Using Python, SQL, ASP.NET and ArcGIS to Process Custom Map Requests

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Overview

• U.S. Drought Monitor background
• Custom map challenges
• Solution
  - How it works
  - Pieces
• Step-by-step through the process
• Improvements
The U.S. Drought Monitor

Background Information
U.S. Drought Monitor

- U.S. Map Depicting Drought Conditions
- Covers 50 states and Puerto Rico
  - Soon to be expanded to U.S. Virgin Islands and Pacific possessions
U.S. Drought Monitor

- Produced on a weekly basis
- Data compiled by one author each week
- Author edits shapefiles in ArcMap
U.S. Drought Monitor

- Data are processed by the NDMC on Wednesday afternoon/evening
  - Process currently happens in Python

- Data are released on Thursday morning at 8:30 a.m. Eastern Time
U.S. Drought Monitor

- Almost 3,300 map files produced

- Areas mapped:
  - National
  - State
  - Other areas (regions, 2-digit HUCS, etc.)
Custom Map Requests
and the challenge they present
Mapping Challenges

• Large number of maps produced
  - Over 3,200 files
  - Over 1 GB of data

• Doesn’t seem like a lot but…
  - over 900 weeks of data
Mapping Challenges

• Limited time to produce maps
  - **16 hours** between final edits and data release

• Process happens during “non-business” hours
  - Between 5 p.m and 7 a.m. Central Time
Mapping Challenges

• Requests for maps of areas that are not part of the process

• Can’t map everything due to the time and resource limitations
Solving the Mapping Conundrum

Available options
Option Number One

- Produce custom map requests manually
  - Time consuming
  - Need to store a number of files (mxds, layers, etc.)
  - Possibility for map inconsistencies

- Basically the potential for chaos!!!
Option Number Two

• Add more maps as part of normal process
  - Processing time constraints
  - Disk space constraints
  - Opens the door for more and more requests
Option Number Three

- Create a custom map request tool
  - Allow users to request maps at their convenience
  - Handle processing automatically upon request
We Have a Winner!
(Option number three)
Solution

• On-demand custom map request module/process
  - Maps generated automatically upon user data submission
  - Minimal use of storage space and staff resources
Solution

- Allows users to request maps as needed
- Can provide maps of areas that are not part of current process
- Users can specify some map options that are not part of current process
How does it Work?
A look under the hood
How it Works

Web Interface ➔ SQL Database

Python Scripts ➔ Server Tasks
Web Interface

- ASP.NET page which writes to the SQL database
  - Site built in DNN content management system
Web Interface

- Multiple selection options
  - Area
  - Map Type
  - File Format
  - Resolution (if applicable)
Web Interface

• User submits a valid email address

• Request is written in the SQL database as a new record
Web Interface

United States Drought Monitor

Custom Map Request Form

Select a Map Date
Choose a U.S. Drought Monitor map date:
April 18, 2017

Select an Area Type
Choose the type of area from the list below:
National

Select a Specific Area
Select a specific area from the list below:
CONUS

Select a Map Type
Choose the type of map to create:
No Text

Select a Map Format
Select a file format for the map:
PNG

Enter a Map Resolution
Enter a map resolution between 70 and 600:
96 dpi

Note that 96 dpi is ideal for images displayed on the web, while 300 dpi or greater is necessary for print materials.

Enter a Valid Email Address
Enter an email address where the finished map file can be sent:
Table inside the USDM database to handle requests
## SQL Database

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Several columns hold map parameters
- Area type
- Area ID number
- Map type
- Map resolution
SQL Database

- Email address stored
- Map file name recorded
  - Combination of date and map parameters
- Parameter to indicate whether or not map has been emailed
Python Script: Mapping

- Script handles the mapping process
  - Uses parameters from the data request

- Creates map to a folder on the server
Python Script: Mapping

- Searches database for records that have no file name listed
  - Creates a map for each record
  - Uses parameters submitted to the database to create the map
  - Writes the filename to the database
  - Exports the map to a folder on a server
Python Script: Email

- Second script handles the email
  - Sends a canned email response with the newly created map as an attachment
Python Script: Email

- Script checks the database for records that have parameter value of 0
  - Locates the file name listed for each record
  - Sends the automated email to the address listed in the record
  - Attaches the map file to the email
Server Scheduled Tasks

- Two scheduled tasks run every 15 minutes
  - First task runs the mapping script
  - Second task runs the email script
Other Pieces

- MXD files containing map templates
  - Used by the Python Scripts
  - Same MXDs that are used in the regular production process
Other Pieces

- Layer files with symbology for maps
- Accessible location on the sever for map storage
Step by Step Example

The process from start to finish
Submit my Information
Submit my Information

Your information has been successfully submitted. Expect your map file to be delivered to the email address provided within the next 15 minutes.

This tool lets you generate a custom map. Once you make your choices and submit them, we'll email the map within 15 minutes.

Select a Map Date
Choose a U.S. Drought Monitor map date:
April 16, 2017

Select an Area Type
Choose the type of area from the list below:
National

Select a Specific Area
Select a specific area from the list below:
Total U.S.

Select a Map Type
Choose the type of map to create:
Map with Impacts

Select a Map Format
Select a file format for the map:
PNG

Enter a Map Resolution
Enter a map resolution between 70 and 600:
300 dpi

Note that 96 dpi is ideal for images displayed on the web, while 300 dpi or greater is necessary for print materials.

Enter a Valid Email Address
Enter an email address where the finished map file can be sent:
nothwehr2@unl.edu

Submit
Record Added to Database

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![U.S. Drought Monitor](image.png)

20170418_usdm.png
Email Sent

Hello,

The U.S. Drought Monitor map you have requested is attached to this email. Please contact me if you have any questions.

Chris Poulsen
National Drought Mitigation Center
GIS Manager
(402) 472-8828
cpoulson2@unl.edu

Unable to log in to SharePoint. Click here to log in.
### Database Updated

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Improvements
and other potential changes
Potential Improvements

- More error checking
  - Check validity of email
  - Captcha or some other spam prevention
Potential Improvements

• Process to clean up map files after they are sent
  - Delete files in order to save space
Web Form

• Any type of web form should work

• Need to be able to write to a database

• Indicate that user’s email will not be shared with anyone else
SQL Database

• Use Boolean variables to record when events happen
  - Used to determine that map has been emailed in this example
Python Scripts

• Used **pyodbc** to write to database
  - Free add in which must be installed
  - Simple way to interact with databases
Python Scripts

• Make sure scripts successfully change check variables
  - Prevent tasks from running endlessly
  - Prevents duplicate emails to users
Python Scripts

• Use "try" and "except" statements to handle errors

• Set up an email script to alert someone if errors occur
Scheduled Tasks

- Can run at longer or shorter intervals
  - 15 minutes used in this example

- Indicate to users how much wait time is possible
Other

• Make sure your symbology layers have a valid data source
  - Layers with a missing data source won’t work
Other

• As with anything, test thoroughly before deploying
  - Don’t want maps with errors going to users
Questions?

Contact:

jnothwehr2@unl.edu