

Future Internet Application Areas

Introduction

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1 Introduction

Applications are software systems perceived and utilized by their intended users to carry out a specific task. Applications are what users are actually using in their working environments and their daily lives, hence applications are the medium that enables them to interact with the rapidly advancing technologies. This implies that we should take the users' needs and aspirations as a point of departure for developing and introducing advanced applications. Therefore, it is extremely important to pay attention to the openness of the process of developing, testing and validating applications and to the involvement of users in that process.

Applications evolve as they depend on the capabilities provided by several real systems. For example, the end-user devices they run on as well as virtual resources they utilize e.g. for mash-up applications are depending on the distributed services that provide the functionalities needed by these applications. In the Future Internet (FI) era, the applications will enjoy both the advances we have seen on the hardware e.g. running on mobile devices such as smartphones with memory and CPU power that comparable to supercomputers a couple of decades ago, as well as on the software side, where virtualization of the infrastructure and real-time communication and computation on data is possible. Taking advantage of the rich information offered by various stakeholders as well as the FI platform core facilities, the FI applications are expected to be seamlessly adjusting to the user's needs and context, while in parallel hiding the complexity of the underlying infrastructure and the interactions with the other services and systems.

Some of the key Internet-based technologies underlying smart Future Internet applications include cloud computing, real-world user interfaces of cyber-physical systems and the semantic web. Cloud computing, a new way of delivering com-

puting resources, will have considerable impact as it is opening up new possibilities in virtualization of physical spaces. The rapid advance of Internet of Things technologies will enable us to sense the real-world and will empower a new class of applications that are able to receive real-time information from the physical surrounding and interact with it. For example, a new generation of location-aware applications and services and, on the longer term new types of spatial intelligence, will advance the end-user application capabilities while it will blend easily in a global ecosystem of web applications, social media and crowdsourcing. Finally, the semantic web is expected to facilitate the merging of data from different sources and presenting them in a meaningful way, thus bringing social media based collaboration and collective intelligence to a higher level.

As the Future Internet will be a very complex system of systems, the applications will be the entry point for many users to interact with it and enjoy its offerings. In such a complex and rapidly changing environment the application developer will have to deal with multiple heterogeneous information sources that will need to be integrated as well as an increasingly number of heterogeneous devices that will be used to interact with the user. To achieve this, we will witness further increase in the trend to go beyond monolithic applications towards composite ones that collaborate both with parts of the Future Internet infrastructure as well as with other services and apps. This collaborative way of interactions is expected to lead to emergent behaviours in the Future Internet that at the end will better serve the end-users.

Several challenges need to be mastered in order to empower the visions for highly sophisticated Future Internet Applications. The challenges are increasingly multi-domain (ranging from technical to social, design, economics etc.) while in parallel traditional issues such as security, trust, privacy, user-friendliness and rapid development will still need to be present from day 1 and not added as an aftermath. Complexity management, crowdsourcing, real-time analytics, knowledge capturing and communication, simulation are only some indicative aspects that will need to be investigated as they will impact the next generation of applications. Nevertheless the Future Internet applications are in the heart of emerging visions for a smarter world i.e. smart cities, smart energy, smart health, smart enterprises, smart environment, smart transportation, logistics and mobility, smart manufacturing, smart agriculture and tourism. Their existence has the challenging goal of enabling innovation by empowering the Future Internet users.

2 Papers in the Section Applications

Various papers collected in this section demonstrate aspects of the scope and width of advanced applications based on Future Internet technologies. The papers vary from offering the technology orientation of applications to demonstrating the importance of applications within various application contexts such as service marketplaces and social networking.

More specifically, *I-Search: A Unified Framework for Multimodal Search and Retrieval* focuses on novel approaches for multimodal search allowing for easy

retrieval of diverse media types simultaneously e.g. 3D objects, images, audio and video. These technologies show a high potential value for enabling Internet-based applications in various important sectors, which are characterized by an overwhelming amount of content and could further serve for providing generic enablers to FI-WARE in terms of accessing varied content.

Supporting content, context and user awareness in Future Internet applications presents the general idea of delivering complex services in a distributed networking environment to end-users. The main feature of the proposed idea is that the process of complex services delivery is aware of the content being delivered, the context of the services delivery and that the delivered services are personalized for each separate end-user.

Towards Trustworthy Marketplaces for Services and Apps in the Future Internet presents the concept of trusted service marketplaces playing a key role for the future Internet of Services. Such service marketplaces impose new demands and requirements to trust and security and the paper proposes an approach and vision to address these demands.

Semantically Enriched Services to Understand the Need of Entities describes the evaluation of the proposed “Net-Ontology” aiming to improve network communication with semantics. The paper addresses intermediate network layers and contains an experimental evaluation and a promising comparison against the current TCP/IP stack.

Using Future Internet Infrastructure and Smartphones for Mobility Trace Acquisition and Social Interaction Monitoring focuses on the social networking context of Future Internet applications, which is of high relevance to smart city environments. The authors discuss a system for producing traces for a new generation of human-centric applications, utilizing technologies such as Bluetooth and focusing on human interactions. Two deployments in human-centric environments are described, one in an office environment and one in an exhibition/conference environment. The paper demonstrates the growing interaction between technology development and user interaction,

3 Conclusions

The Future Internet will be information driven and rely on services to empower the interactions among its stakeholders at multiple layers which will be facilitated via the applications. This calls for open information exchange and a new generation of highly sophisticated applications customized to end-user needs. Many of the papers in this volume are dealing with several central schemes of the Internet: content of an increasingly unstructured nature such as images and mixed media, needs to navigate this content using the user context such as location and other sensors and trust in the information that is received and being transmitted. All these application domains will change the way people interact and the way that living spaces are being created, highlighting the impact of the Future Internet on the lives of most of us.