

Esri International User Conference | San Diego, CA Technical Workshops |

## Enterprise GIS Architecture Deployment

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### Agenda

**Deployment options** 

- Introduction
- Application Architecture (Desktop, Web, Mobile)
- Infrastructure Architecture
  - Session/Application Virtualization
  - Hardware Virtualization
  - Cloud Computing and Deployments
- Quality Attributes
  - High Availability Patterns
  - Public-facing Application Security
  - Scalability
- Closing

#### Deployments

- Patterns of delivering GIS functionality
- The state of our knowledge
- Motivations and considerations



Desktop applications that operate in stand-alone, connected, and sometimes connected scenarios.



Browser-based applications that operate in connected scenarios and optionally leverage browser plug-ins.



Standards-based service interfaces that support external applications and systems.



Mobile

Mobile applications that operate in stand-alone, connected, and sometimes connected scenarios.

#### **System Designer**

- 1. GIS System/Solution Design
- 2. Calculate Capacity

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ArcGIS Server .NET 10.0

16.00 GB Software-

MI ArcGIS Server1

# **Application Architectures**



#### **ArcGIS Desktop**



- Rich Client Pattern: <u>http://resources.arcgis.com/content/enterprisegis/</u> <u>10.0/rich\_client\_architecture</u>
- Full range of GIS tools.
- Significant client system requirements (hardware, network, and platform).
- Significant system administration support (installs, upgrades, versioning, etc.)



## Demonstration

#### **Desktop Deployment**



#### **ArcGIS Server Web Applications**



- Web Application Pattern: <u>http://resources.arcgis.com/content/enterprisegis/</u> <u>10.0/web\_app\_architecture</u>
- Server-powered mapping, analysis, editing, etc.
- Minimal client system requirements.

### Mobile



- Mobile Application Patterns: <u>http://resources.arcgis.com/content/enterprisegis/</u> <u>10.0/mobile\_app\_architecture</u>
- Enabling field-based data collection, situational awareness, and mobile GIS.
- A family of platform-specific solutions that leverage a common server-based infrastructure.
- Themes:
  - 1. Always vs. sometimes connected
  - 2. Sometimes connected:
    - a. Getting data on to the devices
    - b. Managing synchronization timing



## Demonstration

ArcGIS Server and Mobile



## Infrastructure Architectures

#### **Session/Application Virtualization**



- Allows Desktop application processing to execute on servers, exchanging graphics and commands with clients.
- Often motivated by easing system administration and support requirements for large deployments.



#### **Customer Experiences and Motivations**



- Simplified/Streamlined Administration
- Release control; Managing Upgrades
- WAN bandwidth and latency tolerance
- High availability for ArcGIS Desktop solutions
- Reduced client side requirements
- Specialized skill requirements for server administration and configurations to support printing, working with local data, etc.

#### **Esri's Testing and Experience**



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- Scope of Esri Support
- Session/Application vs. Desktop Virtualization and VDI
- Graphics, printing, and 3D
- Resources:
  - <u>http://resources.arcgis.com/content/white-</u> papers?fa=viewPaper&PID=25&MetaID=389
  - <u>http://blogs.esri.com/Dev/blogs/enterprisegis/</u> <u>archive/2010/11/05/Citrix-HDX-RichGraphics-</u> <u>with-ArcGIS-Desktop.aspx</u>



## Demonstration

ArcGIS Desktop Application/Session Virtualization



#### **Server Hardware Virtualization**



- Allows the division and/or recombination of one or more physical machines into 'virtual' machines
- Often motivated by costsavings (right-sizing, over-committing) and increased system administration flexibility.



SOURCE: Wikipedia

#### Processors



### **Right-sizing**

#### **Over-commitment**

















### Storage





## Storage Access





## Networking





#### **Esri's Testing and Experience**



- Scope of Esri Support
- Scalability and Virtual Cores
- Right-sizing is good; over-committing should be avoided
- Implementation Risks:
  - Storage I/O contention
  - Network Latency
- Resources:
  - <u>http://downloads2.esri.com/support/whitepape</u> <u>rs/other\_/ArcGISServer\_Virtualization.pdf</u>

#### **Customer Experience and Motivations**



- IT Standards
- Availability
- Disaster Recovery
- Simplified/Streamlined Administration
- Other



## Demonstration

ArcGIS Server Hardware Virtualization



#### **Staging Environment**



#### **Purposes and Uses:**

- User Acceptance Testing (UAT)
- Production Deployment Procedure
   Development and Testing
- Service Staging
- Recovery Procedure Development and Validation

Provisioning Patterns:
Hardware virtualization
Staging licensing
Training labs (for clients)

#### **Development Environment**



Purposes and Uses:Application developmentFunctional/Unit testing

Provisioning Patterns:Developer machinesEDN

### **Cloud Computing**



- Provides hosted, usually off-premises, infrastructure, platform, and/or application services.
- Often motivated by scalability, deployment flexibility, and/or outsourcing objectives.



#### What is Cloud: laaS?

Infrastructure-as-a-Service (laaS)

- Provides virtual server instances
  - Configure virtual servers
  - Configure storage
  - Manage instances
- Examples:
  - Amazon Web Services





#### What is Cloud: PaaS?

Platform-as-a-service(PaaS)



- Set of APIs, services, and product development tools hosted on the provider's infrastructure.
- Developers create applications on the provider's platform over the Internet
- Examples:
  - Microsoft Azure, GoogleApps, Force.com



#### What is Cloud: SaaS?

Software-as-a-service(SaaS)

- Vendor supplies the hardware and software infrastructure ... whole applications
- Broad market
- Examples:
  - ArcGIS.com, bao.esri.com, Crimemapping.com, Salesforce.com





#### **Customer Experiences and Motivations**



- Dynamic, rapid scalability
- Tends to be for public-facing applications
- Outsourcing IT
- Esri Managed Services

#### **Esri Testing and Experience**

- Scope of Esri Support
- Processor Per-Core Capacity
- Design Challenges:
  - Network (Internet)
    - Bandwidth
    - Availability
    - Latency
  - Data
    - Can it really all be in the cloud?
    - Synchronization
    - Caching
  - Amazon Availability
    - Elastic Load Balancer
    - Availability Zones
- Resources:
  - <u>http://www.esri.com/amazon</u>





## Demonstration

#### ArcGIS Server on Amazon

Hardware Dialog			12 - 17	
Site:		Server Role:		
Amazon East Zone 1		GIS_SVR		
Switch:		Hardware Vendor		
default sw	-	Amazon EC2 👻		
Select Hardware Item		[Cores] [SPEC int rate per Core] Hardwares		
Elastic Block Storage		[2] [7.00] Standard L 4 EC2 (2 x 2		
GIS_SVR		Processor Name:	Processor Spe	
		EC2	2000.00	
		SPEC int rate per Core:	SPEC int rate:	
		7.00	14.00	

# **Quality Attributes**

a.k.a. "Non-Functional" Attributes

## **Server High Availability**



- Provisioning systems to continue to operate in the case of component failure.
- Typical motivations are to avoid the loss of revenue (e.g. ecommerce), the loss productivity (e.g. idle workforce), or a mission-critical function (e.g. 911 service).



#### **HA Objectives**



Downtime: Planned and Unplanned

Hours of Operations •Standard Business Hours •24x7x365

- 37 days = 90% uptime
- 18 days = 95% uptime
- 7 days = 98% uptime
- 4 days = 99% uptime
- 1 day = 99.9% (aka "three nines") uptime
- 1 hour = 99.99% (aka "four nines") uptime

## **Redundancy Strategies**



#### **ArcGIS Server HA Techniques**





"Bow-tie"

## HA with Hardware Virtualization



#### State of Knowledge

- Esri's Testing and Experience
  - Scope of Esri Support
  - Multi-faceted Solutions
- Customer Experiences and Patterns
  - Broad and Deep Range
  - Data tier: Active-Passive
  - Services tiers: Active-Active or Active-Passive
  - Managing complexity





#### **Server High Availability**



- Resources:
  - <u>http://proceedings.esri.com/library/userconf/devsummit1</u>
     <u>0/tech/tech\_12.html</u>
  - <u>http://www.esri.com/systemsint/kbase/docs/stratus-</u> server-testing.pdf
  - <u>http://www.esri.com/library/whitepapers/pdfs/arcgis-</u> server-high-capacity.pdf



## Demonstration

#### ArcGIS Server High Availability



#### **Securing Public Access to ArcGIS Server**

- Providing solutions with appropriate access and reliability to the public without compromising internal systems.
- Many motivations including ecommerce, protecting private data, limiting public access, and/or protecting internal systems.



#### **Reverse Proxy or DMZ placement**







#### State of Knowledge with Esri Technology



- Esri's Testing and Experience
  - Scope of Esri Support
- Customer Experiences and Patterns
  - Reverse-Proxy Solutions
  - Separation of Concerns & DMZ
  - Token or Custom Authentication w/ HTTPS

#### **Securing Public Access to ArcGIS Server**

- Resources:
  - <u>http://resources.arcgis.com/content/enterprisegis/10.0/</u> <u>security</u>
  - <u>http://proceedings.esri.com/library/userconf/devsummit</u> <u>10/tech/tech\_45.html</u>
  - <u>http://www.esri.com/library/whitepapers/pdfs/arcgis-</u> security.pdf
  - <u>http://help.arcgis.com/en/arcgisserver/10.0/help/arcgis</u> <u>\_server\_dotnet\_help/index.html#/Ways\_to\_implement</u> <u>security\_in\_ArcGIS\_Server/0093000000p6000000/</u>

#### Scalability



- Systems that perform at low throughputs and high throughputs
- Systems that have balanced resource allocation



### **Processor Bound**



 Most well configured and tuned GIS systems are processor-bound in terms of performance and scalability.



#### State of Knowledge with Esri Technology



- Esri's Testing and Experience
  - Product Team Tests
  - Esri Enterprise Testing Benchmarks
  - Many white papers and reference implementations

http://resources.arcgis.com/gallery/file/enterprise-gis



## Demonstration

**Balanced Hardware and Network** 



- - -

#### **Enhancing Desktop Deployment -- Infrastructure**

- App/Session Virtualization
  - + High Availability
  - + Simplified Administration
  - + Network efficiency / WAN-3D
  - -System admin skill level
  - ~ User Experience

#### **Enhancing Server Deployment -- Infrastructure**

- Hardware Virtualization
  - + High Availability
  - + Disaster Recovery
  - + Right sizing
  - + Staging environment
  - Performance risk

#### **Quality Attributes**

- Vectors
  - High Availability
  - Scalability
  - Security
- Considerations
  - Multi-factor
  - Simplicity -> Success
  - Requires verification testing and monitoring

# Thank you

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