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Department of Justice

U.S. Department of Justice's Global **Global Reference Architecture (GRA)**

Guidelines for Identifying and Designing Services

GRA

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As a part of Global's effort to support information sharing activities that span jurisdictional boundaries within and outside of criminal justice, the Justice Reference Architecture (JRA) has been rebranded to the Global Reference Architecture (GRA). This change will not introduce any significant technical modifications to the architecture but is rather intended to provide a more inclusive service-oriented model that will meet the broader needs of justice, public safety, homeland security, health and human services, and additional stakeholders. The GRA, therefore, is designed to be an information sharing architecture that will meet the needs of government at all levels and fulfill the need for improved collaboration across communities.

Acknowledgements

The Global Reference Architecture (GRA) was developed through a collaborative effort of the U.S. Department of Justice (DOJ) Global Justice Information Sharing Initiative (Global) membership and DOJ's Office of Justice Programs (OJP), Bureau of Justice Assistance (BJA). The Global Infrastructure/Standards Working Group (GISWG) would like to express its appreciation to BJA for continued support and guidance. GISWG is under the direction of Tom Clarke, Ph.D., National Center for State Courts. The creation of this document was a volunteer effort by numerous contributors, and sincere thanks is extended to them for the development of this resource.

Although this document is the product of Global and its GISWG membership, it was primarily adapted from the technical reference architecture developed by the state of Washington, and sincere appreciation is expressed to Mr. Scott Came, state of Washington and SEARCH, The National Consortium for Justice Information and Statistics, for his guidance and leadership. In addition, parts of the architecture were derived from the Organization for the Advancement of Structured Information Standards (OASIS) Reference Model for Service-Oriented Architecture (SOA-RM) 1.0. Other major contributors deserving of recognition include the OASIS Court Filing Technical Committee, OASIS SOA Reference Model Technical Committee, Messaging Focus Group, and GISWG Service Implementation Committee.

A sizeable portion of the Service Identification Methodology Process outlined in this document was condensed and formalized from the state of Pennsylvania Justice Network's (JNET) integrated service methodology. Appreciation is expressed to the state of Pennsylvania JNET for providing guidance to the work group and for sharing its experience in identifying services, aligning services to business objectives, and its methodology for prioritizing services.

For more information about the Global efforts, including the Global Reference Architecture initiative and corresponding deliverables, please refer to the Global Web site, <http://it.ojp.gov/globaljra>, for official announcements.

Document Conventions

In this document, use of a bold small-caps typeface, as in this **EXAMPLE**, indicates an important concept or a term defined either in the glossary or in the body of the text at the point where the term or concept is first used.

In this document, use of a bold caps typeface, as in this **[EXAMPLE]**, indicates an important resource document noted in the Reference section of this document.

Intended Audience

The intent of this document is to provide guidelines to justice organizations that have interest in following or applying the Global Reference Architecture (GRA) in development of a Service-Oriented Architecture (SOA). This document concentrates on an approach to identifying and designing services that will enable effective information sharing with justice partners.

The approach described in this document utilizes a number of proven methodologies for services identification and design. It combines these methodologies into a cohesive approach that is aligned with the GRA and takes into consideration the challenges justice organizations face when implementing information sharing initiatives.

The presented methodology is based on analysis of the business capabilities and technical environment that significantly influence information sharing. The proposed approach also relies on interaction analysis methodologies to elaborate and refine the results of the capabilities analysis. The methodology also utilizes a proven prioritization process that would allow justice organizations to define a catalog of services to be implemented and deployed during the different phases of the GRA adoption process.

This document can be used by project managers, business analysts, technical architects, and developers tasked to research, plan, design, or implement the Global Reference Architecture. To effectively use this document in the process of services identification and design, the reader should have a conceptual knowledge of SOA and be familiar with the GRA Specification.

1. Introduction

The GRA is based on the concept that justice partners have capabilities that they provide to one another. These capabilities are what organizations use to solve problems and therefore add value, directly or indirectly, to their stakeholders.

Although the GRA is generic enough to support virtually any kind of capability, the purpose of the GRA is to describe an approach to integrating automated, computer software-based information systems. In other words, we are only interested in modeling information exchange between justice partners. Therefore, the GRA, and the guidelines presented here, consider those business capabilities that are provided by (or implemented by) information systems. The GRA calls these systems *provider systems* and establishes that provider systems implement those capabilities as services. The primary capabilities of interest to the justice community are those which can be leveraged by partners to achieve real-world effects—in our case, the access to and sharing of justice information.

Each capability produces one or more real-world effects, each of which is an outcome of the business value sought by one or more of the partners. A real-world effect can be either the obtaining of information, the changing of something of business relevance to the participating partners, or both.

2. Assumptions/Prerequisites and Considerations

2.1 Assumptions

This document makes a number of assumptions regarding the reader and the agency's/organization's background, knowledge, and understanding. These assumptions must be understood and met to ensure success with service identification and design.

- This document assumes that the agency/organization desires to facilitate broader information sharing within the justice reference architecture.
- This document assumes that the agency/organization has a clear vision and mission and that they are well-defined and understood.
- This document takes into consideration that the agency/organization may already have defined services which are intended to be built.
- This document relies on availability of business and technical staff to participate in service identification and design.

- This document assumes that the team participating in the services identification and design initiative would read the complete document before implementing a service identification and design methodology.

2.2 Prerequisites and Considerations

- This document assumes that the agency/organization has a governance process that recognizes IT and service-oriented architecture.
- This document relies on the agency/organization to determine how ongoing work and projects will be related to the service identification process and to the service implementation priorities.
- This document requires that if the agency/organization is planning to start implementing services (after service identification and prioritization), it should have already deployed or be in the process of simultaneously addressing execution context requirements and building SOA infrastructure.

3. Concepts

3.1 Service Orientation

One of the goals of the GRA is to embrace service orientation and, as a result, to enable better alignment between the business requirements of the justice community and the information sharing services provided. This would lead to increased effectiveness in the process of justice information sharing and agility of the information sharing environment.

In the process of traditional system modeling, achieving true alignment between the technology and the business model has proven to be difficult because the gap between the two perspectives is simply too large. (See Figure 1.)



Figure 1: Classic System Model

Technical architects must become more outward facing and connect more deeply with the business side of the justice enterprise. While they do not need to become experts in the business, they need an objective language that allows them to talk with business analysts about the business. Architects, in particular, provide the communications channel and the link between the justice business requirements and

the resulting technology solution. They need to ensure that business requirements and solutions are as tightly interdependent as possible. This interdependence can be achieved by working very closely with business analysts to ensure that the solutions proposed are much more aligned with the justice business requirements. Adopting this perspective is perhaps the best (if not the only) way to arrive at the right granularity for the capabilities and, ultimately, services that an organization would build leveraging a service-oriented approach.

In our common vernacular, we talk about “exposing the business architecture.” Since the capabilities in a given line of business within the justice enterprise are very similar, or even identical, both business analysts and technical architects can use a standard set of questions and processes to elicit relevant information about the business architecture for requirements gathering. By using a standard process to identify an organization’s capabilities, even nonexperts in a given business domain (justice enterprise) can facilitate a very useful discussion about business requirements and divulge important information on function, metrics, performance, maturity, interconnectedness, governance, and compliance. Because [justice] business process experts [practitioners] are answering questions from a technical architect, the architect in fact helps to expose a view that the practitioners may not yet have. The introduction of a service model between the business model and the technology model is a key factor that can help achieve this goal. The three-part model of service orientation demonstrates an improvement to the classic system model. (See Figure 2.)



Figure 2: Three-Part Model of Service Orientation

The three-part model of service orientation interposes a service model between the business and technology models of the classic system model. The introduction of the service model presents several advantages. The service model is where the semantics and functionality enable the services to be more outward or business facing. The service model provides a logical place to define the agreements and ensure that the [justice] business is aligned with the technical solution from a requirements perspective. By inserting the service model, architects are required to explicitly consider service-model artifacts in the design process.

The service model helps architects discover artifacts and define capabilities at the right level of abstraction to satisfy and align with justice business needs. It also enables business analysts or practitioners to have part ownership of the design process and to achieve better business-requirements traceability.

In addition to providing a model in which business analysts and technical architects can collaborate to meet business requirements through technical solutions, the service model enables the GRA requirement for agility. The introduction of the service model facilitates agility by providing an abstract layer where changes in business requirements within the business model can be easily incorporated into the service model, thus affecting the implementation within the technology model. Essentially, the service model bridges the gap and promotes agility between the business and technology models.

3.2 Service Design Principles

3.2.1 Background

In a service-oriented architecture, a **SERVICE** is the means by which one justice partner gains access to one or more capabilities offered by another partner. Justice organizations have a multiplicity of capabilities that others want access to, both inside and outside the traditional justice community. Since the justice community has close to 100,000 justice agencies, all with their own applications, hardware, and networks, this presents a very complicated and serious problem. The only way true interoperability can be achieved and those capabilities can be made accessible to others is to transcend the technical implementation layer and define a consistent approach to identifying and describing services. Additionally, the services and their interactions need to be able to be implemented in many different technical environments. Before a service-oriented solution can be developed, we need to determine what makes a service suitable from a GRA perspective.

Knowing what capabilities to expose as services and how to describe those services is not an easy exercise. The exercise can be helped by establishing a set of principles that can guide service identification and design decisions. The service design principles should be considered in each step of the service identification and design methodology, presented in this document, and especially during granularity analysis. Additionally, compliance with the service design principles is validated by describing the services so they can be leveraged by justice partners.¹ These principles take into consideration the best practices of industry as well as the needs and desires of the justice community to share a variety of information and improve interoperability.

Additional principles exist and new principles are emerging. Presented below are the service design principles that are currently adopted by the Global GRA specification.

3.2.2 GRA Service Design Principles

Service design principles within the GRA provide consistent guidance regarding the overall partitioning of capabilities into services and the relationships between

¹For more information on describing services, refer to the Services Specification Package Documentation.

services. The service design principles are core to the design of services regardless of what underlying technology is used to implement them.

Services Are Reusable

To achieve reusability, logic is divided into services with the intention of promoting reuse. Service orientation encourages reuse in all services. Applying design standards that make each service potentially reusable increases the chances of being able to accommodate future requirements with less development effort. Inherently, reusable services also reduce the need for creating wrapper services that expose a generic interface on top of less reusable services.

Services Are Loosely Coupled

Loosely coupled services maintain a relationship that minimizes dependencies and requires only that they maintain an awareness of each other. Loose coupling is a condition wherein a service acquires awareness and knowledge of another service while still remaining independent of that service. Loose coupling is achieved through the use of agreements that allow services to interact within predefined parameters. One of the fundamental requirements of the GRA, the requirement for agility, is directly supported by establishing a loosely coupled relationship between services.

Services Are Based on Abstraction

The principle of abstraction allows services to act as black boxes, hiding their details from the outside world. The scope of logic represented by a service significantly influences the design of its actions and its position within a process. The scope of logic a service represents is influenced by the principle of service abstraction.

Services Are Composable

Under the principle of composability, collections of services can be coordinated and assembled to form composite services. A service can represent any range of logic from various types of sources, including other services. The main reason to implement this principle is to ensure that services are designed so that they can participate as effective members of other service compositions, when required. This requirement is irrespective of whether the service itself acts as the composer of others.

The requirement for any service to be composable also places an emphasis on the design of service actions. Composability is simply another form of reuse; therefore, actions need to be designed in a standardized manner and with an appropriate level of granularity to maximize collaboration opportunities.²

²Services collaboration is related to services orchestration or choreography. The terms “orchestration” and “choreography” describe two aspects of emerging standards for creating business processes

Services Are Autonomous

Autonomy requires that the range of logic exposed by a service exist within an explicit boundary. As a result, services have control over the logic they encapsulate. This principle allows a service to execute self-governance of all its processing. It also eliminates dependencies on other services, which frees a service from ties that could inhibit its deployment and evolution. Service autonomy is a primary consideration when deciding how application logic should be divided up into services and which actions should be grouped together within a service. Autonomy does not necessarily grant a service exclusive ownership of the logic it encapsulates. It only guarantees that at the time of execution, the service has control over whatever logic it represents.

Services Are Cohesive

This principle dictates that services expose functions that belong together because of their purpose. Cohesiveness applies to the functions a service performs and the information it manipulates and communicates. To achieve cohesiveness, a service should perform only functions that are related to each other and be responsible for information that is semantically connected. For instance, a service that submits fingerprint information for identification and at the same time submits driver license information for driver history verification would not be cohesive. A successful approach for achieving cohesiveness is analyzing the functions and the messages a service is responsible for and making sure they are related and interdependent.

Services Are Stateless

Services should minimize the amount of state information they manage and the duration for which they retain it. State information is data specific to a current activity. While a service is processing a message, for example, it is temporarily stateful. If a service is responsible for retaining state for longer periods of time, its ability to remain available to other requestors will be impeded. Statelessness is a preferred condition for services and one that promotes reusability and scalability. For a service to retain as little state as possible, its individual actions need to be designed with stateless processing considerations.

Services Are Discoverable

Services must be designed to be outwardly descriptive so that they can be found and accessed via available visibility mechanisms. To achieve discoverability, services define what features of a provider system the system owner makes accessible to business partners. Services also provide a logical description of the information

utilizing sets of services. The design choice between orchestrated and choreographed sets of services is usually dependent on the execution context. For more information, please refer to the Terms and Acronyms section of this document.

exchanged between consumer and provider systems as the consumer accesses the capability.

Service discoverability aids **VISIBILITY** and helps avoid the accidental creation of redundant services or services that implement redundant logic. Because each action provides a potentially reusable piece of processing logic, metadata attached to a service needs to sufficiently describe not only the service's overall purpose but also the functionality offered by its actions and profiles.

In the GRA, **VISIBILITY**, as the name implies, defines how service consumers and providers of capabilities “see” each other in a way that enables interaction between them. The service-orientation design principle of discoverability is related to, but distinct from, **VISIBILITY**. At the GRA level, **VISIBILITY** refers to the architecture's ability to provide a discovery mechanism, such as a service registry or directory. This effectively becomes part of the infrastructure and can support numerous implementations of SOA. On a service level, the principle of discoverability refers to the design of an individual service so it becomes as visible as possible.

Many of the above-mentioned principles aid in achieving *separation of concerns* by promoting the breakdown of a larger problem into a series of smaller problems and by instigating separation of the triggering event from the resulting response. Principles that directly contribute to the notion of separation of concerns are the principles of reusability, composability, loose coupling, abstraction, and autonomy.

Avoiding Excessively Broad Services

By applying the design principles just described—in particular, that services should be abstract, autonomous, cohesive, and discoverable—service designers and architects should avoid the identification and specification of overly broad services. Services should be scoped as narrowly as business requirements allow. For example, a federated query that searches for generic person information from a broad range of information sources would fit a business requirement of a broader service scope. However, an improperly scoped service is one where the business requirement is specific (e.g., “submit supervision conditions”) and a generic action—indicated by a very generic name like “doExchange” or “receiveMessage” is defined. This type of service or service action hides the real-world effect of that service and the specific action. Designers and architects can have a tendency to design such services with convenience in mind, knowing that such a service can be “reused” in new contexts (or for new exchanges) simply by changing the structure of the message.

The services and actions defined by LEXS and N-DEx are examples of appropriately scoped, broad services, since those services are intended to satisfy broad business requirements.

However, such services exhibit a number of problems, including:

- Reliance on documentation outside the service specification to understand the real-world effect, since it is “hidden” behind the generic action name.
- Lack of discoverability due to the generic nature of the action name that does not reveal the real-world effect.
- Often, a very complex service information model (often represented by a single IEPD) which contains a large NIEM subset to support the very generic service action.
- Hidden implementations that force consumer systems developers to rely on the message structure, rather than the interface, for determining service behavior.
- Tight coupling of the hidden underlying actions—handling of one type of interaction is necessarily coupled to the handling of other types, by virtue of their being within the same service.

To avoid excessively broad scope, service designers should consider the following:

- Design the behavior model of each service carefully, paying particular attention to alignment of the real-world effect(s) and the names of actions.
- Minimize “gateway” and message broker logic in service implementations; if the first logic encountered in a service implementation is an “if-then-else” construct, then it is likely the service needs to be refactored.
- Avoid “message type” or “action” data (flags, codes) in the information model of a service.
- Ensure that each action in a service’s behavior model does one clearly defined thing.
- Be wary of expansive impacts of change—if a change in one area of the business affects other areas of the business that are otherwise unrelated, then an overly broad service definition may be part of the problem.

- Review and consider process modifications or fine tuning to your service identification methodology (specifically see Sections 4.6 and 4.7 for more information).

4. Service Identification Methodology

There are a number of service identification methodologies in use today. More often than not, these methods are combined in an approach to identifying services for an organization.

Service identification methodologies include the following:

1. Business process decomposition
2. Business functions
3. Business entity objects
4. Ownership and responsibility
5. Goal-driven
6. Component-based
7. Existing supply (bottom-up)
8. Front-office application usage analysis
9. Infrastructure
10. Nonfunctional requirements

The service identification approach presented in this document can be considered to use a combination of methodologies 2, 5, 7, and 8 shown above.

In the presented approach, identifying the services to be implemented and the priority in which these services are to be deployed is based on (1) identifying those business capabilities required and (2) the technical capabilities already implemented or planned for implementation by the agency. Successful service identification would imply compliance with the service principles provided in this document in conjunction with the use of common service identification methodologies.

Determining a list of capabilities for service enablement is the first and probably the most important step in moving toward service enablement. This discovery process will assist in documenting, from a business perspective, the lines of business, business functions, subfunctions, and capabilities. From a technical perspective, all current systems, subsystems, and interface/applications are identified, and their capabilities are documented. In turn, the business and technical capabilities identified are consolidated into a catalog of *service candidates* that are critical to providing value to justice users and partners.

The business capabilities analysis will document a mix of current and future capabilities. Current capabilities in this context are defined as capabilities currently

implemented that provide value to a justice organization. Future capabilities are perceived to be those capabilities which could be implemented to provide additional value to a justice organization.

The systems capabilities analysis will primarily document current [technical] capabilities but will also provide information about required capabilities or enhancements to the existing capabilities.

Utilizing business-oriented methodologies is very important from a strategic perspective and allows the organization to plan and achieve its long-term information sharing goals. It is also practical to use the system-oriented approach to identify the services to be implemented in the short term. This approach allows a justice agency to realize immediate efficiencies in implementing services driven by some of its immediate objectives. Additionally, it allows an organization to gain experience with defining, implementing, deploying, and maintaining services in its environment while planning for agility and efficiency on its long-term service identification and prioritization strategy.

Best practices indicate that it is efficient to employ both of these approaches together to realize the full benefits of deploying a Service Oriented Architecture.

Figure 3 depicts the process of identifying services utilizing both the business and system-oriented approaches.

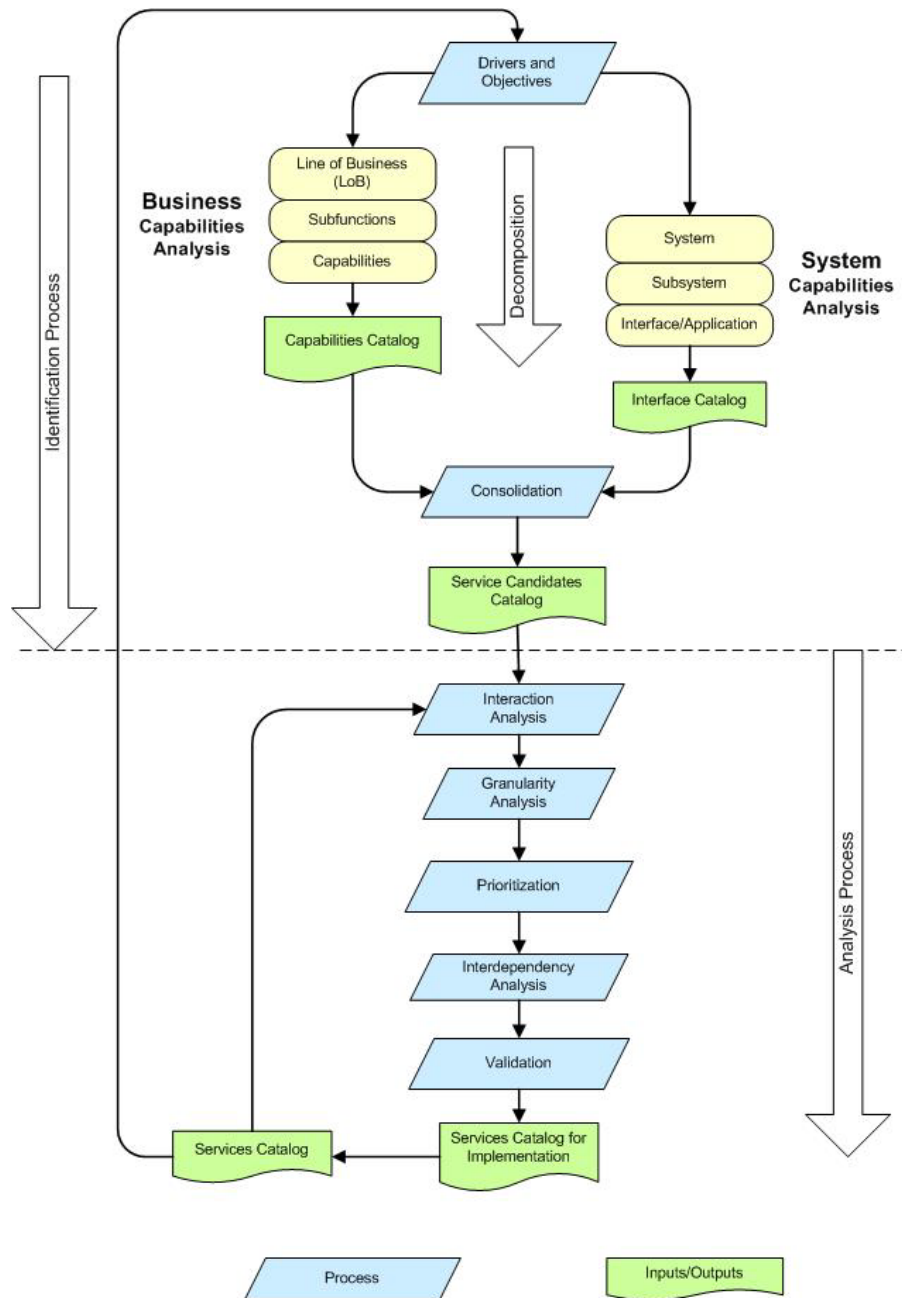


Figure 3: Services Identification Approach

4.1 Scope

It is important to note that the suggested methodology for identifying services is an iterative methodology. Service candidates are identified based on business drivers, and a complete business or technical decomposition is not required in any of the iterations. A justice organization can assess the scope and the level of detail it would like to achieve during each iteration of the service identification methodology presented in this document.

The analyst should consider the trade-off between a too-large or too-specific scope. Too large a scope will require a lot of time and effort and could be viewed as paralysis by analysis. On the other hand, a too-narrow scope will limit the usefulness of the process (as more iterations will be necessary), including the prioritization process. Specific point solutions should move directly on to either the prioritization or interdependency processes.

In essence, the scope of your effort should coincide with goals, objectives, and resources.

4.2 Drivers and Objectives

The first step in the *service identification methodology* is to determine business drivers and associated objectives within the larger scheme of business goals. Drivers and objectives define the strategic bounds within which to conduct the service identification process.

As mentioned, the determination of drivers and objectives establishes bounds within which to identify and prioritize services. For example, although it is possible to apply a service identification methodology to the entire enterprise, practical application suggests that boundaries be established based on business drivers. Drivers could be defined from a number of perspectives. Listed below are some examples of typical drivers that could be used independently or in combination to frame the service identification process. Performance evaluation measures could also be implemented to determine whether those drivers and subsequent objectives are being met by the deployment of services.

- Legislation (e.g., Adam Walsh Act)
- Executive Order (e.g., information sharing initiatives)
- Judicial findings
- Technology [changes]
- Social [changes]
- Liability
- Community interaction

Some objectives associated with business drivers could be:

- Decrease prison population
- Increase operational efficiencies of law enforcement patrol
- Enhance information sharing capabilities between agencies
- Improve operations between law enforcement and the courts
- Improve cost/unit value of IT resources

4.3 Business Capabilities Analysis (“Business-Oriented Approach”)

Although a number of Enterprise Architectures are available to assist in the business categorization process (e.g., state EAs, NASCIO, FEA), the business capabilities analysis approach provided in this document starts with a view of the justice enterprise, its lines of business (LoBs), and business subfunctions from a high-level perspective using the Federal Enterprise Architecture (FEA³) Business Reference Model (BRM). The BRM provides a high-level framework for development of a business capability model. The intent is to develop a model that can be leveraged to identify capabilities within the highest level of the FEA framework and still provide the required lower-level flexibility allowing business decomposition to be applied to any state and/or local information sharing initiative.

In the initial analysis, each business function is identified. During the subsequent decomposition, the analysis of selected business functions is refined and specified in greater detail (subfunctions), until the entire analysis is reduced to those low-level core business capabilities that address the established business drivers.

Once the core business capabilities are identified through the business functional decomposition described above, business process modeling (BPM) techniques can be used to identify business processes components surrounding those capabilities which may help to identify additional capabilities.

Figure 4 illustrates the components of the Business Capabilities Analysis model derived from the Federal Transition Framework (FTF⁴) Meta-model. In this model, we decompose a business into its functional components, which ultimately identify business capabilities. Access to these capabilities is provided through services.

³ For more information about the Federal Enterprise Architecture, refer to Appendix A.

⁴ For more information about the Federal Transition Framework, refer to Appendix B.

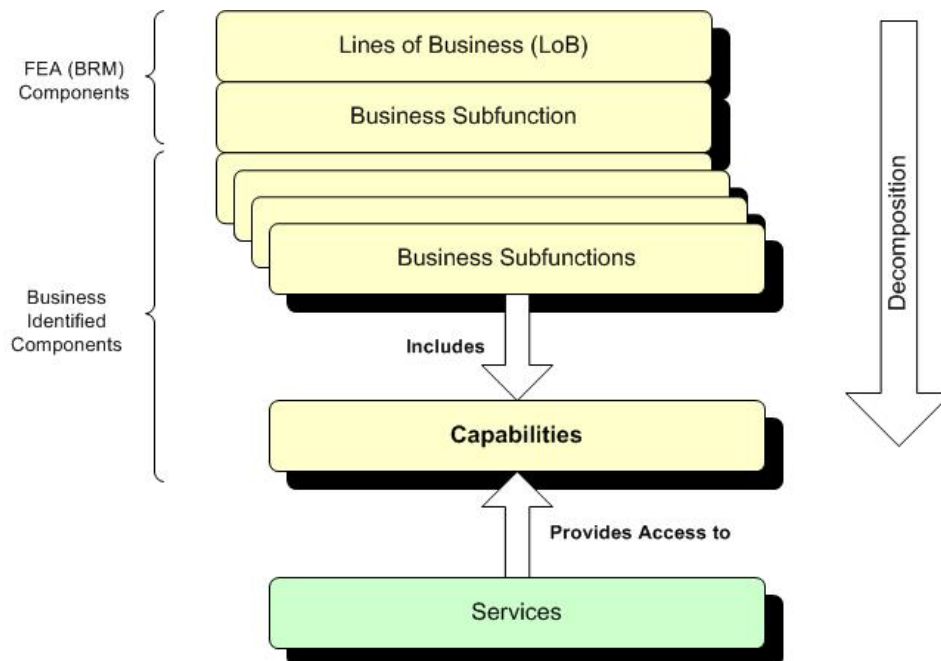


Figure 4: Business Capabilities Analysis Model

The result of the business capabilities analysis is a catalog of business capabilities that will be utilized during the next step of the services identification methodology. For the purpose of simplicity at this step of the process, it is assumed that each business capability is provided by a single service or service candidate. In other words, it is assumed that the relationship between business capabilities and services is one to one.

4.3.1 Business Considerations

In the context of performing a business capabilities analysis, which is an iterative process, the following business considerations can assist in determining a catalog of service candidates:

- Are there capabilities which can in the future be utilized by other justice agencies?
- Are there business requirements to share information with other justice agencies in the near future?
- Does the model incorporate strategic planning initiatives?
- Does the model accurately reflect business policies and procedures?

4.4 System Capabilities Analysis (“System-Oriented Approach”)

The system-oriented approach to services identification starts with identification of the individual technical systems. Most systems can be viewed as comprising subsystems and, upon further decomposition, interfaces and applications. As a result, each of the systems identified is decomposed and specified in greater detail to form subsystems. Interfaces/applications and their functions or capabilities are then identified and documented. It is at the interface/application layer where a justice organization provides technical capabilities and could provide or consume services in the process of sharing information.

The system-oriented approach to services identification requires detailed analysis and documentation of the current systems environment, the existing systems and subsystems, and their external interfaces. This approach would also include documenting in detail the known requirements for enhancing the existing systems or solutions or for the implementation of new systems or solutions. This would lead to a catalog of systems, subsystems, and applications/interfaces.⁵

Figure 5 illustrates the components of the described System Capabilities Analysis model.

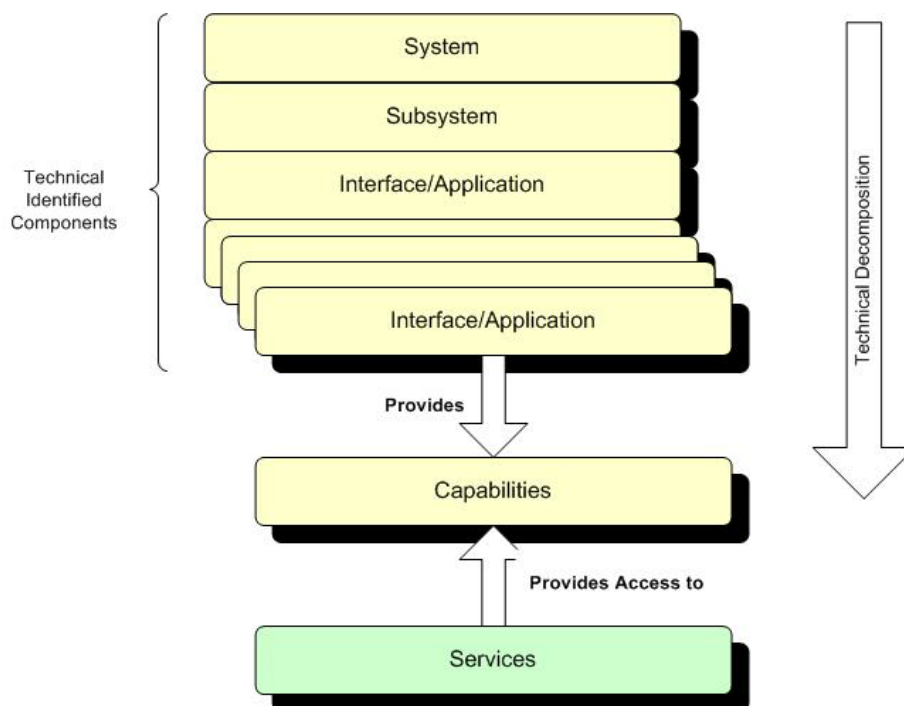


Figure 5: System Capabilities Analysis Model

⁵While this document uses system, subsystem, and interface/application for decomposition of the technical environment of an organization, there are other widely adopted terminologies. If a different terminology is used by an organization, it might be practical to preserve this terminology in the decomposition process to avoid confusion and ensure understanding.

Justice organizations may already have listings or inventories of some of the existing or required interfaces/applications. This information might also be available within existing information sharing agreements or as part of an architecture technical specification, system configuration, system release, help desk system, or other documentation. These are common places where justice organizations typically categorize systems, subsystems, and interfaces/applications. It is suggested that the above-mentioned resources be reviewed for currency and, if applicable, be leveraged in the process of system capabilities analysis.

To achieve efficiency in the process of system capabilities analysis, it is implied that not all systems, subsystems, and applications/interfaces are completely decomposed and documented during this process. Only those systems and subsystems which fall within the bounds established in the process of identifying business drivers and objectives are incorporated into the analysis. In addition, one or more of the following criteria can be utilized to identify a system or subsystem that is a good candidate for service enablement.

A system or subsystem which...

- Has high importance for the agency's mission and maintains highly critical information
- Plays or will play a major role in the agency's information sharing
- Is stable and for which there are no existing plans for replacement
- Has a large number of high-priority enhancements pending
- Can satisfy high demand to build new interface(s) or a system
- Provides current interfaces that are not maintainable
- Provides interfaces or will need to provide interfaces that require higher transaction rates

The interfaces/applications provided by these systems or subsystems would be added to a catalog of interfaces/applications to be considered for service enablement. Some business and technical considerations for evaluating and documenting the interfaces/applications follow:

- Are there interfaces which can be utilized by other justice agencies in the future?

- Are there requirements to build interfaces to other justice agencies in the near future?
- How are the interfaces to other justice agencies implemented?
- How many interfaces to other justice agencies does the system provide?
- Are the existing interfaces to other justice agencies stable, efficient, and maintainable?
- What are the current usage statistics of the existing interfaces?
- What are the expected transaction rates for the interfaces that need to be provided in the near future?

The result of the system capabilities analysis is a documented catalog of technical capabilities that will be utilized during the next step of the service identification methodology. For the purpose of simplicity at this step of the process, it is assumed that each capability equates to a single service. In other words, it is assumed that the relationship between technical capabilities and services is one to one.

4.5 Consolidation

At this step of the service identification process, an organization will combine the service candidates developed from both the business capabilities and system capabilities analyses. The two service (2) candidate catalogs will be consolidated into one catalog.

Based on an organization's drivers and objectives, the business capabilities analysis will allow an organization to capture current and desired capabilities for the business. In a similar fashion, the system capabilities analysis will enable systems to be decomposed into subsystems and ultimately interface/applications that either currently exist or are in the planning stages of development. During consolidation, the business and technical capabilities catalogs are merged, revealing both business capability requirements and existing technical capabilities that can be leveraged to create services.

Each service candidate should also be tagged as having been identified, either through business (B) or system (S) analysis [decomposition] or both. Services candidates identified by both decomposition approaches are considered to be viable for service enablement. Services identified only by the business decomposition might represent capabilities that are not currently implemented technically or the technical implementation is relatively stable and not considered for service

enablement in the near future. Services identified only by the technical decomposition might indicate technical capabilities that are not currently required or of importance to the organization. It is recommended that the reason for the discrepancy between the two decompositions be analyzed and well-understood prior to making a decision for including the service candidate in the [consolidated] catalog.

It is important for the organization to recognize that this consolidated catalog of service candidates is partial, since it is based on the business drivers and objectives for a given iteration of the process.

Figure 6 is an example of a consolidated service candidate catalog in a spreadsheet format. Ultimately, this catalog is aligned with the justice organization's drivers and objectives and thus with its ability to affect performance metrics by providing real-world effects.

Business-Oriented and System-Oriented Approaches						
#	(B)usiness (S)ystem	Line of Business System	Business Subfunction Subsystem	Business Subfunction Interface/Application	Capability	Service
1	B	Law Enforcement	Criminal Apprehension	Arrest	Knowing when and where arrests are taking place.	Arrest
2	B	Law Enforcement	Crime Prevention	Identification/Biometrics	Preventing crime by associating biometrics with the individual.	Identification
3	B	Law Enforcement	Crime Identification and Surveillance	Identification Nonbiometrics	Preventing crime by associating nonbiometrics with the individual.	Identification
4	S	Messaging Environment	Event Message Publication	Arrest Message	Knowing when and where arrests are taking place.	Arrest
5	S	Child Support System	Locate	Warrant Application	Finding individuals who have child support warrants.	Warrant Request
6	BS	Child Support System	Person Demographic	Person Inquiry	Locating personal attributes for those owing or paying child support.	Identification
7	BS	Driver's License	Person Demographic	Person Inquiry	Locating personal attributes for those having a driver's license.	Identification
8	S	Driver's Photo Application	Person Demographic	Photo Inquiry	Locating and providing a person's driver's license photo(s).	Identification

Figure 6: Business-Oriented and System-Oriented Approaches

This catalog will be further used in the interaction and granularity analysis process and in building a next iteration of the services candidates catalog. This catalog will eventually be used again in the prioritization steps.

4.6 Interaction Analysis

The business capabilities and system capabilities analysis approaches to service identification are based on a decomposition of the organization into its core capabilities to identify service candidates. Thus, these approaches are based on static views of the business and technology environments of the organization and its capabilities. An important step in identifying and confirming the service candidates is analyzing the interaction between the business and technical capabilities of the organization. This allows evaluation of the capabilities breakdown from another perspective, thus validating the catalog of service candidates.

Business process modeling techniques can be used to break down the components of a specific business process to identify the interactions and relationships between specific business functions and capabilities. It is suggested that the business process modeling be performed for the as-is, as well as for the to-be business case.

The diagram below (Figure 7) illustrates the justice process for a search warrant request as modeled using the Business Process Modeling Notation (BPMN).

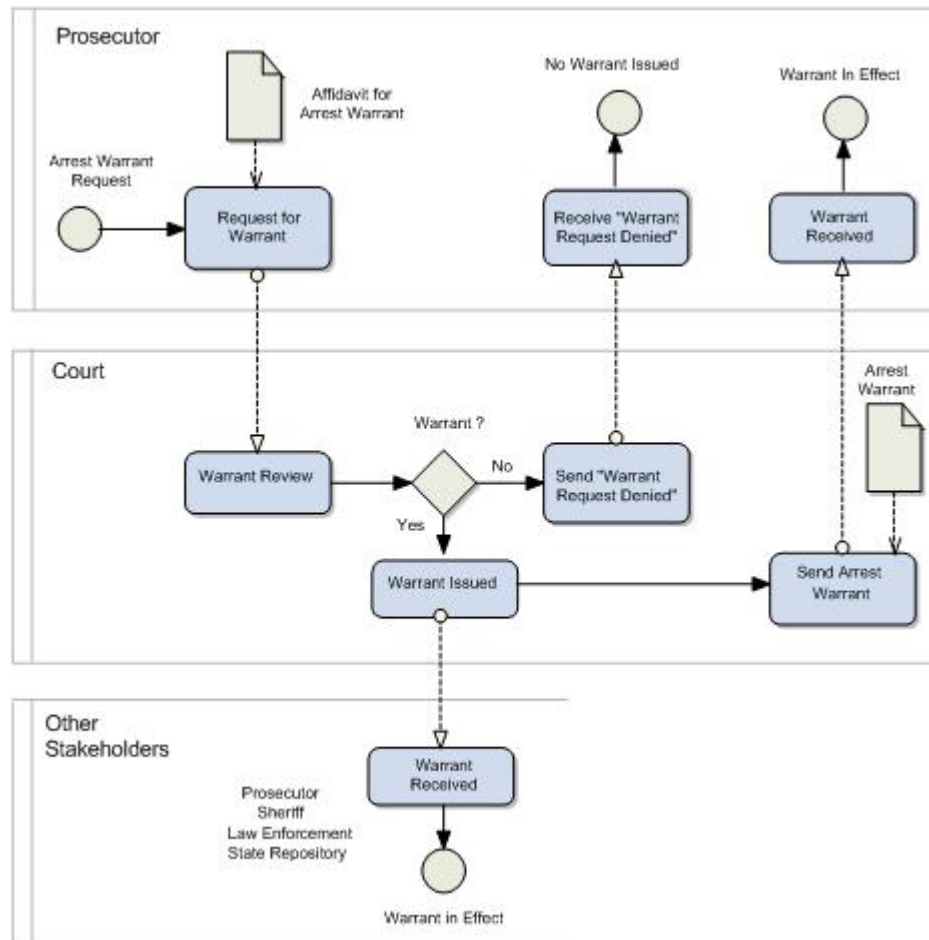


Figure 7: BPMN Diagram for "Request for Warrant"

The interaction analysis step of the process is performed to draw a relationship between the capability models and the business process model. A capability model, unlike a business process model, models what an individual business function does. It is not concerned with how the business function is achieved (e.g., business process model), but rather with its externally visible behavior and its expected level of performance (that is, its outcomes) and real-world effects that are exposed through services.

A key benefit in focusing on business capabilities is that while organizational structures and business process flows are transient, the essential capabilities of businesses tend to remain constant over time. A business capability abstracts and encapsulates the people, process, procedures, and technology associated with a given business function into a simple building block. The decomposition of the business into capabilities provides the top-level decoupling for the underlying service contracts implemented by service specifications. The interaction analysis approach provides a validation of the consistency of the above decomposition.

The business capabilities analysis approach to service identification can also involve business process modeling techniques to break down the components of a specific business process to identify the relationship between specific business functions and capabilities [service candidates].

Other techniques for business process analysis or interaction analysis can be used during this step. The Justice Information Exchange Model (JIEM) can be efficiently leveraged for the interaction analysis component of information exchanges because of its applicability to the justice information sharing domain.

4.7 Granularity Analysis

The next step in the overall service identification and design process is to analyze and determine the required granularity for exposing the capabilities identified. This step is extremely important because it contributes to achieving service granularity, which is aligned with the service design principles outlined in Section 3.2 of this document. The granularity analysis utilizes clustering, refactoring, and decomposition as main approaches to allow the business analyst and the technical architect to determine the most efficient approach for organizing the service candidates into reusable services. This step of the process also significantly contributes to achieving the goal of separation of concerns.

Earlier in the services identification process, it was assumed that each identified capability will be exposed as a service. In other words, an assumption was made that the relationship between capabilities and services is initially one to one. The granularity analysis step reorganizes the services and looks at opportunities to combine them differently so that a maximum level of separation of concerns, interoperability, and reusability is achieved.

Clustering, refactoring, and decomposition of the candidate services are the three main approaches used during this step of the process. Clustering requires changing the standard interactions of a service with another service. Decomposing services allows splitting services into more basic, “granular” services. Refactoring involves decomposing services and then grouping them based on relationships. The clustering, refactoring, and decomposing process is based on affinity factors that

influence grouping or separating services. Some of the affinity factors to be considered are:

- Affinity of critical or common private data
- Affinity of the interactions
- Density of interactions
- Time constraints of the interactions
- Transactions or referential integrity of update activity
- Natural separation of activities
- Designer determination/choice

Occasionally, new factors affecting service granularity are identified during the process of service specification and documentation. In this case, going back to the previous step of the identification process might lead to more efficient service identification. Thus, the service identification process is an iterative process in which additional iterations might be viable even after deploying an initial set of services.

4.8 Prioritization

The goal of the prioritization step is to create a catalog of services in prioritized order for implementation. The prioritization of the services should occur in a systematic way using a given set of criteria. Having a solid process will go a long way in dispute resolution and will facilitate a solid mechanism for organizing and reorganizing services based on criteria. The high-level methodology for a systematic prioritization is the following:

- Determine prioritization categories, types, or factors
- Assign values or weighting to the categories, types, or factors
- Calibrate/modify the service prioritization values and weighting
- Pilot the service prioritization
- Assign and record the service prioritization
- Sort the service score in the service catalog sheet

Keep in mind your criteria may change over time. If this happens, you will need to be able to change the criteria and their values or weighting. This should be done for all of the new and nonimplemented services being considered for prioritization.

Other prioritization methodologies include service priorities directly set by management (which could have been addressed/combined in the driver's section) and a specially designed service review governance or board that reviews and assigns service prioritization. In any prioritization process, the end goal is the same—a ranked service catalog for implementation.

The term **PRIORITIZATION** is used to refer to the ordering of services based on an organization's business and technical priorities. All services related to the business driver(s) should be prioritized. This prioritization should be done using a consistent set of business criteria that are weighted based on the main business priorities and/or performance objectives.

The service prioritization exercise will focus on the service candidate catalog produced from the granularity analysis step. The practitioner and technologist (or assigned group) should make a first pass through the service candidate catalog to assign a service priority.

Service Priority Conflict Resolution

It is important to understand that priorities may vary widely in and between the business and technical communities. Therefore, it is important that you identify and define a common mechanism for resolving priority conflicts within your organization. It may be necessary to engage executive management to resolve these conflicts. No matter what mechanism is used for service conflict resolution, it should be a collaborative process and clearly understood by both the business and technical groups. Experience has shown that having a more formalized prioritization mechanism, as discussed above, will minimize conflicts and provide tangible rationale for the specific prioritizations.

The prioritization step will bring together the output from the granularity analysis step to create a prioritized catalog of service(s). The higher-priority services will provide more organizational value and support the delivery of more functions. In turn, service prioritization provides a systematic way to order services for implementation that support an organization's vision and mission.

4.9 Interdependency Analysis

Interdependency Evaluation

It is recommended that, after a service prioritization has been performed, the interdependence between services be determined. The interdependence evaluation is an important consideration as an organization moves towards or considers actual service implementation. Services may be dependent on other service(s). This is especially true for composite services. By definition, composite services typically have dependencies on other business services. Additionally, business services typically have dependencies on enabling service(s). Therefore, it is important that all service interdependencies be fully understood before beginning any service implementation. This is necessary to ensure efficient and successful service implementation. Dependency information captured during this step is also used within the Service Specification Package. Figure 8 highlights some of the business-

based service dependencies. Column F depicts the predecessor interdependencies for a given service.

Service Interdependency Evaluation (1)				
Service #	Service Name	Service Description	Service Interdependency	1st Pass
1	Find a Picture	Using Department of Transportation, corrections, probation, and arrest systems, search for all pictures.	8	3
2	Find a Person	Using any combination of information, find a person of interest's demographics including current and last known address(es).	1,6,8	6
3	Find a Warrant	Using any combination of information, determine whether a warrant exists on an individual.	2,1,6,8	5
4	Conduct Background Check—CJIS	Access various sources to determine whether an individual can access NCIC/III via CJIS requirements.	1,2,3,5,6,8	7
5	Conduct Federal Employee Background Check	Access various sources to determine whether a federal employee clears FIPS 201 background check.	1,2,3,6,8	8
6	Find a Fingerprint	Using an individual's set of fingerprints, obtain a state or federal identifier.	8	1
7	Notify of Prison Release	Service publishes information to subscribers based on an individual's impending release from prison.	8	2
8	Authentication	Service provides authentication of both users and services.	None	4

Figure 8: Service Interdependency Evaluation

Note: Depending on the business drivers selected during the first step of the service identification process, it may be necessary to depict other service interdependencies. For any given project, it would be necessary to represent the project-to-project and project-to-service interdependencies. Knowing all of the service-to-project dependencies will determine which services are needed to complete which projects and the order in which services should be completed to facilitate direct high-business value.

Independently of the drivers selected, it is important to understand all service interdependencies before implementing services. Performing a service interdependence analysis will achieve a proper service ordering for implementation. This will ensure limited costs and the correct ordering of any dependent services to deliver on the identified business objectives.

After the Service Interdependency Evaluation above has been completed, the total service prioritization score from the service catalog prioritization sheet should be merged. This is accomplished by ranking the *total service prioritization* scores from greatest to smallest (assigning a 1 to the highest total service score, a 2 to the next highest service total score, and on down to the lowest service score). The highest-ranked number should equal the total number of services being identified. Column G (1st Pass) in the table below represents the priority of the total service prioritization from the service catalog prioritization sheet.

Figure 9 shows the results of such an exercise. The service prioritization will show the balancing of the service interdependencies, high-priority projects, and capabilities needed by an organization.

After merging the work from the service catalog prioritization scores and the Service Interdependency Evaluation, a final priority for service implementation can be calculated. In the sheet below, Column H (2nd Pass) represents the final priority for service implementation. This column value is calculated by starting with the highest-priority service (1 in Column G) and tracing the service interdependencies. For example, the “Find a Fingerprint” service has a dependency on the “Authentication” service. There are no further interdependencies on the “Authentication” service, so the 2nd Pass column is assigned priority 1. If additional interdependencies exist, the tracing of the interdependencies should be continued and performed until no other service interdependencies exist or all the services interdependencies have been given a value in the 2nd Pass column, or other existing interfaces can be used until they can be services enabled. Subsequently, this process should be performed for the next priority in the 1st Pass column (priority 2, “Notify of Prison Release”).

Service Interdependency Evaluation (2)					
Service #	Service Name	Service Description	Service Interdependency	1st Pass	2nd Pass
1	Find a Picture	Using Department of Transportation, corrections, probation, and arrest systems, search for all pictures.	8	3	4
2	Find a Person	Using any combination of information, find a person of interest's demographics including current and last known address(es).	1,6,8	6	5
3	Find a Warrant	Using any combination of information, determine whether a warrant exists on an individual.	2,1,6,8	5	6
4	Conduct Background Check—CJIS	Access various sources to determine whether an individual can access NCIC/III via CJIS requirements.	1,2,3,5,6,8	7	8
5	Conduct Federal Employee Background Check	Access various sources to determine whether a federal employee clears FIPS 201 background check.	1,2,3,6,8	8	7
6	Find a Fingerprint	Using an individual's set of fingerprints, obtain a state or federal identifier.	8	1	2
7	Notify of Prison Release	Service publishes information to subscribers based on an individual's impending release from prison.	8	2	3
8	Authentication	Service provides authentication of both users and services.	None	4	1

Figure 9: Service Interdependency Evaluation

These two lists will bring together work currently affecting your organization and the high-priority capabilities needed to produce real-world effects. By reviewing both of these documents and discussing your business and technical goals, your organization will be able to create an accurate catalog of prioritized services for implementation.

Interdependency Resolution

The end goal of the interdependency resolution process is to provide a final catalog of services for validation. This step depends on your organization's level of management and budget involvement in the service definition process. This process

should be actively considered, defined, and deployed for organizations that require a more active level of management in services being identified for implementation.

This process allows for any final trade-offs in the priority pressures and the interdependencies that were identified in the preceding process. It is a simple review of the interdependency evaluation with the key decision makers. This process will review the difficulties with priorities and service interdependencies. Additionally, this is the right time to highlight any existing interfaces that can be used temporarily and the risk of doing so with the key decision makers. During this process, the key decision makers should include and highlight any other political pressures not previously identified in the prioritization tool. Most of the discussion in the resolution process will be balancing the services prioritization and the resources (cost, time) necessary to complete the services. This resolution process will allow a final “level-setting” with the key stakeholders before the final services are validated for implementation.

4.9.1 Validation

The end goal of the validation step is to ensure that the draft catalog of services created in the previous steps is validated against the business processes of the organization and that an appropriate architectural foundation is in place for the services being considered for implementation. This process should confirm and solidify the catalog of service candidates that will provide business value and ultimately real-world effects for the organization.

Business Value Validation

It is necessary to balance the projects and the service interdependencies to get a catalog of services that will allow for delivery in accordance with top business drivers. Since the services have been previously aligned with their respective business values, they can be sorted based on business value from high to low. This sorted catalog will provide a validation that the services planned for implementation and assigned high value are truly in the right order. This work, in essence, will validate the business value associated with the identified services.

Architectural Validation

Consideration needs to be taken to determine whether the architecture to support the volume and speed of implementing services is available. Trying to implement or deploy too many services that require functional parts and capabilities from the existing architecture [e.g., security, authentication, privilege management] that might be either missing or immature will present risk. This risk to the business needs to be weighed against the business gains derived from implementing without this functionality.

To effectively give adequate consideration to the architecture needed by the catalog of services, it is recommended that a service to architecture cross=matrix be created. The architectural foundation items to be considered might include a grouping of specific functional items such as:

- Mediation
- Security
- Governance

For more information about the architectural foundation elements associated with SOA and identified by the GRA, please refer to the GRA Execution Context Guideline Document.

A valuable approach to validation of the services identified and prioritized is mapping them to the as-is or to-be business process model created during the interaction analysis step of the process.

5. Terms and Acronyms

Choreography—Refers to an executable business process that can interact with both external and internal services. Compared with orchestration choreography, represents collaboration between the producer and the consumer of the service.

Orchestration—Refers to an executable business process that can interact with both external and internal services. Orchestration always represents control from the perspective of either the producer or the consumer of the service.

Prioritization—Refers to the ordering of services based on an organization's business and technical priorities.

Service—The means by which the needs of a consumer are brought together with the capabilities of a provider.

Visibility—The capacity for those with needs and those with capabilities to interact with each other.

6. References

- FEA WIKI** Federal Enterprise Architecture, Wikipedia.
http://en.wikipedia.org/wiki/Federal_Enterprise_Architecture.
- FTF** U.S. Office of Management and Budget. *Federal Transition Framework (FTF) Metamodel Reference*, Version 2.0, January 2008.
http://www.whitehouse.gov/omb/assets/fea_docs/FTF_Metamodel_Reference_Ver_2_0.pdf.
- GRA** Global Infrastructure/Standards Working Group (GISWG) Global Reference Architecture (GRA) Specification, Version 1.8, April 2011. <http://it.ojp.gov/globaljra>.
- SOA Principles** Erl, Thomas. *An Introduction to the Service-Oriented Paradigm*. www.serviceorientation.org.

Appendix A—Federal Enterprise Architecture (FEA)

The FEA consists of a set of interrelated reference models designed to facilitate cross-agency analysis and the identification of duplicative investments, gaps, and opportunities for collaboration within and across agencies. Collectively, the reference models comprise a framework for describing important elements of the FEA in a common and consistent way.

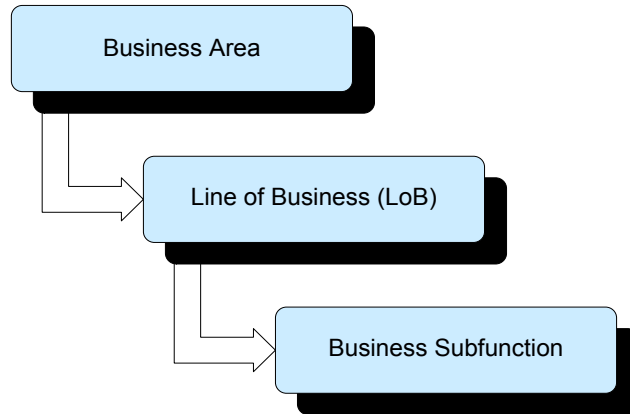
Through the use of this common framework and vocabulary, IT portfolios can be better managed and leveraged across local, state, and federal governments. The five reference models (RM) that comprise the FEA are listed below:

- Performance Reference Model (PRM)
- Business Reference Model (BRM)
- Service Component Reference Model (SRM)
- Technical Reference Model (TRM)
- Data Reference Model (DRM)

In developing the Business Capabilities Analysis model, we use the FEA Business Reference Model (BRM) lines of business (LoB) and business subfunctions to provide a high-level framework in which to begin identifying those capabilities within a given justice organization. Subsequent functional decomposition of business subfunctions and capabilities specific to an organization are performed to produce a capabilities catalog.

FEA Business Reference Model (BRM)

The BRM provides a framework facilitating a functional (rather than organizational) view of the federal government's LoBs, including its internal operations and its services for citizens, independent of the agencies, bureaus, and offices performing them. The BRM describes the federal government around *common* business areas instead of through a stovepiped, agency-by-agency view. The BRM is structured into a tiered hierarchy representing the business functions of the federal government that can also align with state and local governments at the highest level of the model.



FEA Business Reference Model (BRM)

In development of the Business Capabilities Analysis model, we use the BRM “Service for Citizens” business area, which contains those LoBs and corresponding high-level business subfunctions that align with the justice enterprise.

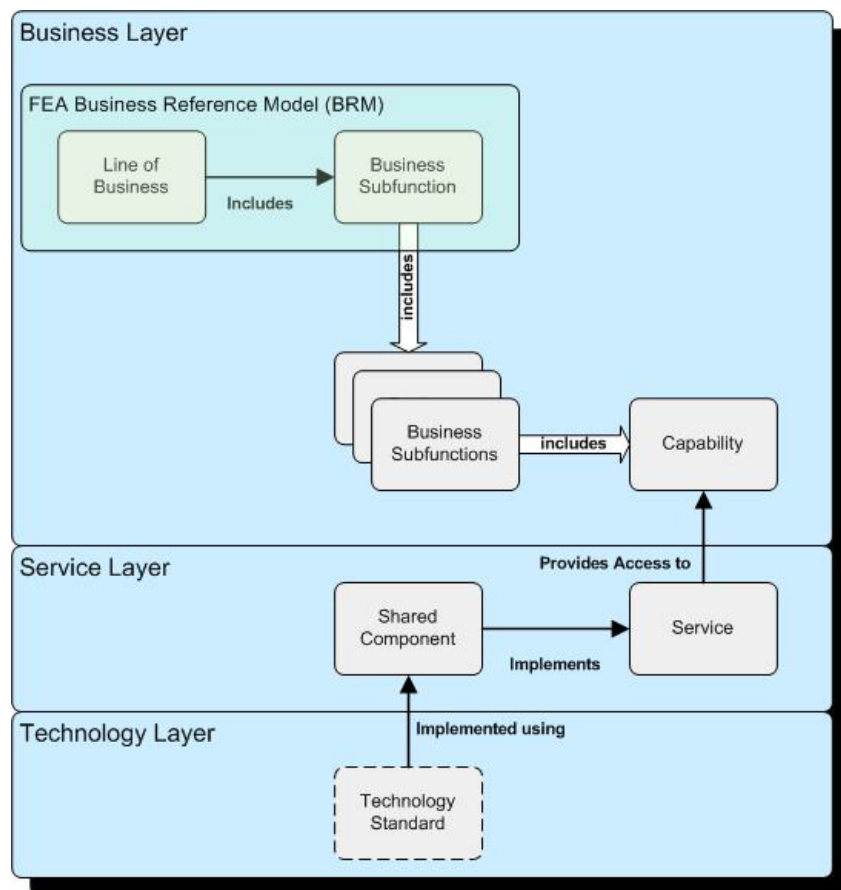
The following table shows justice domains and their associated BRM LoBs and business subfunctions used in our Business Capabilities Analysis model. This provides the high-level framework in which to perform a functional decomposition for any state, regional, or local business entity. The functional decomposition process will yield the underlying business capabilities associated with those functions.

Domain	BRM LoB and Business Subfunctions
Law Enforcement	(115) Law Enforcement
	044: Criminal Apprehension
	045: Criminal Investigation and Surveillance
	046: Citizen Protection
	047: Crime Prevention
	048: Leadership Protection
	049: Property Protection
	050: Substance Control
	051: Citation
	(104) Disaster Management
Corrections	008: Disaster Preparedness and Planning
	010: Emergency Response
	(102) Correctional Activities
Courts	005: Criminal Incarceration
	006: Criminal Rehabilitation
	(116) Litigation and Judicial Activities
	051: Judicial Hearings
	052: Legal Defense
Integrated Sharing Environment (ISE)	053: Legal Investigation
	054: Legal Prosecution and Litigation
	055: Resolution Facilitation
	(115) Law Enforcement
	(113) Intelligence Operations
	213: Intelligence Planning and Direction Needs
	214: Intelligence Collection
	215: Intelligence Analysis and Production
	(103) Defense and National Security
	211: Operational Defense
	(111) Homeland Security
	033: Border and Transportation Security
	034: Key Asset and Critical Infrastructure Protection
	035: Catastrophic Defense

BRM LoBs and Business Subfunctions for the Justice “Enterprise”

Appendix B—Federal Transition Framework (FTF)

In development of the Business Capabilities Analysis model, we use components within the business and service layers of the FTF to perform the business decomposition. Of these components, shown in the following diagram, two are provided by the FEA BRM to establish a framework in which we identify lower-level business subfunctions, capabilities, and services. As shown, services provide [automated] access to capabilities.



Business Component Definitions

Domain—A [justice] organization that is composed of one or more LoBs [e.g., fusion centers, law enforcement, corrections].

Line of Business (LoB)—A particular kind of product or service provided within a given domain.

Business Function—Decomposition of a line of business into smaller, more concrete functions.

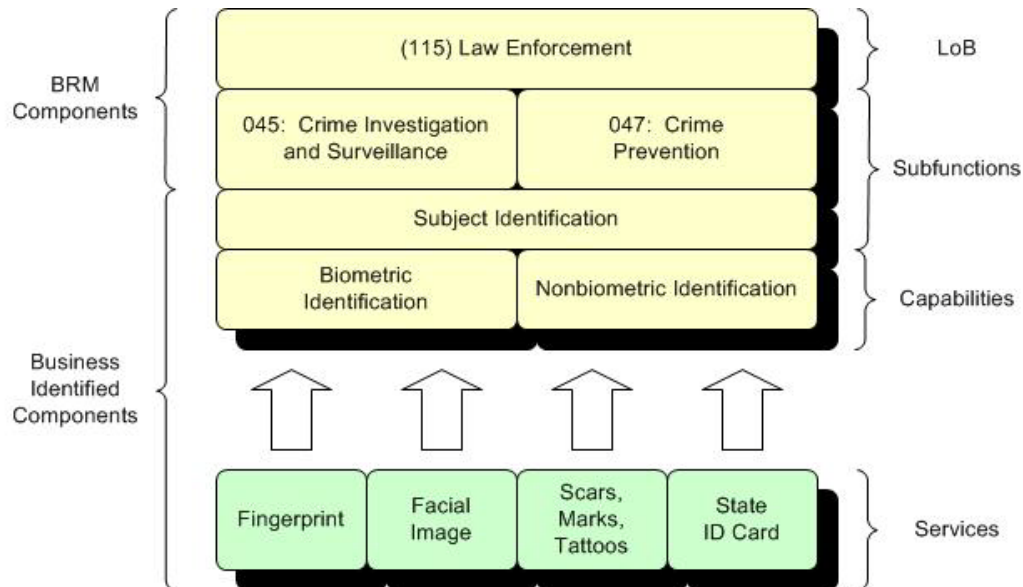
Business Subfunctions—Further decomposition of business functions into additional lower-level concrete functions.

Capability—An activity performed by a justice domain [e.g., fusion centers] yielding a result of measurable value [real-world effect] to one or more justice domains.

Service—In a service-oriented architecture, a service is the way in which one partner gains access to a capability offered by another partner. A partner that uses a service to gain access to another partner's capability is called a service consumer. Services can be shared across a single or multiple domains.

Appendix C—Business Capabilities Analysis Example

The following diagrams show a Business Capabilities Analysis model example for law enforcement. In this example, we identify the capabilities Biometric Identification and Nonbiometric Identification within corresponding business subfunctions. Access to the capabilities is provided by services.



The Business Capabilities Analysis model can also be represented in narrative as follows:

The <blank> Domain is composed of the <blank> LoB that includes the <blank> Subfunction [that includes the <blank> Subfunction] that includes a <blank> Capability through which access is provided by the <blank> Service.

For example:

The <Cayuga County Sheriff's Office> is composed of the <115-Law Enforcement> LoB that includes the <045-Crime Investigation and Surveillance> Subfunction that includes the <Subject Identification> Subfunction that includes a <Biometric Identification> Capability through which access is provided by the <Fingerprint> Service.

Users are encouraged to provide more levels of detail in their modeling through the use of multiple subfunctions to determine core capabilities.

Document History

Date	Version	Editor	Change
December 2008	1.0	Scott Came	Initial draft
April 2011	1.1	James Douglas	Update to paragraph titled “Avoiding Excessively Broad Services.”
April 2011	1.1		Changed JRA to GRA.

Editors

Scott Came	James Douglas	David Gillespie

About Global

The U.S. Department of Justice's Global Justice Information Sharing Initiative (Global) serves as a Federal Advisory Committee to the U.S. Attorney General on critical justice information sharing initiatives. Global promotes standards-based electronic information exchange to provide justice and public safety communities with timely, accurate, complete, and accessible information in a secure and trusted environment. Global is administered by the U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Assistance.

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