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BUSINESS SERVICES ORCHESTRATION

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BUSINESS SERVICES ORCHESTRATION

THE HYPERTIER OF INFORMATION TECHNOLOGY

WAQAR SADIQ
Electronic Data Systems

FELIX RACCA
Fuego Inc.

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*T*his book is dedicated to my wife, Talat, and to my children, Zan and Marium, for their continuing support and understanding while I was writing this book.

Waqar Sadiq

I dedicate this book to my wife, Marta, who has had infinite patience during the writing of the book, and to my children, Marina, Santiago, and Mariano, who were deprived of their usual weekend outings with their Dad.

Felix Racca

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About the Authors

Waqar Sadiq has more than 16 years of experience in software development. He currently leads EDS's Web services strategy as head of several proof-of-concept teams for building future service offerings. Prior to that, he developed application server technology before EJB specifications came to market. Mr. Sadiq has also worked in key technical roles at Vitria Technologies, maker of business process automation software, helping clients solve real problems by automating business processes. He is the author of *Developing Business Systems Using CORBA*.

Felix Racca has more than two decades of experience developing and delivering the right software at the right time. Alongside fellow developer Emilio Lopez-Gabeiras, Mr. Racca co-founded InterSoft S.A. in 1983. By 1989, InterSoft took a majority share of the enterprise resource planning software market in Latin America. In 1996, Mr. Racca co-founded Fuego Technology Corporation, which focused on the Business Process Management tool that today has become Fuegotech. Mr. Racca is a frequent speaker and contributor to the enterprise infrastructure software community. He has appeared in numerous magazines, including cover stories in *Information Week*.

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Foreword

Does technology encourage or inhibit business innovation? At first blush, the question seems naïve and the answer obvious: It is clear that information technology is an enormous spur to innovation. New technological capabilities enable companies to perform activities of which they had previously only dreamed. Modern data management facilities, for example, allow organizations to conduct customer analyses that they always had desired but previously had been unable to do and thereby develop customized offerings and marketing messages. In some cases, new technology even allows companies to solve problems of which they had previously been unaware. A classic example is the invention of the xerographic copier. Prior to its arrival in the marketplace, people did not have an expressed need for such a device. They used carbon paper and similar technologies to make extra copies of a document while it was being produced and resigned themselves to living in a world where one could not make copies thereafter. Indeed, early market research studies showed no demand for a convenience copier. Only later, as people started to appreciate the capability that the new technology offered them did they recognize the opportunity that it represented.

At times, however, technology can have the opposite effect and inhibit business innovation. In particular, investments in expensive technology platforms represent a "sunk cost" for most organizations, a cost that they are reluctant to reincur. Even when they recognize that new technology might have important applications, the prospect of abandoning existing technology and the investment in it prevents many companies from acquiring and exploiting the new technology. The costs that discourage innovation go beyond the money needed to purchase the new technology; they also include the expense and travail of converting databases, retraining personnel, and so on. This helps account for the peculiar phenomenon where developing countries often are equipped with more advanced communications infrastructures than are highly industrialized countries. Countries with massive

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investments in facilities find it difficult to abandon those investments to move to the next generation of technology.

Nowhere is this inhibiting behavior more evident than in the sphere of so-called legacy systems. In effect, a legacy system is any application system that a company regrets having installed in the first place, usually because it lacks the capability to support new requirements. Clearly, no one sets out to create such a system. All large system investments must clear such hurdles as extensibility, compatibility, upgradability, and so on. Yet if the history of information systems teaches us anything, it is that organizations inevitably create systems that turn into legacies. The underlying reason is, of course, that one doesn't know what one doesn't know. When installing a major system, managers can validate that it satisfies all the criteria currently on the company's radar screen. The nature of business, however, is such that new business goals and systems criteria inevitably arise, and only by the rarest happenstance is an existing system compatible with these new goals and criteria. For example, when systems were built in the 1960s and 1970s, few people saw the need to ensure Y2K compatibility; this issue came to light only in the late 1990s and led, of course, to massive remediation and system replacement efforts.

In the absence of catastrophic consequences, such as those associated with Y2K, companies cannot afford to replace their legacy systems simply to meet a new business need. The number of times that managers have been told by systems personnel that "The system won't let us do that" and that replacing the system with one that could do that is far too costly is beyond counting. Systems installed by well-meaning people to meet immediate business needs inevitably turn out to be inadequate for meeting future needs and opportunities not anticipated at the time the systems were installed. As a result, these needs and opportunities remain unaddressed for long periods, while aggressive new competitors, unburdened with legacies of the past, are able to respond to these opportunities and harvest enormous benefits from them.

Today, this phenomenon is being felt keenly in the arena of business processes. "Process" is a term widely misused and misunderstood. The sense in which it is used here has nothing to do with bureaucracy and formal procedure; rather, "process" means end-to-end work – holistic work that spans an organization to create a result of value to customers. The work of most companies is encompassed by a relatively small number of major business processes (such as order fulfillment, order acquisition, product development, post-sales support, and the like). These in turn can be decomposed into a relatively small number of subprocesses. Processes represent a novel way of looking at work and business – novel at least since the Industrial Revolution. For the past 200 years, work has been broken down into constituent tasks as part of the doctrine of division and specialization of labor, first articulated by Adam Smith and later championed by Henry Ford and Frederick

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Taylor. The task-oriented, functional approach to work had its advantages. It enabled mass production by dramatically increasing task productivity and it allowed organizations to grow rapidly in the face of escalating customer demand.

Unfortunately, it also had significant disadvantages. Fragmenting work across an organization creates an enormous amount of non-value-adding work, overhead needed to "glue" the pieces of work back together. This non-value-adding work in turn leads to costs, errors, delay, and inflexibility. These consequences have been with us since the beginning of the industrial era, but until recently, the customers who had to suffer them had little recourse. No longer. Today's economy is characterized by extravagant customer power as a result of overcapacity in virtually all industries, global competition, the commoditization of products and services, and increased information availability. Customers now are in a position to demand unprecedented levels of performance that cannot be delivered by work that is decomposed into piecemeal tasks and fragmented across an organization. The non-value-adding overhead associated with conventional work design can no longer be borne. Yet while the business environment for which the task approach to work was relevant died in the 1970s, organizations have persisted in adhering to it.

Forced by their customers, companies are now embracing the process concept. By looking at their work holistically and managing and designing it on an end-to-end basis, they are achieving startling improvements in performance. Reductions in cycle time of 80 percent to 90 percent and cost reductions of 50 percent to 75 percent are very common when work is seen through the process rather than the task lens. Process has come out of the shadows and has entered the business spotlight.

Converting a traditional organization into one focused on its processes is not an easy undertaking. It entails massive organizational change, as virtually all aspects of the enterprise, from metrics through career paths, need to be realigned around processes. Technology, in the form of a company's legacy information systems, is also a significant barrier to harnessing the power of processes. For most of the past five decades, companies built systems that matched their organizational structures and corresponded to individual functional departments. Procurement, manufacturing, marketing, sales, and customer service each had its own system with its own database, tailored to optimize the performance of that department and its activities. Lost in the shuffle was the larger context, the end-to-end processes of which each of these activities was just a part. As companies began to focus on and address their processes, they discovered that their existing systems only supported pieces of them. One system might handle credit checking, another inventory allocation, yet another production planning, and another billing. The process, however, crossed all these areas and systems, and to support, measure, and manage it, a system that similarly spanned all of them was required.

Neither of the two traditional solutions to this challenge is viable. The first, of course, is to undertake a massive system replacement to substitute a new

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process-oriented system for the portfolio of legacy systems. Rare indeed is the company that is willing to accept the level of cost and investment this would entail. The other solution is to retrofit the legacy functional systems together into a process system by using various application integration tools. Whereas this is superficially promising, it is also not practical. The result of such an effort is, in fact, just another legacy system, inflexible and wired to a particular way of doing business. Should the business need to redesign the process – and it will – then it must "rewire" these constituent systems, now joined in a fixed and even incomprehensible fashion. Moreover, systems are part – an important part, but still just a part – of a complete process. Some process steps are performed by systems, some by people using systems, and some just by people. Leaving people out of the process framework prevents the organization from tracking work through the process as a whole and measuring its overall performance.

History teaches us another important lesson: Whenever we install a system that purports to support an end-to-end business process, we discover before long that this process is, in fact, only part of a larger process that crosses even more organizational boundaries. For example, some ERP systems support a process that begins with order entry and ends with receipt of payment. However, many companies have decided that the "real" process begins earlier and ends later than this, extending from initial customer contact through follow-on sales. This process is not circumscribed by an ERP system, but rather requires the integration of ERP with CRM and possibly other systems. Nor does this phenomenon end there. The latest development in the process arena is the growing importance of inter-enterprise processes, processes that cross corporate as well as functional boundaries. For example, "supply chain" is not a euphemism for procurement but is a process that begins with the provider of raw materials and ends with the final customer. Supporting this process on an end-to-end basis requires integrating systems from separate companies. Trying to create an "ultimate" process system through application integration is akin to pursuing the Holy Grail: An unachievable goal.

For these reasons, companies have been unable to develop systems to support new processes as quickly as they can develop and install the processes themselves. In other words, the difficulty of creating end-to-end process systems acts as a significant brake on companies' ability to address their business processes and to reap the benefits of doing so.

Where technology inhibits, however, technology also liberates. Enter the Business Service Orchestration (BSO) described in this book. BSO encompasses a philosophy, a methodology, and a system architecture; it is a new way of thinking about how to support processes with information systems. BSO recognizes that legacy systems will always be with us and that the road to process management has twists and turns that cannot be anticipated – indeed, that it may never end. Accordingly, BSO argues that processes must be supported through a hyper-layer of

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software that focuses directly on the process itself, independent of the underlying systems or other mechanisms used to implement it. This layer enables companies to define and document their processes, measure and manage them, and specify which parts will be performed by what system. The methodology directs how to address a business process, model it in the hyper-layer, and connect it to tangible systems and other service providers. The system architecture relates these concepts to the current mechanisms, from J2EE to XML and SOAP, that are emerging as ways of connecting disparate systems into a coherent whole.

Winston Churchill is reputed to have said, "America can be counted on to do the right thing, once it has exhausted all the alternatives." Something similar might be said about large enterprises and their information systems organizations. Having tried a wide range of mechanisms for supporting their processes, the enthusiasm for an application software-independent approach is growing. This book, the first to articulate an entire approach based on this philosophy, should accelerate business's progress toward this goal.

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Introduction

To start, we would like to set the stage. Please read slowly, and use your imagination. Remember the scene in *2001: A Space Odyssey* where the *Blue Danube* waltz is sounding. The space shuttle is rotating on its axis trying to match the rotation of the space station. Perfect synchronization. Harmony. Striking beauty. A fantastic Orchestration.

For these first paragraphs only, we will use *Star Trek* as an allegory while the finely orchestrated waltz of *2001: A Space Odyssey* sounds in the background. We will say that the Federation (as in *Star Trek*) is the modern enterprise, the president of the Federation its CEO. The *USS Enterprise* is one of the many starships that are capable of performing a mission according to a predefined plan (implementing an Orchestration): an orchestration vehicle. Captain Kirk is the mission owner (Orchestration owner) for this orchestration vehicle. He is ultimately responsible for the different possible missions (deliverables) and maintains the captain's log. He is also responsible for overseeing the execution of the process (Orchestration) that fulfills the mission. He is not an expert in managing the engine; that's Scotty. He's not an expert in connectivity; that's Ohura. He's not an expert in dealing with the crew's ailments; that's Dr. McCoy.

The *USS Enterprise* needs to be able to use its own internal services (engine, molecular transporter, computer, view screen, navigation equipment, communication equipment, energy sources, crew services, etc.) at different points in the space-time continuum to complete the mission. The *USS Enterprise* also needs to be able to utilize services from external sources as well as respond to external stimuli such as attacks from the Klingons. The Klingons are the Federation's competitors. They too have starships, with different capabilities in terms of their internal services and ability to respond to external stimuli. The *Enterprise* needs to have security features such as electromagnetic shields that protect against Klingon attacks. Our *USS Enterprise* has many smaller fighter ships that also constitute

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orchestration vehicles. And the *USS Enterprise* is subject to Earth as the master orchestration vehicle.

So, an orchestration vehicle is a self-propelling system that can manage internal and external services according to a plan to fulfill a mission.

Hear the lazy loops of the *Blue Danube* as you imagine the Earth orbiting the Sun, spawning starships that embark on their elliptic trajectories, which spawn fighter ships that have their own missions and trajectories. If you have been able to see the fireworks while you hear the waltz, you are one of the visionaries who have the ability to orchestrate images and music in four dimensions in your mind, that fourth dimension being time. You can be an Orchestrator; you're a natural, you can play three-dimensional chess, you would be Spock in *Star Trek*. A complete Vulcan could not be an Orchestrator, but, as Spock, who is at least half human, you would be motivated to make an impression on the audience. If you immediately identified with Captain Kirk, you are a Process owner. You are to build the requirements for the Orchestrator to create a flight plan that will allow you to accomplish your mission. If you would rather deal with the health of the crew, or the engine room, or communications, you are a member of the functional staff that participates in the mission in your preferred role.

For Spocks and Kirks, this book is a must read; it's the reference for implementing orchestrations that accomplish missions. In the smaller fighter ships, the orchestrator and the captain are one and the same. Must read. In the Federation we have the Admiral, the Master Orchestrator (CIO). Must read. The Presidents of the Federation may want to read the first two chapters, just to know what the half-Vulcans are talking about. The McCoys need to read the first third of the book, the Ohuras the middle. All of the above may benefit from a careful read of the last third.

The Orchestration engine is the source of energy for the Orchestration vehicle; it's what makes it self-propelling, it's what puts the crew and the automated services in different points of space-time so that they can perform the appropriate activity within the necessary series to accomplish the mission. The Scottys are in charge of keeping that engine up and running. They need to know everything about the enabling technologies for that engine and how to discover and manage the services it will use. The Scottys needs to read this book; they need to master the middle third and read the last third.

We all know that without the Dilithium crystal-powered orchestration engine, the modern *Enterprise* would not fly. Its predecessors, based on fission reactors (work-flow engines), could never attain warp speed. This is why, initially, there was this idea that warp speeds could only be attained by ships without their own propulsion systems, ships that "sailed" on the legacy photon streams and slingshot trajectories of gravitational pull (messages on a universal messaging bus – EAI) from solar system bodies (the legacy applications). Scientists called this

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"loosely coupled" navigation. However, building the huge phaser belts (adapters or connectors) needed to create the photon streams around each star had proven to be too expensive and complicated and there had been a number of accidents due to the inability to foresee exceptions such as asteroids or worlds passing through the streams. On top of it all, there was the discovery of various parallel universes, whose photon streams were incompatible with ours.

Many visionaries had been telling us about the need for self-propelled orchestrations for a couple of decades. We didn't want to listen. Self-propelling spaceships are like off-road vehicles. They are perceived as risky because they leave the main spaceways. This means navigating uncharted space, having to build charts of your own and being able to change them on the fly. We thought we were incapable of doing it. We thought that our legal counsel would never approve of it – too much risk. We thought this approach was for savage Klingons who wanted to reinvent the wheel and didn't care to die. We wanted to follow the charts of our legacy and thought that just piecing them together would give us a chart of the Universe; we would be navigating the Perfect Economy! We were wrong. There was much more white space than charted space; furthermore, the Universe is in continuous expansion but charts are not. The Klingons were taking over the ever-growing white space. It took the bursting of the supernova bubble that took most of the phaser-belt adapter companies along with it for us to come back to our senses. We needed to go back to the principles of the Free Enterprise and pioneering that made our Federation great.

We finally reacted. Now, let's get on with the principles of Business Services Orchestration (BSO) and then . . . let the waltz begin!

Navigating Through the Galaxy

Let's be honest. The galaxy is large and complex. So we will divide it into two virtual sectors. Sector 1 comprises Chapters 1 through 4 and Sector 2 comprises Chapters 5 through 9.

Sector 1 was designed so that the Kirks, McCoys, Spocks, and Scottys could all feel reasonably comfortable in them. Although BSOs have the primary goal of increasing business performance, the orchestration of business services ends up weighing more heavily on the Spocks and Scottys than on the Kirks and McCoys. Therefore, Sector 2 is a place where only the Spocks and Scottys would feel comfortable.

In Sector 1, we have Chapters 1 through 3, which introduce the main concepts of BSO. All of those chapters have parts that are definitely in the Kirks' domain of expertise, but few that are in McCoys' domain. They are primarily oriented toward the Spocks. The Scottys will probably get impatient and want to move on

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quickly through Chapters 1 and 2, but we recommend that they look closely at the definitions.

Chapter 3 is where the desired architecture for the *USS Enterprise* is discussed. The Spocks and Scottys must master this chapter because it's the basis for understanding Sector 2; the Kirks may want to read it to understand the lingo.

Chapter 4 delves into the methodology framework for planning services that the enterprise will provide to the Federation. This chapter is a must-read for Kirks and Spocks. A crucial part of any stellar mission is the planning. The Scottys will probably fall asleep here and the McCoys will protest that they have real work to do. So please, Scottys and McCoys, read this chapter as a curiosity. The Kirks and Spocks should pay special attention to phase 2 of this chapter because it provides an end-to-end example that may prove to be very important for lucrative missions.

Sector 2 comprises Chapters 5 through 9 and is mostly for the Spocks and Scottys. This sector describes the technologies that enable development of BSOs.

Chapter 5 gives an overview of the important capabilities required from any platform used to build business services. The Scottys will find useful reference material in this chapter; the Spocks will find a good overview of the necessary capabilities. Even Kirk and McCoy may pick up some knowledge about the technologies, enough to be dangerous.

Chapter 6 starts talking about the technologies implemented on top of platforms and starts putting into perspective some guiding principles behind different integration approaches. Spocks among the readers will find this chapter most useful. The Scottys will find discussion of the technologies related to Web services interesting, but the Kirks and McCoys may just want to gloss over the chapter.

Chapter 7 is mostly for the Spocks. This chapter introduces metadata concepts related to the BSO reference model introduced earlier in the book. The Scottys may find it useful as well because the metadata are managed by the underlying infrastructure.

Chapter 8 discusses in detail the capabilities required to form a BSO system. This chapter talks about the basic and advanced concepts involved in process automation. These concepts are discussed through examples of an XML-based language, describing the data items that need to be captured for them. This chapter borrows the concepts and features available in many of the available orchestration languages that exist today.

Fundamental to BSO is its ability to integrate human services. It accomplishes that through work portals. Chapter 9 discusses involvement of human participants in the orchestration through the portal interface. This chapter will be of interest to Kirks, McCoys, Spocks, and Scottys alike.

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