Foreword

Historically, enterprise architecture has been a non-issue because in the industrial age, it was the industrial products that were growing in complexity and changing and the concept of the enterprise was relatively simple: create a good product and then find a lot of people to sell it to. As we approximate the realities of information age, major changes are taking place in the global marketplace. It is the enterprise that is growing in complexity and the enterprise that is changing. No longer is business as simple as “get yourself a good product and then find a lot of customers to sell it to.” That is, historically, from the perspective of the enterprise, the market (the customers) is integrated. Increasingly, the concept is, find yourself a good customer and then you (the enterprise) identify the range of products (or services) required to keep that customer a good customer. That is, from the perspective of the customer, the product and/or the enterprise must be integrated to the customer’s requirement.

If the enterprise has to treat each customer as a unique requirement and customize every product or service of the enterprise to the perspective of each customer, it will drive the complexity of the enterprise out of sight and I would suggest that this information age characteristic is quite independent of whether it is the enterprise or the enterprise’s product or whether the enterprise is public sector or private sector or how big or small the enterprise is.

Integration is where the complexity lies. Increasingly, all the parts of the enterprise have to be engineered to fit together to the specification of the customer... enterprise-wide. Furthermore, to create complex industrial products that are economically viable, as many parts as possible must be engineered as standard, interchangeable parts, reusable, or “normalized.” That is, in the information age, the enterprise is going to have to be engineered such that all of the “parts” fit together enterprise-wide and that everything possible is engineered to be standard and interchangeable (reusable) and that, in order to be “lean,” no concept should recur, (everything (not only the data) will have to be “normalized”).

A second characteristic of the changing global marketplace is dramatic escalation of the rate of change. The way that dramatic escalation of the rate of change affects products (or enterprises) is in reducing the time-to-market, that is, reducing the time it takes from the point in time an order is placed for a new product until a finished good is produced, in the case of enterprises until a new enterprise-wide, integrated, implemented enterprise, is produced. The information age customer demand is for custom products (integrated to the specification of the customer requirement), mass-produced in quantities of one for immediate delivery, that is, a time-to-market of virtually zero. You might recognize this as the present definition of “mass-customization.”

In short, the known characteristics of the information age are extreme complexity and dramatic escalation of the rate of change. There is a plethora of business and academic literature that argues this case.

A survey of 7,000 years of history of human kind would conclude that the only known strategy for accommodating extreme complexity and high rates of change is architecture. If you can’t describe something, you can’t create it, whether it is an airplane, a hundred storey building, a computer, an automobile... or an enterprise. Once you get a complex product created and you want to change it, the basis for change is its descriptive representations. I would suggest that architecture is the total set of descrip-
tive representations relevant for describing something, anything complex you want to create, which serves as the baseline for change if you ever want to change the thing you have created. You don’t need architecture if you want to create a simple object. For example, if all you want is a log cabin, chop down trees and build a log cabin. You don’t need architecture. You can see and understand everything all at the same time. On the other hand, if you want a hundred storey building, you cannot see and understand everything all at the same time and you are going to have to have architecture and the architectural representations will be the basis for changing it once it is built.

If you want to reduce the time-to-market for creating a complex product, you could engineer the parts, prefabricate them, have them in inventory long before you ever get the order. Then you could reduce the time to market to just the time it takes to assemble the product. If you cleverly engineered the parts such that they could be assembled into more than one finished good, you could build a virtually infinite number of custom finished goods from the same set of prefabricated parts. In other words, you could manufacture custom products, mass-produced in quantities of one for immediate delivery. I might observe that although there is no manufacturer that has completely perfected the concepts of mass-customization, the Japanese taught the western manufacturers a lot of hard lessons in the last 25 or 30 years and anymore, to get into or stay in a complex industrial product manufacturing business, mass-customization is fundamental and integral to survival.

Clearly, my argument is, we will have to apply the same kind of concepts to the enterprise in the information age that we have applied to the industrial products of the industrial age. We will have to produce different, custom manifestations (or implementations) of the enterprise, enterprise-wide, on demand.

By mixing the metaphor (industrial products and enterprises), I have tried to encapsulate in a few short paragraphs the underlying argument for enterprise architecture. In the information age, I am quite certain that the question to the enterprise is, “how do you intend to deal with extreme complexity and dramatic escalation of the rate of change?” I would submit, if the enterprise does not have an enterprise architecture strategy, they are neither going to accommodate extreme complexity nor the escalating rate of change and therefore, I would suggest, it is questionable whether they are going to be able to exist. My opinion is enterprise architecture is the most profound, significant, issue of the information age.

The next question is, “what is enterprise architecture, what does it look like?” We know what architecture is for airplanes. We know what architecture is for buildings. We know what architecture is for computers. We know what architecture is for industrial products because in the industrial age, it was the industrial product that was increasing in complexity and changing. If we hadn’t figured out what architecture is for industrial products, we would not have Boeing 747s (airplanes), hundred storey buildings, computers, ocean liners, or Acura Legends (automobiles). We would not have complex industrial products.

An observation of architecture for industrial products shows that architecture is architecture is architecture. All industrial products have bills-of-materials. They all have functional specs, they all have drawings, they all of operating instructions, they all have timing diagrams, and they all have engineering design objectives. Each of these sets of descriptions is completely different and varies independently from one another. However, they are all related to one another. Generically, they describe WHAT the product is made of, HOW the product works, WHERE the components are located, WHO is responsible for operation, WHEN do things happen, and WHY do they happen. This classification of descriptive representations has been employed by humanity for thousands of years. It is universal.

There is another dimension of classification of descriptions that have to do with the audiences for which the descriptions are prepared and employed. Very complex products will have some scoping or bounding expression for the originators. They all have concept definitions (requirements) for the end owners. They all have logic representations (schematics) for the designers. They all have technology constructs (blueprints) for the builders. They all have production tool configurations for the implementers.

These two classifications for descriptive representations are orthogonal and constitute a structured order or schema for descriptions, that is, a “framework for architecture,” which classifies and defines the set of descriptive representations for anything.
I spent something over 40 years of my professional life trying to find an answer to the question, “What does architecture look like for enterprises?” If I have done anything of any value, my contribution has been in the form of a framework, a framework for enterprise architecture, which simply puts some definition around the set of descriptive representations that are relevant for describing enterprises. Anyone who has followed my work would recognize my framework in the previous description of the architecture schema. I simply put enterprise names on the same engineering design artifacts that constitute architecture for industrial products. In 2006, the time of writing this foreword, we do not have experience with producing all of the descriptions (models) for an enterprise that are prescribed by this framework, in fact, we don’t even have formalisms for many of them. There is a lot of room for creativity, research and development, and collaboration.

Which brings me to Pallab Saha’s book… this is a very timely and important book. Pallab Saha has assembled substantive discussions about all of the known architecture-related subjects of which we are aware at the moment. The subjects are wide and varied and clearly, there is a lot of creativity and work that needs to be done. I do not think that we will have several hundred years to accumulate experience, develop formalisms, and do all the architectural instantiations that will be required to operate enterprises in the information age. In fact, we may only have several decades to make major progress because at the point in time that the enterprise finds itself in extremis, unable to accommodate any more complexity and unable to cope with the escalating rate of change, that is, at the point in time the enterprise discovers it is imperative to have enterprise architecture to survive, it is going to be too late to start working on it. Pallab’s book is timely because tomorrow morning is not too early to start working on enterprise architecture!

I hope Pallab Saha starts working on the next book immediately. The next book must integrate and normalize all the subjects of the first book. He would likely find my framework for enterprise architecture helpful if he actually undertook this next endeavor. However, the present book is a good place to start. It is a book that not only systems people should read, but enterprise business people should read as well. In fact, I hope in my brief foreword, I have sufficiently argued that enterprise architecture is an ENTERPRISE issue, not simply a systems issue. Maybe, by the time the next book is ready for publication, the urgency of complexity and change will be so apparent to the business world, they will be more prepared to read it.

John A. Zachman
Glendale, California 2006

John A. Zachman is the originator of the Framework for Enterprise Architecture, which has received broad acceptance around the world as an integrative framework, or “periodic table” of descriptive representations for enterprises. Dr. Zachman is not only known for his work on this book, but is also known for his early contributions to IBM’s information strategy methodology (business systems planning) as well as to their executive team planning techniques (intensive planning).

Dr. Zachman retired from IBM in 1990, having served them for 26 years. He is chief executive officer of the Zachman Institute for Framework Advancement (ZIFA), an organization dedicated to advancing the conceptual and implementation states of the art in enterprise architecture. Dr. Zachman serves on the executive council for information management and technology of the United States General Accounting Office. He is a fellow for the College of Business Administration of the University of North Texas. He serves on the advisory board for the Data Resource Management Program at the University of Washington and on the advisory board of the Data Administration Management Association International (DAMA-I) from whom he was awarded the 2002 Lifetime Achievement Award. He was awarded the 2004 Oakland University, Applied Technology in Business (ATIB), and the Award for IS Excellence and Innovation. Dr. Zachman has been focusing on enterprise architecture since 1970 and has written extensively on the subject. He is the author of the e-book, “The Zachman Framework for Enterprise Architecture: A Primer on Enterprise Engineering and Manufacturing.” He has facilitated innumerable executive team planning sessions. He travels nationally and internationally, teaching and consulting, and is a popular conference speaker known for his motivating messages on enterprise architecture issues. He has spoken to many thousands of enterprise managers and information professionals on every continent. Prior to joining IBM, Dr. Zachman served as a line officer in the United States Navy and is a retired Commander in the U.S. Naval Reserve. He chaired a panel on “Planning, Development, and Maintenance Tools and Methods Integration” for the U.S. National Institute of Standards and Technology. He holds a degree in chemistry from Northwestern University, has taught at Tufts University, has served on the board of councilors for the School of Library and Information Management at the University of
I congratulate Dr. Pallab Saha and the authors who have contributed to the *Handbook of Enterprise Systems Architecture in Practice*. This book covers a wide range of enterprise architecture (EA) issues in a way that reflects many aspects of a global EA discussion that has been going on for nearly 20 years. You will find some variance in the approach and lexicon that contributing authors use in many of the chapters, but you will also find a number of common threads that are an indication of both the richness and diversity of thought in the EA community and of the continuing maturity of EA as a management best practice and a career field for business and technology professionals. As such, the *Handbook of Enterprise Systems Architecture in Practice* is a valuable addition to the reading list of executives, managers, and staff in business, government, and other sectors who seek to keep their enterprises agile and efficient as they manage change, implement new business processes and supporting technologies, and pursue important strategic goals.

EA is distinguished from, and yet encompasses, other forms of business, service, systems, data, and technology architecture. EA seeks to be the over-arching framework and methodology for integrating strategic, business, and technology planning across the entire enterprise. In so doing, EA claims to be the highest level of all meta-concepts that guide the analysis, design, and ongoing improvement of enterprises in the public, private, military, academic, and non-profit sectors. This expanded claim arises not from ego, but from necessity, as CEOs, CFOs, CIOs, and COOs seek new ways to envision and transform the enterprises they lead. Architectures exist in the mind of every executive and manager, yet these architectures are mostly held within, as executives are not familiar with EA methods and frameworks that offer ways to take abstract mental images and transform them into a sharable model of the enterprise. The CEO is the ultimate owner of the EA, yet that too is not fully realized. When it is, EA will further contribute to the ongoing success of enterprises in all sectors.

This book presents over two dozen articles by leading authors, researchers, and practitioners, who cover various aspects of implementing systems architecture in the context of solving enterprise-level business problems.

The approach to EA that I have written about previously centers on a framework with five hierarchical levels (strategic goals, business services, information flows, systems, and infrastructure) and three threads that pervade all levels of the architecture (security, standards, and training). In teaching this and other approaches to EA, I have had the privilege of helping to create several training programs and have delivered EA courses and seminars all over the world. To convey the essential and unique aspects of EA as it is most effectively practiced, I start my lectures with a simple equation: $EA = S+B+T$ that stands for “EA equals strategy + business + technology.” This is meant to differentiate EA from early stand-alone forms of business architecture, data architecture, systems architecture, and network architecture… all of which are active and relevant sub-architectures within an integrated EA. This equation also indicates that strategic priorities drive business requirements, which drive technology solutions… including the design, implementation, and operation of information technology systems. EA is not just about technology, it is about designing and improving enterprises in all aspects, doing so through a repeatable and increasingly effective and mature methodology.

My next lecture point is to usually say that a complete approach to EA must include an interlocking set of elements, including (1) a detailed step-by-step methodology for establishing the EA program and documenting current and future versions of the EA on an ongoing basis; (2) an analysis and documentation framework that establishes the scope and relationship of the EA; (3) a set of EA documentation artifacts (also known as work products) that cover all areas of the EA as defined by the framework; (4) the selection of a set of proven best practices for doing EA analysis, design, and documentation work, and which cover all areas of the framework; and (5) an online repository for archiving EA artifacts that incorporates automated documentation and analysis tools to the maximum extent possible. Unfortunately, many current approaches to EA do not have all of these elements, and/or the elements are not designed to work together. Examples include a lack of a complete set of
artifacts to cover all areas of the EA framework; artifacts that are not derived from proven best practices, best practices that do not map to all levels of the framework, and a repository design that does not reflect the underlying analysis and design framework and is therefore difficult to understand, navigate, and use.

I also point out how EA is but one of a number of areas of business and technology governance that must work together to be effective. These areas of governance include the decision-making processes, standards and policy for strategic planning, capital planning, enterprise architecture, workforce planning, program management, records management, security, systems development, and operations.

The final lecture point that I usually present at the beginning of an EA seminar or class is to talk about five areas of value that EA creates for the enterprise: (1) increased alignment of business and technology programs with strategic goals; (2) increased business agility through improved decision-making and reduced cycle time in conducting workflow/dataflow/systems analysis, design, and implementation; (3) the ability to embark on business transformation initiatives and the improved management of change through the visualization of the entire enterprise in the strategic, business, and technology dimensions; (4) increased success in implementing or changing technologies that support key business processes and service/product delivery; and (5) increased ability to control otherwise escalating technology costs through the avoidance of duplication, and better matches between business requirements and technology solutions that extend across more lines of business.

While these lecture points and lists are not all-inclusive, they hopefully address important points for students who are first being exposed to the multitude of concepts that EA encompasses. By being “the” meta-concept for enterprise analysis, design, and improvement, EA has become a rich, complex set of methods that must be effectively integrated and explained to those who sponsor and implement architectures in equally complex and dynamic enterprises. Fortunately, EA has itself become agile and purposeful as it matures and systems architecture is an essential part of this.

Again, I congratulate Dr. Pallab and the other authors on the publication of this important contribution to the global EA discourse. I recently had the opportunity to talk with Dr. Pallab while on a teaching trip to Singapore and I can tell you that he not only understands all aspects of EA and systems architecture, but he is a thought leader in business and technology governance as well. His talk with my students about the integration of architecture and investment planning was very informative. I also know that many of the authors are active EA practitioners, teachers, researchers, or consultants and I especially value the opportunity that the Handbook of Enterprise Systems Architecture in Practice has given me to stay current in our evolving discipline through the sharing of their thoughts and best practices.

Scott A. Bernard, PhD
August 2006

Scott A. Bernard currently serves as the deputy chief information officer and chief enterprise architect of the Federal Railroad Administration in Washington, DC. He is also an assistant professor for the School of Information Studies at Syracuse University, and a senior lecturer in the Executive Program of the Institute for Software Research International at Carnegie Mellon University’s Computer Science Department. Dr. Bernard founded and currently serves as president of the Association of Enterprise Architects and is chief editor of the Journal of Enterprise Architecture. Dr. Bernard has nearly 20 years of experience as an information technology (IT) executive and manager including work in the academic, federal government, military, and private sectors. He has held positions as a chief information officer (CIO), senior management consultant, line-of-business manager, network operations manager, telecommunications manager, and project manager for several major systems installations. Dr. Bernard’s areas of current research, teaching, and consulting include IT-related leadership, e-government policy development, strategic planning, enterprise architecture, systems analysis and design, project management, and capital planning.