



**System
Design and
Tuning**

Lucity 2014 R2

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Lucity History

Lucity 7.0

- Even though 7.0 wasn't the first web product (6.74), it was a start of a new era
- Hardware Requirements

Hardware Requirements

gbaMS Workstation (Web User)
gbaMS Workstation (Fat Client)
File Server
Services Server
Database Server
Web Server
GIS Web Server²

| Minimum Hardware Specification | | | | | | |
|--------------------------------|--------|------------------------------------|--|---------------|----------------------------|--|
| CPU | RAM | Storage Controller | Storage Space ¹ | Minimum Video | DVD-ROM Drive ³ | |
| 450 MHz | 256 MB | N/A | 20 MB | 800x600 | ✓ | |
| 450 MHz | 256 MB | N/A | 400 MB | 1024x768 | ✓ | |
| 1 GHz | 512 MB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A | ✓ | |
| 1 GHz | 512 MB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A | ✓ | |
| 1 GHz | 1 GB | RAID Controller (RAID 1 or RAID 5) | 2 GB/gbaMS DB SQL Server 10 GB Oracle | N/A | ✓ | |
| 1 GHz | 1 GB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A | ✓ | |
| 1 GHz | 1 GB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A | ✓ | |

Lucity 7.0

- 2010 Solutions
 - Lucity Web
 - Lucity Desktop
 - Lucity Services
 - Lucity Database
 - GIS Tasks (Early Lucity WebMap)





Lucity Currently

Lucity 2014 R2

HARDWARE REQUIREMENTS

| Minimum and Recommended Hardware Specifications | | | | | | |
|---|-------|-------|----------|---------------------------------------|-------------------------------------|---------------|
| | CPU | Cores | RAM | Storage Controller | Storage Space ¹ | Minimum Video |
| Lucity Web User | 1 GHz | 1 | 1GB | N/A | 50 MB | 1024x768 |
| Lucity Desktop | 1 GHz | 1 | 1GB | N/A | 500 MB | 1024x768 |
| File Server | 2 GHz | 2,2 | 2GB, 2GB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A |
| Services Server | 2GHz | 2,4 | 2GB, 2GB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A |
| Lucity Database Server | 2 GHz | 2,4 | 4GB, 8GB | RAID Controller (RAID 1 or RAID 5) | 2 GB/ Lucity DB SQL Server | N/A |
| Lucity Web Server | 2 GHz | 2,4 | 4GB, 8GB | RAID Controller (RAID 1 or RAID 5) | 2 GB | N/A |
| Lucity Mobile Server | 2 GHz | 2,4 | 4GB, 8GB | RAID Controller (RAID 1 or RAID 5) | 1 GB | N/A |
| Lucity REST API Server & Lucity Document Server | 2 GHz | 2,2 | 2GB, 4GB | RAID Controller (RAID 1 or RAID 5) | 1 GB | N/A |
| Lucity Citizen Portal Server | 2 GHz | 2,2 | 2GB, 4GB | RAID Controller (RAID 1 or RAID 5) | 1 GB | N/A |

Lucity 2014 R2

- 2014 R2 Solutions
 - Mobile Server (Microsoft IIS: For Android and iOS)
 - Web and WebMap (Microsoft IIS)
 - Desktop
 - Lucity Mobile Desktop DB Post
 - Lucity Mobile Desktop Synchronizer
 - Lucity PM
 - Lucity Scheduler
 - Services (4)
 - Citizen and Web Rest APIs (Microsoft IIS)
 - Database Server
 - Document Server (Microsoft IIS)
 - Citizen Portal (Microsoft IIS)



Lucity 2014 R2



- 2014 R2 GIS Integration
 - Feature Services (Redlining and Edit)
 - Image Services
 - Geocoding Services
 - Map Services
 - Inspection Integration for ArcGIS Online Apps
 - Geometry Services
 - Collector for ArcGIS and other ArcGIS Online Apps



Web

Lucity Web



- It's a Web application installed on IIS Web Server
 - Clients must have Silverlight installed on local workstation
 - Browser Based using IE9 and higher
 - Should be internal only
 - Recommend 2Ghz, 4 cores and 8GB of RAM
 - Could be placed on the database server or on an application server. Recommend an application server
 - If stand alone, consider RAID 1 10k SAS or better
 - Consider newer VMWare or 2012 R2 hyper-V for VM core support
 - Windows 2008 Server SP2 or higher

Lucity Web

- Software requirements
 - .NET framework 4.5.1 (full)
 - ASP.net 4.5 enabled in IIS
 - IIS 6 Metabase Compatibility
 - IIS 6 WMI Compatibility
 - Windows Authentication
 - WCF HTTP Activation feature
 - For performance, enable Dynamic Content Compression in IIS



- ☒ Web Server (IIS) (22 of 43 installed)
 - ☒ Web Server (16 of 34 installed)
 - ☒ Common HTTP Features (4 of 6 installed)
 - ☒ Health and Diagnostics (1 of 6 installed)
 - ☒ Performance (Installed)
 - ☒ Static Content Compression (Installed)
 - ☒ Dynamic Content Compression (Installed)
 - ☒ Security (3 of 9 installed)
 - ☒ Application Development (6 of 11 installed)
 - ☒ .NET Extensibility 3.5 (Installed)
 - ☒ .NET Extensibility 4.5 (Installed)
 - ☐ Application Initialization
 - ☐ ASP
 - ☒ ASP.NET 3.5 (Installed)
 - ☒ ASP.NET 4.5 (Installed)
 - ☐ CGI
 - ☒ ISAPI Extensions (Installed)
 - ☒ ISAPI Filters (Installed)
 - ☐ Server Side Includes
 - ☐ WebSocket Protocol
 - ☐ FTP Server
 - ☒ Management Tools (6 of 7 installed)
 - ☒ IIS Management Console (Installed)
 - ☒ IIS 6 Management Compatibility (3 of 4 installed)
 - ☒ IIS 6 Metabase Compatibility (Installed)
 - ☐ IIS 6 Management Console
 - ☒ IIS 6 Scripting Tools (Installed)
 - ☒ IIS 6 WMI Compatibility (Installed)
 - ☒ IIS Management Scripts and Tools (Installed)
 - ☒ Management Service (Installed)

Lucity REST API



- Lucity's Application Programming Interface for developers who want to extend the capability of Lucity
 - Can be placed on the same server as Lucity Web



Document Server

Document Server



- It's a file management system that allows users to upload files as an attachment to Lucy records
 - Used in Lucy Web and Lucy Mobile for (iOS and Android)
 - Should be on internal server; can be on same server as Lucy Web
 - Uses Microsoft IIS Web Server
 - Recommend 2Ghz, 2 cores and 4GB of RAM
 - If stand alone, consider RAID 1 10k SAS or better
 - Consider newer VMWare or 2012 R2 hyper-V for VM server support
 - Windows 2008 Server SP2 or higher



File Server

File Server



- Not an application but rather a server to store
Lucity Attached documents and sometimes
used to store the Lucity configuration files
 - At least 2Ghz CPU, 2 cores, 2GB of RAM is
recommended
 - Storage location for Lucity Document Server
 - RAID 1 or higher
 - At least 2GB of Storage Space
 - For CCTV, Documents, and media at least 1TB of
space
 - **Case study:** 14TB of available space on a RAID 5
Array; less than \$2,000
 - Backup files on a fireproof device



Database Server

Database Server



- Lucity Databases uses SQL Server or Oracle
 - Up to 10 Databases excluding GIS

| | | |
|---|---|----------|
|  |  | GBAComm |
|  |  | GBAElec |
|  |  | GBAEquip |
|  |  | GBAPark |
|  |  | GBASewer |
|  |  | GBAStorm |
|  |  | GBAStret |
|  |  | GBAUser |
|  |  | GBAWater |
|  |  | GBAWork |

Database Server



- Lucity Database Specifications
 - Recommend at least 2 Ghz, 4 cores and 8GB of RAM
 - Recommend RAID 1 or Higher (RAID 5 or 10 for medium to large organizations)
 - At least 2GB of Space for all databases minus GIS
 - Consider other databases like GIS, Financials, Permitting, CCTV and more
 - Consider newer VMWare or 2012 R2 hyper-V for VM server support
 - Not on the same server as ArcGIS for Server







Services

Lucity Services



- Lucity Services are services that run in Windows; each service is unique

-  Lucity Mobile Desktop DB Post
-  Lucity Mobile Desktop Synchronizer
-  Lucity PM
-  Lucity Scheduler

Lucity Services



- Lucity Mobile Desktop DB Post Service
 - Posts nightly databases for the Lucity Field Laptops

Lucity Services



- Lucity Mobile Desktop Synchronizer Service
 - Watches for Lucity Field Laptops that are trying to Synchronize back to the Lucity Database

Lucity Services



- Lucity PM
 - Generates work orders based on a Preventative Maintenance schedule and performs varied other nightly recalculations of data within Lucity like:
 - Fleet calculations
 - Clearing old object locks
 - Update current asset values for server construction records
 - Removes stale availability records
 - Updates work order calculations
 - More details found at **help.lucity.com** under Services, Lucity PM services

Lucity Services



- Lucity Scheduler Service
 - Initializes every minute to run processes
 - There are four processes within this service
 - Request Generator
 - Send E-mail Notifications
 - Spatial Indexer
 - GIS Scheduled Tasks

Lucity Services



- Lucity Scheduler Service - Request Generator
 - Allows for e-mails to be sent to a specific e-mail address. This process will convert the e-mail into a Lucity Work Request.
 - You can setup multiple e-mail accounts linked to a specific problem code.
 - Service logs events into GBAWork database, table WKREQEMAIL

Lucity Services



- Lucity Scheduler Service - Send E-mail Notifications
 - This process allows Lucity to generate e-mails through a notification trigger configurable in the Desktop or the Web

Lucity Services



- Lucity Scheduler Service - Spatial Indexer
 - Process generates work order/request, and assets spatial attributes in SQL Server Spatial or Oracle Spatial so users can view live data in ArcMap or Lucity Web Map
 - X, Y location stored in database
 - Ability to control maximum days to process records
 - Must have SQL Server 2008 or higher

Lucity Services



- Lucity Scheduler Service – GIS Scheduled Tasks
 - Process is designed to run GIS Scheduled Tasks. These tasks push changes made in inspections for Lucity to GIS and from inventory for GIS into Lucity. Inventory Lucity to GIS changes are synchronized immediately through the feature service.

Lucity Services



- Hardware Specifications
 - Recommend at least 2 Ghz, 4 cores and 2GB of RAM
 - Recommend RAID 1 or Higher (RAID 5 or 10 for medium to large organizations)
 - At least 2GB of Space
 - Consider newer VMWare or 2012 R2 hyper-V for VM server support
 - Consider increasing RAM and CPU availability as services are using more resources based on functionality enabled in Lucity.
 - Recommend locating Lucity Services on Database Server and not Lucity Web Server.



Citizen Portal

Lucity Citizen Portal



- Web interface that allows customers to create work requests
 - Can be installed on internal application servers depending on your workflow
 - At least 2Ghz, 2 cores, 4GB of RAM recommended
 - RAID 1 or higher
 - At least 1 GB of Storage Space
 - Citizen Portal Rest API is available as well



Mobile Server

Lucity Mobile Server



- Mobile server allows for Android and iOS devices to connect to Lucity Databases and business logic
 - Rest Services
 - Two Security Architectures for Lucity Mobile Server Deployments
 - Installed on an internal application server for organizations using VPN
 - Installed on an external application server for organizations using DMZ
 - HTTPS and a signed SSL recommended
 - Self-Signed SSL does not work

Lucity Mobile Server



- Hardware Specifications
 - At least 2 Ghz CPU, 4 cores, 8GB or RAM Recommended
 - RAID 1 or higher
 - At least 2GB of Storage Space



2014 Android Devices

2014 Devices



- Samsung Galaxy Tab Pro, Note 2014 and Note Pro
- Sony Xperia Z2 or Z3 Tablet
- Nexus 8.9" (aka 8 or 9), 10
- Consider 32GB of Internal Storage or higher



2014 Apple Devices

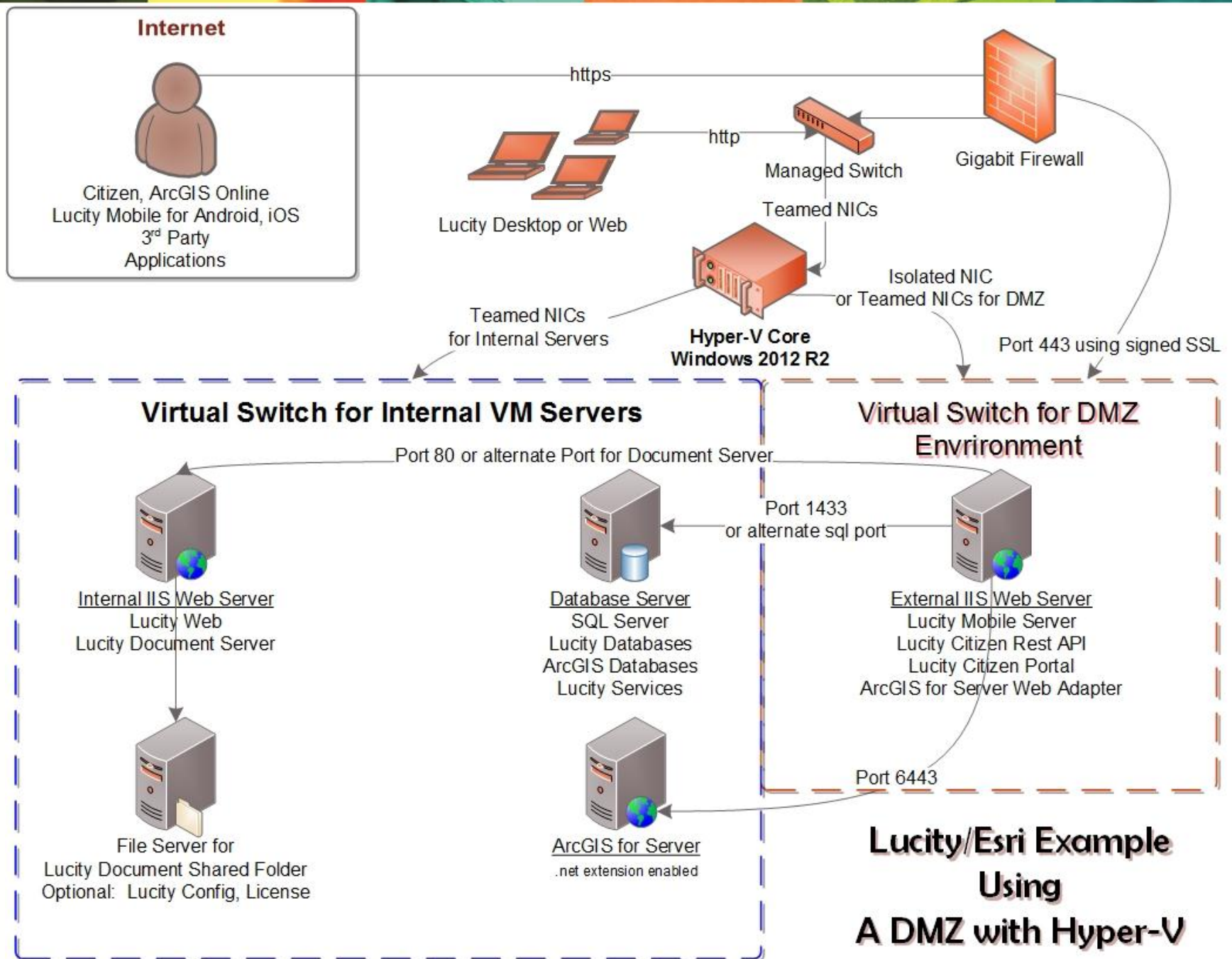
2014 Devices



- iPad Air 2 and Mini 3 (November, December?)
- iPhone 6



Lucity Network Architecture



DMZ Considerations



- Be strict with firewall rules from DMZ to Internal LAN.
- Setup DNS to forward to internal IP to DMZ for an alias (i.e. <https://lucitymobile.lucity.com>)
- Add host record for the internal alias to database server on the DMZ server hosts file
- Internal Lucity Services needs to be able to talk to the DMZ web server where Lucity Mobile Server is installed. Also applies to VPN.

DMZ Considerations



- For Internal LAN, add NAT from external IP DMZ Web Server so inside can route to the DMZ Web Server *example*
 - 74.95.78.22 (External Static IP) -> 10.0.12.34 (Internal DMZ IP)
- Force internal Trust of SSL certificate for Lucy Document Controls and outside address through Group policy
- Lucy Mobile Server, Citizen Portal and Citizen Portal Rest API needs to be able to talk to Lucy Document Server through http (suggest non-standard port assignment for Document Server).



Infrastructure Considerations

Hyper-V Considerations



- IOPS (Input/Output Operations Per Second)
 - [Calculations of Max Concurrent Users](#)
 - Hyper-V RAID Array: 15 IOPS per max concurrent user

Options Hard Drive Type 10K SAS ▾

Hard Drive Capacity



Read Percent



Number of Drives



Write Percent



*Assumes NO Hot Spares

*SSD IOPS Is An Estimate Due to SSD/NAND Performance Differences

| | CAPACITY | IOPS |
|---------|----------|-------|
| RAID 10 | 4,822 GB | 1,071 |
| RAID 6 | 8,037 GB | 500 |
| RAID 5 | 8,037 GB | 682 |

Hyper-V Considerations



- RAM Overhead using Hyper-V
 - 32MB for the first GB of each VM
 - 8MB for each GB after the 1st GB used

| RAM Calculations in Hyper-V | | |
|-----------------------------|----------|------------------------|
| Test Server | | |
| Description | RAM (MB) | RAM VM Allocation (GB) |
| Hypervisor | 300 | |
| VM RAM (first 1GB) | 128 | 4 |
| VM RAM (after first 1GB) | 182.4 | 22.8 |
| OS Manager | 4000 | |
| Overhead | 4610.4 | |
| Total | 31410.4 | 26.8 |
| | | |
| South Placer | | |
| Hypervisor | 300 | |
| VM RAM (first 1GB) | 256 | 8 |
| VM RAM (after first 1GB) | 1024 | 128 |
| OS Manager | 4000 | |
| Overhead | 5580 | |
| Total | 141580 | 136 |

Hyper-V Considerations



- CPU
 - Hyper-V uses logical cores
 - Example: Intel 12 core will allow for up to 24 logical cores in Hyper-V
 - **Case Study:** 2 x Intel e5-2695v2
 - Total logical cores = 48
 - » 8 logical cores to SQL Server
 - » 4 logical cores to ArcGIS for Server
 - » 4 logical cores to Tyler Incode Web
 - » 4 logical cores to Lucity Web

Hyper-V Considerations



- Plan system for 40% initial utilization for future scalability.
- Consider multi-processes for each user connection (15 IOPS per user times and processes per user). Better to have too much than too little.
- Consider HDD spindle latency (3ms versus 5ms).
- Make sure DAS or SAN is expandable for future growth.

Network Connections



- Check your network connectivity
 - Connections: Cat 5 over ballasts or anything that could impede frequency
 - Recommend CAT 6 insulated or higher
 - Switches: Are they Gigabit?
 - Unmanaged versus Managed?
 - Switch Redundancy for failover in Server Farm?
 - Firewall: Can you configure VPN or DMZ?
 - Does it have Gigabit ports?
 - What's the max user count for VPN connections?
 - What's the total bandwidth/throughput?

System Environment



- Does your servers have an independent climate control?
- Does your server room have air purification system?
- Is there ample power to scale your server room in the near future?
- What is the maximum amount of time for UPS (uninterrupted power supply) in case of a power failure?

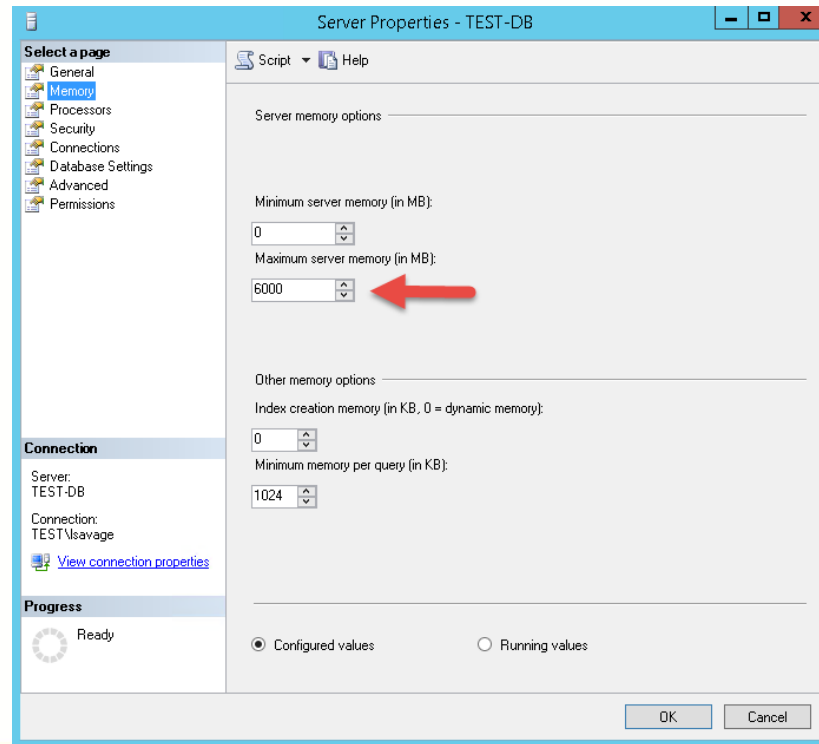


SQL Server Tuning

SQL Server Tuning



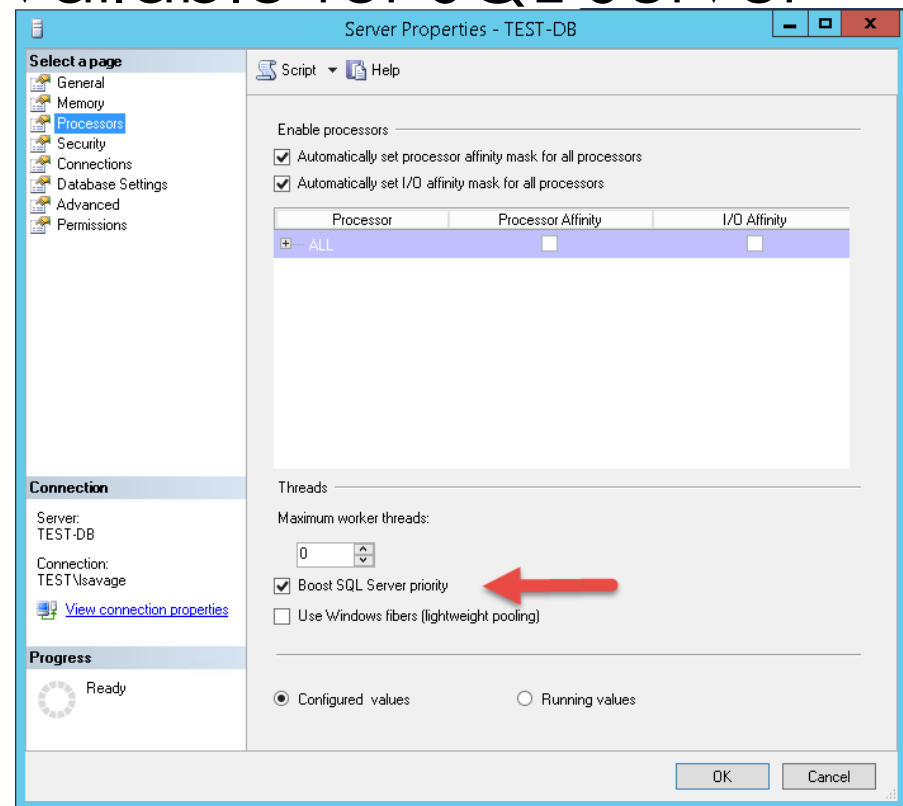
- SQL Server 2012+ RAM Caching
 - SQL Server utilizes RAM more efficiently for data that is used frequently for faster queries
 - If plenty of RAM available, try 12-16GB of RAM max memory



SQL Server Tuning



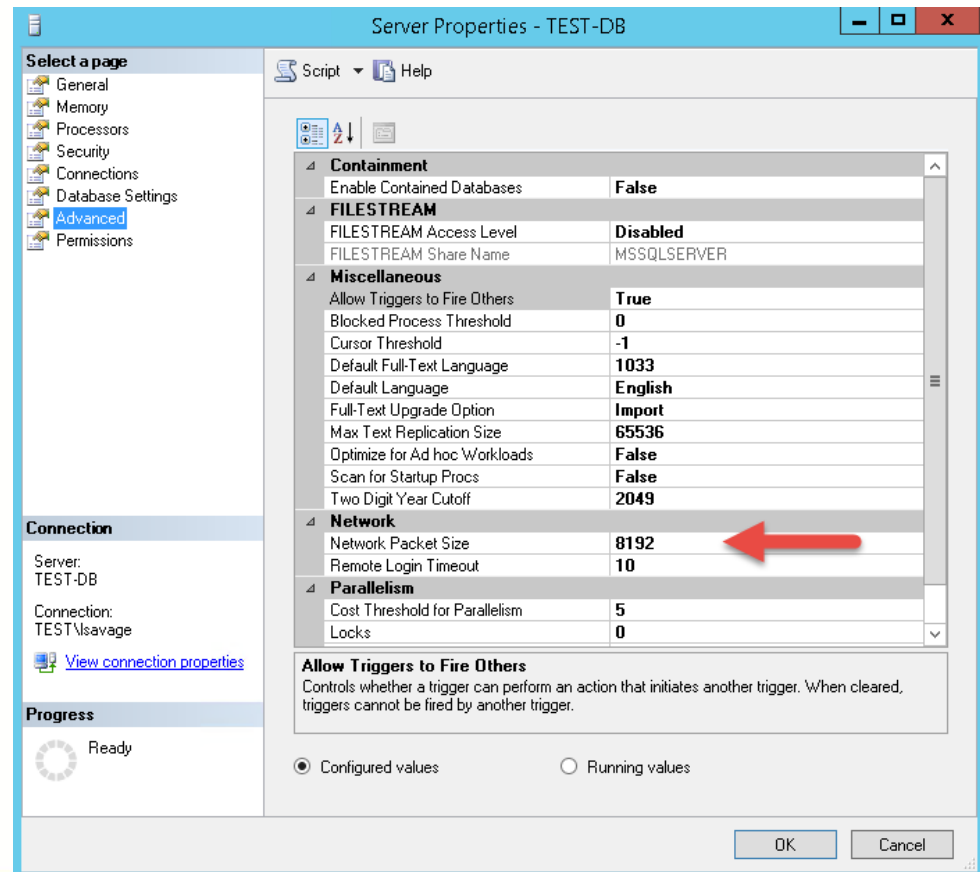
- Is SQL Server a priority?
 - Boosting SQL Server priority will ensure resources will be available for SQL Server continuously



SQL Server Tuning



- Minimize I/O contention in SQL Server
 - Increase the network packet size to 8192 instead of 4096 default for GIS



SQL Server Tuning



- Consider migrating to DBO Schema instead of SDE Schema
 - Allows SQL Server DBAs to manage SDE
 - Backdoor for SA
 - Integrate with Active Directory Groups and Users
 - Flexible deployment
 - Easier to move the database
 - SDE Schema has limited life

SQL Server Tuning



- Raster data should have it's own database separated away from vector databases
 - Different backup needs
 - Has different maintenance routines
 - Can configure the sde dbtune table to be raster specific and exclude vector storage
 - Security and Access of data are different

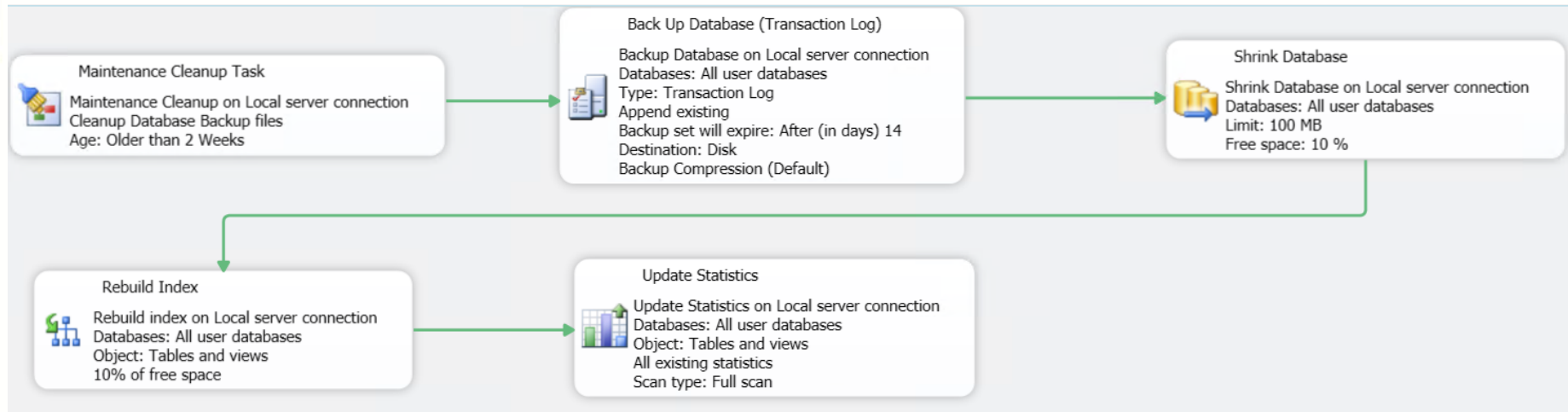


Backups

SQL Server Backup



- Create a Maintenance Plan for SQL Server
 - All Lucity Databases (simple versus full recovery)
 - Consider backup (.bak) backups rather than backing up mdf and ldf files.
 - Analyze, Index and Update Statistics
 - Shrink Logfiles only
 - Consider Full, Intermediate and Transaction Log backups



File Server Backup



- Make sure you backup your file based documents to a secure offsite location or fireproof system if onsite
 - Media like CCTV inspection videos
 - Word, Excel, PDF documents
 - Photos such as jpg images
 - AutoCAD drawing files
 - Backup SQL Backup files (.bak, .trn)



GIS Maintenance

GIS Maintenance



- Make sure you compress per week at least
 - Analyze, index and update statistics during the compression routine
 - Recommended: Zero State compress at least once a year
- Backup your Enterprise Geodatabase
 - Recommend: At least once a year backup into a File Geodatabase in addition to RDBMS backups



Budget and Planning

Budget and Planning



- Plan for Migration to new technologies
 - Infrastructure every 3 to 5 years
 - Warranty and Support for hardware considerations
 - Mobile products sometimes every 2 years or less
- Should be a part of your operating costs
- Constant feedback from the field on how the system is operating is a plus
 - Are they using the products?
 - What are they having problems with?
 - Involve your Lucity support staff or Regional Manager to help
 - Be proactive instead of always reactive