The S-Cube Research Vision

Mike Papazoglou\textsuperscript{1}, Klaus Pohl\textsuperscript{2}, Andreas Metzger\textsuperscript{2}, and Willem-Jan van den Heuvel\textsuperscript{1} together with the S-Cube team

\textsuperscript{1} European Research Institute in Service Science (ERISS), Tilburg University, PO Box 90153, 5000 LE Tilburg, The Netherlands m.p.papazoglou@uvt.nl w.j.a.m.vdnheuvel@uvt.nl

\textsuperscript{2} Paluno (The Ruhr Institute for Software Technology), University of Duisburg-Essen, 45127 Essen, Germany klaus.pohl@sse.uni-due.de andreas.metzger@sse.uni-due.de

Chapter Overview. This chapter sets the scene and gives the background for S-Cube’s research vision and activities described in the remainder of the book. It does this by describing, in Section 1.1, how the anticipated growth in services and service-based systems that together form the Internet of Services will have a profound effect on business and society. Section 1.2 discusses in more detail some selected, fundamental cross-cutting research challenges and how the cooperation of different research disciplines plays an important role. In Section 1.3 we describe the research framework S-Cube has adopted to assist in unifying research communities and agendas across Europe to meet the challenges faced in realizing the Future Internet.

1.1 The Internet of Services

The next decade holds the prospect of remarkable progress in a wide range of pervasive technologies culminating in the introduction of the Future Internet — a global, open platform with emphasis on mobility, massive scale of connected devices, increased bandwidth and digital media. The goal is the development of a converged information, communication and service infrastructure that gradually will replace the current Internet, mobile, fixed, satellite and audiovisual networks. This infrastructure will not only be pervasive, ubiquitous, and highly dynamic, but will also offer almost unlimited capacities to users, by supporting a wide variety of nomadic and mobile interoperable devices and services, a variety of content formats and a multiplicity of delivery modes. Beyond technological aspects, the Future Internet is likely to have a profound effect on our society, from a societal, organizational or business perspective. Future Internet-based systems are set to revolutionize the worlds of healthcare, agriculture, the environment, transport, telecommunications, manufacturing, distribution, recycling, and retailing, to name just a few ap-
plication areas, so much that the Future Internet could be of huge benefit to mankind.

Central to this vision is the availability of rich and flexible service capabilities, where the Internet world comprises of cooperating services with application components than can be combined dynamically with little effort into globally value-added services that can be traded outside traditional ownership and provisioning boundaries to yield higher levels of productivity. With these technological changes on the horizon, there is enormous potential for globally-available software services that gravitate towards new kinds of high-speed networks that employ a multiplicity of wired and wireless devices, sensors (e.g., RFID) and other service delivery artifacts. With global availability service-related functions are independent of the underlying devices, platform characteristics, connectivity protocols and transport technologies. This not only widens considerably the scope of systems but also provides the possibility of developing a new range of innovative systems, which can be provisioned by widely distributed network infrastructures.

In this new environment, software services (or simply services) constitute self-contained computational elements that support rapid and flexible composition of loosely coupled distributed software systems. The functionality provided by a service can range from answering simple requests to executing sophisticated processes requiring peer-to-peer relationships between a multitude of service consumers and providers. Services are described, published, discovered, and can be assembled to create complex service-based systems and service-based systems, which are inherently distributed. For the service consumer, a service represents functionality that can be invoked through the service interface. The actual software or application logic that implements the service composition is owned by the service provider. However, the composed service itself as well as the services which are aggregated by the composed service are often owned, executed and maintained by third parties. Thus, services take the concept of ownership to the extreme: not only is the development, quality assurance, and maintenance of the software under the control of third parties, but the software can also be executed and managed by third parties.

Software services and service-based systems imply fundamental changes to how software is developed, deployed, and maintained. More specifically, three broad classes of challenges need to be addressed:

- **Evolution and Adaptation:** Service-based systems run in dynamic business environments and address constantly evolving requirements. These systems hence have to be able to adequately identify and react to various changes in the business requirements and application context. Besides run-time mechanisms and strategies to support system adaptation, this requires novel engineering and design approaches that consider these mechanisms and strategies during the construction service-based systems.