

A Proposal for Reinvigorating the American Economy Through Investment in the US National Spatial Data Infrastructure (NSDI)

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Summary

As America struggles with the most significant economic downturn of the past 60 years, we need to take bold actions that ensure a rapid economic recovery and at the same time lays the foundation for a bright economic future for the nation. Decision makers must prioritize investments in infrastructure to accomplish both goals. As is the case with investment in physical infrastructure, investment in information and communication technology (ICT) have immediate fiscal impact as well as implications for broad downstream economic growth. An investment in building the US National Spatial Data Infrastructure (NSDI) will provide immediate benefits to the American ICT industry, including the seeding of new technologies, businesses and offspring industries. The collection and processing of geospatial data is a "shovel ready" activity able immediately to create jobs, though the shovels in this case comprise a wide range of geospatial technologies and tools for infrastructure design and modeling used by a large, nation-wide community of professionals. Further development of the NSDI will also yield tremendous long term benefits in such diverse areas as emergency management, sustainable urban design, disaster response, homeland security, environmental protection, green infrastructure development, natural resource management and disease control, as well improvements in the efficient provision of everyday government services at all levels.

To broaden the economic impact of an NSDI development activity; to minimize the up-front and ongoing costs to taxpayers; and to maximize the effectiveness of Federal guidance and funding, the NSDI must be viewed as a "system of widely distributed systems" like the Web itself, based on openness and interoperability, and not on centralized control and ownership. Consequently, it is clear that creation of an effective NSDI can only result from two distinct but related programs of activity: a data/metadata collection and hosting effort which needs to begin as soon as possible; and, coordinated with it, a comprehensive planning process designed to consolidate the past successes and current activities of those organizations most concerned with building the NSDI and active in promoting its development over the last two decades.

Proposal

The stimulus currently being forged by the Congress and the Obama Administration is filled with difficult choices and bold initiatives aimed at reviving the American economy. Unprecedented physical infrastructure investments are being planned which will greatly change the American landscape. The collection of geospatial data that chronicles this change is essential to both economic development and general improvement in the quality of life for all. It is the comprehensive, timely, and accurate compilation and management of the various forms of this data (e.g., imagery, terrain, parcel data, ecosystem data, and 3D data accurately capturing buildings, facades and the urban infrastructure that exists both above ground and beneath a cities surface in a spatially coherent and accurate context), its collection and processing, which are essential to underwrite the most critical government mandates – from climate to sustainable development to security -- and to fuel the current renaissance of private sector innovation positioned to drive a unique and timely generation of economic productivity for the nation.

In this context the times compel us to recognize the necessity of appropriate action on the part of the federal government, as follows:

1. Funding for the immediate launch of a geospatial data collection and processing initiatives designed to fuel ongoing and future NSDI development and maximize critical economic benefits, an approach not inconsistent with the expressed sentiment of the US Government's National Geospatial Advisory Council's (NGAC) transition recommendations to the new Administration (October 2008).
2. Direct funding and agency by agency mandates to initiate concerted public/private partnership efforts to design and deploy a nationally-scalable, interoperable, secure, and reliable NSDI including urban design, infrastructure and modeling data, building on the currently available – and already sufficient -- data coordination efforts and standards-related organizations and programs. This collaborative effort would focus on ensuring that geospatial data collected in the past, present and future will be seamlessly available to American state/local/Federal government organizations, American citizens, and American industry.

Why a National Spatial Data Infrastructure (NSDI)?

The benefits of a National Spatial Data Infrastructure are broad and deep. The NSDI is a fundamental component of our national critical infrastructure, providing visibility into many aspects of the national economic and governance process. Country by country, the NSDI is considered "mission critical" by enterprise level CIO's, and provides a platform for public/private collaboration among national groups worldwide. The US Government's own National Geospatial Advisory Council (NGAC) has provided transition recommendations to the new Administration (in October 2008) that outline the power of such a spatial data infrastructure – and the criticality of immediate, large-scale geospatial data collection and processing. The NGAC recommendations, though not specifically addressing the details of modern architectures and service platforms, represents a broad consensus among the key public and private stakeholders in the geospatial data and technology field, and forms a principal basis for this proposal. An NSDI, built using open, standards-based information and communications technology infrastructure, will seamlessly enhance critical applications and improve the efficiency and effectiveness of essential operations of government and industry.

It should, however, be noted in this regard, that US Federal Government agencies, in collaboration with the major ICT corporations and diverse suppliers of geospatial products and services, have for years, in fact, been laying the foundation for a coherent, systemic and interoperable NSDI for the US. In addition, the Global Spatial Data Infrastructure (GSDI) organization, a voluntary collaboration oriented to SDI development in which US organizations play a prominent role (see www.gsdi.org), works to promote adherence to common standards and practices on a global basis so that all participating nations are able to share data to the extent possible given prevailing policy restrictions. In fact, to these ends, the US government has for years significantly invested and participated in the Open Geospatial Consortium (OGC) (www.opengeospatial.org), with the express purpose of ensuring that the necessary technical standards and best practices exist at both national and global levels, so that a nationally-scalable, secure, interoperable and globally capable NSDI could someday be realized. Stimulated by the emergence of such ISO-validated standards, the Office of Management and Budget has in parallel promulgated a

Federal Enterprise Architecture Geospatial Profile which draws on these OGC standards in its guidance to all Federal agencies. And, many agencies (the USGS, NASA, DHS, NGA, Census, NOAA, EPA, etc.) have adopted and contributed to the further development of OGC standards as they have begun to implement their critical NSDI components.

Firstly, many geospatial data gaps have long been identified as impediments to the efficient and effective prosecution of a variety of public missions and private initiatives. Moreover, we have seen how the availability of extensive, high resolution, geospatial data has enabled world-changing applications such as Google Earth/Google Maps, Microsoft Virtual Earth and countless other applications. In this context, these gaps have become more acute and have been amplified in public discourse. Certainly, the acute nature of these gaps has been clearly articulated by the National Geospatial Advisory Committee, in terms of imagery, terrain data, parcel data, and ecosystem data. Industry is currently responding to the problems posed by the lack of available, consumable high-quality 3D structural data within the US via emerging standards such as CityGML, Building Information Model (BIM) and Digital Cities that enable data-driven urban models to improve planning and reduce infrastructure life-cycle management costs. Moreover, our nation's rich legacy of geospatial data created and collected by the public sector (including hydrography, topography, roads, buildings, utility network, geonames, landmarks, land cover/land use, soil types, political jurisdictions, demographics, physical geography, and more) in effect comprise another acute gap as they are simply not managed in such a way as to be available as business-critical or mission-critical data services.

Secondly, if designed and deployed properly, the technical implementation of the NSDI will allow government and business entities to engage in sophisticated business analytics that leverage their personnel, financial, asset, customer/citizen, economic, and infrastructure data against the rich sets of geospatial data that would be collected, processed and managed under this proposal. The benefits to public missions at the local/state/Federal levels of government, the positive externalities that will flow to the private sector, and the social returns to this investment would be enormous.

The present day dependence on geospatial capabilities is such that progress in both government and industry will undoubtedly slow if comprehensive, timely, geospatial data collection and processing is not supported. The stimulus plan is an opportunity to resolve these gaps, ensure both short and long term economic growth, enable the essential public missions, and open up entirely new domains of economic activity that cannot be contemplated without such an investment.

The collection and processing of this geospatial data, and its availability through the NSDI will allow agencies at all levels of government access to a powerful tool capable of quickly marshalling its business/mission data within a spatio-temporal context that facilitates rapid, accurate public decision making. As it currently stands, decision makers cannot rapidly marshal the government's data in response to a business/mission need in some specific place in the US (or the World) at some specific time.

An NSDI brings together all key national datasets to support action – whether this action is emergency management, disaster response, homeland security, environmental protection, green infrastructure development, natural resource management, disease control, or simply the effective and efficient provision of everyday government services. Once completed, it will be a priceless national resource and an indispensable tool for public sector policymakers, planners, operators, analysts, and support personnel as well as businesses across the private sector.

However, while an NSDI could begin design immediately, it is unrealistic to believe that it would be deployed fast enough to speed the start of job-rich physical infrastructure projects funded under the stimulus plan. It is simply not feasible that a technical system of national proportions could be developed and deployed that quickly. And, virtually every Federal agency already has enterprise licenses of basic GIS technology to plan projects. However, it is feasible that geospatial data be collected on these projects as they evolve, and made available via the NSDI as it is implemented.

Collectively, the improvements in our ability to plan and execute; create and implement policy; and innovate across a broad range of domains as a direct result of an up-to-date, available NSDI that exposes comprehensive geospatial data, robust 3D urban design and modeling data will deliver tangible, immediate value. The value delivered by this essential infrastructure will contribute directly to immediate national objectives that include transparency; efficiency, sustainability, security and the development of improved accountability across an increasingly responsive government.

Technical fundamentals of a National Spatial Data Infrastructure

An NSDI integrates information from many sources and authors using standardized protocols (particularly an Open Geospatial Consortium compliant Service Oriented Architecture) so that geospatial data and spatially-enabled business data can be harmonized and integrated into a common framework capable of supporting multiple missions at all levels of government and a wide variety of private business initiatives.

Unfortunately, much of the geospatial technology currently deployed was simply not designed for nationally scalable, interoperable and secure operations. And, the 24x7 hosting such data and decision support services simply does not exist. Guarantees of privacy, confidentiality, protection of proprietary financial data, and similar concerns have not been built in at the foundation and at every level. Indeed, so much technological innovation has occurred across the geospatial technology marketplace over the past decade, and so much innovation has occurred in the underlying ICT framework of products, frameworks and standards, that much consideration must go into the design of a multi-vendor, scalable, interoperable, secure National Spatial Data Infrastructure.

An NSDI will result in the following:

- A well maintained collection of geospatial datasets, licensed (when necessary) to allow national use, published via standard Open Geospatial Consortium (OGC) compliant web services so that government and private sector entities are not forced into a single technology vendor solution;
- Standards-based transactional workflows that allow authorized users to remotely update and maintain these datasets;
- A data management solution based on the OGC SOA that allows for the dynamic discovery of, and access to, these geospatial data assets;
- Basic standards-based data processing services that allow for derivative data products to be calculated on the fly-rather than needlessly hosting countless derivative products;
- The ability for any public sector or private sector organization to deploy web applications capable of consuming geospatial data via OGC SOA web services;
- A set of such applications supporting specific public functions;
- A designated Federal entity to drive the effort, a data governance model, an oversight Board providing accountability and transparency to the process, and institutionalized relationship with the new Federal CTO.

NSDI Leadership and Costs

The National Geospatial Advisory Committee (NGAC), in consultation with the Department of Interior and other stakeholders, have developed detailed recommendations on how to quickly embark on the geospatial data collection and processing efforts necessary to realize a US National Spatial Data Infrastructure, as described above. The full and timely implementation of Imagery for the Nation (IFTN), Elevation for the Nation (EFTN) and National Land Parcel Data (NLPD), have each been vetted by the NGAC. Another initiative focused on mapping ecosystem data (specifically, wildlife corridors and crucial habitats) has also been defined to inform decisions on community growth, alternative energy expansion, biodiversity preservation, and resolving water resource issues. And, industry has highlighted the critical need for the development of rich urban 3D datasets that will enable new

industrial applications, homeland security applications, and public planning applications to be developed. Together, these are priced at \$1B, expended over a 3 year period.

Since much of the interagency planning, contracting and program management capacity already exists, there will not be the need to develop much additional government capacity in order to immediately execute the IFTN and the EFTN portions of the geospatial data collection and processing initiative proposed above. However, no program offices, data guidelines or contracting processes yet exist for the ecosystem mapping or 3D urban collection. These capacities must be established.

It is anticipated that a small government management office will need to be established in order to execute the technical side of the NSDI. While the overall management for the data collection should be provided by Secretary of the Interior, with significant involvement from the USDA, DOC, DHS/FEMA, and other cabinet agencies, the Secretary of the Interior will consult with the new Federal Chief Technology Officer (CTO) in order to determine the best path for implementing the technical aspects of the NSDI across various agencies. These efforts are priced at \$250 million expended over 3 years.

Conclusion

For several years now, the need for a nationally-scalable, interoperable, secure National Spatial Data Infrastructure has become more and more acute. The failure of previous Federal investments to provide such a nationally-scalable system has resulted in lost opportunities to better support public missions and private initiatives. The current crisis offers us the opportunity to lay this infrastructure, beginning with the collection and processing of comprehensive, high quality framework data layers. A National Spatial Data Infrastructure properly designed and effectively implemented will provide enormous downstream economic growth, as the backbone for a new spatially-enabled information economy capable of supporting our national physical infrastructure investments. A public utility of distributed data and information technology assets under distributed ownership and management, the National Spatial Data Infrastructure will become a foundation for next generation industries and technologies of the future.

Attachment A:

A successful National Spatial Data Infrastructure will depend on the rapid collection and processing of key datasets, including imagery, terrain, parcels, ecosystem, and 3D urban structure and infrastructure data.

Imagery

Imagery for the Nation (IFTN) is an intergovernmental initiative conceived of to provide for the nation's basic imagery needs. Largely focused on aerial imagery provision, IFTN is open to any imagery provider that can meet the specifications. Imagery is broadly known to have countless applications across the public and private sectors. IFTN will enable all levels of government to partner in the acquisition of data according to published specifications, in a way that lowers costs and reduces duplication. The National States Geographic Information Council initiated IFTN, which has also been endorsed by the FGDC and the NGAC (approximate cost \$140 million).

Elevation

Elevation for the Nation (EFTN) is the nickname used to explain the need for high resolution digital elevation models and source terrain data. LiDAR and IfSAR are aerial mapping technologies (respectively laser- and radar-based) that provides highly accurate mapping of ground elevations. Space based SAR is increasingly common. While FEMA currently uses LiDAR data for flood mapping, there are much broader applications for high resolution terrain (both natural and urban terrain) products across every domain of use outlined in this document. An investment in EFTN would produce much needed, comprehensive coverage of high resolution elevation data across the entire country (approximate cost \$300 million).

Parcels

National Land Parcel Data (NLPD), as outlined in the recent National Academies of Science, National Research Council (NRC) report "National Land Parcel Data: A Vision for the Future," also known as cadastral data, is used by governments to make decisions on land use, development, commercial zoning and permitting, regulatory compliance, emergency response, disaster recovery, and law enforcement. The NGAC endorsed the NRC report's recommendations at its October meeting (approximate cost \$200 million).

Ecosystems

The Western Governors' Association has recommended developing data related to Wildlife Corridors and Crucial Habitats, in order to enable ecologically sensitive land development. Such data helps state/local governments better manage growth and development, energy corridor development, water resource management, and the protection of sensitive ecosystems. (approximate cost \$110 million).

3D Urban Structures

Industry leaders have called for enhanced 3D urban structure data resources in order to drive virtual world applications which have profound impacts on homeland security, land development planning, scientific research and innovative commercial technology offerings. The lack of consistent 3D urban structure data and models that capture the urban and built environment in way that supports visualization, modeling and simulation across the US has been identified by industry leaders as an impediment to evolving from mere 2D GIS to robust virtual globe applications. (approximate cost \$250 million).

National Spatial Data Infrastructure Design and Deployment

In order to design and deploy a nationally-scalable, interoperable, secure National Spatial Data Infrastructure, significant effort will be needed in professional services and technology acquisition. In order to integrate currently-existing agency map layers and the layers outlined above into this technical infrastructure, technical and business processes will need to be developed. The new Federal Chief Technology Officer would determine which Agency should lead this system design and deployment (approximate cost \$250 million).