ORACLE

UTILITIES

An Oracle White Paper
January 2012

Meter-To-Cash Performance Using Oracle Utilities Applications on Oracle Exadata and Oracle Exalogic

Oracle Utilities Customer Care and Billing, Meter Data Management, and Smart Grid Gateway Plus Oracle Exalogic and Oracle Exadata Demonstrate Unprecedented Throughput for 10 Million Interval Meters

ORACLE

Introduction

New technologies and business processes are dramatically increasing the volume of data utilities handle during the meter-to-cash process. As a result, utility business managers and executives must examine existing software and hardware infrastructure to ensure that they can process data and produce results needed to drive the meter-to-cash process in a timely manner.

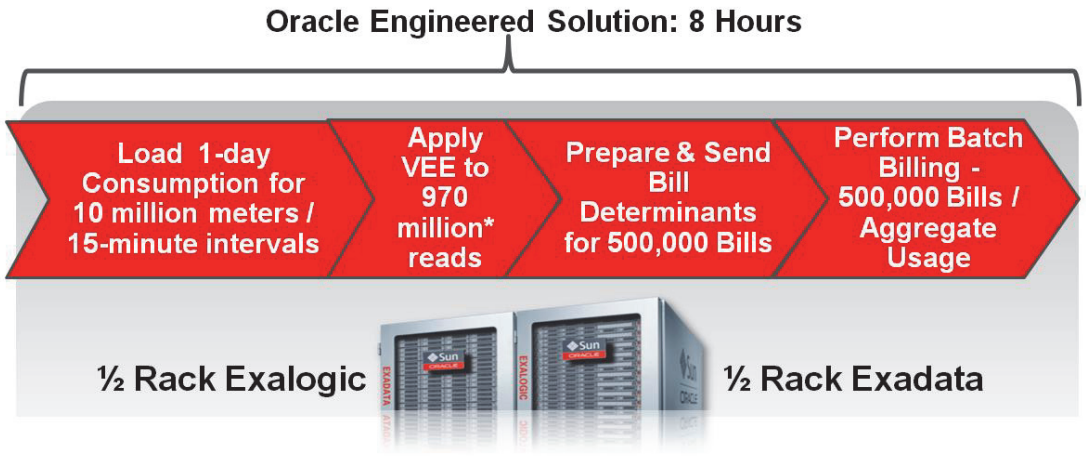
Many utilities are concluding that combining best-of-breed applications from different vendors and integrating them on various hardware creates unnecessary cost and risk. They increasingly find that they can achieve faster, more accurate results at lower cost by using software and hardware combinations engineered to work together. Billing speed and accuracy have obvious bottom-line benefits—from reducing calls to the contact center to realizing revenue more quickly. There are also secondary benefits. Engineered systems help utilities:

- Reduce IT complexity, lowering the cost to staff and maintain systems.
- Provide new data analysis that identifies and assesses consumption patterns quickly. This helps utilities rapidly identify customers who could benefit from specific utility programs and products.
- Move data to customer portals in real time, as the data is processed. This helps customers make timely conservation decisions that help them meet their conservation and budget goals, thus increasing customer satisfaction.
- Gain insights into network performance that help them direct maintenance to problem assets, minimize network power losses, and reduce outages.

But before utilities adopt these systems, they need assurance that they will perform as expected.

Summary of Results

Oracle performed the tests described in this white paper to provide these assurances. The tests demonstrates that Oracle Utilities Customer Care and Billing, Oracle Utilities Meter Data Management, and Oracle Utilities Smart Grid Gateway can complete all key nightly meter-to-cash batch operations within an 8-hour window using a half rack Oracle Exadata X2-2 and a varying number of Oracle Exalogic compute nodes to a maximum of a half rack Oracle Exalogic X2-2.



Load data / 10 million meters	2.6 hours
VEE / 970 million reads	4.0 hours
Calculate bill determinants & bill	1.0 hour
Aggregate usage	26 minutes

**96 interval reads/ day/meter + 1 scalar read/day/meter*

Meter-to-Cash Process Performance on Oracle Exadata and Oracle Exalogic

Additionally, the test demonstrated that:

- This hardware/software combination demonstrated near-linear scalability. This means that utilities requiring faster performance or throughput of increased data volumes can accomplish that objective through a simple addition of hardware.

- The database partitioning structure used in this test demonstrated that the amount of history maintained in the Oracle Utilities Meter Data Management does not have an impact on performance.

- Oracle Exadata's Hybrid Columnar Compression is able to reduce the overall database size by 4x.

Test Details

Software and Hardware Used in the Test

This test used Oracle's Application Integration Architecture (AIA) to integrate:

- Oracle Utilities Customer Care and Billing (CC&B) v2.3.1.
- Oracle Utilities Meter Data Management (MDM) v2.0.1.
- Oracle Utilities Smart Grid Gateway (SGG) v2.0, CC&B and MDM integration (or AIA).

These integrated applications were installed on an Oracle Exadata X2-2/ Oracle Exalogic X2-2 platform. At their maximum, the tests used a half rack Oracle Exadata X2-2 and a half rack Oracle Exalogic X2-2 server.[1]

Data Volume

The test used data reported from ten million Landis & Gyr (L+G) smart meters. Each meter had one interval channel that reported 96 reads per day plus one scalar channel that reported one read per day.

In addition, the test used:

- One (1) month's worth of meter read history on Oracle Utilities Meter Data Management (30 billion meter readings).
- Six (6) month's worth of billing history on Oracle Utilities Customer Care and Billing (60 million bills).

The Meter-to-Cash Business Process

The test used business rules and daily processing volumes designed to be representative of the daily processing needs for a typical utility service provider with 10 million smart meters using 15-minute consumption intervals. Each account was billed using three different rates (simulating "peak," "shoulder," and "off-peak" rates).

The meter-to-cash business process used the following steps.

- Oracle Utilities Smart Grid Gateway received 97 meter reads from each account on a daily basis and delivered these reads to Oracle Utilities Meter Data Management.
- Oracle Utilities Meter Data Management validated, edited, and estimated (VEE) all meter reads on a daily basis using:
  - Twelve separate VEE rules to check interval data.

[1] The platform also used OEL 5.5, WLS 10.3.4, JRockit (R28), and SOA 11g.

  - Four separate VEE rules to check scalar data.
- Oracle Utilities Customer Care and Billing requested bill determinants for 500,000 accounts on each of 20 days.
- Oracle Utilities Meter Data Management calculated the bill determinants and returned them to Oracle Utilities Customer Care and Billing.
- Oracle Utilities Customer Care and Billing calculated bills by:
  - Calculating charges.
  - Storing the charges in print-ready form.
  - Performing full GL accounting.
- Oracle Utilities Meter Data Management performed usage aggregation, summarizing large amounts of individual meter interval data to a higher, more meaningful level for use in the billing, network, and other processes.
  - MDM aggregated interval usage using 5 days' worth of meter reads for 10 million interval constituent meters across 4000 aggregation points.
  - MDM also aggregated a scalar usage factor using 5 days worth of meter reads for 10 million interval constituent meters across 4000 aggregation points.

  In both cases the aggregation points might represent meters, transformers, or other meaningful nodes on the network.

Thus, the data volumes being processed during these tests were:

- Oracle Utilities Smart Grid Gateway to Oracle Utilities Meter Data Management: 970 million reads/day on each of 30 days; 29.1 billion reads/month.
- Oracle Utilities Meter Data Management VEE: 970 million reads/day on each of 30 days; 29.1 billion reads/month.
- Oracle Utilities Meter Data Management bill determinant calculation: aggregation of 1.5 billion meter readings into 2 million bill determinant buckets (on/off/shoulder/total) /day on each of 20 days.
- Oracle Utilities Customer Care and Billing bill calculation: 500,000 bills/day on each of 20 days.
- Oracle Utilities Meter Data Management aggregation:
  - Interval usage: 5 days' worth of meter reads for 10 million interval constituent meters across 4000.
  - Scalar usage factor for 10 million meters across 4,000 aggregation points.

  Note that on each of the 20 days on which bills were calculated, Oracle Utilities Customer Care and Billing and Oracle Utilities Meter Data Management handled the 500,000 bill calculations in 4 batch jobs executed serially.

Monthly Meter-to-Cash Processing

Results

The test demonstrated completion of all key nightly batch operations within an 8-hour window using a half rack Oracle Exadata X2-2 and a varying number of Oracle Exalogic compute nodes to a maximum of a half rack Oracle Exalogic X2-2.

The results for the various steps in the business process were as follows:

USE CASE/DAILY PROCESSING VOLUMES	MEASURED PERFORMANCE	HARDWARE USED
Daily meter read upload to Meter Data Management from Smart Grid Gateway	2.6 hours	• 1/2 Rack Oracle Exadata X2-2 • 1/5 Rack Oracle Exalogic X2-2
Validation, editing and estimation for 10 million interval IMDs and 10 million scalar IMDs (1 billion measurements)	4 hours	• 1/2 Rack Oracle Exadata X2-2 • 2/5 Rack Oracle Exalogic X2-2 (12 MDM compute nodes)
Daily batch billing for 10 million residential accounts (500k account/bill cycle)	500k bills in 1 hour	• 1/2 Rack Oracle Exadata X2-2 • 1/2 Rack Oracle Exalogic X2-2 (8 CCB, 2 AIA and 7 MDM compute nodes)
Interval Usage Aggregation	22 minutes	• 1/2 Rack Oracle Exadata X2-2 • 2/5 Rack Oracle Exalogic X2-2 (12 MDM compute nodes)
Scalar Usage Aggregation	4 minutes	• 1/2 Rack Oracle Exadata X2-2 • 1/15 Rack Oracle Exalogic X2-2 (2 MDM compute nodes)

Analysis of the performance demonstrated that billing and VEE processes were IO bound with a 1/2 rack of Oracle Exadata. Extrapolating from the linear scalability results indicate that increasing Oracle Exadata to a full rack would reduce these times by nearly half.

A Note on Storage

The test achieved up to 45x compression ratio by HCC compression for the table data (relative to the uncompressed table data).

Since indexes are incompressible, the overall storage reduction was observed to be 4x (relative to the uncompressed data).

When the test dropped a redundant index but maintained runtime performance by keeping data clustered after compression and leveraging Oracle Exadata flash cache for the table data access, overall storage reduction was observed to be 4x (relative to the uncompressed data).

By dropping the redundant index, utilities would be able to store two years of history for 10 million smart meters each with a 15-minute interval channel and a daily scalar channel using only 39 Terabytes.

Meter-To-Cash Performance
Using Oracle Utilities Applications
on Oracle Exadata and Oracle Exalogic
January 2012

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200

oracle.com

Oracle is committed to developing practices and products that help protect the environment

Hardware and Software, Engineered to Work Together