



# Garmin's Application Deployment and Consolidation on Exadata

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# Garmin – the Company

- **Garmin is the global leader in satellite navigation.**
- **Since 1989, Garmin has designed, manufactured, marketed and sold navigation, communication and information devices and applications.**
- **Garmin's products serve our customers in the areas of *automotive, aviation, marine, outdoor and sports.***
- **Garmin has more than 9,200 associates in 35 offices worldwide.**

# Garmin's Business Drivers for Exadata

## Primary Goal:

**Long term reduction of Total Cost of Ownership for Oracle databases and supporting infrastructure**

## Focus Areas:

- **Service Quality – I/O challenges existed on critical systems. RAC and Data Guard had not yet been implemented.**
- **Operational Agility – Mixed platforms and operating systems create added complexity. This leads to increased maintenance and higher costs.**

# Our Oracle Databases

- **ORBIT** – E-Business Suite (11.5.10.2) with over 2400 sessions on Solaris M9000, single instance, 10.2.0.3.
- **PLAN** – E-Business Suite (11.5.10.2) used for decentralized planning, with approximately 300 sessions on Solaris M5000, single instance, 10.2.0.3.
- **CONNECT** – used to store data uploaded from Garmin outdoor and sports fitness devices. Linux, single instance, 10g.
- **50 other databases** including copies of the above, plus Kana, Agile, Hyperion, GRC, SOA, etc.

# Our Exadata Configuration

## Two Exadata V2 half-racks

- **One ½ rack for production databases. Use High Performance drives for speed and reliability.**
- **One ½ rack for production Data Guard and non-production. Use High Capacity drives to provide storage for many copies of databases.**



# Consolidation Planning

We evaluated our databases during peak times, examining:

- M-values (CPU capacity)
- I/O rates
- Memory
- Database Size
- Redo Generation
- Number of Connections

	db name	Environ	Current Max M value (CPU requirements) peak 5 min for a day	peak reads/s	peak writes/s	peak TPS from AWR	time when measured	Current Size (gb)	One year growth rate (%)	Total size in one year (Gb) DATA diskgroup	4 days of archivelogs (gb) RECO diskgroup	flashback logs (gb)	Current SGA_TARGET	sga_target (gb) future	pga target (gb)	Number of connections
Connect	conctprd	PROD	52,150	938	500	36	2-4pm Sun	3,000	50	4,500	478		20	15.0	3.0	600
Cognos	bidwprd	PROD	41,720	21,344	167	1	4-6pm aug	1,153	50	1,729	401		8	8.0	1.0	150
Cognos metadata	biprd	PROD		16	3	1	8-10am	24	30	31	6		2	2.0	1.0	120
Orbit	orbit	PROD	208,650	17,709	637	42	6-8am	1,944	30	2,527	68		120	30.0	22.0	1,500
Plan	acspr	PROD	34,775	266	537	6	6-8am	755	30	981	56		80	30.0	6.0	200
Kana	rsprd	PROD	21,960	889	17	3		524	30	681	13		3	3.0	1.0	200

# Exadata Node Assignments

We made our best guess at how to balance the CPU load across our Exadata compute nodes.

PED Node 1	Node 2	Node 3	Node 4	Dynamically changeable?
Connect – General user activity (not high CPU)	Connect- explore function (long running activities)			
		PLAN-conc mgr	ORBIT- conc mgr	No
ORBIT forms	ORBIT Forms	ORBIT forms	ORBIT forms	No
ORBIT_SERVICE	ORBIT_SERVICE	ORBIT_SERVICE	ORBIT_SERVICE	Yes
	ORBIT Cognos	PLAN Cognos		Yes, Once the Extract of ETL finishes
Backup – ORBIT			Backup – PLAN/Hyperion	Yes, once backup finishes
	Discoverer- ORBIT	Discoverer – ORBIT		Yes, for most connections
		PLAN- forms	PLAN forms	No
		PLAN_SERVICE	PLAN_SERVICE	Yes
		Hyperion db	Hyperion db	
	SOA - ORBIT	SOA - ORBIT		No
Shareplex/RUBYTW	Shareplex/RUBYTW			



# Exadata Implementation Timeline

## Oracle Blueprint Services and Proof Of Concept

- August 2010

## Oracle Transition Services

- September 2010 to February 2011

## PLAN Production Migration

- January 2011

## CONNECT Production Migration

- February 2011

## ORBIT Production Migration

- January 2012

# Hardware and Software Challenges

- **A problem with a storage cell patch led to compute nodes crashing.**
- **Many disks and batteries had to be replaced.**
- **Working with Oracle Support has led to permanent fixes for all major outstanding issues.**
- **Our systems have become more stabilized by:**
  - **Getting up-to-date on critical patches**
  - **Replacing bad hardware**

# Memory Challenges

- **There was not enough memory for the databases that we planned to move to Exadata.**
- **We requested Oracle provide an increase of physical memory for our compute nodes.**
- **Oracle researched, tested, and delivered a memory upgrade kit for Exadata. This doubled the memory for our compute nodes, increasing it from 72GB to 144GB.**
- **This helped Garmin better maximize our investment in Exadata.**

# Consolidation Challenges

- **More coordination and communication is required between internal groups at Garmin that represent the different databases on Exadata.**
- **We must coordinate:**
  - Resource allocations: Memory, CPU, and I/O (must share these)
  - GI Version (all databases must be certified with this)
  - GI Home patching windows (all instances down on node)
  - Database Home patching windows (all instances down)
  - Storage Cell patching windows (during low activity)
  - InfiniBand patching windows (during low activity)

# Maintenance Window Challenges

- Some systems in our Exadata cluster have similar maintenance windows.

Example: PLAN and ORBIT systems are least busy on weekends.

- Other systems had different maintenance windows.

Example: CONNECT is most busy on weekends (when fitness enthusiasts often use their Garmin devices).

# Accommodating Maintenance Challenges

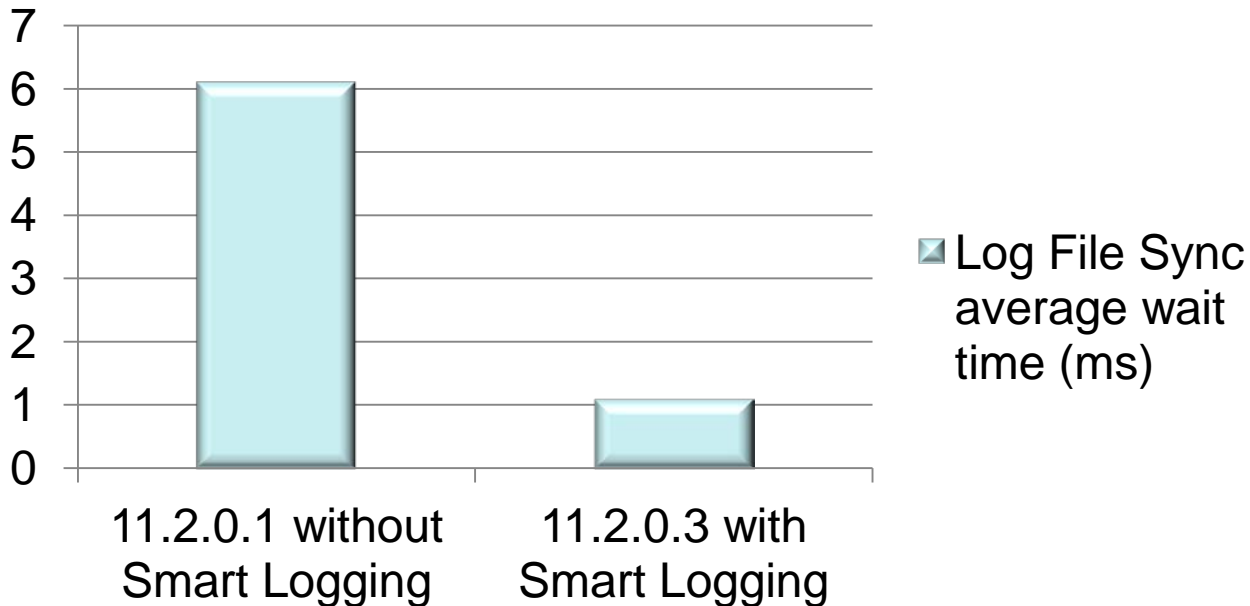
- **Negotiate outage times** – Saturday night was often more acceptable for both ERP and CONNECT.
- **Take down only one resource at a time** – e.g.: take down only one instance at a time, and make sure the surviving instance(s) can handle the remaining load.
- **Ensure storage cells have enough free space** to copy files to other storage cells for redundancy in case of failure.
- **Make sure InfiniBand is completely available** before starting maintenance on the other InfiniBand switch.

# Performance Improvements

- **Approximately 95% of ERP programs ran faster on Exadata with no changes.**
- **Overall performance of our E-Business Suite programs improved 47% on average. This means jobs took about half the time after migrating to Exadata.**

# Exadata Smart Logging

**Exadata Smart Logging automatically reduced redo log write latency, significantly improving database throughput and response time.**





- Check MOS Note 888828.1 frequently for a list of current patches and software releases for Exadata Storage Servers, Databases, GI Home, and InfiniBand switches.
- Check MOS Note 1270094.1 for a list of critical patches that can help prevent data loss and system outages.
- Run Exachk before and after major maintenance such as patching storage servers, GI homes, or database homes. See MOS Notes 1070954.1 and 757552.1 for details.

## Expanding Footprint of Exadata at Garmin

- **We plan to add two additional Exadata X2-2 half racks**
- **Continue migrating other databases from legacy hardware to Exadata.**
- **Attempt to line up our Exadata clusters based on operational requirements and maintenance windows to provide easier coordination of downtimes.**

- **Garmin Case Study:**

<http://www.oracle.com/technetwork/database/availability/garmin-1667151.pdf>

- **Garmin Exadata Customer Success Story:**

<http://www.oracle.com/us/corporate/customers/customersearch/garmin-international-1-exadata-ss-1561598.html>

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