TOMORROW
starts here.

Deploying and Optimising Virtual Desktop Infrastructure (VDI) in the Data Centre

BRKVIR-2002

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Systems Engineer

#clmel

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Abstract

The recent trend towards VDI and away from traditional fixed desktops is due to the drivers of operational efficiency and user experience demands. While the concept of remote desktops is certainly not new, modern networks can enabled transparent, media rich, virtual experiences when configured well. The desktop is no longer just a piece of hardware its an instance supported by numerous services that can be implemented on a variety of physical and application form factors from desktops to thin clients, various remote clients and browsers to simplified mobile experiences.
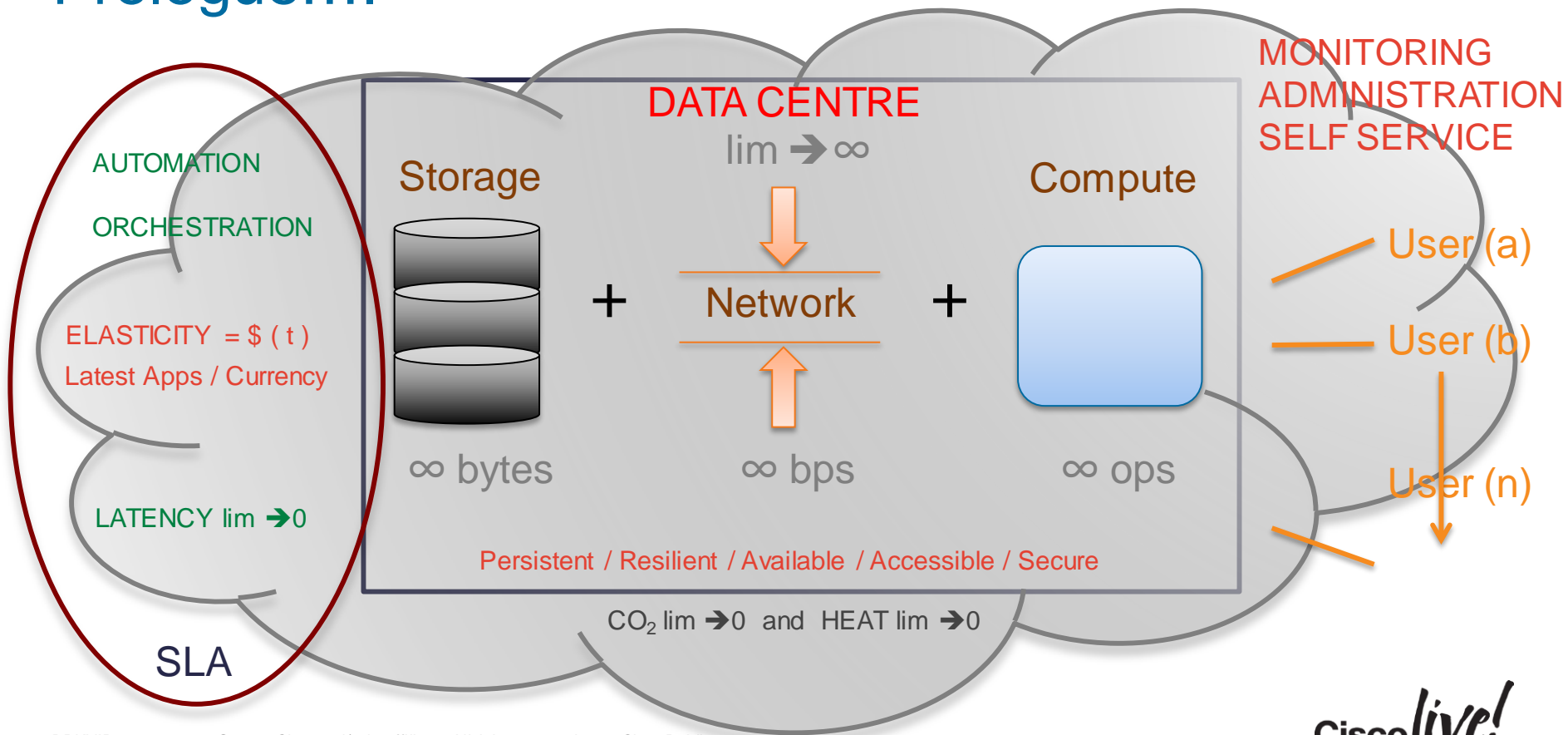
The Architecture of the entire VDI system needs to be tailored to support the highest quality application transactions. New instances must be enabled with automation, rapid spawn, monitoring and failover capabilities. Users demand fast application and storage transaction speeds and no loss of capability between differing device portals. Because the nature of VDI data flows, their size and new technology innovations such as ACI and storage acceleration, the overall architecture required to support VDI is very different today than it has been in the past. This session takes you from a VDI overview right through to the innovations used to optimise VDI delivery, from server, to storage, acceleration and network optimisation techniques.

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Agenda

- Overview

- Software and Object Abstraction

- Enterprise Networks

- Data Centre Compute, Storage and Network

- Newest Concepts

- Application Acceleration

- Strategy

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Prologue….

SLA
- AUTOMATION
- ORCHESTRATION
- ELASTICITY = $ (t)
  Latest Apps / Currency
- LATENCY lim ➔ 0

DATA CENTRE
lim ➔ ∞

Storage + Network + Compute

∞ bytes   ∞ bps   ∞ ops

Persistent / Resilient / Available / Accessible / Secure

CO_2 lim ➔ 0 and HEAT lim ➔ 0

MONITORING
ADMINISTRATION
SELF SERVICE

User (a)
User (b)
User (n)

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Overview

The Desktop Ball and Chain

Keyboard, Video, Mouse

- Large OS
- Many local applications
- Vulnerable
- Constant patching
- Data backup
- Complex management
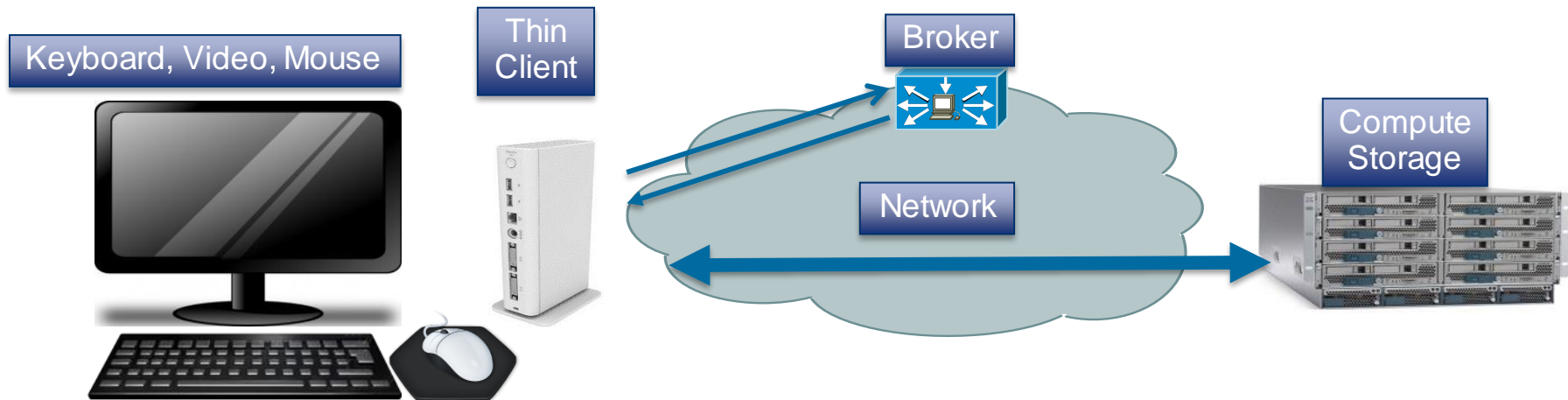- Software distribution delivery challenges
- Skilled local support staff required

- Personal Computer is disaggregated
- Keyboard, Video, and Mouse stay with user
- Compute and storage move to the data centre
- Network availability is required for all application access
- Network performance is critical to user experience

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The Network is the Desktop

Keyboard, Video, Mouse | Thin Client | Broker | Network | Compute Storage

- Personal Computer is disaggregated

- Keyboard, Video, and Mouse stay with user

- Compute and storage move to the data centre

- Network availability is required for all application access

- Network performance is critical to user experience

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The "Modern Desktop"
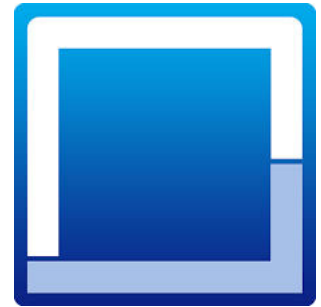is Not a Desktop At All…

The Anywhere Any-device Consumer Demand

New Methods and Combinations to achieve desired outcomes

- Overarching Management eg AppSense

- New models VMWare App Volumes (formerly Cloud Volumes)

- New wrappers, VSAN ready, Branch Desktop Virtualisation

- Desktop sharing
  - Webex
  - Project Squared

- Software/Endpoint form factor Differentiation/Optimisation

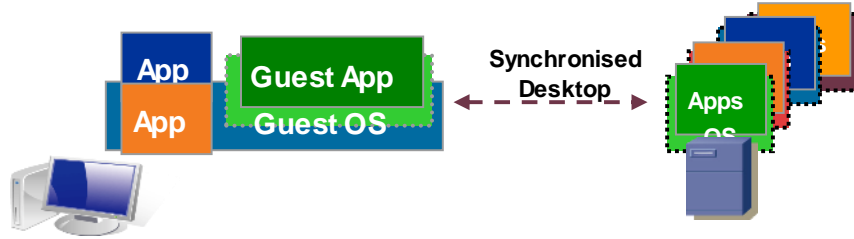- Options: Distributed Virtual Desktops or User State Virtualisation

Software and Object Abstraction

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Virtual Desktop Models

Virtual Desktop Streaming

App
App
Guest App
Guest OS

Synchronised Desktop

Apps
OS

Hosted Virtual Desktop

Apps
Apps
Apps
OS
OS
OS
Hypervisor

Application Streaming

App

OS

OS

OS
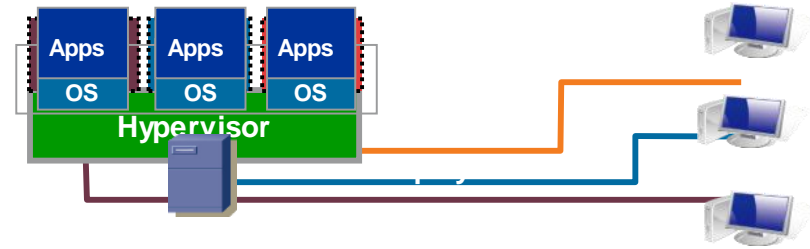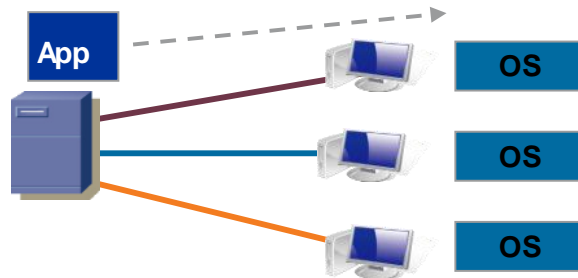
Client Hosted Computing

**Terminal Services
or Published Applications**

App App
OS

Server Hosted Computing

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Software

Major Players – Citrix and Vmware components / Nomenclature

Function	VMware Horizon View	Citrix XenDesktop
Display Protocol Client	Horizon View Client	Citrix Receiver
Desktop Agent	View Agent contains PCoIP and RDP with Wyse TCX	Citrix Virtual Desktop Agent contains ICA and HDX Servers
Broker Provisioning	Composer / Thinapp	Citrix Provisioning Server (PVS)
Broker Routing	Connection Server	Citrix Desktop Delivery Controller (DDC)
Broker Proxy	Security Server	Citrix Access Gateway
Portal	View Portal	Citrix Web Interface
Administration	View Administrator	Citrix Management Console
Personalisation	RTO Persona Management	Ringcube Personal vDisk
Hypervisor	VSphere ESX	XenServer
Orchestration	Virtual Centre	XenCentre

Broker Desktop Entitlement

- **Non-Persistent or Pooled** - Generic virtual desktop assigned to users on a per session first come first server basis and then returned to the pool (possibly with profile removed) or destroyed

- **Persistent or Assigned** - Permanently assigned to a user statically or by first to connect

- **Personalised Non-persistent** – Abstracted persona applied to non-persistent desktops

Desktops

Pool of Virtual Machines

Entitle Group to Desktop

Assign Pool

Entitle User to Desktop

Users and Groups

Assign Individual

Template
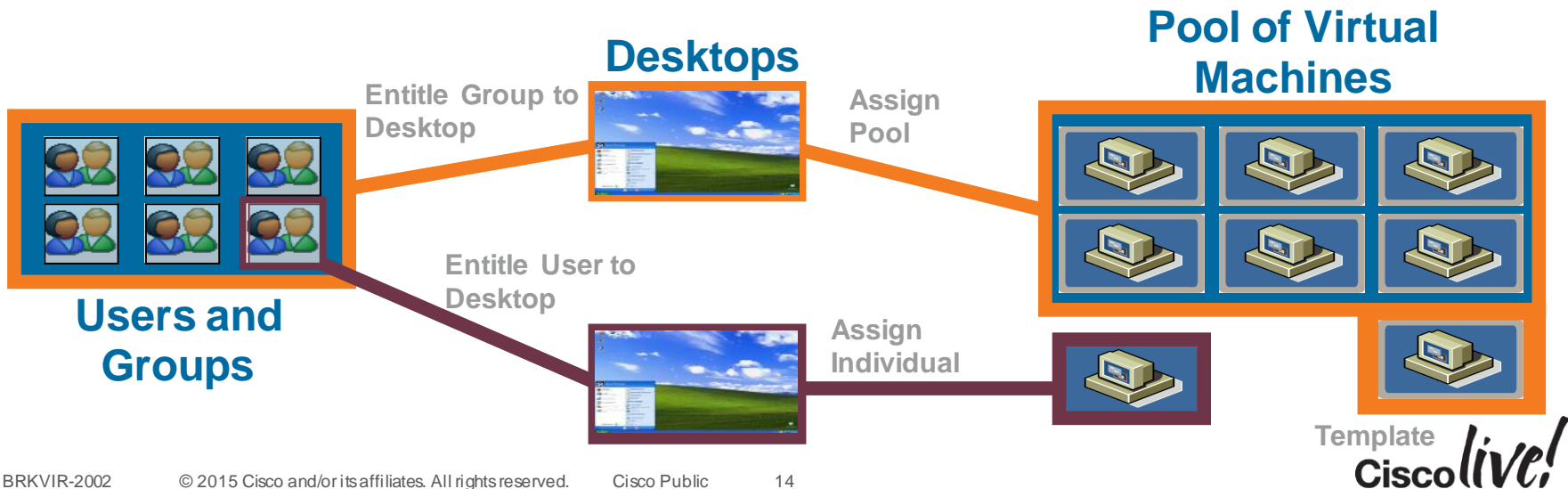
VMWare View Model
Desktop (OS) Virtualisation

Remote Connections Directed by Broker	

Agent	Agent	Agent	Agent	Agent	Agent	Agent	Agent	ESX
VM Guest #1	VM Guest #2	VM Guest #3	VM Guest #4	VM Guest #5	VM Guest #6	VM Guest #7	VM Guest #N	Service Console
VMTools	VMTools	VMTools	VMTools	VMTools	VMTools	VMTools	VMTools	

VMware ESX Host VMKernel (ESXi Console)

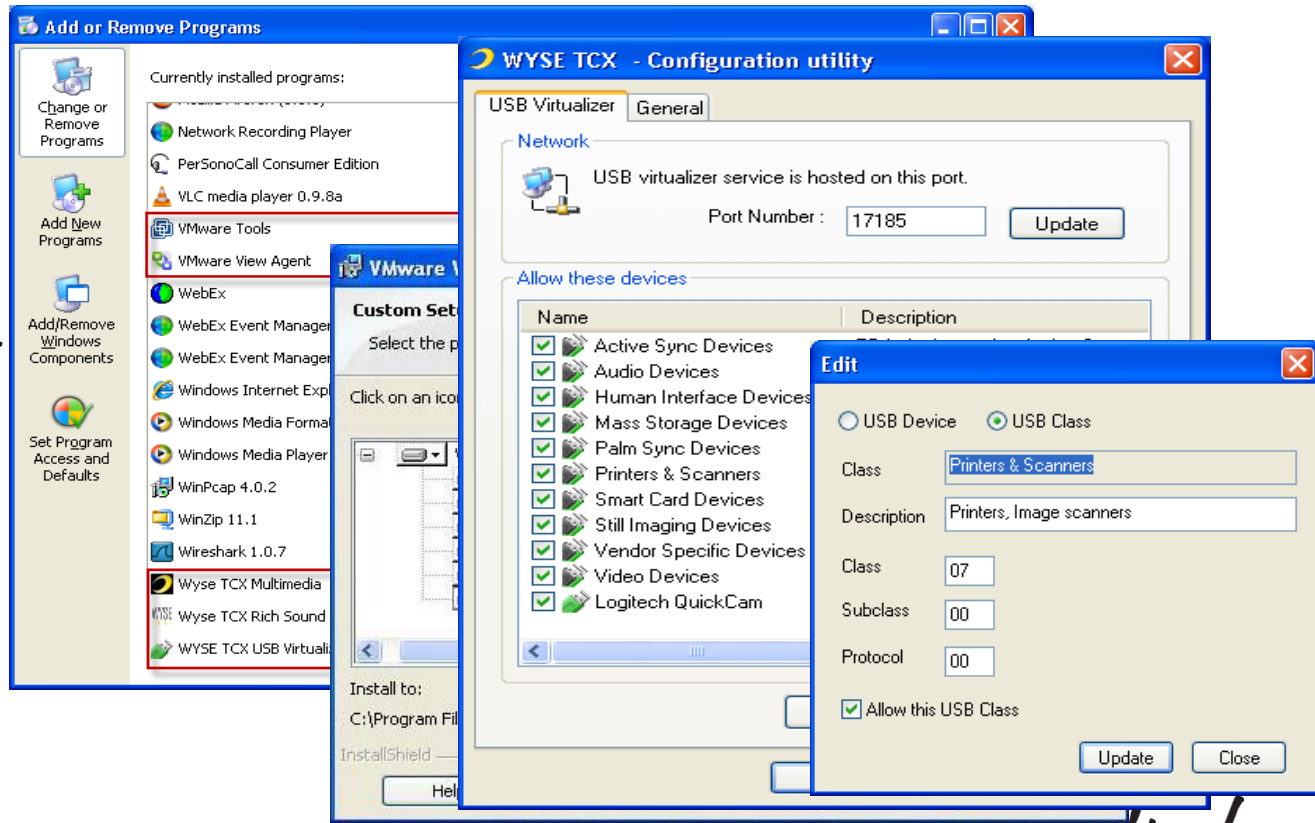| SCSI	Fibre Channel	Cisco Nexus 1000v or Distributed Virtual Switch			
		VMKernel		VM Network	Service Console
		iSCSI	NFS	LAN	VC Mgmt
SCSI , iSCSI, FC SAN VMFS Block Data Store		NAS File		IP Data Networks	

- Virtual Machine (VM)
- Small Computer System Interface (SCSI)
- Storage Area Network (SAN)
- Virtual Machine File System (VMFS)

- Fibre Channel (FC)
- Network File System (NFS)
- Network Attached Storage (NAS)
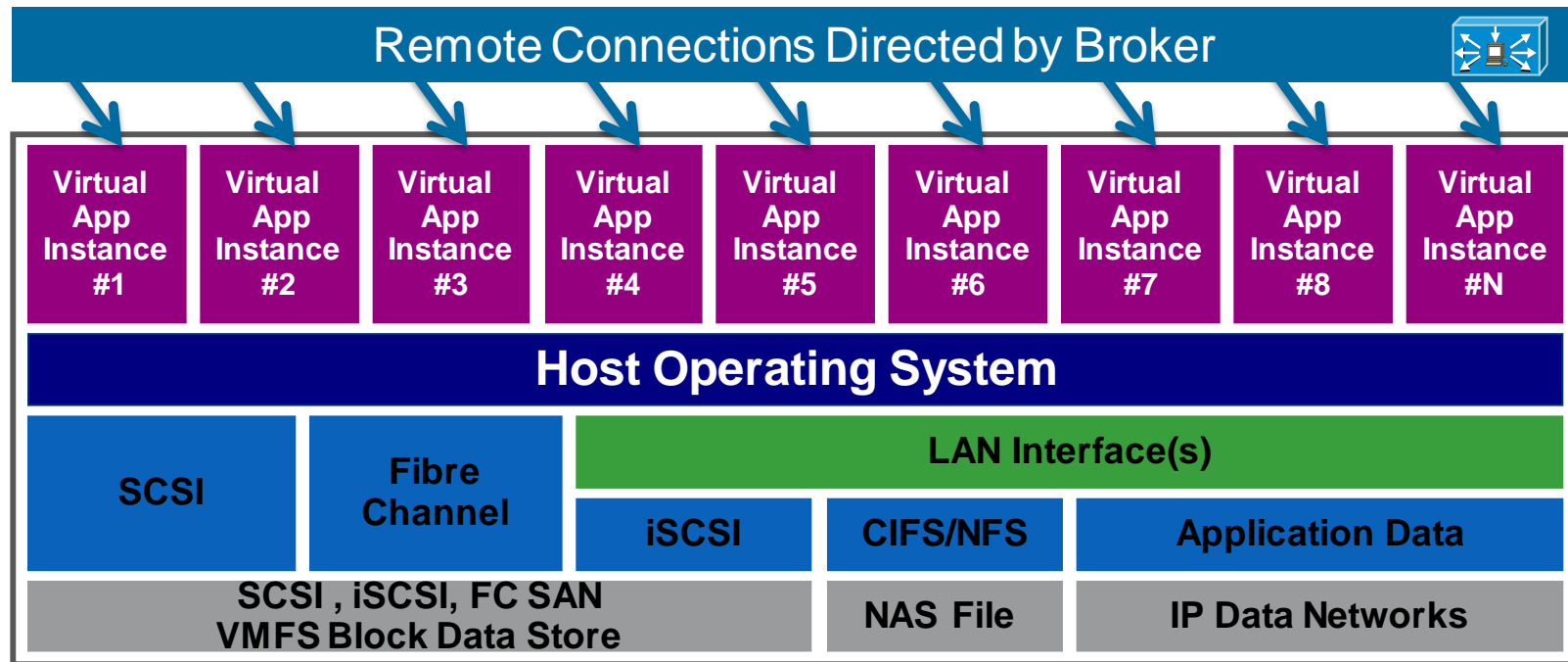- Virtual Centre (VC)

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Display Protocol Server Components (Agent)

- VMware Tools

- Broker Agent

- Multimedia Redirector (Windows Media and Flash)

- Rich Sound Server (Analog Mic/Skr)

- USB Virtualisation Server

XenApp Model
Application Virtualisation (Terminal Services)

Remote Connections Directed by Broker

Virtual App Instance #1	Virtual App Instance #2	Virtual App Instance #3	Virtual App Instance #4	Virtual App Instance #5	Virtual App Instance #6	Virtual App Instance #7	Virtual App Instance #8	Virtual App Instance #N

Host Operating System

SCSI	Fibre Channel	LAN Interface(s)		
		iSCSI	CIFS/NFS	Application Data

SCSI , iSCSI, FC SAN VMFS Block Data Store	NAS File	IP Data Networks

May not work if:

- No device or kernel drivers
- No Windows services
- No Windows class names or window name
- Installers cannot require a restart during install

- Support shared IP addresses
- No Inter-Process Communications
- No Distributed Component Object Model (DCOM)
- Registry/App Objects must link to USER32.DLL

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Direct Mode Broker Exchange

```
<broker                <broker ve        <?xml version="1.0"?>
<config                 <id>CN=dc        <broker version="3.0">
 <resul                 <name>dc1         <desktop-connection>
 <offli                 <type>sti          <result>ok</result>
 <broke                 <state>di          <id>CN=dc1-p,OU=Applications,DC=vdi,DC=vmware,DC=int</id>
 <authe                 <session-          <address>10.87.121.28</address>
 <scree               id>COMPANY           <port>3389</port>
  <name                @cn=XXXX,o          <additional-listeners>
  <para                 <reset-al          <additional-listener name="MMR">10.87.121.28:9427</additional-listener>
   <par                 <reset-al          </additional-listeners>
    <na                 <user-pre          <protocol>RDP</protocol>
    <va                 <preferen          <user-name>jifrench</user-name>
   </pa                 <preferen          <password>YzZmNGFlMTMt</password>
  </par                 <preferen          <domain-name>COMPANY</domain-name>
 </scre                 <preferen          <enable-usb>true</enable-usb>
</authe                 <preferen          <enable-mmr>true</enable-mmr>
                        </user-pr          </desktop-connection>
                       </broker>          </broker>
```

C1   WAVE   WAN   WAE   SLB   Broker   UCS   NAS

HTTP/HTTPS Request To Broker

Welcome Response and Challenge

Capabilities Exchange

Direct Connect RDP/PCoIP

VMFS via DAS, FC, NFS, iSCSI

User Data CIFS

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Software
Published Desktop

Desktop
- Challenge
- Windowing

Display Desktop

Broker
- Security (AAA)
- Monitoring
- Publishing
- Routing

Display

Display

Display

Display

Display

Display

Data Centre

Storage

Terminal Services XenApp Hosted Applications

EMC²
where information lives®

NetApp™

HITACHI
Inspire the Next

Co-Located Storage

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Software
MultiUser Hosted Shared Desktop (HSD)

Desktop
- Challenge
- Windowing

Display Desktop

Broker
- Security (AAA)
- Monitoring
- Publishing
- Routing
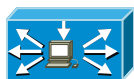
Data Centre

Storage

Windows 2008 R2 Desktop Experience

Display

Co-Located Storage

Stateful Desktop
Hosted Desktop with Streamed Virtual Application

Display Connection #1

Display Connection #N

Empty Windows Virtual Desktop #1	Agent	Empty Windows Virtual Desktop #N	Agent
	VMTools		VMTools
Windows OS		Windows OS	

Cisco UCS with Hypervisor

Desktop   **Application Streaming Server**   **Profile**   **Data**
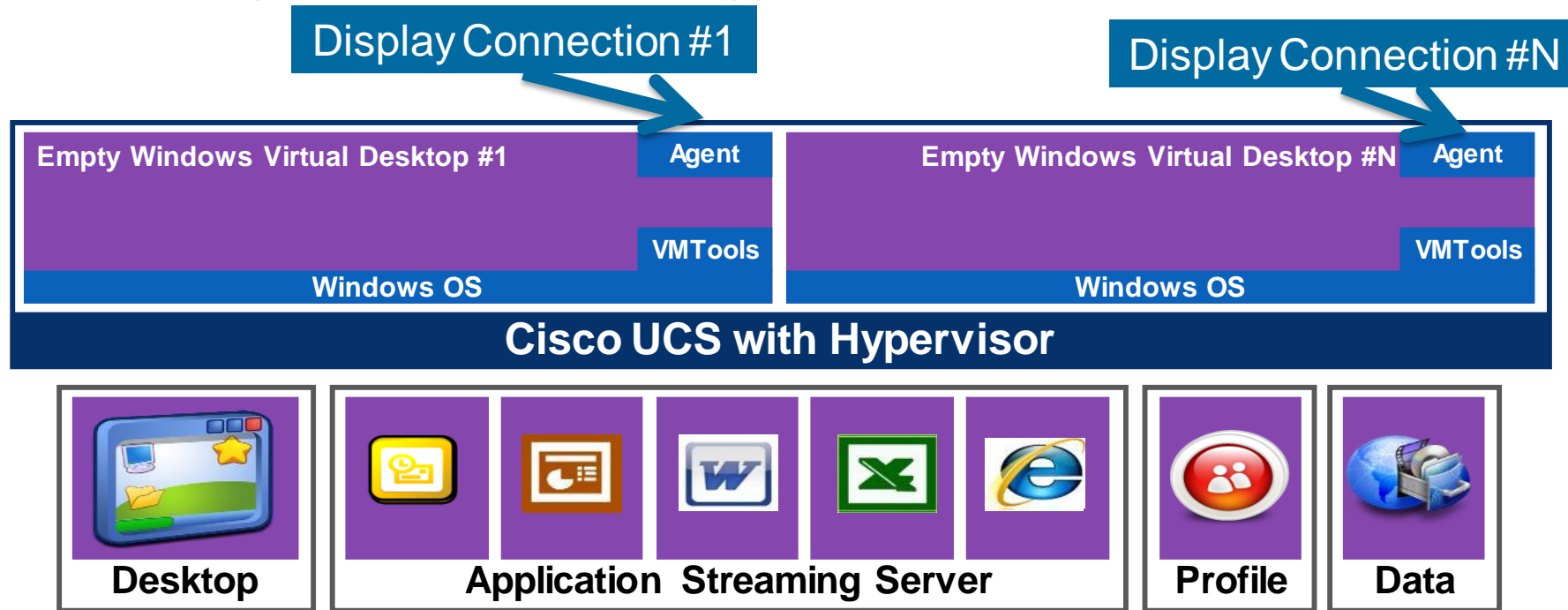
- Profile decoupled from desktop OS using tools like AppSense
- Desktop provisioned with minimal or fixed set of applications installed

- Applications reside on File (VMware) or Streaming Server (Citrix)
- Administrator manages one master copy of an application that is streamed at run time

Software

Presentation Desktop

Presentation	Publishing	Access	Hosting		Data

Interactive Voice/Video

Hosted Client/Server Applications And Desktops

SIP/Web

Display

Display

Display

Display

Web

Web

HTML5

Web Apps SAAS

Desktop
- Challenge
- Windowing

Broker
- Security (AAA)
- Monitoring
- Publishing
- Routing

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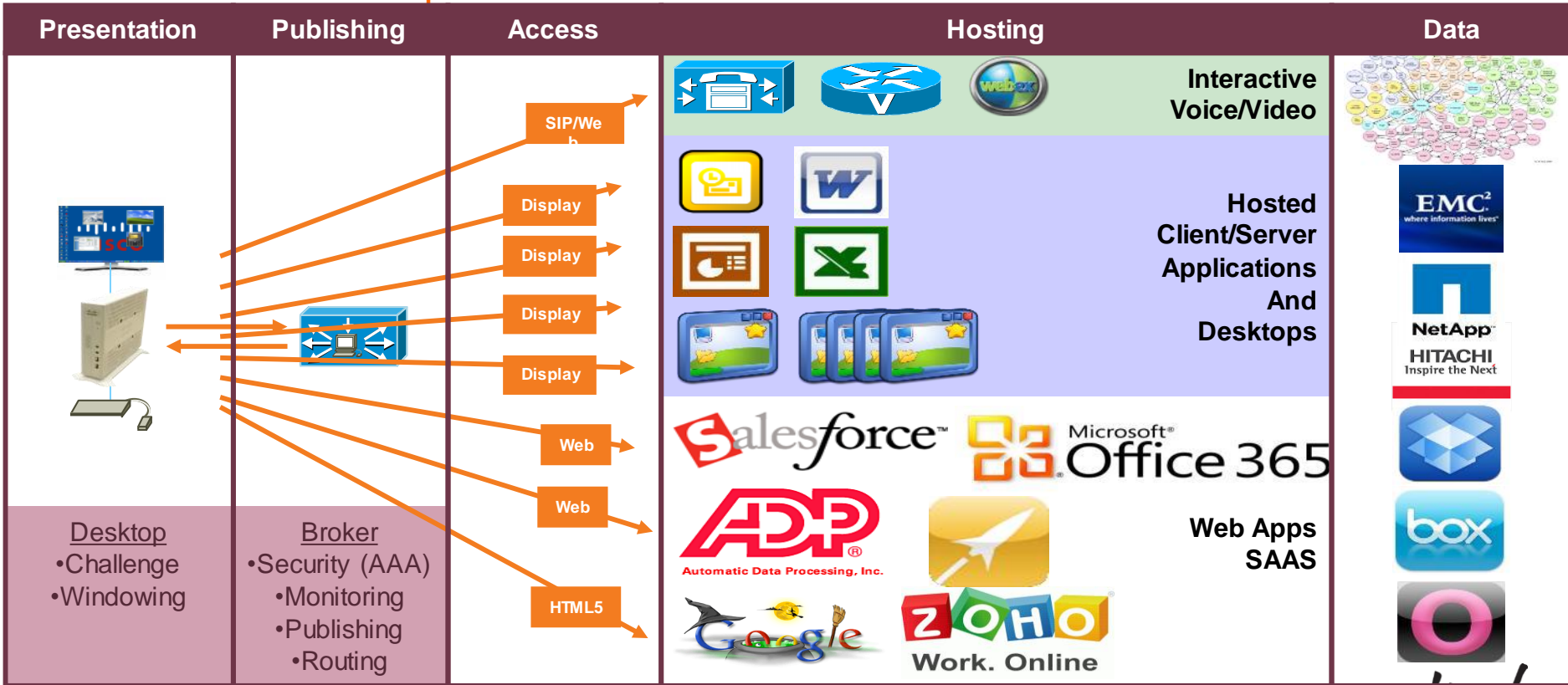
Software

Display versus Web Application Presentation

RDP/ICA/PCoIP Display Client or Web Browser

Intranet Employee	VPN/SOHO Employee	Extranet Partner/ Customer	Internet Partner/ Customer	Internet Cloud

Access Network

Display Protocol Presentation Desktop or Application Clients	Web Presentation

Virtualised Servers	Application Servers

Database

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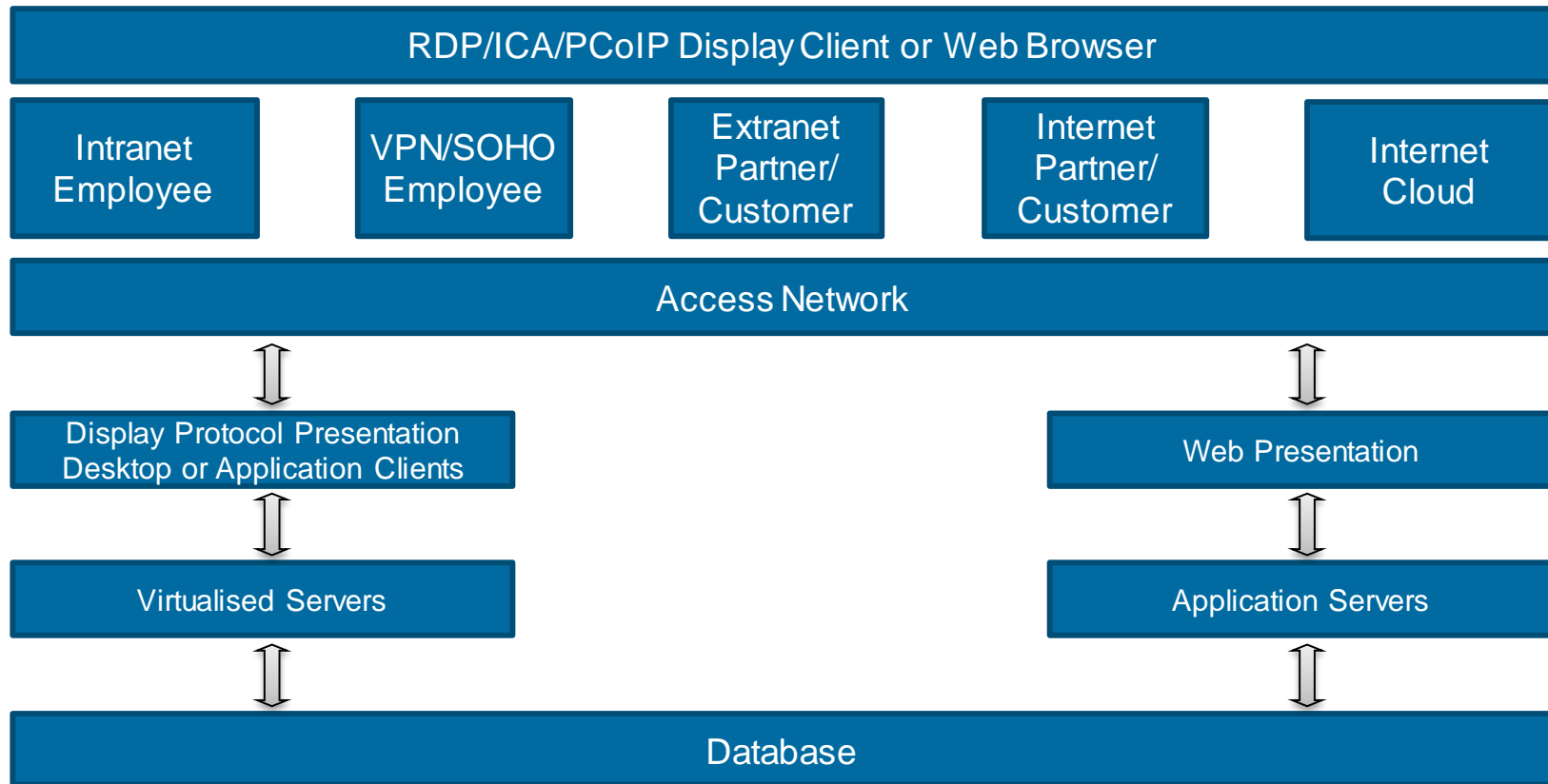
Where To Go

Citrix and Vmware as Cisco Desktop Virtualisation Partners

Vmware and Cisco

- http://www.cisco.com/go/vmware

- Cisco Desktop Virtualisation with VMWare Horizon: http://www.ciscovmwarevdi.com/

- VMWare and Cisco Branch:http://www.cisco.com/c/en/us/products/collateral/servers-unified-computing/ucs-e-series-servers/solution_overview_c22-726883.html

Citrix and Cisco

- www.cisco.com/go/citrix

- VDI-in-a-Box: http://www.cisco.com/en/US/netsol/ns978/index.html

- Cisco ACI and Citrix Netscaler joint Solution: http://www.cisco.com/c/en/us/solutions/data-center-virtualization/unified-fabric/citrix-netscaler.html

- Citrix VDI-in-a-box: http://www.cisco.com/c/dam/en/us/solutions/collateral/data-center-virtualization/unified-computing/fle_sb_citrix.pdf

Collaboration

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Collaboration

- Communications
  - Peer to peer
  - Real time experience
  - Call Admission Control

- Client/Server
  - Client to server
  - Mix of real time and bulk transfer
  - Allow all

- Web/Streaming/SAAS
  - Client to server
  - Network tolerant
  - Mostly bulk transfer

Telephony Client

Display Client

Browser Client

Call Control/Proxy

Connection Broker/Proxy

Quad/DMS Web/SAAS Ironport

Poor Experience

Poor Experience

Google.com

Salesforce.com

Webex.com

Azure.com

Zoho.com
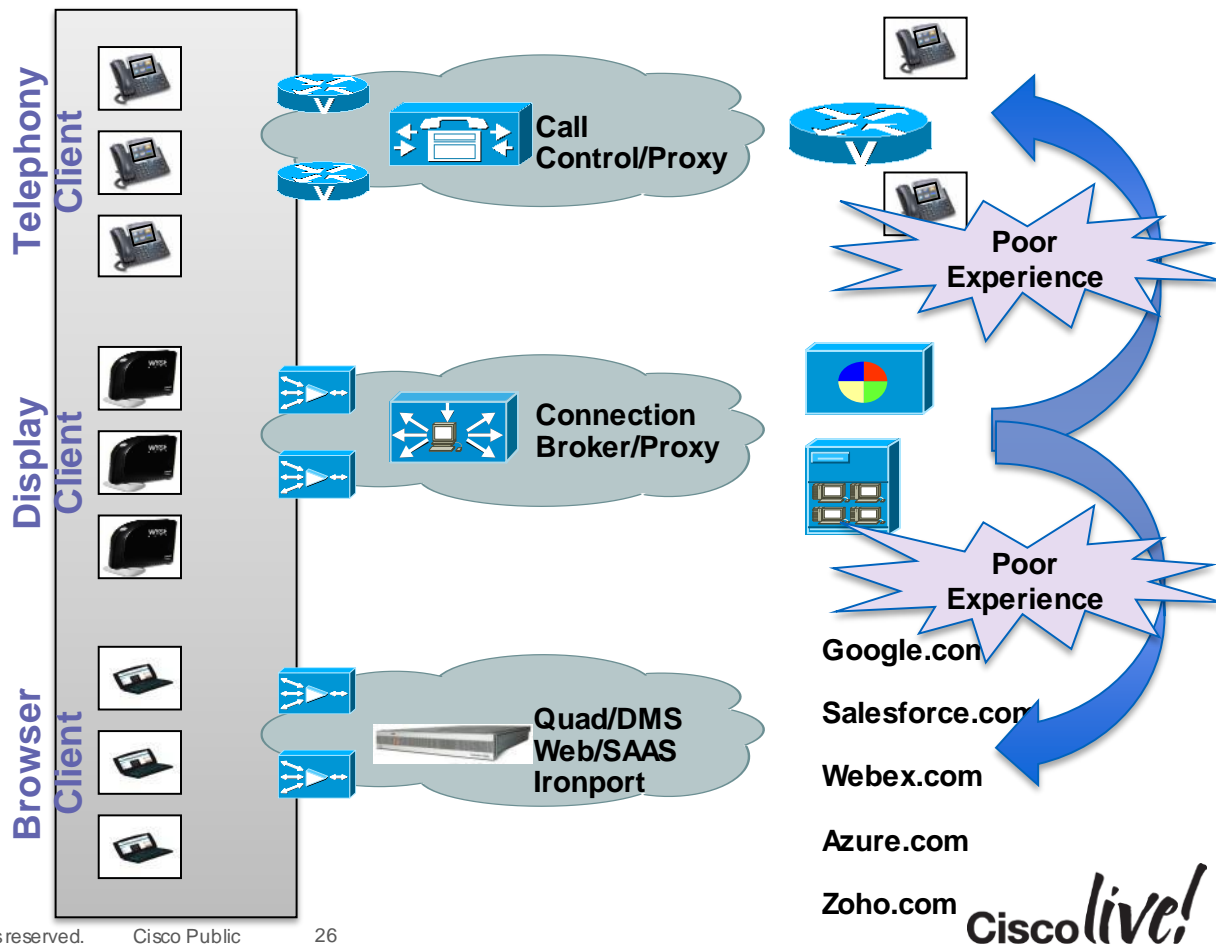
Collaboration

Cisco Jabber Two Deployment Modes for Voice/Video
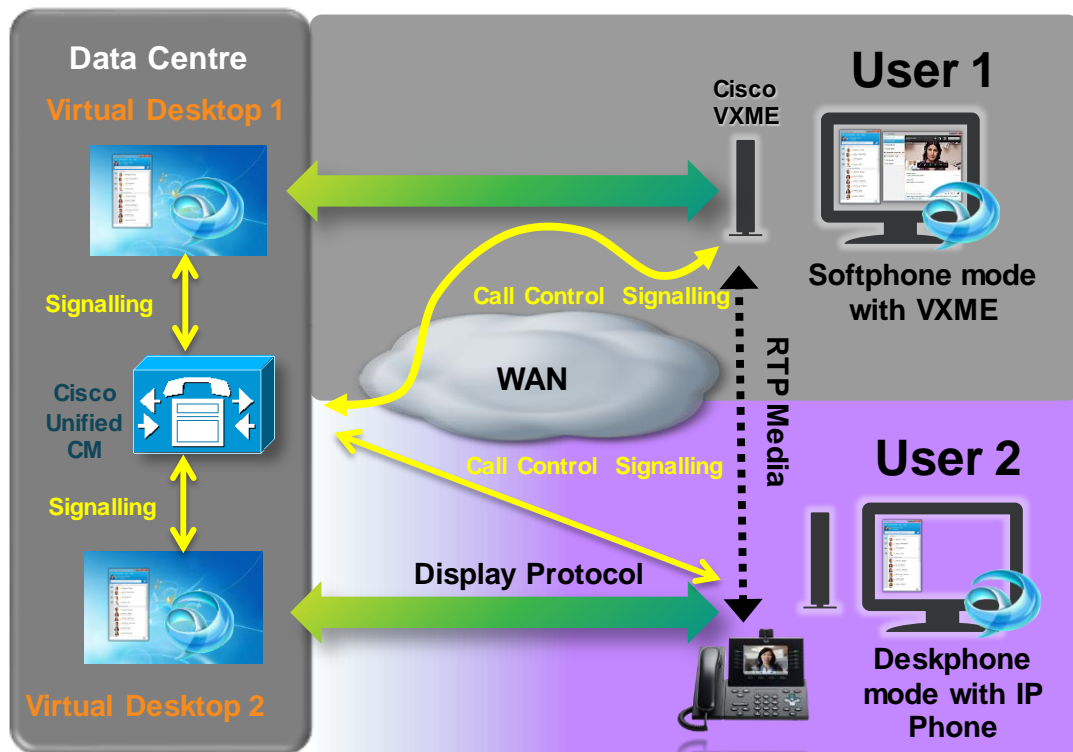
- Cisco Jabber Windows on remote virtual desktop
  - Citrix XenDesktop, XenApp (published desktop) and Vmware View

- Softphone mode with VXME
  - UC voice/video offloaded to VXME on local thin client
  - Voice/video overlaid on remote virtual desktop for integrated experience

- Deskphone control mode (CTI) of Cisco IP Phone
  - UC voice/video offloaded to Cisco IP Phone
  - Voice/video displayed on Cisco IP Phone

Collaboration

Virtualisation Experience Media Engine Interaction

Data Centre

HVD – User 1

Virtual Channel Broker

HVD Agent

Cisco Jabber for Windows

Unified Presence

CTI Manager

SIP Line

Unified CM

User 1- Thin Client with VXME

Display Protocol Receiver

SIP

Virtual Channel Broker

VXME Plugin

Virtualisation Experience Media Engine

User 2 - 9971

XMPP Signalling
CTI Signalling
SIP Signalling
RTP Media (Voice, Video)
Display Protocol API / Virtual Channel

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Collaboration

Software Strategy for Virtual Environments

- Virtualisation Experience Media Engine (VXME)
  - Software that enables Jabber to run in virtualised environments

- Thin client and Windows PC
  - Dell Wyse Z50 with Linux VXME
  - Windows thin clients and PCs

- Enable the Jabber experience running on virtual desktop as available today on your PC
  - Presence & IM
  - High definition video & wideband audio
  - Conferencing

VXME for Dell Wyse Z50D: Released

VXME for Windows PCs: June 2014

Collaboration
Cisco DX80 Collaboration End Point

VDI (Virtual Desktop Interface) allows users to access their remote virtualised desktops, apps, and docs from a DX80 with Android based software client.

Can also be utilised simply as a screen for external thin client on top of collaboration capabilities.

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Enterprise Networks

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Enterprise Networks
Decoding the VDI Protocol Stack

Application	VMware View	Microsoft RDS	Citrix XenDesktop
Underlying Protocols	PCoIP 4172	RDP 3389	ICA/HDX 2598/1494
	UDP	TCP	
Deployment Considerations	• Client-side hardware often used for optimal experience • Server side hardware available • MMR with Win7 desktops not supported • TCP 4172 used for control • AES-256 bit encrypted	• No Client-side hardware dependency • Remote FX requires H/W assist (server GPU) • Standards-based encryption model • SSL encrypted	• No client-side or server-side hardware dependency • Announced hardware specification for 3rd parties • Standards-based as well as proprietary encryption models • RC5 or SSL encrypted

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Enterprise Networks
Display Protocol Considerations Checklist

- Network
  - Transport – TCP, UDP, RTP
  - Behaviour - bandwidth, congestion, latency, drop
- Channels
  - Inband
  - Out of band
- Acceleration
  - Encryption
  - Compression
- USB
  - Headset
  - Print
  - Drive
  - Security

- Voice
  - USB headset
  - Analog microphone/speaker
- Graphics/Video
  - Quality– Lossy or lossless
  - Streaming - Windows Media, Adobe Flash, QuickTime, or SilverLight
  - Telephony – Jabber, Skype, Lync, Google, etc.
- Print
  - Print server
  - Printer location
  - User mobility

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Enterprise Networks
Display Protocol Summary

Protocol	Vendor	Transport	Bandwidth without WAAS (Approx)	Bandwidth with WAAS (Approx)
Remote Desktop Protocol (RDP)	Microsoft	TCP 3389	384 Kbps	96 Kbps
Independent Computing Architecture (ICA)	Citrix	TCP 2598 CGP TCP 1494 ICA	120 Kbps	60 Kbps
PC over IP (PCoIP)	Teradici / VMware	Media – UDP 50002/4172 Control – TCP 50002/4172	192 Kbps	192 Kbps

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Client Types and Strategy

	User	Hardware	OS	Software	Execution	Storage	Security	Life (Yrs)
Zero	Task	Chip	Firmware	None	All remote	None	Low risk	7-10
Thin	Task/Knowledge	Limited	Hardened	Display	All remote	None	Low risk	5-7
Hybrid	Knowledge	Capable (possible media offload)	Hardened General (Linux or Windows Embedded)	Display Rich Media Web	Client/Server remote Rich media local	Transient Encrypted	Medium risk	5-7
Thick	Knowledge or Power	High End	Open General (Windows, Linux, Mac)	Unlimited	Mostly local Some remote	Persistent	High risk	3-5

1. Status-quo - Use whatever desktop/notebook/etc you already have

2. Recycle PC - Convert old PC hardware to a "homebrew" thin-client

3. New PC - buy new desktop/notebook hardware with HVD and application virtualisation rollout

4. New thin/zero clients

5. New Collaboration (Hybrid) end point with receiver/client capability

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Enterprise Networks

Display Protocol Channels

- Display protocols operate at the session layer

- Display protocols were intended to remote applications and not desktops

- Desktop interactions require that some local client services be extended to the remote virtual desktop

- Channels provide a means to extend remote virtual desktop services

- Traditional channels cannot leverage network services like QoS, security, media bridging, stream splitting, or multicast

Display Protocol TCP

USB
Video
Sound
Print

Enterprise Network
VDI User to Application Interactions

- The entire client display with all user interactions such as mouse movements and keystrokes is sent over the network. This requires not only bandwidth efficiency but fast throughput.

▪ With VDI, the same applications now transfer data between the Citrix server and the origin application server.

Virtualised Desktop

Display Protocol

Keystrokes | **Mouse**

Display | **Print**

File
Email
Backup
Web

Virtual Desktop Server

App Servers

- **Increased WAN BW per user**
- **Keystrokes go across the WAN**
- **Limitations on local services (i.e. print)**

+ **Centralised Applications**
+ **Centralised Desktop Image Administration**
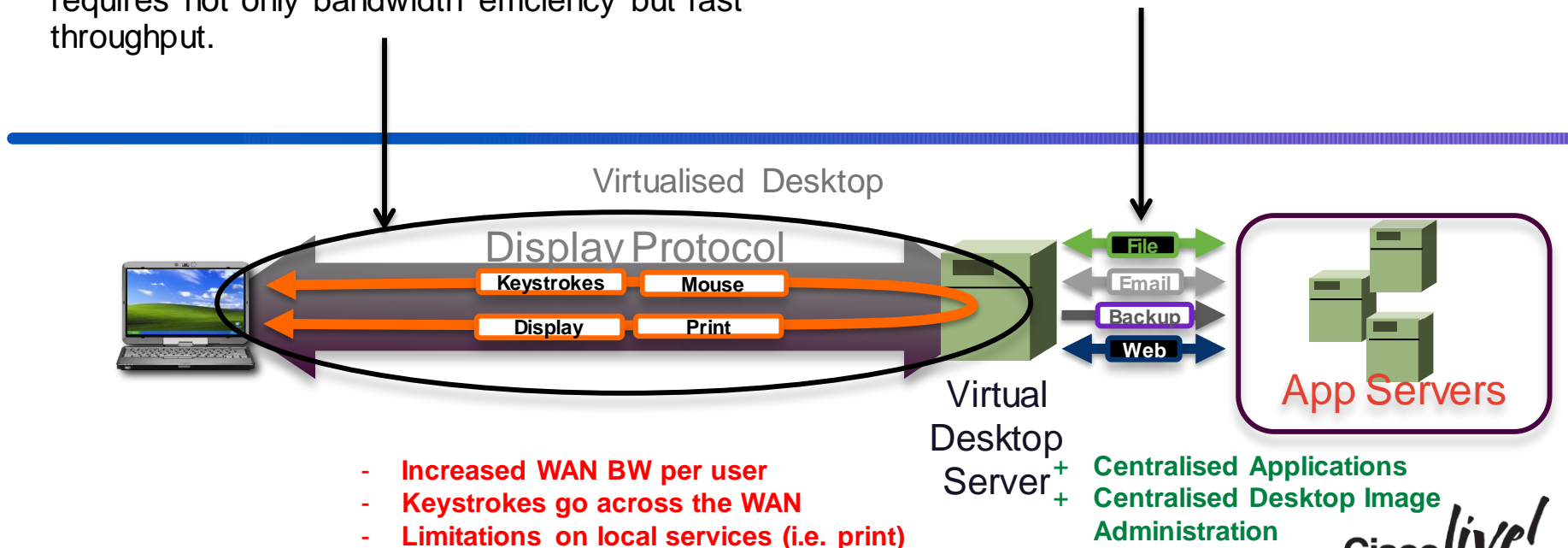
Enterprise Network

Citrix ICA Enhances VDI

ICA Connection (or Stream) — Print Channel, USB Channel … Display Channel
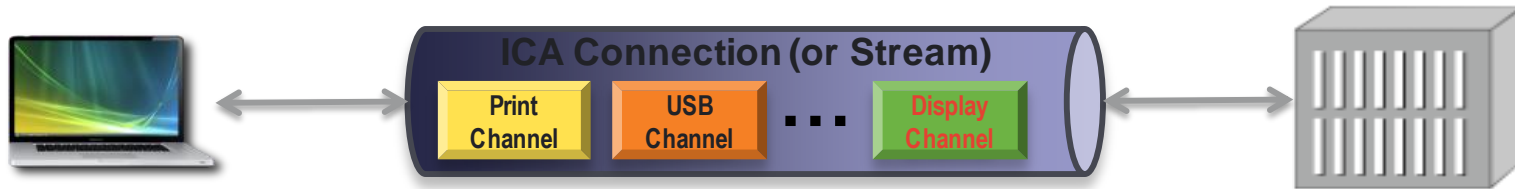
- Wide Area Application Services (WAAS) optimises all channels within the ICA stream

- Single TCP connection (Stream) per ICA Client

- Citrix Proprietary Encrysption

- All ICA virtual channels inside the single stream

- Network based QoS cannot be applied to individual ICA virtual channels

Enterprise Network
Multi-stream ICA (MSI) Splits a User into 5 Streams

• MSI is disabled by default in Citrix

DSCP Marking Very High (audio)

DSCP Marking Medium (USB Redirect)

DSCP Marking Low (COM Port)

Channel	Channel	. . .	Channel	**TCP**
Channel	Channel	. . .	Channel	**TCP**
Channel	Channel	. . .	Channel	**TCP**
Channel	Channel	. . .	Channel	**TCP**
Channel	Channel	. . .	Channel	**UDP**
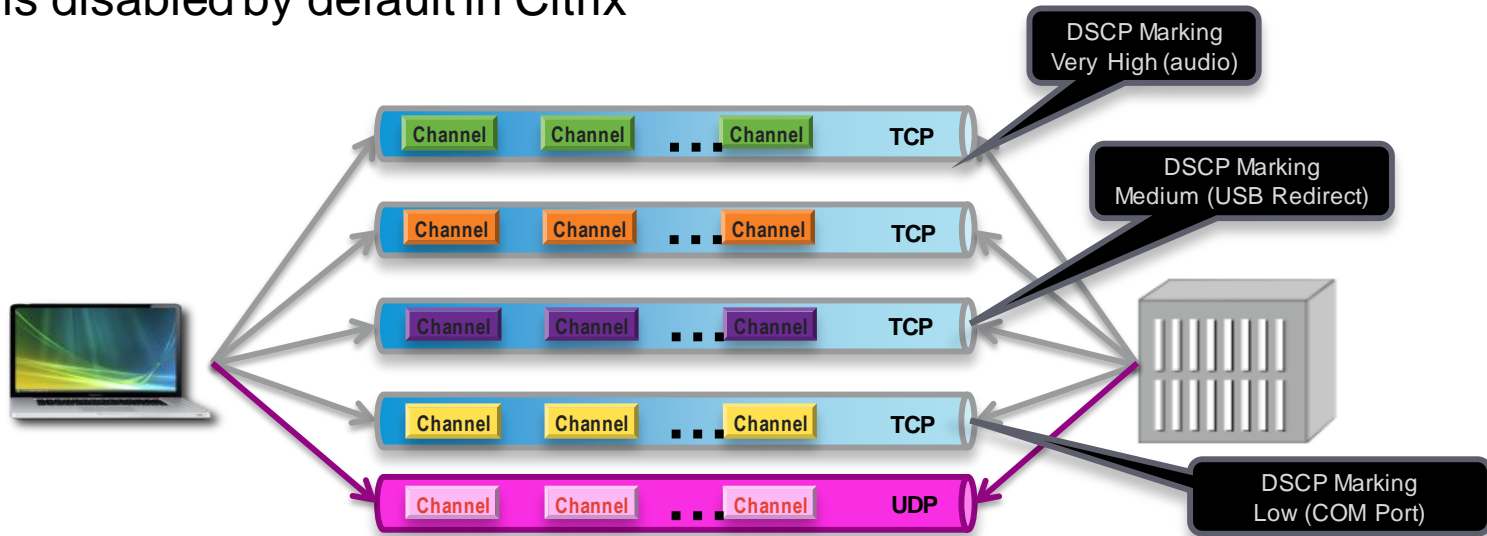
• Enabling Multi-Stream ICA on WAAS automatically enables it through Citrix.

• WAAS automatically discovers/optimises channels which use separate TCP connections.

• WAAS can dynamically apply DSCP markings to match Citrix priorities.

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Enterprise Networks
WAAS Reduces MMR Bandwidth up to 99%

- Rich Media Streaming w/ MMR (Direct Connect)

BW Optimization for VIEW MMR Traffic

Overall BW Consump.: 1.75 MB
(After WAAS Optimisation)

Overall BW Consump.: 20 MB

60
40
20
0

0:50 0:53 0:56 0:59 1:02 1:05 1:08 1:11 1:14 1:17 1:20 1:23 1:26 1:29 1:32

20 MB 1.75 MB

■ Original (MB)   ■ Optimized (MB)

PCoIP Session
RDP Session
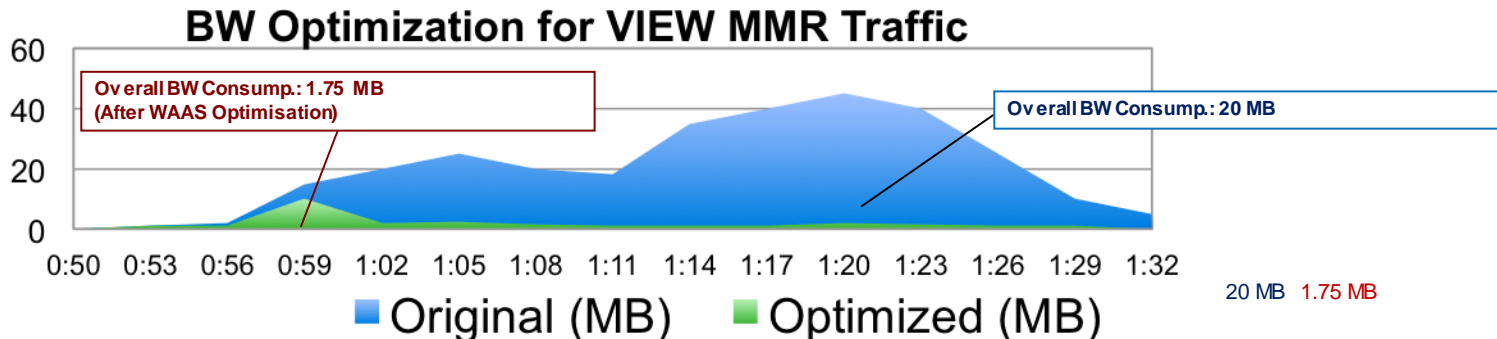
Source IP:Port	Dest IP:Port	Peer Id	Applied Policy	Open Duration	Org Bytes	Opt Bytes	% Comp	Classifier Name
10.10.3.111:1719	10.10.1.53:32111	Core-WAE		0:4:9	6.376 KB	3.167 KB	50%	USBRedirect
10.10.3.111:1721	10.10.1.53:9427	Core-WAE		0:2:27	4.7251 MB	52.3486 KB	99%	MMR
10.10.3.110:1296	10.10.1.54:32111	Core-WAE		0:0:59	6.2959 KB	2.8584 KB	55%	USBRedirect
10.10.3.110:1299	10.10.1.54:9427	Core-WAE		0:0:3	1.3522 MB	18.376 KB	99%	MMR

Solutions Setup

2 Concurrent View Clients
Display Protocol: RDP and PCoIP
View Deployment Mode: Direct Connection
BW/Latency: T1/80 ms
Play Time: 5-6 Minutes of Repeat Tracks

Audio: Format: MP3
Bitrate/Size: 192 Kbps/8.3 MB
Video: Format: WMV v.9
Bitrate: 1527 Kbps and 1772 Kbps
Size: 18.8 MB and 62.4 MB

WAAS Applied Policies: TFO, DRE, LZ
WAAS Classification Map:
  - MMR – TCP Port 9427
  - USB – TCP Port 32111
Overall Compression: 79.8%

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Enterprise Networks
Bring Your Own Device (BYOD)

Use Case Requirements			Design Requirements		
Telephony	**Client/Server**	**Local Apps/Data**	**VDI**	**VPN**	**MDM**
Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	No	Yes	No	No
Yes	No	Yes	No	Yes	Yes
No	Yes	Yes	Yes	Yes	Yes
No	No	Yes	No	Yes	Yes
No	Yes	No	Yes	No	No

- BYOD or Not – Who cares who bought it?
  - Company buys
  - Employee buys
  - Gift if you're lucky…

- VDI or Not
  - Offers access to legacy hosted client/server apps
  - Allow display only access to client/server with no local data
  - VPN generally not required

- Mobile Device Management (MDM) or Not
  - Often coupled with local device apps/data and VPN

- VPN or Not
  - Often used with local device apps/data beyond mobile mail and display client

- Cisco Communications or Not
  - Local communications software commonly using VPN (future embedded VPN)

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Enterprise Networks

VDI Firewalls For Remote Access

- Non-Persistent desktops

- No direct network to network VPN

- Reduce data leakage risk

- Control access of consultants, contractors, developers, extranets connections, BYOD users, etc.

- ASA provides access gateway

- Identity Services Engine (ISE) provides user based access control policies

- ISE may also provide access client user identity, location, and device access control

Intranet Secure Data

ISE / ASA

Apps | Apps | Apps | App | App
OS | OS | OS | OS

Secure Hypervisor

ASA Firewall / Access Gateway

Display Data Only

Internet Guest Net

Extranet
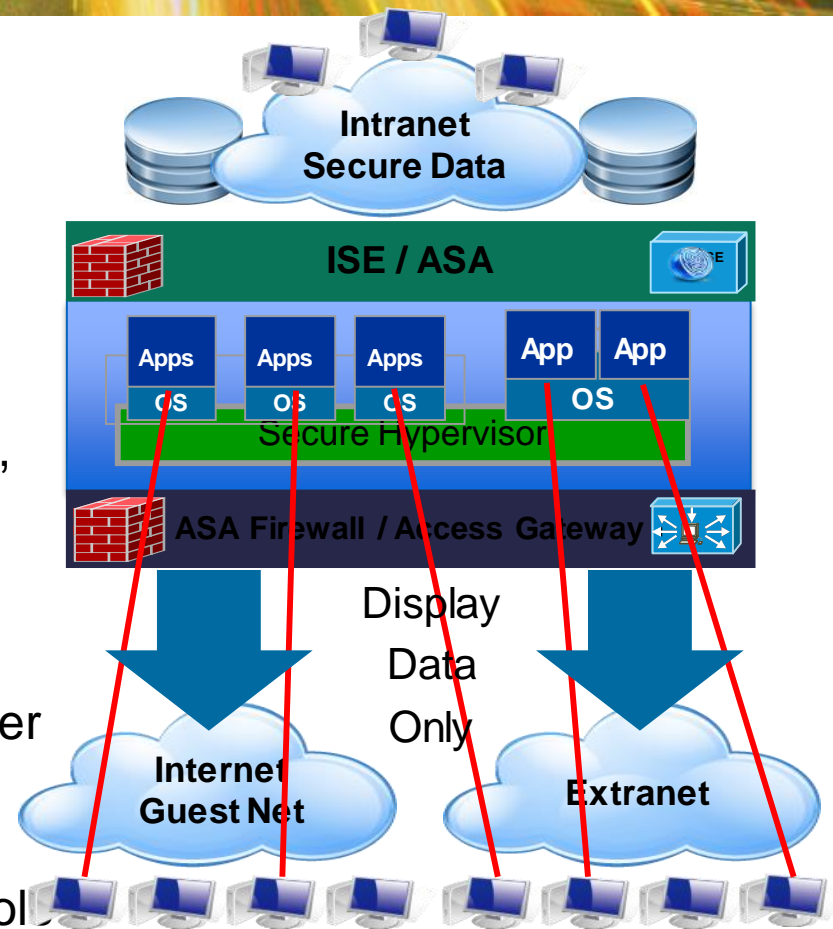
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Data Centre

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Data Centre
Considerations

- Compute
  - Scale
  - Cost
  - Performance
  - Power/Cooling
  - Space
  - Cabling

- Storage Scale
  - Scale capacity (Linked and Flex Clones)
  - Scale IOPS

- Client Network Services
  - Security
  - Monitoring
  - IP address management

- Automation/Orchestration
  - Inter DC
  - Intra DC
  - InterCloud
  - Policy development
  - Enforcement/Error reduction
  - Profiles

Data Centre

Orchestration with UCS Director

End Users **IT Admins** **IT Operations**

LDAP, CMDB, Metering DB

- Single, unified product built from the ground up
- Modular architecture
- Extensibility through APIs
- Deployed as an on-premise Virtual Appliance(s)

Mobile Platform

Cloupia Network Services Agent

Self Service Catalog **Admin Console** **Dashboard** **Enterprise Systems Integration**

Amazon, Entel, Rackspace

Savvis VPDC, Terremark

Other Providers

Virtual Infrastructure Management

Cisco UCS Director
Multi-tenant Infrastructure Management Platform

Provides:
- Policy-Driven
- Self-Service Infrastructure
- Lifecycle Management

API to Cisco UCSM

Blade Server Managers **Storage APIs** **Network API/CLI** **vCenter** **SCVMM** **RM**

Physical Infrastructure

Cisco UCS DELL hp Cisco Nexus NetApp EMC² CISCO DELL Force10 BROCADE CISCO

Virtual Infrastructure

CITRIX Microsoft redhat vmware

UCS Director Provides Unified, Centralised Management of Physical and Virtualisation Infrastructure in Private and Hybrid Clouds

Data Centre

Compute Statelessness For Automation & Efficiency

- Application virtualisation decouples application from OS (i.e. ThinApp, AppV, Provisioning Server, etc.)

- Hypervisor decouples OS from compute hardware

- UCS Service Profile decouple server from BIOS

- Nexus Port Profile decouples cabling from server
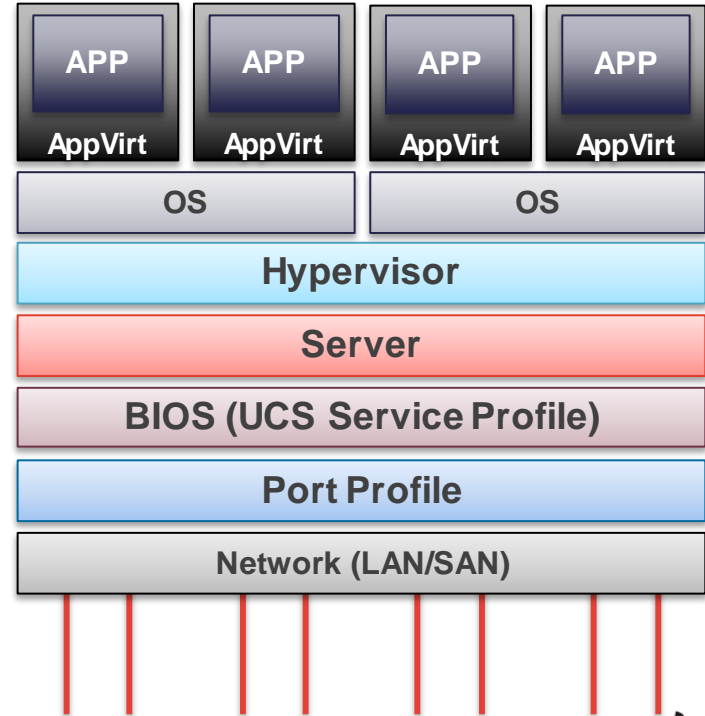
Data Centre - Compute

UCS B Series - Blade Servers

	B22 M3	B200 M3	B200 M4	B230 M2	B420 M3	B440 M2	B260 M4	B460 M4
Proc	2	2	2	2	4	4	2	4
CPU	E5-2400/v2	E5-2600 /v2	E5-2600 /v3	E7-2800 / 8800	E5-4600	E7-4800 / 8800	E7 v2	E7 v2
Cores	20	16	36	20	32	40	30	60
Max RAM	384GB (32 DIMMs)	768GB (24 DIMMs)	768GB (32 DIMMs DDR4)	512GB (32 DIMMs)	1.5TB (48 DIMMs)	1TB (32 DIMMs)	3TB (48 DIMMs)	6TB (96 DIMMs)
Disk	2 x 2.5" HDD (2TB)	2 x 2.5" HDD (2TB)	2 x 2.5" SSD (3.2TB)	2 x 2.5" SSD (600GB)	4 x 2.5" (4TB)	4 x 2.5" (3.6TB)	2 x 2.5" (2TB)	4 x 2.5" (4TB)
Raid	0/1	0/1	0/1	0/1	0/1/5/10	0/1/5/10	0/1	0/1
MaxI/O	80Gbps	80Gbps	80Gps	20Gps	160Gbps	40Gbps	160Gbps	320Gbps
Mezz	2	2	1	1	3*	2	2	4

* Using port expander technology VIC1240/1240/1280 combination

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Data Centre - Compute
http://www.cisco.com/go/ucs

UCS Rack Servers

* RAID optional - 0, 1, 5, 6, 10, 50, 60

	C22 M3	C24 M3	C220 M3	C220 M4	C240 M3	C240 M4	C420 M3	C260 M2	C460 M2	C460M4
Proc	2	2	2	2	2	2	4	2	4	2
CPU	E5-2400v2	E5-2400v2	E5-2600v2	E5-2600v2	E5-2600v2	E5-2600v3	E5-4600	E7-2800/8800	E7-4800/8800	E7-4800/8800v2
Cores	16	16	16	24	24	16	32	20	40	16
Max RAM	384GB (12 DIMMs)	384GB (12 DIMMs)	512GB (16 DIMMs)	768GB (24 DIMMs)	768GB (24 DIMMs)	768GB (24 DIMMs)	1.5TB (48 DIMMs)	1TB (64 DIMMs)	2TB (64 DIMMs)	512GB (16 DIMMs)
Disk*	8xSFF/4xLFF	24xSFF/12x LFF	8xSFF/4xLFF	8xSFF/4xLFF	24xSFF/12x LFF	24xSFF/12x LFF	16xSFF	16xSFF	12xSFF	8xSFF/4x LFF
I/O	2 x 1Gb + 10Gbps Unified fabric option	2 x 1Gb + 10Gbps Unified fabric option	2 x 1Gb + 10Gbps Unified fabric option	2 x 1Gb + 10Gbps Unified fabric option	2 x 1Gb + 10Gbps Unified fabric option	2 x 1Gb + 10Gbps Unified fabric option	4 x 1Gb + 10Gbps Unified fabric option	2 GE ports Two 10 Gbps ports	2 GE ports Two 10 Gbps ports	2 x 1Gb + 10Gbps Unified fabric option

Data Centre - Compute

UCS Virtual Desktop Densities

Blade	Server CPU	Server Memory	Desktop Configuration	Per Blade	Per Chassis	Per Domain 20 Chassis
B250-M2	Xeon5600 3.33 GHz	192 GB	Win7-32 1.5 GB	110	440	8,800
B230-M2	Xeon2870 2.40 GHz	512 GB	Win7-64 2.0 GB	175	1,400	28,000
B200-M3	Dual E5-2690 / 8 Core	384 GB	Win7-64 2.0 GB	184	1,472	29,440
B240-M3	Dual E5-2690 / 8 Core	384 GB	Win7-64 2.0 GB	186	1,488	29,760

Hosted Virtual Desktop model

Data Centre

CPU Considerations for Virtual Machine

Number of Cores	CPU Clock Speed	Amount of Cache Memory	CPU Virtualization Technology

- CPU class
  - CPU class is affected by number of cores, CPU clock speed, amount of cache memory and CPU virtualisation technology

- CPU core count
  - CPU core count affects virtual machine scalability and performance

- CPU over commitment
  - CPU over commitment occurs when the number of virtual CPUs assigned to the virtual machines exceeds the number of physical CPUs available to the host

- Virtual machine role priority
  - Virtual machine role priority determines how CPU resources are distributed across virtual machines

Data Centre - Compute
Example CPU Capacity Planning
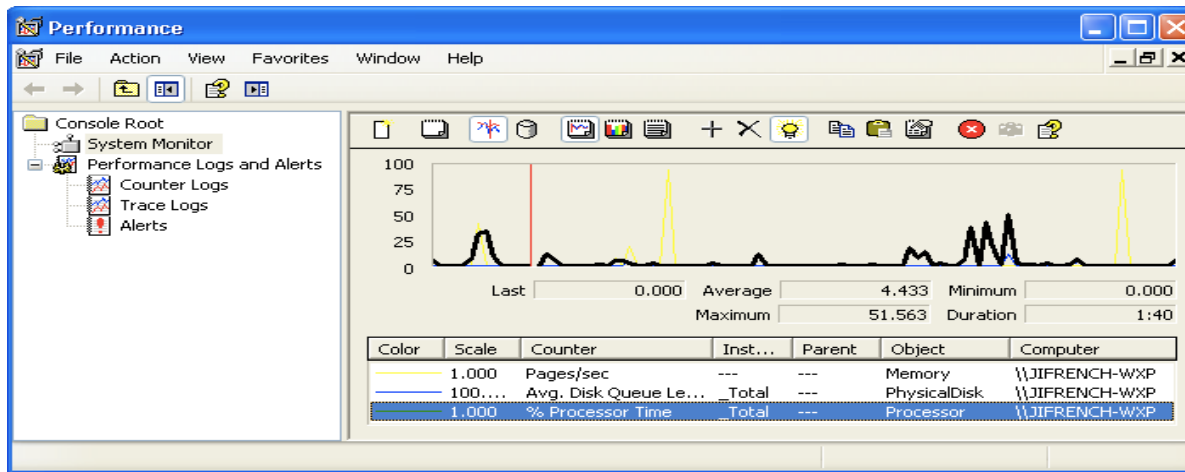
- Win XP % Processor Time average 5% on 2 GHz core

- Requires 100 MHz per desktop (0.05 * 2 GHz)

- 100 desktops require 10 GHz processing (100 * 100 MHz)

- Add 10% to 25% overhead for virtualisation, display protocol, and buffer for spike

- 100 desktops achieved with 12.5 Ghz via 4 cores at >=3.125 GHz per core

- Planning

  Windows 7 400-600 MHz
  Windows 8 800MHz+

Data Centre - Compute
Example Memory Capacity Planning
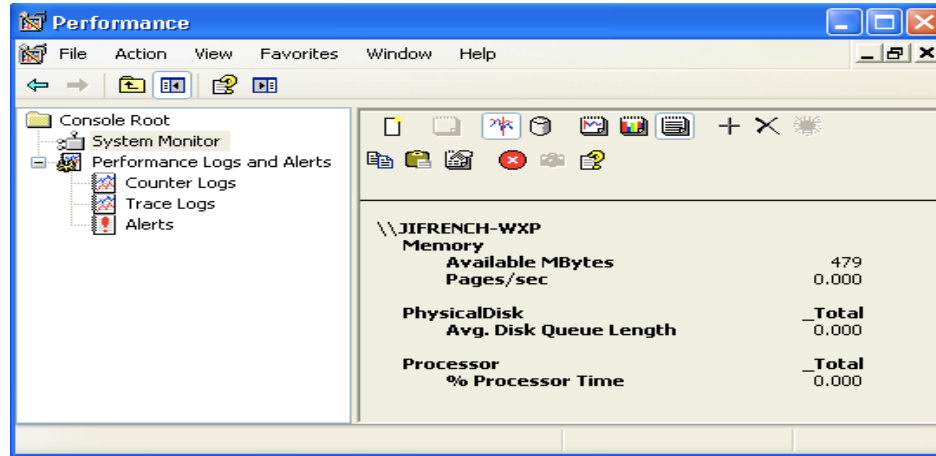
- Vmware ESX Transparent Page Sharing to share master copy of memory pages among virtual machines
  - Windows XP - 4 KB page sharing
  - Windows 7 - 1 MB page sharing

- Planning Without Memory Oversubscription
  - Windows 7-32 bit - 1-1.5 GB
  - Windows 7-64 bit - 2-3 GB
  - Windows 8 32/64
    - Small – 1.5-2GB
    - Medium – 2-3GB
    - Large – 2-4GB

Data Centre

nVidia Graphics Processing Units (GPU)

	nVidia GRID K1	nVidia GRID K2
GPU	4 Kepler GPUs	2 High End Kepler GPUs
CUDA cores	768 (192 / GPU)	3072 (1536 / GPU)
Memory Size	16GB DDR3 (4GB / GPU)	8GB GDDR5
Max Power	130 W	225 W
Form Factor	Dual Slot ATX, 10.5"	Dual Slot ATX, 10.5"
Aux power requirement	6-pin connector	8-pin connector
PCIe	x16	x16
PCIe Generation	Gen3 (Gen2 compatible)	Gen3 (Gen2 compatible)
# users	4 - 100[1]	2 – 64[1]
Watts per user	~ 1.5 W	~ 3.5 W
OpenGL	4.x	4.x
Microsoft DirectX	11	11
VGX Hypervisor support	Yes	Yes

[1] Number of users depends on software solution, workload, and screen resolution

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Data Centre – Compute

GPUs in Virtual Desktop Environments

- GPU Pass-through
  - 1:1 dedicated GPU to user
  - Driver in the Virtual Machine

- GPU Sharing
  - Software virtualisation of the GPU or API Intercept
  - Driver in Hypervisor

- VGX
  - Hardware virtualisation of the GPU through the NVIDIA VGX Hypervisor
  - Driver in the Virtual Machine

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Data Centre – Compute

Supported Hardware and Software

- Hardware C 240 M3/M4 and C 460 M4

- Server OS:
  - XenServer 6.0.2, 6.1
  - Windows Server 2012
  - VMWare ESX 5.1 View 5.2 / 6

- Virtualised Application Support (Shared GPU)
  - Citrix XenApp 6.5 with OpenGL 4.3 or XenApp 7.5

- Virtual Desktop Solutions (Shared GPU)
  - Citrix XenDesktop vGPU
  - Microsoft RemoteFX WS2012
  - Vmware Horizon View 5.2 vSGA

- Virtual Remote Workstation (Dedicated GPU)
  - Citrix XenDesktop 5.6 or 7 with HDX 3D Pro
  - Vmware horizon View 5.3 or higher with vDGA

- NVIDIA GVX K1
  - 4x Entry Level Kepler GPUs
  - 768 NVIDIA CUDA cores
  - 130W
  - 6pin aux power connector

- NVIDIA GVX K2
  - 2x High-end Kepler GPUs
  - 3072 NVIDIA CUDA cores
  - 225W
  - 8pin aux power connector

Compute
Cisco UCS C240 M3/M4 GRID Card Support

Cisco VDI

- UCS C240 M3 Rack Server is 2U, 2-socket server
- Supports up to 186 Virtual Desktops*
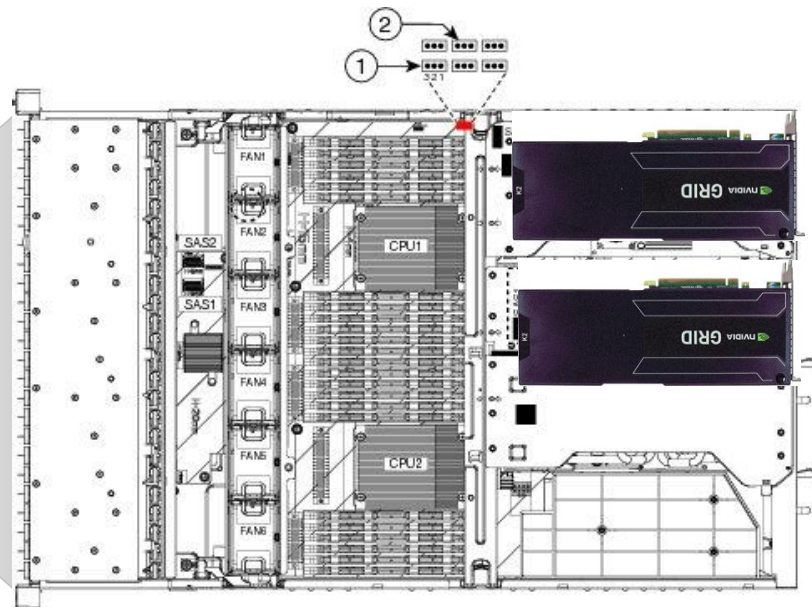
Data Centre
GPU support for VDI Profile

Vendor	GPU Pass-Through	GPU Sharing	VGX
CITRIX	✓	XenApp only	✓ *(Future)
vmware	✓(vDGA)	✓(vSGA)	X
Microsoft	✓	✓	X

Data Centre
GPU Recommended Mode

User	No-GPU	GPU Sharing	GPU Pass-through
Designer	✗	✗	✓
Power User	✗	✗ / ✓	✓
Knowledge Worker User	✓	✓	✓

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Data Centre – Storage

Data Centre - Storage
Overview

- Type
  - Virtual machine
  - User data
  - Profile
  - Virtual applications

- Storage
  - Storage Area Network (SAN)
  - Network Attached Storage (NAS)
  - Direct Attached Storage (DAS)

- File System
  - NT File System (NTFS)
  - File Allocation Table (FAT)
  - Extended File System (ext3)
  - Virtual Machine File System (VMFS)
  - Raw Device Mapping (RDM)

- New Technology Influences
  - Simplivity
  - AppVolumes

- File Access
  - Common Internet File System (CIFS) / Server Message Block (SMB)
  - Network File System (NFS)

- Block Transport
  - Small Computer System Interface (SCSI)
  - Internet SCSI (iSCSI)
  - Fibre Channel (FC)
  - FC over Ethernet (FCoE)
  - SCSI over FC over IP (FCIP)

- Data Deduplication
  - NetApp File Level Flex Clone
  - VMware Linked Clone
  - Atlantis Computing iLio
  - Citrix Intellicache
  - VMware Storage Accelerator
  - Cisco WAAS Transport

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Data Centre - Storage
Implementation Top Challenges

- Boot Storms

- vMotion

- DCI connectivity

- Provisioning/location/cache

- Right storage technology for the right job

- Reduction of Latency

- Backups

- Cloning

- Right Technology for the problem
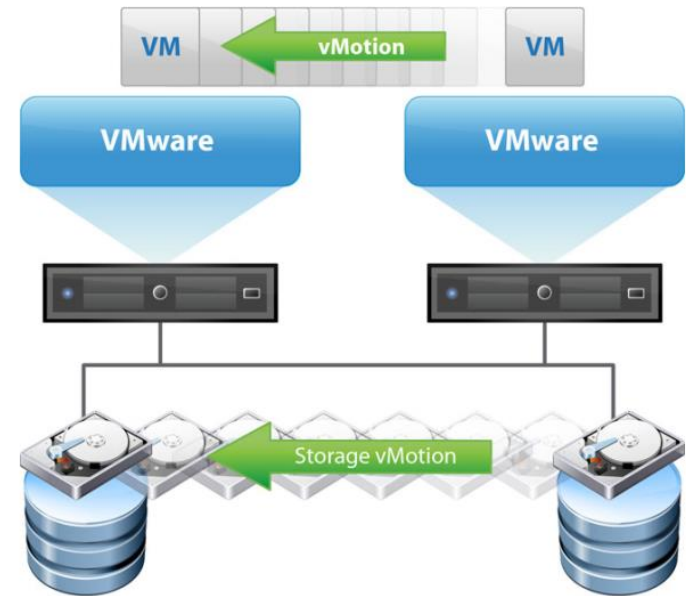
Data Centre - Storage
Business Objectives

Workload Acceleration	Data Reduction	Data Centre Efficiency
Fast I/O	Eliminate Redundant Data	Reduce Energy Consumption
High Bandwidth	Efficient Storage Utilisation	Reduce Floor Space Consumption
Low Latency		Reduce Management Overhead

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Data Centre - Storage
Flexpod - Netapp

**Production
Balanced Infrastructure**

VDI

CPU
Memory
Capacity
IOPS

Higher performance blades and more input/output operations per second (IOPS)

Develop & Test

More computing and less storage

Starting Out

Deploy entry system, then scale up

Data Protection & Backup

Less computing and more storage
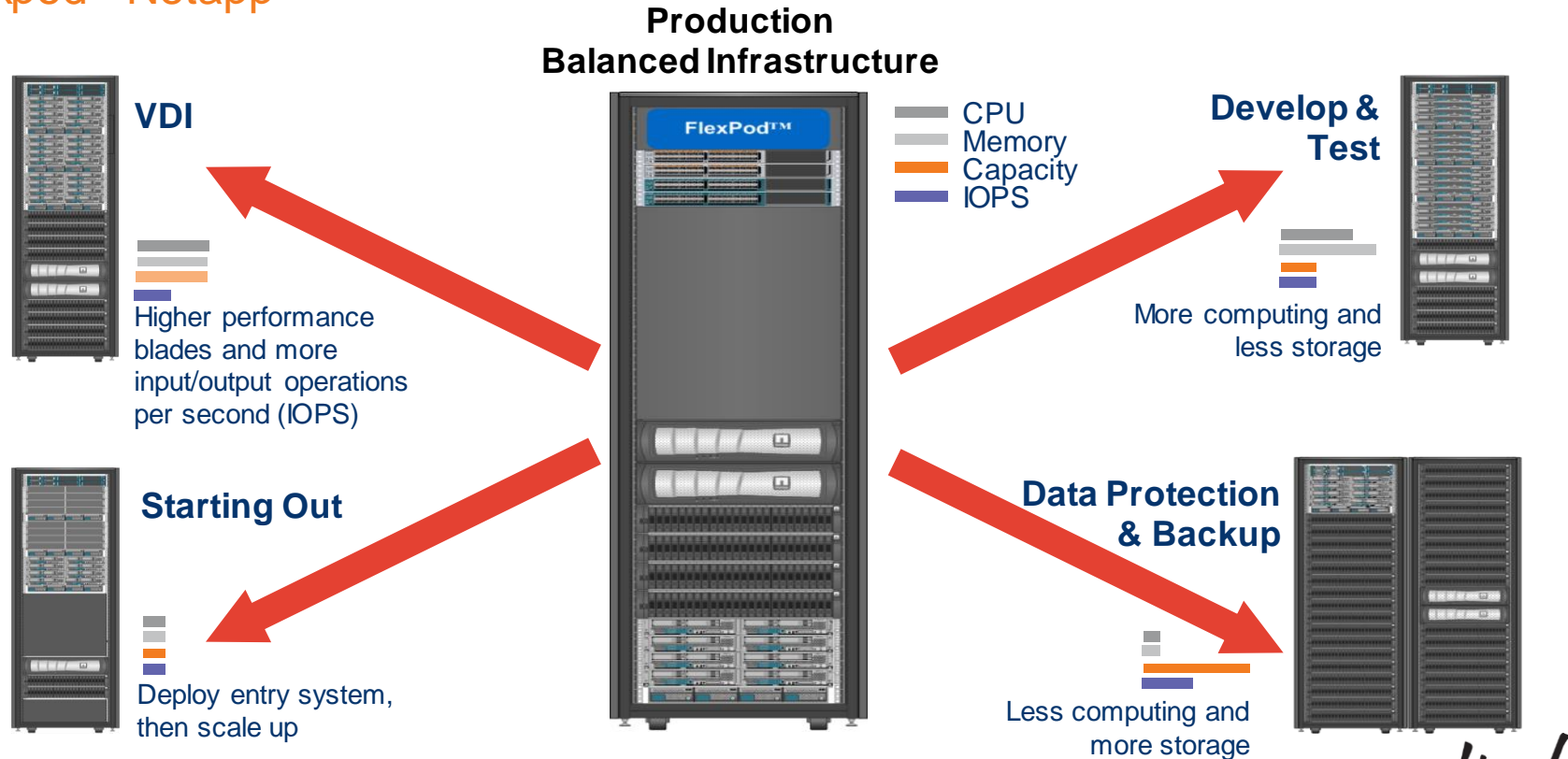
Data Centre – Storage
EMC VSPEX

Application	
Virtualisation	
UCS Server	
Network	
Storage	
Backup	

- Applications
  - Citrix VDI
  - VMware View
  - SharePoint

- Private Cloud
  - VMware vSphere
  - MSFT Hyper-V 2012

- Storage Back and Recovery
  - Avamar
  - NetWorker
  - DataDomain

Data Centre - Storage
Acceleration

VDI IOPS Throughput
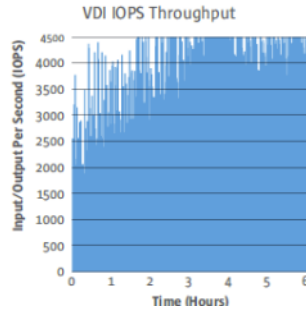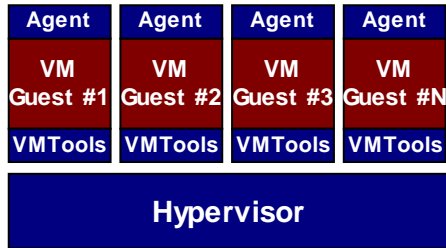
From Atlantis ILIO to Storage

Cache
Optimisations

Shared
Storage
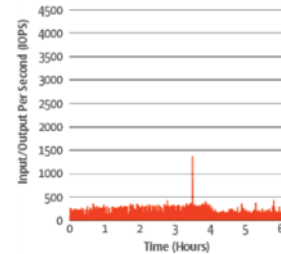
- Atlantis Computing ILIO – Read/Write acceleration (RAM option)

- Citrix Intellicache – Accelerated read with local write

- VMware Storage Accelerator (VSA) – Accelerated read

- Forms of optimisation (~90%)
  - Caching
  - Deduplication
  - Compression
  - Coalescing
  - Content-Awareness

Data Centre - Storage

Faster. Simpler.

41 15K HDDs

25 7.2K HDDs

3 Flash Drives

| 114,950 IOPS | 63.2 TB |

| 180,000 IOPS | 64 TB** |

**Effective Capacity

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Data Centre Storage

Cisco UCS Invicta Series

**UCS Invicta
Scaling System**

**UCS Invicta
Appliance**

250,000 IOPS*
1.2 GBps Bandwidth
Up to 24 TB Raw
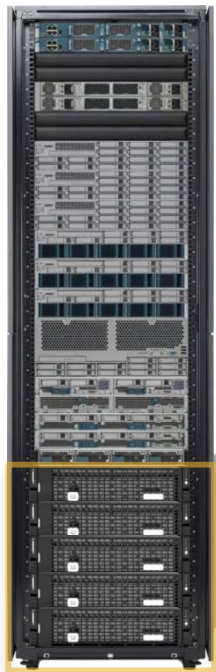
Up to 1.2 Million IOPS**
Up to 9.6 GBps** Bandwidth
Up to 144 TB Raw

6 Node Configuration

*Read IOPS **refer to earlier slide "A Note on Numbers"

✔ Scalability

✔ Modularity

✔ Application Acceleration

✔ Data Optimisation

✔ Multiple Workloads

✔ Tuning-Free
Performance

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Data Centre – Storage

Cisco UCS Invicta Appliance

Hardware Based upon the UCS C Series Platform	**Software** Invicta OS Version 5.0.0

1. Host Connectivity
2. Power-Fail Data Protection
3. Flash Media
	1. Flash Management
	2. Volume Management
	3. RAID
	4. Replication
	5. Snapshots
	6. Reporting
	7. Data Reduction Mode
	    1. De-Duplication
	    2. Thin Provisioning
	8. UCS Director Support
	9. iSCSI & Fibre Channel

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Data Centre - Storage

Cisco UCS Invicta Appliance

Mode	Application Acceleration	Data Reduction
Throughput (GBps)	1.2	1.2
100% Read IOPS	220,000	250,000
Blended IOPS (50%read/50%write)	205,000	180,000
100% Write IOPS	200,000	120,000
Latency (Microseconds)	<100	<100
Size	2 RU	2 RU
Max Capacity (TB)	24 TB Raw	64 TB**

***Effective Capacity*

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OmniStack Integrated Solution with Cisco UCS

- Highly Available VM Infrastructure

- Scale Out Architecture in 2U modular increments

- Data Virtualisation Platform, powered by the OmniStack Accelerator Card: Dedupe, Compress, Optimise, At Ingest, Inline, In Real-Time, Once and Forever: Primary, Backup, Archive, WAN, Cloud

- VM-Centricity & Mobility: all policies, commands and info on per VM basis for backup, replication and DR

- Global Unified Management with one screen: VMware vCenter

- **Infrastructure Management with Cisco UCS Manager**

OmniCube
Accelerator™
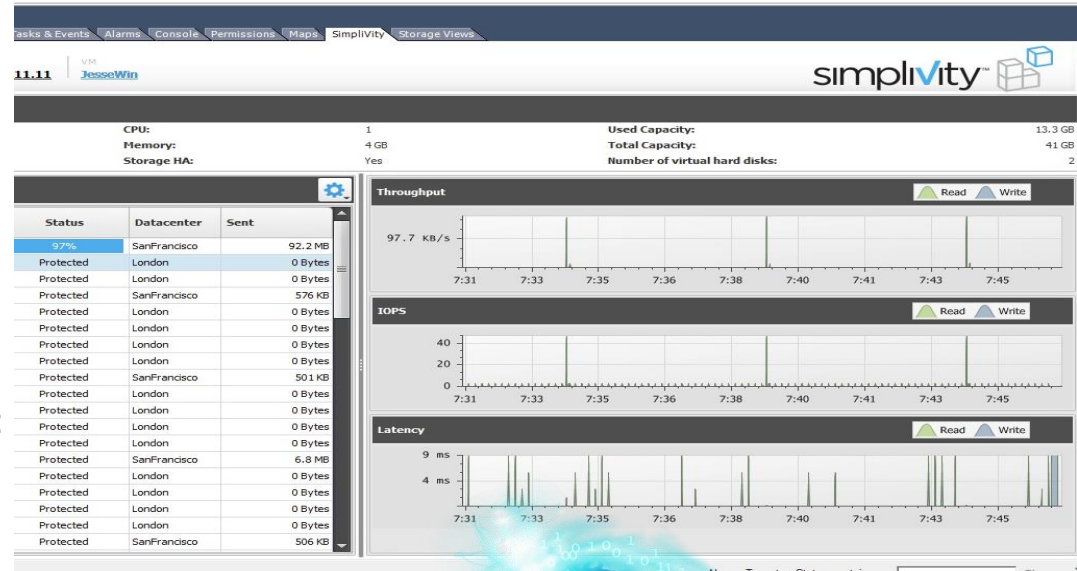
OmniStack Integrated Solution with Cisco UCS

1. Configurable CPU up to
   2 x 12 core Intel CPUs

2. Configurable RAM
   256GB – 768 GB RAM

3. Capacity:

   a. 6 x 400GB SSD, RAID 5

   b. 18 x 1TB HDD RAID 6 (2 disk groups)

   c. 2 or 4 x 10GbE (Copper or SFP+) + 4 x 1GbE

4. Redundant power supplies, fans, hardware components and a highly available configuration = no single point of failure

5. SimpliVity OmniStack Software

6. SimpliVity OmniStack Accelerator Card

UCS B Series Chassis
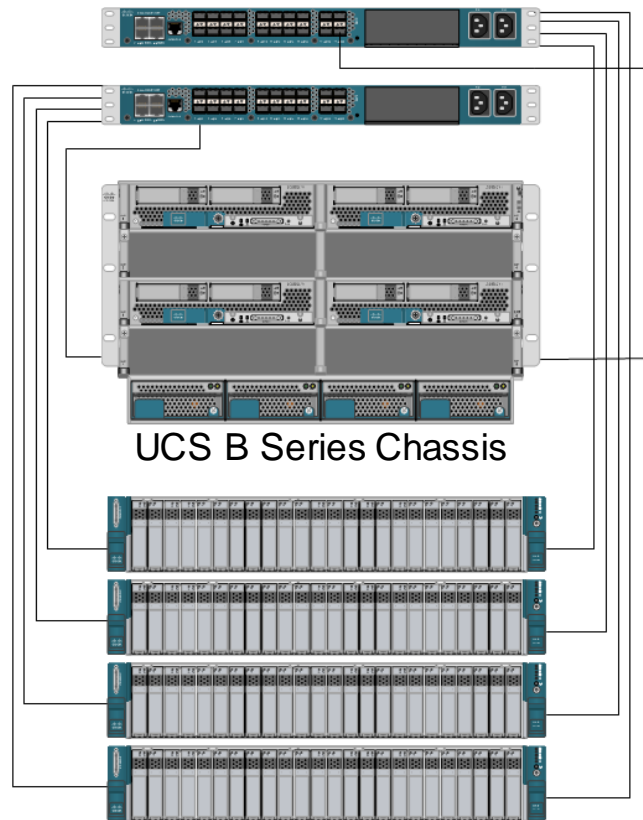
C240s with OmniStack

Data Centre - Storage
Planning

- Storage Requirements
  - Total number of desktops
  - Type of desktops (persistent, non-persistent)
  - Size per desktop
  - OS for desktop
  - Worker workload profile
  - Storage growth horizon
  - Disaster recovery, backup, and data protection requirements
  - Size of NAS (CIFS) home directories
  - Roaming profiles

- Transport De-duplication
  - Transport workload mobility solutions
  - Shared storage replication acceleration (SRDF, SnapMirror, etc.)
  - Workload mobility acceleration (Clone, VMDK access, etc.)

- Planning
  - Consider DAS for Non-Persistent Desktops
  - Use shared storage with RAID and replication for persistent desktops and user data
  - Use Linked Clones or File Level Flex Clones for storage capacity
  - IOPS (4096 Bytes/IOP)
    - WinXP 5-10
    - Win7 10-20
    - 15K RPM drive – 200 IOPS
    - SSD drive – 10,000s IOPS
    - Reads versus writes
    - storage attachment cache/SSD/scaled
  - Consider impact of antivirus
  - Use storage caching to scale
    - Consider data redundancy levels

Data Centre - Network

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Data Centre – Network

Security Options

- Infrastructure placement

- Zoning by user/group, application, desktop, data

- Campus network security features

- Patching
  - Persistent desktop versus non-persistent desktop

- Virus scanning
  - Virtual machine virus scanning
  - VMSafe service in vSphere
  - NAS (file server) based virus scanning
  - Network or proxy based virus scanning (Scansafe/Ironport)

- Virtual desktop access
  - Direct internally or proxied externally

Data Centre – Network

Deployment Considerations

WAN Edge								
DC-1 Core								
VDI			Apps			Data		
VM 1	VM 2	VM 3	VM 4	VM 5	VM 6	VM 7	VM 8	VM 9

WAN Edge								
DC-2 Core								
VDI			Apps			Data		
VM 10	VM 11	VM 12	VM 13	VM 14	VM 15	VM 16	VM 17	VM 18
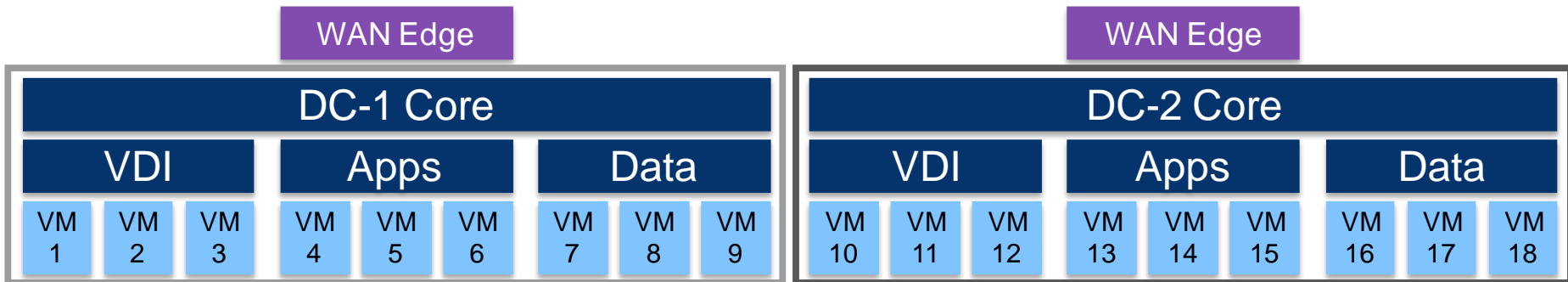
- Hosted virtual desktops in the server farm access considered east/west

- Hosted virtual desktops considered as a campus are north/south

- WAN edge in the access block is east/west?

- Data centre core is becoming an any to any transport

- It's all relative…

- Separate VDI from application environments

- Modular physical, network and compute infrastructure

- Predictable and repeatable scalability

- Campus security best practice

- IP address management

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Cisco UCS with VM-FEX

Virtual Desktop Prioritisation and QoS Pools

Server Blade

Platinum Pool

Silver Pool

Bronze Pool

Hypervisor

Cisco VIC

FEX 2200

FI 6200
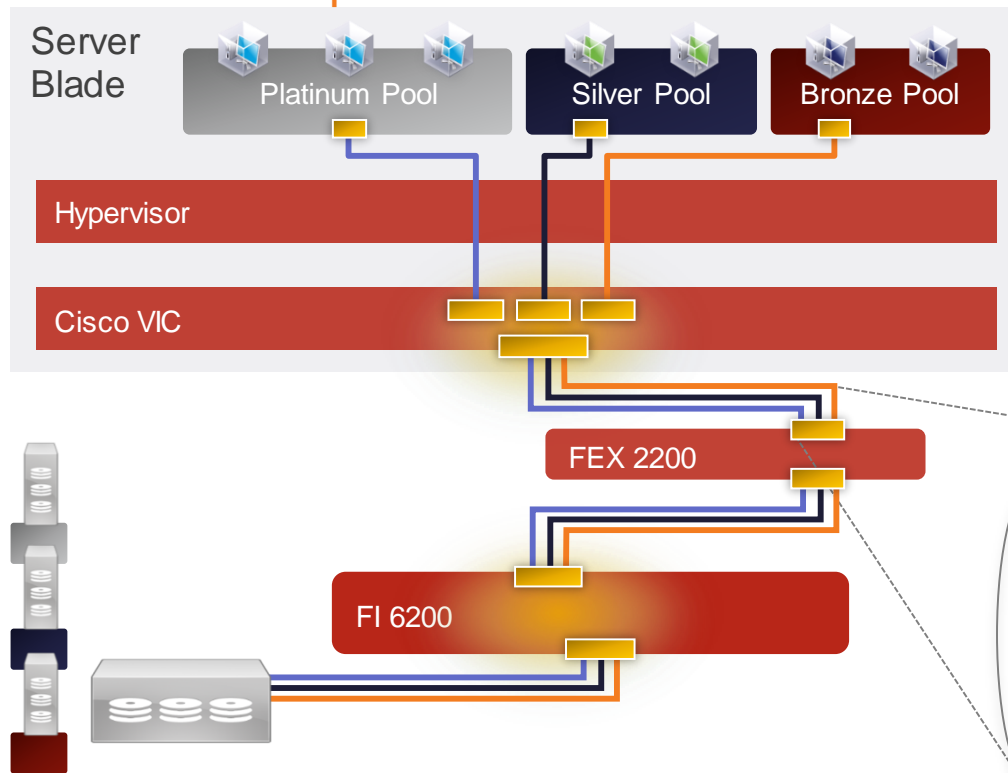
- • QoS controls for tuning Storage and Network flows—Platinum, Gold, Silver, Bronze, best effort, FC QoS Classes
- • Multi-cast optimisations
- • Bandwidth controls
- • Lossless Ethernet—drop/no drop
- • Burst size controls

Platinum Pool — 50% Bandwidth Lossless Ethernet NFS Max burst 64K

Silver Pool — 30% Bandwidth FC with max burst 32k

Bronze Pool — 20% Bandwidth FC with max burst of 16K

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VDI Flow Prioritisation and QoS Pools

Network Throughput without QoS

- vMotion
- Low-priority data
- Medium-priority data
- High-priority data

Network Throughput with QoS

- vMotion
- Low-priority data
- Medium-priority data
- High-priority data
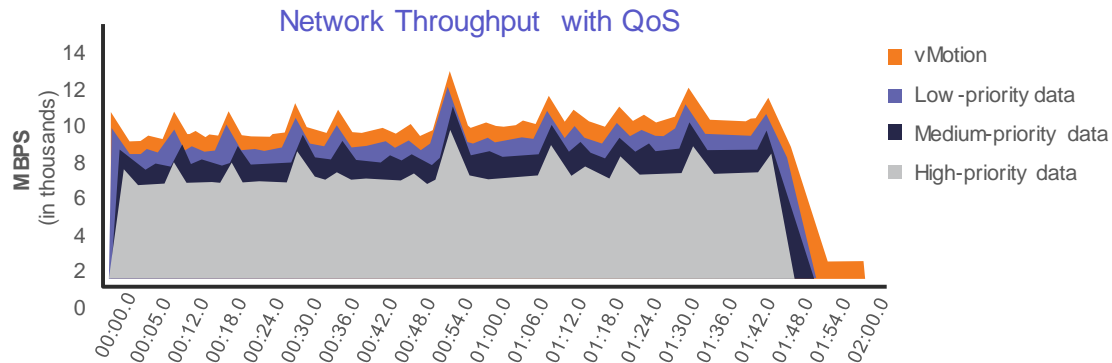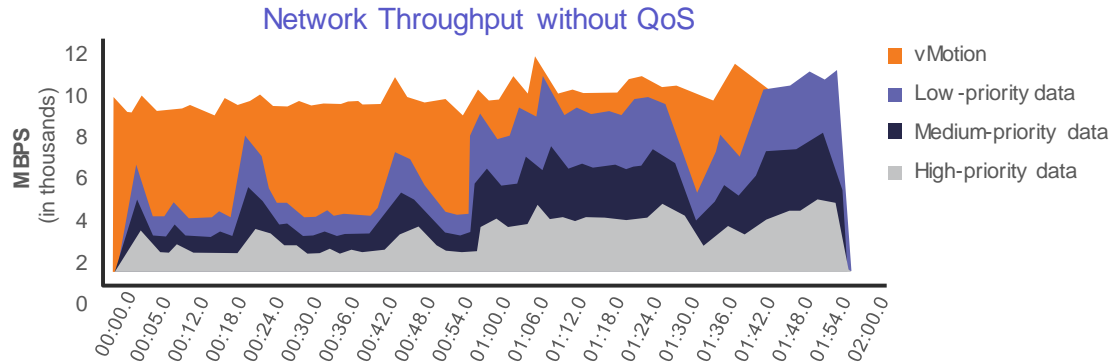
- User experience and SLA association to the virtual desktop

- Prioritisation among multiple virtual desktop pools

- Consistent virtual desktop behaviour with vMotion, backup and other data centre actions

- Burst controls, and other traffic shaping controls

- Separation of cluster management traffic from desktop traffic

- Up to 80 Gb/s bandwidth per server to prevent HOL blocking

Data Centre - Network

Securing VDI with Cisco Virtual Security Gateway (VSG)

- Persistent virtual workspace for the doctor

- Flexible workspace for Doctor's assistant

- Maintain compliance while supporting IT consumerisation

- Security Enforcement
  - ACLs with logging
  - Port Profile Port Security
  - DHCP Snooping
  - Dynamic Arp inspection
  - IP Source Guard
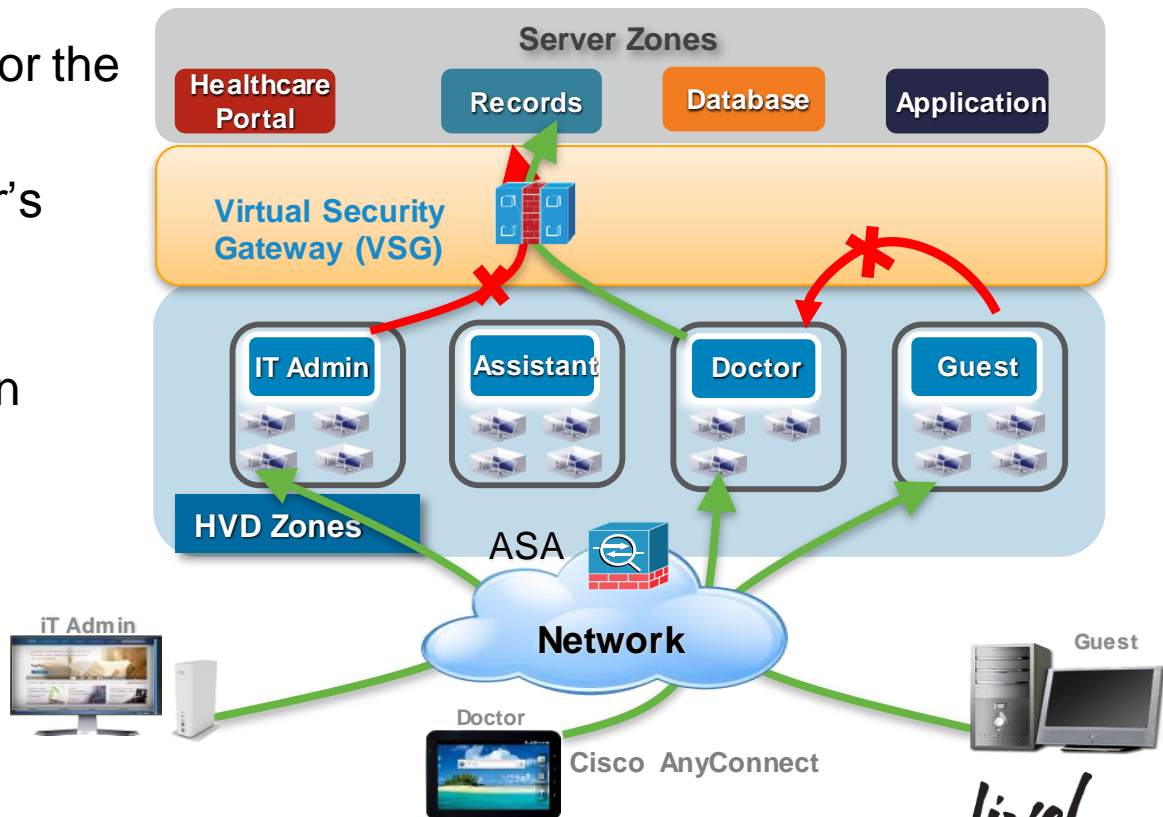
Data Centre

Anti-Virus

- Virus scan is an essential component of the Virtual Workspace

- Traditional AV software impacts HVD densities and hence the TCO

- Storage IOPS requirements and Login/Boot/AV Storms should be considered in the design apart from HVD density impact

18% impact on HVD Density
XenDesktop 5/ ESXi 4.1 , Win 7
32b/1.5G/20G

Workload Profile	AV Scan Policy	HVD Density
Knowledge Worker (KW) only	N/A	110/110
KW with MoveAV 1.5	Default	90/90

Data Centre – Storage
Sample Bandwidth Planning

- Storage (in and outbound)
  - 20 IOPS per desktop at 4K Bytes EA
  - 671 Kbps EA (assume 1 Mbps)
  - 1 Gbps for 1000 HVDs in UCS blade chassis
  - Assume 1 Mbps per HVD

- Network Display (mostly outbound)
  - Assume 1 Mbps per desktop
  - 1 Gbps for 1000 HVDs in UCS blade chassis

- Desktop Protocols (mostly inbound)
  - Estimate 8 Mbps which opens 25MB in 25 seconds and handles streaming and interactive video
  - 8 Gbps for 1000 HVDs in UCS blade chassis

- Total
  - 10 Mbps per HVD for storage, display, and desktop protocols
  - 10 Gbps for 1000 HVDs in UCS blade chassis
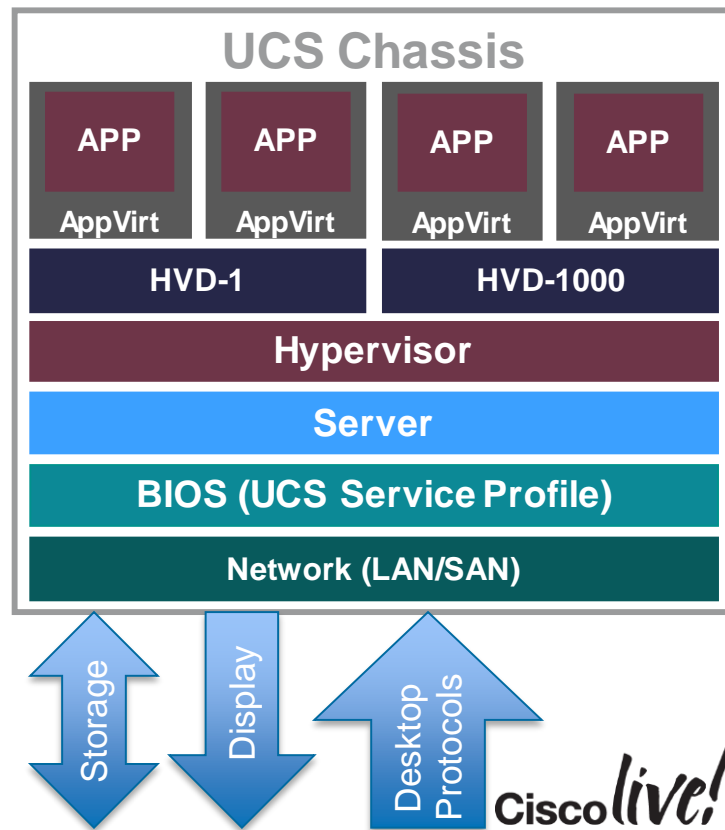
UCS Chassis

| APP | APP | APP | APP |
| AppVirt | AppVirt | AppVirt | AppVirt |

HVD-1   HVD-1000

Hypervisor

Server

BIOS (UCS Service Profile)

Network (LAN/SAN)

Storage   Display   Desktop Protocols

Newest Concepts

Cisco Innovation

Continuous product development and improvement for VDI

- UCS Mini:http://www.cisco.com/c/en/us/products/servers-unified-computing/ucs-mini/index.html

- UCS – E:http://www.cisco.com/c/en/us/products/servers-unified-computing/ucs-e-series-servers/index.html

- UCS Invicta Scaling System:http://www.cisco.com/c/en/us/support/servers-unified-computing/ucs-invicta-series/tsd-products-support-series-home.html

ACI and VDI

The benefits of running VDI on Application Centric Infrastructure

- Implicit whitelist access/zoning

- Fabric topology scaling

- Very low latency fabric

- Abstract Object Unification

- L4-L7 Services integration

- UCS Director integration

- Multi-hypervisor

- One touch point for DC network

- Application visibility
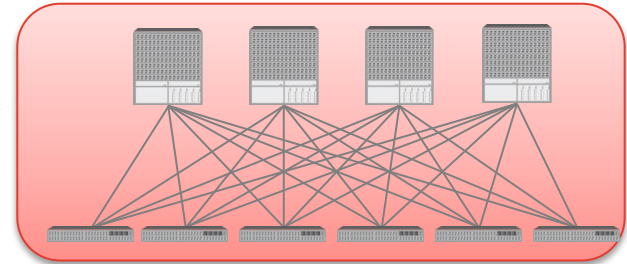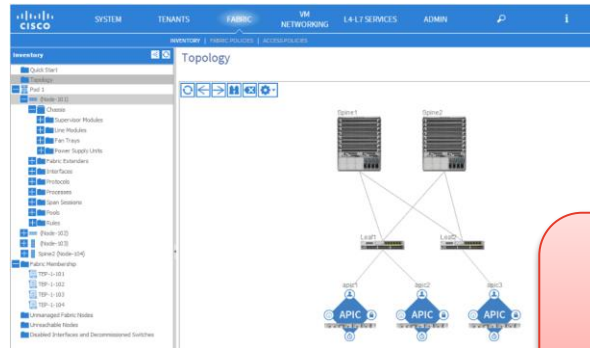
SimpliVity's Core Innovations
with Cisco UCS C-Series Systems

Hyperconvergence

vs
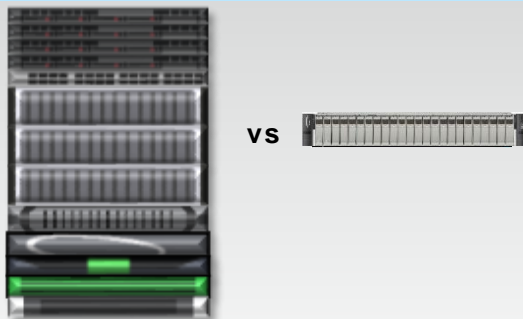
- ✓ Single Shared Resource Pool
- ✓ Integrated Data Protection
- ✓ Reduced Energy Footprint
- ✓ Speed of Deployment
- ✓ Simple Ordering (one SKU!)
- ✓ 300% TCO Savings

simplifyinfrastructure.

Data Virtualisation Platform

OmniCube Accelerator™
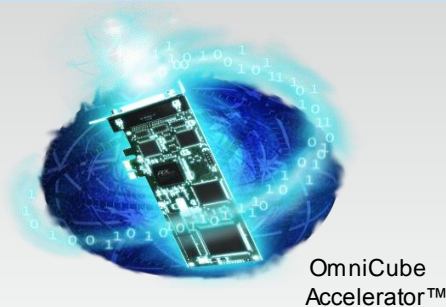
- ✓ Dedupe, Compress, Optimise
- ✓ At Ingest, Inline, In Real-Time
- ✓ Granular: 4-8KB
- ✓ Once and Forever: Primary, Backup, Archive, WAN, Cloud
- ✓ Across All Tiers: DRAM, Flash, HDD

simplifydata.

Global Federated Management
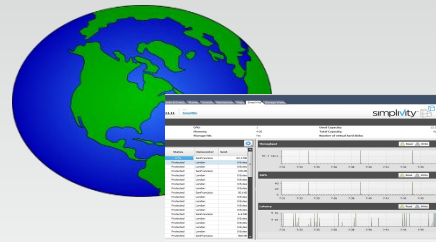
- ✓ VM-Centricity & Mobility: all policies, commands and info on per VM basis
- ✓ All policy abstract from underlying infrastructure
- ✓ One Screen: VMware vCenter
- ✓ Global Scale-Out and Scale-In

simplifyoperations.

VMware

Acquisition of CloudVolumes now AppVolumes with Horizon
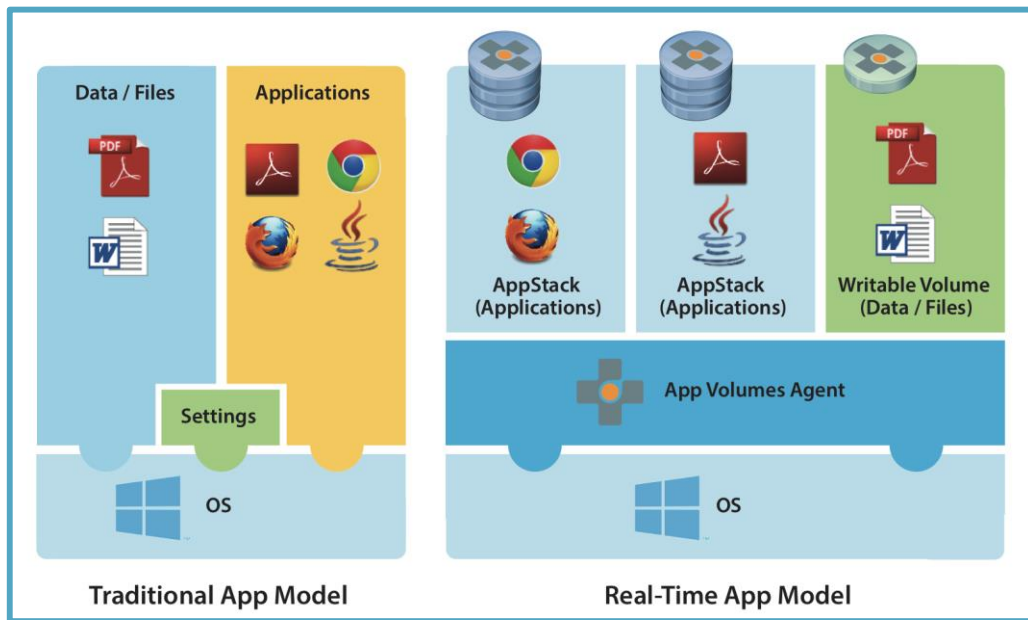
Now imagine this stack:

- VMware Horizon
- VMware AppVolumes
- VDI Windows 7+
- VMware ESX Hypervisor
- Cisco UCS C, B or Mini
- Simplivity OmniStack
- Cisco UCS Invicta

REFERENCE:

http://www.vmware.com/files/pdf/techpaper/vmware-horizon-view-app-volumes-deployment-guide.pdf

VMware Virtual SAN

Hypervisor-Converged storage platform
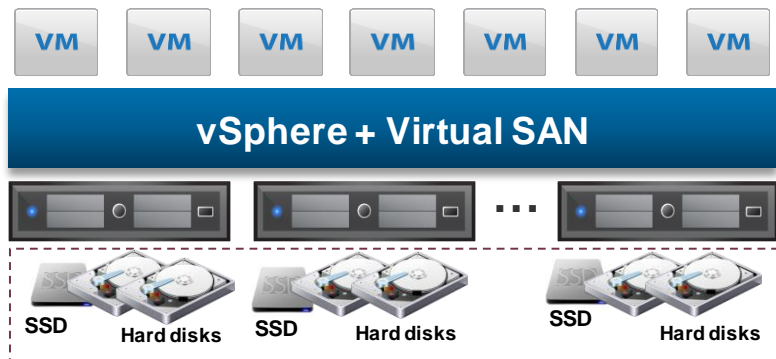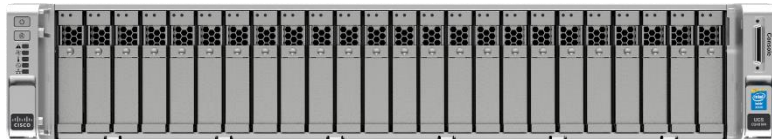
- Software-defined storage software solution
- Aggregates locally attached storage from each ESXi host in a cluster.
- Flash optimised storage solution.
- VM-Centric data operations and policy driven management principals.
- Resilient design based on a Distributed RAID architecture
  - No single point of failure
- Fully integrated with vSphere
- Scale up and Scale out architecture – granular and linearly storage, performance and compute scaling capabilities
  - Per magnetic disks – for capacity
  - Per flash based device – for performance
  - Per disk group – for performance and capacity
  - Per node – for compute capacity

Virtual SAN Datastore

- Virtual SAN is an object store solution that is presented to vSphere as a file system.

- The object store mounts the VMFS volumes from all hosts in a cluster and presents them as a single shared datastore.
  - Only members of the cluster can access the Virtual SAN datastore
  - Not all hosts need to contribute storage, but its recommended.

- Virtual SAN uses the concept of disk groups to pool together flash devices and magnetic disks as single management constructs.

- Disk groups are composed of at least 1 flash device and 1 magnetic disk.
  - Flash devices are use for performance (Read cache + Write buffer).
  - Magnetic disks are used for storage capacity.
  - Disk groups cannot be created without a flash device.
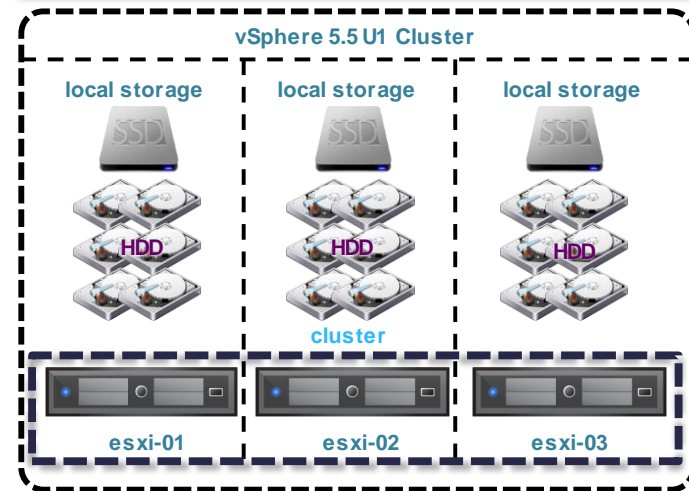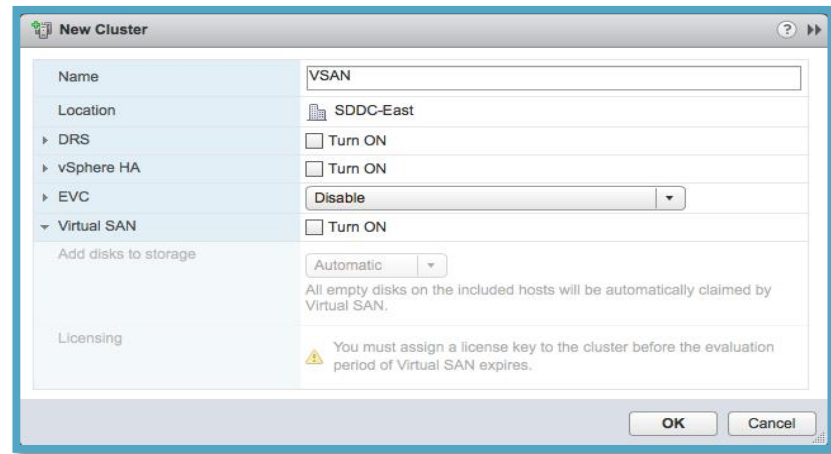
Strategy

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Strategy

Approach

- Centralised when you can
  - Communications – Email
  - Productivity – Office, Wiki
  - Information Management – File, Sharepoint, iDisk, etc.
  - Business applications – Client/Server
  - Business intranet web

- Local when you must
  - Communications
    - IP Telephony (interactive softphone)
    - Video on demand (native encoding with local caching and prepositioning)
    - Video streaming (broadcast)
  - Rich media web
    - Experience
    - Branch split VPN with local web access
  - Print

Strategy

Considerations

- Business
  - Identify worker types (i.e. Task, Knowledge, Power, etc.)
  - Pursue when it makes business sense
  - Address security and compliance requirements
  - Consider the workspace (not just a desktop)
  - Consider the employ onboarding and off-boarding workflow

- Design
  - Fault domains
  - Disaster recovery
  - Shared storage scalability
  - Application concurrency
  - Per application requirements (Containerisation?)
  - Rich media or graphic intensive applications have many caveats
  - Stateless desktop is the goals
  - Which layer solves which problem? eg Linked Clones versus De-dupe versus Simplivity?
  - How best to leverage gross building blocks – eg VSAN

Architecture

Large Scale Virtual Desktop Architecture

- **Branch**
  - Thin Clients or display protocol clients
  - WAN Acceleration (1 connection per HVD/HVA)

- **Desktop Data Centre**
  - WAN Acceleration From Thin Client (1 connection per HVD/HVA)
  - Broker
  - Virtual Desktops
  - Limited applications
  - WAN Acceleration to Application (10 connections per HVD)

- **Application Data Centre**
  - WAN Acceleration From HVD
  - Centralised applications

Disp Protocols

App Protocols

Theatre Desktop Centres

Corporate Application Data Centres
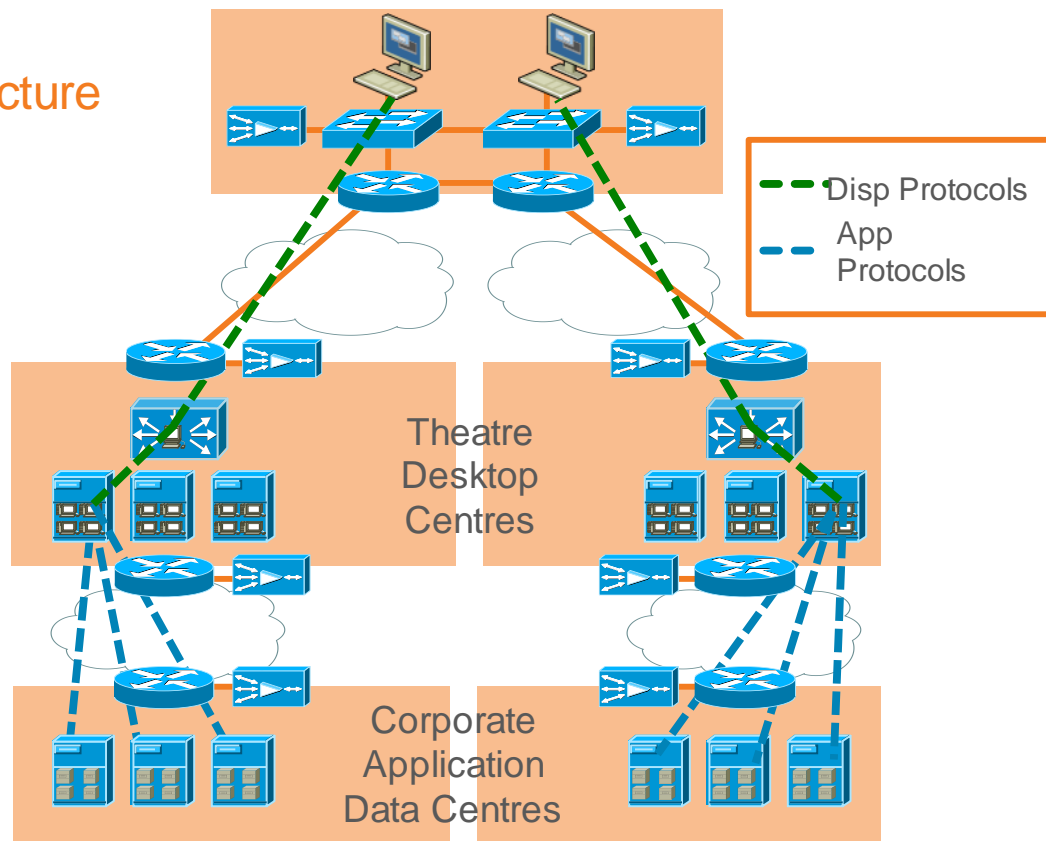
Architecture
Fault Domains

- Client – 1 user

- Branch Switch – Up to 250

- Building or WAN – 2 to 1,000

- SLB – 2,000 to 20,000

- Broker – Up to 1000

- UCS Blade – Up to 332

- UCS Chassis – Up to 1,328

- Storage – 1 to 10,000

Client · LAN · WAE · WAN · WAE · ACE · Broker · UCS · Storage
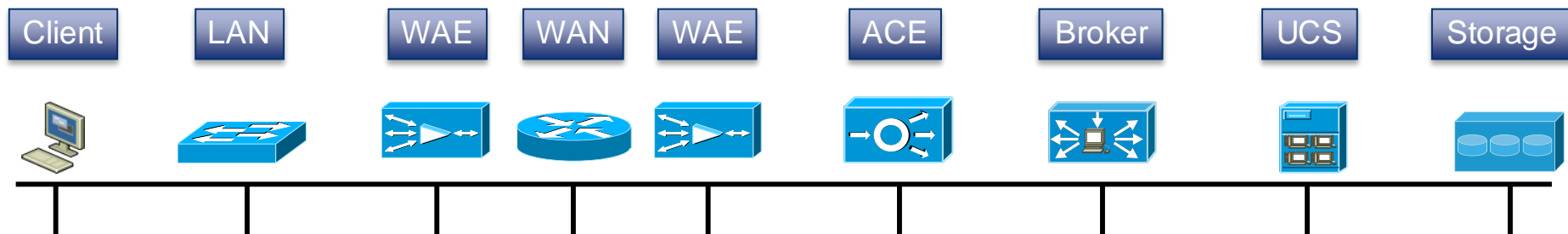
Objectise, Simplify, Automate, Orchestrate

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Plan
Objectise

Physical and Abstract Object Control and Orchestration

- **Unified Management**
  - UCS Director
  - UCS Manager
  - UCS Central
  - Treat Blades an Rack mount the same
  - Profile based management

Build
Simplify

Abstracted Object Definition and Implementation

- **Unified Compute**
  - Converged Network (including FCoE)
  - Wire once
  - Bandwidth scalability
  - Invicta Integration (IOPS)
  - Cache Technologies
  - GPU Capacity

Operate
Orchestrate

Abstracted Object Gating and Connection

- **Unified Fabric**
  - Fabric based Architecture
  - ACI
  - Nexus 1000V
    - Citrix Netscaler
    - ASA
    - VSG
  - DCI Options:
    - Optical
    - MPLS
    - OTV
    - Fabricpath
    - InterCloud
    - Stretch Fabric

Cisco UCS Director

Self-Service Portal for Infrastructure Services
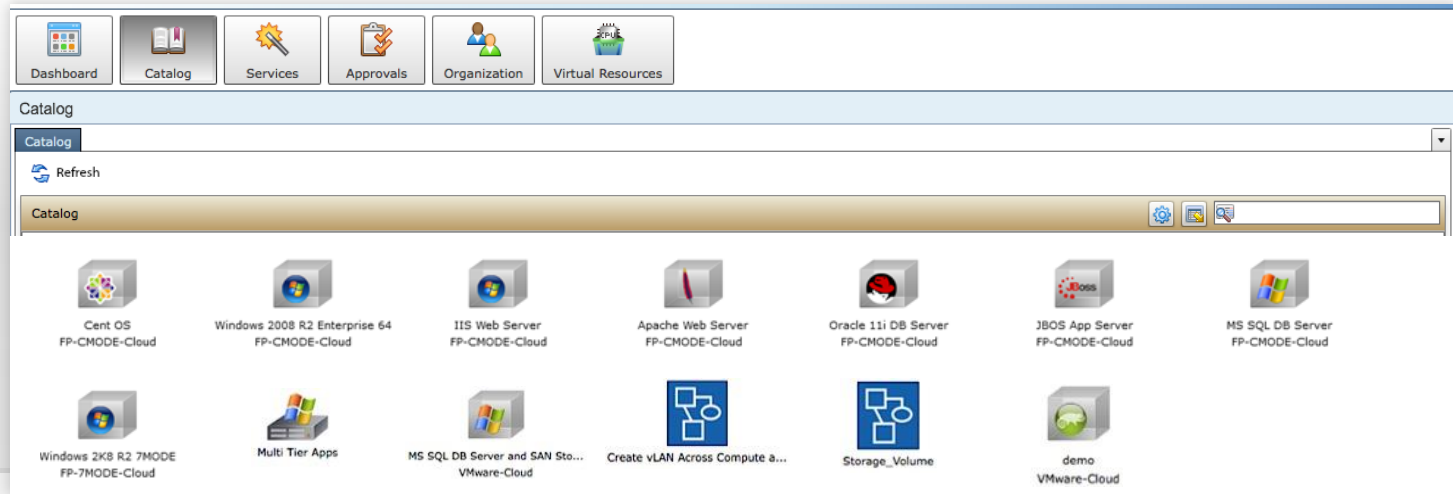
- Self-serve provisioning of IT infrastructure
- Request for Stateless server from Catalog
- Role-based access
- Service delivered in Minutes

Reports

Workflow Service Status

Quick Links

- Desktop Virtualisation with Citrix:http://www.cisco.com/c/en/us/solutions/enterprise/data-center-designs-virtualization/landing_vdi_citrix.html

- Desktop Virtualisation with VMWare:http://www.cisco.com/c/en/us/solutions/enterprise/data-center-designs-virtualization/landing_vdi_view.html

- Cisco and Simplivity:http://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/unified-computing/whitepaper_c11-733376.pdf

- Cisco Desktop as a Service:http://www.cisco.com/c/en/us/solutions/data-center-virtualization/desktop-as-a-service-solution/index.html

- Cisco Office in a Box: VDI:http://www.cisco.com/c/en/us/products/collateral/servers-unified-computing/ucs-e-series-servers/solution_overview_c22-726883.html

- Cisco VSAN Ready Nodes C-Series:http://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/desktop-virtualization-solutions-vmware-horizon-view/whitepaper_C11-732332.pdf

- Cisco UCS Director:http://www.cisco.com/c/en/us/products/servers-unified-computing/ucs-invicta-series-solid-state-system/index.html

Q & A

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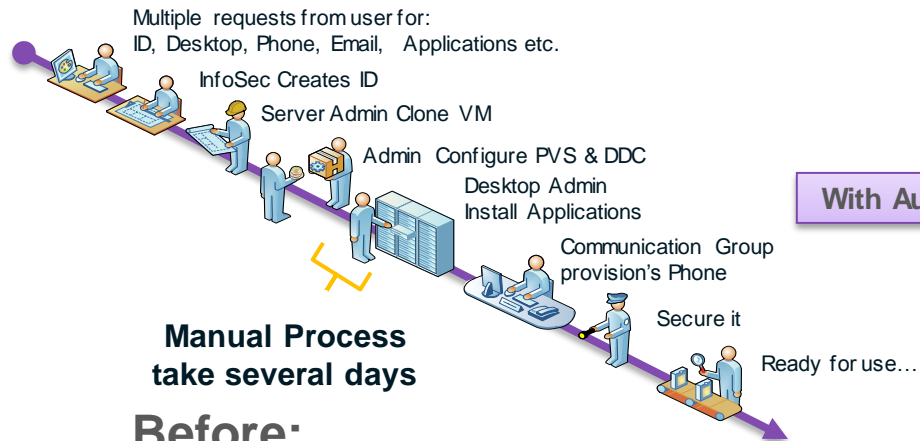
Thank you.

Appendix

# Plan, Build, Operate
Example to suit DevOps model

Multiple requests from user for:
ID, Desktop, Phone, Email, Applications etc.

InfoSec Creates ID

Server Admin Clone VM

Admin Configure PVS & DDC

Desktop Admin
Install Applications

Communication Group
provision's Phone

Secure it

Ready for use…

**Manual Process
take several days**

With Automation

Single request from user, using portal
Approved by Manager

Order goes to Orchestrator

Orchestrator creates User ID

Orchestration Configures
VMWare. Citrix and UCS

Install Applications

Secure it

Ready for use…

**Automated
Self-service
On-demand
within minutes…**

Before:

Conventional VDI

• Manual provisioning
• Hard to control utilisation
• High provisioning & ops cost
• Extended provisioning time
• Configuration risk

After:
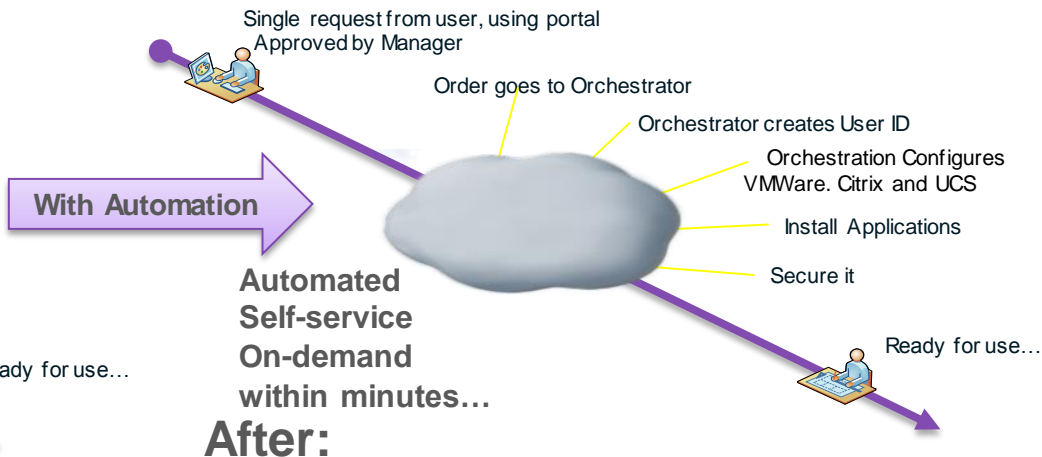
Automated VDI Solution

• Self-service; automated provisioning
• Elasticity (capacity-on-demand)
• Optimised provisioning & ops cost
• Rapid provisioning
• Increased Resiliency and Availability

 Cisco Public

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Enterprise Networks
Quality of Service in a Cisco VDI Network

Protocol	TCP/UDP Port	DSCP /CoS Value
Desktop Virtualisation Protocols		
RDP7	TCP 3389	DSCP af21/CoS 2
PCoIP*	TCP & UDP 50002 TCP & UDP 4172	DSCP af21/CoS 2 DSCP af21/CoS 2
ICA/HDX		
Session	TCP 1494	DSCP af21/CoS 2
Session Reliability	TCP 2598	DSCP af21/CoS 2
Web Services	TCP 80	DSCP af21/CoS 2
USB Redirection (PCoIP)	TCP 32111	DSCP af11/CoS 1
MMR	TCP 9427	DSCP af31/CoS 4
Other Protocols found within Cisco VDI		
Network-based Printing (CIFS)	TCP 445	DSCP af11/CoS 1
UC Signalling (SCCP)	TCP 2000	DSCP cs3/CoS 3
UC Signalling (SIP)	TCP 5060	DSCP cs3 /CoS 3
UC Signalling (CTI)	TCP 2748	DSCP cs3/CoS 3
UC Media (RTP, sRTP)	UDP 16384 - 32767	DSCP ef/CoS 5

- Display protocols obscure multiple traffic types in a single TCP connection

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Enterprise Networks
Quality of Service in a Cisco VXI Network

Ports Used During Classification for QoS

ip access-list **RDP**
 permit tcp any eq 3389 any
ip access-list **PCoIP-UDP**
 permit udp any eq 50002 any
ip access-list **PCoIP-TCP**
 permit tcp any eq 50002 any
ip access-list **PCoIP-UDP-new**
 permit udp any eq 4172 any
ip access-list **PCoIP-TCP-new**
 permit tcp any eq 4172 any
ip access-list **ICA**
 permit tcp any eq 1494 any
!
ip access-list **View-USB**
 permit tcp any eq 32111 any

ip access-list **MMR**
 permit tcp any eq 9427 any
!
ip access-list **NetworkPrinter**
 permit ip any host 10.1.128.10
 permit ip any host 10.1.2.201
!
ip access-list **CUPCDesktopControl**
 permit tcp any host 10.0.128.125 eq 2748
 permit tcp any host 10.0.128.123 eq 2748

Cisco's Nexus 1000v deployed with its ability to safeguard against DHCP snooping, dynamic ARP inspection and IP source guard

In testing, the markings were done on the Nexus 1000v whenever possible

Enterprise Networks
Quality of Service in a Cisco VXI Network

- These example provides a guideline for deploying QoS in a Cisco VXI Network

Class-maps

```
class-map type qos match-any  CALL-SIGNALLING
 match access-group name  CUPCDesktopControl

class-map type qos match-any  MMR-STREAMING
 match access-group name MMR

class-map type qos match-any  TRANS-DATA
 match access-group name RDP
 match access-group name PCoIP-UDP
 match access-group name PCoIP-TCP
 match access-group name PCoIP-UDP-new
 match access-group name PCoIP-TCP-new

class-map type qos  match-any  BULK-DATA
 match access-group name View-USB
 match access-group name NetworkPrinter
```

Policy-map

```
policy-map type qos pmap-HVDPort
 class CALL-SIGNALLING
   set cos 3
   set dscp cs3
    ! dscp = 24
 class MMR-STREAMING
   set cos 4
   set dscp af31
    ! dscp = 26
 class TRANS-DATA
   set cos 2
   set dscp af21
    ! dscp = 18
 class BULK-DATA
   set cos 1
   set dscp af11
    ! dscp = 10
```

Enterprise Networks
Quality of Service Validation with MMR

- Viewing QoS Policy Statistics

DC-WAN#**show policy-map interface**

GigabitEthernet0/0
Service-policy input: HQ-LAN-EDGE-IN

Class-map: **MMR-STREAMING** (match-any)
3532 packets, 5249960 bytes
30 second offered rate 9000 bps, drop rate 0
Match: dscp af31 (26) af32 (28) af33 (30)
0 packets, 0 bytes
30 second rate 0 bps
Match: **access-group name MMR**
3532 packets, 5249960 bytes
30 second rate 9000 bps
QoS Set
dscp af31
Packets marked 3532

Serial0/0/0:0
Service-policy output: WAN-EDGE

Class-map: **MMR-STREAMING** (match-any)
5456 packets, 8052828 bytes
30 second offered rate 393000 bps, drop
Match: dscp af31 (26) af32 (28) af33 (30)
5456 packets, 8052828 bytes
30 second rate 393000 bps
Match: **access-group name MMR**
0 packets, 0 bytes
30 second rate 0 bps
Queueing
queue limit 64 packets
(queue depth/total drops/no-buffer drops) 0/0/0
(pkts output/bytes output) 5456/8052828
bandwidth 5% (76 kbps)
Exp-weight-constant: 9 (1/512)
Mean queue depth: 25 packets

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Enterprise Networks
Citrix ICA QoS

- Branch Considerations
    - Network QoS implications
    - Display Protocol Adaptiveness
    - HDX enhancements in XD5.6
        - Streaming video handling – client or server fetch, client or server rendering
        - Dynamic Adjustments based on BW Available
    - Multistream-ICA that allows for 4 TCP stream ports and 1 UDP stream - visibility into the desktop protocol allows for appropriate QoS handling

Type of Traffic (multi-stream ICA Priority)	Ports	Suggested QoS (DiffServ Classes) on Network
UDP	16500 -16509	EF
TCP: Realtime (priority very high)	Custom	AF4x
TCP: Interactive (priority high)	2598 (original)	AF4x
TCP: Bulk (priority medium)	Custom	AF21
TCP: background (priority low)	Custom	BE

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