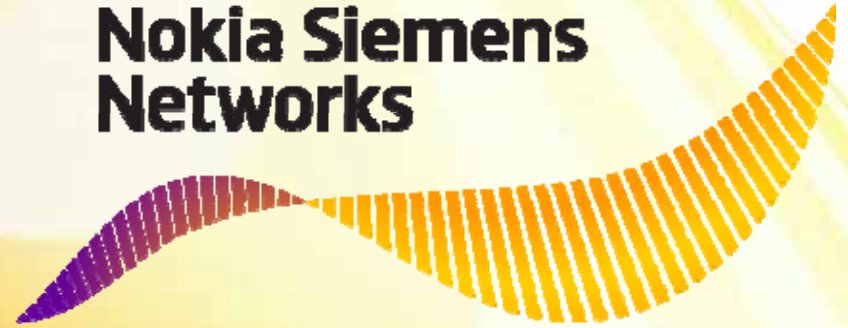


Nokia Siemens Networks



Performance Prototyping einer Convergent Charging Lösung

Nokia Siemens Networks, Rüdiger Hell

Nokia Siemens Networks Worldwide Online Charging Business

Proven Experience and Capabilities:

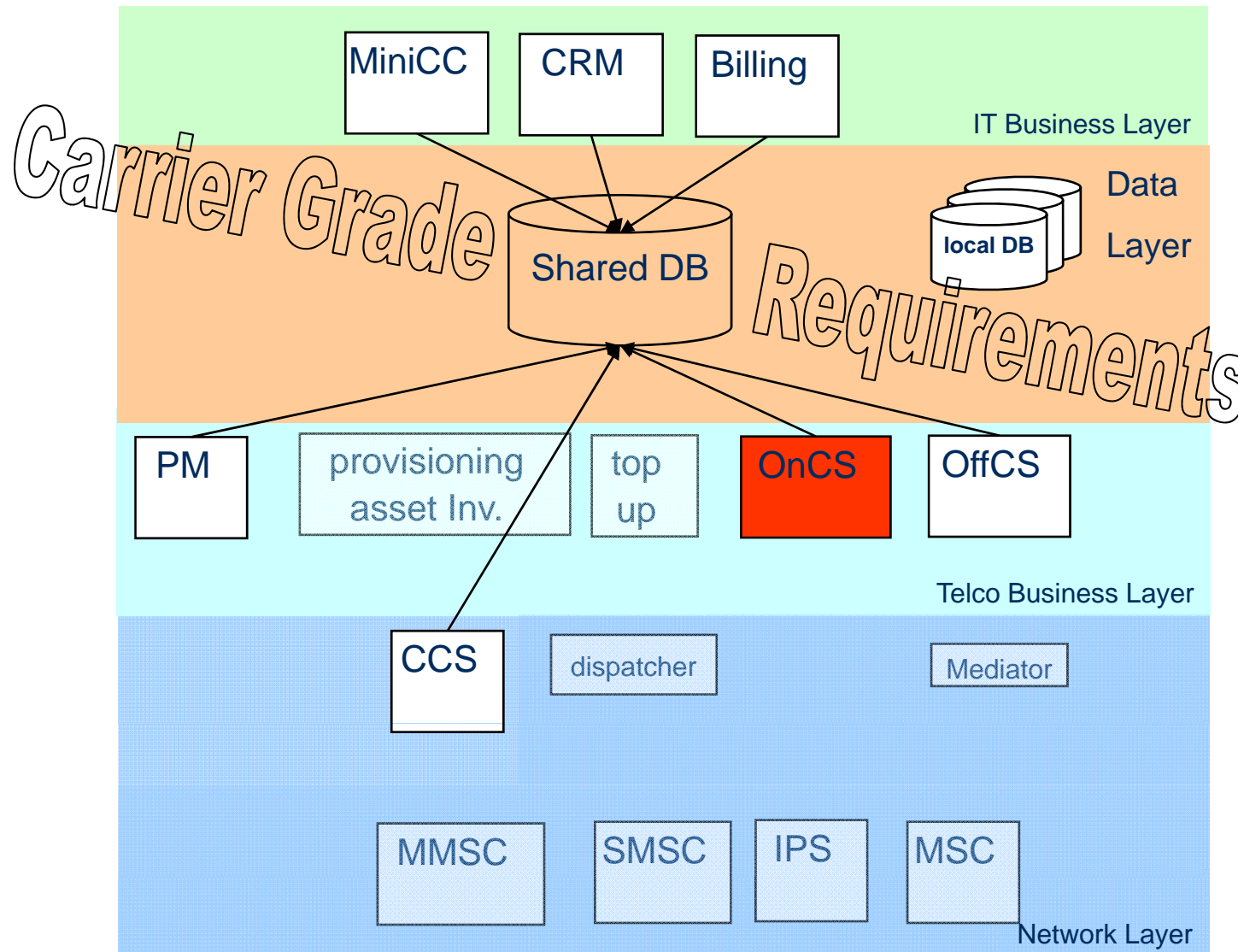
- More than 108 customers in 63 countries
- Servicing more than 240 m online subscribers
- More than 70 Customer Care projects
- The first converged solution in commercial use
- Customization & integration of numerous billing systems

Portfolio:

- Prepaid
- Home Zone Billing
- Convergent Charging
- Customer Care

Overview

Usage by several Applications



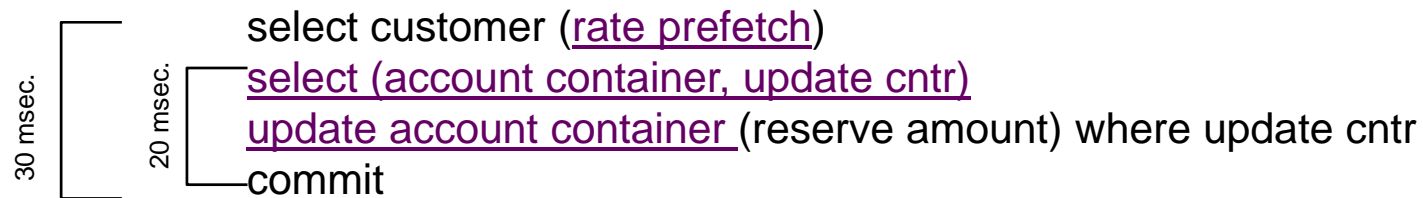
- q95, q99 of response time
- call failure rate
- zero down time
- life cycle aspects
- overload protection
- operator free operation

Requirements for the DB Layer of an Online Charging Server

- 30 mio. customer
 - support of group structures → lock conflicts
 - 90% single member customer, 10% group customer with 5 member
- 1 BHCA per customer on a 10 hours business day → connection of throughput and volumetric
 - a load of **30 MBHCA** has to run over **10 hours**
 - 300 mio. calls per day → replication to disaster recovery side and Event History Server
- MOC simulation, i.e. 2 transactions per call
- 30 msec. 95% quantile of processing time in the first call segment (time between customer prefetch and commit)
- call failure rate less then 0,01 % (1 out of 10.000 calls could be lost)
- 99,999% availability (5 min. downtime per year)
- physical representation of the logical data model
- service management: 300000 inserts of customers
- DBA/GTO: update run in 4 hours

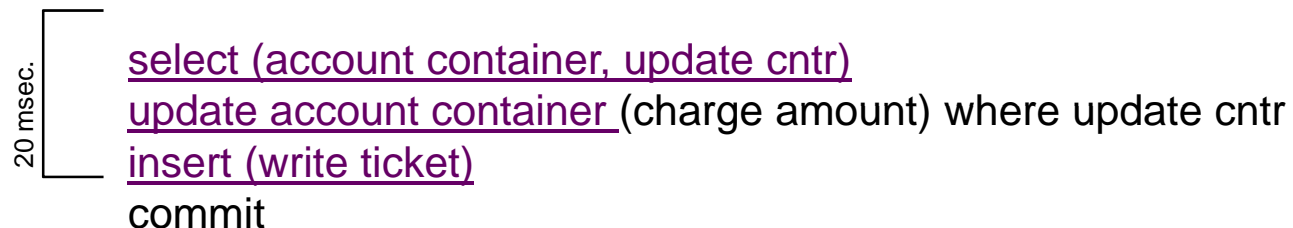
Call Flow for a typical MOC-Call

Call Setup Phase

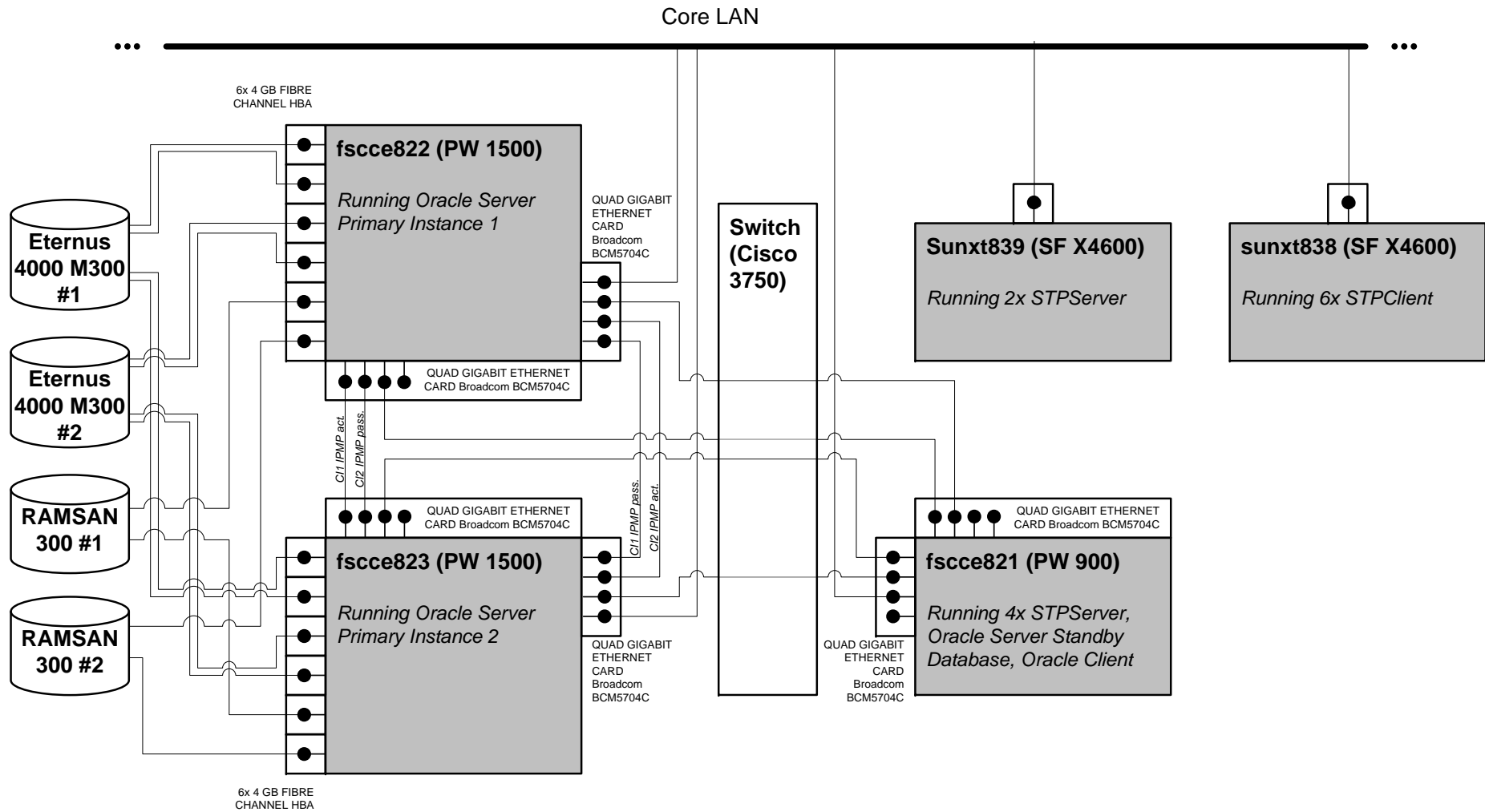


90 sec. Call Duration

Call Termination Phase



Test-Environment Hardware Setup



Test-Environment Software

- DB server
 - Solaris 10-6/06
 - Oracle 10.2.0.3
 - ASM 10
 - CRS 10.2.0.3
 - 2 PrimePower 1500 with 32 x 1,89 GHz CPUs, 128 GB main memory
 - 2 Eternus4000-300 storage, 4 GB cache, 106 x 146 GB disks
- STPserver + Standby DB
 - Solaris 10-6/06
 - Oracle 10.2.0.3
 - ASM 10
 - CRS 10.2.0.3
 - JDK 5
 - PrimePower 900 with 16 x 1,89 GHz CPUs
 - Cx300 storage
 - SF x4600 with 2 x 8 x 2,7 GHz CPUs
- STPclient
 - SF x4600 with 2 x 8 x 2,7 GHz CPUs
 - Solaris 10-6/06
 - JDK 5

Test Scope

1. Compare the **data models** GDM, GEN, TKS large customer!
 - 16 – 32 MBHCA, 1600 connections, ticketing, update batching, client side data access, 6 mio. customer
2. Compare the **small and the large** customer provisioning for the chosen DM!
 - 16 – 32 MBHCA, 1600 connections, ticketing, update batching, client side data access , 6 mio. customer
3. What is the impact of a data dependent routing (**DDR**) on application layer to the server utilization or performance?
4. What do we gain through a **Solid State Disk** (RamSan300) for Oracle redo log files?
5. The data model supports group and family structures. We compare an application layer based optimistic **locking** and a DB layer based explicit locking!
6. Does the **number of connections** has a significant impact on server utilization or performance?

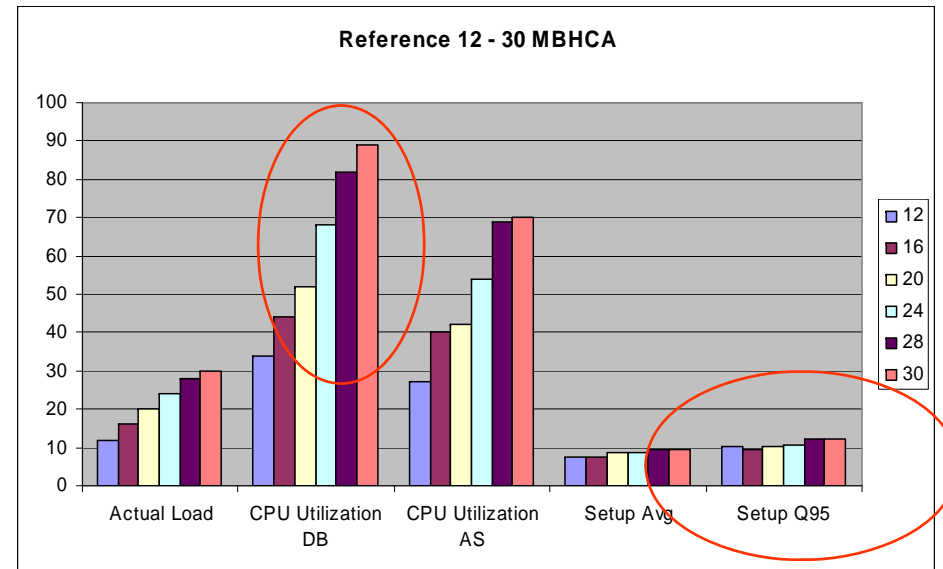
Results Summary

- the performance requirements can be fulfilled
 - 30 MBHCA with 30 msec. response time
 - when complex data dependent routing algorithms are implemented on application side
 - when solid state disks (RamSan300) are used to store redo log files
 - with high end tuning from Oracle experts

Results

Reference Measurement

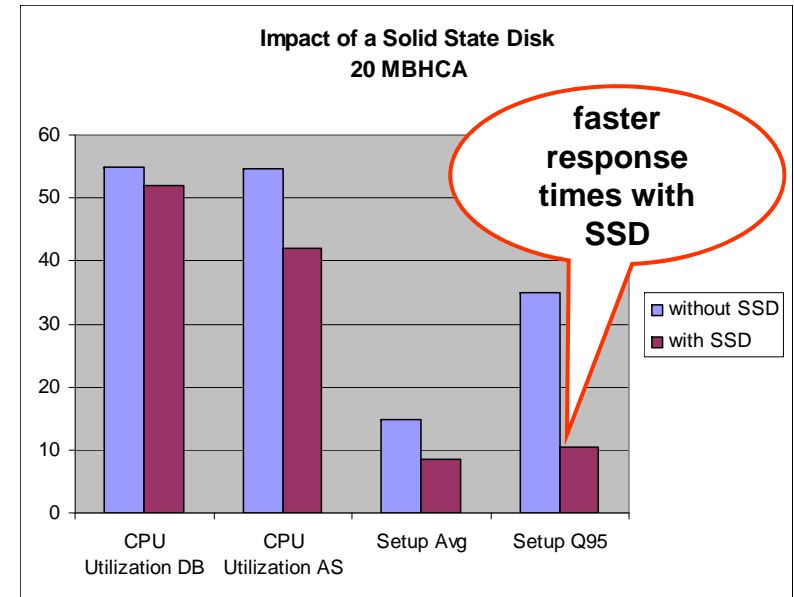
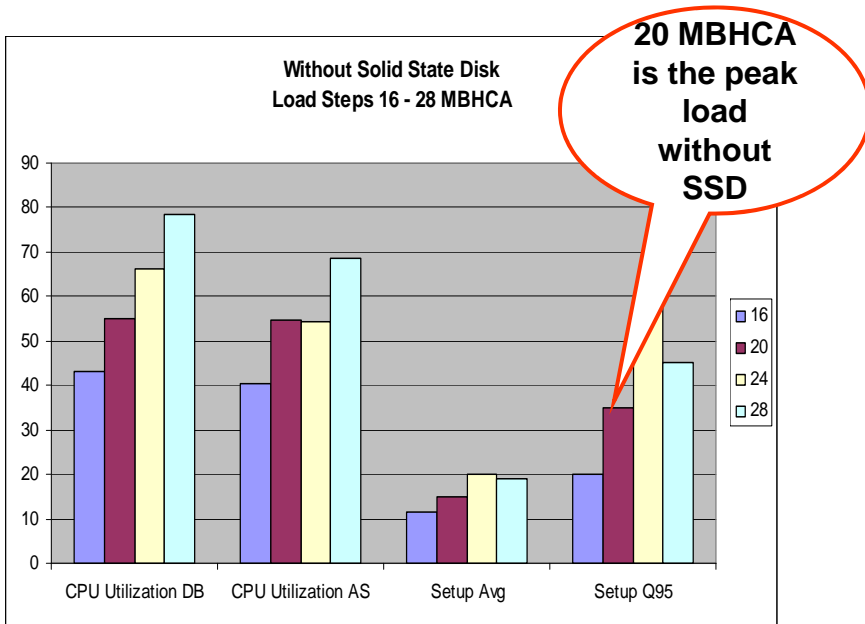
- 12 – 30 MBHCA
- stable response times in average and quantile value
- proportional increase in CPU utilization
- stable load curve
- almost all CPU power used by Oracle server processes (connections)



Loadstep 13: 30000 kBHCA (02:14:44 - 06:14:48; 120561562 Calls)

Processgroup	ms/call (fscce822)	ms/call (fscce823)	ms/call (total)	Percent
DBWR	0.33	0.31	0.32	5.32 %
FG	5.47	5.11	5.29	88.15 %
LGWR	0.18	0.18	0.18	2.97 %
LMS	0.05	0.05	0.05	0.79 %
OCR	0.01	0.01	0.01	0.18 %
OTHER_ORA_BGS	0.04	0.05	0.05	0.77 %
other	0.11	0.10	0.11	1.81 %
total	6.19	5.81	6.00	100.00 %

Results - Impact of a Solid State Disk (I)

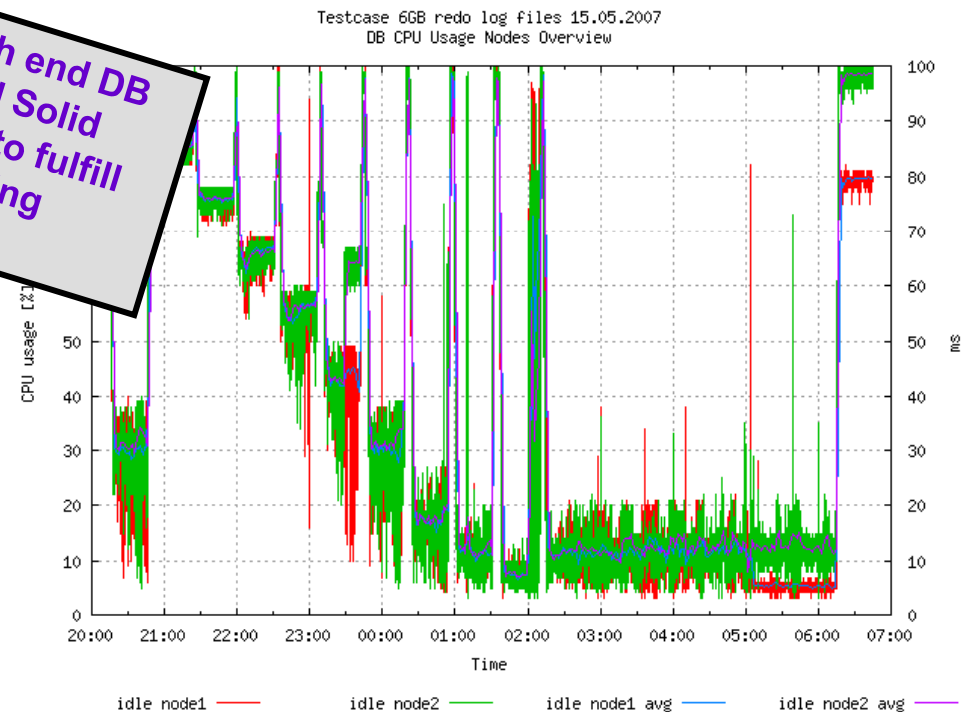
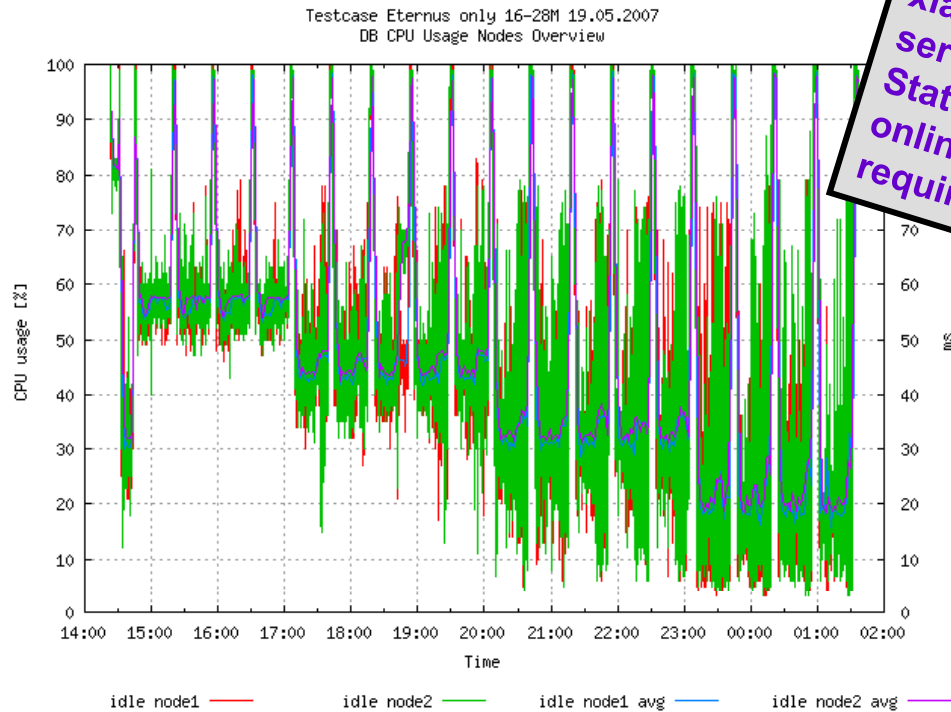


- Solid State Disks are needed to store Oracles redo log files
- peak load without SSD: 20 MBHCA
- peak load with SSD: 30 MBHCA
 - limited by server CPU power (90% CPU usage)
- functional alternative to a SSD could be a transaction handling with “commit_nowait”
 - potential loss of transactions (charge, recharge) in case of node panic
 - no fault intrusion tests done yet
 - low cost alternative

Results - Impact of a Solid State Disk (II)

16 – 28 MBCA without SSD

4 – 32 MBHCA with SSD



xlarge, high end DB server need Solid State Disks to fulfill online charging requirements

- high oscillation of CPU usage
- rather unstable system behavior

- only a few, small peaks
- stable, almost real time behavior

The logo consists of a stylized wave shape composed of many thin, parallel lines. The color transitions from purple on the left to yellow on the right. The text "Nokia Siemens Networks" is positioned to the right of the wave.

**Nokia Siemens
Networks**

Thank you for your attention!
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