ENGINEERING PHARMACEUTICAL INNOVATION

Living in a Virtual World with Tangible Results
Virtualization Overview and Real World Case Study

ISA Tarheel Capital Area Section
Setting the Standard for Automation

North Carolina Biotechnology Center

ISPE ENGINEERING PHARMACEUTICAL INNOVATION | Carolina-South Atlantic Chapter

Overview

- Business Justification

- Software Selection

- System Sizing

- Storage Hardware

- Storage Protocol Selection

- Backing Up

- Final Thoughts

Business Justification

- The start of an idea

  We need to replace some operator workstations, what about running virtual images?

- Taking the next step – virtualize servers

- Centralized management

- Dramatic improvement in disaster recovery capabilities

- Relocation of machines for ease of maintenance

- Pending BMS system upgrade

Software Selection

- Type 1 vs. Type 2
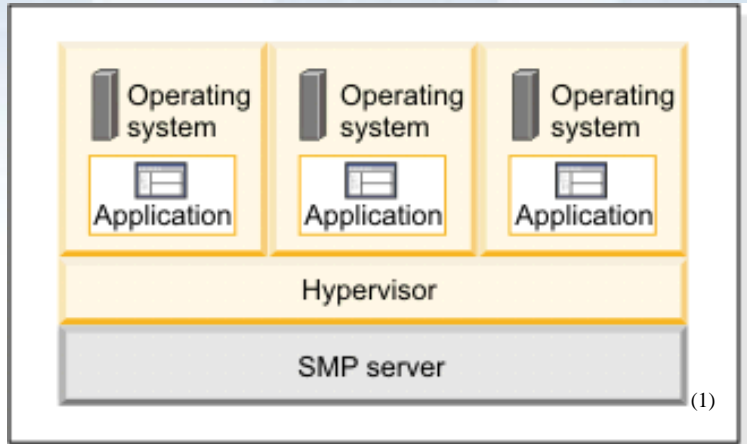
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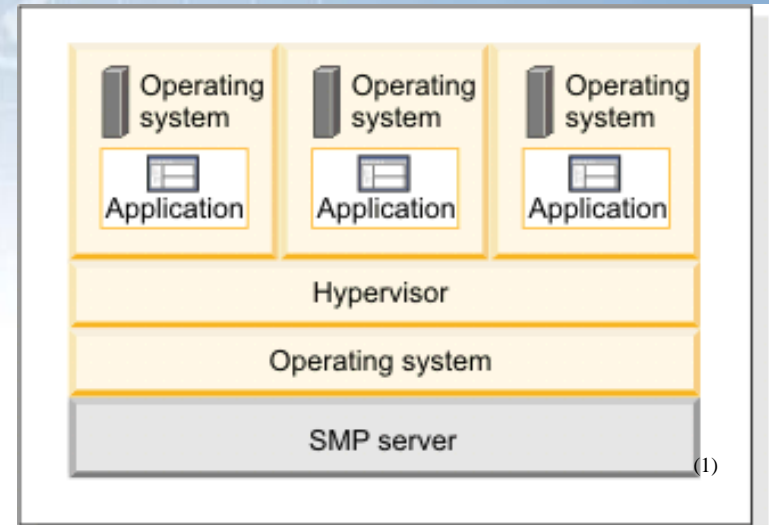
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- VSPhere vs. Hyper-V vs. XenServer

System Sizing

• Cataloging the System Types – Current and Future

Category	Quantity
Process Control Servers (Historians, I/O Servers, etc.)	5
Operator Workstations	8
IT Type Servers (Domain Controllers, Backup Servers, etc.)	5

System Sizing

- Detailed Breakdown – Machine by Machine

Machine	Service	Space Required (GB)	Memory Required (GB)
Server 1	Historian	200	2
Server 5	I/O Server, Tag Server, Alarm Server	50	2
Workstation 1	Dedicated Operator Workstation	20	1
Server 6	Backup Exec Server	20	2
Workstation 8	Dedicated Operator Workstation	20	1
Server 7	Existing Print Server	10	1
Server 8	New Sharepoint Server	50	2
…	…	…	…
	Totals	830	23

System Sizing

- Planning for Growth – Machine by Machine

Machine	Service	Growth Factor	Planned Space (GB)
Server 1	Historian	100%	400
Server 5	I/O Server, Tag Server, Alarm Server	100%	100
Workstation 1	Dedicated Operator Workstation	25%	25
Server 6	Backup Exec Server	50%	30
Workstation 8	Dedicated Operator Workstation	25%	25
Server 7	Existing Print Server	25%	12.5
Server 8	New Sharepoint Server	50%	75
…	…	…	…
		Total	1433

System Sizing

- Planning for Growth – System Level

- Add 50% factor to Memory and Storage

  - 35 GB of Memory

  - 2.1 TB of Primary Storage

- Safety Factor for underestimating machine requirements
or machine count

Networking

- Dedicated Storage Network

  - Redundant gigabit switches

  - Redundant NIC connections to each switch

- VM Communications Network

  - Single gigabit switch – redundant later if necessary

  - Redundant NIC connections to switch

- Pay attention to separating redundant connections across adapters

Storage Hardware

- Most Critical Selection

    - Performance, Scalability, Reliability, Availability

- 4 Major Classes of Storage

    - Component Hardware, Redundancy, Availability

    1 – Single Controller, Commodity SATA Hard Drives

    2 – Redundant Controllers, SAS Hard Drives, Online Managament

    3 – Snapshotting and Deduplication

    4 – Capacity to handle PB of data

Storage Hardware

- This project - Class 2

    - Phase 1 : (4) 300 GB 15K SAS Drives (Primary)

        (3) 1 TB 7.2K SAS (Nearline/Backup)

    - Phase 2 : +(5) 300 GB Drives

        Additional 1TB Drives

Storage Protocol Selection

- ISCSI vs NFS vs FCOE

- Scale and Performance need not drive selection

- FCOE ruled out due to complexity and cost

- ISCSI Slightly more complex

  - LUN Setup with VMFS

  - 2 TB LUN Limitation

- Ultimate choice driven by device selection

System Backup

- Best reason to virtualize (in my humble opinion)

  - Scares people away due to unfamiliarity

- Chose ESXPress from PHDVirtual over Veeam Backup

  - Familiarity

  - Small footprint (No Windows Install)

  - Appliances to perform backup

  - Deduplication

    - 15-20x reduction in space
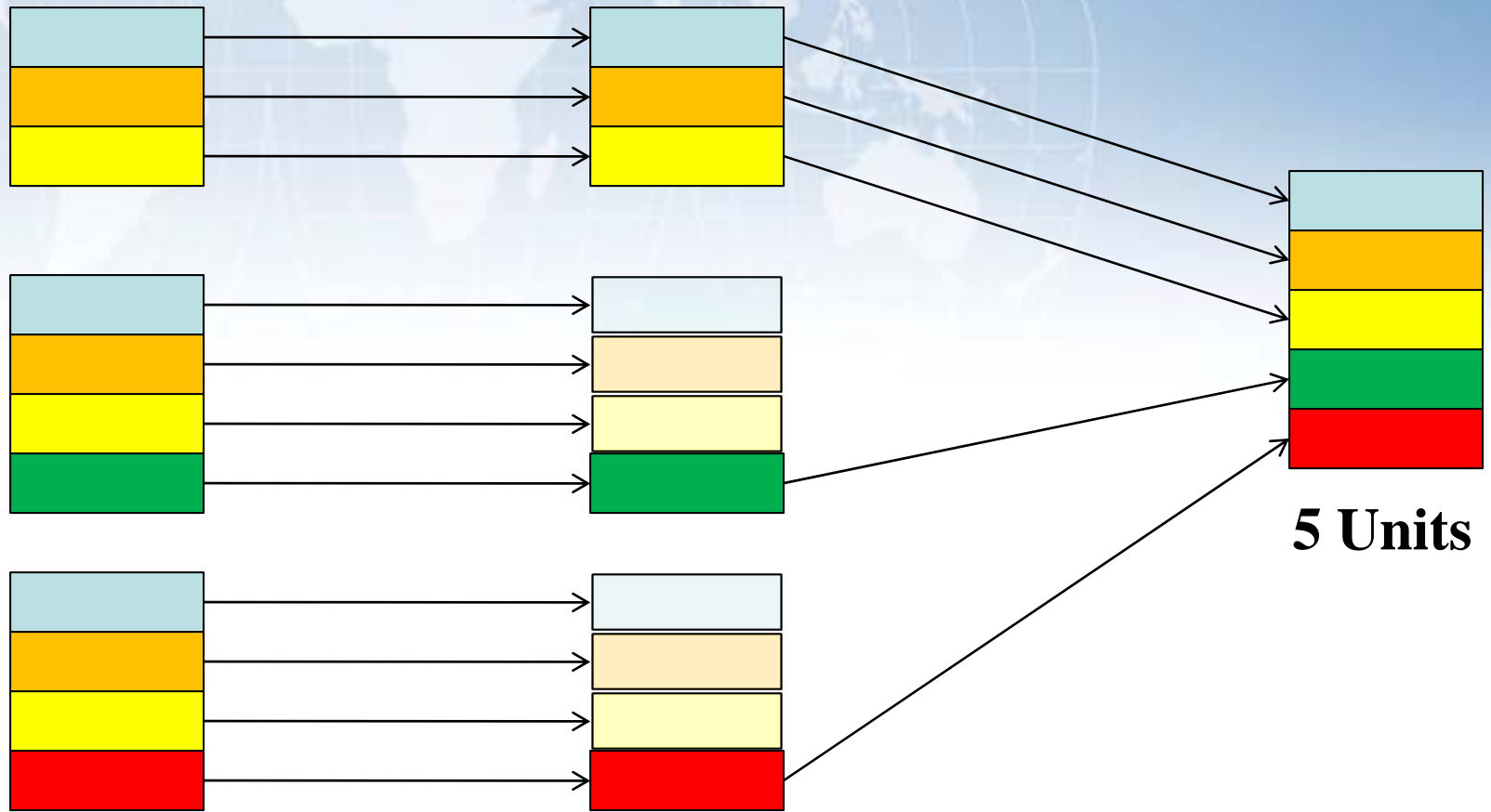
Data Deduplication

11 Units

5 Units

Backing up the Backups

• Deduplicated data stored as series of self describing data blocks in folders

• Use traditional backup methods to backup data blocks

   • Backup to tape once a week

   • Incrementals not necessary

      • Deduplication so efficient you can keep weeks of daily backups

   • SAS Tape drive special challenge – utilized DirectPath
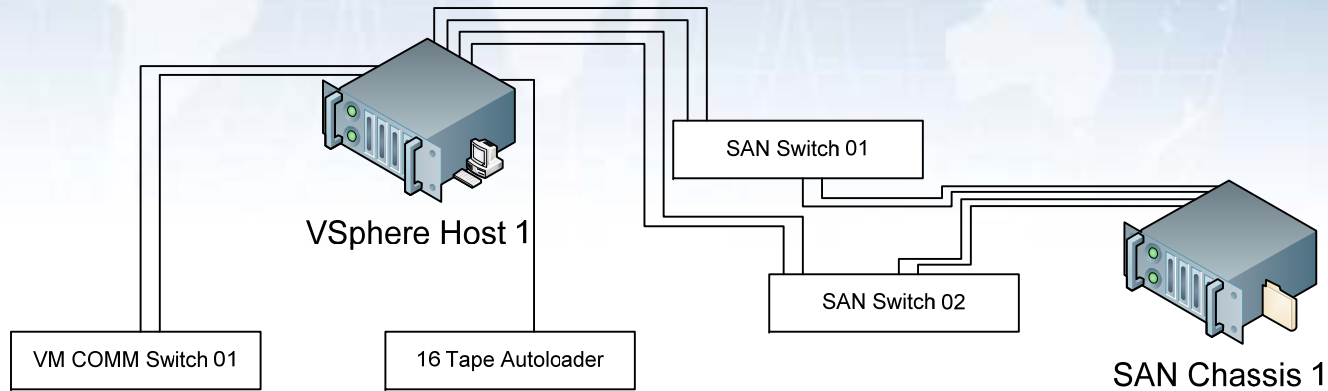
A Quick Word on Power

- Think about power planning and segregation

    - Redundant Power Supplies on UPS

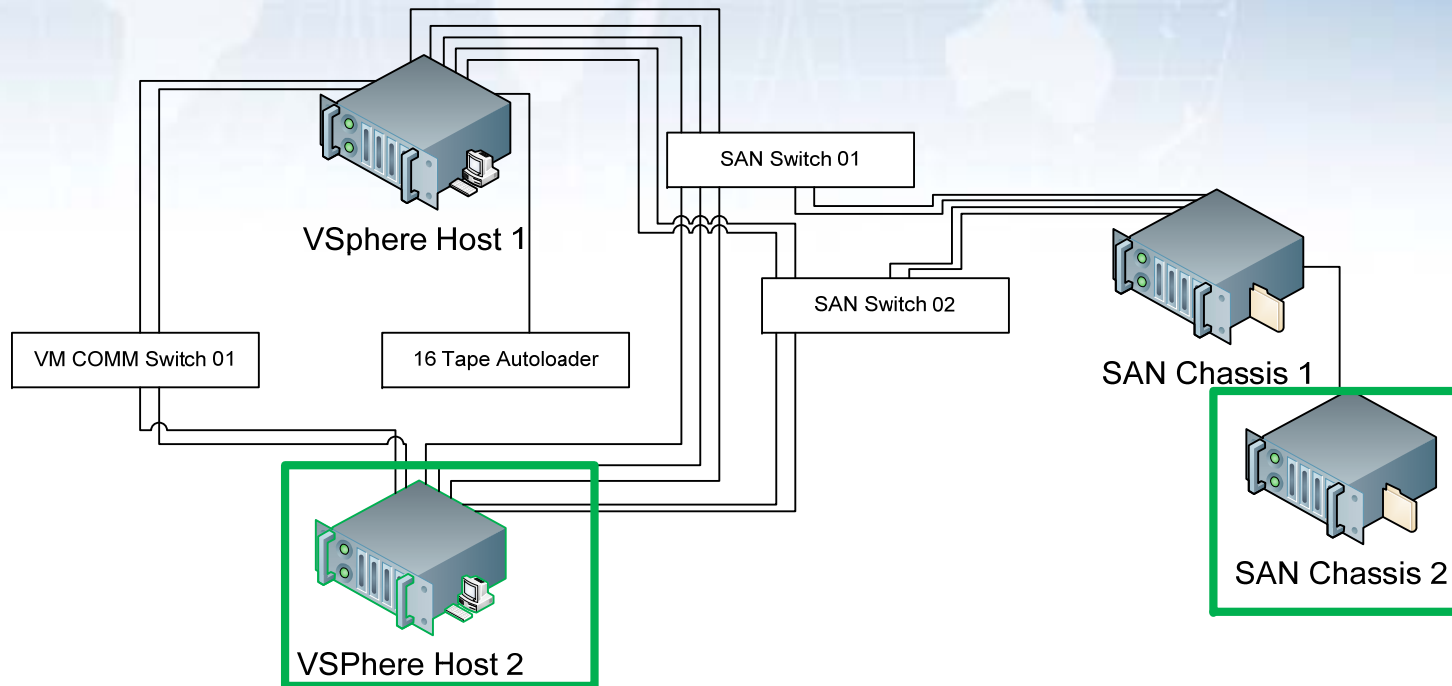   - Plan for Worst Case – All machines starting up together on common circuit.

System Layout

Phase 1 – Single Host, Single SAN Chassis

VSphere Host 1

SAN Switch 01

SAN Switch 02
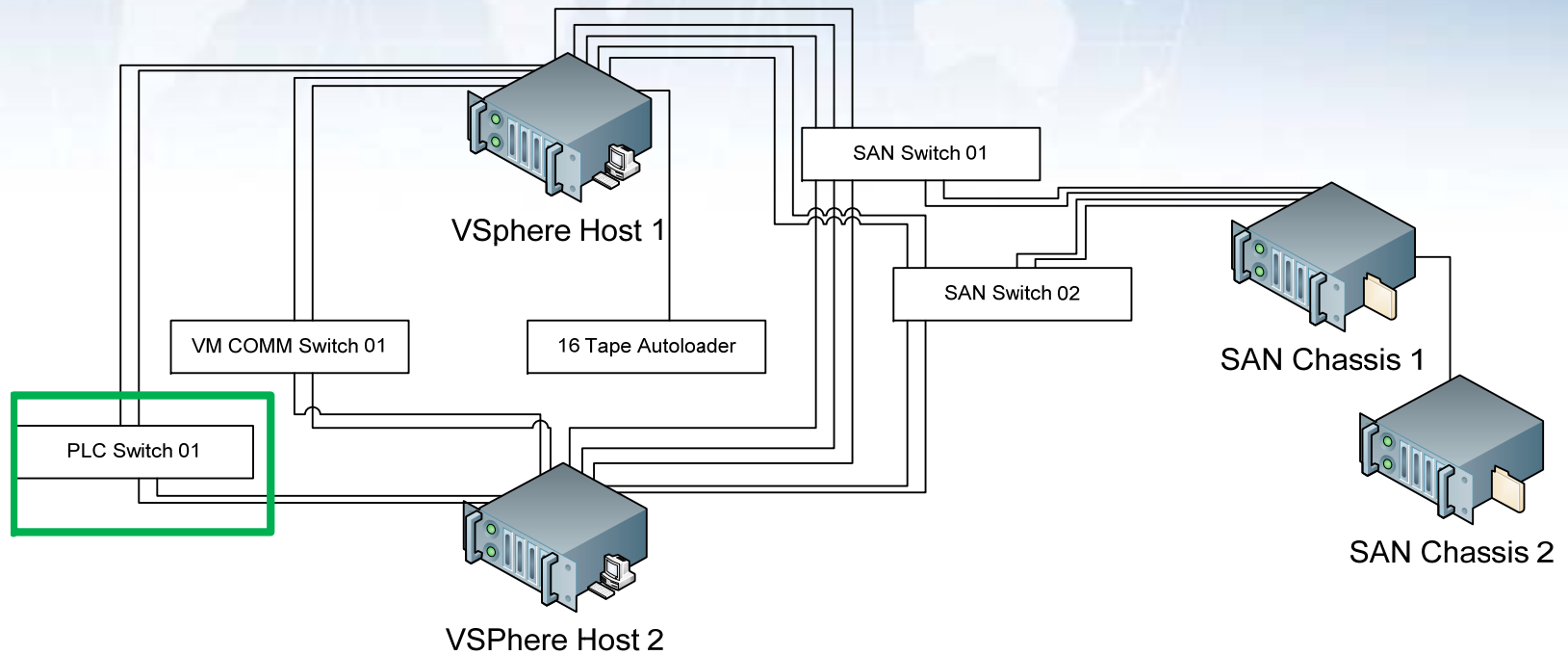
SAN Chassis 1

VM COMM Switch 01

16 Tape Autoloader

System Layout

Phase 2 – Redundant Hosts, Extra SAN Chassis

System Layout

Phase 3 – Dedicated PLC Network

Final Thoughts

- Virtualization is about more than just saving space, power, and money

    - Take credit for disaster recovery

- Plan to spend the most time and money on storage.

- Don't overthink your backups, let the technology do the work for you

- Virtualization doesn't reduce the TSLC (Total System Lifetime Complexity), it just shifts it to the design phase instead of operation and maintenance.

Questions, Comments, Thoughts