



# Enterprise GIS Architecture Deployment Options

Andrew Sakowicz

# Audience

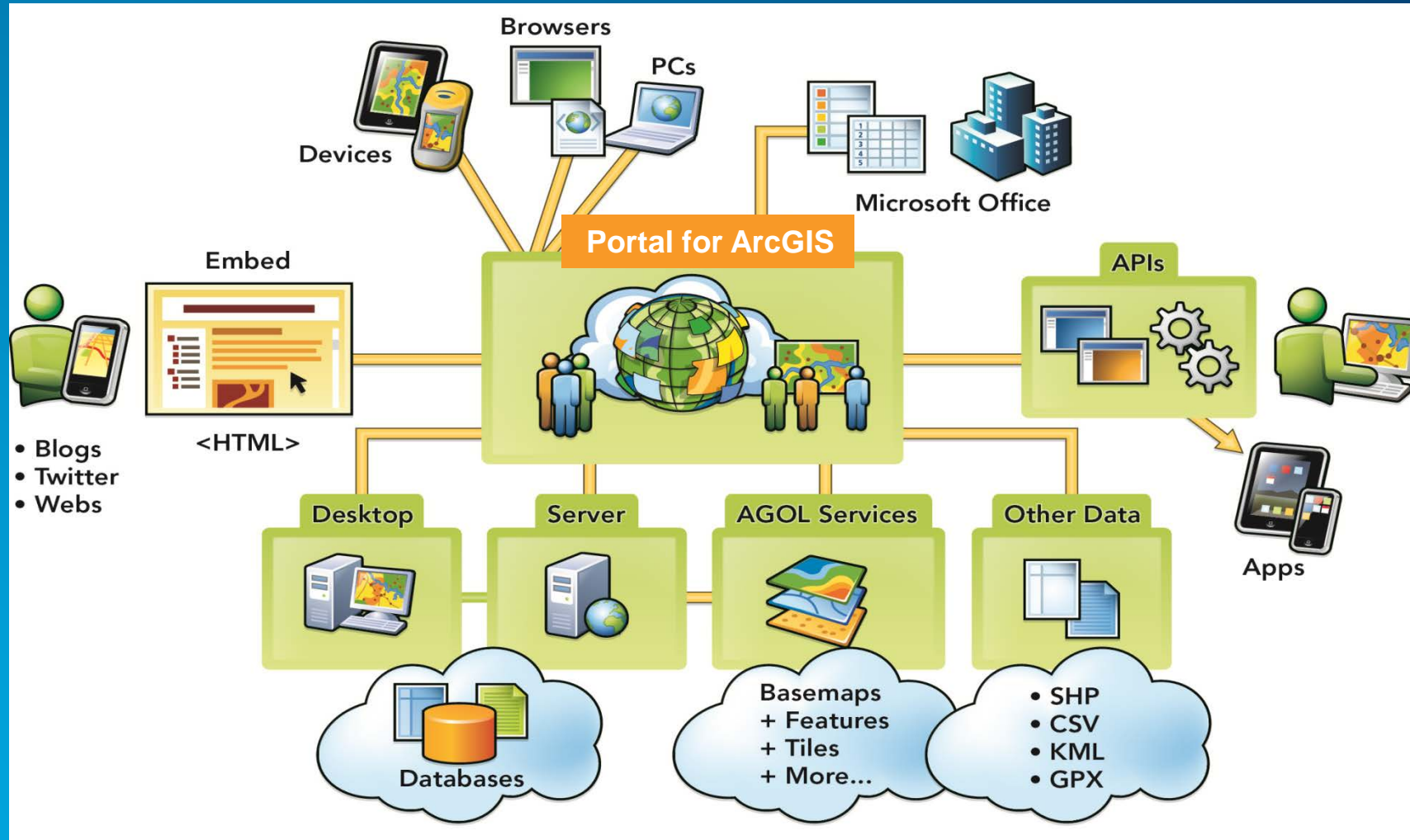
- **Audience**
  - Architects
  - Developers
  - Administrators
  - Project Managers
- **Level:**
  - Beginner / Intermediate

# Introduction

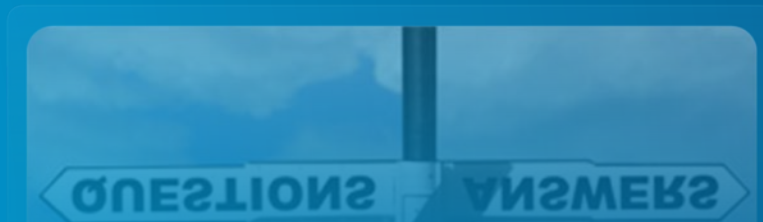
- **Andrew Sakowicz**
  - **Esri Professional Services**
  - [asakowicz@esri.com](mailto:asakowicz@esri.com)

# ArcGIS Platform

# ArcGIS Platform



# Choosing the option that's right for you



# Cloud deployment options

# On-Premises, Online or hybrid



On-premises



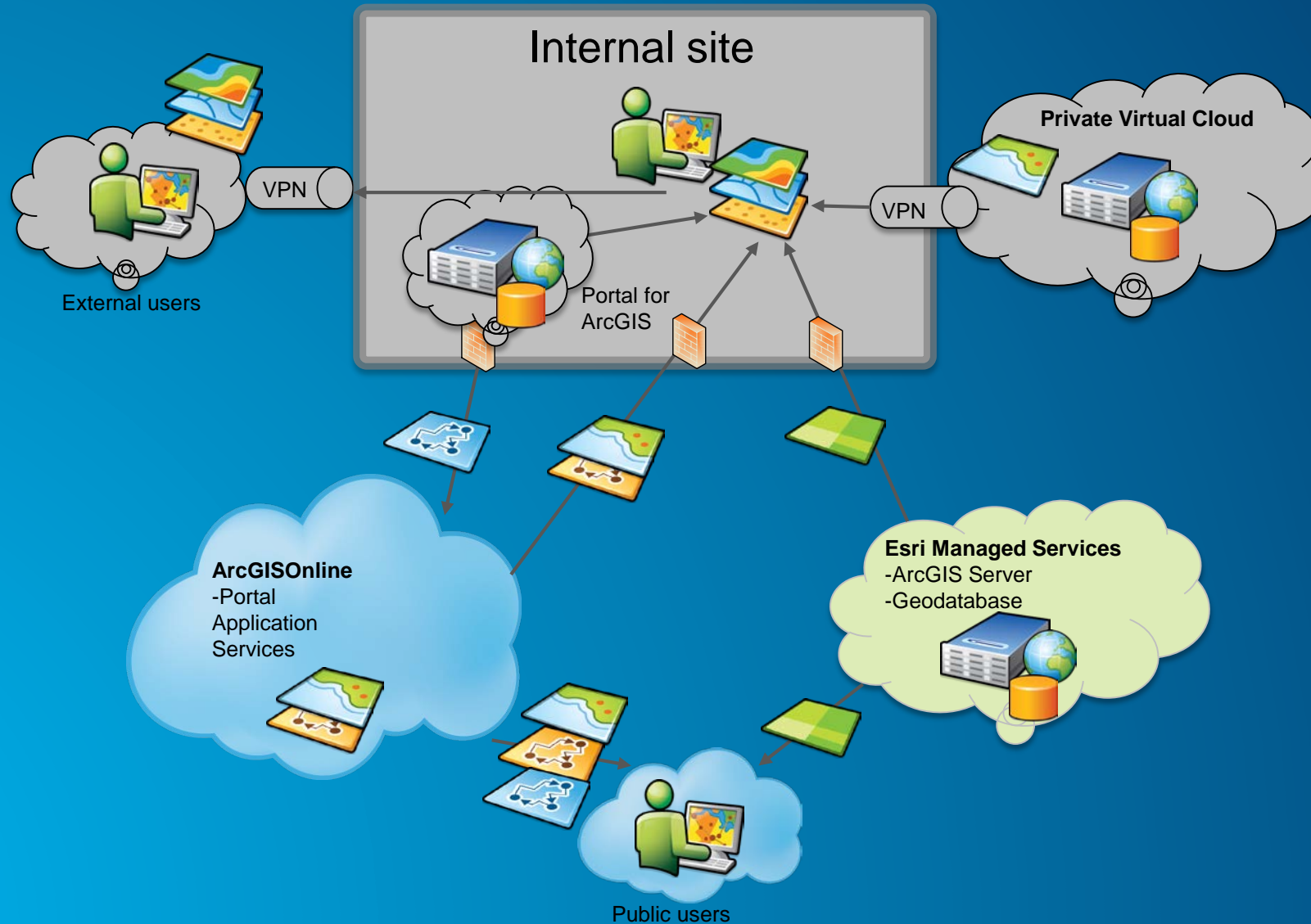
Public Cloud



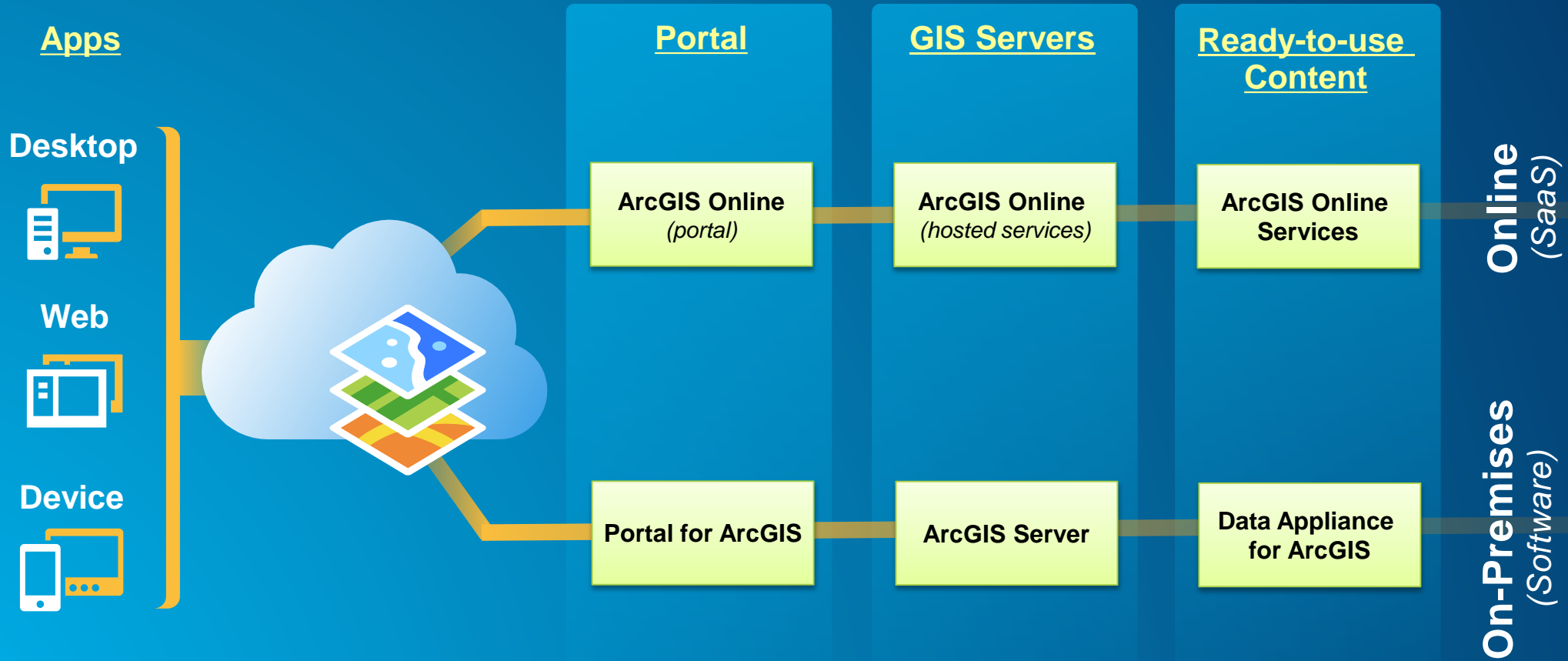
Hybrid



# Cloud deployment options



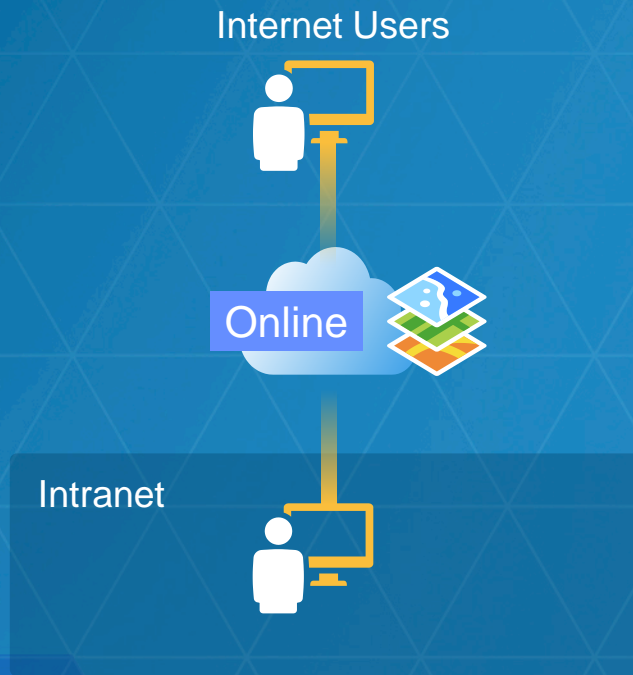
# On-Premises, Online or hybrid



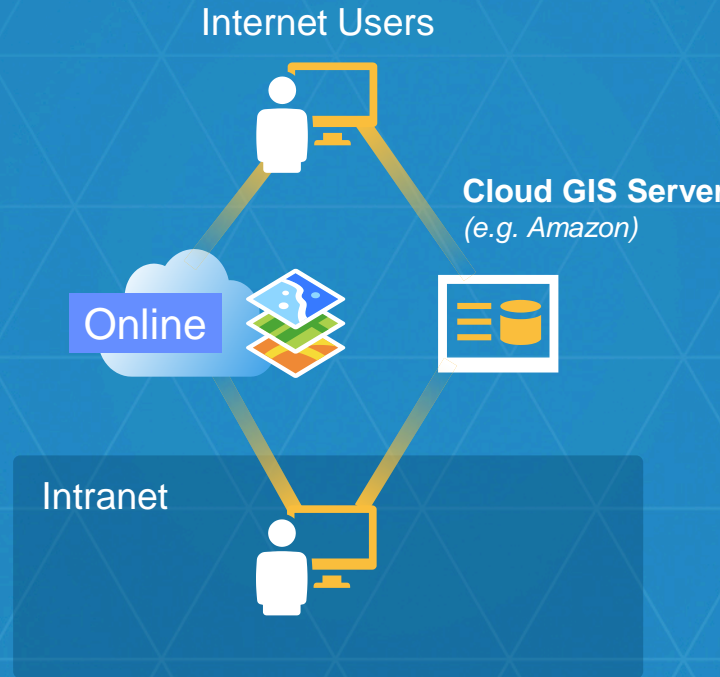
# On-Premises, Online or hybrid

- **Online**
  - **Fast Start & No Additional Software**
  - **Likely Lower TCO**
  - **Some “Metadata” Stored in Cloud**
  - **Limited Functionality**
  
- **On-premises or hybrid**
  - **More Control**
  - **All Data & Metadata On-Premises**
  - **More Security Integration Options**
  - **Additional Software to Manage**
  - **Architecture Becomes More Complex**

# Cloud options



ArcGIS Online



ArcGIS Online  
w/ Cloud GIS Server(s)



ArcGIS Online  
w/ Esri Managed Cloud Svcs

# ArcGIS Online

- Create, share, collaborate
- Subscription-based
  - Named User
  - Credits – pay as you go
- Updates and enhancements occur behind the scenes

ArcGIS FEATURES PLANS GALLERY MAP SCENE HELP Sign In

# ArcGIS

Location Analytics for Supply Chain

Downtown Washington D.C. Shortlist

Washington ParkScore

USGS Historical Topographic Map Explorer

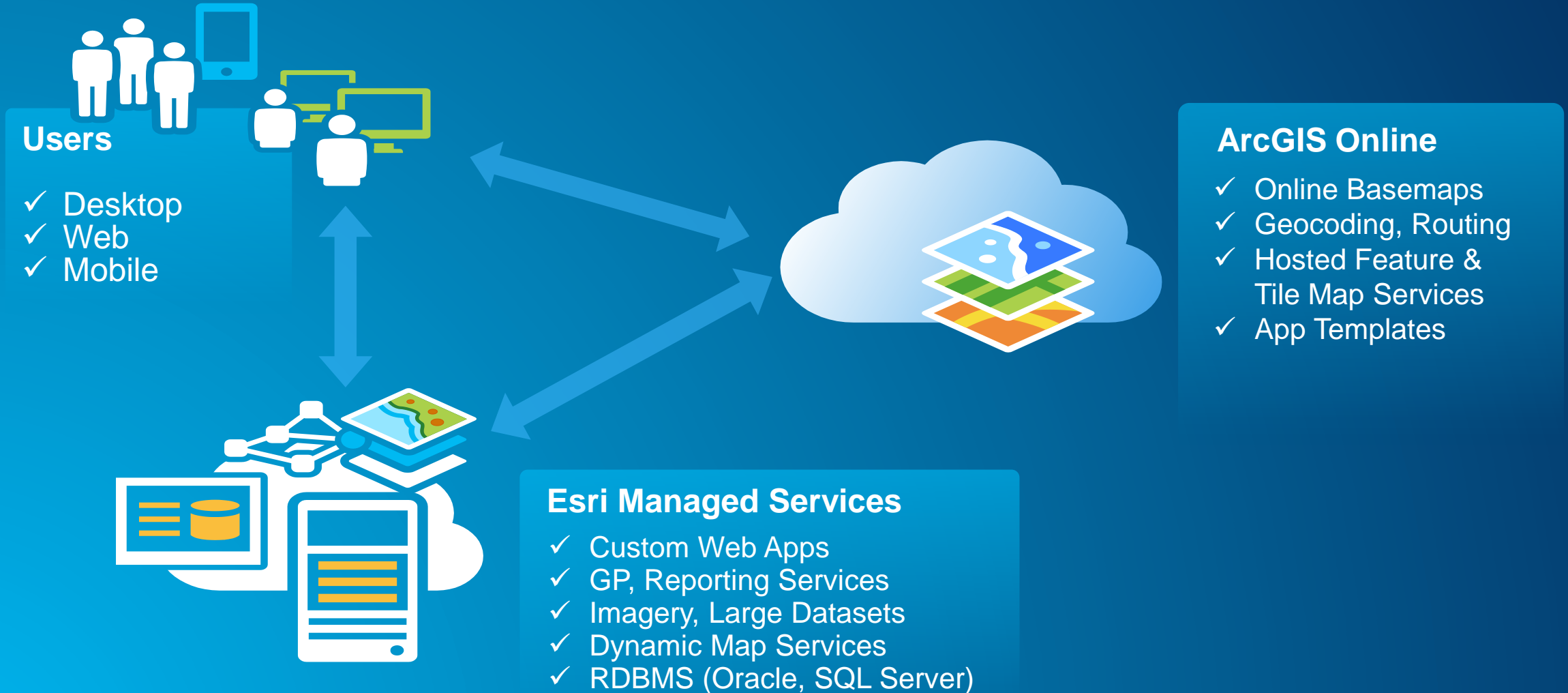
✓ Sign-up now  
Get a free ArcGIS Online account and start making web maps today.

✉ Make a Map  
Create a map that can be viewed in a browser, desktop or mobile device. Share it on a blog, via email, or embed it in a website.

📄 ArcGIS for Developers  
Build custom web and mobile applications that incorporate your maps and data.

▶ Featured Videos  
Watch these short videos to quickly get started making maps and apps.

# ArcGIS Online and Managed Services



*ArcGIS Online front-end, Managed Services back-end*

# Esri Cloud Hosting Options

Provided by ArcGIS Online and Esri Managed Services



## ArcGIS Online

- Web Mapping Platform
- Ready-to-Use Content
- Feature Services
- Tiled Map Services
- Developer API



## ArcGIS Online + Advanced GIS Services thru Managed Services

- ArcGIS Online, plus...
- Imagery Services
- Dynamic Map Services
- Analysis Services
- Custom App Hosting



## Turnkey GIS Hosting with Managed Services

- Full Service Hosting
- System Design
- Backup and Archive
- Data Management
- 24/7 System Monitoring

Self Service

Full Service

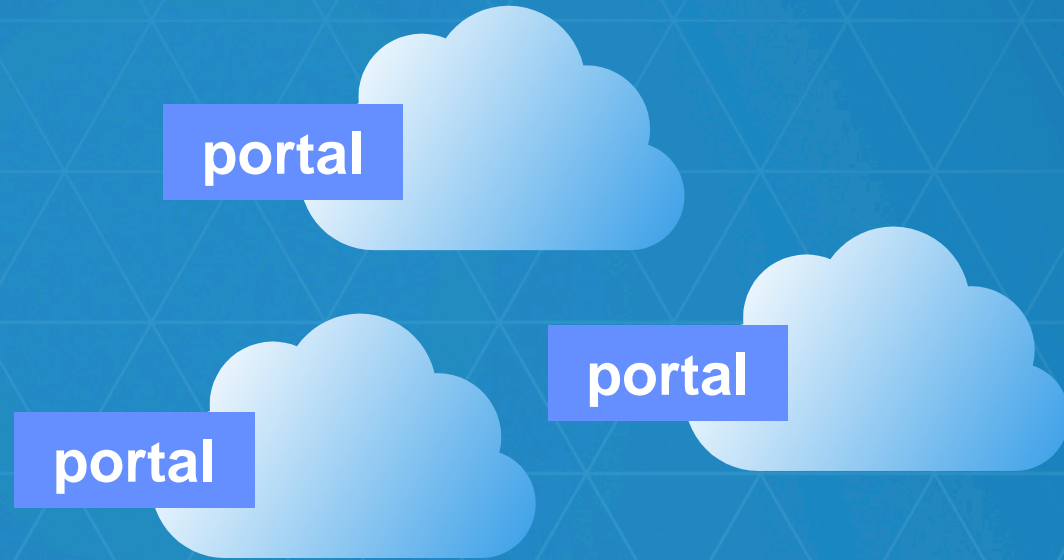
# Portal deployment options



# One or multiple portals



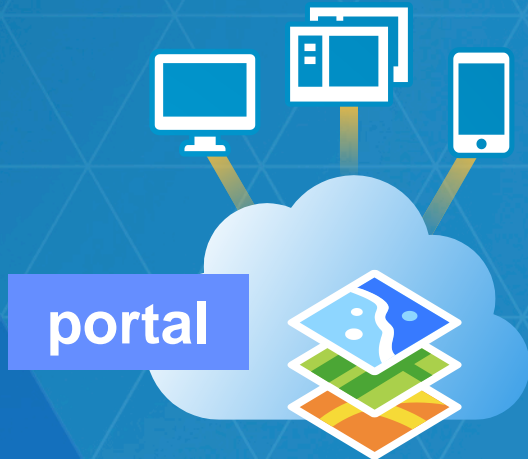
One Portal



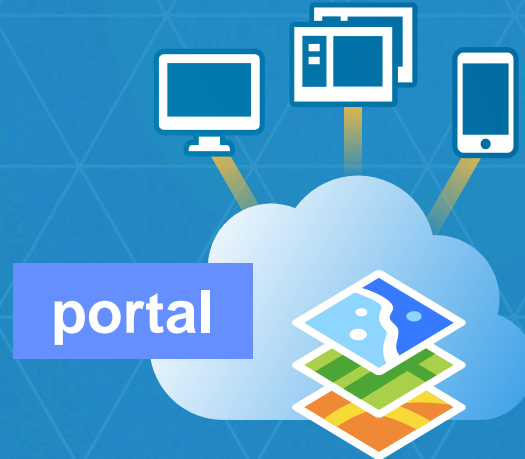
Many Portals?

# Portal deployment options

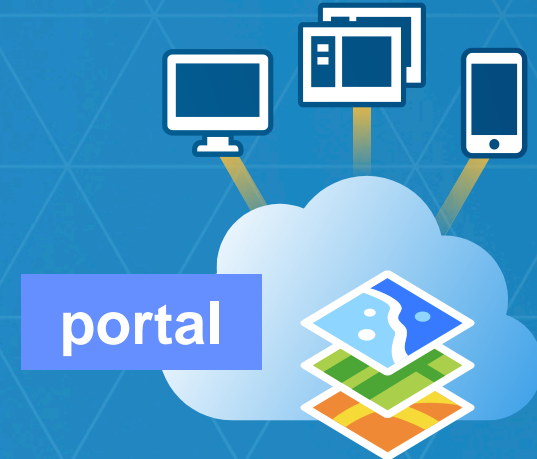
Department A Users



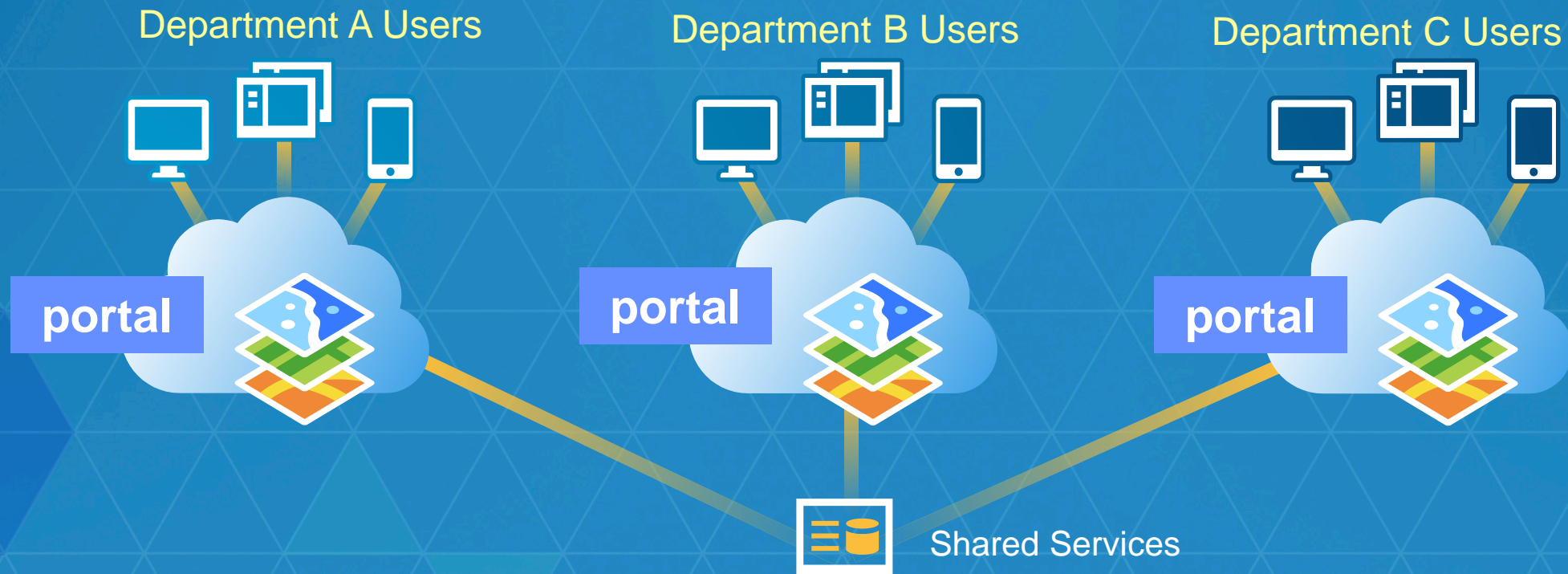
Department B Users



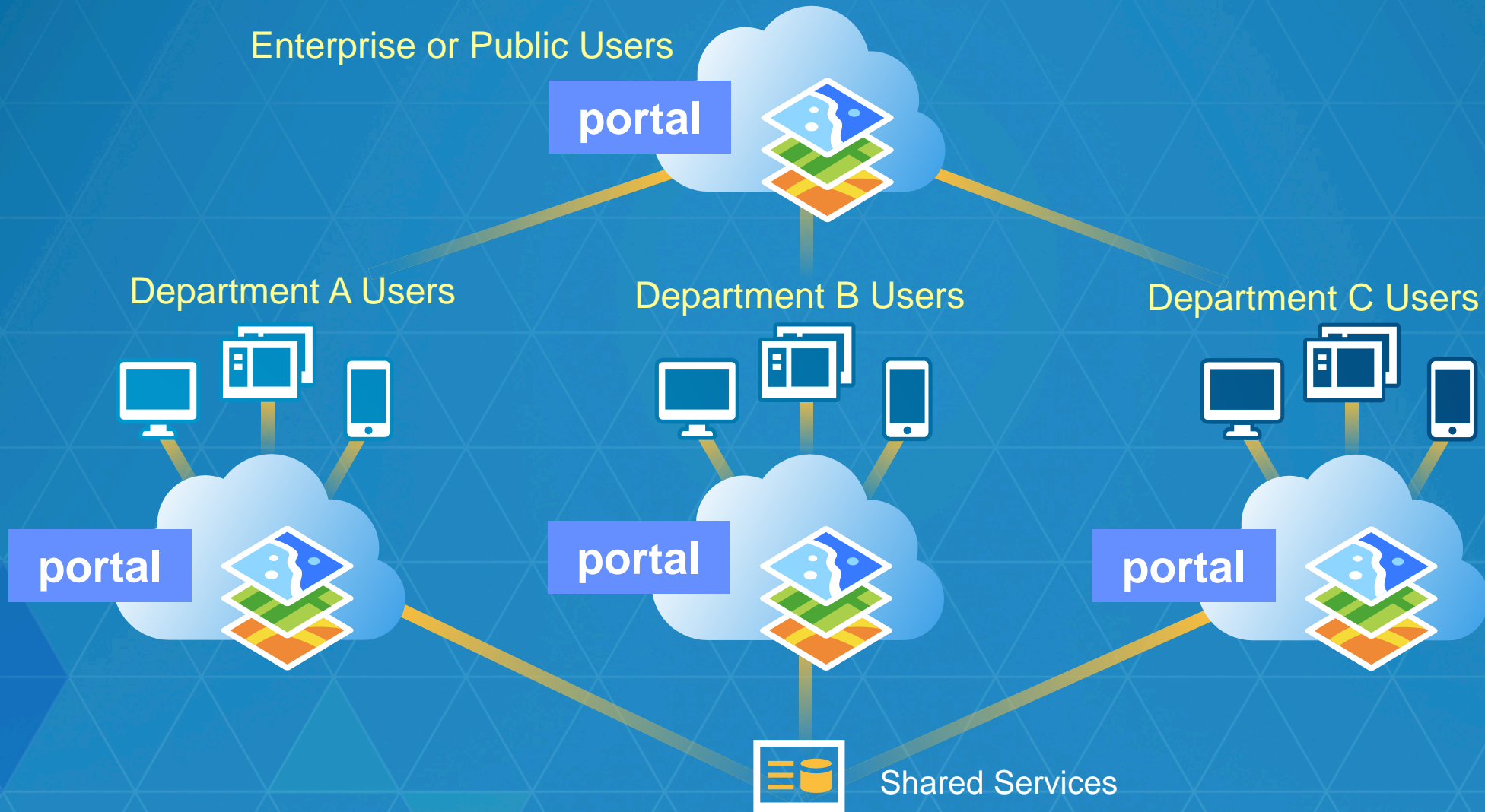
Department C Users



# Portal deployment options

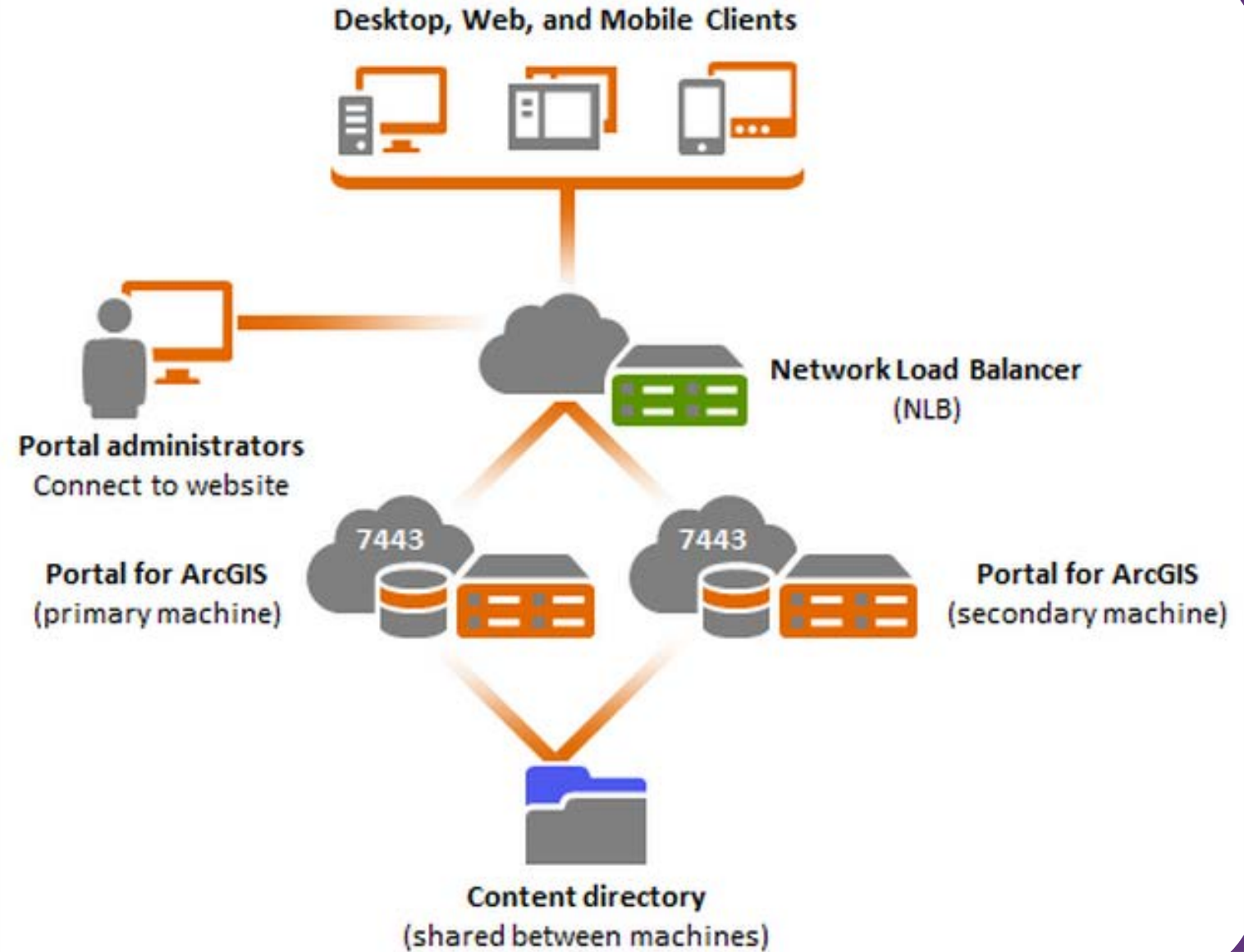


# Portal deployment options



# High Availability

3<sup>rd</sup> party load balancer



(shared between machines)

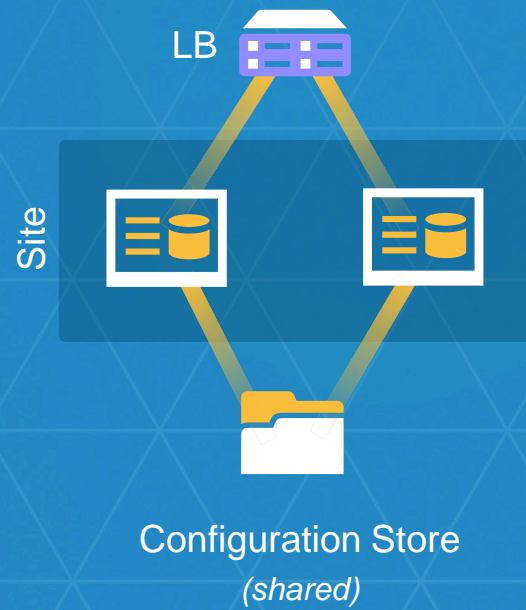
# ArcGIS Server deployment options

# Silos, Sites & Clusters

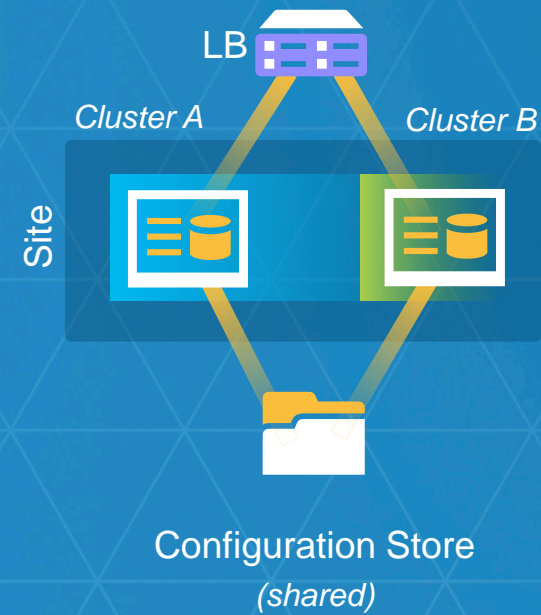
## Silo



## Site



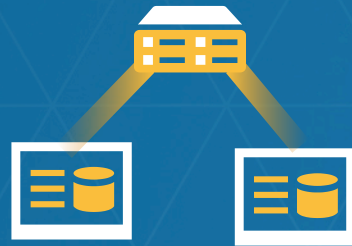
## Clusters



*Use silos or small sites*

# Load Balancing options

## ArcGIS Web Adaptor



- Provided by Esri
- Works w/ ArcGIS Server sites *(not silos)*
- Discovers new machines dynamically
- Can't load balance Portal for ArcGIS

## 3<sup>rd</sup> Party Load Balancer



- Not provided by Esri *(e.g. F5, CSM, NGINX)*
- Works w/ ArcGIS Server sites & silos
- Doesn't discover new machines dynamically
- Typically already fault tolerant
- Can load balance Portal for ArcGIS



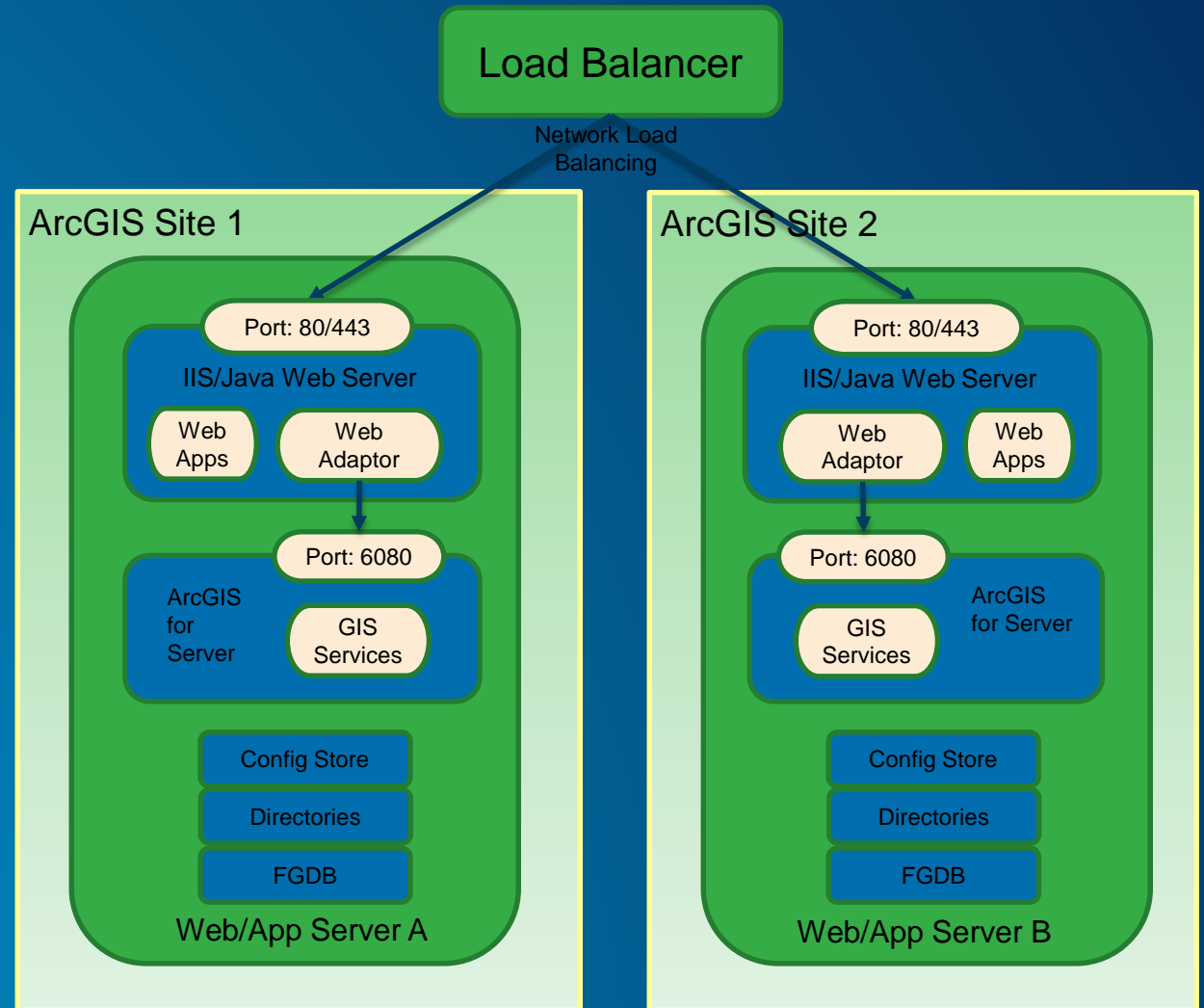
# Load Balancing

## Recommendations

- **Use a third party load balancer, if**
  - You have hardware load balancer and support
  - Using silos
  - Windows authentication not required
- **Use the ArcGIS Web Adaptor**
  - You don't have available hardware load balancer
  - if web-tier authentication is required

# Silo with Web Adapter

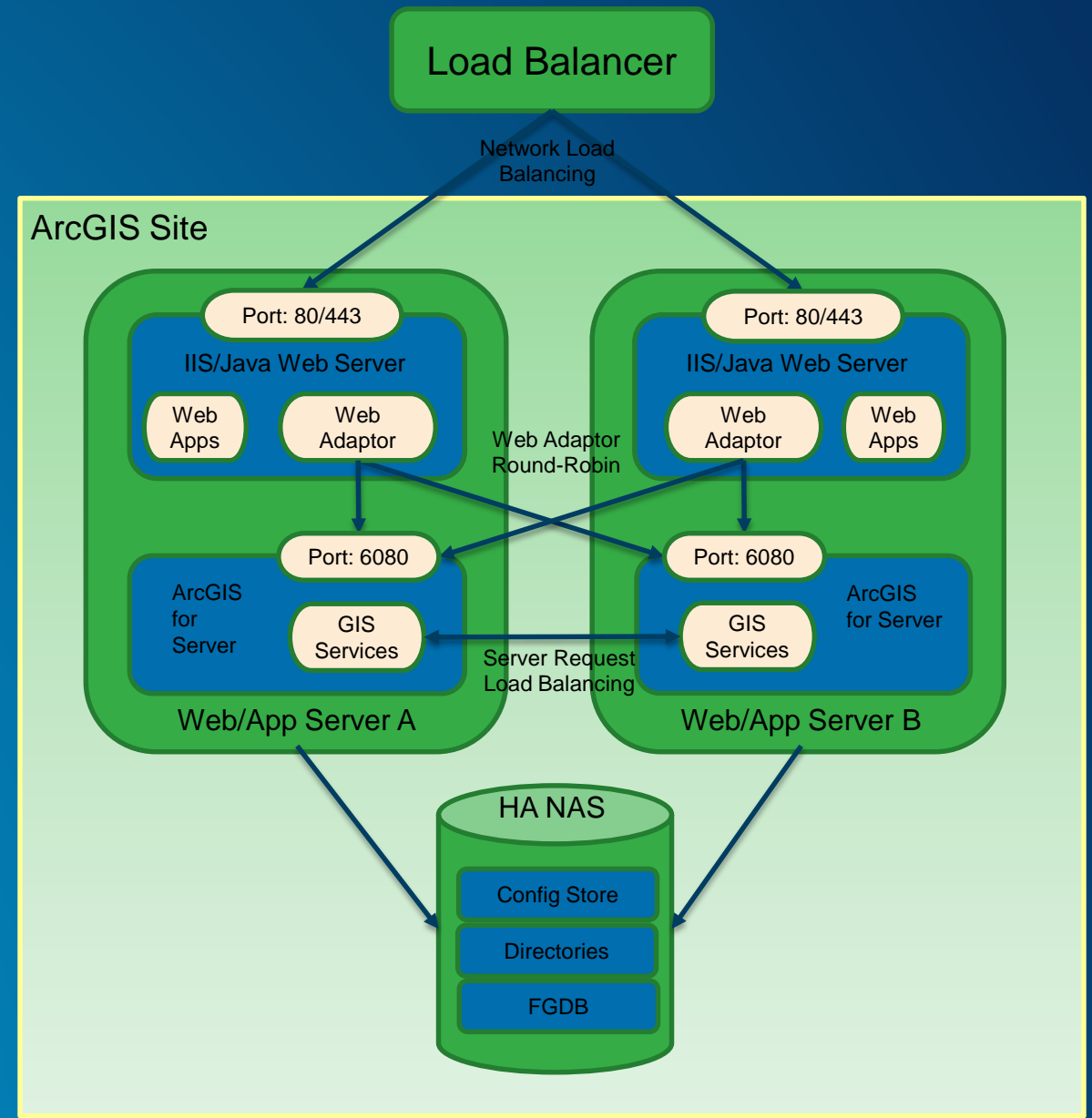
- High stability
- Easy horizontal scalability
- Duplicate publication of Web services
- Duplicate Configuration Store,
  - Directories, and Data
- Web services exposed via port 80/443
- Supports Windows Authentication



# Single-Site

Web Adapter on a the same tier

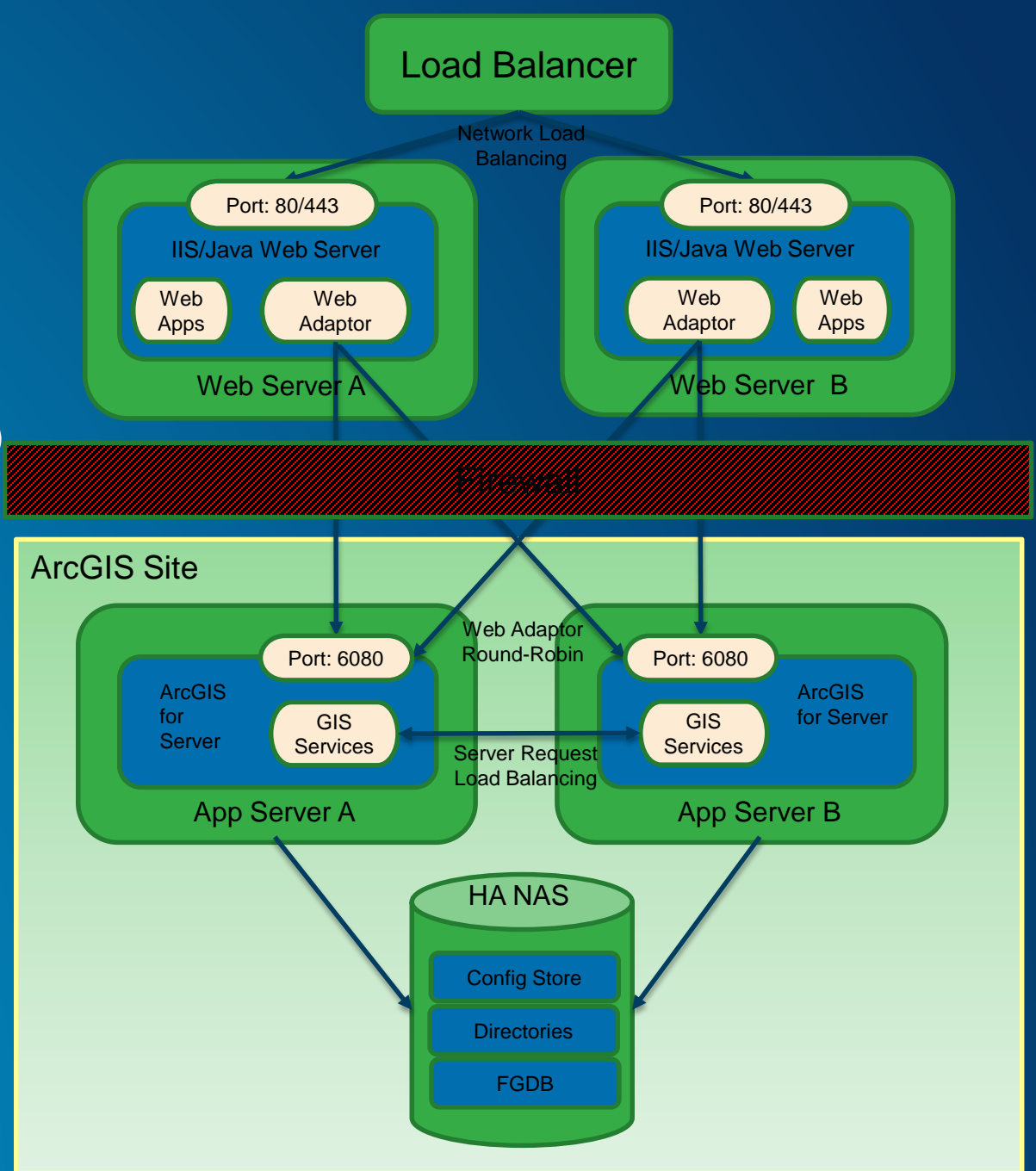
- Web applications deployed with server
- Single publication of Web services
- Requires fault Tolerant/HA NAS
- Web services exposed via port 80/443
- Supports Windows Authentication



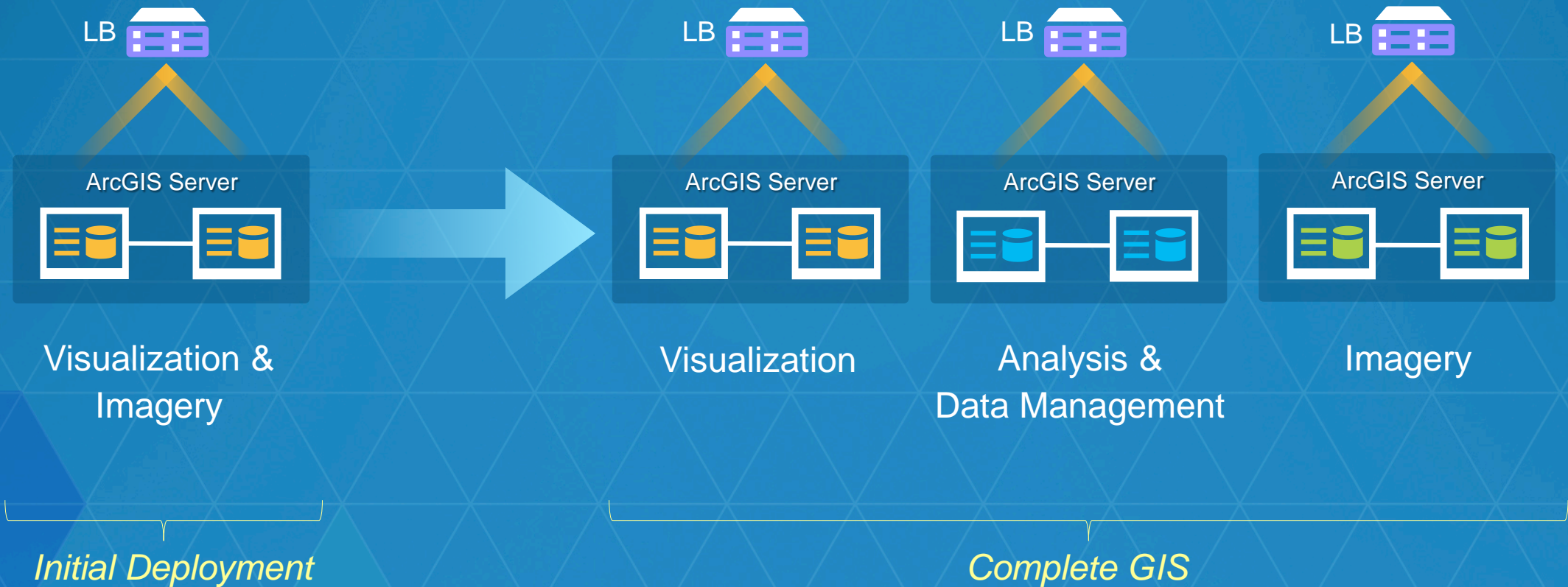
# Single-Site

Web Adapter on a separate tier

- Two-Tier
- Supports “tiered” standards (e.g., FISMA)
- Utilizes Web Adaptor as a proxy
  - (DMZ configurations)



# Workload Separation



# Site design consideration

Multi-node, high number of services

- **Ensure require infrastructure resources**
  - **Network stability**
  - **NAS stability for ArcGIS Server and Portal config stores**
  - **RAM**
  - **CPU**
- **Avoid during the working hrs:**
  - **Publishing high number services**
  - **Adding/removing nodes**
- **Distribute recycle times**

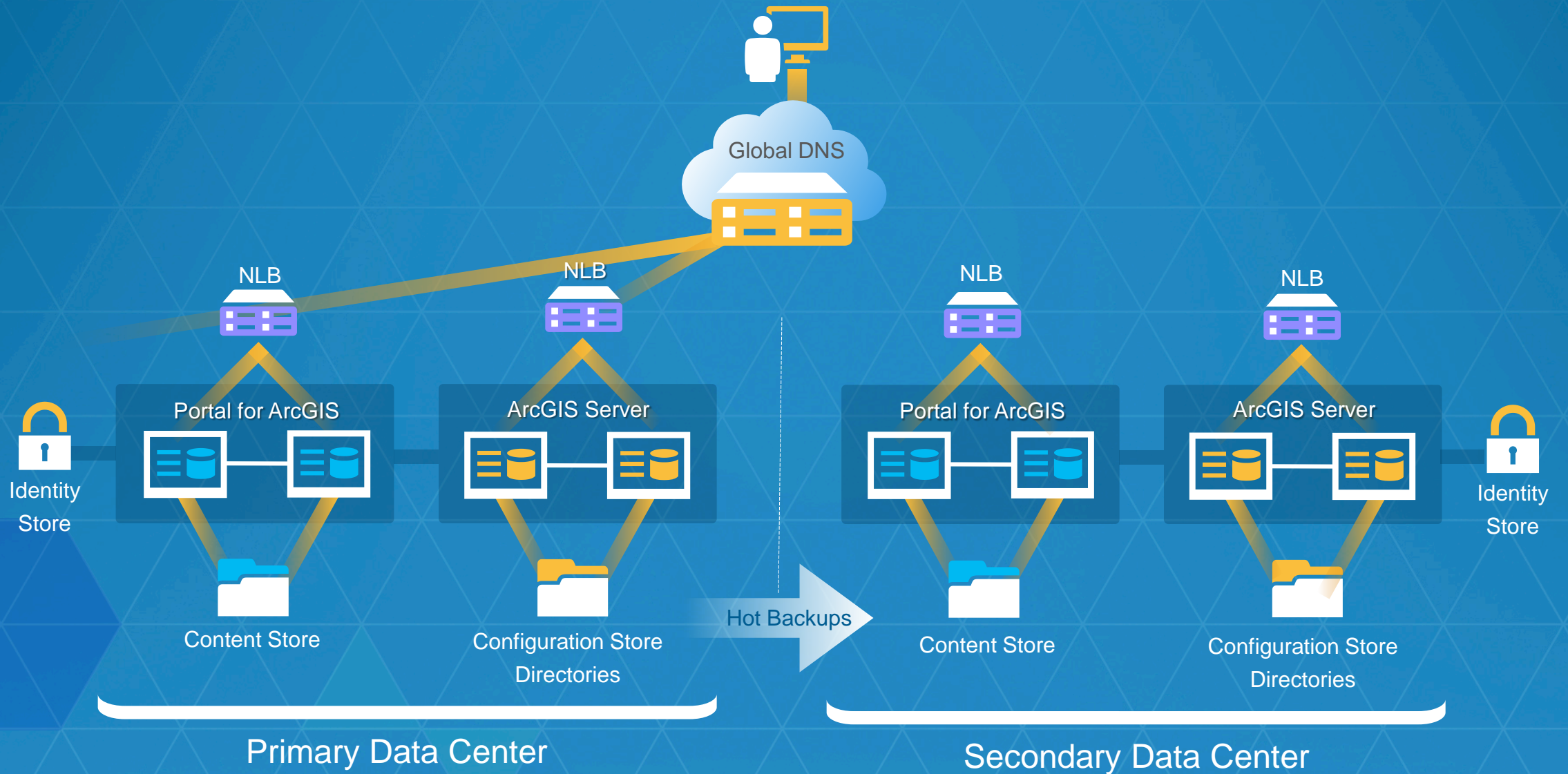
## Site management consideration

- **Identify unused services and reduce min (to 0 if possible)**
- **Tune slow services**
- **Provide best practices to the publishers**
- **Monitor resources:**
  - **RAM and committed memory**
  - **CPU**
  - **Network latency**

# Disaster Recovery options



# Disaster recovery



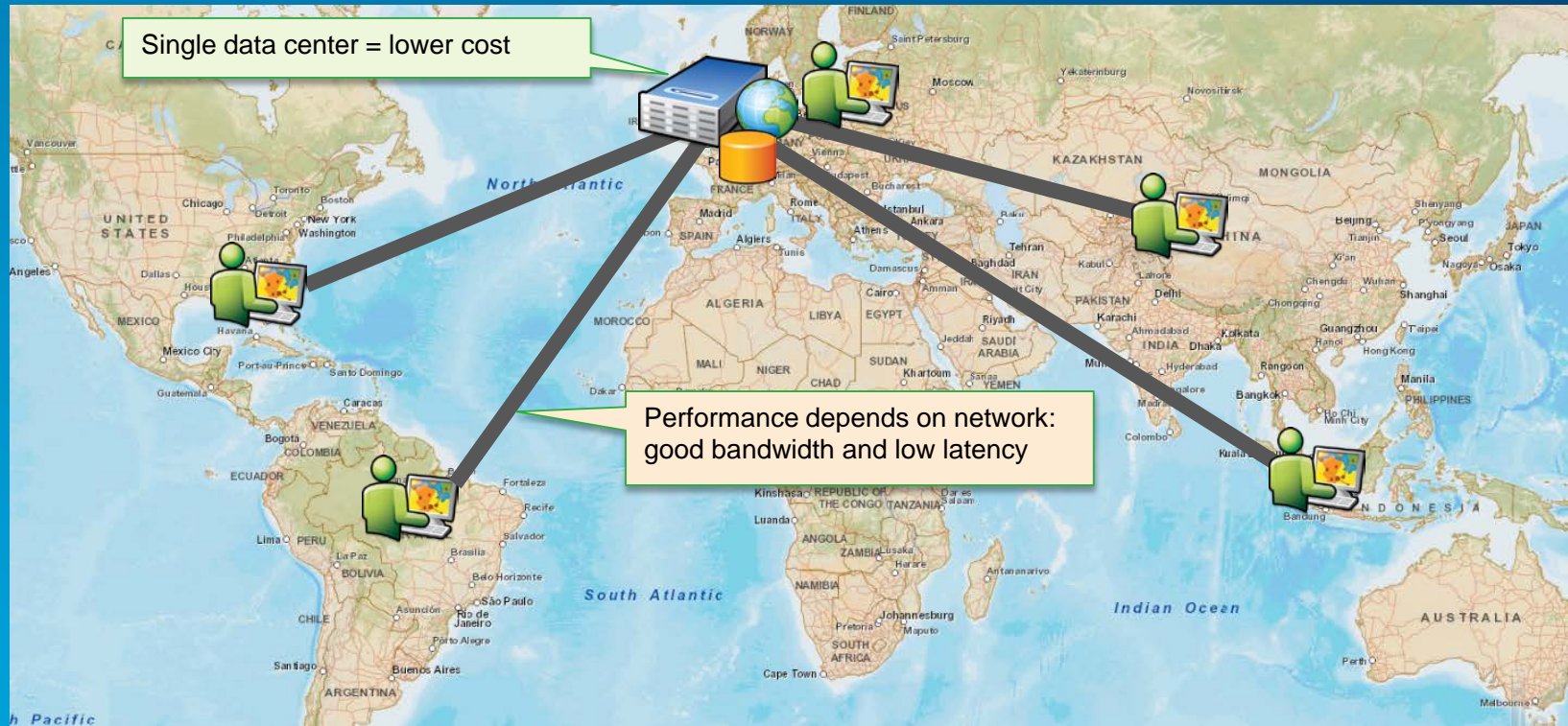
## Disaster recover and high availability

- Availability is a spectrum
- High availability & disaster recovery are not the same
- High availability & disaster recovery is not trivial to implement
- See related session:
  - ***Building your Server for High Availability and Disaster Recovery***
  - **Thursday, 23 Jul 2015, 3:15pm - 4:30pm**
  - **Location: Room 05 B**

# Data management options

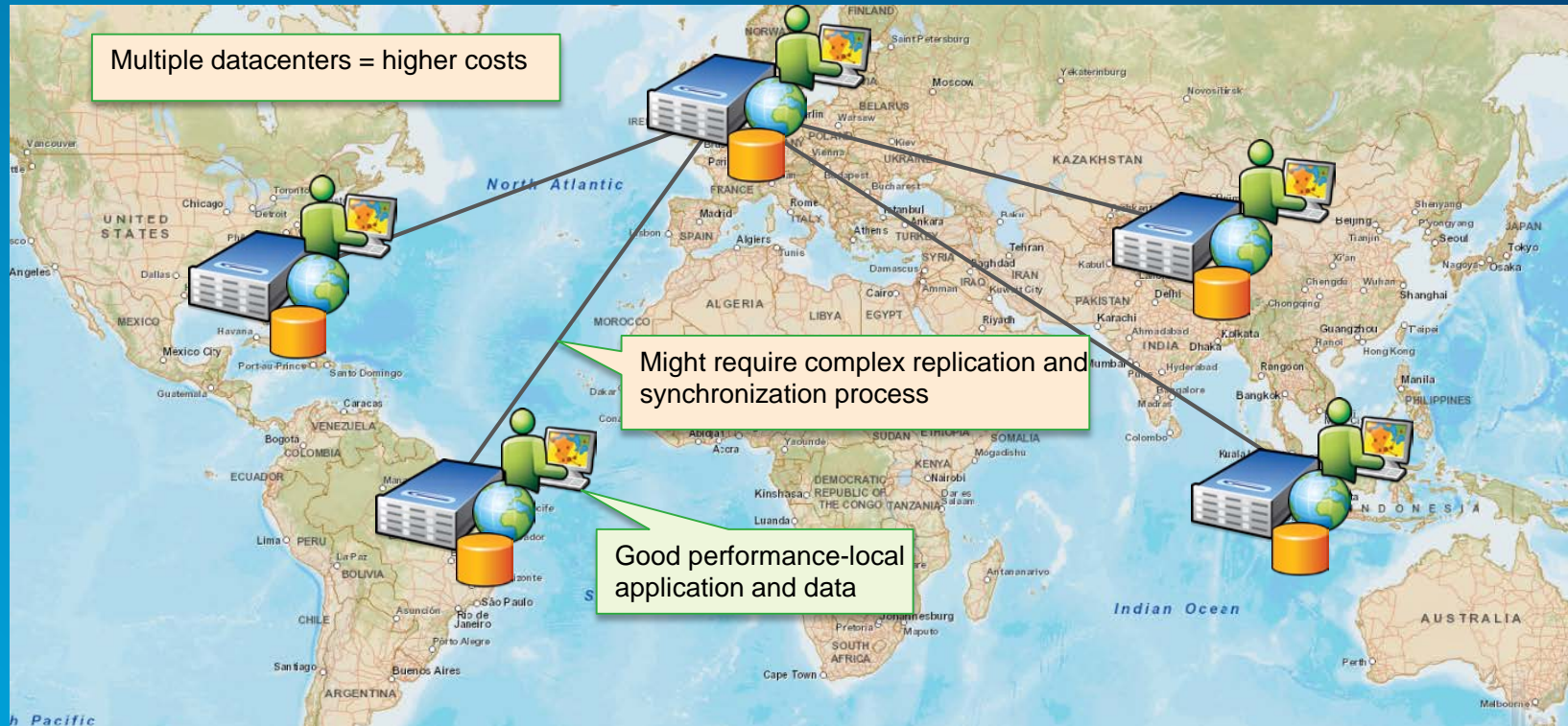
# Data management strategy

## Centralized



# Data management strategy

## Distributed



# Data management strategy

- **Geodatabase export / import**
- **RDBMS export / import**
- **RDBMS replication**
- **ETL Tools (e.g. FME, Informatica)**
- **Geodatabase replication**

# Network Test

## Bandwidth and transport time

- Mbps - Bandwidth
- Mbits / req - Response size
- TH - Throughput (req/hr)

$$Mbps = \frac{TH \times Mbits / req}{3600}$$

$$Transport(sec) = \frac{Mbits / req}{Mbps - Mbps_{used}}$$

*No need to calculate it manually, System Designer Tool does it for you:*

# Performance Factors

## Network transport time

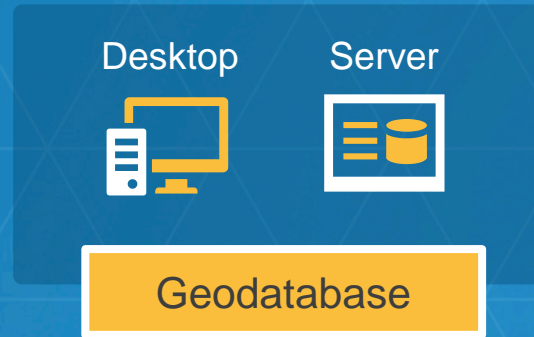
- **Impact of service and return type on network transport time**
  - **Compression**
  - **Content, e.g., Vector vs. Raster**
  - **Return type, e.g., JPEG vs. PNG**

					Network Traffic Transport Time (sec)					
					56 kbps	1.54 Mbps	10 Mbps	45 Mbps	100 Mbps	1 Gbps
Application Type	Service/Op	Content	Return Type	Mb/Tr	0.056	1.540	10.000	45.000	100.000	1000.000
ArcGIS Desktop	Map	Vector		10	178.571	6.494	1.000	0.222	0.100	0.010
Citrix/ArcGIS	Map	Vectror+Image	ICA Comp	1	17.857	0.649	0.100	0.022	0.010	0.001
Citrix/ArcGIS	Map	Vector	ICA Comp	0.3	5.357	0.195	0.030	0.007	0.003	0.000
ArcGIS Server	Map	Vector	PNG	1.5	26.786	0.974	0.150	0.033	0.015	0.002
ArcGIS Server	Image		JPG	0.3	5.357	0.195	0.030	0.007	0.003	0.000
ArcGIS Server	Map Cache	Vector	PNG	0.1	1.786	0.065	0.010	0.002	0.001	0.000
ArcGIS Server	Map Cache	Vector+Image	JPG	0.3	5.357	0.195	0.030	0.007	0.003	0.000



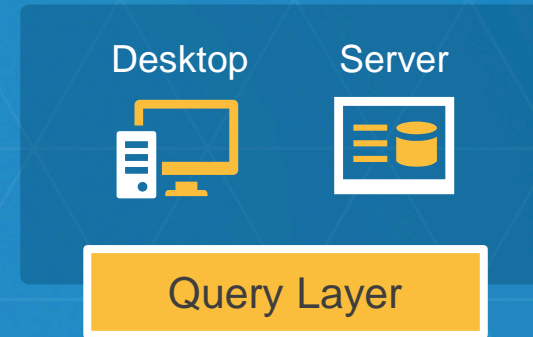
# Data management strategy

Full GIS Capabilities  
Read / Write



Geodatabase  
*File*  
*Personal*  
*Enterprise*

Limited GIS Capabilities  
Read Only

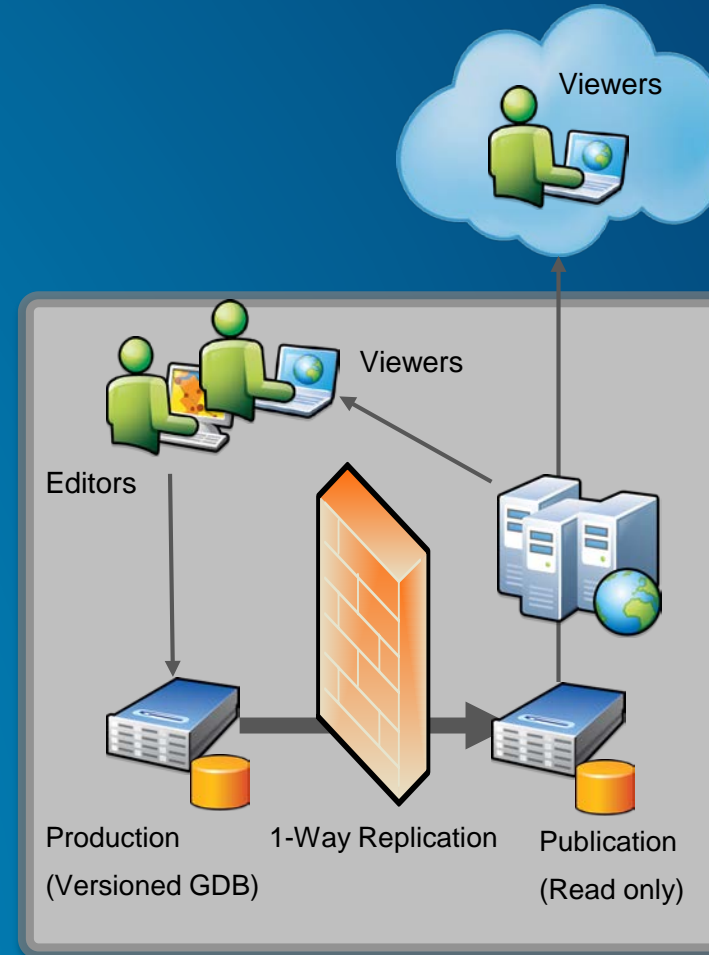


RDBMS or Data Warehouse  
*Oracle, SQL Server, etc.*  
*Netezza, Teradata, Hana, etc.*

# Data management strategy

Production and Publication (external access)

- **Pros:**
  - Better security
  - Improved performance
  - Additional capacity
- **Cons:**
  - Requires replication
  - Additional hardware

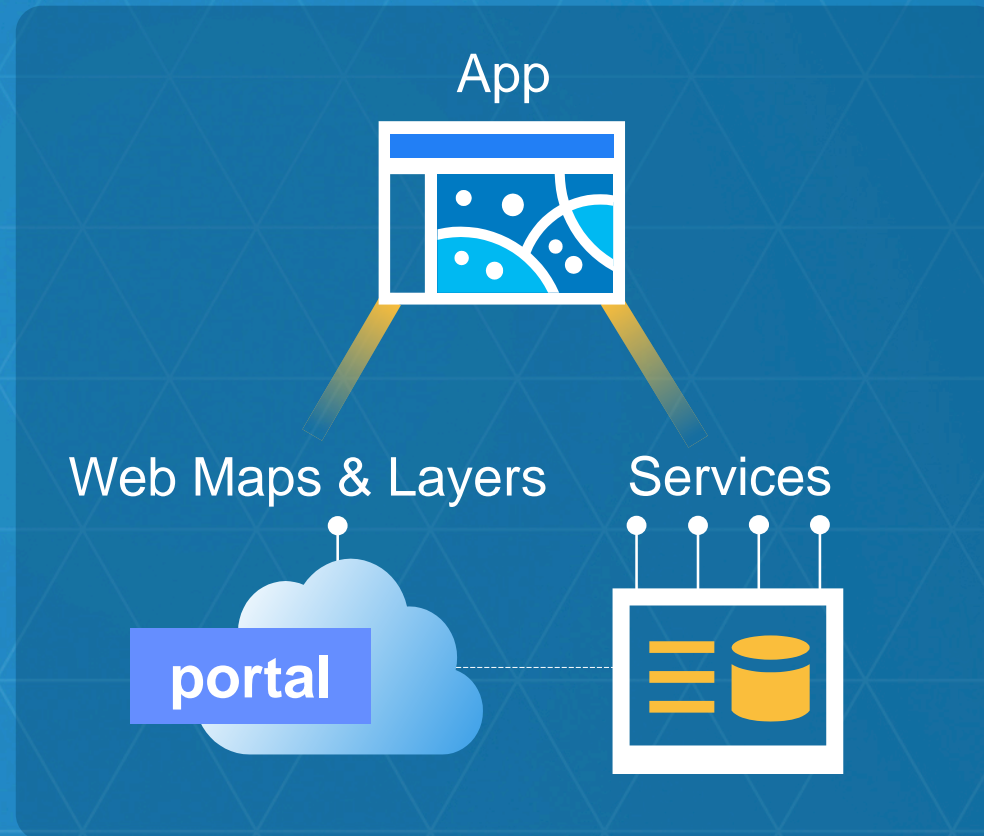


# Publication options

## Server Pattern

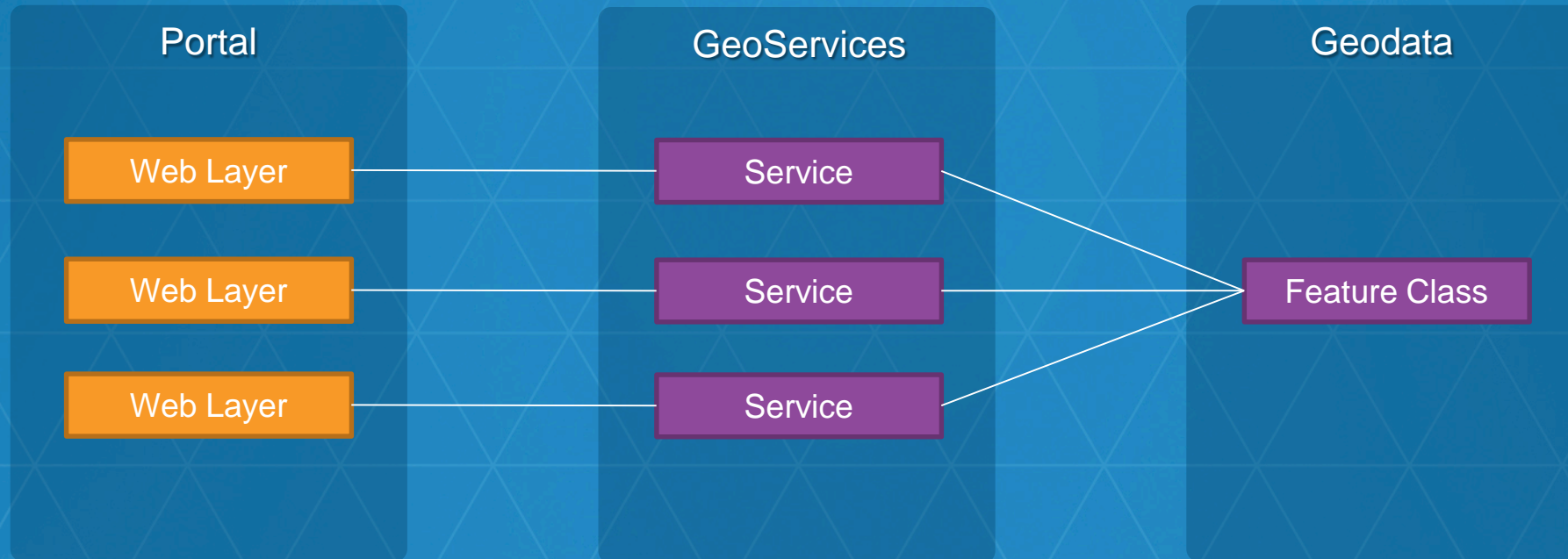


## Web GIS Pattern



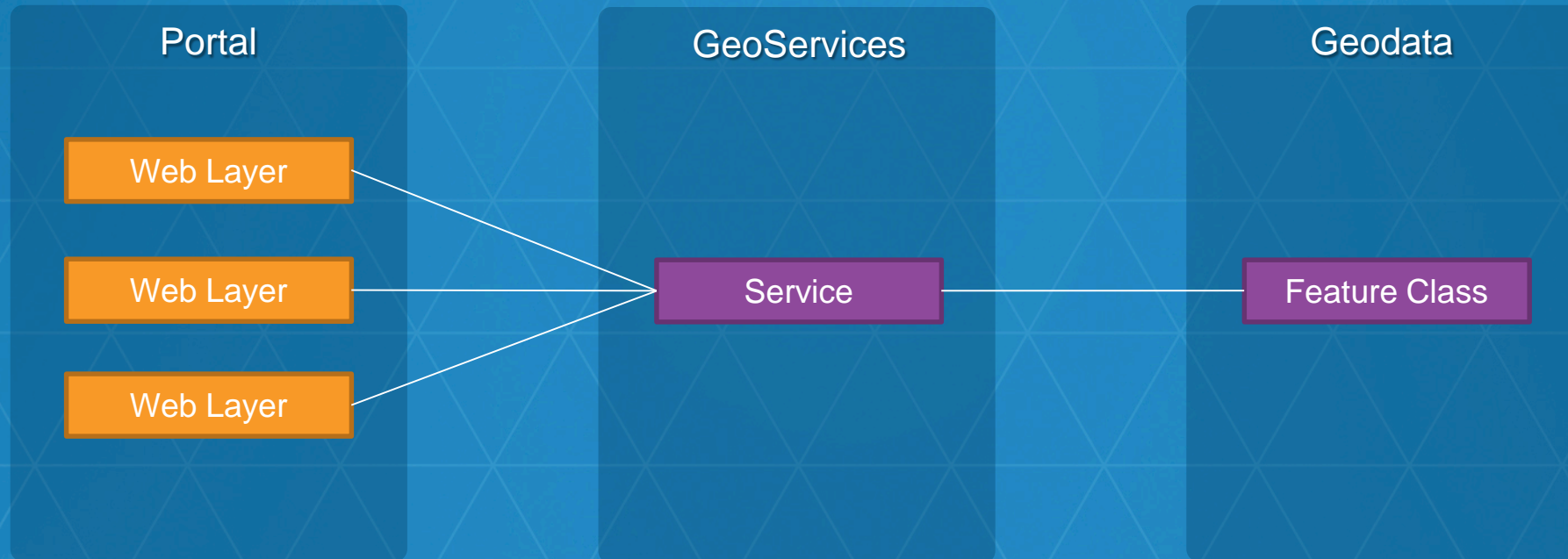
# Publication Strategies

## The Role of Portal & Web Layers



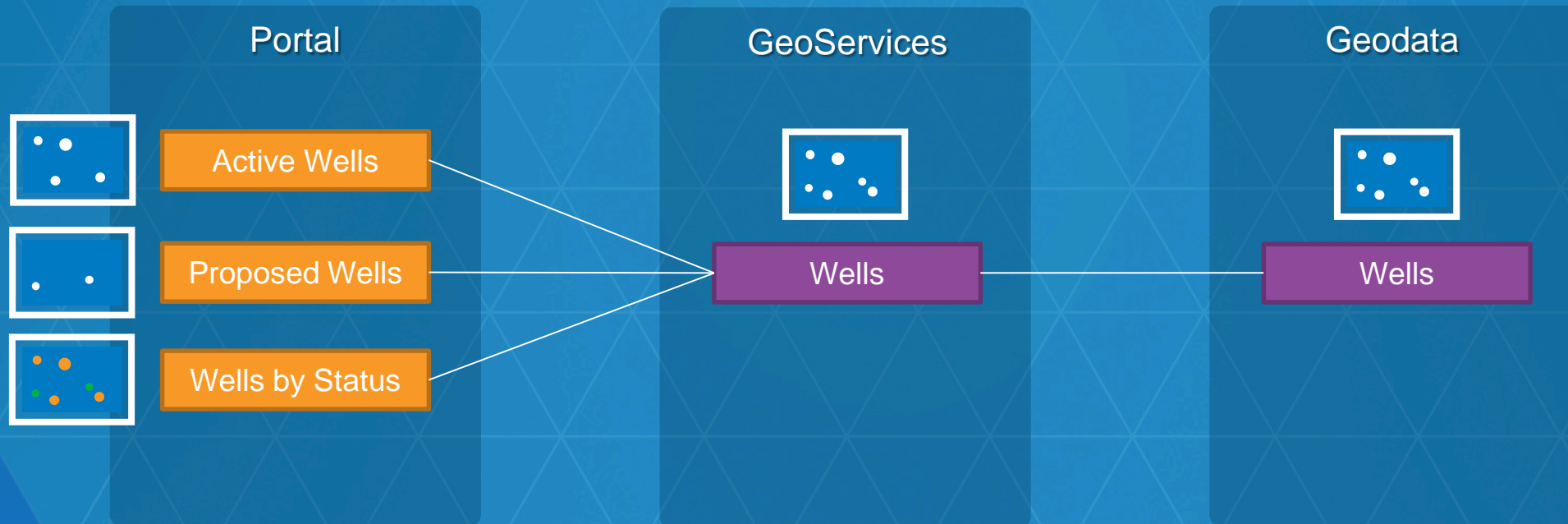
# Publication Strategies

## The Role of Portal & Web Layers



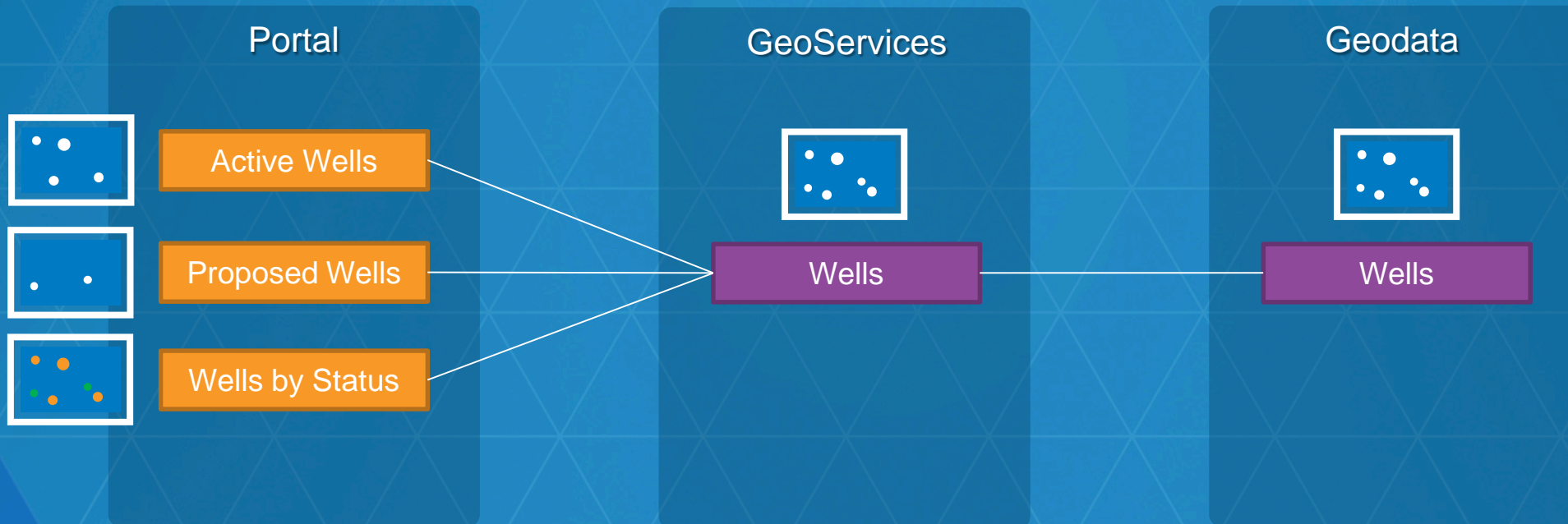
# Publication Strategies

## The Role of Portal & Web Layers



# Publication Strategies

## The Role of Portal & Web Layers

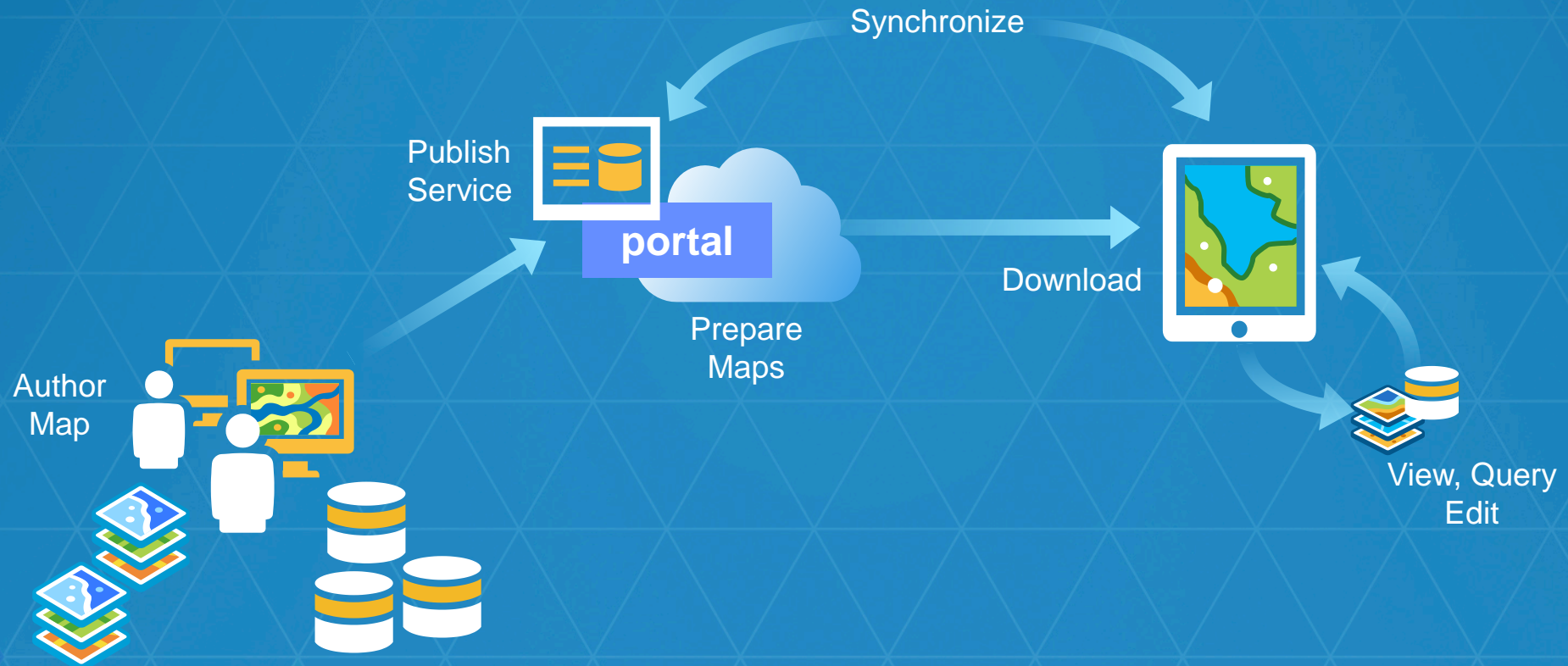




# Mobile deployment options

# Mobile GIS Deployment

Offline w/ Services Pattern

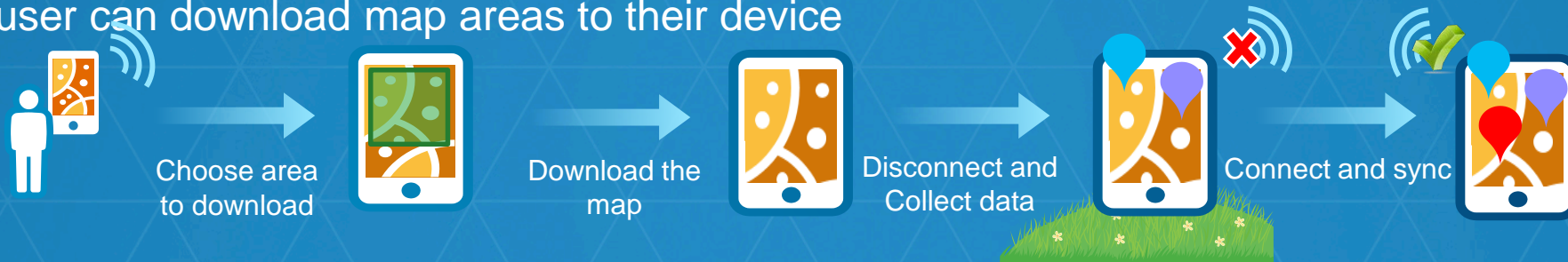


# Mobile GIS Deployment

## Offline w/ Services Pattern

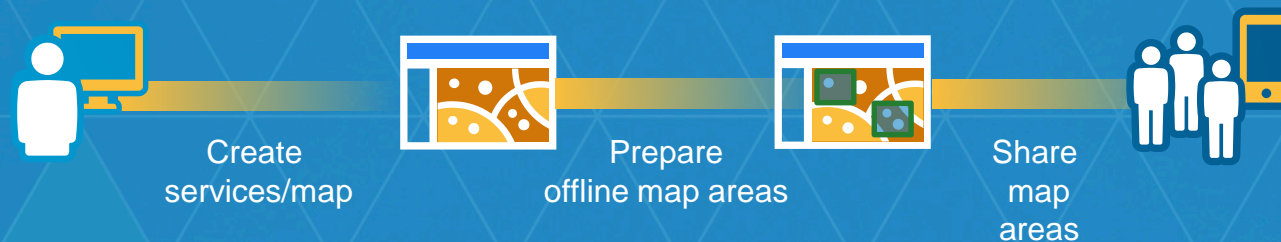
### Today

Collector user can download map areas to their device



### Future

Field managers can improve field workflows by preparing maps for Collectors



# Desktop deployment options

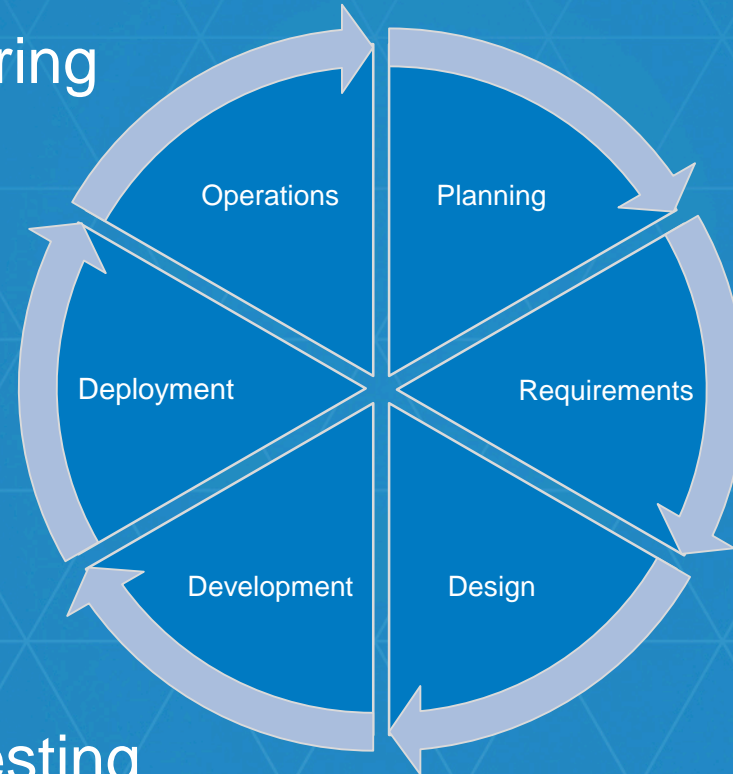
# Desktop GIS Deployment



# System Management options

# System Management

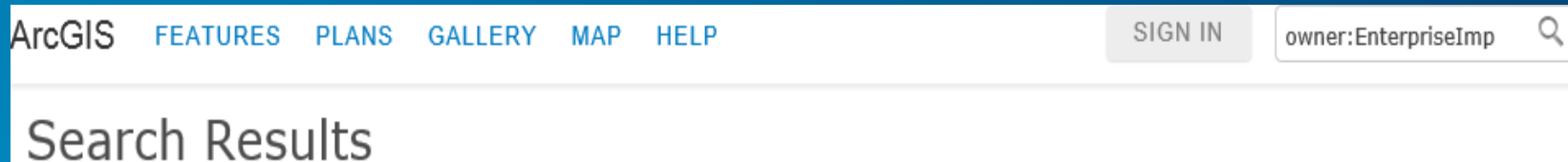
System Monitoring



System Design

System Testing

# System Tools overview



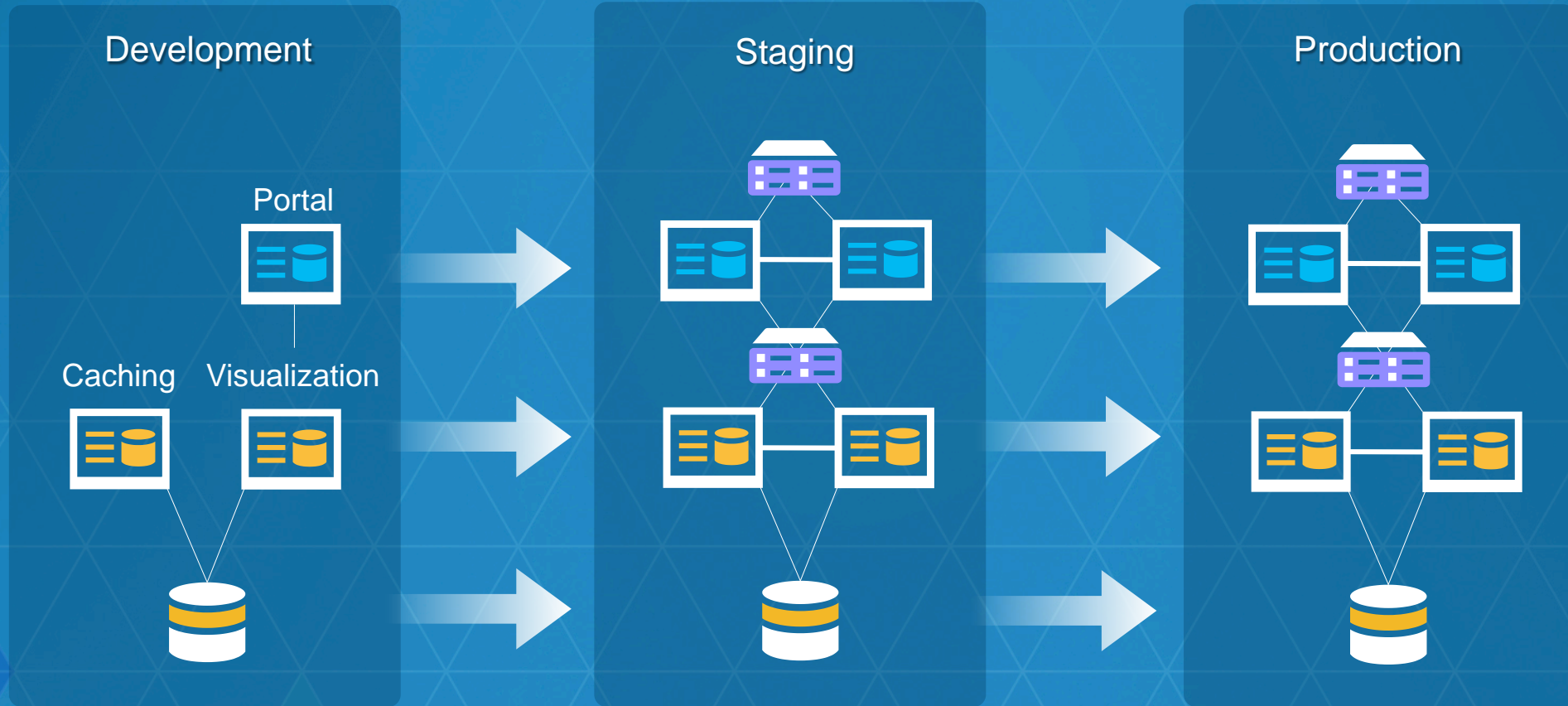
- <http://www.arcgis.com>
- `owner:EnterpriseImp`
- Show ArcGIS Desktop Content

A screenshot of the search results page for 'owner:EnterpriseImp'. The page shows 6 results. On the left side, there is a sidebar with the following sections: 'All Results' (with sub-links for Maps, Layers, Apps, Tools, Files), a checked checkbox for 'Show ArcGIS Desktop Content', and 'Related Searches' (with the text 'Find groups owned by "EnterpriseImp"'). The main content area displays the following results:

- System Designer**: A comprehensive tool for designing and capacity planning of GIS solutions. It is developed by Professional Services and it is a part of Professional Services consulting practice. Desktop Application Template by EnterpriseImp. Last Modified: June 18, 2014. (5 ratings, 10 comments, 2,601 downloads)
- System Monitor (1.1.3)**: System Monitor is a tool for monitoring and analyzing your enterprise GIS system. It is developed by Professional Services and it is a part of Professional Services consulting practice. Desktop Application Template by EnterpriseImp. Last Modified: June 30, 2014. (6 ratings, 18 comments, 2,619 downloads)
- System Test**: A performance and load testing tool designed specifically for testing gis services and applications. It is developed by Professional Services and it is a part of Professional Services consulting practice. Desktop Application Template by EnterpriseImp. Last Modified: July 4, 2014. (2 ratings, 8 comments, 1,848 downloads)
- mxpperfstat**: An ArcGIS Engine command line tool to diagnose typical mxd performance problems. Supports ArcGIS 9.3, 10, 10.1, 10.2 versions. Desktop Application Template by EnterpriseImp. Last Modified: December 20, 2013. (3 ratings, 0 comments, 1,290 downloads)



# Managing Tiered Environments



# System Management

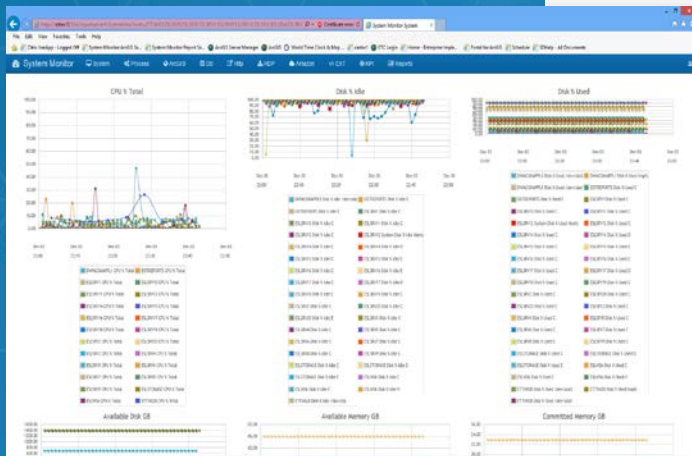
## Monitoring

- System Monitoring
  - Esri product options (*e.g. ArcGIS Server statistics, Activity Dashboard*)
  - System Monitor Tool
  - Integrating with 3<sup>rd</sup> party monitoring tools
- Troubleshooting best practices

# System Management

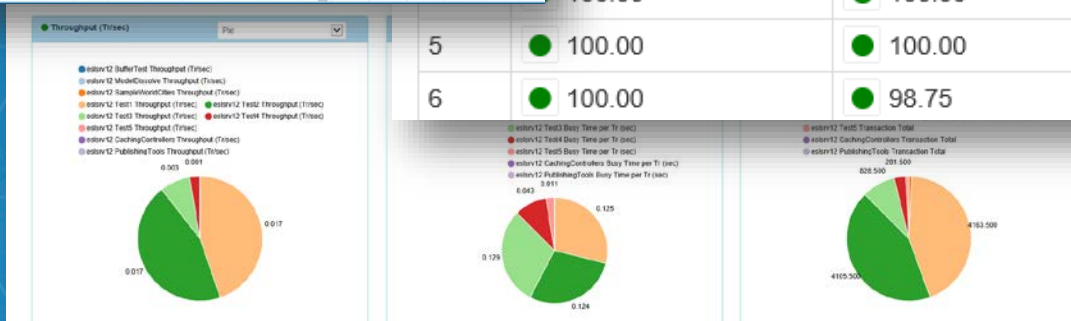
## Monitoring







### Key Performance Indicators:



● Process ● ArcGIS ● DB ● ! Http ● RDP

Coverage	% Uptime	% Alert
100.00	100.00	100.00
100.00	100.00	0.00
100.00	100.00	0.00
100.00	100.00	0.00
5	100.00	0.00
6	100.00	98.75

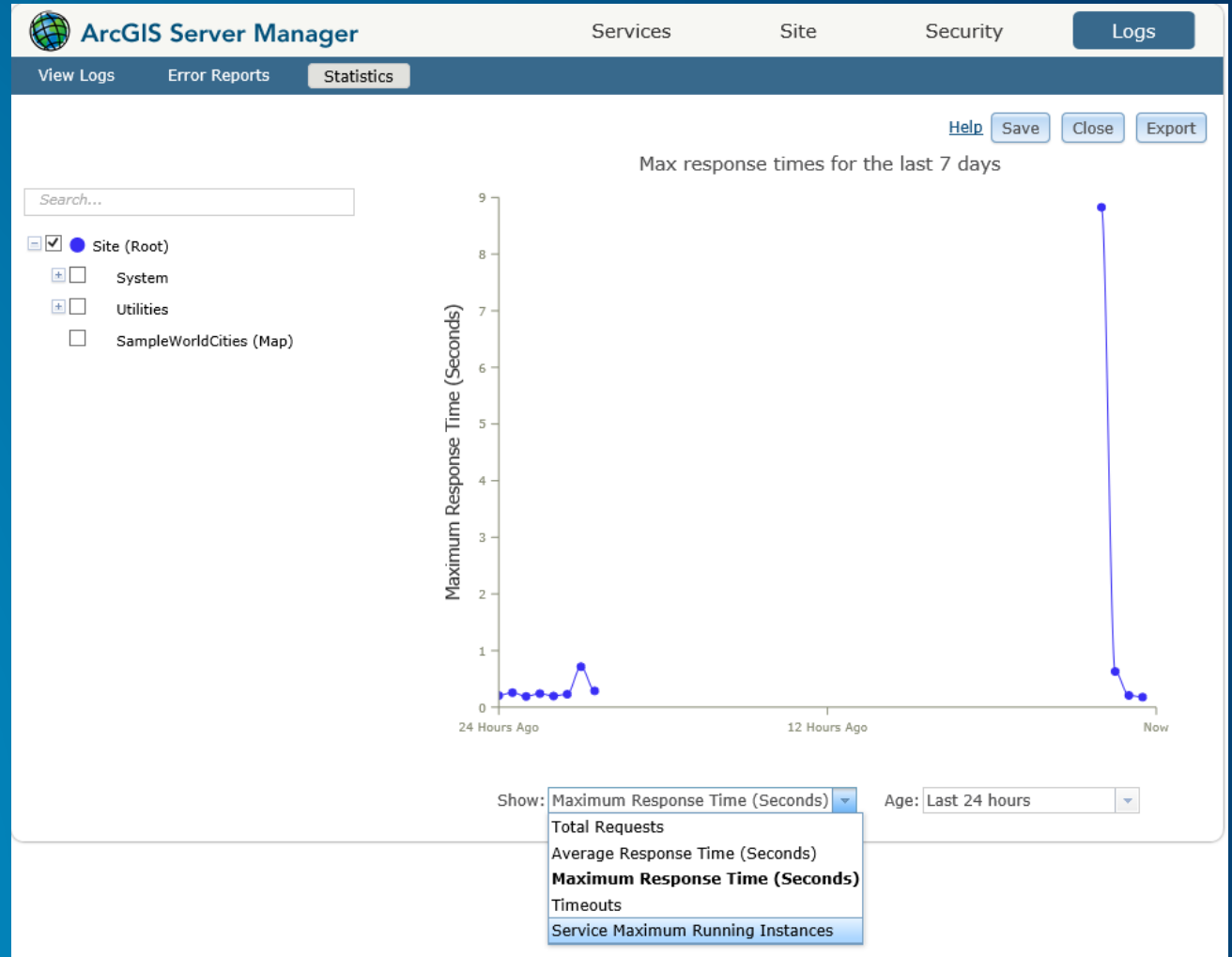


-  Network
-  Hardware
-  Web Server
-  ArcGIS Server
-  Geodatabase
-  RDBMS

# ArcGIS Server 10.3.1 Statistics

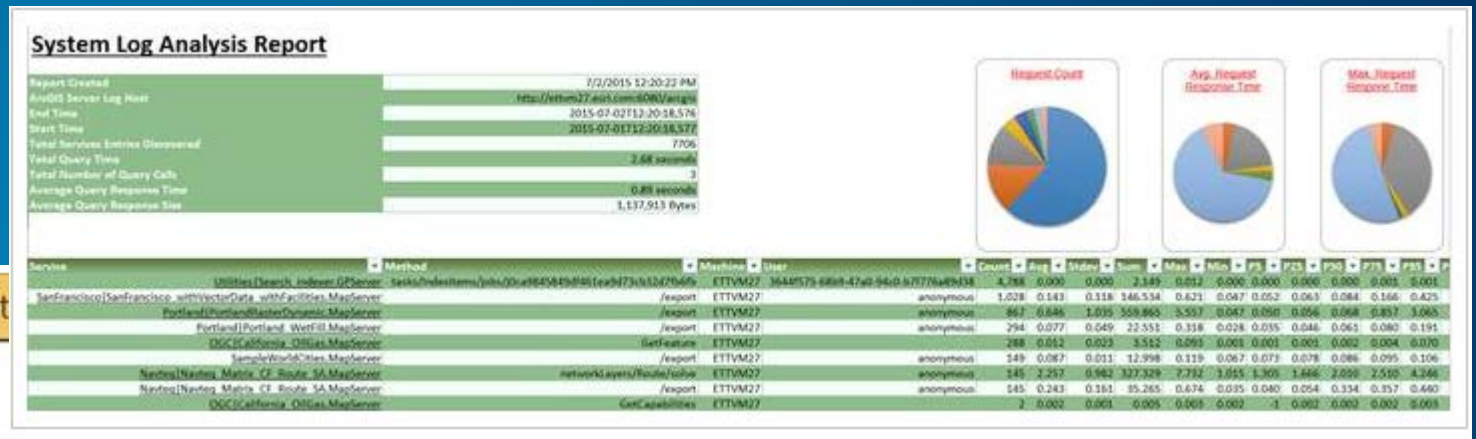
<http://server.arcgis.com/en/server/latest/administer/windows/about-server-statistics.htm>

- Total requests
- Average response time
- Maximum response time
- Timeouts
- Maximum running instances
- 30 min resolution reports



# ArcGIS Server Logs

<http://www.arcgis.com/home/item.html?id=90134fb0f1c148a48c65319287dde2f7>



## System Log Parser

Server URL:

Authentication:

User Name:

Password:

End Time:

Start Time:  (ago)  (ago)

Analysis Type:

Report Type:

Log Level:

Maximum Number of Service Items to List:

Output Directory:

Auto Open Report

# System Monitor –ArcGIS Server Statistics

- <https://systemmonitoring-emcs.esri.com/#/arcgis/ESLSRV12>
- **User:** esridemo
- **Password:** esridemo

ESLSRV12 (default) Jul 19, 2015 12:50:46 PM

[Export to CSV](#)

Alerting	Name	Folder	Type	Throughput (Tr/sec)	Busy Time per Tr (sec)	Transactions	Max	Busy	Free
✓	Summary (default)	Summary	Cluster Summary	0.117	0.285	431,564	35	0	16
✓	SampleWorldCities	Root	MapServer	0.100	0.245	420,875	1	0	1
✓	test	test1	MapServer	0.017	0.040	5,641	2	0	1
✓	Portland_sql_pvtdb	Root	MapServer	0.000	0.000	4,251	8	0	8
✓	PublishingTools	System	GPServer	0.000	0.000	746	2	0	1
✓	WorldCities_secured	Root	MapServer	0.000	0.000	22	2	0	1
✓	Geometry	Utilities	GeometryServer	0.000	0.000	22	2	0	1
✓	World_Map	Root	MapServer	0.000	0.000	3	2	0	1

# Thank you...

- Please fill out the session survey in your mobile app
- Select [enter session title here] in the Mobile App
  - Use the Search Feature to quickly find this title
- Click “Technical Workshop Survey”
- Answer a few short questions and enter any comments

