

NO
LIMITS

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Characterize Performance in Horizon 6

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Agenda

1 Horizon 6 Performance

- Workload: VMware View Planner

- RDSH Performance

- VDI Performance (Virtual SAN)

3 Use Cases

4 Horizon 6 Performance Best Practices

5 Conclusion

Virtual Desktops and Apps from a Single Platform



RDS
Hosted Apps



RDS
Session-Based
Desktops



Virtual
Desktops



Packaged
ThinApps

Single Platform with Cloud Scale

Horizon RDS Desktops and Hosted Apps

Reduce TCO for Windows Application Access



Overview

- Integrated delivery of applications and full desktops running on Microsoft Windows Remote Desktop Services.
- Seamless access to Windows Apps from mobile devices
- Utilize the standard View Clients (Win, Mac, IOS & Android) with PCoIP™

Benefits

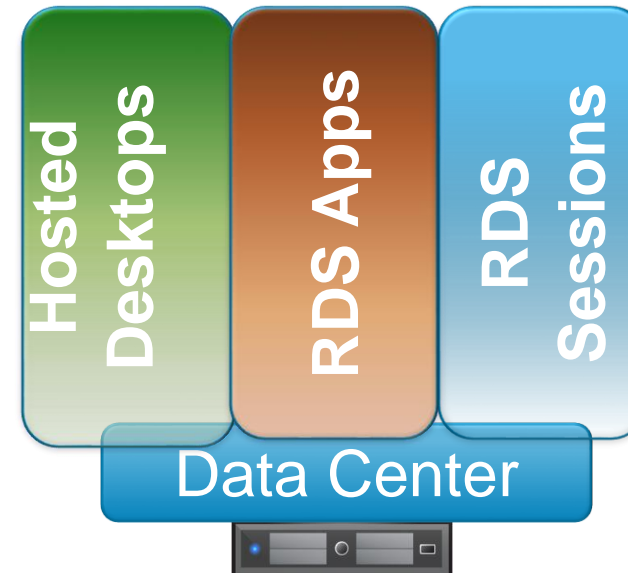
- Low TCO with a classic Terminal Services model, and favorable licensing from Microsoft.
- Great, high performance, cross-platform user experience with View Clients, PCoIP™ and Horizon Workspace.

Horizon 6 RDSH Performance

RDSH Session Performance

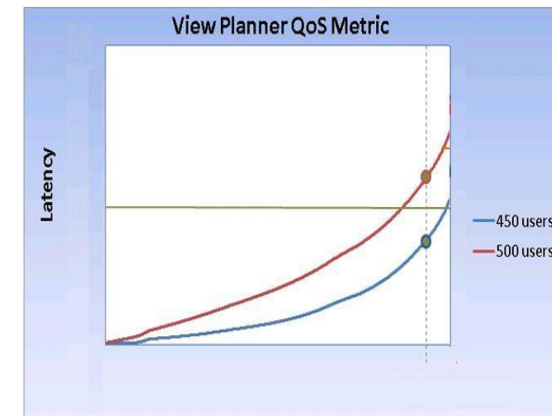
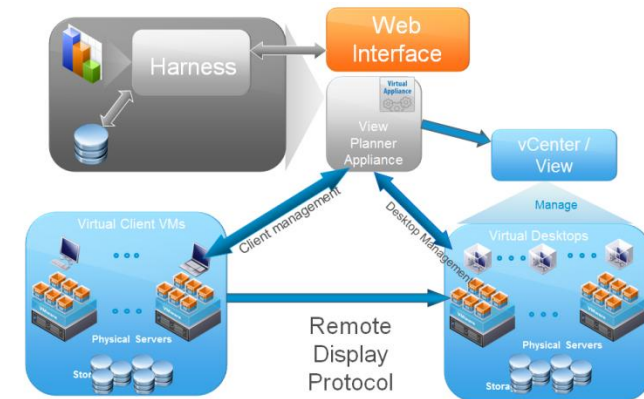
Challenges for sizing and benchmarking

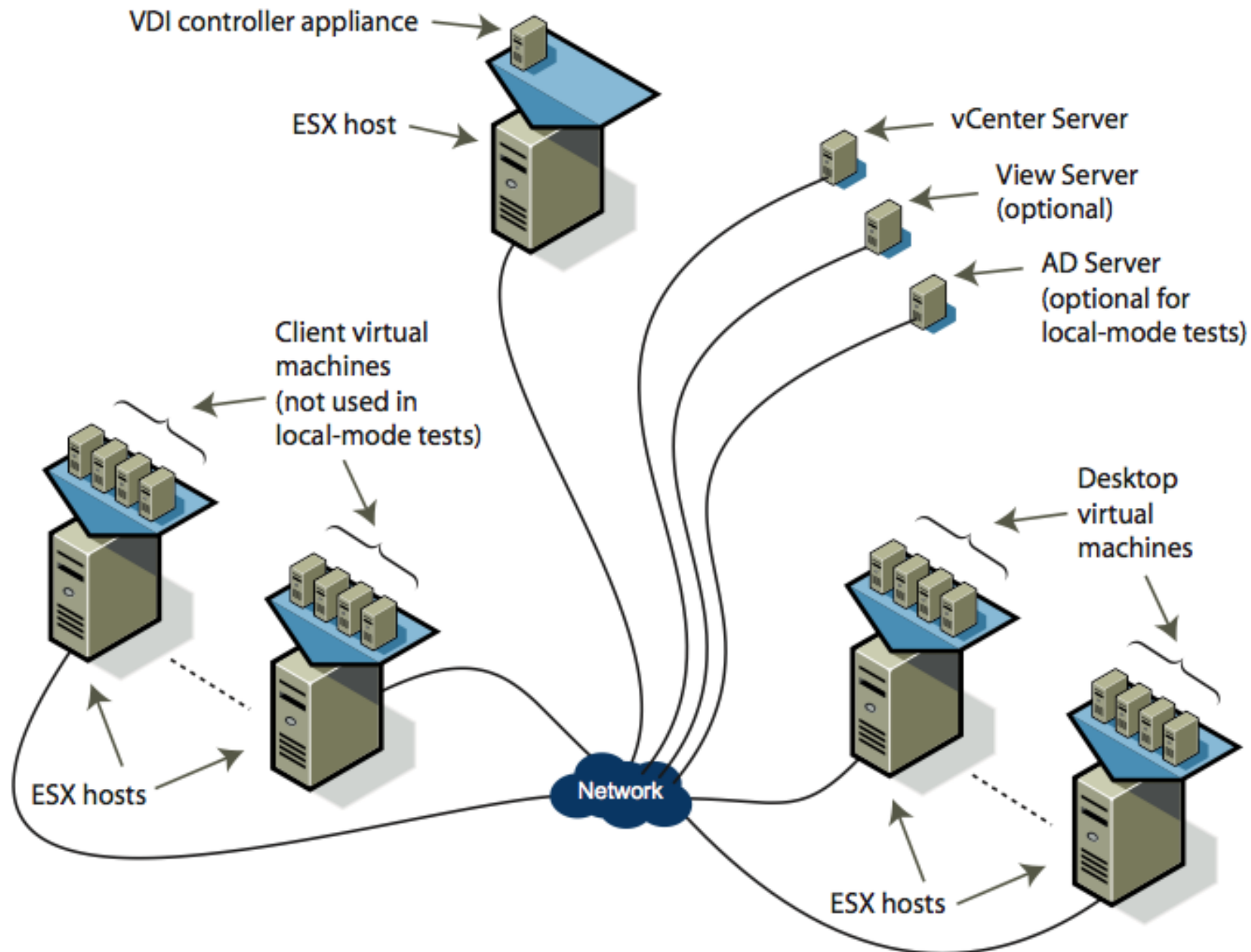
- Need help for various activities:
 - Capacity and sizing planning for various solutions
 - End to end hardware/architecture comparison over generations
 - Platform optimization and fine tuning
- Need a tool to help simplify these tasks



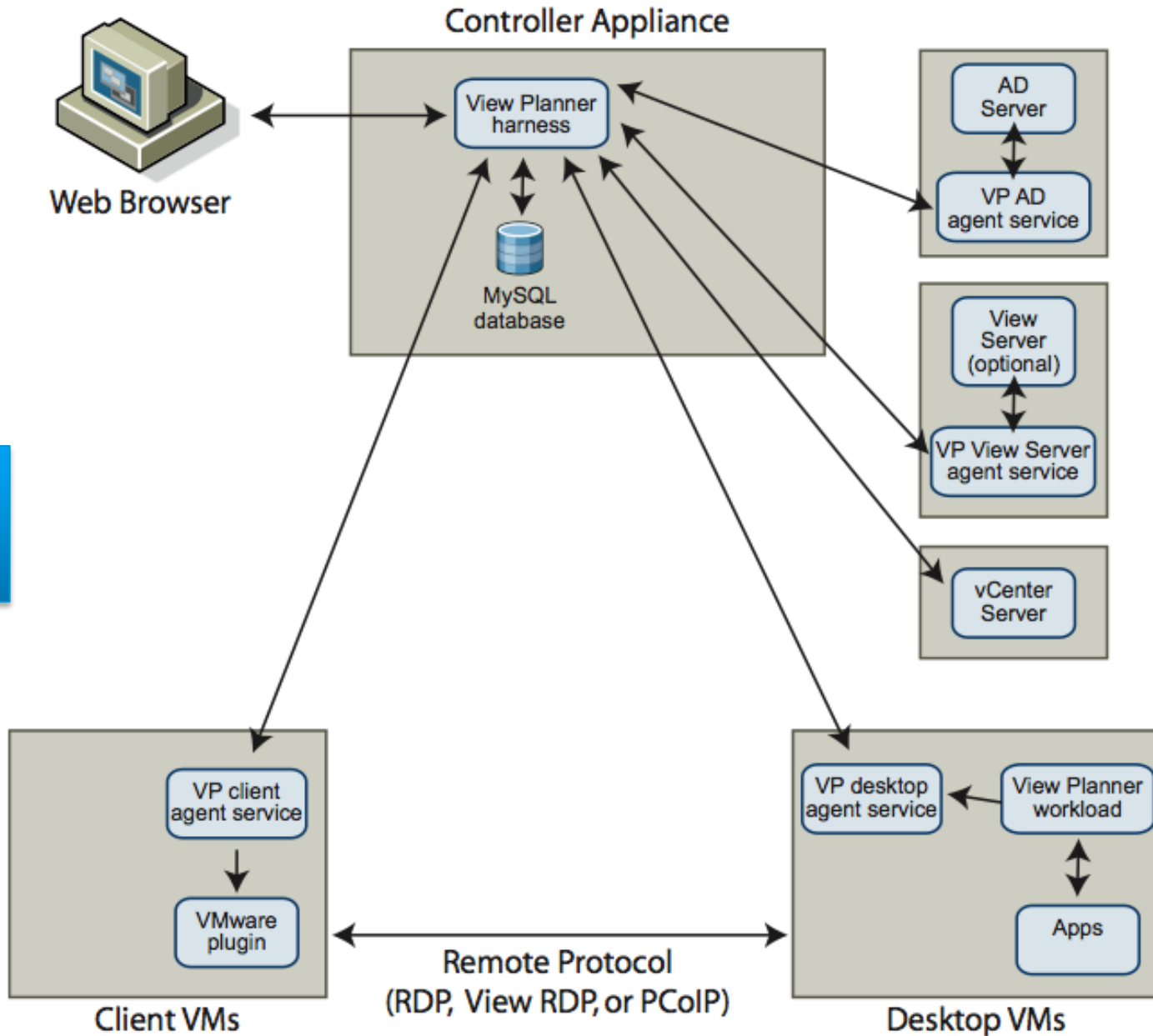
Workload: VMware View Planner 3.5

- Workload generator and sizing tool
 - Platform characterization (CPU, memory, storage)
 - Evaluate user experience
 - Understand scaling issues and identify bottlenecks
- Workload parameters
 - All applications selected (Office 2010: PowerPoint, Excel, Word, Outlook, Web album, Video, Firefox, Adobe, 7Zip, IE11)
 - Thinktime of 5 seconds
- A newer benchmark version (3.5) will release soon. For more info, send email to
 - viewplanner-info@vmware.com
 - Previous talk on VP 3.5 (EUC 1630)

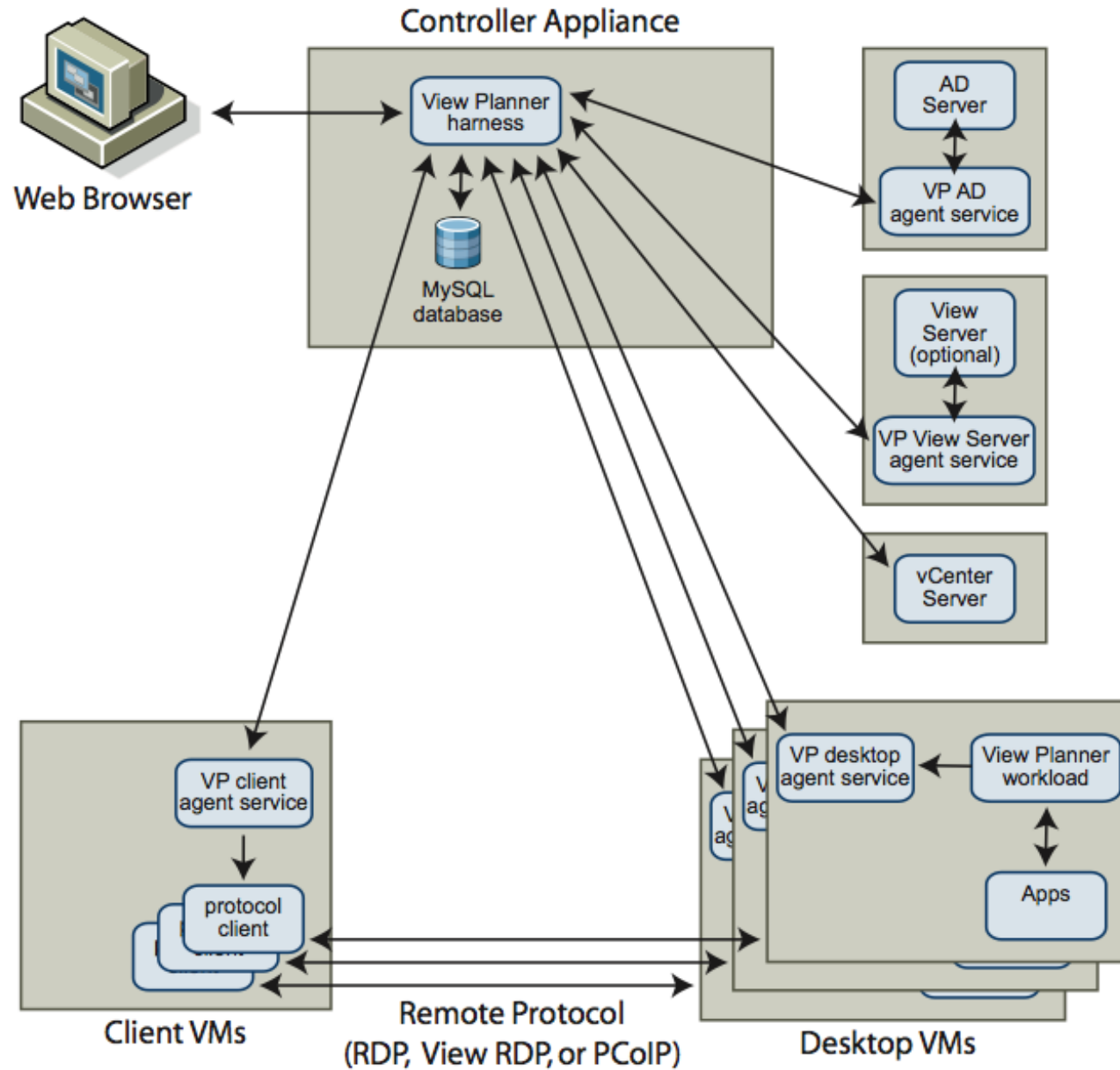




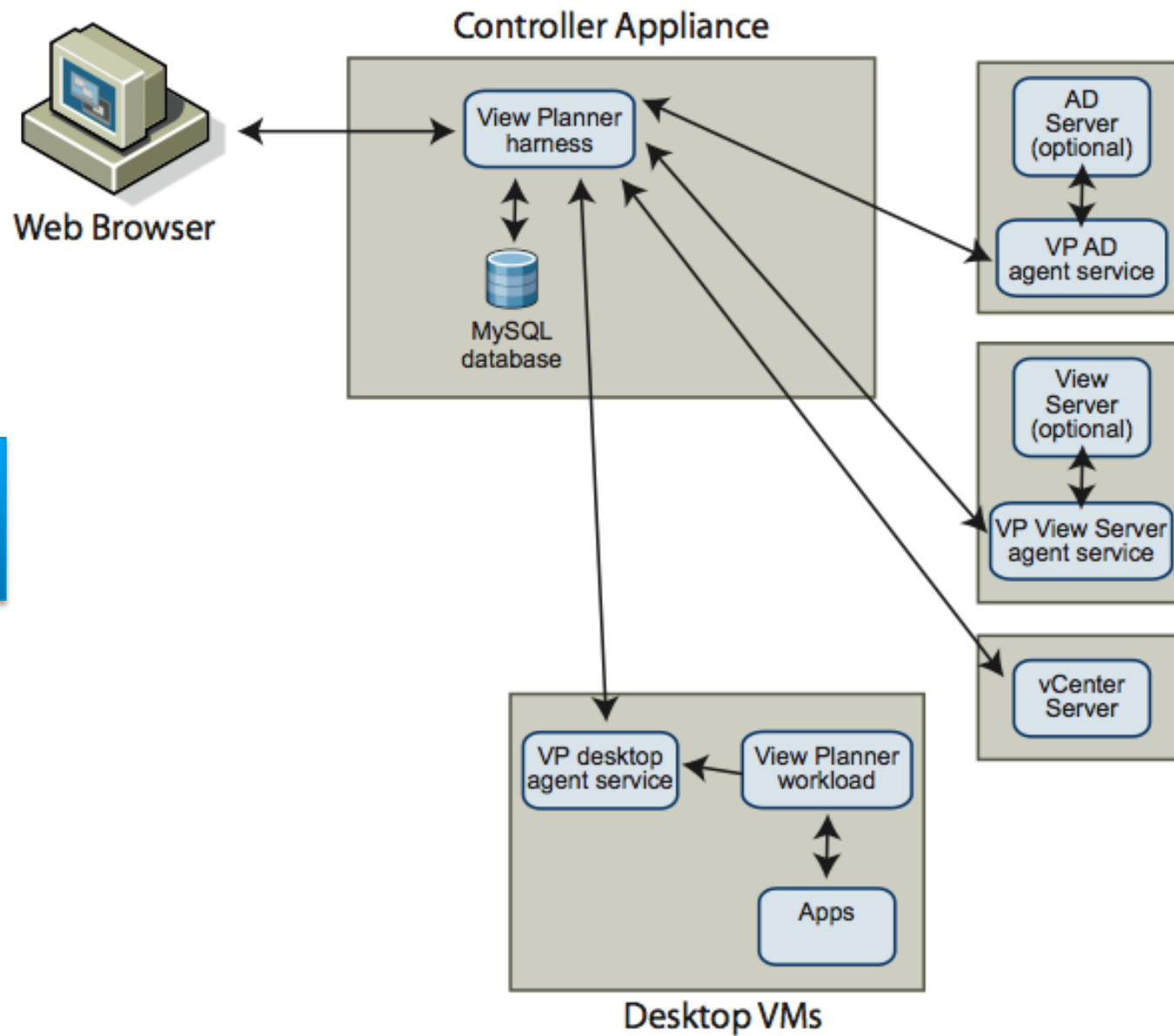
Remote



Passive



Local



Scoring Methodology

Test Group	Operation Type	Result
Group A	Interactive or fast-running operations that are CPU bound, such as browsing through a PDF file or modifying a Word document.	95 th percentile: 0,5287s (BR: <= 1.0 sec)
Group B	Long-running slow operations that are I/O bound, such as opening a large document or saving PowerPoint file.	95 th percentile: 3,2498s (BR: <= 6.0 sec)

RDSH Performance Evaluation

How to Size your RDSH server?

- Very little prior information available
- Many questions may arise during deployment
 - How many sessions/core?
 - What should be the level of CPU over-commitment?
 - 1:1, 1:1.5, 1:2
 - Should we scale up (add more vCPUs) or scale out (add more instances of lower vCPU RDS servers)?
 - For example, on a 32-core physical server (4 socket with 8 cores each) – how do you decide?

1:1 overcommit

2 x 16-vcpu
4 x 8-vcpu
8 x 4-vcpu

1.5:1 overcommit

3 x 16-vcpu
4 x 12-vcpu
6 x 8-vcpu
8 x 6-vcpu
12 x 4-vcpu

2:1 overcommit

4 x 16-vcpu
8 x 8-vcpu
16 x 4-vcpu

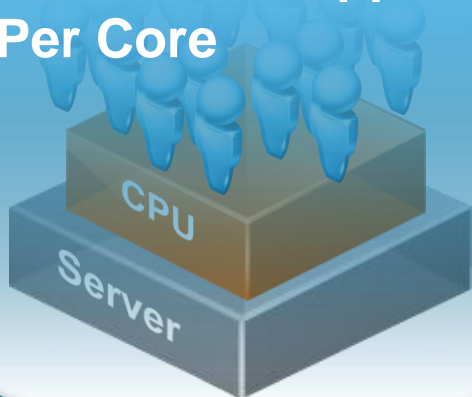
To summarize the main consideration

Instances of
RDSH VMs

vCPU : CPU
core ratio



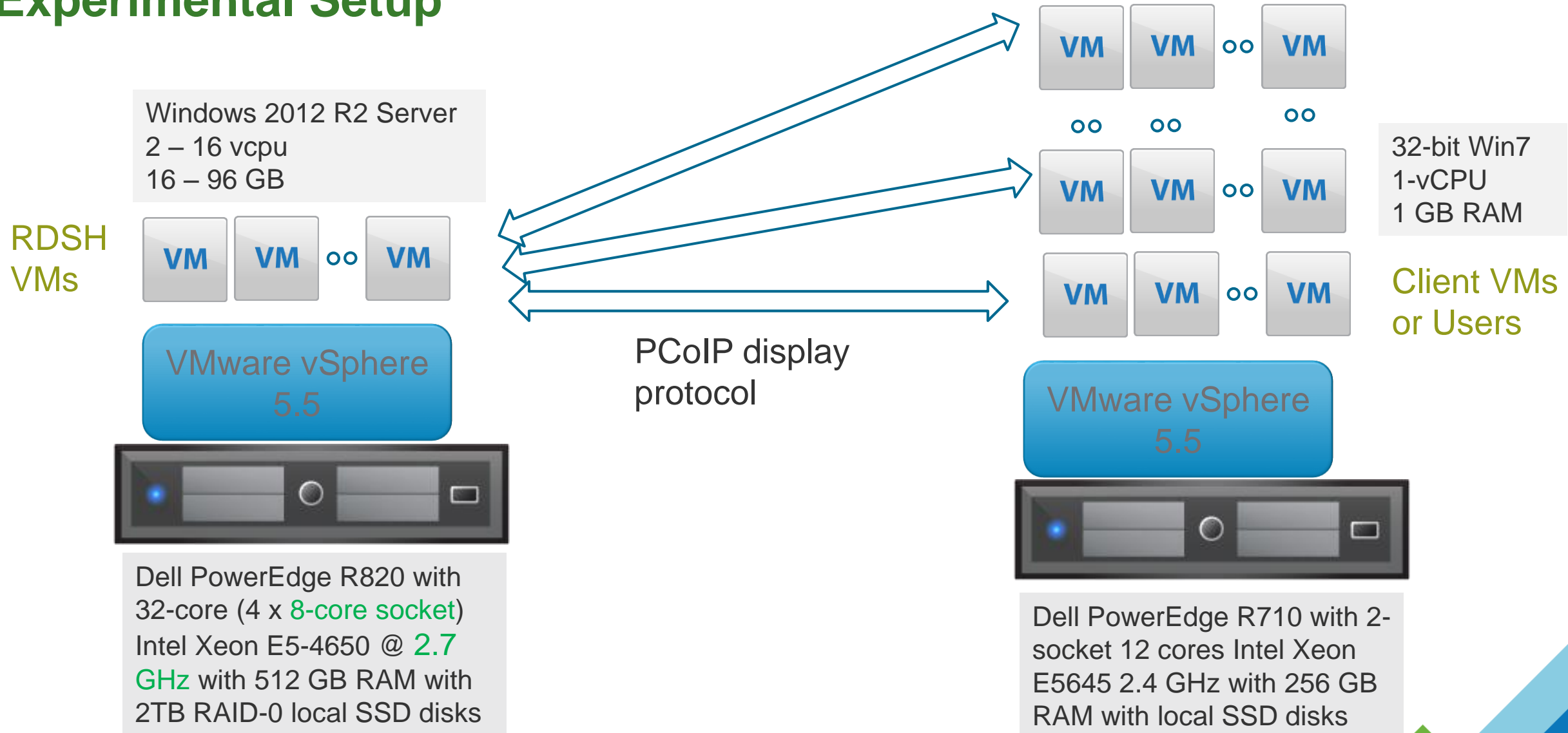
Sessions/Apps
Per Core



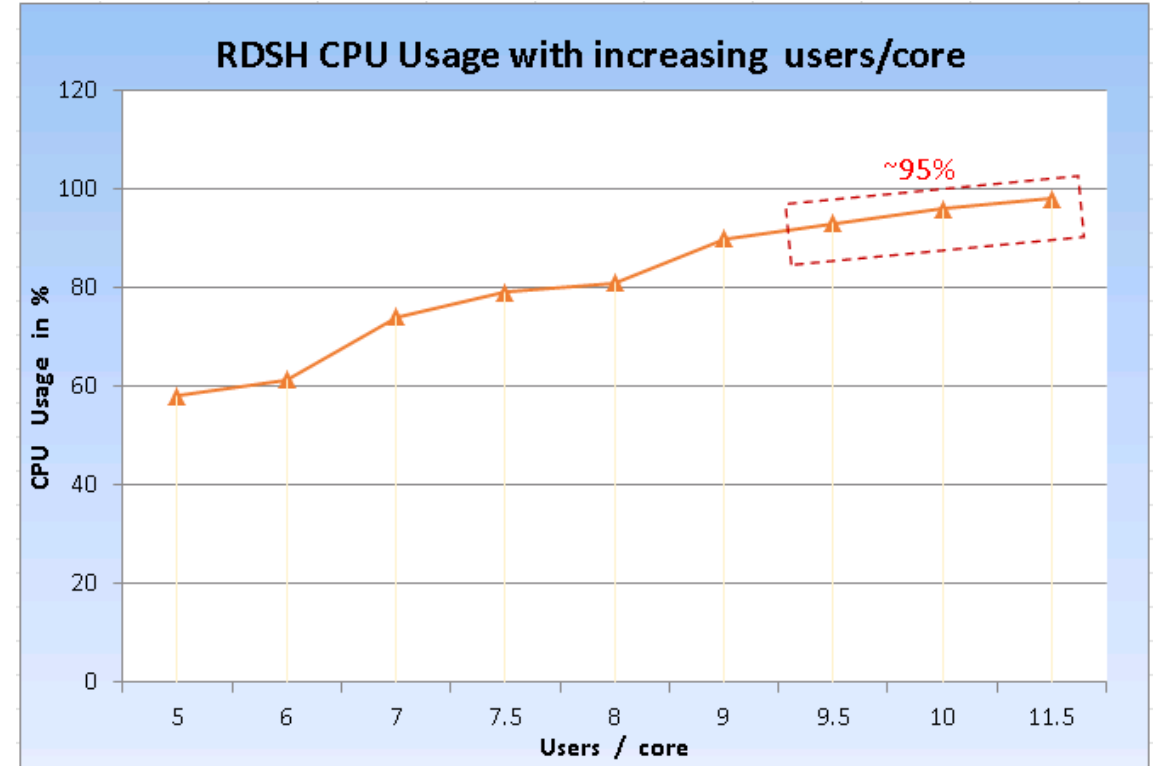
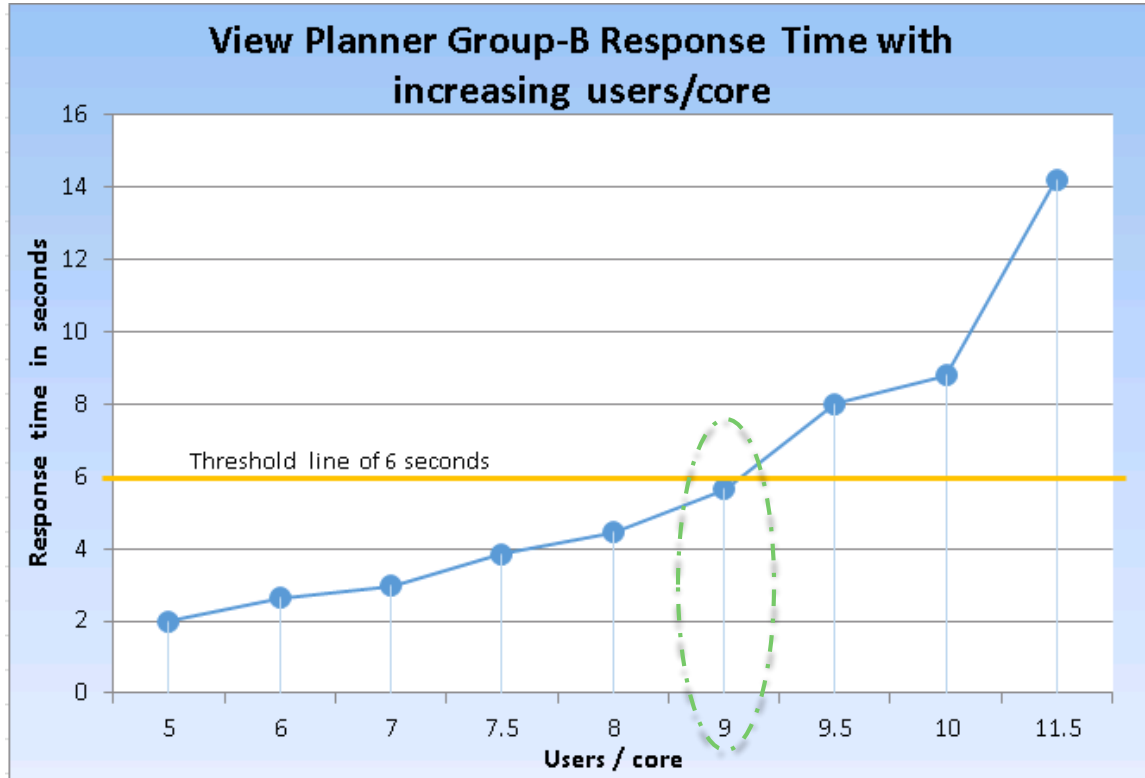
Optimal (#vCPU's) size of each
RDS server VM to achieve best
result on your Host



Experimental Setup



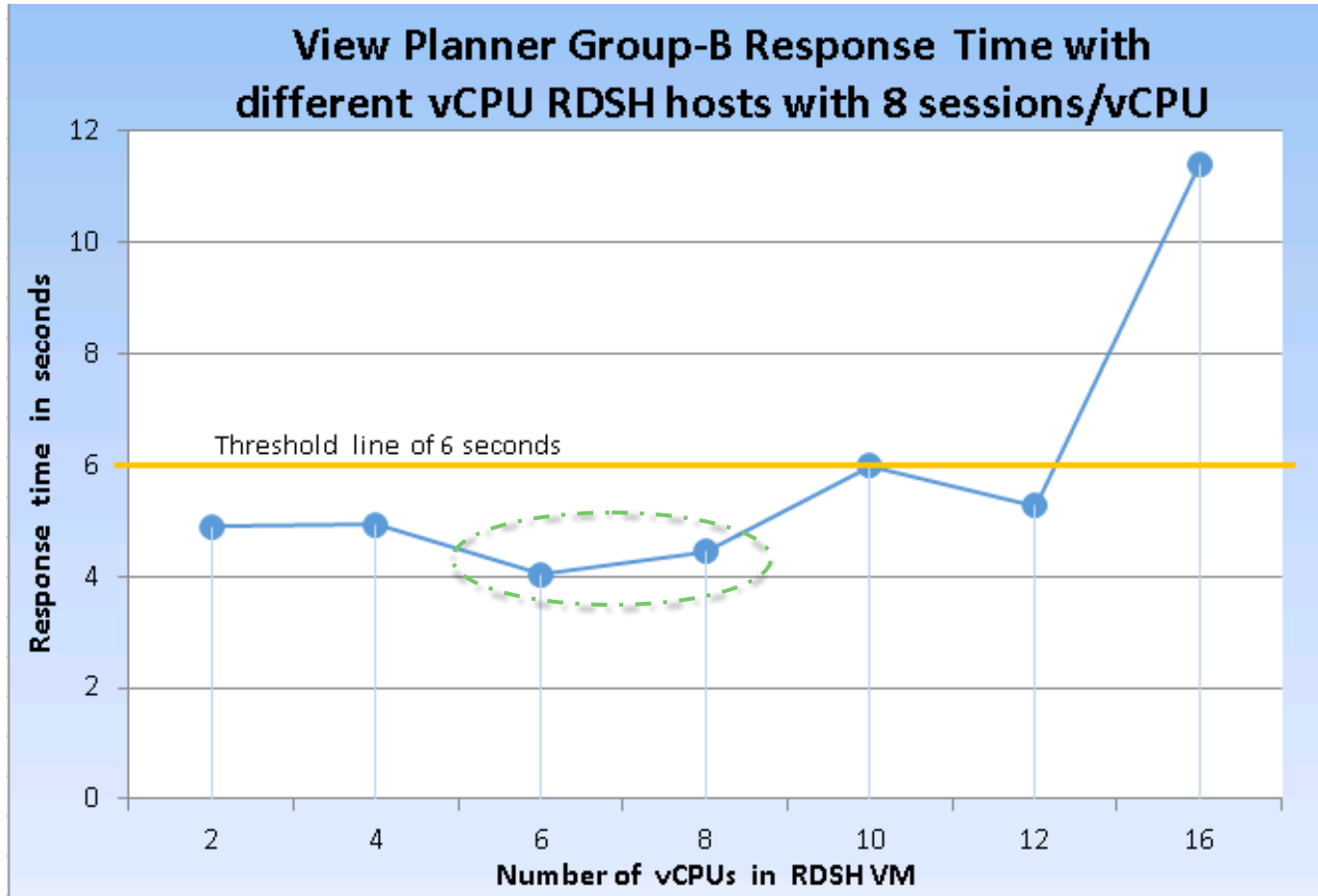
1. Find the right sessions/physical core (MHz per User)



- 9 Users per 2700 MHz core (about 300 MHz per user)
- Average CPU utilization about 90% at 9 sessions/core

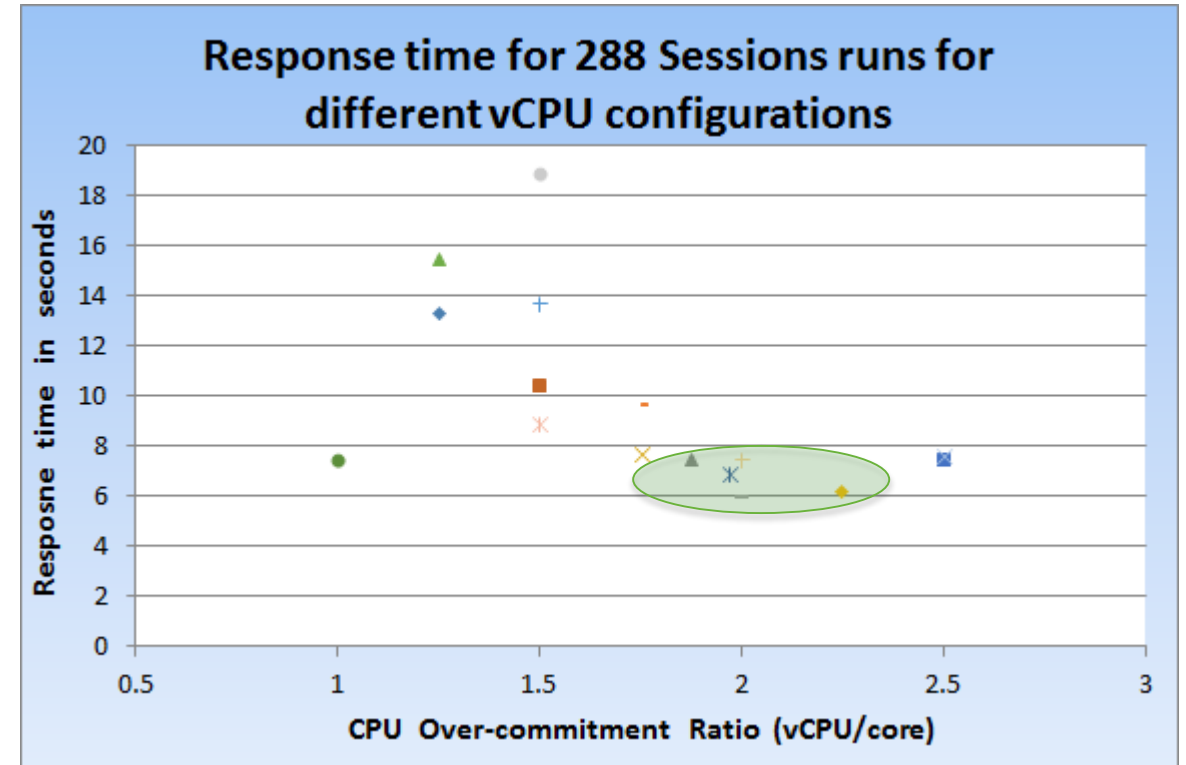
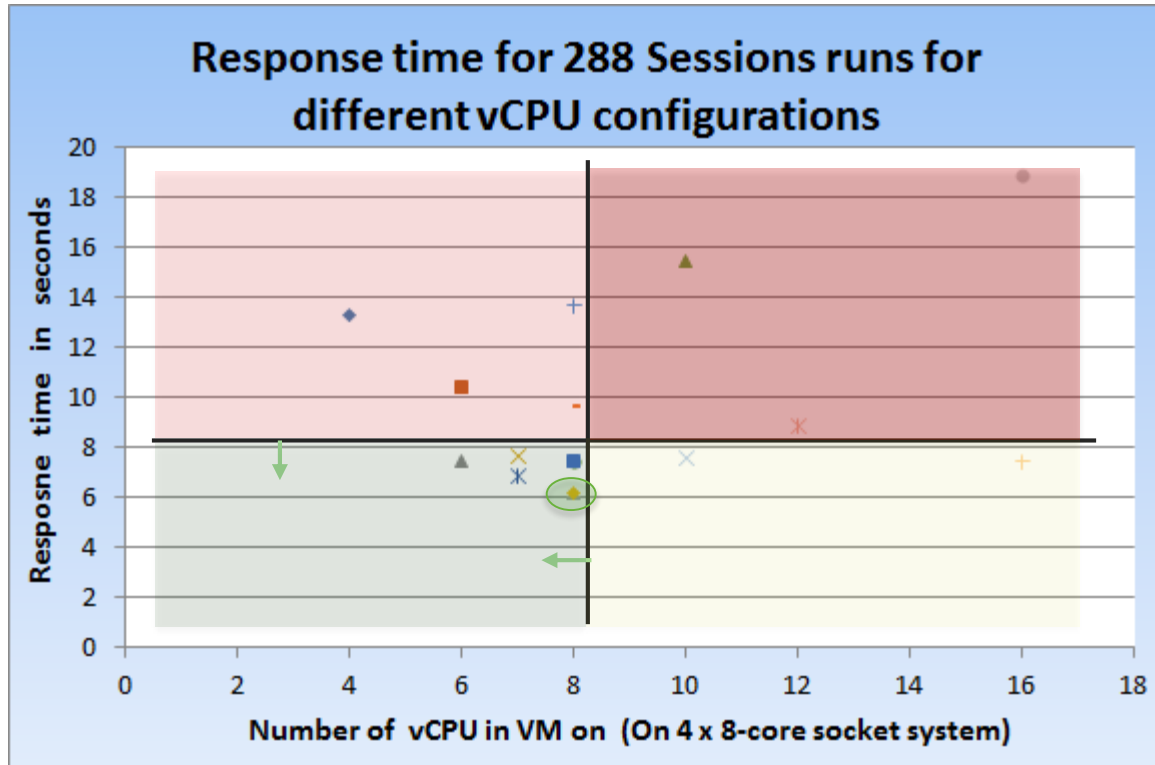
Total users on the system if we scale out linearly
 $32 \text{ Cores} \times 9 \text{ sessions/core} = 288$

2. What is the right number of vCPU for RDSH VM?



- Increasing vCPU on RDSH VM on plenty of cores (32)
- 6-vcpu and 8-vcpu VM gives better performance
- Number of vcpu \leq number of cores in the socket

3. Scale Out: How many instances of RDSH VMs?



- 8 x 8-vcpu VMs gives the best performance
- Some other configurations of 7-vcpu and 8-vcpu performance is closer to the best case
- 2:1 CPU-overcommitment provided the best performance

Lessons Learnt for RDS Server Sizing

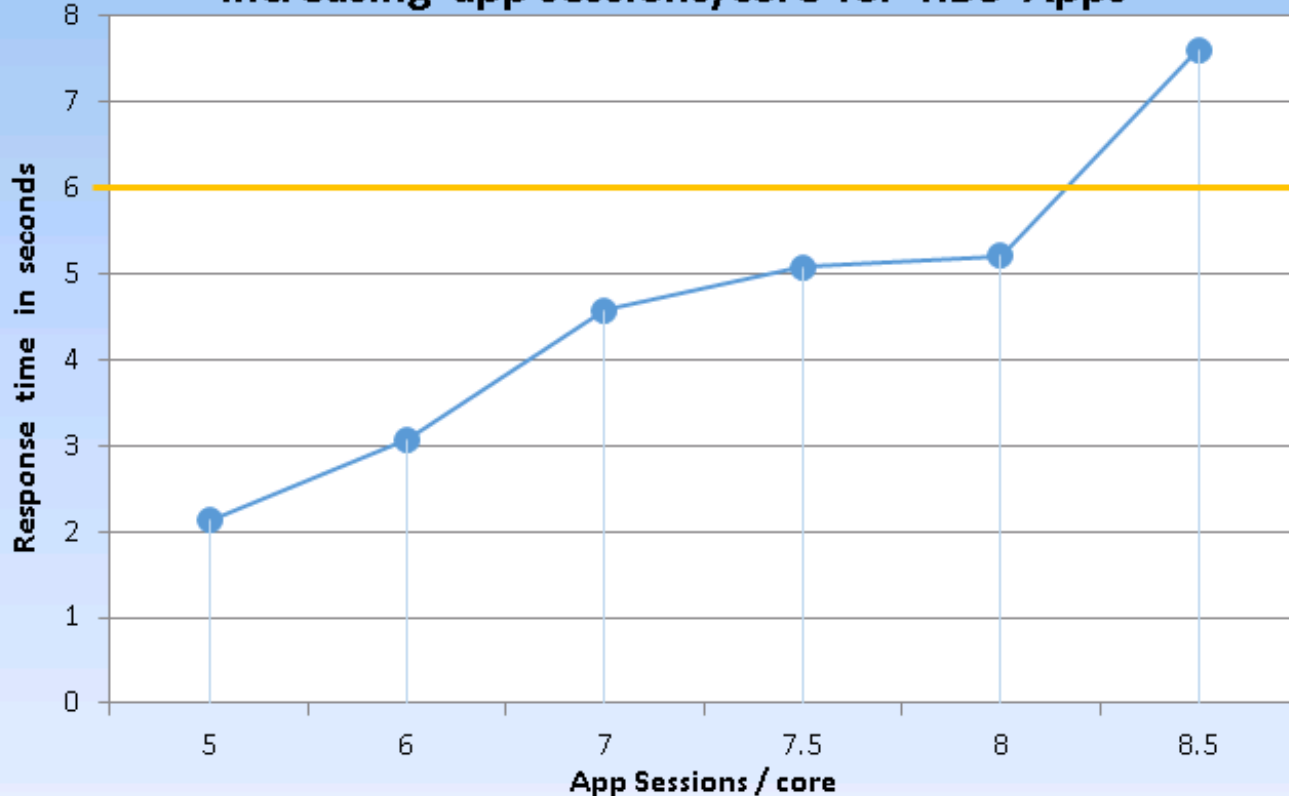
- Scale out. Don't scale up.
- vCPU for RDS server VM \leq Number of cores in the socket
 - 6-vcpu and 8-vcpu VMs showed better performance on a 8-core socket
- 2:1 CPU over-commitment worked better (64-vcpu on 32 cores)
- Allocate CPU/memory that will fit in the NUMA node

- Resources per session (conservative estimates)
 - CPU: 300-500 MHz per session
 - Memory: 400-500 MB per user for 9 apps, For applications, select appropriately based on the working set
 - Disk space: 200-300MB per user in OS disk for profiles, temporary files, etc
 - Network: 50 kbps per session

RDSH Seamless Apps Performance

Seamless Applications Performance

View Planner Group-B Response Time with increasing app sessions/core for RDS Apps



- Same setup as session experiment
- 9 seamless applications on the client side per application session
- Increased application sessions from 40 to 68 on a 8-vCPU RDSH VM
- Density seen between 8 and 8.5 users per core
 - Slightly lower than the sessions (9/core)
 - However, we ran all apps including video and video may not be run as seamless apps in real use cases.

Competitive RDSH Performance

Comparison with RDP8 and ICA

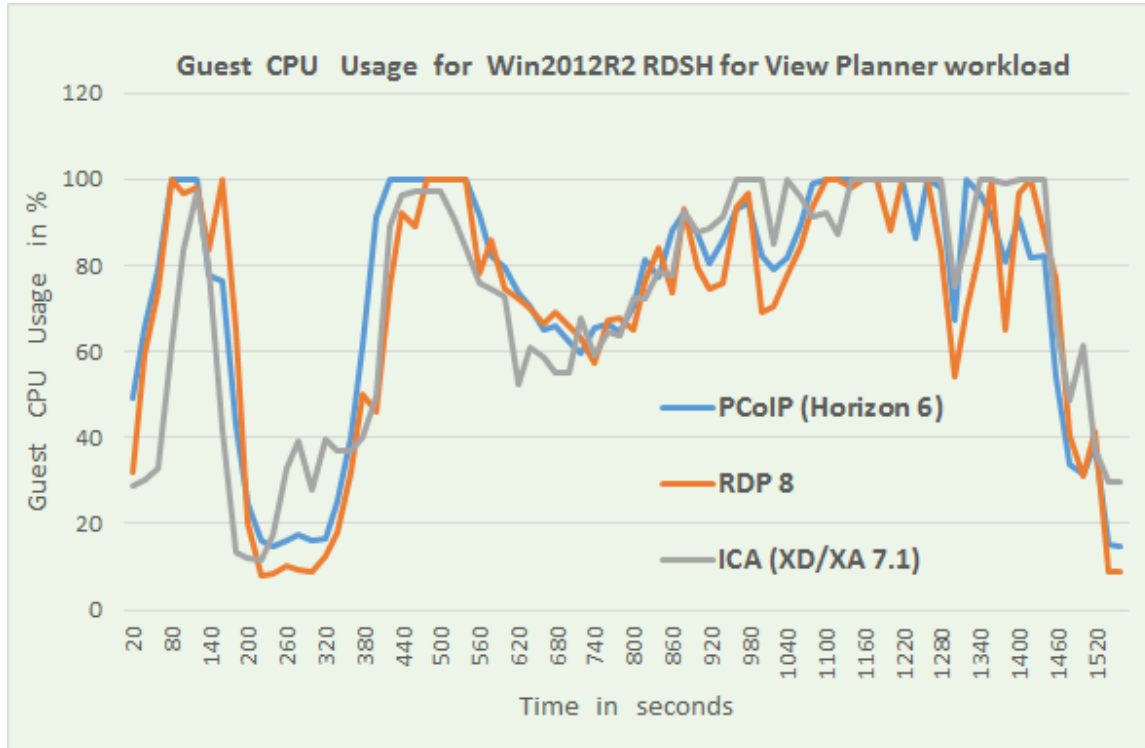
Competitive Performance Analysis

- Display protocols
 - PCoIP : Horizon 6
 - RDP 8 : Windows Server 2012 R2
 - ICA : Citrix XenDesktop/XenApp 7.1

- Run Configurations
 - 60 sessions on a 8-vcpu Windows 2012 R2 RDS VM
 - Workload:
 - All applications except video, 5s thinktime, 3 iterations
 - Resolution and color depth: 1152x864 and 32-bit color

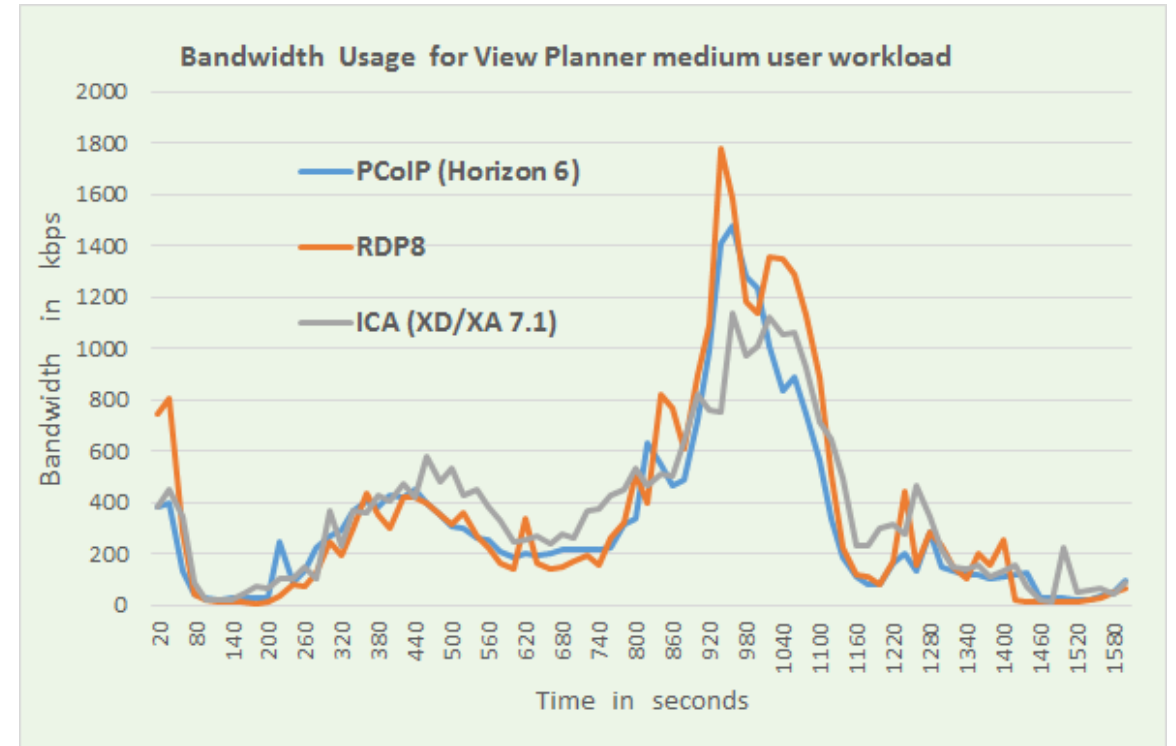
Competitive Performance Analysis: Results

CPU Usage



PCoIP - 71.6%
RDP - 68% (3% better)
ICA - 71.2%

BW Usage

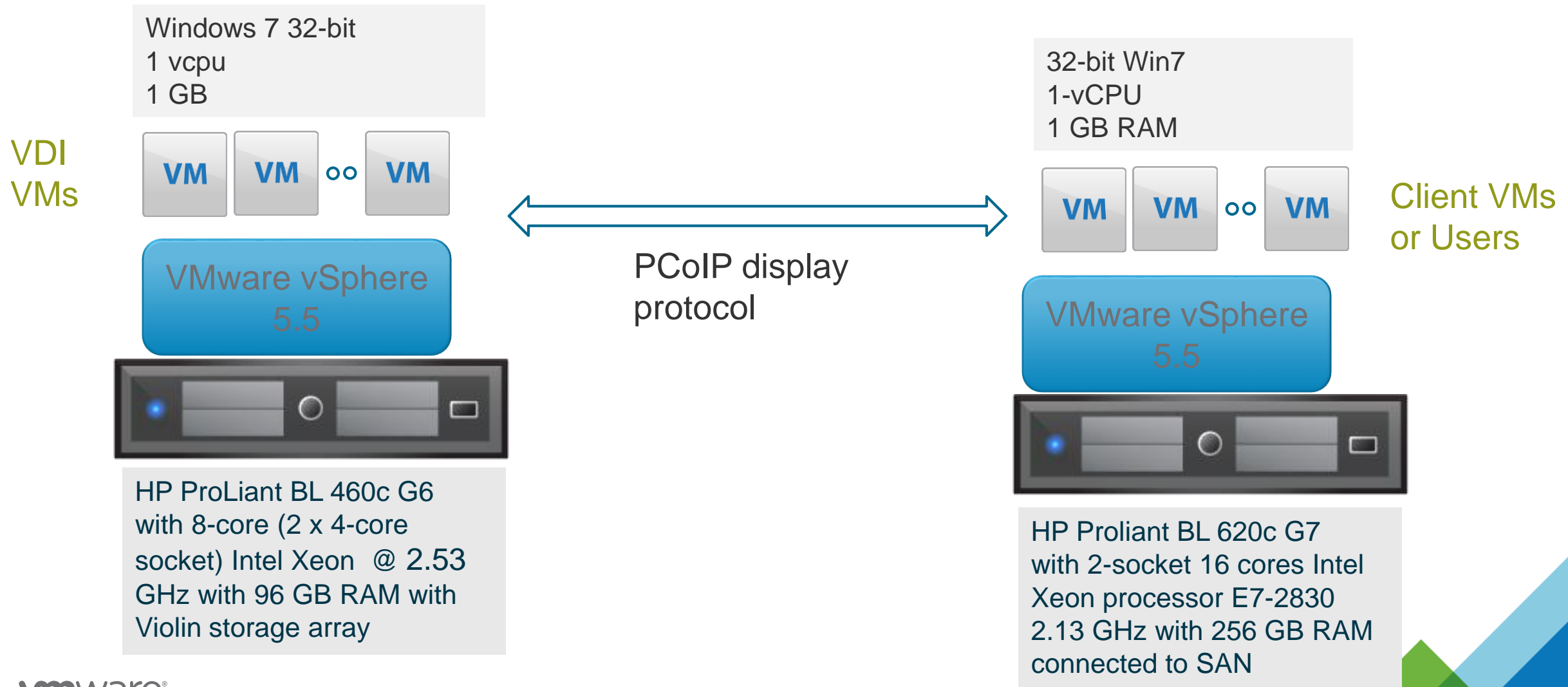


PCoIP - 44.7 kbps per session (>10% better)
RDP - 50.7 kbps per session
ICA - 48.4 kbps per session

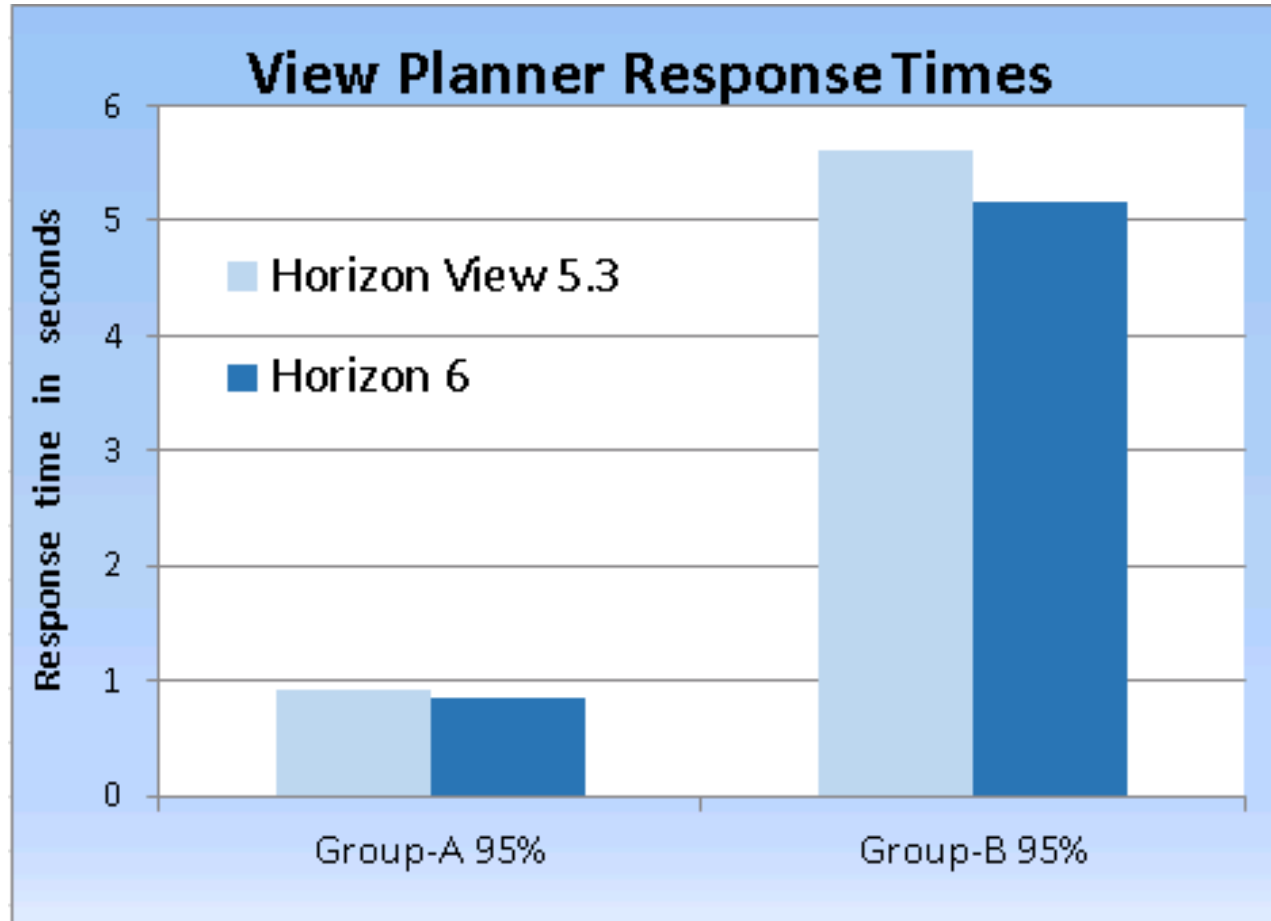
Horizon 6 VDI Performance

Single VM and Scale runs

Experimental Setup



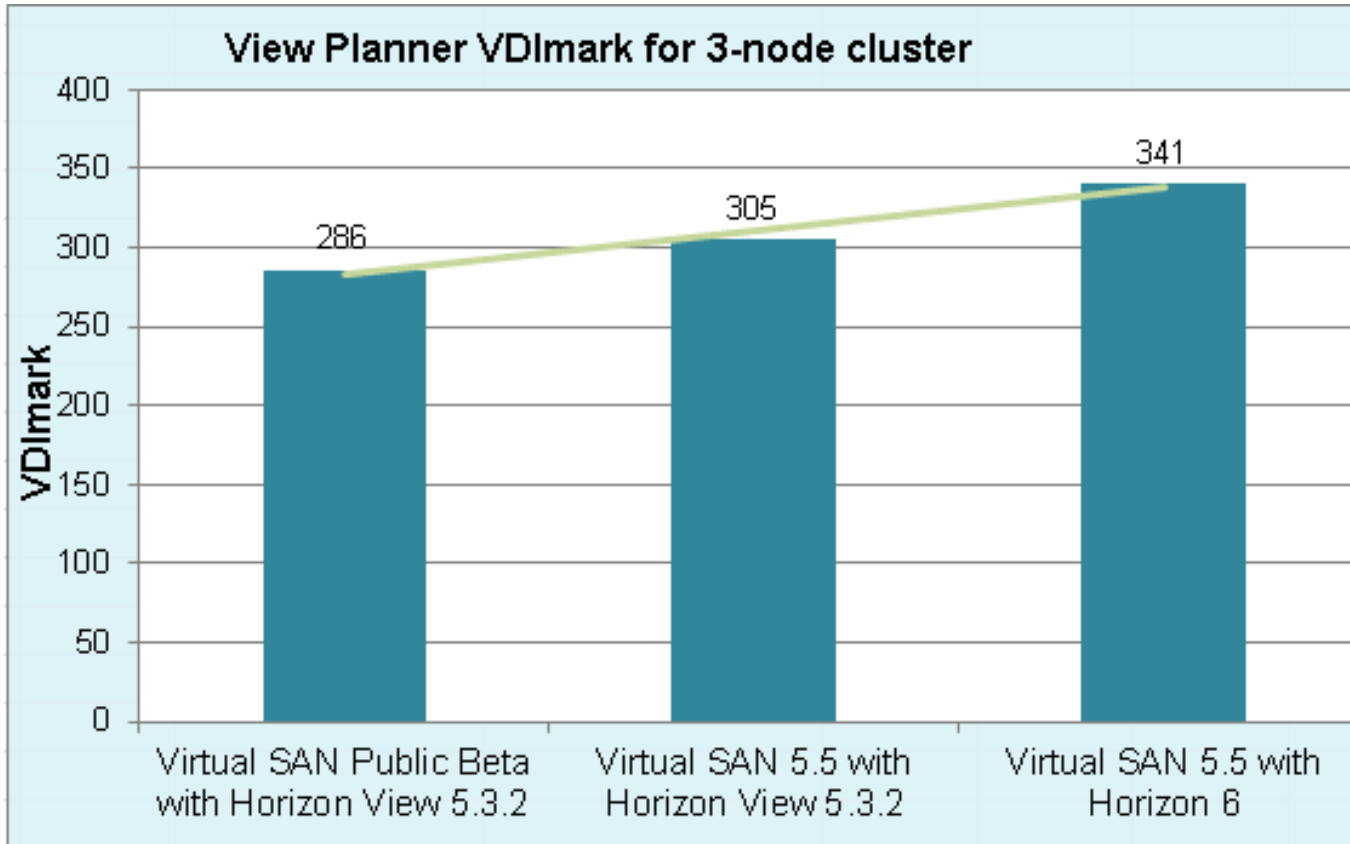
Group-A and Group-B Response Times



- 40 desktop VMs on 8-core system running heavy workload profile
 - 2s think time
 - 720p video
- Passing criteria:
 - 1s for Group-A
 - 6s for Group-B
- See about 10% Improvement in both group response times

Horizon 6 Performance on Virtual SAN

Horizon 6 Performance on Virtual SAN



- With new PCoIP defaults, we are getting 10% improvement in Horizon 6
- Can host about ~114 VMs per node compared to about 100 VMs per node in View 5.3
- Check other talks on VDI/VSAN
 - EUC 1874

Taking it for a spin

View Planner in the real world

Scenarios

“What happens if...”

Scalability

Knowing instead of guessing

Burn-in

Infrastructure validation

Scenarios

Customer specific scenarios

Workload Profiles

Attribute	Value										
Workload Profile name	PowerUser										
Application	<table border="1"> <thead> <tr> <th>Attribute</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Workload Profile name</td> <td>TaskWorker</td> </tr> <tr> <td>Applications</td> <td> Word Internet Explorer Adobe Reader Excel Sort Powerpoint Presentation Archive 7-Zip Firefox Outlook Multimedia Applications (MEDIUM) Web Album </td> </tr> <tr> <td>Iterations</td> <td>7 (Including ramp-up and ramp-down)</td> </tr> <tr> <td>Think time</td> <td>20</td> </tr> </tbody> </table>	Attribute	Value	Workload Profile name	TaskWorker	Applications	Word Internet Explorer Adobe Reader Excel Sort Powerpoint Presentation Archive 7-Zip Firefox Outlook Multimedia Applications (MEDIUM) Web Album	Iterations	7 (Including ramp-up and ramp-down)	Think time	20
Attribute	Value										
Workload Profile name	TaskWorker										
Applications	Word Internet Explorer Adobe Reader Excel Sort Powerpoint Presentation Archive 7-Zip Firefox Outlook Multimedia Applications (MEDIUM) Web Album										
Iterations	7 (Including ramp-up and ramp-down)										
Think time	20										

“When will it break...?”

Attribute	Value
Number of desktops	125
Number of hosts	1
Memory per. VM	1536MB (1.5GB)
vCPUs per. VM	1
Run Profile	TaskWorker125

Attribute	Value
Number of desktops	150
Number of hosts	1
Memory per. VM	1536MB (1.5GB)
vCPUs per. VM	1
Run Profile	TaskWorker150

125 sessions

Results

Attribute	Value
Number of desktops	125
Number of hosts	1
Memory per. VM	1536 MB
vCPUs per. VM	1
Application Latency	0.672943 seconds (pass)

Performance

Metric	Average value	Maximum value
CPU READY% (VM)	1.12 %	4.39 %
CPU USAGE % (Host)	69 %	83 %
SWAP Usage (MB)	0 MB	0 MB
Ballooning (MB)	0 MB	0 MB
Read IOPS (Host)	166	391
Read Latency (host)	0.82	2.37
Write IOPS (Host)	333	801
Write Latency (Host)	0.81	1.57

150 sessions

Results

Attribute	Value
Number of desktops	150
Number of hosts	1
Memory per. VM	1536 MB
vCPUs per. VM	1
Application Latency	0.738885 seconds (pass)

Performance

Metric	Average value	Maximum value
CPU READY% (VM)	2.18 %	6.37 %
CPU USAGE % (Host)	86.4 %	100 %
SWAP Usage (MB)	0 MB	0 MB
Balooning (MB)	0 MB	0 MB
Read IOPS (Host)	205	507
Read Latency (host)	0.95	3.87
Write IOPS (Host)	409	947
Write Latency (Host)	0.77	2.98

Scalability

Consolidation Ratio and Breaking Points

Scalability

- No need for 100% infrastructure scenarios when validating vCPU per pCPU ratio
 - Local mode often well suited
- Following View Pod & Block design allows for linear scaling
 - Validate a single host will validate them all
- Operational testing can / should be done as well
 - Re-compose, refresh, delete etc.
 - Use View Manager to build client and desktop pools for testing
- Only 1 run at a time
 - Timings
- Network conditions
 - Simulate different networking conditions

Burn-in

100% scenarios

Burn-in

- Different from “What If” Scenarios
- Validates 100% scenarios
- Infrastructure roles tested as well
 - DHCP, AD, vCenter, Composer etc.
- Takes time
 - Typically thousands of desktops
 - Many iterations for continuously load
- Single vCenter instance only

Horizon 6 Performance Best Practices

Platform
Guest
Display Protocols
Network

Platform Best Practices

Config	Best Practices
View Storage Acceleration (CBRC)	Always enable CBRC (on by default) Will reduce bootstorm IOPS requirement by 80% Will also reduce loginstorm IOPS requirement
Flash	Use Flash wherever possible -- keep the desktop replica on SSD Make use of Virtual SAN for fast and cost-effective storage
IOPS requirement	Typical knowledge worker anywhere about 7-12 IOPS. Depending on your applications, YMMV
CPU requirement	About 300 to 500 MHz per user depending upon the application requirements
Memory	<ul style="list-style-type: none">- Enable page sharing- Disable large pages- You can also increase TPS scan speed to reclaim memory faster with very small overhead if you want to.
Network	Check packet buffers at intermediate switches and avoid deep buffering Check for packet re-ordering and re-transmits

Guest Level Optimizations

Parameter	Configuration
vCPU	1 for WinXP/Win7/Win8, 2 for multimedia intensive apps No-of-cores in the socket for RDS vCPU, and use 2:1 overcommit
Memory	512-768 MB for WinXP, 1GB for 32-bit Win7 and Win8 2GB for 64-bit Win7 and Win8, 1.5-2GB for WinXP, Win7, and Win8 32-bit, 3GB for Win7 and Win8 64-bit for memory-intensive apps Plan for 500MB-1GB per user for RDS server
Network adapter	Vmxnet3, flexible
Storage adapter	pvSCSI or LSI logic SAS
VMware Tools	Latest installed
Visual settings	“Adjust to Best performance”, Disable Animations for Windows Maximize and Minimize operations Use default cursor for busy and working cursor
Disabling services	Windows Update, Super-fetch, Windows Index,
Group policy settings	Disable Hibernation, System restore disable, Screensaver to None
Other settings	Turn off clear-type Disable fading effects Disable last access timestamp

More details in the white paper: <http://www.vmware.com/files/pdf/view/vmware-horizon-view-best-practices-performance-study.pdf>

Protocol / Network Condition Tuning Recommendations

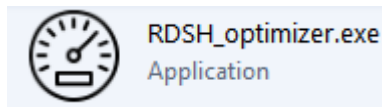
Setting	Recommendation	Benefit	Description
Build to lossless	Off	Reduces bandwidth	Reduces bandwidth by building to perceptually lossless quality
Maximum Initial Image Quality	80	Reduces peak bandwidth and helps with video	Reduces CPU and bandwidth for video
Session Audio BW limit	50 - 100Kbps	Reduces bandwidth and CPU usage	Reduces BW usage of audio with usable quality
Maximum frame rate	10 / 15 FPS Standard Desktops	Reduces Bandwidth and CPU usage	In WAN conditions, this will be helpful for video playback and fast graphics operations
Client side cache size	50 – 100MB Depending on available client RAM	Avg. 30% reduction in bandwidth	This allows you to configure the client side image cache size.

More details in the white paper: <http://www.vmware.com/files/pdf/view/vmware-horizon-view-best-practices-performance-study.pdf>

RDSH Tuning and Optimization Strategies

- Platform
 - CPU Socket and Cores
 - Memory (NUMA)
- Guest (RDSH VM)
 - Windows Services
 - Registry and Group Policy Settings

- Tool



https://dl.dropboxusercontent.com/u/39803429/RDSH_Optimizer/RDSH_optimizer.exe

- If you want to see the registry changes, run process monitor (procmon) and set filter on WriteRegistry (regsetvalue, etc)

Conclusion

RDSH Session Sizing

- Scale out. Don't scale up.
- vCPU for RDS server VM \leq Number of cores in the socket
- 2:1 CPU over-commitment worked better (64-vcpu on 32 cores)
- 300-500 Mhz per user session

VDI in Horizon 6

- PCoIP defaults have changed
- 10% better performance compared to View 5.3
- Virtual SAN provides linear scaling and better cost-effective storage solutions.

RDSH App Sizing

- Similar to session sizing
- 200-300 MB memory per user. Your mileage may vary based on the applications

Performance Best Practices

- Tune the VDI and RDSH VM using the available tools and optimization guides



Thank You

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