Orchestrating Open Source Components for Home SANs

Abhinav Jawadekar
Agenda

- Networked Storage Requirements for Home
- Options and Approaches
- Open Source Components
- Orchestration Considerations
- Challenges
Home Compute and Communication Environment

- Desktop PCs
- Laptop PCs
- Netbook PCs
- Handheld Mobile Devices
- Multimedia Devices
- Many compute and communication systems with a lot of data
- Huge need for consolidation and central management
Sharing

- Share data among compute and communication devices
- Share storage devices among compute and communication devices
  - USB disks (pen drives, USB hard disks)
  - CD/DVD drives
  - Device attached hard disks
- Access management
- Connectivity
Features

- Data Repository
  - Compute and communication device backup
- Storage Tiers
  - Solid state disk
  - High capacity hard disk
  - Cloud storage
- Data protection, backup to secondary device and cloud
- Expandability
- Recovery Point more important than Recovery Time
  - High Availability NOT a requirement
- Performance only moderately important
Usability

- Easy to understand and intuitive to use
- Default options should suffice common usage
- Should work well with removable devices
### Options

<table>
<thead>
<tr>
<th>Network Attached Storage</th>
<th>Cloud Storage</th>
<th>Storage Area Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ File and underlying storage infrastructure sharing</td>
<td>□ Backup + much more</td>
<td>□ Raw device (block) access</td>
</tr>
<tr>
<td>□ File (folder/share) level access control</td>
<td>□ Data/file sharing over internet</td>
<td>□ Storage infrastructure sharing</td>
</tr>
<tr>
<td>□ IP based file sharing protocols</td>
<td>□ High capacity data repository</td>
<td>□ Pass-through access to external devices such as USB drives, CD/DVD drives etc.</td>
</tr>
<tr>
<td>□</td>
<td>□ Internet APIs</td>
<td>□ Device level access control based on computer system</td>
</tr>
<tr>
<td>□</td>
<td></td>
<td>□ Enabled by iSCSI technology</td>
</tr>
</tbody>
</table>

![Network Attached Storage Diagram](image)

SAN, NAS and Cloud storage – A Home needs it all!
Home Networked Storage Environment
Approaches

Network Based
- Network router as the intelligence and gatekeeper of the home IT infrastructure
- May or may not have native storage
- Device interfaces such as USB
- Ideal for home and low end SMBs

Storage Appliance
- A low-end storage array based on industry standard server
- Has native storage
- Device interfaces such as USB
- Suitable for SMBs and high-end tech savvy homes
Linux Storage Components for SAN

- Linux raw device access
  - `/dev/sd_x`
- Software RAID – MD
  - Disk redundancy
- Logical Volume Manager - LVM
  - Aggregation
  - Provisioning
- iSCSI Enterprise Target – iET
  - Device and storage presentation
## Orchestration considerations: Software RAID - MD

<table>
<thead>
<tr>
<th>Relevant Features</th>
<th>Network Based</th>
<th>Storage Appliance</th>
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<tbody>
<tr>
<td>Disk redundancy with RAID levels 1, 4, 5, 6, 10 etc.</td>
<td>Focus on Mirroring or RAID – 1</td>
<td>All RAID levels provided by MD</td>
</tr>
<tr>
<td>Dynamic resizing, hot replacement, hot spares – many sophisticated and complex features</td>
<td>Easy to understand</td>
<td>Features such as hot spares, remove and replace drives</td>
</tr>
<tr>
<td>Ability to move disks easily is crucial</td>
<td>More granular redundancy not required</td>
<td>Dynamic expansion and changes</td>
</tr>
</tbody>
</table>
Orchestration considerations: Logical Volume Manager - LVM

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<tbody>
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<td>Aggregate raw disk devices as well as md devices</td>
<td>Tight coupling with md for simplicity with either raw or value added shared disks</td>
<td>Allowing user the choice of coupling with md</td>
</tr>
<tr>
<td>Provision required sizes of logical volumes</td>
<td>Only concatenation</td>
<td>Concatenation and striping</td>
</tr>
<tr>
<td>Striping, mirroring and concatenation</td>
<td>Dynamic expansion</td>
<td>Dynamic expansion</td>
</tr>
<tr>
<td>Dynamic expansion, snapshots etc.</td>
<td>Snapshots only for applications such as backup</td>
<td>Snapshots</td>
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Network Based

- Tight coupling with md for simplicity with either raw or value added shared disks
- Only concatenation
- Dynamic expansion
- Snapshots only for applications such as backup

Storage Appliance

- Allowing user the choice of coupling with md
- Concatenation and striping
- Dynamic expansion
- Snapshots

Network Based Storage Appliance

- Allowing user the choice of coupling with md
- Concatenation and striping
- Dynamic expansion
- Snapshots
### Orchestration considerations:
**iSCSI Enterprise Target - iET**

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<td>- Present block devices and file based raw data as iSCSI LUs</td>
<td>- Block device (pass through or LV) presentation</td>
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</tr>
<tr>
<td>- Target level access control</td>
<td>- Only one LUN (0) per target to ensure simplicity</td>
<td>- Target and LUN hierarchy</td>
</tr>
<tr>
<td>- CHAP Authentication</td>
<td>- Integration with DHCP/DNS to know potential hosts</td>
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<td>- Dynamic Target and LUN creation</td>
<td>- Target level access control</td>
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Orchestration Glue and User Interface

- Essential but missing parts
- Orchestration Glue
  - Programmatic logic required for systematic coordination of raw devices, MD, LVM and iET
- Web UI
  - Simple and Intuitive
  - Must provide easy to understand big picture
    - Should differentiate between Network Based and Storage Approaches in terms of details and sophistication
Challenges and TBDs

- Simple language that is appropriate for intended audience
- iSCSI Initiators for hand held and mobile devices
- More thought to iSCSI based plug-n-play
- Better pass-through device support
- Plug-ins requiring no direct client involvement
  - Cloud backup
  - Cloud storage applications
  - Storage Tier applications
- Glue logic to coordinate among SAN, NAS and Cloud application
Technology Options

- FreeNAS
- OpenSolaris
Conclusion

- Homes need SAN, NAS and Cloud Storage
- IP based protocols and open source software components provide the vehicle and functionality
- Orchestrating glue, an intuitive Web UI and most importantly simple language that can be easily understood by a layperson are the main challenges
Thanks!

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