Preface

The way enterprises conduct business today is changing rapidly and significantly. The enterprise has become more pervasive with a mobile workforce, distributed sites and outsourced data centers and is considering the use of even more cost-efficient computing platforms. These may run internally, or be offered by trusted providers and utilized only by selected business partners or may be open and run on public infrastructure. In addition, companies seeking to optimize their processes across their supply chains are implementing integration strategies that include their customers and suppliers rather than looking inward.

Today enterprises are enduring a strong pressure on cost reductions and an intensifying market competition forcing them to be more efficient, productive, agile and innovative in order to meet business objectives. Consequently there is increasing demand for technologies that help enterprises increase their customer base while reducing their costs and extending their competitive advantage.

It is important for any enterprise to understand how its business has performed at any given time in the past, now, and in the future. Bringing value networks together in the so-called Virtual Organizations (VO) over a shared IT infrastructure brings very strong benefits in terms of cost reduction, increased agility and shorter cycle-time and time-to-market. However, the presence of multiple authorities and complex relationships regarding the ownership of resources and information in contexts that span across organizational borders, mean that different authorities must be able to define policies about entitlements, ICT resource utilization and access. ICT resource administrators and resources may not necessarily belong anymore to the same organization. It therefore becomes much harder for an enterprise to govern its collaboration with other enterprises in a safe and controlled way.

Enterprises need better mechanisms to control how trust is established between business partners, how identities and other security attributes are shared, how security policy is defined and enforced—especially when policy applies on users and resources that are not controlled by a single enterprise. Improvements are also required for sharing and federating information and data efficiently across the value chain while ensuring privacy, confidentiality of corporate information and compliance to data protection. There is also a need for well-orchestrated, end-to-end operations management that provides controlled visibility, governance of network and

IT state, flexible license management models, understanding of how operations perform against Service Level Agreements (SLA) and timely assessment of the impact of security policy violations and the availability of resources.

Technologies such as Service Oriented Architecture (SOA) based Web Services, Grid Computing and more recently Cloud Computing, which we classify under the general term Service Oriented Infrastructures (SOI), form the basis of the technology tool-box that organizations utilize in modern enterprises in order to face such challenges. As Cloud Computing matures we expect these strategies to increasingly involve outsourcing models that integrate in-house and in-cloud services or integrate services hosted in different Cloud Computing platforms.

However there are still disparities between the research and technological advancements of the last decade in SOI and its uptake by the market to the extent that technological innovation is applied to bring real improvements in everyday business. This is a gap that BEinGRID tackled. BEinGRID, Business Experiments in GRID, is the European Union's largest integrated project funded by the Information Society Technologies (IST) research, part of the European Union's sixth research Framework Programme (FP6). This consortium of 96 partners was led by project management team in Atos Origin and a technical director from BT. *This book presents the main technical results of the BEinGRID project.*

The strategic mission of BEinGRID was to understand the commercial requirements for SOI use and to apply of these technologies in commercial environment, involving software vendors, IT integrators, service providers and end-users. The project run 25 business pilots in diverse economic sectors such as entertainment, pharmaceutical, engineering modeling for ship building or aeronautics, finance, textile industry logistics, earth observation, etc that helped on one hand to understand and extract common requirements and on the other hand to validate the designed and developed solutions. Technological innovation in BEinGRID focused on areas where we witnessed either significant challenges that inhibit widespread commercialization or where the anticipated impact of the innovation (i.e. the "innovation dividend") is particularly high.

As part of implementing this mission teams of technology experts and business analysts embedded in the pilot projects have attempted to reduce the adoption barriers by eliciting common technical requirements that solve common business problems across these vertical markets, by defining innovative generic solutions, called *common capabilities*, that meet these requirements, by producing design patterns that explain how these solutions can be implemented over commonly used commercial and experimental platforms and by elaborating best-practice guidelines demonstrating how these solutions can be applied in exemplar business scenarios. These contributions can be classified in the following areas:

- *Virtual Organization Management* capabilities help businesses establish secure, accountable and efficient collaborations sharing services, resources and information. These include innovations that enable the secure federation of autonomous

administrative domains, and the composition of services hosted by different enterprises or in-cloud platforms.

- *Trust & Security* capabilities address areas where a perceived or actual lack of security appears to inhabit commercial adoption of SOI. These include solution for brokering identities and entitlements across enterprises, managing access to shared resources, analyzing and reacting to security events in a distributed infrastructure, securing multi-tenancy hosting, and securing the management of in-cloud services and platforms. These innovations underpin capabilities offered in Virtual Organization Management and other categories.
- *License Management* capabilities are essential for enabling the adoption of "pay-per-use" and other emerging business models, and had so far been lacking in the majority of SOI technologies including Grid and Cloud computing.
- Innovations to improve the management of *Service Level Agreements* cover the whole range from improvements to open standard schemes for specifying and negotiating agreements to solutions to ensuring fine-grained monitoring of usage, performance and resource utilization.
- *Data Management* capabilities enable better storage, access, translation and integration of data. Innovations include capabilities for aggregating heterogeneous data sources in virtual data-stores and ensuring seamless access to heterogeneous geographically distributed data sources.
- Innovations in *Grid Portals* enable scalable solutions based on emerging Web 2.0 technologies that provide an intuitive and generic instrumentation layer for managing user communities, complex processes and data in SOI.

The originality of BEinGRID findings and proposed solutions is that they have already been tried out. The results are not about theories or frameworks, but about real, tested, experimented, adapted solutions and the experiences gained by their use. The case studies that BEinGRID produced are real, conducted by a broad spectrum of European businesses which operate in the real world. Return-on-Investment has been examined, the legal context has been worked out, the technical problems have found a solution often involving a high innovation dividend.

We hope that this book will deliver the essential technical concepts of many years of research and innovation on Service Oriented Infrastructures in Europe in a condensed way and ultimately becomes a source of references for researchers and practitioners alike. The timing of this book is in line with the maturation of Grid computing and the emergence of Cloud Computing as the attraction of research interest in Service Oriented Infrastructures. The book offers a set of concepts and tools that will help companies in Europe and world-wide to adopt SOI technologies and to realize this transition successfully.

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