



# ArcGIS Enterprise: Architecting Your Deployment

Craig Cleveland

2021 ESRI  
DEVELOPER SUMMIT

## Assumptions and prerequisites

- You know what the ArcGIS Enterprise product is and understand the capabilities
- You are in a role where you are involved with architecting and/or installing Esri software

### Recommended prerequisites:

- Prior familiarity with ArcGIS Server
  - e.g. you know what an ArcGIS Server 'site' is.
- Familiarity with System Architecture conceptual items
  - Virtual machines, load balancers, DNS, etc.

### Bonus prerequisites:

- Prior familiarity with ArcGIS Enterprise (Portal, Server, Data Store, etc.)
  - e.g. you're familiar with the concept of 'federating' an ArcGIS Server site with the portal

# Scope

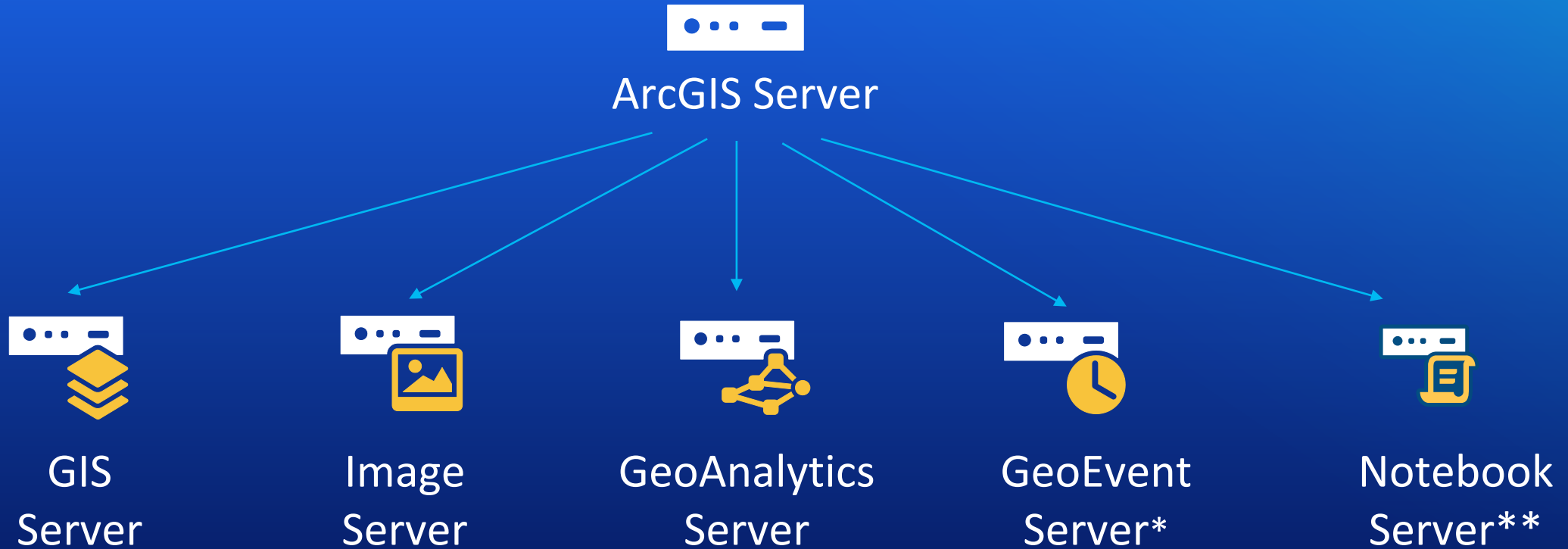
- Covers architecture as it relates to ArcGIS Enterprise 10.5 – 10.9
- Primarily focused on the components of the base ArcGIS Enterprise deployment
- Discusses additional server roles as well and how they can be used to expand the base deployment with features or by scaling out



# Software Components



# Server Licensing Roles



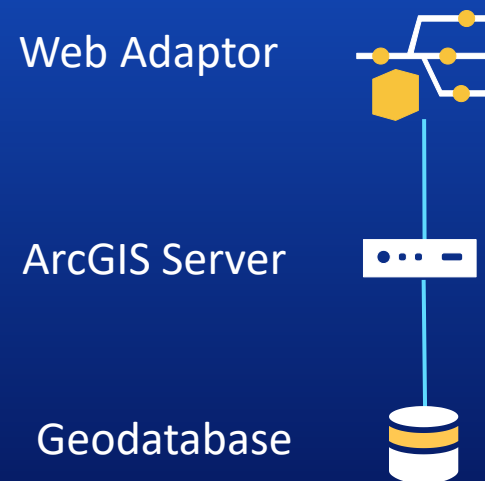
One software component, multiple server roles

\* GeoEvent Server requires installing the ArcGIS Server software + overlaying the GeoEvent Server setup

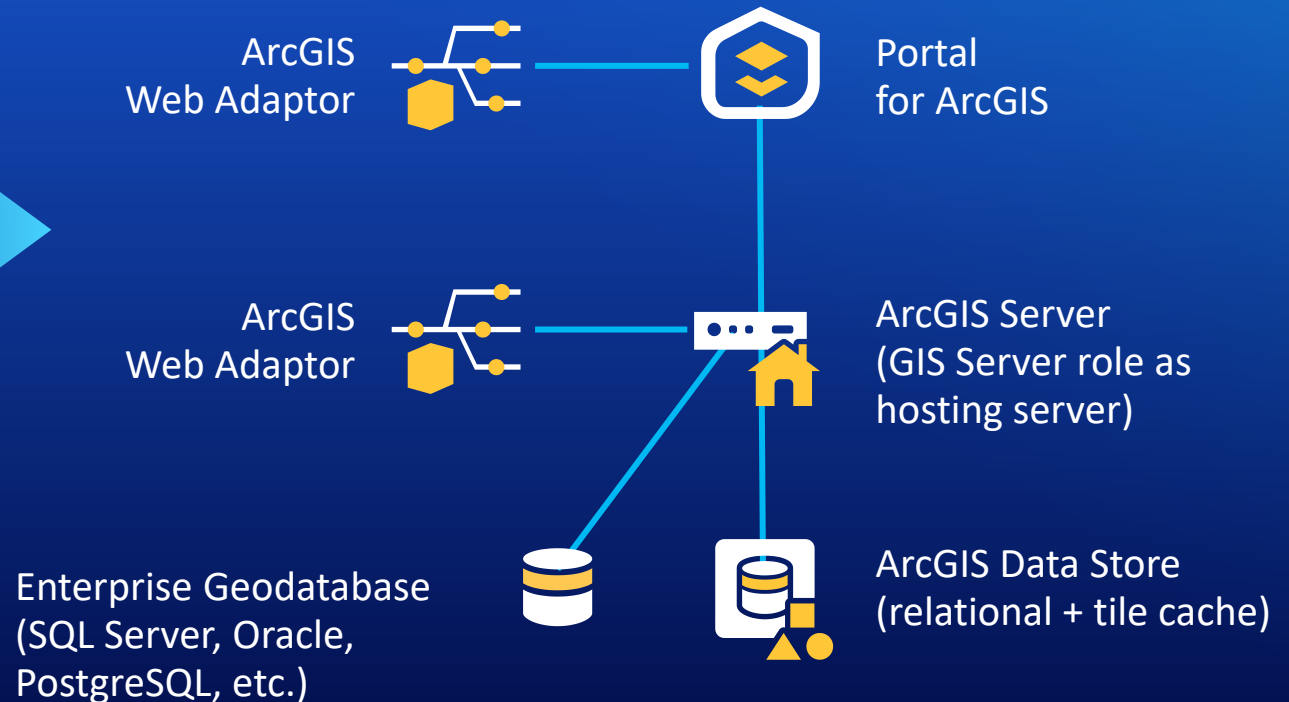
\*\* Notebook Server is a separate download and install that does not require the main ArcGIS Server setup

# Coming from ArcGIS Server to ArcGIS Enterprise

## Typical deployment of ArcGIS Server



## Base deployment of ArcGIS Enterprise





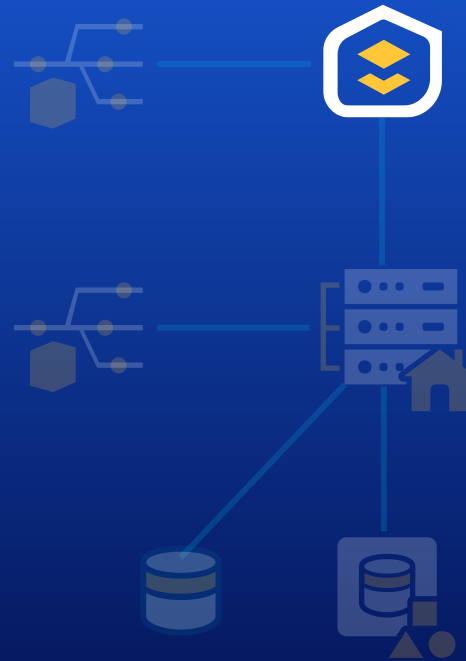
# Base Deployment Logical Architecture

## ArcGIS Web Adaptor

Integrates with your organization's existing web server to provide a single endpoint that **distributes incoming requests** and enables you to use **web-tier authentication**.



# Base Deployment Logical Architecture



## Portal for ArcGIS

The software component that enables the ArcGIS Enterprise portal. Portal for ArcGIS is the **web frontend and API backend** that supports a user's interaction and overall experience with your Web GIS.



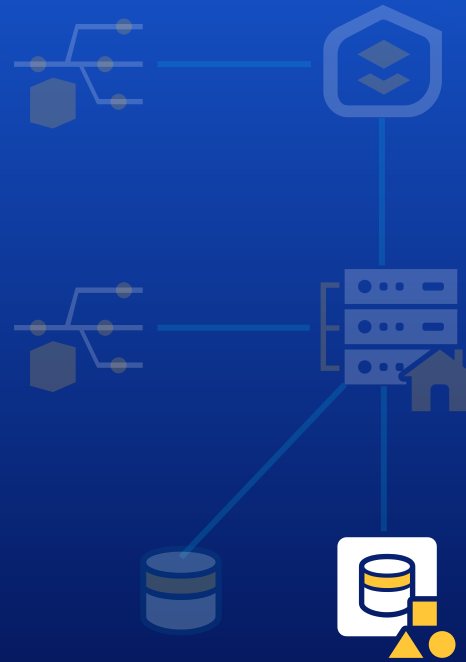
# Base Deployment Logical Architecture



## ArcGIS Server (hosting)

In a base deployment ArcGIS Server should be configured with a **GIS Server licensing role** and as **the hosting server**. In this capacity it gives you the ability to **publish and share** maps and layers from ArcGIS Pro using your own business databases and by copying data to the server.

# Base Deployment Logical Architecture



## ArcGIS Data Store

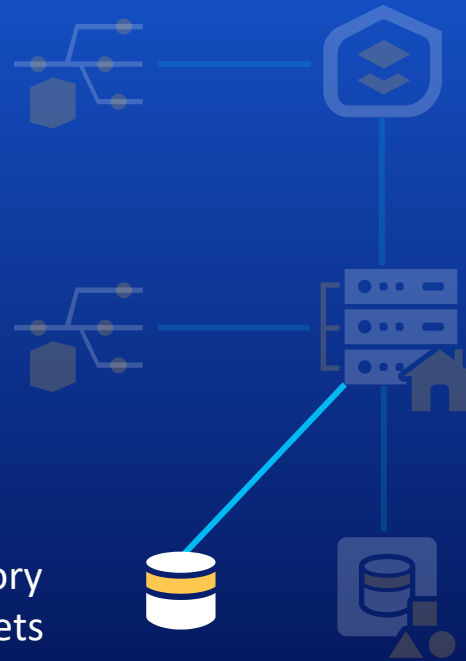
The ArcGIS **managed data repository** that stores the Enterprise portal's hosted content. It is not a replacement for your enterprise geodatabases.

- Relational
- Tile Cache
- Spatiotemporal

# Base Deployment Logical Architecture

## Enterprise Geodatabase

The **user-managed** data repository that stores organizational datasets



# ArcGIS Enterprise

Home Introduction Essentials Installation and Deployment

Introduction / Introducing ArcGIS Enterprise

## Introducing ArcGIS Enterprise

What is ArcGIS Enterprise?

What's new in ArcGIS Enterprise 10.8.x

Upgrade ArcGIS Enterprise

Base ArcGIS Enterprise deployment

ArcGIS Enterprise Builder

Tutorial: Set up a base ArcGIS Enterprise deployment

ArcGIS Enterprise deployment tools

ArcGIS Enterprise server roles

## Base ArcGIS Enterprise deployment

ArcGIS 10.8 (Windows) | Other versions

ArcGIS Enterprise comprises four software components. The minimum setup of ArcGIS Enterprise is called a base ArcGIS Enterprise deployment, and consists of the following:

- [ArcGIS Server](#), licensed as [ArcGIS GIS Server Standard](#) or [ArcGIS GIS Server Advanced](#) and configured as the [hosting server](#) for your portal.
- [Portal for ArcGIS](#).
- [ArcGIS Data Store](#), configured as a [relational and tile cache data store](#).
- Two installations of [ArcGIS Web Adaptor](#), one installation for traffic to your [ArcGIS Enterprise portal](#) and another for traffic to your [hosting server](#).

You can install the base deployment across one or more machines, any of which can be physical, virtual, or cloud machines. For details about the required machine specifications for the ArcGIS Enterprise components, see the [system requirements](#).

### In this topic

[Single-machine deployment](#)

[Multi-machine deployment](#)

[Set up a highly available deployment](#)

[Scaling the base ArcGIS Enterprise deployment](#)

# Functionality of the base deployment

- **Everything from traditional ArcGIS Server**

- Ability to publish map services, feature services, network services, geoprocessing services, geocoding services, and much more.
- Publish content from referenced data sources
  - file-based data (file geodatabases, shapefiles), enterprise geodatabases, other spatially-enabled databases.

- **Self-service mapping workflows**

- Users can publish and share their own data without accessing a database – just like ArcGIS Online

- **Configurable application templates**

- Attachment Viewer, Compare, Impact Summary, Minimalist, Time Aware and much more!

- **Experience Builder and Web AppBuilder for quickly creating web applications**

# Functionality of the base deployment

- **StoryMaps, Dashboards, and ArcGIS Enterprise Sites**
- **Full suite of Esri native applications**
  - Field Maps, Survey123, QuickCapture...
- **Other custom applications built on the ArcGIS API for Javascript and ArcGIS Runtime SDKs**



# Base Deployment

## Choosing a pattern

- **Choosing a base deployment pattern**

- **Software Tiers**

- Portal for ArcGIS + Web Adaptors (web tier)
    - ArcGIS Server (app tier)
    - ArcGIS Data Store/EGDB (data tier)

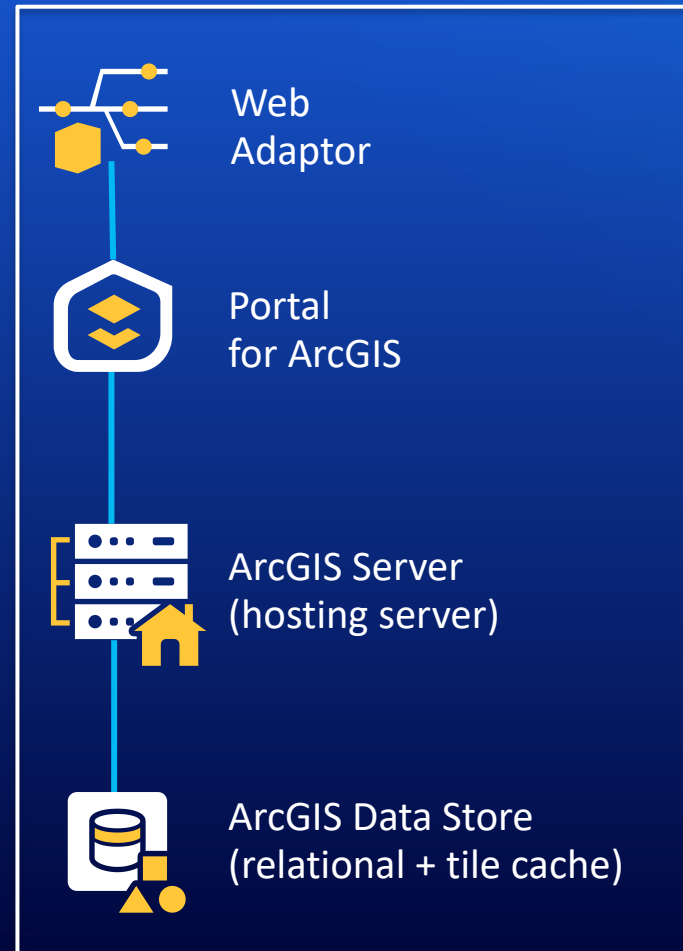
- **All-in-one single machine deployment**

- Great, simple approach for small and medium sized organizations
    - For Development systems

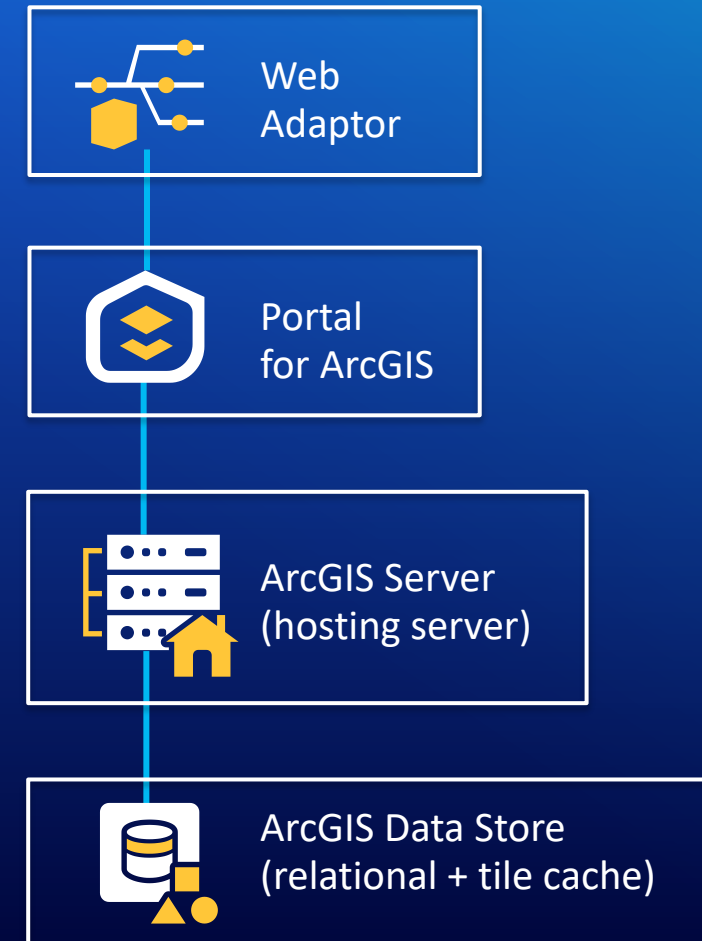
- **Multi-machine deployment**

- Web Adaptor
    - Portal for ArcGIS
    - ArcGIS Server
    - ArcGIS Data Store

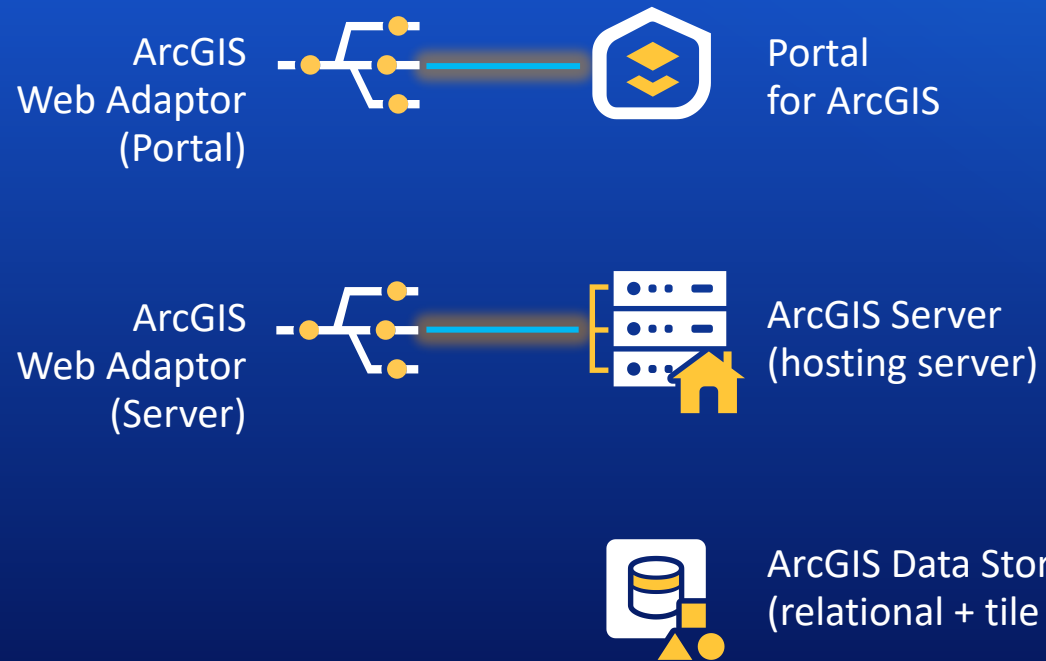
### Single Machine



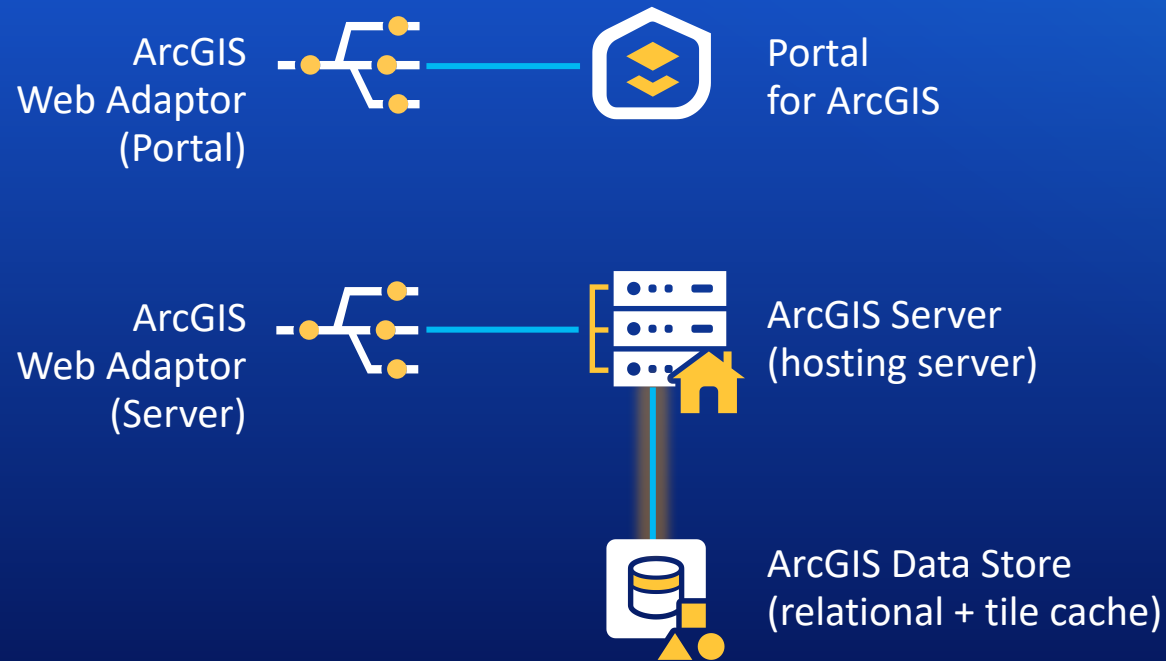
### Multi-Machine



# Base Deployment Configuration Quick Steps



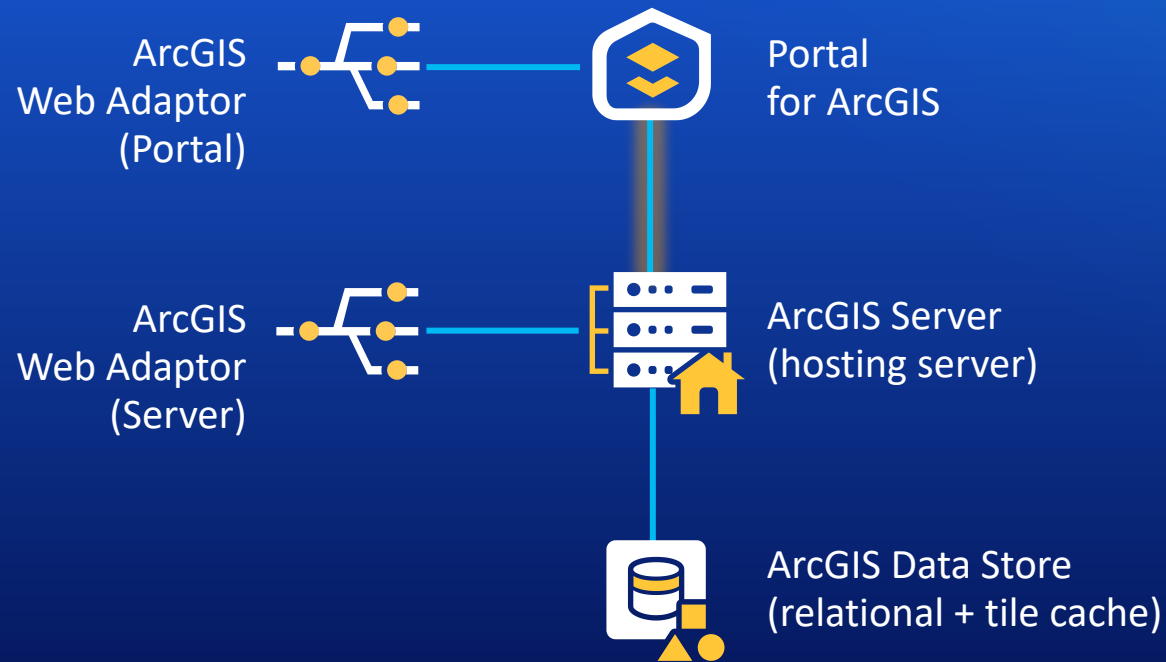
## Base Deployment Configuration Quick Steps



2

Configure the data store  
and register with server

## Base Deployment Configuration Quick Steps



**3** Federate server with the portal and designate as hosting server

# ArcGIS Enterprise

[Home](#)[Introduction](#)[Essentials](#)[Installation and Deployment](#)[Introduction](#) / [Introducing ArcGIS Enterprise](#)

## ▼ Introducing ArcGIS Enterprise

[What is ArcGIS Enterprise?](#)[What's new in ArcGIS Enterprise 10.8.x](#)[Upgrade ArcGIS Enterprise](#)[Base ArcGIS Enterprise deployment](#)[ArcGIS Enterprise Builder](#)[Tutorial: Set up a base ArcGIS Enterprise deployment](#)[ArcGIS Enterprise deployment tools](#)[ArcGIS Enterprise server roles](#)[Publishing in ArcGIS Enterprise](#)

## Tutorial: Set up a base ArcGIS Enterprise deployment

[ArcGIS 10.8 \(Windows\)](#) | [Other versions](#) ▼

This tutorial provides an overview of setting up a single machine [base ArcGIS Enterprise deployment](#). This configuration is commonly used for testing and prototyping purposes. It enables self-service mapping and can be used with ArcGIS Pro, ArcMap, and other client applications. Although this configuration can be used in a production system, your performance, system architecture, and other requirements will dictate the deployment pattern your production deployment follows.

The resulting deployment will include the following:

- An ArcGIS Server machine [licensed as ArcGIS GIS Server](#) and used as a [hosting server](#)
- Portal for ArcGIS
- ArcGIS Data Store configured as a relational and tile cache data stores
- Two ArcGIS Web Adaptors

# ArcGIS Enterprise | Deployment Options

## ArcGIS Enterprise Builder

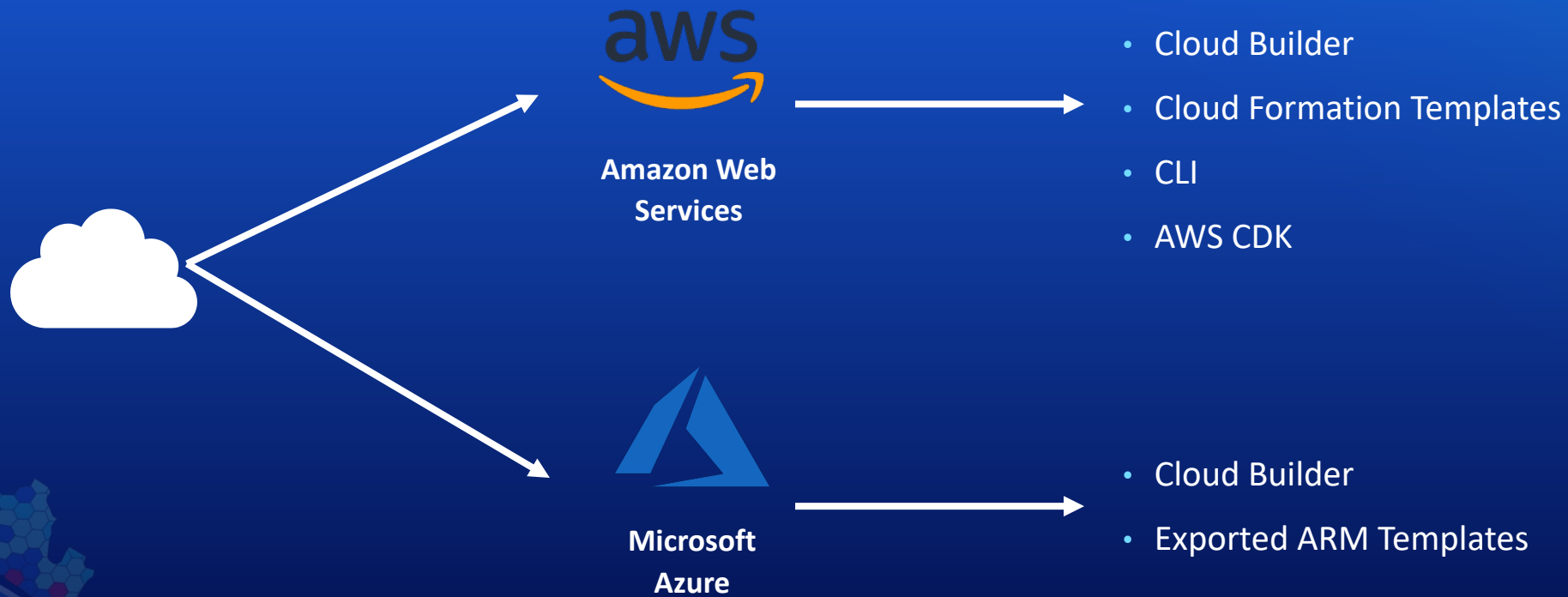
- Base Deployment on a single machine
- No longer have to click executables to install and configure
- Makes configuration much easier than it previous was





# ArcGIS Enterprise | Deployment Options

## Machine Images & Cloud Builders



# ArcGIS Enterprise | Deployment Options

## Automation Tools

PowerShell DSC



- **AllNodes** - This contains all the nodes on which the components of ArcGIS Enterprise will be installed.
  - **nodeName** - Each node is represented by a node name, which can be a machine name or an IP address.
  - **Role** - The software component role of the node; this can accept one or multiple values as a comma-separated list. Enter in the order you want to execute the roles on the node. Accepted values are 'Server', 'Portal', 'DataStore', 'ServerWebAdaptor', 'PortalWebAdaptor', 'RasterDataStoreItem', 'Desktop', 'Pro', 'LicenseManager', 'SQLServerClient', 'SQLServer', and 'FileShare'.
  - **DataStoreTypes** - This is a valid parameter when the node role is 'DataStore'. Valid values are 'Relational | SpatioTemporal | TileCache'.
  - **SslCertificates** - (Optional) SSL Certificates specific to the node. This block is an array where each SSL Certificate in the array can target multiple components or each of them individually.
    - **Path** - The file path of your SSL Certificate. A local or network share address.
    - **Password** - The password of the SSL certificate to be installed.
    - **PasswordFilePath** - Encrypted password file path of the SSL certificate to be installed.
    - **CNameFQDN** - Refers to a fully qualified domain name (CN/SAN) associated with the certificate.
    - **Target** - Target Components (array) on Node on which the Certificate will be installed on [Server | Portal | WebAdaptor].
  - **PortalLicenseFilePath** - (Optional) License File Path to be used with the given Portal installed on the Node. Overrides the file path given in "ConfigData" block.
  - **PortalLicensePassword** - (Optional) License Password associated with the Portal License File.
  - **PortalLicensePasswordFilePath** - (Optional) Encrypted License Password File Path associated with the Portal License File.
  - **ServerLicenseFilePath** - (Optional) License File Path to be used with the given Server installed on the Node. Overrides the file path given in "ConfigData" block.
  - **ServerLicensePassword** - (Optional) License Password associated with the Server License File.

Chef



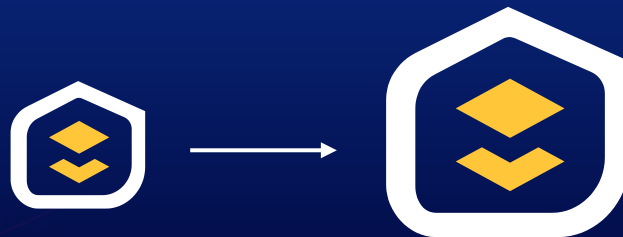
Cookbooks	Recipes	Roles
<ul style="list-style-type: none"><li>• ArcGIS Enterprise</li><li>• ArcGIS Desktop</li><li>• ArcGIS GeoEvent</li><li>• Insights for ArcGIS</li><li>• Tomcat for Esri</li><li>• IIS for Esri</li></ul>	<ul style="list-style-type: none"><li>• Set up system</li><li>• Install ArcGIS Server</li><li>• Install Web Adaptor</li><li>• Federate Server</li><li>• Enable GeoAnalytics</li><li>• Create IIS certificate</li></ul>	<ul style="list-style-type: none"><li>• Base deployment</li><li>• Big data store</li><li>• GeoAnalytics Server</li><li>• Additional GA Server</li><li>• File server</li><li>• Uninstall deployment</li></ul>

# Moving Beyond the Base Deployment



## Scaling and expanding the base deployment – Portal

- **When do you need to scale out the Portal for ArcGIS tier?**
  - Rarely – CPU and Memory does not usually drive scaling
  - For Storage – in-place expansion
  - Provide more resources for your existing machine(s)
    - Note: Use two machines with Portal for ArcGIS for high availability purposes *not* for scaling
  - Monitor CPU and memory usage to see if you need more resources



# Scaling and expanding the base deployment - Server

- **When do you need to scale out the ArcGIS Server hosting server site?**
  - **If your hosting server is performing double duty:**
    - Hosted services
    - Traditional services published from ArcGIS Pro
  - **Consider setting up a separate ArcGIS Server site for this purpose!**
  - **Hosting server resources can become an issue:**
    - Serving a lot of requests for hosted feature layers
    - If your users are making heavy use of the built-in analysis tools via the map viewer or ArcGIS Pro
    - If you have a lot of ArcGIS Insights users





# Scaling and expanding the base deployment - Data

- **When do you need to scale out the ArcGIS Data Store tier?**
  - When the usage of one data store type begins to impact the others

- **Relational Data Store**

- Hosted feature layers
  - ArcGIS Insights



**When to scale relational data store:**

- Lots of users requesting data concurrently from many different hosted services: more memory often helpful
- Lots of concurrent requests: CPU can become a bottleneck

- **Tile Cache Data Store**

- Scene Layers (3D)



Note: the spatiotemporal big data store is not part of the base deployment. It supports GeoEvent Server, GeoAnalytics Server, and ArcGIS Tracker workflows covered in later slides.

- **Monitor for bottlenecks!**

- Consider ArcGIS Monitor
  - CPU, memory, disk I/O are all important
  - Pre-10.5.1 versions do not always handle out of disk space conditions gracefully. Avoid running out of disk space!





## Expanding out from the base deployment – new Server Roles

A couple of starting points:

- **You can have any number of federated ArcGIS Server sites within your ArcGIS Enterprise deployment**
  - Just because you can, doesn't always mean you should
  - Don't overcomplicate past a single machine if you don't need to
- **Different server roles have different recommendations and restrictions**

# Expanding out from the base deployment

- Multiple reasons and ways to add to the base deployment

1. Adding additional GIS Server sites

- Add capacity, separate workloads



2. Adding additional capabilities

- Image Server
- GeoEvent Server
- GeoAnalytics Server
- Notebook Server
- Mission Server
- Business Analyst Server



# GIS Server



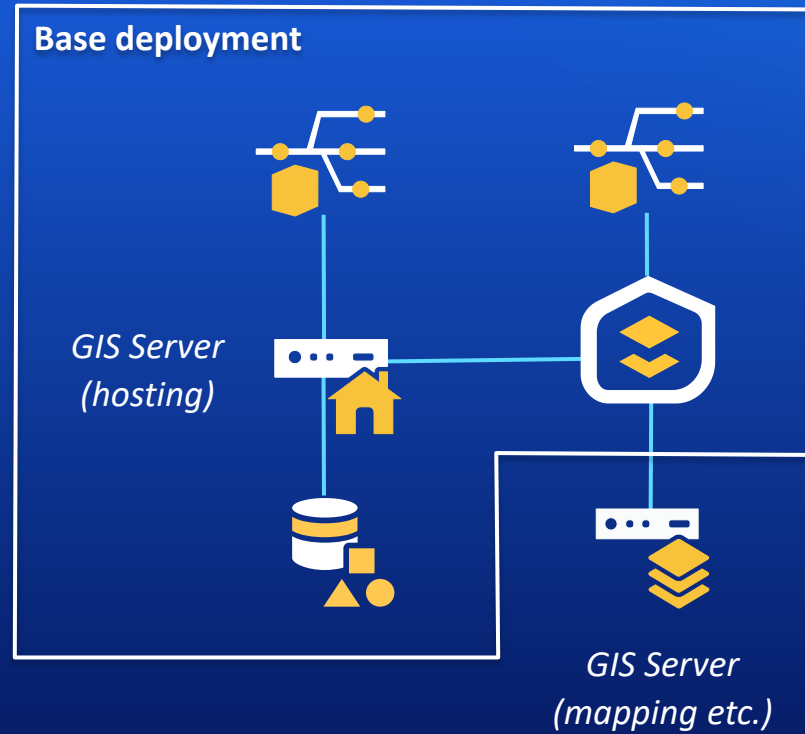
# Adding additional GIS Server sites to your deployment



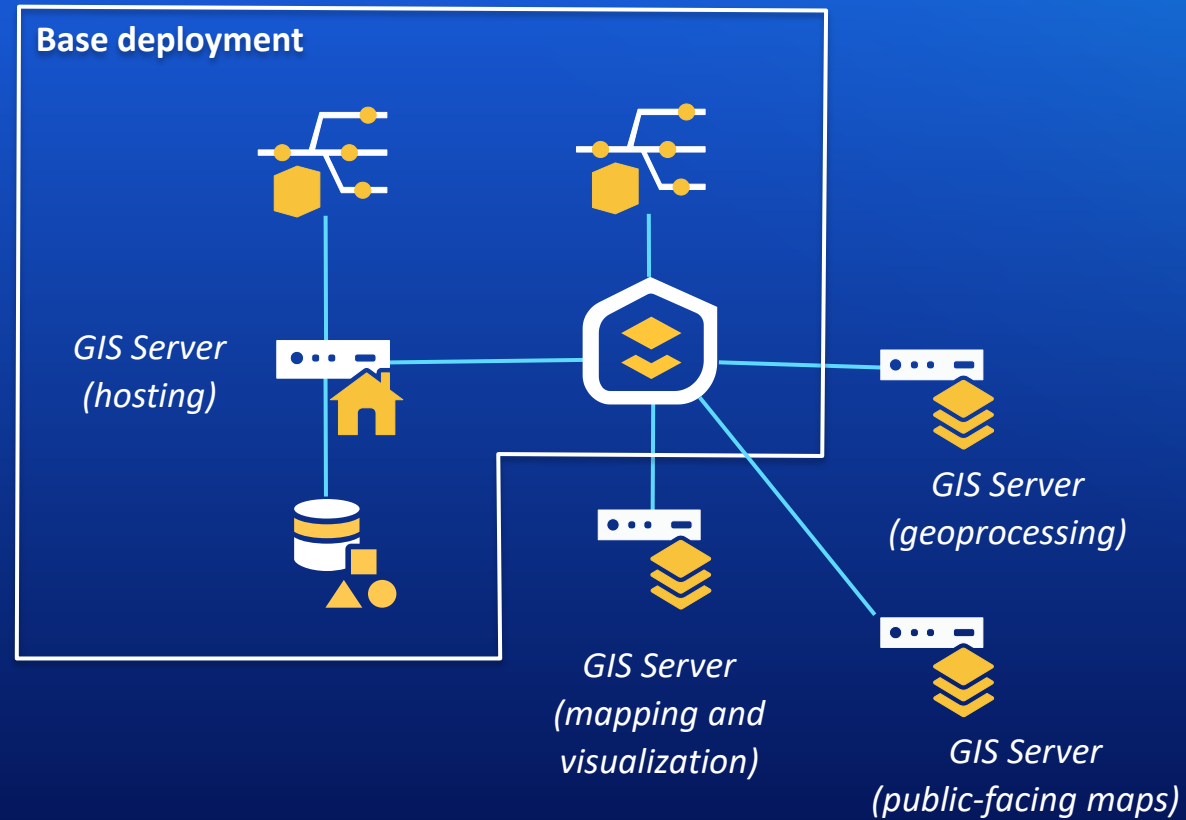
- **GIS Server**

- You already have a GIS Server site as part of the base deployment (your hosting server)
- Consider if you need additional sites. You can setup as many sites as make sense for your particular deployment following workload separation recommendations
- **Common workloads that benefit from separate site(s):**
  - Highly used sets of dynamic map services
  - Heavy-weight geoprocessing
  - CPU-intensive routing services
  - Mission critical services that have different SLAs than other services
- **Note *Shared Instances* feature in ArcGIS Enterprise 10.7 and beyond:**
  - Memory consumption of map services shouldn't drive scaling
    - number of *requests* may drive need to scale out
    - number of *services* shouldn't have to

## Adding additional GIS Server site to your deployment

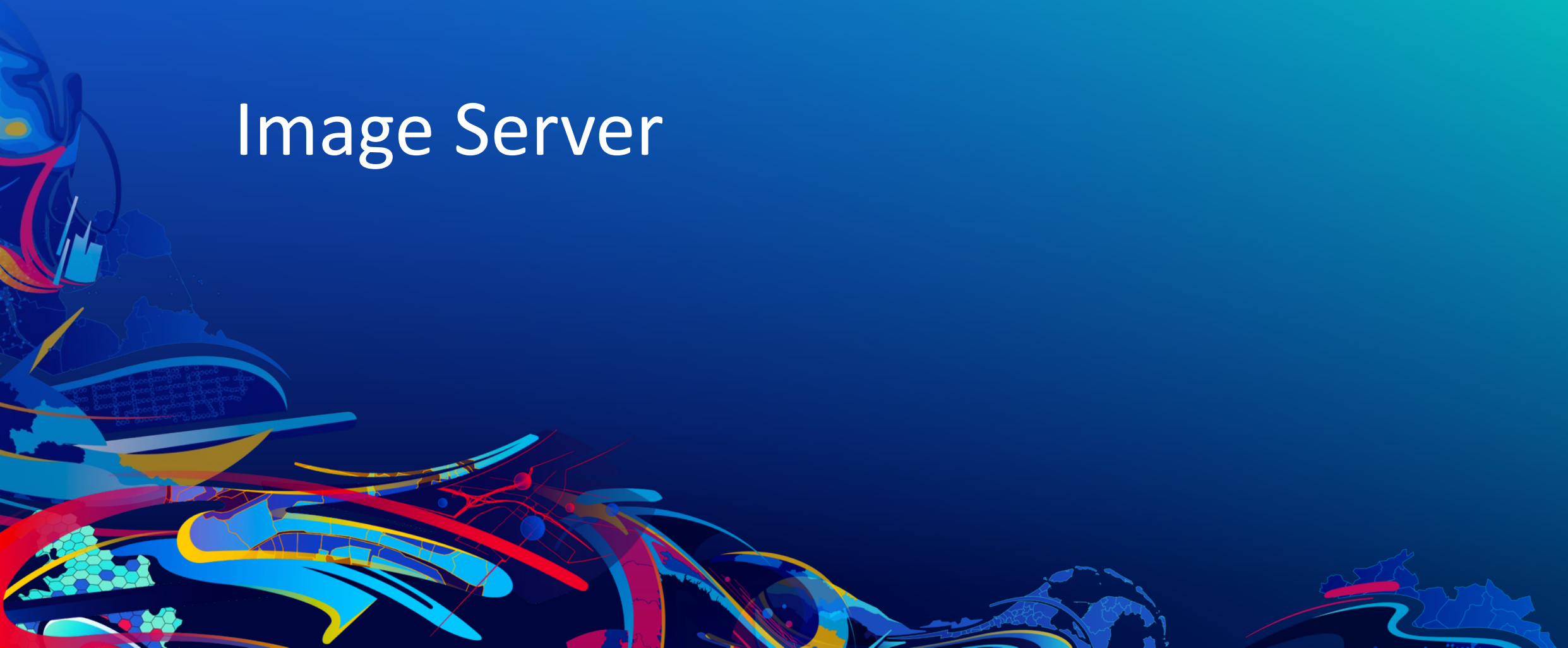


# Adding additional GIS Server site to your deployment





# Image Server



# Adding Image Server to your deployment



## Image Server provides four key capabilities

### 1. Dynamic image services from your own mosaic datasets

- Serve large collections of imagery, LiDAR and rasters with dynamic mosaicking and on-the-fly processing
- $N$  number of sites

### 2. Raster Analytics Site (designate in the portal)

- Extracting information from imagery- distributed processing and analysis of imagery and rasters creating new persisted output at full source resolution
- Only 1 site can do raster analytics

# Adding Image Server to your deployment



## 3. Raster Hosting Site (designate in the portal) – New in 10.7

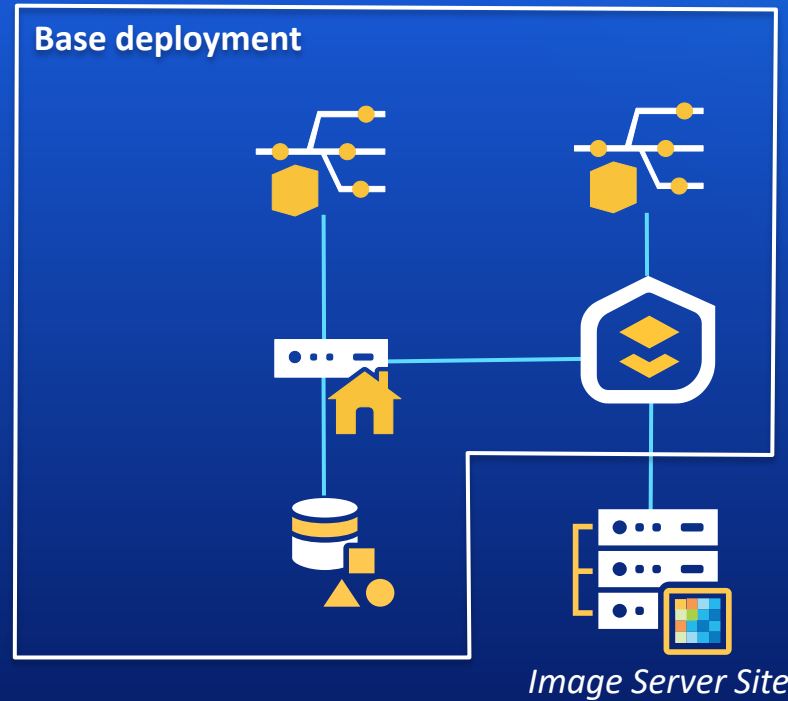
- Upload and publish an image collection from raster data store
- Hosts results from raster analytics

## 4. Ortho mapping

- Server-side processing of satellite, aerial, or drone imagery into digital terrain models and orthomosaics
- Outputs used in other analysis

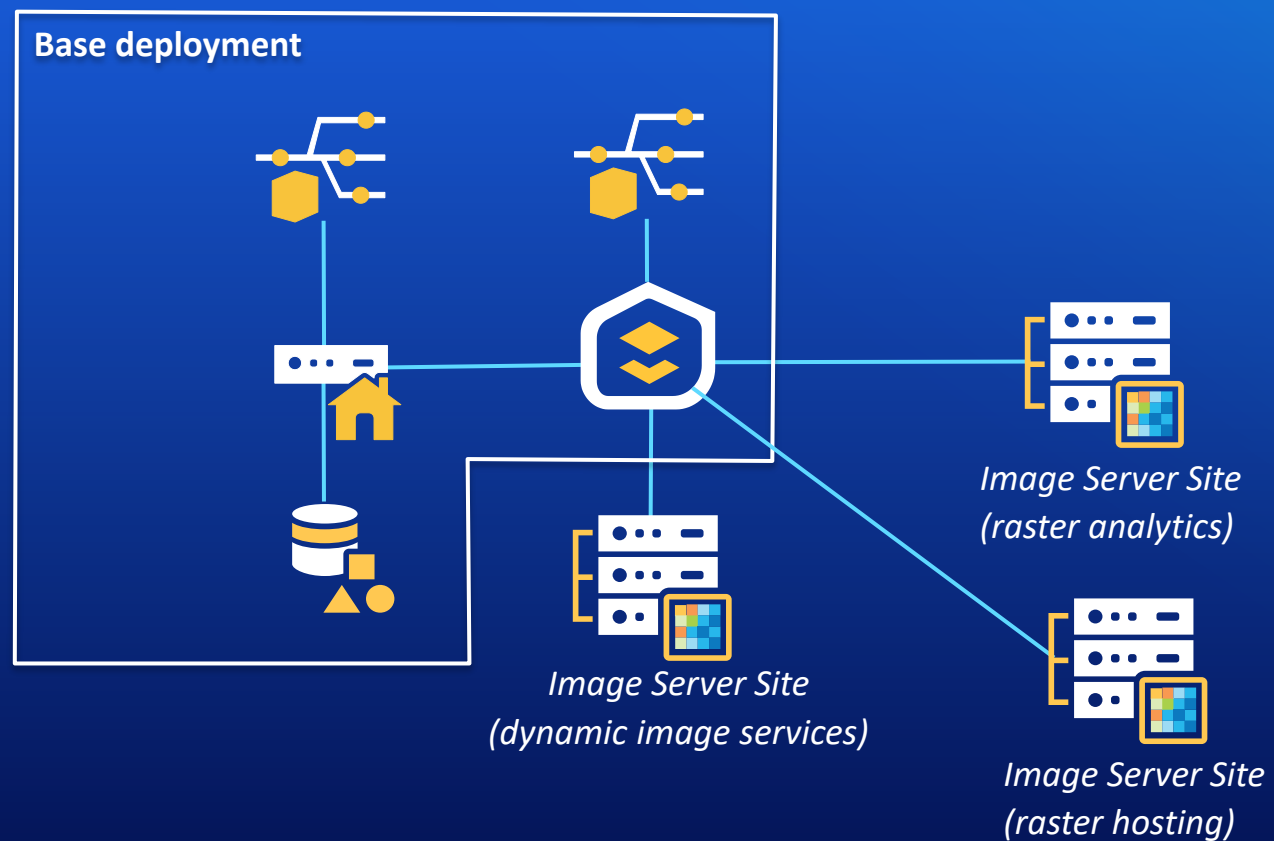
Imagery Best Practices & Workflows

# Adding Image Server to your deployment



*One Image Server site for both capabilities*

# Adding Image Server to your deployment



*Separate Image Server sites for each capability*

# GeoAnalytics Server





# Adding GeoAnalytics Server to your deployment



- **GeoAnalytics Server provides distributed computing infrastructure for processing large volumes of vector and tabular data**
  - **One site for GeoAnalytics Server**
  - **Requires spatiotemporal big data store to be configured with the base deployment**
    - Note: ArcGIS Data Store (relational, tile cache, spatiotemporal) is always configured with *the hosting server site*
    - Provide at least 16 GB memory and at most 64 GB for spatiotemporal big data store
  - **Many variables go into sizing a deployment**
    - More machines or more cores or more memory does *not* always mean faster processing!
    - Many workflows benefit immensely from just a 1 machine GeoAnalytics Server setup
    - If possible: scale a single machine, it's simpler to manage. Scale to 3 machines when needed. Only single or 3-machine configurations are supported.

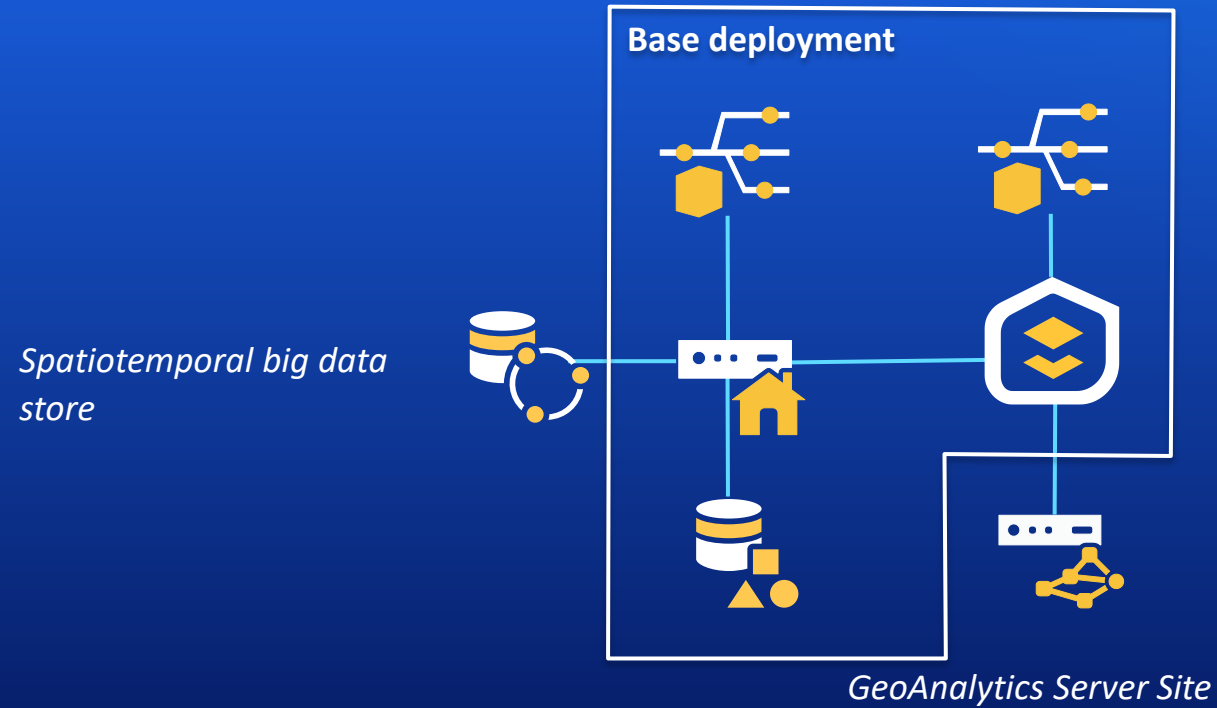
# GeoAnalytics Server performance variables – don't panic!

It's not just about adding more cores to make GeoAnalytics work faster

- Type of data
  - *file-based (CSV, shapefiles) vs. web-based (feature service) vs. big data store (HDFS, Hive, etc)*
- Location of data and number of files
  - *local (low latency) vs. on network (potential latency)*
- Local network
  - *100 mbps vs. 1 gbps, latency between machines and data source*
- Storage
  - *SSD vs. traditional HDD (disk I/O)*
- Size of data
  - *tens of MB vs. hundreds of MB vs. gigabytes vs. terabytes*
- Ratio of CPU cores to RAM
- Ability to write result data as fast as it is being generated
  - *(scale spatiotemporal big data store too!)*

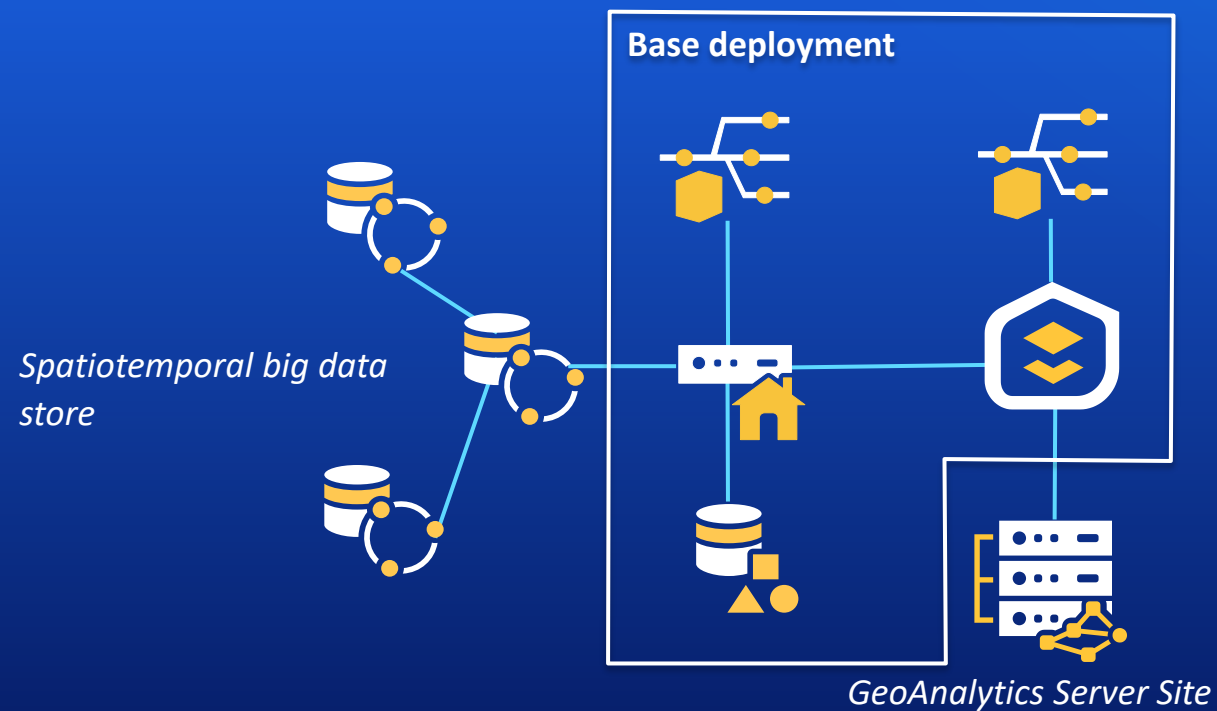
*Prototype deployment using your own data and workflows*

# Adding GeoAnalytics Server to your deployment



*Minimum 3 machines to support base deployment + GA + spatiotemporal; scale the GeoAnalytics site from 1 to 3 machines beyond that*

# Adding GeoAnalytics Server to your deployment



*You may need to scale spatiotemporal big data store with additional nodes when going from 1 to 3 GeoAnalytics Server machines*

# GeoEvent Server



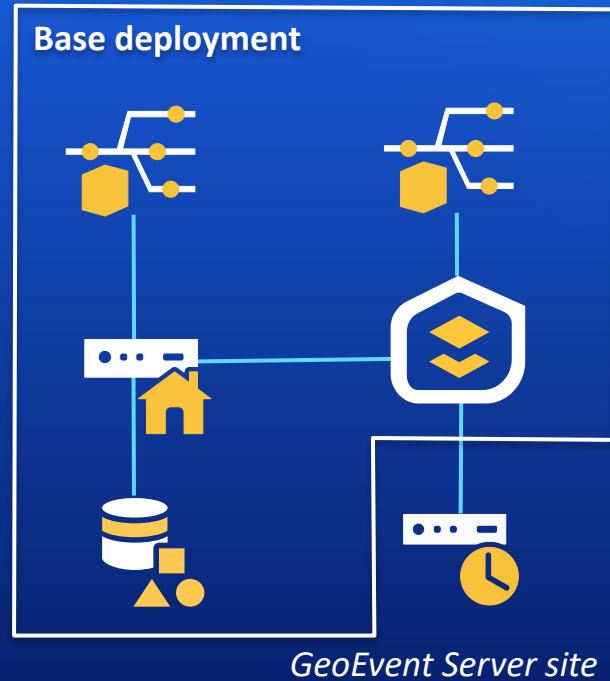
# Adding GeoEvent Server to your deployment



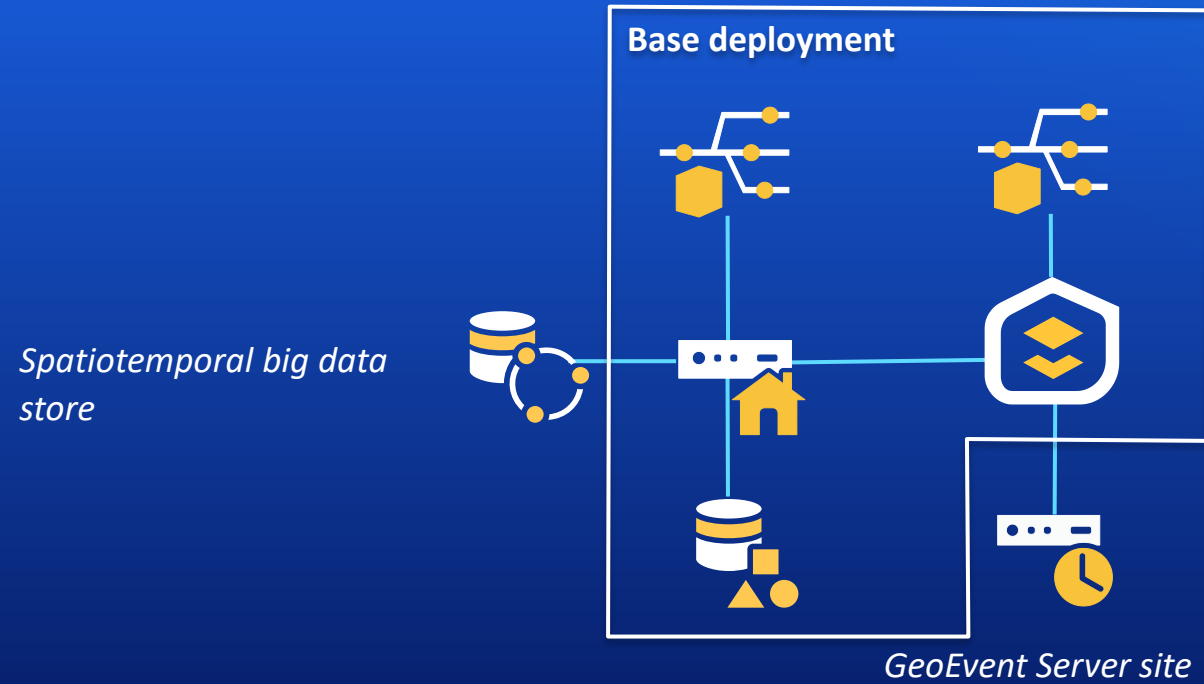
- **GeoEvent Server provides the ability to create GeoEvent services to process real-time data ingestion and processing**
  - With GeoEvent Server 10.6 and up it is possible to create a multi-machine site
  - Each site must be powerful enough to handle peak throughput for the combined set of GeoEvent services (scale up!)
  - To handle multiple input streams that go beyond a single site: use additional separate GeoEvent Server sites
  - If archiving large volumes of data, use the spatiotemporal big data store



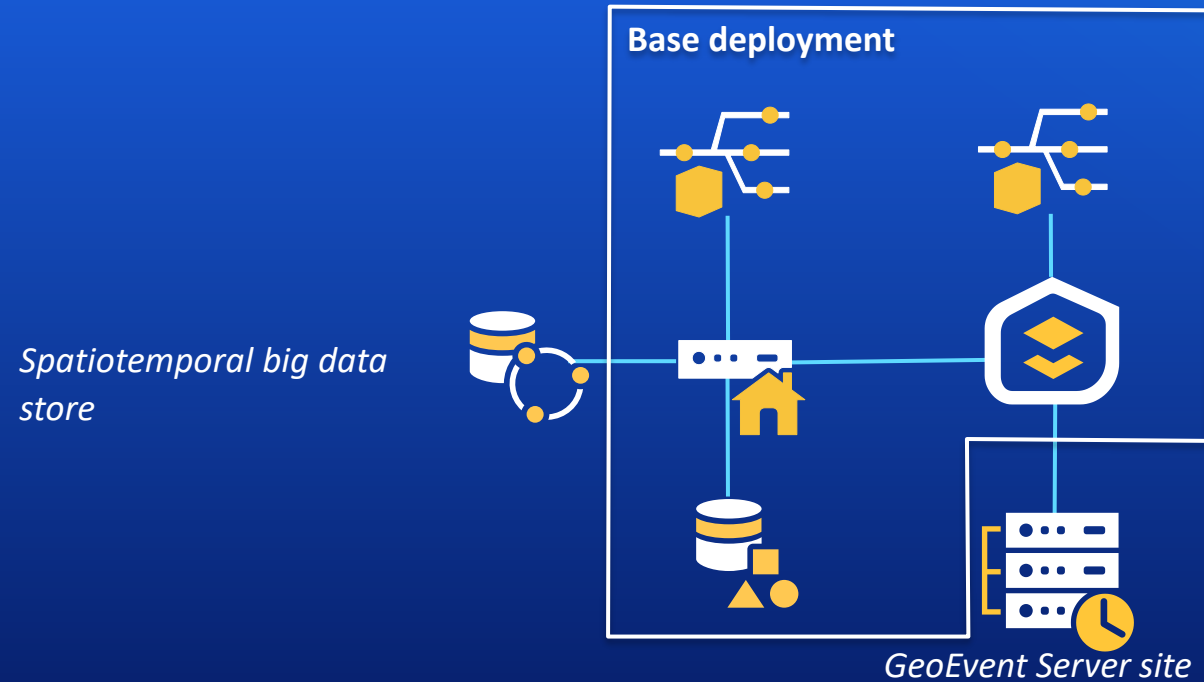
# Adding GeoEvent Server to your deployment



# Adding GeoEvent Server to your deployment



# Adding GeoEvent Server to your deployment



*For 10.6 and higher: scale out individual GeoEvent Server sites with multiple machines for resiliency and capacity*

# Notebook Server

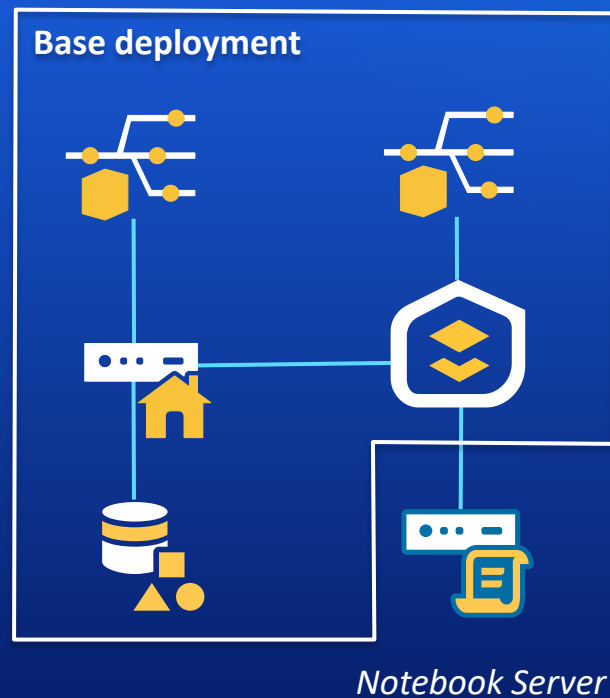


# Adding Notebook Server to your deployment



- **Notebook Server provides a web-based interface for executing powerful geospatial data analysis in your ArcGIS Enterprise portal.**
  - Available starting with the ArcGIS Enterprise 10.7 release
  - Different deployment model: deployed with Docker on a dedicated machine
    - Windows – Hyper-V
    - Linux – Many flavors
  - Can be a different Operating System than your base deployment
    - Strong recommendation for Notebook Server is to **use Linux** for your Notebook Server site

# Adding Notebook Server to your deployment



*Note: Notebook Server runs on Docker. Please see the [documentation](#) for more information.*



# Other considerations for Enterprise deployments



# Additional Deployment patterns and considerations

- **High Availability**
  - Requires duplicate infrastructure and possible licensing requirements
- **Load Balancers and Management**
  - Requires the collaboration with organizations IT/Security department
- **Performance Testing and Scalability**
  - Testing to make sure the deployment meets a certain level of requests
- **Hybrid Deployments (with ArcGIS Online) and Distributed Collaboration**
  - Allows for expansion of the platform to other external or internal users and business units
- **Migrating a Deployment**
  - New servers, new operating system, on-premises to cloud, separating components, etc.

*Things to consider.....*

# Best practices

- **Do *not* use clusters!**
  - Discouraged on any version. Officially deprecated as of 10.5.1.  
No longer supported starting with the ArcGIS Enterprise 10.7 release!
- **Do federate your ArcGIS Server sites**
  - Required for the modern deployment patterns and newer functionality
- **Do *not* unfederate your ArcGIS Server sites**
  - Lost item links, broken apps, unhappy users!
- **Do use the web adaptor unless there's a good technical reason not to**
  - Simplifies a lot of configuration that otherwise has to be done manually.

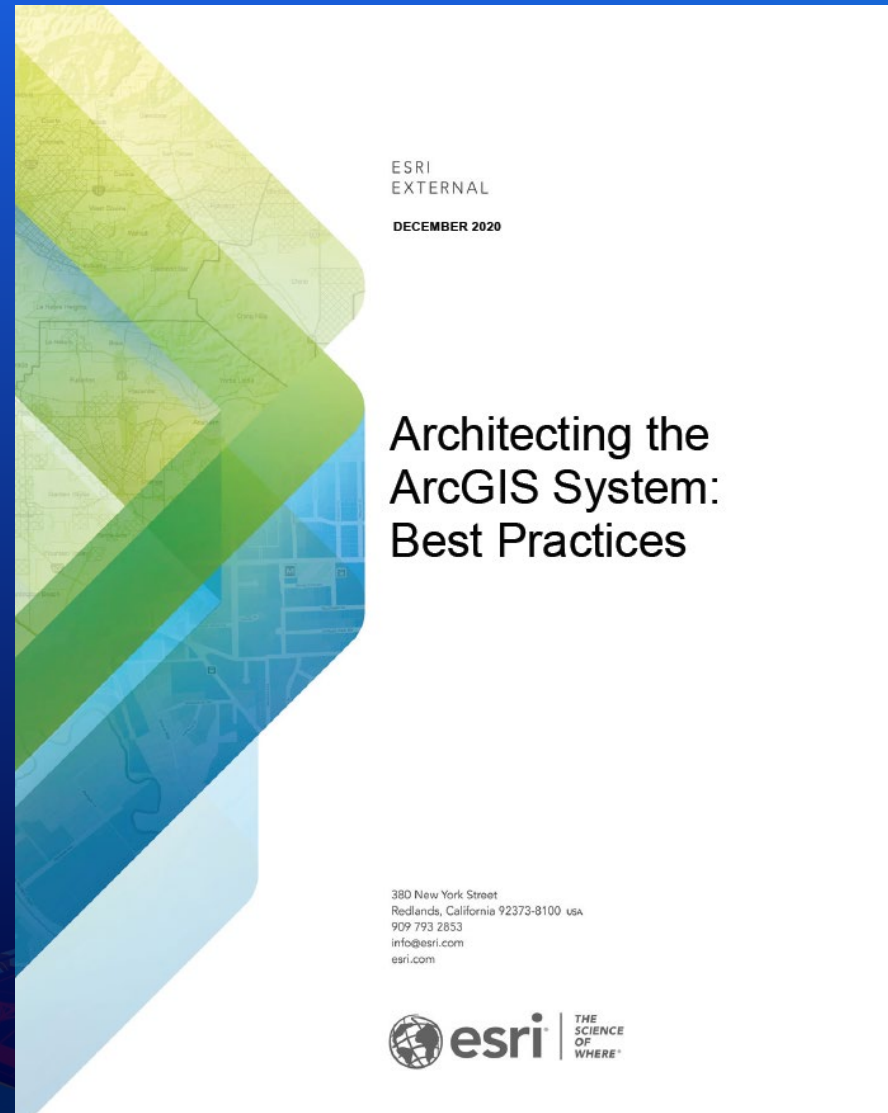
# Takeaways

- **Understand the base deployment and what each part adds to the whole**
- **Don't overcomplicate things unnecessarily**
  - small to medium-sized orgs can often use a single machine deployment in production.
- **Stay up to date on best practices. They change over time!**
  - What was good advice for 10.2/10.3/.. is not necessarily as good for 10.6/10.7/.. onward
- **ArcGIS Enterprise relies on the federated server model**
  - Certain features require the federated server model – e.g. Raster Analytics and GeoAnalytics
- **Understand the individual server roles and the requirements of each**

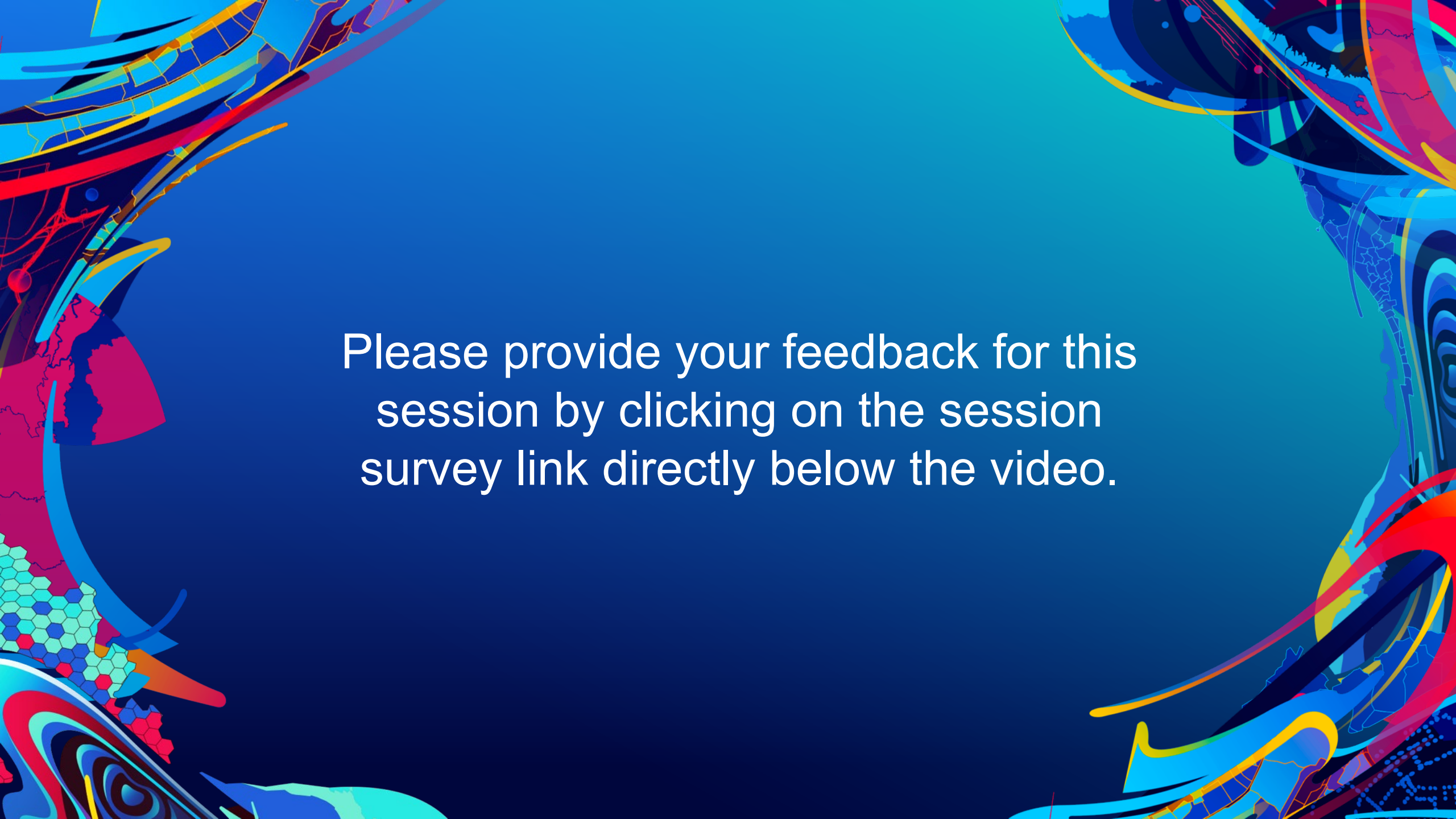


# Architecting the ArcGIS System: Best Practices

New technical paper!





The background is a vibrant, abstract composition. It features a central area of solid blue and teal. The left and right sides are framed by complex, colorful patterns. On the left, there are swirling shapes in red, yellow, and blue, along with a section of a hexagonal grid in shades of green and blue. On the right, there are more swirling patterns in blue, red, and yellow, with some areas resembling a grid or circuitry. The overall effect is dynamic and modern.

Please provide your feedback for this session by clicking on the session survey link directly below the video.





esri®

THE  
SCIENCE  
OF  
WHERE®