IBM XIV Storage System
Enterprise Storage Reinvented

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XIV Company Profile

- Executive Chairman - Moshe Yanai
  - Invented and led Symmetrix systems development
- Founded in 2002 by a group of 5 graduates of Talpiot
  - Talpiot is an elite Israeli academic program for the sciences, physics, and mathematics
  - All from the 14\textsuperscript{th} year of the project (XIV=14 in Roman numerals)
- Product in development for 6 years
  - More than 50 patents filed (major architectural patent has already been approved)
- 1000+ systems shipped to date worldwide
  - 90+ \% of evaluation systems have gone into production
  - Over 40\% of Fortune 500 have deployed XIV
  - A/ NZ growth from 0 to 12 systems in 2009 so far
XIV now – an IBM Company

• XIV was acquired by IBM on December 31, 2007
• XIV is now operating as a subsidiary of IBM reporting to IBM’s storage organization
• Moshe Yanai was appointed an IBM Fellow
• For our customers, this means:
  – Next-generation storage product
  – IBM support and services
With this legacy architecture, scalability is achieved by using more powerful (and more expensive) components.
Traditional SAN Management

- All disks accessible by all controllers
- Cache mirrored
- Tiered storage by type
- Hot spares needed by type
- Segment by RAID type & sets
- Spare space discontiguous
- Disk placement matters
- Pre-plan for growth
- Tune LUNs for segment size and ownership
- More fine tuning

How do I maintain this as data grows unevenly?
IBM XIV Storage Architecture

Design principles:
- Massive parallelism
- Granular distribution
- Off-the-shelf components
- Coupled disk, RAM and CPU
- User simplicity

Scale Out

Switching

Interface

Interface

Interface

Interface

Interface

Data Module

Data Module

Data Module

Data Module

Data Module

Data Module

Data Module
XIV System Components
XIV System Description

- 15 modules, each with:
  - 12 x 1TB disk drives
  - 8GB memory
  - 1 Quad core CPU (2 on Interface Modules)

- 180 disk drives in each rack
  - (180TB raw, 79TB user data)
    - Global spare space — full module plus 3 disks
    - 79TB = (180 - 12 - 3) / 2 - 3.5 (internal use)

- 120GB of memory

- 24 FC ports

- 6 iSCSI ports

- 84 Intel Xeon cores

- IBM Service and Support
  - 1 year or 3 year, 4 hour response, 24x7 Same Day On-Site Repair
  - IBM HW and SW Installation
IBM XIV Storage Distribution Algorithm

- Each volume is spread across all drives
- Data is “cut” into 1MB “partitions” and stored on the disks
- XIV algorithm automatically distributes partitions across all disks in the system pseudo-randomly

XIV disks behave like connected vessels, as the distribution algorithm aims for constant disk equilibrium.

Thus, IBM XIV’s storage overall disk usage could approach 100% utilization when loaded.
XIV Distribution Algorithm on System Changes

- Data distribution only changes when the system changes
  - Equilibrium is kept when new hardware is added
  - Equilibrium is kept when old hardware is removed
  - Equilibrium is kept after a hardware failure
XIV Distribution Algorithm on System Changes

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XIV Distribution Algorithm on System Changes

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The fact that distribution is **full and automatic** ensures that all spindles join the effort of data re-distribution after configuration change.

Tremendous performance gains are seen in recovery/optimization times thanks to this fact.
IBM XIV Storage: Concept of “Spare”

- **Traditional approach**
  - Dedicated disks used for spares
  - In many systems spares are dedicated for a RAID group

- **IBM XIV Storage approach**
  - Recovery time: 30 minutes for 1 TB disk (full)
  - No dedicated spare disk, only global capacity
  - All disk are equally used
  - Minimize the risk of technician mistakes
  - Higher availability with no performance impact

- **180TB raw is 79 TB net**
  - Spare space for 3 disks and a full module
  - $80 = (180 - 12 - 3) / 2 - 3.5$ (internal use)
IBM XIV Storage: Thin Provisioning

- Defining logical volumes bigger than physical capacity
- Installing physical capacity only if and when needed
- No space consumed when data is 0
- Pools are used to manage quota

Results:
- Reduced overall direct storage cost
- Storage expenses spread over time, exploiting price reductions
- Easier management
- Save 20-50% of storage capacity
IBM XIV Snapshots - Virtually without Limits

- Snapshot creation/deletion is instantaneous
- High Performance WITH snapshots
- Unlimited number of snapshots
- Differential snapshots save 15-30% of storage capacity

High performance snapshots provide:

- Easier Physical Backup to Tape
- Instant recovery from Logical Backup
- Easy creation of Test Environment
- Boot-from-SAN with easy rollback
- Easy Data-Mining on Production data
XIV Partial Rack Configurations

- All options available to order
- Field upgrade possible
### XIV Partial Rack Configurations

<table>
<thead>
<tr>
<th>Total number of modules</th>
<th>6</th>
<th>9</th>
<th>10</th>
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<th>12</th>
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<td>Number of disks</td>
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<td>120</td>
<td>132</td>
<td>144</td>
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<td>Weight (KG)</td>
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<td>BTU/hour</td>
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<td>Net capacity (decimal)</td>
<td>27.26 TB</td>
<td>43.09 TB</td>
<td>50.29 TB</td>
<td>54.65 TB</td>
<td>61.74 TB</td>
<td>66.16 TB</td>
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XIV Footprint

Raised Floor Requirements

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<thead>
<tr>
<th>Index</th>
<th>Metrics (MM)</th>
<th>English (Inches)</th>
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<td>A</td>
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<td>E</td>
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<td>F</td>
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Clearances for service and cooling - dimensions
Thank You

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As Easy as XIV
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