

Chapter XI

Service Science and Automation Laws

INTRODUCTION

The purpose of this chapter is to define a scope of service science and service automation in service economy based on ideal generic service systems originally developed by the author. There are two goals of this study: 1) to develop generic service categories and their generic systems, and 2) to define a scope of service science based upon the presented generic models of service systems, which determine the required support from emerging system science. The research methodology is based on the architectural modeling according the paradigm of enterprise-wide systems (Targowski, 2003).

The architectural system approach is based on the philosophy of the system approach (Klir, 1985), and management cybernetics (Beer, 1981) which provide comprehensive and cohesive solutions to the problems of systems design, thus eliminating the fuzziness of the "application portfolio" and the "information archipelago" (McFarlan, 1981; Targowski, 1990). The mission of the architectural system approach is to find the ultimate synthesis of the whole system structure that involves appropriate logic, appropriate technological accommodation, operational quality, a positive user involvement, and co-existence with nature

(Targowski, 1990). In its nature, the architectural system approach is of deductive rather than inductive nature. It looks for the ideal model of a solution, which in practice is far away from its perfect level. The difference between the architectural system approach and the engineering approach is in the level of abstraction. The architectural models are more conceptual whereas engineering outcomes are more technical and specific. The architectural system approach is the response to the complexity of expected outcomes. Prior to spending a few million dollars for a new information system, one must provide its information architecture and the business and social implications associated with it (Targowski, 2003). In this sense, this study will define service systems' architectures.

Service economy can refer to one or both of two recent economic developments. First is the increased importance of the sector in industrialized economies. Services account for a higher percentage of U.S. GDP than 20 years ago, since modern-day off-shore outsourcing of manufacturing contributes to the growing service sector of the American economy. The 2006 Fortune 500 companies list contains more service companies and fewer manufacturers than in previous decades. The service sector is classified as the tertiary sector of industry (also known as the service

industry) and is one of the three main industrial categories of a developed economy, the others being the secondary industry (manufacturing, construction), and primary industry (extraction such as mining, agriculture and fishing). Services are defined in conventional literature as “intangible goods” (Drucker, 1969; Rathmell, 1974; Bell, 1976; Shostack, 1977). According to Laroche (2001), it is clear that intangibility has been cited by several authors as the fundamental factor differentiating services from goods (Rust, Zahorik, & Keiningham, 1996; Breivik, Troye, & Olsson, 1998; Lovelock, 2001). All other differences emerge from this distinction (Bateson, 1979; Zeithaml & Bitner, 2000). According to evident practice, service tends to be wealth-consuming, whereas manufacturing is wealth-producing. The tertiary sector of industry involves the provision of services to businesses as well as final consumers and citizens (users of government services). Services may involve the transport, distribution and sale of goods from producer to a consumer as may happen in wholesaling and retailing, or may involve the provision of a service such as in pest control or entertainment. Goods may be transformed in the process of providing a service, as happens in the restaurant industry. However, the focus is on people interacting with people and serving the customer rather than transforming physical goods.

Since the 1960s, there has been a substantial shift from the other two industry sectors to the tertiary sector in industrialized countries. The service sector also consists of the “soft” parts of the economy such as insurance, government, tourism, banking, retail and education. In soft sector employment, people use time to deploy knowledge assets, collaboration assets, and process-engagement to create productivity (effectiveness), performance improvement potential (potential) and sustainability. Typically, the output of this time is content (information), service, attention, advice, experiences, and/or discussion (“intangible goods”). Other examples of service

sector employment include public utilities, which are often considered part of the tertiary sector as they provide services to people. Creating the utility’s infrastructure is often considered part of the secondary sector even though the same business may be involved in both aspects of the operation.

Economies tend to follow a developmental progression that takes them from a heavy reliance on agriculture and mining toward the development of industry (e.g., automobiles, textiles, shipbuilding, and steel) and finally toward a more service-based structure. For example, IBM treats its business as a service business. Although it still manufactures high-end computers, it sees the physical goods as a small part of the “business solutions” industry. They have found that the price elasticity of demand for “business solutions” is much less elastic than for hardware. There has been a corresponding shift to a subscription pricing model rather than receiving a single payment for a piece of manufactured equipment. Many manufacturers are now receiving a steady stream of revenue for ongoing contracts.

Manufacturing tends to be more open to international trade and competition than services. As a result, there has been a tendency for the first economies to industrialize to come under competitive attack by those seeking to industrialize later, for example, because production, especially labor costs, are lower than in those industrializing later. The resultant shrinkage of manufacturing in the leading economies might explain their growing reliance on the service sector.

Service economy can refer to the relative importance of service in a product offering. That is, products today have a higher service component than in previous decades. In the management literature, this is referred to as the servitization of products. Virtually every product today has a service component to it. The old dichotomy between product and service has been replaced by a service-product continuum. Many products are being transformed into services.

Figure 11-1 depicts the contribution of the service sector to the U.S. gross domestic product in 2005. Since government provides mostly services to its citizens, one can state that the service sector contributes 80% to the U.S. gross domestic product. This level of contribution must turn attention of system developers, who up till now are mostly engaged in the production and commerce systems.

THE NATURE OF SERVICES

The first goal of this study will be pursued in defining first the nature of services and their categories. Later, comprehensive graphic models will be developed for generic systems, supporting major categories of service processes.

Service can be defined as follows:

Services are a diverse group of economic activities that include high-technology, knowledge-intensive sub-sectors as well as labor-intensive, low-skill areas. In many aspects, service sectors exhibit marked differences from manufacturing, although these distinctions may be blurring (OECD Report, 2000).

A good review of definitions of service is provided by Heskett (1990). Simply defined, services on demand are a diverse group of economic activities not directly associated with the manufacture of goods, mining or agriculture. They typically involve the provision of human value added in the form of labor, advice, managerial skill, entertainment, training, intermediation and the like, mostly after manufacturing or goods (such as natural resources and food) delivered to customers. They differ from other types of economic activities in a number of ways. Many, for example, cannot be inventoried and must be consumed ("customized") at the point of production. This could include trips to the doctor, enjoying a meal at a restaurant, flying from Chicago to Paris, or attending a concert.

This is in marked contrast with manufactured products, whose tangible character allows them to be stored, distributed widely, and consumed without direct interaction with the entity that produced the good.

Technological advances are, however, narrowing the differences between services and other economic activities. While it has not reached the point where someone can enjoy the ambience of a good restaurant without physically going to one, information and communication technology (ICT) now enables people to participate in a growing number of service-related activities in real or deferred time without having to be physically present. Copies of movies and most other performances can be recorded and mass-produced for future consumption like manufactured products. Software is developed and boxed like any other manufactured product and is considered, for all intents and purposes, a good—albeit with a high service-related content. In these instances, services have, in a sense, taken on the characteristics of commodities—one provider is mass-producing a common product for many people. Service providers are thus increasingly able to benefit from economies of scale. The benefits have not, however, been restricted to large enterprises as small firms can achieve similar gains through increased networking.

The relationship between service providers and consumers is also changing in other ways that may have significant implications for economies. Technology now allows providers to produce a single product which is not mass-produced but which is capable of being mass-consumed, either on a standardized or customized basis. Such is the case with online Internet access to dictionaries, encyclopedias, newspapers, museum collections, and so forth. It will also apparently be the case with key, basic operating software in the near future, as both Microsoft and Sun Microsystems have announced their intention to supplement distribution of "boxed" software with online versions (Taylor, 1999).

Technology is also affecting the relationship between providers and consumers in areas previously unthinkable such as healthcare, where the need for personal contact to diagnose and treat ailments is becoming less essential. Internet-based banking, real estate, retail and financial services provide other examples where personal or on-site contact with service providers is no longer essential for the services to be performed. In many instances, such services can, in fact, be provided far more efficiently via the Internet.

Table 11-1 characterizes services in the developed economy

Figure 11-2 illustrates the processive architecture of the U.S. national economy, which also

indicates that "service" dominates the economic activities of the American Society in term of its functionality, business, and pursuit for the complete life.

A CLASSIFICATION OF SERVICES IN A DEVELOPED ECONOMY

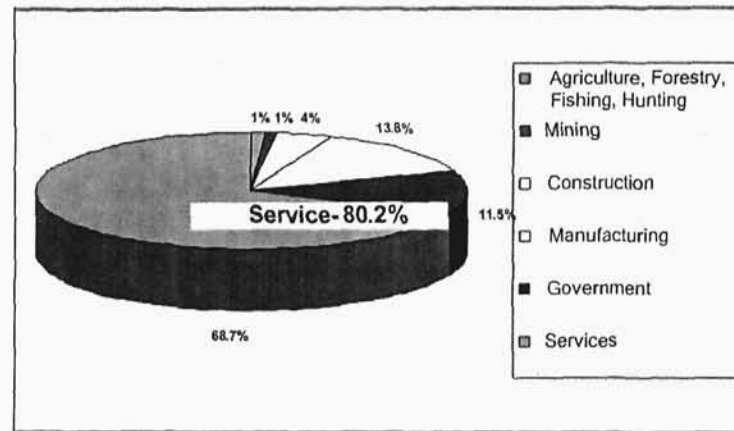
Once the developed economies moved to service economies in the second part of the 20th century (Bell, 1973), the development of different kinds of services became almost endless. In order to grasp their realm, it is necessary to classify them. Some of the first who undertook this task were Malchup

Table 11-1. Illustrative list of services

Service	Activities Related to the:
Wholesale and retail trade	Sale of goods
Information	Gathering and dissemination of written, audio or visual information including films and records
Transportation and warehousing	Distribution of goods
Finance and insurance	Facilitation of financial transactions, including those related to risk management
Real estate, rental and leasing	Temporary transfer of property, and the temporary or definitive transfer of real estate
Professional, scientific and technical	Provision of specialized, generally "knowledge-based," expertise (e.g., legal, accountancy, and engineering)
Management of companies and enterprises	Management of holding companies
Healthcare and social assistance	Provision of healthcare and social assistance (e.g., doctors, hospitals and clinics)
Education	Provision of instruction and training (e.g., schools and specialized training centers)
Arts, entertainment and recreation	Provision of entertainment in a broad sense (e.g., museums, opera, theatre, sports and gambling establishments)
Accommodation and food services	Provision of lodging, or the provision of meals, snacks or beverages
Public administration	Governing or administration of public entities and programs
Other	Provision of personal services, repair and maintenance activities, professional societies, religious institutions, and so forth

Source: Based on US Bureau of Census, 1999

Figure 11-1. Contribution by sector to U.S. gross domestic product 2005



Source: Bureau of Economic Analysis, Industry Table E, January 2007

(1962) and Porat (1977) who wanted to address the rise of knowledge and information-based activities in national economy. They provoked Bell (1981) to emphasize that industrial economy is being transformed into information economy, which defined four criteria of his classification schema. All these three classifications turned public attention to new economic activities and emerging people's knowledge and skills. Eventually, business strategies intercepted the torch of service classifications. The first was Lovelock (1983), who defined classification of services from the point of view of how to gain strategic marketing internally. Later in his famous and very good textbook with Wirtz (2007), he extended this classification into the four categories of service classification.

A review of these service classifications is provided in Table 11-2.

Every listed classification in Table 11-2 was defined according to a given purpose. The economic orientation is the purpose of first seven classifications while the marketing orientation is the purpose of the last two classifications. Certainly, these purposes served well in the broad context of national economy and marketing strategies, respectively.

In this investigation, the e-service system architecture is the purpose of a new service classification. Three categories of service will

be recognized as the main schema of the classification. Another three categories of services will be differentiated by applying a criterion of service intangibility, defined by Laroche (2001). In the post-industrial economy, more and more physically intangible products exist in our society, often called "information products" (Freiden et al., 1998), which are almost totally intangible. Laroche (2001) characterizes tangibility as more typical for "traditional" products and services. In a new service classification, services of six categories will be recognized either as "tangible" (traditional and "touchable") or as "intangible" (idea-information-oriented).

Figure 11-3 defines six categories of services applying the following criteria:

1. Society served:
 - Services directed at citizens and communities (tangible service)
 - Services directed at the nation (intangible service)
2. People served:
 - Services directed at a person (tangible service)

Table 11-2. A review of most popular classifications of service activities

Author	Purpose	Perspective of	Classification Schema	Classification Sub-schema
Smith (1776)	To facilitate economic analysis	Economist	1.Productive activities (creating tangible product) 2.Nonproductive activities (creating intangible services)	
Clark (1940)	To analyze the transition of economy	Economist	1.Primary sector (extracting) 2.Secondary sector (manufacturing) 3.Tertiary sector (services)	
Ger-suny and Rosen-gren (1973)	To analyze the economic activities	Economist	Tertiary sector	Quasi-domestic services (food and lodging) Business services “quinary” group including recreation, healthcare, and education
Machlup (1962)	To emphasize the importance of knowledge production and distribution	Economist	1. Education 2. R & D 3. Communication media 4. Information machines 5. Information services	Expenditures made by: Government Business Consumers
Porat (1977)	To define what economic activities can be attributed to information activities	Economist	1.Markets for information	Media and educational institutions
			2.Information in markets	Advertising, insurance, finance, brokerages
			3.Information infrastructure	Printing, data processing, telecommunications, information goods
			4. Wholesale and retail trade in information goods	Bookstores, computer stores, theaters, and so on
			5.Support facilities for information activities	Buildings used by information industries, office furnishing, and so on
Bureau of Economic Analysis (2008)	To calculate GDP	Economist	1.Finance, insurance, Real estate 2.Retail trade 3.Wholesale Trade 4.Transportation and Public Utilities 5.Communications 6.Other services 7.Government and government enterprises	

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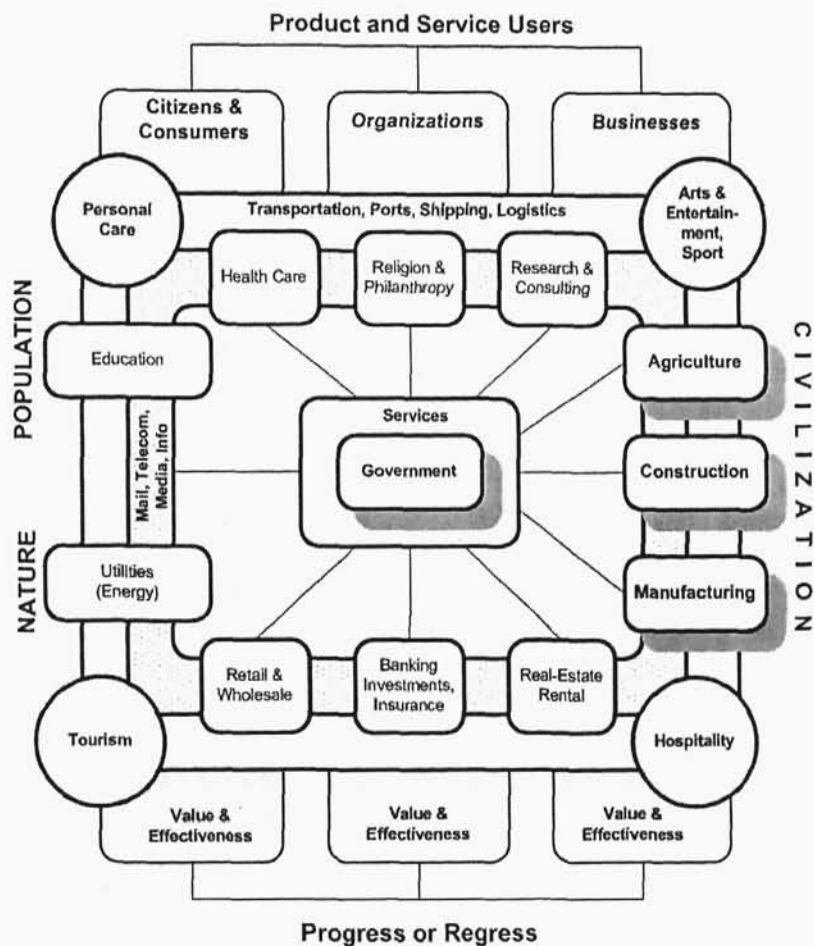
Bell (1981)	To indicating the transfer from Industrial to Information Economy	Sociologist and Economist	1. Knowledge	Education, R &D, Libraries, Lawyers, Doctors, Accountants
			2. Entertainment	Motion Picture Television, Music
			3. Economic Transactions and Records	Banking, Insurance, Brokerage
			4. Infrastructure Services	Telecommunications, Computers, and Programs
Lovelock (1983)	To gain strategic marketing inside	Business marketing strategist	1. Basic demand characteristics	Object served (persons vs. property), Extent of demand/supply imbalances, Discrete vs. continuous relationships between customers and providers,
			2. Service content and benefits	Extent of physical goods content, Extent of personal service content, Single service vs. bundle of service, Timing and duration of benefits
			3. Service delivery procedures	Multisite vs. single site delivery, Allocation of capacity (reservation vs. first come, first served)
Bowen (1990a)	To integrate marketing with organizational behavior	Business marketing strategist	1. Service production 2. Service delivery 3. Service consumption	Focusing on service as a face-to-face game between persons.

- Services directed at a people's awareness (intangible service)
3. Possession served (criterion applied by Lovelock and Wirtz 2007):
- Services directed at property (tangible service)

- Services directed at information-communication handling (intangible service)

This classification is, to a certain degree, extending Lovelock and Wirtz's classification (2007) which is business-oriented. Their classification of service categories contains *four* major categories, such as tangible actions of people, tangible actions of possessions, intangible actions of people, and

Figure 11-2. The progressive architecture of the U.S. national economy



intangible actions of possessions. The presented classification in Figure 11-3 differentiates six major categories and differs in some titles of these categories and their content. For example, two new categories were added to reflect the whole national economy, and not just business such as society served at the levels of citizens and communities and the nation; this includes 20 new kinds of services. Some titles in the presented classification look perhaps similar but are more precise. For example, “information processing” is recognized as “info-communication handling,” which incorporates many telecommunication-oriented services typical for the Information Age

(1998+). In comparison, the older classification of “data processing” is more characteristic for the Computer Age (1980+) when technology-based services emerged as the main trend in the economy, but certainly not as e-services. The old classification’s “mental stimulus processing” services sounds too Freudian. The new classification offers “services directed at people’s awareness.”

The new service classifications presented can be applied to modeling of the same type of services’ systems. The service modeling approach by Dabholkar (1996) is mostly limited to technology-based self-service and testing customer attitude

in the scope of cognitive attributes (e.g., speed of delivery, ease of use, reliability, enjoyment, control) and affective attributes (e.g., attitude toward using technological products and the need for interaction with a service employee). These attributes can be applied to many kinds of services classified in Figure 11-3 if they are delivered as a technology-based self-service.

Applying three main and six supportive criteria, it was possible to differentiate about 82 kinds of services. In practice, perhaps this table can accommodate about 1,000 kinds of services (e.g., copying, tanning, blacksmithing) which all cannot be listed here. Certainly, one can apply many other criteria to classify services such as service substance, service output, service ownership, and so forth. In the presented approach, the main criterion is the kind of serviced users, since this leads to the processes recognition and eventually should help in e-service systems' architecture planning. On the other hand, one must state that e-service may not cover all needed services. In this approach a scope of services which can be globalized is not considered.

THE E-SERVICE SYSTEM REQUIREMENTS

E-service system (e-SS) is a mission-goal-strategy-driven configuration of technology, organizational processes and networks designed to deliver services that satisfy the needs, wants, or aspirations of customers, citizens, and users. Marketing, operations, and global environment considerations have significant implications for the design of an e-service system. Four criteria can impact e-service systems architecture:

- service business model
- customer contact and level of involvement (service user interface),
- service provider's enterprise complexity (enterprise systems and networks)

- scope of goods involved in service

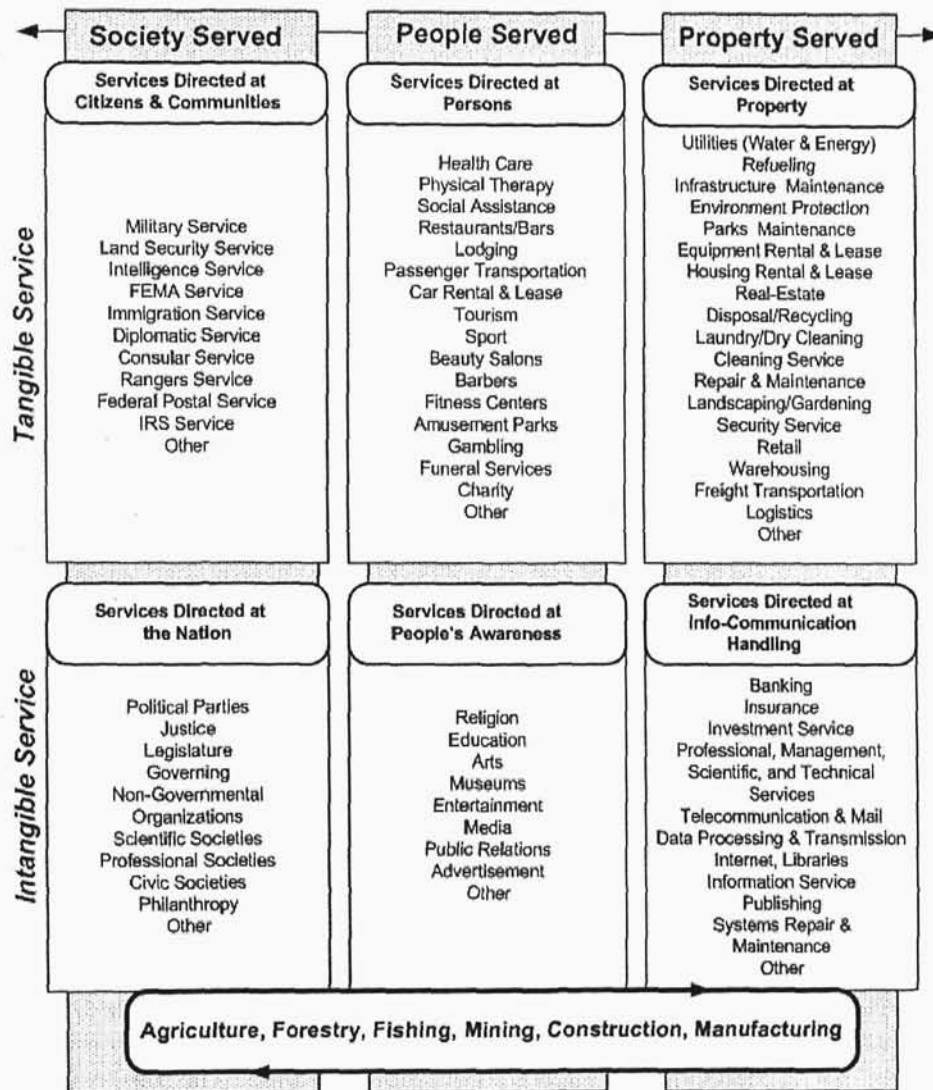
Properly designed e-service systems employ technology for organizational networks that can allow relatively inexperienced people to perform very sophisticated tasks quickly, vaulting them over normal learning curve delays. Ideally, empowerment of both service provider employees and customers (often via tself-service) results from well-designed e-service systems. Figure 11-4 illustrates the general architecture of IT-driven service systems.

E-service systems range from an individual person equipped with tools of the trade (e.g., architect, entrepreneur) to a portion of a government agency or business (e.g., branch office of a post office or bank) to complete multinational corporations and their information systems (e.g., Pizza Hut, UPS). Hospitals, universities, cities, and national governments are designed service systems. The language, norms, attitudes, and beliefs of the people that make up a service system may evolve over time as people adjust to new circumstances. In this sense, e-service systems are a type of complex system that is partially designed and partially evolving. E-service systems are designed to *deliver* or *provision* services but they often consume services as well.

The e-service system is both a service provider and a customer of multiple types of services. Because service systems are designed both in how they provision and consume services, services systems are often linked into a complex service value chain or value network where each link is a value proposition. Service systems may be nested inside of service systems, for example, a staff and operating room unit inside a hospital that is part of a nationwide healthcare provider network.

E-service system developers and architects often seek to exploit economic complementarities or network effect to rapidly grow and scale up the service. For example, credit card usage is part of a service system in which the more people and businesses that use and accept the credit cards, the more value the credit cards system can eventually

Figure 11-3. Six categories of services



offer to the provider and all stakeholders in the e-service system. E-service system innovation often requires integrating technology innovation, business model (or value proposition) innovation, social-organizational innovation, and demand (new customer wants, needs, aspirations) innovation. For example, a national e-service system may be designed with policies that enable more citizens (the customers of the governments) to become an

entrepreneur, and thereby create more innovation and wealth for the nation. E-service systems may include payment mechanisms for selecting a level of service to be provided (up-front or one-time payment) or payment based on downstream value sharing or taxation derived from customers who received the benefit of the service (downstream or ongoing payment). Payments may also be in the form of or other types of intangible value.

Table 11-3. Application requirements for e-service and enterprise systems

SERVICES DIRECTED at	BUSINESS MODEL (Service Organization)	SERVICE USER INTERFACE (Customer-Service Provider)	E-SERVICE SYSTEM	ENTERPRISE SYSTEMS & NETWORKS	GOODS INVOLVED
SOCIETY SERVED					
Citizens and communities	Efficiency & Value	Web-driven, Open Portal, Extranet	Citizens Orders, Licenses, Payments, Scheduling, News Letters, Citizens Service, Intranet	ERP, SCM, e-DMS, WFS, MIS, KMS, EUC, LAN, MAN, WAN	Highly
The nation	Value	Web-driven, Open Portal, Extranet	Polls, Blogs, Forums, News Letters, Memberships, Payments, Donations, Meetings, Membership Service, Intranet	e-DMS, WFS, MIS, FIS, AIS, KMS, EUC, LAN, MAN, WAN	Minimal
PEOPLE SERVED					
Person	Value & Profit	Web-driven, Open Portal & traditional, Extranet	Customer Orders, Scheduling, Payments, News Letters, Customer Service, Intranet	CRM, SCM, KMS, MIS, WFS, FIS, AIS, EUC, LAN, MAN, WAN	Significantly
People's awareness	Value & Efficiency	Web-driven, Open Portal & traditional, Extranet	Blogs, Forums, News Letters, Customer Orders Payments, Donations, Meetings, Membership Service, Intranet	CRM, SCM, ERP for large organizations, KMS, MIS, EUC, LAN, MAN, WAN, GAN	Significantly
POSSESSION SERVED					
Property	Effectiveness	Web-driven, Open Portal & traditional, Extranet	Customer/Citizens Orders, Payments, Scheduling, Forums, News Letters, Customer/Citizens Services, Intranet	CRM, SCM, ERP for large organizations, KMS, MIS, WFS, EUC, LAN, MAN, WAN	Highly
Info-communication handling	Value & Effectiveness	Web-driven, Open Portal & traditional, Extranet	Customer Orders, Payments, Scheduling, News Letters, Customer Service, Intranet	CRM, SCM, ERP for large organizations and KMS, WFS, MIS, FIS, AIS, EUC, LAN, MAN, WAN	Depends

Figure 11-4. The general architecture of service-driven IT systems

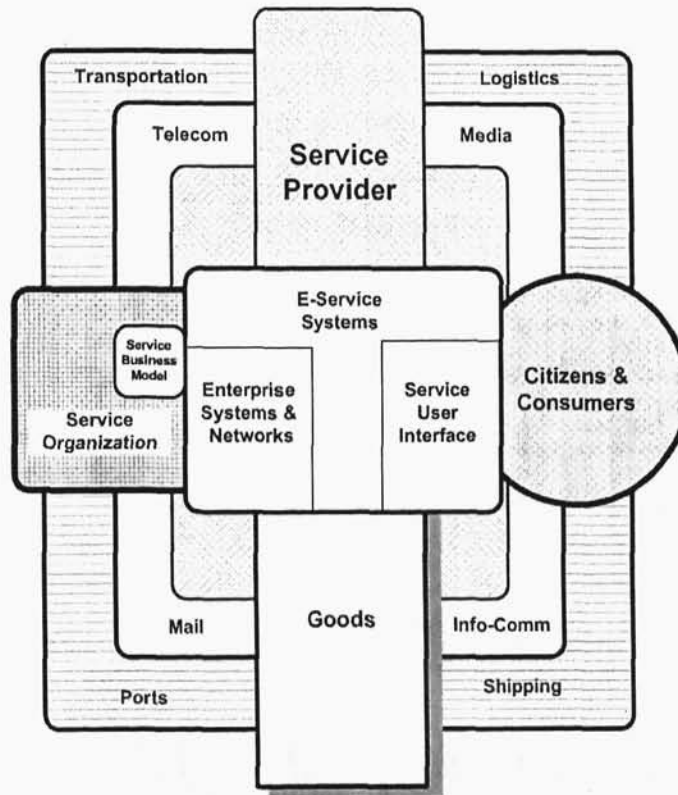


Table 11-3 provides application requirements for each of the six e-services systems categories. It is important to notice that in majority cases, the e-service system is the transition layer between service user interface and enterprise systems and networks.

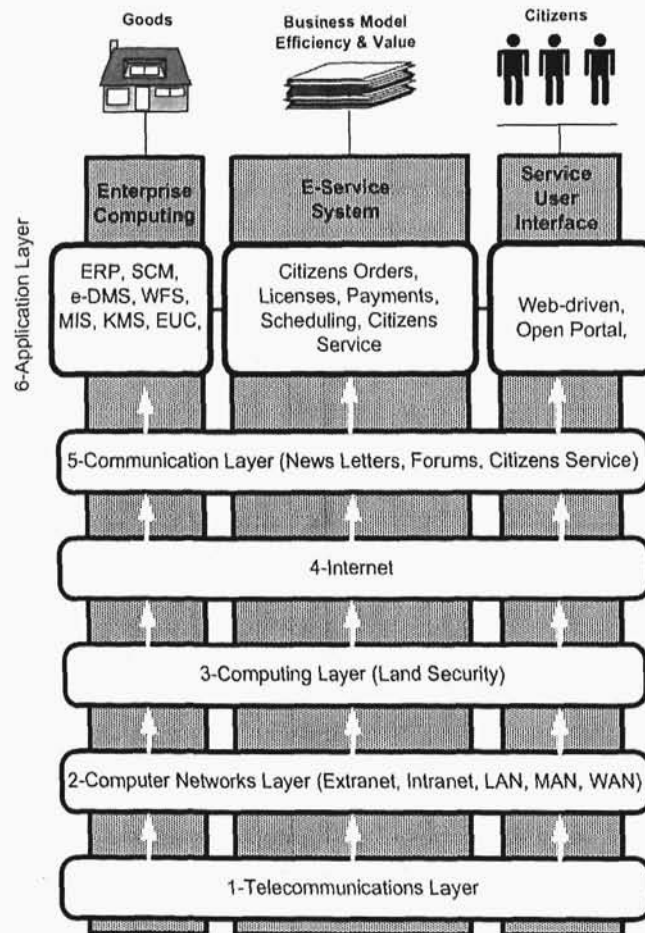
The architectures of Web-driven services are well developed and widely described in the professional literature of the emerging 21st century (Erl, 2004; Felipe, 2005; Rosenfeld & Morvil, 2006; and others). In this study, the main point is that the Web-based service architectures should be an extension of enterprise-wide computing, of course, if the nature of e-service is based on relatively complex enterprise computing, which is called the “mortar and click” solution. If a solution is based on the modest “click and click” approach,

then the enterprise-wide computing may be of limited application.

The following components are included in the e-service and enterprise systems requirements (Targowski, 2003):

- ERP as a set of service demand planning (SDP), service resources planning (SRP), financial information system (FIS), accounting information system (AIS), and others
- SCM – supply chain management
- CRM – customer relations management
- WFS – work flow system
- E-DMS – electronic document management system
- KMS – knowledge management system, composed of data warehouse and data mining

Figure 11-5. The architecture of a citizens and community e-service system (ERP - enterprise resource planning, SCM - supply chain management, e-DMS - electronic document management system, WFS - work flow system, MIS - management information system, KMS - knowledge management system, EUC - end user computing)



- MIS—management information system, composed of transactions processing system (TPS), enterprise data base management system (EDBMS), enterprise performance management system (EPMS), and executive information system (EIS)
- EUC—end-user computing
- LAN—Local Area Network
- MAN—Metropolitan Network
- WAN—Wide Area Network

- GAN—Global Area Network
- Other

THE GENERIC ARCHITECTURES OF E-SERVICE SYSTEMS (E-SS)

Based on the application requirements provided in Table 11-2, two generic architectures are defined for the citizen and community e-service system