ArcGIS for Desktop Best Practices in a Citrix XenApp Environment

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Primer - 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
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*
Two Traditional Desktop Deployment Options

**Thick-Client**

Classic client/server

- Data Connection
- Data Server
- ICA Connection
- Keyboard & Mouse
- Application Processing
- Citrix XenApp
- Server Farm

**Thin-Client**

Session Virtualization via Remote Desktop Services / Citrix XenApp

- ICA Connection
- Keyboard & Mouse
- Bitmaps & Draw Commands
- Citrix XenApp Server Farm
- Application Processing
- Data Connection
- Data Server
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)

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 for 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
Citrix XenApp Release History

XenApp was previously WinFrame, MetaFrame, and Presentation Server

XenApp 6.5 is the current release
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

• Video – 28 min: Fundamentals of the Presentation Server Architecture:
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)
  - Esri has certified ArcGIS 10 SP2 as a hosted application with Citrix XenApp 6 and Windows 2008 R2 using the Citrix ICA Online Plug-in for Windows 12.1.
  - ArcGlobe, ArcScene, and any other 3D application generally will not work well over Remote Desktop or other Windows Terminal Services clients, because these clients do not support 3D graphics acceleration.
ArcGIS for 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.
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 user lands on

- Hybrid approach (copy in/out portions of profile that are updated including normal.mxt, etc.) and use folder redirection

- Investigate use of Citrix Profile Management

- Profile options: [http://support.citrix.com/article/ctx120285](http://support.citrix.com/article/ctx120285)
• When printing jobs cross a network with limited bandwidth (i.e., WAN), Citrix recommends routing jobs through the client device so that the ICA protocol compresses the jobs and enables the administrator to limit the maximum consumable bandwidth.
Printing with Citrix XenApp

- For LAN environments, it is not necessary to print through the ICA channel and print jobs can be sent directly from the XenApp server, across the network, and directly to the print server.
• Avoid traversing network three times when the Print Server is in the Data Center (via the “Direct connections to print servers” policy).
Printing with Citrix XenApp

- In environments with a large number of printers per user, Citrix recommends to auto-create only one default printer.

- The automatic installation of print drivers should be disabled to ensure consistency across the XenApp servers to simplify support and troubleshooting.

- It is Citrix Pest Practice is to keep the number of print drivers installed on a XenApp server to a minimum to help reduce management and potential stability issues. Therefore the Citrix Universal Printer Driver should be used whenever possible to reduce the number of print drivers required.

- 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
  - 3rd-Party Solutions (ThinPrint / UniPrint / Screwdrivers)
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

Introduced in XenApp PS 4.5 and XenDesktop 2
HDX 3D Progressive Display

- Ensure the HDX Progressive Display policy (graphics policy in XA 6.5) 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.
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
HDX Progressive Display ArcMap 10 Demos

• **Pan Test – No Compression**
  - 336 KB downloaded

• **Pan Test – Ultra High Compression / Heavyweight**
  - 261 KB downloaded

• **Start Up with MXD Test – No Compression**
  - 2.2 MB downloaded

• **Start Up with MXD 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 ArcGIS 9.3.1 SP1

• Printing large images (Fragmented memory issue)
  - Workaround available for 9.3.1

• Default to “default” printer under certain conditions with session remapped printing when loading ArcMap

• Help in ArcMap on 64-bit servers 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](http://resources.arcgis.com/content/kbase?fa=articleShow&d=34906)
  - Introduced by XenApp 4.5 RP2
  - Fixed in XenApp 4.5 RP3
    - Citrix Windows 2003 64-bit PS 4.5 Hotfix: [http://support.citrix.com/article/CTX125005](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

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Windows terminal services

- Platform capacity is changing

<table>
<thead>
<tr>
<th>Intel Server Platform Technology</th>
<th>Platform Capacity (transactions per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xeon E5-2690 2 core (0.25 chip) 2900 MHz VM</td>
<td>2012, 2 core Virtual Server</td>
</tr>
<tr>
<td>Xeon E5-2643 4 core (1 chip) 3300 MHz</td>
<td>2012 platform technology</td>
</tr>
<tr>
<td>Intel Xeon X5677 4 core (1 chip) 3467 MHz</td>
<td>2010 platform technology</td>
</tr>
<tr>
<td>Intel Xeon X5260 4 core (2 chip) 3333 MHz</td>
<td>2006 platform technology</td>
</tr>
</tbody>
</table>

* Potential bottlenecks:
  - Disk I/O contention
  - Heavy memory swapping
  - Heavy video processing

Based on 80% platform capacity
RDS / Citrix Workstation Capacity Planning

- System Design Strategies Wiki – Workstation Platforms

### Workstation platform recommendations

<table>
<thead>
<tr>
<th>Windows Workstations</th>
<th>Relative Performance per Core (SPECrate_int2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Xeon E5-1600 4 core (1 chip) 3600 MHz</td>
<td>49.80</td>
</tr>
<tr>
<td>Intel Xeon E5-1600 6 core (1 chip) 3300 MHz</td>
<td>47.35</td>
</tr>
<tr>
<td>Intel Xeon E5-2637 4 core (1 chip) 3400 MHz</td>
<td>46.21</td>
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<tr>
<td>Intel Xeon E5-2643 4 core (1 chip) 3300 MHz</td>
<td>45.25</td>
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<tr>
<td>Intel Core i5-660 2 core (1 chip) 3333 MHz</td>
<td>34.78</td>
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<tr>
<td>Intel Core i7-965 4 core (1 chip) 3200 MHz</td>
<td>28.61</td>
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<tr>
<td>Intel Core i7-920M 4 core (1 chip) 2666 MHz</td>
<td>25.76</td>
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<tr>
<td>Intel Core i5-650 2 core (1 chip) 3465 MHz</td>
<td>24.60</td>
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<tr>
<td>Intel Core 2 Duo E8500 2 core (1 chip) 3166 MHz</td>
<td>19.06</td>
</tr>
<tr>
<td>Intel Core 2 Duo E6850 2 core (1 chip) 3000 MHz</td>
<td>18.46</td>
</tr>
<tr>
<td>Intel Core 2 Duo T7700 2 core (1 chip) 2400 MHz</td>
<td>13.50</td>
</tr>
</tbody>
</table>

ArcGIS memory = 3 GB minimum (recommend 64bit Windows Operating System)
6 GB may be required to support large file-based data sources

ArcGIS for Desktop power users
ArcGIS for Desktop standard users
Windows terminal clients
ArcGIS browsers

Turbo Boost improves performance during light loads
RDS / Citrix Network Planning Factors

- System Design Strategies Wiki – Network Communications

<table>
<thead>
<tr>
<th>Client Platform</th>
<th>Data per display KBpd</th>
<th>Traffic per display Kbps</th>
<th>Kbps Traffic per user 6 dpm</th>
<th>Kbps Traffic per user 10 dpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Server Client</td>
<td>1,000</td>
<td>50,000</td>
<td>5,000</td>
<td>8,333</td>
</tr>
<tr>
<td>Geodatabase Client</td>
<td>1,000</td>
<td>5,000</td>
<td>500</td>
<td>833</td>
</tr>
<tr>
<td>Terminal Client (vector)</td>
<td>100</td>
<td>280</td>
<td>28</td>
<td>47</td>
</tr>
<tr>
<td>Terminal Client (raster)</td>
<td>100</td>
<td>1,000</td>
<td>100</td>
<td>167</td>
</tr>
<tr>
<td>Web Browser Client (light)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>167</td>
</tr>
<tr>
<td>Web Browser Client (medium)</td>
<td>200</td>
<td>2,000</td>
<td>200</td>
<td>333</td>
</tr>
<tr>
<td>Web Desktop Client (light)</td>
<td>200</td>
<td>2,000</td>
<td>200</td>
<td>333</td>
</tr>
<tr>
<td>Web Desktop Client (medium)</td>
<td>400</td>
<td>4,000</td>
<td>400</td>
<td>667</td>
</tr>
</tbody>
</table>

KBpd = Kilobytes per display
Kbps = Kilobits per display
dpm = Displays per minute
Mbdp = Megabits per display
ArcGIS General Best Practices

- Avoid use of application streaming (i.e., application isolation) technology for ArcGIS for Desktop due to software complexity which results in poor performance.

- Avoid deploying XenApp servers with server virtualization in production environments due to performance degradation. This is subjective though and there are several variables to consider.

- 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 XenApp (ArcScene, ArcGlobe, ArcGIS Explorer) is not recommended.
  - Note: ArcGIS Explorer 1200 will not launch via remote interface, 1700 will launch
  - Note: ArcGlobe 10 will not launch via remote interface
Changes at ArcGIS for 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 for 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\<user>\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).
Changes at ArcGIS for 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.

- ArcGIS for Desktop 10, 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
Citrix Reference Sites
Reference Sites…

• What are the best practices for running ArcGIS for Desktop in a Citrix XenApp environment?

• Top 10 items found by Citrix consulting

• Enterprise GIS Resource Center
  - http://resources.Esri.com

• Esri Terminal Server Printing Whitepaper
  - http://resources.arcgis.com/content/whitepapers?fa=viewPaper&PID=43&MetaID=1190
Reference Sites…

- Change the ArcGIS for 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

- Citrix Farm Hardware Considerations
Reference Sites…

- XenDesktop and XenApp Best Practices
  - [http://support.citrix.com/article/CTX132799](http://support.citrix.com/article/CTX132799)

  - [http://support.citrix.com/article/CTX129761](http://support.citrix.com/article/CTX129761)

- Best Practices for Citrix XenApp Hotfix Rollup Pack Installation and Deployment
  - [http://support.citrix.com/article/CTX120842](http://support.citrix.com/article/CTX120842)

- Best Practices for XenApp Administrators
  - [http://support.citrix.com/article/CTX127574](http://support.citrix.com/article/CTX127574)
Reference Sites…

- XenDesktop and XenApp Printing - Planning Guide
  - http://support.citrix.com/article/CTX134943
Bonus – “Why Do I Still Need Citrix XenApp in Addition to Windows Terminal Server?”

Citrix XenApp on Remote Desktop Services

- Self-Service Applications
- Any Device Anywhere
- High Definition Experience
- Single Instance Management
- Secure by Design
- Enterprise Class Scalability

Microsoft Windows Server Remote Desktop Services Presentation Virtualization Platform

- Security
- Extensibility
- Stability
- Connectivity

Windows Server increases the breadth of the solution
# Bonus – “Why Do I Still Need Citrix XenApp in Addition to Windows Terminal Server?”

## Citrix XenApp extensions to Remote Desktop Services

<table>
<thead>
<tr>
<th><strong>Self-Service Applications</strong></th>
<th><strong>Enterprise-class Infrastructure</strong></th>
<th><strong>High Definition Experience</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified Application Delivery</td>
<td>Comprehensive load management</td>
<td>User Self-Provisioning</td>
</tr>
<tr>
<td>Application Scheduling</td>
<td>&gt;1,000 server availability</td>
<td>Retention of Printer Properties</td>
</tr>
<tr>
<td>Proactive Performance Monitoring</td>
<td>Simplified Graphic Workflow development Environment</td>
<td>Controlled Security Rights for Client Printers</td>
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<tr>
<td></td>
<td>Centralized Client Plug-in Management</td>
<td>Client Printer Provisioning</td>
</tr>
<tr>
<td></td>
<td>Delegated Administration</td>
<td>Network Printer Provisioning</td>
</tr>
<tr>
<td></td>
<td>Administrative Logging</td>
<td>Generic Universal Print Driver</td>
</tr>
<tr>
<td></td>
<td>Advanced Server Health Monitoring</td>
<td>Driver Replication</td>
</tr>
<tr>
<td></td>
<td>Integration with Desired Configuration Management</td>
<td>Driver Compatibility Control</td>
</tr>
<tr>
<td></td>
<td>Integration with Multiple 3rd Party Configuration Systems</td>
<td>Printer Bandwidth Limit</td>
</tr>
<tr>
<td></td>
<td>Centralized Resource Monitoring</td>
<td>Print Traffic Routing</td>
</tr>
<tr>
<td></td>
<td>Application Performance Monitoring</td>
<td>SmoothRoaming</td>
</tr>
<tr>
<td></td>
<td>Custom Branding Support in Web Interface</td>
<td>Server to Client URL redirection</td>
</tr>
<tr>
<td></td>
<td>Broad Server Platform Support for Web Services</td>
<td>Microsoft ActiveSync® Support</td>
</tr>
<tr>
<td></td>
<td>Support for Novell®@Directory</td>
<td>Scanner Support</td>
</tr>
<tr>
<td></td>
<td>Policy-Based Control of Bandwidth Usage</td>
<td>Profile Management</td>
</tr>
<tr>
<td></td>
<td>Policy-Based Control of Audio</td>
<td>Click-To-Call</td>
</tr>
<tr>
<td></td>
<td>Policy-Based Control of TWAIN Device Support</td>
<td>Application Folder Management</td>
</tr>
<tr>
<td></td>
<td>Comprehensive Server Configuration</td>
<td>Automatic Reconnection</td>
</tr>
<tr>
<td></td>
<td>Zone Preference and Failover</td>
<td>Disconnect or Close All Applications</td>
</tr>
<tr>
<td></td>
<td>Broad Database Engine Support</td>
<td>User Controlled Network Optimizations</td>
</tr>
<tr>
<td></td>
<td>Preferential Load Distribution</td>
<td>Priority Packet Tagging</td>
</tr>
<tr>
<td></td>
<td>Virtual Memory Optimizations</td>
<td>High Latency Network Support</td>
</tr>
</tbody>
</table>

## 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

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*Esri UC2010 | Tech Workshops*