Implementing the World’s Largest Exalytics Program

Gary Crisci, Principal Data & Information Architect
General Electric
Introduction
Biography

Gary Crisci
EPM Principal Technologist, GE Digital

- Oracle Ace (BI/EPM)
- Co-Author: *Developing Essbase Applications*
- 20 Years Finance/IT Experience
- ODTUG Director

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See tutorial regarding confidentiality.
The Industrial Internet of Things (IIoT) differs greatly from the Internet of Things (IoT) touted by mass media. The focus of the IIoT is not on connecting coffee pots to alarm clocks, but rather on connecting industrial assets, such as turbines, jet engines, and locomotives, to the cloud and to each other in meaningful ways.

GE is pioneering the industrial cloud computing space. Predix represents the starting point of a journey that will yield increasingly important improvements in key industrial and business processes. Aggregating the data and operational capabilities of intelligent devices enables industrial companies to significantly improve business processes. Whether turning to the industrial cloud for real-time asset optimization in power generation, improved analytics and diagnostics in healthcare delivery, or improved production management in large industrial factories, Predix is designed to support the future of business.
Introduction to EPM at GE

The GE Exalytics Shared Services program is built on state of the art, high performance, engineered systems for Oracle Enterprise Performance Management (EPM) software.

Exalytics delivers extreme in-memory analytic performance for business Intelligence and enterprise performance management applications. Built using best-in-class hardware, market- leading business intelligence software and in-memory database technology, Oracle Exalytics is an optimized system that provides speed-of-thought analysis with unmatched intelligence, simplicity, and manageability.
Enterprise Standards
EPM Shared Services
What is an Enterprise Standard?

A set of consistent principles, or standards, to be applied across GE globally for key operational and financial transactions. Enterprise Standards streamline processes and the global systems infrastructure to drive simplification and reduce complexity across the company.

**Approach**
- Provide guiding principles
- Share key tenets to drive standardization
- Formalize specific decisions

**Platforms**
- Identify preferred technology solutions
- Develop architecture that supports the regions
- Create transactional solutions
- Define data standards

**Processes**
- Ensure consistency across the company
- Document process flows
- Identify key activities and controls

**Roles/Ownership**
- Define organization structures and ownership
- Define roles and responsibilities
- Develop metrics, KPIs, SLAs

Enables profitable GE growth and creates a better way to do business

“Simplification gives us an opportunity to do even more” – John Rice
Why Enterprise Standards?

**Legacy**
- GE is complex.
- Through acquisitions and/or growth, we’ve added complexity.
- Complexity adversely impacts our customers and our people.
- Numerous systems, processes and centers
- Multiple business units, locations and delivery models
- Numerous SOPs, SLAs, contracts and Statements of Work

**Future**
- Maximize use of shared services.
- Leverage our scale to be competitive in a fast paced world.
- Be more responsive to customers and the business.
- Formalized policies
- Leverage existing best practices
- Integrated GE master data
- Decreased platform(s) and tools enabling finance
Current Enterprise Standards

- Source to Buy
  - Includes the processes of setting up a supplier, negotiations with the supplier, approval of a supplier and requisitioning, and ends with a valid PO to hand off to the Accounts Payable process.

- Buy to Pay
  - The processes for receipt of an invoice, matching it to a PO, and payment to the supplier.

- Fixed Assets
  - Establishes standard processes for the initiation, acquisition, maintenance, disposition and reporting of the Company’s property, plant and equipment assets.

- Invoice-to-Cash
  - Includes the Accounts Receivables processes of invoice distribution, collections, dispute facilitation, cash application and reconciliation.

- Stat & Tax
  - Defines common processes and platforms for the statutory accounts, corporate income tax (CIT) and value added tax/goods and services tax (VAT/GST) return preparation and filing processes.

- Customs
  - Contains standards, policies and governance for the management of customs activities (administration and collection of the duties levied by a government on imported goods). Enhancements to this standard will define standard process workflows for exports.

- Payroll
  - Describes standard processes for payroll processing, from transmission of employee data to payroll calculation and processing the employee payment, to tax reporting and accounting.

- Travel & Living
  - A single GE-wide policy governing T&L expenditures and reporting.

* Enterprise Standard or enhancements in process
Business Case
EPM Shared Services and Engineered Systems
The Risk of a Commodity Server Platform

✓ **Patching across a large server footprint**
  ✓ Multiple operating systems (Windows, Linux, Solaris) require multiple skill-sets
  ✓ Patching and upgrades must be accomplished on a machine-by-machine basis resulting in greater system downtime and heavy IT involvement

✓ **Less adherence to the Oracle release schedule**
  ✓ Incentive to stay on current release rather than upgrade and run into hardware issues
  ✓ Exalytics provides streamlined upgrade activities because of a reduced server footprint which will allow the application stack to stay up-to-date

✓ **Challenges in ability to react to increased user/application demands**
  ✓ Centralizing on an Exalytics framework will allow for both vertical and horizontal scaling

✓ **Application backups and restores across a multi-server deployment leads to complexity**

✓ **Lack of standardization reduces economies of scale**

✓ **Commodity environments have unstructured growth**
  ✓ Environments grow reactively out of need
3 main drivers

Performance

Centralization / Standardization

Server foot print reduction
Key Benefit Areas

Increased productivity
- Streamline backup, recovery and maintenance activities
- Decreased downtime, improved data latency and faster recovery

Improved decision making
- Exalytics will improve system performance
- Data will be in the hands of the business faster & more often...

Faster time to value
- Simplified installation, patching & upgrades
- Tuning and Optimization

Lower total cost of ownership
- Fewer ongoing resources for support and tuning
- Centralize Patching & Upgrades
- Reduce consulting costs

Future Proofing
- Roadmap of Exalytics optimizations, feature, etc.
- Gateway to cloud
Development, Support, and Maintenance

Change in Support Model | Corporate EPM Shared Services

Corporate EPM

- Expertise: Hyperion experts to provide technical guidance
- Consistency: Centralized processes to drive cross biz consistency
- Efficiency: Cost savings insourcing deep tech expertise
- Operationalize: 24X7 support from dedicated team
- Risk: Intellectual property and expertise reside in-house

Engagement landscape

<table>
<thead>
<tr>
<th>Business</th>
<th>Infrastructure</th>
<th>Architecture</th>
<th>Operations</th>
</tr>
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<tbody>
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<td>Aviation</td>
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<tr>
<td>Corporate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Full engagement
- Partial engagement
- Potential engagement

Benefit drivers

- Expertise: In-house Hyperion experts w/ relevant GE & external exp
- Cross biz standardization: Consistent processes design to drive better controllership

Holistic end to end service to drive standardization and cost efficiency
Infrastructure
Infrastructure Simplification

EPM Environment Evolution

- ~ 50 EPM Environments | Hundreds of servers
- FCM, ARM, DRM, HFM/Planning/Essbase/FDMEE
- R2R Consolidated Internal VM Cloud Environment
- Exalytics
Exalytics Benefits

**Performance**
- Faster online response time
- Faster consolidation time

**Consolidation**
- IT Infrastructure reduced
- Reduced TCO (Total Cost of Ownership)

**Lifecycle**
- Simplified deployments
- Ability to scale with ease
- Faster backups
- Reduced patching downtime

**Support**
- Reduced business disruptions
- Reduced failure risk
Oracle Exalytics T5-8 features:

- 4 TB of RAM
- 6.4 TB of PCIe Flash memory
- 9.6 TB of raw disk capacity
- 128 CPU cores (1024 threads)
GE Enterprise Exalytics EPM Cloud

Storage Tier
(12 RAC DB Servers (4-Node RAC 16x256, SAN (150GB per BU) & ZFS Dedicated Backup and Recovery, and Essbase NAS Application Tier)

Exalytics Tier
(Base Server Hardware 14 T5’s/3X-Series)
# Exalytics Tier

## Physical Hardware

<table>
<thead>
<tr>
<th></th>
<th>Dev</th>
<th>Stage</th>
<th>Prod</th>
<th>Total</th>
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<tr>
<td>Exalytics T5</td>
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<td>6</td>
<td>6</td>
<td>14</td>
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<td>Exalytics X2-4</td>
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<td></td>
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<td>Exalytics X4-4</td>
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<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>ZFS Appliance</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Windows</td>
<td>9</td>
<td>9</td>
<td></td>
<td>18</td>
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</tbody>
</table>

**Total Physical Hardware** | 3   | 18   | 18   | 39    

*Development Windows environment consists of 8 virtual servers*
## Managed Hosts

<table>
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<tr>
<th></th>
<th>Dev</th>
<th>Lab</th>
<th>Stage</th>
<th>Prod</th>
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<td>82</td>
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<tr>
<td><strong>Total T-5</strong></td>
<td>18</td>
<td>4</td>
<td>37</td>
<td>37</td>
<td><strong>96</strong></td>
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<td>3</td>
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<td><strong>4</strong></td>
<td><strong>38</strong></td>
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<tr>
<td>Windows</td>
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<td>2</td>
<td>9</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total Managed Hosts</strong></td>
<td><strong>28</strong></td>
<td><strong>6</strong></td>
<td><strong>49</strong></td>
<td><strong>49</strong></td>
<td><strong>132</strong></td>
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</table>
Hardware Details

- There are 39 physical pieces of hardware that are segregated into 132 managed hosts within the Exalytics platform.
  - 14 x T5-8
    - Eight sixteen-core 3.6 GHz SPARC T5 processors = 128 Cores (1024 processor threads)
    - One hundred twenty-eight 32 GB DDR3 ECC Registered DIMMs = 4TB RAM
    - 6.4 TB PCIe Flash
    - 9.6 TB of raw disk capacity
  - 1 x X2-4
    - Four Intel Xeon E7-4800 series processors = 40 CPU cores
    - 2TB RAM
    - 1 TB PCI Flash
    - 2.5 TB Hard disk
  - 2 x X4-4
    - Four Intel Xeon E7-8895v2 processors running at 2.8 - 3.6 GHz = 8 - 60 cores (capacity on demand)
    - 2 TB RAM
    - 2.4 TB PCI flash
    - 7.2 TB Hard disk
  - 4 x ZFS Appliances
  - 18 x Windows Physical Servers (EPMA)
# DB Tier

## Dev

<table>
<thead>
<tr>
<th>Type</th>
<th>OS</th>
<th>Nodes</th>
<th>DB</th>
<th>CPU</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual RAC</td>
<td>Linux OEL 5.9 64 bit</td>
<td>2</td>
<td>Oracle 12c</td>
<td>8</td>
<td>48GB</td>
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</table>

## QA

<table>
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<th>DB</th>
<th>CPU</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical RAC</td>
<td>Linux OEL 6.0 64 bit</td>
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<td>Oracle 12c</td>
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<td>128GB</td>
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</table>

## Prod

<table>
<thead>
<tr>
<th>Type</th>
<th>OS</th>
<th>Nodes</th>
<th>DB</th>
<th>CPU</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical RAC</td>
<td>Linux OEL 6.0 64 bit</td>
<td>4</td>
<td>Oracle 12c</td>
<td>16</td>
<td>128GB</td>
</tr>
</tbody>
</table>
**Installed Software**

- The Exalytics environment has the following Oracle EPM software installed:
  - Hyperion Financial Management (HFM)
  - Hyperion Planning (HP)
  - Oracle Essbase
  - Hyperion Financial Reports (HFR)
  - Oracle Data Integrator (ODI)
  - Oracle Business Intelligence, Enterprise Edition (OBIEE)
  - Financial Data Management (FDMEE)
  - Enterprise Performance Management Architect (EPMA)
  - Hyperion Shared Services

[GE logo]
What is ZFS?

ZFS Storage Appliance
• High Performance Hardware Architecture
• Dual ZFS Controllers for Redundancy
• Able to expand/add Storage Racks as your environment grows.

ZFS Features
• Built in De-duplication to reduce capacity constraints and cost.
• Compression (10-50x) lowers storage footprint.
• Hybrid storage pools increase performance by serving up to 90% I/O from DRAM (1000x faster than flash)
Unified DR Strategy

✓ Zone Snapshots
  ✓ OS and Application Directory Snapshots of entire environments are taken in seconds.

✓ ZFS Site – Site Replication
  ✓ Snapshots are replicated from Production Data Center to Non-Production (DR) Data Center.
Implementation
Oracle ACS Engagement

The build out of the world's largest Exalytics environment was a significant success in planning, execution, and utilization of resources across multiple teams. The goal was to build out a private cloud to support all EPM applications across all of GE. In less than 6 months GE, our partners, and Oracle resources installed

- 39 physical pieces of hardware and configured 132 hosts of which EPM software was installed on 95 of them.
- Over 400 URLs were configured to support all of the products.
- The core team consisted of approximately 20 individuals
Project Status

Timeline of the Environment Builds

Workout with CoreTech & DBA Teams
- JAN

Design & Order HW & Data Center Changes
- FEB/MAR

QA - Completed
- APR/MAY

Approval!
- FEB

Dev – COMPLETED
- MAR

PROD – Completed
- MAY/JUN
<table>
<thead>
<tr>
<th>Week</th>
<th>Env</th>
<th>Location</th>
<th>Resources</th>
<th>Notes</th>
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<tbody>
<tr>
<td>2/2/15</td>
<td>ALL</td>
<td>REMOTE</td>
<td>1</td>
<td>Backoffice</td>
</tr>
<tr>
<td>2/9/15</td>
<td>ALL</td>
<td>REMOTE</td>
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<td>Backoffice</td>
</tr>
<tr>
<td>2/16/15</td>
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<td>2/23/15</td>
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<td>Backoffice</td>
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<td>ALL</td>
<td>REMOTE</td>
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<td>QA Backoffice</td>
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<tr>
<td>3/9/15</td>
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<td>Backoffice</td>
</tr>
<tr>
<td>3/16/15</td>
<td>DEV</td>
<td>GA</td>
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<tr>
<td>3/23/15</td>
<td>DEV</td>
<td>MI</td>
<td>4</td>
<td>SW Install and Config</td>
</tr>
<tr>
<td>3/30/15</td>
<td>DEV</td>
<td>MI</td>
<td>4</td>
<td>SW Install and Config/Handover/Documentation</td>
</tr>
<tr>
<td>4/6/15</td>
<td>DEV &amp; QA</td>
<td>REMOTE</td>
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<td>QA Backoffice</td>
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<tr>
<td>4/13/15</td>
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<td>GA</td>
<td>4</td>
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<td>QA</td>
<td>GA</td>
<td>4</td>
<td>Infrastructure T5-8</td>
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<td>QA</td>
<td>MI</td>
<td>3</td>
<td>SW Install and Config</td>
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<tr>
<td>5/4/15</td>
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<td>MI</td>
<td>3</td>
<td>SW Install and Config, Handover, Documentation. - PROD Backoffice</td>
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<td>OH</td>
<td>4</td>
<td>Infrastructure T5-8</td>
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<tr>
<td>5/18/15</td>
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<td>OH</td>
<td>3</td>
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<td>5/25/15</td>
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<td>MI</td>
<td>3</td>
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<td>6/1/15</td>
<td>PROD</td>
<td>MI</td>
<td>3</td>
<td>SW, Handover, Documentation</td>
</tr>
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</table>
HFM 11.1.2.4

- HFM 11.1.2.4 was a major enhancement to the Oracle Financial Management product suite.

- Prior versions of HFM were built only for Windows platform and heavily dependent on Microsoft technology. With 11.1.2.4 Oracle changed many of the backend components and consolidated them into a single Java agent. This was the first release that was able to run on a Unix based platform.

- The initial release was not supported for Solaris, which is the OS for the Exalytics T5, however GE worked with Oracle through the early adopter program to get pre-release builds of HFM that could run on Solaris.

- As expected there were issues that needed to be worked through. As one of the first adopters of 11.1.2.4 and one of only two on Solaris, GE partnered with Oracle to flush out bugs and functionality issues.

- Officially, version 11.1.2.4.100 was the first release certified for Solaris. GE worked closely with Oracle HFM development and CEAL teams on numerous defects. The process was expedited by onsite workouts at GE locations as well as Oracle offices. From July through November 2015 GE and Oracle have closed over 20 SRs, and Oracle has fixed over 30 defects resulting in 11.1.2.4.102 being the first stable version of HFM on Solaris.

- GE's influence and strong relationship with Oracle enabled us to quickly work through the issues and stabilize the platform for GE development teams.
Migrations
Exalytics Migration: Engagement Model

**Pre-Work**
- Application Assessment
- Complete Survey
- Assign resources
- Project Plan

**Kick-off**
- Finalize Project Plan
- Agree on migration path
- Application export
- User list
- Assess scripts for Automic conversions

**Dev**
- Access Validation
- UAT User list
- Application validation
- UAT test cases
- Sign-off on Dev
- Automic scripts Dev

**QA**
- Access Validation
- Test Case execution

**UAT**
- UAT with users
- Re-test fixes/ bugs
- Sign-off on UAT
- Prod User list & groups
- Exa migration deliverables
- Production migration Checklist

**Production Migration / Stabilization**
- Validations
- Access validations

**Business**
- Initiate meeting
- Send out Survey
- Assign resources
- Integrate BU Project Plan

**EPM Shared Services**
- Review Migration Path
- Review resource allocation
- Prepare environment

**Support**
- Application migration
- Security setup
- Support Validation

**Environment Issue resolution**

**Project Updates**

**Partnership from the onset will ensure successful transition to Exalytics Platform**
Application Migration Strategies

Lift and Shift
• Move the application “as is”

Lift, Shift, and Tune
• Move application as is and then tune to optimize for Exa features

Redesign
• Revisit requirements
• Build to leverage full power of Exa

New Development
# SDC Exalytics Project

**15 week (May-5 to Aug-31)**

## Development
- 5th Jun 15
  - ✔ Schema Migration
  - ✔ Unit Testing
    - Artifact Validation
    - Performance Check
    - High Level Data Validation

## Stage
- 26th Jun 15
  - ✔ SSR / DXL Setup
  - ✔ sFTP
  - ✔ Develop Automation
  - ✔ SIT
    - ✔ GL Load
    - ✔ SSR/DXL
    - ✔ Backup

## Production
- ✔ Data Migration from legacy Prod
- ✔ User Training
- ✔ UAT(2 Weeks)
- ✔ LCM
- ✔ Dry-Run
  - ✔ GL Load
  - ✔ SSR/DXL
  - ✔ Backups

### What Went Well:
- Collaboration between DI, Infra, MARS, SDC Team
- Automation script Development
- DR Drill using LCM method
- User Communication
- Participation from Functional teams

### Learnings:
- Server whitelisting at Genpact Firewall
- DR-Drill using ZFS replication
- Outage Communication
- Automic
- GAPC Alerts
- Pointing Legacy SmartView link to Exa
- Archive App Setups
# SDC Legacy vs. Exalytics performance

## Comparison

<table>
<thead>
<tr>
<th></th>
<th>Legacy</th>
<th>Exalytics</th>
<th>V%</th>
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<tbody>
<tr>
<td><strong>MARS Load</strong></td>
<td></td>
<td></td>
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<tr>
<td>SDC</td>
<td>15.32</td>
<td>6.30</td>
<td>-58%</td>
</tr>
<tr>
<td>Data Export</td>
<td>1.38</td>
<td>0.55</td>
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<tr>
<td>Data Import</td>
<td>0.10</td>
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<td>Calc</td>
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<tr>
<td>Calc</td>
<td>4.25</td>
<td>2.09</td>
<td>-51%</td>
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</table>

## Key Update

1. **SDC MARS Load**: Overall SDC MARS load performance reduced to half in Exalytics. Calc execution reduced by 60%.
2. **SDC Export**: Updated script to include FIXPARALLEL command.
3. **Backup Timings**: Significant time reduction in backup timings.
4. **Consistent MARS load Timings**

### First 10 run Comparison

![Graph showing performance comparison between Legacy and Exalytics](chart)
SDC MARS Data Load Timings

Observations:
- Consistent Load timings in Exalytics
- Fragmentation is always 0% in Exalytics
- Parallel processes do not interfere with GL load timings
- 40% faster form save timings
- Users do get logged out due to site minder (Exalytics do not use Site-mider)
SDC Over the Year

- **1Q'14:** SDC GL load waiting for USDRQ / INTL level 0
- **2Q'14:** Split File process Implemented
- **3Q'14:** Export Optimized, Calc Dim optimized
- **3Q'15:** Exa Migration
Voice of Customer

I executed the discop program tonight for all the MEs - it went pretty quick actually - I’d say it only took me about 10 minutes. So exalytics seems much faster.
- Katie Stevens (Capital)

I like interface of new system its crisp
- Iris Chen (Corporate)

Completed for all those periods!!!!!! Impressive speed.
- Tony Pertocelli (Corporate)

New System is very fast, I have personally saved 40% of my time tonight.
- Kshitiz (Capital, Genpact)
## CCL Hyperion Migration

**10 weeks: Sept-08 to Nov-18**

### Development
- Sept 26
  - ✓ Automatic Development
  - ✓ Unit Testing
    - o Artifact Validation
    - o Performance Check
    - o High Level Data Validation

### Stage
- Oct 23
  - ✓ Tuning settings
  - ✓ SIT
    - o FI Load
    - o Script Validation
    - o Performance tests

### Production
- Nov 18
  - ✓ Data Migration from legacy Prod
  - ✓ UAT(1 Week)
  - ✓ LCM
  - ✓ Dry-Run
    - o FI Load
    - o Script Validations

### Keys to Success
- ✓ Excellent Team work
- ✓ Functional engagement
- ✓ Continuous improvement

### Automatic Benefits
- ✓ Reduced Implementation time
- ✓ Able to create a workflow with all the jobs for COPCFOA data load in 30 minutes
- ✓ Reusable components can be leveraged in all future projects

---

See tutorial regarding confidentiality
## End User Experience: R2R Versus Exalytics

<table>
<thead>
<tr>
<th>Use Case - Retrieves</th>
<th>26-Oct</th>
<th>26-Nov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prod R2R (In sec)</td>
<td>66</td>
<td>33.3</td>
</tr>
<tr>
<td>Prod EXA (In sec)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Version</td>
<td>37.5</td>
<td>28.7</td>
</tr>
<tr>
<td>BS</td>
<td>2.96</td>
<td>0.9</td>
</tr>
<tr>
<td>CoCo- Assets</td>
<td>10.81</td>
<td>6.9</td>
</tr>
<tr>
<td>CoCo-Liabilities &amp; Equity</td>
<td>17.33</td>
<td>10.5</td>
</tr>
<tr>
<td>CoCo - Net Earnings</td>
<td>75</td>
<td>73</td>
</tr>
<tr>
<td>Attributes</td>
<td>65</td>
<td>38.9</td>
</tr>
<tr>
<td>CCs - 1CORPC</td>
<td>12.11</td>
<td>6.3</td>
</tr>
<tr>
<td>Drill down on Cost Center</td>
<td>20.41</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Performance Improvements across all scenarios – Continue to Monitor and Tune
# Process Timing Comparisons (R2R vs Exalytics)

<table>
<thead>
<tr>
<th>Application</th>
<th>Process</th>
<th>R2R Prod (min:sec)</th>
<th>Exa Prod (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPGOPLN</td>
<td>Metadata Load</td>
<td>10:6</td>
<td>10:41</td>
</tr>
<tr>
<td>COPGOPLN</td>
<td>Backup</td>
<td>4:52</td>
<td>1:02</td>
</tr>
<tr>
<td>COPGOPLN</td>
<td>Plan LCM Backup</td>
<td>0:56</td>
<td>0:28</td>
</tr>
<tr>
<td>COPGOPLN</td>
<td>EPMA LCM Backup</td>
<td>1:48</td>
<td>NA</td>
</tr>
<tr>
<td>COEGORPT</td>
<td>Metadata Load</td>
<td>12:03</td>
<td>10:35</td>
</tr>
<tr>
<td>COEGORPT</td>
<td>Data Load</td>
<td>4:35</td>
<td>11:13</td>
</tr>
<tr>
<td>COEGORPT</td>
<td>Backup</td>
<td>7:50</td>
<td>2:19</td>
</tr>
<tr>
<td>COPCFOA</td>
<td>Metadata Load</td>
<td>10:00</td>
<td>8:37</td>
</tr>
<tr>
<td>COPCFOA</td>
<td>Data Load (Process changed from ODI/FDM to Essbase)</td>
<td>10:22</td>
<td>1:26</td>
</tr>
<tr>
<td>COPCFOA</td>
<td>Backup</td>
<td>1:00</td>
<td>0:13</td>
</tr>
<tr>
<td>COPCFOA</td>
<td>Plan LCM Backup</td>
<td>0:46</td>
<td>0:32</td>
</tr>
<tr>
<td>COPCFOA</td>
<td>EPMA LCM Backup</td>
<td>1:03</td>
<td>NA</td>
</tr>
<tr>
<td>All</td>
<td>EPMA LCM Backup</td>
<td>2:21</td>
<td></td>
</tr>
<tr>
<td><strong>Total Time</strong></td>
<td></td>
<td><strong>63.75</strong></td>
<td><strong>47.67</strong></td>
</tr>
</tbody>
</table>

## Highlights
- 25% savings on processing timing in Exalytics when compared to R2R
- Leveraged Automatic scripting for all data loads & backup processing
- Continue to monitor and tune scripts for improved performance
TR’s Essbase & Planning Migration to Exalytics

### Project Plan

<table>
<thead>
<tr>
<th>Resources</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automation Testing</td>
<td>Mr 8/15</td>
<td>Mr 8/18</td>
</tr>
<tr>
<td>IDNX patch applied in Dev-Pend B (Confirm)</td>
<td>Mr 8/15</td>
<td>Mr 8/18</td>
</tr>
<tr>
<td>Command Deploy in Studio still an issue (need Oracle to provide patch)</td>
<td>Mr 8/15</td>
<td>Mr 8/18</td>
</tr>
<tr>
<td>ExaAutoAdmin (3 provisioned)</td>
<td>Wed 8/16</td>
<td>Wed 8/16</td>
</tr>
<tr>
<td>PXXI in QA</td>
<td>Wed 8/16</td>
<td>Wed 8/16</td>
</tr>
<tr>
<td>QA Approvals installed (Dxv/Mn)</td>
<td>Wed 8/16</td>
<td>Wed 8/16</td>
</tr>
</tbody>
</table>

### Legacy vs. Exalytics

#### Essbase Comparisons

<table>
<thead>
<tr>
<th>Row Labels</th>
<th>Legacy</th>
<th>Exalytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>GETS HYP AR CUBE</td>
<td>9.9</td>
<td>7.3</td>
</tr>
<tr>
<td>GETS HYP CM CUBE</td>
<td>4.2</td>
<td>3.9</td>
</tr>
<tr>
<td>GETS HYP FC CUBE BUILD</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>GETS HYP GL CUBE BUILD</td>
<td>5.6</td>
<td>4.7</td>
</tr>
<tr>
<td>GETS HYP ORDERS CUBE</td>
<td>8.9</td>
<td>8.4</td>
</tr>
<tr>
<td>GETS HYP SALES CUBE</td>
<td>7.2</td>
<td>10.5</td>
</tr>
</tbody>
</table>

#### OBIEE Comparisons

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Default Filters</th>
<th>Legacy</th>
<th>Exalytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Statement</td>
<td>2 sec</td>
<td>10 min</td>
<td>207 sec</td>
</tr>
<tr>
<td>Home Statement - Non Plan</td>
<td>10 min</td>
<td>10 min</td>
<td>10 min</td>
</tr>
<tr>
<td>Total Core Reporting &gt; C10000</td>
<td>8 sec</td>
<td>35 sec</td>
<td>22 sec</td>
</tr>
<tr>
<td>Total Core Reporting &gt; C10000 &gt; C90000</td>
<td>8 sec</td>
<td>35 sec</td>
<td>22 sec</td>
</tr>
</tbody>
</table>

### Observations

- 8 weeks project – Essbase & Planning
- Overall performance improvements in Exalytics
- Excellent partnership between Business & EPM
- Shared services
- Continue to tune apps for improvements
New Development
Enterprise Standard HFM

Global Enterprise Standard HFM application(s)

- Centralized development based on collective set of core requirements for all GE businesses
- Standardized
  - COA from DRM
  - Business Rules
  - Data Integration Processes
Planning

- Enterprise Standard Guidelines for Planning apps in Shared Service Environment
- Leverages ES COA via DRM
- Integrated with ES HFM
ES ASO Reporting Cubes

- Leverages ES COA from DRM
- FDMEE / ODI integration to pull from HFM and Planning
- Extremely high performant on Exalytics platform
DevOps
24/7 Centralized Support Team

- One global support team for all EPM
- Standard backup and lifecycle management processes
- Routine Maintenance
- Segregation of duties
- Centralized risk management
- Standardized Security Model
Support Team Overview

Staff
- 23 total headcount
- 24/7 support
- Staff in Mexico, India and U.S.
- Only level 3 and 4 support staff opens tickets with Oracle

Process
- Segregation of duties
- Proper use of tools
- Controlled escalation process
- Support from above

Server Count - Breakup

Server Count

Feb'16: 604
Mar'16: 592
Apr'16: 549
May'16: 547
# Routine Activities

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Quarterly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Monitor daily jobs</td>
<td>• Log rotation (as needed)</td>
<td>• LCM cleansing</td>
<td>• Review/upgrade patch sets</td>
</tr>
<tr>
<td></td>
<td>• Scan logs</td>
<td>• Review disk usage</td>
<td>• Server statistic trending analysis</td>
<td>• Security audit assistance</td>
</tr>
<tr>
<td></td>
<td>• Verify backups</td>
<td>• Service restarts</td>
<td>• Purge temp logs</td>
<td>• Capacity planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Data Base checks (DBA Team)</td>
<td></td>
</tr>
</tbody>
</table>
Standardized Security Model

- Utilizes Shared Services LDAP groups only
- Engage with EPM Shared Services Security team for guidance
- Follows standard naming conventions
Knowledge Management - Confluence Wiki

EXALYTICS
Exalytics@GE

Created by Jennifer Tran (Admin), last modified by Crisci, Gary C on Feb 18, 2016

* Please note this site is continuously updated. Please check back often and consider following this wiki by clicking the "Watch" button at the upper right corner of this page and selecting 'watch all content in this space'.

End User URLs
Open a Support Ticket in ServiceNow
FAQ
Distributed Command Line Interface (DCLI)

The dcli utility executes commands on multiple Oracle Engineered servers in parallel, using the InfiniBand (bondib0) interface to make the connections. You can run the utility from any server.
Oracle Hyperion Smartview is the MS Office client for interacting with Oracle Hyperion EPM applications. Smartview has many URLs for each product across all (Dev, Stage, and Prod) environments. Historically users would modify options to point to different environments or as an alternative many would set up Private Connections. This is a time consuming process and keeping track of all the URLs can be challenging.

As an alternative in the Exalytics shared service platform, we have created web based xml files with the appropriate connections for each BU.

By following a few simple steps you can point to one of the hosted xml files to simplify your management of host URLs. This approach also has the benefit of being centrally managed so in the event a connection changes, the shared service team can update the file in a single location and all users will get the updated connection info the next time they connect.
Automic manages workflows across all of an organization’s critical finance applications, ensuring a repeatable, fully auditable end-to-end process.

Automic’s EPM Workload Automation solution integrates with
- HFM (GA)
- FDMEE and EPMA (Beta)
- Essbase and Planning (in development)

*Cooperative partnership with GE to build EPM adapters.*
What Automic offers

- Provide visibility, management and control over financial processing
  - Automation makes their current process more efficient, reducing latency, and giving IT transparency
  - Removes silo based in Finance ERP, FDMEE, HFM and manual instigation today
  - Provide dynamic “Point of View”

- Extends reach of workload automation to HFM processing needs
  - Business event detection, business outcome checking, IT success

- Integrates HFM processing into enterprise wide processes
  - Reduces manual effort
  - Removes human error
  - Provide an auditable solution for finance (what happened, where, when and why)
  - Enforces consistency of execution, every month and every entity
Automic Product Overview

- New agent that enables our workload automation story to be extended to Hyperion Financial Management environments

- Covers processing of both HFM and FDMEE processing

- Combined with broad application coverage including SAP and Oracle enables and key business milestone detection within finance

- **Script free** – point and click interface enables workflow to be easily assembled and then managed.
Automic Built in facilities for FDMEE and HFM

- Allocate
- Calculate
- Calculate Contribution
- Clear Data Slice
- Close Period
- Consolidate
- Copy Data
- Extract Data to Database
- Extract Data to Flat file
- Extract Journals
- Extract Member Lists
- Extract Metadata

- Extract Rules
- Extract Security
- Load Data
- Load Journals
- Load Member Lists
- Load Metadata
- Load Rules
- Load Security
- Translate
- Load Data Rules
- Load Metadata Rules
- Run Batch Process
- Write Back
Built in Health, Usage, Business / IT SLA reporting and Root Cause Analysis allows service levels to be managed for entire business processes.
Accelatis

Accelatis is a cloud-enabled Application Performance Management Solutions company. They provide both IT and Business users insight and control they need to effectively manage their enterprise software systems.

Differentiators

- Accelatis was built from the ground up for use by both Finance and IT.
- The Accelatis platform is based on the Center of Excellence methodology and the integration of multiple APM disciplines such as monitoring, automation, auditing, performance testing, and optimizing into a single holistic system.
- Integrated at the Product API layer for uniquely powerful insight and control unavailable in generic performance management software.
Accelatis Performance Management Platform


Accelatis CoE Performance Management Platform

Reporting | Alerting | Provisioning | Communication | User Interface
Accelatis use at GE

1. Monitoring at both Infrastructure and Application Level
2. Help Keep Servers and Environments Synchronized
3. Automated Environment Documentation and Change Tracking
4. Track Changes to Business Objects: Metadata, Rules, Reports, etc...
5. On-Demand Performance Testing by a Broad Audience
(Some) Lessons Learned
Lesson 1

➢ Bite off more than you can chew, then chew it
➢ Plan more than you can do, then do it
Lesson 2

1. Each condition of your life *right now*, good or bad, is the end-product of the process that preceded it.

2. The world is not a place of chaos; it’s a logical collection of individual systems. Examined separately, each makes sense.

3. *Seeing* and then separating these individual systems delivers enormous personal control.

4. If a step is to be taken, take it NOW.
What’s Next?
Exadata Hardware Architecture
Complete | Optimized | Standardized | Hardened DB Platform

- **Standard Database Servers**
  - 2-socket server ➔ **36 cores**, up to **768GB DDR4 DRAM**
    Scalable to ...
  - 8-socket server ➔ **120 cores**, up to **12TB DRAM**

- **Unified Ultra-Fast Network**
  - 40 Gb InfiniBand internal connectivity
  - 10 Gb or 1 Gb Ethernet data center connectivity

- **Scale-out Intelligent Storage Servers**
  - Extreme Flash Storage Server ➔ **12.8 TB NVMe Flash**
  - High Capacity Storage Server ➔ **6.4 TB NVMe Flash** + 48 TB SAS drives
  - 2-socket servers ➔ **16 cores per server**

Fully Redundant
* 3Q16 includes expected addition of Alstom legacy activities (exact timing TBD)
** 4Q17 assumes approx. 50% growth in GOF, 400% growth business
FCM On-Premise Cloud

Exadata Storage Tier
(Half Rack Exadata X5-2 DB Machine - HC Drives
Zero Data Loss Recovery Appliance – EXP)

Exalytics Tier
(T5-8 – 4TB RAM, 128 CPU Cores)

ARM
Dedicated Zones

CM (FCM)
Dedicated Zones

Dedicated Zones

FCM On-Premise Cloud
## Comparisons – ARM/CM Combined

<table>
<thead>
<tr>
<th>Metric</th>
<th>Current Commodity</th>
<th>Exalytics</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exalytic Servers</td>
<td>0</td>
<td>Three T5’s</td>
<td>Dev/QA/Lab/Prod</td>
</tr>
<tr>
<td>Application Servers</td>
<td>13</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total # of Servers</td>
<td>20</td>
<td>3 (16 zones)</td>
<td></td>
</tr>
<tr>
<td>HW &amp; EPM Install</td>
<td>$250K EPM</td>
<td>$250K EPM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$50K CoreTech</td>
<td>$15K CoreTech</td>
<td></td>
</tr>
<tr>
<td>Annual Cost</td>
<td>$384</td>
<td>$305K</td>
<td></td>
</tr>
</tbody>
</table>
Thank you.