Migration of a Core Banking Application to ExaCC - PoC Experience with Finnova

SOUG 2024, Basel
April 17th, 2024

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swisscom

Speaker

Moritz Werning

- Product Manager DB Services@ Swisscom (Schweiz) AG
- master's degree in computer science (University of Tübingen in Germany)
- 16 years experience with the Oracle database, Oracle engineered Systems and data warehousing

Agenda

1. Introduction
2. Motivation: Why an PoC, and why on ExaCC?
3. Phase 1 - Functional Tests of Finnova Core banking on OCI Exadata Platform
4. Phase 2 - Performance Tests on ExaCC@ Swisscom on Customer Volume Data
5. Results & Conclusion

Intro Swisscom

Swisscom Switzerland– Oracle Footprint

- **Swisscom**, Switzerland's leading telecom company and one of its leading IT companies
- 2022 over 19,000 employees generated sales of CHF 11.1 billion
- It is 51% Confederation-owned
- one of Switzerland's most sustainable and innovative companies

Swisscom Oracle Footprint:

- 7 B2B data center's in Switzerland
- ~20 PB data online
- Oracle Exadata
- Oracle Exadata Cloud@Customer
- Oracle Private Cloud Appliance
- Oracle ZDLRA
- Oracle Database Appliance
- Oracle Exalogic
- Oracle Exalytics
- Oracle Big Data
- Real Application Clusters
- Active Data Guard
- Advanced Security
- Advanced Compression
- Golden Gate
- Data Integrator
- APEX & ORDS

Active in Switzerland for over 40 years

100+

implemented core banking migrations

72

BPO customers (payments, securities)

31

Banks & Financial Service Providers having research provided by e.foresight

For **52**

Banks we operate the banking platform

200+

different peripheral systems

Why an Finnova Core Banking PoC on Exadata / ExaCC?

PoC Avaloq on Exadata successfully carried out! PoC Finnova?

Remark: no tuning before / during PoC's

Avaloq & Oracle DB update
Release Upgrade from 4.10/19.10 to 5.2/19.13 was **30% faster than** on IBM P9.

Backup/Recovery
Fast Recovery with RMAN Roll Forward Image Copy are **extremely fast** (took 6 min to complete)

Performance
End of Day was **50% faster than** on IBM P9
OLTP Testing with 4'500 concurrent users showed on avg. **40% better Response Times**

Exadata X8M-2 Half Rack

ExaCC

Setting the scene
It's a good time for a new workload strategy!

HW Lifecycle

HW Lifecycle for Avaloq, Finnova & ADAI are in sight; End of life for Solaris 2037 (various DB Servern)

PoC Avaloq on Exa successfully carried out

Good results with new platform!

Consolidation into Cloud at Customer

Consolidating the various Oracle platforms paired with Cloud Functions on prem makes sense for Swisscom

Oracle workload strategy

Taking various factors into account, we want to offer an optimal Oracle workload strategy for our customers, based on Exadata.

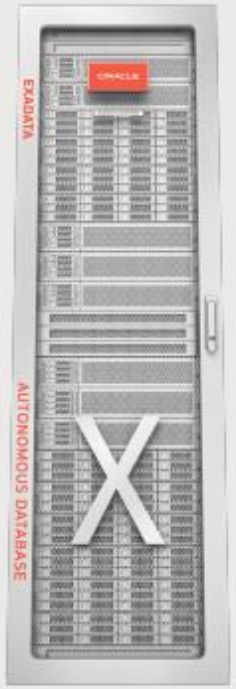
New licensing options need

Exa CC offers an interesting option with savings potential

Certification from Avaloq (& Finnova ?)

Full releases and support (including RAC) are pending, but are on their way.

Oracle Exadata Database Service on Cloud@Customer (ExaCC)?



Exadata On-Premises

+

- Flexible Subscription Model
- Cloud Automation
- Unified Control Plane
- Cloud Security and Hardening
- Oracle-Managed Exadata Infrastructure

Can't use Public Cloud

Can use Public Cloud

Exadata Cloud@Customer

In Swisscom Data Centers

Exadata Cloud Infrastructure

In Oracle Public Cloud Data Centers

Swisscom Oracle Exadata Cloud@Customer live since 2023/05

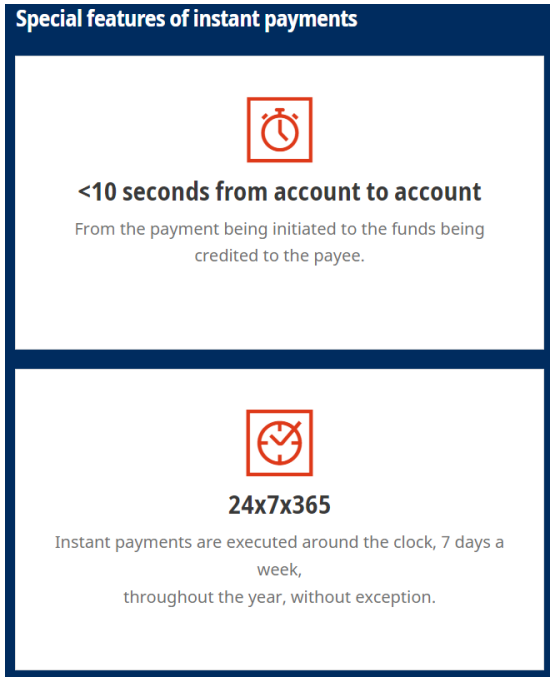
Swisscom Banking Applications already migrated to:

BI Solutions

- "Classic" warehousing, core-banking-system as main source system
- Reporting (financial, operational)
- Controlling
- Reason for migration:
  Lifecycle; actually, Oracle Exadata on-prem

Card Solutions: with Instant payment

- go-live in Switzerland: 08/2024



- Reason for migration:
  data-base availabiliy (zero down-time)

Experience from Swisscom Smart Banking ExaCC Project

ExaCC - It's an Exadata

Exadata **high Performance**

No majors or outages so far

Swisscom and Oracle managed Infrastructure **accepted by Banks**

Smoothly Migration – Oracle Solaris T7

Multitenant & RAC & DG on 19C

Endian Migration

Charset Conversion

ExaCC License Included model

Simplified license & billing management

Cost savings & be more flexible

Advanced Security and many more **Options included without additional Cost**

ExaCC Flexibility and scalability

Use and pay only as much **CPU** as you need at a certain point in time

Scale up/down for high/low Workload like end of Period (**dynamic scaling**)

ExaCC Cloud Interface & Cloud Automatism

Oracle Infrastructure **Patching**

CDB&PDB **Management**

Cost Management

Oracle brings **improvements** and fixes often

Decision for PoC
Oracle & Finnova & Swisscom

Decision: A Two-Phase approach in Collaboration with Oracle and Finnova

Phase 1 - Functional Tests of Finnova banking Core on OCI Exadata Platform

Phase 2 - Performance Tests on ExaCC@ Swisscom on Customer Volume Data

Phase 1 - Functional Tests of Finnova banking Core on OCI Exadata Platform

Paolo Kreth, Cloud Platform Architect - ORACLE Switzerland

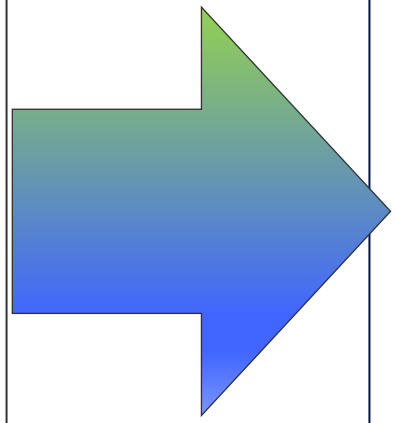
Swisscom – Finnova & Oracle

A POC On OCI and ExaCC – Phase 1

November 20th 2023

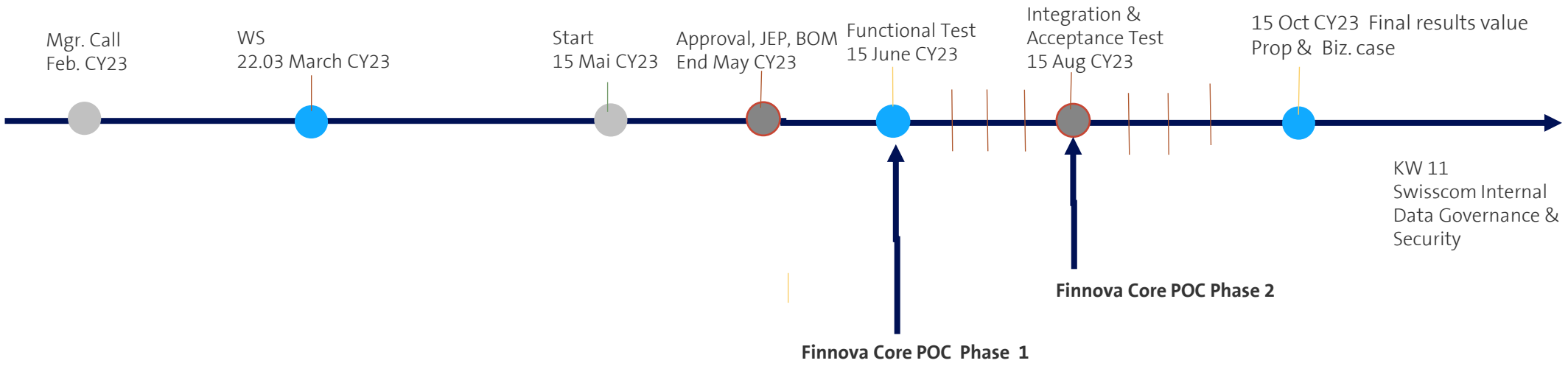
Joint Execution Plan

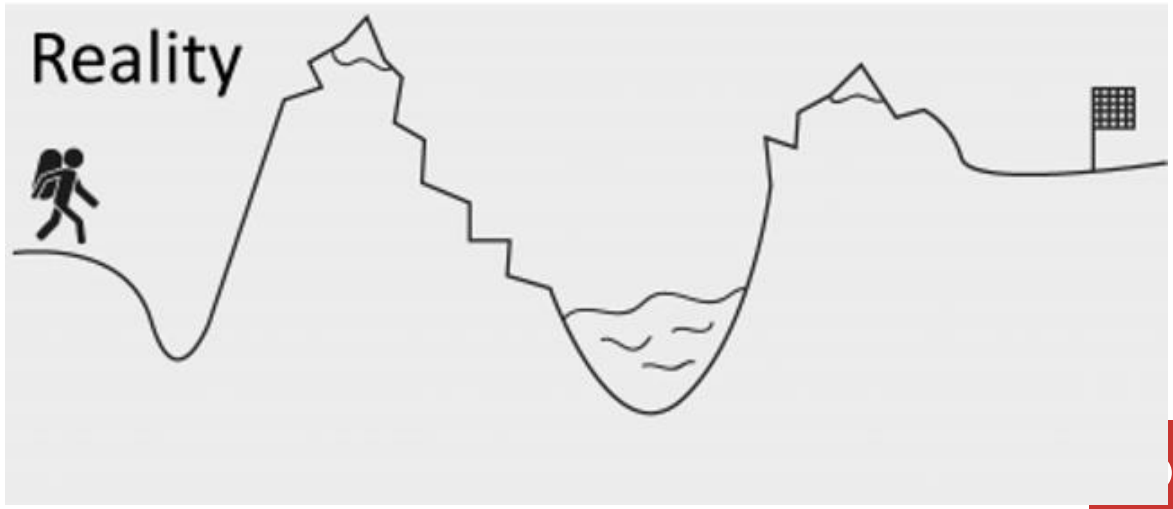
- Phase 1 - Functional Tests of Finnova banking Core on OCI Exadata Platform
- Phase 2 – Performance Tests on ExaCC@ Swisscom on Customer Volume Data



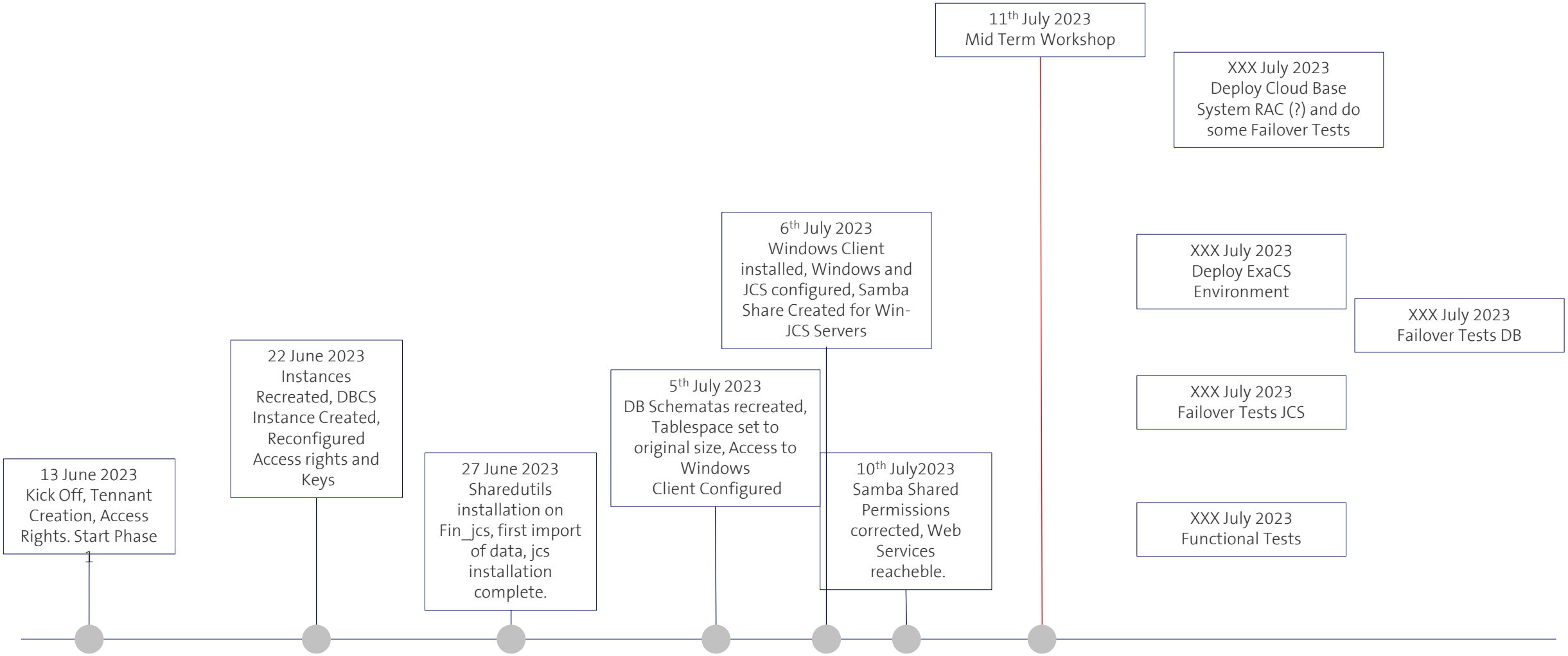
- Core Tests – Base Environment Works as expected
  - Functionallity of JURE-GUI
  - FIL-IS Rest Services
  - TEV and MEVs with Finnova Modelbank
  - JCS Functionality
- High Availability
  - JCS redundant set up with failover tests
  - Dataguard Switches
  - RAC Tests
    - Single Node Setup
    - Primary Secondary Node Setup
    - Active/Active Setup

Roadmap – Finnova Core Modernization on Exa Platform

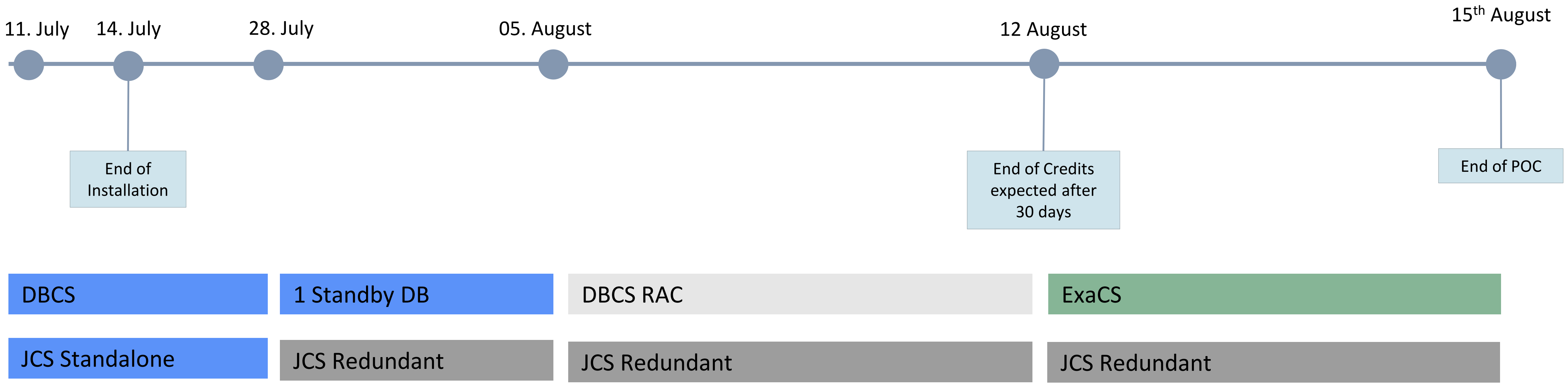




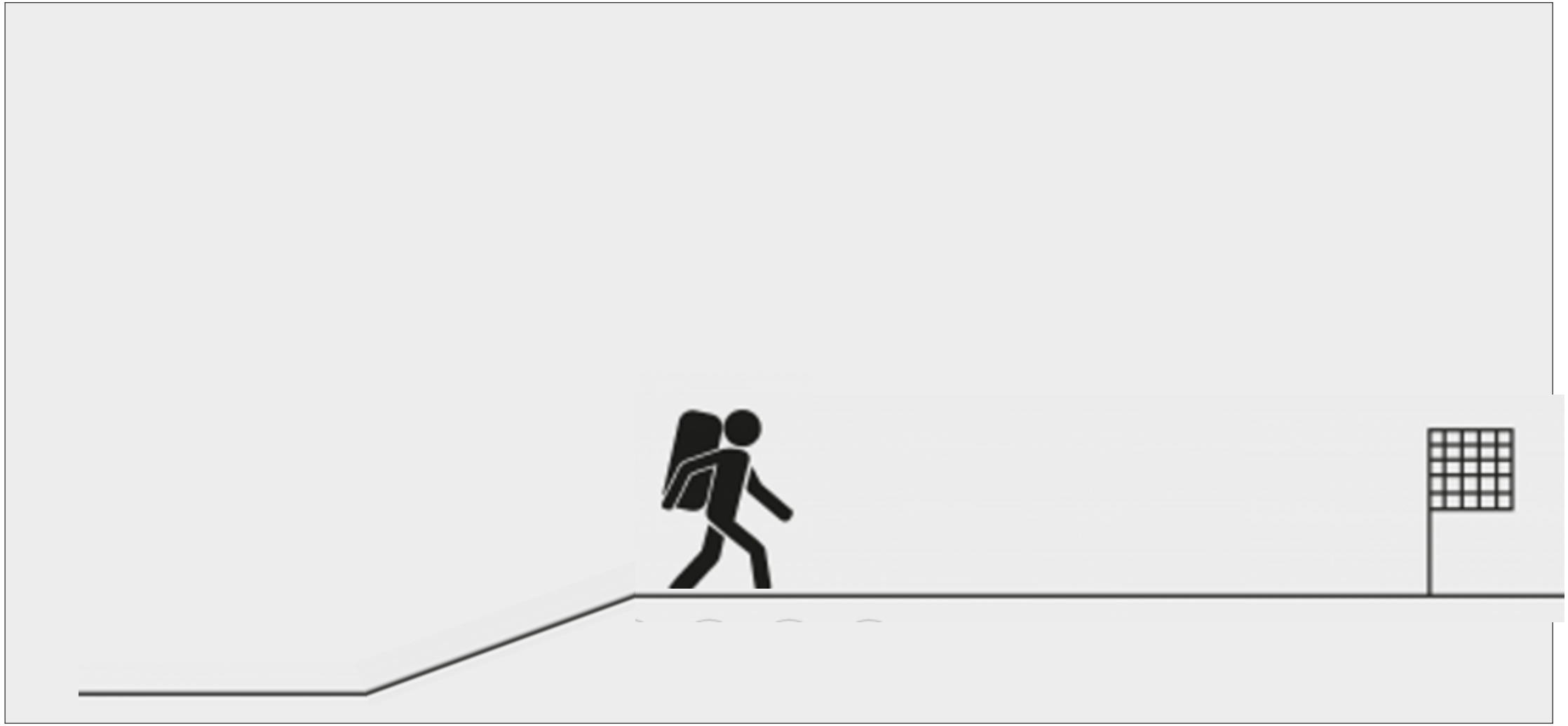
11th July Mid Term Workshop



Planning – Original



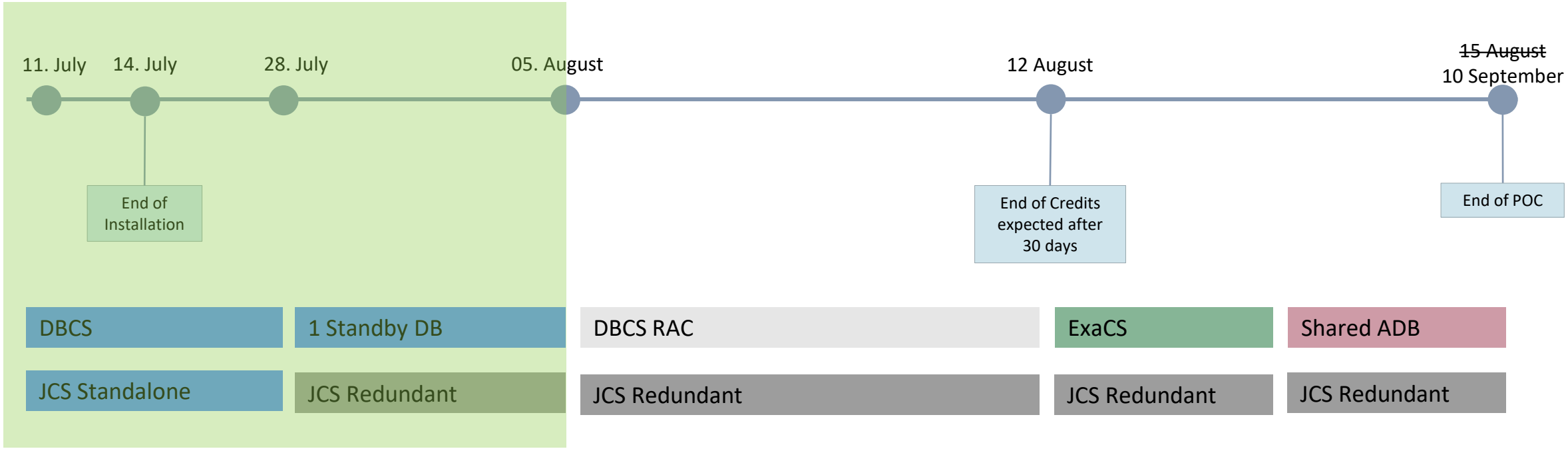
This was our perception before July workshop



Workshop 5th August

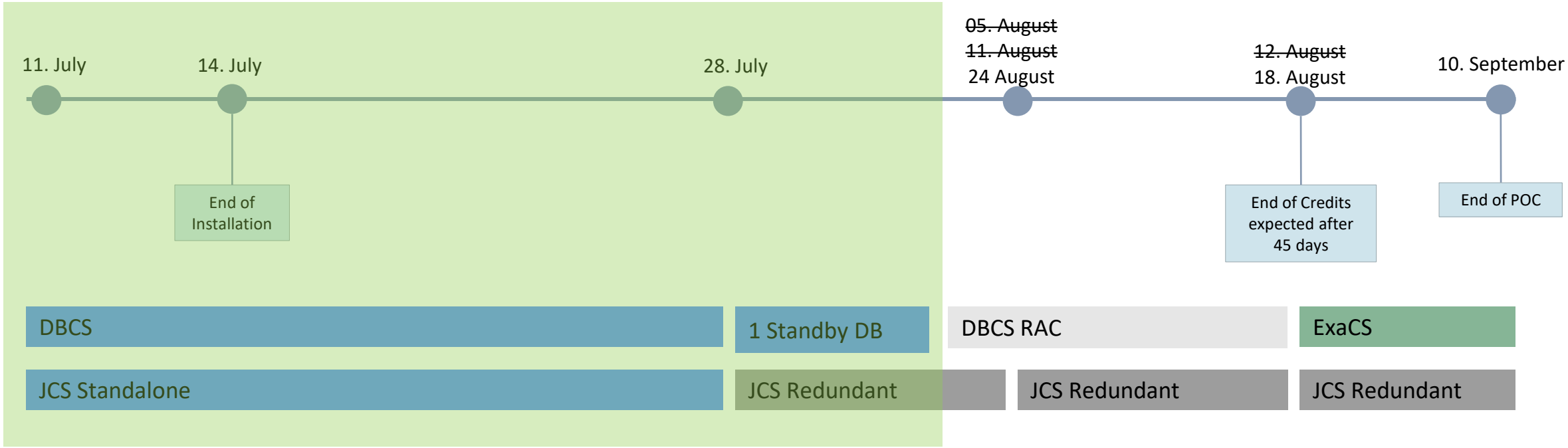
Topic	Decision
Samba Share or Network Filesystem	Jcs-fin server has to be reinstalled. Two instances with an OCI network file system to test dual mode
Windows Server actually in public and private network	We will leave the actual configuration for the tests, in parallel only the windows server will be reinstalled only in private network to test connectivity.
Next Tests ? DBCS with RAC or directly ExaCS ?	From the start of the first ExaCS QR we will have max 90 days cloud credits for testing due to the infrastructure costs. The decision is to test as much as possible before deploying the ExaCS infra, therefore RAC tests on DBCS. → Extension of phase 1 until 10.09.23
JCS aktiv/passiv	In progress
Autonomous Database Tests	If some times and credits are left we will do some tests with ADB

New Planning



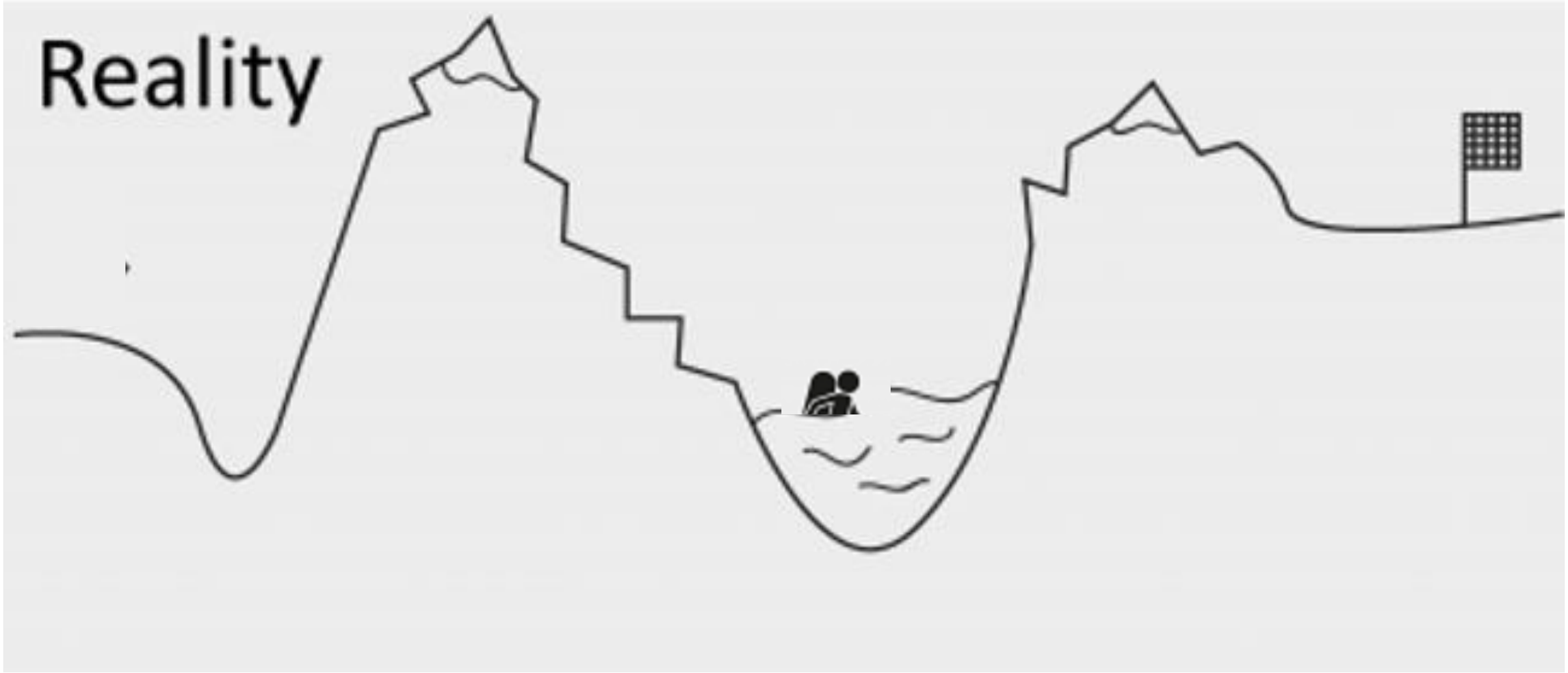
What could go wrong?

24th of August Dataguard Switches complete – ready for RAC



- Vacation of different Key Players (Oracle, Finnova)
- Load Balancer Problems solved – JCS Redundant
- Dataguard Switches Successful

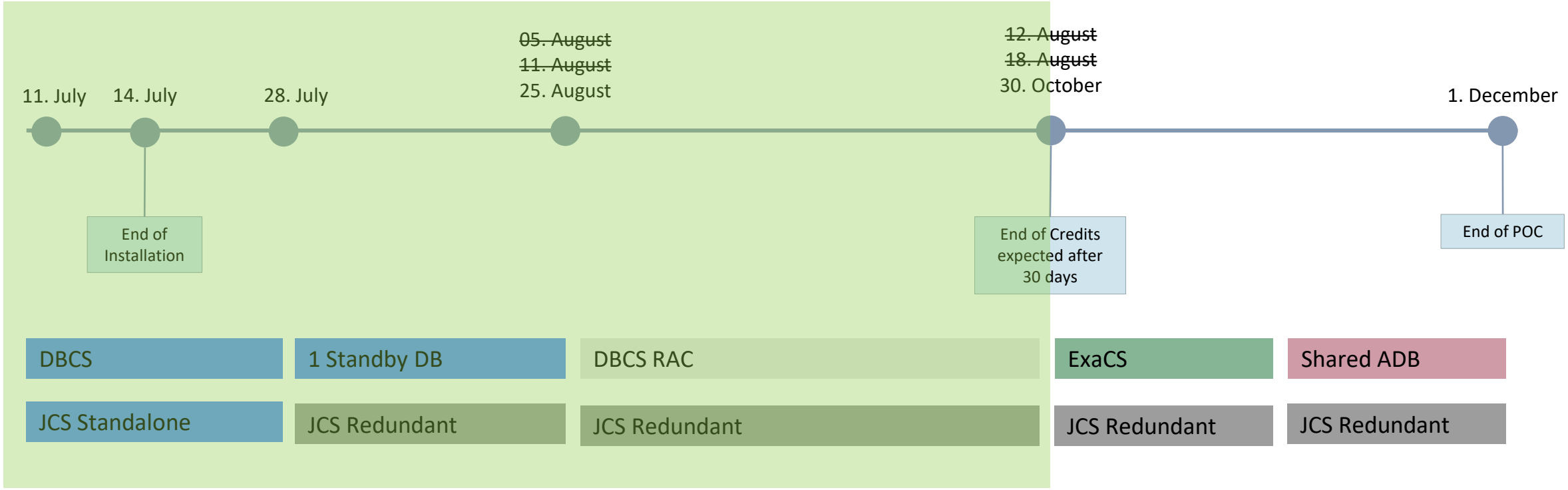
RAC Import never Ends



28th August started RAC installation 22nd September finished

- RAC Import stucks and missing queues
- Asked for a limit increase (OCPUs and Memory) on a POC environment
  - First step without PM approval
  - Second Step with PM Approval
  - Two weeks lost
- Clone from Single Instance to RAC through backup not possible in cloud automation
- Applied Patchset
- Opened SR
- Decided to switch to PDBClone to solve issue and move on

1 Month to test RAC until 30th of October



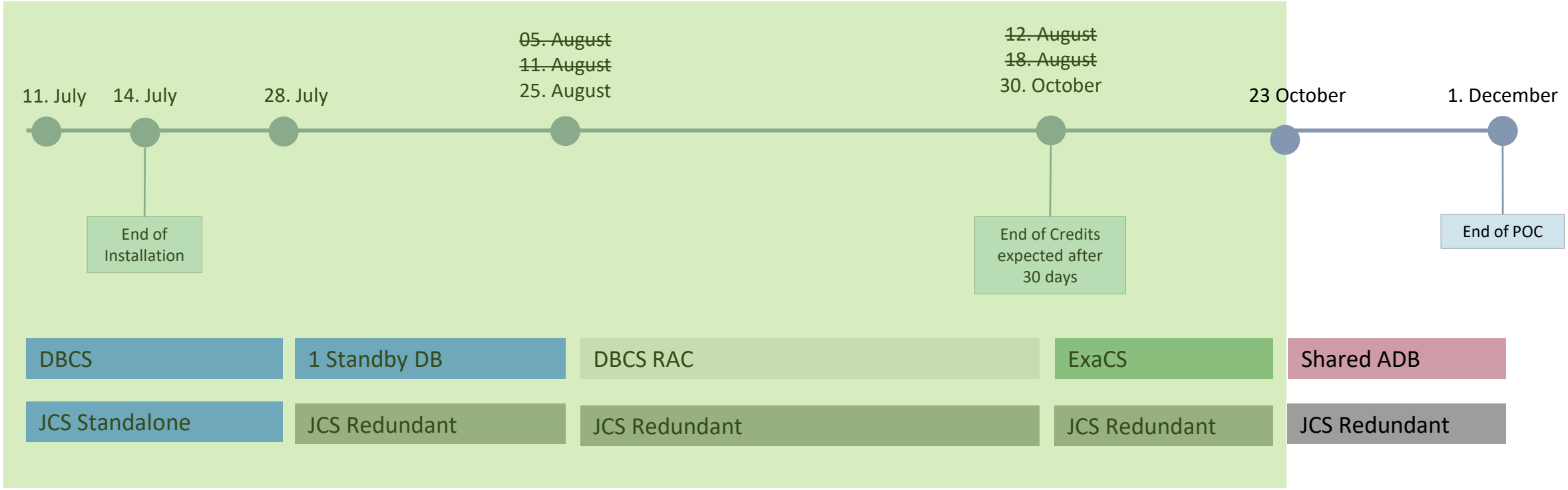
Lessons learned

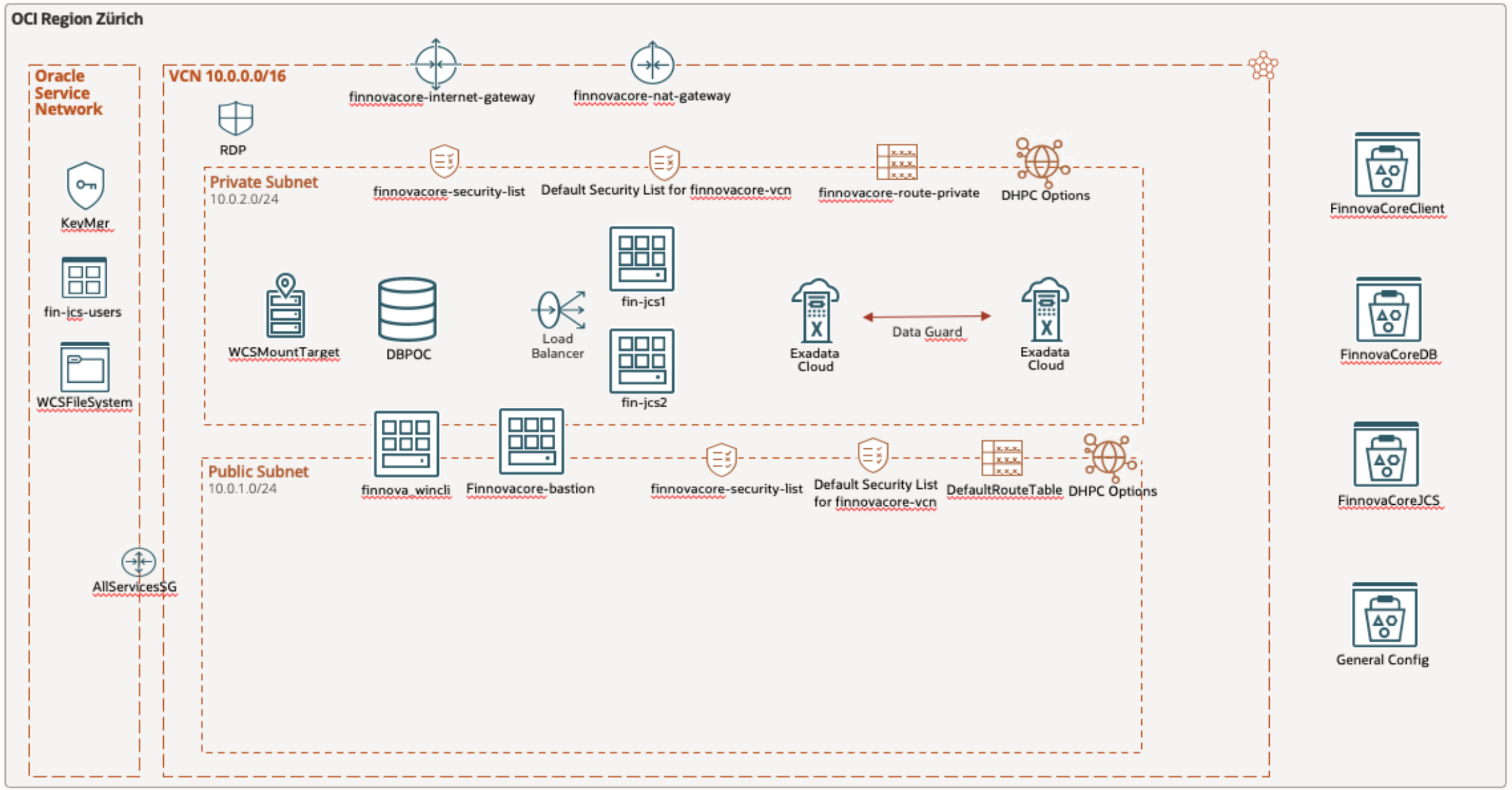
Issue	Impact	Outcome
During active-active configuration performance issues due to parallel slaves on different nodes	Solved performance issue on RAC with changing parameter: **`PARALLEL_FORCE_LOAD = TRUE - DEFAULT IS FALSE`**	Performance issues solved
Performance Database Base Service (preferred node and active-active)	No impact	Comparable to single instance
RAC Configuration with preferred node	No impact	The service was configured with options with -preferred and -available: `srvctl add service -db <db_name> -service MYSERVICE –preferred inst1 -available inst2 -pdb <pluggable_database> -notification TRUE -drain_timeout 300 -stopoption IMMEDIATE -role PRIMARY`

Lessons learned

Issue	Impact	Outcome
Performance issues with two active RAC Nodes	Performance Impact during TEV, from 10 to 30 minutes with RAC active-active configuration	After parameter change on application issue solved. Finnova will continue internally the investigation.
Transparent Application Continuity (TAC)	Session do not failover automatically when one RAC node goes down.	Hikari driver used by Finnova does not support TAC and connection pooling in sense of Oracle. This issue will be discussed internally by Finnova.
Drainover of Sessions for planned maintenance	For planned maintenance session draining would help to keep the application running, but tests showed that this is not working with	Hikari driver used by Finnova does not support TAC and connection pooling in sense of Oracle. This issue will be discussed internally by Finnova.
Encryption	No Impact	Database Encryption was always on
Issue with Import DB	Encountered a bug on importing XML types causing the import to hang and eventually fail.	Realizing the impact on time, not wanting to delay the POC any further, we switched to PDB cloning. This reduced the setup time for a database POC environment to 2 hrs.
Performance issues with two active RAC Nodes	Performance Impact during TEV, from 10 to 30 minutes with RAC active-active configuration	After parameter change on application issue solved. Finnova will continue internally the investigation.

23 October ExaCS tests finished




OCI Region Zürich
Oracle Service Network
VCN 10.0.0.0/16
finnovacore-internet-gateway
finnovacore-nat-gateway
RDP
KeyMgr
fin-jcs-users
WCSFileSystem
AllServicesSG
Private Subnet
10.0.2.0/24
finnovacore-security-list
Default Security List for finnovacore-vcn
finnovacore-route-private
DHPC Options
WCSMountTarget
DBPOC
Load Balancer
fin-jcs1
fin-jcs2
Exadata Cloud
Data Guard
Exadata Cloud
Public Subnet
10.0.1.0/24
finnova_wincli
Finnovacore-bastion
finnovacore-security-list
Default Security List for finnovacore-vcn
DefaultRouteTable
DHPC Options
FinnovaCoreClient
FinnovaCoreDB
FinnovaCoreJCS
General Config

```
-----------------------------------------------------------------------------------------------------------------------
Premigration Advisor Report Check Summary
-----------------------------------------------------------------------------------------------------------------------
  Number of checks run:           A total of 51 checks were performed
  Number of schemas analyzed:     59
  Number of schemas in source DB: 94
  List of schemas analyzed:       F2LDW1P0, PDBUSER, F2LARCP0, F2LBATP0, F2LSECP0, F2LMG0P0, F2LAAAP0, F2LALCP0, F2LALMP0, F2LAMIP0,
                                   F2LBSAP0, F2LCDSP0, F2LCLRP0, F2LCM0P0, F2LDMDP0, F2LDMXP0, F2LFAFP0, F2LFANP0, F2LFFPP0,
                                   F2LFILP0, F2LGBSP0, F2LHISP0, F2LHYPP0, F2LI2IP0, F2LIB4P0, F2LIN2P0, F2LINAP0, F2LKACP0,
                                   F2LKARP0, F2LKZRP0, F2LLOGP0, F2LMG1P0, F2LNVZP0, F2LODSP0, F2LOPUP0, F2LOUPP0, F2LOVPP0,
                                   F2LRZFP0, F2LRZSP0, F2LS01P0, F2LS02P0, F2LS03P0, F2LS04P0, F2LS05P0, F2LS06P0, F2LS07P0,
                                   F2LS08P0, F2LS09P0, F2LSAPP0, F2LSB0P0, F2LSELP0, F2LTKPP0, F2LWMDP0, F2LX01P0, F2LDATP0, PAOLO,
                                  REMOTE_CLONE_USER, C##DBA, ADRIAN
  Fatal Checks:                   There were 0 checks with Failed results
  Action Required Checks:         There were 8 checks with Action Required results: has_data_in_other_tablespaces_serverless
                                  (33,449 relevant objects), has_xmlschema_objects (109 relevant objects),
                                  has_tables_with_xmltype_column (11 relevant objects), has_user_defined_objects_in_sys (9 relevant
                                  objects), has_refs_to_user_objects_in_sys (2 relevant objects), has_sys_privileges (2
                                  relevant objects), has_role_privileges (1 relevant objects), has_common_objects (1
                                  relevant objects)
  Review Required Checks:         There were 5 checks with Review Required results: has_refs_to_restricted_packages_serverless
                                  (3,140 relevant objects), has_noexport_object_grants (82 relevant objects), has_directories
                                  (4 relevant objects), has_db_links (2 relevant objects), nls_national_character_set (1
                                  relevant objects)
  Review Suggested Checks:        There were 8 checks with Review Suggested results: has_basic_file_lobs (2,571 relevant objects),
                                  has_db_link_synonyms (63 relevant objects), has_default_tablespace_not_data (59 relevant objects),
                                  modified_db_parameters_serverless (38 relevant objects), has_enabled_scheduler_jobs (14
                                  relevant objects), has_index_organized_tables (3 relevant objects), has_trusted_server_entries (1
                                  relevant objects), standard_traditional_audit_adb
  Passing Checks:                 There were 30 checks with Passed results: dp_has_low_streams_pool_size (3 relevant objects),
                                  timezone_table_compatibility_higher_serverless (1 relevant objects),
                                  options_in_use_not_available_serverless,
                                  has_active_data_guard_serverless, xdb_resource_view_has_entries,
                                  has_fmw_registry_in_system, has_users_with_10g_password_version,
                                  has_user_defined_pvfs, has_java_objects, has_java_source,
                                  has_columns_with_media_data_types_adb, has_external_tables_serverless,
                                  has_xmltype_tables, has_logging_off_for_tables,
                                  has_logging_off_for_partitions, has_logging_off_for_subpartitions,
                                  has_ilm_ado_policies, has_clustered_tables,
                                  has_parallel_indexes_enabled, nls_character_set_conversion, nls_nchar_ora_910,
                                  has_libraries, has_dbms_credentials, has_incompatible_jobs,
                                  has_columns_with_spatial_data_types, has_sqlt_objects_adb,
                                  has_mining_model_issues, has_csmig_schema,
                                  has_illegal_characters_in_comments, unified_and_standard_traditional_audit_adb
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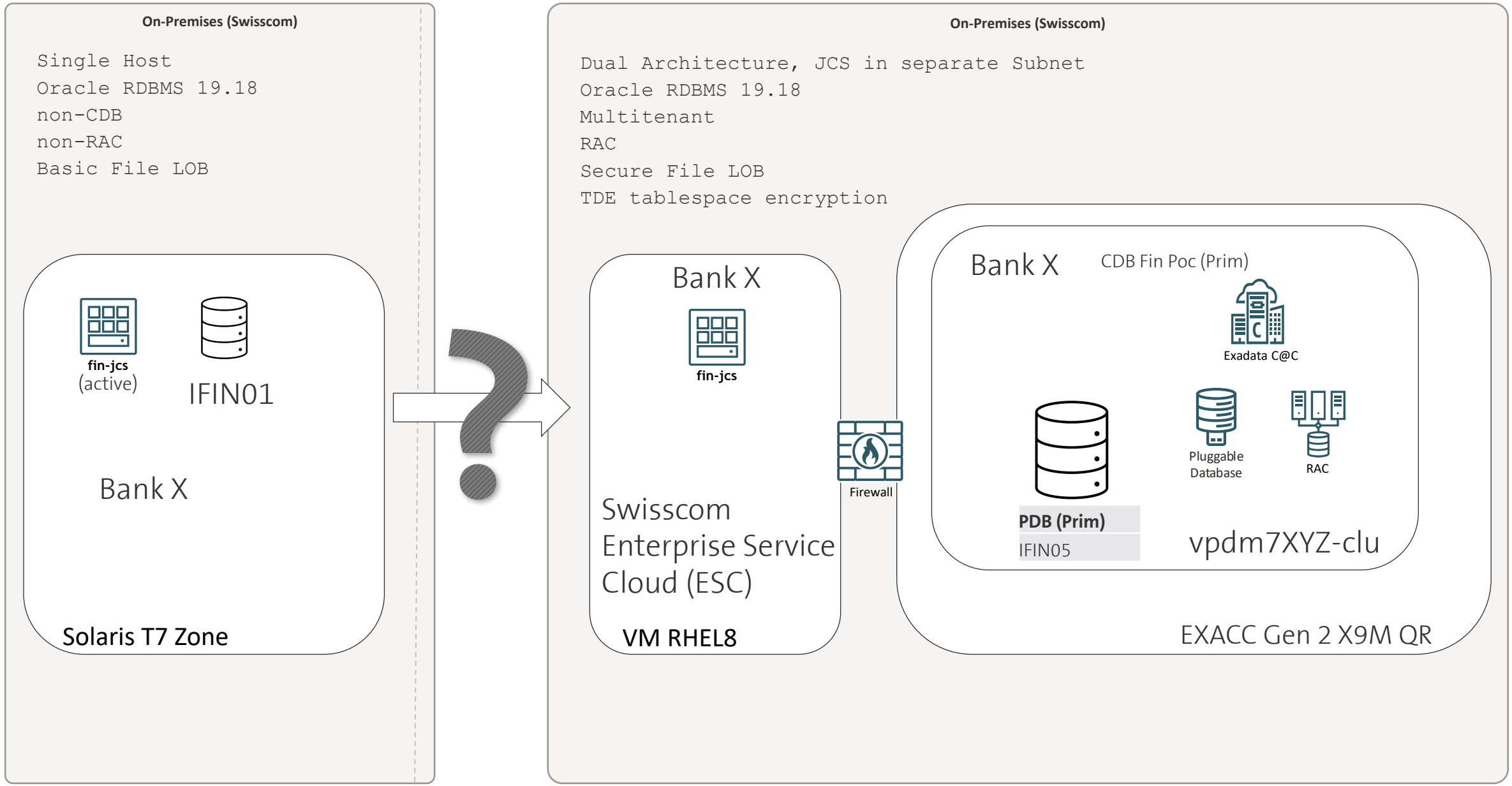
Phase 2 - Performance Tests on ExaCC@ Swisscom on Customer Volume Data with a real bank

Test Finnova on EXACC: Move from Single Host to Dual Architecture?



Goal Phase 2: PoC ExaCC
Finnova FCS application with a real Bank is running on ExaCC with RAC (Real Application Clusters) and Multitenant (RDBMS 19.18)

EOD Processing real Bank

EOP (End of Period, EOD, EOY) calculation for a real customer Bank could be done **without error**

- RAC works
- Multitenant works

Business Regression Test

Relevant Business Regression Test can be done **without problem** caused through the new Setup

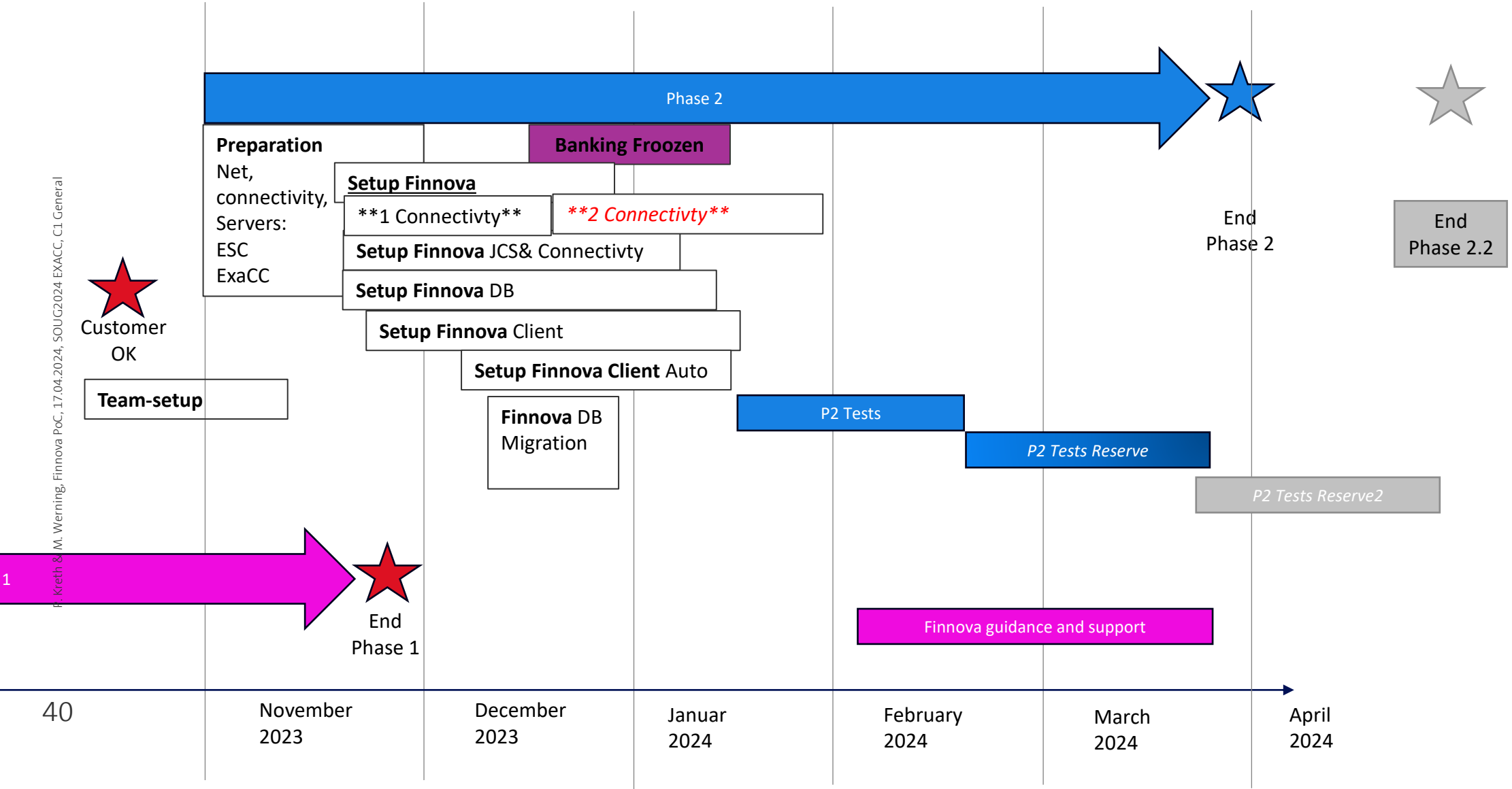
- Finnova Core Gui
- PMS
- Automated Business Regression Test successful

Performance & RAC Waits

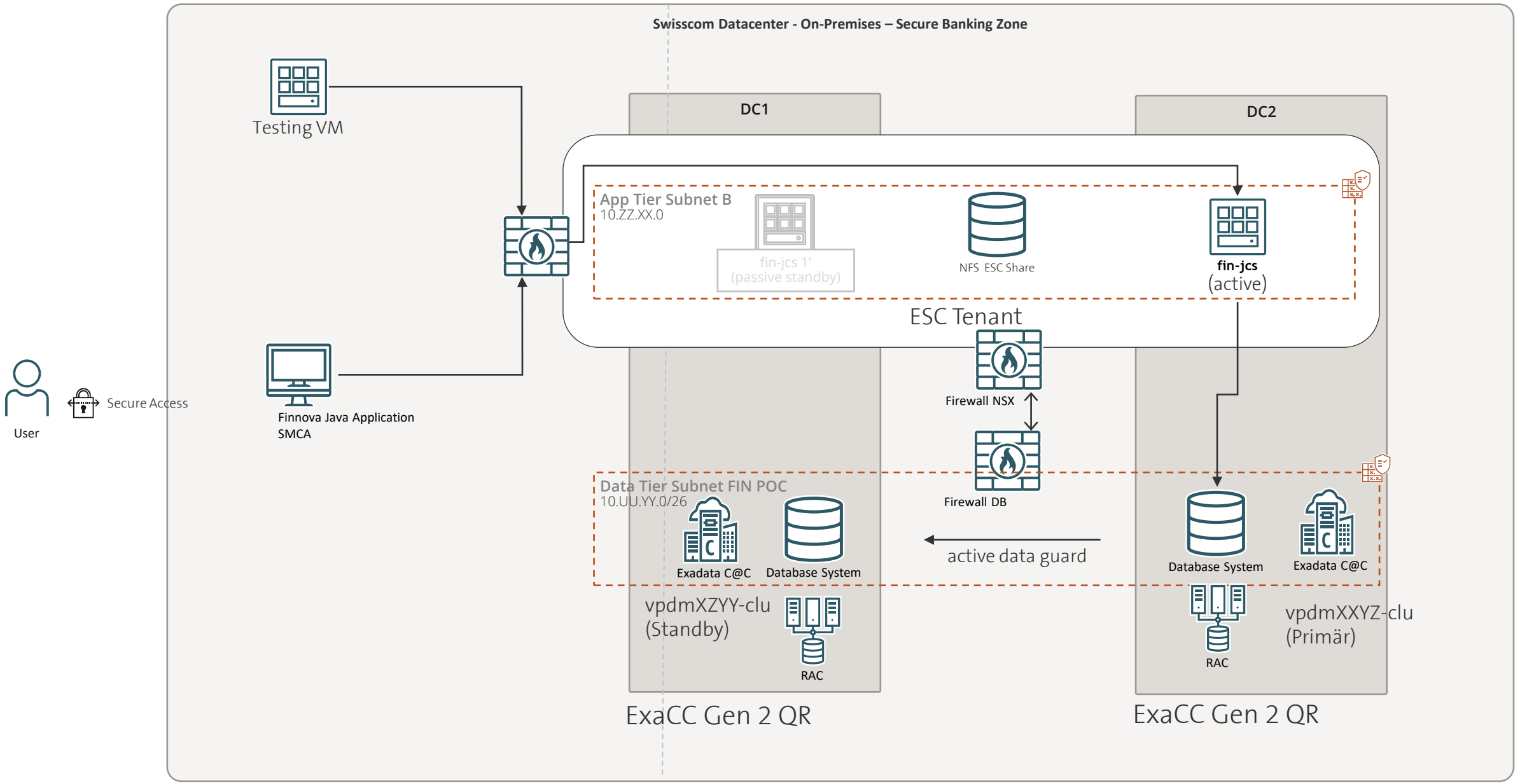
The overall Performance is **better or equal with** the new MAA Setup

- EOD Processing CPU Bound
- RAC/Cluster waits <10 %
- RAC Node workload distribution is not worse than 60%/40%

Planning EXA CC Finnova PoC 2@ Swisscom



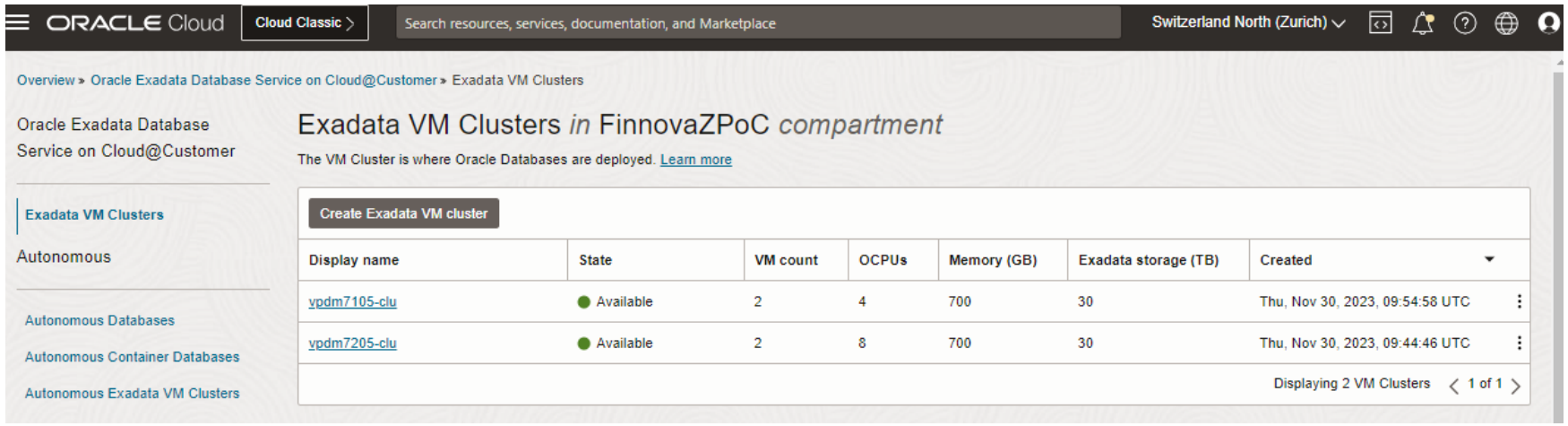
Target Setup: Finnova on ExaCC: Oracle DB on EXA@CC & Application Server on Swisscom ESC



Finnova PoC: Setup

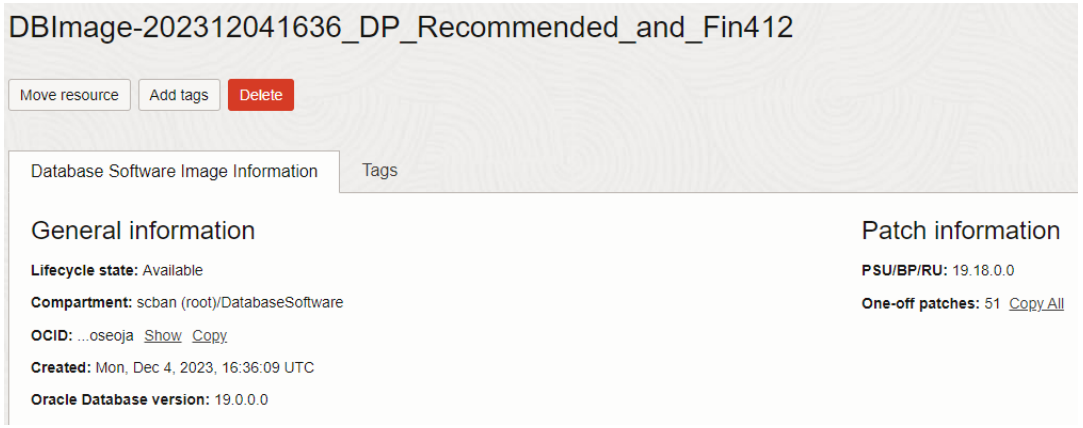
OCI & OS Setup ExaCC VM Cluster

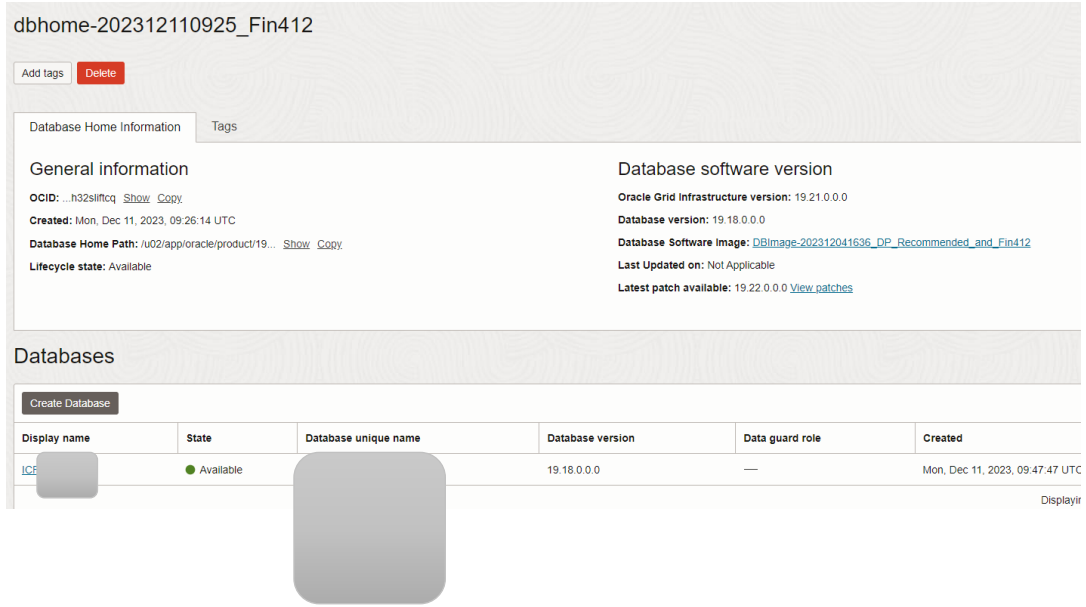
- Setup an Finnova PoC Compartment
- Setup VM-Cluster Network
- Create & Setup VM Cluster
  - Update
  - Swisscom Install necessary Agents
- Register Cluster to OEM Monitoring
- OCI DB Setup
  - DB Home
  - Create CDB
  - Create PDB



OCI EXACC DB Home

19.18 with Finnova recommended Patch + DP BP Patches





Finnova PoC: DB Setup

Finnova DB Setup

- RAC (Real Application Clusters)
- Multitenant
- (Active Data Guard)
- SECUREFILE LOBs
- BIGFILE tablespace
- TDE Tablespace
- CDB AL32UTF8
- PDB WE8ISO8859P15
- Set the DB parameter 1:1 to the environment you compare your results to
  - And double check them on each run.

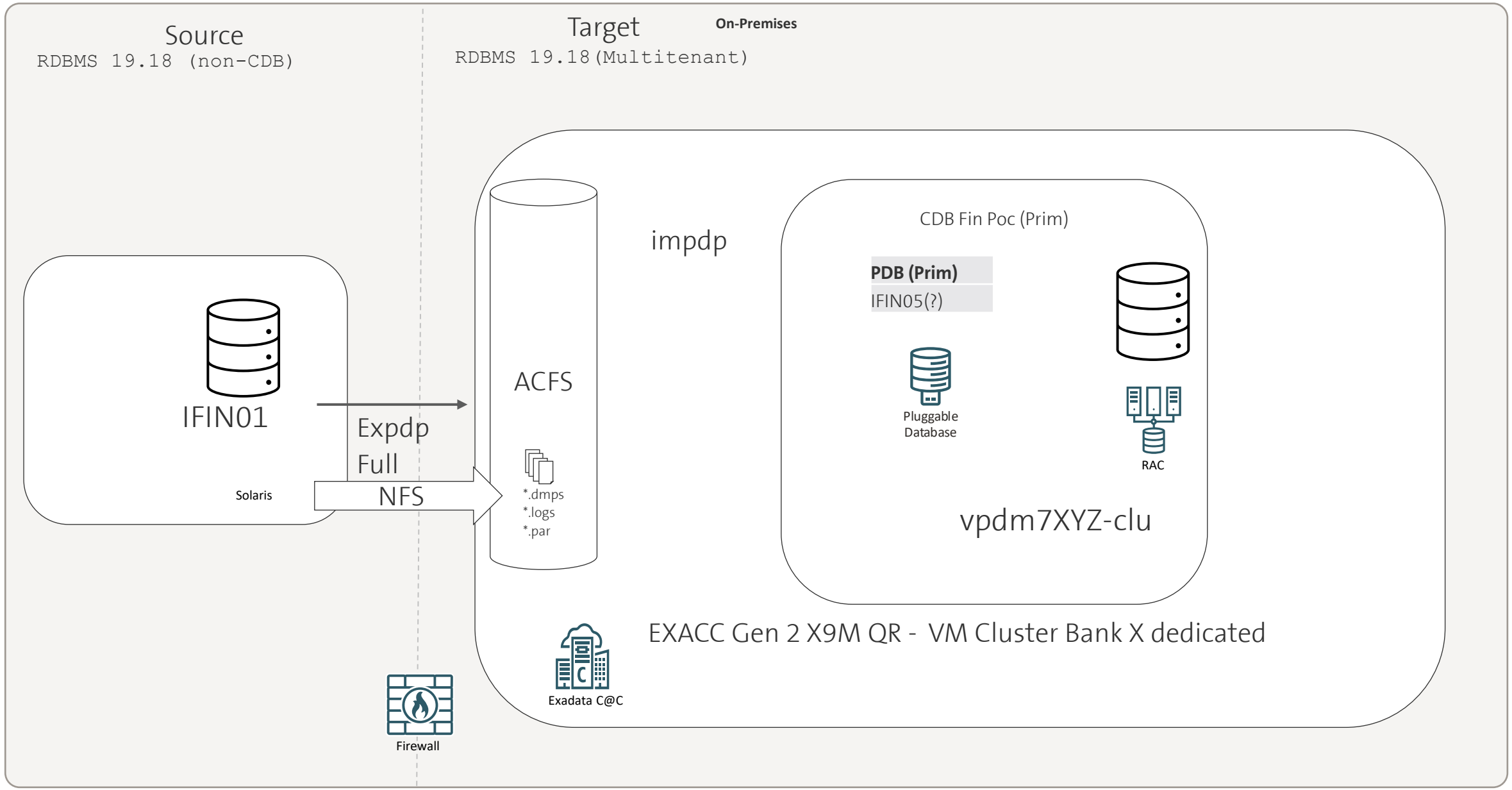
Finnova PoC: Connectivity

Connectivity

- EXACC Network Validation needs reverse DNS entry's (same Checks than the EXACC Prechecker Scripts)
- DB Server to JCS Server needs a lot of connectivity (when in different Subnets)
  - We had to iterative reverse engineer this rules
  - RMI has a random Port Range between tcp30000 - tcp50000 (not configurable?)
- JCS to DB
  - tcp1521
  - tcp6200
- Java Application to JCS
  - More than we thought

Migration

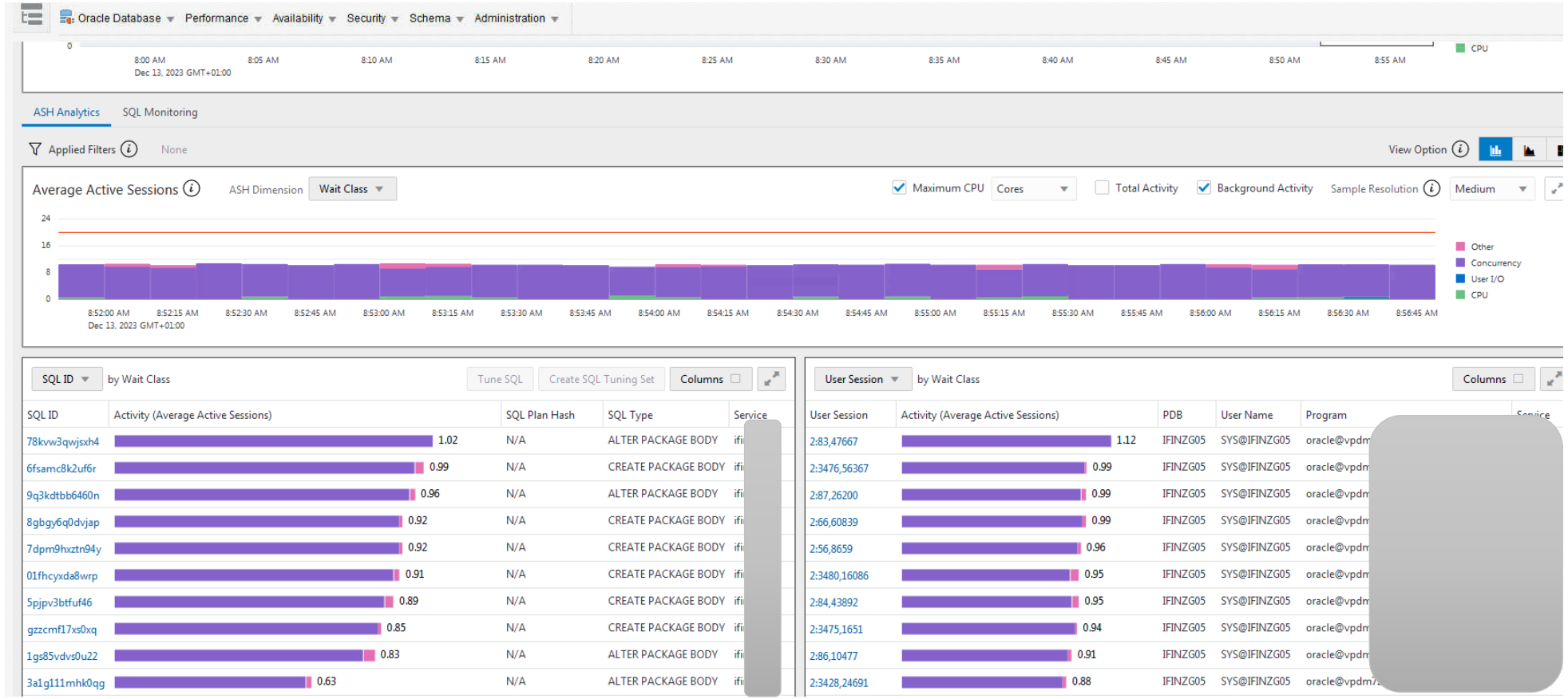
Test Finnova on EXACC: Oracle DB Migration to EXA@CC



DB Data pump Import: first try PACKAGE_BODY : Library Cache Lock Waits

DP Parallel 20 with 20 OPCU per VM without setting **"_lm_share_lock_opt"=FALSE**

packages "create package" and "alter package" operation, => Library Cache Lock Waits because of dependencies

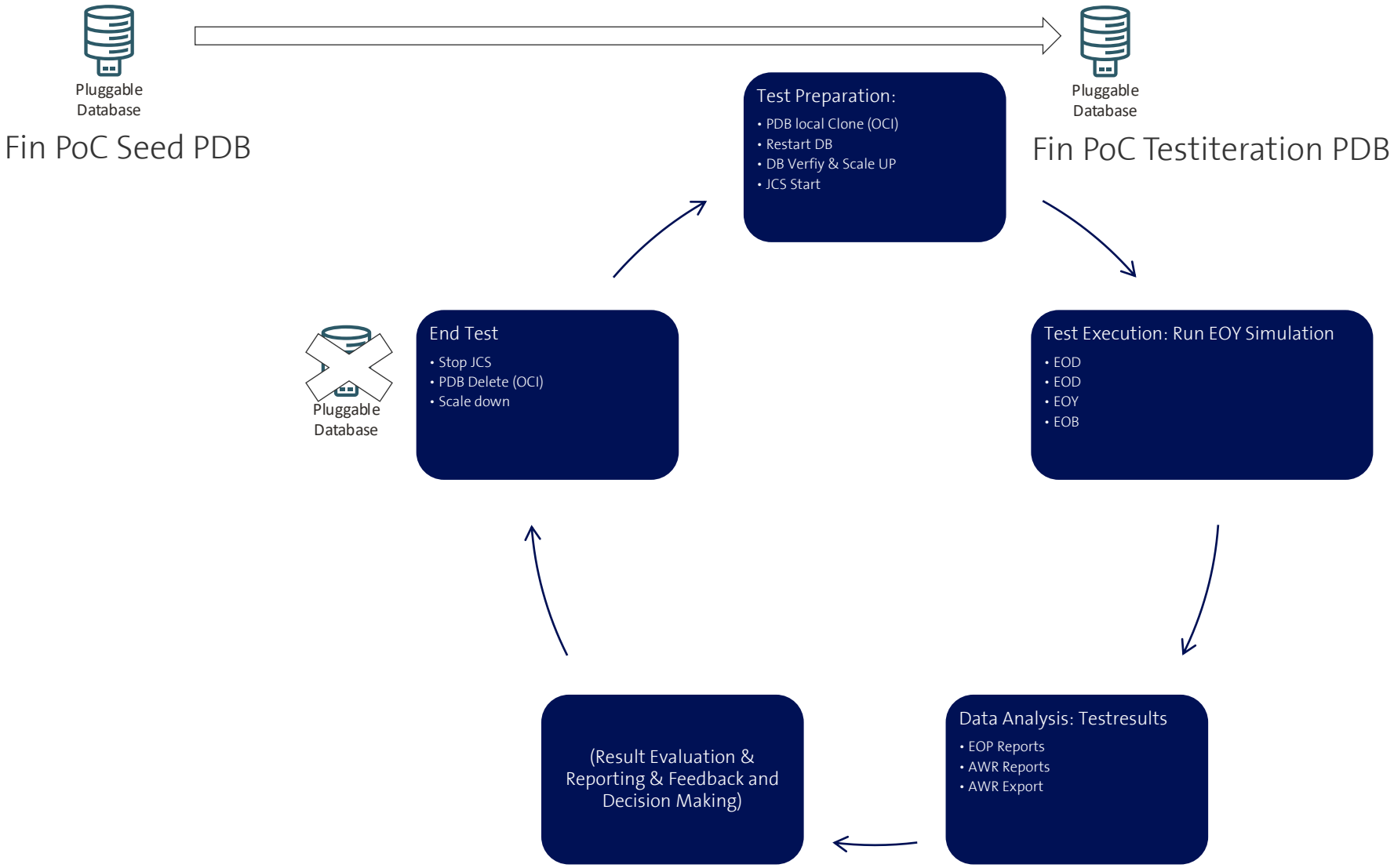


DB Import Tests & Post Import Steps

- Improvement with 2 Step approach:
  - 1. Meta Data Only 2. Data
    - fastest "_lm_share_lock_opt"=FALSE & parallel=1 (02:08:33)
    - Ok "_lm_share_lock_opt"=FALSE & parallel=4 (02:53:09)
- Post Migration Steps needed
  - Post Import Tasks via JCS App Server (Thanks for the guidance from Finnova) and recompiling, all DB objects are now VALID and match the exported data
    - XMLTypes were recreated
    - Queues were recreated
    - DB Users were unlocked
    - Missing GRANTS given

Tests on EXACC

Finnova PoC: Test cylcle, new PDB Clone per Iteration



Get results of test runs

- EOD
  - TEV Detail Steps Runtime Report per EOD:
    - Report detailing the execution times of individual steps within TEV for each EOP
  - Integrated into TEV Workflow:
    - Report or steps are integrated into the overall TEV process flow
    - Report detailing the execution times of individual steps within PMS for each EOP
- OEM Activity Summary
- AWRs
  - AWR auf RAC Instance CDB Level (with Exadata Statics)
  - Generation using SQL Based on EOP Processing Start and End Dates to Create AWR

EOP Comparative Test runs

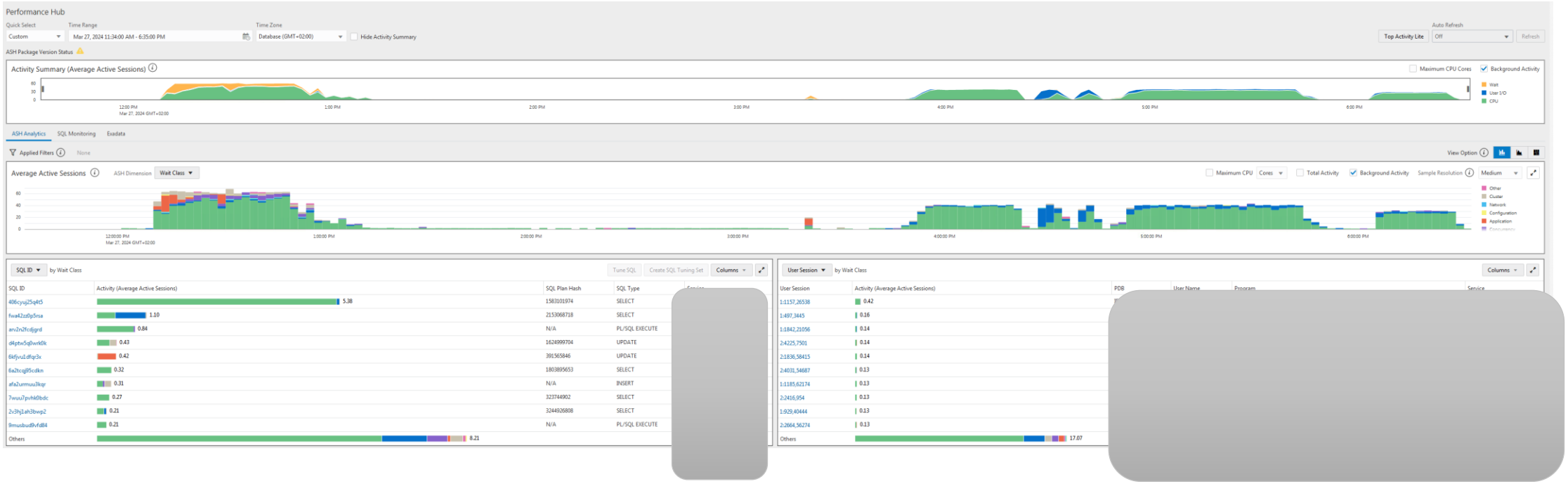
NR	Testplaning EXACC FIN POC Tech	Feature	CPU VM	CPUCount	RAC	DG
TSEXACCENT-317	*TEV (tech)*	mixed One Node /RAC(active+active)	2-16	4-32	mix	no
TSEXACCENT-320	*TEV Comparative Tests*	RAC(active+active)	16	32	active/active	no
TSEXACCENT-325	*TEV Comparative Tests (2)*	RAC(active+active)	16	32	active/active	no
TSEXACCENT-327	*TEV Comparative Tests (3)*	RAC(active+active)	16	32	active/active	no
TSEXACCENT-329	*TEV Comparative Tests (5)*	RAC(active+active)	16	32	active/active	no
TSEXACCENT-333	TEV Comparative Tests (6)- RAC Single Node	RAC(active+passive)	32	64	single	no
TSEXACCENT-336	TEV Comparative Tests (7)- RAC	RAC(active+active)	16	32	active/active	no
TSEXACCENT-340	TEV Comparative Tests (8) - RAC min OCPU	RAC(active+active)	4	8	active/active	no

- Problems, we faced and why we had "some" iterations:
  - VM Cluster not scaled UP
  - FCS Executoren settings were not comparable
  - EOD Settings (Next Date) were not comparable
  - DB Parameter were not comparable from the start (BUFFER Cache)
  - Test Scenario was not optimal at the start
  - Filesystem full, Listener Log ...

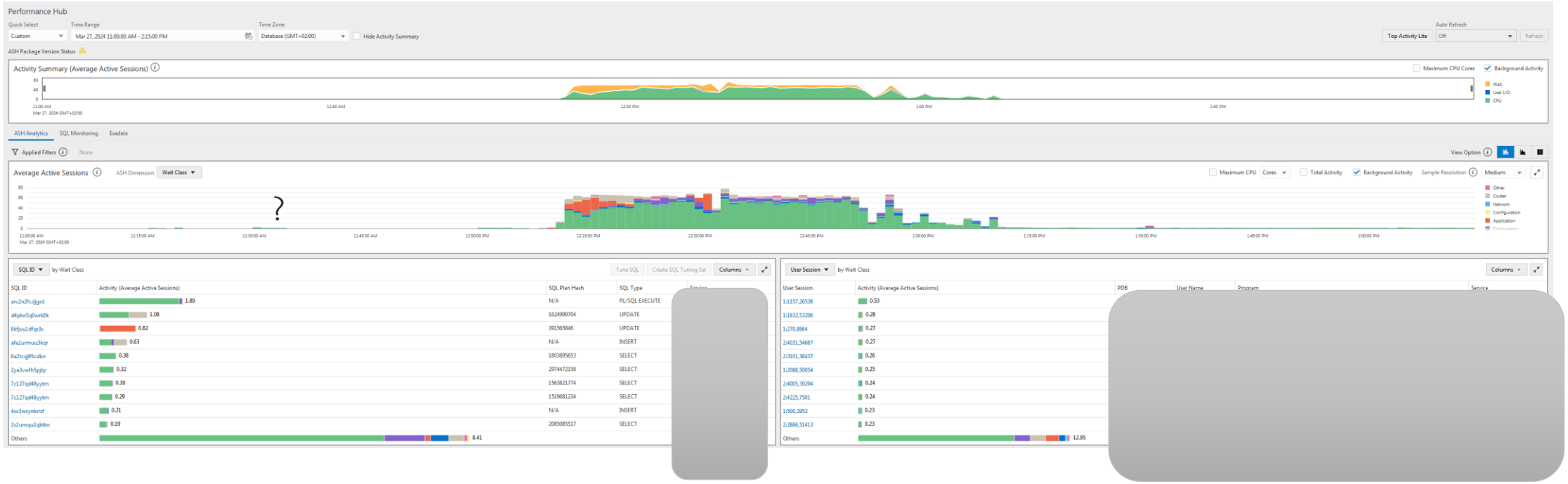
EOY Simulation: 4-5 x EO Calculations per comparative Test run

TEV Date	Laufzeit TEV	Laufzeit TEV I6	Diff T I6	% IFIN01	Ticket	TEV start I7	TEV end I7	Laufzeit TEV	Diff T / I7	% IFIN01	Ticket
Mi, 03.01.2024	00:36:59	00:35:12	00:01:47	5%	TSEXACCEN T-333	28.03.2024 06:34	28.03.2024 07:33	00:59:30	-00:22:31	-61%	TSEXACCEN T-336
So, 31.12.2023	**04:48:32**	**03:00:29**	**01:48:03**	**37%**	**TSEXACCEN T-333**	**27.03.2024 11:00**	**27.03.2024 14:17**	**03:17:09**	**01:31:23**	**32%**	**TSEXACCEN T-336**
Fr, 29.12.2023	00:38:12	00:33:08	00:05:04	13%	TSEXACCEN T-333	26.03.2024 15:32	26.03.2024 16:12	00:40:19	-00:02:07	-6%	TSEXACCEN T-336
Do, 28.12.2023	00:54:21	00:34:25	00:19:56	37%	TSEXACCEN T-333	26.03.2024 14:01	26.03.2024 14:55	00:53:34	00:00:47	1%	TSEXACCEN T-336
Fr, 08.12.2023		00:42:35	#########		TSEXACCEN T-333	26.03.2024 09:31	26.03.2024 10:45	01:13:53			TSEXACCEN T-336

OEM Activity EOY & PMS (7 RAC)



OEM Activity EOY (7 RAC)



AWR EOY TOP10 (7 RAC) CPU bound

2-Node RAC: RAC Node 1

Instance Efficiency Percentages (Target 100%)

Buffer Nowait %:	99.90	Redo NoWait %:	100.00
Buffer Hit %:	99.61	In-memory Sort %:	100.00
Library Hit %:	99.80	Soft Parse %:	98.58
Execute to Parse %:	88.14	Latch Hit %:	99.76
Parse CPU to Parse Elapsd %:	30.65	% Non-Parse CPU:	99.56
Flash Cache Hit %:	100.00		

Top 10 Foreground Events by Total Wait Time

Event	Waits	Total Wait Time (sec)	Avg Wait	% DB time	Wait Class
DB CPU		44.9K		77.9	
library cache: mutex X	444,819	1532.5	3.45ms	2.7	Concurrency
enq: TX - row lock contention	59,534	1484.3	24.93ms	2.6	Application
cell single block physical read: flash cache	2,498,023	814.7	326.15us	1.4	User I/O
gc buffer busy acquire	1,059,999	792.4	747.57us	1.4	Cluster
library cache pin	2,397,953	707.6	295.07us	1.2	Concurrency
enq: UL - contention	6,057	706.3	116.61ms	1.2	Application
row cache lock	1,829,015	610.4	333.71us	1.1	Concurrency
library cache lock	1,542,027	539	349.53us	.9	Concurrency
gc current block 2-way	4,277,416	490.7	114.72us	.9	Cluster

Wait Classes by Total Wait Time

Wait Class	Waits	Total Wait Time (sec)	Avg Wait Time	% DB time	Avg Active Sessions
DB CPU		44,932		77.9	4.2
Concurrency	9,095,063	4,498	494.51us	7.8	0.4
Cluster	13,028,667	2,714	208.31us	4.7	0.3
Application	107,951	2,213	20.50ms	3.8	0.2
User I/O	4,038,145	1,835	454.36us	3.2	0.2
Other	6,901,585	730	105.78us	1.3	0.1
System I/O	2,574,588	514	199.76us	.9	0.0
Configuration	154,228	144	936.90us	.3	0.0
Network	1,037,068	7	6.77us	.0	0.0
Commit	41,249	7	165.21us	.0	0.0

Host CPU

CPUs	Cores	Sockets	Load Average Begin	Load Average End	%User	%System	%WIO	%Idle
32	16	2	27.61	1.18	14.8	1.4	0.0	83.1

Instance CPU

%Total CPU	%Busy CPU	%DB time waiting for CPU (Resource Manager)
14.1	83.2	0.0

RAC Node 2

Instance Efficiency Percentages (Target 100%)

Buffer Nowait %:	99.91	Redo NoWait %:	100.00
Buffer Hit %:	99.68	In-memory Sort %:	100.00
Library Hit %:	99.87	Soft Parse %:	98.92
Execute to Parse %:	88.65	Latch Hit %:	99.70
Parse CPU to Parse Elapsd %:	37.14	% Non-Parse CPU:	99.47
Flash Cache Hit %:	100.00		

Top 10 Foreground Events by Total Wait Time

Event	Waits	Total Wait Time (sec)	Avg Wait	% DB time	Wait Class
DB CPU		41.9K		72.7	
library cache: mutex X	573,211	2290.7	4.00ms	4.0	Concurrency
enq: TX - row lock contention	74,444	1910.7	25.67ms	3.3	Application
library cache pin	4,017,189	1290.6	321.27us	2.2	Concurrency
row cache lock	3,213,174	1118.3	348.05us	1.9	Concurrency
cell single block physical read: flash cache	2,498,321	899.7	360.11us	1.6	User I/O
gc buffer busy release	480,779	662.3	1.38ms	1.1	Cluster
library cache lock	2,044,478	644.3	315.13us	1.1	Concurrency
gc buffer busy acquire	973,247	585.1	601.19us	1.0	Cluster
enq: UL - contention	13,414	577.3	43.04ms	1.0	Application

Wait Classes by Total Wait Time

Wait Class	Waits	Total Wait Time (sec)	Avg Wait Time	% DB time	Avg Active Sessions
DB CPU		41,891		72.7	3.9
Concurrency	12,725,462	6,631	521.10us	11.5	0.6
Cluster	12,485,038	2,771	221.95us	4.8	0.3
Application	130,271	2,513	19.29ms	4.4	0.2
User I/O	3,951,845	1,706	431.71us	3.0	0.2
Other	7,528,721	760	101.00us	1.3	0.1
System I/O	2,756,781	428	155.33us	.7	0.0
Configuration	157,631	141	896.57us	.2	0.0
Network	876,188	39	44.61us	.1	0.0
Commit	39,555	5	118.84us	.0	0.0
Scheduler	3	0	316.67us	.0	0.0
Administrative	2	0	128.50us	.0	0.0

Host CPU

CPUs	Cores	Sockets	Load Average Begin	Load Average End	%User	%System	%WIO	%Idle
32	16	2	25.92	0.62	13.2	1.4	0.0	84.8

Instance CPU

%Total CPU	%Busy CPU	%DB time waiting for CPU (Resource Manager)
13.1	86.3	0.0

RAC / Cluster Waits < 5% ✓

AWR EOY Load Profile (7 RAC)

2-Node RAC: RAC Node 1

	Snap Id	Snap Time	Sessions	Cursors/Session	Instances	Pluggable Databases Open
Begin Snap:	4030	27-Mar-24 11:30:16	481	5.2	2	6
End Snap:	4036	27-Mar-24 14:30:26	478	4.3	2	6
Elapsed:		180.17 (mins)				
DB Time:		961.59 (mins)				

Report Summary

Top ADDM Findings by Average Active Sessions

Finding Name	Avg active sessions of the task	Percent active sessions of finding	Task Name	Begin Snap Time	End Snap Time
Top SQL Statements	24.36	32.60	ADDM:977829987_1_4031	27-Mar-24 11:30	27-Mar-24 12:00
PL/SQL Execution	24.36	21.30	ADDM:977829987_1_4031	27-Mar-24 11:30	27-Mar-24 12:00
Hard Parse Due to Literal Usage	24.36	14.36	ADDM:977829987_1_4031	27-Mar-24 11:30	27-Mar-24 12:00
Top SQL Statements	2.80	54.92	ADDM:977829987_1_4032	27-Mar-24 12:00	27-Mar-24 12:30
Shared Pool Latches	24.36	6.00	ADDM:977829987_1_4031	27-Mar-24 11:30	27-Mar-24 12:00

Load Profile

	Per Second	Per Transaction	Per Exec	Per Call
DB Time(s):	5.3	0.1	0.00	0.04
DB CPU(s):	4.2	0.1	0.00	0.03
Background CPU(s):	0.3	0.0	0.00	0.00
Redo size (bytes):	3,968,221.2	73,479.1		
Logical read (blocks):	208,899.1	3,868.2		
Block changes:	23,773.2	440.2		
Physical read (blocks):	949.6	17.6		
Physical write (blocks):	1,076.9	19.9		
Read IO requests:	588.4	10.9		
Write IO requests:	345.0	6.4		
Read IO (MB):	7.4	0.1		
Write IO (MB):	8.4	0.2		
IM scan rows:	0.0	0.0		
Session Logical Read IM:	0.0	0.0		
Global Cache blocks received:	607.4	11.3		
Global Cache blocks served:	595.8	11.0		
User calls:	146.4	2.7		
Parses (SQL):	1,003.6	18.6		
Hard parses (SQL):	14.3	0.3		
SQL Work Area (MB):	225.9	4.2		
Logons:	6.7	0.1		
User logons:	0.1	0.0		
Executes (SQL):	8,464.3	156.7		
Rollbacks:	24.4	0.5		
Transactions:	54.0			

RAC Node 2

	Snap Id	Snap Time	Sessions	Cursors/Session	Instances	Pluggable Databases Open
Begin Snap:	4030	27-Mar-24 11:30:16	475	5.1	2	6
End Snap:	4036	27-Mar-24 14:30:26	469	4.4	2	6
Elapsed:		180.17 (mins)				
DB Time:		960.12 (mins)				

Report Summary

Top ADDM Findings by Average Active Sessions

Finding Name	Avg active sessions of the task	Percent active sessions of finding	Task Name	Begin Snap Time	End Snap Time
Top SQL Statements	27.62	30.68	ADDM:977829987_2_4031	27-Mar-24 11:30	27-Mar-24 12:00
PL/SQL Execution	27.62	20.15	ADDM:977829987_2_4031	27-Mar-24 11:30	27-Mar-24 12:00
Hard Parse Due to Literal Usage	27.62	15.67	ADDM:977829987_2_4031	27-Mar-24 11:30	27-Mar-24 12:00
Shared Pool Latches	27.62	8.44	ADDM:977829987_2_4031	27-Mar-24 11:30	27-Mar-24 12:00
Java Execution	27.62	5.58	ADDM:977829987_2_4031	27-Mar-24 11:30	27-Mar-24 12:00

Load Profile

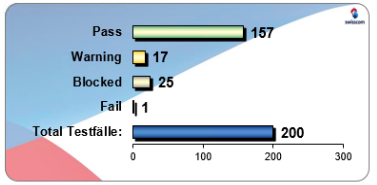
	Per Second	Per Transaction	Per Exec	Per Call
DB Time(s):	5.3	0.1	0.00	0.03
DB CPU(s):	3.9	0.1	0.00	0.02
Background CPU(s):	0.3	0.0	0.00	0.00
Redo size (bytes):	3,881,094.8	66,488.7		
Logical read (blocks):	223,255.9	3,824.7		
Block changes:	26,312.8	450.8		
Physical read (blocks):	855.5	14.7		
Physical write (blocks):	1,015.2	17.4		
Read IO requests:	528.7	9.1		
Write IO requests:	210.2	3.6		
Read IO (MB):	6.7	0.1		
Write IO (MB):	7.9	0.1		
IM scan rows:	0.0	0.0		
Session Logical Read IM:	0.0	0.0		
Global Cache blocks received:	595.9	10.2		
Global Cache blocks served:	607.4	10.4		
User calls:	164.7	2.8		
Parses (SQL):	1,234.0	21.1		
Hard parses (SQL):	13.3	0.2		
SQL Work Area (MB):	243.7	4.2		
Logons:	7.3	0.1		
User logons:	0.1	0.0		
Executes (SQL):	10,872.1	186.3		
Rollbacks:	26.9	0.5		
Transactions:	58.4			

RAC Node workload distribution ✓

Other Testcases

NR	Testplaning EXACC FIN POC Tech	Feature	CPU VM	CPUCount	RAC	DG
TSEXACCENT-323	Automated Business Regression Test (tech test)					
TSEXACCENT-331	Automated Business Regression Test		16	32		no
TSEXACCENT-332	AC Test1 Patching EXACC Infra (without setup change)					no
TSEXACCENT-335	PMS Business Regression Test	RAC(active+passive)	32	64	single	no
TSEXACCENT-339	Performance Test ZV	RAC(active+passive)	32	64	single	no
TSEXACCENT-336	Performance Test ZV	RAC(active+active)	16	32	active/active	no
TSEXACCENT-336	PDB Local Clone Force local false		16	32	active/active	no
TSEXACCENT-321	PDB Local Clone Force local true		16	32	active/active	no

Automated Business Regression Tests



Total Iterationen: 306

swisscom

Testset	Env	TechUser	Run time AVG	RunStatus	Run time EXACC
VTP-Basic	IMP5	**Admin1**	2h	✓	1h 50m
VTP-Run	IMP5	**Admin1**	2h 45m	✓	2h 40m
VTP_Spez	IMP5	**Admin2**	2h 30m	✓	2h 05m
RTP_A2	IMP5	**Admin2**	2h	✓	1h 55m
RTP_MTP	IMP5	**Admin6**	4h 40m	✓	4h
RTP_U1	IMP5	**Admin4**	5h 30m	✓	4h 50m
RTP_U2	IMP5	**Admin5**	3h 30m	✓	3h 05m
RTP_ZA1	IMP5	**Admin3**	2h	✓	1h 42m
RTP_ZA2	IMP5		2h 30m	✓	2h 15m
RTP_nEoD	IMP5		15m	✓	10m

Problems:
Gui freezes on Logout, because of missing connectivity .
Blocked, Warning, Failed were not applicable

Finnova PoC EXACC Tipps & “Lessons Learned”

- Runtimes FCS EOP: Sometimes a run takes more time but the why is not clear from DB site.
- Team: PL, Test manager, Connectivity, DBA & Finnova AM/AO
  - get a Test manager, comparative Tests are time consuming
    - A lot of data is generated and has to be interpreted
  - Verify that you have all the detail data you need for your comparative test from the environment you compare to
- Connectivity
  - Dual Architecture in different subnets, challenging...
- DB: Increase default AWR & log retention
- DB Setup & OCPU Scaling should match Application parallel settings

Results & Conclusion

Results Phase 2: PoC ExaCC
Finnova FCS application with a real Bank is running on ExaCC with RAC (Real Application Clusters) and Multitenant (RDBMS 19.18.)

EOD Processing real Bank

EOP (End of Period, EOD, EOY) calculation for a real customer Bank could be done without error ✓

- RAC works ✓
- Multitenant works ✓

- No errors in EOD caused by the new Architecture

Business Regression Test

Relevant Business Regression Test can be done without problem caused through the new Setup

- Finnova Core Gui ✓
- PMS Checks ✓
- Automated Business Regression Test successful ✓

- All (applicable) Business Regression Test successful

Performance & RAC Waits

The overall Performance is better or equal with the new MAA Setup

- EOD Processing CPU bound ✓
- RAC/Cluster waits <10 % ✓
- RAC Node workload distribution is not worse than 60%/40% ✓

- Performance ok (some activity to be analyzed)
- The Cluster/ RAC overhead is considered acceptable

PoC Avaloq & Finnova on Exadata successfully carried out!

Remark: no tuning before / during PoC's

Avaloq & Oracle DB update
Release Upgrade from 4.10/19.10 to 5.2/19.13 was **30% faster than** on IBM P9.

Backup/Recovery
Fast Recovery with RMAN Roll Forward Image Copy are **extremely fast** (took 6 min. to complete)

Performance
End of Day was **50% faster than** on IBM P9
OLTP Testing with 4'500 concurrent users showed on avg. **40% better Response Times**

avaloq

Exadata X8M-2 Half Rack

Phase 1 PrePOC OCI Test
Finnova, Oracle and Swisscom test **successfull**

Automated Business Regression Test
159 successfull (all matching)

Dual Architecture
New architecture: DB & App separated;
DB: with Multitenant, RAC

Performance
End of Year and End of Day **up to 40% faster** than on Oracle T7 Solaris

finnova.

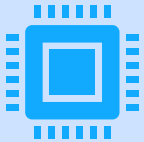
ExaCC X9M-2 Quarter Rack

Next Steps & Timeline

> **“Finnova wants to support/release the "Oracle Exadata" as soon as possible as an alternative to, for example, Oracle Solaris (and other OS) for the "Finnova Core Suite." Finnova is working hard to ensure that the first banks/bank towers can migrate by 2025."”**

finnova AG Bankware (translated)

Next Steps PoC



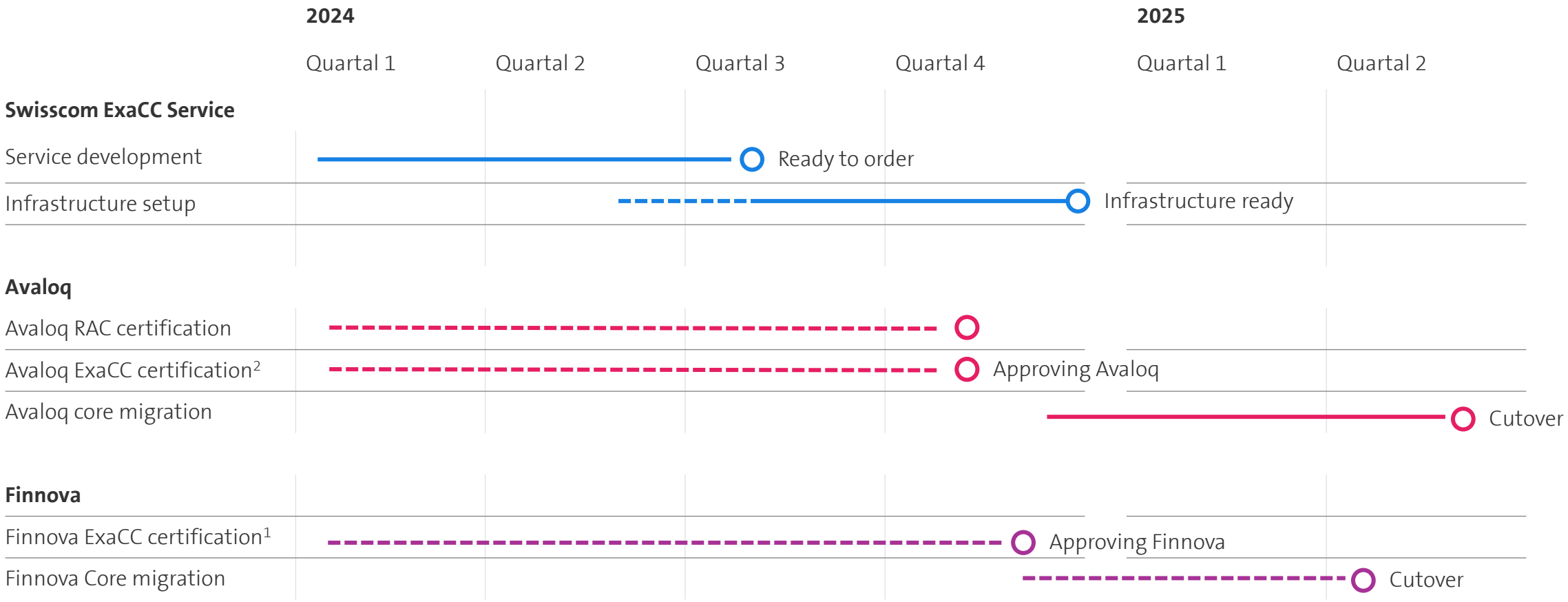
Finish the open Testcases

Analyze the gaps in workload Application Continuity (AC)

Data guard

Support Finnova in the Certification of ExaCC, RAC and Multitenant on 19C

Timeline



[1] Finnova wants to support/release the "Oracle Exadata" as soon as possible as an alternative to, for example, Oracle Solaris (and other OS) for the "Finnova Core Suite." Finnova is working hard to ensure that the first banks/bank towers can migrate by 2025." finnova AG Bankware (translated)
[2] Swisscom's estimation, which is in discussion with Avaloq


Thank you! Questions?

Contact

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