



# ***NATIONAL BIOLOGICAL INFORMATION INFRASTRUCTURE***

## NBII Enterprise Architecture

### Section 1 – Introduction

Version 1.0

*NBII Program*

*January 2004*

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## 1 Introduction

Information about the natural world, ecosystems, and the biodiversity found within them, is fundamentally important to all sectors of society. The United States has invested many millions of dollars in the collection of this type of information but, unfortunately, most of it is inaccessible and resides in forms that are not easily used. Based on estimates that the Federal government produces and holds only 10 per cent of the biological research and monitoring data and information of the US, it is assumed that data and information from diverse sources are necessary to build a complete catalog of our Nation's biological resources. The National Research Council confirmed this assumption in 1993 in their report, *A Biological Survey for the Nation*, which said, "There is wide agreement on the urgent need to organize existing biological information and make it more readily available and to coordinate future data collection and exchange."

The NBII provides the framework for making this vast storehouse of information accessible and also provides the tools needed to make it coherent and useful to a wide audience. The NBII is a web-based information system, coordinated by the USGS; it provides data and information on the nation's biological resources. NBII links biological databases, information products, and analytical tools maintained by NBII partners from all sectors including Federal, State, local, and tribal government agencies, international organizations, academic institutions, non-government organizations, and private industry.

The goals of the NBII include:

- Develop the framework to support knowledge discovery and creation for the Nation's biological and ecological resources enterprise,
- Create an integrated library of biological knowledge by systematically discovering, organizing, storing, and making available scientific data and information from diverse sources,
- Lead the development, selection, and distribution of tools and standards necessary to facilitate interoperability and allow meaningful interactions with scientific data and information, and
- Empower NBII users by creating awareness of NBII and its capabilities and providing the support for users to realize its value.

Fundamental to the NBII Program's growth and success is its capacity to build and strengthen partnerships across federal, state, local, tribal, international, academic, private sector, and non-profit scales in accordance with the Federal Enterprise Business Model. If the NBII is to succeed in providing qualitative and quantitative natural resources data and information to decision-makers, it must incorporate all of these sectors in order to ensure the most complete picture possible, drawn from the best possible sources. These partnerships not only facilitate data sharing, but also enable leveraging of funding by all parties, making possible more comprehensive products than those that would be created from allocated funds alone.

Functioning as a distributed network of information providers, the NBII architecture allows partners the security to control their data, while encouraging collaborative projects to provide more qualitative decision support and modeling tools. Adopting NBII standards for data

description and modeling, partners are building tools and resources that are interoperable and adaptable, thus eliminating costly duplication of effort and tools that stand in isolation.

## 1.1 Progress to Date

The NBII was created in response to a recommendation of the National Research Council in the 1993 report *A Biological Survey for the Nation*. This recommendation described broad parameters to tackle the issue of dealing with the immense volume of biological information funded by the Federal and State governments and the private sector and making it available to and use-able by policy/decision makers, resource managers, researchers, and others.

In 1998, a report issued by the President’s Committee of Advisors on Science and Technology reviewed the NBII and recommended that content should be increased dramatically; leading edge information technology needed to be incorporated; and the NBII architecture should be based on a structure of nodes. For many years, the NBII was an unfunded program, whose growth and development was due largely to Program Office staff and the leveraging of partner-ships for in-kind services.

In 2001, the NRC affirmed the NBII’s success to date toward the objective stated in the National Research Council report: “By developing a national approach for using the internet to distribute biological information – the National Biological Information Infrastructure – the USGS has been at the forefront of these efforts and is playing a key role in encouraging other nations to develop similar, linked capabilities” (*Future Roles and Opportunities for the US Geological Survey*, NRC, 2001). In FY01, the NBII received specific allocations from the Congress to support the development of information hubs in ten (10) designated regions, dedicated to creating products and services to support regional information needs, identified national priorities, and system-wide interoperability. The NBII Program office established “lead” organizations for these NBII “nodes” in each of the designated regions, working closely within these regions to develop proposals and identify partners for delivery of information products that meet the needs of various stakeholders

The NBII’s success in its inaugural year as a funded program garnered the attention of both the Congress and the scientific community, and resulted in an overall funding increase of 25% in FY02 for designated projects. These increases have enabled the designated nodes to bring in additional partners and data sources, and have allowed development of tools and technologies whose benefits extend to the entire NBII system. The FY 2004 President’s Request calls for additional funds to be entrusted to the NBII to handle general development, as well as specific in-formation management related to invasive species and Chronic Wasting Disease.

The NBII is committed to serve the nation by providing reliable scientific information for many purposes, including efforts to manage biological and other natural resources. The development of technological and partnership networks continues to grow, facilitating the increasing availability of more data and data integration tools to users. Services provided by the NBII help the USGS to maximize the Nation’s investment in science research and monitoring activities by leveraging Federal research dollars against those expended by other organizations in all sectors. This benefits everyone by avoiding costly duplicative data collection. The USGS Annual Performance Plan validates the necessity for the NBII’s dual tasks of (1) providing a single point of access for



USGS biological data and information, as well as (2) playing a leadership role in coordinating biological data and information from other organizations in order to provide a clearer picture of the Nation's biodiversity and natural re-sources. This validation is echoed in the words of the National Research Council, which de-scribed the USGS as a “vitaly important provider and coordinator of information related to critical issues in the natural sciences.”

Additional national-level issues of biological importance, as well as the natural resources information needs in other regions of the country, have resulted in calls for additional NBII nodes. These new hubs will address issues such as the health and sustainability of oceans, large rivers and coral reefs; issues of “smart growth” and urban biodiversity; amphibian declines; and regional needs for natural resources information in the Southeast, Southwest, and the Great Lakes areas. In addition to these well-established scientific information needs are rapidly emerging issues such as wildlife disease and its potential impact on human health. The spread of the West Nile Virus and Chronic Wasting Disease - whose potential human-health impacts are still unknown and potentially significant - draws attention to the need for national-level, real-time modeling and information dissemination to enable access to critical data by wildlife managers, human health officials, and legislators. The distributed nature of the NBII system, as well as its vast network of public and private partners, enable comprehensive information delivery for both known and unanticipated natural resource needs.

The USGS to set for itself long-term and annual goals addressing the need for the organization of environmental and natural resource information, to be measured in terms of long-term data collection and management efforts toward maintaining, improving, and supporting large data infrastructures. In addition, the agency is committed to fostering partnerships with universities, states, and other organizations for the supply and analysis of this information. The NBII is a partnership-based, collaborative infrastructure. It has fully complied with the strategic direction of the USGS of combining and enhancing diverse programs, capabilities, and talents, and increasing customer involvement to strengthen the Nation's scientific leadership and contribution to the resolution of complex issues. The NBII has achieved the Nation's strategic goals by successfully fostering many partnerships including ones with other federal agencies, state and local governments, universities, private industry, and non-government/non-profit organizations.

The future of NBII is starting to take shape. Building upon our existing accomplishments and partner relationships, NBII will continue to improve the effectiveness of the technical infrastructure to facilitate network collections development, organization, access, and delivery. New information applications will enhance analysis, integration, and synthesis capabilities, providing more efficient knowledge development and problem-solving capabilities. The completion of the NBII Enterprise Architecture baseline will facilitate the continued enhancement of the NBII as a premier biological information infrastructure that serves the nation and the world.

## **1.2 Enterprise Architecture Standards**

The NBII architecture must not only meet the needs and goals of the NBII Program, but also be compatible with USGS, DOI, and Federal enterprise architecture initiatives. Therefore,



development of the NBII Enterprise Architecture baseline included alignment with applicable enterprise architecture standards. These standards included:

- USGS Information Architecture
- DOI Enterprise Architecture
- Federal Enterprise Architecture

The following sections describe the relationships between the NBII Enterprise Architecture and the applicable guidance documents.

### 1.2.1 USGS Information Architecture

The USGS issued an Information Infrastructure Plan in January of 1999. This plan identified USGS information infrastructure principles that are presented within the context of a technical reference model. The technical reference model consists of eight hierarchical components that focus on the inter-relationship between USGS entities. The following table summarizes the relationship of the NBII architecture to the applicable governing principals:

**Table 1-1. USGS Information Architecture Principles**

COMPONENT	PRINCIPLE SUMMARY	NBII RELATIONSHIP
Science	All IT decisions and planning must strategically support the USGS science mission.	The NBII provides information that supports the understanding of environment and natural resource issues on regional, national, and global scales. Additionally, the NBII enhances predictive/forecast modeling capabilities.
Information and Process Flow	Provide effective, efficient, and adaptable methods for finding, retrieving and integrating data and information with internal and external customers.	As a collaborative program, the NBII is focused on building a community of providers of biological information for the purpose of ensuring the availability of reliable, high-quality biological information to support a range of consumers and a variety of uses. The NBII provides the link between the producers or contributors of biological information and the consumers of that information.
Applications	Applications should provide direct support to business processes, support data integration, provide World Wide Web access, and use common administrative systems.	The NBII is helping people make better decisions about managing the Nation’s biological resources. The collaborative nature of the NBII helps avoid duplicative data collection efforts, allowing scarce resources to be utilized more effectively to fill important biological data gaps. Additionally, the NBII supports the Federal government’s mission to identify opportunities to consolidate IT investments and processes, providing an infrastructure for the sharing of biological information that can be leveraged by multiple organizations.



COMPONENT	PRINCIPLE SUMMARY	NBII RELATIONSHIP
Data and Representation	Support the processing of data into usable information via data integration and metadata standards.	The underlying foundation of the NBII is the established standards and taxonomy that support the consistent application of NBII business rules, enable effective and efficient exchange of information, facilitate the discovery of information, and significantly enhance information management. The NBII Program supports the ongoing development, distribution, and usage of standards and taxonomy.
Information Technology	The physical layer of the infrastructure should support the processing of data into usable information and knowledge.	One of the principal goals of the NBII network is to provide seamless access to vast amounts of biological information that exist in the nation. The NBII, through a distributed network of nodes and delivery of data tools, provides users access to regional, national, and international biological data and information through a systematic and coordinated approach to handling biological information. The NBII infrastructure supports a consolidated and integrated set of technologies and techniques that form the platform for delivering the required business functions to meet NBII's mission.
People and Culture	Training, recognition, and information support services are crucial to empowering USGS employees to make effective use of USGS data.	To ensure that ensure that data and information resources provided by the NBII are of the highest quality possible and to effective use of NBII resources, the NBII provides various training. Training provided to biological information contributors is designed to support the creation of metadata describing biological resources and collaboration between contributors via the NBII Portal. Additionally, the NBII Program is investing in establishing bioinformatics curricula at several universities to support future biological data and information management requirements. The NBII has also established working groups within the NBII Network to share applications, distribute "lessons learned" among participants, and provide expert support for basic questions.
Managing and Funding	Program management and planning should emphasize the funding of projects that meet bureau goals.	The scope of the NBII Program includes not just the sharing of national biological resources, but also the development of cooperative participation with Complementary Initiatives that are designed to increase the global visibility of biological information. Effective planning is required to ensure that NBII resources are efficiently managed and allocated across both NBII's national and international efforts. To support this goal, the NBII Program Office determines strategic direction, identifies and establishes programs and processes to enable planned and effective change, and allocates capital among the program and processes supported.



COMPONENT	PRINCIPLE SUMMARY	NBII RELATIONSHIP
Strategy	The information architecture should be based on agreed-upon standards and be adaptable to meet future requirements and accommodate future technologies.	The NBII Program has established a set of annual and long-term strategic goals, identifying and recommending appropriate approaches to meet these goals. Strategic planning efforts are reviewed on a regular basis and adjusted to meet changing technical, regulatory, and business drivers. Additionally, the NBII Program is responsible for the creation and documentation of the NBII Enterprise Architecture, including principles and goals, management environment, the balance between Program-level and Node-level services, and the elaboration of the business and design architectures. NBII's Enterprise Architecture will be included in the USGS and DOI Enterprise Architecture efforts.

The USGS has established an integrated bureau-level team that has begun development of the USGS enterprise architecture. The USGS enterprise architecture will build on and support the Department-wide architecture developed by the Department of Interior while also accommodating the unique, bureau-specific business requirements of the USGS. Following a similar strategy, the NBII's enterprise architecture was developed using the DOI architecture guidance documents. The NBII enterprise architecture will be adjusted as necessary to retain compliance with the USGS enterprise architecture standards and principles while maintaining the unique business requirements of the NBII.

### 1.2.2 DOI Enterprise Architecture

The Department of the Interior (DOI) has developed a high-level Enterprise Architecture. The Interior Enterprise Architecture (IEA) provides a framework for making strategic technology investment decisions in a cost effective, Interior-wide manner. The IEA is currently described in three DOI documents

1. Common Requirements Vision (CRV): business and technical requirements that will drive the development of architecture principles.
2. Conceptual Architectural Principles (CAP) : set of principles that guide the engineering of information systems and technology infrastructure
3. Technical Reference Model (TRM): set of domain-specific technical standards, protocols, and products that support the architecture principles.

#### 1.2.2.1 Common Requirements Vision

The Interior Enterprise Architecture includes a set of requirements, both business and technical, from which the architecture must be derived. The Common Requirements Vision (CRV) starts with an identification of the influencing environmental trends that impact the DOI's business and program strategies. Major internal and external forces (e.g., policies, regulatory changes) and important technology trends were synthesized into four categories of trends, 1) policy focus, 2)



general public “facing” focus, 3) interior organization focus, and 4) technology focus. The following table summarizes the results of an analysis of the DOI CRV Environmental Trends and identifies those environmental trends that are addressed by the objectives and architecture of the NBII.

**Table 1-2. DOI CRV Analysis – Environmental Trends**

CRV REF	SUBSECTION	DESCRIPTION	NBII RELEVANCE
ET-1	Policy Focus	Increasing legislative pressure and administrative requirements for inter-government systems interoperability and coordination with end goal of unobstructed information.	Increasing needs for various biological agencies and groups world-wide to share data (e.g., GBIF, NSDI, IABIN).
ET-3	Policy Focus	Increasing need for legislative clarity around the politics of public sector information - charging for service, information sharing, privacy, and equal access - because of impediments current laws bring to E-government. Data and information from the private and commercial sector has proprietary and privacy issues; legislation needs to be forthcoming that balances these issues with the public's right to information.	NBII does deal with Threaten and Endangered Species (T&E) data through some of its partner organizations. This data does require special data handling processes and systems due to its sensitivity.
ET-4	Policy Focus	Growing use of comprehensive packaged solutions by government organizations because resulting systems are integrated and facilitate business process improvements.	Use of Plumtree portal provides packaged solution with variety of "build-in" gadgets/web services. Services within portal package support business process workflow (e.g., collaboration, communities of practice, projects).
ET-5	General Public "facing" focus	Growing use of E-government services provided via a single point of entry that increasingly cuts across bureau boundaries.	Ultimate goal is to serve all NBII products through portal. Three proposed portlets (public, private, world data center) should be accessible via single switch board that authenticates user rights, authorizing access to appropriate portlets and web services.



CRV REF	SUBSECTION	DESCRIPTION	NBII RELEVANCE
ET-6	General Public "facing" focus	Increasing need to assure the public's trust in the services and activities of government organizations as automation use increases.	Trust can be achieved through NBII data quality processes and standards through such efforts as the NBII metadata Clearinghouse and NBII Content Management standard for web resources.
ET-8	General Public "facing" focus	Increasing demand by the public and commercial enterprises for access to Interior information.	Provides public and commercial enterprise access to nation's biological resources - data developed by federal organizations, educational institutions, non-profit organizations, and private sector organizations.
ET-9	Interior Organization focus	Decreasing number of skilled workers available for Interior positions without a corresponding decrease in the volume of work.	NBII information delivery mechanism provides USGS and other federal/non-federal organizations with an infrastructure that supports data sharing, freeing scientific resources to concentrate on the work of gathering and analyzing the data. Leveraging the architecture across multiple groups provides technical economies of scale, ultimately saving budget dollars.
ET-10	Interior Organization focus	Increasing need for quick and easy sharing of information with multiple organizations (i.e., Federal, state, local and tribal governments, private organizations & business) collaborating on common goals.	NBII portal services and various search mechanisms provide mechanism for sharing information and collaborating across Federal, state, local, and tribal governments, private organizations, and business.
ET-11	Interior Organization focus	Continuing advancements in wireless connectivity and voice recognition will enable government personnel to spend more time in the field using a "location-less office" with access to organization-wide information resources.	NBII promotes a flexible working environment for it's staff and has invested in remote access tools to support administrative functions, via the My NBII portal, and also remote/wireless field activities through the development of hand-held units for data collection by researchers, etc.
ET-12	Technology focus	Increasing need for faster, more complete access to information by Interior personnel to improve service delivery, worker productivity, and management of public resources.	See ET-9 above.



CRV REF	SUBSECTION	DESCRIPTION	NBII RELEVANCE
ET-13	Technology focus	Increasing demand for the capture, electronic storage, delivery, and archiving of Interior resources (including those that are currently paper-based).	NBII Portal provides the ability to "serve-up" information in a variety of formats (documents, graphics, geospatial, etc.). NBII has also developed various tools and technologies to support wireless data collection in the field, several data collection web-forms to aid in reporting of species information (i.e. Bird conservation), and participates in various related cross-government innovation efforts.
ET-14	Technology focus	Growing gap between the cycles of technology evolution and the planning, budgeting and procurement cycle within government (e.g., acquisitions are often obsolete before deployment).	Portal technology based on W3 and other emerging technology standards (e.g., XML, SOAP) places NBII on the cutting edge of technology. Infrastructure supported by "web services" technology mitigates risk of technical obsolescence.

Based on the major environmental trends identified, the DOI developed a list of business strategies to respond to each trend. These strategies are “cross-Interior” responses that will influence shared environments. The following table summarizes the results of the analysis of the DOI CRV Business Strategies and identifies those business strategies that addressed by the objectives and architecture of the NBII.

**Table 1-3. DOI CRV Analysis –Business Strategies**

CRV #	SUBSECTION	DESCRIPTION	NBII RELEVANCE
S-2	Policy Focus	Ensuring that the scientific programs focus on understanding, assessing, and monitoring resources and ecosystems to provide scientific understanding and technologies needed to support sound land and resource management decisions.	NBII information delivery mechanism provides USGS and other federal/non-federal organizations with an infrastructure that supports data sharing, freeing scientific resources to concentrate on the work of gathering and analyzing the data. Leveraging the architecture across multiple groups provides technical economies of scale, ultimately saving budget dollars.



CRV #	SUBSECTION	DESCRIPTION	NBII RELEVANCE
S-3	Policy Focus	Utilize technology to increase efficiency, expand collection of natural science data, establish, and maintain national Earth and biological science databases for use by Federal, state, and local land management and regulatory agencies.	Today, the NBII is helping people make better decisions about managing the Nation's biological resources, while avoiding duplicative data collection, so we can focus on filling important biological data gaps. This is accomplished through the development of tools, creation of infrastructure, and providing leadership to the biological sciences community.
S-4	General Public "facing" focus	Utilize and implement E-government.	E-gov "...is about using technology to its fullest to provide services and information that is centered on citizen groups." NBII provides services and information to a variety of groups.
S-5	General Public "facing" focus	Offer "one-stop shopping" for Interior information and services through an interagency Federal web site, (e.g., recreation services through "Recreation.Gov.").	NBII information is available via the Internet to all organizations. Specific Interior agencies are active partners within the NBII network to insure that there data and programmatic needs are met.
S-6	General Public "facing" focus	Engage in long-term monitoring and forecasting, short-term prediction, real-time monitoring and communication with civil authorities and others during a crisis (e.g., adding earthquake sensor reporting in real time, forest fire monitoring, etc.)	Specific data accessible via NBII assists groups in identifying, tracking, and forecasting biological trends to support early detection and remediation of issues of interest (e.g., invasive species).
S-8	General Public "facing" focus	Implement an Interior-wide customer feedback system.	NBII actively responds to all webmaster feedback through its central program office and its network of Nodes throughout the country. Policies are in place to address the timeliness of responses, type of responses received, and how this information can support the program goals and objectives.
S-9	Interior Organization focus	Incorporate enterprise architecture approaches that are flexible, allow systems growth, and logically fit Interior work needs (e.g., Financial System, Land Management System).	Portal technology based on W3 and other emerging technology standards (e.g., XML, SOAP) places NBII on the cutting edge of technology. Infrastructure supported by "web services" technology mitigates risk of technical obsolescence.



CRV #	SUBSECTION	DESCRIPTION	NBII RELEVANCE
S-10	Interior Organization focus	Utilize appropriate technologies to support management objectives.	See S-9 above. "The goal of the NBII is to provide swift user access to biological databases, information products, and analysis tools maintained by Federal, State, and local government agencies, non government institutions, and private sector organizations in the United States and around the world. Thus the NBII promotes the availability of biological information and its associated documentation on the internet."
S-11	Interior Organization focus	Explore and utilize delivery and collaboration methodologies to help satisfy training requirements (e.g. web, computer-based training (CBT), video conferencing, etc.)	The NBII includes training materials developed with flash technology, broadcasting training session via the Internet, to assist NBII users in the implementation and adoption of NBII tools and technologies. Significant resources are also applied in the development of system document, on-line training guides, and other quick guides for NBII tools and systems.
S-12	Interior Organization focus	Improve access to technical assistance (e.g., the new central web site that is a clearinghouse on policies, standards, training and technical assistance.)	The NBII portal has easy access to technical support with a resource designated to assess and respond to user requests. The NBII website supports such efforts as "Towards Best Practices (TBP) is a new electronic forum, built as a resource for the conservation community, and those involved in studying and managing the complex interactions between life forms - including human populations - and the environment. TBP is an electronic meeting place where users can submit and discuss high quality, science-based publications that define state-of-the-art methodologies, protocols, applications, and analytical tools related to studying and managing biocomplexity. These are just representative of the types of "communities of practice" that the NBII is supporting within the biodiversity and scientific community."



CRV #	SUBSECTION	DESCRIPTION	NBII RELEVANCE
S-15	Technology focus	Improve data management systems (e.g., policy and procedures relating to data standards, data privacy, data security, etc.)	Define the framework for standardization in the field of geographic information and sets forth the basic principles by which this standardization takes place (www.iso.org). Applicable standards include: <ul style="list-style-type: none"> <li>• ISO 191001:2002, Geographic information – Reference model</li> <li>• ISO 19105:2000, Geographic information – Conformance and testing</li> <li>• ISO/TR 19120:2001, Geographic information – Functional standards</li> <li>• ISO/TR 19121:2000, Geographic information – Imagery and gridded data</li> </ul>
S-16	Technology focus	Encourage innovation in our products and services by keeping abreast of and applying new technologies and work practices.	Portal technology based on W3 and other emerging technology standards (e.g., XML, SOAP) places NBII on the cutting edge of technology. Infrastructure supported by "web services" technology mitigates risk of technical obsolescence.
S-17	Technology focus	Utilize new collections management software to improve the efficiency of inventory data entry and management.	NBII and its network of Nodes are actively deploying and developing technologies related to improved data collection methods to support research efforts in the field and at remote locations. Handheld units have been deployed within DOD and NPS lands to support NBII partner information needs.
S-18	Technology focus	Develop reusable, consistent, and sharable components (e.g., standards, guidelines, procedures, etc.) for the Information (Interior-wide) Architecture Service Areas.	Development of generic portal gadgets as web services that can be leverage for other Interior organizations (e.g., Lotus Notes). The NBII Program is a leader among other federal agencies in providing, sharing, and leading cross-federal organization portal implementation, sharing of gadgets/web-services, and integrating cross-agency related information. Significant funding has been leverage by the DOD, NIH, and other agencies through the NBII leadership in this area across agencies.

The DOI architecture team next identified nine business change drivers that address a related set of environmental trends and business strategies. These business drivers represent the IT and business objectives and activities that must be accomplished. The following table summarizes the



results of the analysis of the DOI CRV Business Drivers and identifies those business drivers that are addressed by the objectives and architecture of the NBII.

**Table 1-4. DOI CRV Analysis – Business Drivers**

CRV #	DESCRIPTION	NBII RELEVANCE
BD-1	Leverage the Internet to support Interior's business, as appropriate.	"The NBII promotes the availability of biological information and its associated documentation on the internet. NBII also relies heavily on the Internet to aid in collaboration of remote offices, manage the NBII network of Nodes, and integrate partner organizations into the NBII network"
BD-2	Provide easy, reliable, and secure access to appropriate information and services for all interested parties. Assure that the information is complete, timely, and accurate.	The NBII is based on various standards developed by the International Standards Organization, "that define the framework for standardization in the field of geographic information and sets forth the basic principles by which this standardization takes place" and standards governing security of NBII and USGS information resources. USGS and NBII portal users are authenticated and authorized access depending on the user's profile.
BD-5	Provide for increased sharing of information and computer applications/ systems for efficiency and effectiveness.	Provides public and commercial enterprise access to nation's biological resources - data developed by federal organizations, educational institutions, non-profit organizations, and private sector organizations.  NBII information delivery mechanism provides USGS and other federal/non-federal organizations with an infrastructure that supports data sharing, freeing scientific resources to concentrate on the work of gathering and analyzing the data. Leveraging the architecture across multiple groups provides technical economies of scale, ultimately saving budget dollars.
BD-6	Provide for increased partnerships with the private sector, universities, tribes, non-profits, and other government organizations.	NBII portal services and various search mechanisms provide mechanism for sharing information and collaborating across Federal, state, local, and tribal governments, private organizations, and business. Additionally, the NBII supports the Increasing needs for various biological agencies and groups world-wide to share data (e.g., GBIF, NSDI, and IABIN).
BD-8	Improve critical business processes to make them faster, more reliable, flexible, and cost-effective while improving the quality of services that customers receive.	NBII, through the implementation of the My NBII Portal, has significantly improved internal NBII Business Process and NBII network processes. This include: NBII Proposal process, Node reporting, providing collaboration capabilities for NBII working groups, reducing travel through remote meetings, etc.



CRV #	DESCRIPTION	NBII RELEVANCE
BD-9	Provide policy makers and senior managers with quality and essential information for decision-making.	Specific data accessible via NBII assists groups in identifying, tracking, and forecasting biological trends to support early detection, decision-making, and remediation of issues of interest (e.g., invasive species).

Satisfaction of the business drivers requires that specific activities be performed to make information available to business decision-makers. These business information requirements identify what information is needed, by whom the information is needed, when the information is needed, and from where the information comes. The following table summarizes the results of the analysis of the DOI CRV Business Information Requirements and identifies those requirements that are addressed by the objectives and architecture of the NBII.

**Table 1-5. DOI CRV Analysis – Business Information Requirements**

CRV #	DESCRIPTION	NBII RELEVANCE
BIR-1	Provide anytime, anywhere access to all appropriate Interior systems, information, and services, as soon as practical.	As a service delivered via the internet, the portal supports 24-7 collaboration between resources at distributed geographic locations. USGS and NBII partner resources not at their home office can use the portal to collaborate with co-workers regardless of their location on or off-site.
BIR-3	Provide secure and electronic access to systems and information (both real time and summary) maintained by other Federal, State, or local partners.	Security plays a vital role in ensuring the integrity of the biological content provided by NBII and in managing the permissions and connections to ensure appropriate information sharing. Security ensures the proper use of NBII data, provides for 24x7 availability of NBII information, provides mechanisms for the assessment of security effectiveness, and includes backup/contingency plans for the network. Security for the NBII investment was designed to support the “The Three A’s”: authentication, access control, and auditing.
BIR-4	Design and build applications that use web technology (when appropriate) to make services more accessible and easier to use.	The NBII information is accessed via web technology. In addition to deploying technology that supports the deliver of information over the internet, the NBII has developed guidelines that enhance website accessibility to all users, including the disabled.



CRV #	DESCRIPTION	NBII RELEVANCE
BIR-8	Provide a single, secure login to authorize access to appropriate Interior information and services.	A potential future application of NBII portal security could include the synchronization of security between the Portal and applicable systems, supporting the integration of security policies and single sign-on. This capability has been piloted and can be fully implemented to support USGS and other agency users with whom the required technology prerequisites have been established.
BIR-9	Provide an easy and consistent user experience in accessing systems and information through multiple technologies.	Portal user's can customize my.NBII.gov to access various portal documents, tools, and data via a single interface.
BIR-10	Provide common information in consistent ways (e.g., language of requestors, 'plain' languages, comprehensible).	The NBII promotes use of ITIS as a standard taxonomy for the data it delivers. ITIS, Integrated Taxonomic Information System provides "taxonomic information on plants, animals, fungi, and microbes of North America and the world. We are a partnership of U.S., Canadian, and Mexican agencies (ITIS-North America); other organizations; and taxonomic specialists. ITIS is also a partner of Species 2000 and the Global Biodiversity Information Facility (GBIF)."
BIR-11	Provide program-monitoring information to staff to assess progress in carrying out legislative intent, meeting established performance goals and targets, and to properly measure program performance.	The NBII Program monitors the data sharing activities within the NBII network to determine the extent to which the network complies with applicable laws, regulations, and policies.
BIR-14	Provide electronic means as an option for training of existing staff.	Upon request, the NBII offers training in the use of tools designed to interact with data served through the network, and also respond to ad hoc requests for assistance from users. Users may request such assistance via the Web, telephone, or mail. Additionally, the NBII provides training to biological information contributors. This training is designed to support the creation of metadata describing biological resources and collaboration between contributors and consumers of NBII information.
BIR-15	Provide a means to make Interior business information available to support work when outside of the office.	The NBII allows biological information consumers and contributors to collaborate on projects to set schedules, assign tasks, share documents, participate in threaded discussions, and exchange ideas via the internet. The NBII Portal provides interactive workspaces where NBII consumers and contributors can drive initiatives, exchange information, and interact with other resources integrated into the portal.



CRV #	DESCRIPTION	NBII RELEVANCE
BIR-19	Provide for substantial increases in data quantity and demand for the data.	An important consideration in development of the NBII was the need to ensure that data and information resources are of the highest quality possible, are meet the needs and are permanently available to users, and are maintained for currency. NBII accomplishes these goals by dedicating staff resources to develop standards, review and approve content, develop tools to aid in the identification and management of relevant data and information, and implement state-of-the-art technologies to support the discovery and retrieval of biological information.
BIR-21	Provide means of sharing information across organizational boundaries both internal (e.g., within and across bureaus) and external (e.g., suppliers, providers).	The NBII is a boundary transparent framework that supports information discovery, knowledge creation, and sharing of the Nation's biological and ecological resources across multiple public, private, and international organizations.
BIR-22	Provide for increased use of structured workflow (e.g., routing and approval).	The portal software selected for the NBII includes a Content Server "workflow engine allows organizations to institute multi-stage business processes for posting new support articles to a knowledge-base, or publishing announcements to a portal page."
BIR-23	Ensure that information is made available while securing Interior assets and personal privacy (e.g., constituent confidentiality).	Security of the NBII infrastructure is based on standards developed by ISO. The NBII Program Office has developed processes to support the control and oversight of its operations to ensure that information is secure and that the provision of that information complies with applicable laws, regulations, and policies (e.g., Privacy Act).
BIR-24	Provide anytime, anywhere access to all appropriate Interior systems, information, and services, as soon as practical.	NBII supports several partner and biological community user infrastructure needs through data hosting services, mirroring applications, and serving data for those that do not have the capability or resources.

The final step in the DOI Common Requirements Vision process was to translate the business information requirements into requirements for technical architecture. These requirements are descriptive in nature, not prescriptive; they identify what is required of the technical architecture in order to support the business information requirements. The following table summarizes the results of the analysis of the DOI CRV Requirements for Technical Architecture and identifies those requirements that are addressed by the objectives and architecture of the NBII.



**Table 1-6. DOI CRV Analysis – Requirements for Technical Architecture**

CRV #	DESCRIPTION	NBII RELEVANCE
RTA-1	The IIA will support a shared data, information, and records infrastructure environment that provides flexible access to a consolidated data source. Data will be defined by standard definitions stored in a common repository and will be maintained by clearly identified data stewards.	Via the NBII Clearinghouse, users can search descriptive information (metadata) about various biological databases on a network of computers. A key to implementing the Clearinghouse has been the development of an accepted set of metadata standards by NBII and its partners.
RTA-2	The IIA will provide the ability to collect, model and analyze Interior's internal and external information (e.g., financial, constituent, demographic) across Interior for decision-making and accountability.	NBII promotes sharing and analysis of the nation's biological resources. Additionally, the Clearinghouse provides access to software tools to use in analyzing, integrating, and applying biological data.
RTA-3	The IIA will enable access by interested parties, from multiple locations, via multiple methods and media, to appropriate information.	The NBII Portal provides the user experience and administrative framework for a comprehensive online working environment for sharing information and interacting with systems across NBII participants and partners. The portal consists of an extensible architecture for integrating content and services.
RTA-4	The IIA will enable an increase in the types and quantity of internal business metrics collected, monitored, and analyzed for use by management.	The NBII Program Office develops and implements metrics and engages in continual performance measurement.
RTA-5	The IIA will provide common application and data interoperability mechanisms to facilitate process interoperability and information exchange. Support will exist to exchange management and operational information within Interior and with outside entities.	The NBII Portal supports web services, "software components that other software programs can access via HyperText Transfer Protocol (HTTP), the protocol used to connect all computers on the Internet. Relying on HTTP, Web services created in different environments and operating on different platforms and networks can still work together. As a result, developers can use almost any programming language to create Web services, or applications that consume Web services." This level of interoperability between software components provides NBII with the flexibility to create solutions based not just on different components, but on components hosted on different platforms and networks.
RTA-6	The IIA will enable the ability to provide around-the-clock business operations and an Interior-wide systems management capability (e.g., event alert monitoring, performance analysis, capacity planning, etc.)	Critical to the success of the NBII Enterprise Framework is the technical foundation that supports and enables the various services provided by the NBII. The NBII Program provides technology support and management of the "core" NBII databases and systems. This effort, managed by the USGS Center for Biological Informatics in Denver, Colorado, provides interoperability, availability, and consistency of resources throughout the network.



CRV #	DESCRIPTION	NBII RELEVANCE
RTA-7	The IIA will enable the ability to support, capture, store, and display interested parties interactions and how they prefer to interact with Interior and its partners.	Currently, portal authentication is being used to deliver customized information to NBII biological information consumers and contributors via the NBII Portal and to authenticate and allow access to portal collaborations and communities. NBII users can create and maintain a unique profile within the NBII Portal that controls their unique portal settings and personalize the portal interface according to their own interests, determining what and how data is displayed. Additionally, portal users can create personalized portal pages where they can assemble the information, services, and tools relevant to their work.
RTA-8	The IIA will provide employees with cost effective connectivity to the public Internet (e.g., news services, research, and customer collaboration), intranets (e.g., human resource, organizational news, and training), and other specialized information providers (e.g., extranets.)	NBII's collaborations, as well as its partnerships with agencies at all levels of government, non-governmental and inter-governmental organizations, academia, and private sector enterprises, ensure that its efforts are complementary and that the nation's biological information resources are leveraged to provide a greater return on investment.  The portal provides a mechanism by which technology investments in analytical tools and data sources can be leveraged across a greater user community, increasing the return on investment and freeing economic resources for other activities.
RTA-9	The IIA will provide a means to deliver interactive training (e.g., video teleconferencing, computer-based training, etc.) where the teachers and students are not co-located.	The NBII provides online help supporting both the NBII Portal and the NBII Clearinghouse search capabilities. This online help is context sensitive therefore Clicking on the 'Help' link provides help information specific to the webpage that a user is currently viewing. Another source of technical help is the "My NBII Portal" tutorial that provides the user with basic information regarding the set up and use of the NBII Portal. In addition to the technical tutorial, via the NBII Portal, users are provided access to a range of online and interactive tutorials regarding various biological topics.
RTA-10	The IIA will provide support for major increases in productive (collaborative) teamwork including emails, file transfers, video/audio links, secure teleconferencing, work flow processes etc.	The NBII allows biological information consumers and contributors to collaborate on projects to set schedules, assign tasks, share documents, participate in threaded discussions, and exchange ideas. The NBII Portal provides interactive workspaces where NBII consumers and contributors can drive initiatives, exchange information, and interact with other resources integrated into the portal.



CRV #	DESCRIPTION	NBII RELEVANCE
RTA-11	The IIA will provide secure access to all computing and information resources for employees (including mobile).	The NBII Portal offers advanced security, designed to let customers build many applications within a single portal instance, and to expose a wide range of resources operating on local networks to the Internet, safely and securely."
RTA-12	The IIA will provide unified directory services that integrate the existing identification, routing, connectivity, and access control functions of our computing environments (e.g., security, Domain Naming Services, e-mail, authentication, authorization).	Currently, portal authentication is being used to deliver customized information to NBII biological information consumers and contributors via the NBII Portal and to authenticate and allow access to portal collaborations and communities. A potential future application of portal security could include the synchronization of security between the Portal and applicable systems, supporting the integration of security policies and single sign-on.
RTA-13	The IIA will provide Interior-wide systems that support the creation, tracking, capture in a record keeping system, storage, publication, retrieval and disposition of documents, images and other information rich objects that are used within bureau processes or are exchanged with external organizations and constituents.	Information management improves the quality of the services provided by the NBII Program by ensuring that information is available to biological information consumers. Information management involves the coordination of information collection processes, information storage, information dissemination, and management of the policies, guidelines, and standards regarding information management. It includes services in compiling, aggregating, and storing biological data and information. Specific to the NBII program are critical processes, mechanisms, and standards that support information management. These include standards and taxonomy, content delivery, search services and intelligent agents, and collaboration and communities.
RTA-14	The IIA will provide comprehensive information technology security and privacy mechanisms as well as access rights management to ensure compliance with contractual, regulatory, and other legal information requirements.	Security of the NBII infrastructure is based on standards developed by ISO. The NBII Program Office has developed processes to support the control and oversight of its operations to ensure that information is secure and that the provision of that information complies with applicable laws, regulations, and policies (e.g., Privacy Act).

### 1.2.2.2 Conceptual Architectural Principles

The Conceptual Architecture Principles (CAP) is based on the business requirements of the Common Requirements Vision. The CAP describes a set of principles that serve as a guide for aligning technology with business requirements. The Business issues of importance to the leadership of Interior are reflected in these principles. The NBII used the Technical Architecture Requirements of the DOI's Common Requirements Vision and the CAP to help guide the design of the technical domains (e.g., Networks, Data) of the NBII as expressed in NBII Design Architecture. The following table summarizes the results of the analysis of the DOI CAP and identifies those principles that are addressed by the objectives and architecture of the NBII.



**Table 1-7. DOI CAP Analysis**

NUMBER	CATEGORY	SUBJECT	PRINCIPLE	NBII
1	Business	Information is an Interior asset	Information is valued as an Interior asset to accelerate sound decision-making, improve management, and increase accountability.	NBII leverages the nation's biological information, providing a mechanism by which information can be shared with the public and its partners. NBII has developed policies and metadata standards to support the sharing of information and participates on various partner workgroups to refine standards definitions. Metadata is currently used in two formats: 1) data that describes the content of information available within a specific data set, and 2) data that describes a biological information resource
2	Business	Data and information stewardship	Data and information must be managed and maintained as a stewardship responsibility to support the mission of the department.	The NBII is structured to provide data stewardship at various levels. NBII participants are responsible for the integrity of data collection and submission of metadata. The NBII program provides data quality assurance, metadata standards development and implementation (leveraged from FGDC standards), and data management for its network of nodes. Additionally, it is the national node for several international biological information projects, including GBIF and IABIN.
3	Business	Integration and interoperability	Systems must be designed, acquired, developed, or enhanced such that data and processes can be effectively shared across Interior and with our partners.	The NBII Infrastructure Node focuses on developing information technologies (e.g., tool suites, hardware and software protocols, standards, and geospatial technologies) that facilitate interoperability and transparent access to and exchange of biological information across NBII and its Nodes.



NUMBER	CATEGORY	SUBJECT	PRINCIPLE	NBII
4	Business	Reuse vs. buy, buy vs. build	In considering system requirements (e.g., new functionality), we should look to reuse existing components before we buy. If no components exist, purchased solutions (e.g., COTS or GOTS) should be explored before we build.	The NBII shares information over the internet using HTTP over TCP/IP transport mechanisms, provides data encoding via XML, and leverages common industry protocols (e.g., SOAP). Additionally, the NBII portal provides the ability to deliver applications, solutions, and data that can be accessed and utilized by users on various platforms. This structure provides for a high level of reuse of "web services" based components.
5	Business	Ensure security, confidentiality and privacy	IT systems should be implemented in adherence with security, confidentiality, and privacy policies to assure proper safeguards and limitations for information availability and access.	Users of the NBII public network outside the company can access only the DMZ host. The DMZ may typically also have the company's Web pages so these could be served to the outside world. However, the DMZ provides access to no other company data. In the event that an outside user penetrated the DMZ host's security, the Web pages might be corrupted but no other company information would be exposed. NBII participants and partners can elect whether and what data is shared through NBII.
6	Business	Continuity of operations planning	An assessment of business continuation and recovery requirements is mandatory when acquiring, developing, enhancing or outsourcing systems. Based on that assessment, appropriate disaster recovery and business continuity planning, design, testing and maintenance will take place.	Disaster recovery and business continuity planning is the responsibility of the NBII Program Office and Infrastructure Node. The NBII Security plan documents procedures to follow in the event of a failure of all or part of the NBII's primary web/data serving facility. There are numerous options in dealing with system failures, depending upon the nature and severity of the failure. The NBII Security Officer is responsible for maintaining this plan with approval required from the NBII Research and Technology Director before being adopted or implemented.



NUMBER	CATEGORY	SUBJECT	PRINCIPLE	NBII
8	Technology	Enterprise Network as "Virtual" LAN	We must implement an Interior-wide "interoperable network" performing as if it were a virtual, Interior-wide Local Area Network.	The NBII portal was developed using portal software based on industry standards and open architecture. The web services approach of the selected portal software supports the future integration of and with other DOI applications across a variety of platforms.
9	Technology	Information Access	Easy and timely access to data and information is the rule rather than the exception, without security and privacy being compromised.	The NBII infrastructure supports the distributed sharing of nation's biological information resources in a timely manner. NBII nodes are required to comply with Section 508.
12	Technology	Mainstream Technologies	IT solutions will use industry-proven and "state-of-the-art" mainstream technologies.	The NBII portal was built using the most mature, widely deployed corporate portal software in the industry. Customer awards and industry recognition includes: Halliburton: Best e-Business Portal - April 2003; Ford Motor Company: Best Intranet, Premiere Project of the Year - December 2002, Halliburton: The InfoWorld 100 - November 2002, Fannie Mae Foundation: Best Portal Web Site - October 2002; Ketchum: E-Business Top 56 - August 30, 2002; NBII: Intergovernmental Solutions Awards - June 3, 2002; Maryland.gov: E-Gov 2002 Awards "Best of the Best" - May 8, 2002; Ford Motor Company: Best-in-Class Internal Corporate Portal Award - February 11, 2002; Ford Motor Company, Ketchum: Web Business 50 Award - December 1, 2001; Ketchum: Information Management 2001 Awards - November 29, 2001; First Energy: 2001 CAKI Award: Best IT Implementation - November 3, 2001; AmeriKing: Technology Innovation Award - October 23, 2001; Ministry of Agriculture, Food and Fisheries: Public Sector Technology Award for Electronic Service Delivery - September 26, 2001; California Casualty: Top 20 Web Sites - March 28, 2001



NUMBER	CATEGORY	SUBJECT	PRINCIPLE	NBII
13	Technology	Industry Standards	Priority will be given to products adhering to industry standards and open architecture.	The portal software selected to support NBII relies on Web services, which allow components on different platforms, built according to different standards, to communicate with one another. 1) Web Services Architecture: components can be hosted on different platforms and networks, connected via HTTP and SOAP, 2) Open Interfaces: supports both Java Server Pages and Active Server Pages user interfaces and Java or COM programming interfaces, 3) Open Application Integration: actively supports integration development in all the major environments, including JSP, ASP, C#, Perl and ColdFusion, 4) Open Security Model: can import users, groups and privileges from any LDAP-compliant user directory, and integrates with all the leading policy management and single sign-on vendors, 5) Portlet Standard Support: supports other vendors' portal components, such as SAP MiniApps and Microsoft Web Parts, vendor is participating in the WSRP and JSR-168 standards efforts, and 6) Cross-Platform Support: can run in either 100% UNIX or Windows operating environments.
14	Technology	Architecture Management	The planning and management of the Interior Information Architecture will follow a unified "federated" model. It will include sufficient support and review structures to ensure that the integrity of the architecture is maintained as systems are acquired, developed, and enhanced.	The NBII developed its Enterprise Architecture following the guidance provided by the Federal Enterprise Architecture Program Management Office. This guidance included the Business Reference Model, Service Component Reference Model, and Technical Reference Model. Additionally, the NBII referenced the Information Architecture Guidance document developed by the USGS and the Department of Interior (DOI) Enterprise Architecture documents including the Common Requirements Vision, the Conceptual Architecture Principles, and the Technical Reference Model. The NBII will refine its enterprise architecture as necessary to support the achievement of a DOI unified "federated" model while maintaining the unique functions that support the achievement of NBII's mission.

### **1.2.3 Federal Enterprise Architecture**

As part of the Federal Government’s development of a business-based architectural framework, the Federal Enterprise Architecture (FEA) Program Management Office (PMO) developed a set of reference models to guide the alignment of federal IT resources. The reference models used by the NBII to guide the development of its enterprise architecture and the documentation of the baseline Business and Design Architectures include:

- Business Reference Model (BRM) v2.0
- Service Component Reference Model (SRM) v1.0
- Technical Reference Model (TRM) v1.0

#### **1.2.3.1 Business Reference Model**

The purpose of the FEA BRM is to define and communicate how the Federal government achieves its various missions, separating government operations into four distinct business areas. The Services for Citizens business area “describes the mission and purpose of the United States Government in terms of the services it provides both to and on the behalf of the American citizen. The NBII Business Architecture identifies the lines of business and sub-functions, as described in the FEA BRM, which are supported by the NBII.

#### **1.2.3.2 Service Component Reference Model**

The purpose of the FEA SRM is to support the discovery of government-wide business and application service components that may be leveraged across Federal agencies supporting reuse of the investment of IT investments. The service components are classified by based on support provided for a business function and/or performance objectives. The NBII Conceptual Architecture is a logical depiction of the allocation of NBII service layer functions between core and enabling technology components. The NBII Conceptual Architecture, describe in the Design Architecture document, is organized by service reference component, as described in the FEA SRM.

#### **1.2.3.3 Technical Reference Model**

The FEA TRM provides a foundation to describe the standards, specifications, and technologies supporting the secure delivery, exchange, and construction of business components. The NBII Technical Reference Model, described in the Design Architecture document, identifies the standards and technologies that support the delivery of NBII’s services across a technical framework. The reference model depicts the baseline or “as is” design architecture of the NBII and illustrates the technology components, as described by the FEA TRM, which support the NBII technical framework.



### 1.3 Summary

The DOI's Common Requirements Vision begins with the description of the DOI information architecture from a business context. This description of the business context provided the framework that helped guide NBII's business architecture development. Through a series of elaborations, this business context is translated into the technical context through the Technical Architecture Requirements. These requirements, along with the DOI's Conceptual Architecture Principles, provides the guidance used by the NBII to support the development of standards and policies that govern the NBII design architecture.

The NBII used the reference models developed by the FEA as a framework by which the NBII business and design architectures were articulated and described. The NBII Business Architecture provides a business overview of the NBII Program. It defines the business needs being met by the NBII today and includes a discussion of the environment in which the NBII Program operates. Specifically, the NBII Business Architecture illustrates the concept of operations (the business objective), describes the context in which that objective must be met (what is provided, how is it provided, to whom is it provided, and from what business locations), and illustrates the concept and context within a high-level business model. The NBII Design Architecture documents the consolidated and integrated set of technologies and techniques that form the platform for delivering the required business functions to meet NBII's mission. The NBII Design Architecture is a snapshot in time as it documents the baseline or "as is" combination of technologies, tools, techniques, and strategies that existed at a single point in time.

The NBII Enterprise Architecture will serve as the foundation that guides the initiatives, both tactical and strategic, that are planned, under development, or currently deployed to implement an array of technologies that support NBII's missions, goals, and objectives.