



# **GIS—A Critical Defense Infrastructure**

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# GIS—A Critical Defense Infrastructure

## An ESRI White Paper

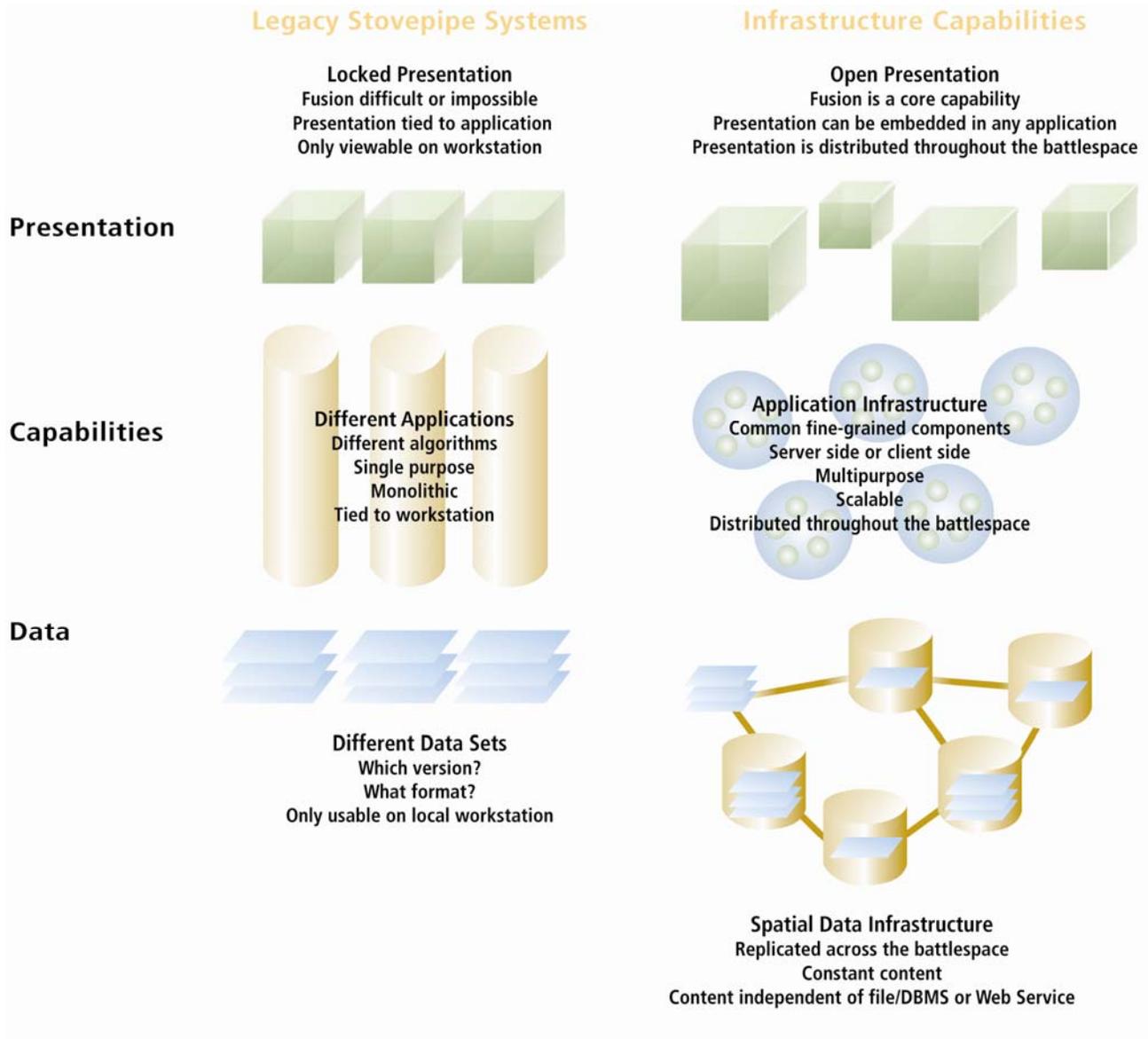
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# GIS—A Critical Defense Infrastructure

## **GIS as an Infrastructure**

ESRI is the largest supplier of geographic information system (GIS) technology to defense and intelligence communities worldwide. GIS technology is rapidly moving from its historic niche usage within defense to becoming a critical defensewide infrastructure. The criticality is based on the fact that defense operations depend on battlespace awareness—and the battlespace is geography. This involves more than an understanding of location—geography is a science that creates a framework for understanding the relationships between all battlespace entities. This, in turn, develops knowledge from the flood of data.

Defensewide spatial infrastructures break down the "stovepipes" that divided systems in the past to provide a common framework for handling mapping, charting, geodesy, and imagery across all defense systems. This is important because it avoids having the government pay time and time again for the same core functions to be developed for each system. It also ensures that the war fighter receives the latest capabilities from the commercial off-the-shelf (COTS) community where information technology (IT) innovation occurs.



**War Fighter Support**

An infrastructure must be ubiquitous. An infrastructure that just supports strategic decision makers and leaves the war fighter in the dark is not an infrastructure—it is yet another stovepipe.

The ESRI® ArcGIS® platform provides an infrastructure that can ensure a flow of spatial information from battlespace sensors to the war fighter across challenging network environments. This distribution of battlespace awareness across all levels of command is based entirely on industry-standard IT. This permits the dispersion of spatial data and functionality across the network and supports scalability from ArcGIS servers supporting national defense headquarters down to ArcPad® software on mobile or wearable computing devices.

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This vision of fusing information from disparate sources into a common, distributed situational awareness environment is what ESRI technology delivers today. This is about far more than disk awareness—the near instantaneous transfer of data from disk into a map display. This is about the transfer of information from all connected and relevant battlespace sensors into the network and then into viewers embedded into C4ISR applications. Inevitably, that is not an instantaneous process—but it is battlespace awareness, which is the best view possible of all relevant battlespace entities.

### Disk Awareness

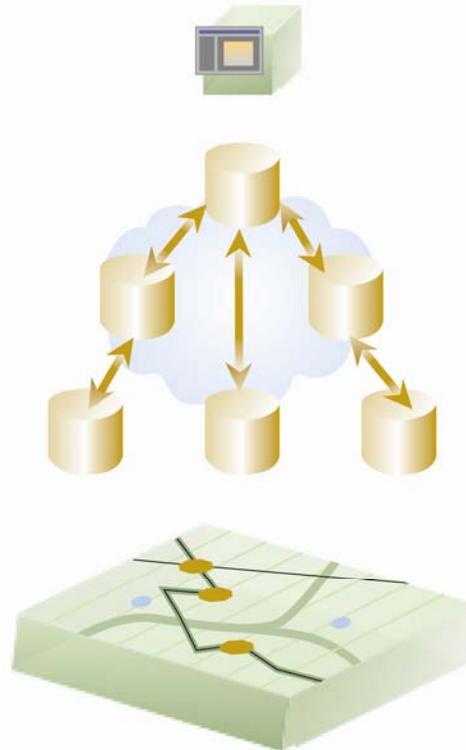
It is not just about how fast this is.



This is easy to define and measure.

### Battlespace Awareness

It is about a flow of information from sensor to headquarters to war fighter.



This demands a holistic view of the complete defense information infrastructure.

***Interoperability***

The words used previously define interoperability: "transfer," "fuse," "connected," and "distribute." Any closed and proprietary technology cannot participate in network-centric operations (NCO). Technology must be open and capable of adaptation to meet different interoperability strategies.

It is important to differentiate between data interoperability and software interoperability. Data interoperability has been achieved through the use of standard formats requiring the development of readers, importers, and exporters—work that ESRI has always supported and will continue to support.

Software interoperability was originally handled using an application programming interface (API)-based approach, so all mission systems are built from common APIs. For a variety of reasons, standard APIs have not been successful—the level of granularity has often been at odds with developments in the commercial software industry.

Today, the focus is shifting to loosely coupled Web service architectures using industry IT standards such as SOAP and XML. An interesting aspect of ESRI's ArcGIS platform is that it can deliver to multiple interoperability paradigms within the same technology framework.

In the past, migration has been expensive and risky as architectures have migrated. Today, the ArcGIS platform ensures that migration can support multiple architectures from a common COTS component foundation—ArcObjects™, the C++ components that underpin the ArcGIS platform. They are exposed to developers of clientside applications such as the ArcGIS Engine Developer Kit; developers of serverside capabilities such as ArcGIS Server; and professional GIS users such as the range of ArcGIS Desktop products: ArcView®, ArcEditor™, and ArcInfo®.

This enables the ArcGIS platform to support emerging service-oriented architectures at the same time as more traditional client/server, peer-to-peer, and stand-alone implementations.

Another key aspect of interoperability is conformance with the many standards that are defined in the IT industry. ESRI's primary focus is on engineering compliance with IT standards in the core of the ArcGIS platform. This ensures that ArcGIS can participate in a wide variety of IT scenarios—cross platform, multiple database management system vendors, and support for a wide range of customization environments.

It is also critical that geospatial-specific standards are supported. ESRI continues to support standards defined by the North Atlantic Treaty Organization Digital Geographic Information Working Group; the International Organization for Standardization; and the Open Geospatial Consortium, Inc., among many others.

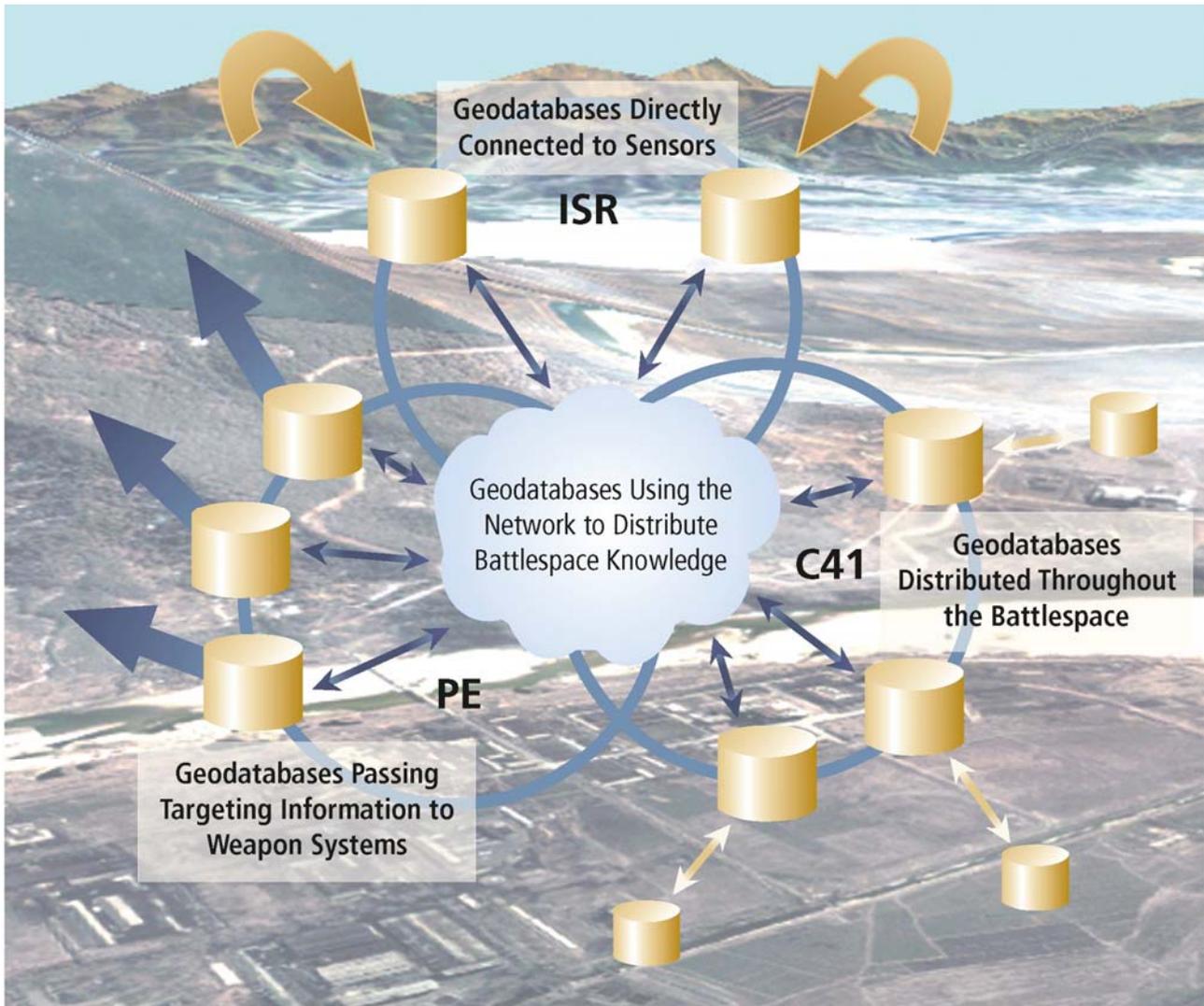
***Network-Centric Operations***

The idea of delivering interoperability is only part of the rationale of creating a defensewide infrastructure. Far more important is the contribution that this spatial information infrastructure contributes to network-centric operations. Network-centric operations represent a revolution in military affairs that is affecting every nation in the world. It represents a fundamental reengineering of defense organizations, doctrines, and systems to take full advantage of the capabilities of modern information technology.

GIS is the critical infrastructure that connects the three concepts of network-centric operations: situational awareness (intelligence, surveillance, and reconnaissance, or ISR); command, control, computers, communications, and intelligence assessment, or C4I; and precision engagement. So sensors in the ISR domain are being directly coupled to geodatabases that are then distributed and replicated into the C4I domain to support decision making, then distributed and replicated into the precision engagement domain to coordinate and target weapon systems.

GIS is the COTS technology that makes all of this affordable. ArcGIS supports the very scalable and rich geodatabases that support population from a wide range of sensors, distribution and replication of geodatabases across zero- to high-bandwidth networks, and the advanced analysis and dissemination of information to support precision engagement, thus permitting the more effective employment of existing weapon systems.

## GIS as a Critical Network-Centric Operations Infrastructure



### *ArcGIS for Developers*

ArcGIS is also a toolkit that permits a wide range of system integrators to work with an advanced, open, and scalable multiplatform, multiarchitecture, and multi-API set of components to deliver the capabilities built on the infrastructure. ESRI has extensive experience ensuring the success of a wide range of system integrators who are able to deliver capabilities to the war fighter at a fraction of the cost of using government software. This is great news for the taxpayer and also great news for the war fighter who is increasingly getting today's technology delivered today instead of yesterday's technology tomorrow.

Capability developers are increasingly interested in the services-oriented architectures that can provide the framework for network-centric operations. The ArcGIS platform is

engineered to support services-oriented architectures and is capable of distributing functionality and data throughout the battlespace. This is an essential move away from the historic need to bring data to the workstation where functionality resided and where the results could be viewed. Now, a battlespace viewer (browser, embedded, or full-functioning desktop GIS) can see data fused from multiple, distributed, and open servers and can view functionality brokered from any of those servers.



### **Capabilities**

The capabilities of the ArcGIS platform represent a significant step forward as illustrated by the following examples:

- Real-time weather sources can be fused into any mission system display. This enables answers to requests such as the following:
  - Show me all my surveillance and target acquisition systems that are currently affected by intense weather.
  - Show me airfields that are currently out of operation due to adverse weather.
  - Show me how my logistics plan will be impacted by adverse weather.

- Any mission system display can access information portals anywhere on the network. These information portals are not just cataloging data sources around the network, they are cataloging analysis services, visualization definitions (maps and globes) and work flows and allowing any client to exploit those—whether they are a thin client browser or a desktop client. This is already creating powerful collaborative decision support environments.
- ArcGIS supports developers creating serverside applications with the same component framework as desktop developers. This enables the efficient creation of heterogeneous mission systems that can connect to Web services functionality and data when the network is available or revert to thick client applications with cached data when the network is down.

## **Conclusion**

The ArcGIS platform is providing defense organizations around the world with a powerful COTS infrastructure on which to base a wide range of capabilities. This critical defense infrastructure is supporting the flow of battlespace knowledge throughout the battlespace.

ArcGIS is playing a key role in the emerging service-oriented architectures that will support network-centric warfare. At the same time, it is also supporting today's war fighters in stand-alone, peer-to-peer, and client/server configurations.



For more than 35 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

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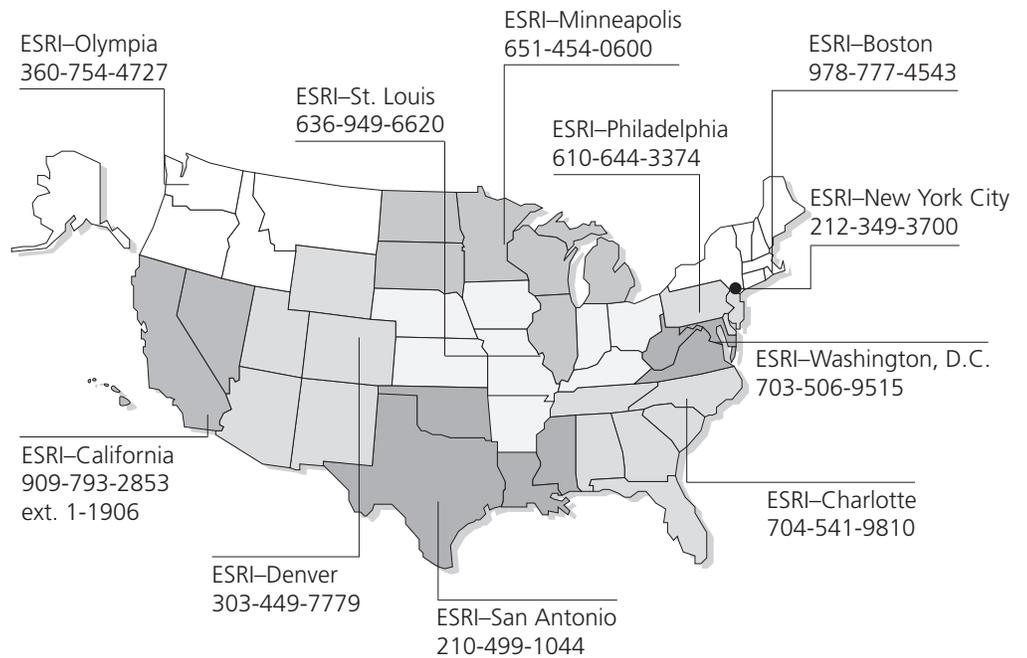
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