

Using Design Patterns, Frameworks and CORBA to Reduce the Complexity of Developing Reusable Large-Scale Object-Oriented Concurrent Communication Components and Systems

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"Developing high quality communication software is hard; developing high quality reusable communication software is even harder. The principles, methods, and skills required to develop reusable software cannot be learned by generalities. Instead, developers must learn through experience how reusable software components and frameworks can be designed, implemented, optimized, validated, maintained, and enhanced by applying good development practices and patterns.

This tutorial describes OOD/OOP techniques and software that have been successfully used to reduce the complexity of developing large-scale concurrent communication systems, including online transaction processing, telecommunication call-processing, network management for large-scale global personal communication systems, electronic medical imaging systems, real-time avionic systems, and high-performance parallel communication protocol stacks, among others. Two types of software complexity are addressed: complexity due to quality of service (QoS) requirements and complexity due to functional and quality requirements.

The techniques that can significantly simplify and enhance the development, use, and reuse of communication software include object-oriented design (such as patterns, layered modularity, and information hiding), C++ language features (such as abstract classes, inheritance, dynamic binding, and parameterized types), tools (such as object-oriented communication frameworks) and Object Reuse Brokers (ORBs), advanced operating system mechanisms (such as event de-multiplexing, multi-threading, multi-processing, and explicit dynamic linking), and emerging standards for distributed object computing such as OMG CORBA and Distributed COM (DCOM)."

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Dr. Schmidt is an Associate Professor and Director of the Center for Distributed Object Computing in the Department of Computer Science and in the Department of Radiology at Washington University in St. Louis, Missouri, USA. His research focuses on design patterns, implementation, and experimental analysis of object-oriented techniques that facilitate the development of high-performance, real-time distributed object computing systems on parallel processing platforms running over high-speed ATM networks and embedded system interconnects. Dr. Schmidt is an internationally "recognized expert on distributed object computing and has published widely in top IEEE, ACM, IFIP, and USENIX technical

conferences and journals. His publications cover a range of experimental systems topics including high-performance communication software systems, parallel processing for high-speed networking protocols, real-time distributed object computing with CORBA, and object-oriented design patterns for concurrent and distributed systems.

In addition to his academic research, Dr. Schmidt has over a decade of experience building object-oriented communication systems. He is the chief architect and developer of the ADAPTIVE Communication Environment (ACE), which is a widely used, freely-available object-oriented framework that contains a rich set of components that implement design patterns for high-performance and real-time communication systems. Dr. Schmidt has successfully used ACE on large-scale projects at Ericsson, Siemens, Motorola, Kodak, Lucent, Lockheed Martin, Boeing, and SAIC. These projects involve telecommunications systems, medical imaging systems, real-time avionic systems, and distributed interactive simulation systems. Dr. Schmidt and the members of his research group in the Center for Distributed Object Computing are currently using ACE to develop a high performance, real-time CORBA ORB endsystem called TAO (The ACE ORB). TAO is the first real-time ORB endsystem to support end-to-end Quality of Service guarantees over ATM networks. Dr. Schmidt received B.S. and M.A. degrees in Sociology from the College of William and Mary in Williamsburg, Virginia, and an M.S. and a Ph.D. in Computer Science from the University of California, Irvine (UCI) in 1984, 1986, 1990, and 1994, respectively. His Ph.D. advisor was Tatsuya Suda. Dr. Schmidt is a member of the IEEE, ACM, and USENIX. In his 'spare' time, Dr. Schmidt enjoys Ballroom Dancing and Corvettes."