

ALIGNING ENTERPRISE ARCHITECTURE AND IT INVESTMENTS WITH CORPORATE GOALS

Richard D. Buchanan
Vice President
Enterprise Planning and Architecture Strategy Service
META Group, Inc.
&
Richard Mark Soley, Ph.D.
Chairman and CEO
Object Management Group

The Challenge IT Faces

Every CIO knows that his or her job is getting harder. The world in which companies operate is changing faster all the time. New enterprise solutions need to be delivered more quickly and directly linked to measures of business improvement. New technologies are being introduced with greater frequency. Organizations are more dependent on IT than ever before and most projections suggest that the dependence will grow in the years ahead. As IT becomes more central to the survival of the company, one might think CIOs would get more respect.

Unfortunately, many CEO's are unsatisfied with how their IT organizations are performing. Many studies have suggested that senior business executives do not think they are getting a good return from their IT investments. One study suggested that out of 145,000 major IT projects conducted by Fortune 500 firms between 1998 and 1999 (costing in excess of \$265 billion), fewer than 25% met their narrowly defined project goals. Worse, senior managers felt that fewer than 12% fundamentally advanced the strategic goals of the enterprise. Thus, even as their importance to the company increases, CIOs are under more pressure to justify the cost of IT development, devise more effective means to manage IT projects, and justify the value of the IT organization.

This whitepaper describes an approach to strategic planning, architecture development and software project management that is based on research undertaken by META Group, Inc. (www.metagroup.com). It describes META Group's Enterprise Architecture Planning Process (EA Process) that provides IT organizations with a systematic approach to aligning IT projects with corporate goals and priorities. It goes on to show how the Object Management Group's new Model Driven Architecture™ (MDA™) can be used to implement the enterprise systems identified by the EA Process, thus providing organizations with a comprehensive approach to the management and development of IT environments.

META Group is an international advisory and consulting organization that provides advice on business and technology strategies to more than 3300 clients in more than 40 countries. The Enterprise Planning and Architecture Strategy Service has proved one of its most popular advisory services. The Object Management Group is an international standards consortium that has 800 members. It has recently adopted MDA, a new approach to software architecture and development. In effect, these two separate organizations, META Group and the OMG, one working from the top, down, and the other working from the bottom, up, have each arrived at a similar and complementary analysis of what IT organizations need and how it should be implemented.

The Role of an Enterprise Architecture

Most complex organizations conduct some form of business strategic planning, often coordinated through a strategy committee or planning organization that identifies threats and opportunities emerging from the environment and recommends appropriate organization responses and investments. These recommendations become part of company plans and budgets. The maturity and usefulness of these efforts vary, but most CEOs or Boards of Directors recognize that this work is necessary.

At the same time, most IT organizations have groups that establish IT goals and manage the acquisition and development of new hardware and software systems. In a well-aligned company, the IT organization would derive its goals and priorities from the corporate strategy and planning groups. This would insure that IT projects routinely supported corporate goals. What is missing in most organizations is a mechanism that can align or “bridge the gap” between the concerns of corporate strategists and IT project managers.

Based upon their research on industry best practices, META Group has developed such a mechanism, which it refers to as the Enterprise Architecture Process. For META Group, Enterprise Architecture represents a process, not a thing. The process will result in the creation and iterative refinement of many artifacts that collectively define a future enterprise architecture, and it will identify the gaps between the current state and this future architecture. The enterprise architecture, in effect, describes the logical linkages between the enterprise business, information and technical architectures and the enterprise solutions architecture. The traditional notion of an enterprise architecture is extended so that the hierarchy of architectures extends from the business strategy level and links to the IT implementation level. This enables organizations to align business goals and IT investment plans, and facilitates communication and decision-making between business strategy and IT management groups. (See Figure 1 and Figure 2)

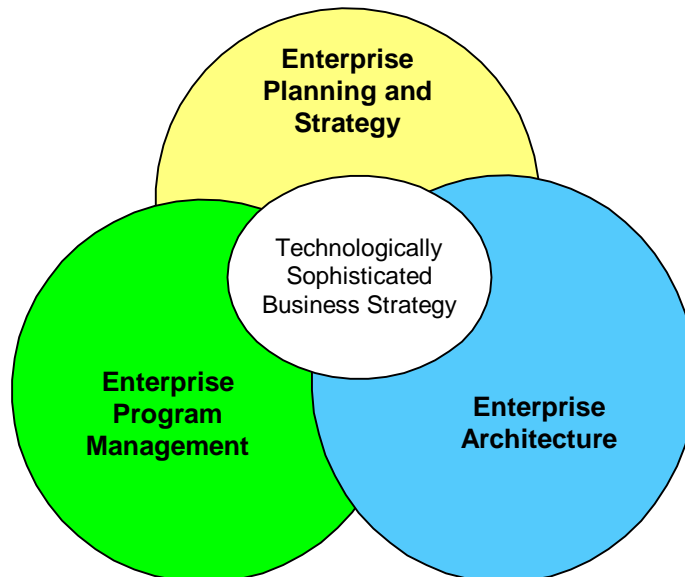


Figure 1. A technologically sophisticated business strategy is the result of integrating three key variables.

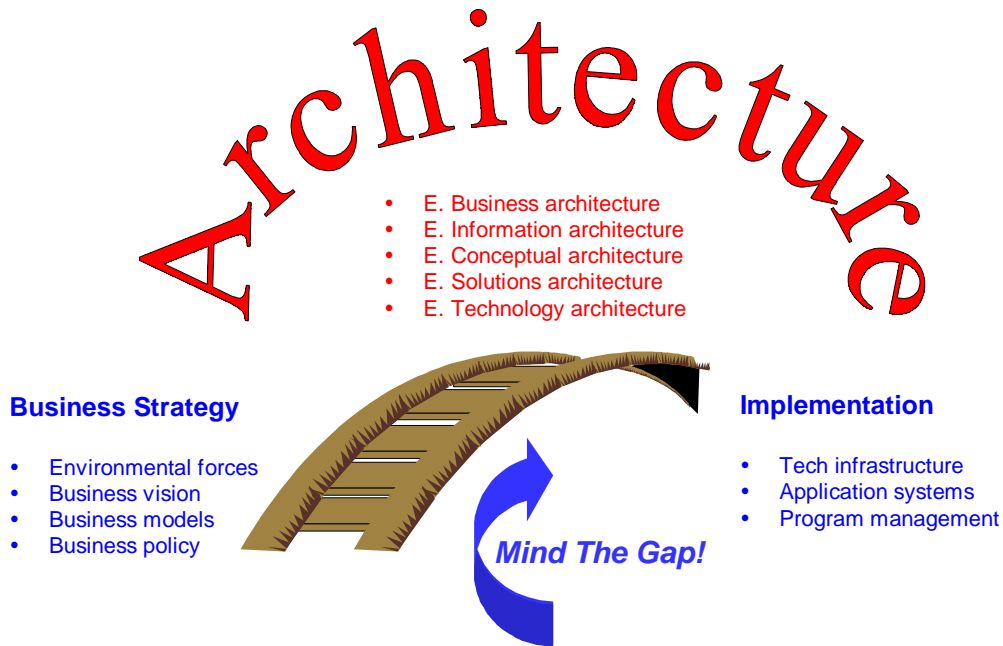


Figure 2. Enterprise Architecture serves as a bridge between business strategy and program management.

It is important to emphasize that the enterprise architecture does not represent a series of static documents, but an ongoing process. The business architecture is constantly being refined or revised as strategists and corporate planners identify environmental trends that require new corporate responses or priorities. Similarly, as corporate responses are modified, the information and technical architectures must be modified. That, in turn, leads to new application and infrastructure development priorities.

Before we can talk about how these architectures fit together, however, we need to establish an agreement on some basic assumptions and explain the context within which the enterprise architecture is developed.

One concept that is key to understanding the role of the Enterprise Architecture is the concept of value. Too many organizations use this term too narrowly, and define it in terms of purely financial goals. In other words, they define value in terms of reduced costs. In fact, value, rightly considered, involves two interacting concepts: financial efficiency and business effectiveness. Financial efficiency results from reducing costs or enhancing the financial yield from investments. Business effectiveness results when the company increases its market share, beats competitors, improves quality or cements a tighter relationship with customers. Board members often focus on business effectiveness while middle managers are more likely to focus only on financial efficiency. Effective companies need to develop measures that capture both aspects of value, and use these enhanced and more complete value measures to guide their investment and architectural decisions.

A related concept is the idea of the extended value chain of core business process. The idea of the value chain gained attention in the mid-Eighties, when Michael E. Porter, of Harvard Business School, popularized it in his book *Competitive Advantage* (1985). Porter was already a well-established consultant because of his earlier work, *Competitive Strategy* (1980). Most corporate strategy groups still rely on models, like Porter's five forces model, that were introduced in *Competitive Strategy* to help define corporate environmental threats and opportunities.

Competitive Advantage focused on business processes or value chains that cut across organizational, departmental or functional lines. A value chain includes all of the business processes needed to get from a customer order to the delivery of the final product. Porter urged companies to stop thinking in terms of departmental silos and to start conceptualizing all their processes and activities holistically and systemically. Porter also introduced the idea that specific activities either add value to the end product, or don't, and suggested that companies focus on value-adding activities. All of these ideas were taken up by business process reengineering gurus in the early 1990s and are much talked about today. Unfortunately, only a few companies have taken these ideas to heart and implemented systems that focus managers on processes rather than on more narrowly functional concerns.

Figure 3 shows how specific, value adding business processes can be related in a value chain and how application systems can be aligned with processes to clarify how each fits in the company's overall strategy.

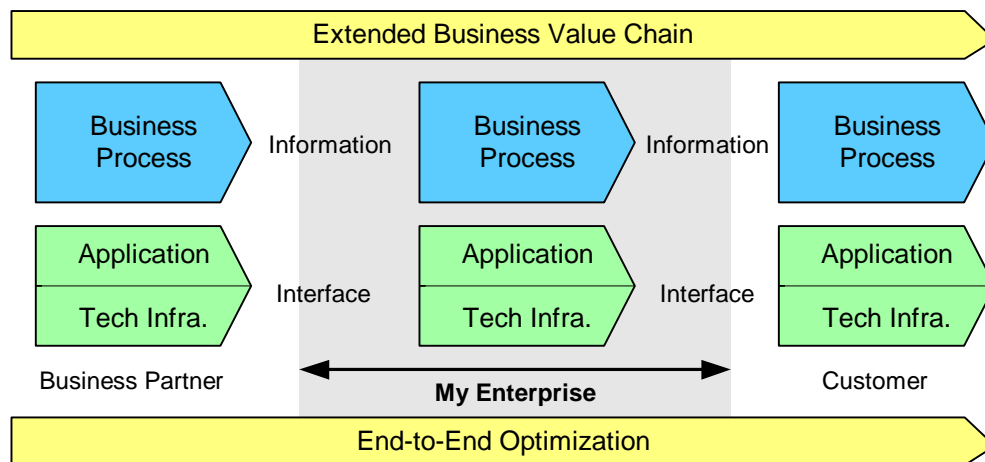


Figure 3. Business process and applications fit together in a value chain.

Processes or activities are enabled by the flow of information. The required, enabling information represents a “mirror image” of the processes. The applications that support the processes are linked together by interfaces. Once one has an understanding of the interfaces required to support these linked applications, one is well prepared to conceptualize the kind of infrastructure needed to run them. Moreover, when both business managers and IT managers can agree on the overall organization of key value chains, everyone is in a position to communicate more clearly about the needs of each group.

Best practice research indicates, moreover, that enormous value can be obtained without analyzing all of these business processes in agonizing detail. In other words, the “80/20 rule” applies. Eighty percent of what the organization needs to know about these processes can usually be obtained within the first 20% of the time devoted to analyzing it. Enterprise architecture can be developed, therefore, in a very pragmatic fashion.

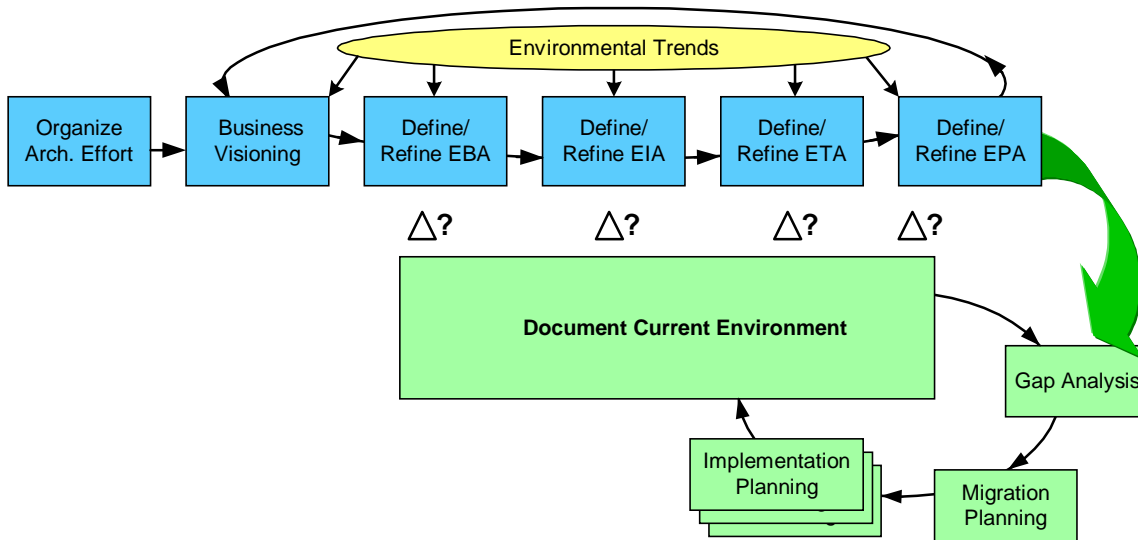


Figure 4. META Group's Enterprise Architecture process model.

Figure 4 delineates META Group's EA process, and a brief tour through it will help us understand its value and how it can be leveraged. The first step is to understand the complete definition of the concept.

Enterprise architecture is a top-down, business strategic driven process that coordinates the parallel, internally consistent development of an enterprise business architecture (EBA), an enterprise information architecture (EIA), and an enterprise-wide technology architecture (EWTA), as well as the enterprise application portfolio (EAP). It represents the holistic expression of the enterprise's key business, information, application, and technology strategies and their impact on business functions and processes. Conducted within an appropriate, collaborative, organization/governance context, EA artifacts consist of a Common Requirements Vision (CRV), Conceptual Architecture (CA), as well as current and future state models of the four key architectures described above.

The EA process is "top-down" in the sense that analysis begins by "looking out the window" at new market, competitive and other environmental forces that may affect the organization. This approach contrasts with the typical approach many IT organizations adopt which is to examine existing processes, an approach we might describe as "looking in the mirror." Once new opportunities and threats are identified, the strategy and planning group must decide if they warrant changes in the company's strategies. This results in a new or refined business vision, which in turn, results in a new business strategy.

Despite the fancy term, an enterprise business architecture is simply a more precise description of an organization's business strategy. It answers the question, "Given our business strategy and goals, who is going to do what?" In other words, it identifies (in a very targeted, pragmatic way) which assets will engage in what processes in support of the forward business strategy. The formal definition is as follows:

An enterprise business architecture is a business vision-driven process, that decomposes the enterprise's business strategies, the assets and processes required to execute them, as well as their impact on business functions. Artifacts of the EBA consist of a Common Requirements Vision (CRV), Conceptual Architecture (CA), as well as current and future state models of business activity that articulate the extended enterprise value chain. EBA is implemented through the enterprise's EIA, EWTA, and EAP, and defines the business design for sustainable competitive advantage.

Downstream from the EBA analysis lay the areas of traditional concern to the IT community – Enterprise Information Architecture, and the technical means of supplying required and useful information, i.e., the Enterprise Application Portfolio and the Enterprise Wide Technical Architecture (in essence, shared infrastructure). As the formal definitions of these make clear, these are derived from the EBA analysis.

The development of an Enterprise Information Architecture is driven by the EBA. This disciplined process details the enterprise’s information strategies, its extended information value chain, and their impact on technical architecture. A “mirror image” of the EBA, the artifacts of the EIA consist of a Common Requirements Vision (CRV), Conceptual Architecture (CA), as well as current and future state information models that describe the extended information value chain, delineate the key information artifacts of business events, models and information flows, provides logically consistent information management principles and enables rapid business decision making and information sharing.

The Enterprise Application Portfolio is an EBA and/or EIA driven collection of integrated application systems required to satisfy business information needs, including the existing and planned inventory of applications and components, complete with relationships to supported information and business processes, and engineered linkages to EWTA and infrastructure services.

The Enterprisewide Technical Architecture is an EBA or EIA-driven process that details the enterprise’s technology strategies, its extended technology linkages and their impact on program/project initiatives. Consistent with the EBA and EIA, artifacts of the EWTA consist of a Common Requirements Vision (CRV), a Conceptual Architecture (CA) that defines a logically consistent set of principles that guide the engineering of an organization’s information systems and technology infrastructure, as well as current and future state models of the enterprise’s infrastructure and technology platforms required for the EAP, and which enables rapid engineering, solutions development and technical innovation.

These related architectures are developed iteratively, over time and that architects “add more detail” during each. Figure 5 illustrates how these architectures are added to the basic EA process. The Common Requirements Vision is the most abstract description of the related architectures and is created first. The Conceptual Architecture consists of a set of well articulated principles that are logically consistent and used to “guide the engineering” of business processes, information models, and (ultimately) applications and infrastructure.

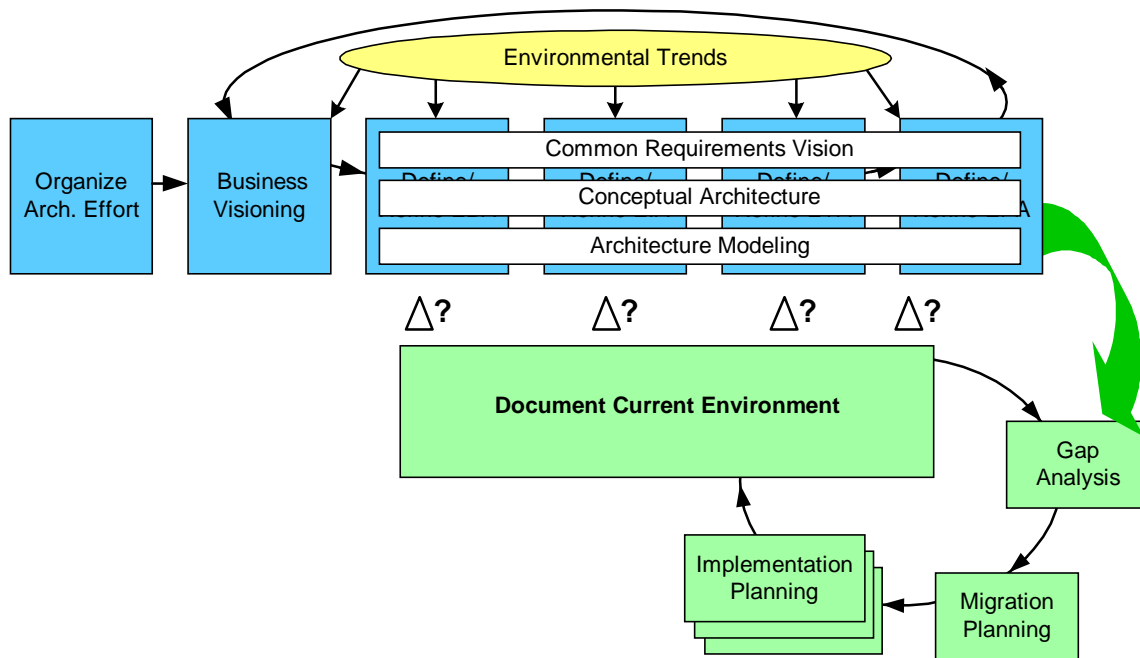


Figure 5. META Group's Enterprise Architecture process model.

As an example, a commonly stated principle for EBA states that “The organization will only invest in those value adding activities that provide a competitive advantage, and will outsource those activities irrelevant to our competitive position.” Thus, Microsoft would not develop in-house its own , “captured” shipping organization for software, since FEDEX can do this more effectively and shipping provides Microsoft no competitive advantage. A commonly stated principle for EIA states that “all information must derive from a known source and be vetted by the responsible information steward for accuracy and relevance.”

The point is that all of the related “architectures” are described first in abstract terms before more detailed modeling is conducted. Detailed modeling is only done in a selected and highly pragmatic way, when profoundly important business strategy “change drivers” are identified. Thus, the goal is not to “model the world” but to concentrate on those aspects of the business process that will need to be changed in order to deliver the new corporate values and priorities. The key is to describe each architecture and its relationship with higher-level architectures, first in terms of requirements, then in terms of principles, and only, as necessary, in terms of specific models. As META describes the goal, it’s “just enough architecture, just in time.”

As specific models emerge from the information and technical architectures, they are fed “downstream” into the organization’s Program Management function. Any change in principles or in models results in an analysis of the gap between what already exists and what is called for by the changed strategy and the redefined enterprise architecture. Based on values and priorities assigned to requirements and principles, IT is in a position to create a set of priorities for modifications and to plan changes. For most IT organizations, this is a major shift. Projects are not undertaken based on arbitrary criteria, according to who is “screaming the loudest” for them or because of lobbying by a specific business manager. Instead, IT investments are made according to objective measures of business strategic value and in accordance with a long term plan for infrastructure and architecture development. Moreover, when business strategies change, IT investment plans can change dynamically in response.

Thus, the EA process coordinates two related efforts, which remain (unfortunately) disconnected in most Global 2000 organizations today. This first effort runs from strategy and planning through the specification of the enterprise architecture. It enables us to answer the questions,

“What are we trying to architect?” and “How should it be designed?” The second effort runs from changes in the enterprise architecture through changes in the IT program management process, and it enables us to answer the question, “How should we prioritize the IT investments we must make to support our future business strategy?” These analyses represent a closed loop that enables continuous improvement as the architecture team monitors the existing IT development processes and reports on the achievement of desired architectural goals.

Obviously, the approach we have described is not easy to establish. It takes senior management commitment and skilled people to create and then to operate an enterprise architecture process. At the same time, the need for business-IT alignment has never been greater, and in many companies, dissatisfaction with strategic planning and the value delivered by IT are at all time highs. This is a strategy designed to resolve serious problems. It requires a serious effort, but it can deliver a very valuable outcome.

Leveraging the Enterprise-wide Technology Architecture

So far we have described a management process that META Group has helped a number of Global 2000 companies install and use successfully. By working together, an architecture group comprised of business and IT managers, can systematically coordinate the communication of strategic needs to IT project managers and communicate the needs of IT for infrastructure changes to business managers.

At this point, we want to shift attention to the specific problems of creating and maintaining an enterprise-wide technology architecture. To date, in their consulting engagements, META Group has maintained neutrality concerning the exact nature of a technology architecture that would be most compatible with this approach. Different companies rely on different technology architectures, adapted to their legacy IT systems and their application needs, and this will undoubtedly continue for the near future.

We wish, however, to draw attention to the fit between the enterprise alignment strategy supported by META, and the Model Driven Architecture (MDA) recently adopted by the OMG. In the sense that we have been using the term in this article, the “architecture” referred to in MDA can embrace all of the architectural concerns of the IT organization, including the information architecture, the technical or infrastructure architecture and the application portfolio.

To understand the OMG’s current interest in MDA, one needs to recall the history of the OMG. The consortium was founded in 1989 to encourage the creation of standards that would facilitate the development of distributed systems. Throughout the Nineties, the member companies that comprise the OMG labored to create a set of standards, commonly known as the Common Object Request Broker Architecture (CORBA®). CORBA standards define how messages from diverse languages can be translated into a common intermediary language, the OMG’s Interface Definition Language (IDL), and then retranslated into the language of the target object or component.

When most people think of CORBA, they probably think of the diagram that the OMG popularized during the Nineties. It shows a thick double-headed arrow that is, in effect, the CORBA ORB and services that keep track of the locations and names of the various distributed objects or components that might need to interact with one another. Above and below the CORBA arrow are the distributed applications and services that companies might use to create systems. In effect, the OMG’s CORBA defined and popularized a middleware-based approach to distributed systems development that is so pervasive today.

In 1989, when the OMG was established, its members hoped that they could create a single object-oriented middleware standard that everyone could embrace, thereby simplifying the

problems involved in creating distributed software systems. Unfortunately, this never happened. Microsoft developed and promoted its own proprietary alternative, DCOM. Sun developed Java, which came with its own middleware standards. And, even more recently, the Internet has resulted in another set of middleware standards, using the currently popular XML.

To make matters worse, even as the middleware options proliferated, companies began to increase their use of the Internet and Web, putting more pressure on IT groups to create integrated systems. To create Web-based applications that allow customers to access a variety of corporate databases and applications, developers must find a way to link all of these databases and applications together in a way that can provide Web users with almost instantaneous responses. Consider a banking application that lets a user access a checking account from an ATM. Once the balance is checked, the same user may create electronic transfers that move money from his or her account to a variety of payees. In the next instance, our same user may decide to move money to or from a savings account, or shift money to pay down a bank credit card balance. In a matter of minutes our user has accessed three or four major bank databases and used three or four different applications to update accounts and transfer funds. None of these applications was originally designed to work with the Internet and they certainly weren't designed on the assumption that hundreds or thousands of users might seek to use them more-or-less simultaneously on a Friday afternoon.

To create new Web-based e-business systems of this kind – and B2B supply chain systems can be much more complex – companies find themselves struggling to integrate diverse databases and applications written in different languages. They also find themselves struggling to get different middleware systems. Enterprise application integration has emerged as one of the key challenges facing IT

In 1999, the 800 member companies that make up the OMG, began to consider how they could contribute to the solution of this problem. It was clear to the members of the OMG that CORBA would never be able to replace all of the other middleware standards their companies were using. Instead, OMG member companies decided they would have to learn to live with and integrate a variety of operating systems, languages and databases, as well as a variety of middleware standards.

Faced with this reality, the OMG began to consider a new approach to distributed systems development. In the late Nineties, the OMG sponsored the development of an integrated software modeling language, the Unified Modeling Language™ (UML™). Unlike CORBA, with its dependence on IDL interfaces, UML is completely independent of any programming language or middleware conventions. Using UML, you can create a high-level model that describes how two applications could be linked together without concerning yourself with any of the details involved in implementation. Starting from that high-level UML diagram, you could proceed to create a design that implemented the linkage in DCOM or in CORBA. Similarly, you could just as well specify that the linkage be implemented in Java, Visual Basic, Enterprise JavaBeans, or XML.

After considering some of the pioneering work by member organizations, (See Box 1) the OMG decided to adopt a new architecture, the MDA. In effect, the OMG has popped up a level and decided to focus on describing how a system should be integrated. This is not to suggest that the OMG is abandoning CORBA. Rather, it will continue to support the CORBA middleware architecture, while simultaneously, developing a second, more comprehensive, UML-based architecture. A developer using the MDA approach begins by creating a UML model that describes the applications and components the company supports and defines how they should be integrated. Later, this model is used to structure the actual development of code to facilitate the integration described in the model.

Figure 6 provides an overview of the MDA approach. At the top there is a platform independent architecture that models the business functionality and behavior, undistorted by technology

details. One could easily imagine an enterprise architecture group that had followed the META EA approach creating and revising this model. From the platform independent model, one or more platform specific models are generated, depending on the platforms supported by the organization. From the platform specific models, code is generated for specific applications. The entire MDA system supports reverse engineering, so that changes in code can be captured in the platform specific model and then passed upward to the platform independent model.

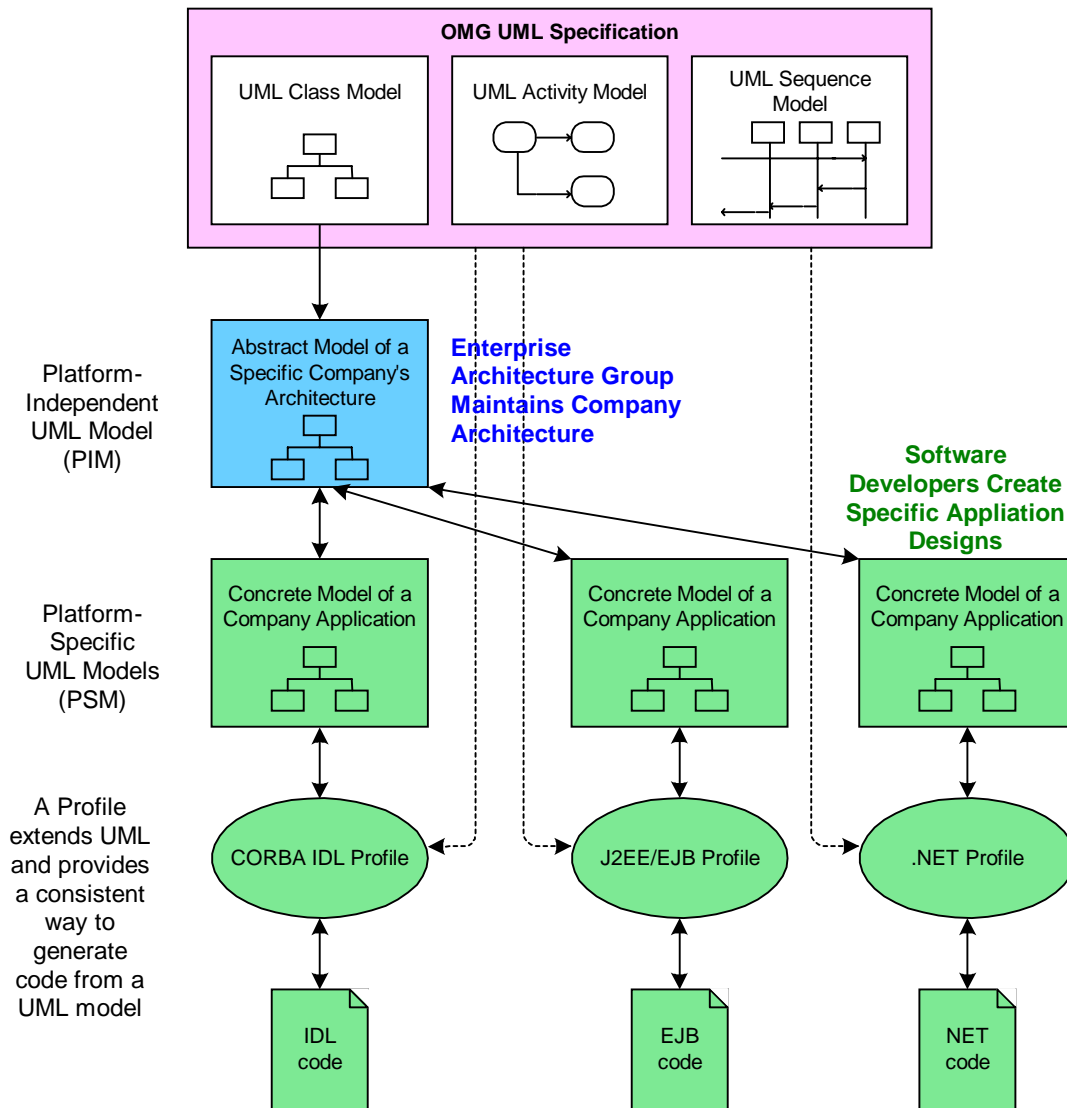


Figure 6. Creating an MDA application.

In other words, the use of MDA does not determine which languages, operating systems or middleware a company must use. Instead, MDA describes how applications are organized into processes and how they integrate with each other. Once these high-level relationships are determined, tools can be used to generate whatever language or middleware code is needed. In effect, MDA is focused on introducing software engineering principles and greater efficiency into software development. This is exactly what is needed if companies are going to shorten the IT development cycle while simultaneously maintaining the flexibility they need to change quickly.

Just as META has moved to a more abstract business architecture to link strategy and goals to more technical IT architectures, the OMG has defined a model-based approach to application development. The exciting development at hand concerns the merger and alignment of these two streams of analysis. UML, because of its flexibility and ability to extend across multiple business

processes can be used to model functional business patterns. Currently, UML is valuable for designing suites of related applications. Business architecture modeling functions at this same high level of abstraction. Thus, UML can be used to model business functional patterns and provide a foundation for deeper application design, integrating the two approaches.

Since adopting the MDA approach, the OMG has set to work creating standards that will support its new approach. Many of the needed standards are already in place. UML is already defined. A database repository for UML specified applications (the Common Warehouse Model) is already defined, and an XML language for passing UML information between applications (XMI) is already in existence. OMG industry-specific task force groups are already working on new standards for specific industry applications.

All of these developments provide an idea of how the OMG was already working to provide more extensive support of UML and to standardize techniques that would make UML diagrams more dynamic and useful.

Most large companies throughout the world already use UML to design new software applications. In most cases, the software development team begins by creating a use case model of the application, one or two generic business models, described via class diagrams or activity diagrams. Then the team moves on and elaborates these initial diagrams into a detailed design by adding more and more specificity to the UML diagrams.

The idea behind the OMG's new Model Driven Architecture is simplicity itself. What the OMG proposes is that companies create high-level UML models of how applications will be structured and integrated. These descriptions will be independent of any actual implementation details. From such a high-level UML model, which the MDA architecture terms a Platform-Independent Model or PIM, a more constrained UML design, termed a Platform-Specific Model or PSM, can be generated. A PSM design can then be converted into language code designed for a specific platform. The final product, code for a specific platform, is termed an Enterprise Deployment Model or EDM. Put another way, a PIM model can be used to generate any of several different PSM models, each of which could generate a different specific application (EDM). In essence, MDA assumes that companies will create UML descriptions of applications and middleware links and then use those graphical descriptions to generate code.

Figure 7 suggests how the OMG's MDA can fit within the enterprise alignment framework we were discussing earlier. In effect, MDA offers companies a standard way to specify an enterprise business architecture model. Changes in the business architecture can be quickly incorporated into the MDA model of the IT organization which can then regenerate the interfaces needed to support changes in the current environment. Obviously an MDA model of a large company or division would be a complex thing and one would still face priority problems, but the problems involved in identifying where changes were needed would be vastly simplified, and the generation of code for applications that topped the priority list would also be considerably faster.

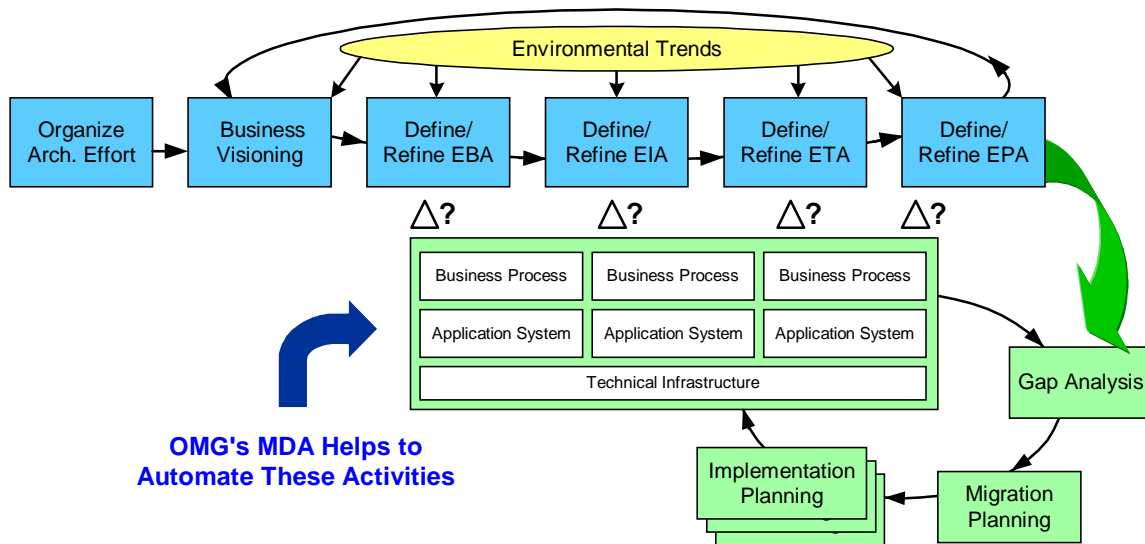


Figure 7. Where the OMG's MDA fits into META Group's EA process.

Summary

CIOs face major challenges in the years ahead. Those that succeed will figure out how to align IT organizations, priorities and development processes with company strategies in a systematic way in order to assure that IT efforts support company goals. Using an enterprise architecture that bridges between strategy and corporate planning and IT planning and project management is one way to do that. Using the OMG's new Model Driven Architecture to support the use of models and model driven development is a way to both reinforce the use on an enterprise architecture strategy and to increase the efficiency of software development.

References

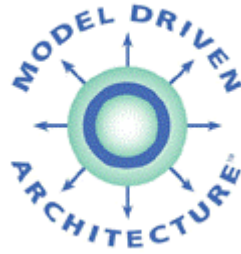
- Porter, Michael E. *Competitive Strategy*. The Free Press, 1980.
- Porter, Michael E. *Competitive Advantage*. The Free Press, 1985.

Model Driven Architecture™, MDA™, UML™ and Unified Modeling Language™ are trademarks, and CORBA® is a registered trademark, of the Object Management Group. All other products or company names mentioned are used for identification purposes only, and may be trademarks of their respective owners.

META Group's Enterprise Architecture Process is the sole property of META Group, Inc., and the contents of this paper are Copyright © 2002 META Group, Inc. and the Object Management Group. All rights reserved.

About META Group

META Group is a leading research and consulting firm, focusing on information technology and business transformation strategies. Delivering objective, consistent, and actionable guidance, META Group enables organizations to innovate more rapidly and effectively. Our unique collaborative models help clients succeed by building speed, agility, and value into their IT and business systems and processes. Connect with www.metagroup.com for more details.



For more information to OMG's Model Driven Architecture, see

<http://www.omg.org/mda>

The Object Management Group™ (OMG™) is an international organization of information system vendors, software developers, and end-users. Through its members, the OMG produces and maintains software specifications for interoperable enterprise and Internet applications. With well-established standards covering software development from design, through development, to deployment and maintenance, the OMG supports a full-lifecycle approach to enterprise integration.

For information on joining the OMG or additional information, please contact Nicole Glazen, Director of Business Development at OMG headquarters by phone at +1-781-444 0404, or fax at +1-781-444-0320, or by email at info@omg.org.



Object Management Group
First Needham Place
250 First Avenue,
Needham, MA 02494 USA
Phone: +1-781-444-0404
Fax: +1-781-444 0320
<http://www.omg.org>