Applying Oracle 12c and Real-World Performance Techniques to SAP

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RWP Sessions @ OOW17 Oct 4th Rm 3012

When	ID	Topic
11am	CON6560	Optimizing Table Scans in Today's Cloud Platforms
12pm	CON6561	Migrating On-Premises Applications to the Cloud: Examining the Connection Strategy
1pm	CON6629	Real-World Challenges with Cloud Migrations and Proof-of-Concept Projects
2pm	CON6660	Applying Oracle Database 12*c* and Real-World Performance Techniques to SAP

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What is Real-World Performance 2017?

Bridging the Divide from Today's Performance to What is Possible

Real-World Performance 2017

Who We Are

- Part of the Database Development Organization

- Global Team located in USA, Europe, Asia

- 350+ combined years of Oracle database experience

- Innovate to achieve exceptional Database Performance

- Our methods:
  - Use the product as it was designed to be used
  - Numerical and logical debugging techniques
  - Educate others about the best performance methods and techniques
  - Avoid and eliminate "tuning" by hacking/guessing/luck

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Real-World Performance

Online Video Series

Real-World Performance Engineers discussing

and demonstrating performance issues, root causes

and when to apply the correct techniques

- – The Optimizer
- – Core DB Performance
- – Extreme OLTP
- – Extreme DW
- http://www.oracle.com/goto/oll/rwp

Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Program Agenda

1 ▸ A 30 year old Problem – OLTP tx and reporting

2 ▸ How RWP tackles this challenge?

3 ▸ An example: OLTP and Ad hoc Reports

4 ▸ Summary

SAP R/3 / Netweaver Business Apps

Background

- Vast majority of any SAP code is row by row

- OLTP Tx processing is the highest priority

- Most inflexible commercial software in the market – for databases

Business Challenge:

How to have predicable, real-time Ad Hoc reports without impacting OLTP business transactions?

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How to do Ad Hoc Reporting

Fundamentally there are at least two choices:

A. OLTP Tx database & dedicated reporting database

B. OLTP and Ad hoc reporting in a single database

Let's look a little closer

(A) - Dedicated Databases (OLTP and Reporting database)

Pro

- DW schema for analysis
- No resource conflicts
    - (CPU, Memory, I/O)
- Designed for one purpose only
- Predicable performance
- Merging Data → Analytics

Con

- No Real-Time Ad Hoc reports
- More systems to maintain
- More software licenses
- More hardware support
- Data replication
- Potentially data inconsistency

Let's look a little closer

(B) - Single Database (OLTP and Ad hoc reporting)

Pro

- Real-Time Ad Hoc reports
- No data replication
- Consistent data
- Less systems
- Less hardware support

Con

- Potential resource conflicts
  - (CPU, Memory, I/O)
- Less predicable
- More challenging for Database
- Less / no choices about schema Design

Program Agenda

1 A 30 year old Problem – OLTP tx and reporting

2 How RWP tackles this challenge?

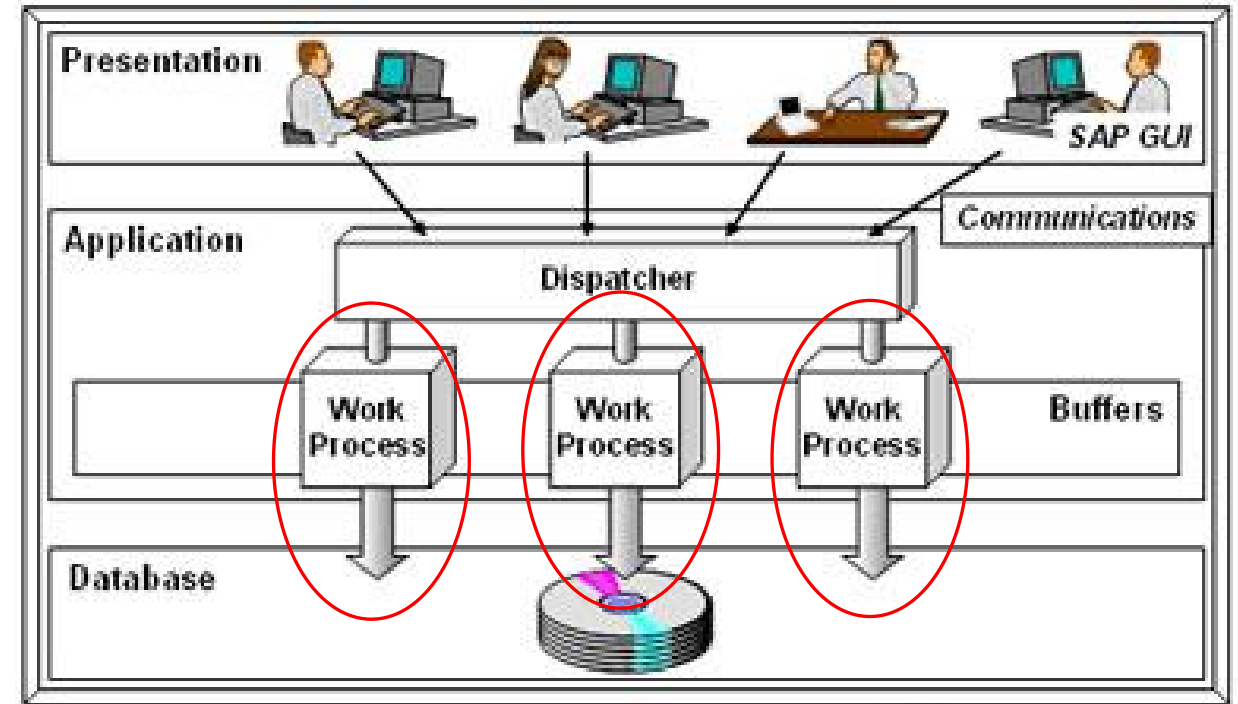**3** An example: OLTP and Ad hoc Reports

4 Summary

RWP Technique: Connection Management

SAP Apps (ERP, SCM, BW,…) use

- Connection pooling

- Fixed number of DB Connections

However,

- Monitor the usage of workprocesses

- Minimize # of work processes – ABAP and JAVA, OLTP, RFC and OLAP

See CON6460 – Migrating On-Premises Applications to the Cloud – Examining the Connection Strategy

RWP Technique: Connection Management

What we do about DB conncetions on SAP

- Design goal minimize DB connections
  - Minimize # of Workpocesses (WP)
  - # of WP is a function of Hardware Cores
  - Processor affinity → Bind WP to Core via OS

- Balance the Dialogue WP vs. Update WP – Goal:
  - A small queue on the Update WP
  - No queue on Dialogue WP and RFC WP

- Run Update requests on the same SAP instance where Dialogue runs

RWP Technique: OLTP

What we do about OLTP tx on SAP

Minimize any Latency on the entire OLTP Tx

- Logfile sync times < 1 ms or less – ALWAYS

Keep in mind log file sync is a function of fast writes and ability to post/wake up committing processes and log writer

- Network latency
  - App server <-> DB server
  - App server <-> App server

RWP Technique: Data Model and Schema

Optimization Process

- What is the Data Model?

- What is the Schema?

- How does the Data look like?
  - What are the Cardinalities?
  - What are the distinct Values of the Attributes ?
  - Is the data skewed?

- What are the Measures?

- What are the Attributes?
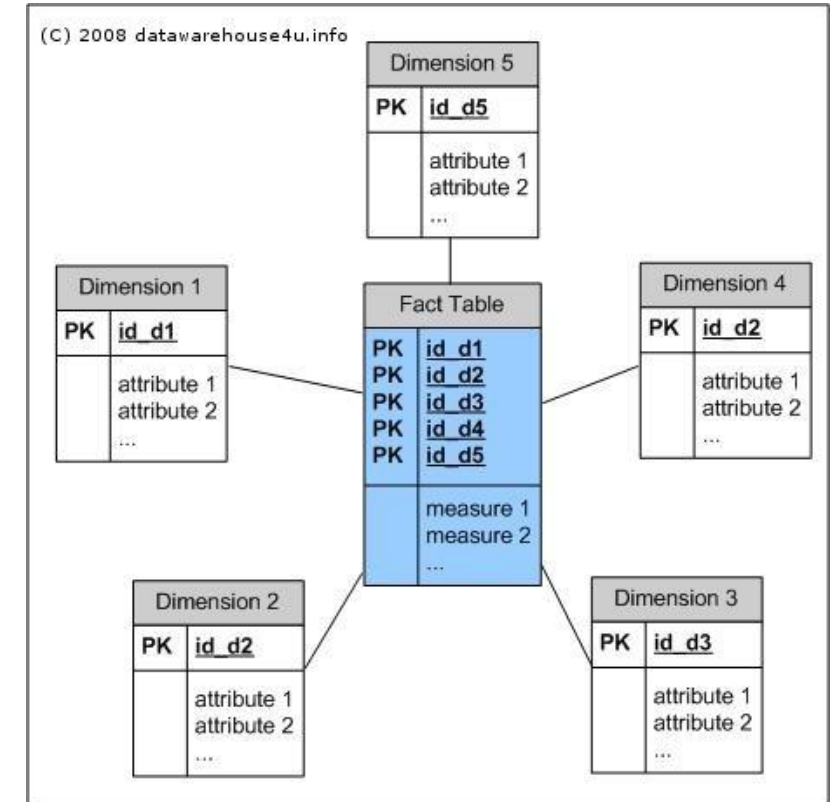
RWP Technique: Schema

Optimization Process – Star and Snow Flake

Understand where the time is spend:

- Data acquisition, Joins, Aggregation / Sorting

Measure and decide for best techniques on your environment:

- Star –Transformation
  - Primary – Forgein Keys
  - Bitmap Index
  - HASH Joins /w Bloom Filters
- Data Partitioning
- Cloud and Engineered Systems
  - Full Table / Index scans
  - Hybrid Columnar Compression
  - Push-Down Aggreation

See CON6560 - Optimizing Table Scans in Today's Cloud Environments

(C) 2008 datawarehouse4u.info

RWP Technique: Schema

Optimization Process – Flatten

- Columnar Format
  - Perfect for fat, flat tables and filtering on columns

A simple way to "de-normalize" an extended Star?
  - Use an MV
    - In Column store on Flash or IM
      - Push Down (Min, Max, SUM,..)
      - Dynamic Scans
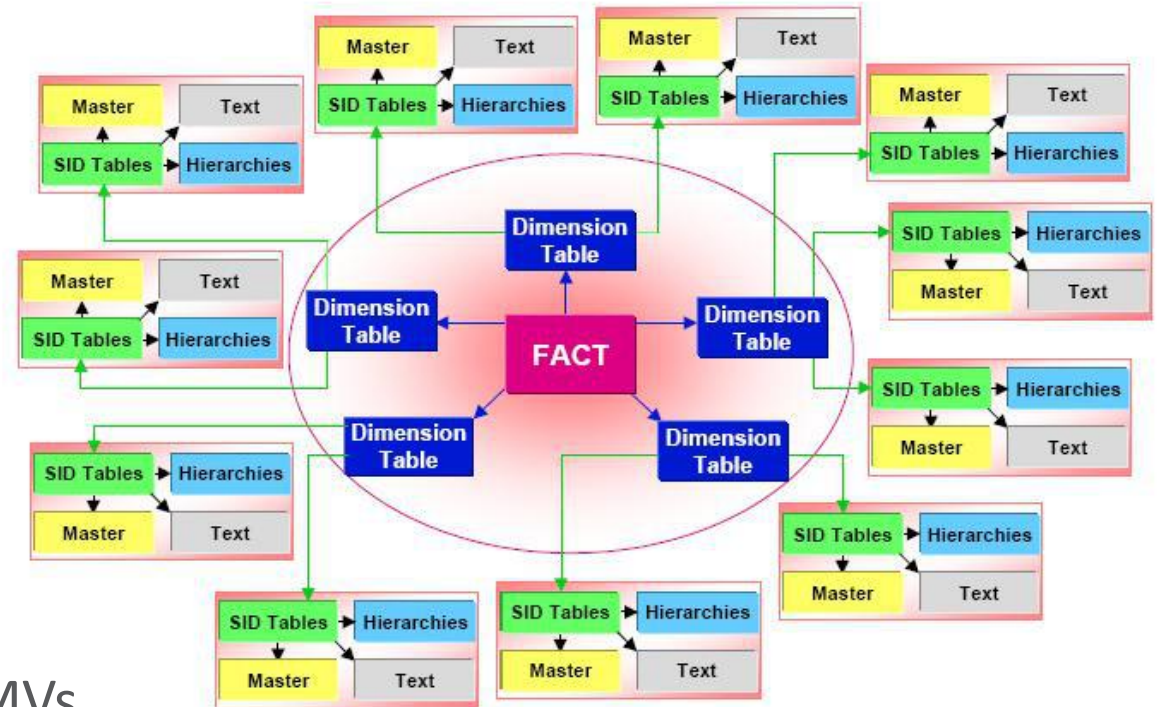   - IM Aggeration
      - Zonemaps

Oracle Column Store

Fact-Columns   Dim-Col.   SID-Col.
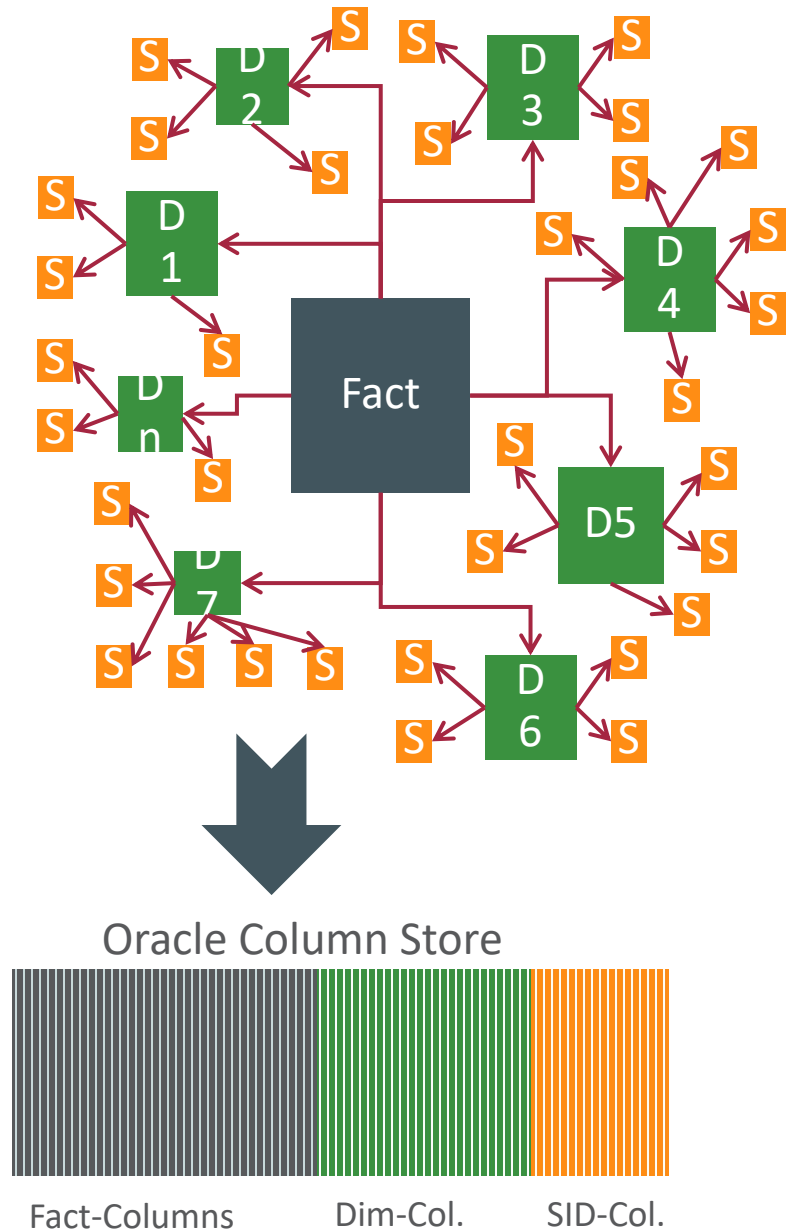
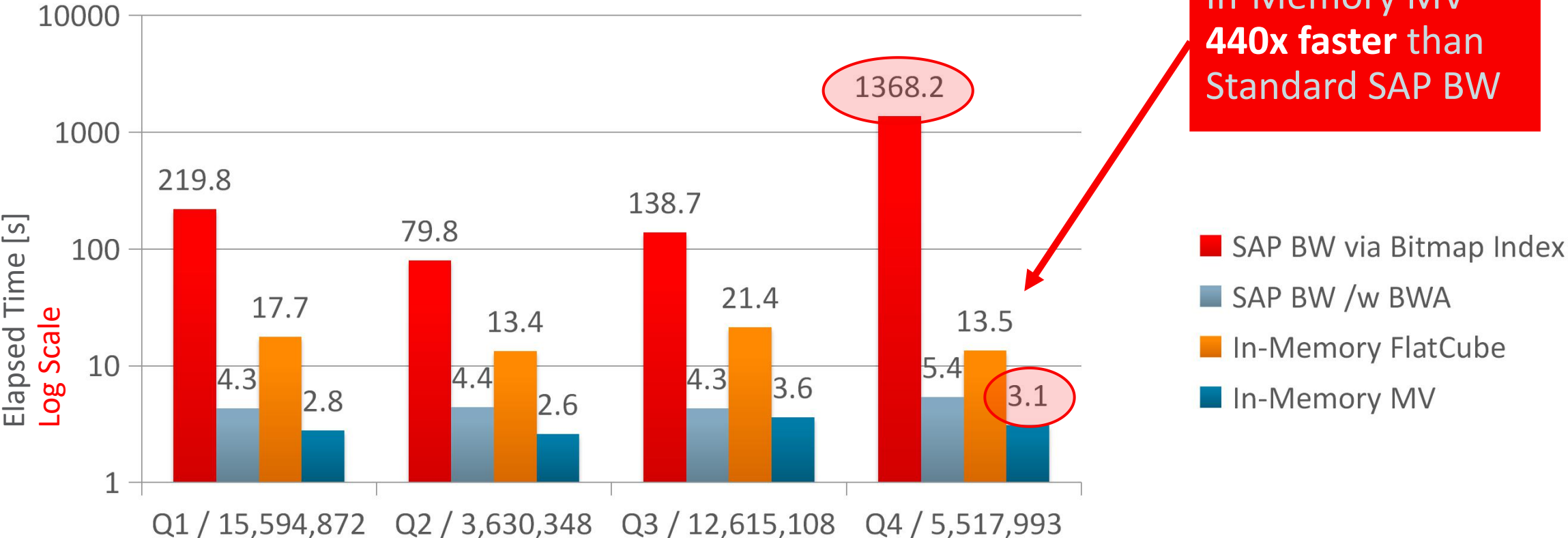# RWP Technique: Schema

What does SAP supply?

- InfoCube – Extended Star
- DSO – Star Schema
- FlatCube – Star Schema

- Oracle 12c In-Memory Toolkit
  - Works by SAP Object Names
  - Generates SQL scripts to enable IM and MVs

Multi-dimensional Data model in BI

Oracle 12c In-Memory for SAP BW

InfoCube

In-Memory MV
440x faster than
Standard SAP BW

Elapsed Time [s]
Log Scale

10000 — 1000 — 100 — 10 — 1

219.8   4.3   17.7   2.8
79.8   4.4   13.4   2.6
138.7   4.3   21.4   3.6
1368.2   5.4   13.5   3.1

Q1 / 15,594,872   Q2 / 3,630,348   Q3 / 12,615,108   Q4 / 5,517,993

■ SAP BW via Bitmap Index
■ SAP BW /w BWA
■ In-Memory FlatCube
■ In-Memory MV

Customer: Global Food Manufacturer

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Real Time Ad hoc Reporting on OLTP Data

Let's apply Real-World Performance Techniques

- Imagine to run OLTP Tx and Ad hoc reporting
  - on the same system
  - on the data source
  - No application code changes

  If that works it will:
  - Reduce complexity
  - Provide true Real-Time Data access
  - Result in less or smaller reporting systems

SAP's Approach,…

How about to make it simpler?

- What is SAP's answer:
  - Extract data from Oracle
  - Use SAP HANA for BW on specialized HW
    - Extra SLT SW License to extract data in "Real-Time"

Or

- Just go to S4 / HANA,…..

Really - Is this the best option?

Oracle's Approach

How about to make it simple?

- What Oracle provides:
  - Single Database
  - Best in OLTP
  - Best in OLAP and In-Memory
  - No Data replication
  - No Data duplication

Just leave the heavy lifting to Oracle 12c

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Oracle 12c and SAP – The Test

OLTP and Ad Hoc reporting concurrently

- **Single Database**:
  - SAP OLTP Tx
  - Ad Hoc queries against OLTP Tx tables
- **Two Scenarios:**
  - In-Memory = DISABLED   (A)
  - In-Memory = ENABLED   (B)
- **The Measures:**
  - Resource consumption
  - Throughput – OLTP and Ad Hoc

- Test Machine:

  Exadata X5-2 – Extreme Flash
  - One Compute Node = 36 Cores
  - Cell_Offload_Processing = FALSE

- Test Load:
  - SAP Business Tx = OLTP via RAT
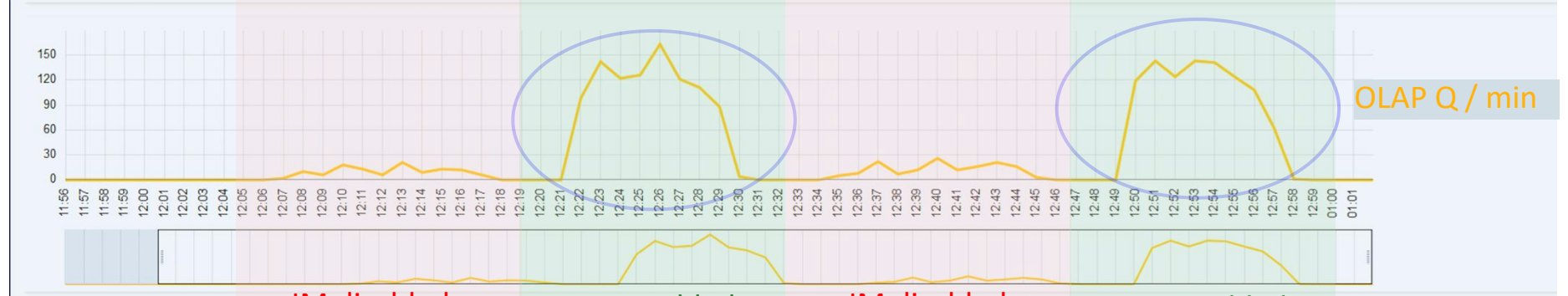 - Business Queries = Ad Hoc 20 concurrent sessions

Test Timeline Overview

OLTP Tx – Constant ➤
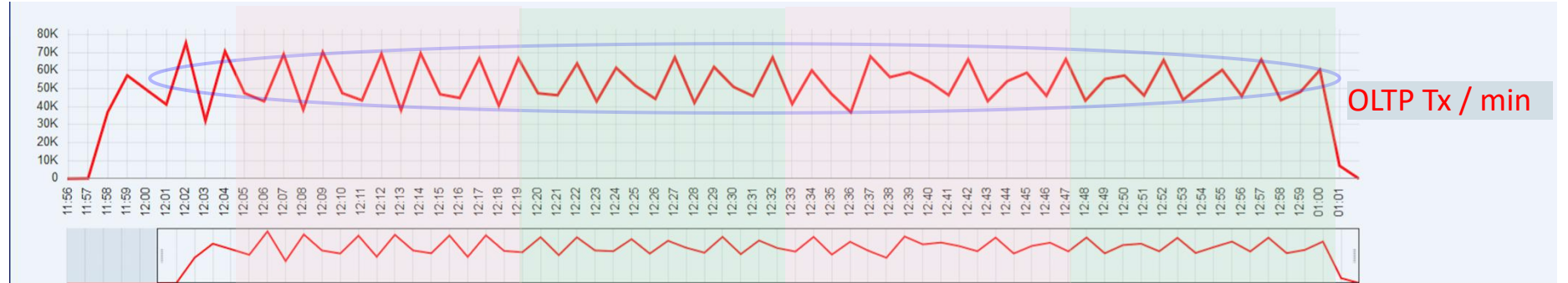
Increased OLTP tx times with NO IM ➤
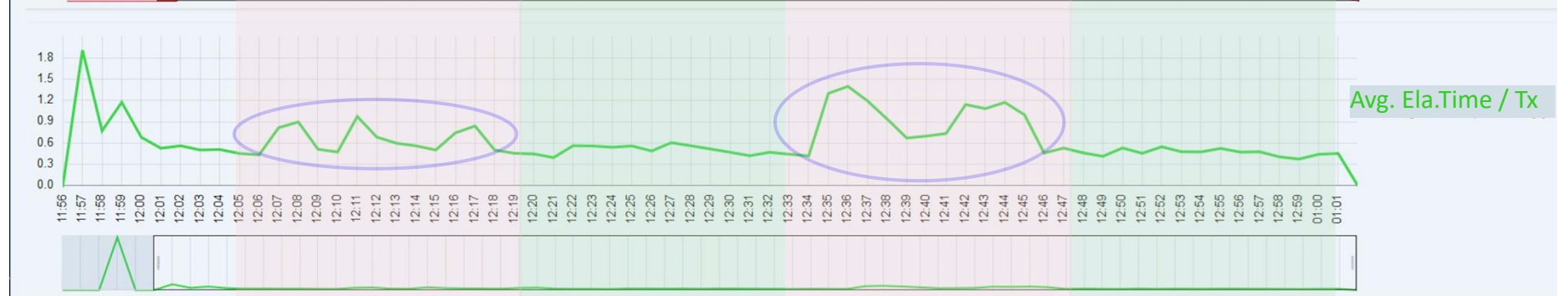
10 x higher AdHoc Reports Throughput With IM ➤

OLTP Tx / min

Avg. Ela.Time / Tx

OLAP Q / min

IM disabled   IM enabled   IM disabled   IM enabled

Test Summary

Activity | Services | Instances

○ Foreground Only   ○ Foreground + Background

42% wasted CPU
Wait on I/O

Legend:
- Average Active S...
- Miscellaneous
- Application
- User I/O
- CPU

IM disabled   IM enabled   IM disabled   IM enabled

Workload	In-Memory	DB CPU [%]	DB CPU [%] User I/O wait	DB I/O [MB/s]	OLTP [Tx/min]	Ad hoc [Q/min]
OLTP	Disabled	5	~ 0	60	~55,000	NA
OLTP + Ad hoc	Disabled	14	~6	6000	~55,000	12
OLTP	Enabled	5	~ 0	60	~55,000	NA
OLTP + Ad hoc	Enabled	34	~ 0	600	~55,000	130

10x more Queries/min

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Some Oracle 12c – SAP Customers

For years we apply Oracle RWP Techniques

RWP: Design the best, build it right and enjoy the result - never settle on good enough

RWP Team is ready to enage with your team

Summary - Real-World Performance and SAP

- Oracle enables **both** options
  - Single database
  - Dedicated Systems

- Oracle 12c Technologies – transparent to the SAP App
  - Enable **Ad Hoc Reports** directly on ERP, ECC, CRM,...
    - **No extra SAP License costs** (i.e. to cumbersome data replication via SAP SLT)
    - Business queries can be implemented via ABAP, BOBJ, APEX,...
  - Execellent for SAP BW to
    - Accellerate OLAP queries
    - Replace BWA → No need for a cumbersome HANA sidecar

RWP: Design the best, build it right and enjoy the result - never settle on good enough

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Integrated Cloud
Applications & Platform Services

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Oracle and SAP Applications

How can you do that?

- Several choices to implement your Business Query
  - ABAP
  - SAP BOBJ
  - Oracle APEX (Full use Oracle Customers, free and fully supported)
- SAP Business Tables are well documented (by SAP and many others)
- Check with your Business Owners what they like to read in Real-Time
  - Sales Revenue Today, Revenue YTD, per product
  - Items sold today, Items sold by Sales rep., Items sold by region,..

  And all that on the CURRENT data.

Oracle and SAP Applications

Example Simple Query

```
SELECT
 TO_CHAR(sum(netwr),
 '$999,999,999,999.99')
 AS Total_rev
FROM  VBAK
WHERE ERDAT
BETWEEN '20161231'
AND '20171004'
```

```
--------------------------------------------------------------------------------
| Id  | Operation                      | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT               |      |     1 |    13 |  5395   (8)| 00:00:01 |
|   1 |  SORT AGGREGATE                |      |     1 |    13 |            |          |
|*  2 |   TABLE ACCESS INMEMORY FULL   | VBAK | 6088K |   75M |  5395   (8)| 00:00:01 |
--------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
   2 - inmemory("ERDAT">='20161231' AND "ERDAT"<='20170714')
       filter("ERDAT">='20161231' AND "ERDAT"<='20170714')
```

```
--------------------------------------------------------------------------------
| Id  | Operation                      | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT               |      |     1 |    13 |  128K   (1)| 00:00:06 |
|   1 |  SORT AGGREGATE                |      |     1 |    13 |            |          |
|*  2 |   TABLE ACCESS STORAGE FULL    | VBAK | 6088K |   75M |  128K   (1)| 00:00:06 |
--------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
   2 - filter("ERDAT">='20161231' AND "ERDAT"<='20170714')
```

Oracle and SAP Applications

What is Oracle APEX – Oracle Application Express?

Build applications using only your web browser

Simple to develop business reports for browsers or as mobile app

- Integrated flexible User Access Control –

- Fully integrated development environment – for teams, version control,..

- Fully supported by Oracle

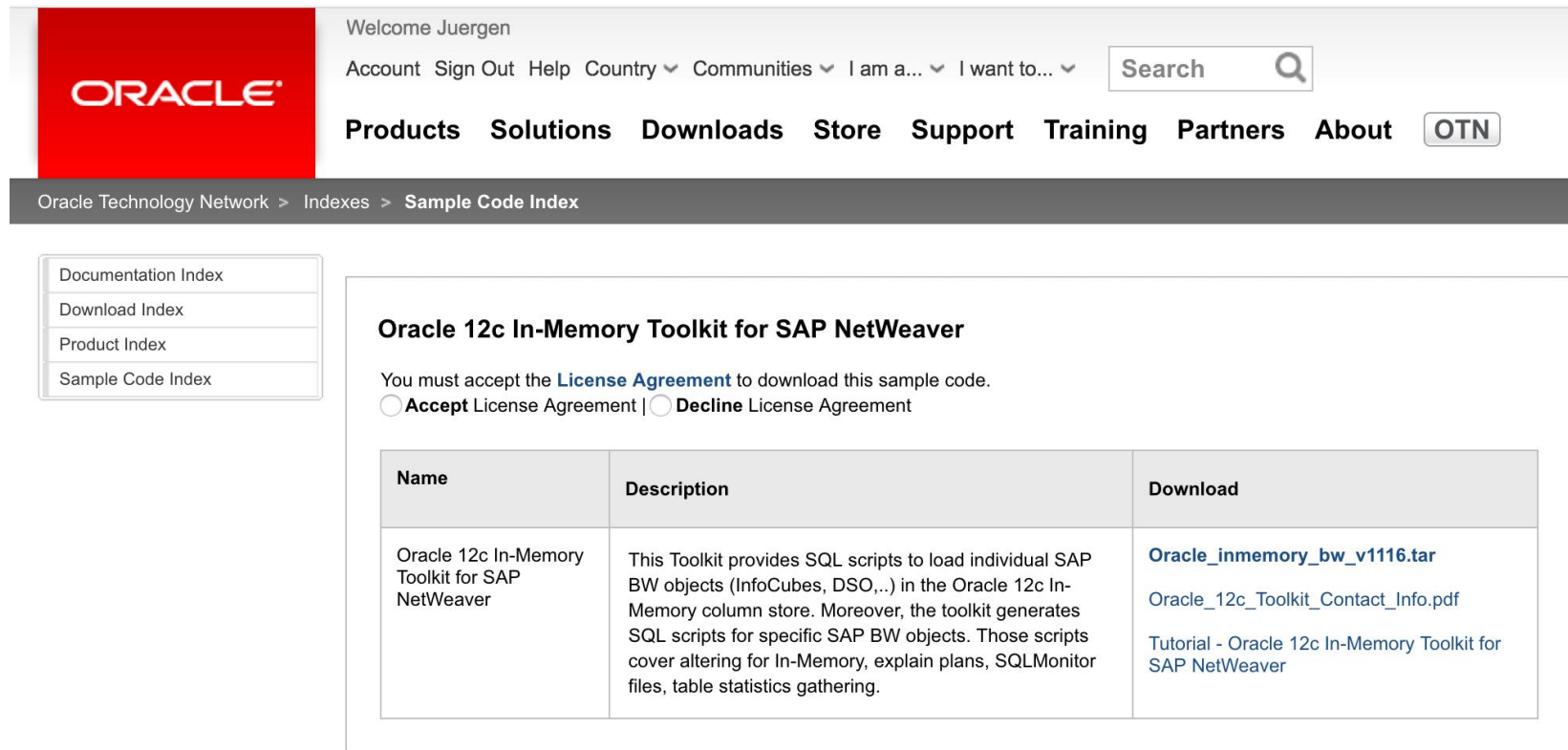→All in all, simple to use, fast to apply and rewarding to get results

Check it out at https://apex.oracle.com/en/

Oracle 12c In-Memory Toolkit for SAP Apps

Where to download?

On OTN http://www.oracle.com/technetwork/indexes/samplecode/in-memory-toolkit-3076228.html