Chapter 6
Components and Artifacts

Chapter Overview
Chapter 6 defines and describes EA components and artifacts within the context of an EA framework. Using the EA3 Framework as an example, EA components are replaceable elements within the framework that come and go with changes in strategy, business services, and new designs for resources involving information flows, applications, networks and other infrastructure. Descriptions are provided of example EA components at each level of the framework. Appendix E gives examples of each artifact.

Key Term: EA Component
EA components are those ‘plug-and-play’ changeable resources that provide capabilities at each level of the framework. Examples include strategic goals and initiatives; business services; information flows and data objects; information systems, web services, and software applications; voice/data/video/mobile networks, cable plants, equipment, and buildings.

Key Term: EA Artifact
An EA artifact is a documentation product, such as a text document, diagram, spreadsheet, briefing slides, or video clip. EA artifacts document EA components in a consistent way across the entire architecture.

Learning Objectives
- Understand what EA components are and their role in an EA framework.
- Understand how EA artifacts describe EA components.
- See examples of EA components and artifacts throughout an EA framework.
- Understand how management views help executives understand EA components.

Introduction
While an EA framework provides an overall structure for modeling the enterprise’s business and technology operating environment, EA components are the working elements of the framework at each level. In other words, EA components are “building blocks” that create discrete parts of the overall IT operational capability. EA artifacts describe EA components.

Home Architecture Analogy: EA components are like the rooms of the house. Rooms can be added, remodeled, or taken away. EA documentation products are the description of each room, and can include statements, stories, pictures, and/or videos.
Discussion

EA components are the active elements of the enterprise’s business and technology operating environment. EA components include IT-related strategic goals and initiatives, supply chains, information systems, software applications, knowledge warehouses, databases, websites, and voice/data/video networks, and the security solution. These EA components should function together to create a robust and seamless IT operating environment that effectively supports the enterprise’s business needs. Availability, reliability, security, scalability, and cost effectiveness are key performance measurement areas for the general IT operating environment. These areas apply to each EA component, along with measures for integration and reuse.

EA artifacts are types of documentation that describe components, including reports, diagrams, charts, spreadsheets, video files, and other types of recorded information. High-level EA artifacts are often text documents or diagrams that describe overall strategies, programs, and desired outcomes. Mid-level EA artifacts are documents, diagrams, charts, spreadsheets, and briefings that describe organizational processes, ongoing projects, supply chains, large systems, information flows, networks, and web sites. Low-level EA artifacts describe specific applications, data dictionaries, technical standards, interfaces, network components, and cable plants. When these EA artifacts are harmonized through the organizing taxonomy of the EA framework, new and more useful views of the functioning of EA components are generated. This is one of the greatest values of EA as a documentation process... creation of the ability to see a hierarchy of views of the enterprise that can be examined from several perspectives.

For example, by recognizing that EA components are the building blocks of the an EA framework, and that most IT hardware and software is now commercially procured (versus being custom developed in-house), the stage has been set for a “plug-and-play” approach to IT support that must be reflected at all levels of the EA framework. Figure 6-1 provides examples of EA components and artifacts at each level of the EA³ Cube Framework.

Figure 6-1: EA Components and Artifacts

The following are detailed descriptions of EA components at each level of the EA³ Cube Framework. A more detailed description of the current view of EA components and artifacts is provided in Chapter 8, and a description of the future view of these components/artifacts is provided in Chapter 9. Appendix E provides detailed examples of each type of artifact.

EA Components at the Goals and Initiatives Level
EA Components:

- **Strategic Plan**
- **E-Commerce/E-Government Plan**

EA Artifacts:

- Strategic Plan (S-1)
- SWOT Analysis (S-2)
- Concept of Operations Scenario (S-3)
- Concept of Operations Diagram (S-4)
- Balanced Scorecard™ (S-5)

Large, complex enterprises often require a formalized approach to planning that accounts for changing conditions, participants, and goals. An enterprise’s purpose and direction, as well as its approach to leveraging resources, are documented at the strategic ‘Goals and Initiatives’ level of the framework. Strategic Plans should be viewed as “living documents” which are updated periodically and which help an enterprise understand itself and adapt to changing conditions. Strategic Plans almost never are implemented without changes to the original version, because unforeseen internal and/or external events make elements of the plan unfeasible or sub-optimal for ensuring survival and maximizing success. The value of strategic planning is more in the process than in the product. By having a rational, repeatable process for dealing with the chaos and complexity of many operating environments, enterprises can better and more rapidly set a direction and goals in a formal plan that provides a common referent. The plan can be then modified periodically in response to changes in the environment.

The two EA components at this level are (1) the Strategic Plan, and (2) E-Commerce or E-Government Plan. EA artifacts at this level are the mission and vision statements, scenarios, strategies, goals, and initiative measures that are developed through the strategic planning process. While the basic mission, purpose, and/or direction of an enterprise may change infrequently; the scenarios, goals, initiatives, and measures are the flexible components of the process that can be changed as needed to reflect new mission areas, market opportunities, competitor actions, laws and regulations, economic conditions, resource constraints, and/or management priorities.

**Strategic Plan**

Strategic planning produces a high-level view of the direction that an enterprise sets for itself. This direction is further articulated in long-range scenarios, strategies, goals, and initiatives that serve as the baseline for short-term tactical (operational) planning that is updated annually. Strategic Plans for enterprises in dynamic and/or highly competitive environments should look three to five years into the future and be updated annually. Strategic Plans for enterprises in more stable environments should look five to ten years into the future and be updated approximately every three years.

A Strategic Plan is a composite EA artifact that should guide the enterprise’s direction over a 3-5 year period in the future by providing the following items, each of which are primitive (basic) EA artifacts. Full versions of abbreviated primitive artifacts are separate artifacts.
• Provide a Mission Statement and a Vision Statement that succinctly captures the purpose and direction of the enterprise.

• Develop a Statement of Strategic Direction that fits the enterprise’s purpose, ensures survivability, allows for flexibility, and promotes competitive success. This statement is a detailed description of where the enterprise intends to go.

• Summarize the results of a SWOT Analysis that is based on the statement of strategic direction and which identifies the enterprise’s strengths, weaknesses, opportunities, and threats. The full SWOT analysis is artifact S-2.

• Summarize the situation and planning assumptions for several ‘Concept of Operations’ CONOPS Scenarios that support the enterprise’s strategic direction. This summary should include one current scenario that describes at a high-level the coordination of ongoing activities in each line of business, as well as several future scenarios that account for different combinations of internal and external drivers identified through the SWOT Analysis. The complete scenarios are artifact S-3.

• Develop a CONOPS Graphic that in a single picture captures the essence of and participants in the current operating scenario. This graphic is artifact S-4.

• Develop a General Competitive Strategy for the enterprise that incorporates the current and future CONOPS scenarios and moves the enterprise in the intended strategic direction in a way that and address internal/external drivers such as culture, line of business requirements, market conditions, competitor strategies, and risk.

• Identify Strategic Goals that will accomplish the competitive strategy, and specify the executive sponsors who are responsible for achieving each goal.

• Identify Strategic Initiatives and resource sponsors for the initiatives, which are the ongoing programs or development projects that will accomplish each Strategic Goal.

• Summarize Outcome Measures for each Strategic Goal and Initiative, using the Balanced Scorecard™ or similar approach. The full scorecard is artifact S-5.

Because some of these areas will contain sensitive information that the enterprise will want to protect from its competitors, the full Strategic Plan should be written for internal use by decision-makers. A generalized version can then be developed for external distribution.

By using proven approaches to developing the Strategic Plan, such as the Balanced Scorecard®, enterprises are able to identify IT-related goals for the enterprise that support overall strategic goals, as well as initiatives for achieving those goals and measures for tracking progress within each initiative. Figure 6-2 shows these relationships.
Mission Statement

An enterprise’s Mission Statement succinctly describes the purpose and direction of the enterprise. This statement should be long enough to get the point across but provide no detail (1-2 sentences is recommended). The Mission Statement answers the “who are we” question at the level of the entire enterprise. Examples are provided below.

Mission Statement Example-Business:

“The Acme Insurance Company provides high-quality, affordable business insurance to small business owners and farmers.”

Mission Statement Example-Government:

“The Orange County Highway Department provides safe and efficient roadways and bridges for pedestrian and vehicle traffic.”

Vision Statement

An enterprise’s Vision Statement describes in abbreviated form the competitive strategy of the enterprise. This statement should be short and memorable. The Vision Statement answers the “how are we getting there?” question at the level of the entire enterprise. The following are examples of Vision Statements from business and government:

Vision Statement Example-Business:

“In offering unbeatable value and service, the Acme Insurance Company will be the insurance provider of choice for small business owners and farmers.”

Vision Statement Example-Government:

“State-of-the art planning, execution, and responsiveness will make Orange County’s roads and bridges the safest and most efficient in the State.”

Vision statements are more than advertising slogans, they are meant to help members of the enterprise understand the primary direction that is being pursued, and then be able to communicate that inside and outside of the enterprise.

Figure 6-2: Relationship of Strategic Level Artifacts

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<tr>
<th>Initiative 1-1</th>
<th>IT Component</th>
<th>Performance Measure(s)</th>
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<tbody>
<tr>
<td>Initiative 1-2</td>
<td>IT Component</td>
<td>Performance Measure(s)</td>
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<tr>
<td>Initiative 1-3</td>
<td>IT Component</td>
<td>Performance Measure(s)</td>
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Strategic Goal #2

Intended Outcome(s)

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<tr>
<th>Initiative 2-1</th>
<th>IT Component</th>
<th>Performance Measure(s)</th>
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<tr>
<td>Initiative 2-2</td>
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<tr>
<td>Initiative 2-3</td>
<td>IT Component</td>
<td>Performance Measure(s)</td>
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IT Implementation and Support Strategy
Strategic Direction Statement

This statement establishes the strategic direction that the enterprise will pursue during the period covered by the Strategic Plan. It builds on the statements of purpose, mission, and vision, and identifies the character of the enterprise in its envisioned future state. While protecting sensitive competitive information, the statement of strategic direction should provide a guidepost for members of the enterprise to use in understanding general expectations for their contribution to survival and competitive success. It should also promote understanding among external stakeholders such that trust and perceptions of value are increased.

SWOT Analysis

One of the earliest activities the enterprise performs in developing a strategic plan is a ‘Strength, Weakness, Opportunity, Threat’ (SWOT) Analysis. This analysis looks at internal and external factors to determine areas that the enterprise should focus on to increase its survivability and success, as well as areas that the enterprise should avoid, or decrease its exposure to. The results of the SWOT Analysis should be summarized in the Strategic Plan, and the full SWOT Analysis is archived in the EA Repository as a separate primitive artifact (S-2). Figure 6-3 provides an example of how to present the results of a SWOT Analysis.

Concept of Operations Scenarios

Enterprises may find it helpful to develop detailed current and future ‘Concept of Operations’ (CONOPS) scenarios that encompass several years of operating activity, and which take into account different combinations of internal and external drivers that were identified in the SWOT Analysis. In so doing, the enterprise can evaluate the planning assumptions and expected outcomes in each scenario and evaluate the relative merit and danger of pursuing a particular course of action. Additionally, the enterprise can refine and maintain an ongoing file of information on several of the most plausible scenarios in order to be able to “bracket” a range of suitable strategies and goals for successful competition. The scenario development activity may be particularly valuable to enterprises in highly dynamic and turbulent operating environments. A summary of the scenarios and planning assumptions (matrix format) is included in the Strategic Plan, while the full version of the scenarios is a separate ‘primitive’ artifact (S-3). Chapter 8 provides more details on the development of future scenarios.

Concept of Operations Graphic

The CONOPS Graphic is very important to the enterprise, as it describes in one picture all of the major activities in the current CONOPS, as well as the relationship of those activities. The CONOPS graphic becomes a touchstone to help the enterprise understand what it does at a basic level.
Competitive Strategy
This area of the Strategic Plan identifies how the enterprise will achieve success in pursuing its stated strategic direction. This is done at two levels: first, a general strategy related to growth, and second, a more specific strategy related to competition and/or differentiation.

First, at a general level the enterprise establishes that it intends to grow, shrink, or stabilize. Whether it is a turnaround strategy to recover lost ground, a growth strategy to enter new markets or provide new services, or a stabilization strategy to absorb and solidify recent growth or reduction, the competitive strategy must first and foremost be flexible enough to ensure survival in the face of unplanned internal and external events, and then promote success in the goals that the enterprise decides to pursue during the period of the Strategic Plan.

Second, the competitive strategy is detailed in a statement regarding service and/or product differentiation and delivery. This area identifies one or more methods that the enterprise will pursue to achieve success in what it produces. Examples include delivering the highest quality; delivering the lowest price; having the most flexibility and/or options; being first-to-market; being a niche player; dominating market share; and acquiring competitors. These statements involve sensitive information, which the enterprise may want to hold in a separate addendum to the Strategic Plan.

Strategic Goals
The enterprise’s strategic goals are those objectives that when achieved together will ensure survival and attain success, as defined in the outcome measures and performance metrics that the enterprise develops for itself. Strategic goals also serve to logically divide enterprise activities into areas that will make a meaningful and valued impact on the enterprise to move it in the direction that the Strategic Plan sets forth.

Strategic Initiatives
The enterprise’s strategic initiatives are those activities which are chartered by and support strategic goals. Not all of an enterprise’s activities are strategic in nature, as some activities are support functions (i.e., payroll, accounting, IT infrastructure management, and human resources). Initiatives that are strategic in nature include those ongoing programs and specific projects that accomplish one or more strategic goals. One of the questions that executive decision makers often ask when funding decisions are made for an initiative is whether there is strategic value in the planned outcome(s). Investments that have a linkage to strategic goals are said to be “aligned”.

Outcome Measures
Knowing that progress is being made on strategic goals and initiatives is imperative for an enterprise’s success. By definition, these are the activities that are the most important to the enterprise and therefore require regular review and refinement. By identifying goals and initiatives that can be measured, the enterprise is able to manage these activities. Measures are the most detailed EA component at the strategic level of the EA framework, and are found at each of the other levels as well.

It is important to understand the difference between “outcome” measures and “output” measures. Outcome measures identify progress being made toward some new end-state, such as better product quality, increased customer satisfaction, or more efficient processes. Output measures provide data on activities and things, such as how many cars are produced in a day, how many
new customers are gained or lost each month, or how closely an activity meets a quality checklist. Outcome measures often have both quantitative and qualitative elements to them, while output measures are usually quantitative. Output measures are important for indicating progress in an initiative area, but it is the attainment of outcomes that correlate to goal attainment, and an enterprise’s strategic progress. Examples of outcome and output measures are provided below.

Outcome Measure #1: Improve the factory safety environment by reducing injuries by 5 percent within one year.
Output Measure #1-1: Increase the number of safety inspections by 10 percent.
Output Measure #1-2: Require 100 percent use of safety helmets and eyewear.
Output Measure #1-3: Require accident report completion within 24 hours.

**E-Commerce/E-Gov Plan**

An E-Commerce/E-Government Plan is often needed by an enterprise in addition to the general Strategic Plan. This is because the general Strategic Plan usually does not address IT in sufficient detail to identify the various IT-related initiatives that may enable many of an enterprise’s strategic goals. This is said in recognition that many enterprises are becoming “information centric”, in that they depend on information and on IT resources to successfully accomplish key business, manufacturing, service, research, financial, human resources, and office automation functions. The E-Commerce/E-Government Plan is more like a tactical plan due to the dynamic nature of IT resources and the processes they support. The E-Commerce/E-Government Plan should provide specific program, outcome, and performance information for a two or three-year timeframe. Beyond about three years, it is difficult to predict with accuracy what new capabilities IT will be able to provide. The E-Commerce/E-Government Plan should be updated every 1-2 years.

**EA Components at the Products & Services Level**

**EA Components:**
- *Business Services*
- *Business Products*
- *IT Capital Planning Portfolio*

**EA Artifacts:**
- *Business Plan (B-1)*
- *Node Connectivity Diagram (B-2)*
- *Swim Lane Process Diagram (B-3)*
- *Business Process/Service Model (B-4)*
- *Business Process/Product Matrix (B-5)*
An enterprise’s key business and support processes are documented at the Business level of the EA framework. EA components at this level include business process documentation and an IT capital planning portfolio that provides business case documentation on each investment in IT that meets operational and financial thresholds. Relationships between participants in E-Commerce and E-Government activities are often referred to as “B” for business, “G” for government, and “C” for citizen, resulting in acronyms such as B2B for business-to-business and G2C for government-to-citizen.

**Business Services**

Business services are those enterprise activities that directly contribute to mission accomplishment. This can be in the form of strategic initiatives to develop new or improved services or artifacts, ongoing manufacturing activities, public service delivery, and “back office” finance, accounting, administrative, and human resource functions. Business process documentation includes flow charts and modeling techniques that detail the inputs, outputs, enabling resources, and controls of an enterprise activity. It also includes the documentation of activities that completely reengineer an organizational process (called Business Process Reengineering-BPR), and activities that provide minor adjustments to a process (called Business Process Improvement-BPI).

**Business Products**

Business products are the tangible and intangible goods that the enterprise produces in pursuit of business and strategic goals. Examples include manufactured items, financial instruments, vehicles, structures, intellectual capital, art, music, and special events. Business product documentation is important to an enterprise as it captures and protects intellectual capital and various patent, trademark, and copyrights. Also, documentation of products is useful in BPR and BPI activities. EA artifacts that document business products contain sensitive information that should be protected when it is archived in the EA repository (see Chapter 12).

**IT Capital Planning Portfolio**

Because resources are limited in most enterprises, the value of making a significant investment in IT should be shown in order to identify the costs, benefits, and rate of return on capital. It may be shown in a manner to justify not using those resources on other initiatives (opportunity cost). A ‘business case’ for any investment is a standardized format for developing and presenting the various aspects of alternatives, cost and benefit, and return that executives are interested in. A business case should include:

- Requirement Statement
- Alternatives Analysis
- Cost-Benefit Analysis
- Net Present Value Calculation
- Return on Investment Calculation

The IT Capital Planning and Investment Control (CPIC) process is a key management activity
that is designed to plan, select, control, and evaluate the enterprise’s major investments in IT. The CPIC process works in concert with the EA Management Plan to move an enterprise from the current architecture to the future architecture on an ongoing basis. The use of standardized IT Project Management Plans helps make the CPIC process more efficient and more useful to project managers (see Chapter 10 for more information).

**EA Components at the Data and Information Level**

EA Components:

- *Knowledge Warehouses*
- *Information Systems*
- *Databases*

EA Artifacts:

- *Knowledge Management Plan (D-1)*
- *Information Exchange Matrix (D-2)*
- *Object State-Transition Diagram (D-3)*
- *Object Event Sequence Diagram (D-4)*
- *Logical Data Model (D-5)*
- *Physical Data Model (D-6)*
- *Activity/Entity (CRUD) Matrix (D-7)*
- *Data Dictionary/Object Library (D-8)*

How an enterprise uses data and information is documented at the ‘Data and Information’ level of the EA³ Cube Framework. EA components at this level include documentation on the design, function, and management of information systems, databases, knowledge warehouses, and data marts. It also includes detailed documentation on the structure and processing logic of data that the enterprise is interested in.

**Knowledge Warehouses**

Knowledge warehouses evolved from large mainframe databases that served multiple applications and user groups across multiple systems and networks. A knowledge warehouse is a one-stop-shop for data and information about various activities and processes in the enterprise. The more types of data and information in the knowledge warehouse, the more valuable it is for analysis activities that extend beyond simple queries and report generation, but enable ‘data mining’ wherein all levels of the enterprise can look for patterns or new information from otherwise disparate data. This helps build new views of these activities and the enterprise.

Typically, users interact with a knowledge warehouse through a portal-like interface that enables customized access to various elements such as databases, presentations, and data, audio, and video files. A knowledge warehouse may be developed for a specific use or bought as a customizable product.

**Information Systems**
Information comes in three forms: data, information, and knowledge. Aggregation, meaning, and context are what differentiate each of these forms.

Definitions are provided as follows:

**Data**: Raw facts about people, places, events, and things that are of importance in an organization. Each fact is, by itself, relatively meaningless.

**Information**: Data that has been processed or reorganized into a more meaningful form for someone. Information is formed from combinations of data that hopefully have meaning to the recipient.

**Knowledge**: Data and information that is further refined based on the facts, truths, beliefs, judgments, experiences, and expertise of the recipient. Ideally information leads to wisdom.

Information systems consist of hardware and software that work together to efficiently collect and disseminate data, as well as to enable the development and analysis of information. Information systems serve many lines of business in enterprises including administrative and financial support, manufacturing, marketing and sales, government regulation, public services, and defense systems.

Information systems originally were designed to support a particular need in an enterprise and connect to a single database. As enterprises developed more uses for information systems, greater efficiencies were achieved when several information systems shared one or more databases. This movement from “stovepipe” information system designs to more distributed and integrated designs, which span the entire enterprise and which tie together via information warehouses, is one of the driving factors in the development of the concept of enterprise architecture.

**Databases**

Databases are software applications that are designed to support the storage, retrieval, updating, and deletion of data elements and/or data objects. Data elements are the fundamental facts and values that are stored in databases. Data elements and their identifying and characteristic attributes are usually stored in relational databases that consist of data tables which are logically related to create a speedy, efficient, and flexible query capability. Data objects are discrete ‘blocks’ of code that contain attribute information about a data element as well as behaviors that create an ability for objects to interact with each other in different ways, depending on the type of triggering event.

**EA Components at the Systems and Applications Level**

- **EA Components**:  
  - *Software Applications*  
  - *Web Services*  
  - *Service Bus and Middleware*  
  - *Enterprise Resource Planning (ERP) Solutions*
• **Operating Systems**

**EA Artifacts:**
• System Interface Diagram (SA-1)
• System Communication Diagram (SA-2)
• System Interface Matrix (SA-3)
• System Data Flow Diagram (SA-4)
• System/Operations Matrix (SA-5)
• Systems Data Exchange Matrix (SA06)
• System Performance Matrix (SA-7)
• System Evolution Diagram (SA-8)
• Web Application Diagram (SA-9)

The systems and applications that an enterprise uses to support its business services, product delivery processes, and information flows are documented at the ‘Systems and Applications’ level of the EA³ Framework. One of the purposes of EA is to improve the integration and efficiency of the support systems and software applications across the enterprise. Duplication of functions and a lack of interoperability can be addressed through the establishment of technical and product standards for software. Components at this level range in size and complexity from large multi-function ERP solutions that extend throughout the enterprise to single-user desktop tools that enhance productivity.

**Software Applications**

Applications are software programs that provide a functional capability for “front-office” IT systems (e.g., manufacturing, sales, government services, logistics, and knowledge warehouses) or “back-office” IT systems (e.g., financial systems, human resources systems, e-mail, and office automation products such as word processors, spreadsheets, diagramming tools, photo editors, and web browsers). Enterprises often possess a myriad of applications from different vendors that are limited in their ability to function together. The selection of applications from a controlled number of vendors and/or which adhere to widely accepted standards is a method that can be used to promote the interoperability of software applications.

**Web Services**

Just as EA trends are emphasizing the use of plug-and-play software applications; the use of web-based IT services is significantly extending and accelerating this concept. These open-standards based web services are replacing software applications that have unique hosting and access requirements. By using the TCP/IP, SOAP, and UDDI protocols for web service management and internationally-accepted formats for information retrieval/exchange (e.g., HTTP, HTML, J2EE, and XML), a common hosting and operating environment is created for web services. A web service is defined as any IT resource (e.g., application, program, database, or information portal) that functions through a web-based graphical user interface (GUI), such as a web browser. Web services include email, web-based ERP applications, websites, electronic commerce systems, web-based knowledge warehouses…. virtually any front or back-office function that is web-based and which operates within the enterprise on TCP/IP based compliant
internal networks (Intranets). Service-Oriented Architecture (SOA) is the EA-related movement that focuses on web services.

**Service Bus/Middleware**

The “Service Bus” is a SOA term for a common operating environment for systems, applications, and web services that is characterized by non-proprietary open standards protocols and middleware for data exchange, software/hardware interfaces. The Service Bus is platform independent and allows any system/service to interoperate with any other system/service that is logically and physically linked to the Bus. SOA approaches promote the support of business functions through the use of shared, reusable services, which increasingly are web-based. The term that SOA approaches use for this capability is a “Virtual Enterprise Network”, and the SOA term for the Service Bus is a Network Application Platform. Middleware is a software program that links other applications together which otherwise would not be able to exchange data and information. Examples include integrating older mainframe applications and databases to those which are web-based, or enabling the sharing of data between artifacts from different vendors that may have different application programming interfaces (APIs) that incorporate standards such as the Simple Object Access Protocol (SOAP) or the Representational State Transfer (REST).

**Enterprise Resource Planning (ERP) Solutions**

ERP solutions are marketed by vendors as one way to increase application interoperability and reduce the duplication of functions. Often based on “modules” of capability, ERPs are essentially a suite of applications offered by the same vendor that are designed to work together to create an enterprise-wide capability. ERP solutions exist for finance, marketing, human resources, payroll and accounting, and supply chain management, all of which can be interconnected to create a relatively seamless environment for sharing information. While ERPs accomplish some of the goals of EA, they fall short of providing the holistic planning, documentation, and decision-making support that EA is intended to develop and maintain. Also, ERPs normally are not able to support all of the application requirements of the enterprise (i.e., office automation, finance and accounting, product line support, executive decision-making, e-mail). This wider yet incomplete coverage of application component requirements is one of the shortfalls of ERP solutions, which the EA program can address by establishing standards for the integration of ERP modules with other applications.

**Operating Systems**

Operating systems are applications that enable computers to provide basic networking and processing functions. Differences in operating systems are a large part of what distinguishes older centralized mainframe designs from newer decentralized client-server designs. Larger enterprises may operate computers that use several different types of operating systems, which may hinder the interoperability of these component resources. Commercial vendors traditionally have produced operating systems that are proprietary and are designed to limit integration to their own products; however, the proliferation of client-server network designs and the emergence of the Internet have forced vendors to offer operating systems that are increasingly interoperable.

**EA Components at the Network & Infrastructure Level**
EA Components:

- Data Networks
- Telecommunications Networks
- Video Networks
- Mobile Networks
- Cable and Wireless Backbones
- Security Solutions
- Buildings and Server Rooms
- Equipment

EA Artifacts:

- Network Connectivity Diagram (NI-1)
- Network Inventory (NI-2)
- Capital Equipment Inventory (NI-3)
- Building Blueprints (NI-4)
- Network Center Diagram (NI-5)
- Cable Plant Diagram (NI-6)
- Rack Elevation Diagram (NI-7)

The Technology Infrastructure level of the EA³ Cube Framework functions to integrate and connect the enterprise’s IT resources at the application and information levels. Seamless integration of voice, data, video, and transport (cable/wireless) resources is one of the keys to creating an operationally effective and cost-efficient IT infrastructure.

Data Networks

Data networks are designed to transport data and information in coded digital form between various computers that support storage, retrieval, updates, and processing for end-users. These networks have a logical design that identifies how data and information will flow between systems, applications, databases, and websites. The network also has a physical design that consists of a data transmission “backbone”, an information hosting environment, and external interface points (unless it is a standalone system). The network backbone often consists of commercially procured routers, switches, hubs, security equipment, backup power units, equipment racks, and cable. The hosted network environment includes commercially procured computers for storage, processing, and end-users, as well as commercial software for business and office automation requirements and custom-developed software that is designed to support unique requirements. Data networks within an enterprise, referred to as Local Area Networks (LANs) or Internal Networks (Intranets) normally interface with a telecommunications network to connect to the global Internet. Enterprise-specific External Networks (Extranets) are also known as Wide-Area Networks (WANS).

Telecommunications Networks

Telecommunications networks are designed to transport voice signals in coded form (analog
waves or digital electron/photon flows) between end-users. These networks also have a logical design that identifies how voice signals are transported between network components and a physical design that identifies the types of equipment involved in signal processing and transmission. This includes hardware, software, cable plants, cellular/wireless nodes, microwave repeaters, and relay satellites. Telecommunications networks exist at a local level to support parts of an enterprise or an entire enterprise. These are known as “Public Business Exchange” (PBX) systems which are commercially available from a number of vendors. Telecommunications systems that are regional, national, or international in nature often involve multiple sub-networks that interface at numerous points to increase coverage, routing, and reliability. Because of the ubiquitous presence of telecommunications networks, the rapid development of the Internet on a global basis has been made possible in large part due to the conversion of voice transmission capacity to dedicated data transmission, as well as the addition of significant amounts of new capacity from existing and new commercial providers. The co-transmission of digital voice and data signals is now commonplace, and new standards have arisen to support this on most telecommunications networks (e.g., ISDN and Voice-Over-IP).

**Video Networks**

Video networks are designed to transport video image signals in coded form (analog waves or digital electron/photon flows) between production sites and viewing sites. Like the other types of networks, video networks have logical designs to show the flow of image signals and physical designs to identify production, transmission, and receiving equipment. National and international standards have emerged that promote the transmission and reception of video signals on a global basis. Video networks can be as small as peer-to-peer computer-based applications or video teleconferencing (VTC) equipment that operates within an enterprise or between several users, or as large as a regional, national or international television network.

As with voice networks, digital coding of video signals supports the co-transmission of this information on the same network backbone that transports voice and data. This seamless integration of voice, data, and video transmission capabilities brings new capabilities for information exchange within and between enterprises. Future architectures will often call for this type of integration, with applications and equipment that will support it.

**Mobile Networks**

Mobile networks are those which are specifically focused on providing telecommunications connectivity to users who are using compact devices to remotely connecting to a voice, data, or video network from outside of the network. This includes the use of cellular telephones, portable laptop computers, tablets, and personal digital assistants. Connectivity to mobile (also called wireless) networks from a distance of up to 50 miles can be achieved through wireless radio frequency (RF) connections between telecommunications networks, cellular transmission towers and repeaters. Longer range RF connections to remote locations can be relayed by satellites in geostationary or low-earth orbit. Close proximity connectivity between mobile devices can be achieved through infra-red communications of up to 100 feet or low-power RF connections provided by technologies such as Bluetooth™.

**Transmission Backbones**

The transmission capability of an information network (voice, data, or video) has its foundation in connectivity between network equipment. This connectivity can be provided through various
media including cables (copper or glass fiber), wireless cells (short-range radio waves), transmission towers (medium range microwaves), and/or satellite links (long-range up-link and down link of VHF, UHF, or EHF radio waves). These “backbones” of interconnectedness are what allow the electrons and/or photons to flow in a super fast stream of binary (on or off) code or in analog waves that are translated into data, voice signals, and/or video signals. Improvements in hardware, software, and cable media have allowed for the near instantaneous transmission of millions of binary elements called bits (one binary element) and bytes (a group of 8 binary elements). The ability to now transmit billions of bits and bytes of digital information has allowed for the development of sophisticated applications and databases that bring new capabilities for people and enterprises to communicate in robust ways that include information in the form of data, images, and sound.

**Management Views of EA Artifacts**

EA management views are high-level composite graphics that depict multiple aspects of EA components in a simplified or more attractive big-picture format than that which is normally produced by EA tools. Without management views, the basic (primitive) EA artifacts may consist primarily of technical models that do not hold the interest of EA executive sponsors and users, therefore putting the EA program at risk. The purpose of management views is to lower this risk by:

- Gaining and maintaining EA executive sponsors and resources
- Communicating high-level management-friendly views of EA
- Showing the boundaries of the enterprise being documented
- Combining EA and other IRM artifacts into actionable information for managing and decision-making

EA management views can help various types of users to both understand and share EA artifacts. For example, members of the EA team who are modeling data in several information systems can develop a management view to show how information from those systems is used between various LOBs, and in so doing gain the support of managers in those business areas. In addition, management views can help to translate EA artifacts that are in technical modeling or analytic formats into views that are easier to understand by those who are not trained in that documentation methodology.

**Summary of Concepts**

This chapter described the purpose of EA components and artifacts within an EA framework. Using the EA³ Cube Framework as an example, EA components were described as replaceable elements within the framework that come and go with changes in strategy, business services, and new designs for IT resources involving information flows, applications, and the technology infrastructure. Descriptions were provided of the types of EA components that exist at each level of the framework. Chapters 7 and 8 will focus on current and future views of the EA artifacts that describe EA components at all levels of the framework.

**Chapter 6 Questions and Exercises**

1. What are EA components and how do they relate to a framework?
2. What are EA artifacts and how do they relate to EA components?
3. What parts of an enterprise’s Strategic Plan could be viewed as EA components?
4. Why can an enterprise’s business services, information flows, applications, and networks be viewed as EA components?
5. Why are national and international standards important to EA components?
6. Which elements of a security and privacy program can be viewed as EA components?
7. List several hypothetical EA components at each level of the EA³ Framework for a large automobile manufacturing company.
   a. Compare and contrast the use of the term “component” in the context of how it is used in this chapter with the use of the term in the software and application development industry.
   b. Obtain the Annual Report of a Fortune 500 corporation and list potential EA components at each level of the EA³ Framework.
Case Study:  
Danforth Manufacturing Company  
Scene 4: Developing Current and Future EA Views

CIO Sam Young and Chief Architect Vince Albright are leading an EA Working Group through the development of architecture segments that cover several lines of business at DMC. These segments of the overall DMC enterprise architecture will help COO Kate Jarvis and CFO Jim Gorman work together as they evaluate requirements and plan solutions for new information systems. Scene 3 had covered the need for a detailed implementation methodology, and this scene describes the approach the Working Group will take in documenting the current and future views of these segments of the DMC EA.

“Thank you for coming to today’s meeting of the Enterprise Architecture Working Group” said Sam. We are going to talk about the method for developing current and future views of the two segments of the company’s enterprise architecture we are developing. These segments cover manufacturing and production, which are the lines of business identified by Kate and Jim that require more IT support. At the last meeting we developed the detailed implementation methodology that will guide our efforts and reduce the risk that we will not be successful. Vince Albright, our Chief Architect, will describe the documentation of current and future views.”

“Thank you Sam” said Vince. “In accordance with our implementation methodology, we will be using the EA³ framework to organize and guide the documentation of current and future views of these segments of the DMC architecture. Following the framework’s structure, we will gather existing artifacts of information on the lines of business in the following order: strategic goals and initiatives, business services, information flows and data elements, systems and support services, and the network infrastructure. These documentation artifacts come in many forms including reports, policy memos, manuals, spreadsheets, briefing slides, diagrams, and video files. By organizing these artifacts in the online EA repository into categories that match the levels and areas of the framework, we can establish links between the information to produce robust new views of the lines of business. This also establishes a baseline of EA information for future planning and decision-making.”

Vince continued. “As for documenting the future views, we will start by establishing several future operating scenarios with Jim, Kate and their staff members. These scenarios are short stories about possible future activities in a variety of friendly and hostile business climates. The scenarios help us to identify important planning assumptions about their future line of business activities, depending on the environment. Once the most probable scenario is selected, we will use the planning assumptions to guide discussions in our Working Group, and decisions by Jim and Kate on what they want to invest in to best position themselves for success in the future. Finally, we will identify how these decisions cause changes to the current EA at each level of the framework, and will document those changes in new artifacts that are saved in the EA repository in a separate future EA section.”

Over the next several weeks, the EA Working Group gathered existing or developed new documentation artifacts for the current views of the two EA segments at each level of the EA framework. The Group then developed several future operating scenarios from which future
view artifacts were developed. Chapters 7 and 8 provide more details on the development of current and future EA views.