6.0
ENTERPRISE SOLUTION ARCHITECTURE (ESA)

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The overarching ESA is described in this section and includes a discussion of the current state and future state of the solutions environment. For the current state the focus is on information systems/applications software and for the future state vision the focus is on a comprehensive set of services-oriented solutions to meet State's business needs. This section also includes a summary of the T&S Plan to achieve the future state vision for the ESA.

The ESA plays a critical role in enabling the State's vision of realizing an integrated enterprise that consists of streamlined and efficient operations for all business processes. The ESA is also the most tangible and direct support layer of the EA in relation to the business mission and services. It also is the IT component that staff and the public directly interact with in automation of business process and information delivery. The ESA is considered as the driving force for the structure and complexity of the underpinning technology architecture layer and requires a robust multi-functional technological platform.

6.1   ESA CURRENT STATE

The current state of the ESA was characterized as part of the Final Report. The report noted the weaknesses and legacy condition of the few, true statewide solutions, the large number of applications that have proliferated within the State and the critical need for "right-sizing" the applications portfolio. The findings from the Final Report are summarized in Table 3 by the criteria that indicate the maturity of the application portfolio as a whole and the characterization of any single application within this spectrum.

Table 3: Solution or Applications Assessment Results

Application Portfolio Assessment Criteria	Findings
Stability – the number and extent of failures, down-time, "break-fix" cycles, or general risk	• Numerous applications due to staff reductions and funding shortages exist in an aged condition • Many initiatives to upgrade or replace legacy applications and their supporting middleware and hardware infrastructures were postponed
Optimization – measuring redundancy, duplication, and "waste"	• Over 700 applications • A significant set of older mainframe applications, based on the "batch processing" model, require numerous smaller applications to support data interface feeds and outputs • A lack of enterprise-wide data governance and integrated databases results in numerous interfaces in order to support data mapping and translation • A lack of effective central systems for many of the shared service areas cause the Departments to develop their own supporting systems to ease their interfaces with the central system • Federal program-driven funding promotes solution architecture decisions that do not support enterprise application consolidation • A lack of budget/funding creates an environment that proliferates single user or small work group applications that are easier and less costly to create

Application Portfolio Assessment Criteria	Findings
Standardization – measuring the underlying technologies (middleware and hardware/software platforms) required	• Lack of funds to support upgrades results in a broad set of older technologies continuing to be used in the environment, and this increases incompatibilities (e.g., desktops requiring older, unsupported version of Windows or Internet Explorer) • Numbers of software product incompatibilities make it almost impossible to plan for enterprise-level upgrades, and this mixture of new and old software versions opens the enterprise to increasing levels of vulnerability from malware
Integration – the characteristics and ability for an application to be well integrated with other applications and data within the enterprised	• Point-solution approaches/situations have proliferated and work against enterprise or LOB integration • Lack of an enterprise organization to champion integration and/or funding to support enterprise solutions reduces integration
Alignment – to business mission, services, priorities, strategies – the value in achievement of critical, high priority mission objectives	• Significant investments within the "have" Departments and minimal investments in the "have not" Departments to develop and maintain applications perpetuate an imbalanced environment • Fundamental capabilities expected in enterprise solutions are lacking (e.g., global address list, shared calendaring, paper-based processes, lack of emerging technology support such as mobile devices and social media) cause frustration
Responsiveness and Agility – to changing business needs – ability to respond with relative ease to change versus being overly complex and awkward to supporting change	• Agility is limited because considerable customizations have been made to custom-off-the-shelf (COTS) software • Reliance on one-off applications (e.g., the DCCA Lotus Notes-based Legislation Tracking System) and their proliferation as pseudo-enterprise systems are now preventing the application of vendor upgrades

One of the weakest areas of the solutions or applications portfolio is the apparent lack of control in enterprise integration and consolidation for statewide support services. As noted in Table 3 many Departments have developed redundant capabilities. Creating the "right number" of enterprise support service solutions is the key challenge for the future state.

6.2   ESA FUTURE STATE

The State is facing an environment of continuous and rapid change due to technological surges and the need to transform old paradigms into new agent-based, service-oriented dynamic integration architectures. The demand for real time integration across disparate lines of business, enterprise applications, Web services, mobile interfaces, and networks, is driving industry toward pursuing standards that will enable open systems architectures to realize seamless access to multiple platforms and services. The desired outcome is the total integration of internal and external entities across the total enterprise.

The vision for the future ESA is a dynamic mobile integration architecture that responds rapidly to change and delivers quality information from trusted sources all stakeholders. This promising computing environment enables efficient services selection by LOBs delivering enterprise services while providing for the seamless integration with external stakeholders and in this case the citizens and residents of Hawai`i . The combination of intelligent Web services and mobile agents provides for the personalized demands needed by state employees to perform their missions and for the citizens and residents of Hawai`i to directly access information that is relative to their personal situations.

The future state ESA will be implemented within a common solutions framework that achieves the desired interoperability and integration, as illustrated in Figure x below. The key elements of the future state vision are outlined Figure 26 .
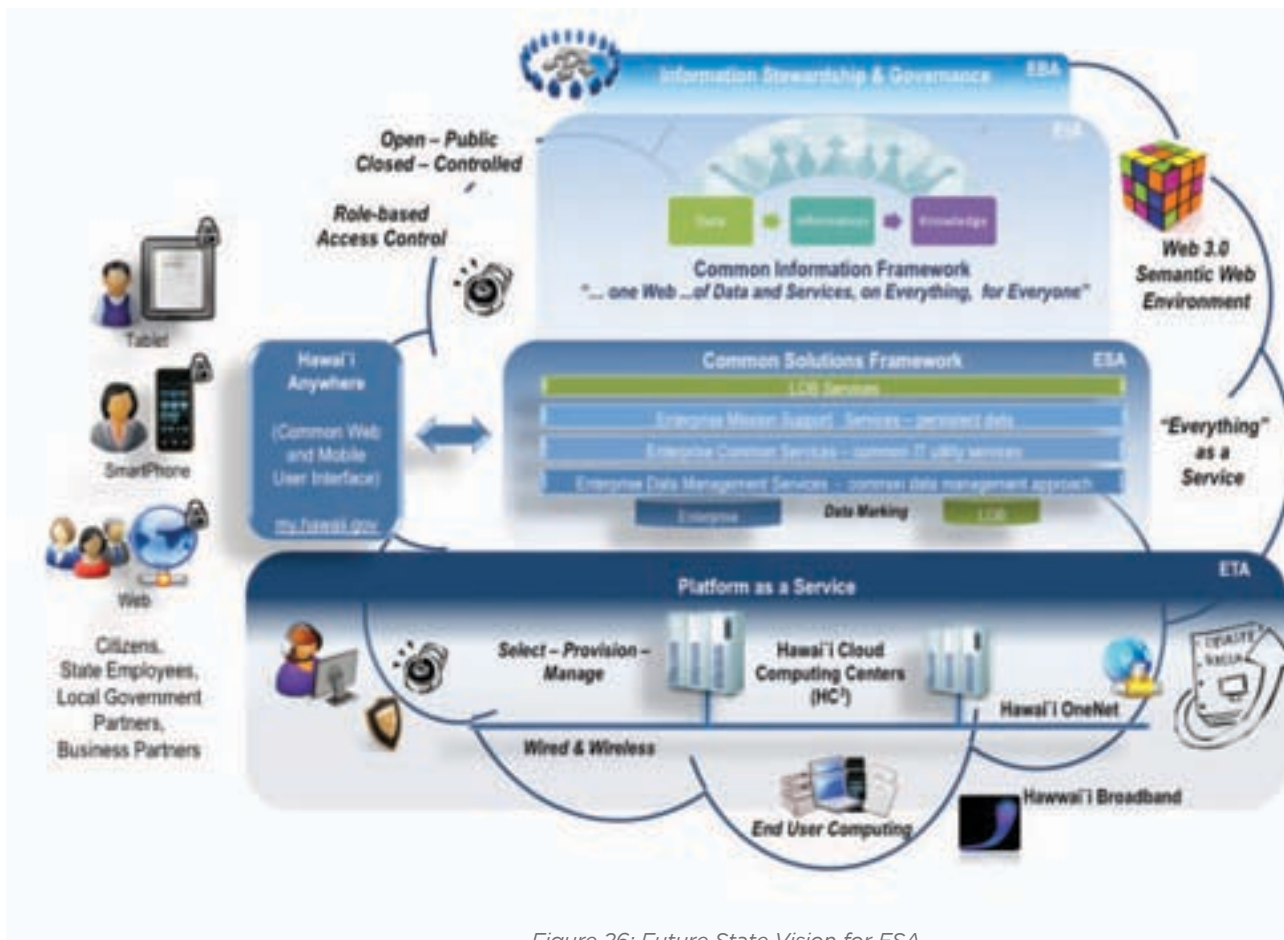
Figure 26: Future State Vision for ESA

6.2.1 VISION FOR THE FUTURE STATE ESA

The enabling of this vision occurs through a common solutions framework within the State that includes the following:

• Each individual's user experience with the State's automated solutions is personalized through a "my Hawaii.gov" portal that knows the person's roles, history of service usage, information interests, and tailors the portal accordingly – constantly changing based on usage. The user interface has shifted to mobile Smartphones and tablets with the portal look and feel consistent across all user devices. Solutions are built once with a user interface standard like HTML5 that works equally well across all mobile platforms.

• The solutions within the State's portfolio have been completely rationalized and transformed. All common support services have been reengineered with new service oriented solutions that effectively meet the needs of the core mission areas – all redundant support applications, like procurement or financial reporting have been eliminated.

• All of the support services have been automated through a common, integrated ERP system – resulting in broad integration across these shared services. The ERP scope includes planning and resource allocation, budgeting, financial tracking and reporting, time and attendance, payroll, accounts payable/warrants, accounts receivable, revenue collection, human resource management, procurement, asset management, facilities management, and other general services.

• "Everything is a service" is the new solutions paradigm enabling full integration across the enterprise. Business process automation has moved to a to a full component assembly approach, like LEGOTM building blocks, implemented through services and linked resources supplying information (Semantic Web).

• Cross-cutting services are organized into two subordinate layers for effective governance:

– Enterprise Common Services – a "utility" layer for common enterprise IT services to include security services such as identity and access management; digital content services supporting documents and records; process automation supporting end-to-end workflow, robust search capabilities across the enterprise; and integrated collaboration, analytics, and geospatial visualization capabilities.

– Enterprise Mission Support Services – a layer for common business support functions and information persistence to include customer and case master information; business management master information for organizations, programs, plans, and portfolios; service management life cycle support for performance tracking and continuous improvement; ERP services for common budgeting, financial, human resources, and acquisition functions; and knowledge management for retention and reuse of problem domain knowledge.

• The enterprise data layer has been separated from the application software itself through a robust set of official enterprise and LOB databases and Web accessible data resources – the enterprise information and data has been liberated for widespread use within and outside the State government, and all State business solutions can make use of it.

• The people of Hawai`i and citizens are full stakeholders – State information is published through "data.Hawaii.gov" and some of the most important new applications are created by citizens. The solutions portfolio for the core mission areas such as public health or land and natural resources has a true blending of support from joint partnerships with community, private businesses, and Federal and local governments.

• "App stores" or catalogs are maintained across these stakeholder communities for sharing and reuse. The application communities include the ability to leverage and reuse applications from other States and the Federal government. An applications development ecosystem model is used to support the collaboration and reuse of open source and community source software.

• Internal to the State's portfolio management discipline, solution patterns have been standardized resulting in optimized development approaches, tools, technical skills, and technology infrastructures, which reduces maintenance support costs and facilitates synergies in enterprise-wide knowledge and expertise. In a controlled manner, any recommendations for evaluating new emerging technologies are sanctioned, and an overall enterprise discipline for "new product/technology evaluation and insertion" has matured. The solutions portfolio includes a lifecycle perspective, incorporating refresh plans after a reasonable life expectancy.

6.2.2
GUIDING PRINCIPLES FOR THE COMMON SOLUTIONS FRAMEWORK

The guiding principles for the State's Common Solutions Framework were outlined above and are expanded below. The discussion identifies the common goals, end objectives, strategies, policies, and guiding principles of the State's Common Solutions Framework to achieve the future state vision.

6.2.2.1 ENTERPRISE INTEGRATION

It is the intent of the State of Hawai`i to achieve optimal business performance through business functions and processes being integrated through the use of common solutions. The solutions will be viewed as enterprise assets and not "owned by" individual Departments or programs.

The State of Hawai`i directs and controls the design and implementation of integrated solutions through its EA Methodology. The emphasis for achieving integration is placed on managing architectures at an enterprise level and at a LOB segment level. Integration will be achieved through analysis of integration requirements at these respective levels and architecting solutions and technologies to implement them.

6.2.2.2
USE OF INDUSTRY STANDARD APPLICATION SOFTWARE WITHIN A SERVICES-ORIENTED ARCHITECTURE

Standard practice for the State of Hawai`i is to pursue the acquisition and implementation of industry standard application software. For State government, industry standards are found in both commercially available and government available off-the-shelf application software (COTS/GOTS). Industry standard application solutions should adhere to standards for services-orientation; so that they will be compatible with and interoperable with all service components within the ESA common solutions framework.

Implementing comprehensive application software packages provides a significant advantage due to industry standard "best practices" and the scope of integration across the business functions they implement. Packages are chosen to address as many functions within the enterprise as is practical. As a result, the number of application packages is minimized. Customizations to the standard industry business processes and rules contained within the package are kept to a minimum.

The State is an active participant in State and Federal communities of practice in order to collaborate on standard solutions. The State leverages and reuses applications from other States and the Federal government.

6.2.2.3 STEWARDSHIP/LEADERSHIP AND GOVERNANCE

Management and oversight of common information assets, systems, and supporting technologies is based on a stewardship approach that continually assesses the benefit for the people of Hawai`i and citizens and internal and external organizational stakeholders. Stewardship/leadership responsibilities are established at the two levels of integration.

1. The CIO and OIMT will have primary responsibility for managing the EA, and

2. The Department Director/Deputy Director designated as the LOB lead or portfolio executive has primary responsibility for managing the LOB Segment Architecture.

The overall management and oversight of the ESA is conducted in accordance with the established OIMT governance model with two primary bodies – the Executive Leadership Council (ELC) leading business strategy and architecture and the CIO Council (CIOC) leading IT strategy and architecture. The ELC governs decisions regarding customizations to COTS/GOTS software and function as a liaison to the Legislature for appropriate legislative adjustments to facilitate changes to business processes to minimize COTS/GOTS customizations.

6.2.2.3
OPEN SOURCE SOFTWARE AND COMPLIANCE WITH OPEN STANDARDS

The State of Hawai`i should consider the use of software that incorporates or uses open standards when making decisions on software solution procurements. Open source software presents opportunities to implement solutions with minimal acquisition cost and maintenance of licenses. Decisions on use of open source software or software in compliance with open standards should be made in the context of total cost of ownership to include both acquisition and on-going operational costs.

6.2.2.4
SERVICE ORIENTATION, SOFTWARE REUSE, AND SOLUTIONS INTEGRATION

The EA development for the State of Hawai`i inserts itself into a "point in time" where the software development paradigm continues to evolve from object orientation to component-based development and now to service-oriented architecture (SOA). Each of these paradigms and frameworks share some common foundational goals for best practices in software development:

• Objects, components, and services all represent natural building blocks. By moving software development to a building block and assembly paradigm, like LEGOTM building blocks, building of more complex structures is facilitated through reuse of solid, well formed, and tested pieces resulting in higher quality solutions.

• The building blocks are defined and structured to accomplish discrete routine functions that are highly interoperable and facilitate reuse, and this very building block/assembly paradigm results in unique approaches within the software architecture, design, and implementation lifecycle activities.

• Each block is structured as an independent "black box" (i.e. self contained) in accomplishing its function(s) and it presents a well defined and relatively simple "interface" to its users or consumers {loose coupling or loosely joined) in order to maximize reuse.

• Services go beyond object-oriented or component-based development paradigms in achieving these goals of independence, loose coupling, and simplicity of interface. Services are independently published for use and stand on their own (no linking or builds of executables), have no specific development technology or platform constraints, and services have evolved relatively simple and elegant interface specifications through Web service technologies such as XML and Simple Object Access Protocol (SOAP).

To achieve these benefits, the State's common solutions framework incorporates a services orientation approach and framework within its software development life cycle (SDLC) – a set of principles, methods, and tools/technologies for architecting, designing, and developing enterprise solutions using highly interoperable services. To this end, the ESA features a horizontal services layer that implements these common reusable services to achieve extensive integration across the enterprise.

It should be noted that the development of a services orientation or SOA framework for the State of Hawai`i is approached in a pragmatic manner. There is recognition in the value of the design principles of SOA even at a departmental level, and that benefits can be realized with a standardization of Web service oriented technologies, as opposed to implementation of a framework based on proprietary technology choices, an example being an enterprise service bus technology. It is this lightweight approach that the State will be pursuing.

Effective reuse of services as well as open source or community source software requires knowledge within the development community of what services and software are available and how to effectively use them. The OIMT Enterprise Architect has the primary responsibility for maintaining a catalog of services and for steering the architecture of individual solutions towards use of the enterprise services and software.

6.2.2.5 STANDARD ENTERPRISE SOLUTION PATTERNS

One of the primary objectives and standardization strategies of the ESA is the establishment and maintenance of standard enterprise solution patterns. Standard solution patterns include guidance and specifications on implementation methods, p latforms, tools/technologies, service/component reuse, available training, and available consulting support. Standard approaches and technologies for application software development are required to optimize human resource skills within the increasing complexity of the multi-tier development paradigm for Web and mobile applications (apps).

The cultural history of the State government has funded programs to create individual point solutions that are implemented on a dedicated technical infrastructure. Going forward programs "buy into" the standard solution patterns that are part of the ESA with necessary representation, participation, and collaboration from the CIOC. In the long run, the overall cost effectiveness of managing standard technologies and the ability for the enterprise to more effectively leverage technology for enhancing impact in business service delivery are optimized.

Also, standard solution patterns support and are facilitated by the State moving to a cloud computing environment where standard application platforms can be rapidly provisioned through a service catalog request.

Solution patterns are initially developed by a working group convened and empowered by the CIO and the CIOC to develop the details of the framework. The working group includes technical architects from a number of State Departments that have significant experience with software development and system integration.

The Enterprise Solution Patterns framework is used to give focus to the development and maintenance of solution patterns that have broad application across the State's business lines. A list of potential solution patterns includes the following:

• Web Application
• Mobile Application
• Web Service
• Analytics Application

Any given application or system might not fit cleanly into exactly one of these patterns. The patterns are not meant to concisely categorize an application, but rather to provide guidance to the design, development, and deployment of applications that have significant elements from any and all patterns. The fundamental idea is to provide guidance on how to effectively implement solutions that fit one or more of the standard patterns.

Each solution pattern specification provides guidance for the common set of topics provided in Table 4.

Table 4: Common Set of Specification Areas for Each Solution Pattern

Guidance Area	Description
Implementation Methods and Best Practices	• Guidance provided on extensions to the standard SDLC methodology specific for the pattern.
Implementation Platforms	• Guidance provided (consistent with the State's ETA) on platforms that are recommended for implementation.
Tools/Technologies	• Guidance provided that outlines appropriate and recommended tools and technologies applicable to the pattern.
Available Training and Consulting Support	• Guidance provided on useful and available training relevant to implementation of the pattern. Where appropriate, sources of potential consulting or 3rd party assistance will be identified.

6.2.2.6 THE ROLE OF THE ESA

Initial implementations of both the EA and the LOB Segment Architectures were developed during the second half of FY2012. Moving forward these architectures will be maintained and used as the goal or "north star" guidance for achieving the desired integration of all information assets, systems, and technologies. Individual technical solution projects obtain integration and standardization requirements from these architectures and design and implement the target systems in compliance with the architectures.

6.2.3   CONCEPTUAL SOLUTIONS ARCHITECTURE

The conceptual solutions architecture depicts the future state enterprise solutions architecture as a common model of the comprehensive set of services required to fulfill all business requirements for the State.

The conceptual solutions architecture is characterized as follows:

• Formative – The conceptual solutions architecture establishes the overarching structure of the ESA to organize vertical LOB solutions and horizontal services and to clarify stewardship leadership boundaries. It is an initial high level version implemented with the expectation that it will continue to be refined and expanded. The diagram organizes the solutions and services within three horizontal bands: 1) Enterprise Mission Systems or LOB solutions, 2) the Enterprise Support Systems, and 3) the Enterprise Services.

• Notional Approach – This set of solutions are notionally based on the defined business functions within the LOBs. A primary goal of the ESA is to move the State towards a rationalized set of solutions recognizing that the current state has over 700 applications or systems. There are approximately 200 business services associated with the LOBs within in the EBA layer and one business solution per business function supported by Enterprise Services provides a more reasonable portfolio size. Additionally, the implementation of COTS/GOTS packages (e.g.,

ERP system within the Enterprise Support Systems band of the future state model) further supports the consolidation.

• The set of Enterprise Services is also notionally based on the SRM identified in the EBA and defines a set of shared services for further evaluation and refinement.

6.2.3.1   LOB SERVICES

Some Departments are further along in the development of a future state ESA architecture for their associated LOBs and in those cases the conceptual solutions architecture must be perpetually updated with that information. Additional refinement to the ESA also occurs as a result of the segment architecture development, and this information is discussed in Appendix A.

6.2.3.2   ENTERPRISE SERVICES

One of the most important elements of the ESA is establishing the approach and framework for integrating the State's applications or solutions going forward. As discussed above, this integration is primarily achieved through the Enterprise Common Services band within the ESA. It supports the services oriented framework that provides – independent of business function – a leverage-able foundation to support the reuse of applications, application capabilities, components, and business services.

Key concepts and considerations for future action regarding the Enterprise Services are outlined here.

• The organization and content for the services structure is originally based on the Federal SRM. This provides the State a vetted starting point, while making some adjustments that streamline the set to those services oriented to common shared use. The initial set of services derived from the SRM need to be continually assessed, refined, and prioritized for use in the State.

• The enterprise services are organized within 2 levels; the rationale for this is to facilitate the appropriate stakeholder governance participation for requirements and change management.

- The Enterprise Mission Support Services are business functional services that are common in support of LOB mission activities and feature the management and persistence of key shared data. Examples include customer (citizen, resident, state employee, business partner) data retention, or common functions within the enterprise resource planning realm such as financial tracking, asset inventory tracking, or procurement execution.

- The Enterprise Common Services are common IT utility services such as collaboration, digital content management, or geospatial visualization.

• The level of the conceptual solutions architecture establishes an organizational structure, scope and boundaries, and business objectives for these services. Oversight of this architecture should move into a next phase to detail requirements and to determine opportunities to prototype/pilot, and to determine an overall implementation approach.

Descriptions of each of the service domains are discussed below organized within the two layers of Enterprise Mission Support Services and Enterprise Common Services.

ENTERPRISE MISSION SUPPORT SERVICES

Customer Management Services

The Customer Services Domain consists of the capabilities and persistent information that are directly related to the end customer, the interaction between the business and the customer, and the customer-driven activities or functions. Table 5 provides a description of these areas.

Table 5: Customer Management Services Domain Description

Service Types	Service Components
Customer Relationship Management	• Customer / Account Management – retains identifying information about the customers of the organization and their interest in specific services • Customer Analytics – the analysis of an organization's customers as well as the scoring of third party information as it relates to an organization's customers. • Contact and Profile Management – provides a comprehensive view of all customer interactions, including calls, email, correspondence and meetings; also provides for the maintenance of a customer's account, business and personal information. • Partner Relationship Management – provides a framework to promote the effective collaboration between an organization and its business partners, particularly members of the distribution chain (e.g., channel and alliance partners, resellers, agents, brokers, and dealers) and other third parties that support operations and service delivery to an organization's customers; includes performance evaluation of partners. • Customer Feedback – collect, analyze and handle comments and feedback from an organization's customers.

Service Types	Service Components
Customer Preferences	• Personalization – defines the set of capabilities to change a user interface and how data is displayed. • Subscriptions – defines the set of capabilities that allow a customer to join a forum, listserv, or mailing list. • Alerts and Notifications – defines the set of capabilities that allow a customer to be contacted in relation to a subscription or service of interest.
Customer Assistance	• Self-Service – defines the set of capabilities that allow an organization's customers to sign up for a particular service at their own initiative. Reservations / Registration – defines the set of capabilities that allow electronic enrollment and confirmations for services. Multi-Lingual Support – defines the set of capabilities that allow access to data and information in multiple languages. • Assistance Request - defines the set of capabilities that support the solicitation of support from a customer. • Scheduling - defines the set of capabilities that support the plan for performing work or service to meet the needs of an organization's customers.
Customer Case Management	• Customer Case Management – defines the set of capabilities for identifying and tracking the history of claims or investigations for a customer and presumption of a particular case or investigation within its workflow

The Business Management Services Domain consists of the capabilities that support the management and execution of business functions and organizational activities that maintain continuity across the business and value-chain participants.

Table 6: Business Management Services Domain Description

Service Types	Service Components
Organizational Management	• Organizational Management – defines the set of capabilities that support management of all levels of organization within the enterprise, including the organization hierarchy structure; all inherent levels such as departments, agencies, divisions, branches, etc.; and the identification of executives, managers, and staff members within the various sub-groups of the organization.
Program/Project Management	• Program/Project Management – defines the set of capabilities that support management of programs and projects, as well as more ad hoc workgroups of multiple users working on related tasks; and the associated executives, managers, and staff members.
Process Management	• Change Management – defines the set of capabilities that control the process for updates or modifications to the existing business processes of an organization. • Configuration Management – defines the set of capabilities that control the environments, as well as documents of an organization. • Requirements Management – defines the set of capabilities that gather, analyze, and fulfill the needs and prerequisites of an organization's efforts. • Governance / Policy Management – defines the set of capabilities intended to influence and determine decisions, actions, business rules and other matters within an organization.

Table 6: Business Management Services Domain Description

Service Types	Service Components
Process Management	• Quality Management - defines the set of capabilities intended to help determine the level of assurance that a product or service will satisfy certain requirements. • Business Rule Management – defines the set of capabilities for the management of the enterprise processes that support an organization and its policies. • Risk Management – defines the set of capabilities that support the identification and probabilities or chances of hazards as they relate to a task, decision or long-term goal; includes risk assessment and risk mitigation
Investment Management	• Strategic Planning and Management – defines the set of capabilities that support the determination of long-term goals and the identification of the best approach for achieving those goals. • Portfolio Management – defines the set of capabilities that support the administration of a group of investments held by an organization. • Performance Management – defines the set of capabilities for measuring the effectiveness of an organization's financial assets and capital.
Resource Planning and Allocation	• Resource Planning and Allocation – defines the set or capabilities that support the determination of strategic direction, the identification and establishment of programs and processes, and the allocation of resources (capital and labor) among those programs and processes.

KNOWLEDGE MANAGEMENT SERVICES

The Business Management Services Domain consists of the capabilities that support the management and execution of business functions and organizational activities that maintain continuity across the business and value-chain participants.

Table 7: Knowledge Management Services Domain Description

Service Types	Service Components
Knowledge Management	• Categorization – defines the set of capabilities that allow classification of data and information into specific layers or types to support an organization. • Knowledge Engineering – defines the set of capabilities that support the translation of knowledge from an expert into the knowledge base of an expert system. • Knowledge Capture – defines the set of capabilities that facilitate collection of data and information. • Knowledge Distribution and Delivery - defines the set of capabilities that support the transfer of knowledge to the end customer.
Information Management	• Information Retrieval – defines the set of capabilities that allow access to data and information for use by an organization and its stakeholders. • Information Mapping / Taxonomy – defines the set of capabilities that support the creation and maintenance of relationships between data entities, naming standards and categorization. • Information Sharing – defines the set of capabilities that support the use of documents and data in a multi-user environment for use by an organization and its stakeholders.

The ERP Services Domain consists of the capabilities that support the management of enterprise planning transactional-based functions.

Table 8: ERP Services Domain Description

Service Types	Service Components
Financial Management	• Billing and Accounting – defines the set of capabilities that support the charging, collection and reporting of an organization's accounts. • Credit / Charge – defines the set of capabilities that support the use of credit cards or electronic funds transfers for payment and collection of products or services. • Expense Management – defines the set of capabilities that support the management and reimbursement of costs paid by employees or an organization. • Payroll – defines the set of capabilities that involve the administration and determination of employee's compensation. • Payment/ Settlement – defines the set of capabilities that support the process of accounts payable. [Component and definition discovered in CRM dated 5/05] • Debt Collection – defines the set of capabilities that support the process of accounts receivable. • Revenue Management – defines the set of capabilities that support the allocation and re-investment of earned net credit or capital within an organization. • Internal Controls – defines the set of capabilities that support the methods and procedures used by the organization to safeguard its assets, produce accurate accounting data and reports, contribute to efficient operations, and encourage staff to adhere to management policies and mission requirements. [Added in FY06 submission; definition from CRM dated 5/05] • Auditing – defines the set of capabilities that support the examination and verification of records for accuracy. • Activity – Based Management – defines the set of capabilities that support a defined, specific set of finance-related tasks for a given objective. • Currency Translation - defines the set of capabilities that support the calculations and differences among multiple mediums of exchange.
Human Resources	• Recruiting – defines the set of capabilities that support the identification and hiring of employees for an organization. • Resume Management – defines the set of capabilities that support the maintenance and administration of one's professional or work experience and qualifications. • Career Development and Retention – defines the set of capabilities that support the monitoring of performance as well as the professional growth, advancement, and retention of an organization's employees. • Time Reporting – defines the set of capabilities that support the submission, approval and adjustment of an employee's hours. • Awards Management – defines the set of capabilities that support the recognition of achievement among employees of an organization. • Benefit Management – defines the set of capabilities that support the enrollment and participation in an organization's compensation and benefits programs. • Retirement Management - defines the set of capabilities that support the payment of benefits to retirees.

Table 8: ERP Services Domain Description

Service Types	Service Components
Human Resources	• Personnel Administration –defines the set of capabilities that support the matching between an organization's employees and potential opportunities as well as the modification, addition and general upkeep of an organization's employee-specific information. • Education / Training – defines the set of capabilities that support the active building of employee competencies to include the range of training from professional development to general awareness training. • Health and Safety – defines the set of capabilities that support the security and physical well-being of an organization's employees. • Travel Management – defines the set of capabilities that support the transit and mobility of an organization's employees for business purposes.
Human Capital Management	• Skills Management – defines the set of capabilities that support the proficiency of employees in the delivery of an organization's products or services. • Workforce Directory / Locator – defines the set of capabilities that support the listing of employees and their whereabouts. • Contingent Workforce Management – defines the set of capabilities that support the continuity of operations for an organization's business through the identification of alternative organization personnel. • Workforce Acquisition / Optimization – defines the set of capabilities that support the hiring and re-structuring of employees and their roles within an organization.
Assets/Materials Management	• Property / Asset Management – defines the set of capabilities that support the identification, planning and allocation of an organization's physical capital and resources. • Asset Cataloging / Identification – defines the set of capabilities that support the listing and specification of available assets. • Asset Transfer, Allocation, and Maintenance – defines the set of capabilities that support the movement, assignment, and replacement of assets. • Facilities Management – defines the set of capabilities that support the construction, management, and maintenance of facilities for an organization. • Computers / Automation Management – defines the set of capabilities that support the identification, upgrade, allocation and replacement of physical devices, including servers and desktops, used to facilitate production and process-driven activities.

Table 8: ERP Services Domain Description

Service Types	Service Components
Supply Chain Management	• Procurement - defines the set of capabilities that support the ordering and purchasing of products and services. • Sourcing Management – defines the set of capabilities that support the supply of goods or services as well as the tracking and analysis of costs for these goods. • Inventory Management – defines the set of capabilities that provide for the balancing of customer service levels with inventory investment. • Catalog Management – defines the set of capabilities that support the listing of available products or services that an organization offers. • Ordering / Purchasing – defines the set of capabilities that allow the placement of request for a product. • Invoice / Requisition Tracking and Approval – defines the set of capabilities that support the identification of where a shipment or delivery is within the business cycle. • Storefront / Shopping Cart - defines the set of capabilities that support the online equivalent of the supermarket cart, where orders and merchandise are placed. • Warehouse Management – defines the set of capabilities that provide for the storage and movement of materials within a warehouse, including these processes: material receipt, order picking, packaging, labeling, and shipping. • Returns Management – defines the set of capabilities for collecting, analyzing, and resolving product returns or service cancellations. • Logistics and Transportation – defines the set of capabilities that provide for efficient freight and traffic management.

SERVICE MANAGEMENT SERVICES

The Service Management Services Domain consists of the capabilities that support the development, management, execution, performance tracking, and continuous improvement of business services.

Table 9: Service Management Services Domain Description

Service Types	Service Components
Service Portfolio Management	• Service Portfolio Management – defines the set of capabilities that facilitate the creation and maintenance of products and services, including the design of service levels. • Service Demand Management – defines the set of capabilities that facilitate the promotion of a product or service, and the management of customer needs and service demand, and the management of customer service agreements.
Service Analytics	• Service Analytics - defines the set of capabilities that allow for the extraction, aggregation, and presentation of information to facilitate decision analysis and business evaluation, specifically analysis of service performance, customer satisfaction, and continuous improvement.

ENTERPRISE COMMON SERVICES

Data Management Services

The Data Management Services Domain consists of the capabilities that provide for the usage, processing and general administration of structured data and databases.

Table 10: Data Management Services Domain Description

Service Types	Service Components
Data Management	• Data Exchange – defines the set of capabilities that support the interchange of information between multiple systems or applications; includes verification that transmitted data was received unaltered. • Data Mart – defines the set of capabilities that support a subset of a data warehouse for a single department or function within an organization. • Data Warehouse – defines the set of capabilities that support the archiving and storage of large volumes of data. • Meta Data Management – defines the set of capabilities that support the maintenance and administration of data that describes data. • Data Cleansing – defines the set of capabilities that support the removal of incorrect or unnecessary characters and data from a data source. • Extraction and Transformation – defines the set of capabilities that support the manipulation and change of data. • Loading and Archiving – defines the set of capabilities that support the population of a data source with external data. • Data Recovery – defines the set of capabilities that support the restoration and stabilization of data sets to a consistent, desired state. • Data Classification – defines the set of capabilities that allow the classification of data.

ANALYTICAL SERVICES

The Analytical Services Domain consists of the capabilities that support the extraction, aggregation, and presentation of information to facilitate decision analysis and business evaluation.

Table 11: Analytical Services Domain Description

Service Types	Service Components
Analysis and Statistics	• Mathematical – defines the set of capabilities that support the formulation and mathematical analysis of probabilistic models for random phenomena and the development and investigation of methods and principles for statistical inference. • Structural / Thermal – defines the set of capabilities that support the use of data flow and data modeling diagrams for applying systematic analysis of data. • Radiological – defines the set of capabilities that support the use of radiation and x-ray technologies for analysis and scientific examination. • Forensics – defines the set of capabilities that support the analysis of physical elements using science and technology for investigative and legal purposes.

Table 11: Analytical Services Domain Description

Service Types	Service Components
Visualization	• Graphing / Charting – defines the set of capabilities that support the presentation of information in the form of diagrams or tables. • Imagery – defines the set of capabilities that support the creation of film or electronic images from pictures or paper forms. • Multimedia – defines the set of capabilities that support the representation of information in more than one form to include text, audio, graphics, animated graphics and full motion video. • Mapping / Geospatial / Elevation / GPS – defines the set of capabilities that provide for the representation of position information through the use of attributes such as elevation, latitude, and longitude coordinates.
CAD	• CAD - defines the set of capabilities that support the design of products with computers.
Knowledge Discovery	• Data Mining - defines the set of capabilities that provide for the efficient discovery of non-obvious, valuable patterns and relationships within a large collection of data. • Modeling – defines the set of capabilities that develop descriptions to adequately explain relevant data for the purpose of prediction, pattern detection, exploration or general organization of data. • Simulation – defines the set of capabilities that utilize models to mimic real-world processes.
Business Intelligence	• Demand Forecasting/Mgmt. – defines the set of capabilities that facilitate the prediction of sufficient production to meet an organization's sales of a product or service. • Balanced Scorecard – defines the set of capabilities that support the listing and analyzing of both positive and negative impacts associated with a decision. • Decision Support and Planning – defines the set of capabilities that support the analyze information and predict the impact of decisions before they are made.
Reporting	• Ad Hoc – defines the set of capabilities that support the use of dynamic reports on an as needed basis. • Standardized / Canned –defines the set of capabilities that support the use of pre-conceived or pre-written reports. • OLAP - defines the set of capabilities that support the analysis of information that has been summarized into multidimensional views and hierarchies.

SOFTWARE DEVELOPMENT AND INTEGRATION SERVICES

The Software Development and Integration Services Domain consist of the capabilities that provide communication between hardware/software applications and the activities associated with deployment of software applications.

Table 12: Software Development and Integration Services Domain Description

Service Types	Service Components
Software Development and Integration	• Legacy Integration – defines the set of capabilities that support the communication between newer generation hardware/software applications and the previous, major generation of hardware/software applications. • Enterprise Application Integration – defines the set of capabilities that support the redesigning of disparate information systems into one system that uses a common set of data structures and rules. • Data Integration – defines the set of capabilities that support the organization of data from separate data sources into a single source using middleware or application integration as well as the modification of system data models to capture new information within a single system. • Instrumentation and Testing – defines the set of capabilities that support the validation of application or system capabilities and requirements. • Software Development –defines the set of capabilities that support the creation of both graphical and process application or system software.

SECURITY MANAGEMENT SERVICES

The Security Management Services Domain consists of the capabilities that protect an organization's information and information systems.

Table 13: Security Management Services Domain Description

Service Types	Service Components
Security Management	• Identification and Authentication – defines the set of capabilities that support obtaining information about those parties attempting to log on to a system or application for security purposes and the validation of those users. • Access Control – defines the set of capabilities that support the management of permissions for logging onto a computer, application, service or network; includes user management and role/ privilege management. • Cryptography - Support the use and management of ciphers, including encryption and decryption processes, to ensure confidentiality and integrity of data. • Digital Signature Management – defines the set of capabilities that supports the use and management of electronic signatures to support authentication and data integrity; includes public key infrastructure (PKI). • Intrusion Prevention - Includes penetration testing and other measures to prevent unauthorized access to a government information system. • Intrusion Detection – defines the set of capabilities that support the detection of unauthorized access to a government information system. • Incident Response - provides active response and remediation to a security incident that has allowed unauthorized access to a government information system.

Table 13: Security Management Services Domain Description

Service Types	Service Components
Security Management	• Audit Trail Capture and Analysis – defines the set of capabilities that support the identification and monitoring of activities within an application, system, or network. • Certification and Accreditation - supports the certification and accreditation (C&A) of information systems, as described in NIST SP800-37. • FISMA Management and Reporting - supports management and reporting of compliance with the Federal Information Security Management Act of 2002. • Virus Protection - provides anti-virus service to prevent, detect, and remediate infection of government computing assets.

The Collaboration Services Domain consists of the capabilities that allow for the concurrent, simultaneous communication and sharing of content, schedules, messages, and ideas within an organization.

Table 14: Collaboration Services Domain Description

Service Types	Service Components
Collaboration	• Email - defines the set of capabilities that support the transmission of memos and messages over a network. • Threaded Discussions – defines the set of capabilities that support the running log of remarks and opinions about a given topic or subject. • Document Library – defines the set of capabilities that support the grouping and archiving of files and records on a server. • Shared Calendaring – defines the set of capabilities that allow an entire team as well as individuals to view, add and modify each other's schedules, meetings and activities. • Task Management – defines the set of capabilities that support a specific undertaking or function assigned to an employee.

COMMUNICATION SERVICES

The Communications Services Domain consists of the capabilities that provide communication between hardware/software applications and the activities associated with deployment of software applications.

Table 15: Communication Services Domain Description

Service Types	Service Components
Communications	• Real Time / Chat – defines the set of capabilities that support the conferencing capability between two or more users on a local area network or the Internet.
	• Instant Messaging – defines the set of capabilities that support keyboard conferencing over a Local Area Network or the Internet between two or more people.
	• Audio Conferencing – defines the set of capabilities that support audio communications sessions among people who are geographically dispersed.
	• Video Conferencing – defines the set of capabilities that support video communications sessions among people who are geographically dispersed.
	• Event / News Management – defines the set of capabilities that monitor servers, workstations and network devices for routine and non-routine events.
	• Community Management - defines the set of capabilities that support the administration of online groups that share common interests.
	• Computer / Telephony Integration - supports the connectivity between server hardware, software and telecommunications equipment into a single logical system.
	• Voice Communications – defines the set of capabilities that provide telephony or other voice communications.

SEARCH SERVICES

The Search Services Domain consists of the capabilities that provide for the probing and lookup of specific information and data from information and data sources.

Table 16: Search Services Domain Description

Service Types	Service Components
Search	• Query – defines the set of capabilities that support retrieval of records that satisfy specific query selection criteria.
	• Precision / Recall Ranking – defines the set of capabilities that support selection and retrieval of records ranked to optimize precision against recall.
	• Classification – defines the set of capabilities that support selection and retrieval of records organized by shared characteristics in content or context.
	• Pattern Matching – defines the set of capabilities that support retrieval of records generated from a data source by imputing characteristics based on patterns in the content or context.

SYSTEMS MANAGEMENT SERVICES

The Systems Management Services Domain consists of the capabilities that support the administration and upkeep of an organization's technology assets, including the hardware, software, infrastructure, licenses, and components that comprise those assets.

Table 17: Systems Management Services Domain Description

Service Types	Service Components
Systems Management	• License Management – defines the set of capabilities that support the purchase, upgrade and tracking of legal usage contracts for system software and applications. • Remote Systems Control – defines the set of capabilities that support the monitoring, administration and usage of applications and enterprise systems from locations outside of the immediate system environment. • System Resource Monitoring – defines the set of capabilities that support the balance and allocation of memory, usage, disk space and performance on computers and their applications. • Software Distribution – defines the set of capabilities that support the propagation, installation and upgrade of written computer programs, applications and components. • Issue Tracking – defines the set of capabilities that receive and track user-reported issues and problems in using IT systems, including help desk calls.

6.3
ESA TRANSITION AND SEQUENCING PLANNING SUMMARY

Considerations for "go forward" requirements and implications for the T&S Plan have been organized in two focus areas:

• Stabilize – to address urgent needs to stabilize the legacy environment of the State's application solutions.

• Rationalize and Integrate – to modernize the overall solutions architecture by "right-sizing" the number and scope of the future set of solutions and implementing the long-term integration strategies.

Activities will take place in these areas in parallel, but the activity emphasis moves from urgent and immediate actions to strategic and long-term.

6.3.1   STABILIZE

6.3.1.1 ADDRESS CURRENT "FLAGSHIP" OPPORTUNITIES

Consistent with recommendations in the Final Report, the CIO and OIMT will pursue opportunities that exist with current funded systems development projects to lay enterprise foundations for solutions and infrastructure. As OIMT continues to move forward on development of the enterprise future state vision and architecture and in understanding in greater detail the scope of current funded initiatives, opportunities to jointly establish portions of enterprise solutions and infrastructure will be sought after. Opportunities may exist for potential reuse or consolidation with other efforts, in establishing enterprise standards or practices, or implementing key components of the future state enterprise infrastructure. Examples are outlined below in Table 18.

Table 18: Opportunities for Flagship Projects to Lay Enterprise Foundations

Service Types	Key Project Description	Implications for the Enterprise
DHS	**New MedQuest Eligibility System (Affordable Care Act)** Pending Review million new eligibility system to increase timeliness and transparency, electronically verify information, and interface with health insurance exchange. Replaces current 23 year old system.	Establish and leverage enterprise application integration capabilities
DHS	**Benefit, Employment, and Support Services Division BPR Project** BPR evaluation of the existing financial assistance and SNAP eligibility process, redesign work flow processes for efficiencies in issuing benefits; address document imaging and e-forms and portable devices to allow DHS staff to be more mobile in addressing routine tasks (e.g. child care licensing) and for responding to emergency disasters (e.g. emergency food stamps); explore the possibility of expanding the concept of telecommuting with the availability of portable devices.	Establish and leverage enterprise capabilities in BPR methodology, mobile apps, and telecommuting
AG	**Hawai`i Integrated Justice Information Sharing Program (HIJIS)** Strategic initiative to build enterprise-wide integrated information sharing capabilities between justice agencies and other government entities throughout the State to improve public safety and enhance the efficiency of operations.	One of the largest, most successful information sharing initiatives in the State – pattern for broader adoption
DOH	**Hawai`i Health Data Warehouse** Strategic initiative to standardize the collection and management of Hawai`i's health data; dedicated to providing useful data to support public health professionals, the community and health agencies to become more effective in the application of health data.	One of the most successful data sharing initiatives in the State – pattern for broader adoption
DOTAX	**Tax Modernization** Strategic initiative to explore ways to streamline and modernize tax processing electronically so that it is more cost effective and efficient.	Position enterprise for broader Financial Management improvements
HHSC	**Health IT** Health information technology initiative to improve the quality and efficiency of health care through electronic health record (EHR).	Establish and leverage enterprise application integration capabilities
DBEDT/DCA	**Hawai`i Broadband Initiative** A major economic development initiative to provide statewide access to affordable ultra, high-speed Internet by 2018. Positions Hawai`i to be the first state in the nation with 1 gigabit per second broadband connectivity at every public school, every public library, and every public university and college campus by using about Pending Review of federal monies received through the American Recovery and Reinvestment Act (ARRA).	Leverage connectivity for State offices at remote islands and improvements for State NGN

6.3.1.2
LEGACY APPLICATION SOLUTION UPGRADES

As the State modernizes its solution platforms, there will be a number of compelling drivers to re-platform sets of applications. Some notable reasons would be the age and condition of the platform, such as the legacy mainframe applications; or that a platform may be eliminated such as Lotus Domino. This initiative would assess and stabilize critical applications. An analysis of the overall applications portfolio will identify the top risk areas. Projects will be authorized to plan and work through conversions, upgrades, and refreshes to stabilize the applications. Examples include:

- Continue work underway to implement near-term enhancements to the legacy payroll system to automate EFT to minimize demands for check printing.

- Stabilize the email system versions and enhance overall enterprise capabilities ncluding addressing a global address list and shared calendaring.

- Migrate current Lotus Domino applications to a standard enterprise solution pattern for web applications.

The portfolio management process and program is being established along with other IT/IRM programs in OIMT such as the EA program. The applications perspective of the portfolio management process will include considerations for the appropriate life cycle of all applications software and plan for its replacement at the proper time. Create application

technology lifecycle management and refresh plans. This initiative is included in the ETA, Section 7 below.

6.3.2
RATIONALIZE AND INTEGRATE

6.3.2.1 IMPLEMENT ERP SYSTEM

The State is moving forward with implementation of an enterprise-wide ERP system that will replace the large majority of the current "central" systems within the Enterprise Support Services band. The conceptual solutions architecture has established a notional set of current systems that should be replaced by the ERP system. The ERP implementation is a critical foundational component of the future strategy. As stated in the Final Report, the proliferation

of many applications within the current state architecture is the result of the significant issues that the Departments have with the common central systems. A significant percentage of the goals and objectives related to business and IT/IRM transformation can be accomplished through a successful ERP system implementation. The plan for ERP implementation is specified in more detail in Appendix A.

6.3.2.2
IMPLEMENT OTHER ENTERPRISE SOLUTIONS

Additional significant opportunities exist for standardizing on common systems to support enterprise needs. Specific investment initiatives should be considered for the following critical areas, and the working groups in alignment with the technology domains within the ETA provide additional detail on these initiatives.

ENTERPRISE EMAIL SYSTEM

Evaluate options for upgrade or replacement of the current email system to address a number of current issues such as the lack of a global address list or shared calendaring and to enhance the overall future enterprise capabilities for greater collaboration, migration towards smartphones and tablets, and greater efficiency and cost savings in from Total Cost of Ownership including future provisioning models "as a service".

ENTERPRISE COLLABORATION SOLUTION

Establish standard collaboration solutions across the State adopting technology platforms such as Microsoft SharePoint or Lotus Domino Quickr (in conjunction with the email system initiative). Implement necessary technical underpinnings and connectivity for cross-departmental workgroup and project collaboration.

IDENTITY MANAGEMENT SOLUTION

Establish a standard solution for management of user account identity and authorized roles and access permissions integrated with standard user directory services and enterprise services for authentication.

ENTERPRISE DASHBOARD SOLUTION

Establish a standard management-level dashboard reporting solution with supporting data aggregation and summarization capabilities. Implement "rolling up" program-level information for project and operational performance, and institute processes for projects and operations to begin reporting.

OPEN GOVERNMENT SOLUTIONS

Establish a State of Hawai`i data. gov internal and public-facing web site to facilitate the sharing of "master data sets" as defined above. Support internal-facing (for State use as w ell as application integration through web services layered on top of XML data sets) and external, public-facing (for publishing public-domain master data sets). Establish an internal-facing web site to facilitate sharing of "master data sets" for application integration through web services layered on top of XML data sets.

KNOWLEDGE MANAGEMENT SOLUTION

Establish enterprise processes and system for knowledge management. Utilize for IT services knowledge management initially, but consider use and application in other service areas. For IT services, ensure that all documentation regarding IT environments; IT system and server configurations; and known problems, workarounds, solutions, and resolution scripts are all stored within the knowledge management repository. Ensure that IT workers at all levels use the knowledge management repository for environment and work instruction documentation.

CUSTOMER SERVICE SOLUTION (REQUEST AND INCIDENT REPORTING)

In conjunction with organizational changes to standardize on shared service centers such as an Enterprise IT Service Desk or other back office functions related to the ERP implementation, establish an enterprise-level service desk or call center solution with tracking for resolution of all customer or user service and support requests, incidents, and event resolution.

ENTERPRISE SYSTEM MANAGEMENT SOLUTION

Establish and implement an enterprise systems management solution, such as the SolarWinds product used in some organizations today. The enterprise systems management solution would automate basic availability (systems, service, and server uptime); capacity management (CPU, disk space, bandwidth, etc.); and security and data center operations. The solution would perform life cycle tracking of all events related to these areas and integrate event management information with the customer service solution.

6.3.2.3
ESTABLISH STANDARD ENTERPRISE SOLUTION PATTERNS

The State of Hawai`i will establish standard enterprise patterns for kinds of common solutions such as web applications, mobile applications, data analytics applications, and web services. As discussed above, the desired outcomes in establishing the patterns are as follows:

- Simplify and standardize to capitalize on staff expertise, reduce support costs, and to facilitate reusable code and data across the environment.

- Rapidly baseline current assumptions regarding sunset, legacy, preferred, and standard application platforms, architectural stacks, and technologies, and develop standards and guidance

regarding future technology decisions, specifically with respect to application architecture, design, and implementation for use and adoption across the Departments, Divisions, and programs; and create a communication plan to "market" the standards and guidance within each Department. Upgrade needed human resource skills for growth including both advanced training programs for staff and putting in place contractor resources.

- Leverage successful models, such as HIC's work for DLNR or Ocean IT's mobile app development for DOD, and adjust as needed to minimize the approaches used.

The State will approach the adoption of solution patterns in an evolutionary manner that moves the State through what are defined as four different Operating Levels as described in Table 19 below.

Table 19: Solution Pattern Operating Levels Indicating Evolution of Adoption within the Enterprise

Service Types	Level Characteristics
Opportunistic	At this initial level the state is looking for projects to attach to the initiative and include the definition of pattern artifacts in the project scope. The idea is to attach to projects that are on task to create applications that are prototypical of one of the solution patterns, and to capture and document the best practice guidelines being used by that project.
Tactical	At this level, projects will be selected that might benefit from one or more of the documented solution patterns. The initiative will attach these projects and offer pattern guidance and validate and improve the pattern guidance.
Strategic	At this level, use of pattern guidance should be relatively routine part of the development process. The initiative will be more focused on interacting with projects to determine the patterns they are using and incorporate any feedback, rather than offering counseling and guidance.
Managed	At this level the set of solution patterns are essentially complete and the initiative is focused on tracking the use of the patterns and recognizing the need for new patterns as technology advances.

Tracking the state's progress through these four operational levels will facilitate the ongoing process of selling and obtaining funding for the Solution Patterns initiative by providing some quantifiable measurement of the adoption of and use of the patterns across the enterprise. Within this implementation framework, the State should continue to review, refine, and expand its set of enterprise solution patterns.

The initial set of priority patterns are outlined below and expanded in the ETA in Section 7.

ENTERPRISE WEB APPLICATION SOLUTION PATTERN

Standardize on common solution methods, architectures, and technologies for web applications development. The most common in use today within the State include the Linux/Apache/MySQL/PHP or Python (LAMP) stack, the Windows stack (Windows\IIS\SQL Server\.NET), and the Java web application stack (Linux or Solaris/Tomcat/JSP).

ENTERPRISE MOBILE APPLICATION SOLUTION PATTERN

Establish a standard mobile applications solution pattern and approach with standard methods, skill development, contractor resources, and tools/technologies. Conduct in conjunction with adoption of preferred smartphones and tablets in the future state technology architecture. Since mobile application development has a very small footprint in the State at this time, this initiative will need to analyze, pilot, and invest/implement in a standard approach, capabilities, and tools for developing mobile applications.

ENTERPRISE DATA ANALYTICS APPLICATION SOLUTION PATTERN

Establish a standard data analytics solution pattern and approach with standard methods, skilled resources, and tools. Evaluate and leverage, as appropriate, notable implementations of end-user data access systems to make critical data available for analysis and decision making, specifically: FAMIS Data Mart, DOH Data Warehouse, and Juvenile Justice Information System (JJIS).

ENTERPRISE APPLICATION INTEGRATION WEB SERVICE SOLUTION PATTERN

Establish a standard enterprise solution for application integration that includes standard approaches, methods, knowledge/expertise, skilled resources, and tools/technologies to enable and support web services implementation and use. Evaluate and leverage notable implementations of application data integration through advanced capabilities (e.g., SOA, specifically DOH Services Implementation and HIC).

COMMUNITY APPLICATION SOFTWARE "STORES", REPOSITORIES, AND DIRECTORIES

In conjunction with establishing these standard application solution patterns, establish capabilities to facilitate application software subscription, download, or common source code reuse. There are two primary considerations: an app store to subscribe and download standard apps, and shared source code or web services for reuse in application development.

- App Store – anticipate future mobile apps for the State and establish "app stores" for internal marketing of existing application capabilities and the ability for organizations to reuse those applications – a version of an internal "apps store" catalog.

- Community Source Repository – anticipate reuse of considerable portions (services/components) of application code such as single sign on or payment processing. Ability to leverage shared source code across trusted communities within or outside the State using a SourceForge type collaboration environment. Include trusted specifications, component code, or application code from other states.

- Web Services Directory – anticipate future enterprise web services for the State and establish web service directories using industry standards such as UDDI (Universal Description, Discovery, and Integration) specifications.

6.3.2.4 IMPLEMENT ENTERPRISE APPLICATION INTEGRATION SERVICES

The State of Hawai`i will achieve integration strategies across its enterprise and LOB application solutions through the implementation of an integration services layer within the ESA. Similar to the solution pattern implementation described above, these enterprise services, the State will approach the adoption of a services oriented applications development approach in an evolutionary manner that moves the state through the four different Operating Levels as outlined in Table 20.

Table 20: Services-Oriented Operating Levels indicating Evolution of Adoption within the Enterprise

Operating Level	Level Characteristics
Opportunistic	At this initial level the state is beginning to prototype and defines its services-oriented development policies and procedures. Pilot projects are being selected based on their suitability for refining those policies and procedures, and for their suitability in proving out required technology elements of the EA. The focus is on selecting and investing in projects that will produce quick success and bolster the efforts to sell and fund an ongoing enterprise application integration initiative.
Tactical	At this level, rudimentary policies, procedures, and technology components are in place and are being refined based on lessons learned. Projects are being selected that focus the effort to build low level cross-cutting services that can be used by multiple lines of business. It is at this level that the details around versioning, testing, and deployment of services are being fleshed out.
Strategic	At this level, polices, procedures, and technology components are well established and the focus on investment in services-oriented development is on the retirement of legacy applications and infrastructure using the SOA model that builds replacement software incrementally using the technique of service composition.
Managed	At this level not only are the policy, procedure and technical components established and in widespread use, but there is an active and robust measurement and management program in place that tracks the use of developed services and focuses service development to improve performance and extend re-use opportunities.

Tracking the state's progress through these four operational levels will facilitate the ongoing process of selling and obtaining funding for the enterprise integration initiative by providing some quantifiable measurement of the adoption of services-oriented principles across the enterprise.

Rather than define and build out a full governance and technology stack upon which to build SOA compliant services, the state will take an approach that provides for investment in projects that can incrementally fill out gaps in the EA, and incrementally bring governance processes and technology onboard. Consequently the selection of projects for SOA investment will be a critical success factor for the SOA implementation. Industry best practice research indicates that highly successful SOA based projects

can be roughly categorized into three different value categories:

- **SOA Integration Projects**
  SOA Integration Projects employ industry open and standardized service technologies (XML, WSDL, etc.) to provide synchronization of data flow among applications, most notably between custom written applications and COTS software packages. The use of open and standard service technologies and design approaches often result in a much improved cost profile over older point to-point custom interfaces or more traditional EAI software, e.g. SAP XI, Tibco, BizTalk, IBM MQSeries, MS MSMQ, etc.

- **New Composite Application Projects**
  New custom written applications are largely Web based and consequently are well positioned to make use of SOA

service level components. Existing legacy applications, on the other hand, are not generally well-suited to service composite solutions because of their dependence on proprietary technologies and their highly stovepipe design focused on automating specific business processes. Identifying new applications that can benefit from a SOA approach of development of low level and composite services will provide for applications that are more maintainable, and that provide opportunities for component reuse by other applications.

- **Mainframe/Legacy Modernization Projects**

Mainframes and associated legacy applications often consume the lion's share of an organization's IT budget. Retiring those applications and associated

infrastructure can be a daunting and long term proposition, high in cost and full of risk. An incremental approach that can be used is to build out new user facing applications that leverage the existing legacy applications by interfacing with SOA wrapped services that abstract the functionality of the underlying legacy application. Creating these wrappers provides a migration path toward applications with new user facing technologies that continue to use the legacy functions of the existing applications. Over time, these new user facing applications built as a composition of services can be redirected toward new back-end services that replace the legacy functionality.

Unlike traditional approaches that use a rigorous waterfall approach to infrastructure build out, the SOA framework here is expected to be built out incrementally. It provides the State with the ability to select projects that can contribute to the SOA build out, regardless of the SOA operating level that is in play. Over time the state will realize a flexible SOA infrastructure and a rich inventory of services that provide for effective maintainability and high re-use.

Consistent with the notional set of enterprise services included in the Conceptual Solutions Architecture, the initial set of priority services are outlined below and included in the ETA, Section 7.

SUPPORT SERVICES — SECURITY — IDENTITY AND ACCESS MANAGEMENT

Establish a standard set of authentication and single sign on services for use by all enterprise applications.

DIGITAL ASSET SERVICES — DOCUMENT/RECORDS MANAGEMENT

Establish common services for identification and submission of digital content to be managed as an official document or record. Investigate current capabilities that exist: KOFAX and/or IBM FileNet within DOT, B&F, (and the Judiciary), AG, DAGS, DOTAX.

BUSINESS ANALYTICS SERVICES — GEOSPATIAL

Establish common services for linking and visualizing State data with geospatial data. Investigate current capabilities such as ARCInfo within DOD, DAGS, DOT, DBEDT, DLNR, DOH, HDOA, AG, DOE, and UH.

BUSINESS ANALYTICS SERVICES — DASHBOARD REPORTING

Establish common services for reporting performance data against measures that need to be reported in a common dashboard reporting solution.

BACK OFFICE SERVICES — ERP

Establish common services within the financial management and human resource management domains in conjunction with the ERP implementation.

PROCESS AUTOMATION SERVICES — WORKFLOW

Establish common services to support enterprise workflow across application solutions.

PROCESS AUTOMATION SERVICES — CASE MANAGEMENT

Establish common services to support a case management life cycle and data reuse across application solutions.

CUSTOMER SERVICES — EVENT/ INCIDENT/REQUEST REPORTING

Establish common services to support reporting of events, incidents, or requests that need to be tracked in a common customer service solution.