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# Computer Aided Strategic Planning, Engineering and Management for Global eServices

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**Abstract[1]**

Most of the developing countries and other underserved segments around the globe are re-inventing the wheel in their efforts to launch eServices -- especially in the areas of healthcare, education, economic development, public welfare, and public safety. Due to the unnecessary trial and error, the failure rates in these segments are very high (around 85%). Unfortunately, these segments also lack educational and financial resources to improve their situation. A Computer Aided Strategic Planning, Architecture and Management Environment – spinoff of the GAID eNabler Project -- has been developed to address this problem. This Environment -- endorsed by more than 100 countries -- quickly produces highly customized plans for the type of service as well as the country/region by using the latest thinking in the field. It significantly reduces failures due to trial and error and is being used very effectively to educate as well as assist individuals in different countries to accelerate and sustain progress in crucial areas.

## Introduction

eBusiness, eGovernment, and eCommerce initiatives, collectively referred to as ICT (Information and Communication Technologies) services in this paper, have resulted in tremendous economic development, improvements in quality of life, and operational efficiencies around the globe. Broadly speaking, the ICT services of interest are of two types: the *business-aware* services that provide business value (e.g., online purchasing) and *business-unaware* services, known as the ICT infrastructure services (e.g., wireless network), that support and enable the business-aware services. In addition, the individual ICT services are typically combined to provide powerful *enterprise-wide* services that serve an entire firm (e.g., eCorp such as Amazon.com) or city (e.g., eTokyo) to create new economies. Finally, inter-enterprise services between government agencies and businesses create tremendous opportunities for public welfare (e.g., collaboration between public health and public housing) and trade at local as well as national levels.

Unfortunately, many ICT services fail, i.e., they are never used by the intended users (the well known Standish Group Chaos reports indicate failures to range from 50% to 70%). Failures in developing countries are much higher – in the range of 85% [15]. This is a huge problem, keeping in mind that out of the 192 countries recognized by the United Nations, about 150 are considered under-developed (out of these, 52 are considered least developed – they have practically nothing). This *digital divide* represents the underserved segment of our society globally that lacks ICT resources plus the financial means and the technical know-how to conquer the divide [20]. The situation is worse because significant digital divide exists in developed countries also at the local government and small to medium business levels. The major, and perhaps the most unfortunate, challenge is that the underserved segments have no room for failures -- a poor country can neither afford to spend 50 million dollars on a project that fails nor hire expensive consultants to help them out.

Most failures in the underserved segments occur due to re-invention of the wheel throughout the system life cycle -- the unnecessary trial and error is not limited to one phase. Table 1 summarizes the key reasons based on literature surveys and firsthand knowledge. For success, the entire life cycle activities (Learn-Plan-Do-Check) shown in Table 1 must be executed properly. For example, we have found government officials lacking knowledge and experience in launching ICT services, unable to develop plans that can be justified and funded, unaware of the different choices and tradeoffs in system acquisitions and integrations, not aware of project management approaches, and having no knowledge of the best practices and standards. This is understandable because most individuals involved in launching an ICT service (e.g., a mobile health clinic) face many Learn-Plan-Do-Check challenges: "how do I understand the basic issues, policies, and approaches", "how do I develop a customized plan that is specific to my country", "how do I successfully execute the developed plan", "how do I monitor and evaluate the progress being made", and "how do I do everything without re-inventing the wheel?"

These are non trivial questions that are further complicated in global settings due to the differences in geographic situations, different problem types ranging from simple to large and complex, different lessons learned by using the same approach, wide range of technical and management issues, and different cultures and diverse training and experience levels of the participants. Answers are known but the major challenge is: h*ow to transfer the know-how to the needy parties:*

- *Rapidly,*
- *Economically, and*
- *Globally*

This challenge was raised at the GAID (Global Alliance for ICT Development) Annual Conference in 2009 and resulted in

[1] This paper is based on first hand experience gained by working with GAID (Global Alliance for ICT Development) -- an initiative established by the United Nations in 2006 -- as the Chief Architect of the eNabler and SPACE Projects. This experience has been greatly enriched by working with the officials of Commonwealth of Pennsylvania, USAID and the InfoPoverty Initiative. Names of specific countries are not used due to sensitivity reasons.

launching of the eNabler Project in 2010. The initial focus of the eNabler Project was to accelerate the pace of Millennium Development Goals (MDGs) through ICT (see www.un.org/millenniumgoals/). A spinoff of the eNabler Project is a computer aided planning environment called SPACE[2] (Strategic Planning, Architecture, Acquisition, Controls & Education) that exclusively attempts to address the aforementioned challenge. SPACE supports the entire Learn - Plan-Do-Check cycle and quickly produces highly detailed plans based on best practices for a wide range of ICT services that are customized for the chosen country/region.

A working prototype of SPACE (previously known as Strategic Planner) has been demonstrated at UN-GAID conferences in Geneva (May 2010), Riyadh (July 2010), Bahrain (August 2010), New York (September 2010), and Abu Dhabi (December 2010) with strong support from more than 100 countries and international organizations such as the World Bank, World Health Organization (WHO), Red Cross, UNESCO, Microsoft and WITSA (Worldwide IT Services Alliance). SPACE has also been presented at the International Conference on Least Development Countries in Istanbul (May 2011), Annual Conference in Bahrain (May 2011), and e-Democracy Conference in Macedonia (October 2011). SPACE has gone beyond MDGs and is currently being used in 20+ eGovernment as well as eBusiness initiatives globally. It is also supporting graduate courses in ICT Planning and Architectures, and helping a Certificate Program for Government CIOs of the Commonwealth of Pennsylvania.

This paper gives an overview of the SPACE environment, its basic model and the methodology used in selecting individual services and composing enterprise-wide and inter-enterprise services in health, education, public safety, public welfare and ICT infrastructure. The use is illustrated through several real life examples in mobile health clinics, online education for primary school teachers, women's shelters against domestic violence, cyber cities, mobility initiatives, and supply chains for food distribution. The patterns-based knowledge processing model used is also reviewed briefly.

## Key Requirements and the Conceptual Model

SPACE must satisfy the following basic requirements to address the aforementioned challenge:

- Systematically guide the users through the entire Learn-Plan-Do-Check cycle, instead of one narrow topic, to reduce the chances of failure.
- Provide a "one-stop shop" that supports the people, processes and technologies issues throughout the system life cycle.
- Help users with different background and training instead of highly skilled workers. Specifically, the users could range from beginners to managers and specialists.
- Support online computer aided consulting that can be used by anyone around the globe thus contributing to global equality.

Table 1: Typical Reasons for ICT Failures [7, 13, 15]

| | |
|---|---|
| "Learn" Activities<br>• No knowledge of best practices and methods<br>• Inadequately trained and/or inexperienced managers and technical staff<br>• No mechanism for enforcing standards and guidelines | "Plan" Activities<br>• Poor plans and planning processes<br>• Inadequate documentation of requirements<br>• None or poor effort estimation or cost/benefit analysis |
| "Check" Activities<br>• Failure to set and manage expectations<br>• Poor leadership at any and all levels<br>• Inadequate communication and progress tracking | "Do" Activities<br>• Misalignment between business and technology<br>• Lack of an overall architectural vision<br>• Inadequate implementation and testing procedures |

In addition, SPACE users should be able to select potentially high impact services, such as the following (these services directly support the eight goals of MDGs and are also of value to all underserved segments, including developed counties):

- Public welfare services with focus on poverty reduction through economic development, support for micro-financing, and entrepreneurship networks between startups and financiers.
- Healthcare services especially mobile health clinics that are proving to be very effective in combating HIV, infant mortality and maternal health. In addition telemedicine services are vital for remote areas.
- Public education with focus on eLearning for primary school teachers and mobile apps for the handicapped.
- Public safety services such as emergency response systems that require real-time support from various agencies.
- Collaborative services that combine individual services into enterprise-wide and inter-enterprise services for major impact. Examples are supply chains for food distribution in developing countries, and information exchange networks between different government and business agencies for rapid industrial growth.

For sustainable impact, SPACE must also serve as a massive checklist that can help the users to succeed in each of these services (Gawande [5] in his best selling book "The Checklist

[2] SPACE, available at www.space4ictd.com, is based on previous research [8, 9, 10, 11, 12] that has resulted in a planning, integration, security and administration (PISA) environment that is currently being used for small to medium businesses (SMBs). SPACE is basically an extension of PISA (www.ngepisa.com) to handle public sector services with focus on developing countries.

Manifesto: How to Get Things Right", successfully argues that a checklist is a very powerful tool to avoid failures in projects). In addition, SPACE must address the reasons for failure as listed in Table 1. Thus SPACE must satisfy the following operational requirements:

- Produce business plans that can be used for obtaining funding, technical planning reports that show the architecture and the needed policies/enabling technologies, standardized RFPs (Requests for Proposals) for potential vendors, and project management reports for tracking progress
- Provide help in evaluation and selection of the most viable alternatives *before* initiating the project and accelerate the development processes by quickly generating plans (hours instead of weeks or months)
- Introduce and enforce the same standards and best practices quickly and uniformly across all users. Also hide technical details so that it can be used by people with different backgrounds
- Be accessible over the Internet by people living anywhere and thus level the playing field between developed and developing countries
- Provide educational tools (e.g., what-if analysis of different planning scenarios and business games) for training of management and technical staff

Satisfying these requirements is a daunting task. A survey of the available tools revealed that tools of this nature are not readily available in the marketplace. Most available tools are very narrow in scope (e.g., they cover network planning only), are unaware of global issues (e.g., do not include country information and thus assume that the same plan will work in every country), are limited to one sector (e.g., healthcare) or one technology (e.g., mobile services), are intended for one type of user (mostly technical staff), are not available as SAAS (software as a service) thus requiring tedious downloads and installation procedures, and/or are only drawing tools because they have no knowledge of existing business or technology patterns. An extensive analysis of the available tools is beyond the scope of this paper due to space limitations.

Figure 1 shows a conceptual model of SPACE that attempts to satisfy the aforementioned requirements. As shown, SPACE covers the entire Learn-Plan-Do-Check cycle through the following capabilities:

- **The Directory** (the core) provides a quick reference, simple games/simulations, and an overview of SPACE for the beginners.
- **The Knowledge Repositories** (the middle circle) expose the users to educational materials, case studies, and examples needed throughout the cycle.
- **The Decision Support Tool -- The Planner** (the outer circle) goes beyond documents and actually walks the users through various decisions in strategic planning, architectures, acquisition, controls and education/training. We will concentrate on Planner in the balance of this paper because it is a distinguishing feature of SPACE.

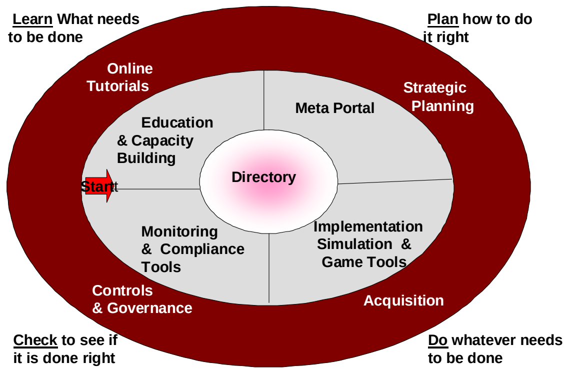


Figure 1: Conceptual Model of SPACE

### Overview of the SPACE Planner Methodology

As stated previously, SPACE provides three capabilities: Directory, Knowledge Repositories, and Decision Support Tool (the Planner). We will concentrate primarily on the Planner because it is a distinguishing and most heavily used feature of SPACE. Figure 2 shows a conceptual overview of the Planner. The Planner is not an expert system, but is a set of expert systems ("advisors") that collaborate with each other through an extensive knowledgebase. Thus it is an integrated intelligent system [14]. The Planner covers five phases (P0 to P4), shown in Figure 2. Each phase is supported by an advisor that provides phase specific guidance. The first two phases (P0 and P1) capture country and service specific information. Phase 2 generates a customized plan based on P0 and P1. P3 supports execution of the plan and phase P4 supports monitoring and control with heavy emphasis on project management and quality controls

The Planner relies heavily on a *pattern repository* that **h**ouses government patterns for different government sectors and business patterns for more than 20 industry segments including education, healthcare, transportation, public safety, telecom, and manufacturing. The pattern repository also contains application patterns, platform patterns, network patterns, security patterns and integration patterns. Patterns play a central role in SPACE and are explained briefly in Exhibit 1. Basically, the user conducts a simple interview with the Planner that locates the most appropriate patterns and then the these patterns are modified, extended and combined with other patterns to produce country and problem specific solutions. Details of knowledgebase and knowledge processing are given in Exhibit 3.

The outputs produced by the Planner contain a mixture of generic and customized information. The generic information captures common best practices (e.g., security). Country/ region specific information is customized by using the factors published by international agencies such as the World Economic Forum (www.weforum.org), the World Bank Institute Open Data (http://data.worldbank.org/) and service specific information gathered through interviews.

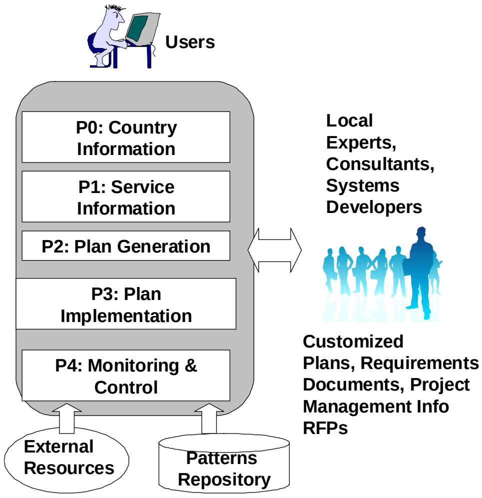


Figure 2: Planner Methodology – High Level View

The following example illustrates the Planner methodology by using broadband deployment as a service in a developing country. The purpose here is to help a government widely provide broadband access services (through wired or wireless means) to its constituents. The following description shows the flow of the Planner, as displayed in Figure 2:

In the P0 phase, the user (government agency) chooses a country (e.g., Nigeria) and the Planner fetches the information about Nigeria from its pattern and knowledge repositories.

In the P1 phase, the user selects a service to be deployed (broadband) and the Planner fetches information about broadband services from its pattern and knowledge repositories. It then goes through a self assessment (based on the capability maturity model [16] and gets access to general information, educational resources and best practices (e.g., reports from UN, other links, university courses etc.) on broadband access.

In the P2 phase, the government agency is led through strategic analysis (buy, rent, outsource) and cost-benefits tradeoffs associated with the broadband service. The agency is also guided through policies and procedures needed for the broadband service. It is very likely that the government agency will choose the strategy of "outsource", i.e., the actual development and deployment of broadband will be done by third parties (e.g., telecom providers). The output of this phase is a detailed business and technical plan that can be used by the agency as a starting point for developing bids and RFPs (Request for Proposals). Several rules are invoked in this phase to produce the detailed plan.

In the P3 Phase, different implementation options are evaluated through simulations, games and decision support tools.

In the P4 Phase, a detailed project management and governance plan is generated based on techniques specified in the Project Management Book of Knowledge (PMBOK) and other relevant standards such as COBIT (www.isaca.org/Knowledge-Center/**COBIT**/).

This short example highlights the main flow of the Planner. At the end of each phase, extensive documentation is provided to support the next phase. For example, at the end of P3, complete documentation is made available to the users to support the later phases of implementation and monitoring/control. The Planner integrates and aggregates the external information already available in portals such as the United Nations Public Administration Network (www.unpan.org) and the UN-GAID website (www.un-gaid.org). In addition, it provides access to useful educational and training materials in different steps of P0, P1, P2, P3 and P4 to educate the users as they develop the plans.

As illustrated in Figure 2, the outputs generated by the Planner are used by local experts who may customize and modify the plans generated by the Planner for local considerations. Our main objective is to produce very detailed and highly customized plans that are based on best practices and open standards in a 30-40 minute session. The Planner does 80% of the work, the other 20% is done by local experts. This significantly reduces the time as well as cost of the project.

The Planner is currently being used by developing countries to quickly generate detailed ICT plans that can be used as the basis for obtaining funding, and generating RFPs (Request for Proposals) and detailed project management plans. The range of services supported (from eHealth to eCities), the decisions supported (e.g., how to compose larger and more complex services), and algorithms used to produce results quickly are discussed next. Specific examples and case studies are used to illustrate the key points.

**Exhibit 1: Quick Overview of Patterns**

Patterns are a well-known format for capturing engineering knowledge. The idea was introduced by Christopher Alexander, a civil engineer, who wrote a series of books [2, 3] observing that well accepted buildings have common structures. Based on this, he devised a set of rules for architects to construct such buildings. According to Alexander, "Each pattern describes a problem that occurs over and over again in our environment and then describes the core of the solution to that problem in such a way that you can use this solution a million times over without ever doing it the same way twice"[3]. The "Gang of Four" extended the pattern format to software design [6]. Since then, patterns have been used extensively in software design and have been extended to e-business patterns [1] with good results. In addition, requirements patterns, architecture patterns, integration patterns, security patterns, and others have been developed. See the website (www.hillside.net/patterns) for extensive discussion, tutorials, and articles on patterns.

At a very basic level, a pattern $T$ is a tuple $T(p, c, s)$ where $p$ is the problem to be solved, $c$ is the context (under what conditions the pattern holds, i.e., why the problem needs to be solved), and $s$ is the solution (what works in practice). Additional information such as examples and limitations can also be added to a pattern to help the designer. In addition, each pattern is assigned a name. The following is a simplified example of a well known design pattern (Adapter) that occurs commonly in software engineering. Some patterns can be quite detailed and complex. Due to space limitations, we cannot show every pattern completely. The following is an example of Adapter pattern that shows how an intermediate object can be used to integrate two systems together.

**A Pattern Example (Simplified)**

**Name**: Adapter

**Problem**: How to interconnect and integrate two different systems

**Context**: Whenever different systems need to communicate with each other

**Solution:** Develop or buy a new component that does the translation between the two systems. Imbed all the methods that do the translation in this new component and make it general so that it can be reused over and over again. .

**Examples**: Power adapters for different power sources and mobile application adapters that connect handset apps to back-end applications and data sources.

**Planner Services: Individual and Composites**

A key requirement for Planner is that it must support a large number of services for different countries and regions. Specifically, the users should be able to select a single service (e.g., mobile health clinic) within a sector (e.g., healthcare) or combine these services into large initiatives (e.g., eCities) or interagency and B2B services (e.g., supply chains). Figure 3 shows a high level view of the services provided, initiatives supported and reports generated. These capabilities are described briefly.

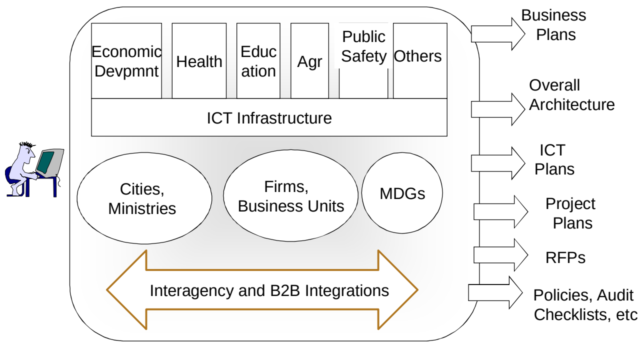


*Figure 3:Service Types in SPACE*

**Individual Services and Sectors.** The overall environment is organized into sectors and services within each sector. For example, Figure 3 shows sectors such as economic development, healthcare, education, and e-government. These "vertical sectors", shown as vertical bars, are supported by a horizontal sector (ICT Infrastructure) with services such as network access and mobile computing that support all vertical sectors. Each sector provides many individual services. For example, healthcare sector provides patient care and administrative services. For each vertical and horizontal service, we have created a pattern that is fetched and manipulated when needed. SPACE pattern repository at present contains more than 70 service patterns (we are constantly developing new service patterns).

**Enterprise-Wide Services (e.g., Firms, Cities and Ministries).** A user can combine different individual services into enterprise-wide services ("initiatives") that are managed by one organization. These services, shown as circles or ellipses in Figure 3, can be used to model departments, government agencies, firms or business units, This capability of the Planner to combine several individual services from different sectors to form new services is a very powerful feature that can be and has been used to represent the following real-life situations:

- Business divisions or complete enterprises in the public or private sectors such as healthcare, eduortation, manufacturing, telecom, and others
- eCity and eVillage Initiatives that provide a wide range of ICT services that span public safety and welfare in addition to economic development and education sectors.
- Millennium Development Goals (MDGs) that span economic development, education, and other sectors
- Mobility Initiatives that focus on introducing mobile apps and location based services in one or multiple agencies.
- Government specific initiatives at local as well as national levels in different countries (e.g., the Digital Britain Initiative).

The Planner treats each enterprise service as a single organizational unit (enterprise unit) that is managed by a central authority that can introduce and enforce common policies and procedures. This simplifies several inter-system communication problems. The interagency problems that require collaboration and coordination between multiple independent agencies are discussed next.

**Inter-Enterprise and Inter-Agency (B2B, G2G) Services.** In addition to individual services and enterprise-wide services in domains such as healthcare and economic development, the Planner can be used to represent large and more complex services that include multiple independent agencies and organizations. The Planner provides a capability that takes different scenarios and services and composes them into larger and more complex services such as the following:

- A document exchange network between different government agencies
- A B2B marketplace with numerous buyers and sellers
- A supply chain system consisting of several consumers and suppliers
- A government/business network such as a health information network (HIN)

The Planner treats each service developed in a session as an individual service (a reusable component) and composes large and complex services from these components by using SOA (Service Oriented Architectures). The type of management and technical solutions needed depend on the organizational composition and other parameters such as the number of participants (organization units), volume of transaction handled by the composition, value of transactions handled, security and trust level between the partners, etc. For example, the collaboration between partners in a health information network requires different types of considerations than a supply chain of household products. The next section briefly discusses these plus other decisions made in a Planner session.

**Decision Support Capabilities**

At a simple level, the users make the following major decisions in a Planner session:

- Selecting a country and/or region within a country
- Selecting a service from vertical as well as horizontal domains
- Deciding how to offer a service (local or national level with or without the Internet)
- Deciding how to combine different services into larger composites

**Country/Region Selection:** The users choose a country and/or a region within a country from a list of about 190 countries. We have developed government patterns and fetch other data about all countries from sources such as WEF (World Economic Forum) and UNPAN (UN Public Area Network).

**Service Selection**: The users choose a service from domains such as healthcare, education, public safety, economic development and others. These "vertical services" are supported by several horizontal services that belong to the "ICT Infrastructure" domain. The horizontal domains and services support multiple vertical domains and services as discussed previously and shown in Figure 3.

**Service Offering Decisions.** A given service can be offered at different levels and through different delivery mechanisms. For example, a tourism service can be offered through a tourist information center that just provides pamphlets to a sophisticated tourism portal that provides online booking of tours and packages with flights, hotels and car rentals. Naturally, the ICT plan for the tourism portal would be more complex than that of a walk-in tourism center. The view presented in Figure 4 illustrates the main idea in terms of four dimensions:

- <u>Service Type:</u> a service can be informational only (e.g., provide information about different tours), transactional (e.g., make bookings for tours), real-time (e.g., inform tourists about cancellations), and composites (combination of multiple services from multiple agencies). Each service type introduces unique considerations in planning.
- <u>Levels (Boundaries Crossed):</u> a tourism service, as an example, can be offered locally within a city, in a region/province, in a country, or internationally (across countries). Each boundary level also has its own unique challenges.
- <u>Web Reliance:</u> The tourism service may just rely on pamphlets, may use simple informational websites based on static content, or may use dynamic sites with Web 2.0+ features. Higher Web reliance supports more sophisticated services but also introduces more complex technical and management considerations.
- <u>Mobility Reliance</u>: The services may rely on simple handsets for text messages to sophisticated location-based devices with sensor networks. Increased mobility reliance also enables more powerful services but requires more complex infrastructure.

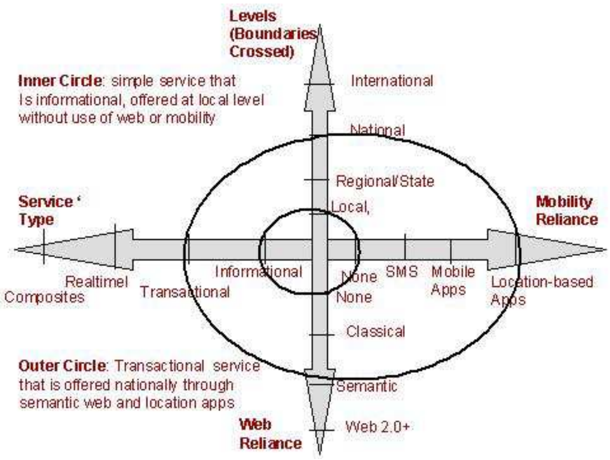


Figure 4: Conceptual View of the Services Covered

Thus a given tourism service can be represented as a circle in Figure 4. Similarly, an entrepreneurship service can be offered by a government at informational, transactional or composite level for a local, national or international agency by using different types of web and wireless technologies. The circles in Figure 4 depict two sample service offerings. As illustrated in the diagram, some services may be very simple (depicted as inner circle) or more sophisticated (outer circle). The outermost circle, not shown, would represent extremely powerful international services that require extensive planning. We have built rules that suggest plans of a service based on the four dimensional view presented in Figure 4.

**Building Composites from Individual Services.** Many real life situations in eBusiness and eGovernment involve multiple services within a sector (e.g., public safety services), across sectors (e.g., communications between department of health and department of public safety), or across countries (e.g., the EU services for the European Union countries).

Building composites from individual services is a non-trivial task with many policy, regulatory and technical implications. The Planner has been designed so that the users can make the choices clearly based on the following factors:

- If all services are centrally controlled, then they can be modeled as a large initiative within one sector and can be analyzed by using the EAI (Enterprise Application Integration) methodologies [17].

- If multiple services belong to multiple agencies with no central control, then they can be modeled as a B2B or G2G initiative where each agency/business is treated as a separate business. Such composites can be analyzed by using the B2BI (Business to Business Integration) methodologies [18]. For G2G services, models such as NIEM (National Information Exchange Model) can be used [19].
- If multiple services belong to multiple countries, then they can be modeled as an N2N (Nation to Nation) initiative where each nation is treated as a completely independent entity (naturally). Such composites can be analyzed by extending the G2G services because good models for N2N communications are not readily available at present. We are currently investigating to see how NIEM with its completely decentralized approach can be used for N2N communication. In particular, the international popularity of NIEM is quite interesting (http://www.ijis.org/EDblog/?p=417).

The SPACE Planner invokes different rules based on the EAI, B2B or N2N composites.

### Case Study: Launching a Mobile Health Clinic[3]

To explain how the SPACE Planner could be used in practice, let us take the example of a Mobile Health Clinic. It is well known in the UN circles that these clinics, combined with the mobile computing technologies, have been highly effective in combating HIV and malaria, improving maternal health, and reducing infant mortality in Peru, South Africa, Uganda, and the Philippines. In particular, location-based text messaging applications have been highly effective to attract young people to mobile clinics that provide informational, testing, and/or clinical services.

While there are many success stories about mobile clinics, numerous failures have occurred due to logistical issues (e.g., running out of supplies in the middle of nowhere), technology issues (no wireless signal in the area), procedural problems (healthcare professionals could not get visas on time), and social issues (some parents did not like their children to be invited to a clinic without parental consent).

A *Mobile Clinic Support System* is needed to address the people, process and technology issues and thus assure repeatable success of these clinics. Figure 5 shows a conceptual view of a support system that leverages the latest ICT developments to serve the physicians, the patients, the healthcare facilities, the suppliers of materials and the regulating authorities. Such a support system could profoundly impact the delivery of healthcare to different parts of the World and could be of value to central governments, municipalities, cities, or NGOs (non-governmental agencies) with interest in operating mobile health clinics around the globe. In addition, it can be offered with minimal technologies or sophisticated web and wireless support. How can the aforementioned Learn-Plan-Do-Check cycle be used to assure success? To gain some insights, let us go through the said capabilities of the SPACE Planner.


*Figure 5: Overview of a Mobile Health Clinic Support System*

**Learn:** A user (government agency or NGO) starts by first visiting the Directory and the Knowledge Repositories for case studies and information on different aspects of mobile health clinics. In particular, the Portal of Portals (meta portal) provides "yellow pages" type capabilities to a wide range of existing valuable portals instead of a single portal with "selfish" content.

**Plan:** Go beyond case studies and actually use the Strategic Planner to generate a country and situation specific plan. The Planner, described previously, provides step-by-step guidance for mobile health clinics. Specifically, the Planner guides the users through the maze of decisions in cost-benefit analysis, business process modeling, technology selection, system integration, disaster recovery, and information security that is specific to the country in which the mobile clinic is supposed to operate.

**Do**: The generated plan serves as a solid starting point for the implementers to refine and operate mobile health clinics for different situations in different regions of the world. A wide range of simulations and business games could be used to create and exercise some what-if scenarios such as running out of supplies, loss of key staff, and technology failures.

**Check**: The operation of the mobile health clinics, the problems encountered, and the solutions that work and the ones that did not, can be monitored through project management techniques such as "management dashboards". The lessons learned could then be used to reiterate, refine and improve the deployment of future mobile health clinics.

### Short Case Studies and Examples

Although SPACE is currently not a production system, it is being used to help developing countries and small to medium businesses to plan and engineer their systems. In addition,

[3] Source:" UN-GAID eNabler Overview" Document.

SPACE is being used extensively to support graduate courses and professional education in strategic planning and enterprise architectures and integration. Specifically, we have worked with and are currently working with more than 10 countries (Bahrain, Cambodia, Camaroon, Nepal, Niger, Nigeria, Liberia, Macedonia, Myanmar (formerly Burma), and Southern Sudan) on projects that range from simple a eService to inter-agency and inter-country communications. In addition, we have and are working with almost 20 businesses in healthcare, telecommunications and defense services and more than 20 universities in the United States, Russia, UAE, and New Zealand. We have also formed partnerships with Enterprise and Solutions Architecture Institute (ESAI) and Government Technologies Institute (GTI) to offer online training to government officials and practitioners in industry. Specific examples of the practical use of SPACE are given below.

**Individual Services**: The participating countries, businesses and students have developed a series of individual services such as the following:

- Mobile health clinics (MHCs) for remotely located populations that need urgent help. MHCs are the *primary* healthcare method for countries like Southern Sudan where no established hospitals exist. Special considerations are also needed for mobile clinics in the Far East where remote populations can be reached only by boats.
- Helping design of ICT-based women shelters against domestic violence. These shelters are being supported by the Gender Equality initiatives in countries such as Cambodia.
- Online education for primary school teachers to address the urgent need of improving primary school education and also online education of the government officials in Cambodia, Myanmar and Niger to properly plan and manage ICT projects.
- Support social welfare projects such as ICT-based assisted living facilities in Central Europe. These facilities are being developed to support aging populations that choose to move to developing countries for economic reasons.
- Mobile computing apps, especially location based services, to support large numbers of users that need wireless access to existing eGovernment and eBusiness systems such as online purchasing, customer relationship management and portals.

**Enterprise Wide Services and Initiatives**: A number of initiatives at present involve multiple services within the same public or private sector. Examples are:

- Economic development, especially entrepreneurship networks between startups and financiers. This includes entrepreneurship centers with focus on micro finance in countries such as Nepal and Camaroon.
- Working with Nepal to develop a detailed plan for a digital city in Hetauda County. The plan was generated to obtain public acceptance and funding.
- Working with Liberia to help them develop their five year plan by using the SPACE capabilities.
- Support of mobile services in the public safety sector for emergency response units and law enforcement for an island in the Pacific.

**Interagency and B2B Integrations:** A few projects between agencies are already operational. Examples are:

- Information exchange networks between different government/business agencies for industrial growth in countries such as Macedonia.
- Supply chains for food distribution and eAgriculture for food safety in developing countries such as Niger. We are using SPACE in collaboration with AidMatrix (a large food distribution company) to improve supply chains for food distribution.
- NIEM (National Information Exchange Model)-based interagency communications that interconnect the individual government agencies. This project is in its early stage but has very high interest from three different countries.

**Combinations:** Most of our projects involve a combination of individual, enterprise-wide and inter-enterprise services. Exhibit 2 briefly describes an ICT planning project that has been inspired by our work with the Cyber Cities of Nepal Initiative. Similarly, the Mobile Health Clinic described above can be easily expanded to a Health Information Network, depending on the type of situation (e.g., a single service run from a small provider, an enterprise wide service from a large hospital, a B2B health service between multiple agencies, or even an N2N service between health providers in neighboring countries).

The most interesting example, perhaps, is our recent work with Southern Sudan – a newly formed country. We are working with Southern Sudan Network (an NGO) that wants to rapidly build Southern Sudan by using ICT. In other words, SPACE is evolving from planning of eGovernment services to planning of cities and even countries such as Southern Sudan.

**Current Status and Future Directions**

In its mature prototype (Beta) mode, the SPACE Environment is available at www.space4ictd.com and can also be accessed from the UN-Gaid eNabler site (www.enabler4mdg.org). Potential users can choose more than 70 individual services spanning health, education, agriculture, public welfare and economic development and generate detailed planning reports that contain business plans, policies, requirements, technologies and project management recommendations. In addition, SPACE fully supports composition of these individual services into enterprise-wide and inter-enterprise services. The eBusiness capabilities are provided through a similar environment called PISA (Planning, Integration, Security and Administration) available at www.ngepisa.com.

We have learned several invaluable lessons in this project. The key positive finding is the significant reduction of time (from 4-5 months to 2-3 days) and increased chance of success due to consistency of processes and quick availability of common practices. This reduces cost and reduces expensive retries and thus could possibly lead to equality at a global level. The major challenge is training of the practitioners in the underserved sectors. To address this challenge, we have been improving the training and educational capabilities of the SPACE environment and have reorganized the SPACE website so that different user types are exposed to different sections of SPACE. A major limitation of the SPACE environment is that it produces a large number of reports that overwhelm some users. We are attempting to reduce the number as well as the size of reports produced.

Our long range goal is to make the SPACE environment a very powerful tool that can play a crucial role in advancing eGovernment and eBusiness initiatives in developing countries. Some of the future directions are:

- Expand the "Learn and Replicate" capabilities by extensively using a social network between the users of the system. We have already started doing this. This will help the users to exchange ideas, views, experiences and lessons learned.
- Significantly expand the games and simulation capabilities. Most of the SPACE advisors at present are implemented as Web Services so that they can be invoked from another advisor or from a game. We are especially investigating the growing field of "gamification" to understand how large number of games can be developed based on the SPACE advisors.
- Support more complex services that span multiple agencies (e.g., multiple government agencies from multiple countries). This is currently operational but we want to expand it for N2N (Nation to Nation) communications for developing countries. For insights, we are reviewing the N2N communications for EU (European Union) specifications of 20 services that will be available throughout Europe.
- Add plug-ins to well known Enterprise Architecture Frameworks such as TOGAF (The Open Group Enterprise Architecture Framework).
- Provide deeper and broader knowledge support by expanding the capabilities of the patterns repository
- Expand the intelligence capabilities of the inference engine by improving the reasoning and learning features through use of recent developments in machine learning, fuzzy logic and case-based reasoning
- Propose new areas of work in ontologies, government patterns, patterns languages, case based reasoning and similarities for governments. For example, we are somewhat disappointed with the current work on enterprises ontologies. We are currently using some of the WEF factors for customizing the plans and also to determine if a case study (a success story) from one country can be applicable to another country. We need to better understand and generalize this process.

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**Exhibit 2: Planning of City and Intercity Services**

This project, inspired by our work with the Cyber Cities of Nepal Project, is being used for management training and graduate courses in Strategic ICT Planning, Architectures and Management. The class is divided into several teams, 3 to 4 persons per team, and each team was asked to choose one city (population from 10,000 to 30,000 people) from any part of the world. Their first assignment is to do the following by hand:

- Each team member develops ICT plan for one service of the chosen city in the area of public health, education, welfare, and safety.
- Combine the chosen city services into a city-wide architecture that works smoothly
- Each city (team) is then asked to partner with another city (team) and to exchange information about their services for a set of scenarios (e.g., food shortage)

The second assignment is to do Self Assessment of the results from Assignment 1 by using SPACE. This allows the students to redo their work by using the SPACE tool and then improve their results based on the hands-on experiments.

This project is currently being converted into an online tutorial because it required the students to understand the concepts of developing individual services, then integrating them for enterprise wide scenarios, and finally struggle through interagency communications for G2G and B2B integration. They gain tremendous insights by using SPACE as a Self Assessment Tool.

**Exhibit 3: Knowledgebase and Knowledge Processing**

Figure 6 shows a more detailed view of the Planner. The core of the Planner is a knowledgebase (KB) that contains best practices, patterns, and rules needed to address various domains in eGovernment. In addition to patterns, commercial products are stored in a separate repository and the generated planning models are stored in yet another repository. The knowledgebase and its underlying ontology is explained in detail elsewhere [11].

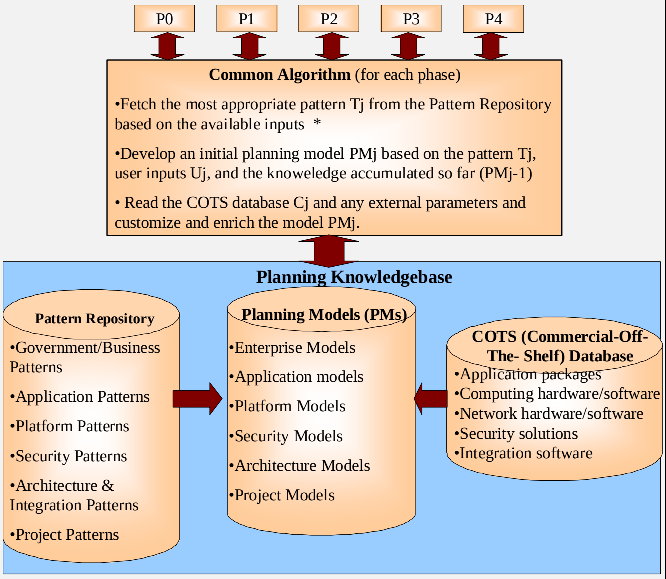


Figure 6: Detailed View of the Planner

All phases of the Planner (P0 to P4) use a common knowledge processing algorithm that is based on the following relationship:

$$PM_j = f\,(E, U_j, T_j, PM_{j-1}, C_j) \text{ for j = 0 to 4}$$

This relationship shows that the planning model produced in phase j ($PM_j$) is constructed by using enterprise parameters such as country information ($E$), patterns $T_j$ for phase j, accumulated knowledge $PM_{j-1}$ in the planning repository, phase specific inputs $U_j$ and COTS (Commercial Off-The-Shelf) database entries $C_j$ for phase j. The common algorithm shown in Figure 6 implements this relationship and the Planner advisors (each phase is supported by an advisor) specialize this algorithm for their tasks as needed. The main output produced by this process is the planning model *PM*, a set which consists of several subsets where each subset represents results of a planning stage. The initial planning model (*PM*) created is a simple sketch that is successively enriched as more advisors are invoked. Basically, *PM* is a set which consists of several subsets and each subset is created by and maintained by an advisor. At the conclusion of an interview, a complete plan is represented in the *PM*, i.e., *PM* = {*M, A, I*} where *M, A*, and *I* represent the enterprise model, the application plan, and the integrated architecture plan, respectively

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