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REPORT

A Report on the 3rd IFIP/IEEE International Workshop on Management of the Future Internet (ManFI 2011)

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Abstract The 3rd IFIP/IEEE International Workshop on Management of the Future Internet (ManFI 2011) was held on May 27, 2011 in Dublin, Ireland. This report summarizes the presentations and discussions in ManFI 2011 and provides a high-level view of challenges, strategies and the current state of the research activities in the field of the Future Internet management.

Keywords Future internet · Network management · Future Internet management · Management architecture · Autonomic networking

1 Introduction

The 3rd IFIP/IEEE International Workshop on Management of the Future Internet (ManFI 2011) was organized as a forum to promote Future Internet research activities and to provide up-to-date results that focus on the management aspects of the Future Internet (FI). The workshop took place on May 27, 2011, at Trinity College Dublin, in conjunction with the 12th IFIP/IEEE International Symposium on Integrated Network Management (IM 2011). ManFI 2011 was sponsored by the IEEE Communications Society, Autonomic Communications Forum, and POSTECH IT Convergence Engineering (ITCE). The workshop was endorsed by the

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IEEE Communication Society's Technical Committee on Network Operations and Management (CNOM).

It is widely agreed that despite its many successes the current Internet also has a set of systemic problems, ranging from an upcoming shortage of IP addresses to insufficient security. However, the lack of scalable and agile manageability is arguably more important, as without such management, it is impossible to build systems that adapt the services and resources offered in a context-dependent manner.

The first edition of ManFI was held in 2009 with IM 2009 in New York [1] and the second was held in 2010 with NOMS 2010 in Osaka, Japan [2]. Each year, there is a growth in the community that is dedicated to exploring how the Future Internet can be better governed and managed. ManFI is typified by a motivating keynote, an invited talk, and excellent papers that explore the state-of-the-art in managing the Future Internet. All these aspects of ManFI feature a high degree of interaction between the speakers and the audience.

ManFI is one of only a few workshops that are completely devoted to managing the Future Internet. ManFI encourages the development of new ideas and promising approaches; this further encourages extensive discussion. Science needs this kind of exploratory adventure, and we have been strongly motivated to continue preserving this atmosphere of exploration and discussion in this year's technical program. With the advent of increasing malware, the depletion of IPv4 address, the emergence of cloud computing, and many other issues becoming more and more important, we believe that this year's edition of ManFI will help stimulate other researchers in considering how to manage the Future Internet.

The ManFI 2011 program featured a keynote address, presentations of eight technical papers, and two invited talks. All submitted papers were reviewed by at least three members of the technical program committee.

2 Keynote Address

The opening keynote titled, "Optimization, Control and Management of Multilayered Dynamically Reconfigurable Networks of the Future," was given by Deep Medhi, who is Professor of Computer Science & Electrical Engineering within the School of Computing and Engineering at the University of Missouri-Kansas City. Deep pointed out that most research thus far has focused only on two-layer networks, but more than two layers are involved in practical cases. Multilayer networks should be considered for the research of the Future Internet, as well as the current Internet. A communication network is on top of another communication network such as the IP network over the OTN (optical transport network) over the DWDM network; each such communication network has its own routing that operates on different timescales and information granularity along with its own technological constraints. He summarized several key research issues on multilayer networks such as the stability of the system when routing in each layer is highly dynamic, and management coordination between layers.

3 Technical Paper Sessions

The technical paper sessions consisted of three paper sessions and one session for the invited papers. A total number of eight papers was selected for presentation at the workshop. Accepted papers represented the latest results in research and development in the management of the Future Internet, and covered topics including architectural aspects of the management of the Future Internet, shortcomings of current management of the Internet, surveys of Future Internet research activities and how they approach management, automation of management functionality, and more. In the following, we provide a brief overview of the contributions of each paper.

- Roberto Riggio (CREATE-NET) presented "A Distributed Network Monitoring Framework for Wireless Networks". This paper described a distributed network monitoring framework, specifically developed for wireless multi-hop networks. The system architecture and the protocols were presented. The evaluation of the proposed method was done over a real-world IEEE 802.11-based mesh testbed. Experimental results showed that the framework generates a limited amount of traffic, and that the system is able to consistently recover from node failures.
- Deep Medhi (University of Missouri-Kansas City) presented "Network Virtualization in GpENI: Framework, Implementation and Integration Experience". This paper described a framework, implementation and integration experience with network virtualization in GpENI [3]. In particular, this is described through their experience of implementing and integrating the XORP (eXtensible Open Router Platform) routing platform into Great Plains Environment for Network Innovation—Virtual Network Infrastructure (GpENI-VINI).
- David Hausheer (University of California, Berkeley and University of Zurich) presented "Towards a Compelling New Internet Platform". In this paper, he sketched the characteristics that he thinks a new Internet platform should have in order to be compelling. He argued for a platform that offers rich programmability at low performance cost and that separates traffic to enhance security and to limit interference among applications. Moreover, the platform should be open and accessible to a wide community of users and have a high usability in terms of being easily programmable by application developers.
- Sin-Seok Seo (POSTECH) presented "OSLAM: Towards Ontology-based SLA Management for IPTV Services". He analyzed various IPTV performance indicators including Device Performance Indicators (DPIs), Key Performance Indicators (KPIs), and Key Quality Indicators (KQIs) from various standard organizations such as ITU-T, DSL Forum, ATIS, TM Forum, and ETSI. He suggested an IPTV performance indicator hierarchy by extending the DEN-ng information model [4]. He described the proposed architecture that uses an ontology and Semantic Web Rule Language to manage SLAs, and more specifically to detect SLA violations.
- Leonidas Lymberopoulos (National Technical University of Athens) presented "Managing Federations of Virtualized Infrastructures: A Semantic-Aware Policy Based Approach". He described his work toward organizing and

managing various forms of federations of virtualized infrastructures. To cater for context awareness, he planned for a common information model, based on the Network Description Language (NDL), capturing a common set of abstractions of virtualized resources and services, nodes, routers and switches, custom network topologies with specific bandwidth demands, etc.

- Klass Roobroeck (Ghent University) presented "Optimized Network Utilisation through Buffering in PCN enabled Multimedia Access Networks". This paper pointed out the underutilization problem of centralized admission control mechanisms. Measurement based admission control mechanisms, such as the IETF Pre-Congestion Notification (PCN), have been proposed to allow better network utilization. However, PCN still introduces unnecessary bandwidth headroom caused by the variable bit rate of videos. This paper proposed an additional buffering step before traffic enters the PCN domain and determined configuration guidelines for the parameters. The performance of the proposed method was evaluated via an NS-2 simulator [5] and the evaluation results showed a 26.5% increase of network utilization.
- Cathryn Peoples (University of Ulster) presented "Context-Aware Characterisation of Energy Consumption in Data Centres". This paper demonstrated how approaches to energy challenges in data centers are standalone, tackling individual aspects such as optimizing temperature or responding to platform type. Energy-managing frameworks do not consider effects of paths traversed between clients and data centers. The proposed Data Centre Energy Efficient Context-Aware Broker (DCe-CAB) algorithm that has scope to utilize a range of attributes and to optimize the effectiveness of DC selection and operation was presented.

4 Invited Talks

There were two invited talks at ManFI 2011. The first invited talk was given by Martin Johnsson (FAME, TSSG, Waterford Institute of Technology) who presented "Inherently Self-Managed Networks: Requirements, Properties and an Initial Model". Martin gave an overview of selected recent advances in network architectures supporting self-management capabilities including IBM's MAPE-K control loop, 4WARD project, FOCALE architecture, and FAME project. He identified both their strengths and limitations as well. This analysis provided input for a definition of the requirements and core properties for networks to become inherently self-managed. The main requirements for inherently self-managed network are four-fold: re-application to all parts of a system, crossing system boundaries, enforcement and monitoring, and self-mutate. The core properties are recursion, network algebra, design by contract, and system DNA. He then outlined a generic model termed "Netcell" that seeks to support the identified requirements and core properties.

The second invited talk was given by Sven van der Meer, who is a Senior Research Fellow for network and service management at Telecommunications Software and Systems Group (TSSG) in Waterford Institute of Technology (WIT). He presented an experience of building a policy management system. Existing

policy environments are different, so it is hard to integrate and to manage them. The talk focused on how they built a policy management system using a comprehensive methodology to understand shared semantics.

5 Concluding Remarks

All technical papers presented at ManFI 2011 were published with the technical papers from another IM 2011 workshop called 1st IFIP/IEEE Workshop on Managing Federations and Cooperative Management in a joint publication called the Proceedings of Management of Federations and Future Internet 2011, No. 14, Germany, as a volume of Multicon Lecture Notes, 2011, ISBN: 978-3-930736-17-1. The papers were also published in IEEE Xplore. Further, all the program information of the workshop is available online at: http://www.manfi.org.

In summary, the workshop was very successful. All presentations were given as we planned and there were many fruitful discussions during and between sessions. We would like to thank the IM 2011 workshop chairs for their organizational support as well as all the authors and participants of ManFI 2011. The next ManFI workshop is planned to be organized again in collocation with NOMS 2012 in Maui, Hawaii. If anyone is interested in getting involved in the organization and planning of ManFI 2012, please contact Prof. James Hong (jwkhong@postech.ac.kr).

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Author Biographies

Sungsu Kim is a PhD student in the Department of Computer Science and Engineering at POSTECH, Pohang, Korea. He received a BS degree in the Department of Electrical and Computer Engineering from Sungkyunkwan University in 2007. His research interests include autonomic network management and semantic peer-to-peer networking.

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John Strassner is a Professor in the Division of IT Convergence Engineering at the Pohang Univ. of Science and Technology (POSTECH), and leads the Autonomics Group Previously, he was a Visiting Professor at Waterford Institute of Technology in Ireland, where he worked on various FP7 and Irish research programs. Before that, he was a Motorola Fellow and Vice President of Autonomic Research at Motorola Labs, where he was responsible for directing Motorola's efforts in autonomic computing and networking, policy management, and knowledge engineering. Previously, John was the Chief Strategy Officer for Intelliden and a former Cisco Fellow. John is the Chairman of the Autonomic Communications Forum, and the past chair of the TMF's NGOSS SID, metamodel and policy working groups, along with the past chair of several IETF and WWRF groups. He has authored two books (Directory Enabled Networks and Policy Based Network Management), written chapters for 5 other books, and has been co-editor of 5 journals dedicated to network and service management and autonomics. John is the recipient of the Daniel A. Stokesbury memorial award for excellence in network management, is a member of the Industry Advisory Board for both Univ. of California Davis and DePaul Univ., a TMF Fellow, and has authored over 225 refereed journal papers and publications.

Taesang Choi is a Principal Engineering Staff in ETRI, having joined the institute in 1996 after research and development careers on network and service management of telecommunications during his Ph.D studies at the University of Missouri at Kansas City. He has successfully managed a number of projects in the area of telecommunications, especially in Internet traffic engineering, measurement and analysis, and QoS management. He has had substantial experience as an educator, workshop facilitator and public speaker. He has spoken at various regional and international conferences and workshops (NOMS, APNOMS, IM, etc.) as a technical session speaker and tutorial speaker. He has worked as an active organizing committee member in a number of conferences, workshops and symposiums. He has also reviewed and written many technical papers in a number of conferences and journals. He has also been actively contributed to various standardization organizations such as DAVIC (Digital Audio Visual Council), ITU-T and IETF in the area of real-time high quality and high speed audio visual multimedia services, Internet traffic engineering, Internet traffic measurement and analysis, and Future Internet since 1993.