Open Source eGovernment Reference Architecture

OSeRA

Business Plan

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1 Executive Summary

1.1 Empowering agile e-Government

The president's management agenda openned the door to a bold vision of an agile government empowered with more effective processes, organizations and technologies. Turning this vision into reality will require a new approach to the design of government agencies and the technologies that support them. OSeRA is designed to enable this transformation with needed tools and methodologies supported by a vibrant Open Source community.

In this empowered view of agile government, business goals and drivers from multiple sources, business lines, organizations and regions are collected and refined to provide a clear vision of how the organization should evolve to better provide value to its customers. This evolving *Executable Enterprise Architecture* is part of and supports the dialog among stakeholders to drive critical initiatives.

The resources, capabilities and processes of the organization can also be clearly seen and are fully in sync with how the organization and supporting systems actually run - this is the executable enterprise model that is the kernel of OSeRA. With this clear view of the organization and well understood critical initiatives, alternative processes, resource distribution, organization structures and information systems are re-shaped to better support the future vision of the organization.

With the initiatives and business design fully in hand the design is then simulated to make sure that it meets its goals and makes sense in terms of the organization and its customers. The derived costs and resulting impact of change support the decision process for deployment. The executable enterprise model can then be approved as part of the organizations architecture and planning cycles.

Specifications for the supporting automated components of the enterprise are produced from the enterprise architecture and any required projects to fill in gaps in the supporting infrastructure are instituted. Reusable business and technical components are assembled and reconfigured to better meet the needs of the evolving enterprise. Once these components are validated against the system model, the transition plan is put into place and an automated workflow system begins to help train the staff on their new responsibilities, processes and systems. At the scheduled time the new capabilities are deployed and the re-shaped organization begins to deliver its new or refined value to customers.

This level of change is happening continually and quickly. Initiatives can be planned and executed within weeks with minimal disruption and cost. The organization is successful because it is able to adapt quickly to the needs of stakeholders and collaborate effectively inside and outside of its boundaries.

This kind of agile and empowered approach to e-government is fully within our grasp, all we need do is begin the process.

1.2 Formal Architecture for Empowering agile e-Government

There are several core capabilities that will help get us closer to agile e-government. One crucial factor is that we need a common, shared and consistent way to understand our organizations and act on that understanding. We are currently throwing away vast amounts of critical information or trapping that information in "dead documents" that do not foster agility or evolve with the organization.

Architecture at many levels is well established and proven. But, these architectures are not integrated, consistent or really used as the enablers of change that they could be. Fragmentation of architecture at different levels (enterprise, systems, capital, FEA, software, human capital) allow for confusion and disparity of initiatives. Architectures are not maintained and not delivering full value. How do we get value from our architectural efforts?

A set of living, consistent and formalized architectures would have the capability to enable agility and optimize results while making government more efficient. To this end we introduce the notion of a ***formal architecture*** with the business and technical infrastructure to support it.

1.2.1 What is a formal architecture?

To provide the benefits desired a formal architecture must have certain capabilities;

- **Well defined**; the terms of formal architectures must be well defined and mutually understood such that there is no confusion as to what the architectures specify.
- **Traceable**; there are many levels and views of architecture across the enterprise. These views have to be interconnected and traceable such that the levels and views are mutually supportive and consistent.
- **Consistent**; the architectures must be consistent such that business and technical inconsistencies are identified and resolved.
- **Living**; the architectures must change with the organization and continually reflect what is and what should be.
- **Shared**; the architectures must available to all that depend on them and modifiable by all those with the authority to do so.
- **Modeled**; models provide the rigor, methodologies and technologies needed to support formal architectures.
- **Automated**; humans are virtually incapable of creating and maintaining a set of well defined, traceable, consistent, living and shared architectures without substantial support from automated systems. The architectures must be maintained, shared and realized through such automation based on models.

1.2.2 How will formal architecture enable agile e-government?

Formal architectures, once made a part of the approach to government, will have advantages at many levels;

- Serving as a communication vehicle among stakeholders.
- Serving as a subject for consensus and approval.
- Serving as a specification for systems and business initiatives.
- Serving to help realize business initiatives more quickly and less expensively.
- Serving to enable government shared services.
- Serving to drive information systems to more directly support business needs.

1.2.3 Why aren't our architectures formal now?

Most architectures today fail on almost every level.

- The language of the architecture is not well defined. PowerPoint architectures can be interpreted in many ways.
- The architectures are not traceable, complementary efforts are frequently ignored. A "line of sight" from business requirements to software implementation is not created or maintained reliably.
- The architectures are not consistent, even within it's self – the informal methods employed are simply incapable of achieving consistency.
- Architectures are delivered as documents that are difficult if not impossible to modify and keep "living". Changes in one document are very difficult to propagate to other documents. Boundaries between contractors can prevent the sharing of information already developed.
- Documents are not shared and are typically lost within the context of a project or program. Tools lock information behind proprietary repositories of tool suites.
- Documents may or may not be derived from models, many are simple "pictures".
- The process is not automated, imposing excess human intervention and human error. Once architectures are complete there is no mechanisms to automate the production of systems that satisfy the architecture.

1.2.4 How will OSeRA support formal architectures for agile e-government?

Models of formal architectures become the linchpin of business focused agility. The OSeRA environment will define and support formal architectures for government with software based on open standards and Open Source. OSeRA will provide the support infrastructure to enable a transition to a formal architecture methodology.

A key capabilities for doing this is the repository and tooling for formal architectures, providing views into the enterprise that are appropriate for each stakeholder while integrating these views into a common vision. The capability to create, share, evolve and

derive value from this repository is the basis for an environment to support the “agile e-government” vision. The environment surrounding this is OSeRA. OSeRA will use the capabilities of enterprise models and the abilities to transform those models into the executable support platform for the organization.

OSeRA will enable the modeling of the architectures of an organization, its processes, information, structure, components and resources. It will then allow this information to be used to create and deploy automated systems, making designs into reality and creating applications, documentation, specifications, as well as training workers. Information, process, roles, resources, policies, drivers and information systems will finally be part of the same picture.

2 OSeRA Vision

Achieving the transformation goals of the government community at large is challenging in itself. It is made even more difficult by the fundamental heterogeneity of governance, budgets and tools, in the current environment of the software industry. Major software corporations are only selectively responsive to their business and government customers. Requirements that demand interchangeable, mix-and-match components for a standard architecture of “best of breed” constituent parts are largely replaced with individual company attempts for product “lock-in”.

An effort is needed to level the playing field for all and maximize the capabilities represented in pockets of excellence. Such an effort will jump start the long-term goals of government transformation and normalize the approach to information technology interoperability and its use in service to citizens.

2.1 The Problem

Under the e-governement initiatives of the President, the Federal Enterprise Architecture (FEA) calls for an architectural accountability of software products, services, and deployments to the business functions that they serve, i.e., a “line of sight” from the business requirements to the software and technology that implements those requirements. In a changing world of software technology, this line of sight, if ever established, is almost impossible to maintain. Changes at one level of abstraction need to be reflected at all levels and in all artifacts that depend on it. In a large business, supported by large systems, this is intractable.

Currently, enterprise architecture tools (such as Popkin and Metis, etc.) focus on the business visualization of any given architectural framework (such as Zachman, FEAF, C4ISR/DODAF, OMB xRM, and many others) and the realization of the business domain strategy in the form of as-is, to-be, and gap-transition planning documents. In contrast, Model Driven Architecture tools emphasize the separation of design and implementation, focusing on metamodels assumed to encapsulate the business domain that can be mapped to generate code for diverse deployment technologies, such as CORBA, EAI, .NET, J2EE, Web services, etc.

The central problem is that the resulting notations (models, documents, frameworks, etc.) are solely for the static expression of the business value of IT systems (in the case of enterprise architecture tools) or as static representations of system designs (in the case of MDA tools). Some are actionable for business decision makers, but they are not actionable for IT stakeholders, and vice-versa. This gives rise to an undesirable separation of analytical requirements and implementation details, often resulting in uncertainty between business and IT stakeholders.

Typically, failure ensues, and millions of dollars get wasted (to the detriment of executives, engineers and taxpayers alike). More often than not, work is performed by different teams with no correspondence or interaction as document artifacts are `thrown

over the transom' to the next participant with a different specialization. In practice a disconnect remains inherent in the business management and information technology communities, which cannot be overcome by any idealized solution development life cycle methodology. Most experienced practitioners believe this gulf between the business strategy and requirements owners and the IT owners is the fundamental cause of the staggering failure of IT development projects.

2.2 Business Vision

Comment [EVS1]: Deleted text is moved to section on Open Source Vision.

OSeRA will act as a government sponsored catalyst for the reinvention of the software industry's value proposition. It will put ownership and control back into the hands of the users - government and business, knowledge workers and citizens - creating a viable way for a precious and largely untapped national resource of software developers to maximize their contributions. This will be accomplished within the context of requisite common criteria governance and technical frameworks that focus and combine their individual efforts towards our national goals for using IT as the e-government and citizen-centric transformation enabler.

2.2.1 Level Playing Field

OSeRA will stimulate competitive differentiation and provide a consistent lens for comparing commercial software platforms, and level the field of comparison by giving government a better foundation from which to understand vendor offerings. It will further reinforce trends inherent in OMB guidance, which, among many other objectives, desires to create a consistent way for the vendor community and the government to engage each other. This will help to visualize and coordinate the roadmap of vendor value add, and to align the resources of private interests with the needs of government transformational process.

OSeRA combines forward thinking technology trends and time tested best practices. It sponsors the commercial aggregation of Open Source software into composite units of functionality, augmenting these where necessary, to provide a cohesive platform and guide for industry partner engagements.

2.2.2 Government Leadership

The government must exert a leadership presence to industry partners to maintain the balance and accordance of capitalistic and socio-economic interests. OSeRA is this normalization mechanism.

The ability to assemble the disparate efforts of the Open Source communities and best of breed into a cohesive managed platform is not a current (or even conceivable) goal of the Open Source community. This is a fundamental barrier to the adoption of Open Source technologies on the large scale. Not only is this possible for an entity like GSA to sponsor and fund the consolidation of these technologies into a cohesive Platform, it is a great added value provided by GSA back to the Open Source community.

GSA would provide the OSeRA platform as a software subscription or managed service environment to any entity that wants to use this utility platform. This enables all those whose budgets and resource constraints would otherwise present a barrier to entry. This would provide value to organizations that are attempting to create a federated information brokering partnerships across all government, such as NASCIO and DI-IS.

2.2.3 Academia

The OSeRA Program presents an opportunity for institutions of higher learning to participate by developing student programs that contribute to multiple and distinct but intrinsically linked efforts of the individual citizen, their personally enabling universities and colleges, the software industry, and our Government. Institutionalizing these combined efforts presents powerful mechanism towards the realization of each party's individual goals and their shared interests.

- Government wins by providing a focal point for the tremendous pool of private and public intellectual capital whose collective contribution has no cost burden.
- Universities are handed a curriculum that every student of computer science and information technology will have immediate interest in.
- Students and any other citizen contributors gain a more holistic technological understanding of their present and future careers in our knowledge based economy. This will condense expert learning currently requiring decades of experience to obtain, and establish a direct relationship with an important part of our National agenda and the computer based industries alike.
- The software industry gets a unified view of the business and IT gap. This combines the most highly skilled and experienced professionals with the country's most creative and energetic resources generating a direct relationship with it's future talent pool, and ultimately reinvents its practices and revitalizes performance in delivering business value.

2.3 Technology Vision

Comment [EVS2]: Deleted text is (almost word for word) redundant with text that is now in Section 1 (and sounds better there…).

In its technological aspects, OSeRA is a platform for the development of tightly business-linked information systems – from conceptualization through actual deployment in operational environments. The platform allows business people, architects, designers, analyst, developers, implementers, testers and, ultimately, users to build and view the artifacts required in their job in whatever form or format that is most comfortable to them – as long as it is based on existing or developing standards. In a nutshell, it provides an organization with both a communications tool (between and amongst the various constituencies) and a way to achieve both technology and business agility.

The intent of the OSeRA Platform is to define and realize organizational goals with the assistance of automated systems. The foundation of the Platform is a set of models at multiple levels. Specification models define the environment, the platform, the tools and the organization. Other models transform these specification models into the artifacts that enable the organization to achieve its goals, as specified by the models. These models are integrated into an extensible model framework that joins the multiple viewpoints of the enterprise and enterprise systems into a unified structure.

One of OSeRA's key capabilities is a repository for a body of enterprise knowledge that provides views into the enterprise that are appropriate for each stakeholder within it while integrating these views into a common vision. The stakeholder can use the tools to which he is accustomed, operating at his customary level of business/system abstraction. To do this OSeRA provides a model repository that supports multiple levels of abstraction that can be projected out to any modeling tool. Whether an analyst is using Rational's UML editor, an enterprise architect is using Popkin System Architect, or Data Access Technology's Component-X, the tools draw from the same repository that has a standards based semantic core supporting the superset of semantics required by each tool. The OSeRA environment is itself extensible in both capabilities (as defined by the models) and technology (as defined by the platform). The platform is “virtual” and can be implemented across a number of infrastructures (e.g., J2EE and .NET), but it comes with an Open Source platform that is ready to run.

2.4 Organization and Governance Vision

OSeRA is a partnership between government and the private sector. OSeRA manages the Open Source OSeRA platform and government sponsored projects to improve and evolve that platform. The OSeRA partnership also provides a vehicle for certified experts and suppliers to help organizations be more effective by using OSeRA and building on the OSeRA platform.

OSeRA is fully integrated with the rapidly evolving Open Source community and packages and integrates much of the capabilities provided by this vibrant community. As part of its value, OSeRA will establish guaranteed intellectual property rights for the entire platform providing legal indemnification under an Open Source license.
The biggest differentiator of OSeRA is the Open Source paradigm itself. The virtual corporation that is managed by the Government (GSA) has infinitely more resources in the international Open Source community than any one commercial company will ever have. The key to the government's role in this virtual organization is the consolidation of the tools and the focus provided by the Platform, not just any component or layer of service that currently exists independently. The result of maintaining an Open Source enterprise is complete control over systems configuration and management lifecycles.

The most important global transformation idea is the enablement of this virtual organization on behalf of those that don't have the resources, thus helping teach the world of budget starved and directionless state/local governments how to participate in the NASCIO/DHS/OMB vision. This effort is also likely to be of significant interest to other large focal areas that also need modernization or transformations, such as educational institutions, as previously mentioned.

2.5 Open Source Vision

In the past five years, Open Source software has become one of the most discussed topics among software users and practitioners. The increasing interest in Open Source software has been motivated by at least three factors:

- the success of products such as Linux and Apache, which are gaining increasing shares in their own markets (operating systems and http servers);

- the uneasiness about the Microsoft monopoly in the software industry; and, finally,
- the increasingly strong opinion that ‘‘classical’’ approaches to software development are failing to provide a satisfactory answer to the increasing demand for effective and reliable software applications.

According to Fuggetta[1], the interest in Open Source is visible at different levels and in different contexts:

- There is a very large community of individual users who support and promote Open Source.
- Many companies are focusing their attention and effort on Open Source software. This is the case of important computer manufacturers such as Sun, Unisys and IBM, which consider Open Source (or variations of this approach) as a strategic opportunity to undermine the Microsoft monopoly and to enforce the establishment of an open operational platform. Indeed, Open Source is also being adopted and exploited by an increasing number of companies, which consider Open Source products such as Linux a viable and competitive alternative to proprietary solutions.
- Finally, public institutions and governmental agencies are increasingly interested in Open Source software. The increasing reliance of governments and public administrations on software systems has generated a number of concerns about their security, safety, and trustworthiness. Moreover, public administration and governments are concerned about their dependency on specific software providers and are therefore extremely interested in identifying approaches that may help them increase their independence. In this respect, Open Source advocates claim that the unrestricted availability of the source code makes it possible to address these issues effectively.

While the Open Source community has enjoyed a number of successes, it lacks a “forcing function” to bring together the disparate efforts into a cohesive managed platform that can serve business needs top to bottom. This produces a fundamental barrier to the adoption of Open Source technologies on a large scale.

Assembling Open Source parts and pieces from multiple Open Source organizations into a cogent, consistent architecture is a daunting task. Each component needs to be vetted for its own functionality and its compatibility with various versions of other components. There is currently no organization to do this; consequently it is as difficult to maintain Open Source systems as proprietary ones.

Intellectual property rights are often unclear in an Open Source system. This provides another major barrier in its adoption in large commercial and government deployments.

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[1] Open source software—an evaluation. Alfonso Fuggetta. The Journal of Systems and Software, 66 (2003) 77–90.

OSeRA will provide the overarching organization needed to vet Open Source contributions generated within it, and those adopted from other Open Source organizations. This will provide roadmaps of tested configurations so that the consumer can confidently assemble what is needed and be assured of the parts working together.

Comment [EVS3]: Is it really necessary to spend so much more space justifying Open Source?

2.5.1 General Benefits

There are economic arguments for investing in an Open Source project. For instance, if we take the premise that Open Source is "better" in some ways, it is logical to assume that the government should help promote it. In theory, two sorts of arguments might be made:

- One is that Open Source is superior and should be used more by prudent purchasers, and the government is no different from business.
- The other is that Open Source could provide various economic benefits if successful, so government should give it a boost.

Open-source software in general has several strengths. One involves the use (as opposed to the creation) of intellectual property. Intellectual property may be expensive or difficult to create, but, once created, the marginal cost of using it is zero. As a result, society benefits most from an already-created piece of intellectual property when it is made available to all for free. Open source more or less does this. The availability of source code for open-source programs means that technically adept users can tailor the software to their particular needs. They can also fix bugs and provide those fixes to other users. These advantages will appeal more to business users than to typical home users, of course, since medium and large businesses are likely to have technically adept staff to maintain their networks and corporate software. Since technically adept users can inspect the source code if they so desire, it is possible that they might be able to create bug fixes more quickly than occurs with proprietary software; whether such bug fixes can easily be put into the hands of general users is less clear.

At least in theory, Open Source may be more protective of "privacy" than proprietary software. With Open Source, it would be difficult for a programmer to include code that would "spy" on unsuspecting users because other programmers could simply remove such code. Whether this theoretical advantage is a real-world advantage is not clear, since there is little evidence that commercial software engages in such behavior.

In a recent study, Heintzman[2] points out the general benefits of Open Source Software (OSS) from the point of view of both businesses and governments. According to him, businesses and governments see value in the following OSS features:

- Flexibility to modify. Some businesses or governments require specialized modifications to a code base to accommodate specific business or technical requirements. OSS offers this flexibility. The National Security Agency (NSA) has done just this and created a secure version of Linux
- Cost effectiveness. OSS often has some attractive up-front cost advantages, although there is much debate as to the total cost of ownership (TCO). There is

[2] An introduction to open computing, open standards, and Open Source. D. Heintzman, Rational Edge Nov. 2003.

anecdotal evidence that some companies have realized considerable license savings. On the other hand, it is argued that scarcity of skills translates to higher support and maintenance costs that nullify the up-front cost advantage. The economic case will vary from geography to geography as the availability of skill and labor rates vary. Unfortunately, there is no clear data on the total cost of ownership of OSS vs. commercial software yet.

2.5.2 The Case for Government Promotion of Open Source Software: Private and Public Advantages

According to Stoltz's repport[3], Open Source software has several distinct advantages over proprietary software. For instance, the widespread peer review process involved in Open Source development creates software, which is more error-free and resource-efficient than proprietary software. In addition, OSS is a must for security-critical applications. Low cost, reliability, security, and the ability to modify software to suit specific needs are all important priorities to government purchasing authorities.

Still according to Stoltz, a great benefit of OSS is that it eliminates the economic loss, which results from duplicated work. The vast majority of all code (a standard estimate is 75%) written for a specific task by a single company, government agency, or military branch, and is never used for any other purpose. Many problems in computer engineering show up in multiple fields and applications. If a private company creating software for scientific research, for example, must spend its cash and programmer time to create a specific tool from scratch when a military research facility has already written software which performs the same function, economic waste occurs which hurts U.S. productivity as a whole. If source code developed for a specific government application is made publicly available, corporations can spend their resources to improve this software, add value, and find new markets for it, rather than recreating it from scratch. The reverse is true as well: government and military agencies could use source code developed by corporations at no cost, allowing huge savings in government procurement and R&D expenditures.

Finally, Stoltz argues that perhaps the most compelling reason why the promotion of Open Source software serves a public good is that OSS is inherently anti-monopolistic, and may serve as an effective antidote for the monopolistic tendencies which some economists believe exist in the software industry.

2.6 Milestones (TBD)

[3] The Case for Government Promotion of Open Source Software. A NetAction White Paper By Mitch Stoltz.

3 Products and Services

The purpose of OSeRA is to support a consistent approach that government agencies may use to build and operate successful, service-oriented e-government systems. This support is provided though a set of products and services, as described in this section.

The primary OSeRA product will be a package of Open Source software provided to enable agencies to develop, integrate, and reuse components in order to build and deploy e-government systems. The efficiencies of e-government, along with the cost savings associated with properly validated open-source software, have the potential to substantially lower the cost of government. Much of the open-source software is expected to be developed through one of the already-flourishing Open Source communities (such as Eclipse, Apache, etc.).

Released OSeRA software packages will also be supported by appropriate consultation, training and stakeholder orientation services. Especially for early releases of the OSeRA software, such support services will be necessary to help agencies make the most effective use of the new approach to developing their systems. Thus, such support must include not only assistance in installing and using the OSeRA software, but also consultation in developing and provisioning the appropriate enterprise models the agency will need to use the OSeRA software effectively.

3.1 OSeRA Software Packages

An OSeRA software package is a complete set of tools that allow an agency to model their enterprise, design appropriate e-government systems for that enterprise and then create real systems meeting those designs. This subsection describes the functional capabilities required in such a software package, a preliminary architecture for the software and an initial survey of some existing Open Source technology that supports the proposed architecture.

3.1.1 Functional Capabilities

An OSeRA software package provides four major functional capabilities that, together, allow an agency to construct and operate a complete e-government solution.

1. *Modeling.* The OSeRA vision is based on a model-driven approach to system development, and the OSeRA software will include all the tools necessary for an agency to create the models requisite to such an approach. Note that model creation will need to be supported at several different levels, for a number of different stakeholders, who will see the system under development from different viewpoints. The following are some of the modeling viewpoints that will be supported.

    - Business models: Business process models, business architecture models
    - Enterprise models: Enterprise data models, enterprise architecture models, business process realization models

- Component models: Component interface models, component interconnection models, component design models

- Technical models: Database models, software models, network models

2. *Provisioning.* The key tenet of model-driven development is that the models drive the construction of the operational system. Thus, the OSeRA software will include the capability to create the artifacts and allocate the resources required to actually implement e-government systems that have been modeled. Ideally, such provisioning will be based on the integration of reusable components at as high a level as possible, but OSeRA will allow for the generation and deployment of new code, scripts and other artifacts to as low a level of granularity as may be necessary. The result of the provisioning process is an executable e-government system that may be deployed into the agency's operational environment.

3. *Executing.* OSeRA will not only provide the tools for building e-government systems, it will also include a common infrastructure platform for executing those systems. Having such a platform is important for making the provisioning process tractable and robust. It also allows for common support of the management of operational e-government systems across agencies and the ability for the upgrading of agency operational environments using evolving best-practice technology. Because of the model-driven approach inherent in OSeRA, an agency will be able to re-provision their e-government systems to an upgraded infrastructure platform with little or no change to their enterprise models—because it is the platform-independent models, not the platform-dependent code, that are the primary artifacts.

4. *Managing.* A major goal of OSeRA is to provide the means for an agency to maintain a clear "line of sight" from its business models, though its technical models, to its operational e-government systems. Doing this requires careful management of all the artifacts produced using the OSeRA tool set. In particular, since the models will be the primary artifacts for e-government system development, their configuration will have to be carefully and thoroughly managed, including the maintenance of clear lines of traceability. Traceability between models will then extend, via the provisioning process, down to the deployed, executable systems, whose configuration will therefore need to be managed in relation to the models to which they trace.

3.1.2 Preliminary Architecture

Among the deliverables of the first phase of the OSeRA initiative was a model that defines, at a high level, the make up of OSeRA software packages.[4] This model provides, in effect, a preliminary architecture for the OSeRA software. While this architecture will need to be refined as OSeRA software development proceeds, the phase one model

[4] *A Model of OS-ERA: Open Source eGovernment Reference Architecture, Model-Driven Documentation Prepared for the U. S. Government Services Administration, Version 01-01,* submitted by David Frankel Consulting, Data Access Technologies and Barquin International, 1/3/05.

provides an initial conception of how the functional capabilities of OSeRA software packages can be concretely realized.

The preliminary architecture decomposes an OSeRA software package into three parts.

1. *Integrated modeling environment (IME).* An IME can be thought of as a next-generation integrated development environment (IDE). However, rather than supporting development in traditional programming languages such as Java, C++ or C#, an IME provides the tools necessary to support the use of models as the primary artifacts for developing systems. These tools include the following.
    - *Modeling tools* for all the sorts of models required for the model-driven development of an e-government system.
    - A *provisioning facility*, including
        - Programs that generate the artifacts to be provisioned
        - Tools for configuring the generators
        - A *model-based debugging facility* that makes it possible to debug the provisioned artifacts and the models from which they are generated
        - A *resource allocator* that allocates resources in the service-oriented integration platform (SOIP)
    - A *metadata management facility*, including
        - A component that makes it possible to use XML to exchange models among tools.
        - A component that manages models in a repository (that is, in a database).
        - An interface to the model repository that makes it possible for tools to deposit models in the repository and retrieve them as well
        - A tool for browsing and searching models in the repository
2. *Service-oriented integration platform (SOIP).* A SOIP is a run-time, infrastructure platform for the execution of e-government systems provisioned from an IME. It raises the level of abstraction of development languages, by using abstract models rather than Java, C++, and C# as the central, machine-processable description of software behavior. It also raises the level of abstraction of platforms, since an SOIP that hides minutia from programmers hides it from provisioning facilities as well, making it easier to write the generators that produce source code and other artifacts required to execute models. An SOIP thus integrates the following facilities into a coherent whole, while hiding some of their technical minutia.
    - A *service-oriented application server* manages many of the complications of component-based, distributed, service-oriented systems that support internal operations and electronic commerce.
    - A *deployment facility* manages the deployment of software to machines.

- A *security facility* controls access to system resources and components. Many security facilities operate on the principle of role based access, which assigns permissions to roles, while people are assigned to fill roles and thus acquire permissions assigned to those roles. Additional features help to control software's access to resources and components, as opposed to people's access.
- A *runtime operations management facility*, consisting of the following.
    - A *service-level agreement (SLA) monitor* monitors compliance with service-level agreements (SLAs) that are part of the contract between trading partners in a service-oriented architecture. Ultimately it should be possible to generate such components from formal models of service agreements between the trading partners
    - *A resource manager* manages resources such as server and client machines, processes, threads, database connections, and so on.

3. *Configuration management facility.* A configuration management facility manages the configuration of all development artifacts, whether they are software, models or documents. This includes the establishment of relationships among artifacts, the mechanisms for managing different versions of these artifacts, the management of changes to the artifacts and the maintenance of audit records on the changes that are made. Such a facility typically consists of the following.
    - A *version control facility* maintains and tracks multiple versions of artifacts, lessening the burden on system administrators who need to control which versions of which artifacts are available in which deployed systems.
    - A *check-in check-out facility* mediates access to artifacts by multi-person teams.
    - A *development process manager* enforces a development process. Some development process managers make it possible to customize the development process model that is enforced.
    - A *change auditing facility* produces audit reports of the changes that have been made to artifacts over time.
    - A *change impact analyzer* projects the impact that changes to designated artifacts would have on the system or systems for which those artifacts are specifications or components.

In addition, an OSeRA software package will include a library of components, at various levels of applicability, which may be used as a base from which to compositionally integrate e-government systems. Provided with each such component will be information about the domain that the component addresses. There are three kinds of domains:

1. *Generic business*. Examples of generic business domains include business process, value chain, business information, and so on.

2. *Line-of-business.* Examples of line-of-business domains include: procurement, currency options, radar stations, retail banking, and so on.

3. *Technical.* Examples of technical domains include persistence, latency, distribution, and so on.

Note also that the OSeRA architecture is itself component based. Some of the components that OSeRA software packages contain are called *ecosystems*. An ecosystem is an executable component that is extensible via a coherent plug-in architecture.

Eclipse is an example of an ecosystem. It is built from the ground up to be extensible, via an architecture that provides a way for new components to "plug in" to the ecosystem.

An integrated modeling environment (IME) is an ecosystem, because it is built from the ground up to make it possible to plug in new modeling tools, metadata management facilities, provisioning facilities, and so on. A service-oriented integration platform (SOIP) is an ecosystem, because it is built from the ground up to make it possible to plug in new executable components, deployment facilities, security facilities, and so on.

Some of the components of IMEs and SOIPs are ecosystems in their own right. For example, a provisioning facility is an ecosystem that makes it possible to plug in new generators that create code, deployment scripts, and other such artifacts.

3.1.3 Candidate Open Source Technology

Table 1 presents a list of candidate standards and Open Source technology that might be used to support the implementation of the OSeRA architecture. This list is a result of a preliminary assessment and, during further development of OSeRA, these and other candidates will be assessed.

Table 1. Preliminary OSeRA Open Source Candidate Projects

Modeling	OMG EDOC	The Enterprise Distributed Object Computing (EDOC) standard aims at providing a platform-independent, recursive, collaboration-based modeling approach that can be used at different levels of granularity and different degrees of coupling, for both business and information systems modeling. This standard contains a platform modeling facility, called ECA, which provides concepts for the modeling of business process, business process roles, and business information needs.
	OMG UML	The Unified Modeling Language (UML) specification defines a graphical language for visualizing, specifying, constructing, and documenting the artifacts of distributed object systems.
	OMG ODM	The Ontology Description Metamodel (ODM) standard aims at providing modeling capabilities for defining ontologies.
	OMG MOF	The Meta-Object Facility (MOF) is an extensible, model-driven integration framework for defining, manipulating and integrating metadata and data in a platform-independent manner. MOF-based standards are in use for

		integrating tools, applications and data.
IME	Eclipse	Eclipse is an open platform for tool integration built by an open community of tool providers. Operating under an Open Source paradigm, with a common public license that provides royalty free source code and worldwide redistribution rights, the eclipse platform provides tool developers with ultimate flexibility and control over their software technology.
	EMF	The Eclipse Modeling Framework (EMF) is a modeling framework and code generation facility for building tools and other applications based on a structured data model. From a model specification described in XMI, EMF provides tools and runtime support to produce a set of Java classes for the model, a set of adapter classes that enable viewing and command-based editing of the model, and a basic editor. Models can be specified using annotated Java, XML documents, or modeling tools like Rational Rose, then imported into EMF. Most important of all, EMF provides the foundation for interoperability with other EMF-based tools and applications
	Eclipse UML2	Eclipse UML2 is an EMF-based implementation of the UML 2.0 metamodel for the Eclipse platform
	GMT	The goal of the Generative Model Transformer (GMT) project is to construct/assemble a set of tools for model driven software development with fully customizable platform-independent models, platform description models, texture mappings, and refinement transformations.
	Octopus	Klasse Objecten has developed a tool to support the use of the Object Constraint Language (OCL). This tool is called Octopus, which stands for “OCL Tool for Precise UML Specifications”. Octopus is able to check the syntax of OCL expressions, as well as the types and correct use of model elements like association roles and attributes. It is more powerful than the previous OCL 1.4 syntax checker.
	Netbeans	
SOIP	Hyades	The Hyades project provides an Open Source platform for Automated Software Quality (ASQ) tools, and a range of Open Source reference implementations of ASQ tooling for testing, tracing and monitoring software systems.
	GUITAR	GUITAR is an automated tool that generates new test cases using a new technology of event-flow graphs. Pre- and postconditions are used to generate expected

		responses. Coverage (event and code) is evaluated. Free.
	JUnit	JUnit is a Java testing framework. It is used by a developer who implements unit tests in Java and for regression-testing.
	Apache Cactus	Cactus is a simple test framework for unit testing server-side java code (servlets, EJBs, tag libraries, filters, etc.). The intent of Cactus is to lower the cost of writing tests for server-side code. It uses JUnit and extends it.
	Apache JMeter	Apache JMeter is a 100% pure Java desktop application designed to load test functional behavior and measure performance. It was originally designed for testing Web Applications but has since expanded to other test functions.ch
	JBoss	JBoss is a Java 2 Enterprise Edition (J2EE) application server which provides plug-ins for Eclipse
	Apache HTTP Server	The Apache HTTP Server Project is an effort to develop and maintain an open-source HTTP server for modern operating systems including UNIX and Windows NT. The goal of this project is to provide a secure, efficient and extensible server that provides HTTP services in sync with the current HTTP standards.
	Apache Tomcat	Tomcat is the servlet container that is used in the official Reference Implementation for the Java Servlet and JavaServer Pages technologies. The Java Servlet and JavaServer Pages specifications are developed by Sun under the Java Community Process.

3.1.4 Open Source Code, Open Source Models

OSeRA introduces the concept of *Open Source models*. The notion of Open Source models expands upon the concept of Open Source code. In addition to making auto-generated and manually written source code publicly available, OSeRA plans to make available models that were used to design and generate the executable software, including UML models, high-level business process models, models of service-level agreements for e-commerce, and so on.

OSeRA will also make available the source code and specifications for the provisioning facility that provisions executing systems from models.

As mentioned earlier, many of the components of OSeRA software packages will have been developed by Open Source communities such as Eclipse and Apache. Source models for such software may not be available to include in OSeRA software packages. However, software developed specifically for OSeRA will include source models.

3.2 OSeRA Support Services

Figure 1 summarizes the contents of an OSeRA software package. Each release of an OSeRA software package will be supported by the following associated services.

1. *Consulting services*, providing assistance in the use of OSeRA software packages.
2. *Training packages*, including curricula and execution plans for training users of an OSeRA software package
3. *Stakeholder orientation*, including presentations and papers providing orientation, for specific stakeholder communities, to an OSeRA software package.

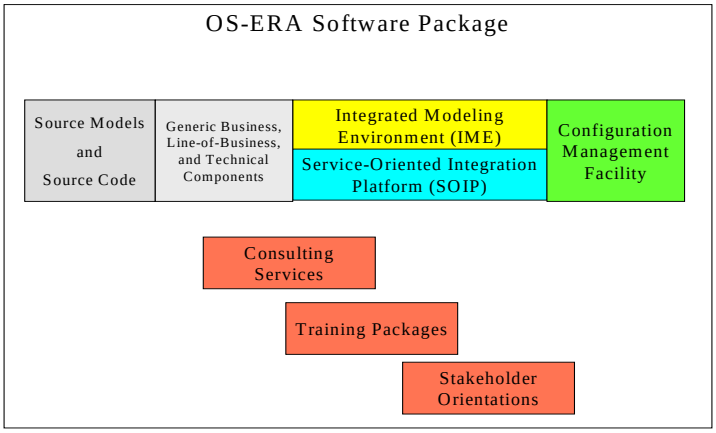

Figure 1: The Contents of an OSeRA Software Package

3.3 Roadmap *(TBD)*

4 Market Analysis

Although the concepts, methodologies, frameworks and deliverables being proposed by the OSeRA project certainly have applicability outside of the U.S. Federal Government market, this initial effort will focus on the needs and requirements of only the U.S. Federal Government marketplace. Once OSeRA is implemented and freely available as an Open Source project, it is highly likely that commercial, not-for-profit, state and local governments and foreign government and non-government entities will participate in furthering its success. It is certainly the intention of the GSA to both supply to and take advantage of any and all developments related to this OSeRA project.

This initial focus on the U.S. Federal Government market will allow us to provide a reasonable estimation of the market, value to that market and cost-benefit for that market.

In this section we will identify the target market audience for OSeRA, segmenting it by major potential participants. We will then identify each of the segment's specific needs and market gaps and identifies why OSeRA fills those.

We then take a measure of basic market trends driving each of the segments including the impact of the legislative environment, economic pressures and personnel availability.

Significant barriers to entry, economic, legal, market and historical currently affect this opportunity. We examine these and present some of the alternatives that will make it far easier to enter this market both as a user of OSeRA's product as well as a significant participant in its progress and success.

All of the above will culminate in a broad estimate of the potential growth of this market over the next few years.

Finally we take a detailed look at the probable participants in this market and the competition that it will face. The Open Source community is likely to be a major partner in the work of OSeRA so, some time is devoted to analysis of its participation and contribution.

The reaction of supplies to this market is important and we will analyze the probable market reactions of both large and small suppliers, including the major suppliers: Microsoft, Unisys, IBM, Sun and others.

The opportunity for participation by the academic community is also examined in its potential effect of strengthening our knowledge base, supplying intellectual capital (and strengthening it) as well as potentially linking curriculum with the OSeRA theme and roadmap.

4.1 Market Segmentation

The major market segments identified for this early phase of the OSeRA project include the following:

- The General Services Administration itself and its major current and projected Lines of Business
- The Department of Homeland Security, primarily because of its sheer size and current desperate need for interoperability between its constituent parts
- Other Executive Branch Agencies that must meet the requirements for an overarching Enterprise Architecture and be evaluated by the Office of Management and Budget
- The Department of Defense, which has already expressed a strong interest and has invested heavily in OMG Standards-based technologies
- The Intelligence Community, now undergoing radical transformation with its absolute requirement for interoperability
- Major suppliers to the U.S. Federal marketplace

Each of these segments will be examined in more detail, but, as mentioned earlier, there is a vast array of potential market participants outside of the U.S. Federal Government market. For completeness, we wish to, at least, list the major segments we see at this point in time for this huge market (basically, the rest of the world):

- State and Local Governments
- Non-U.S. (parallel) Federal, State and Local Governments
- The non-governmental/commercial marketplace which could be segmented into many both vertical (Financial Services, Medical, Pharmaceutical, Aerospace, Manufacturing, Transportation, Agriculture, etc., etc., etc.) and horizontal (CRM, Accounting, Personnel, etc., etc., etc.)

4.1.1 The General Services Administration

The GSA itself is the initial prime market and customer for the OSeRA product and project. Driven by the current "OneGSA" Enterprise Architecture project and the agency's "Get It Right" campaign, OSeRA provides the underlying infrastructure today and moving forward to meet the requirements of both of these critical efforts.

The multiple lines-of-business within GSA also provide for an excellent, controlled testbed for developments in OSeRA. Currently very siloed in implementation and interoperability, each of the major SSOs in GSA offer a wealth of improvement opportunity. Our current OneGSA work only scratches the surface of what might be accomplished with the implementation of OSeRA only within the GSA.

Within GSA we would postulate that the system redundancy identification and elimination that OSeRA could facilitate would, by itself, provide for more than an order

of magnitude in cost savings over and above the cost of OSeRA. These cost savings and productivity improvements do not even approach what OSeRA could provide if a full modernization program, using OSeRA were to be undertaken.

GSA is responsible for almost $20 billion in expenses, more than $10 billion representing acquisitions from the private sector. Our initial, very high level, analysis of GSA's siloed procurement environments pointed to more than 12 separate procurement systems that support this level of acquisition. We have not done the analysis that OSeRA would afford us, but the savings in this area alone to the Government and the citizen could be enormous.

The clarity and ability to react to changes in the market that OSeRA would provide would be a major boost for the market's confidence in GSA and its ability to react to change. Buying patterns are changing as rapidly as the internet is growing. Estimates of the increase in commercial purchases over the internet during the recent holiday season range from 24 to 29 percent. OSeRA can help GSA utilize new technologies, like the web, to provide its customers the most cost effective services available.

Another area of importance to GSA is how to meets the Office of Management and Budget Federal Enterprise Architecture requirements as outlined in the various published Reference Models (Performance, Business, Services, Technical and Data). OSeRA provides a clear Enterprise Architecture focus that will give GSA the leading edge in this area.

GSA's role as a government services "market maker" can also be enhanced through the adoption and "resale" of OSeRA to other government constituencies. If OSeRA can help GSA to meet its enterprise architecture requirements and provide best practices to meet OMB's requirements, then it certainly should be able to "market" these benefits to its traditional customer base, the other executive federal agencies and the DoD. GSA is a natural to provide this market-making capability.

Another critical key, talked about in much more detail elsewhere in this report, is the ability GSA could provide to indemnify the GSA market (as well as other markets) for software copyright/patent infringement for the use of OSeRA. We are assuming here that one of the key deterrents to the use of Open Source developed (or integrated) infrastructure, tooling and applications is the fear of infringement and resulting potential liability (e.g., the market mess created by SCO and Linux). Numerous large federal software suppliers and integrators have refused to use Open Source in their development work for just this reason. OSeRA, backed by a GSA "warranty" would provide an EA infrastructure second to none.

4.1.2 The Department of Homeland Security (DHS)

The current restructuring of much of the Executive Branch "security" apparatus into a single agency offers a major opportunity for OSeRA. The absolute need for

interoperability amongst the many systems and services that now comprise DHS has been often documented…and documented in the fact that it is not happening as quickly or smoothly as would be desired for the security of the nation. The adoption and strong contribution to OSeRA by DHS would speed the necessary integration of the hundreds of systems that now comprise DHS.

Using current methods and tools to attempt to reconfigure the entire DHS systems and data bases for interoperability would probably be not only a prohibitively expensive task, but probably an impossible one within anything that could be defined as a reasonable timeframe, leaving the safety of the Nation under considerable risk. Participation in OSeRA offers DHS the opportunity to prioritize its development, targeting those applications, systems and services that are most readily required.

Also, as libraries of reusable components are developed at the federal level, DHS can readily adapt those components in its electronic partnerships and data sharing with those on the front-lines, the first responders at the state and local level.

4.1.3 Other Executive Branch Agencies

Although we specifically call out DHS, each of the Executive Branch Agencies, from the State Department, to the Department of Energy, to much smaller agencies, departments and commissions will be able to benefit from the developments of OSeRA. OSeRA will offer the opportunity to share and use components that have to be built only once. It gives the Executive Branch, as a whole, the opportunity to create cross-agency services that can truly supply economies of scale while, at the same time, cater to the specific business needs of the individual agencies.

A simple example here is a truly singular Executive Branch Financial Service, as is currently envisioned by the GSA OCFO Line-of-Business. Utilizing OSeRA with its imbedded Model Drive Architecture (MDA) processes and standards will allow for the truly agile business and systems environment that will allow the ever-changing business requirements to drive the systems that support the agencies and the citizen.

4.1.4 The Department of Defense

The Department of Defense (DoD) is already an active participant in many MDA activities. It is developing numerous systems using both the MDA approach and numerous MDA focused vendor tooling. Participation in OSeRA will allow it to drive those system development tasks even further along the MDA path.

There are numerous aspects of the OSeRA project that should appeal to various DoD elements: componentization, reuse, and in particular, the ability to provide both simulation of potential solutions and the ability to view solutions/models from different tools and (thus) perspectives.

The DoD also provides funding for numerous "leading edge" technology organizations, such as DARPA, whose role is to fund extremely promising technological and/or systems developments. The potential rewards from the full development of the OSeRA vision should be very attractive to DoD, its leading edge developers, and its mainline businesses – those that actually execute the systems strategy – and go to war.

4.1.5 The Intelligence Community

The recently announce reorganization of the US domestic and foreign intelligence community agencies under one head offers yet another major opportunity for investment in and use of OSeRA to fundamentally change and enhance the interoperability of this community. A major recognized flaw in today's Intelligence environment is its difficulty in communicating information across agency boundaries. OSeRA offers the opportunity to help mitigate that problem through its focus on interoperability and common componentization.

4.1.6 Major Technology Suppliers to the U.S. Federal Government

One comment we have heard from numerous major suppliers to the US Federal Government (the Lockheed Martin's, IBM's, Unisys' or SAIC's of the world) is that there is too much risk involved in utilizing Open Source solutions for their Federal customers. They acknowledge that Open Source provides a wealth of capabilities at *very* attractive pricing, but, because of the liability potential (as exampled by situations like Linux and SCO's legal actions), they are very averse to utilizing Open Source in any major Government development environment.

Now, this situation seems to be improving somewhat with IBM and Unisys leading developments in areas like the Eclipse Foundation and IBM's recently announce opening of 500 patents to "Open Source". These, however are very leading edge efforts and have not reached the mainstream where they would be a "natural" resource to the major Federal SI/development suppliers. The risk element associated with Open Source is still too strong.

One of the major targets of the OSeRA project is to find a way to eliminate (or at least practically minimize) the liability risk associated with the OSeRA products and deliverables. This may, literally, take an "Act of Congress" to accomplish, but the benefits heavily outweigh any cost - in the savings, time-to-market and services-to-the-citizen that could be generated.

4.2 Target Market Segment Strategy

This sub-section identifies the overall needs of the identified market and its segments in terms of Executable Enterprise Architecture. We identify what is driving those needs, both from a market, technology and a legislative perspective. We examine the overall trends in those market segments that make the adoption of OSeRA imperative. We

describe the substantial barriers to entering this market and finally, take a very broad stab at the market's potential for growth.

4.2.1 Market Needs

The Federal marketplace is unique in many ways. Most relevant to the OSeRA opportunity is the fact that the President's Objectives, as reflected in significant OMB work, are requiring all Executive Agencies to develop, maintain and utilize an enterprise architecture. OMB has created five reference models to "help" agencies reach a "green light" level of implementation and maturity. This is rapidly advancing the role of the architect in the Federal Market.

OSeRA takes this at least one step further, by taking that Federal Enterprise Architecture beyond its originally intended budget development and tasking arena to that of Executable Enterprise Architectures.

4.3 Market Trends

Numerous market trends are of relevance in viewing the potential impact of OSeRA:

- Potential to stem the tide of offshore outsourcing: Because OSeRA takes a strong Model Driven Architecture (MDA) approach and provides for considerable abstraction requirements; it raises the intellectual level required for the production of software, components and systems. The Industry will no longer require "coders" whose tasks, as we have already seen, are relatively easily outsourced. Instead, it offers the opportunity for America to take back the leadership in software development by taking a large step towards making "the model is the code". Architects and modelers, very closely aligned with the business requirements of the organization then are the key roles in software development.
- Within the Federal Government, itself, accountability at all levels is becoming a critical success element. Accountability requires the ability to derive a credible and pertinent set of metrics. Those metrics must be traceable from the business needs of the organization through to the systems and processes that implement those needs. We are calling this linkage between progressively aggregated sets of metrics "line of sight". OSeRA offers the opportunity to create and manage a "line of sight" set of metrics that will provide great value to each organization and will be used by such organizations as the Office of Management and Budget (OMB) to measure and report government performance.
- We have already mentioned much on the trend to Open Source development which can provide great benefits to its users. OSeRA takes full advantage of, and furthers that movement.
- The commercial environment is now faced with numerous legislated mandates that that are driving significant changes in business processes and resulting systems (Sarbanes-Oxley, HIPPA, etc.). It is highly likely that these same type of accountability requirements will be legislated on the government agencies as well

(we are already seeing this in things like the GSA's "Get It Right" campaign reaction to various accountability discoveries).

4.3.1 Barriers to Entry

OSeRA will, because of its Open Source basis, minimize any barriers to entry. A project of this size and scope could only be undertaken by the largest of software development companies (and is being paralleled somewhat by Microsoft) or by a directed (and government funded) Open Source – or similar – undertaking. OSeRA levels the playing field so that, initially, Federal Government has a choice of standards-based, Open Source development platforms, with all the advantages and disadvantages that entails, versus proprietary choices – with their substantial advantages (e.g., tightly coupled application tools) and disadvantages.

Another key barrier to entry that OSeRA breaks down is the substantial question and risk that can be associated with Intellectual Property (IP) rights. Key suppliers to the Federal Government have openly stated that they will not embrace Open Source technology in their deliverables precisely because of this risk. As envisioned, the OSeRA business governance and licensing arrangements will mitigate those risks, for the benefit – and relief – of all participants. This, literally, may take an Act of Congress to accomplish, but the value returned is huge. Only a Federal Government backed project like OSeRA could accomplish this risk mitigation.

4.3.2 Market Growth

Although we have not had the research opportunity to quantify the growth of this "market", qualitative and anecdotal observations point to its huge potential. It is being driven by such forces as the requirement for organizational agility, the need for measurable results, the budget and legislative pressures being placed on all organizations (inside and outside government), the blurring of boundaries between organizations and other factors.

There are a number of factors that must be considered in examining potential growth:

- The growth of the Open Source movement
- The strong movement to Service Oriented Architectures
- The phenomenal growth in XML based standards and their implementations
- The strong movement towards, and value recognition of enterprise architecture efforts
- The huge growth in modeling based approaches to software development

We are at the very beginnings of the "market" that OSeRA supports. Its potential can be both transformational and positively disruptive.

4.4 Participants

This sub-section focuses on the various market participants (primarily from a supplier perspective) and how they might react to the development of this market as described

herein. It assumes that GSA will be the major driving and supporting organization behind the development of OSeRA.

Here we examine the potential and probable reactions of the "external" suppliers and players in this market. We look at the role that the Open Source community is expected to play - although somewhat clouded by what Open Source is morphing to. However there are major players in this space – or at least portions of it – and it is important to understand what their potential reactions might be to a Government (GSA) led effort in this space.

4.4.1 Link with Open Source (OS) Community

A major source of expertise, talent, testers, and users would, over time, come from this community. The OS "community" is becoming more and more "mainstream" as the months pass. With major efforts – maybe not de jure, but de facto – from Unisys, IBM, Novell, Sun and other major market players the OS community is getting considerable financial and market support.

For instance, much of the work that OSeRA envisions is an integration and/or amalgamation of already existing OS project work. We will probably be using works from the Apache Foundation, Mozilla, Eclipse, and others. We will however, be providing a service far beyond any of these individual efforts today deliver and this will take the development of our own OSeRA project and organization.

The intent of OSeRA is *not* to reinvent the wheel. We will cooperate with existing and new OS organizations and utilize their work product in our own as is appropriate and practical.

4.4.2 Competitive Analysis

This section examines the potential market reaction of various classes of organizations that may be either contributors or competitors to the OSeRA efforts.

4.4.2.1 Large Company reaction

Most large user organizations should look upon the efforts of OSeRA as highly beneficial to their organizations. It is our hope that, initially within the Federal Government and eventually far beyond, to include very large commercial user organizations, the benefits provided by OSeRA will accelerate the current software development paradigm shift. It will be of most benefit to user organizations.

Software supplying organizations will, however be dramatically impacted by this accelerating software development paradigm shift and the accelerating effects that OSeRA can bring to this. Most large software developers, however, are already preparing for this change and have, at least experimentally, "joined" the Open Source and MDA movements.

4.4.2.1.1 Microsoft reaction

It is highly likely that Microsoft, because of its user base and market power will not embrace this shift and will be a strong competitor to OSeRA and any "Open" or "Open Source" software development paradigm shift. We speculate that Microsoft, because of its position in the market, its still rather complete hold on the desktop and other elements of its massive momentum, will develop similar – but proprietary – methodologies and tools.

GSA's leadership in OSeRA, however, can provide for one of the main benefits to the Government: by providing a viable competitive offering to a Microsoft Development Environment, it is providing a level playing field for Federal Government to choose between. There will be advantages to a Microsoft environment in areas like direct integration with the Microsoft desktop and advantages to OSeRA in its openness and potential cost savings. The Federal Government will have a real choice in how it develops its citizen-centric business and technology environment.

4.4.2.1.2 Other Large Company reaction

Other large software development companies are rapidly changing their development paradigm to embrace more and more Open Source. Moves by IBM, Unisys, Sun, Novell, Oracle and many others to actively embrace and support Open Source projects point the way of the future in business application development.

It is thought that many of these organizations will become active participants and contributors to OSeRA, again, helping to maintain a level playing field.

4.4.2.2 Small Company reaction

Over the past decades, much of the innovation, creativity and growth in all sorts of technological advancements have been driven by the small companies of the world. This is very likely to continue. Small companies can take significant advantage of OSeRA from a number of different perspectives:

- They can be suppliers to the OSeRA project, gaining Federal Government sponsorship for specific efforts where they may provide expertise
- They can be users of OSeRA in development work for their Federal Government clients
- Eventually, as OSeRA goes to its next level, that of a commercial nature, they can develop specialized add-ons, industry specific tooling or who knows what else that will help propel their growth.

4.4.2.3 Academic Community reaction

One of the major potential beneficiaries of and participants in OSeRA can be the academic community. As an Open Source project, and as a prime accelerator of the ensuing technology development paradigm shift, OSeRA provides a great "lab" for innovation, creativity and recognition.

There are numerous aspects that need further exploration, but the obvious – computer science curriculum – is not the only potential for OSeRA oriented academic study. There will be economic and social shifts that result from this wide ranging change and approach to technology. By moving to the "next level of abstraction", the United States has the opportunity to provide a means to slow or end (IT oriented) outsourcing, to mane just one area of economic impact and study.

Computer science (or similar academic curriculum) can be most effected by, take advantage of and contribute to OSeRA.

4.4.2.3.1 Academic world collaborates with GSA supplying intellectual capital and labor

There is the opportunity for GSA and the rest of the Federal Government to leverage the academic community and obtain both intellectual capital and labor. As an Open Source project, OSeRA will afford the opportunity to build curriculum elements, programs and maybe even whole degree programs around OSeRA. This, for instance, is already happening around other Open Source projects such as Eclipse. Individual students are taking the initiative, some backed by the support of their professors to contribute to these Open Source projects. The structure, MDA basis and Open Source nature of OSeRA, should provide the academic community a wealth of opportunities.

4.4.2.3.2 Link between job outcomes and what is accomplished in academic environs

One probable outcome of a strong linkage between the academic community and the OSeRA project is a wealth of talent available to both government and those commercial organizations that support government. With an initial target market of the Federal Government, as outlined above, the academic participants in the OSeRA project would be natural sources for openings in Federal Government organizations utilizing OSeRA and their supporting commercial partners.

4.4.2.3.3 Link between theme/roadmap and curriculum

It is important that, for the success of the academic relationship and realization of its potential benefits, there needs to be a challenging link between the OSeRA themes/roadmap and the academic curriculum. Encouraging the academic community to provide research leadership, especially in some of OSeRA's "leading edge" technologies, will be a natural alignment. The OSeRA project, jointly with the academic community can coordinate these research focused efforts – providing challenging academic opportunities – to the OSeRA roadmap.

5 Strategy

This section examines the potential strategic approaches that could be undertaken in the development of the OSeRA platform and market. We examine the potential risks associated with GSA's leadership in this market space, its strategic fit within GSA's own Charter. We then look at both a marketing and sales strategic approach.

5.1 Risk Analysis

There are a number of inherent risks associated with the OSeRA undertaking. Some of these are pure market take-up in nature and won't be dealt with in this business case as they could be argued to be generic for any market entry strategy. There are other key risks that are totally unique to this effort and do require examination. The two most prominent ones are the issue of intellectual property (IP) ownership in an Open Source environment and its corollary, the potential for individual contributor – and more importantly – user - liability for infringement on IP rights.

5.1.1 IP Ownership

There has been much in the press recently about this issue with lawsuits being brought by SCO against IBM and others. In an Open Source development environment there is a risk that code that is brought to the project could be the intellectual property of another (as SCO claims of some of the Linux code being directly from its IP in UNIX). The major risk is that the end users of the Open Source project software will be liable to the claimant of IP. This is the major reason that many of the major system integrators to the US Government are not using Open Source to fulfill their development obligations.

5.1.2 Liability Mitigator

One of the major benefits of developing OSeRA under the GSA is the opportunity to provide a mechanism to mitigate this liability potential. There, of course, will still be the need to do substantial vetting of the software contributions and have contributors, to the best of their ability, assign uncontested rights to the software to OSeRA, but, as claimed by SCO of Linux, there could be slip ups.

It may, literally, take an "act of congress" to allow GSA to mitigate this liability and there still needs to be considerable – especially legal – research into its possibility and consequences, but the benefits could be tremendous for the government, its suppliers and the citizen.

5.2 Strategic Fit

The ability to assemble the disparate efforts of the Open Source communities best of breed efforts into a cohesive managed platform is not a conceivable goal of the Open Source community, and a fundamental barrier to the adoption of Open Source technologies on the large scale. Not only is this possible for an entity like GSA to sponsor

and fund the consolidation of these technologies into a cohesive Platform, it is a great added value provided by GSA back to the Open Source community.

GSA would provide the OSeRA platform as a software subscription or managed service environment to any entity that wants to use this utility platform provided by GSA, enabling all those whose budgets and resource constraints would otherwise present a barrier to entry. This would provide value to organizations that are attempting to create a federated information brokering partnerships across all government, such as NASCIO and DHS.

Comment [EVS4]: This is a repeat of wording in Section 2. I don't know if it is better here or there.

5.2.1 Holistic View

OSeRA combines forward thinking technology trends and time tested best practices while sponsoring the commercial aggregation of Open Source software into composite units of functionality, augmenting these where necessary, to provide a cohesive platform and guide industry partner engagements. The government must exert a leadership presence to industry partners to maintain the balance and accordance of capitalistic and socio-economic interests. OSeRA is this normalization mechanism.

As detailed above, the OSeRA Program presents an opportunity for institutions of higher learning to participate by developing student programs that contribute to multiple and distinct but intrinsically linked efforts of the individual citizen, their personally enabling universities and colleges, the software industry, and our Government.

Institutionalizing these combined efforts presents powerful mechanism towards the realization of each party's individual goals and their shared interests.

- Government wins by providing a focal point for the tremendous pool of private and public intellectual capital whose collective contribution has no cost burden.

- Universities are handed a curriculum that every student of computer science and information technology will have immediate interest in. Students and any other citizen contributors gain a more holistic technological understanding of their present and future careers in our knowledge based economy that condenses expert learning currently requiring decades of experience to obtain, and establish a direct relationship with an important part of our National agenda and the computer based industries alike.

- The software industry gets a unified view of the business and IT gap, combines the most highly skilled and experienced professionals with the country's most creative and energetic resources generating a direct relationship with its future talent pool, and ultimately reinvents its practices and revitalizes performance in delivering business value.

5.3 Marketing Strategy

This section describes the way GSA intends on marketing the OSeRA project within itself (i.e., to its separate lines of business) and to its Federal Government customers. We are intentionally focusing on the identified target markets and described above, even though, in the longer term it is expected that this market will broaden greatly to other government entities and the commercial market.

5.3.1 Positioning Statement

The OSeRA program will provide an Open Source public IT utility platform, with subscription based distribution, runtime deployment, configuration management, and contributor community governance provided by the General Services Administration. This platform offering will create Federal Government business IT agility by removing barriers to entry in the federation of Federal Government entities, to enable their unique contributions to the fulfillment of e-governement and citizen-centric future state goals and today's mission critical requirements, such as those of DHS and DoD.

5.3.2 Pricing Strategy

The pricing strategy for OSeRA is multilevel.

1. As an Open Source project, the developments and source code will be available to all who want access, at no charge. This is an essential prerequisite to be classed as Open Source.

2. The project itself however will have numerous classes of membership, enumerated in Section 6, below. Each of those classes and potential combinations of classes will bear certain cost elements that will range from solely the contribution of funding to the contribution of resources (or both). The pricing of these membership levels are yet to be determined, but may be directly proportional to the priority an organization or contributor puts on the completion of an OSeRA task. Members that provide funding for specific tasks will likely work with GSA and others to prioritize those tasks and “find” appropriate resources to accomplish them.

3. Ultimately, GSA will offer OSeRA as a managed service, accessible at a yet to be determined subscription based pricing. This service will provide the additional services, facilities and personnel that would normally support a complex software offering, but at substantially lower pricing because of its Open Source development base.

4. In addition, such services as training, consulting and stakeholder Orientation will be provided by contractual arrangement with the GSA. This could take the form of a BPA or a GWAC like schedule with multiple commercial vendors delivering the services as required.

5.3.3 Promotion Strategy

OSeRA promotion strategy will be based on documenting proven results, starting initially within the GSA itself. These documented results will then be promoted through numerous channels to include, but certainly not limited to:

1. The CIO and other relevant Federal Government "Councils"
2. OMB
3. At various, architecture and government focused trade shows/events
4. At appropriate Standards body events/meetings (OMG, OASIS, W3C, etc.)
5. Trade and government press
6. The publishing of white papers
7. The Open Source community
8. OSeRA's own web site

The documented results will include case studies and specific use cases.

5.3.4 Distribution Strategy

GSA will act as the prime distributor of the OSeRA product and services to the Federal Government. This will be done via appropriate contract vehicles that allow the using agency the utmost in implementation/usage freedom while providing for the services and service levels required by the "using" organization.

The most appropriate contract vehicle is yet to be determined and could range from a BPA to a GWAC to other more appropriate forms (firm-fixed, time-and-materials and performance-based are all under consideration). As the value and the actual preferred distribution method are codified, the appropriate contract vehicles will be easily identified.

Also, within GSA, the appropriate distribution service line (SSO) has not, as yet, been clearly identified. Again, as OSeRA develops and usage patterns emerge, the specific GSA organization t handle distribution will be identified. Initially it is expected to be under the direction of the OCIO.

5.3.5 Marketing Programs

Marketing programs will be tied to the deliverable milestones outlined above and aligned with the specific target markets identified. The programs will consist of program management that identifies, promotes, prices and identifies appropriate distribution for each of the OSeRA "products" as they are productized for each of the identified target markets.

For instance, some releases that are of critical interest to the DoD or DHS may not be of significant interest to other Executive Agencies. The marketing programs developed will take these important elements into considerations as specific and targeted programs are developed.

5.4 Sales Strategy

There are two elements of the sales strategy for OSeRA. The first is targeted at obtaining initial funding for both Domain and Vertical market efforts.

As opposed to much of the sales efforts that currently take place emanating from the GSA, the OSeRA project intends on developing a highly specialized team of technical experts aligned with subject matter experts (SMEs) for specifically targeted domains. For instance, the alignment of an OSeRA technical expert with a financial systems domain expert will proactively solicit usage and funding from financial offices across the Federal Government. The strategy here is to develop a funding pool for a domain-specific practice that will drive the targeted development of OSeRA for that domain. It is a "spread the cost" strategy for cross organizational domains.

The vertical market strategy will pair (in many cases the same) OSeRA technical expert with vertical market SMEs – such as someone with total GSA expertise or another with DHS. This sales strategy, again proactive, will target the specific target markets identified above and generate and fill requirements specific to the target market.

These sales strategies align with the marketing programs described above.

The second element of the sales strategy focuses on developing a "user" base for the proposed GSA OSeRA Managed Service. This will take existing services and sell them to appropriate Federal Government organizations. This will be a more generalized sales effort and will rely more heavily on marketing and promotion than on specifically targeted selling.

5.4.1 Sales Forecast (TBD)

5.4.2 Strategic Alliances

There are two types of strategic alliances foreseen for the OSeRA project.

The first is along vertical market lines and would involve very large and specific funding by organizations such as DHS and elements of DoD. This also aligns with both the marketing and sales strategies.

The second would be with major suppliers to the targeted vertical markets. IBM and Unisys, for instance are both highly involved in the Eclipse Foundation and would be natural strategic alliance partners for GSA. They could eventually provide the market basis for taking OSeRA beyond the Federal Government marketplace and into State and Local as well as foreign governments and to the commercial market.

5.4.3 Milestones

The sales milestones are directly aligned with the strategic and vision milestones described above and are as yet TBD.

6 Basic Governance and Management

Figure 2 depicts the main organizational and human roles required to govern and manage OSeRA. The business plan being submitted along with the OSeRA model suggests which organizations and people should play those roles.

Comment [EVS5]: Isn't the present document the business plan??

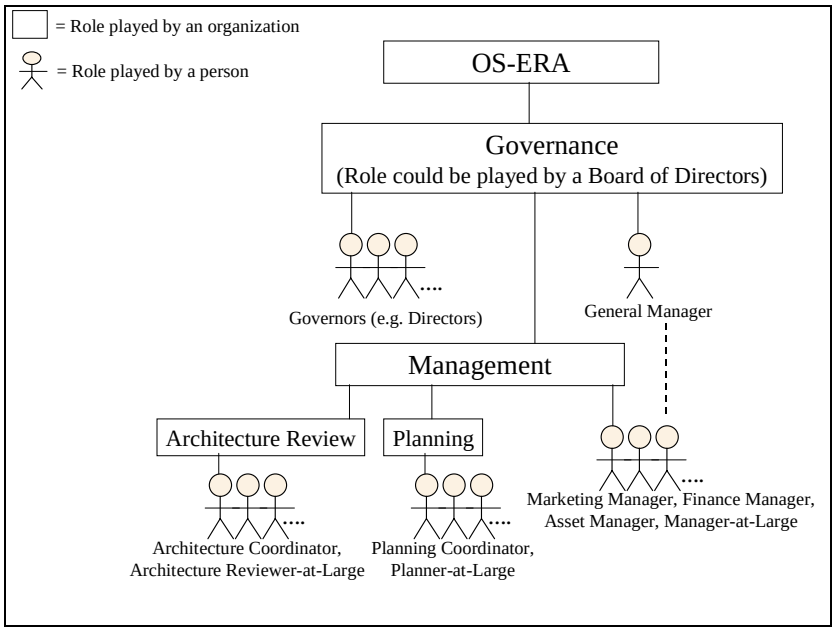

Figure 2: Basic Governance and Management Roles

An organizational role is a role played by an organization. A human role is a role played by a person, who is a member of an organization. For our purposes, membership in an organization on the part of a person includes being an employee of or performing work on contract for the organization. The same organization can assume more than one organizational role, and the same person can assume more than one human role.

6.1 Organizational Structure

The OSeRA organizational role represents the overall OSeRA organization. Were OSeRA to incorporate, the corporation would play this role.

The Governance organizational role represents the legal governance of OSeRA. Were OSeRA to incorporate, a Board of Directors would play this role. If OSeRA does not incorporate, a lesser organization could play this role, such as a policy council. The Governance role is executed by a number of Governors. Were OSeRA to incorporate, members of the Board of Directors would play the Governor role. The General Manager is accountable to the Governance organization.

The Management organization is staffed by a number of Managers (people), including a

Marketing Manager, a Finance Manager, and an Asset Manager. The Asset Manager is responsible for physical facilities and for the maintenance of the OSeRA membership rolls. Managers have dotted line accountability to the General Manager, but work at the pleasure of the Management organization.

The organization that assumes the Management role is ultimately responsible for planning releases of OSeRA software packages, and for reviewing the architecture of prospective releases. However, Planning and Architecture Review are broken out as separate roles, because the Management organization will probably delegate planning and architecture review to other organizations.

The Planning role could be assumed by a new organization, such as an OSeRA Planning Committee. This is the likely outcome, as explained in the business plan, but the model itself leaves open which organization will assume the role. The model also allows for a pre-existing organization, such as the GSA, to assume the role. The Architecture Review role could be assumed by a new organization such as an OSeRA Architecture Board. This is the likely outcome, but, again, the model itself leaves open which organization will assume the role.

The Planning organization is staffed by Planners (people), one of whom is designated as the Planning Coordinator. The Architecture Review organization is staffed by Architecture Reviewers (people), one of whom is the Architectural Coordinator.

The governing organization is responsible for formulating a set of by laws. The by laws include a statement of goals for OSeRA, and mandate certain documents that must be produced, maintained, and approved. The planning organization is responsible for the Roadmap document, which describes an overall plan for achieving the goals stated in the by laws.

6.2 Memberships

Organizations can be members of OSeRA. There are four basic kinds of membership:

- *Contributing member*—Contributes human resources to staff OSeRA projects
- *Financing member*—Contributes financial resources to fund OSeRA projects
- *Academic member*—Contributes student interns and academic liaisons to staff OSeRA projects
- *Premier member*—Contributes human and financial resources to staff and fund OSeRA projects

The formulas for the exact requirements for human and financial resource contributions have yet to be worked out. However, it is worth noting that the OSeRA model makes it possible to enter the formulas formally into the model, whereupon software can be generated that helps to enforce the formulas. In that sense, OSeRA governance and management will itself be model-driven, to some extent.

Membership in OSeRA confers certain privileges, including:

- *Seats in the Governance organization*
- *Seats in the Management organization*, which, as Figure 2 illustrates, could include Managers, Architectural Reviewers, and Planners
- *Direct access to the OSeRA repository*. Although OSeRA releases will be publicly available, the general public will not have direct access to the OSeRA repository, allowing members to review work-in-progress. Write access will be more sharply restricted than read access.

The formulas for allocating the number of seats permitted to various members have yet to be determined. Again, these formulas can be entered into the model and generated software can help enforce them.

6.3 Management Team (TBD)

6.4 Operations

This sub-section covers the operational aspects of the OSeRA organization along with its Technical Governance. We examine a proposed method for Product/Services creation and delivery (by delivery here, we mean its "productization"). We discuss the need for aftermarket customer support and

6.4.1 Product/Service Delivery - Projects

Although projects are ultimately owned by the Management organization (see Figure 3), OSeRA member organizations kick projects off by producing a Project Plan, which must be reviewed and approved. The Project Plan must explain how it helps to achieve at least one of the goals outlined in the by laws.

For each project, a Project Management Organization (PMO) is created. Various project management personnel, including a Project Lead and Developers, staff the PMO. It may also be staffed by liaisons to academic institutions (institutions that are OSeRA Academic members) and by academic Interns. Interns are responsible to the Project Lead, with dotted line responsibility to the liaison for their institution.

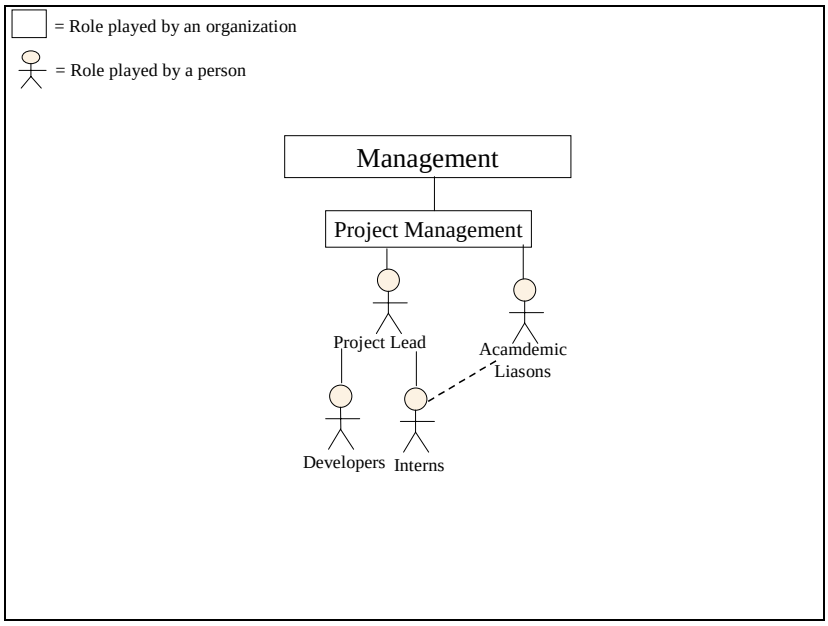

Figure 3: Project Management Roles

6.4.2 Releases

A project leads to the release of OSeRA software. There may be multiple releases per project, where each successive release represents a new version of the software.

A release consists of one or more OSeRA software packages. The packages of a particular release differ from each other only in which platforms they support. For example, one package in a release may support Windows, another may support Linux, and yet another may be platform-independent. A platform-independent package may contain platform independent-models that were used to create the software.

The planning organization is responsible for maintaining a Comprehensive Release Plan that sequences the releases and provides a rationale for sequencing. The Comprehensive Release Plan is dependent upon the Roadmap, in that it must demonstrate how the plan fits into and advances the Roadmap.

6.4.3 Reviews

The Roadmap, the Comprehensive Release Plan, individual Project Plans, and releases have to be approved by the Planning,, Architecture Review, and Governance organizations.

Basically, the Planning organization reviews first; however, in the case of the Roadmap and the Comprehensive Release Plan, the Planning organization is responsible for these documents, and thus, when it has prepared and approved a draft, the planning review is considered to have been completed. In the case of Project Plans and releases, a rejection

by the Planning organization means that the item in question goes back to its creators for further work. As mentioned earlier, member organizations prepare Project Plans for review. Project Management Organizations prepare releases for review.

Once an item has been approved by the Planning organization, the Architecture Review organization reviews it. If it rejects the item, it goes back to its creators for further work and starts the review cycle over again; that is, the item must once again be reviewed by the Planning organization before it can be submitted to the Architecture Review organization again.

Once an item has been approved by the Architecture Review organization, the Governance organization reviews it. If the Governance organization rejects the item, it goes back to its creators for further work and starts the review cycle over again. Approval by the Governance organization means that the item has completed all required reviews successfully. In case the item being scrutinized is a release, the Architecture Review organization is responsible for testing the release as part of its review responsibilities. However, it may delegate testing to another organization.

6.4.4 Customer Service and Support

As this project develops, and especially as it moves to a GSA managed service, a central customer service and support organization will need to be instantiated. This organization will provide the services, including training, outlined in section 3.2 above. This service and support organization will most probably be contracted out to an expert organization in this area. Note, however, its focus is not universal in the fact that it will be dedicated to the customers of the GSA managed service.

It is highly likely that other government and commercial organizations will provide all of the services outlined in section 3.2, but for those organizations that choose to use OSeRA, but not as a managed service.

In its effort to “maintain a level playing field” GSA may want to invest in and build this organization so that it could provide support to both managed service customers and others as well, but that is yet to be determined.

6.4.5 Personnel Plan

A personnel plan that provides for both the Management of OSeRA and its required infrastructure will need to be developed. It is highly likely that much of the personnel contributions to OSeRA will be from the membership, but it is envisioned that there will have to be some basic management and support infrastructure that will be a permanent “employees” of the project.

The personnel plan to be developed will include the requirements for all levels of activity and identify resources that are tied into each of the milestones and deliverables as the OSeRA project plan is fully detailed. It will vary with funding levels and with contributed resources, but some basic assumptive levels for the project to go forward and succeed will be detailed.

7 Financials (TBD)

7.1 Assumptions

7.2 Funding/Budget

7.3 Financial Indicators and Benchmarks

7.4 ROI over Time

7.5 Financial Statements