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INTRODUCTION
TOPIC 1: ONLINE GIST AND WEB MAPPING

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Contents

Introduction to web mapping

This course is composed of seven topics. A useful video is: https://youtu.be/RMnmxMTCtUA

Topics

1. Introduction to Online GIST and Web Mapping (this module). This module will give an overview of the course so that a general understanding can be established before learning specific content in each of the topics.

2. Esri ArcGIS Server, is commercial software and can only be loaded on a server class machine. This type of server will also be referred to as a Geospatial Server. The server must utilize Microsoft Server. While no direct knowledge of servers is required, networking and server processes for this class will be covered when needed. The server can be a physical server or a virtual server (a virtual sever is preferred).

   a) Installation, the user will not be required to install the server operating system or to configure the server, but will be required to set-up the ArcGIS Server software. It is strongly suggested that Esri ArcMap Desktop be installed on the server.

   b) Connections to storage arrays and relational databases in the data store are critical to production operations. In the production environment, most companies do not keep mapping information on the geospatial server machine and definitely not on the desktop computers.

      1) A storage array is a large amount of storage that can be accessed as common storage by members of the organization. Mapping information that is used from a storage array in ArcGIS Server can be read but not modified; this is referred to as a map service. The information can be stored in folders or personal databases.

      2) A relational database allows multiple simultaneous connections to the same data set, those that have appropriate credentials will have the ability to edit the information and to create new information. A relational database is different from that of a personal database like Microsoft Access. With a relational database, a feature class service can be created, which can be editted.

      3) Creating a service, is taking the data that is stored on the Geospatial Server and providing a data stream that can be used by both web and desktop applications. In general, there are two types of services one which can be edited and those which are static and can only be viewed. Generally, most map services are a titled vector layer. Therefore, the information is automatically made into a cached bitmap image and is created at numerous zoom levels, which is different from the desktop application, which can zoom to any level. These predetermined zoom extents make for faster application loading. When a zoom level is request the tiles are saved for the specific geographic region at that zoom level, but all the tiles

are based upon the vector data. Most geospatial servers allow the user to pre-cache tiles, but this requires more storage and might be impossible for large regions at a very high magnification (small scale). When possible an outside service should be used as a basemap. Therefore, most of the information being used will be tiled on the basemap server and not on the local server.

3. Local Hosted Web Maps will require a server that is connected to the Internet and running an internet protocol. For this course the protocol will be Microsoft Internet Information Service (IIS). This should have been previously installed and configured appropriately. Several other tools could be used to display the map services on a web page instead of IIS. In this course, Silverlight and Flex will be explored.

4. Esri ArcGIS Online (AGO) is a purchased service. This service interfaces directly with Esri ArcMap Desktop allowing the user the ability to export maps seamlessly so that they can be seen externally. This is not a free service and credits will be charged depending on the amount of processing that is required for the information placed in AGO.

    a) Creating web maps using ArcGIS Online, which goes beyond just exporting map data to the server, the map must be configured into a dynamic map, similar how a map is prepared for publishing by adding a title, scale bar, etc.

    b) Esri Collector and AGO can be used to collect field data. The use can collect the data using a smart device containing a GPS. For data to be collected, an app must be installed on a smart device. This application will work on multiple smart device platforms.

5. OpenStreetMap, is an open-source basemap service, which users can modify by the user. Most basemaps are static images that cannot be modified. OpenStreetMap gives a user the ability to add features and correct their targeted area.

    a) Data editing and creation

        1) OpenStreetMap has three different internal editors, which will be explored, each of these editors have a very short learning curve. When a change is made to OpenStreetMap, it does not immediately appear because the map will require re-caching the information to a variety of scale levels. In addition, new modifications may be reviewed by volunteers to insure accuracy.

        2) OpenStreetMap can also be edited with external programs; such has QGIS, JOSM and Esri ArcGIS Desktop. Some external editors may require plugins.

    b) Cartography – Mapbox Studio, is used not to add or change information to OpenStreetMap but instead is used to change the look of OpenStreetMap, i.e. the cartography. Every item contained in OpenStreetMap can be modified, these are

local modifications and do not affect the general appearance of the map. For example, a river is normally shown as blue, but all rivers could be displayed as yellow, no real justification to do this but it could be done.

6. Mapping Applications

    a) A Story Maps utilizes a position(s) along with appropriate maps, photographs and other graphical information as well as a written dialogue. There are many types of story maps, which have a variety of purposes and different platforms that can be used to host story maps. Some platforms are free and other requires a subscription either to the application or to use data within the application.

        1) Google Tour

        2) Knightslab Story Map

        3) Esri Story Map

            1. Online hosted map, there are numerous templates that can be used for the hosted maps.

            2. Local hosted map (optional), in this case software would need to be downloaded and configured. The information would need to be placed on a server class machine. The user might need to perform some level of information configuration for complete functionality and it might not be as simple as utilizing a hosted services, but may be more dynamic.

7. Open-Source

    a) Cloud based services and applications, that will be manipulated using a web browser in general. Not all software applications that utilize a web interface are cloud based, for example, Esri ArcMap Server uses a browser but is locally installed.

    b) Local Servers, for these servers it is important to note the operating system that is required as well as the Internet protocol that will be used. Many of the open-source programs will not run on a Microsoft Server environment meaning that both the operating system and the Internet protocol must be open-source as well.

Assumptions

Requirements:

1. The learner should be an experienced user of geoprocessing tools and have operational knowledge of ArcMap at the desktop level. It is assumed that all maps can be constructed for this class from previous knowledge, as might be gained in an introduction to GIST course(s). For those users who are not familiar with Esri ArcMap Desktop it suggested that a quick review of the software be done prior to beginning this course.

2. The learner needs to understand and can utilize Microsoft Windows file structure, through File Explorer. It is extremely important that the user understand the tree file structure and can locate information that is saved both on their computer and on a file server.

3. The learner should understand basic map projections and be able to implement them. All maps created and placed on a server will need the correct projection so that they can be viewed properly.

4. The learner needs to have knowledge of basic cartography. Selecting mapping items and then locating them properly on a map is critical, this includes selecting color ramps, labeling levels, layers to display and appropriate fonts.

5. The learner will need administrative rights to a Windows based server.

6. The learner will need to have an ArcGIS Online account, and authorization file for desktop and server applications.

7. The learner will also need to have a broadband connection to the Internet.

Helpful for the learner, but not required:

1. Knowledge of open-source software.

2. Knowledge of programming languages and html/xml code.

3. Knowledge of server functionality including IIS.

Purpose

- This course will provide the learner with the knowledge of how servers function in geoprocessing and how they are interconnected in the operational fabric of modern enterprise geospatial processing.

- This course will use open-source software that is cloud based as well as private cloud operations; this will include both commercial and free products.

- This course will have multiple levels of complexity. Some operations will be relatively simple but new to the learner; others will be more complex building on previously acquired knowledge.

Topic: ArcGIS Server

- A geoprocessing server can create services containing geospatial data that can be projected within ArcMap Desktop and in other mapping applications as well as online.

- The student will install and configure Esri ArcGIS Server software on a Microsoft Windows Server that can be either a physical box or a virtual machine. Full administrative rights to the Server is required to load and configure the software It is assumed that the Microsoft Windows Server has been installed and configured prior to

being made available to the learner. Other operating systems could be considered for the server, but for this operation, only Microsoft Windows servers will be used. When referring to the Microsoft Window Server it will be noted as the server and when referring to the Esri ArcMap Server it will be referenced as either the Esri Server or the Geospatial Server.

- The ArcGIS Server will be connected to other resources such as storage arrays and relational database servers. A storage array is a network storage device that can be accessed by multiple individuals; it could be a set of file folders or personal geodatabases, but not a relational database. There should be redundancy in the data storage, such as mirroring the hard drives for data protection. A relational database might be a device like Microsoft SQL, Oracle or MySQL.

- The learner will create geoprocessing services. A geoprocessing service is a connection to geospatial data that can use bi-directional communication. Some services are read-only which is an example of single direction communication, while others can be modified if connected with a relational database.

Topic: Web Mapping Applications

- There are different mapping packages that can take a geospatial data stream from a server and display it as an online interactive map. The maps can be editable if the service is connected with a feature class service. Feature class services are generally connected to a relational database server.

- Maps will be created using multiple interfaces. Both the Silverlight viewer and the Viewer for Flex will be relatively easy to navigate, they each have unique features that can produce the same data but with different looks. The HTML 5 and Java mapping applications are an optional features and depending on the instructor, they may be required components.

Topic: ArcGIS Online (AGO)

AGO will be utilized to create web based services, an Esri account is required. Esri accounts will be obtained from the instructor. Note: the instructor will create an initial password that should be changed when the account is received. The instructor will not have access to the account once the password has been changed. If the password has been lost, the instructors can send a link to reset the password but cannot reset the password directly. Your instructor will not have access to information in your account. The instructor may choose to limit the number of credits available to the learner during the class. Users outside of the educational community are charged for the number of credits they utilize.

- The learner will utilize a map service from their server and create a web map using the tools contained within ArcGIS Online.

- The learner will utilize a feature class service from their server and create a web map that can be edited. The web map that is created will be connected back to the learner's relational database.

- The learner will create an application in Esri Collector utilizing just AGO. The learner may also be required to create a feature service in AGO.

Many companies, depending on their needs and the security of their data, may use only an online service like AGO. They may also use a combination of services like AGO and their own hosted services and servers or maintain all information behind a secure firewall and only publish appropriate public information out of their secure work environment.

Topic: OpenStreetMap

OpenStreetMap is an open-source mapping software in which users can modify the items contained on the map. There are levels of curation to insure that only appropriate information is added to the map. There are different types of editors that can be used and several will be explored.

- The learner will add and edit content in OpenStreetMap. OpenStreetMap is much like Wikipedia for maps, since it is maintained by the user community and is constantly improved in accuracy by the user community. The editors can be those contained within the OpenStreetMap, a JOSM editor, QGIS or ArcMap.

- The learner will work with the cartography tool, Mapbox Studio (free for limited amounts of storage), to change the characteristics of how OpenStreetMap is displayed for the users project(s). This will be done through simple XML type code (CSS), no previous knowledge of XML is required, but can be useful.

Open Street Map is a good base layer that can be used in both open-source and commercial products. The author uses this layer in most of his mapping operations, using it with ArcMap Desktop as well as server applications.

Topic: Story Mapping

A story map is as its name indicates a story that is tied to one or more maps. The learner will explore different types of story mapping which will include both commercial and open-source software. Several story map components will be explored, including:

- Timeline

- Location of places

- Split screen

Esri Story maps as well as those of Google and Knight Lab will be included in this topic. Each of these types of story maps have their own limitations. In addition, some versions of Esri Story

Maps can be hosted on the users own servers. The learner may be required to install applications on their geospatial server and make minor code modifications.

Topic: Working with Open-Source Servers and Cloud based storage

It is important to understand that multiple solutions may be required to solve a need in the production environment. These solutions may include both commercial and open-source software for the same problem. For example, the user might use an open-source desktop solution and then use a commercial product from server applications.

While commercial software is always a good solution because of the development efforts and the backend support, sometimes these solutions can be cost prohibitive and lack the flexibility that the designer requires. For example, most basemaps cannot be modified unless you are using OpenStreetMap.

Open-source servers, may not be completely free (open-source does not mean free), they are generally more flexible, but may also require more programming knowledge than those that are built on a purely commercial platform. In addition, the type of server required may be outside the expertise of the Information Technology department. For example, if an organization is a Microsoft shop, the expertise for setting up a LINUX box may be lacking or be prohibited on the network. It is always good to have a close working relationship with the computer services director.

In general, there are open-source components that do similar jobs as those that have been commercially created.

Remember:

- Open-source and free software are **not** the same.

    – **Some** open-source software is free.

- Open-source may be cloud-based or may require a download and installation.

- Many open-source software applications will run on multiple platforms such as Apple OS, LINUX, and Windows. For example, ArcGIS Desktop will only operate on a Microsoft platform, but QGIS will operate on multiple platforms.

    – Additional programming knowledge can be required to implement the software successfully since it is more code driven.

    – The user community instead of a company helpdesk often provides help.

    – Most open source programs require less storage space, but may require installation of specific modules or plugins as needed. Some of these plugins may contain bugs depending on the platform.

    – In general, the code is open and not locked which allows for more customization if the user has the appropriate programming skills.

Focus

This course will focus specifically on web creation using open-source and commercial software; the class will not focus on general geoprocessing at the desktop level, it is assumed that the user already has this knowledge either through previous classes, personal or professional development.

It is assumed that the learner can create appropriate maps and the course will begin the focus on how to put the information online in a usable format. If the learner cannot create a high-level detail map, it is strongly suggested that these skills be obtained before proceeding with this course.

Quiz

The learner will be required to take a brief quiz over the different concepts of this course. This quiz will show that the student has accessed the course materials and has a basic understanding of the course content.

Quiz Questions

http://216.69.2.80/Learning_Modules/GIS/GIS260/Storyline/Quiz1 - Storyline output/story.html