IBM Symposium - 2011
Verbesserte Performance und neue Möglichkeiten für IBM i Umgebungen mit POWER7, DS8800 und Virtualisierung

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Agenda - 1

- Who is UniCredit Global Information Services GmbH - UGIS

- Power 795 upgrade
  - Situation before upgrading to POWER7
  - Perfect synergy by putting IBM i & AIX workload on the same box
  - Other considerations on the ways to Power 795 & VIOS
  - Upgrade from POWER6 595 to Power 795

- UGIS IBM Power System environment

- The way to virtual I/O in UGIS
  - How are we implementing virtualization for disk
  - How are we implementing virtualization for network
  - Some findings
  - What's missing to use VIO Server in production
Agenda - 2

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- Why are we using external storage

- Performance test results and suggestions for DS8800
  - DS8800 POC performance test – Target / Scope
  - Test Phase 1 – Scalability of DS8800
  - Test Phase 2 – VIOS / NPIV attachment
  - Test Phase 3 – Solid State Disks (SSD)
  - Overall Summary
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Who is UniCredit Global Information Services GmbH - UGIS

- UGIS is the IT provider of the UniCredit Group
  - About 4,500 employees
  - 19 Sites in 8 countries
  - 3 global Data Centers
  - About € 1.5 billion turnover

- iSeries Large User Group Member (LUG)

UNICREDIT GROUP AT A GLANCE

- Employees: over 162,000
- Branches: over 9,600
- Banking operations in 22 countries
- International network in ~ 50 countries
- Total Assets: € 929 billion
- Market Leader in Central Eastern Europe (CEE)

Source: UniCredit Group profile as of Dec. 31st 2010
UGIS - Main IBM i customers
We represent the core IT Operations platform for 18 Banks in 14 Countries

UniCredit Bank Banja Luka (Bosnia & Herzegovina)
UniCredit Bank Bosnia & Herzegovina
UniCredit BulBank (Bulgaria)
UniCredit Bank Hungary
UniCredit Jelzaogbank (Hungary)
UniCredit Bank Latvia
UniCredit Bank Lithuania
UniCredit Bank Estonia
UniCredit Tiriac Bank (Romania)
UniCredit Bank Serbia
UniCredit Bank Slovenia
UniCredit Bank Slovakia

Fineco Prestiti
UCFin Germany
UCFin Bulgaria
UCFin Italy
UCFin Czech Republic

UniCredit BA’s Export Financing & Cash Management Departments

SG Splitska Banka, decentralized support
Applications running on IBM i

- There are two different groups of customers running on IBM i and both are using a different set of applications:
  1. Core Banking System: within the group developed RPG application (all performance graphs are based on this application)
  2. Banking System focused on Credit Cards and Loans: externally developed COBOL application
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Technical Overview
Situation before upgrading to POWER7

Upgrade Scenario to Power7 795

**current situation**
2010-11

Location 1

Two Power6 595 server

Four Power5 570 server

Location 2

Two Power6 595 server

Four Power5 570 server

Upgrade Scenario:
595 to Power7 795

Location 1

One Power7 795 server

One remaining Power6 595 server
(no 570)

Location 2

One Power7 795 server

One remaining Power5 595 server
(no 570)
Proposal to implement two Power 795

Starting Situation
- 2 POWER6 Model 595 were used for IBM i and 8 POWER5 / 6 Model 570 were used for AIX workload
- Based on customer requirements 18 additional single processor activations were needed for IBM i
- For TSM growth 10 additional processor activations were needed for AIX

Target Scenario
- Upgrade of two POWER6 Model 595 servers to Power 795 instead of single processor activations at same cost
- Consolidation of eight servers Model 570 and two Model 595 into two Power 795 server
- The relevant IBM i-, TSM-, AIX- and VIOS workload can be distributed to distinct LPARs on the two Power 795 servers
Proposal to implement two Power 795

Advantages
- Prevention of step cost from separate stand alone investment for upgrade to Power 795 servers
- Upgrade to Power 795 covers all current demands and eliminates 8 Model 570 server
- Following cost savings can be achieved
  - Separate Upgrade Investment for POWER7
  - HW/SW-Maintenance
  - DC Power Consumption
  - DC Floor Space

Total Savings of approx. Euro 700k within 4 years
Perfect synergy by putting IBM i & AIX workload on the same box

- With our **IBM i workload** we need **too much High Speed IO slots** on one Power 795 in relation to the now available number of CPUs.

- With our **AIX workload** we need a **lot of CPUs** with only a **few IO cards**.

<table>
<thead>
<tr>
<th></th>
<th>IBM i</th>
<th>AIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPUs used</td>
<td>22</td>
<td>34</td>
</tr>
<tr>
<td>How many VIO server</td>
<td>4</td>
<td>2 (+2 SEA)</td>
</tr>
<tr>
<td>Number of FC cards</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>Most utilized resource</td>
<td>I/O load</td>
<td>Network traffic</td>
</tr>
<tr>
<td>Client LPARs per server (Prod, Test, Backup)</td>
<td>~ 17</td>
<td>~ 50</td>
</tr>
<tr>
<td>Attached disk space per server</td>
<td>~ 65 TB</td>
<td>~ 4 TB</td>
</tr>
<tr>
<td>Backup</td>
<td>Directly to tape</td>
<td>TCP/IP – IBM TSM</td>
</tr>
<tr>
<td>Attached storage</td>
<td>IBM DS8000</td>
<td>EMC, NetApp</td>
</tr>
</tbody>
</table>
Other considerations on the way to Power 795

“No” single point of failure

- Multipath: When using SAN attached disks we decided to implement multipath for all LPARs
- Having multipath requirement, at least 2 FC adapters per LPAR are needed

We hit the limit of high performance slots within our Power 795

- One solution is to consolidate large LPARs on 8 GB adapter instead of 4 GB
- Other solution is to use VIOS / NPIV for all small LPARs as well as for tapes
Other considerations on the way to Power 795

- With the number of LPARs on one server it gets impossible to coordinate down times with our customers
  - By using partition hibernation we can shut down test LPARs even while long running batch jobs are currently executed
  - By using Live Partition Mobility we will be able to move the LPARS to an other server without interrupting the business

- Processor power shortage in the case of planed or unplanned server down times
  - Using PowerFlex we are able to have 4 Power 795 systems in one “capacity pool”
  - Nice add-on: On/ Off Processor Days for short term projects (960 Temporary Capacity on Demand units per node – but no main storage activations)
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UGIS IBM Power System environment

Location 1
2 Power7 795 FHB

IBM i LPARs:
Production 15
Test/Development 11
Backup 8
AIX about 50

Location 2
2 Power7 795 FHB

IBM i LPARs:
Production 15
Test/Development 11
Backup 8
AIX about 50

Tape Roboter
IBM TS3500

16 Tape3592 EDB Drives for IBM i
20 Tape3592 EDB Drives for ITSM

Metro Mirror

Capacity:
241 TB net
453 TB gross
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The way to virtual I/O in UGIS - History

- **February 2009:** Migration from **POWER5** to **POWER6**

- **May 2009:** 1st **virtual I/O server implementation** for IBM i, AIX and Linux
  - VIOS holding all the discs; attached via 4Gb FC adapter
  - Mapped to IBM i client LPAR using vSCSI technology
  - Some drawbacks due to errors in VIOS
  - Started to play around and learn …

- **October 2009:** IBM officially announces **NPIV support for IBM i**
  - Exchange 4Gb with new 8Gb FC adapter
  - Started to migrate from vSCSI to NPIV technology for all VIOS attached client LPARs
    - Migration from vSCSI to NPIV for IBM i not possible because of 512/520 byte mapping done by VIOS causes different size of disk drives
    - Had to save/restore client LPARs or use “replace disk” functions to migrate
The way to virtual I/O in UGIS – current activities

- **Continuously Testing**
  - **Security** (e.g. role based access – allows to fine tune security)
  - **Performance** (e.g. save/restore to NPIV attached tape drives)
  - **Networking** (e.g. shared Ethernet adapter with failover on 1 Gb and 10 Gb Ethernet adapters)
  - **Handling** (e.g. how to migrate to virtual I/O and back)
  - **Backup/Restore** (e.g. is it really needed to backup VIOS or easier to new install and recover config?)

- Invited IBM Lab Services to Vienna to discuss various virtualization topics

- **2011:**
  - Upgrade 4 systems from POWER6 to POWER7
  - Performance test in Rochester with IBM i and DS8800
    - Doing most of the tests on virtualized hardware
  - Start of tests with partition hibernation / resume
  - Waiting for partition mobility …
How are we implementing virtualization for disk?
How are we implementing virtualization for network?
Some findings

- **No noticeable performance degradation when using NPIV attachment**
  - Easier handling of SAN attachment due to dynamical adapter mapping possibility

- **Performance of virtual I/O server**
  - NPIV attachment and heavy I/O load causes higher CPU utilization on VIO servers

(sample of 10 LPARs with NPIV attached disks running batch workload at same time)
Topics we are currently working on before we start to use VIO Server in our large IBM i productive environment?

- Automated solutions for
  - Error reporting
  - Alerting in the case of performance bottlenecks for NPIV/SEA
  - Monitoring

- In October 2011 ITM should support performance monitoring / alerting for virtual FC connections on VIOS
  - It should be possible to measure / monitor IO workload per virtual WWPN

- Current administrators are perfectly handling IBM i, but doubt when touching AIX, Unix, …

- VIOS should be more as an appliance than an open system
  - Just put in DVD and install …
  - Have a guided setup (e.g. Wizard) to define basic system configuration
  - Do not want to bother about adapter firmware, device drivers, …
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  - Test Phase 1 – Scalability of DS8800
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**Location 1**

IBM i LPARs:
- Production 15
- Test / Development 11
- Backup 8
- AIX about 50

2 Power7 795 FHB

**Location 2**

IBM i LPARs:
- Production 15
- Test / Development 11
- Backup 8
- AIX about 50

2 Power7 795 FHB

- Tape Robot
- IBM TS3600

16 Tape 3592 E06 Drives for IBM i
20 Tape 3592 E06 Drives for ITSM

**Storage Subsystems for IBM i**
- IBM DS8300
- IBM DS8700
- IBM DS8800

Capacity:
- 241 TB net
- 453 TB gross

**Metro Mirror**

**BROCADE**

**BROCADE**

**BGS SAN High Performance SAN**

**Capacity:**
- 241 TB net
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Why are we using external storage (1)

- It was the easiest and most secure way to have in-sync backup LPARs for all our customers

- We buy a new storage box frequently and gain each time approx. 20% - 30% performance improvement for all our customers

- Simple Data Migration
  - Storage migration is easier and reduces the migration effort and duration

- Disaster Recovery
  - We currently consider an asynchronous copy to a 3rd location
Why are we using external storage (2)

- With Storage functions (flash copy) it is easy to create test partitions
- Very flexible in the case that an LPAR does need additional storage (we can provide additional storage within hours)
- Very good performance because of for example pre fetch algorithm of the cache

TPC: Overall Read and Write Cache Hits Percentage (%):
Agenda

- UGIS IBM Power Systems environment
- Why are we using external storage

**Performance test results and suggestions for DS8800**
- DS8800 POC performance test – Target / Scope
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DS8800 POC performance test – Target / Scope

Following main test scenarios were conducted:

- **Phase 1: Scalability of DS8800**
  - Linear scaling of DS8800 (1 to 10 EODs in parallel)
  - Scale out tests (Throughput of DS8800 and IBM i FC adapter)
  - FlashCopy SE functional test

- **Phase 2: VIOS / NPIV attachment**
  - Comparison of NPIV to dedicated FC adapter

- **Phase 3: Solid State Disks (SSD)**
  - IBM i Media Preference
  - Easy Tier featured SSDs
Test environment in Rochester
Workload description of an End Of Day

- An EOD is our most critical and most workload intensive Batch Job
- As this Job is composed of all various workload profiles, we were able to determine which HW configuration is best for the overall part of the job
- This workload is much more reality than any “benchmark tool” which development normally uses for testing

Total I/O Rate (overall) – DS8800

Read Transfer Size DS8800
Write Transfer Size DS8800
Test Phase 1 – Scalability of DS8800

Goal was to explore the overall **scaling characteristics of the DS8800** and FlashCopy
- All test runs were done using physical FC adapter in each LPAR
- Linear scaling of DS8800
  - **2 to 10 EODs in parallel**, each EOD in a different LPAR
- FlashCopy SE functional test
  - FlashCopy SE before EOD and reverse FlashCopy afterwards
- **The DS8800 was faster with 10 EODs in parallel compared to the DS8700 with only 8 EODs in parallel**
**Test Phase 2 – VIOS / NPIV attachment**

- The goal was to compare the run time when using physical FC adapter to VIOS / NPIV connections.

- The test was done running 10 EODs in parallel:
  - Each LPAR used the same number of FC connections (4 virtual ports per LPAR).
  - Each LUN used the same number of disk path (2).

- The runtimes of **10 EOD in parallel using NPIV** was nearly the same as using dedicated FC adapters.
Test Phase 3 – Solid State Disks (SSD)

- Goal was to compare the different SSD usage methods like “Easy Tier” Virtualization of DS8800 or “Database Media Preference” of IBM i.

The Database Media Preference runs performed about 17% faster than an EOD on spinning disk.

- The Easy Tier runs showed that Easy Tier is working sometimes faster and sometimes slower than spinning disk runs. The fastest Easy Tier run was approx. 7% faster.
Overall Summary

- The **POWER7 upgrade** provided **huge financial synergies**
- Technically **POWER7** does provide **great new possibilities for virtualization**
- Enhancements in IBM i are delivering **needed improvements**
- The **DS8800** is **performing** and scaling **much better than the DS8700**
- **UGIS** will use **VIOS / NPIV** for FC virtualization in the future
Questions ??
Some Graphs

TPC: Overall Read, Write and Total I/O Rate (ops/s):

TPC: Overall Read, Write and Total Data Rate (MB/s):

TPC: Read, Write and Overall Response Time (ms/op):

TPC: Overall Read and Write Cache Hits Percentage (%):