

Citrix XenApp and Best Practices for ArcGIS

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April 11, 2011



Desktop Key Deployment Considerations

- Before a desktop deployment option can be considered, several factors must be considered.
 - *Desktop processing requirements*
 - *User type and application pattern*
 - *User location relative to the data*
 - *Available network bandwidth*
 - *IT standards / constraints*



How Compute Intensive is GIS?

- **Processing Intensive (CPU)**
 - Analysis and geoprocessing
- **Memory Intensive (RAM)**
 - Complex applications and MXDs
- **Network I/O Intensive**
 - Data query and analysis
- **Disk I/O Intensive**
 - Data loading and conversion
- **Graphics Intensive (GPU)**
 - Fly-through and 3D

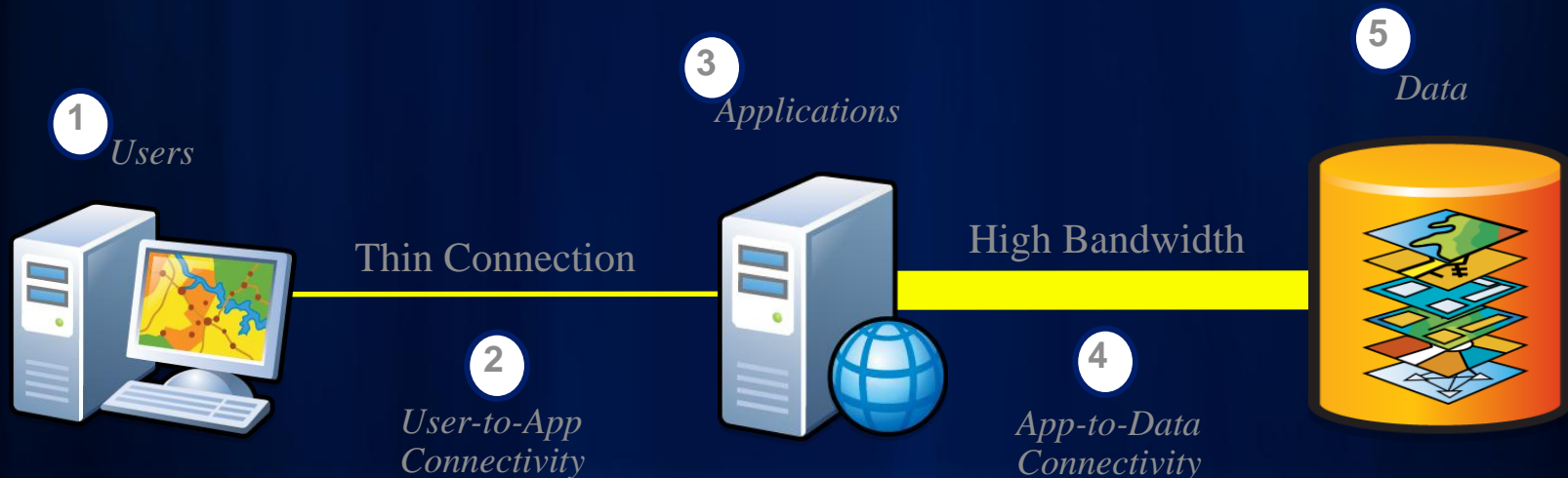


Three Elements & Two Network Types

- Where do each reside (Data Center, Regions, etc) and what is the network connectivity like between these three?
 - LAN vs. WAN
 - Network Bandwidth and Latency
 - Frequency of Outages or Drops

Three Major Elements:

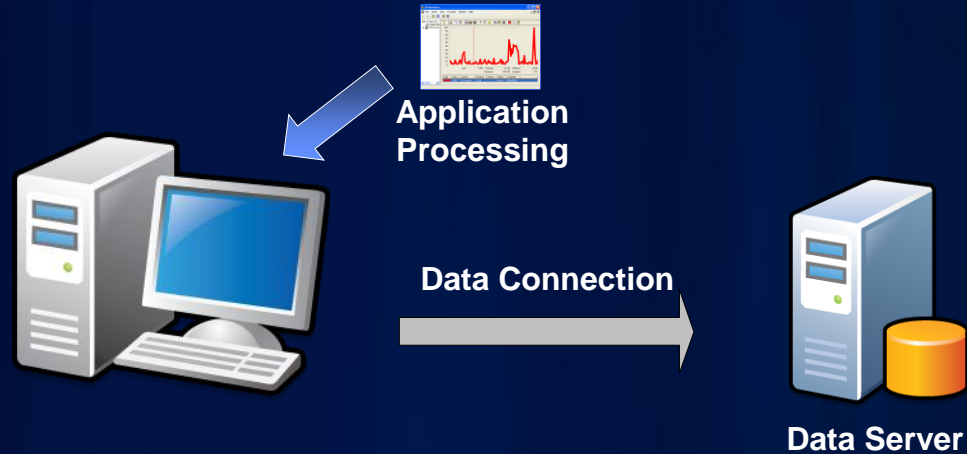
1. Users Locations
2. Applications Types
3. Data Types & Locations



Two Traditional Desktop Deployment Options

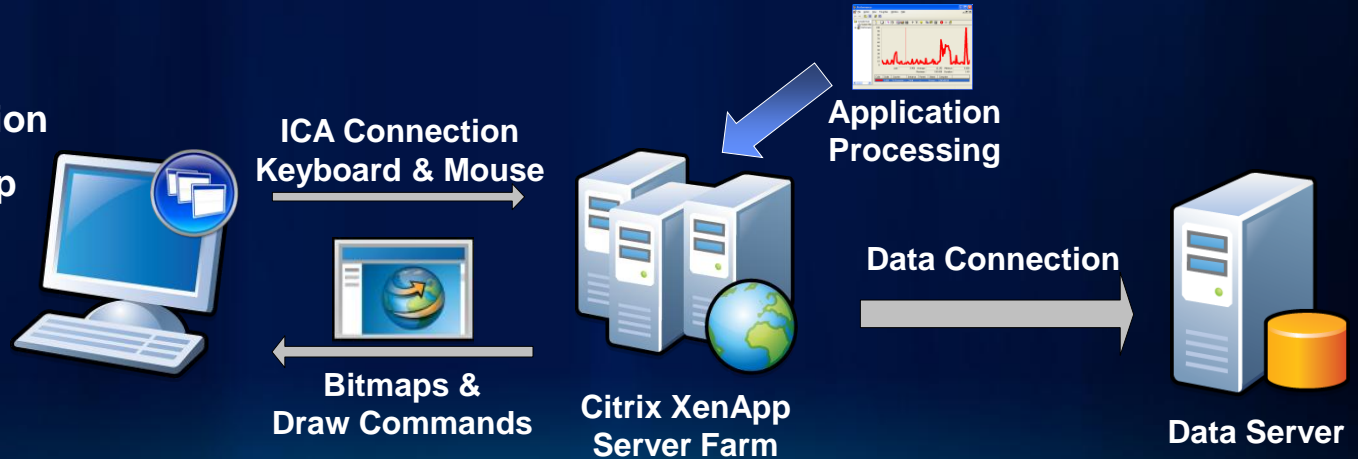
Thick-Client

Classic client/server



Thin-Client

Session Virtualization
via Remote Desktop
Services / Citrix
XenApp



What is XenApp?

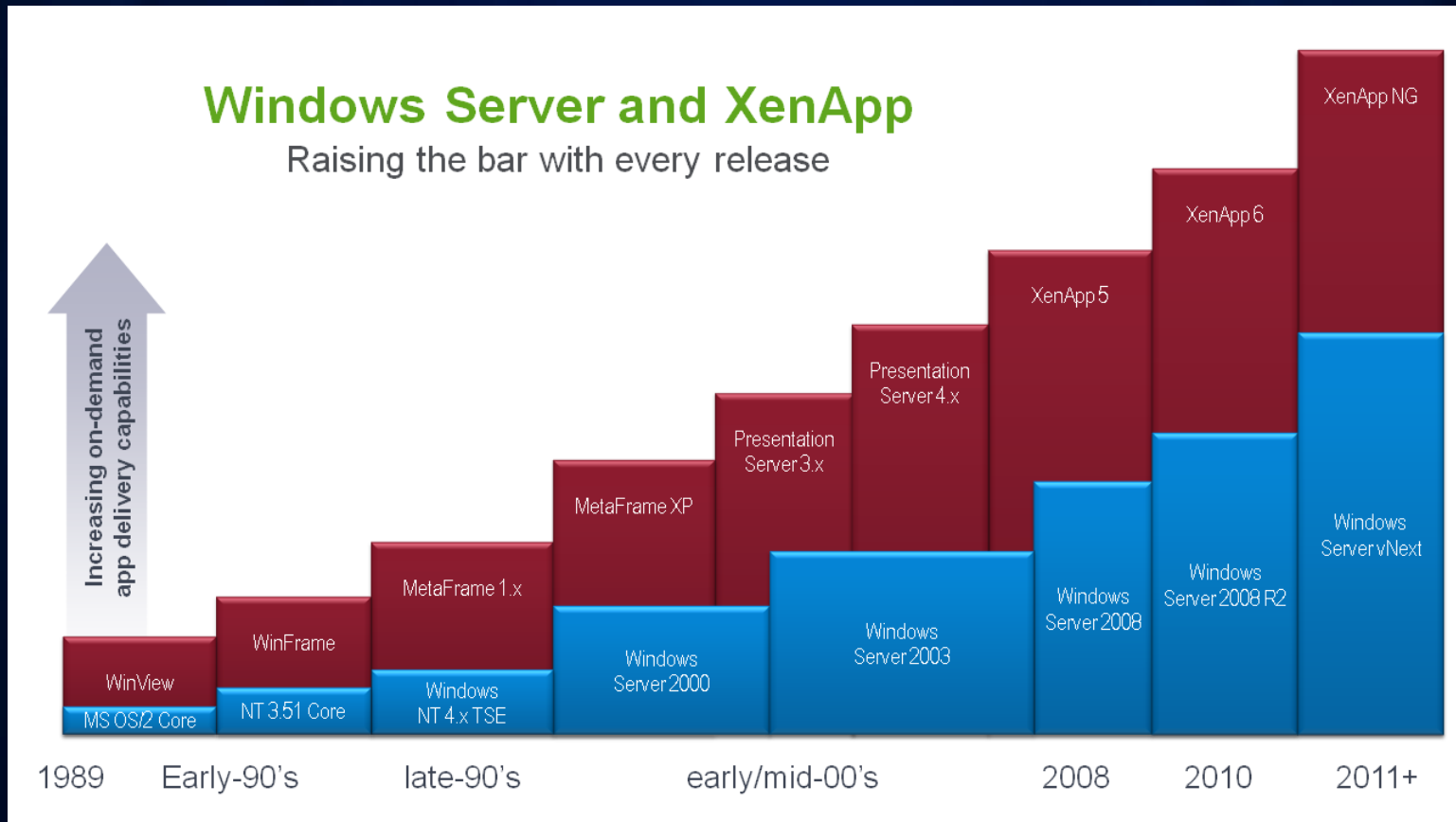
- “Citrix XenApp is the on-demand application delivery solution that enables any Windows application to be virtualized, centralized and managed in the datacenter and instantly delivered as a service to users anywhere on any device.”
- XenApp provides three primary benefits
 - Reduces Application Management Costs
 - Ensures Secure Access
 - Improves Performance
- It provides two methods for delivering application to users
 - Session Virtualization (i.e., thin-client computing)
 - Application Virtualization (i.e., streamed to client computing)

Video – 2.5 min.: How XenApp Works:
<http://www.citrix.com/tv/#videos/632>

Citrix & Esri History

- Esri has been working with Citrix and Esri customers deploying Citrix since at least 1998.
- Esri has a large deployment base for ArcGIS Desktop on Citrix.
- Original performance testing with Data General in 1998 established thin-client capacity metrics. Various joint testing projects over the years including:
 - Scalability testing with 8-core systems
 - NetScaler performance testing
 - WanScaler (now called Branch Repeater) performance testing
 - Graphics enhancement performance testing (which led to SpeedScreen Progressive Display)
 - EdgeSight for Load Testing
- <http://techdemos.Esri.com> technology demo site.

Citrix XenApp Release History



XenApp was previously WinFrame, MetaFrame, and Presentation Server

XenApp 6.0 was released in March 2010 (<http://www.citrix.com/tv/#videos/1852>)

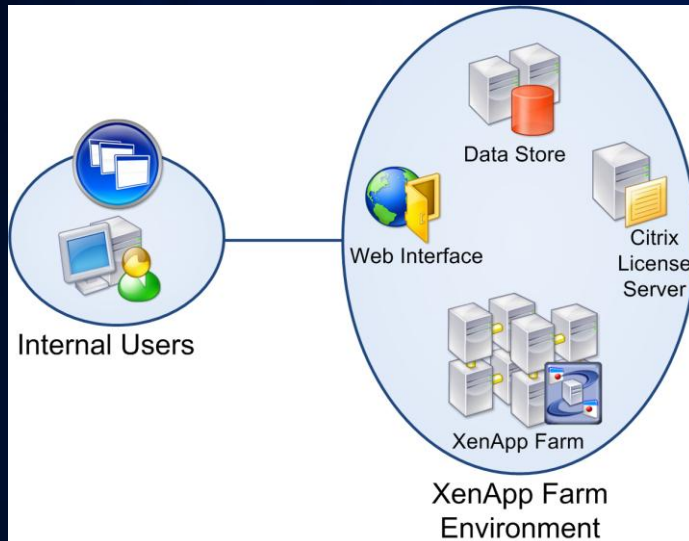
Top 10 Benefits of a GIS Citrix Farm

- 1. Supports any device anywhere deployment**
 - **Deploy XenApp based applications on a variety of devices and client operating systems**
- 2. Provides Self-Service Applications**
 - **Access applications from portal interfaces based on user credentials**
- 3. Consumes less traffic and provides greater stability across WAN connections (i.e., latency tolerant)**
 - **Enables remote GIS users to access GIS desktop across slower / latent WAN connections**
- 4. Leverages the power of enterprise class servers**
 - **Fast cores, large memory, 64-bit, Gbit connectivity, cache disk controllers, etc.**
- 5. Extends the useful life of user workstations**
 - **No need for costly high-end workstations upgrades for each GIS user**

Top 10 Benefits of a GIS Citrix Farm

6. **Easy to scale over time**
 - **Add additional servers to the farm as user demand grows**
7. **Results in decreased system administration**
 - **Centralized management / configuration of Client GIS software / Upgrades & Patches**
8. **Provides easier detection and resolution of software bugs and performance issues**
 - **Multiple user environment can be monitored more frequently**
9. **Faster turn-a-round for development & QA integration testing**
 - **GIS users can access multiple environments concurrently from their local workstation**
10. **Is secure by design**
 - **User sessions and data are kept in data center**

Citrix XenApp Essential Components



- XenApp Servers
- Data Store
- Data Collector
- License Server
- Web Interface



Data Store (DS)

- Core farm configuration & settings
- Published apps
- Load evaluators
- Citrix administrators
- Server groups



Data Collector (DC)

- Connected sessions
- Disconnected sessions
- Load balancing



License Server

- License file
- Licenses in use
- Licenses available

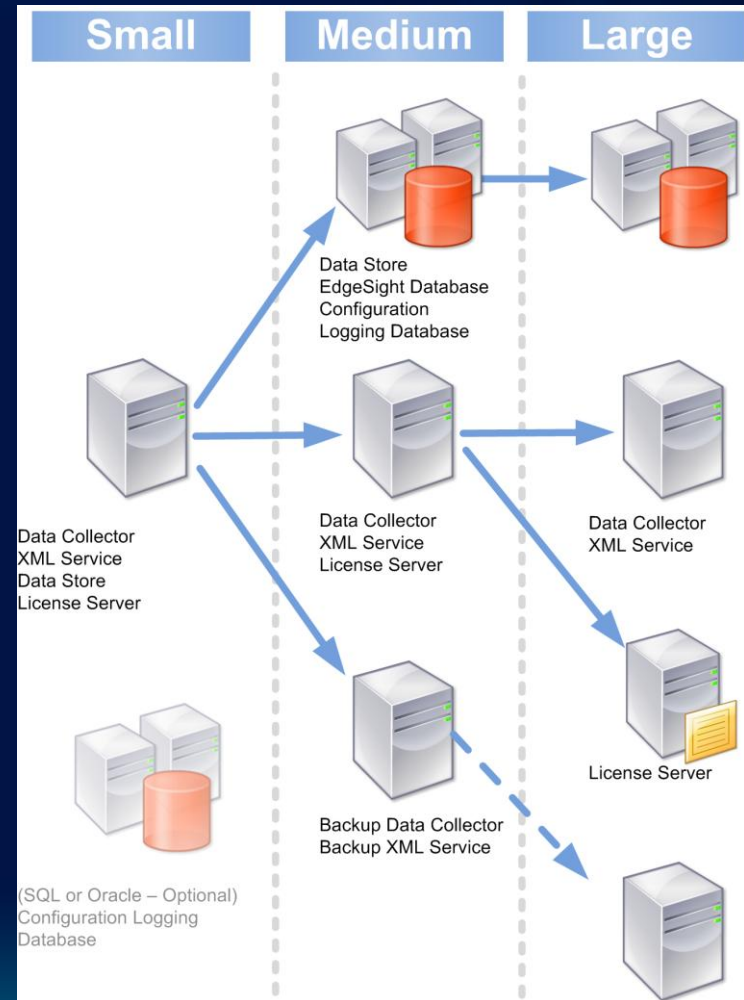


Web Interface

- Portal for Citrix Apps
- Web Plug-In Client
- Customizable

XenApp Farm Design

- XenApp components can be installed all on one server or multiple servers depending upon the size of the farm
- Video – 18 min: Understanding and Designing Presentation Server Farms
<http://www.citrix.com/tv/#videos/1364>
- Video – 28 min: Fundamentals of the Presentation Server Architecture:
<http://www.citrix.com/tv/#videos/1369>



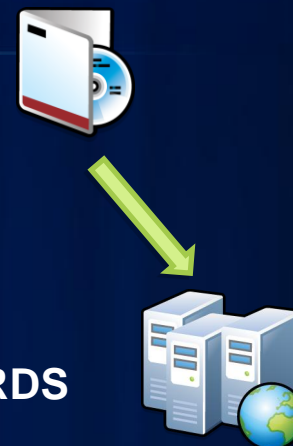
Citrix XenApp Support



- **Which XenApp Version is “Supported” by Esri?**
 - All versions are known to “work”
 - XenApp 4.5 or higher is recommended primarily due to HDX 3D technology (discussed later)
 - **ArcGIS Desktop 10 is supported on XenApp 4.5 and 5.0**
 - ArcGlobe 10 is not supported
 - **ArcGIS Explorer 1700 is supported**
- **Which Citrix Client Version is “Supported”?**
 - Recommendation is to use latest supported client from Citrix

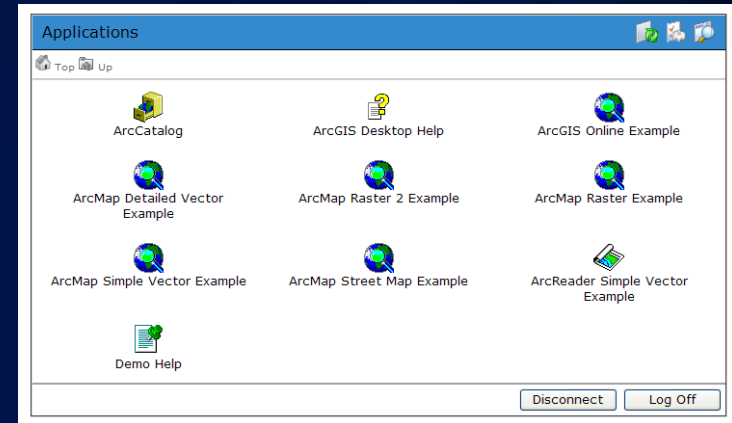
ArcGIS Desktop Installation on Citrix

- **Installation process is identical as a local workstation**
- **Follow best practices for application installation in a RDS environment (i.e., use “install mode”)**
 - Install applications on Terminal Server via Add/Remove Programs with Windows 2003
 - Install applications on Terminal Server via Control Panel with Windows 2008
- **Install the 32-bit DBMS client on the XenApp servers for Direct Connect support**
 - SQL Server native client needed at 9.3.1 only if using new Spatial Data Types which requires SQL Native Client
 - SQL Server native client is included with 10 install and is required for Direct Connect at 10



Application Publishing and Access

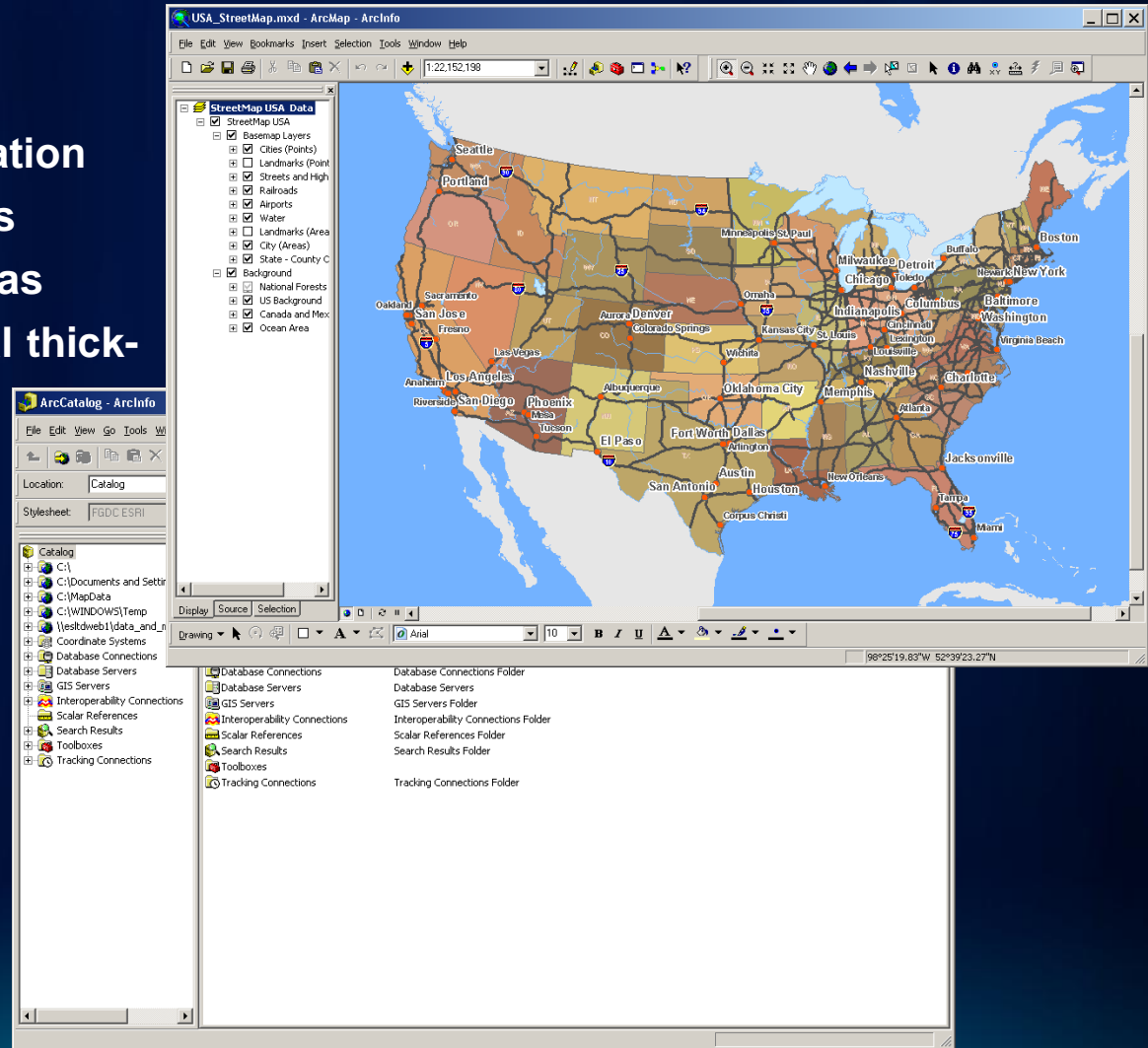
- GIS applications are published like any other application
- Different icons can be published representing ArcMap, ArcCatalog, etc.
- Applications can be accessed using web client via Citrix Web Interface or directly via plug-in client
- Application access is managed by the publishing tools and application icons are only visible to those users that require access



Example: <http://techdemos.Esri.com>

GIS Application “Look and Feel”

- “Seamless” application publishing provides similar experience as compared to typical thick-client access

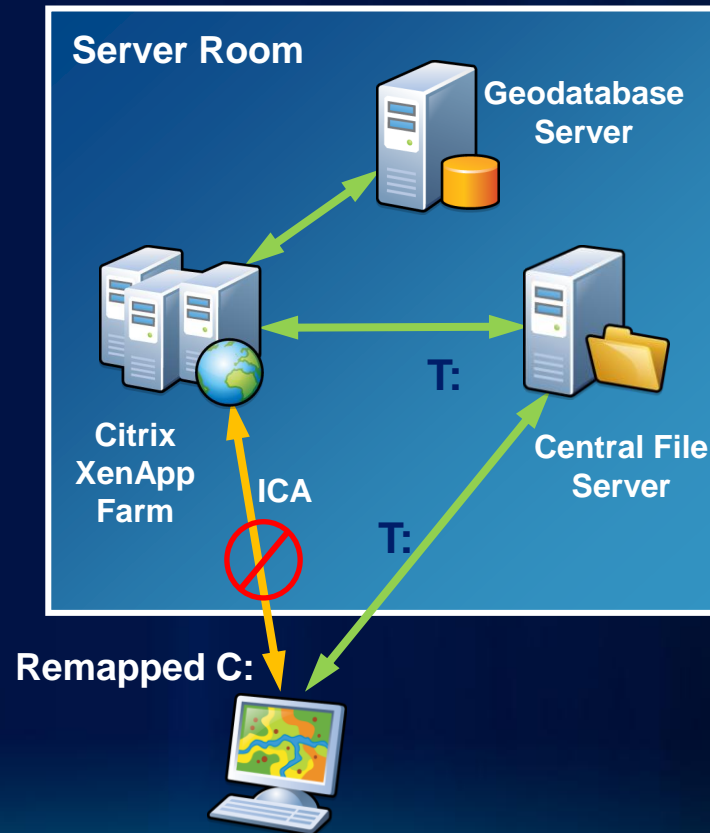


Managing Esri Licenses

- Default Terminal Server behavior is utilize existing session for additional application launches which results in single Esri license checked
- Environment Variables for Supporting Multiple ArcGIS License Sessions on Same Citrix Terminal Server:
 - ArcInfo: ESRI_SOFTWARE_CLASS=Professional
 - ArcEditor: ESRI_SOFTWARE_CLASS=Editor
 - ArcView: ESRI_SOFTWARE_CLASS=Viewer
 - **Note:** The environment variables are case sensitive
- Example Two-Line Batch File for Launching Specific ArcMap Published Applications (.MXD) with a Viewer License
 - Set ESRI_SOFTWARE_CLASS=Viewer
 - ArcMap.exe <local_machine>:\ <PublishedApp.mxd>

Managing Central File Server Access

- Minimize use of “remapped” client drives
- Utilize central file server for project files, data, profiles, etc. (critical for WAN)
- Optional similar mapping directly from client (LAN environments only)

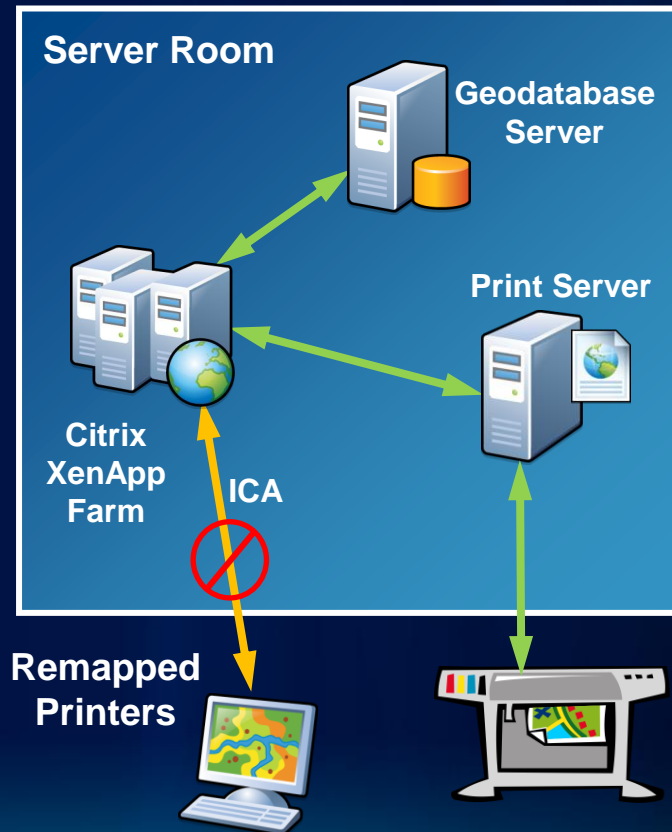


Managing Central Profiles

- Utilize roaming profiles vs. local server profiles to ensure same experience regardless of which server a users lands on
- Hybrid approach (copy in/out portions of profile that are updated including normal.mxt, etc.) and use folder redirection
- Separate profiles are required to be maintained when mixed ArcGIS Desktop releases are supported by same profile (normal.mxt differences, etc.)
- Investigate use of Citrix Profile Management
- Profile options: <http://support.citrix.com/article/ctx120285>

Printing with Citrix XenApp

- The nature of a thin-client solution creates a “printing problem” since printers are not in the data center
- Minimize use of “remapped” client printers
- Use server-side printers and use a print server to offload print processing from XenApp servers



ArcGIS Printing with XenApp

- **Test all print drivers and carefully control drivers on Citrix application servers.**
- **Use Universal Print Driver (UPD) for normal (non-plotter) printers or those where native print driver does not work.**
 - UPDs have limited capabilities
- **Consider optimized workflows or third-party printing solutions to help with printer administration and bandwidth management**
 - Export to PDF then download to client for local printing
 - ThinPrint
 - UniPrint
 - Screwdrivers
 - More....

HDX Technologies

Delivering a high definition user experience



HDX Broadcast

HDX MediaStream

HDX RealTime

HDX Rich Graphics

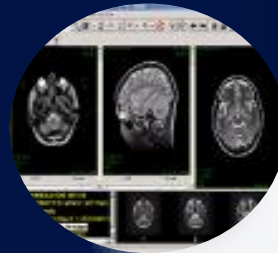
HDX Plug-n-Play

HDX SmartAccess

HDX WAN Optimization

HDX 3D Progressive Display

- **Up to 15X faster performance for 2D and lightweight 3D graphics**
 - Medical Picture Archiving & Communication Systems (PACS)
 - Geographic Information Systems (GIS)
 - Business Intelligence (BI)
 - 2D image editing
- **Reduces cost of delivering graphics-intensive apps**
 - **Lowers bandwidth consumption by up to 93%**
 - Supports any ICA client device



Advanced

Enterprise

Platinum

Introduced in XenApp PS 4.5 and XenDesktop 2

HDX 3D Progressive Display

- **Ensure the HDX Progressive Display policy has been configured and applied to reduce network traffic for raster data displays.**
- **Best performance will be provided by using maximum compression while in process (i.e., while display is in motion) and high compression while at rest.**
 - **Default ICA compression is set to medium without the policy**
 - **Progressive compression is not used without policy in place**
 - **Need to balance quality and performance needs to determine settings for your organization**
- **The heavyweight compression is optional. It will provide additional compression while panning, etc., but at the cost of slightly additional CPU consumption on the client and server.**
- **Video – 5 min: Citrix SpeedScreen demo (ICA vs. RDP)**
 - **[http://www.youtube.com/watch?v= RMTM7vaMnI](http://www.youtube.com/watch?v=RMTM7vaMnI)**

Citrix HDX 3D Recommendations

Recommended configuration

LAN Connections

Low compression
Progressive Display **medium compression**
Extra color compression **Off**
Visually lossless

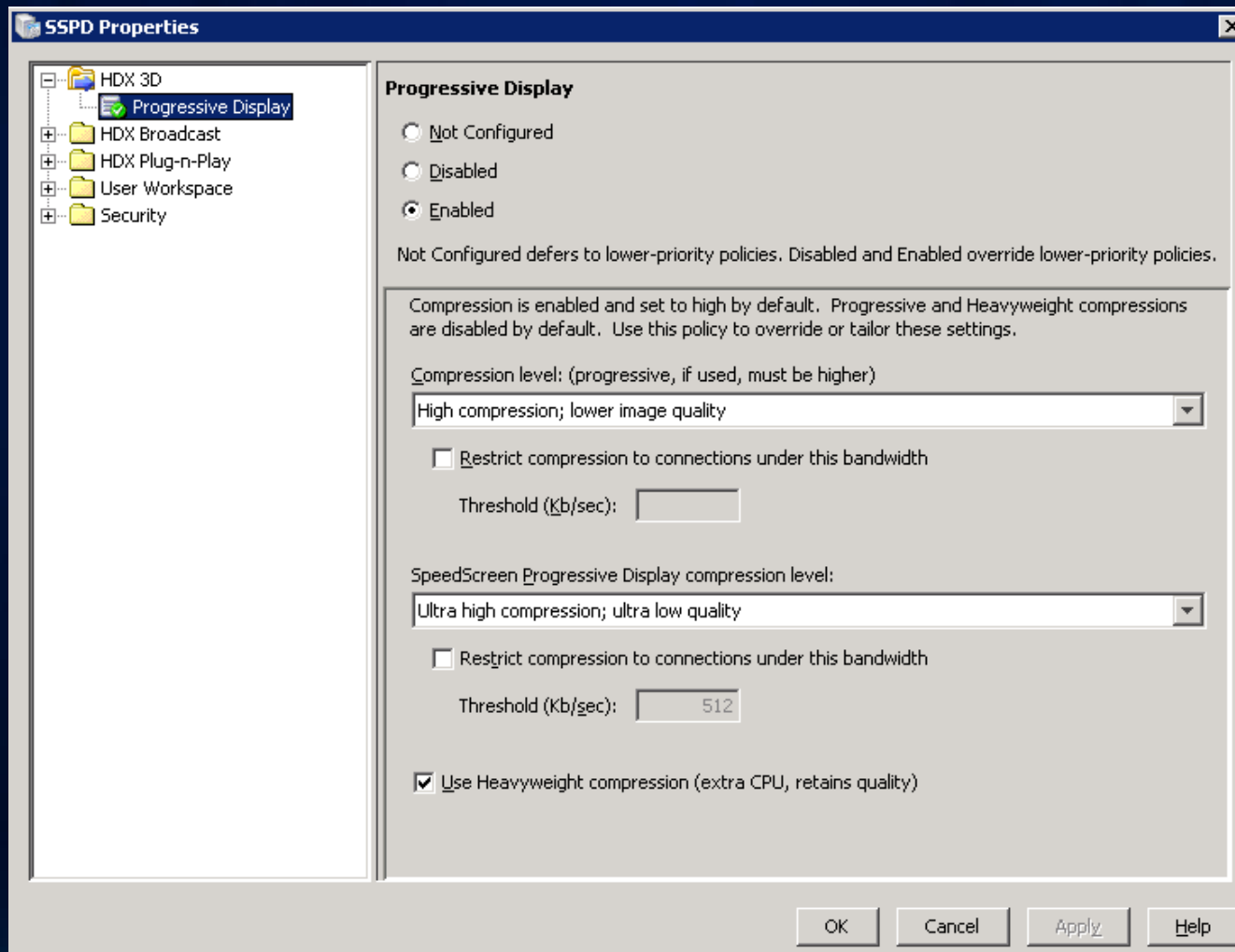
WAN Connections

Medium compression
Progressive Display **high compression**
Extra color compression **On**
Balanced image quality and interactivity



NOTE: Extra color compression applies to XenDesktop

HDX 3D Progressive Display Policy



HDX Progressive Display Demo

**Medium vs. High ICA
Compression**

**HDX Progressive
Display Ultra High
Compression with
Heavyweight
Compression**

- Railroad
- Street
- Elevation Sample
 - Elevation
 - 499.669 - 508.102
 - 491.236 - 499.669
 - 482.803 - 491.236
 - 474.37 - 482.803
 - 465.938 - 474.37
 - 457.505 - 465.938
 - 449.072 - 457.505
 - 440.639 - 449.072
 - 432.206 - 440.639
- Redlands Area Image
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3



**Medium
Compression**

- Railroad
- Street
- Elevation Sample
 - Elevation
 - 499.669 - 508.102
 - 491.236 - 499.669
 - 482.803 - 491.236
 - 474.37 - 482.803
 - 465.938 - 474.37
 - 457.505 - 465.938
 - 449.072 - 457.505
 - 440.639 - 449.072
 - 432.206 - 440.639
- Redlands Area Image
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3



**High
Compression**

HDX Progressive Display ArcMap 10 Demos

- **Pan Test – No Compression**
 - 336 KB downloaded
- **Pan Test – Ultra High Compression / Heavyweight**
 - 261 KB downloaded
- **Start Up Test – No Compression**
 - 2.2 MB downloaded
- **Start Up Test – Ultra High Compression / Heavyweight**
 - 500 KB downloaded

Known ArcMap on Citrix Issues / Fixes

- **Memory Allocation Patch Hot Fix for 9.3 and 9.3 SP1**
 - Available by request from 93_931memory_allocation@Esri.com
 - Fixed in 9.3.1 SP1
- **Printing large images (Fragmented memory issue)**
 - http://webhelp.Esri.com/arcgisdesktop/9.3/index.cfm?id=448&pid=447&topicname=Printing_a_map
- **Default to “default” printer under certain conditions with session remapped printing when loading ArcMap**
- **Help in ArcMap does not launch**
 - Workaround: Publish Help as a separate Citrix application
 - `C:\WINDOWS\SysWOW64\hh.exe "C:\Program Files (x86)\ArcGIS\Help\ArcInfoMain.chm"`
 - Fixed in ArcGIS 10

Known ArcMap on Citrix Issues / Fixes

- **File-based Data Performance / Attribute Table Opening and Feature Selection is Slow**
 - <http://resources.arcgis.com/content/kbase?fa=articleShow&d=34906>
 - Introduced by XenApp 4.5 RP2
 - Fixed in XenApp 4.5 RP3
 - May reappear at XenApp 4.5 RP6
 - Citrix Windows 2003 32-bit PS 4.5 Hotfix: <http://support.citrix.com/article/CTX125004>
 - Citrix Windows 2003 64-bit PS 4.5 Hotfix: <http://support.citrix.com/article/CTX125005>
- **Unable to Hide Server C: Drive from User Sessions**
 - Operating system permissions are used to “lock down” the C: drive from user sessions but the C: drive still appears in ArcCatalog, etc.
 - Known issue for many years (NIM000206 recently created)
 - Fixed in ArcGIS 10
- **A single MXD and normal.mxt file can only be opened approximately 20 times (concurrently)**
 - Primarily impacts load test environments

Troubleshooting and Problem Isolation

- ***Fact vs. Fiction: Most of the time, issues classified as “Citrix issues” turn out to be application or environment related. Very few issues have turned out to be Citrix specific.***
- **Logical Tests to Isolate Source of Problem**
 - **Does the issue occur via Terminal Services?**
 - Isolates if strictly related to XenApp....which is rarely the case
 - **Does the issue occur on a stand-alone workstation?**
 - Helps to isolate if general application issue or in fact specific to server based computing environment
 - **Does the issue occur outside of a seamless window?**
 - Certain display issues, typically with custom applications, have been shown to be sometimes sensitive to seamless window environments
 - **Does the issue occur using an Administrator account?**
 - Often the issue is permissions related and testing with an admin account can help determine if the issue is permissions related

RDS / Citrix Server Capacity Planning

- **The number of users a XenApp server can support depends on several factors, including:**
 - The server hardware technology
 - The applications deployed (CPU and memory requirements)
 - The user application workflows
 - The maximum target resource usage on the server (for example, 80% CPU peak utilization)
- **Recommendations**
 - Leverage modern CPU technology to optimize scalability and performance
 - Use RAID technology for internal drives (typically RAID-1 for OS/Apps)
 - Utilize separate disks for applications and OS with separate disk controllers
 - Use SAS or SCSI drives (i.e., SATA may become a bottleneck)
 - Deploy 64-bit operating systems to avoid 32-bit memory bottlenecks

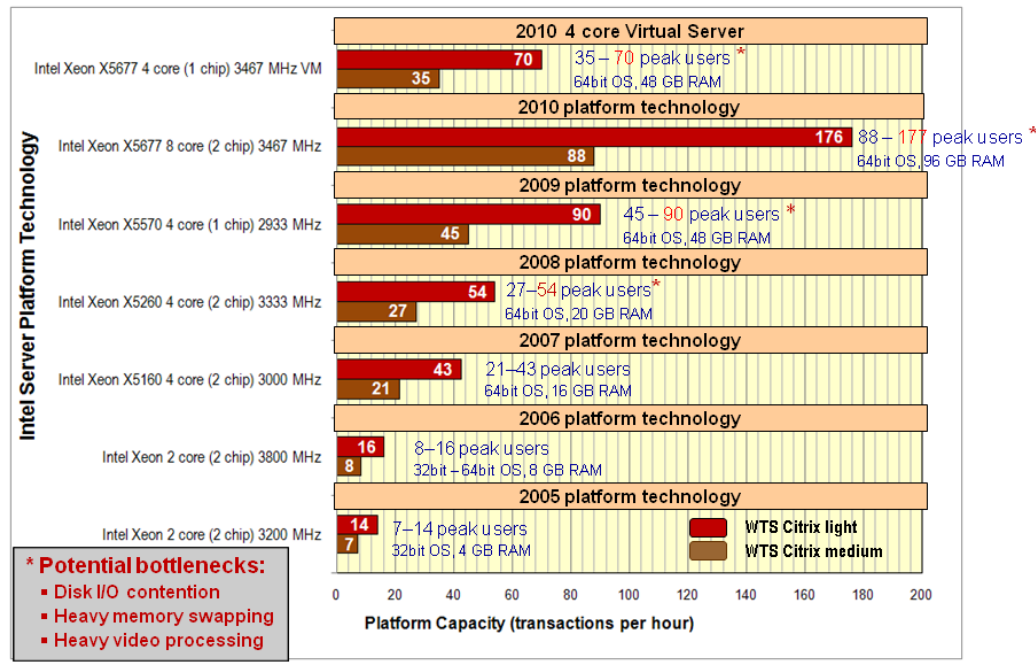
RDS / Citrix Server Capacity Planning

- System Design Strategies Wiki – RDS Platforms

- http://www.wiki.gis.com/wiki/index.php/Platform_Performance#Windows_Terminal_Server_Platform_Sizing

Windows terminal server

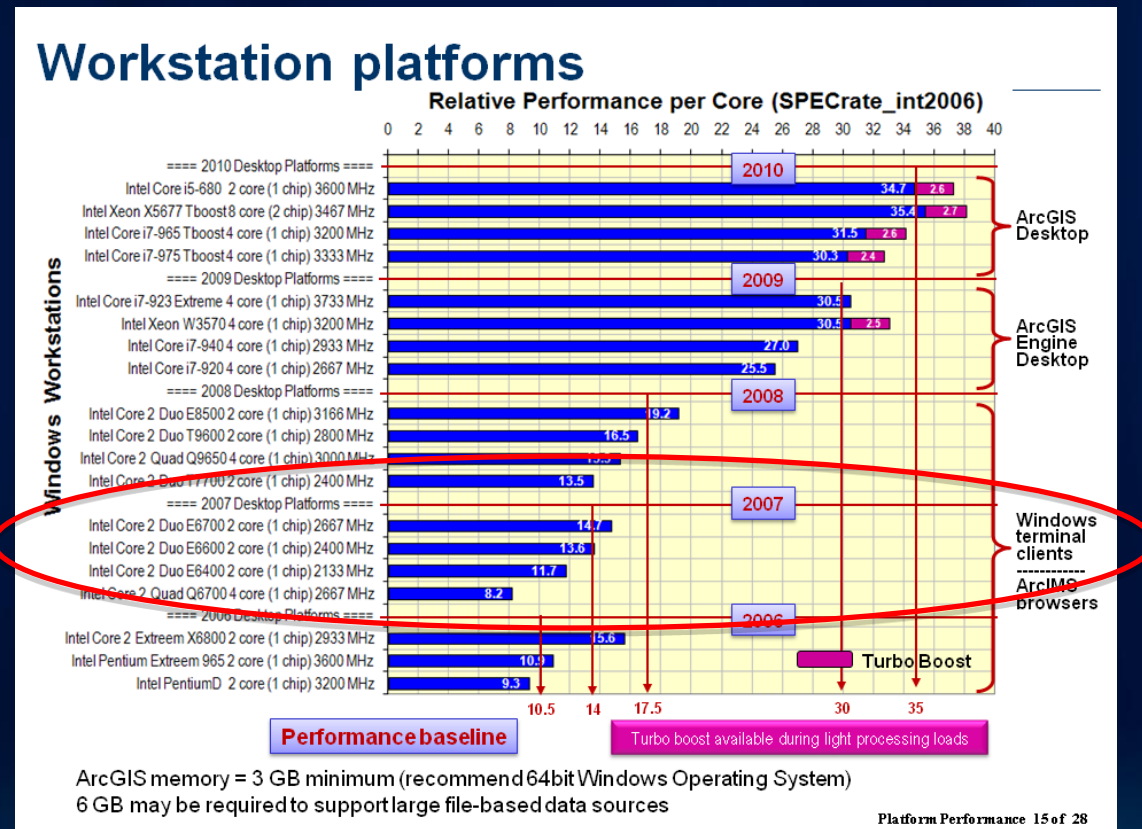
Platform capacity is changing



RDS / Citrix Workstation Capacity Planning

- System Design Strategies Wiki – Workstation Platforms

- [http://www.wiki.gis.com/wiki/index.php/Platform_Performance#ArcGIS Desktop Platform Sizing](http://www.wiki.gis.com/wiki/index.php/Platform_Performance#ArcGIS_Desktop_Platform_Sizing)



RDS / Citrix Network Planning Factors

- System Design Strategies Wiki – Network Communications

- http://www.wiki.gis.com/wiki/index.php/Network_Communications#Network_Design_Guidelines

Client Platform	Data per display		Traffic per display		Kbps Traffic per user	
	KBpd	Adj KBpd	Kbpd	Mbpd	6 dpm	10 dpm
File Server Client	1,000	5,000	50,000	50	5,000	8,333
Geodatabase Client	1,000	500	5,000	5	500	833
Terminal Client (vector)	100	28	280	0.28	28	47
Terminal Client (raster)	100	100	1,000	1	100	167
Web Browser Client (light)	100	100	1,000	1	100	167
Web Browser Client (medium)	200	200	2,000	2	200	333
Web Desktop Client (light)	200	200	2,000	2	200	333
Web Desktop Client (medium)	400	400	4,000	4	400	667

KBpd = Kilobytes per display
Kbpd = Kilobits per display

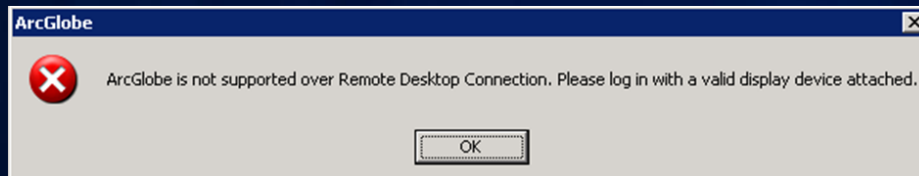
Mbpd = Megabits per display
dpm = Displays per minute

ArcGIS General Best Practices

- **Avoid use of application streaming (i.e., application isolation) technology for ArcGIS Desktop due to software complexity which results in poor performance**
- **Avoid use of server virtualization in production environments due to performance degradation**
- **Deploy GIS applications to dedicated servers within the Citrix farm**
- **Utilize HDX 3D (Progressive Display) policy with Imagery. However, publishing 3D or graphic intensive applications via Citrix (ArcScene, ArcGlobe, ArcGIS Explorer) is not recommended**
 - **Note: ArcGIS Explorer 1200 will not launch via remote interface**
 - **Note: ArcGlobe 10 will not launch via remote interface**

Changes at ArcGIS Desktop 10

- ArcGIS 10 will leverage the LARGEADDRESSAWARE compile option for 64-bit environments which will allow a process (ArcMap.exe, ArcSOC.exe, etc.) to utilize up to 4 GB of memory on a 64-bit server.
- ArcGlobe 10 now utilizes the same switch/check that ArcGIS Explorer uses and does not launch via remote connections (RDS and Citrix).



- Windows that utilize WPF technology can result in “flickering” with the remote displays on Windows 2003. This is already fixed in Windows 2008. Fix is to install a patch from Microsoft and looks like it is scheduled to be part of Windows 2003, SP3: <http://support.microsoft.com/kb/955692>. There is also information on our beta resource center for the WPF issue: <http://blogs.Esri.com/Dev/blogs/arcgisdesktop/archive/2010/03/01/Windows-Terminal-Server-and-Citrix-Patch.aspx>

Changes at ArcGIS Desktop 10

- **ArcMap is starting to utilize WPF windows (attribute table window, view item description window, etc.). WPF windows are treated as bitmaps by RDP/ICA as opposed to rendering via draw commands and may result in increased network traffic.**
- **At ArcGIS 10 user templates are stored separately based on version (e.g., C:\Documents and Settings\\Application Data\Esri\Desktop10.0). This should help situations where a Citrix farm is supporting multiple ArcGIS versions with the same user profiles (i.e., template files, etc., are not compatible between ArcGIS releases).**
- **The SQL Server Native Client is installed as part of the core ArcGIS installation (required for Direct Connect with SQL Server using ArcGIS 10).**
- **ArcGIS Desktop Help now launches at 10 from within ArcMap (bug at 9.3).**

Changes at ArcGIS Desktop 10

- **Background geoprocessing is the default configuration and launches an ArcSOCP.exe process on the server. This new functionality will allow parallel geoprocessing and interactive user processing. Need to consider this when doing capacity planning, etc.**
- **Service Pack 1 added a registry switch to disable WPF based dockable windows. Moving these windows within a thin-client environment can result in large amounts of network traffic (due to constant display refreshes). <http://resources.arcgis.com/content/kbase?fa=articleShow&d=38474>**
- **Prior to ArcGIS 10, ArcCatalog ignored the configuration when a GPO/policy was configured to hide the C: drive. At 10, by default, ArcCatalog has no connection to the C drive and the dialog to make a connection to the C drive respects the group policy.**

Citrix Reference Sites

Reference Sites...

- **Top 10 items found by Citrix consulting**
 - <http://support.citrix.com/servlet/KbServlet/download/18928-102-19722/Top%2010%20Items%20Found%20by%20Citrix%20Consulting%20on%20Assessments%20v2.pdf>
- **Enterprise GIS Resource Center**
 - <http://resources.Esri.com>
- **Esri Support for Windows Terminal Server (RDS) and Citrix XenApp**
 - <http://resources.arcgis.com/content/white-papers?fa=viewPaper&PID=14&MetaID=389>
- **Esri Online Tech Demos including Citrix XenApp**
 - <http://techdemos.Esri.com>

Reference Sites...

- **Esri Terminal Server Printing Whitepaper**
 - <http://resources.arcgis.com/content/white-papers?fa=viewPaper&PID=43&MetaID=1190>
- **Change the ArcGIS Desktop License Type in a RDS/Citrix environment**
 - <http://resources.arcgis.com/content/kbase?fa=articleShow&d=24633>
- **Citrix SpeedScreen Progressive Display Demo**
 - http://www.youtube.com/watch?v=_RMTM7vaMnI
- **Esri Citrix Alliance Site**
 - <http://www.Esri.com/partners/alliances/citrix/>

Reference Sites...

- **Citrix XenApp**

- <http://www.citrix.com/xenapp>

- **Citrix Farm Hardware Considerations**

- <http://hqextsrvsft01.citrix.com/proddocs/index.jsp>

- **Citrix HDX web site**

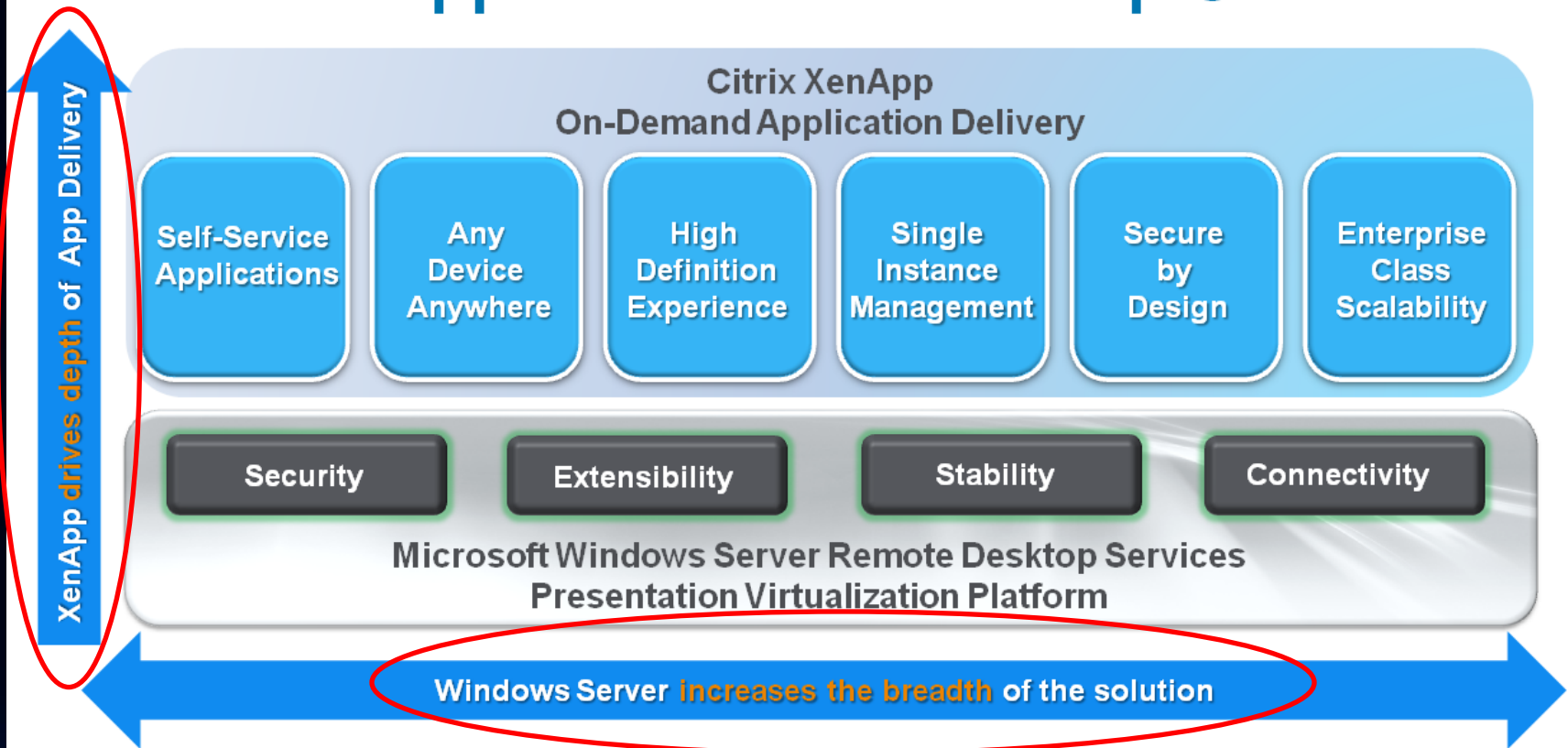
- www.citrix.com/hdx

Citrix Printing Articles

- **Esri Enterprise Printing Whitepaper (Published September 2006). Printing with ArcGIS Desktop Software Hosted on Windows Terminal Server/Citrix [PDF-269 KB, 27 pages]**
 - <http://www.Esri.com/library/whitepapers/pdfs/printing-wts-citrix.pdf>
- **BrianMadden.com: General Article on 'best practices' for Citrix printing. Not all of this may pertain to GIS environments, but still very helpful.**
 - <http://www.brianmadden.com/content/content.asp?id=622>
- **Using HP printers/plotters in the Citrix environment**
 - http://h71019.www7.hp.com/ActiveAnswers/downloads/HPprinters_CitrixPresentationServer.pdf

Bonus – “Why Do I Still Need Citrix XenApp in Addition to Windows Terminal Server?”

Citrix XenApp on Remote Desktop Services



Bonus – “Why Do I Still Need Citrix XenApp in Addition to Windows Terminal Server?”

Citrix XenApp extensions to Remote Desktop Services*

Self-Service Applications

- Unified Application Delivery
- Application Scheduling
- Proactive Performance Monitoring

Single Instance Management

- Content publishing
- Centralized Publishing
- Single Image Provisioning
- Single, Auto-updating client

Secure by Design

- Application password management
- Session recording and activity logging
- Centralized Access Policies
- Adaptive User Access
- Active Directory Federation Services Support
- Anonymous Access
- Integrated SSL VPN

Any Device, Anywhere

- Heterogeneous Client Support

Enterprise-class Infrastructure

- Comprehensive load management
- >1,000 server scalability
- Simplified Graphic Workflow development Environment
- Centralized Client Plug-in Management
- Delegated Administration
- Administrative Logging
- Advanced Server Health Monitoring
- Integration with Desired Configuration Management
- Integration with Multiple 3rd Party Management Systems
- Centralized Resource Monitoring
- Application Performance Monitoring
- Custom Branding Support in Web Interface
- Broad Server Platform Support for Web Services
- Support for Novell® eDirectory
- Policy-Based Control of Bandwidth Usage
- Policy-Based Control of Audio
- Policy-Based Control of TWAIN Device Support
- Policy-Based Control of Application Delivery
- Comprehensive Server Configuration
- Zone Preference and Failover
- Broad Database Engine Support
- Preferential Load Distribution
- Virtual Memory Optimizations

High Definition Experience

- User Self-Provisioning
- Retention of Printer Properties
- Controlled Security Rights for Client Printers
- Client Printer Provisioning
- Network Printer Provisioning
- Generic Universal Print Driver
- Driver Replication
- Driver Compatibility Control
- Printer Bandwidth Limit
- Print Traffic Routing
- SmoothRoaming
- Server to Client URL redirection
- Microsoft ActiveSync® Support
- Scanner Support
- Profile Management
- Click-To-Call
- Application Folder Management
- Automatic Reconnection
- Disconnect or Close All Applications
- User Controlled Network Optimizations
- Priority Packet Tagging
- High-Latency Network Support
- Web Browser Performance Optimizations
- Adobe® Flash® Performance Optimizations
- WAN Performance Optimizations
- Session Reliability
- Graphics Display Optimizations

Thank you!
Questions?



esri