and forecasts
 - Data mining for insight and prediction
 - Provides knowledge discovery of hidden patterns and insights
 - It is aligned with the IEC CIM model

The CIM is acts as a *Common Language* to Provide Relevant Information to a User Regardless of Source



The IEC Common Information Model (CIM) - What Is It?

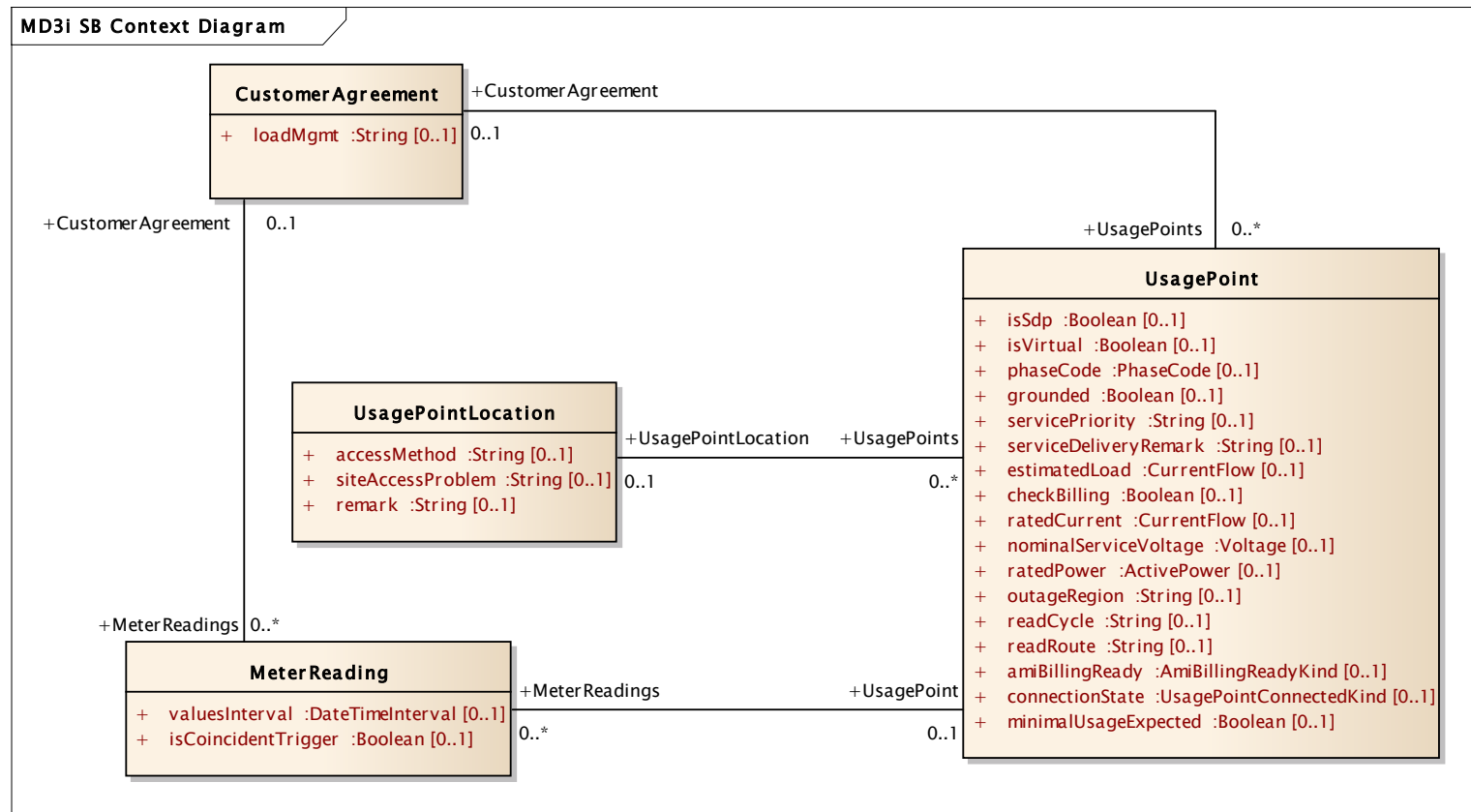
- A set of standards to enable system integration and information exchange based on a common model of utility networks, operations and planning
 - Enables integration of applications/systems
 - CIM Provides a common set of semantics for all system interactions
 - Basis for defining interface profiles for each information exchange and associated message/file schemas for all messages/files exchanged between systems
 - Enables data access in a standard way
 - Common language to navigate and access complex data structures in any database
 - Inspiration for logical data schemas (e.g., for a data warehouse)
- A key differentiator: The CIM standards are based on a Unified Modeling Language (UML) based information model representing real-world objects and information entities exchanged within the value chain of the electric power industry
 - Not tied to a particular application's view of the world
 - But permits same model to be used by all applications to facilitate information sharing between applications
 - Developed and standardized by IEC using Sparx Enterprise Architect modeling tools
 - Responsible Standards Organization: www.iec.ch
 - CIM Users Group: www.ucainternational.org

Design Considerations

- How to deal with CIM inheritance?
- How to deal with CIM many-to-many relationships?
- How to deal with unique identifiers and multiple names?
- Primary key: natural or surrogate?
- Normalization or de-normalization?
- Granularity?
- How to deal with CIM <<compound>> data types?

How to Use CIM to Build Data Model

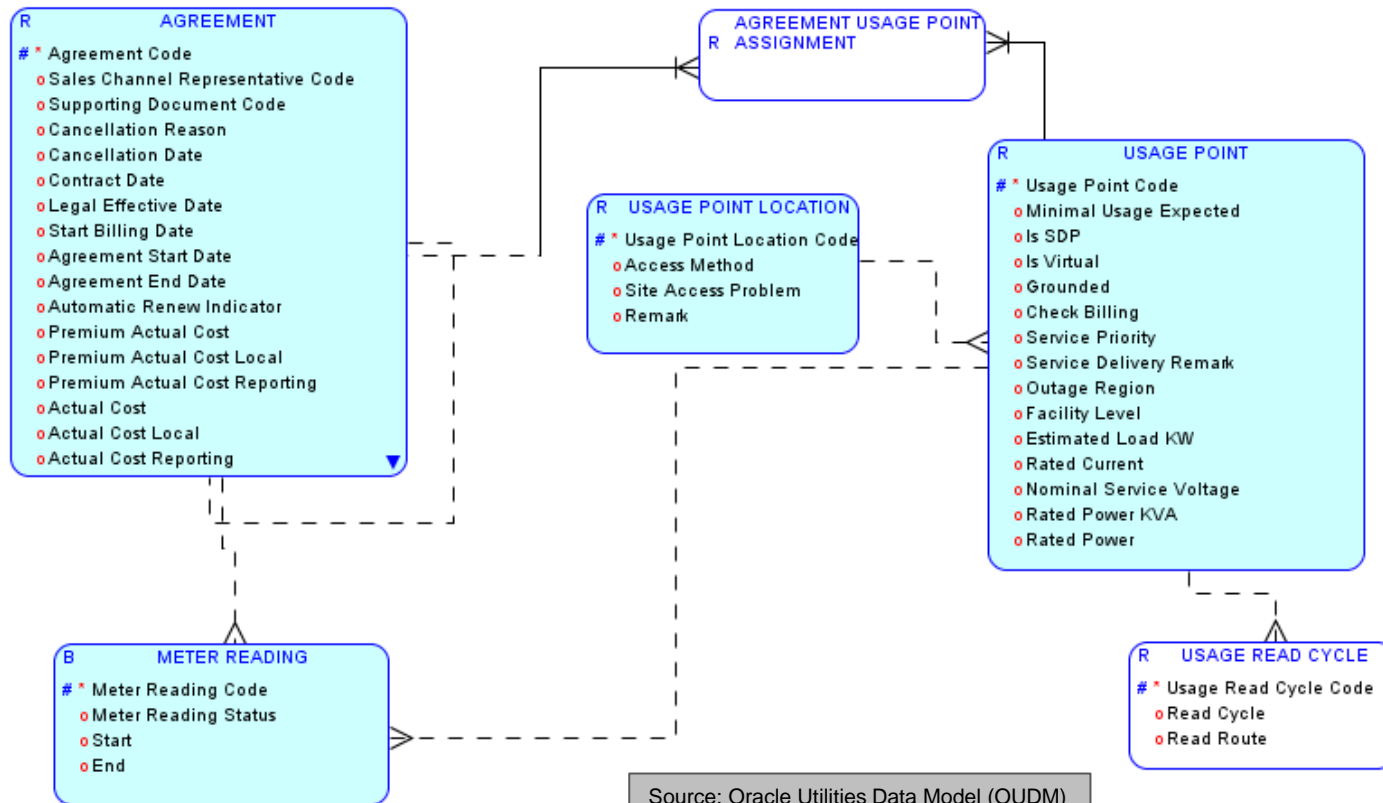
- Example in CIM model (for UsagePoint and MeterReading)



CIM-based Data Model

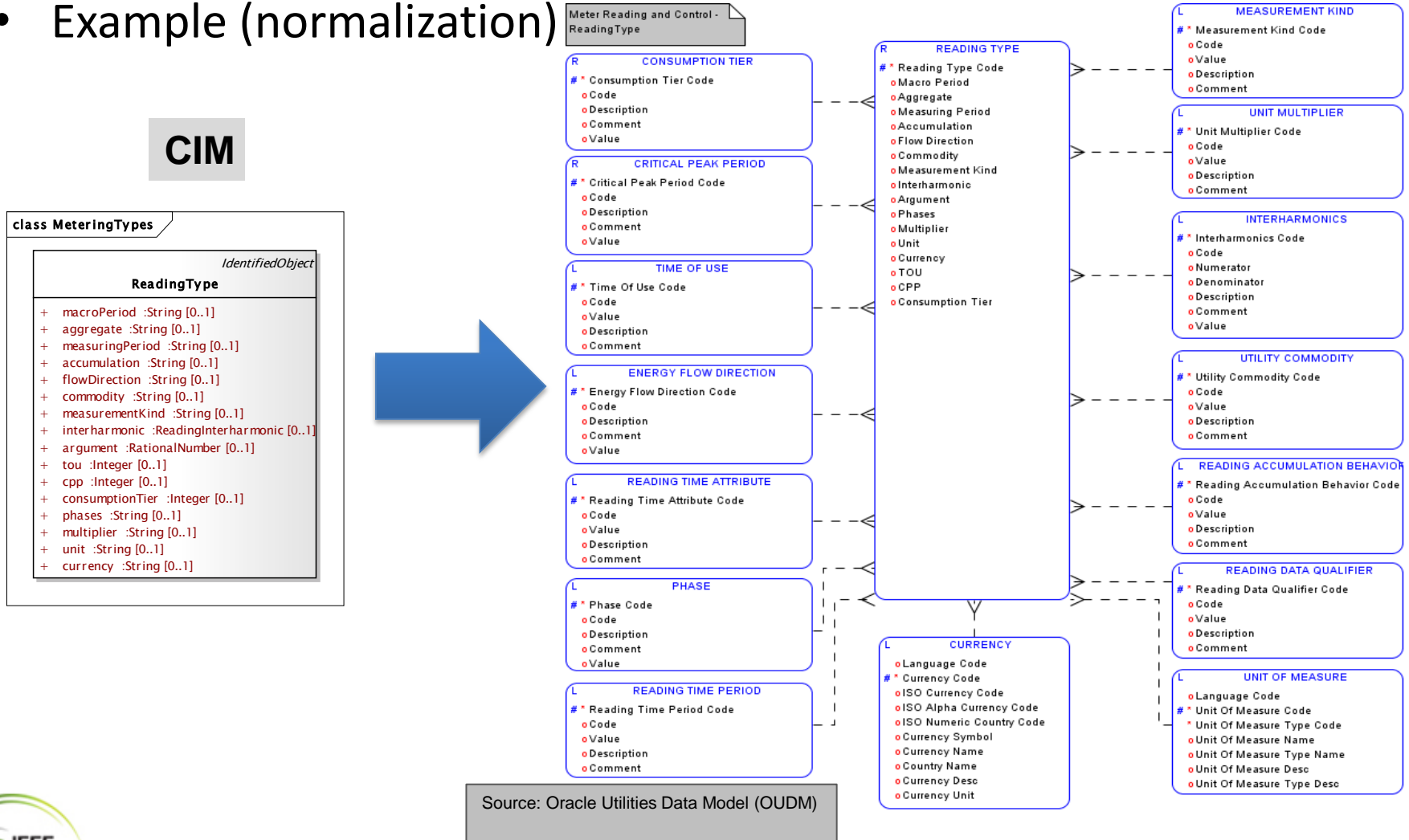
- Bridge table added
- Normalized

- Example in UDM model



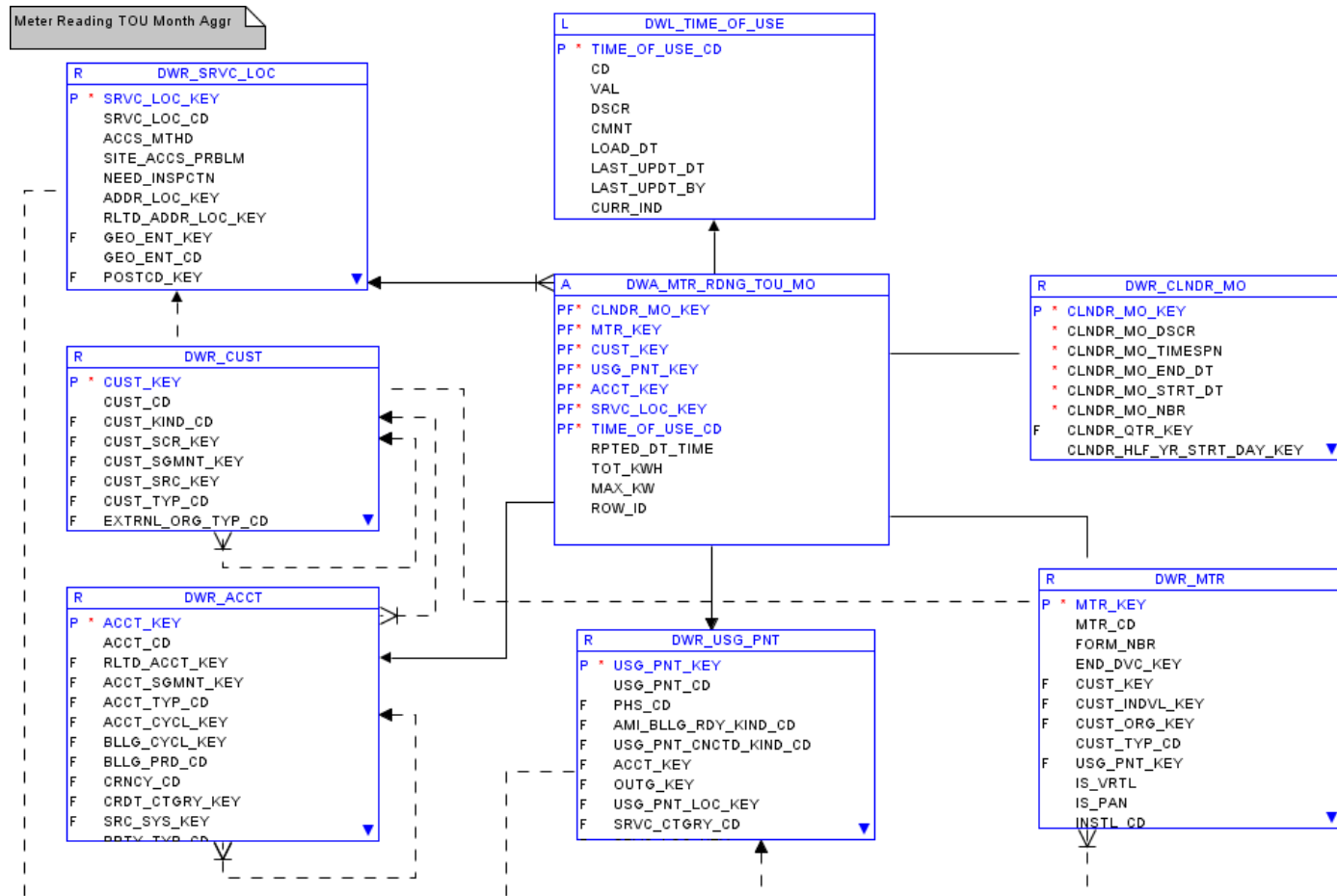
CIM-based Data Model

- Example (normalization)



Physical Model – Star Schema Example

- Meter Reading TOU Month Aggregate



Source: Oracle Utilities Data Model (OUDM)

Typical Business Areas Included in UDM

Business Areas:

Account Management

Asset Management

Customer Management

Meter Reading and Control

Network Operation

Outage Management

Weather Model

Work Management

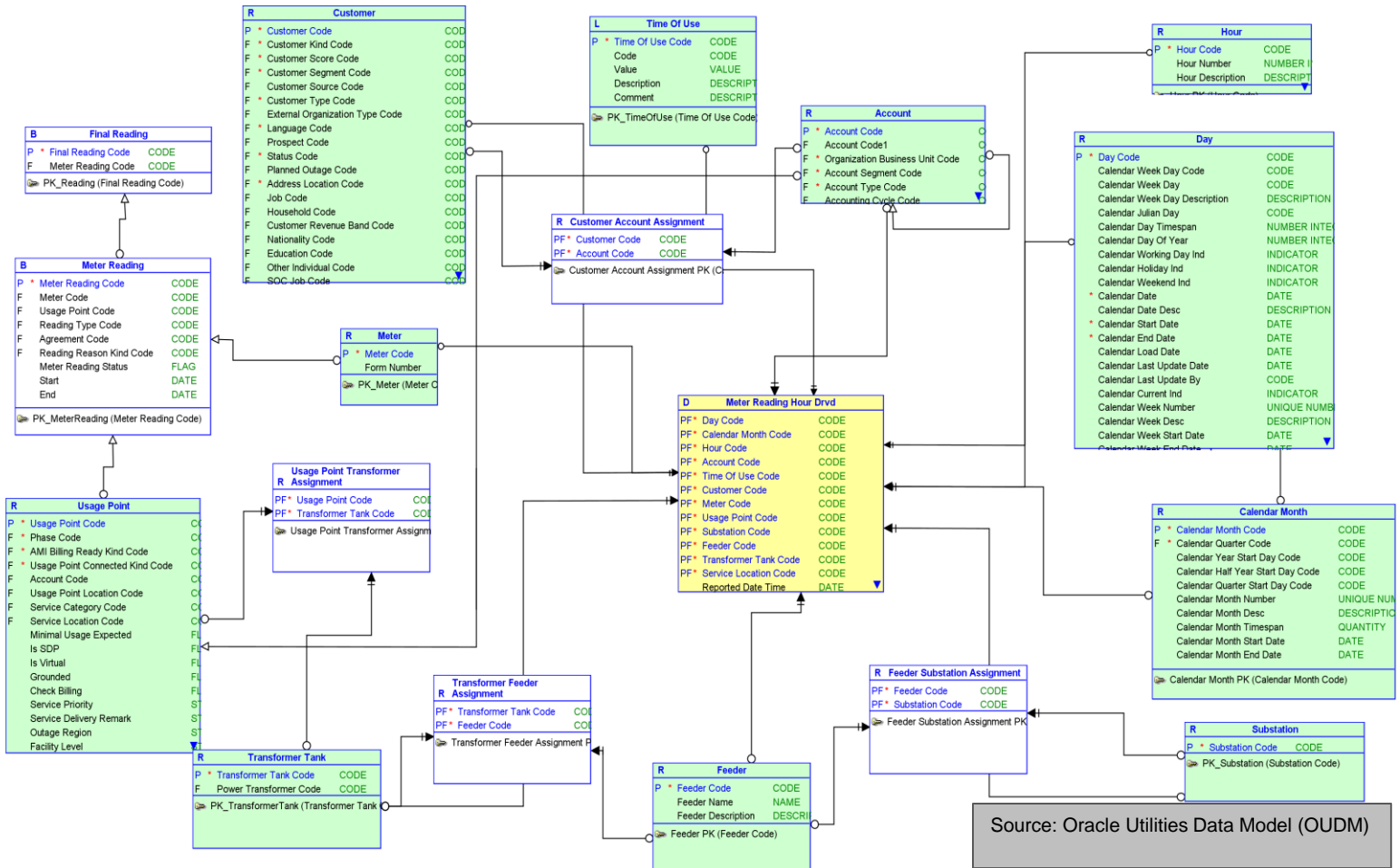
Subject Areas

Subject Area: Account	Subject Area: Meter Reading
Subject Area: Account Balance	Subject Area: Meter Reading and Control Overview
Subject Area: Account Credit Limit	Subject Area: Meter Reading Register and Channel
Subject Area: Agreement	Subject Area: Meter Reading Type
Subject Area: Asset	Subject Area: Meter Reading and Events
Subject Area: Asset Information Classes	Subject Area: Network Operation
Subject Area: Billing	Subject Area: Outage Management
Subject Area: Business Interaction	Subject Area: Party Organization Business Unit
Subject Area: Channel	Subject Area: Payment
Subject Area: Connectivity Model	Subject Area: Premise and Node
Subject Area: Cost	Subject Area: Pricing Structure
Subject Area: Curve Schedule	Subject Area: Promotion and Campaign
Subject Area: Customer	Subject Area: Phase Model
Subject Area: Customer Account and Agreement	Subject Area: Regulating Equipment Model
Subject Area: Demand Response Program	Subject Area: SCADA
Subject Area: Employee	Subject Area: Schedule Model
Subject Area: End Device Control	Subject Area: Substation, Feeder, and Transformer Hierarchy Model
Subject Area: End Device Event	Subject Area: Switching Equipment Model
Subject Area: Financial	Subject Area: Tap Changer Model
Subject Area: Generating Unit	Subject Area: Transformer Model
Subject Area: Line Model	Subject Area: Usage Point, Agreement, Account, Customer, and Premise
Subject Area: Load Model	Subject Area: Usage Point and End Device
Subject Area: Location	Subject Area: Voltage Control Model
Subject Area: Meter Asset	Subject Area: Weather Model
Subject Area: Meter Event and Reading	Subject Area: Work Management

Source: Oracle Utilities Data Model (OUDM)

Sample Report – Meter Data Analysis

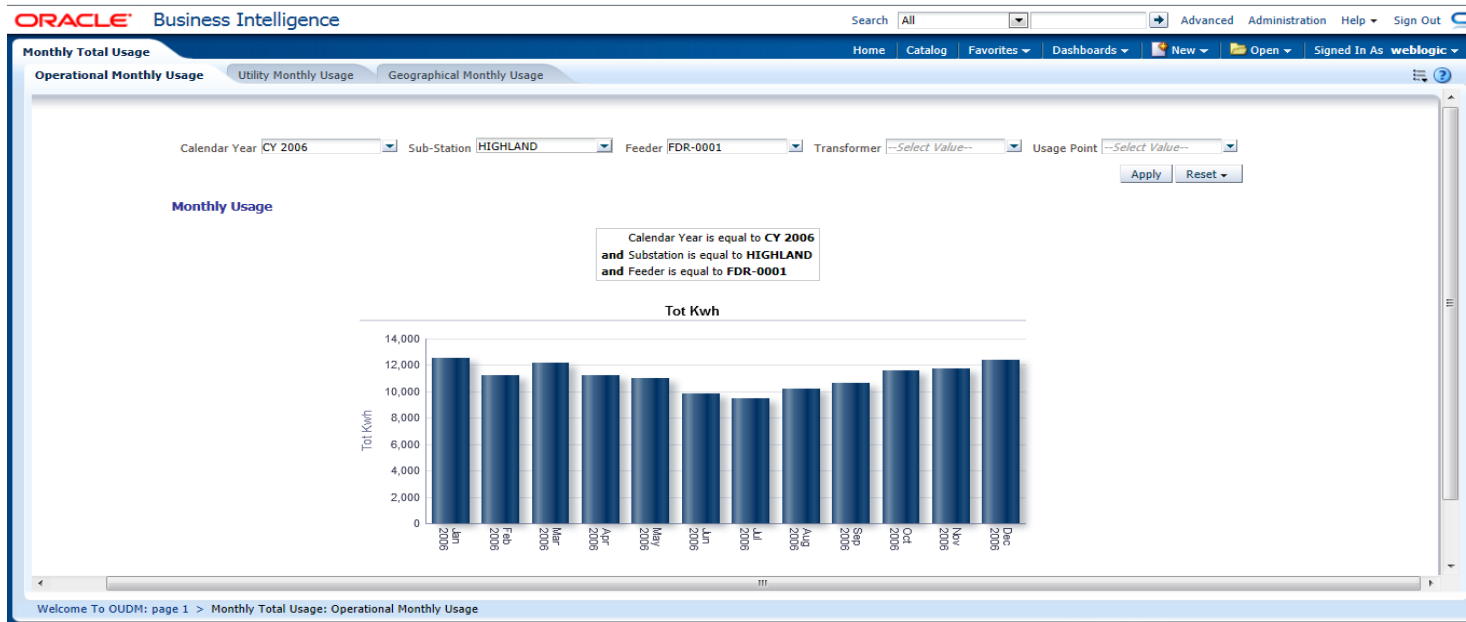
- Star Schema – Meter Reading by Hour



Source: Oracle Utilities Data Model (OUDM)

Sample Report – Meter Data Analysis

- Monthly Usage
 - Operational Zone
 - Geographical Zone
 - Utility Region

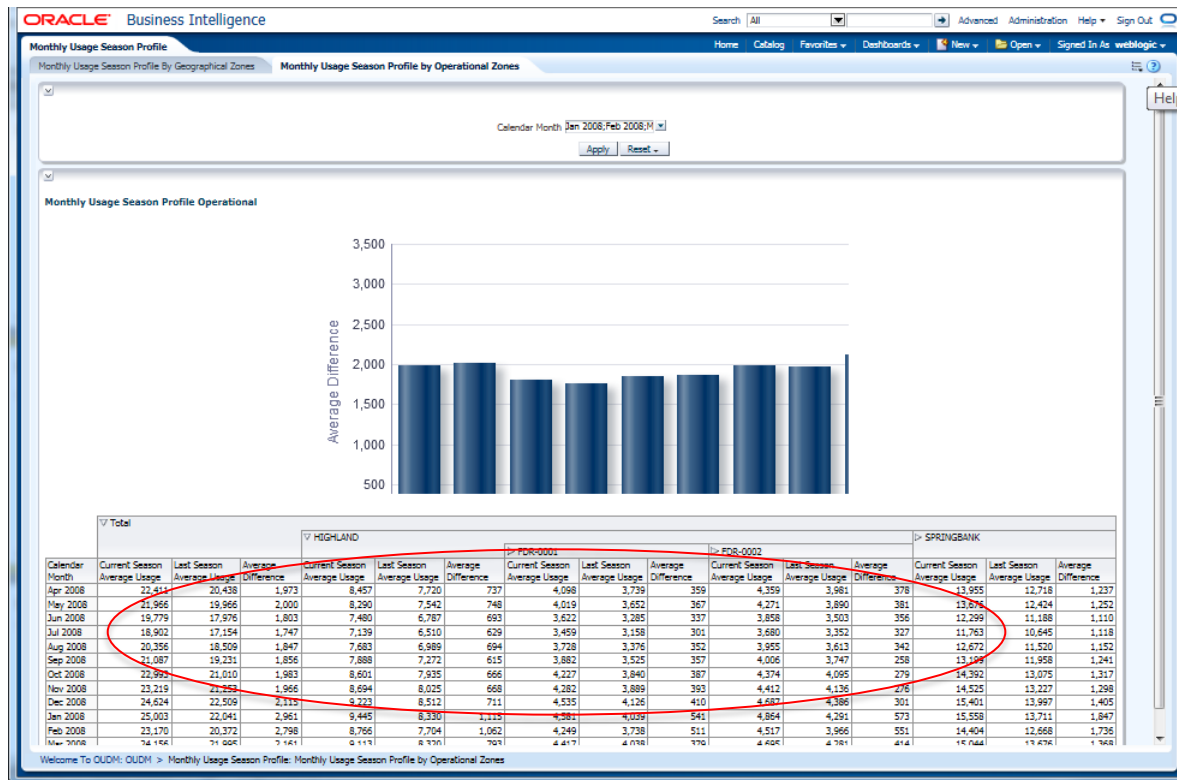


Sample Report – Meter Data Analysis

- Top N Customers by Usage
- Monthly Usage Season Profile
- Daily Usage Season Profile
- Monthly Total Usage
- Low Usage by Usage Point
- TOU Usage Profile
- TOU Usage Tread
- Top N Customer with Usage Change
- Customer Count by Usage Grouping

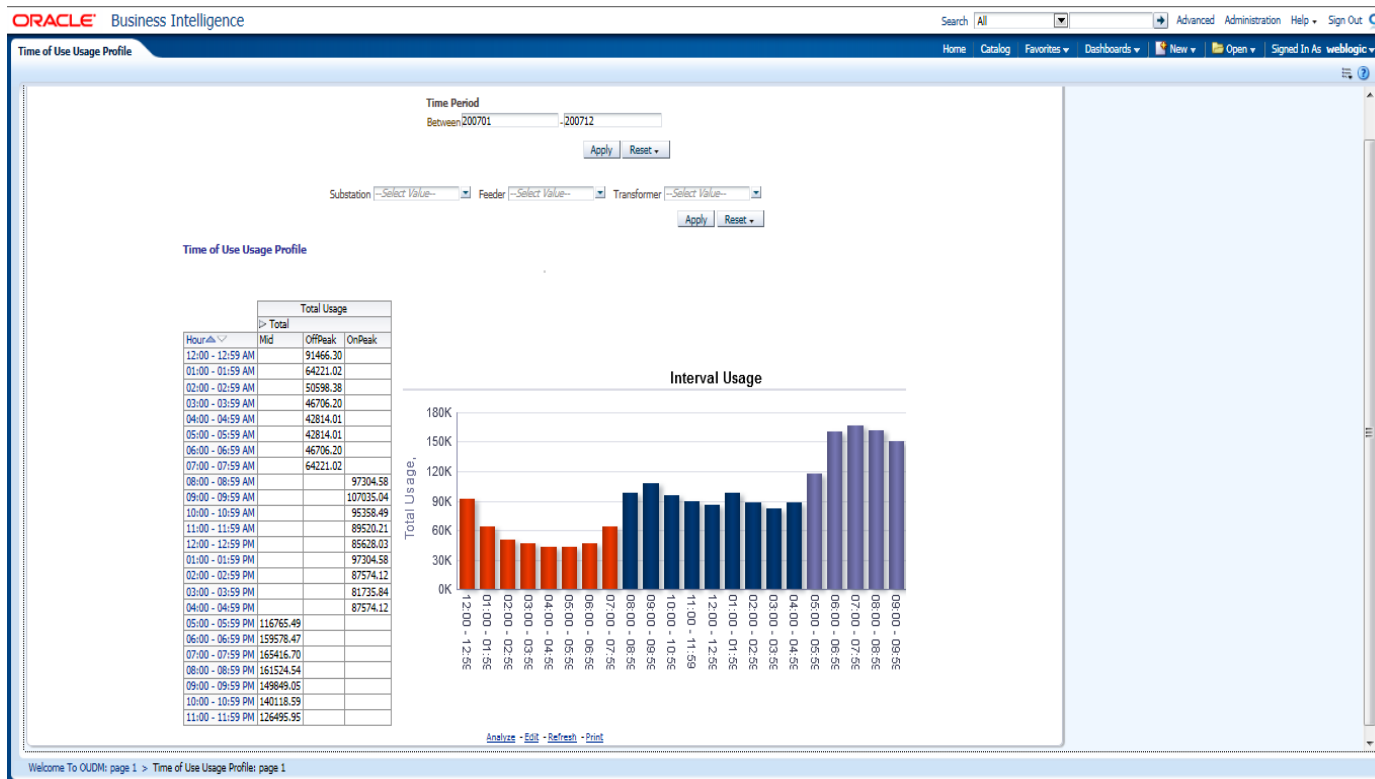
Sample Report – Meter Data Analysis

- Monthly Usage Season Profile by Operational Zones



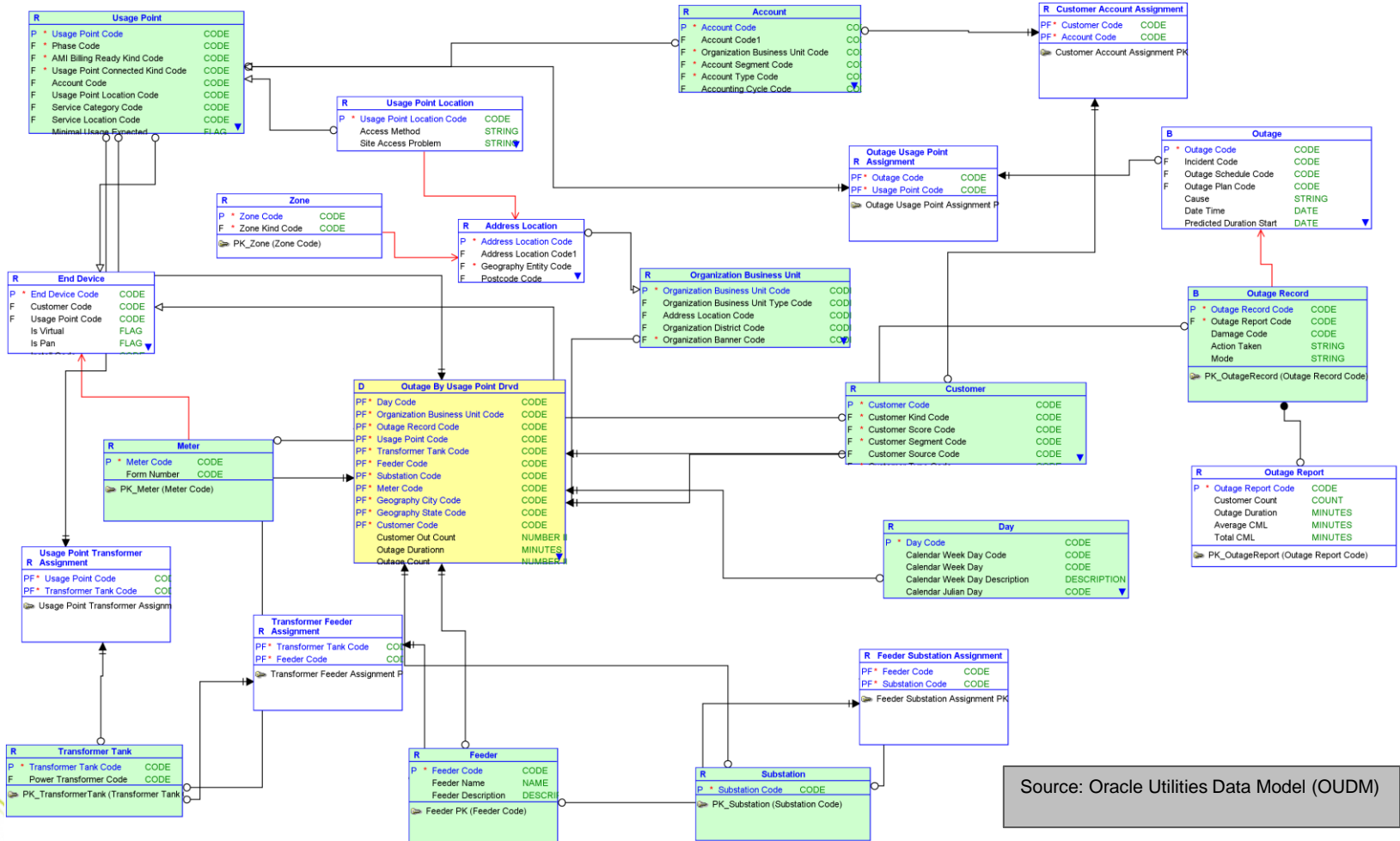
Sample Report – Meter Data Analysis

- TOU Usage Profile



Sample Report – Outage Analysis

- Star Schema – Outage by Usage Point



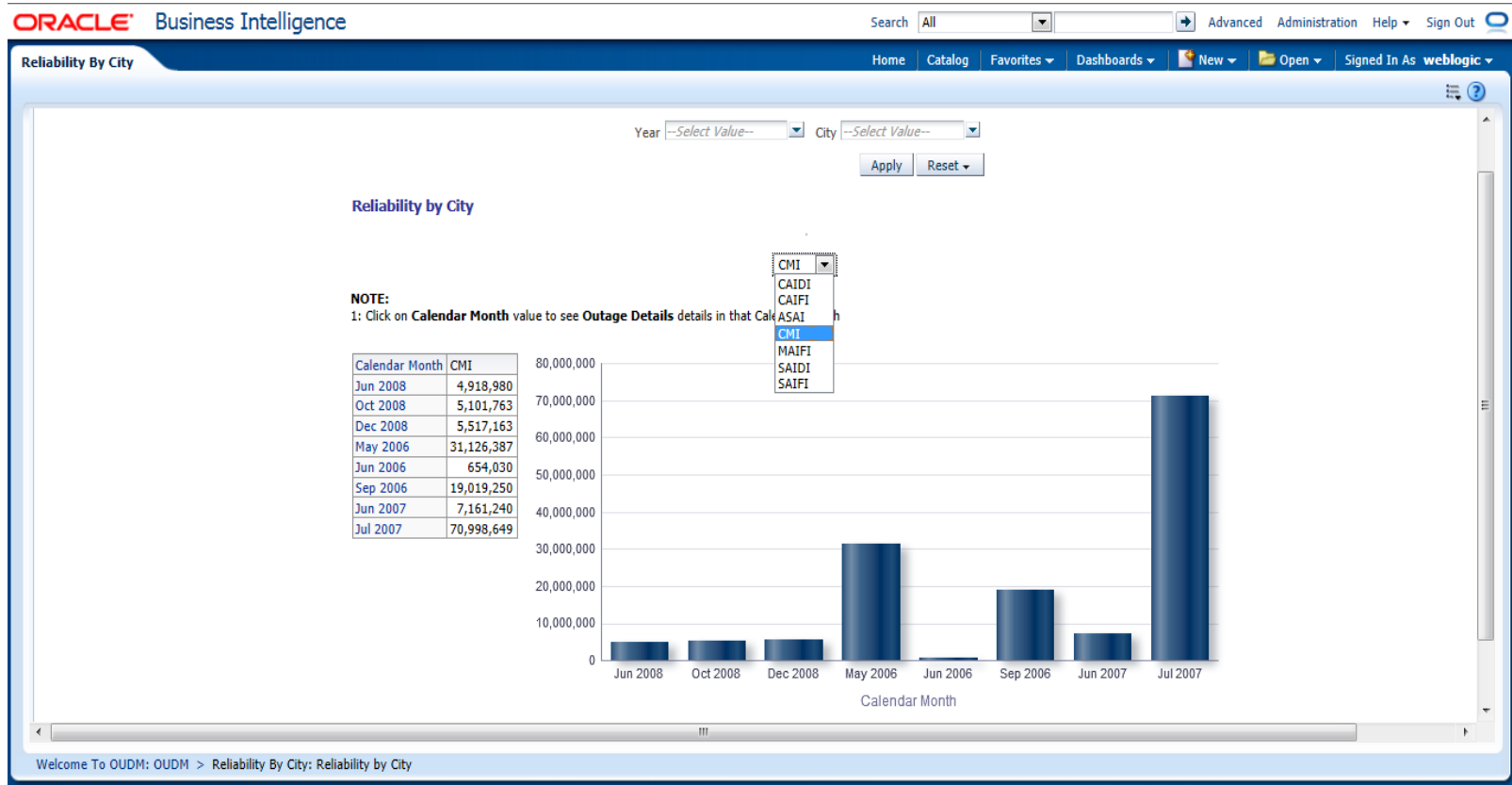
Source: Oracle Utilities Data Model (OUDM)

Sample Report – Outage Analysis

- Reliability by City
- Worst Performing Feeder
- Top N Customers by CMI
- Top N Customers by # Outages
- Top N Feeders by Outage Count
- Top N Feeders by Total Minutes Lost
- Top N Feeders by Reliability Indices
- Top N City by Outage Count
- Top N City by Total Minutes Lost
- Top N City by Reliability Indices
- Top N Region by Outage Count
- Top N Region by Total Minutes Lost
- Top N Region by Reliability Indices

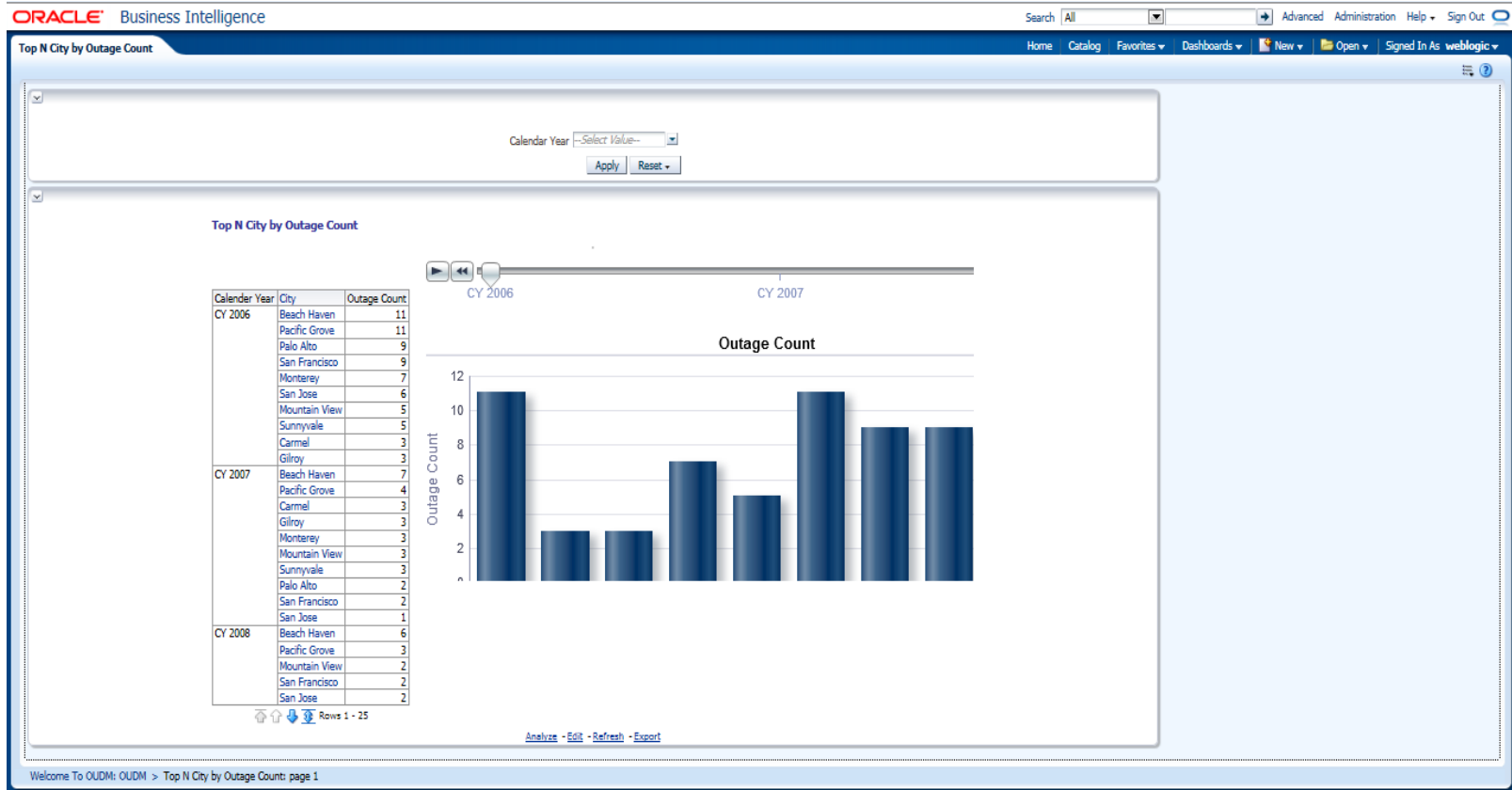
Sample Report – Outage Analysis

- Reliability by City



Sample Report – Outage Analysis

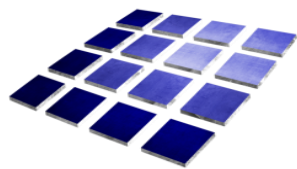
- Top N City by Outage Count



Comments & Questions?

For Further Information

- CIM Users Group (CIMug) Sharepoint site (www.cimug.org)
- Contact Terry Saxton tsaxton@xtensible.net, 612-396-7099
or Shawn Hu shu@xtensible.net, 612-860-0066



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