BOOK REVIEW

Achieving Real-Time in Distributed Computing:
From Grids to Clouds

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Achieving Real-Time in Distributed Computing: From Grids to Clouds
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INTRODUCTION

A real-time system is a type of hardware or software that operates with a time constraint. In a real-time system the correctness of the system behavior depends not only the logical results of the computations, but also on the physical instant at which these results are produced. A real-time system changes its state as a function of physical time.

A distributed system links a number of independent computing entities with local properties by way of a communication mechanism. As a consequence, algorithms and other design components must take into consideration the synchrony and the failure model.

Achieving Real-time in Distributed computing is useful for three fundamentally different reasons. First, the processing and response requirements of some applications are so extreme that even the fastest uni-processors are inadequate. It is natural to apply multiple processors/computers to such problems. Second, such systems may use multiple copies of system components, thus providing fault-tolerance through redundancy. Third, some real-time applications are by nature geographically distributed.

Distributed systems have spawned many familiar technologies across the years, including grid computing and Cloud computing. Where Cloud Computing is evolved out of Grid Computing and relies on Grid Computing as its backbone and infrastructure support, and Grid computing is applying the resources of many computers in a network to a single problem at the same time. For all these reasons, a solid reference book on these topics is required.

ORGANIZATION OF THE BOOK

The book is divided into 3 sections: Software as a service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

In the first section, chapter one describe some techniques (Analytical Characterization Models, Queuing Network Models, Soft Real-Time Behavior Modeling and Verification) used to model and analyze the required quality of service level for real-time applications. Chapter two provides up to date approaches, standards, resources, and tools that support different aspects of model-driven software engineering. In chapter three the basic Application Programming Interfaces (APIs) for integrating Real-Time capabilities to Linux kernels was documented. Several approaches were presented and compared in the context of executing soft as well as hard real-time applications. The emergence of Cloud computing brought a revolution and a new perception on application development and execution which lead Service Providers got involved into Cloud-enabled technologies and related products. Chapter 4 elaborates on the service quality modeling techniques, explains the notion of Quality of Experience and how it is nowadays used for evaluation purposes, and describes the techniques that have been proposed for evaluation of service quality from the customer side, as well as for the corresponding side of the provider.

In the second section, chapter 5 has performed classification of the characteristics that a service/resource discovery mechanism may address. This includes a variety of features that can be a part of these mechanisms. A number of indicative solutions that implement part of these features have been presented in detail and with regard to their position in the taxonomy. The investigation of current Cloud-based business models (in the form of the Cloud Computing Stack) and their specific per layer requirements has also been performed, in an effort to identify what are the most attractive characteristics (and therefore appropriate mechanisms). The Gaps between these approaches and the current business models have been identified. In chapter 6, some tools for monitoring the diverse infrastructure resources and the status and performance of applications running on this infrastructure are presented. The existing diversity on monitoring tools and the metrics used makes difficult the integration of monitoring systems as the infrastructure grows. To solve this problem the use of semantic tools could be a solution to allow a coherent data access providing a common understanding of the different metrics used by the different monitoring systems. It is therefore necessary to agree on a common and standardized ontology for monitoring systems. The purpose of chapter 7 is to give an overview of various solutions regarding workflow semantics and languages, as well as their enactment within the scope of distributed systems. Some newest research topics in workflow management distributed systems like scheduling algorithms and advance reservation techniques are also discussed.

In chapter 8, the authors has analysed the different facets regarding the usage of Service Level Agreement (SLA) in real-time service oriented infrastructures (SOIs). Additionally, the implementations of different areas to support real-time applications are discussed.

The current and future challenges for securing real-time interaction applications in federated cloud environments is presented in chapter 9. The author expect the evolution of clouds to be largely driven by the convergence of networks, services, content and things that is leading to the Future Internet as envisioned in Europe.

The challenge for the future is to solve the great interoperability problems that exist between the emerging cloud platforms, how to manage applications among cloud infrastructures and how to connect services or application components deployed on different clouds. In chapter 10, the Web service specifications and the middleware that make use of those specifications, including the description of the commercial interfaces and development tools to create services for the cloud are described.

In the last part, chapter 11 presented state of the art of virtualized large-scale systems and soft real-time systems. As most services do not require hard Real-Time constraints but have

"only" soft Real-Time constraints, Real-Time aware service-oriented infrastructures that provide services on top of virtualized infrastructure are likely to become widely available in the not too distant future. This will enable also smaller companies to satisfy peak loads by exploiting the cost-effectiveness of using cloud resources while still being in control of the customer experience.

Service Oriented Infrastructures (SOI) build upon previous advancements in Distributed Systems, Grid Computing, Cloud Computing, Virtualization, SOA, and technologies alike. Capabilities merged under the banner of SOI offer a solution that serves long-standing business needs, but also meets increasing demand for infrastructures, enabling the fast and flexible deployment of new services. Chapter 12, provides an overview of all these technologies as QoS provisioning, virtualization, and network resource management. This background is enriched with latest research results on future trends and advances in state of the art in network management.

The real-time clouds pose certain unique challenges for the data storage subsystem, which indeed is the "last mile" for all data accesses. Data storage subsystems typically used in regular enterprise environments have many limitations which impedes direct applicability for such clouds, particularly in their ability to provide Quality of Service (QoS) for applications. In chapter 13, the authors discussed some of the storage specific requirements for real-time applications for cloud architectures to address the issues along with a QoS model.

The need for guaranteed QoS and efficient management in Service Oriented Infrastructures is an essential requirement for the deployment, execution, and management of modern business applications. In that frame, the capabilities for fault detection and recovery in all layers of a Service Oriented Infrastructure are essential for the smooth operation of the business. Chapter 14 presented the state of the art mechanisms and techniques for providing fault detection and recovery functionality in Service Oriented Infrastructures.

General-Purpose Operating Systems (GPOSes) are being used more and more extensively to support interactive, real-time, and distributed applications, as found in the multimedia domain. In the last chapter of the book, an overview was done about the real-time support in GPOSes with a particular focus on Linux operating system.

SUMMARY

Recommended- I recommend the book "*Achieving Real-Time in Distributed Computing: From Grids to Clouds*" to anyone who is a novice or expert in the domain of "Real-time distributed systems". Despite that several chapters present "State-of-the art" on specific topics, the coverage topics and the methodology of presentation with the solid information lead me to recommend this book as a reference book for real time distribute systems in grid and cloud computing.

Seifedine N. Kadry is an associate professor of computing in the American University of the Middle East – Kuwait. Kadry was born in Bekaa, Lebanon in 1977. he received his Dr.S(HDR) degree from Sofia university in 2013, PhD degree from the Blaise Pascal University-France in 2007, DEA (Masters) degree from AUPELF-UREF in 2002 and BS from the Lebanese university in 2000. His h-index is 6 and Erdos-number is 2. Currently, Kadry is the editor in chief of two international journals: ARPN journal of systems and software and Research Journal of Mathematics and Statistics. *He published more than 70 articles in international journals and more than 30 articles in international conferences. He published 4 books in international publisher like IGI, Elsevier and LAP. He co-supervised two PhD students and 15 masters' students. He led and participates to 3 funded projects by the Lebanese university.*