STORAGE REENGINNERING

Ako zredukovať storage kapacitu na polovicu a dosiahnuť flexibilitu a agilitu

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Agenda

- Goal of Storage reengineering
- Challenges to be resolved
- Requirements
- Possibilities
- Storage environment As-Is analyses
- Target solution
- Benefits

Goals and challenges

Goals Of the Storage reengineering

- Create a Slovak Telekom strategic concept for storage processing which resolves
  - Current Heterogeneity of storage technologies coming from past different standards
  - Fragmentation on the Box, Technology and in Location level
  - Operational complexity and management
  - DC Consolidation and Relocation
- Reduces Slovak Telekom storages capacity by 40% until end of 2014
- Significantly Reduce Slovak Telekom TCO cost for storage technology and its operation

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Challenges to be resolved

- Fragmentation of available disk space
- Locality and technology dependent fragmentation of space
- DC consolidation
- Lifecycle management coordinated with strategic aims - Devices reaching end of life
- DT standards changed in time – concept shall have partial platform compatibility
- Urgent project demands (NG-CRM, Common DWH, parallel projects in ERP domain)
- Alignment with other running projects
- Specify engineering and operational principles for Storage Capacity reduction and operational efficiency enhancement

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Requirements

Requirements (1)

- Všeobecné požiadavky
- Požadované vlastnosti produktu
- Technické parametre HW
- Technické parametre SW
- Požiadavky na integráciu a podporu

Requirements (2)

Všeobecné požiadavky

- redukovať do 12/2014 súčasnú užívateľskú kapacitu 1PB o 40%.
- old disk arrays lifecycle
- pre virtualizáciu sa uvažuje minimálne o 1/3 celkovej kapacity, zostávajúce 2/3 sa budú rozdeľovať minimálne medzi 3 Tier-y internej kapacity diskového systému v pomere 20:30:50.
- SW licencie bez obmedzenia kapacity
- Green – nízka spotreba elektriky

Požadované vlastnosti produktu

- systém musí byť kategórie **Enterprise**
- škálovateľnosť výkonnosti, kapacity a konektivity musia byť na sebe nezávislé
- škálovateľnosť kapacity musí byť lineárna
- podpora pripojitelnosti rôznych typov OS, technológie Extended Oracle RAC
- všetky upgrady, konfiguračné zmeny a servisné zásahy musia byť vykonateľné online
- firmware update/upgrade controllerov musí byť vykonateľný online
- otvorenosť systému pre monitorovanie a konfiguráciu lokálnym administrátorom
- podpora virtualizácie externe pripojených systémov iných výrobcov
- podpora priameho prepojenia FC kariet s hostom (server, ext.storage, ... - direct attached) a aj SAN

Requirements (3)

Technické parametre HW

- podporovaný a požadovaný počet FC portov
- podporované disky v novom diskovom systéme:
  - SAS 2.5" 146GB, 300GB, 600GB
  - SSD 2.5": 200GB
  - SSD 3.5": 400GB
  - SATA 3.5": 2TB
- podpora súčasnej inštalácie špecifikovaných diskov interne v rámci diskového systému
- podpora RAID 1 (1+0), RAID5, RAID6
- dynamická alokácia cache pre zápis a čítanie bez nutnosti zásahu administrátora
- zálohovanie obsahu cache pri výpadku po neobmedzenú dobu
- cache systému musí byť rozdeliteľná na nezávislé partície pre zaručenie QoS aplikácie
- systém musí byť rozdeliteľný na viacero logických systémov vlastnými administrátormi
- inštalovaná čistá kapacita každého diskového pola musí byť rozdelená na minimálne 3 "Tier-y" pre optimálne splnenie požiadaviek na výkonnosť aplikácií

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Requirements (4)

Technické parametre SW

- systém musí podporovať online presun dát (automaticky na základe merania výkonnosti) na úrovni častí logických diskov/volumov, pričom podporovaný počet "Tier-ov" musí byť minimálne 3
- systém musí podporovať thin provisioning
- systém musí podporovať vyššie spomenuté dva spôsoby online presunu dát aj s logickými diskami, ktoré používajú thin provisioning
- systém musí podporovať vytváranie snapshotov a klonov logických diskov
- systém musí podporovať synchrónnu aj asynchrónnu replikáciu medzi dvoma systémami
- asynchrónna replikácia musí byť realizovaná na úrovni blokov (nie full track) a musí zabezpečiť zapísanie prenesených blokov v poradí
- systém musí obsahovať SW na meranie výkonnosti diskového systému, SAN a hostov

Požiadavky na integráciu a podporu

- migračný plán, migrácia dát a integrácia do existujúceho prostredia
- podpora existujúceho prostredia zálohovania, monitorovania a manažovania
- onsite podpora na 5 rokov 24x7, doba odozvy 0,5hodiny a oprava HW do 24 hodín

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Required features,
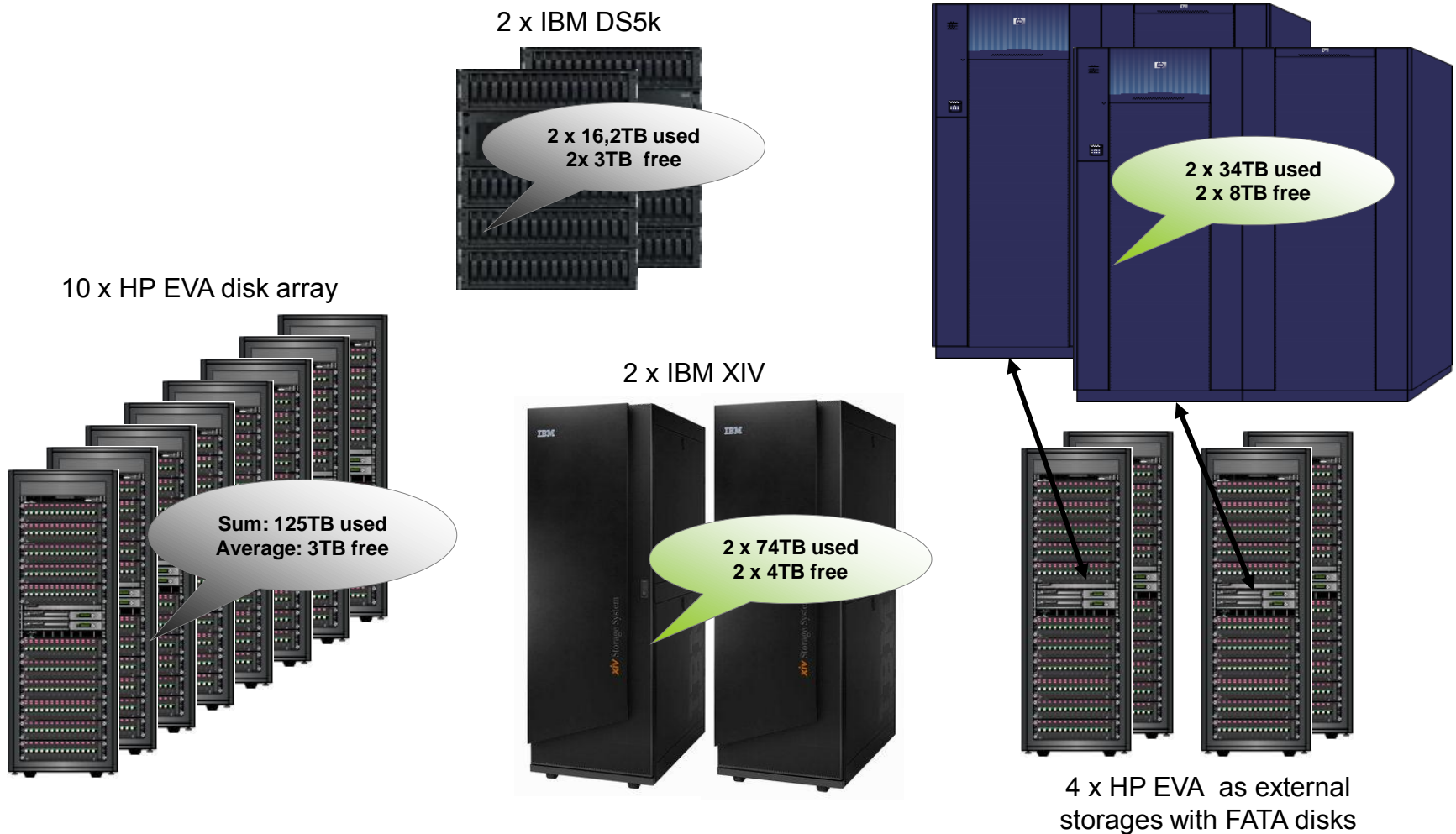# .... Possibilities

Required features of new VHST technologies

Features bellow are considered as enablers of ST storage capacity reduction and data centers consolidation

Virtualization	
	▪ Separation of logical volumes from physical disks provides common pool of storage ▪ Support for heterogeneous storage including remote mirror ▪ No impact to SAN infrastructure or performance ▪ Concurrent data access from two localities (DCs)

Consolidation	
	▪ Fewer storage controllers improve environmentals & management ▪ Less floor space, power, cooling & SAN infrastructure ▪ Incremental upgrades for performance or capacity reduces cost ▪ Simplify Management and D/R Failover & Failback

Dynamic Tiering	
	▪ Mix of storage types per application reduces cost while improving service ▪ Purchasing different types of storage saves money ▪ Allowing storage to move data to appropriate tier to meet changing application service needs ▪ Fully automated storage tiering between three tiers (performance, capacity and flash drives – e.g. SAS, SATA, FC, SSD)

Online Migration	
	▪ Online migration of storage without application disruption ▪ High Bandwidth allows migration to run concurrently with application without impact to performance ▪ 24x7 controller ensures migration completed reliably ▪ Program migration to run off hours automatically

Dynamic Provisioning	
	▪ Dynamically allocates space for writing data to a volume ▪ Eliminates unused volume freespace and so reduces capacity ▪ Transparent to Server & Application ▪ Space reclamation (possibility to reuse freed up unused capacity)

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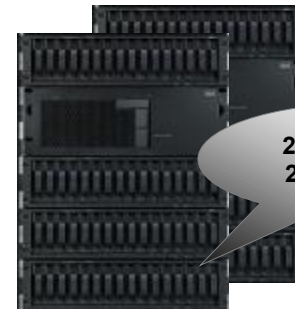# As is analysis

As Is Analysis - Storage overview KE – BZ

2 x IBM DS5k

**2 x 16,2TB used
2x 3TB free**

**2 x 34TB used
2 x 8TB free**

10 x HP EVA disk array

2 x IBM XIV

**Sum: 125TB used
Average: 3TB free**

**2 x 74TB used
2 x 4TB free**

4 x HP EVA as external
storages with FATA disks

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As Is Analysis Storage BA Polus – BA Sitel

2 x 42TB used
2 x 4,6TB free

2 x 35TB used
2 x 3,8TB free

2 x IBM DS8k

2 x EMC DMX3

1x EMC DMX2000

2 x 74TB used
2 x 4TB free

2 x 59TB used
2 x 6,5TB free

2 x 32TB used
2 x 3,5TB free

1 x 13TB used
1 x 1,5TB free

* Free spaces dedicated for production snapshots (10% až 15%)

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Storage Evaluation and Design Methodology

- We consider scope of analysis and target virtualized, tiered hierarchical storage architecture using customer values

- The result will show the potential savings that may be achieved from a virtualized tiered storage architecture summarized by technology

| Financial Information	
Depreciation Term (4 or 5 years)	4
Marginal or Corporate Tax Rate (% per year)	30%
Weighted Cost of Capital (IRR) (% per year)	13%
Cost of electricity (in kW/hour)	€ 0,12
Monthly cost of raised floor space (per m [2)]	€ Z
Cost of Storage Administration per year	€ X.000
Cost of Labor Increase (% per year)	3%
Cost/Time to migrate 1TB of storage	€ Y.000

Storage Parameters	
Current Hardware Maintenance per year	€ TBD
Current Software Maintenance per year	€ TBD

New Tiered Storage Architecture based on VHST				
	Tier1 (15K)	Tier2 300GB	Tier3 600GB	Tier4 2TB SATA
Percent of Total Capacity	15%	30%	30%	25%
Growth Rate per Year	10%	15%	15%	20%
Cost per GB	€ 13,00	€ 9,00	€ 7,00	€ 4,00

*Please note that disk cost/GB is identical for before/after calculations so that despite pricing changes, percentages remain correct)

Expected benefits using new technologies
## Virtualization, Dynamic Tiering, RAID 5 and Dynamic Thin Provisioning
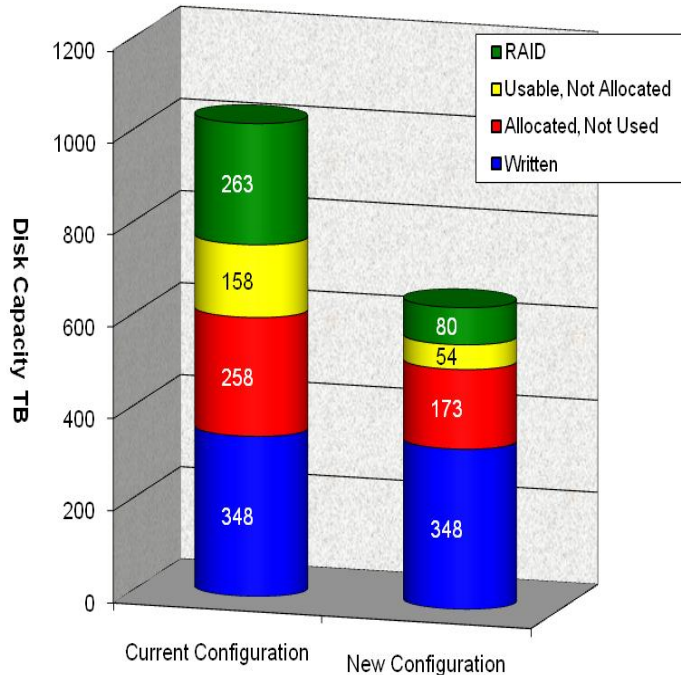
Space utilization, before and after

• With 18-20 storage systems available for consolidation, there is more than 100TB of free space for growth that can be recovered when virtualized into a single pool (65% in savings)

• Dynamic Provisioning eliminates the unused capacity within volumes, recovering between 33-66% of a volume. We have calculated the minimum 33% (24% in savings)

• With a number of RAID-10 systems as well as the savings due to virtualization and HDP, the amount of RAID protection with RAID-5 can now be reduced from 70% in savings.

• Reduction by data optimization will be on top

Reduction of the capacity, reduction and growth trends

By reengineering of the storage solution, migrating all capacity to RAID-5 and applying the benefits of Virtualization, Tiering & Dynamic Provisioning, (as estimated on previous slide) the total amount of capacity that can be saved is closed to 400 TB and can absorb the expected growth rate for the next 2 years!

Storage Capacity Forecast
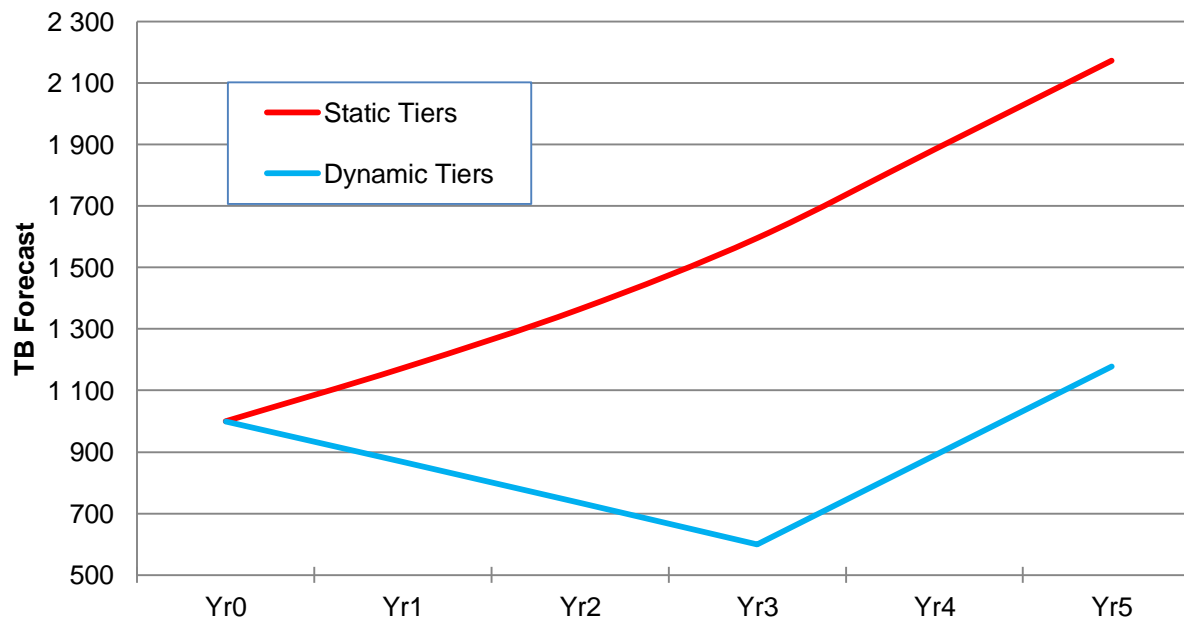
High level solution architecture

Architecture principles for target solution
3 different scenarios

Scenario 1 – migrate to VHST for significantly improved performance & reliability

- Consolidate 151TB Tier1 capacity to 146GB 15K SAS disks in 7+1

- Consolidate 630 TB Tier2 capacity to 300GB SAS disks in 7+1

- Consolidate 245 TB Tier4 capacity to 2TB external SATA disks in 6+2

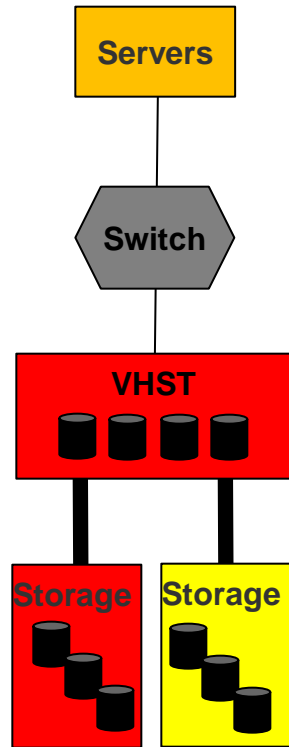**Scenario 2 – migrate 50% of Tier2 capacity to Tier3 for lower costs**

- Consolidate 151TB Tier1 capacity to 146GB 15K SAS disks in 7+1

- Consolidate 315 TB Tier2 capacity to 300GB SAS disks in 7+1

- Consolidate 315 TB Tier3 capacity to 600GB SAS disks in 6+2

- Consolidate 245 TB Tier4 capacity to 2TB external SATA disks in 6+1

Scenario 3 – migrate all SATA externally for lower costs

- Consolidate 151TB Tier1 capacity to 146GB 15K SAS disks in 7+1

- Consolidate 315 TB Tier2 capacity to 300GB SAS disks in 7+1

- Consolidate 561 TB Tier4 capacity to 2TB external SATA disks in 6+2

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Architecture principles for target solution
Selected scenario 2

Based on As Is Analysis and vendors recommendation for Large Corporate 4 Tiering levels are recommended

Data Reclassification will define data Tiering allocation in final

Tiering allocation proposal – migrate 50% of Tier2 capacity to Tier3 for lower costs

1) Consolidate 151TB Tier1 capacity to 146GB 15K SAS disks in 7+1

2) Consolidate 315 TB Tier2 capacity to 300GB SAS disks in 7+1

3) Consolidate 315 TB Tier3 capacity to 600GB SAS disks in 6+2

4) Consolidate 245 TB Tier4 capacity to 2TB external SATA disks in 6+2

High availability, Disaster recovery, Synchronous Replication are required as features expected for virtual DC Active/Active

Servers

Switch

VHST

Storage **Storage**

Example of target solution architecture – Hitachi

Expected benefits using new technologies
Virtualization, Dynamic Tiering, RAID 5 and Dynamic Provisioning

Target solution concept shall cover

- All actual storage needs
- Expected year on year growth
- Urgent requirements in strategically important business areas like NG CRM and DWH

Urgent requirements

a) Storage solution for NG CRM, originally based on XiV technology, shall be resolved within 1 step of standard storage solution

b) DWH lifecycle solution, fast relocation and space for project purposes. For this part we consider either dedicated solution EXADATA or Integrated solution with appropriate urgency. Tests for technical comparison in progress (first done second in execution)

Standard storage solution for all data

c) Standard solution with VHST (e.g. SVP) or similar hierarchical storage for all data in steps harmonized with lifecycle

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Solution Possibilities

A. Virtualization layer - SW, HW or combination (e.g. SVC, VPlex, DataCore, ...)

B. Combination of virtualization layer with additional HW (point A plus disk array with required capacity)

C. Disk array with required features (virtualization, tiering, thin provisioning, ...)

Comment:

• our aim is not only reduce capacity with virtualization and thin provisioning but also storage lifecycle (due to aging - 5-7 years, +1-2 years during implementation)

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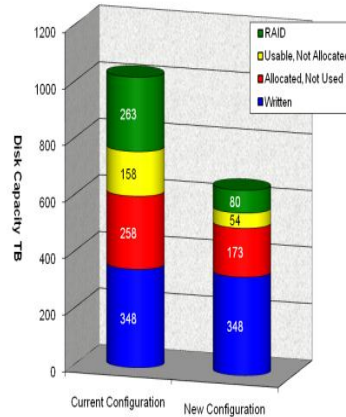# Target Solution Architecture Model
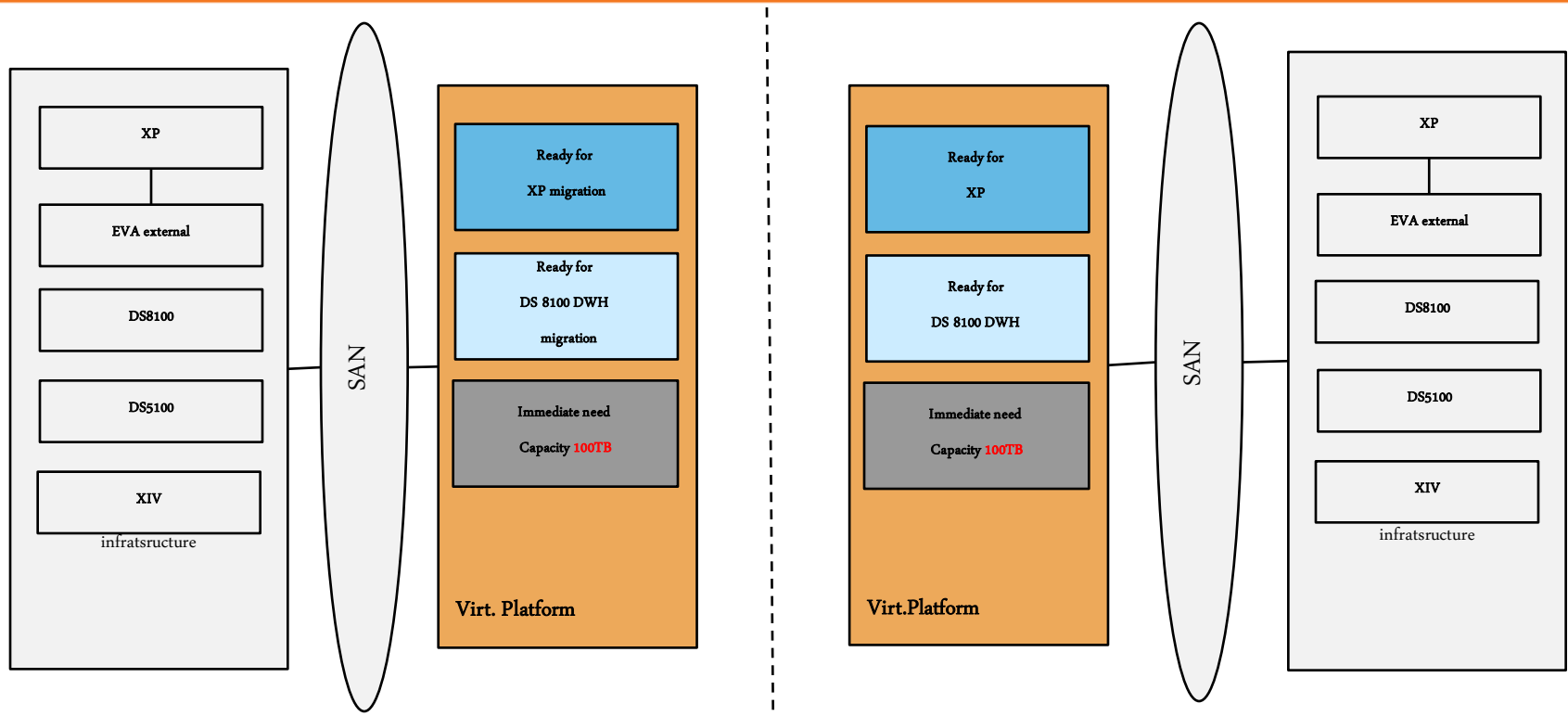
- Initial capacity to create a solution basis
- Migration roadmap in to the target solution in 5 steps in next slides

Target solution – Based on Hitachi SVP
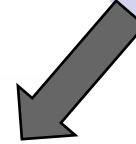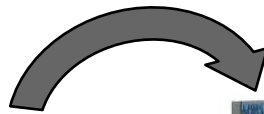## Solution in progress

DCPolus

5 Boxes 280TB

4 Boxes 265TB

DC Sitel

6 Boxes 250TB

2 Boxes

600TB

DC Košice

DC Bzenov

Target solution – Benefits

Step 1

Support and Maintenance cost -188kE

Energy saving (power and cooling) -60kW

Less DC space -7m2

Less complexity, new features, less administration

Total -250kE

Step 2-4

Financial savings according to Business Case

Saving from virtualization, Thin provisionig, Dynamimc Tiering

Questions ...

Ďakujem **Gejzovi Tomkovi** a tímu **Roberta Bednárika** za spoluprácu na príprave prezentácie

Ďakujeme za pozornosť