Business Plan for:

Rhode Island Enterprise GIS

Developed for the:

Rhode Island
Department of Administration
Division of Information Technology

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Prepared with the assistance of:

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1 Executive Summary

The overall direction for the advancement of Geographic Information Systems (GIS) in Rhode Island is encompassed in two existing strategic planning documents. The first is titled "2005-2010 Strategic Management Plan for the Rhode Island Geographic Information System (RIGIS)" and was accepted by the RIGIS Executive Committee in December of 2004 (reaffirmed in March of 2007). The second is titled "Strategic Plan for Geographic Information Systems" and was prepared in 2006 for the Rhode Island Department of Administration, Division of Information Technology (DoIT). Both plans embody similar vision and mission statements and mainly differ in the audience they are directed to. The DoIT Strategic Plan contains the following vision and mission statements:

> **Vision:** A coordinated Geographic Information System within state government will be an acknowledged leader for the utilization of GIS technology and an accepted source of quality geospatial information for all of Rhode Island.
>
> **Mission:** To provide leadership and services related to the use of geographic information system technology in Rhode Island state government and together within the overall RIGIS organizational effort, support initiatives to provide access to a State Spatial Data Infrastructure (SSDI) database of comprehensive geographically related information for use by federal, state and municipal government, academic organizations and private sector enterprises.

This Business Plan is directed at helping Rhode Island build-out it's State Spatial Data Infrastructure by developing and nurturing an enterprise GIS architecture for enhanced data sharing within state government. As such, carrying out this plan will help the state to realize its stated vision and carry out its acknowledged mission.

The overall goal is to develop an enterprise GIS for the State of Rhode Island that capitalizes on existing investments and organizational capabilities to the greatest extent possible. Such an enterprise GIS consists of five functional underpinnings:

1. The incorporation of ***GIS technology into*** the existing Rhode Island state government ***IT enterprise architecture***.
2. The establishment of a ***secure*** common ***repository*** for the efficient storage and on-going maintenance of the existing collection of state agency geospatial data.
3. The provision for broad and ***easy access*** to the data repository for use by all state agencies.
4. The availability of a suite of ***application tools and web services*** that can be integrated with GIS and non-GIS applications to provide consistent and reliable access to spatial information throughout state government and to the general public to which it serves.
5. The formal establishment of a ***GIS management committee*** that coordinates GIS decision making and planning across all state agencies.

This document describes the current state of GIS in Rhode Island and lays out a two phased approach for making incremental improvements that will lead to a successful enterprise GIS architecture within State government. The plan documents how various *existing* GIS components can, through a coordinated effort, be brought together to form a successful enterprise GIS environment that benefits all of state government. In the first phase, resources currently in place in the four state agencies that are now somewhat independently involved with the use of GIS technology are more formally orchestrated into a collaborative federated model. This will initially provide for a high-performance and shared interagency GIS data repository and introduce jointly managed application services. As the enterprise architecture matures into the second phase, these agency-based services are further consolidated into a more centralized GIS infrastructure within the State's existing overall IT enterprise that will provide for more robust operational support and increased disaster recovery capabilities.

2 Program Goals

2.1 Overview

The State of Rhode Island currently maintains two GIS Strategic Plans. The first is titled "2005-2010 Strategic Management Plan for the Rhode Island Geographic Information System (RIGIS)" and was accepted by the RIGIS Executive Committee in adopted in 2004 and reaffirmed in 2007 The second is titled "Strategic Plan for Geographic Information Systems" prepared for the Rhode Island Department of Administration, Division of Information Technology (DoIT) in 2006. These plans embody similar vision and mission statements. The DoIT Strategic Plan for GIS contains the following mission statement:

> **Mission:** To provide leadership and services related to the use of geographic information system technology in Rhode Island state government and together within the overall RIGIS organizational effort, support initiatives to provide access to a State Spatial Data Infrastructure (SSDI) database of comprehensive geographically related information for use by federal, state and municipal government, academic organizations and private sector enterprises.

This Business Plan is directed at helping state government enhance an existing State Spatial Data Infrastructure (SSDI) by developing and nurturing an enterprise GIS architecture for enhanced data sharing.

An overall goal is to develop an enterprise GIS for State government that capitalizes on existing investments and organizational capabilities to the greatest extent possible. Such an enterprise GIS consists of five functional underpinnings:

1. The incorporation of ***GIS technology into*** the existing Rhode Island state government ***IT enterprise architecture***.
2. The establishment of a ***secure*** common ***repository*** for the efficient storage and on-going maintenance of existing and future state agency geospatial data.
3. The provision for broad and ***easy access*** to the data repository for use by all state agencies.
4. The availability of a suite of ***application tools and web services*** that can be integrated with GIS and non-GIS applications to provide consistent and reliable access to spatial information throughout state government.
5. The formal establishment of a ***GIS management committee*** that coordinates GIS decision making and planning across all state agencies.

A two phased approach is recommended to achieve these goals. In the first phase, existing agency resources are more formally orchestrated into a collaborative federated model that provides a high-performance and shared agency GIS data repository and introduces jointly managed application services. As the enterprise architecture matures in the second phase, these agency-based services are further consolidated into a more centralized GIS infrastructure within the State's existing overall IT enterprise that will provide for more robust operational support and increased disaster recovery capabilities.

Background

While Geographic Information Systems (GIS) have been successfully deployed in Rhode Island over the past two decades, the state continues to face several challenges in terms of effectively sharing GIS data and resources. While some of these challenges are organizational and others are technological, there remain significant opportunities for Rhode Island to streamline GIS operations and reduce duplication of effort.

This document describes the current state of GIS in Rhode Island state government and lays out a two phased approach for making incremental improvements that will lead to an enterprise GIS architecture for the state. The plan documents how various *existing* GIS components can, through a coordinated effort, be brought together to form an enterprise GIS environment that benefits all of state government. Critically, this plan is structured so that the first phase leverages existing capabilities to the greatest extent possible and thus avoids a need for any new cash outlays. The following provides a high-level overview of the enterprise GIS vision and the two phases that are detailed within the plan.

An enterprise can be defined as a group of people or organizations that come together around a community of interest to achieve a common mission. As such, an "enterprise GIS" can be seen as a **shared data and technology** infrastructure that can be **used by multiple organizations**. An enterprise GIS should be able to deliver the following benefits to all participants (i.e. Rhode Island state government):

- Broad access to shared data
- Common applications and tools
- Economies of scale for activities such as data updating or new data investment

The Rhode Island state government has a well established, agency-based geospatial infrastructure. Four agencies represent the existing primary GIS stakeholders and all have made significant and consistent investments in their GIS capabilities. The four departments are:

- Department of Administration, (DOA)
- Department of Transportation, (DOT)
- Department of Health, (DOH)
- Department of Environmental Management, (DEM)

Nevertheless, the GIS programs for these four agencies operate in largely independent fashion. Each of these four state agencies has a GIS infrastructure and staff that serve individual agency needs. While there is a good deal of informal coordination and cooperation, at best these programs can be considered only loosely coupled in spite of the fact that they use much of the same data. In addition, while these are the primary GIS stakeholders there are several other entities within Rhode Island government that have, or are currently developing their own GIS capabilities. Once again, these new GIS players would benefit greatly, and avoid duplication of effort if there were enterprise GIS resources that they could simply "plug into".

The most expensive and valuable components of any GIS are the data. While GIS data are expensive to develop, as electronic records they are very easy to share. Ideally, all of

the GIS data that state government creates can be consolidated into a single repository that all state agencies have access to. When a data set is updated, the repository delivers those updates to all state agencies instantly. Rhode Island has already developed a common **state GIS database** comprising of nearly 150 data layers totaling approximately 1 Terabyte of information. However, within state government these GIS data assets are found in many locations and most of the data are stored independently on each agency's GIS server. When a data set changes, those changes must be propagated manually among several servers or local data storage systems.

This core GIS database is combined with other federal (e.g. US Census information), municipal (e.g. local parcels or zoning) and University of Rhode Island (URI) research data into the comprehensive **RIGIS database**. The collective RIGIS database is hosted by the URI Environmental Data Center (EDC). Presently, the URI-EDC plays a key role as the state's geospatial data clearinghouse. The clearinghouse provides two key functions. First, it makes Rhode Island GIS data available to the general public. Almost all of the state's GIS data are available for public download, free of charge via web access from URI. Second, the clearinghouse serves as Rhode Island's node on the federal government's National Spatial Data Infrastructure (NSDI). Contributions of RIGIS data to the NSDI, through the clearinghouse node at URI is an important element in Rhode Island's intentions supporting the larger national effort.

The goal of this Business Plan is to identify opportunities for increased resource sharing and the potential for consolidation of selected GIS resources. The following presents an overview of the two phases of the proposed plan.

Phase I: Development of a Shared State Government GIS Repository

As noted above, several state agencies have advanced GIS program and in fact may have "enterprise GIS infrastructures" that serve independent agency needs (i.e. the "enterprise" is the agency as opposed to state government in general). Phase I is centered on the notion of one of those agencies opening up its enterprise infrastructure to other state agencies. This will provide two immediate benefits with minimal costs. First, agencies will gain increased access and performance to shared data sets such as roads, water bodies or aerial imagery. Agencies such as DOT and DOH have invested in expensive server-based GIS software and actively manage these more complex technologies. Such server-based GIS software can be optimized for delivering large data sets to a wide group of users and existing agency resources could meet current needs.

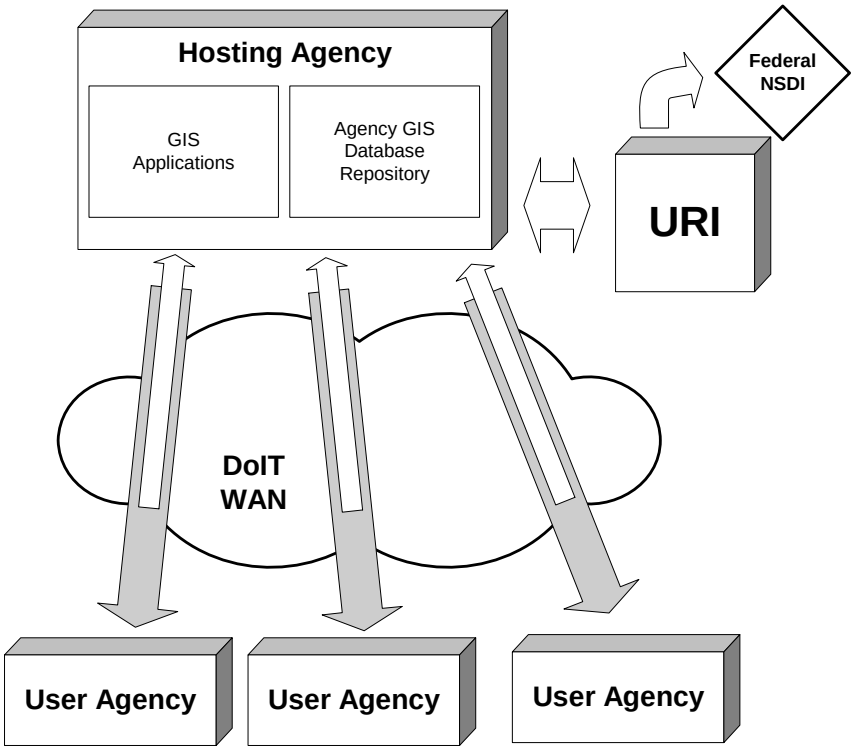
The second benefit is that with all state government data located in a single repository, data updating would be greatly streamline for all GIS users. Rather than having each user update their own "agency database", Phase I would allow the GIS repository to be updated a single time for all users to gain access to the most current information. This would address the largest identified duplication of effort. Once again, these benefits could be gained without a minimal need for new funds as existing agency equipment could fulfill a common requirement. All state agencies involved in this study are supportive of this notion and receptive to allocating staff time to make it happen.

Phase II: The GIS Repository Moves from an Independent Agency to a Consolidated IT Enterprise Configuration

Functionally, and architecturally, Phase II is almost identical to Phase I. The primary difference is that the enterprise technology and software would no longer sit on a "host agency's" equipment, but rather would be managed as shared resource at a Division of Information Technology Data Center. This evolution would involve a requirement for new funding of servers and software and this investment would be warranted on the basis of improved scalability at a time when GIS use continues to grow and enhanced disaster recovery due to the 24x7 staffing of state data centers.

Ultimately, this report contains a concise and cost effective program for enabling Rhode Island to capitalize on enterprise GIS technology to both streamline operations and to begin further benefiting from new technologies.

2.2 Phase 1: Federated Agency Model



2.2.1 Hosting Agency

In this first phase of enterprise GIS development, various ***existing agency resources*** are explicitly selected to provide specific, "communal GIS capabilities" to the four participating agencies involved.

Specific agencies will be identified to "host" specific GIS capabilities. For instance, one agency might be selected to host a data repository (e.g. ArcSDE), and another might host

web services (e.g. ArcIMS and ArcGIS Server). Each hosting agency will support the broader GIS user community by performing system and application administration functions for the services they host.

Cooperative agreements will need to be negotiated and signed between the hosting and user agencies. There is no cost recovery or chargeback mechanism between agencies as envisioned in this first phase. Each hosting agency will bear the costs it currently incurs for internal GIS use as well as for increased costs in providing the service to other participating sister agencies. However, since robust hardware and software capabilities already exist within certain agencies, additional costs are expected to be minimal.

While this model may seem to lack strong benefits for a selected hosting agency, in reality, this only formalizes and expands the status quo of agencies supporting each other. In addition, a hosting agency gains data access and currency benefits by having a greater focus placed within state government on the notion of creating a shared repository for all agency GIS data. In this manner, the state's overall GIS related costs may be reduced through the sharing of hardware and software resources and the reduction of redundant data assembly and update requirements currently performed by each individual agency.

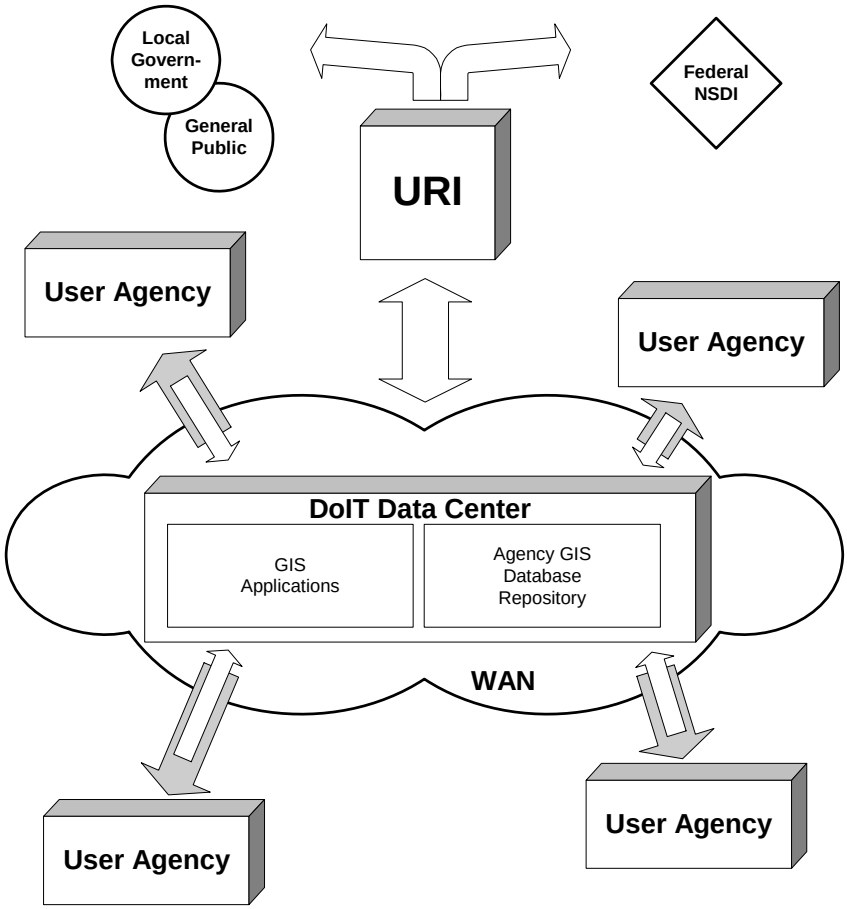
2.2.2 User Agency

In this federated model, the user agency is the consumer of services provided by a hosting agency. Each user agency will enter into a cooperative agreement with the various hosting agencies that are providing server resources and support. Periodically, the user agency uploads data that they create or maintain into the hosted data repository. The user agency, as well as the hosting and other agencies, directly access the data through the hosted repository and consume the ArcSDE layers and/or web services provided.

2.2.3 The State Information Technology (IT) Enterprise

In the federated agency model, the existing state IT enterprise supports the infrastructure within which the GIS architecture exists. Computer and network hardware and software that reside within agencies will continue to be managed by and maintained within the state IT enterprise structure. This provides for sufficient network capacity to enable data and application sharing between agencies, connects the user agencies with the hosting agencies, maintains all WAN routes, and manages network security and firewall configurations. Network connections will be monitored to determine where congestion may occur so that trouble spots can be quickly investigated and resolved. GIS software and GIS applications will be maintained and managed by the hosting agency.

2.3 Phase 2: Centralized GIS Model



2.3.1 State GIS Data Center

Architecturally, Phase 2 is very similar to Phase 1 except for the fact that the shared resources are not hosted by an individual agency, but rather as a state GIS Data Center within the existing state IT enterprise. In the second phase, all common hardware, software and services are physically migrated from the hosting agency to an established centrally managed state data center. The GIS infrastructure is recognized as a part of the overall Rhode Island critical information technology and formally and directly integrated into the Rhode Island IT enterprise. This provides the benefit of having the GIS infrastructure managed with a high level of service that ensures a higher level of availability and performance:

- VMware is used to provide failover redundancy for virtual GIS clusters
- Standard operating system administration is performed across all servers
- Uninterrupted Power Supplies (UPS), air conditioning, raised floors facilities, and physical security contribute to uptime and reliability
- The state GIS Database will be maintained on an enterprise storage area network (SAN)
- Regular on-site and, off-site backups enable disaster recovery efforts

- A change management process tracks system configuration alterations and aids in trouble shooting.

Funding would be provided through a usage based chargeback process already in place for recovery of costs associated with system administration and upgrades to network and server hardware and software. Provisions for additional hardware, and software funding, would be included within the overall state IT capital budget.

2.3.2 User Agency

In the centralized model, all agencies effectively become user agencies. Periodically, they upload data that they create or update to the central GIS data repository. Each user agency directly accesses the data in the hosted repository and consumes the ArcSDE layers and/or web services provided by the centralized server systems.

In addition, GIS application administration is completed within the DoIT operations management structure under the guidance of the GIS management Coordinating Committee mentioned in the next section. However, it is recommended that personnel in the agency, or agencies, that develop a hosted application be directly involved in and share responsibility for its implementation on use. Centralized GIS software administration and maintenance would be implemented as a state GIS software site license is negotiated with the vendor(s).

2.4 GIS Management Coordinating Committee

It is recommended that a formal agency GIS managers committee be formed to act as the coordinating body for the GIS Infrastructure. At periodic, scheduled meetings, this group could develop best practice "rules for the common". The committee will identify areas of common interest and concerns, identify system redundancies, build consensus and provide outreach to new GIS users.

In the federated phase, this group determines which agency should be the host for each of the shared resources and help develop models for the interagency memoranda of understanding. Capacity and support issues would be reviewed and resolved. This would be the body that would select the resources that would eventually move to a centralized data center and determine the time schedule. Once the GIS infrastructure is migrated into phase 2, the centralized GIS infrastructure, this group would become the "GIS infrastructure change management committee" under the present and well developed IT enterprise change management process. It is further recommended that this group be initially chaired by the State GIS coordinator and include a non-GIS related member of the IT technical management staff selected by the CIO.

The Rhode Island culture of cross-agency sharing of GIS resources and close proximity of agency offices easily allows for this type of deployment and application management.

2.5 Outreach to Champions and New Users

Rhode Island has made substantial investments in a statewide GIS organizational and technical infrastructure embodied within the Rhode Island Geographic Information System (RIGIS). It is composed of participants from federal, state and local government

as well as from academic institutions and the private sector. The RIGIS Executive Committee with primary staff support from the GIS Coordinator at the RIDOA Statewide Planning Program acts as an oversight management body for this system. The RIGIS performs outreach functions to municipal GIS users and the general public through an established RIGIS Executive Committee and with assistance from URI's Geospatial Extension Specialist program. The collective RIGIS database housed at the University of Rhode Island consists of data assimilated and contributed by all of its members including the state agencies involved. This valuable information resource is readily available to the general public through a data distribution process jointly managed by the state and the University of Rhode Island. RIGIS data is presently being contributed to the National Spatial Data Infrastructure (NSDI) through a clearing house located at the URI in support of a broad based national effort. The RIGIS relies on a strong leadership role from state government including the four principle state agencies involved. This includes timely contributions of quality data from the state agency GIS database as envisioned in this document.

This plan outlines how these investments can be leveraged into a more accessible, timely, and productive infrastructure. The GIS management coordinating committee, chaired by the State GIS coordinator, fulfills a coordination role among established GIS units in the four primary agencies. The state's GIS program would benefit from the development of a plan to reach out to several additional constituencies within state government.

- Executive management. Effective consolidation efforts that cross agency organizations require commitment and sponsorship. An explicit outreach effort should be undertaken to seek out key champions and provide them with program successes that detail the benefits and the progress of the initiatives contained in this business plan document. Management at the highest levels of Rhode Island state government including the governor, key legislators, agency departmental senior management and the state's Chief Information Officer (CIO) are key candidates for support.
- Potential new state agency GIS users. As described earlier, a centralized data repository and shared resources lower the barriers to entry for new GIS users. The state's newly formed Executive Office of Health and Human Services, of which the Department of Health is a leading agency, is considered a strong candidate for GIS user services. Other agencies such as the Rhode Island Emergency Management Agency and the Rhode Island State Police are increasingly in critical need of GIS capabilities. The GIS enterprise architecture suggested in this document will help them to get involved at a lower required level of effort and cost. Knowledge of the GIS structure and capabilities can play a key role in providing information to enable new state agency users to fully understand what data and services are available and to help them initiate their involvement. Ultimately, the more that the services provided by the shared GIS infrastructure are used, the greater the return on investment.

3 Program Benefits & Risks

3.1 Centralized Model Benefits

As Rhode Island implements the shared GIS infrastructure outlined in this plan, many benefits will be realized.

- A lower barrier to entry for new entrants. The most expensive part of any GIS implementation is the cost of data development. Rhode Island is fortunate to have a rich repository of statewide geospatial data that is well organized, supported, and maintained as the RIGIS database at the URI. The agency GIS database, a subset of the RIGIS database, will be maintained within and accessed through the state IT enterprise. Having this in place removes a large hurdle for organizations attempting to implement GIS. Rather than having to build new data, or collect existing data, new users can come up to speed quickly by "plugging into" the state enterprise architecture. This shared data resource drastically reduces the costs required for additional organizations to implement GIS capability.
- Efficiency through budget consolidation. Any cost that is currently being incurred by more than one agency has the potential to be reduced in a centralized model. As software licenses and other costs are centrally managed, certain agency expenses will be significantly reduced. For instance, fewer standalone ArcGIS software licenses would be required with the availability of a pool of floating licenses than if each organization maintained many individual licenses to support their own maximum number of individual users.
- Reduce duplication of data collection efforts. A shared central repository of data would enable data sharing and reduction or elimination of some data collection efforts all together. For example, DEM informally collects assessors parcel data from towns for internal use. DOT and Statewide Planning desire access to the same data. A centralized model that coordinates these efforts would present a unified request to local municipalities and would eliminate redundant efforts within each organization.
- Reduce "sneaker-netting" and data stagnation. When data is repeatedly copied from computer to computer and handed off from person to person, the information contained within can become out of date resulting in aged copies and a loss of provenance. A central repository allows data to be captured close to its source and enables uniform data standards and quality assurance. If a database repository is implemented properly, users can be assured that the best and most current data, along with good documentation, will always be located in the repository. For example, this will alleviate the need for several independent agencies to obtain their own update of the Rhode Island roads each time those data are changed by DOT.
- Consolidation allows for process integration. When shared GIS application services and the data repository are in place, it will be easier for common processes to be integrated, eliminating redundant work that is now done in multiple places. For example, a single address geocoding capability made

available to all state agencies will allow a master address table to be maintained in a single place. This will eliminate the need for most agencies to edit address lists and will provide consistent results when two, or more, agencies geocode the same address. In addition, these services would be available to non-GIS applications such as those within the Division of Motor Vehicles, the Division of Taxation, and Department of Corrections that have extensive non-GIS databases further extending the benefits of the enterprise GIS architecture.

- Follow current trend in state government IT infrastructure consolidation. A clear mandate exists in Rhode Island state government to consolidate enterprise applications through the established enterprise IT system. Management expertise has been developed for numerous other IT applications that can be applied to the GIS enterprise.

3.2 Consolidation Risks

Certain risks may be associated with this plan and should be anticipated.

- Initial Hardware Budget. The existing IT consolidation policy requires that agencies provide the initial hardware that is moved into the centralized data centers. There may be some reluctance among agencies to relinquish direct management control of physical server hardware. Additional budget money will be required for initial data center hardware budgets.
- Resistance to Cost Recovery Charges. There may be agency resistance to GIS usage chargeback fees generated for centrally managed data center services. Ultimately, the size of the fees will be a key determinant of the relative risk. This is an important issue to resolve as upgrades to the initial hardware are covered by usage-based cost recovery fees charged to agencies.
- Lack of Sufficient Funding. If certain elements of this plan are implemented but sufficient resources are not made available for continued use, not all of the long term benefits will be achieved.
- Lack of an established agency GIS budget . Contributing funding towards a centralized GIS capability will be difficult for some agencies that have few resources, even if there will be some cost offsets afforded by the enterprise architecture. For instance, DEM annually polls their internal programs to determine grant money that might be made available for GIS purposes. This ad-hoc approach will be more difficult to incorporate into a centralized model than more secure budgets with GIS line item expenditures.
- Expectations of non-realistic results. An outreach and training effort must be sustained to keep management and users informed of realistic capabilities and limitations. A continued communications effort is essential in order to dispel possible notions of success or failure of the system based on unrealistic expectations.
- There may be constraints on funding supplied by federal government partners that limit the ability of individual agencies to fully participate in components of the GIS enterprise.

- Lack of Adequate Personnel Resources. Presently individual state agency GIS efforts are at a bare subsistence staffing level with respect to the availability of qualified personnel. Any realistic approach to implementing this plan must address staff augmentation and retention of that staff for existing and additional requirements and operational needs.

4 Program Requirements

4.1 Data Requirements

Rhode Island is fortunate to have made a considerable investment in a collective statewide GIS database known as the RIGIS database. It is presently housed at the University of Rhode Island's Environmental Data Center (URI EDC). The RIGIS database consists of not only information contributed by state agencies, but also by quasi state organizations, public and private academic institutions, and municipal government entities as well as some data from private sector profit and not for profit enterprises. URI fulfills a legislatively mandated role of providing this data to the public through a data distribution system jointly managed with the RIDOA Division of Planning. By housing the RIGIS Database URI also acts as the surrogate GIS repository for several state agencies. Currently, all information including state generated data is passed through the GIS coordinator at the RIDOA who provides some quality control services and generates periodic updates to the URI-based RIGIS database.

URI makes these data accessible to government entities and to the public through on line FTP file sharing services. The data are also loaded into an ArcSDE server within the GIS laboratory at the URI/EDC for internal use. This URI server could in the future be used for replication of portions of the RIGIS Database back to a SDE server containing the State (agency) GIS database. This plan encourages the development of a state-based repository of the State (agency) GIS Database with replication of core database segments from the state *to* URI.

The RIGIS Database currently contains 148 layers each with multiple datasets totaling approximately 1 terabyte of data. The data is grouped in to the following categories:

Layer Name: Description *(example)*
Annotation: Map labeling text or symbols. *(road names)*
Boundaries: Political boundary**,** tile delineation or natural feature lines. *(town lines)*
Coastal Resources: Narragansett Bay and Coastal Features (*shellfish closure areas*)
Cultural: Features related to cultural facilities or resources. *(historic sites)*
Economic: Business and industrial related features *(industrial sites)*
Elevations: Vertical elevation features (*digital elevation models)*
Demographic: Features related to population statistics *(census data*)
Emergency Management: *Facilities and features related to emergency management (cerclis sites*)
Facilities: Government and private services buildings, or area locations. *(libraries*)
Flood: Flood plain related feature. *(FEMA flood zones*)
Geology: Geological features. (*bedrock geology*)
Hydrography/Hydrology: Water related features. *(rivers)*
Landuse: Land cover land use features. (*landuse**)***
Nature: Natural environment and ecology. (*bird species)*
Open Space: Land protected from development. (*protected open space*)
Raster: Raster graphic images. *(Digital aerial photos and orthophotography*)
Soil: Soil *(USDA/NRCS soils*)
Transportation: Transportation infrastructure. *(roads)*
Utilities: Utility service infrastructure. *(sewer lines*)

Wetlands: Natural wetland features (*wetlands)*

Individual RIGIS Database layer names and descriptions can be found on-line in the most recent data catalog on the URI website: http://www.edc.uri.edu/rigis

4.1.1 Agency/Project Data Derivatives

Not all GIS mapping and analysis can be performed directly from the RIGIS or agency GIS Databases. Analysis can also create derivatives of source data from the catalog. For instance, a study to determine where steep slopes exist requires a data layer detailing slope percentage. This layer may not be in the RIGIS Database, but can be *derived from* elevation data that do exist within the catalog. Another example is a potential agency specific need to maintain buffer zones around open space. While open space data exists in the catalog and can be used to create the buffer zones, the zones themselves may be stored and maintained at the agency level.

Each agency, and potentially, each user may need to add and maintain local attributes to features in the RIGIS or State GIS Database layers. For example, DEM may assemble and manage attributes on endangered species that are found at particular open space areas. Again, the open space polygons could be in the RIGIS and State GIS Database, however, the endangered species attributes would be stored locally and managed by DEM.

Thus, there are potentially 3 categories of data:

- Single agency internal use (individual agency draft or proprietary information)
- State agency, but non-public use(state sensitive or classified security information)
- Publicly available via URI/RIGIS (legally declared public information)

For individual data set and layer documentation purposes it is recommended that metadata reference the primary or secondary ArcSDE servers. Some specific mapping may require editing of the data. In this case, a local copy (either housed on a local machine or in the local ArcSDE workspace) could be created and metadata edited locally.

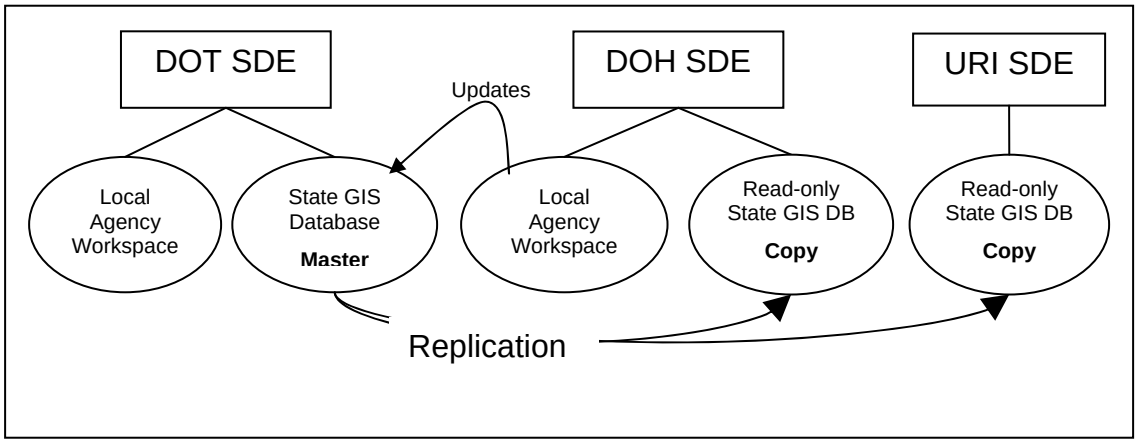
4.2 Technology Requirements

4.2.1 State GIS Dataset Replication between hosted SDE servers

It is recommended that replication be structured between multiple hosted ArcSDE servers. Each ArcSDE server would house a local agency workspace and a State GIS Database workspace (e.g. DOT's server would house a DOT agency workspace in addition to the state Agency data workspace). A primary ArcSDE server would be designated to host the master state GIS Database. A secondary ArcSDE server would contain a read-only replicated copy of the state Agency GIS Database for backup purposes. A third ArcSDE server, located in the URI EDC, would act as a third repository outside the state's network making it available for limited public read-only use as well as disaster recovery. These redundant copies of the state Agency GIS dataset could be replicated during off-peak hours. These replicates would decrease network load for local read-only access and would aid in disaster recovery.

Both the primary and secondary ArcSDE environments would house local workspaces in addition to the State GIS Database workspaces. This workspace segregation enables agency-based practices on agency data while providing a common operating environment with consistent management practices for all state Agency GIS Database replicas statewide. In addition these local workspaces will contain the agency masters for agency owned and generated data. Periodically, the each data owner will post updates of their data from the local workspace to the state master located on the primary ArcSDE Server.

The example diagram below depicts DOT as the primary ArcSDE State GIS Database repository. As also illustrated below, the DOH acts as the secondary ArcSDE state Agency GIS Database replica.



In addition to simply having copies of the state Agency GIS Database on state servers, individual agencies such as DEM (that does not own ArcSDE server software) would be able to access the Agency GIS Database residing at DOT in ArcSDE via their desktop GIS software. This mode of connectivity, as well as the performance benefits was validated through proof of concept pilot implementations during the spring of 2007.

4.2.2 Bandwidth Requirements

The federated model places capability where there is capacity. If one agency has an ArcSDE server license and the disk capacity to support it, it can make that capability available to other agencies. One requirement to make this model effective is sufficient network bandwidth to support three types of access:

- Real time ArcSDE layer access from ArcGIS clients
- Web services
- Off-hour data replication

The state enterprise IT's Sonnet ring and leased line connections to remote agency offices appear to have adequate capacity to support this model. URI also has a fast internal network and the ability to provide ArcSDE replication. However, the network connection between the state and URI needs to be assessed to determine if there is enough capacity to support ArcSDE replication outside of the existing state government wide area network.

5 Organizational Approach

5.1 Current State-of-Affairs

Rhode Island state government has a well organized GIS community. There are several strong GIS departments and other agencies with fewer resources, but there is a heavy realization as to the value of GIS use within many state government entities. The University of Rhode Island houses a Center of Excellence for GIS knowledge at the Environmental Data Center, URI maintains the RIGIS Database, supports the **Geospatial Extension Specialist (GES)** position and provides critical municipal and public outreach efforts. An established **RIGIS Executive Committee** brings together a broad set of GIS stakeholders to discuss current issues and formulate collective strategies. The **State GIS Coordinator** plays a vital and pivotal role in this picture by staffing the RIGIS Executive Committee, coordinating the development and maintenance of the RIGIS Database and assisting with data development projects (e.g. the current statewide land use project). The State GIS Coordinator also acts as the primary representative of the state to national organizations such as the National States Geographic Information Council (NSGIC).

Throughout Rhode Island state government there are examples of interagency resource sharing. An example within the technology arena is the storage area network (SAN) housed at DOH. While a majority of the disk space on the SAN is used for DOH specific data and applications, a portion of the SAN's capacity is used by DoIT for enterprise application support and for backups. This model mirrors what is proposed for GIS: a single agency's capability is used as a multi-agency resource.

Many of the elements for an enterprise GIS are in place, but there is no overarching architecture that provides a framework to guide future development decisions and to foster institutional commitment. This business plan aims to provide that framework and create some initial momentum for the ultimate solution through the low cost phase one implementation.

5.2 Organizational change

In order for a federated model to be effective, an organizational mechanism needs to be implemented to facilitate management of the shared geospatial infrastructure with its data warehousing / replication, web services and server operations. Rhode Island is fortunate in that this shared resource model already exists within the state government.

The DoIT has **Agency IT Managers** that reside in the various state agencies. Although they are in the DoIT budget and reporting structure, they are effectively support their host agencies. These managers meet regularly in various committees that share IT expertise on issues that extend beyond one agency. This model of dispersed experts periodically coming together to manage a shared infrastructure could be used for the management of the federated, and eventually, the centralized GIS environment.

The creation of a **GIS Management Coordinating Committee**, chaired by the State GIS Coordinator, and with senior IT participation and support is an essential step towards the planned, coordinated and sustainable growth of the state's GIS infrastructure.

Another focus area in strategic planning must be to garner the institutional commitment necessary to ensure its success. With the development of this business plan and through the support of the state's CIO, the opportunity exists to elevate geospatial initiatives to a visible and supported priority within the state. In addition, outreach to GIS users at all levels of government within the state (i.e. state, local, and regional) is a key to ensuring that the return on investments made is maximized. With an increased commitment to Enterprise GIS, the State GIS Coordinator role should evolve to help provide these two outreach functions. Ultimately, outreach both *upward* for executive support, and *downward* for grass roots support will be critical to sustaining the effort beyond phase one and into phase two.

6 Repository Implementation Plan

The Implementation Plan as outlined in this section is conceptual in nature and may be modified as conditions change within state government and the individual agencies involved. As organizational structures within state government evolve, relationships within the enterprise may also need to be modified as well. The allocation of funding and personnel resources will be key to the eventual structure of the system. The identification of facilities and equipment as outlined for the various state agencies in this section should be treated as examples of likely possibilities for implementation at the time of the writing of this document.

6.1 State Hosted GIS Database repository

One of the key goals of this plan is to implement a state repository to host the State GIS Database. The hosted agency model for the repository could be implemented in incremental steps by building upon the existing infrastructure.

Early success has been achieved in a proof of concept pilot of the connections between DEM and Statewide Planning desktop ArcGIS clients and the ArcSDE environment located on a server at DOT. Preliminary tests have shown that access to vector data is as "good as if the data was sitting on the desktop". A full proof of concept should begin with the implementation of a single agency hosting of a read-only copy of the full state agency GIS database.

This section outlines one possible approach for implementing a data repository for the state where the most currently published data can be accessed directly from frequently updated databases. URI will continue to fulfill the RIGIS mandate for public distribution of the RIGIS Database including those portions contributed by state government.

Both DOH and DOT have significant GIS infrastructure including ArcSDE and ArcIMS servers, and have indicated a willingness to share that capability with other state agencies. Since DOT has a larger staff, it is recommended that DOT serve as the primary state repository and that DOH provides backup and redundancy services. In future stages, some, or all of these repository servers could be moved into DoIT data centers allowing the agencies to focus on their core business rather than managing GIS server capacity.

During any stage, repository servers can be expanded to provide web services via ArcGIS Server. This additional capability will allow for wide access to GIS data through the use of web-based applications and other thin clients.

6.1.1 Implementation Path

The main steps to implementing a state hosted copy of the State GIS Database are:

- Load the state Agency GIS Database on the existing ArcSDE server presently located at DOT. – This will initially be for read-only purposes. (This may also include significant portions of the updated master copy of RIGIS database housed at URI.)

- Open access to the selected ArcSDE server to allow a single user agency (e.g. DEM) to access the primary ArcSDE server based state Agency GIS Database to test performance and uncover any access or network related issues. This again will initially be for read-only purposes as testing and evaluation continues.
- Replicate to a Secondary Host - Once it has been shown that the full state Agency GIS Database can be made accessible in a hosted agency model, the replication of a primary host (DOT) and a secondary host (DOH) will be implemented.
- Open access to primary (DOT) and secondary (DOH) ArcSDE servers to all other established GIS users within state government. With two replicated copies of the state Agency GIS Database available, it is possible to open access to both for respective intra-agency use and possibly GIS users in other state agencies. This will initially be for read-only purposes as testing and evaluation continues.
- Implement the state Agency GIS Database master update process from state primary SDE server (DOT) to URI. Updates to the state Agency GIS Database portion of the RIGIS database will be shifted to the primary SDE server (DOT) environment. This final step of the proof of concept process signifies the full implementation of the agency hosted model. Subsequently, the State portion of the RIGIS Database at URI will be a (partial) replicate of the master state Agency database located on the primary SDE server (DOT). (There will be portions of the State GIS database that are not sent to URI for public distribution. For instance sensitive or classified data such as draft planning information, names, and social security numbers etc will need to be cleansed from the data prior to public distribution.)

6.1.2 Expedited No-cost Implementation Path

Building upon existing technology and organizations can be the quickest path to implementation of a state hosted copy of the State GIS Database. These steps undertaken with little or no incremental cost:

- Continue/complete proof of concept testing between primary ArcSDE server (DOT) and the existing agency GIS user community (DEM, DOA, EMA, E911).
- Prototype ArcSDE replication services between the agency primary and secondary servers (DOT, DOH) and the remote non-agency SDE server (URI).
- Assemble GIS Management Coordinating Committee, with the endorsement of Agency Directors and the state CIO. Initial tasks to focus on include:
    - Identify GIS software mutual use and license pooling potential
    - Establish timeline for creating an ArcSDE based state Agency GIS Database on the state network
    - Plan for additional shared and federated application capabilities such as web services and ArcGIS Server application hosting
- Establish the hardware/software primary configuration as the "interim" statewide network and commence agency use of the shared ArcSDE instance

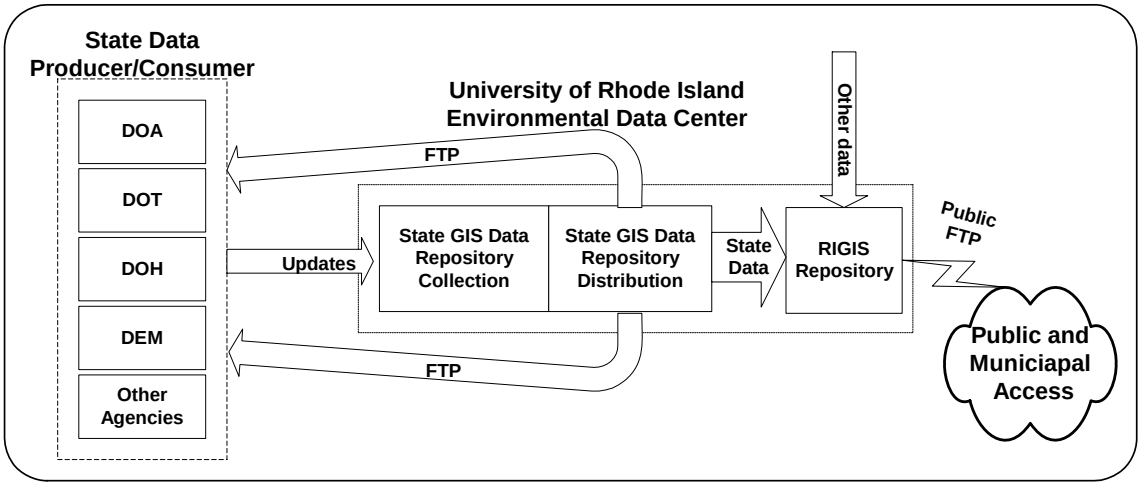
- Formulate plans and processes to archive out of date legacy data.
- Initiate agency efforts to organize local copies of GIS data within installations at the various state agency locations. If older versions of the GIS data are identified, users will be encouraged to access the master copy and use the most recent version of the data.
- Work within the existing state enterprise IT environment to establish data security policies and procedures for all state interagency use.

6.2 Repository Stages

The following sections outline the current state and future stages of implementation of a state Agency GIS Database on the State owned network.

6.2.1 Current State

Currently, each agency locally edits geospatial data that they own. Periodically, selected data sets as determined by individual agencies to be suitable for inclusion in the common database and of interest to the public are sent to URI as updates to the RIGIS Database. In addition, non-state generated data such as federal or municipal government data are collected and modified or enhances as necessary by the State GIS coordinator and sent to URI for inclusion to the RIGIS Database. Selected agencies periodically download, via FTP, copies of portions of the RIGIS Database for local use. There is no published schedule of updates, so agencies may not be aware that their copied version of a portion of the RIGIS Database is out of date. Multiple redundant local copies of potentially out of date or stagnant data exist.



Current State

- Agency custodians maintain local master copies of owned data
- Periodically, updates are sent to the RIGIS Database at URI
- Multiple static snapshots of RIGIS Database are copied, via FTP, for agency use
- The public accesses the most recently published RIGIS Database from URI

- It should also be noted that the full RIGIS Database contains data from other non-state government entities (e.g. academic institutional and municipal information)

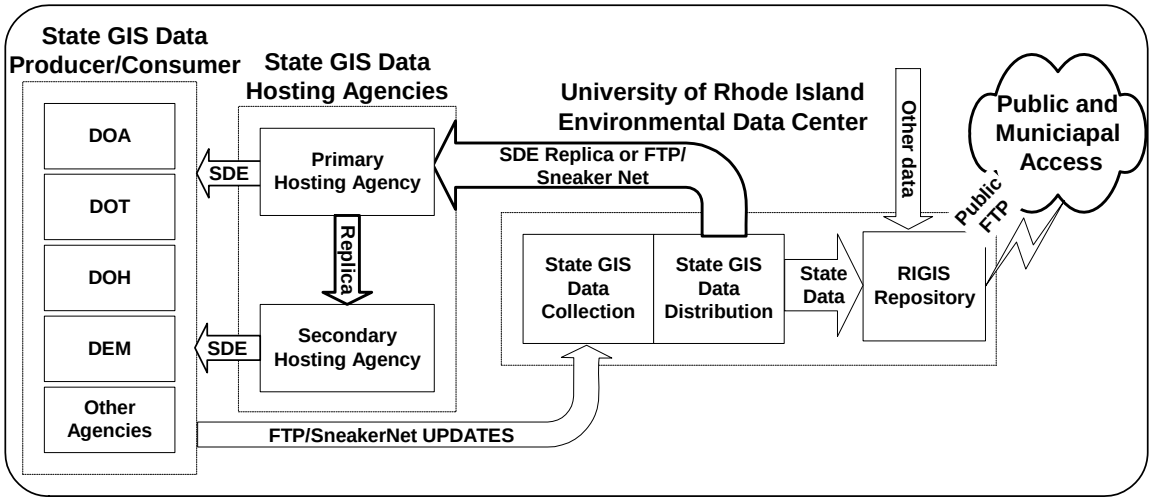
6.2.2 Hosting Agencies, Stage 1

During the first stage of implementation of the hosting agency model, agencies continue to update their local versions of owned data and continue to provide updates through the GIS Coordinator to the URI hosted RIGIS Database. A single agency is selected to host the State copy of the RIGIS Database in ArcSDE. URI will maintain the master copy which will periodically be loaded onto the hosting Agency SDE server. State agency ArcSDE access represents a significant improvement over FTP access for several reasons:

- Local copies of the entire dataset are no longer required
- Local disk space allocation and maintenance is reduced
- Only that portion of the dataset that is necessary for the task being performed is downloaded from the server reducing bandwidth requirements

Access to most recently published data is assured. Outdated copies of State GIS database will become obsolete and archived. There are scheduled ArcSDE replications between the primary and secondary Hosting Agencies. Users within state government can access either the primary or secondary Hosted ArcSDE server, whichever is more convenient. Both repositories will, by design, contain the most currently published data.

Note that the secondary state repository is updated from the primary state SDE server repository, not URI. In future stages, the primary state repository will contain the master copies of state owned and generated data. If the secondary replicates from the primary, no changes will need to be configured once the primary begins to host master copies of state owned data sets.



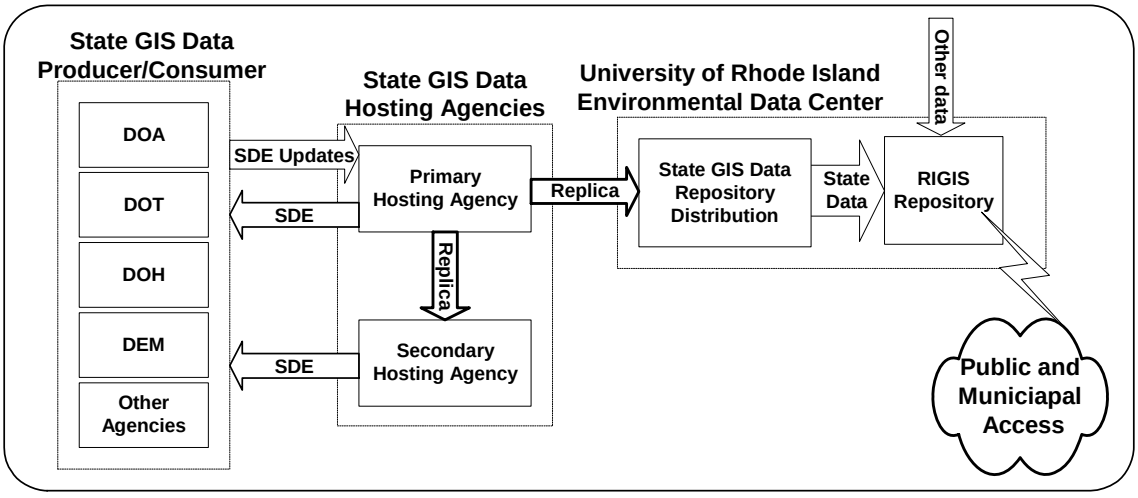
Hosting Agencies, Stage 1

- Agency custodians maintain local master copies of owned data
- Periodically, updates are sent to the State agency portion of the RIGIS Database at URI
- The Primary Hosting Agency replicates data of interest in the URI ArcSDE RIGIS Database
- User Agencies access most recently published state GIS Database via either the primary or secondary ArcSDE servers.
- The public only accesses the most recently published RIGIS Database from URI. There is no public access to the state system.

6.2.3 Hosting Agencies, Stage 2

In stage 2 , URI receives updates of the publicly available information from the state Agency GIS Database through replications from the primary hosting agency ArcSDE Server. State agencies still retain the master of the entire Agency GIS Database and URI has a copy of only the publicly available portion through a SDE replication process. URI uses this as a portion of the overall RIGIS database that it maintains and incorporates into the full master RIGIS database.

URI will continue to fulfill the RIGIS public distribution mandate. This scenario allows the master copy of all state owned data to reside on the state's network. More importantly, on-going direct database updates to the master data will be possible rather than the current periodic file-based snapshots that URI currently receives.



Hosting Agencies, Stage 2

- Agency custodians maintain local master copies of their owned data
- On-going updates to the state Agency GIS Database are made directly into ArcSDE at the primary hosted repository

- URI replicates publicly available state owned data from the primary hosting agency ArcSDE server
- User Agencies access the most recently published State GIS Database and the RIGIS database via either the primary or secondary ArcSDE servers
- The public accesses the most recently published RIGIS Database from URI

6.3 Conclusion

The implementation program presented above will enable Rhode Island to cautiously move forward in deploying enterprise GIS technology. The first phase of the program is designed to leverage existing resources to the greatest extent possible and avoid the need for new cash outlays. The second phase anticipates a future need for scalability and more robust 24x7 management and disaster recovery. The plan also addresses both the technological requirements as well as organizational and collaborative requirements for deploying an enterprise GIS architecture. If carried out, this Business Plan will help Rhode Island to realize the visions that are stated in the existing GIS strategic plans and will enable the state to more fully participate in the federally sponsored National Spatial Data Infrastructure (NSDI) program.

Appendix A. GIS Stakeholder Interview Summaries

Department of Administration (DOA) – Division of Planning and the Statewide Planning Program

Kevin Flynn, DOA Associate Director for Planning

- Jerad Rhodes, DOA/Statewide Planning Program, Chief
  George Johnson, DOA/ Statewide Planning Program, Assistant Chief
  Christine Delage, DOA/Statewide Planning, GIS Analyst
  John Stachelhaus, RIGIS Coordinator and GIS Manager, DoIT

Background

The Statewide Planning Program is charged with preparing and maintaining plans for the physical, economic, and social development of the state; encouraging their implementation; and coordinating the actions of state, local and federal agencies and private individuals within the framework of the state's development goals and policies. The basic charge is established by *Sections 42-11-10 and 12 of the General Laws.*

The State Planning Council oversees the Statewide Planning Program's work. The Council is made up of cabinet level appointees from state government, municipal administrators, representatives the private sector and members from the public sector with overall interests in the general welfare and development of the state. It adopts goals and policies related to planning, most of which are contained within individual plans, as elements of an overall State Guide Plan. The body also advises the Governor on strategic planning matters and is required to ensure that major project and program proposals are consistent with a State Guide Plan. The State Planning Council is chaired by The Director, RI Department of Administration who has chosen to the DOA, Associate Director for Planning, Mr. Flynn, as designee to act in her stead.

Mr. Flynn and Mr. Rhodes administer the Division of Planning and Statewide Planning Program respectively and provide the principle staff support for the State Planning Council. Mr. Rhodes is the designated Secretary of the State Planning Council.

The Division of Planning is that state entity as identified in legislation as the leader in matters regarding a GIS and the maintenance of a GIS database.

In 1990, legislation was enabled to amend the **General Laws of Rhode Island** to include language pertaining to a state wide geographic information system. **Chapter 42-11-2-(v),** which is focused on the **RI Department of Administration** and states that the Department shall have the powers and duties to "devise, formulate, promulgate, supervise and control a comprehensive and coordinated statewide information system"...that ..."may include a Rhode Island geographic information system". **Under Chapter 42-11-10-(f)-(6)** pertaining to the **Statewide Planning Program**, the State Planning Council will "establish and appoint members to an executive committee consisting of major participants of a Rhode Island geographic information system with oversight responsibility for its activities." This Chapter also states "In order to ensure the continuity of the maintenance and functions of the geographic information system, the

general assembly may annually appropriate such sum as it may deem necessary to the department of administration for its support." Furthermore, this Chapter states under **42-11-10-(g)-(3)** that "the **Division of Planning** shall manage and administer the Rhode Island geographic information system of land related resources, and shall coordinate these efforts with other state departments and agencies, including the University of Rhode Island, which shall provide technical support and assistance in the development and maintenance of the system and its associated data base."

This resulted in the establishment of the Rhode Island Geographic Information System (RIGIS) and the RIGIS Executive Committee.

Hardware/Software

ArcGIS ArcInfo software within the Statewide Planning Program is used on high end desktop computers by the GIS analyst, a Transportation Planner with extensive GIS training, and the RIGIS Coordinator. ArcInfo and two software extension ESRI software licenses have been transferred to a license server located at DOT. Statewide Planning contributes funds to support the software maintenance contracts at DOT. Three Planners with mid level experience use desktop computers with ArcGIS Desktop (Arcview) for map creation and limited data creation and map generation functions. There are also some GIS software access capabilities for others within the agency for map, data viewing and basic information query functions. Locked single seat software licenses maintained by Statewide Planning include of 6 individual ArcGIS Desktop (Arcview).

Limitations

There are significant hardware and local network limitations hampering GIS effectiveness within Statewide Planning. There is no networked file system available for GIS use within the agency. This combination requires that “Sneakernet” methods be used to share GIS and other data within the agency.

GIS use within the agency has historically been analytical. However, GIS is gaining ground as a communication tool that will provide better overall service to Statewide Planning. The agency as a whole will benefit from implementation of a statewide strategy and a shared data repository. The current lack of infrastructure would be addressed and inefficiencies and redundancies in the various individual computers within the different operational components sections would be reduced or eliminated.

Budget (FY07)

- $33K yearly GIS budget, which covers the state budget’s share of personnel salary
- Under $20K annual Hardware/Software budget for the entire division of 21 employees.

GIS activities within the Statewide Planning Program are as much as 80% federally funded through yearly allocations from the US Department of Transportation and US Economic Development Agency.

Statewide Planning feels that they do not know how to effectively navigate the DoIT organization. When chargeback invoices (described in a later section of this document) are received, they cover the entire agency's charges. This makes it difficult to allocate bills within the division's accounting system that includes both state money and extensive billing federal funds.

GIS Technology

GIS is a task on the Statewide Planning annual work plan. Depending on resources, projects envisioned for 2008 include:

- Assist in the assembly of a statewide parcel data layer. This is a GIS key goal for the agency.
- An enterprise GIS with seamless networked access to geospatial data
- Updates to the statewide greenways analysis performed in the mid 1990's
- GIS mapping of potentially available housing in response to the 2004 Housing Act
- Continued analysis of statewide land use
- Develop an industrial zoned site inventory GIS data set
- Continue to administer the Transportation Demand Model, (done with Caliper/TransCad software.

A prototype trial connection to the DOT's ArcSDE server proved adequate network performance may be possible with minimal effort. Plans are envisioned for more complete use of the DOT server as a Statewide Planning data repository.

Two state agency data replication models were discussed during the interview: Dual replication where two ArcSDE servers act as each other's backup; and the clearinghouse model where a single robust architecture provides data repository services for all agencies.

Geospatial Data

Statewide Parcels

There is broad interest and some is funding available for development of a statewide parcel layer. It is envisioned that this might be used to generate landuse change tracking application with GIS technology. The tentative first round plan is:

- Engage consultant
- Inventory towns and tally scorecard against the RIGIS Parcels Standard
- Pilot the creation of a statewide landuse based on compiled local CAMA data, if successful, this could warrant a strategic investment.

Zoning

Much of the current zoning data is based on old ordinances, with occasional municipal CAMA input, and raster data with 10-acre grids dating to the 1970s. Updates to zoning data are in the work plan, but not being considered for inclusion in a GIS database this year.

Future Landuse Plan

Landuse plans are compiled by municipality as mandated by the RI Municipal Comprehensive Act of 1989. A statewide composite of these local maps was created in the late 1990's. Developing the process to capture and collect updates to this data is an on-going effort. There has been some discussion of collecting this information electronically, but that presents some challenges to municipalities that may have limited technical capabilities.

RIGIS Coordinator

- John Stachelhaus, DOA /State GIS Coordinator

As the State's RIGIS Coordinator and the GIS manager within DOA for which Mr. Stachelhaus is the primary provider of staff support. Mr. Stachelhaus plays a key GIS role within the state. He balances the internal needs of his state agency with an overall statewide broad responsibility for coordinating the general direction of GIS technology throughout the state. In that capacity he acts as the state GIS coordinator and spends about half of his time on RIGIS related activities including:

- Quarterly RIGIS Executive Committee Meetings,
- Outreach activities involving other state agencies and municipal government
- Participation in workshops, seminars and conferences at the state, regional and national level.
- RIGIS database coordination including brokerage between federal and state agencies, municipal government and private sector contributors for data that resides in the RIGIS database at URI. This includes data acceptance, quality assurance, metadata and standards compliance.
- Mr. Stachelhaus's position is within the DOA Division of Planning's Statewide Planning Program. In this capacity he has a direct role in managing the GIS application activities including assisting with GIS software maintenance, data development and database management within the Division of Planning. He also has responsibilities supporting other GIS needs within DOA including bringing GIS into the IT enterprise managed by the Division of Information Technology.

DOA/Division of Information Technology (DoIT)

- John Landers, Rhode Island Chief Information Officer
- Alan Dias, Assistant Director for Information Technology, DoIT and Agency Information Manager Coordinator for DOT, DOA, DEM, DOC
  James Berard, Associate Director for Information Technology, DoIT, Operations Division
- Phillip Silva, Assistant Director of Information Technology and Agency Information Manager Coordinator for DOH (and other related health and human services state agencies)

Background

Mr. Landers is Chief Information Officer for the state and within the DOA acts as the director of the Division of Information Technology (DoIT). The DoIT management structure includes management of information technology in all state agencies including IT support personnel, computer hardware and network management, technical assistance (help desk), and IT applications support throughout state government. Support for the various state agencies is structured around a DoIT coordinated effort that includes Agency Information Managers (AIMs) for each state agency. Alan Dias as the AIM coordinator for DOT, DEM, DOA (and several other agencies) has a primary interest within those particular Departments that are already involved with using GIS technology. Phillip Silva is an Assistant Director of IT and coordinates the activities of several other state agencies related to health and social services sector including the DOH.

Each agency has an Agency IT manager (AIM) that is in the DoIT budget, but physically resides at the separate state agency to which IT services are provided.

DoIT has a well established track record of managing centralized enterprise applications. Currently supported agency applications areas include Finance, Payroll, Purchasing, Budgeting, Corrections Inmate Management System, State Police, Division of Motor Vehicles are among the current 109 DoIT Operations projects.

Within DoIT Operations, GIS is seen as an important infrastructure with potential critical implications particularly related to public safety. However, they are also well aware of the additional extensive capabilities possible for using GIS within government.

Consolidation Gaining Support

The Governor's Executive Order 04-06 authorized DoIT to drive an effort to physically consolidate IT operations through a statewide IT enterprise approach that includes a system of centrally managed data center facilities.

Prototype Development

During the interview conducted with DoIT (Berard) it was suggested that prototype be developed, perhaps using an agency server to help phase in a shared GIS infrastructure. At a later time, a production environment could be established that would reside in a DoIT data center. It was also strongly suggested that executive sponsorship be sought for

the GIS program initiatives embodied in this business plan be directed toward the Governor's office. (Berard & Dias)

Physical Hardware and Network Infrastructure

There are currently two operational DoIT data centers:

- State Data Center, Hartford Avenue, Johnston
- DOA Network Operation Center (NOC), RIDOA Powers Building, Providence
- Data Center Network capabilities include 3 OC-12 (622 Mbps) connections and CAT 6 Gigabit Ethernet LAN.

DoIT manages a self-healing fiber optic Synchronous Optical NETwork (SONET) gigabit ring connecting the state office campus on Capitol Hill and DEM in Providence and the State data center in Johnston.

DOH is the only agency with its own firewall which was originally in place to sensitive health related information. However, it has become redundant with the more robust state firewalls and is slated to be removed. This will make it easier to integrate DOH with the overall geospatial enterprise framework.

Data Center Operations provide the following services:

- Uninterrupted Power Supply (UPS), redundancy, off-site backups, raised floor, air conditioning
- Server traffic monitoring and system utilization reports
- Centralized network location available to all agencies
- Clustered Virtual Machines: Physical servers are simulated allowing multiple virtual machines to be run on once physical device providing easier administration, failover redundancy, load balancing, and resource sharing.
- 17 Terabyte EMC Symmetrix networked Storage Area Network (SAN)
- Forward facing (internal) firewall
- Available web services in a three-tier architecture with a front end DMZ
- SSL based VPN with Triple DES encryption to facilitate secure remote server management
- Both UNIX (HP-UX) and Microsoft Servers. The virtual machine infrastructure is on UNIX.
- Oracle and SQL Server database servers
- Bronze, Silver, and Gold Service Level Agreements

IT Configuration System Policy Management

All production servers are managed using a configuration change management process:

- An authorized user request a change
- A screen print is captured to document the configuration change

- The change is put through a code review held by the Change Advisory Board, and logged at the service desk
- If a problem occurs, the configuration change can be backed out and the server is returned to the pre-change state.

DoIT is flexible in their approach to system administration. An agency can either maintain system and application level access to the server, or they can turn over system administration to the data center staff and retain remote application level administration. There has been no historical conflict between operations and application development

Charge Back

DoIT charges back to state agencies for services. Charges are cost-recovery only and are not profit based. While the DoIT budget covers personnel, chargeback fees are used to recover datacenter operations and hardware upgrades. Agency budgets provide the hardware when an application is initially moved into the datacenter.

Department of Health (DoH)

Jay Buechner PhD., Chief, Center for Health Data & Analysis –CHDA

Bob Childs, Chief, Office of Information Systems

Ted Cooper, Technical Support Specialist III, Office of Information Systems

Steve Sawyer, GIS Manager/ Senior Public Health Promotions Specialist, CHDA

Background

HEALTH has established the Center for Health Data and Analysis –CHDA to coordinate data and analysis activities Department-wide; as part of this mandate, the CHDA has initiated the development of an internal Geographic Information System -GIS having an Enterprise capacity based on a formal GIS Needs Assessment that was commissioned by the Department's Executive Committee, circa April 2003.

Additionally, CHDA expectations are that this GIS infrastructure will support the Executive Office of Health and Human Services -EOHHS that was created by the Governor to facilitate cooperation and coordination among the five state agencies administering Rhode Island's health and social service programs. Those additional departments located at the Pastore Complex in Cranston are: The Department of Children, Youth and Families, the Department of Elderly Affairs, the Department of Human Services and the Department of Mental Health, Retardation and Hospitals.

Mr. Sawyer is the sole full-time GIS Analyst/ Specialist/ Manager. The CHDA supports approximately 42 Health professionals across the various Centers/Programs that are able to apply this shared technology to their specific vocations. The CHDA GIS program has provided for training, technical support for application integrations, hardware & software configurations, as well as, a collective center of knowledge for GIS resources. Any RFP write-up, spatial analysis product, or data published using this GIS software typically is reviewed and/or edited by the Mr. Sawyer for quality assurance and quality control.

Mr. Childs reports to Mr. Phillip Silva - DoIT Agency Information Manager. HEALTH is the only agency that maintains its own firewall. This is in addition to the firewalls maintained by DoIT on the Wide Area Network (WAN). Tests of interagency connectivity have opened the ports of the firewall and created the appropriate network routes to allow for external GIS users in other agencies to access the HEALTH ArcSDE Enterprise GIS repository server.

HEALTH recognizes that compatibility and interoperability and the relationship between GIS technology and the State IT infrastructure is crucial. Server-side GIS is fully IT compliant and interoperable with other enterprise software such as customer resource management -CRM enterprise application integration -EAI, work management systems, or enterprise resource planning -ERP systems. It offers support for interoperability standards in the GIS domain (Open Geospatial Consortium, Inc.) as well as the broader IT domain (World Wide Web Consortium -W3C). "The inventory show that GIS in HEALTH is fairly advanced in terms of the data and functional capacities…"

taken from the *Information Systems Visualization Project*, CDC Public Health Informatics Team, InfoAid Final Report, pp. 41, June 2007.

The HEALTH ArcSDE Enterprise GIS repository is fully referenced and stored in an XML representation of FGDC Content for Digital Geospatial Metadata or of ISO 19xxx Metadata Standards. HEALTH has incorporated the ESRI GIS Portal Toolkit v3.1 application to provide for a fully dynamic interrelation between user and data. Using the GIS Portal any user has the ability to search for existing data by using keywords or geography; some advanced users have the ability to create, manage, and edit specific programmatic metadata via an Intranet web browser –this aides in further distributing the editing workflow too. Future plans are to fully leverage this documentation application to apply it on all newly created HEALTH databases, including SAS and PDF files.

The HEALTH GIS system has been directly supported under the US Department of Health and Human Services, Center for Disease Control & Prevention –CDC's Public Health Emergency Preparedness Grant. The CDC has required redundancy of HEALTH systems, this could potentially support the future resource sharing efforts. Similarly, the RI Real-time Outbreak Data System RODS –a.k.a. Syndromic Surveillance application has been funded and integrated with the GIS spatial database engine and the Intranet mapping service via ArcXML. Using the existing ESRI GIS Developer Network license v9.2 will aide for future work with vendors for new releases and the latest revisions towards RDBMS inclusions including that of the Microsoft .NET standards.

Geospatial Data

HEALTH has augmented a few of the spatial feature classes (layers) that are available through the RIGIS system. These include: Libraries, Schools, Fire Stations, Police Stations, Medical Facilities. However, there are numerous HEALTH GIS layers that need to be accessible and/or shared within the RI State Agencies; but not shared, with the general public based upon security or data sensitivity levels. Some layers in this category are: Emergency Medical Distributions Sites, Hospital emergency contacts and numbers, Decontamination equipment, Radiation or LAB Air Monitor locations, Medical /Facility Licensing. Also, of significant note is the spatial information that is derived from modeling software in direct support of emergency response and planning between Local, State, and Federal teams. These included data output products from the Federal Emergency Management Agency -FEMA All-Hazards US -HAZUS, the Defense Threat Reduction Agency –DTRA, Consequence Assessment Tool Set -CATS, the Hazard Prediction and Assessment Capabilities -HPAC, Hotspot from the Lawrence Livermore National Laboratory, and the National Hurricane Center –NHC, Hurrivac 2007 model.

The HEALTH leverages the EMC Clariion CX-600 Storage Area Network -SAN, with a dedicated APC UPS, 12 Tb., and Fiber Cable 2 gigabit LAN houses the ArcSDE GIS central data repositories and has been another instrumental key to success. This GIS application leverages the RDBMS methodologies; not only in storing data but to reference it real-time between RAID 1+0 and RAID 5 LUN's, this allows for HEALTH users to gain immediate access the latest up-to-date information. It also allows for the simultaneous editing too. Both, the RIGIS Catalog and the HEALTH Catalog of GIS information exist in a single Statewide Enterprise Geodatabase format supporting: multiple raster datasets, vector feature classes, and relationship tables. It has been made

available to all staff on a 24 hour/7 days-a-week basis since its inception in 2004. Ensuring that all levels of users have immediate access the most current version of data has been a significant challenge under the current RIGIS distribution methods –that being either CDROM or Internet download from the URI/EDC.

GIS Technologies

Hardware:

- 1 Compaq DL-380 Server: 73Gb. RAID R1+0
  - (Linux RedHat ES v3, Apache 2.048 web server, Tomcat 5.030 Web Servlet engine, and the ArcIMS 9.1)
- 1 Compaq DL-380 Server: 73Gb. RAID R1+0
  - (Windows 2003 R2, FlexLM ArcGIS License Manager, SQL Server 2000 RDBMS, and ArcSDE 9.1)
- 1 Dell PowerEdge 2950 Server: 73Gb. RAID R1+0
  - ArcGIS Application Development Server (Windows 2003 R2, SQL Server 2005 RDBMS, and ESRI EDN & ArcServer 9.2)
- 2 Gateway Desktop Workstations (Windows XP SP2)
- 1 Gateway Solo600 Laptop (Windows 2000 Pro, ESRI Fail-safe License)
- 1 HP1055CM DesignJet (36" roll) Large format plotter

Software:

- 1 ArcGIS ArcINFO v9.1 Concurrent Use License (Editing)
- 11 Concurrent Use ArcGIS v9.1 Desktop Licenses
- 1 (each) Concurrent ArcGIS v9.1 Desktop Extensions for:
  - Spatial Analyst,
  - 3-D Analyst,
  - Geostatistical Analyst,
  - Tracking Analyst
  - Network Analyst
  - ArcPublisher
- ESRI EDN v9.2 Development License for 1 developer

Networking:

- HEALTH Cannon Building has an EMC Clariion CX-600 Storage Area Network -SAN, with dedicated APC UPS, and Fiber Cable 2 gigabit LAN. The connection to the State WAN is also fiber optic.
- The EOHHS agencies located at the Pastore Center, Cranston having network connections to the State DoIT WAN. Each office when formalized will have connections to the HEALTH GIS Server(s) for data via client/server requests.
- HEALTH is willing to share its concurrent ArcGIS Licensing providing that State ArcGIS License Manager(s) are pre-staged, pre-set, and/or are dedicated to specific agencies and all work in-tandem to eliminate a single point of failure.

Department of Environmental Management

- Paul Jordan, DEM/Supervising GIS Specialist
  Warren Angell, DoIT/ DEM Agency Information Manager

Background

DEM GIS operations can be best described as a smorgasbord of spatial data collection & management, ad-hoc geographic analysis, and multi-media delivery of spatial information in support of more informed policy, regulatory and management decisions. Although Mr. Jordan is the sole full-time GIS practitioner, there are a dozen or so environmental engineers, scientists and biologists able to apply the technology on a limited basis to their work. The GIS program provides technical support for data & software issues and works with users one-on-one to build new skills. Any work resulting in published GIS data is reviewed and/or edited by Mr. Jordan for quality. The full RIGIS catalog along with numerous internal data sets are made available to staff via file-server and an Internet Map Server client. DEM also maintains a public IMS site on a separate server requiring redundant data storage and frequent data update transfers.

Geospatial Data

DEM maintains a number of natural resource & regulatory mapping layers available through the RIGIS system. These include:

Heritage Sites

The RI Natural History Program maintains site locations (X-Y coordinates) of threatened and endangered species and other significant natural features, management and stewardship needs, and threats to critical areas. Numerous State & Federal regulatory programs must access this data when evaluating proposed alterations to the natural environment. However, the sensitivity of the data requires the access to be limited and provided in such a way that users can only view a small area of interest at any time. ArcIMS & ArcGIS Server technologies are ideal for this purpose.

Land Conservation

Two parcel datasets representing over 135 thousand acres of permanently protected conservation lands are maintained by the DEM GIS. One contains all State protected lands, while the other documents all other (Federal, Local & NGO) conservation lands in the state. RI has a diverse and active land trust community resulting in nearly constant modifications to this dataset. A central data repository would be the ideal method for users of this data to access up-to-date information.

Outdoor Recreation

Companion datasets to the conservation lands include fishing & boating access sites, trout stocked waters, shoreline rights-of-way, multi-use trails, parks & beaches, and

hunting areas. As with previous examples, this information can be somewhat fluid with data collection and revision a constant process.

Water Quality

Surface & ground water classifications (305(b)), impaired waters (303(d)) and drinking water protection areas (WHPA & SWPA) all undergo an semi-annual major revision with near constant tweaking in the interim. Less frequently updated, but still widely distributed within the regulated community are layers depicting wetland permitting authority, phase-two storm water permit areas and currently sewered areas. Again, ensuring that end users have the most current version can be a challenge under the current RIGIS distribution methods.

GIS Technology Employed by DEM

Hardware:

- Dell File Server (2007, Win 2003, IIS6, Tomcat, ArcIMS/ArcServer)
- 3 Dell Precision Workstations
- 1 Dell Precision Portable (laptop) Workstation (primarily for Emergency Response)
- 1 HP designjet 5500ps 42" color plotter
- 1 HP designjet 4200 42" color scanner
- 1 Afga DuoScan 11"x17" color scanner
- Trimble GPS receivers (GeoExplorer, ProXR, GeoXT
- 24" Ledco Laminator
- 42" Rotatrim papercutter

Software:

- 3 ArcInfo/ArcMap 9.2, with spatial analyst, 3d and pubisher extensions
- Approximately 12 single use ArcMap (arcview) desktop (most not managed by GIS program), 2 ArcMap (arcview) concurrent use licenses
- ArcIMS/ArcGIS Server 9.2 Workgroup Standard edition
- Trimble Pathfinder Office 3.0

Networking:

- DEM's main offices at the Foundry Complex in Providence are equipped with a 100mb internal LAN with a long term goal of upgrading to a gigabit LAN. The connection to the State WAN is fiber optic.

Three satellite DEM locations have network connections to the State DoIT WAN. Each of these has a couple of ArcMap users and several consumers of IMS/Server data viewer product.

- Fish & Wildlife Marine Fisheries Center, Jamestown (T1 connection)
- Great Swamp Wildlife Management Area and Target Range (12 users, T1 Connection)
- Division of Forest Environment, North Scituate (3-4 users, Cox connection smaller than T1)

Department of Transportation (DoT)

- Mary Gelardi, DOIT/DOT Director of Management Information Services, DoIT Agency Information Manager For DOT
- Steven Kut, DOT/GIS Manager
- Matt Lang, DOT/DoIT IT Systems Engineer
- William Lincourt, DOT/GIS-DBA

Background

RIDOT GIS serves 3 primary functions for the Department including mapping and analysis, database administration and application development. These functions support all phases of the Transportation process, from the planning phase through design and construction and ultimately maintenance. The GIS unit works closely with the Department's users to provide technical support to desktop GIS clients on application and data development issues. They also are continuously working to integrate spatial technologies into the day to day work flow of the Department. The implementation of a central GIS SDE database along with the use of web based GIS has allowed all users in the Department access to core GIS data. The movement to web clients has continued with the recent implementation of ArcGIS server application that has introduced spatial editing through the web.

Organization

DOT/GIS reports into DoIT through Mary Gelardi the DOT DoIT Agency Information Manager Administrator. DOT/GIS has a staff of 8:

- 1 GIS Manager
- 1 Database Administrator
- 3 GIS Analysts
- 1 GIS application Developer for VB and IMS applications
- 1 Application Developer using ASP and .NET
- 1 Application Developer supporting VB and SQL server database applications

Applications

PlanGIS

The *Plan*GIS application at the Rhode Island DOT is enabling department-wide access to construction plans, right-of-way plats, bridge reports, and other documents using the department's intranet. The application is making the information accessible in one central location in digital format. Users are able to select, view, and print documents accessed by either entering key identifiers such as bridge number or contract number, or by geographically selecting a feature to access all the documents available for the specific location. This is the central ArcIMS driven mapping portal for the department.

Project Management Portal (PMP)

The PMP is the primary end-user application for managing contracts and workflow for design and construction projects. The mapping enhancement to the existing application implements GIS functions and data to enable PMP users to view, interactively enter, edit, and validate construction project/contract locations and stores location information together with related project records in the underlying SQL Server database. The

approach to this project implements custom software components that build on industry and RIDOT's GIS standards and integrate with the PMP. The core GIS products used for this project are ArcSDE and ArcGIS Server products from ESRI. The map service is built using ESRI ArcGIS Server technology.

Geospatial Data

Road Centerline

The State maintains 2 road centerline files. One is maintained by RIDOT that identifies primarily the road classification, road name and jurisdiction. DOT derives its centerline file from E911 geometry. The other is maintained by E911 and carries the standard road name and address ranges. The E911 centerline updates are made based on field work which is approved by RI cities and towns. Both files have all state and locally maintained roads. Periodically, roughly once every 6 months, the two centerline files are exchanged and changes from one are uploaded into the other.

1:5000 Base Data

Road Centerline—Includes state and local roads.
Bicycle Path—Bicycle facilities and Bike tolerant roads.
Boundaries—Political and RIDOT Maintenance zone boundaries. The coverage also includes urban area boundaries.
Accidents—Mile point and intersection-based database that provides accident information.
Design / Construction Projects—Ongoing Design / Construction Project extents.
HPMS—Highway Performance Monitoring System (HPMS) samples and status maintained by route and meter point (mile point?).
Pavement Preservation—Database maintaining the areas and status of treatment contracts, integrated with the division's internal database.
Traffic and Truck Count—Location of traffic count collectors
Airports—Detailed outline of the airport and its facilities.
Railroad—Centerline of railroad tracks. Though 24k data also exists, they are no longer being used.
Railroad Station—Railroad stations in the state.
Highway Inventory Info. System—HIIS Routes generated from the 24k.
Exits—Named and Unnamed exits.
Bridges—Bridge locations stored as points and polygons. Attributes are updated by the Bridge Section and loaded into the GIS.
Bridge Emergency Route—Database showing alternate routes for bridges in floodplains.
Highway Guardrail Attenuators—Statewide database containing guardrail attenuators.
Guardrail—Location of existing guardrail along state roads.
Highway Lighting – Points locations of lighting.
Park & Ride Location—Location of Park & Ride parking lots.
ITS—Location of DOT specific equipment such as traffic detection lamp, signs, cameras
Drainage – Location of outfalls, STU, detention ponds, and catch basins
Signals—Inventory of State traffic signals
Speed Limits Signs— Inventory of speed limit signs on state roads
Snow Plowing Plan—Route showing jurisdiction and maintenance routes.
Video Log—A database containing points from 1998, 2001, 2004 where roadway images (digital video) are linked and available for viewing.

GIS Technology Employed by RIDOT

Hardware:

- 1 Gateway 980 DB server, Quad 3056 Mhz, 4 gig RAM, 400 gig Raid 0 HD
- 1 VM ArcIMS web server
- NAS utilized for serving file based data and images
- 1 Dell Precision Portable Laptop
- 1 Gateway Portable Laptop
- 2 Gateway tablet computers
- 2 Xplore ruggedized tablet computers
- 1 HP Designjet 5500ps 42" color plotter
- 1 HP Color Laserjet 4550 PS
- 6 Trimble GeoXT GPS receivers
- 2 Trimble ProXRS GPS receivers
- CORS/Reference Base Station, a Trimble 5700 Receiver with its Zephyr Geodetic Antenna

DOT has 2 Gateway tablet computers used for field editing of data. They also have 2 ruggedized xPlore tablets with Bluetooth enabled GPS in a construction operations pilot program funded by the FHWA. This is being used to for mapping reduced mowing zones and NPDES storm water inventory and testing. Other applications are also being explored.

Software Licenses:

- 7 ArcInfo 9.2 (2 Shared with RIDOA/Statewide Planning)
- 1 Concurrent Use ArcView (Shared with RIDOA/Statewide Planning)
- 23 Single Use ArcView desktop
- 1 each of Desktop Spatial Analyst, 3D Analyst, Network Analyst and Pubisher extensions
- 1 ArcGIS Server 9.2 Advanced Enterprise (ArcIMS and SDE)
- 1 ArcPad and ArcPad Application Developer
- Trimble Pathfinder Office 3.0

Networking:

- RIDOT's main offices at 2 Capital Hill in Providence are equipped with a 100mb internal LAN with a gigabit backplane. The connection to the State WAN through DOA is 100 meg
- There is a T1 frame relay circuit between DOT headquarters and the Warwick Maintenance headquarters
- 9 satellite Maintenance facilities have 384 k connection using a mix of Verizon and Cox
- DOT averages 40 construction field sites using COX at 384 k

Rhode Island E-9-1-1

- Ray LaBelle, Executive Director of Rhode Island E-9-1-1

Revenue

E-9-1-1 generates roughly $19M in annual revenue with a $5.1M budget for operations. A $1.00/ month/ phone fee goes into the RI general fund. An additional $0.26/ month/ cellular phone surcharge was legislated in 2004 and is due to expire in 2007. These surcharge funds are allocated for GIS. the moving of the PSAP to the new State Police headquarters at the Pastore State Government Campus in Cranston planned in 2 or 3 years, and other technical updates.

Geospatial Data

Within use restrictions, it is possible that the E-9-1-1 backup ArcSDE server at DOA could be used to replicate E-9-1-1 data and the RIGIS data set between E-9-1-1 and the Capitol Hill state office campus.

Pictometry

In 2004-5, at a cost of $150K, Pictometry data was collected 4 pilot towns: Cranston, East Providence, Providence and Warwick. Potential Department of Homeland Security funding is being sought to re-fly the entire state in the fall of 2007.

Site File

In 1996, the FCC mandated that cellular carriers provide enhanced 911 cellular services including caller location data.

Phase 1 requirements:

- Callback number for the phone
- The physical location of the tower

Phase 2 requirements:

- Callback number for the phone
- The latitude and longitude of the caller (with a probability factor)

These FCC requirements are driving E-9-1-1 GIS work. One project is to create a state-wide site file data layer for comprised of address points and ranges. This site file is used during emergency dispatch to aid in the location of incidents and to facilitate first response. 16 types of locations are tracked (buildings, landmarks, hydrants, billboards, etc.). Key data layers include road centerlines, driveways, buildings and emergency service areas.

The E911 street centerline file, presently maintained by MicrodataGIS, a private consultant for RI E911, is based on 1997 DOT road centerline data, updated in 2004. The E911 site file of building points was based on RIGIS 1997 orthophotography and is being updated by MicrodataGIS field units on a town by town basis. Originally, there were 7 Microdata units conducting field operations, currently there are 2. Before field work starts in a town, the Police Chief, Fire Chief, and chief elected officials are contacted.

Originally the project had a $3.9M – $4M budget, and a 2 ½ year project time line. The field work to verify the location points was started in 2001 and is being done on a town-by-town basis. To date, 21 Communities have been completed and 248,000 location points have been identified. The work is scheduled for completion in 2008.

The E-9-1-1 coordinator in each community verifies the field work before it is added to the state-wide layer. These coordinators are responsible for collecting future changes and notifying the state E-9-1-1 office of changes and updates to this data.

The E-9-1-1 site file point data is available to the public, but names of individuals and other private information is not shared. The address points are of particular value to utility companies.

Public Safety Access Point (PSAP)

E-9-1-1 runs a PSAP in North Providence with an identical backup facility located in basement of the DOA building on the Capitol Hill campus. Call handlers receive emergency calls and transfer them to the appropriate responders in the city and towns. There are 14 workstations each with 3 screens showing:

- Call information
- Related GIS data including: Centerlines, site file points, driveways, buildings, emergency service areas (polygon and number)
- Pictometry oblique photos

Images from 80-90 DOT maintained cameras are also available to the PSAP call handlers. In addition, the PSAP has multiply redundant radio systems for communication with first responders.

The main function of the PSAP is to determine the type of emergency (police, fire, medical) and to verify the address, not to debrief the caller. The call is then transferred to the appropriate dispatch center. The PSAP maintains Computer Aided Dispatch (CAD) capability which can transfer data along with the voice call. However, local communities do not have this capability and therefore only the voice portion of the call is transferred.

MicrodataGIS manages the map screens using ArcGIS Desktop 9.2 licenses leased from Microdata that are being migrated to an ArcSDE, SQL Server, ArcEngine back end.

University of Rhode Island

- Charles Labash, labash@uri.edu, Director of the Environmental Data Center

Background

The Environmental Data Center is a twenty year old GIS organization within the Department of Natural Resources. It has an academic site license for ESRI software and works on a cost sharing model. The Environmental Data Center was founded in 1984-85 mainly through the efforts of Dr. Peter August, who is now the Director of the Coastal Institute within the Department of Natural Resources.

In 1990 state legislation was amended to establish RIGIS and included URI: "The University [of Rhode Island] shall cooperate with and provide technical assistance to the Division of Planning of the Department of Administration in the management of the statewide geographic information system and shall advise other state, municipal and federal departments and agencies and the general public in its use."

The center's laboratory is meant to be a one stop shop for GIS needs within the University and includes a local a master copy of the RIGIS database., The URI/EDC provides RIGIS data to the public through a distribution service.. In order for data to be included into the RIGIS database, the data contributor must supply FGDC compliant metadata, and conform to RIGIS digital database standards. The RIGIS coordinator at the RIDOA does a quality check against the standard and ensures that the data is within specification and that the appropriate metadata is developed prior to delivering it to the URI/EDC.

Organization and Funding

There are 12-15 people who work full-time in the lab. 12 full time staff paid with soft money and another 3-5 graduate students.

Through extension FGDC Feature Service grants totaling $240,000 over three years, URI is able to fund, in part, a Geospatial Extension Specialist (GES). The GES supports the public, coordinate of the annual RIGIS conference and holds workshops on geospatial topics. The GES and the RIGIS coordinator are seen as a team: the RIGIS coordinator focuses on data quality/standards and the GES interfaces with the public and provides general GIS training.

Sources of soft money include:

Grants from Federal Agencies

Narragansett Bay Progeam(http://www.narrbay.org) grants and map production

MapCoast (http://www.mapcoast.org) mapping coastal subaqueous soils

Web-based HTML exports of shape files are available for approximately 30-40 non-RIGIS scientific based data sets.

FOIA Policy

URI is not itself a state agency and therefore does not respond to Freedom of Information Act (FOIA) requests. FOIA requests are directed to the relevant state agency. The RIGIS

data collection is copyrighted, though the data itself is not. Through its licensing agreement, URI allows for non-commercial use of the RIGIS data set.

Data Distribution

URI maintains a web site for public distribution of the RIGIS data set using ESRI's portal toolkit. Metadata provided by contributors includes the state agencies creating the data. Most access is via FTP, though web services. Larger data sets (e.g. Orthos) can also be requested on CDROM and are handled by the RI DOA RIGIS coordinator. Demand for these disks has decreased since the data became available on-line. This site is accessible 24/7 and there is no charge to download data. More complex download requests URI maintains the web site and collects user information via the RIGIS license form.

URI supports a number of state agencies by developing specific products and applications including the Rhode Island Emergency Management Agency (RIEMA) and the RI National Guard. URI was a leading support organization during two recent oil spills a state emergency response and mitigation effort that falls under the RI DEM.

GIS Technology

ArcSDE is used internally and there are plans for opening SDE for general public access during the summer of 2007. Periodic SDE extracts are created for posting on the FTP site.

URI has maintained a registered cooperative CORS (Continuous Operating Reference Site) GPS reference station since 1990.

There is good network bandwidth within URI, but the connection to the state network OCEAN is unclear. OCEAN is in the process of being upgraded.

Recommendations

A good integration concept test would be to attempt access to URI SDE servers by a state agency user. This would surface any routing configuration issues and assess the performance of connections between the two networks.

It is possible that a URI repository could also house sensitive data that is not available to the general public if proper data management sharing arrangements were implemented. This could serve as a backup to the hosted state agency and could also be made available during an emergency such as an oil spill.

The URI has maintained a connection to upload RIGIS data to the federal National Spatial Data Infrastructure (NSDI) for over two years.

URI has a MapServer platform in place that could be used to develop geospatial data viewers.

Appendix B. GIS Software License Inventory

Agency	Server/ Desktop	Product	Type *	Quantity	Notes
DOA-Statewide Planning	D	ArcInfo	2-Floating Concurrent	2	2 high level users - Licenses Managed by RIDOT
	D	ArcView	Concurrent	1	Management & Data Viewing- License Managed by RIDOT
	D	ArcView	Single	6	4 mid level users; 1 intern; 1 State GIS Coordinator
	D	Network Analyst	Concurrent	1	ArcGIS Extension License Managed by RIDOT
	D	Publisher	Concurrent	1	ArcGIS Extension License Managed by RIDOT
Department of Health	S	ESRI Portal Toolkit 3.1		1	Metadata Search Engine Software
	S	ArcSDE 9.1		1	SQL Server 2000
	S	ArcIMS		1	Internal DOH Use
	S	ArcGIS Server 9.2 EDN		1	Development EDN
	D	ArcInfo	Concurrent	1	GIS Manager
	D	ArcView	Concurrent	11	42 Mid to Low Level Users within DOH
	D	3D Analyst	Concurrent		ArcGIS Extension
	D	Geostatistical Analyst	Concurrent		ArcGIS Extension
	D	ArcPublisher	Concurrent	1	ArcGIS Extension
	D	Tracking Analyst	Concurrent	1	ArcGIS Extension
	D	Spatial Analyst	Concurrent		ArcGIS Extension
	D	Network Analyst	Concurrent	1	ArcGIS Extension

E-9-1-1	S	ArcGIS Server			License leased by the MicrodataGIS
	D	ArcView	Single Seat	30	At E911 Call Takers Consoles-Leased by MicrodataGIS
DOT	S	ArcIMS	2 CPU License	1	Internal/External Department Use
	S	ArcSDE 9.2		1	Oracle Server
	S	ArcGIS Server		1	
	D	ArcInfo	Floating Concurrent	5 2	5 DOT, 2 Statewide Planning High Level Users
	D	ArcView	Single Seat	24	Low and Mid-Level DOT Users
	D	Network Analyst	Concurrent	1	ArcGIS Extension (Statewide Planning)
	D	ArcPublisher	Concurrent	1	ArcGIS Extension (Statewide Planning)
	D	3D Analyst	Concurrent	1	ArcGIS Extension
	D	Spatial Analyst	Concurrent	1	ArcGIS Extension
	D	ArcPad Application Builder	Concurrent	1	ArcGIS Extension
	S	ArcSDE Developer	Concurrent	1	2-CPU
	S	ArcSDE Developer	Concurrent	1	2-CPU- Five Read Write Connections
DEM	S	ArcIMS	Workgroup Standard Edition	1	External Public IMS (Available for other Agencies Use)
	D	ArcInfo	Concurrent	3	
	D	ArcView	Single Seat	12	Mid to Low Level Users within DEM
	D	Spatial Analyst		1	ArcGIS Extension
	D	3D Analyst		1	ArcGIS Extension
	D	ArcPublisher		1	ArcGIS Extension

*** Note: Concurrent use licenses for desktop software requires a server based license manager.**

Appendix C. Definitions, Acronyms, and Abbreviations

AppGeo	Applied Geographics, Inc.
ArcIMS	ESRI Product: Internet Mapping Server (Software)
ArcSDE	Spatial Database Engine – ESRI database gateway product (Software)
ArcView	ESRI Product: Desktop mapping application (Software)
CAD	Engineering: Computer Aided Drafting (Software)
CAD	Public Safety: Computer Aided Dispatch (Application System)
CAMA	Computer Assisted Mass Appraisal (Municipal Tax Assessment DBM system)
CIO	Chief Information Officer
DEM	Department of Environmental Management (RI State Agency)
DOA	Department of Administration (RI State Agency)
DOC	Department of Corrections (RI State Agency)
DOH	Department of Health (RI State Agency)
DoIT	Division of Information Technology (Division within RI DOA)
DOT	Department of Transportation (RI State Agency)
EOC	Emergency Operation Center (Emergency Management Facility)
ESRI	Environmental Systems Research Institute (Commercial GIS Software Provider)
FGDC	Federal Geographic Data Committee (Federal Government Program)
FHWA	Federal Highway Administration (Federal Government Agency Division)
GES	Geospatial Extension Specialist (Program Position at URI)
GIO	Geospatial Information Officer (Lead GIS Person in Several States)
GIS	Geographic Information System (Spatial Data Management System)
OHHS	Office of Health and Human Services (RI State Executive Office)
HIPAA	Health Insurance Portability and Accountability Act (Federal Government Law)
HSIP	Homeland Security Information Program (Federal Government Program)
PSAP	Public Safety Access Point (For Emergency Response-E911 System)
RIEMA	Rhode Island Emergency Management Agency(RI State Agency)
RIGIS	Rhode Island Geographic Information System(Consortium of GIS Users in RI)
SAN	Storage Area Network (Computer Disk Data Storage Management System)
SDE	See ArcSDE (ESRI Software Package)
URI	The University of Rhode Island