

GEOG 482 / 582 : GIS Data Management

Lesson 9: ArcGIS Server Data Management

Overview

Learning Objective Questions:

1. What is ArcGIS Server data management technology stack?
2. What is UW Geography CGISE?
3. What is the motivation for WAGDA 2.0?
4. What technology stack is used to implement WAGDA data management at UW Libraries?

Lesson Preview

Learning objective questions act as the lesson outline.

Questions beg answers.

ArcGIS Server Data Management

1. What is ArcGIS Server data management technology stack?

ArcGIS Server is now marketed as ArcGIS Enterprise. ArcGIS Server supports full-fledged data management software for the enterprise (i.e., large database systems) environment.

ArcSDE stands for Arc Spatial Data Engine. The packaging of ArcSDE software is different now that we have full-fledged ArcGIS Server software. ArcSDE was originally an ‘installable’ middleware into desktop, which ‘connected’ desktop and server software products, but now fully integrated into ArcGIS Desktop and ArcGIS Pro clients.

Expanding over the years, ArcGIS Server software is now full-fledged GIS software, with very similar capabilities as the standalone desktop, but it is MULTI-USER.

Technology Stack – a layering of hardware and software components to create a system application environment such as a database management system. We focus on the software components.

Key terms

Technology stack

Four layer software stack...

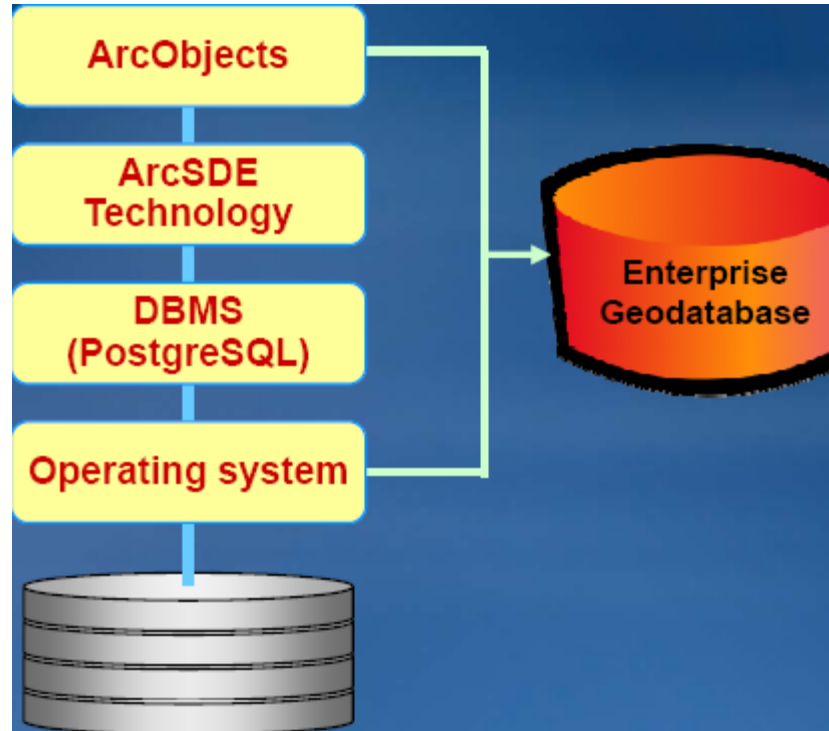
ArcGIS Server with PostgreSQL geodatabase technology

ArcGIS software (ArcCatalog)...

Driver connections to
specific DBMS...

Specific DBMS...

for example, Linux...



See [ArcSDE and PostgreSQL](#) slides for further details about PostgreSQL stack.

ArcGIS Server in Geography

2. What is UW Geography CGISE?

The Geography Department has a server cluster that provides a CyberGIS Environment (CGISE).

Cyberinfrastructure is a term used for data, software, and hardware integrated to offer remote (i.e., networked) processing capabilities. Thus, CyberGIS is a widely distributed GIS capability, often thought of as “high performance with distributed data”.

The “high performance” part deals with much larger databases to support many users on remote server resources.

Esri’s ArcGIS Server: basis of a CGISE deployed for Geography Dept.

Key terms

Technology stack

Purpose of CGISE

UW Geography Program

1. Provide UW GEOG students with a collaborative geospatial information computing environment that supports data management, analysis and mapping functionality.
2. Serve as an operational environment versus the archival approach of WAGDA through the UW Libraries as two different learning environments.

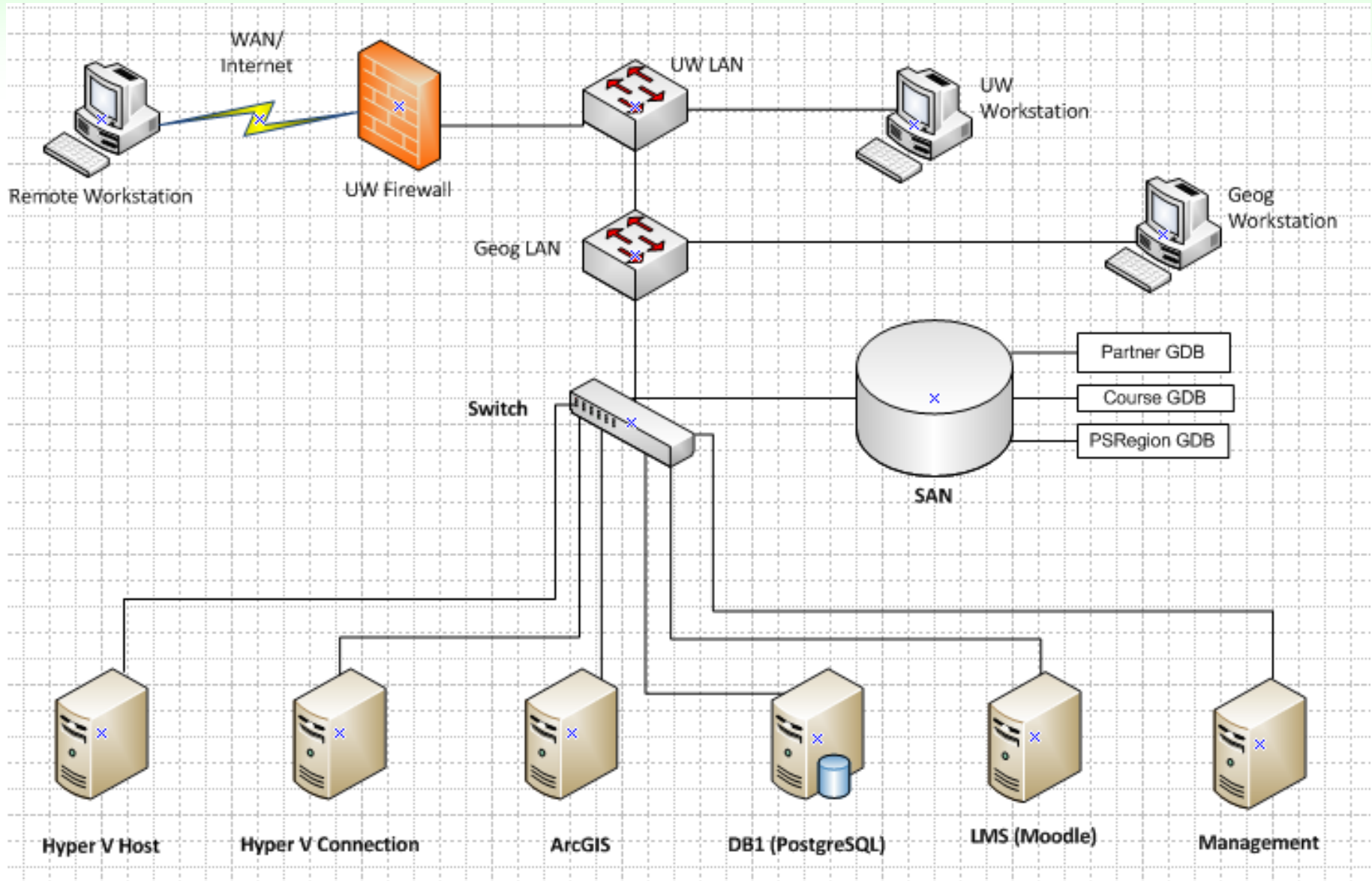
1 & 2 imply full user access to ArcGIS Server to manage data & services

Community Partner Data

3. Serve as a regional node for Puget Sound Region GIS applications for research and education.

Serving data management needs for 1, 2, and 3 point to requirements for system stability and robustness in a data management environment

Geog CyberGIS Environment (CGISE)



Enterprise Data from WAGDA to CGISE

- UW Libraries WAGDA (WA Geospatial Data Archive) hosts both authoritative data (from communities, agencies and institutions) and vetted derived data (from UW students & faculty).
- WAGDA is an “archive”, not an operational database environment.
- CGISE provides both a ‘working’ database and a repository database, collecting data from among multiple courses, which can be vetted and uploaded to WAGDA as a data archive (data warehouse).

System Requirements - Data Management

Three **content types** of GDBs are supported in Geography CGISE operational database environment:

1. Partner (research/education) Project GDBs

Separate GDBs are created for partner projects, e.g., GDB's that synergize the educational activities in courses. Careful attention is given to administrative responsibilities for managing availability and veracity of database.

2. Course (Student Project) GDBs

System administrator creates a GDB, **one** per course, for use in courses. All registered students in the course are assigned as Data Managers.

3. Puget Sound Region GDB (GISHUB)

In order to persist the data from course GDBs, selected feature classes from course (student project) databases will be replicated to GISHUB, together with WAGIC metadata. Students can read the database but do not have update and delete privileges.

WAGDA – a fourth data environment is outside the operational bounds of Geography CGISE, but foundational to database activity as a campus-wide data warehouse with potential connections to broader archives, known as spatial data infrastructures – SDIs, like www.geoplatform.gov.

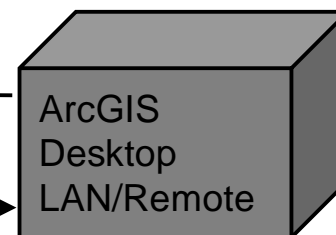
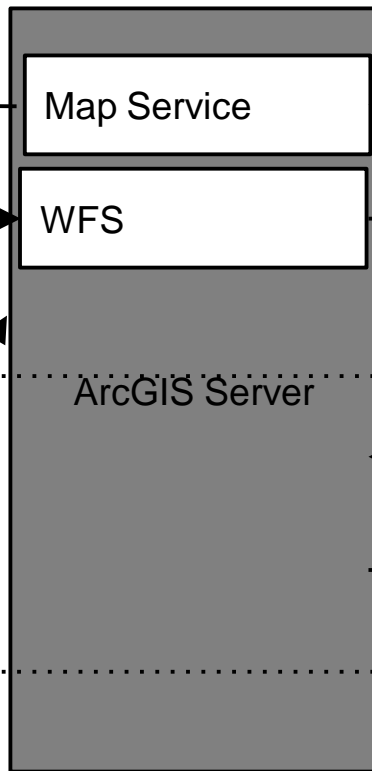
CGISE Application

Web Clients

CGISE

Desktop Clients

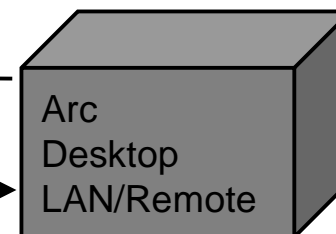
Static: **Web Map Viewer**



Interactive: **Web Map Editor**
draw points, lines, polygons

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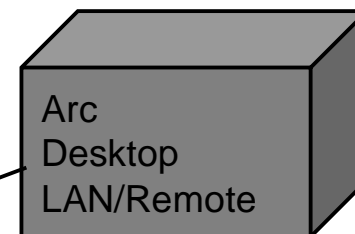
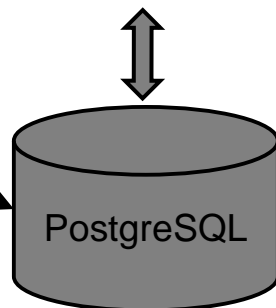
Analytic services within extensions to AGOL



MAPPING

ANALYSIS

DATA



Data Manager:
Connect to project GDB and import features, publish as WFS & map service

Data Manager:
Connect to project GDB and import features publish as WFS & map service

Direct Connect

Direct Connect

Publish

Application Use Case – Multiple Generic Examples

Project Purposes	Data management, analysis and display flood vulnerability by drainage units (watershed, subwatershed and catchment)
User Roles	Project researchers, student researchers, and project analysts
End Users	Specific GIS Analyst (works with data analysis and map services)
System Users	Data Managers (load data in GDB, & manage permissions for Data Editors)
Functional Requirements	
Data Management	Store and serve drainage units with population
Analysis	Flood vulnerability for population by drainage unit
Mapping	Puget Sound drainage units to be served by WAGDA

A ‘real use case’ would be much narrower, focusing on one GIS user task only.

Database Mgmt User Roles & Privileges

NOTE: Each feature class added to GDB is owned by user who added data (stored in their 'schema'). For data to be visible to other GDB users, data owner must manage privileges on data owned.

DB Mgmt User Roles	Privileges
Data Viewer	Generic 'read only' role to provide global access to data
Data Editor	RU operations on GDB
Data Manager	CRUD* on GDB. However, each dataset owner must assign privileges on the dataset to other users (i.e. teammates) registered in the system.
System Administrator	Full access

* CRUD = Create, Read, Update, Delete

In an ideal world, students would create their own GDBs. **HOWEVER**, creating GDBs requires superuser privileges and the server license code. Sys Admin creates a course GDB, and group databases. All registered students are assigned as Data Managers for the group databases. User creation is automated with UW Group Services.

In Lab 4 students work as team on a single data collection, but each submit assignment.

WAGDA Overview

3. What is the motivation for WAGDA 2.0?

WAGDA 1.0

- file-server download capability (now retired)
- System served web (html) pages with links to zipped files from a directory or points users to external locations.
- Accessing data sets is a process that involves locating selecting files to download one at a time, unzipping, and storing files on their local workstations (Google Search cannot index these files, which minimizes discoverability).
- Downloaded data can contain more data than necessary for user which adds to download time and personal disk storage.
- Finding data descriptions (metadata) requires accessing additional links and is a more cumbersome process which impedes the user's determination of fitness for use.

WAGDA 2.0

- More convenient, manageable, and flexible solution was needed.

Key terms

WAGDA

WAGDA 2.0 - Enterprise GIS data management offers

- Faster data search, quicker views to data, and decreases in local file storage.
- Four types of users supported:
 - Data readers
 - Data contributors
 - Data administrators
 - Data editors
- Enterprise GIS data management system offers university data suppliers an opportunity to disseminate data more readily with less maintenance using replication
- Spatial database system uses the ArcGIS Server suite.
- Services make data available in multiple and open formats

Eight functional needs identified for Spatial Data Infrastructure

- **Faster data viewing** – Decreasing the amount of time and number of steps needed to view data sets in a GIS
- **Remote data analysis** – Only store analysis results or relevant extractions of larger data sets on local disk space.
- **Exportable** – Exposing source data to extract and save to conduct analysis and save their results.
- **Interoperability** – Providing data in non-ArcGIS and open formats to ensure the greatest accessibility and usefulness.
- **Modifiable viewer permission** – administrators to enforce multiple permission policies laid out in data sharing agreements.
- **Complete and ready metadata** – Integrated metadata for contributors and readers in communicating the nature of data.
- **Database versions** (historical and transactional) – database versions store data at certain points prior to updates to be made.
- **Replication** – Data producers can push data into the primary database more quickly while maintaining data schema integrity

Key terms

All those terms in bold

Data service connection

- Spatial Database Connection (SDBC) - connect users directly to geodatabase using ArcGlobe, ArcScene, ArcCatalog, ArcToolBox, ArcMap.
- GIS Server Publishing Services
 - Geodata Service - basis for sharing data in open formats using Geographic Markup Language (GML) defined by OGC
 - Image Service - raster imagery (elevation models, land cover, and orthophotos) served and viewed seamlessly from geodatabase
 - Map Service - sharing data from basic, non-extractable views to open format data sharing with a predefined map image, for applications like Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) database

Key terms

Service
Connection

Publishing services with open formats

- Web Mapping Service (WMS) – a view-only map service for cartographic display. Feature attributes cannot be viewed or queried, nor can analysis be performed. No data export
- Web Feature Service (WFS) - vector data service suitable for query, analysis, and extraction. WFS-T allows read-write access for editors with non-ArcGIS platform.
- Web Coverage Service (WCS) - raster data service suitable for query, analysis, and extraction. Equivalent to Image Service but uses OGC specification.
- Keyhole Markup Language (KML) - service can display Google Earth or Maps. Can also use ESRI's ArcGIS Explorer as an alternative for performing basic query and analysis. KML readers available for most spatially aware applications, as it is an open, XML-based format.

Key terms

WMS

WFS

WCS

KML

4. What technology stack is used to implement WAGDA data management at UW Libraries?

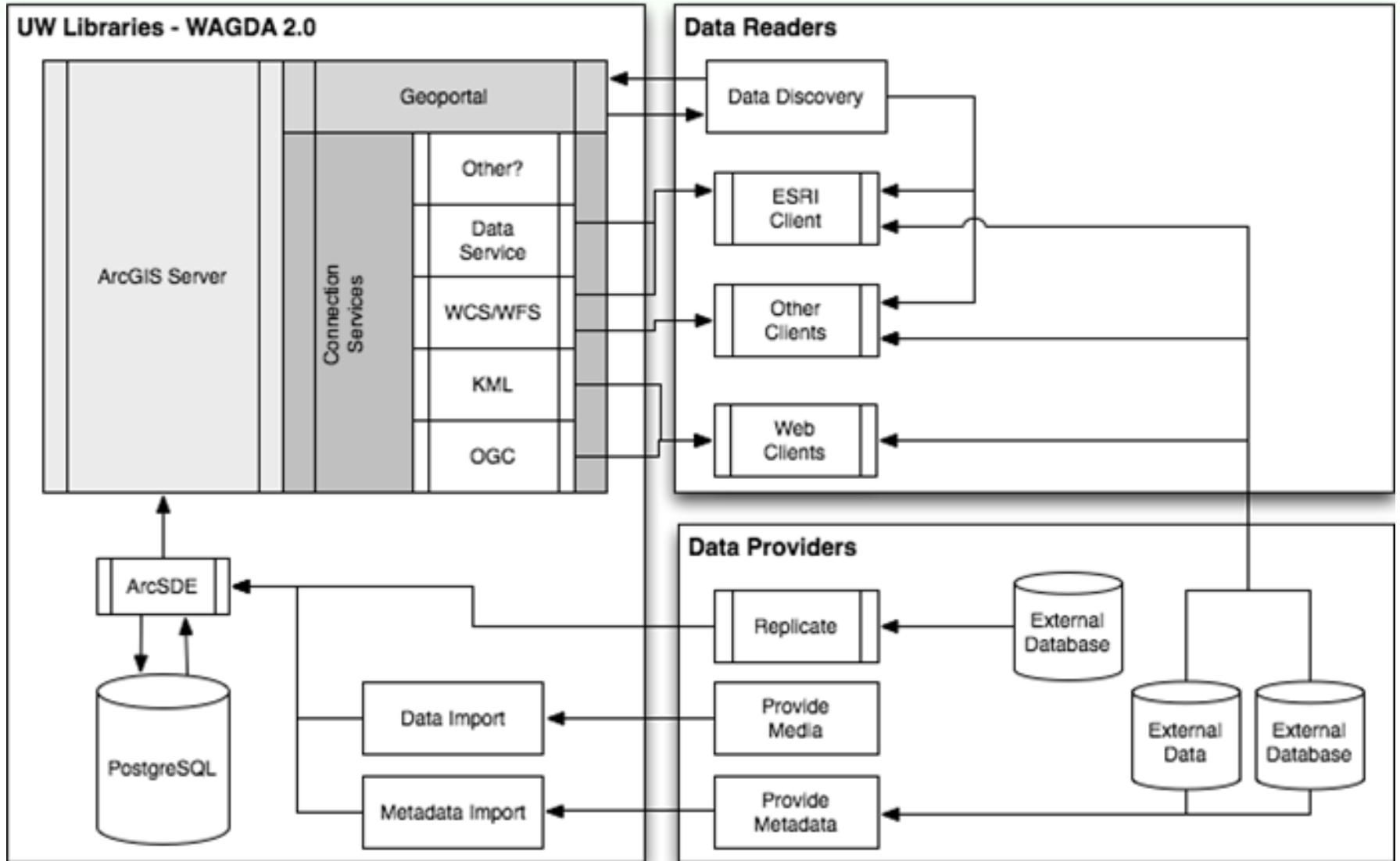
WAGDA uses Browser and Workstation connections from the application architecture

WAGDA uses ArcSDE and PostgreSQL to implement the technology stack for both geospatial DBMS and geospatial data archive.

WAGDA 2.0 system configuration is on next slide.

See UW Libraries [WAGDA Overview](#) slides for further details.

WAGDA 2.0 System Configuration Overview



Systems Components

Data Storage using PostgreSQL and ArcGIS (ArcSDE) Server

Metadata hosting using ArcGIS Server & (esri) Geoportal

Data discovery and dissemination using ArcGIS Server Services & GeoPortal

- All the data services available in ArcGIS
- Several services available
- Still considering if they are the the appropriate services

WAGDA Data Loading

Hand off of data, loaded by library staff

- NAIP Aerial imagery
 - Units of campus
-

Direct database replication

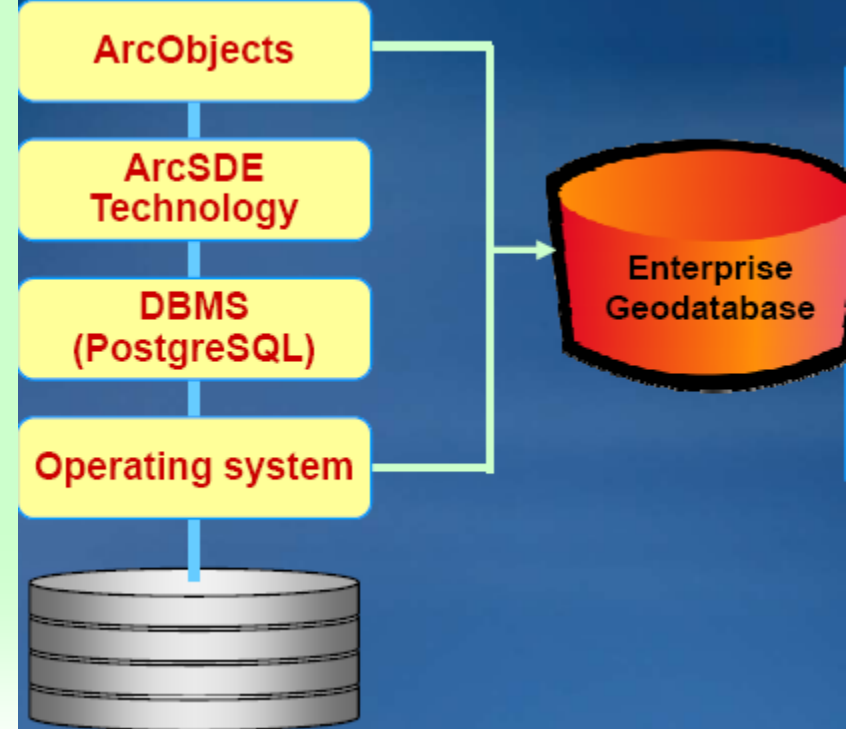
- CSDE (Census Summary Files)
- Non-university organizations
- Operations (Operations, Capital Projects Office, etc.)

Summary

In this lesson, you learned about...

1. Enterprise Geodatabase technology stack
 2. UW Geography CGISE
 3. Motivation for WAGDA 2.0
 4. Technology stack used to implement WAGDA data management at UW Libraries
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Contact me at nyerges@uw.edu if you have questions or comments about this lesson.



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END Lesson 9: ArcGIS Server Data Management