

# Middleware

## Max Hailperin

Middleware for Communications Qusay Mahmoud,2005-06-10 A state-of-the-art guide to middleware technologies, and their pivotal role in communications networks. Middleware is about integration and interoperability of applications and services running on heterogeneous computing and communications devices. The services it provides - including identification, authentication, authorization, soft-switching, certification and security - are used in a vast range of global appliances and systems, from smart cards and wireless devices to mobile services and e-Commerce. Qusay H. Mahmoud has created an invaluable reference tool that explores the origins and current uses of middleware (highlighting the importance of such technologies as CORBA, J2EE and JMS) and has thus compiled the roadmap to future research in this area. Middleware for Communications: discusses the emerging fields of Peer-to-Peer (P2P) and grid middleware detailing middleware platforms such as JXTA and the Globus middleware toolkit. shows how Middleware will play a significant role in mobile computing. presents a Platform Supporting Mobile Applications (PLASMA) - a middleware platform that consists of components for location, event, and profile handling of Location-Based Services. introduces middleware security focusing on the appropriate aspects of CORBA, J2EE, and .NET and demonstrates how to realize complex security capabilities such as role-based access control (RBAC) and mandatory access control (MAC). discusses how Quality of Service (QoS) component middleware can be combined with Model Driven Architecture (MDA) technologies to rapidly develop, generate, assemble and deploy flexible communications applications. This incomparable overview of middleware for communications is suitable for graduate students and researchers in communications and computing departments. It is also an authoritative guide for engineers and developers working on distributed systems, mobile computing and networked appliances.

**Introduction to Middleware** Letha Hughes Etzkorn,2017-06-12 A stereotype of computer science textbooks is that they are dry, boring, and sometimes even intimidating. As a result, they turn students' interests off from the subject matter instead of enticing them into it. This textbook is the opposite of such a stereotype. The author presents the subject matter in a refreshing story-telling style and aims to bring the Internet-generation of students closer to her stories. --Yingcai Xiao, The University of Akron Introduction to Middleware: Web Services, Object Components, and Cloud Computing provides a comparison of different middleware technologies and the overarching middleware concepts they are based on. The various major paradigms of middleware are introduced and their pros and cons are discussed. This includes modern cloud interfaces,

including the utility of Service Oriented Architectures. The text discusses pros and cons of RESTful vs. non-RESTful web services, and also compares these to older but still heavily used distributed object/component middleware. The text guides readers to select an appropriate middleware technology to use for any given task, and to learn new middleware technologies as they appear over time without being greatly overwhelmed by any new concept. The book begins with an introduction to different distributed computing paradigms, and a review of the different kinds of architectures, architectural styles/patterns, and properties that various researchers have used in the past to examine distributed applications and determine the quality of distributed applications. Then it includes appropriate background material in networking and the web, security, and encoding necessary to understand detailed discussion in this area. The major middleware paradigms are compared, and a comparison methodology is developed. Readers will learn how to select a paradigm and technology for a particular task, after reading this text. Detailed middleware technology review sections allow students or industry practitioners working to expand their knowledge to achieve practical skills based on real projects so as to become well-functional in that technology in industry. Major technologies examined include: RESTful web services (RESTful cloud interfaces such as OpenStack, AWS EC2 interface, CloudStack; AJAX, JAX-RS, ASP.NET MVC and ASP.NET Core), non-RESTful (SOAP and WSDL-based) web services (JAX-WS, Windows Communication Foundation), distributed objects/ components (Enterprise Java Beans, .NET Remoting, CORBA). The book presents two projects that can be used to illustrate the practical use of middleware, and provides implementations of these projects over different technologies. This versatile and class-tested textbook is suitable (depending on chapters selected) for undergraduate or first-year graduate courses on client server architectures, middleware, and cloud computing, web services, and web programming.

**Middleware for Network Eccentric and Mobile Applications** Benoît Garbinato, Hugo Miranda, Luís Rodrigues, 2009-02-07 Middleware is a critical foundation needed to leverage the development of a wide range of mobile and ubiquitous applications. Intrinsic challenges when building such middleware require the combination of expertise from areas like distributed systems, networking, software engineering, and application development. This textbook provides a comprehensive introduction to the main fundamental problems, technologies, paradigms, and solutions of concern to developers of middleware for mobile environments. The contributions are grouped into four parts, on networking and programming issues, communication models, middleware issues, and application issues. Each chapter is structured as a self-contained tutorial, presenting an overview of a specific topic and the state-of-the-art solutions for the related problems. In addition, the book also includes an authoritative reference list. The material has been successfully used in several thematic training schools organized by the ESF MiNEMA (Middleware for Network Eccentric and Mobile Applications) program, and the book's organization and presentation is ideal for an advanced course on middleware.

**The Complete Book of Middleware** Judith M. Myerson, 2002-03-05 The challenges of designing, building, and

maintaining large-scale, distributed enterprise systems are truly daunting. Written for all IT professionals, *The Complete Book of Middleware* will aid in resolving new business objectives, new technologies, and vendor disputes. This book focuses on the essential principles and priorities of system design and emphasizes the new requirements brought forward by the rise of e-commerce and distributed integrated systems. This reference highlights the changes to middleware technologies and standards. It offers a concise overview of middleware technology alternatives and distributed systems. Many increasingly complex examples are incorporated throughout and the book concludes with guidelines on the practice of IT architecture. Performance considerations such as caching and monitoring are reviewed and the appendix includes middleware resources and new modeling standards. The scope includes traditional middleware and also next-generation techniques that serve to glue disparate systems in the ever-expanding world of distributed network systems. Provided with concepts, principles, and alternatives discussed in *The Complete Book of Middleware*, systems architects, systems analysts, systems designers, systems developers, and programmers, can proceed with greater confidence in designing complex enterprise systems.

*Middleware Solutions for the Internet of Things* Flávia C. Delicato, Paulo F. Pires, Thais Batista, 2013-09-21 After a brief introduction and contextualization on the Internet of Things (IoT) and Web of Things (WoT) paradigms, this timely new book describes one of the first research initiatives aimed at tackling the several challenges involved in building a middleware-layer infrastructure capable of realizing the WoT vision: the SmartSensor infrastructure. It is based on current standardization efforts and designed to manage a specific type of physical devices, those organized to shape a Wireless Sensor Network (WSN), where sensors work collaboratively, extracting data and transmitting it to external networks to be further analysed and processed. *Middleware Solutions for the Internet of Things* describes this infrastructure and its RESTful-based programming model that allows developers create applications without having specific knowledge about physical devices or networking environments. It is also shown, step by step, how to create a Web Mashup application using SmartSensor.

***Demystifying Embedded Systems Middleware*** Tammy Noergaard, 2010-11-04 This practical technical guide to embedded middleware implementation offers a coherent framework that guides readers through all the key concepts necessary to gain an understanding of this broad topic. It integrates big picture theoretical discussion with down-to-earth advice on successful real-world use via step-by-step examples of each type of middleware implementation. It demystifies core middleware, such as networking protocols, file systems, virtual machines, and databases; more complex middleware that builds upon generic pieces, such as MOM, ORB, and RPC; and integrated middleware software packages, such as embedded JVMs, .NET, and CORBA packages. Technically detailed case studies bring it all together, by providing insight into typical engineering situations readers are likely to encounter. \* The only complete guide to middleware, one of the most important AND most widely misunderstood aspects of embedded systems - hundreds of devices, from digital TVs to smart phones, can't function without it! \* Offers thorough middleware coverage, including basic theory and core middleware, as well as complex

implementations and integrated packages \* Detailed case studies, real-world examples, hundreds of diagrams, and a free CD-ROM provide context and aid understanding of embedded middleware

**Mobile Middleware** Sasu Tarkoma, 2009-03-23 This book offers a unified treatment of mobile middleware technology. Mobile Middleware: Architecture, Patterns and Practice provides a comprehensive overview of mobile middleware technology. The focus is on understanding the key design and architectural patterns, middleware layering, data presentation, specific technological solutions, and standardization. The author addresses current state of the art systems including Symbian, Java 2 Micro Edition, W3C technologies and many others, and features a chapter on widely deployed middleware systems. Additionally, the book includes a summary of relevant mobile middleware technologies, giving the reader an insight into middleware architecture design and well-known, useful design patterns. Several case studies are included in order to demonstrate how the presented patterns, solutions, and architectures are applied in practice. The case studies pertain to mobile service platforms, mobile XML processing, thin clients, rich clients, and mobile servers. Chapters on Architectures and Platforms, Mobile Messaging, Publish/Subscribe, Data Synchronization and Security are also included. Key Features: Provides a comprehensive overview of mobile middleware technology Unified treatment of three core topical areas: messaging, publish/subscribe, and data synchronization Discusses the role of middleware in the protocol stack Focus on both standards and research systems including current state-of-the-art systems such as Symbian, Java 2 Micro Edition, W3C technologies Contains concrete examples showing the presented architectures and solutions in practice Includes an accompanying website with links to open source software, and other resources This book serves as an invaluable guide to systems architects, researchers, and developers. It will also be of interest to graduate and undergraduate students studying computer science (distributed systems, computer networks).

Active Middleware Services Salim Hariri, Craig A. Lee, Cauligi S. Raghavendra, 2012-09-10 The papers in this volume were presented at the Second Annual Workshop on Active Middleware Services and were selected for inclusion here by the Editors. The AMS workshop was organized with support from both the National Science Foundation and the CAT center at the University of Arizona, and was held in Pittsburgh, Pennsylvania, on August 1, 2000, in conjunction with the 9th IEEE International Symposium on High Performance Distributed Computing (HPDC-9). The explosive growth of Internet-based applications and the proliferation of networking technologies has been transforming most areas of computer science and engineering as well as computational science and commercial application areas. This opens an outstanding opportunity to explore new, Internet-oriented software technologies that will open new research and application opportunities not only for the multimedia and commercial world, but also for the scientific and high-performance computing applications community. Two emerging technologies - agents and active networks - allow increased programmability to enable bringing new services to Internet based applications. The AMS workshop presented research results and working papers in the areas of active net

works, mobile and intelligent agents, software tools for high performance distributed computing, network operating systems, and application programming models and environments. The success of an endeavor such as this depends on the contributions of many individuals. We would like to thank Dr. Frederica Darema and the NSF for sponsoring the workshop.

The Internet of Things in the Cloud Honbo Zhou, 2013-03-21 Although the Internet of Things (IoT) is a vast and dynamic territory that is evolving rapidly, there has been a need for a book that offers a holistic view of the technologies and applications of the entire IoT spectrum. Filling this void, *The Internet of Things in the Cloud: A Middleware Perspective* provides a comprehensive introduction to the IoT and its development worldwide. It gives you a panoramic view of the IoT landscape—focusing on the overall technological architecture and design of a tentatively unified IoT framework underpinned by Cloud computing from a middleware perspective. Organized into three sections, it: Describes the many facets of Internet of Things—including the four pillars of IoT and the three layer value chain of IoT Focuses on middleware, the glue and building blocks of a holistic IoT system on every layer of the architecture Explores Cloud computing and IoT as well as their synergy based on the common background of distributed processing The book is based on the author's two previous bestselling books (in Chinese) on IoT and Cloud computing and more than two decades of hands-on software/middleware programming and architecting experience at organizations such as the Oak Ridge National Laboratory, IBM, BEA Systems, and Silicon Valley startup Doubletwin. Tapping into this wealth of knowledge, the book categorizes the many facets of the IoT and proposes a number of paradigms and classifications about Internet of Things' mass and niche markets and technologies.

**Adaptive Middleware for the Internet of Things** Marcus Handte, Pedro José Marrón, Gregor Schiele, Matos Manuel Serrano, 2022-09-01 Over the past years, a considerable amount of effort has been devoted, both in industry and academia, towards the development of basic technology as well as innovative applications for the Internet of Things. *Adaptive Middleware for the Internet of Things* introduces a scalable, interoperable and privacy-preserving approach to realize IoT applications and discusses abstractions and mechanisms at the middleware level that simplify the realization of services that can adapt autonomously to the behavior of their users. Technical topics discussed in the book include: Behavior-driven Autonomous Services GAMBAS Middleware Architecture Generic and Efficient Data Acquisition Interoperable and Scalable Data Processing Automated Privacy Preservation *Adaptive Middleware for the Internet of Things* summarizes the results of the GAMBAS research project funded by the European Commission under Framework Programme 7. It provides an in-depth description of the middleware system developed by the project consortium. In addition, the book describes several innovative mobility and monitoring applications that have been built, deployed and operated to evaluate the middleware under realistic conditions with a large number of users. *Adaptive Middleware for the Internet of Things* is ideal for personnel in the computer and communication industries as well as academic staff and research students in computer science interested in

the development of systems and applications for the Internet of Things.

*Developing Middleware in Java EE 8* Abdalla Mahmoud, 2018-06-30 Use Java features such as JAX-RS, EJBs, and JPAs to build powerful middleware for newer architectures such as the cloud Key Features Explore EJBs to build middleware solutions for enterprise and distributed applications Understand middleware designs such as event-based and message-driven web services Learn to design and maintain large-scale systems and vendor disputes Book Description Middleware is the infrastructure in software based applications that enables businesses to solve problems, operate more efficiently, and make money. As the use of middleware extends beyond a single application, the importance of having it written by experts increases substantially. This book will help you become an expert in developing middleware for a variety of applications. The book starts off by exploring the latest Java EE 8 APIs with newer features and managing dependencies with CDI 2.0. You will learn to implement object-to-relational mapping using JPA 2.1 and validate data using bean validation. You will also work with different types of EJB to develop business logic, and with design RESTful APIs by utilizing different HTTP methods and activating JAX-RS features in enterprise applications. You will learn to secure your middleware with Java Security 1.0 and implement various authentication techniques, such as OAuth authentication. In the concluding chapters, you will use various test technologies, such as JUnit and Mockito, to test applications, and Docker to deploy your enterprise applications. By the end of the book, you will be proficient in developing robust, effective, and distributed middleware for your business. What you will learn Implement the latest Java EE 8 APIs and manage dependencies with CDI 2.0 Perform CRUD operations and access databases with JPA 2.1 Use bean validation API 2.0 to validate data Develop business logic with EJB 3.2 Incorporate the REST architecture and RESTful API design patterns Perform serialization and deserialization on JSON documents using JSON-B Utilize JMS for messaging and queuing models and securing applications Test applications using JUnit and Mockito and deploy them using Docker Who this book is for Enterprise architects, designers, developers, and programmers who are interested in learning how to build robust middleware solutions for enterprise software will find this book useful. Prior knowledge of Java EE is essential

*The Handbook of Mobile Middleware* Paolo Bellavista, Antonio Corradi, 2016-04-19 Device miniaturization, wireless computing, and mobile communication are driving ubiquitous, pervasive, and transparent computing. Supporting these rapidly evolving technologies requires middleware solutions that address connectivity-level, location-dependent, and context-dependent issues. The Handbook of Mobile Middleware is an exhaustive o

**The Middleware Source Book** John Colonna-Romano, Patricia Srite, 1995 The Middleware Source Book is the only book of its kind to identify the standards-based interface (programming and protocols) and middleware products that applications developers and systems integrators cannot do without. This unique book contains a detailed examination of each of the following: \* Twenty five component services, including Motif, remote procedure call, object brokering, SQL dat access,

distributed file systems and directory services. \* Two integrated sets of services, such as OSF DCE and personal computing integration services \* Six frameworks, including electronic data interchange, management, transaction processing, and workgroup frameworks, which are integrated environments for creating distributed applications. The Middleware Source Book provides application developers and system integrators with the critical information they need to choose appropriate middleware for cost effective implementation of their next client/server application. John Colonna-Romaro has been an employee at Digital Equipment Corporation since 1977. Since 1992 John has been a member of the Network Application Support Group, which was chartered to deliver middleware software products to customers. John has been using his experience in building distributed information systems to document the middleware software that is so often missing when building a system. Patricia Srite began writing middleware architecture documentation in 1992 and has over 16 year experience writing technical documentation. Pat began her career as a technical writer at Digital Equipment Corporation in 1978. She is now a consulting writer whose portfolio includes software user manuals, architecture standards, services catalogues, hardware systems, and configuration guides, installation guides, and marketing brochures.

**Middleware Networks** Michah Lerner, George Vanecek, Nino Vidovic, Dado Vrsalovic, 2005-12-27 **Middleware Networks: Concept, Design and Deployment of Internet Infrastructure** describes a framework for developing IP Service Platforms and emerging managed IP networks with a reference architecture from the AT&T Labs GeoPlex project. The main goal is to present basic principles that both the telecommunications industry and the Internet community can see as providing benefits for service-related network issues. As this is an emerging technology, the solutions presented are timely and significant. **Middleware Networks: Concept, Design and Deployment of Internet Infrastructure** illustrates the principles of middleware networks, including Application Program Interfaces (APIs), reference architecture, and a model implementation. Part I begins with fundamentals of transport, and quickly transitions to modern transport and technology. Part II elucidates essential requirements and unifying design principles for the Internet. These fundamental principles establish the basis for consistent behavior in view of the explosive growth underway in large-scale heterogeneous networks. Part III demonstrates and explains the resulting architecture and implementation. Particular emphasis is placed upon the control of resources and behavior. Reference is made to open APIs and sample deployments. **Middleware Networks: Concept, Design and Deployment of Internet Infrastructure** is intended for a technical audience consisting of students, researchers, network professionals, software developers, system architects and technically-oriented managers involved in the definition and deployment of modern Internet platforms or services. Although the book assumes a basic technical competency, as it does not provide remedial essentials, any practitioner will find this useful, particularly those requiring an overview of the newest software architectures in the field.

**Middleware Management with Oracle Enterprise Manager Grid Control 10g R5** Arvind Maheshwari, Debu

Panda,2009-12-04 Monitor, diagnose, and maximize the system performance of Oracle Fusion Middleware solutions using this book and eBook.

**Semantic Management of Middleware** Daniel Oberle,2006-05-28 Current middleware solutions, e.g., application servers and Web services, are very complex software products that are hard to tame because of intricacies of distributed systems. Their functionalities have mostly been developed and managed with the help of administration tools and corresponding configuration files, recently in XML. Though this constitutes flexibility for developing and administrating a distributed application, the conceptual model underlying the different configurations is only implicit. To remedy such problems, Semantic Management of Middleware contributes an ontology-based approach to support the development and administration of middleware-based applications. The ontology is an explicit conceptual model with formal logic-based semantics. Its descriptions may therefore be queried, may foresight required actions, or may be checked to avoid inconsistent system configurations. This book builds a rigorous approach towards giving the declarative descriptions of components and services a well-defined meaning by specifying ontological foundations and by showing how such foundations may be realized in practical, up-and-running systems.

**IT Architectures and Middleware** Chris Britton,Peter Bye,2004-05-24 The challenges of designing, building, and maintaining large-scale, distributed enterprise systems are truly daunting. Written by and for IT professionals, *IT Architectures and Middleware, Second Edition*, will help you rise above the conflicts of new business objectives, new technologies, and vendor wars, allowing you to think clearly and productively about the particular challenges you face. This book focuses on the essential principles and priorities of system design and emphasizes the new requirements emerging from the rise of e-commerce and distributed, integrated systems. It offers a concise overview of middleware technology alternatives and distributed systems. Numerous increasingly complex examples are incorporated throughout, and the book concludes with some short case studies. Topics covered include: Middleware technology review Key principles of distributed systems: resiliency, performance and scalability, security, and systems management Information access requirements and data consistency Application integration design Recasting existing applications as services In this new edition, with updates throughout, coverage has been expanded to include: Service-oriented architecture concepts Web services and .NET technology A more structured approach to system integration design

**Operating Systems and Middleware** Max Hailperin,2007 By using this innovative text, students will obtain an understanding of how contemporary operating systems and middleware work, and why they work that way.

*Distributed Systems Architecture* Arno Puder,Kay Römer,Frank Pilhofer,2006 Annotation. This guide to building robust distributed software includes a complete open source CORBA system.

*Demystifying Embedded Systems Middleware* Tammy Noergaard,2011 When asked, "What is the biggest factor



influencing processor choice for new projects?” engineers overwhelmingly agree that the robustness of the processors' attendant software is the key linchpin of the decision. Not speed, not price, but available software. Because software has become the driving factor in the development of embedded systems, middleware, the “glue” allowing hardware and software to work together effectively, has taken on a role of pivotal importance. However, middleware is perhaps the most mysterious of all the aspects of an embedded system, even to expert designers! Available information is scattered and mostly proprietary, not to mention largely outdated, and obfuscated by a sea of acronyms. This practical technical guide to embedded middleware implementation offers a coherent framework that guides readers through all the key concepts necessary to gain a clear understanding of this broad and diverse topic. Big picture theoretical discussion is integrated with down-to-earth advice on successful real-world use via step-by-step examples of each type of middleware implementation. Hundreds of diagrams help the reader to visualize the complexities of the wide variety of embedded middleware that exists in the industry today. Technically detailed case studies help to bring it all together, providing valuable insight into the typical engineering situations readers are likely to encounter. Expert author Tammy Noergaard keeps explanations as simple and readable as possible, eschewing jargon and carefully defining acronyms. The start of each chapter includes a 'setting the stage' section, so readers can take a step back and understand the context and applications of the information being provided. Core middleware, such as networking protocols, file systems, virtual machines, and databases; more complex middleware that builds upon generic pieces, such as MOM, ORB, and RPC; and integrated middleware software packages, such as embedded JVMs, .NET, and CORBA packages are all demystified. A free companion CD-ROM includes all the open-source code utilized by the author in examples, so that readers can obtain hands-on programming experience without making any further purchase. \* The only complete guide to middleware, one of the most important AND most widely misunderstood aspects of embedded systems - hundreds of devices, from digital TVs to smart phones, can't function without it! \* Offers thorough middleware coverage, including basic theory and core middleware, as well as complex implementations and integrated packages \* Detailed case studies, real-world examples, hundreds of diagrams, and a free CD-ROM provide context and aid understanding of embedded middleware

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