

Business Line Architecture & Integration



Concept Level WHITE PAPER

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NASCIO, and Public Cross Government Initiatives

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ABSTRACT

The Federal Enterprise Architecture (FEA) has defined a set of ‘Lines of Business’ within a top level Business Reference Model. There are 35 defined functional areas that can be used to categorize business communities and business channels of service integration, information distribution and data exchanges paths between and across Federal, State, and local government along with business partners. Business Line Architecture and Integration approach that is used to plan, design, and implement the ‘Lines of Business’, with associated processes, across agencies and stakeholders alike.

By developing a Business Line architecture and its related components, we facilitate integration and operations that can transform the electronic delivery of services and enable information sharing between Federal, State, and local agencies. This sharing of core information is required for Homeland Security, statistics and financial information flow, and communications between the governments agencies and stakeholders. This paper presents an overview of a Business Line oriented Solution approach with both an overall process and top-level reference model. The process defined uses a community based funding strategy and multiple levels of involvement, from the executive team to business line leaders and technical leaders. The approach integrates concepts and approaches from many disciplines such as enterprise architecture, business process management, supply-chain management, cooperative information systems, federated resource and data management, component-based development, declarative and template development, and model-based architecture and integration. The paper proposes a model-driven architecture made up of a combination of commercial products and “open standards” elements based on both open source communities and University Research Government funded initiatives that are integrated into the Business Line Development Environment, Business Line Hub and the Business Partner Gateways.

PRIMARY AUDIENCE

OMB, President's Management Council and the Business Line Owners around the first six areas for integration and consolidation along business lines and those groups and agencies interested in a process for Business Line Management, Architecture and Integration. The document has a strong focus on finding "advocates" and leaders that will take action to break the functional stovepipes and build business communities to solve critical real world government issues with the use of Business Driven Enterprise Architecture and the mature and emerging technologies that can allow a new more cost effective approach.

CREDITS

The CIO Council's Federal Enterprise Architecture Framework (1999), "A Practical Guide to Federal Enterprise Architecture (Feb 2001), Zachman's Framework for an Enterprise Architecture, NASCIO Toolkit, and OMB's Federal Enterprise Architecture Business Reference Model (2002) and other emerging reference models, all provide the foundation and framework for this document. This document also reviewed the II Investment Analysis section of the 2004 budget under a section "Expanding the Transformation by Modernizing Across Agencies". An initial set of business lines that should be focused on during 2004 were identified including: Financial Management, Data and Statistics, Human Resources, Monetary Benefits, Criminal Investigations, Public Health Monitoring to be pilots for an annual cycle that will identify, analyze, and deploy opportunities for integration and deployment. An IAC subgroup has been discussing this issue for a number of months prior to the release this with both Federal and State government officials. We have had extensive involvement with NASCIO with the Partnership for Intergovernmental Innovation(Pi2) and some of the key contributors to initial e-government initiatives.

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Enterprise Architecture Development – the Challenge Just Got Bigger

Congress and the Office of Management and Budget (OMB) have mandated an Enterprise Architecture (EA) as the basis for information systems investments. The GAO report entitled “Information Technology: Enterprise Architecture Use across the Federal Government Can Be Improved” [Reference 1] describes an EA as “...systematically derived and captured descriptions—in useful models, diagrams, and narrative—of the mode of operation for a given enterprise...The architecture describes the enterprise’s operations in both (1) logical terms, such as interrelated business processes and business rules, information needs and flows, and work locations and users, and (2) technical terms, such as hardware, software, data, communications, and security attributes and performance standards. It provides these perspectives both for the enterprise’s current or “as is” environment and for its target or “to be” environment, as well as a transition plan for moving from the “as is” to the “to be” environment.”

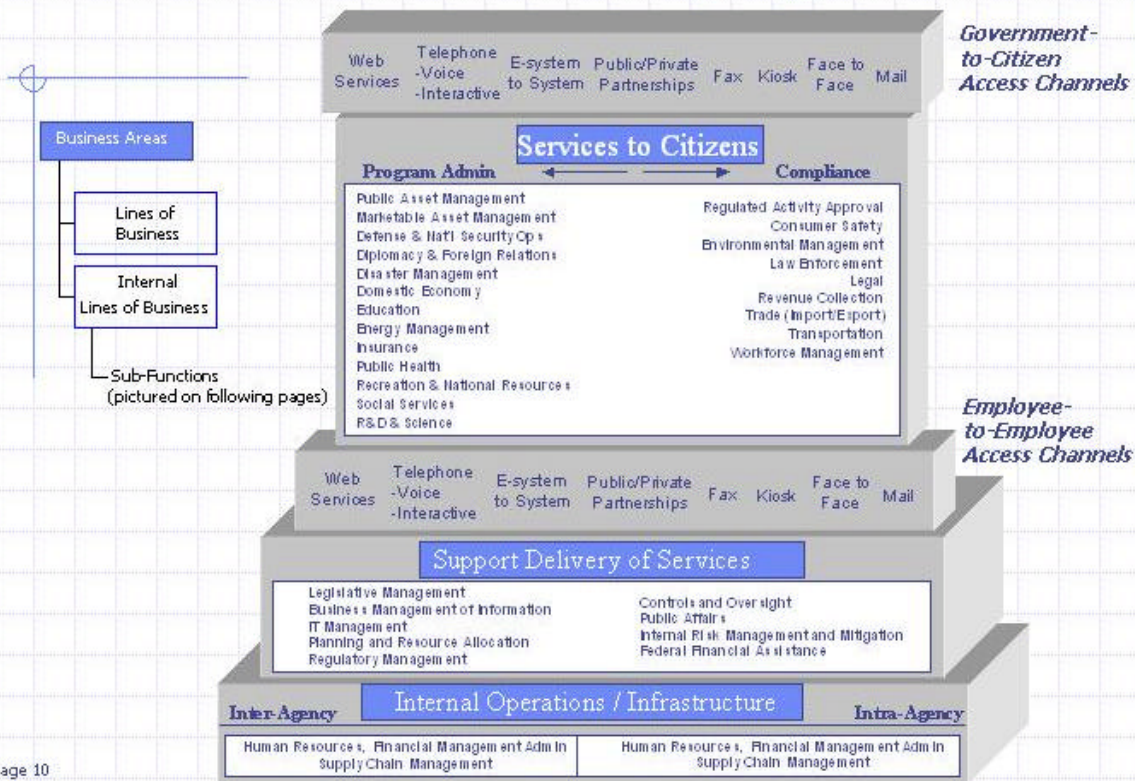
Development and effective implementation of an EA is a major challenge confronting all Federal and other Government departments and agencies today. According to the GAO report, only 5 of the 116 agencies surveyed have successfully developed and/or are using their EAs.

Recent work by the Federal Enterprise Architecture Program Management Office (FEAPMO) is intended to provide direction and focus in achieving the greater communication and collaboration needs between federal, state and local governments, as they respond in the post September 11 era. The FEAPMO is developing the Federal Enterprise Architecture (FEA), a business-based framework for Government-wide improvement. The FEA is being constructed through a collection of interrelated “reference models” designed to facilitate cross-agency analysis and identification of duplicative investments, gaps, and opportunities for collaboration within and across Federal Agencies. Agencies will be required to align their own EAs with the FEA reference models, and will have to manage their EA development across the Federal Government to leverage common ‘Line of Business’ functions developed by other agencies/departments, as well as to facilitate the management of access channels between federal, state and local governments. *The bar just got raised!*

The Federal Enterprise Architecture

At the highest level, the Federal Enterprise Architecture Program Management Office has developed the master set of business functions and 135 sub-functions for the Federal Government, called the Business Reference Model (BRM), illustrated in Figure 1. Its purpose is to describe, at the highest level, the entire Federal Government’s ‘Lines of Business’ and its services to the citizens, across the full range of functions performed. A ‘Line of Business’ (hereafter called business line) is defined as a set of services and products the Federal Government provides to its citizens, e.g., Public Health Monitoring or Criminal Investigations. The Service and Component Reference Models also include 53 common service functions and basic approach to Components that are extended to the coordination, communication, and quality functions needed for business lines along with a meta component model that links with the service descriptions.

The FEA Business Reference Model (BRM), Version 1.0



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Figure 1 – The FEA Business Reference Model (BRM)

The BRM provides a taxonomy, or logical grouping, of functionality without regard to the performing agency or agencies. The BRM serves as the foundation for additional reference models that will be published in 2003. These models are described below.

- The **Performance Reference Model** will identify a common set of general performance outcomes and metrics that Agencies use to achieve much broader program goals and objectives.
- The **Data and Information Reference Model** will describe, at an aggregate level, data and information that support program and business line operations. The model will aid in describing the types of interactions and information exchanges that occur between the Federal Government and its various customers, constituencies, and business partners.
- The **Service Component Reference Model** is a business-driven functional framework that classifies capabilities (or service components) with respect to how they support the business and performance objectives.
- The **Technical Reference Model** provides a hierarchical foundation to describe how technology supports the delivery of the application capability.

The business line architecture, development and integration process and Business Line Service and Component Framework described below extends the concepts to cross-agency and cross-government boundaries and supports the collaborative definition of the business lines.

The Promise of a Business Line oriented Architecture

What is a Business Line Architecture (BLA)? A BLA is a cooperative business and information process and system that operates across organizational boundaries and implements one or more 'Lines of Business'. Each participating organization is one of the business partners and collectively they make up a business community operating within a defined governance model. Our approach is to define a federated architecture that integrates an autonomous set of systems into a set of "systems of systems" that are linked along business communication channels. The architecture will be made up of commercial based, and open source elements, with some of those coming from government sponsored research projects.

In the government there are many functions that are split, in some cases even duplicated, but need to be accomplished in a cooperative and collaborative manner to achieve an economy of scale and efficiency. By using business lines and forming cross government business communities, agencies will focus on natural "common goals and interests", providing an environment for integration and consolidation around the needs of the citizens and stakeholders served. While the members of the business community may have different roles and functions they will form a "domain" where shared services and components, reuse, and process transformation flourish.

To understand the impact of such an approach one only needs to look at the Justice Programs: Over the last few years the law enforcement community under the guidance of the Justice Programs [12-16] has been using many of these concepts to improve law enforcement with a strong focus on defining a common information model around cases and defining the data elements in a shared XML Schema. They also have provided guidance for Public Officials and a strong case for interoperability. They have made extensive use of the many existing associations and relationships to get started using a phased approach. Using the process and ideas from this paper the criminal investigation business line may be represented as shown in Figure 2. The business line architecture process could result in a collaborative environment for investigating cases that cross borders where a special task force was set up to gather information and follow up leads. A Hub could be defined that provides the services and information directories along with the security models and basic set of tools that will allow the partners to tailor their involvement in this case, or set up common information models, collaborative zones or publish-subscribe alerts. We will discuss in more detail the actions that are taken during each stage of process and more information about the architecture framework. Many capabilities are similar the e-government cooperative information used by Italy[20-24].

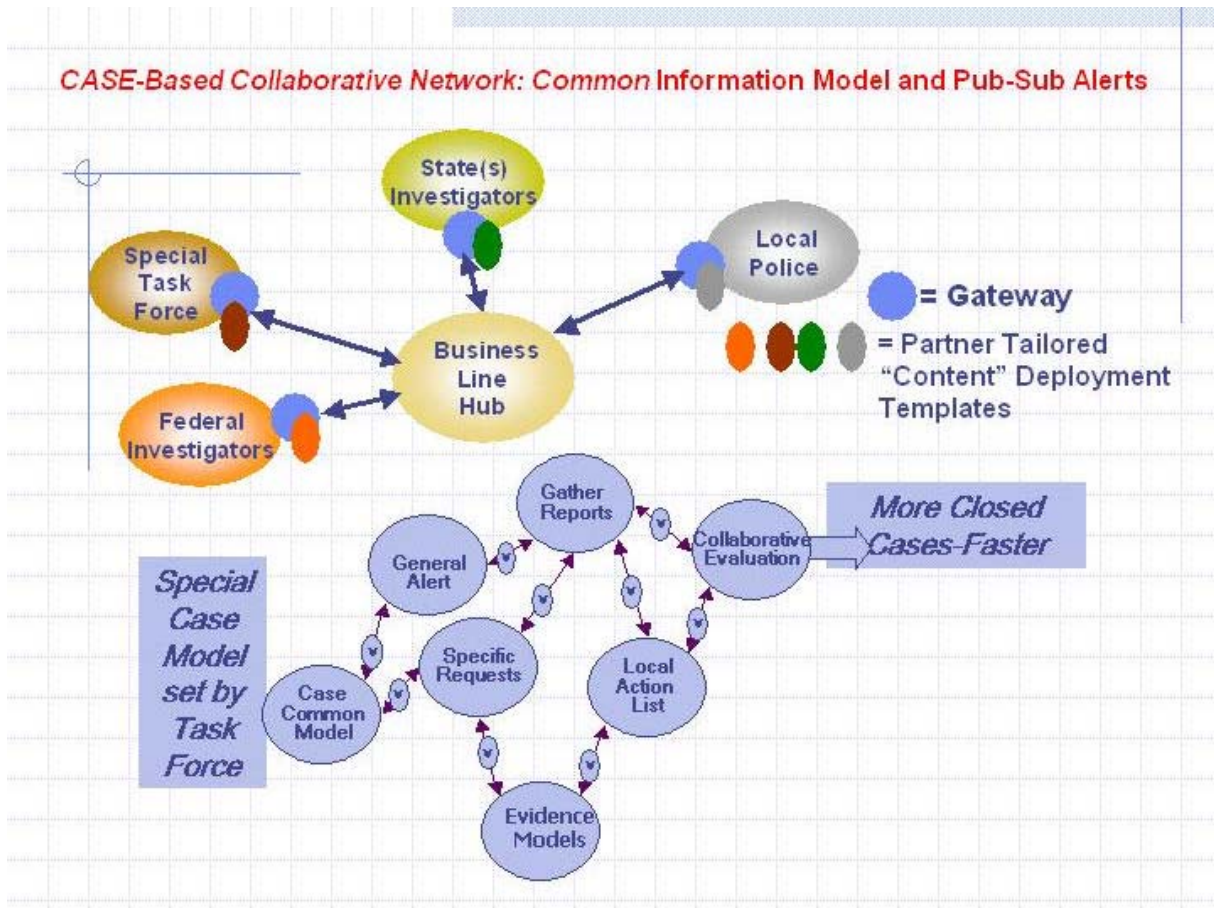


Figure 2: Business Line Vision for Criminal Justice

The drivers for synergy across common needs and business lines are gaining momentum. One of the key signs was the February 2003 release of the 2004 Federal Budget, where initial concepts of working across business lines were defined in the Budget under a section titled, “Expanding the Transformation by Modernizing Across Agencies”. An initial set of business lines that should be focused on during 2004 were identified including: Financial Management, Data and Statistics, Human Resources, Monetary Benefits, Criminal Investigations and Public Health Monitoring to be pilots for an annual cycle that will identify, analyze, and deploy opportunities for integration and deployment.

Benefits of a Business line Architecture

What are the benefits of a Business Line Architecture and a Business Community that provides trusted information sharing and collaboration? Each business line will need to develop and wrestle with its own benefits and create its own value model, but there are some generic benefit types that can be gained. Most importantly the business lines can close the communication and information gap on issues that are no longer local but are national or global such as terrorism, disaster management, criminal investigation, health data monitoring, along with other data and statistics gathering and sharing. The benefits are grouped into these categories:

- Provide reliable information sharing on critical public concerns such as Homeland Security, disaster management, criminal investigation, or health care management.
- Allow service integration for electronic service delivery that crosses-agencies and delivers against, and focuses on, the needs of citizens and those served while hiding the organizational structure. For instance, a trucker may be able to go to one place to fill out all the licensing applications at the federal, state, and local agency will providing basic information only once.
- Provide the opportunity to simplify the delivery of information and services with a set of common interaction and interchange approaches based on open-standards. Efforts have begun to share information between the different levels of government but building custom interfaces is very expensive, error prone.

Other anticipated benefits include the following:

- An IT portfolio that is aligned with business needs of the organization and the business community it represents
- Ease of interoperability along a Business Line
- A clear business case for each IT investment along the business line and a “win-win” situation for all
- Increased automation with a cross-organization collaborative business process
- Response to new information sharing and legislation that impacts federal, state and local organization

There are many benefits and each business line will have to discover and capture those in their business case but the first step is to create the will and foster intergovernmental communication.

Business Line Architecture Integration Process

The overall process of establishing, implementing and evolving a BLA is depicted in Figure 3. The process is based on a business process model driven approach with components that can be tailored based on templates which allow the community members to control the degree to which they collaborate and to facilitate adaptation to changing needs. It develops the BLA as a set of Platform Independent business-level architecture models. The Integration phase generates the platform-specific models that specify how their organization will integrate and share information, processes, and create common information models to meet the shared goals of the business line community. Finally, the Deployment and Adaptation phase makes the integration capabilities available to the community, and updates the capabilities in a series of process and content releases.

Artifacts from each of the four phases are populated into the Business Line Architecture Repository. The repository will have four specific areas: Management and Business Line Community Policy Level, Platform Independent Models, Platform Specific Models, and Change Management and Statistics. The initial approach to developing the Business Line Architecture Repository will be to use a set of very simple templates for the Management and

Business Line Community Policy portions and for the Change Management and Statistics sections. In addition to the templates as much use as possible will be made of tools and models from the Model Driven Architecture UML 2.0/MOF 2.0/XMI technologies for the Platform Independent and Platform Specific Modeling tools. Another key element of the repository is the ability to transfer models and interface specifications to the operational systems that bridge the gaps between the autonomous enterprise systems. These bridging systems reside in one or more Business line Integration Hub(s) and the business partner gateways that can address cross organization business process integration, communication integration, and provide the support for a common set of coordination and collaboration services that simplify business line operations. Figure 1 for the Criminal investigation shows that each of the types of organization can tailor both the view of common model and the types of alerts they receive and frequency using a publish and subscribe alert approach. Separating out architecture and policy concerns and letting them be controlled by each business community representative is a critical element of the approach. Another element is the use of components that can be tailored with declarative templates or high level scripts that will avoid traditional “procedural programming” as much as possible.

The primary components of our business line framework consist of the business line development environment (which includes the business line architecture repository), business line hubs, and business partner gateways. The hubs and associated gateways will connect to the autonomous systems hosted by the business partners. The business line hub will include the metadata, models, directories, and the authentication and other trust management practices. It may also include portal capabilities, data translation, information exchange, local hub data storage for common information systems elements, and ability to include capabilities such as event notification based on publish and subscribe alert and notification services. The business partner gateway is a bridge between the partners systems including content-based filtering and controls that will allow the business partner to start, stop, monitor, and control the type and level of collaboration within the business communities that they participate in. Members of the business communities are responsible for declaring their intentions and for operating their gateway and monitoring their compliance with agreements based on gateway capabilities that they specify in the Integration phase.

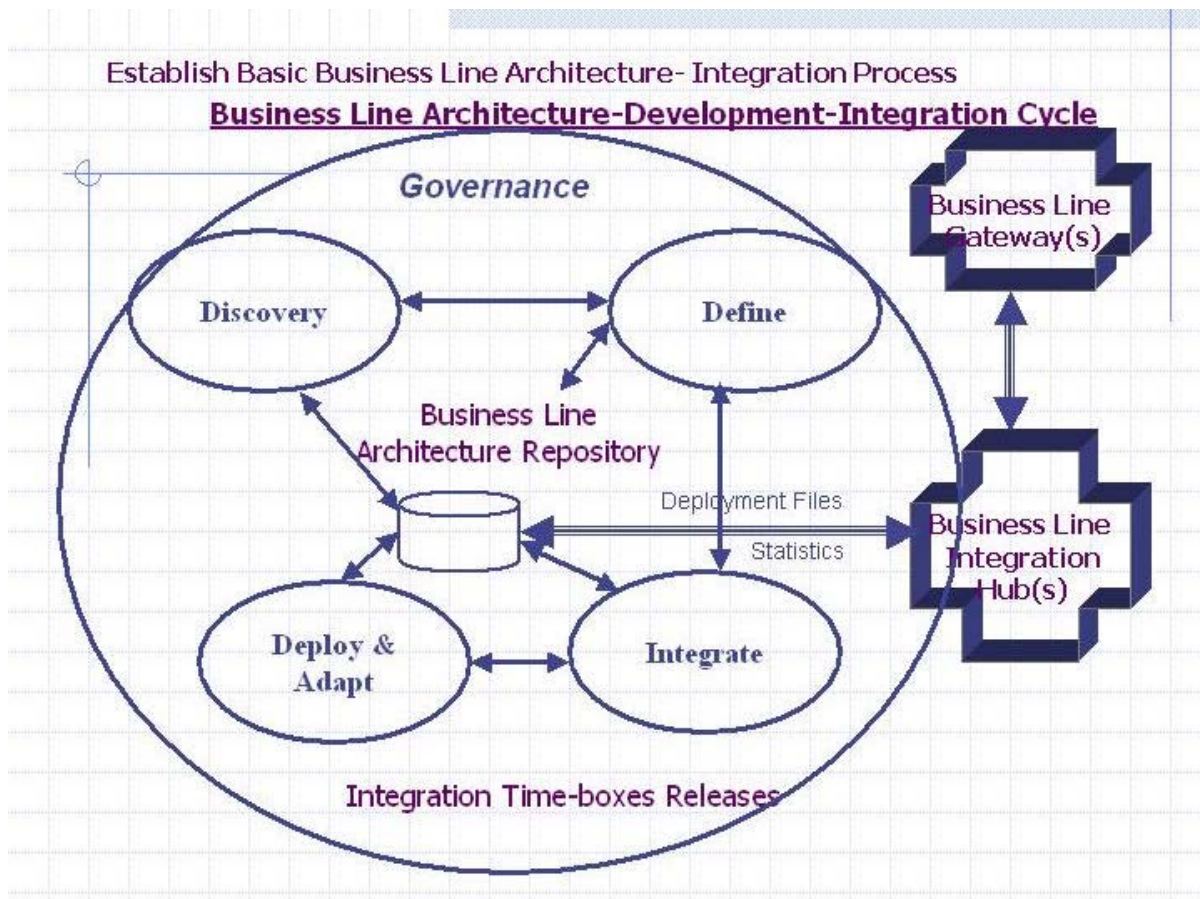


Figure 3 - Basic Business Line Architecture Integration Process

Discovery Phase

The focus in this phase is on coming to a joint agreement on how to integrate the business line across the participating agencies. : Some of the key elements are to discover ongoing initiatives in the community, what the community values and to leverage components and information that will be willingly shared. It must be realistically approached with the understanding that while there will be a number of challenges, the major discussion of benefits will bring broader success to all involved. An especially critical element is to get each business line to take one or two items and move forward to the Definition phase. The bottom line is to not spend too much time on the Discovery phase – keep it to a 4-6 week time frame and move on. Recognize that you will be (re)-discovering and adding more opportunities to the business line mix, with focus on a few in order to make measurable progress and demonstrable ROI, and get recognized for successfully solving some critical problems.

The output of this step is a Business Line Implementation Agreement (BCA). One of the key elements of the BLA should be a clear list of opportunities for improvement and opportunities to leverage the results from across the community. The BCA must address how to address both normal and potential problem scenarios. Examples of problem scenarios include business partners not meeting their obligations, funding strategies, and stalemates on budgeting issues along with addressing performance and continuity of operations issues. The

discussion of “how would we handle” these scenarios and a clear understanding of the benefits and determining any current commitments and constraints on the agreements are critical to defining a sound foundation for the business line. Figure 4 provides some of the high level topics that can be considered in the development of the BCA. Current commitments must be honored and new strategic outcomes determined.

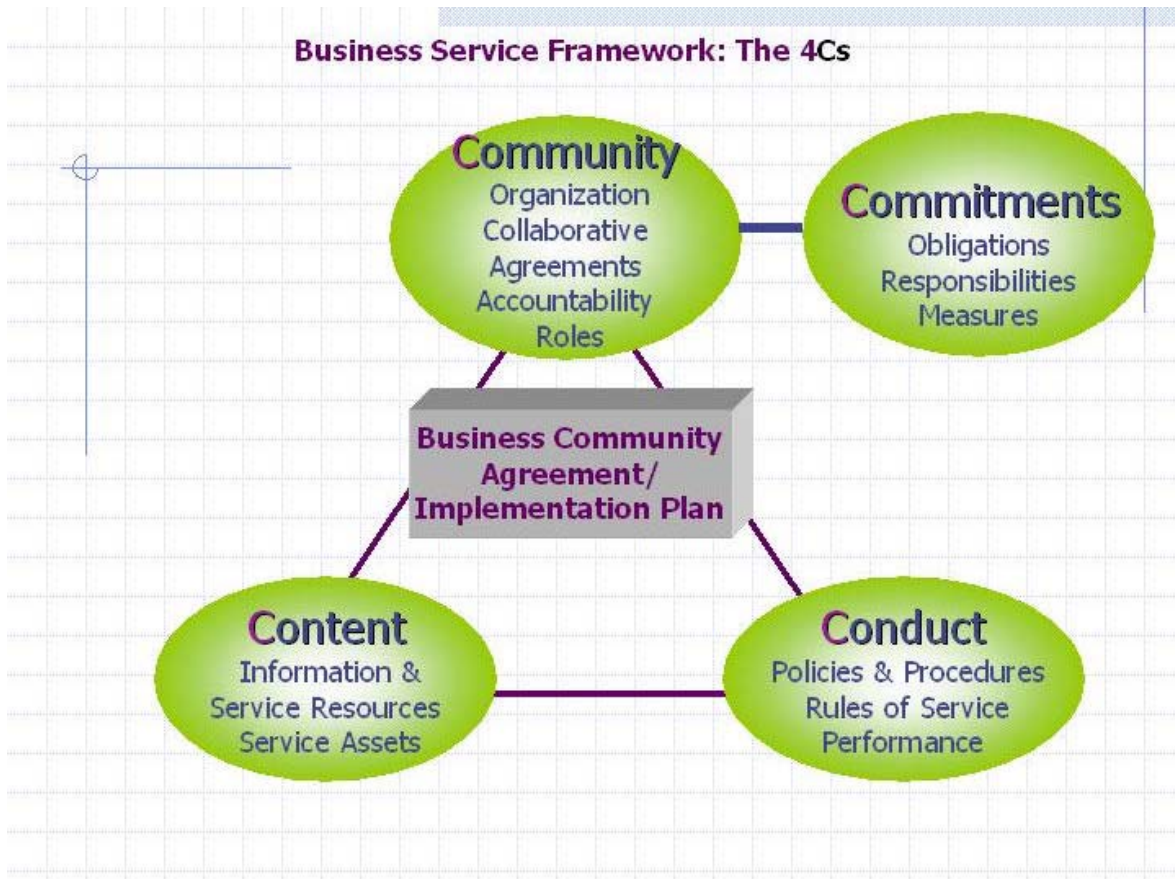


Figure 4 – Business Community Agreement Definition Framework

The Discovery phase is fraught with many challenges. From the reality that everyone has a daily job that includes a clear set of functions to the many attempts being made to reform government, there are challenges. However, the first bottleneck to overcome is the location of the thought leaders and the acquisition of management backing. Many Federal, State, Local as well as international e-government initiatives started as point solutions to address targeted problems, but in meeting and discussion of the issues and lessons learned it was discovered that there was a common theme - convincing agencies of the benefits of integration, collaboration, and consolidation. On the one hand, there are the fears of loss of autonomy resulting from greater intervention by the federal government. On the other hand, there is a recognition that the need for greater collaboration stemming from budgetary pressures and responding to terrorist threats starting with September 11 exists. Homeland Security (9/11) and incidents such as the sniper attacks and anthrax distribution in the mid-

Atlantic region during the Fall of 2002 further raised the attention along with the dedicated efforts of projects such as the Justice Global Network and e-grants initiative. The gaps in emergency preparedness and information sharing all provided a ripe opportunity to introduce a new process approach. Also as agencies such as EPA and Education were collecting data and making plans, it was clear that with pressures from federal, state, and local government there needed to be an approach that would be reusable and create cost efficiencies.

The best way to deal with the startup-mindset challenges is through an open dialog across the participating agencies that clearly outlines both the benefits of a BLA as well as the reduction in autonomy. The approach that is advocated here allows for a phased approach and for many different levels of ownership and control. The conversations have to be made but total agreement may never be reached. Each of the conversations will result in new ideas and insights. The conversational form of communication must be backed with other forms of communications. A cross-agency marketing and communications plan, supported by a mutually agreed upon governance model, should be established to promote the potential and actual benefits of the business line architecture, to foster open dialog and to invite feedback from agency personnel and stakeholders.

The Discovery phase will have narrowed the opportunities to a short list for examination in more detail during this Definition phase. The initial information from the Discovery phase is stored in a series of management, business community context diagrams, and initial set of policies within the Management and Business Line Community Policy Level section of the repository. This section will be defined during the other phases.

Definition Phase

During the Definition Phase the business line leader and technical team will take the opportunity to list and create a 'platform independent' set of models that define the basic business line architecture and types of processes and common information models that will be used. Four basic models will be used with variations based on the type of information that will flow through, or the type of services that will be composed together, by business lines. The four models will include the user interface model, the gateway and Hub model, the business line services model, and the information resource model. A basic set of common, core, agreements will be defined but, the ability to extend and to create special partner agreements among community members will also exist. The business line integration functions will be based on one of a number of standard hub architectures and business partner gateways that will be defined in platform specific forms. The collaborative platform independent models will represent common patterns that can be agreed upon by the business analysts and technical architects from the different community members. A high-level business process modeling language and notation such as business process management notation (BPMN) and Business Process Management Language (BPML) can be used along with UML 2.0 Model Driven Architecture, Enterprise Collaborative Architecture, elements in defining the type of collaboration that will be used. It is expected that a small number of business patterns and "meta models" and templates will be the basic elements used in defining the platform independent models and transformation and mapping from independent to platform specific steps.

Integration Phase

The Integration Phase develops the platform-specific reference models and standards that need to be defined by each of the business partners on how they will collaborate and share information. The basic definition has been set up but now the specifics must be done with each of the partners. A common challenge is realization that “One size does not have to fit all.” Some organizations may want to participate in some activities within the community and not others. Setting up the specific models will result in deployment objects that are sent to the Hub and to the gateways affected. Each business partner will have a business analyst and technical architect that will specify the user interface model, the gateway model and policies, and any specific extensions and tailoring to the collaborative, virtual data models, and common information system models. The outputs from the model development environment will go into the repository and be deployed with “content” and “declaration” to the gateway and the hub. This declarative model driven approach will be used to limit the software developed and to produce deployable content.

Figure 5 provides an overall vision of the high-level Business Line Architecture that includes an environment where the business line analyst from the business partner organizations can create business specific models, fill out templates, and specify how their organization will integrate and share information, processes, and create common information models to meet their shared goals. Using graphical tools and templates the business line analyst along with selected technical architects will create “content” that will be deployed within the hub or within gateways that will be part of the overall process exchange architecture. Initially there will be the integration of elements for the Hub and creation of business partner gateways based on standards and “pluggable” content, models, and scripts that can be used to tailor the business line to meet the different situations faced.

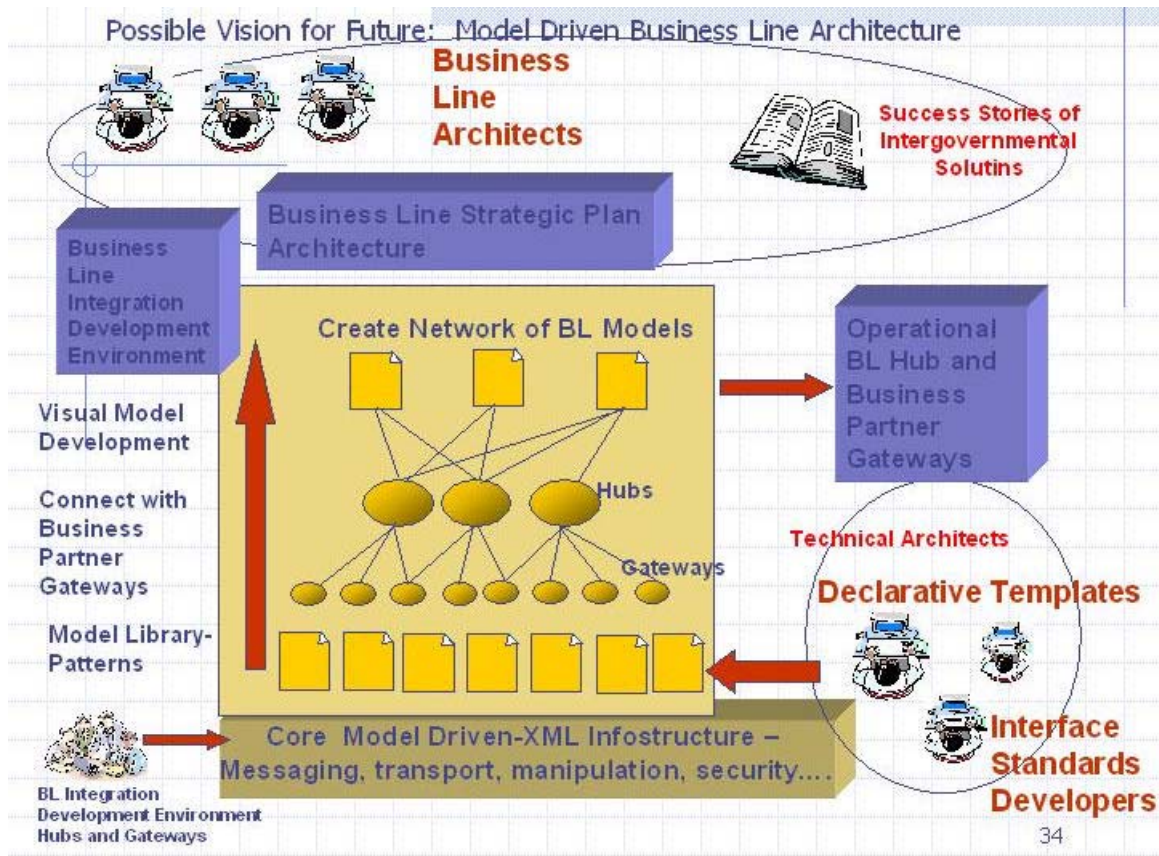


Figure 5: Model Driven Business Line Integration

The high level architecture consists of the following elements:

- Business Line Integration Development Environment- a Model Driven Architecture and declarative model environment[17].
- A Repository of platform independent models and platform specific models shown in the center.
- Foundation level of Core Model Driven-XML Infostructure which includes capabilities to receive and transmit messages, create alerts, translate into the consuming business partners formats, and provide a federated trust management environment. [18]
- Business Line Hub will include both common commercial server and portal elements(e.g. BEA Weblogic) along with publish and subscribe notification services(PreCache, Inc. Netinjector), a virtual data management capabilities(e.g. Metamatrix), along with a series of business line service standards from the (Uniframe-[19]) with the Unified Meta-component Models and approach for distributed Computing, along with Visual and generative modeling capabilities.
- Process level security definitions and models.

The approach uses the commercial base capabilities and applies the innovative element sponsored by government research organizations with emphasis on using open standards based approaches.

The Business Line Integration and Development environment includes an integration and test environment along with a set of profiles, an integration toolkit, and guidance that provides best practice implementation. The profile built around XML and SOAP messages and a common set of services within an adaptable Business Line Integration Hub can provide the basic elements for Business Line Integration with tailoring provided by the business analysts. Once the hub and gateway systems have been defined, limited or no “traditional” programming is needed.

Deployment & Adaptation Phase

The Deployment and adaptation phase is the part where the platform independent becomes focused, as it is extended with the addition of new content and a regular series of business line releases that fit within the architecture framework. It is where those nasty issues of reliability, scalability, error handling, and the “people” issues come together to be addressed. The deployment of the business line capabilities will be done in a phased manner with extensive transition planning. The Business Line Integration Hub must be flexible and designed for change, with the tools built in for continuous integration and service. It must be a low-cost operations center that provides for reporting, exception handling, and recovery.

There are both technical and business challenges to maintaining a government-focused service center. The organization must be a sustained virtual team able to deal with changes in leadership, changes in technology, all while providing ongoing value. It must be driven, and measured by, the community needs. The community itself must understand the expectations and have a means to adjust the value propositions and recommend changes. It will be a managed open community of interest. Running such an organization will require diplomacy, experience, and an unwavering focus on the direction provide by the business community leadership.

Governance & Funding

Key to the success of developing a BLA is the establishment of a mutually agreeable Governance, sponsorship, and funding structures that cross organizational boundaries. The eGrants project between the Federal, State, Local, University, and non-profits organizations has many aspects of a Business Line along with the work of the Federal Data and Statistics community. Charles Havekost the eGrants Program Manager recently shared many of the best-practices in establishing an Executive Board with Cabinet Level visibility and how that board addressed critical issues upfront about the joint funding. The executive board approved the business community policies including the definition of formulae for large, medium, and small organizations to fund the development and a transaction model to be used during operations. This expanded involvement has been built into the eGrants program plan from its inception. Other projects such as Global Justice Network have used organizations such as the National Association of Chief Information Officers (NASCIO) to act as a mediator with the states and counties. Associations are also playing a significant role in the Small Business

Compliance projects where industry associations such as the trucking industry are providing the integrated stakeholder view for business line.

Based on these early experiences a three-tier structure could be used to represent the Business Line Community. An Executive Team from the key partnering organizations could address the policies, define the funding strategy, and approve the business line agreements and the joint business case prepared for executive leadership and funding organization approval. A program office could be created that would include the Business Line Program managers and other full or part-time participants from the partnering agencies. A series of working groups or task forces can be used to address key issues some with strong leadership and responsibility by the contractors involved. Each of the groups must be chartered, know where they fit in, with clearly defined authority and responsibility, the understanding of the limits of that authority and how to escalate issues. A representative kit of such starter material should be available for the business lines. One of the most important elements of all these groups is to have a clearly articulated set of goals and to capture and maintain a set of business and technical agreements.

Conclusions

Developing business line based Enterprise Architectures has the potential of enabling agencies to develop architectures that can effectively meet the new challenges facing the United States today, e.g., budgetary challenges, providing better service to citizens, and the improving cross-government cooperation to meet the threats of terrorism. However, this will require organizations to radically change their approach to developing Enterprise Architectures. Some of the key changes include:

- Focus on cooperative approaches with other organizations that perform similar functions
- Transition to a component based, service-oriented architecture to facilitate reuse
- Establish, and abide by cross-governmental governance

This paper has proposed a process for developing business line architectures, and has described some of the major challenges of implementing the process as well as potential ways to meet the challenges.

Actions & Recommendations

There are two types of actions included in these recommendations. One is the definition of process guidelines, standards, and selection of initial technologies that fit the standards for infostructure. The other items is to take two areas disaster management and Business Compliance and create a pilot demonstrate the feasibility.

A Business Compliance One Stop can include a basic set of common services to find, apply and fulfill forms for registration between federal, state, and local government using a common Framework that includes XML messages, Soap messages, and web service components along with a common integration toolkit.

The Federal –State-Local Disaster Management exchange that can use a simple templating alert mechanism with a set of standardized alert messages that can be shared with information about the local critical infrastructure elements. Simple ebMS system exchange messages and an engine similar to that used by the Center for Disease Control could be considered.

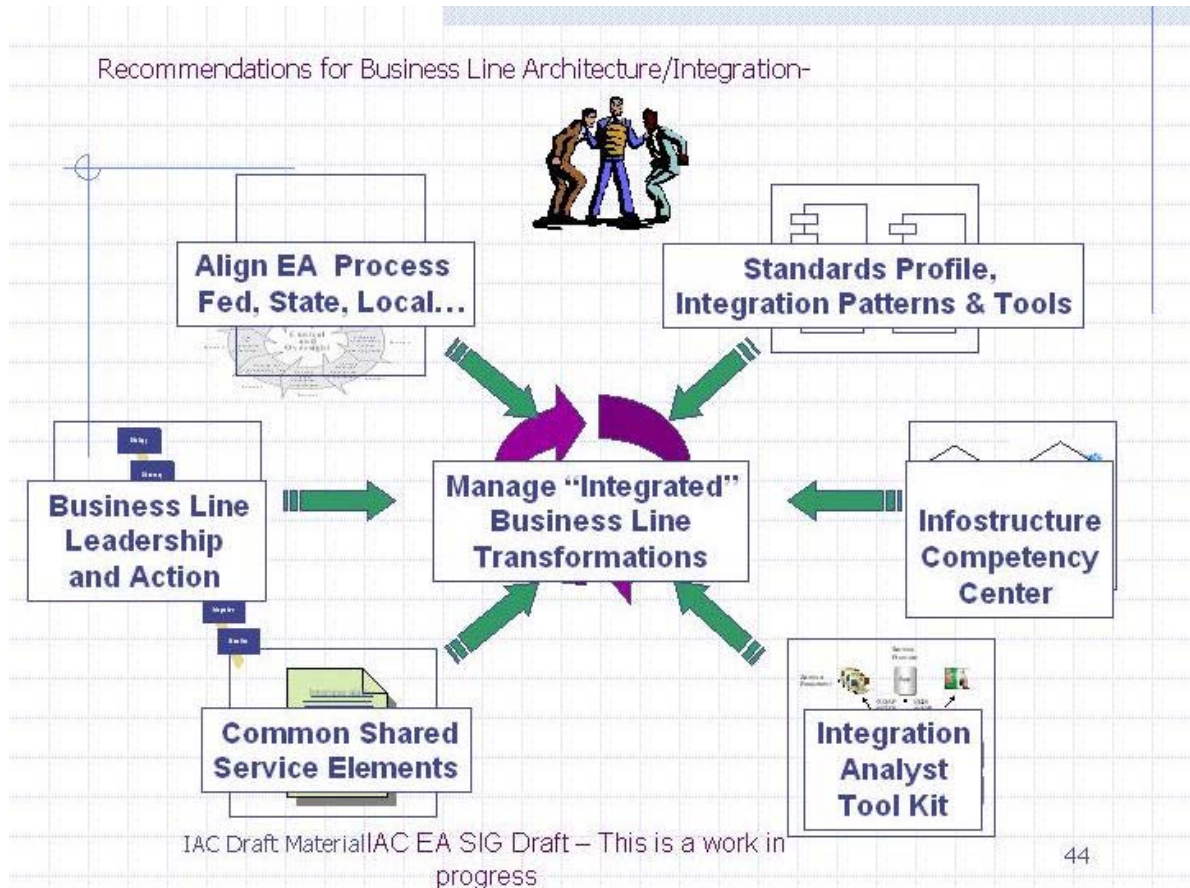


Figure 6: Pilot Programs and Refine Processes are Critical

A set of planned actions including the pilot programs are shown in Figure 6.

1. Meet with Federal-State and Local organizations to define an overall alignment process that will be used on the initial 6 business lines and piloted within more confined areas.
2. Define a set of Cooperative Information System standards profiles and integration patterns as a starter-kit for the six areas.
3. Select the business leaders and business communities and plan an initial discovery and definition phase steps to reach a business line agreement and define one or two actions (“integration and consolidation opportunities”) for each of the Business Lines. Capture both the ongoing activities and focus on “integration and consolidation” opportunities that will provide the highest value to the business community.

4. Provide a business line architecture-integration tool kit that will include templates and estimation-value spreadsheets and end-to-end business line flow maps. Candidate templates and maps are within Appendix A and within the NASCIO Toolkit. Select a common set of tools. The IAC has a series of draft templates for consideration but feels that a workshop or task force is needed to look at their applicability.
5. Provide an Business Line Integration Environment and Infostructure Architecture that will support each Business Line. Work with the OMG, OASIS, W3C, and other standards organization and provide training and support for each of the common technical issues. A service center (Hub) for such support must address with two or more environments a Development and Test capability and a set of operational systems with recovery and disaster management that can be used on 24x7 high availability operations.

The Business Line Architecture and Integration process offers tremendous benefits but it must be introduced in stages with extensive involvement by Federal-State-Local personnel but with a facilitating organization such as the GSA office of Intergovernmental Affairs.

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