

Public Safety Log

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GIS for Public Safety

Pennsylvania Federated GIS Enables Data Sharing across County Lines Counties Maintain Independence and Regional Coordination

Disasters do not respect political boundaries. Emergencies, natural and man-made, often impact a broad community. It's common for emergency response support to pour in from an even wider region including neighboring counties; cities; and, in extreme cases, other states.

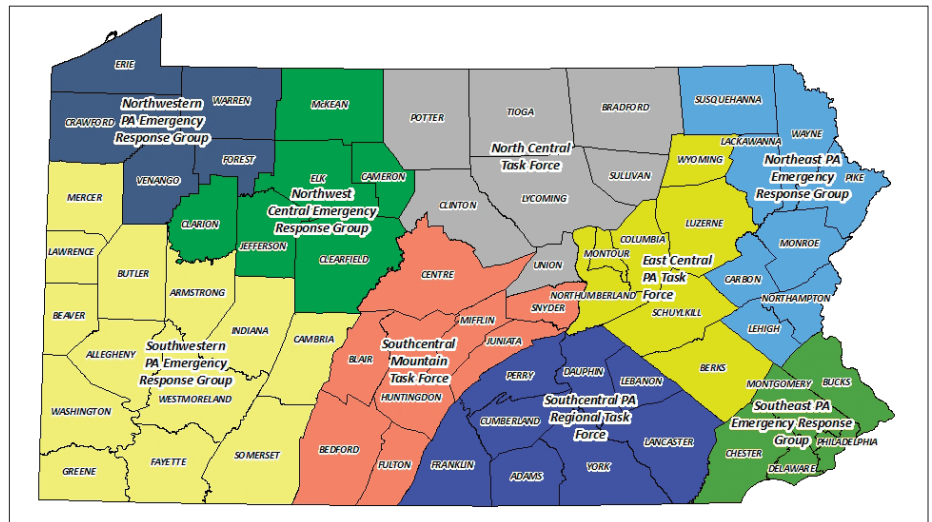
In Pennsylvania, the state's 67 counties are grouped into nine counterterrorism task forces for improved emergency management. Though the task forces were created in the wake of 9/11, they serve not only to strengthen homeland security coordination but also to facilitate quick responses to natural events such as flooding.

For years, counties in the state have realized the importance of sharing geographic data for enhanced emergency response and looked for ways to orchestrate it. Sharing GIS data would also provide backups to a county should its infrastructure become compromised during an emergency. Additionally, a county could use the data of neighboring counties in daily activities.

Across Pennsylvania, counties maintain data in varied formats according to different business requirements, which created a barrier to data sharing. When ArcGIS 9.2 was released at the end of 2006, product enhancements made data sharing easier. With geodatabase replication and the ArcGIS Data Interoperability extension, three counties in Pennsylvania—Clinton, Lycoming, and Union—began to look at how they could share locally maintained GIS data such as road centerlines and tax parcels. The remaining four counties in the North Central Counter Terrorism Task Force joined the effort as did Centre, Luzerne, Wayne, and Mifflin. The Pennsylvania Federated GIS pilot project was under way, with the Pennsylvania GIS Consortium offering funding and guidance.

Creating a Resilient Federated GIS

A federated GIS is based on a distributed collection of connected GIS nodes that share and use each other's geographic information and services. In this case, a county's enterprise geodatabase serves as a



Organizing counterterrorism task force regions helps establish local priorities.

node. ArcGIS Server 9.2 enabled this architecture with replication, which allows copies of a geodatabase to be distributed to other counties' GIS based on an agreed-upon schedule that could be monthly, daily, or more frequent. During a crisis, updates can be made in near real time.

The Pennsylvania Federated GIS was designed to be resilient; if one county's GIS data becomes inaccessible in a crisis, it is still accessible at other locations in the state. Other servers in this connected group could immediately stand in for a disconnected node. From a remote location, the disconnected county's replicated data will run seamlessly in GIS applications.

To achieve this resilience, the Pennsylvania Federated GIS is decentralized. A central server would make participating counties depend on one county or physical location. In the event of an emergency that debilitated the central server, there wouldn't be a backup.

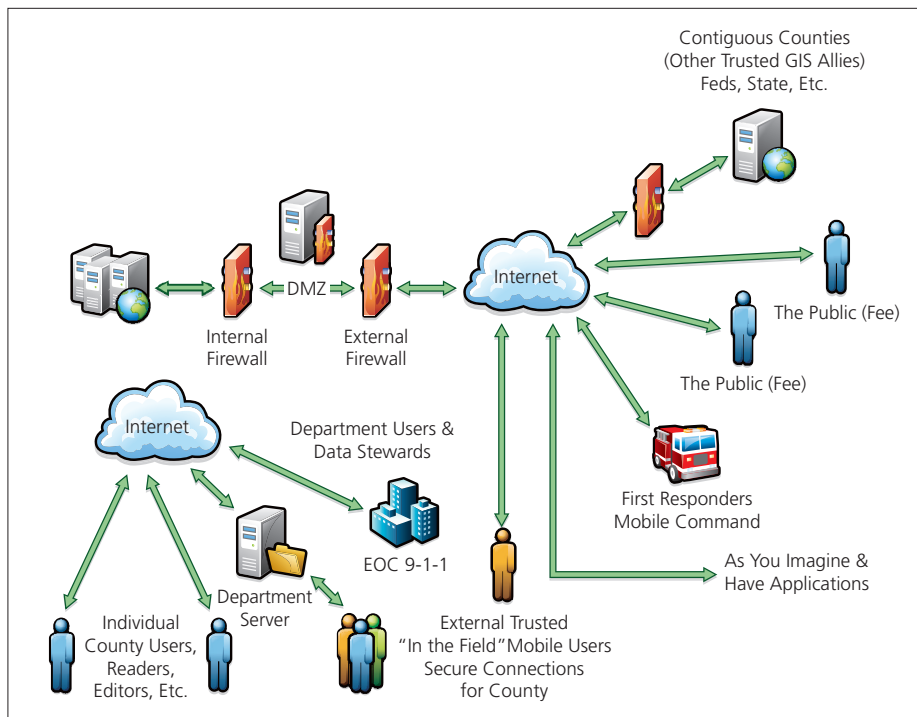
Maintaining the independence of each county was also a top priority. Each county had its own workflows and data formats, which the Pennsylvania Federated GIS respects.

"Part of what made this project unique was that it

was born in an environment where the project planners believed that county independence was non-negotiable, and that the ability to regionally coordinate was nonnegotiable," said Thomas O. Sweet, Jr., chief operating officer of the Pennsylvania GIS Consortium. "Everything else revolved around the question, How do we make it go?" Collaboration among all participants was critical.

The ArcGIS Data Interoperability extension was essential in supporting each county's individuality. The extension eliminates barriers for data sharing since it reads more than 75 spatial data formats and can export to more than 50 spatial data formats. Participating counties have direct data access as well as transformation and exporting capabilities so they can integrate various data types into their GIS.

The ArcGIS Data Interoperability extension allows the counties in the pilot project to process their data and load it into the GIS for the Nation data model or use other unique standards like the Pennsylvania Geospatial Data Sharing Standard (PGDSS), depending on each county's preference. This is typically referred to as an extract, transform, and load (ETL) process, which cre-



Typical/Preferred Individual Participating County Configuration

ates a seamless data layer. The GIS for the Nation data model is a data-sharing information model for local, state, tribal, and national data themes. PGDSS is a standard born out of Pennsylvania's need to facilitate data sharing among the commonwealth's various organizations; it focuses on unique attributes of Pennsylvania.

Replicating Success

The public demonstration of the pilot project took place in 2007 at Union County's Emergency Operations Center (EOC). Representatives from multiple counties, the Commonwealth of Pennsylvania, and various federal agencies were in attendance. For the project, two servers that represented a county were brought online at the

Pennsylvania GIS Consortium office to represent a primary task force server. The presenters were running flood models and conducting a GIS analysis that would be typical during an emergency when the connection to the primary task force server was severed, simulating an EOC becoming disconnected. Without interruption, the Web-based GIS application accessed data from a secondary server on the Federated GIS Network, and the demonstration continued without interruption.

After the pilot counties successfully executed their project, the counties in the East Central Counter Terrorism Task Force began to replicate their GIS data based on the Pennsylvania Federated GIS model. Since the federated GIS is based on out-of-the box solutions from ArcGIS Server, new counties can join the effort without having to learn how to use custom data models from other counties or continuously change their data into a standard format. All the participants can work off of the same ArcGIS Server foundation and the same standard data models.

The East Central task force added to the project's scope with a custom geoprocessing task and a mobile application that will support EOC operations during an emergency. The geoprocessing task is a tool that will improve road closure management across multiple counties in the task force area during floods. Road closure information was previously collected by a number of organizations that often shared the data via fax.

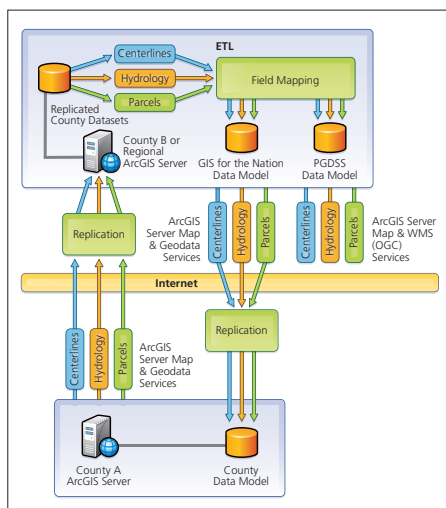
The task force will deploy the geoprocessing tool in three ways. EOC workers can input road closures through ArcGIS Explorer. Local municipalities can input road closure information via a

Web mapping application; then the data would be a part of the county's data repository and could be shared throughout the federated GIS. And the road closure data will be published as a Web service for other partners such as commonwealth or federal agencies to consume. Counties can choose to share this data with anyone who has access to the freely downloadable ArcGIS Explorer.

The East Central task force's mobile application will be used to collect postdisaster damage assessment information. Via laptop computers, county assessment teams will collect data in the field and sync those updates to their county's server. Then, that data can be replicated to other counties in the state. All counties in the East Central task force will use this custom application, and counties outside this task force can choose to implement the application. Since the collected data will be shared in the same manner as the basemap data, this application will assist in creating a regional damage assessment.

The next counties to join the federated GIS effort are in the Northeast Emergency Response Group. Through the federated GIS project, the counties of Pennsylvania are adopting the most up-to-date GIS software and practices to allow ultimate flexibility in emergency response. Interoperability is often the greatest challenge to overcome when outside help is needed, but leveraging local data and workflow processes gives these counties the ability to expertly coordinate regional responses while honoring individual data maintenance processes built around existing business requirements and systems.

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Workflow Diagram of the Export, Transform, and Load (ETL) Process



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