VMWORLD 2007

BREAKOUT SESSIONS

Session: IP10
Virtualization Center of Competency
"A practical guide for moving to and operating
a world class virtualization landscape"

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Siemens Medical Solutions

> Siemens Medical Solutions employs more than 36,000 people in over 130 countries and is a key business unit of Siemens AG, a leading global electronics and engineering company.

> Over fifteen years of virtualization experience on different technical platforms

> 8 Virtual Center

> Over 80 ESX Hosts

> Approximately 500 Virtual Machines of varying types… (Infrastructure, Applications, and Database Servers)
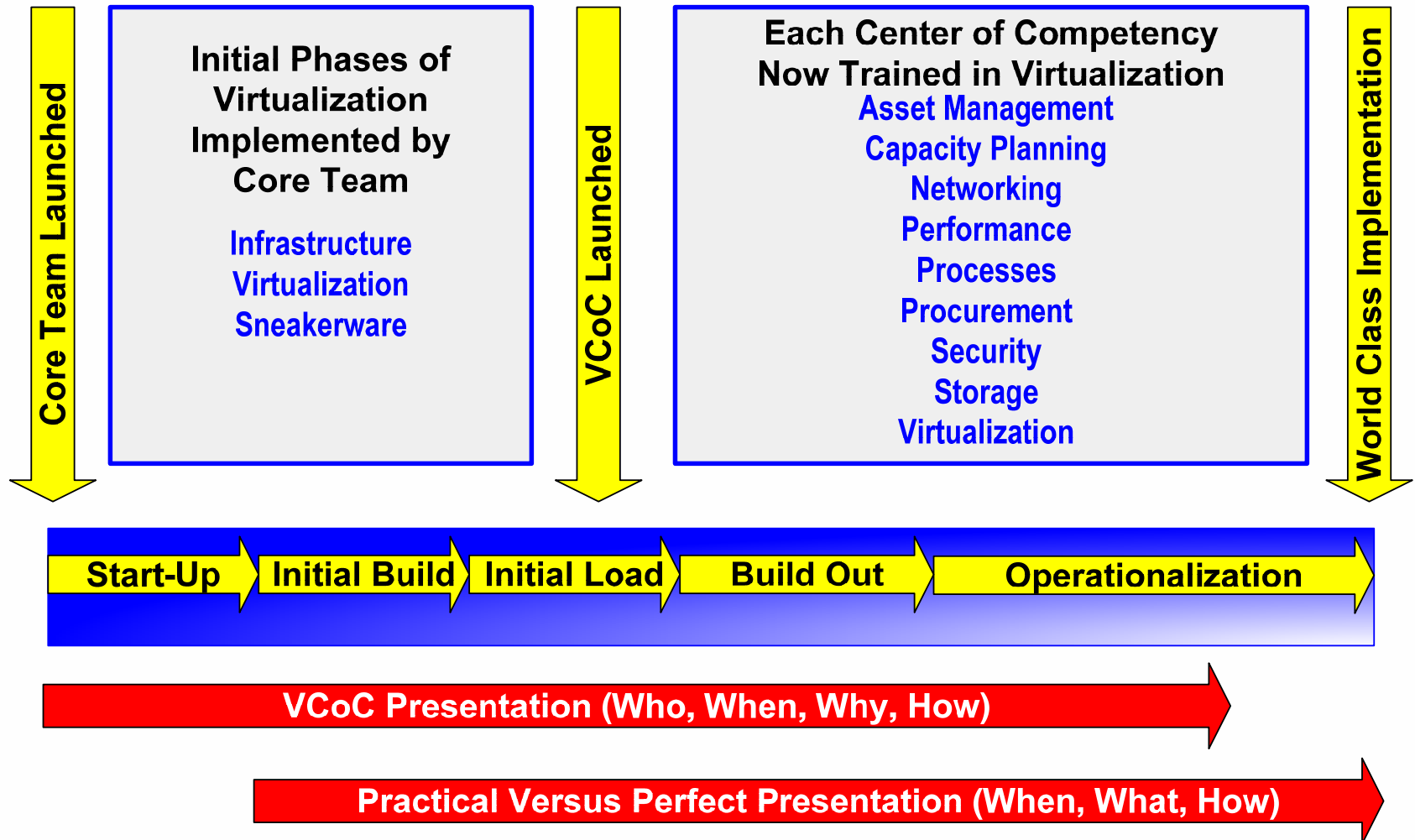
Some of the Things We Will Be Covering

> Common Virtualization Myths and Perceptions

> The Virtualization Timeline

> Definition of Each Timeline Phase

> Forming the Virtualization Core Team

> Necessary Perspectives for Virtualization

> Considerations for Different Timeline Phases

> Building the Virtualization Center of Competency

> Taking the Pulse of the Virtual Environments

> Identifying Hot Spots and Atypical Behavior

Common Virtualization Myths and Perceptions

> "I can do it all myself!"

> "I'm a technician, I don't need to get involved in the business side."

> "I don't need to get buy-in."

> "Virtualization gives you more resources then a physical system."

> "The virtual platform can't handle database servers."

> "I don't have to worry about the other stuff, I can just do ESX."

> "We can continue to keep throwing hardware\resources at problems."

> "Storage is storage, and networking is networking, it works the same."

> "I don't see any errors (on the switch, frame, etc.) it must be the host."

> "Everyone knows that virtualization is an intuitively cheaper solution."

> "I don't need education on virtualization, I can just do it."

> "It's okay to 'Set it and Forget it' once the workload is virtualized."

Virtualization Timeline

Core Team Launched

Initial Phases of Virtualization Implemented by Core Team

Infrastructure
Virtualization
Sneakerware

VCoC Launched

Each Center of Competency Now Trained in Virtualization

Asset Management
Capacity Planning
Networking
Performance
Processes
Procurement
Security
Storage
Virtualization

World Class Implementation

Start-Up | Initial Build | Initial Load | Build Out | Operationalization

VCoC Presentation (Who, When, Why, How)

Practical Versus Perfect Presentation (When, What, How)

Definition of Each Timeline Phase

▶**Start-up:** This phase includes the initial design, strategies, resource allocation, and consensus gathering prior to the actual build.

▶**Initial Build:** This phase forms the foundation for your deployment of the first Virtual infrastructure, The number and size of the ESX Hosts, LUNs, Networking, etc., vary per site but are all key to a successful build out.

▶**Initial Load:** This phase places an initial workload on the virtual infrastructure. It includes a burn in process, guest to host ratio establishment, and increasingly heavy, heterogeneous workload.

▶**Build Out:** This phase is process of scaling up the deployment of your virtual infrastructure, expertise, and staff to accommodate the business needs.

▶**Operationalization:** This is the steady state phase of training, support and turn over of the day to day operations to the support teams (a.k.a. mainstreaming)

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

Virtualization Timeline
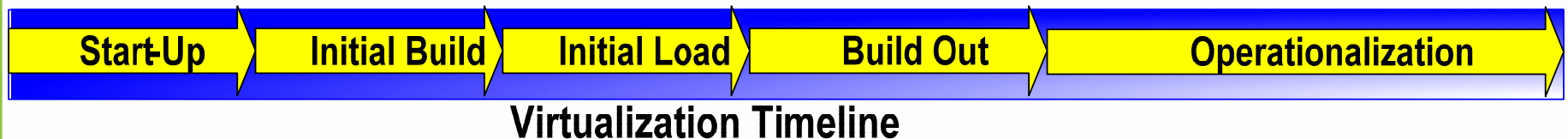
Forming the Virtualization Core Team

This is the core team involved with initial implementation. They are the keys to your virtualization success. Their strengths are in:
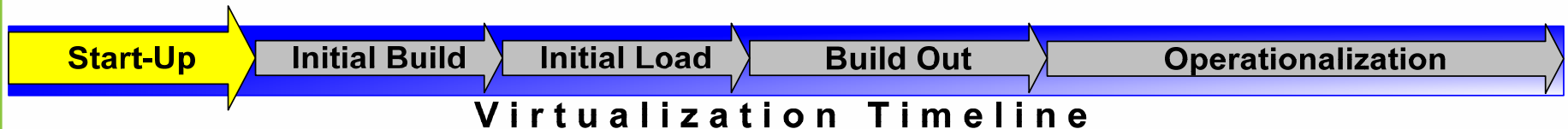
> ### Infrastructure
>   - Storage
>   - Networking
>   - Hardware Configurations
> ### Virtualization
>   - ESX Deployment
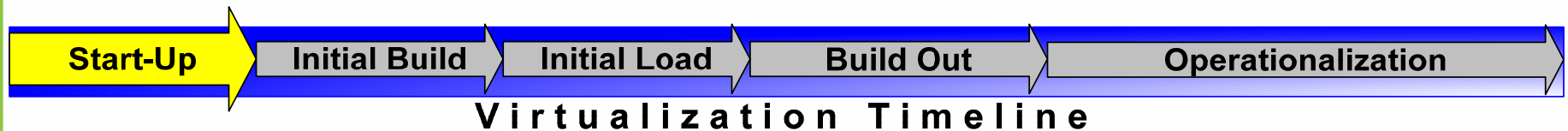>   - Virtual Center Operation
>   - Performance
>   - Security
> ## Sneakerware
>   - A willingness to track down (via sneakerware) any help needed or do any task in order to keep the project on schedule an
>   - Good communications and teaching skills

Start-Up | **Initial Build** | **Initial Load** | **Build Out** | **Operationalization**

V i r t u a l i z a t i o n   T i m e l i n e

Some Best Practices from Other Platforms to Apply

> **Capacity Planning and Reporting**

> **Change Management**

> **File Backup and Recovery Standardization**

> **Financial Targets with Quantifiable/Measurable Metrics**

> **Hardware Monitoring and Alert Notification**

> **Performance Monitoring and Reporting**

> **Recovery Point and Recovery Time Options**

> **Repeatable Processes**

> **Security Role Classification and Assignment**

> **Service Level Agreements with Customers and Vendors**

Start-Up | **Initial Build** | **Initial Load** | **Build Out** | **Operationalization**

V i r t u a l i z a t i o n   T i m e l i n e

Necessary Perspectives for Virtualization - SAN

The Core Team (and subsequent VCoC) needs to embrace some new and old perspectives on established technologies

- Take a serialized view of each component of the SAN path
  - HBA
  - Storage fabric switches/directors
  - Frame Adaptor (SAN front-end)
  - Front end CPUs
  - RAID configuration
  - Disk Speeds and Logical Groupings
- LUNs are now shared and active across multiple hosts
  - LUN queuing becomes more of a concern
  - Keeping track of WWIDs and masking is essential

Start-Up	Initial Build	Initial Load	Build Out	Operationalization

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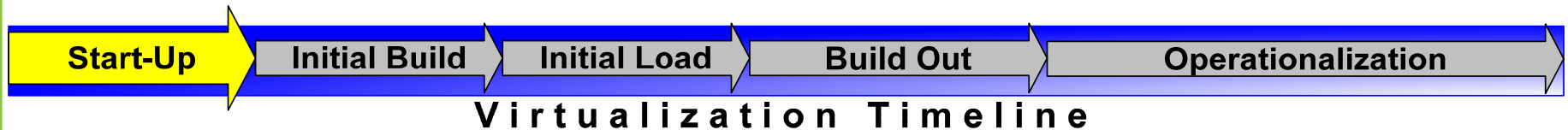
SAN Storage Infrastructure
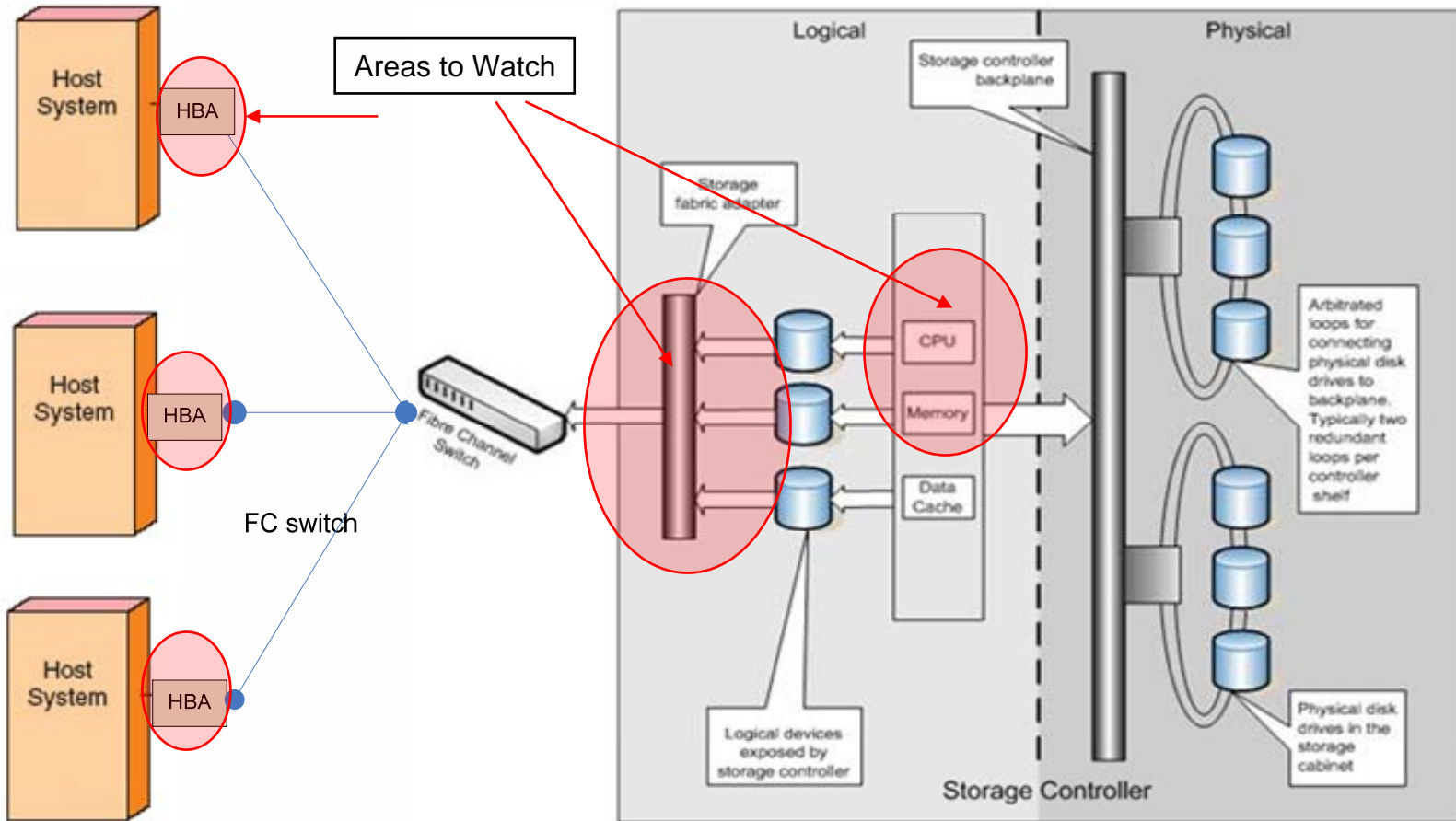
Necessary Perspectives for Virtualization (continued)

> **Networking**

- High network density for virtual infrastructure
- The network now terminates within the virtual infrastructure

> **Performance**

- The virtual context is critical
- View the performance **from the end user's perspective first**
  - Perfmon and Task Manager for the Windows view
  - Virtual Infrastructure Client and ESXTop for the ESX view
- The sampling intervals are key to correct performance analysis
- Look at both trends and real time monitoring for a complete perspective
- Some issues will not be quantifiable since they are one time occurrences (such as when different workloads all peak at the same time)

Start-Up | **Initial Build** | **Initial Load** | **Build Out** | **Operationalization**

V i r t u a l i z a t i o n   T i m e l i n e

VMWORLD 2007
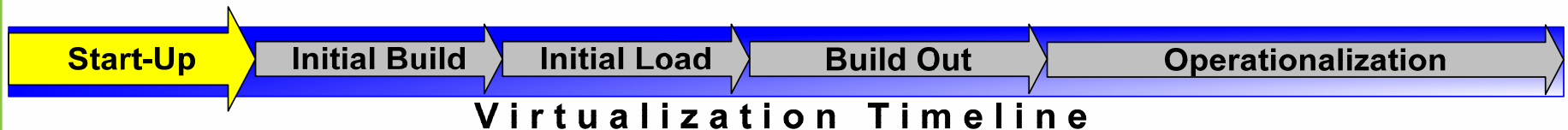
Key Things to Remember During Start-up

> Get buy-in from the financial officers - **No $$, No Go!**

- Build a solid financial plan and get senior level backing

> Leverage the existing talent in the various disciplines

- The mainframe model has been successful for many years. Learn from it!
- *Most* of their expertise from other platforms apply to the virtualization platform
- Don't let them assume that all things are the same
- Get them involved early and facilitate their education

> Virtual Center and VMotion are must haves

> Deploy your initial virtual machines on network storage, avoid local disk

> Consider cold migration times when establishing any maintenance window and choosing your data drive sizes

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

Virtualization Timeline
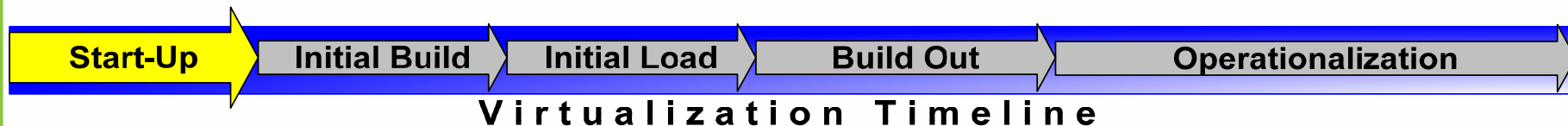
Best Practices: Essential *Processes* During Start-up

Key Points

- Escalation
  - The initial users MUST know who to call for any perceived virtualization issue
  - The Core team must know who to call for any supporting disciplines
  - Set realistic expectations on how quickly the Core Team can respond
- Performance Analysis
  - Establish a process to do increasingly deep performance analysis of workloads
  - Leverage performance analysis skills from other technology platforms
- Provisioning
  - Establish a **repeatable process** to provision net new virtual machines
  - Establish a timely process to procure new ESX host systems
- Sandbox and Staging Servers
  - Required to identify and resolve problems and to apply fixes

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

Virtualization Timeline
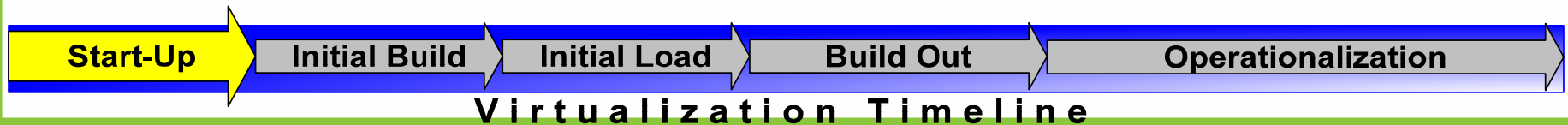
Key Things to Remember During the Initial Build

> Think ENTERPRISE, plan for substantial growth

> Build in additional time for education ramp-up

> Build and get an approved Capacity Plan in place

> Initial decisions must be geared toward scalability

> Determine metrics that can be used to measure success

> Commit to an initially low virtual machine/host virtualization ratio

> Use industry\vendor preferred practices for World Class Implementation

> Use tools such as Platespin's PowerRecon and VMWare's Capacity Planner to estimate your target configuration but rely on real world testing after the loads are virtualized

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

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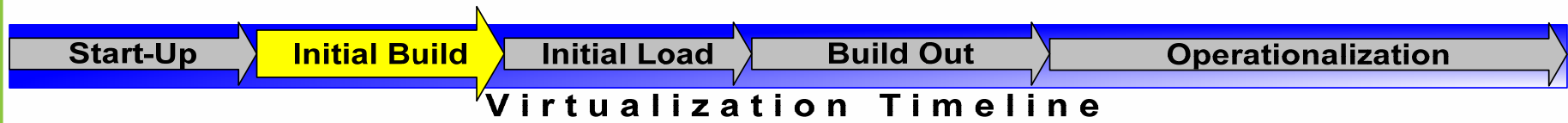
Technical Considerations for the ESX Host Hardware

- All critical resources must be "Truly" redundant
- Always Consult Vendor HCLs\SCLs during farm design
- Minimum dual processor and dual core
- The faster the better to overcome virtualization overhead
- Avoid large (8-way or greater) systems except for large SMP implementations
- Memory capacity is key (2-4GB per CPU in ESX host)
- Local disk capacity is not as important
- Deploy multiple hosts of the same processor family for VMotion
- Bundle NICs whenever possible to avoid single point of failure
- Build a migration strategy for technology refreshes

Start-Up	Initial Build	Initial Load	Build Out	Operationalization

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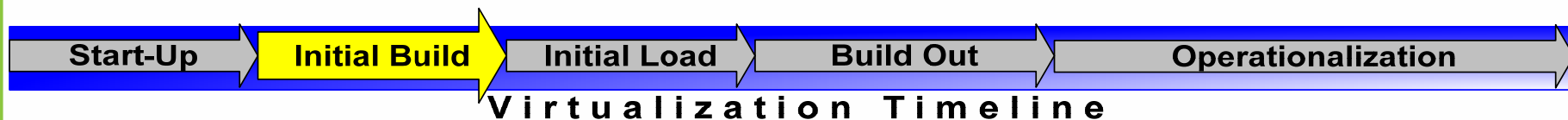
Getting the Storage Subsystem Design Correct!

- ESX places unique demands on storage (all down one "pipe")
- Use multiple fiber HBAs for SAN
- Manually assign different HBAs to guest machines (manual load balancing)
- Spread I/O across multiple adapters and front end CPUs
- Design by capacity **AND** I/Os per Second
- Design SAN for performance at a LUN level not just at the frame level
- Choose the type of RAID carefully
- Consider tiered storage based on capacity and performance needs
  - Tiers can be implemented inside the same SAN frame
    - Different speed and types of disk (ex., Fiber and S-ATA)
    - Different RAID configurations
    - Different groupings of physical disk

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

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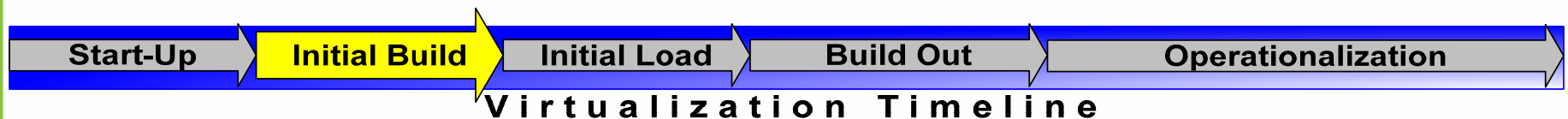
Choosing Your Initial Workloads to Maximize Success

- "Lightweight" tiers such as web and print servers that only need a system drive
- Environments that are destructive at the operating system level
- Multiple copies of essentially the same environments
- Environments that need quick and painless partial or full resets
- Systems that can tolerate some degree of performance degradation
- Servers that are totally under your control
- Servers used by groups that embrace change
- Identify Footprint of initial loads (Core Four Resources)
- Gather requirements of hosted loads (access, software, backups, etc.)
- Understand isolation requirements and deploy loads and VMWare features accordingly
- Transition requirements into farm design\implementation actions (hosts, storage, network)

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

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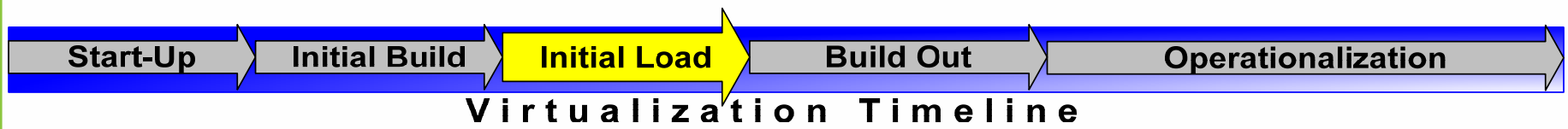
Transitioning from the Initial Load to the Build Out

- Review the Initial Build for Lessons Learned

- Validate the Financial Plan

- Gather the Requirements for the Build Out

- Engage all of the technical, financial, and process groups to determine what should and should not be in the VCoC

- Recognize any final bastions of resistance to virtualization and address their concerns. Rely on metrics from the Initial Build phase to help forecast Build Out requirements

- Use the capacity plan to perpetuate scalability and resource fulfillment

- Consult with critical discipline areas to ensure infrastructure availability

- Target hardware consistency

- Ongoing supportability is very high on the priority list

- Build net new VMs when and where possible

- Be careful of over confidence and stretching the Rules of Thumb

Start-Up	Initial Build	Initial Load	Build Out	Operationalization

V i r t u a l i z a t i o n   T i m e l i n e

Building the Virtualization Center of Competency

The VCoC transitions the virtual landscape from initial build to the build out phase with world class implementation measures. The VCoC comprises the original Core team augmented by resources from the following disciplines:

> Asset Management

> Capacity Planning

> Networking

> Performance

> Processes

> Procurement

> Security

> Storage

> Systems Administration

> Virtualization

Remember that you can't move to a World Class Implementation until ALL of the various disciplines move there! World Class applies to the entire infrastructure and organization, not just to the part that the VCoC handles.

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

V i r t u a l i z a t i o n   T i m e l i n e
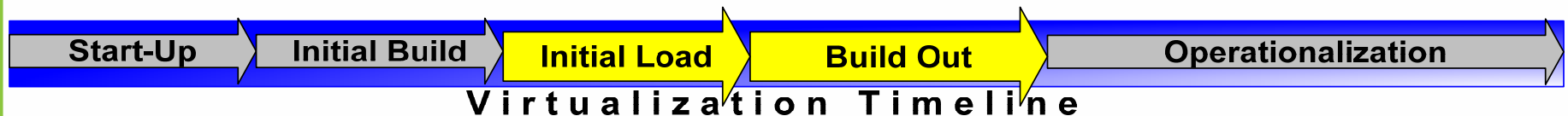
Best Practices: Essential *Processes* During the Build Out

Key Points

> Documentation
>> ■ As painful as it may be, you need to document your processes
>>> □ This is necessary for 24x7 support
>>> □ "If you can't repeat it, you can't support it"

> Establish Repeatable and Measurable Financial Metrics
>> ■ Chargebacks and resource consumption are company requirements

> Knowledge Transfer
>> ■ Establish a mentoring or buddy program to do knowledge transfer
>> ■ Avoid any single point of failures, especially with individuals

> Patching
>> ■ Create a process for patching and upgrading ESX hosts and virtual machines

> Scalability
>> ■ Every infrastructure component must be scaleable
>> ■ Achievable timeframes and costs are needed for infrastructure scaling

Start-Up | **Initial Build** | **Initial Load** | **Build Out** | **Operationalization**

V i r t u a l i z a t i o n   T i m e l i n e
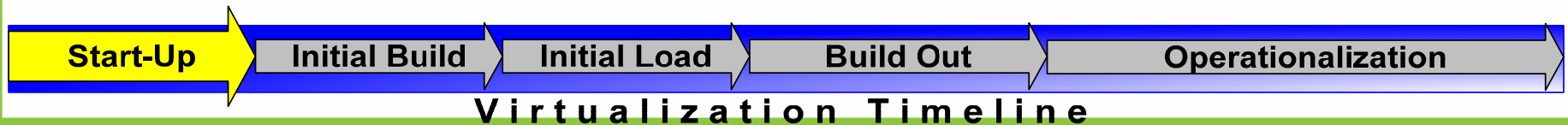
Best Practices: Taking the Pulse of Virtual Environments

> Revisit the configuration of virtual machines whose resource consumption characteristics have changed and can be explained

- Make sure you understand *why* things have changed
- Is it time to increase, decrease, or cap the resource usage?
- Are you still meeting your virtualization target ratios?
- How close are you to requiring additional capacity?

Key Points

> Check network speeds to make sure that AutoNegotiate has not downshifted network bandwidth or moved to half duplex

> Check SAN paths to make sure that all are active

> Check hardware health using software such as Dell's OpenManage

Start-Up	Initial Build	Initial Load	Build Out	Operationalization

V i r t u a l i z a t i o n   T i m e l i n e

Best Practices: Finding Hot Spots and Atypical Behavior

Key Points

- Resolve Hot Spots
  - Hot spots affect other virtual machines, the ESX host, and the whole environment
  - Don't let DRS automatically move a problem that needs to be corrected

- Dive deeply when behavior changes
  - Workloads and usage will change. You have to regularly adjust!
  - Engage the application or server owners since the changes often start in their area

- Right size memory and CPU
  - Differentiate between active and allocated memory
  - Remember that the end user experiences the performance in the virtual machine context

- Use a measured and careful application of SMP
  - SMP should only be used when workloads are independent multi-threaded
  - Use SMP sparingly, and consider the consequences on the virtualization ratio

Start-Up	Initial Build	Initial Load	Build Out	Operationalization

V i r t u a l i z a t i o n   T i m e l i n e
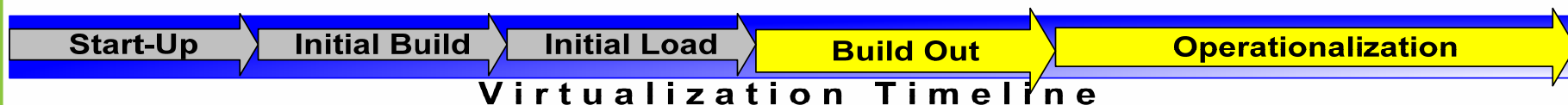
Top Performance Counters per Context

Physical/Virtual Machine

CPU
- **Average physical CPU utilization****
- **Peak physical CPU utilization****
- CPU Time**
- **Processor Queue Length**

Memory
- **Average Memory Usage**
- **Peak Memory Usage**
- Page Faults
- Page Fault Delta

Key Points

Disk
- I/O Reads
- I/O Writes
- I/O Read Bytes
- I/O Write Bytes
- **Split IO/Sec**
- **Disk Read Queue Length**
- **Disk Write Queue Length**
- **Average Disk Sector Transfer Time**

Network
- **Bytes Total/second**
- **Total Packets/second**
- Bytes Received/second
- Bytes Sent/Second
- Output queue length

** Remember that certain counters are "soft" and should be used as general guides only.

Farm/Cluster/Complex

- % CPU utilization
- % Memory Utilization

ESX Host

- Average physical CPU utilization
- Peak physical CPU utilization
- **Physical CPU load average**
- Logical CPU utilization
- CPU Effective Use
- Memory Usage
- Disk Reads/second
- Disk Writes/second
- NIC MB transmit/second
- NIC MB write/second
- % Used CPU (high consuming VMs)
- **%Ready to Run**
- %System (< 5% total)
- %Wait
- Allocated VM memory
- Active VM memory

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |

V i r t u a l i z a t i o n   T i m e l i n e

Healthy

| | Summary | Virtual Machines | Hosts | Resource Allocation | Performance | Tasks & Events | Alarms | Permissions | Maps |

Name or State contains: ▾ [   ] Clear

State	Status	% CPU	% Memory	Memory Size - MB	CPU Count	NIC Count	Uptime
Connected	○○●	5	57	24575.66	2	6	16 days
Connected	○○●	6	57	24575.66	2	6	17 days
Connected	○○●	14	61	24575.66	2	6	17 days
Connected	○○●	9	59	24575.66	2	6	17 days
Connected	○○●	9	60	24575.66	2	6	7 days
Connected	○○●	5	57	24575.66	2	6	16 days
Connected	○○●	16	56	24575.66	2	6	17 days
Connected	○○●	9	65	24575.66	2	6	17 days
Connected	○○●	3	58	24575.66	2	6	16 days
Connected	○○●	17	56	24575.66	2	6	17 days
Connected	○○●	7	58	24575.66	2	6	17 days
Connected	○○●	6	64	24575.66	2	6	17 days
Connected	○○●	6	57	24575.66	2	6	17 days
Connected	○○●	18	56	24575.66	2	6	16 days

Memory Allocation Needs to Be Watched

Start-Up ⟩ Initial Build ⟩ Initial Load ⟩ Build Out ⟩ Operationalization ⟩

V i r t u a l i z a t i o n   T i m e l i n e

Hot Spots Come in Many Forms

Average — High Disk Utilization

PhysicalDisk	_Total	0 C:	1 D:
% Idle Time	53.101	98.529	7.672
Avg. Disk Bytes/Read	6667.575	5416.421	6668.578
Avg. Disk Bytes/Write	6130.834	5960.987	6135.793
Avg. Disk Queue Length	1.941	0.015	1.926
Avg. Disk Read Queue Length	1.713	0.003	1.710
Avg. Disk sec/Read	0.007	0.017	0.007
Avg. Disk sec/Transfer	0.006	0.006	0.006
Avg. Disk sec/Write	0.003	0.005	0.003
Avg. Disk Write Queue Length	0.228	0.012	0.216
Disk Bytes/sec	2109912.837	15190.168	2094722.669
Disk Reads/sec	239.508	0.192	239.316
Disk Transfers/sec	323.179	2.566	320.614
Disk Writes/sec	83.671	2.374	81.297
Split IO/Sec	24.698	0.303	24.395

Maximum — High Split I/Os

PhysicalDisk	_Total	0 C:	1 D:
% Idle Time	62.112	100.024	24.221
Avg. Disk Bytes/Read	16508.121	7065.600	16508.121
Avg. Disk Bytes/Write	14806.710	9557.333	15076.766
Avg. Disk Queue Length	5.374	0.414	5.333
Avg. Disk Read Queue Length	5.047	0.201	5.047
Avg. Disk sec/Read	0.107	0.054	0.107
Avg. Disk sec/Transfer	0.031	0.054	0.034
Avg. Disk sec/Write	0.017	0.039	0.021
Avg. Disk Write Queue Length	1.008	0.414	0.999
Disk Bytes/sec	9232861.634	189452.984	9220572.998
Disk Reads/sec	996.052	12.999	996.052
Disk Transfers/sec	1083.056	29.002	1080.056
Disk Writes/sec	155.030	29.002	146.028
Split IO/Sec	178.010	8.999	178.010

Start-Up → Initial Build → Initial Load → Build Out → Operationalization

Virtualization Timeline

Right Sizing and Hot Spots Viewed Together

Could be trouble areas when virtualized

Windows Task Manager

File Options View Help

Applications | Processes | Performance

Image Name	CPU	CPU Time	Mem Usage	Peak Mem Usage	Page Faults	PF Delta	I/O Reads	I/O Writes	I/O Read Bytes	I/O Write Bytes
TRIGGAG.exe	00	0:08:38	4,976 K	5,172 K	19,218,631	0	95	8	241,348	67
WinMgmt.exe	01	1:11:29	4,184 K	8,140 K	7,346,054	57	1,190	118,808	37,511,188	36,067,706
caiW2kOs.exe	00	0:08:22	8,356 K	9,020 K	5,246,485	0	17,526	133	61,980,590	12,938
System	00	1:05:45	248 K	1,260 K	4,196,283	0	21,424	296,583	10,270,548	217,517,198
igateway.exe	00	0:27:20	15,344 K	15,880 K	2,334,160	0	801,567	226,064	205,391,064	162,113,393
NTRtScan.exe	00	0:17:10	5,016 K	50,468 K	1,387,408	0	112,676	142,963	1,555,040,521	531,148,127
cqmghost.exe	00	2:09:44	6,068 K	6,236 K	1,360,178	0	5,832	25	1,518,336	1,231
pssubhnd.exe	00	0:03:54	96,920 K	166,004 K	1,231,219	0	46,881	1,974	53,452,931	235,916
dsmcsvc.exe	00	0:49:31	11,548 K	33,700 K	516,687	0	240,671	138,093	7,073,027,932	176,327,464
JSH.exe	00	0:02:09	46,564 K	263,272 K	449,028	0	3,951	603	322,424,400	70,861,054
SERVICES.EXE	00	0:15:15	216,080 K	217,504 K	338,670	0	4,324,942	4,165,230	298,876,779	2,473,294,345
psappsrv.exe	00	0:02:06	101,496 K	129,792 K	289,012	0	2,258,122	9,823	2,348,214,388	120,023,939
JSH.exe	00	0:01:52	3,676 K	16,372 K	263,775	0	4,434	494	248,836,920	97,334,419
TmListen.exe	00	0:01:38	7,560 K	8,888 K	238,021	0	28,488	2,861	594,649,336	267,064,883
JSH.exe	00	0:01:33	8,332 K	48,000 K	182,055	0	3,899	602	195,284,286	76,772,493
JSH.exe	00	0:01:29	3,628 K	14,020 K	158,802	0	3,887	927	219,475,240	94,940,773
JSH.exe	00	0:01:52	9,144 K	89,592 K	157,047	0	4,380	1,306	278,508,400	175,645,970
JSH.exe	00	0:01:31	3,624 K	15,644 K	134,467	0	3,172	534	156,360,493	76,799,281
JSH.exe	00	0:01:40	3,944 K	15,896 K	125,830	0	3,832	811	222,210,018	128,143,978

☑ Show processes from all users

End Process

Processes: 165   CPU Usage: 2%   Mem Usage: 2002828K / 7883512K

Start-Up ▷ **Initial Build** ▷ **Initial Load** ▷ **Build Out** ▷ **Operationalization** ▷

V i r t u a l i z a t i o n   T i m e l i n e

Active Versus Allocated Memory
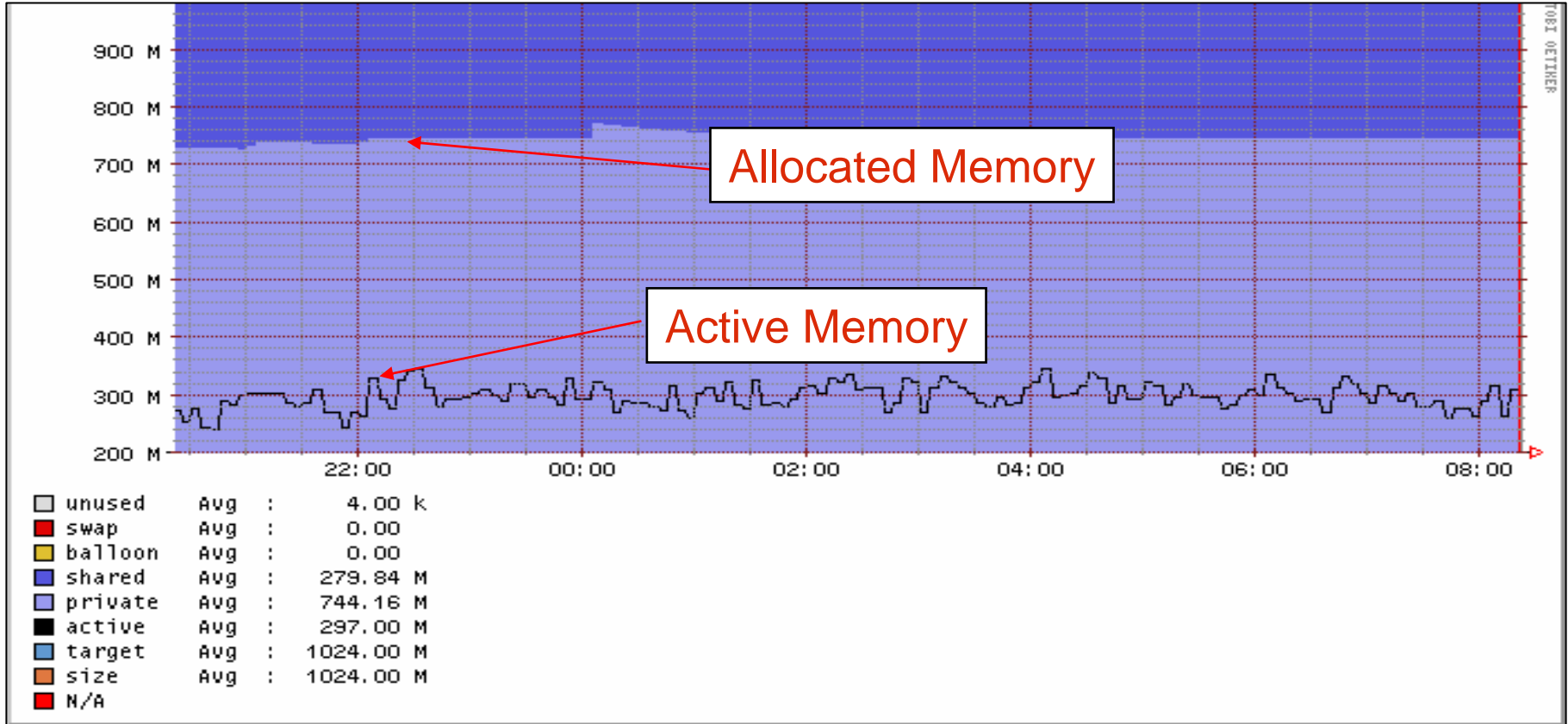
Atypical Behavior or Usage Pattern Change?

What Happened Here?
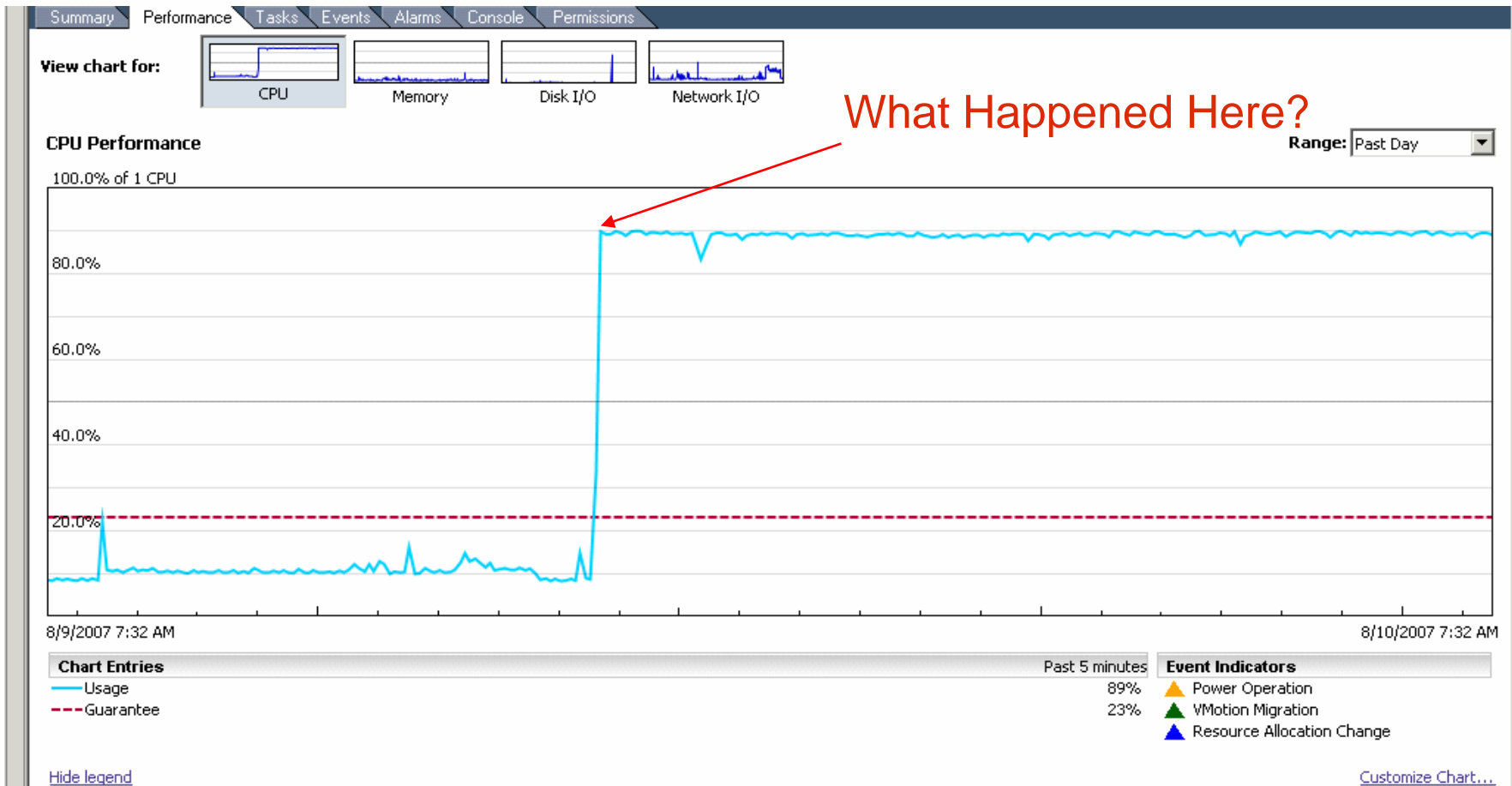
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Is this typical or atypical?

Why is the steady state so high?

V i r t u a l i z a t i o n   T i m e l i n e

| Start-Up | Initial Build | Initial Load | Build Out | Operationalization |
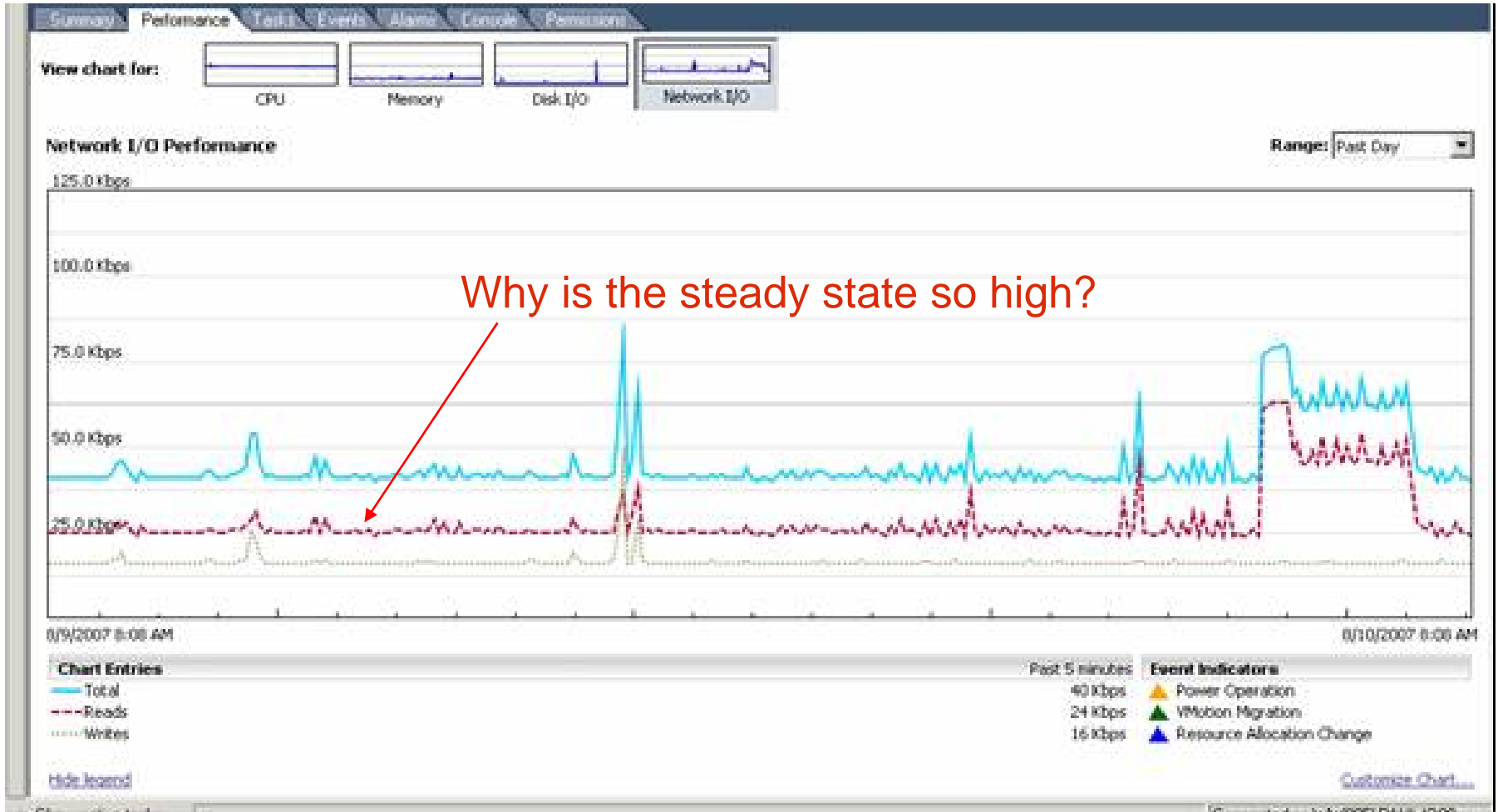
Are these typical or atypical?

Ready to Run at Seven Percent

Thirty Percent Steady State

vcpu0 Avg : 28.74
ready0 Avg : 7.01

% CPU Busy

cpu0 Avg : 41.97
cpu1 Avg : 32.53
Unavailable

Start-Up → Initial Build → Initial Load → Build Out → Operationalization

Virtualization Timeline

Virtual Infrastructure Client

Key	Object	Measurement	Units	Latest	Maximum	Minimum	Average
■	0	CPU Usage (Average/Rate)	Percent	17.8	34.19	6.85	14.91
■	1	CPU Usage (Average/Rate)	Percent	16.75	80.99	4.34	22.41
■	2	CPU Usage (Average/Rate)	Percent	16.78	85.3	4.66	22.09
■	3	CPU Usage (Average/Rate)	Percent	14.83	99.95	5.02	21.78
■	4	CPU Usage (Average/Rate)	Percent	33.76	69.36	1.57	19.72
■	5	CPU Usage (Average/Rate)	Percent	51.41	83.28	2	22.08

Start-Up → **Initial Build** → **Initial Load** → **Build Out** → **Operationalization**

V i r t u a l i z a t i o n   T i m e l i n e

ESXTop – CPU View

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ESXTop – Memory View

Virtualization Timeline: Start-Up → Initial Build → Initial Load → Build Out → Operationalization

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ESXTop – Disk View

V i r t u a l i z a t i o n   T i m e l i n e

Start-Up | Initial Build | Initial Load | Build Out | Operationalization

Some of the Things We Will Cover in the Next Presentation

> If I Only Knew Then What I Know Now

> What is a World Class Deployment of Virtualization?

> Standards of Practice

> World Class Virtualization Deployment Details

> World Class Deployment Strategies

> Build Out Essentials for a World Class Implementation

Closing Comments

> Think Enterprise and World Class during start-up BUT build up gradually

> Financial buy-in should not be assumed, go out and get it!

> Learn from others, don't make their mistakes (you will make plenty on your own!)

> Find and fix the hot spots and recognize atypical behavior

> Attend the next session (IP26) for more details on World Class Virtualization Deployment

> Review most, if not all, of the VMWorld presentations several weeks after VMWorld. They are invaluable references for your deployment!

Questions?

Session: IP10 - Virtualization Center of Competency
"A Practical Guide for moving to and operating a world class virtualization landscape"

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