CONVINcE
D6.2.1

Publication Report #1

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1   EXECUTIVE SUMMARY

The goal of the document is to report the publication activities of the CONVINcE project partners during the first half of the project. The report includes three main parts:

1) Potential events that are relevant to the general idea and scope of the project

    As the project addresses the challenge of reducing power consumption in IP-based video networks, a list of the relevant journals, conferences, workshops and exhibitions has been prepared, including their name, scope and goal of each, with the goal of to make a brief and summarized check list of potential opportunities to publish and disseminate project outputs. This list covers most of the topics that is targeted by CONVINcE project, such as video encoding/transcoding, adaptive bit streaming, core/access networks, energy consumption in CDNs, SDN/NFV, routing protocols, power and QoE measurements and etc.

2) Detail information of the current published scientific papers in the project

    So far, partners have published in summary 17 scientific papers out of their activities in the projects. The main topics that are covered by the published papers are:
    -   Minimizing content access delay in the general CDN architecture,
    -   Energy consumption in content delivery networks,
    -   Performance evaluation of distributed data delivery on Mobile devices using WebRTC,
    -   Key establishment protocols in WSNs,
    -   Characterizing new links and content sharing strategies among OSNs users,
    -   Energy saving in content-oriented networks,
    -   Comparing performance measurements,
    -   New schemes to reduce energy consumption along the e2e routing path.

    The papers have published in the high ranked international conferences, journals and workshops such as ICC'15, SNCNW'15, ASONAM'15, EUCNC'15 and IEEE Communication Magazine.

3) A summary of the partners' participation to the project's relevant events. Partners of the project participated to 11 scientific events such as international conferences and workshops, where the goal was to present the main results of the project technical activities including the published papers, to the community.

This task is an ongoing action of the project and in the next version of this deliverable "D.6.2.2", we will update this report with new publication results out of the CONVINcE project. One of the defined action in the publication plan of the project is to write a joint paper about the scope of the project and present it in an international conference or workshop.

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2 DOCUMENT HISTORY AND ABBREVIATIONS

2.1 Document history

Version	Date	Description of the modifications
0.1	27.07.2015	Draft of ToC (IMT-TSP)
0.2	29.10.2015	Updated by published papers and participated events
0.3	10.11.2015	Internal review, update the content
0.8	13.11.2015	Final version and ready to be reviewed
0.9	23.11.2015	Reviewed by TVN
1.0	26.11.2015	Revised and updated based on the review phase
1.1	09.12.2015	Updated to the final version

2.2 Abbreviations

CDNs	Content Delivery Networks
ITS	Intelligent Transportation Systems
C2R3	Cooperative Content Replication and Request Routing
QoE	Quality of Experience
HIP	Host Identity Protocol
WSNs	Wireless Sensor Networks
OSNs	Online Social Networks
IoT	Internet of Things

3 INTRODUCTION

The project leads significant scientific output and therefore publication is a significant component of the project output. Based on the project proposal, publication strategy has two different main goals, publishing scientific results of the project in worthwhile journals and conferences, and disseminating project outputs among researchers and industry by participating to related events. The purpose of this document is to gather the information on publications.

3.1 Document structure

This report covers the result of two main goals of Task 6.2:
- Scientific publications of the project activities
- Participation in workshops and conferences and other relevant events.

Both lead to present and disseminate project outputs.

In section 4, there is the list of possible related events and journals that can be targeted to publish papers and present project results. Section 5 presents the general information of published or submitted scientific papers. In section 6 we give a list of events that partners have participated to present project outputs so far. Section 7 concludes the document and summarizes the publication results.

4 POSSIBLE EVENTS TO BE TARGETED

Here is the list of possible journals, conferences, workshops and exhibitions that cover the main topic of project. This list can be considered by partners to publish their stand-alone papers, or joint paper addressing the main goals of the project. The list is also consisting of relevant workshops and exhibitions to attend and present project outputs.

4.1 Relevant Journals

- IEEE Communication Magazine

IEEE Communications Magazine provides timely information on all aspects of communications: monthly feature articles describe technology, systems, services, market trends, development methods, regulatory and policy issues, and significant global events.

- IEEE Network Magazine

IEEE Network, published bimonthly, offers readers topics of interest to the networking community. As such, IEEE Network provides a focus for highlighting and discussing major computer communications issues and developments.

- IEEE Transactions on Smart Grid

The IEEE Transactions on Smart Grid is a cross disciplinary and internationally archival journal aimed at disseminating results of research on smart grid that relates to, arises from, or deliberately influences energy generation, transmission, distribution and delivery.

- IEEE Transactions on Intelligent Transportation Systems

The IEEE Transactions on ITS is concerned with the design, analysis, and control of information technology as it is applied to transportation systems. The IEEE ITS Transactions is focused on the numerous technical aspects of ITS technologies spanned by the IEEE.

- Elsevier Journal of Computer Network

Computer Networks is an international, archival journal providing a publication vehicle for complete coverage of all topics of interest to those involved in the computer communications networking area.

- Elsevier Journal of Network and Computer Applications

The Journal of Network and Computer Applications welcomes research contributions, surveys and notes in all areas relating to computer networks and applications thereof.

- International Journal of Communication Systems (Wiley)

The International Journal of Communication Systems provides a forum for R&D, open to researchers from all types of institutions and organizations worldwide, aimed at the increasingly important area of communication technology. The Journal's emphasis is particularly on the issues impacting behavior at the system, service and management levels.

4.2 Relevant Conferences

- IEEE International Communication Conference (ICC)

ICC is an annual international academic conference as an opportunity to share pioneering research ideas and developments, it is also an excellent networking and publicity event, giving the opportunity for businesses and clients to link together, and presenting the scope for companies to publicize themselves and their products among the leaders of communications industries from all over the world.

- IEEE GLOBECOM

IEEE GLOBECOM is one of two flagship conferences of the IEEE Communications Society, together with IEEE ICC. It is one of the most significant scientific events of the networking and communications community, a must-attend event for scientists and researchers from industry and academia.

- IEEE Conference on Computer Communications (INFOCOM)

INFOCOM addresses key topics and issues related to computer communications, with emphasis on traffic management and protocols for both wired and wireless networks.

- IEEE GreenCom

IEEE Greencom is an online conference on green communications, and is dedicated to addressing the challenges in energy-efficient communications and communications for green technologies.

- International Conference on Cloud Computing (CLOUD)

The IEEE Cloud is a prime international forum for both researchers and industry practitioners to exchange the latest fundamental advances in the state of the art and practice of cloud computing, identify emerging research topics, and define the future of cloud computing.

4.3 Relevant Workshops and Seminars

- ACM: Workshop on Energy-Efficient Data Centers

It is a workshop co-located with the ACM e-Energy conference, the International Conference on Future Energy Systems.

- IEEE/ACM: Extreme Green & Energy Efficiency in Large Scale Distributed Systems

The workshop aims to provide a venue for discussion of ideas that can demonstrate "more than small % solution" to energy efficiency and their applicability to "real world".

- IEEE(ICC): Next Generation Green ICT

This workshop is co-located with ICC conference, it aims to find an opportunity to detect, prevent, and automate solutions for energy efficiency as well as creating a more sustainable society. It has three main areas : Energy Efficiency in ICTs, ICTs for Energy Efficiency, and Green Broadband Access.

- IEICE: International Workshop on Energy Efficiency in Wireless Networks

The aim of Workshop is to present and discus the latest research and development issues in the area of energy efficiency in wireless networks.

- IEEE Globecom: Green Standardization and Industry Issues for ICT and Relevant Technologies (GSICT)

This workshop is to collect results and visions of standards, regulations and public policies on global green revolutions relevant to information and communication technologies (ICT) and other relevant issues, including both the impact of ICT on the environments and the impact of environments on ICT.

4.4 Relevant "industry-oriented" opportunities

- IBC (http://www.ibc.org/page.cfm/link=1029)

IBC is the premier annual event for professionals engaged in the creation, management and delivery of entertainment and news content worldwide Originally the International Broadcasting Convention, IBC has evolved from its technical broadcast roots and today it encompasses the whole breadth of media creation management and delivery, from online content to digital cinema, from automated workflows to high resolution capture and display.

- NAB (http://www.nab.org/events/awards/overview.asp?id=2280)

As the premier trade association for broadcasters, NAB advances the interests of our members in federal government, industry and public affairs; improves the quality and profitability of broadcasting; encourages content and technology innovation; and spotlights the important and unique ways stations serve their communities.

- Greentouch (http://www.greentouch.org/)

GreenTouch was a consortium of leading Information and Communications Technology (ICT) industry, academic and non-governmental research experts dedicated to fundamentally transforming communications and data networks, including the Internet, and significantly reducing the carbon footprint of ICT devices, platforms and networks.

4.5 Partners' intention to participate in conferences & exhibitions

This Table is based on the final CPP of the project and shows different partners intention to participate or disseminate in relevant conferences and exhibitions.

Partner name	ACM MSWIM	GreenCom	IEEE IPDP	IEEE Cloud	IBC 2015	IBC2 016	IEEE IPDPS	QoMEX2015 & 2016	ACM SenSys	ACM EuroSys	INOC	ITC	COMM 2016	WWRF 2016	CES 2016	MWC 2016	IEEE GLOBACOM	ANGA 2015	ANGA 2016	IEEE SDN4FNS
TVN					x	x														
Orange Labs		x									x	x								
Kaliterre		x																		
CEA LIST	x	x							x	x										
IMT		x		x																
VTT							x													
University of Oulu	x	x							x	x	x							x		
Ericsson				x					x							x				x
Teleste					x	x												x	x	
BTH		x						x			x	x								
Lund University	x	x	x			x														
TelHoc		x														x				
SONY Mobile						x									x	x				

Table 1 - Conferences & exhibitions relevant to the topics of CONVINcE project

5   PUBLISHED SCIENTIFIC PAPERS

This section includes the scientific publications of the project which is the result of individual partners' activities and the published outcome of their research work out of the CONVINcE project.

In summary, so far, we have 17 published papers in 15 conferences and 2 journals where CONVINcE project's results are disseminated. The following table includes a summary of published/submitted scientific papers.

5.1 Summary of published papers

Paper Title	Journal/Conference name	Journal/Conference Date	Partner Name
REPLICA T7-16-128 - A 2048-threaded 16-core 7-FU chained VLIW chip multiprocessor	48th Asilomar Conference on Signals, Systems, and Computers	November 2-5, 2014	VTT
Towards optimal content replication and request routing in content delivery networks	IEEE International Conference on Communications (ICC 2015), UK, London	8-12 June, 2015	LU
A Simulation Package for Energy Consumption of Content Delivery Networks (CDNs)	OMNeT++ Community Summit 2015, Switzerland, Zurich	3-4 September, 2015	LU
Performance Evaluation of Distributed Data Delivery on Mobile Devices Using WebRTC	IEEE International Wireless Communications & Mobile Computing Conference (IWCMC 2015)	August 24-27, 2015	UO
RADE: Resource-aware Distributed Browser-to-browser 3D Graphics Delivery in the Web	IEEE International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob 2015)	October 19-21,2015	UO
Proxy-based End-to-End Key Establishment Protocol for the Internet of Things	IEEE ICC 2015 Workshop on SECURITY AND PRIVACY FOR INTERNET OF THINGS AND CYBER-PHYSICAL SYSTEMS,	8-12 June, 2015	UO
Efficient Key Establishment for Constrained IoT Devices with Collaborative HIP-based Approach	IEEE GLOBECOM 2015, At San Diego, CA, USA	2015	UO
Group Key Establishment for Secure Multicasting in IoT-enabled Wireless Sensor Networks	IEEE LCN 2015, At Clearwater Beach, Florida, USA	2015	UO
Group Key Establishment for Enabling Secure Multicast Communication in Wireless Sensor Networks Deployed for IoT Applications	IEEE Access	2015	UO
Characterization of Cross-posting Activity for Professional Users Across Major OSNs	ASONAM 2015	25-28 August, 2015	IMT
Link Prediction for New Users in Social Networks	ICC 2015	8-12 June, 2015	IMT

How Far is Facebook from Me? Facebook Network Infrastructure Analysis	IEEE Communication Magazine	2015	IMT
Energy saving in content-oriented networks	CIE'45 proceedings	2015	OL
Hypervisors vs. Lightweight Virtualization: a Performance Comparison	Workshop on Containers (WoC) at IEEE IC2E	March 2015	ER
On the Performance of Uplink Transmission in Cognitive Radio Mesh Networks	Swedish National Computer Networking Workshop (SNCNW)	May, 2015	BTH
On Prioritized Uplink Transmission in Cognitive Radio Mesh Networks	EUCNC	June 29/July 2, 2015	BTH
CONVINcE : Greening of Video Distribution Networks	3rd International Symposium on Energy Challenges and Mechanics - towards a big picture	7-9 July 2015	BTH

Table 2 - Summary of Published Scientific Papers

5.2 Details on published papers

This section provides detailed information on the abovementioned papers. It also includes the connection to the project for each paper.

Lund University	
Title	Towards optimal content replication and request routing in content delivery networks
Authors and Affiliation	Payam Amani, Saeed Bastani, Bjorn Landfeldt. (Department of Electrical and Information Technology, Lund University, Sweden)
Event	2015 IEEE International Conference on Communications (ICC 2015), UK, London
Abstract	Cooperative content replication and request routing (C2R3) has emerged as a promising technique to enhance the efficiency of content delivery networks (CDN). Most existing approaches to C2R3 focus on efficient bandwidth usage and assume a hierarchical CDN architecture targeted towards the delivery of specific content types (e.g., video). Therefore, C2R3 problem of covering the broad range of content types with minimum content access delay in a general CDN architecture has attracted little attention. As a potential solution to C2R3, cooperative web caching techniques have become mature. However, these techniques were designed to improve performance indicators tailored to web contents only (i.e., hit rate and byte hit rate). Arguably, improving such indicators does not necessarily lead to optimal access delay especially when the current trend of user-generated contents with diverse popularities and sizes are taken into account. In this paper, we formulate C2R3as an optimization problem with the objective of minimizing content access delay in a general CDN architecture. A new performance indicator is introduced, and two popularity-based cooperative algorithms are proposed to approach the NP-hard C2R3 problem. Under broad ranges of cache size and popularity distribution parameters, we compare the proposed methods with a cooperative recency-based web caching method. Our simulation results show that the popularity-based methods outperform the recency-based method, and demonstrate close to optimal performance in representative scenarios of real-world situations.
Connection to the project	In this paper, we have proposed an optimization model and a distributed algorithm for minimum-latency content distribution in CDNs. This work is in alignment with the goals of CONVINcE project due to the following reasons: first, energy consumption is proportional to content access delay, i.e. the higher the delay the higher the energy consumption per bit of content delivery. Thus, inarguably, improving the access delay will results in the enhancement of energy consumption, although the optimal solutions for the two cases may not coincide. Second, we have addressed the case of user-generated contents characterized by a heavy-tail popularity distribution which, again, conforms to the key objectives of CONVINcE project in addressing those challenges related to the new trend of content generation on the Internet.
Title	A Simulation Package for Energy Consumption of Content Delivery Networks (CDNs)
Authors and Affiliation	Mohammadhassan Safavi, Saeed Bastani. (Department of Electrical and Information Technology, Lund University, Sweden)
Event	OMNeT++ Community Summit 2015, Switzerland, Zurich
Abstract	Content Delivery Networks (CDNs) are becoming an integral part of the future generation Internet. Traditionally, these networks have been designed with the goals of traffic offload and the improvement of users' quality of experience (QoE), but the energy consumption is also becoming an indispensable design factor for CDNs to be a sustainable solution. To study and improve the CDN architectures using this new design metric, we are planning to develop a generic and flexible simulation package in OMNeT++. This package is aimed to render a holistic view about the CDN energy consumption behavior by incorporating the state-of-the-art energy consumption models proposed for the individual elements of CDNs (e.g. servers, routers, wired and wireless links, wireless devices, etc.) and for the various Internet contents (web pages, files, streaming video, etc.).

Connection to the project	In this paper, we have proposed a simulation package to be developed in OMNeT++ discrete event simulation software. The layered and modular architecture of the proposed package allows for incremental implementation of the simulation components, one at a time, and with regards to our demands in the CONVINcE project (mainly in WP3). The main purpose of this simulation package is to enable large-scale experiments about the behaviour of energy consumption in content delivery networks. This simulation package is aimed to assess and verify the models/protocols subject to development within the Task 3.3 of WP3 (energy saving in CDNs).

University of Oulu - Center for Internet Excellence	
Title	Performance Evaluation of Distributed Data Delivery on Mobile Devices Using WebRTC
Authors and Affiliation	Arto Heikkinen, Timo Koskela, Mika Ylianttila, Center for Internet Excellence, University of Oulu, Finland
Event	IEEE International Wireless Communications & Mobile Computing Conference (IWCMC 2015), August 24-27, Dubrovnik, Croatia
Abstract	Direct peer-to-peer connectivity between web browsers is becoming reality with the emerging and constantly developing WebRTC technology stack. This opens possibilities for new kind of plugin-free web applications, such as browser-to-browser file transfers and multi-party conferencing. In this paper, the performance of WebRTC on mobile devices is evaluated with different mobile device, wireless network connectivity and web browser configurations. The evaluation was conducted with a WebRTC test environment that was implemented based on PeerJS JavaScript library and PeerServer signaling server. The measurements include session establishment delay and overhead, session maintenance overhead, resource consumption of multiple simultaneous file transfers and efficiency of different file transfer approaches. Based on the results, the delay for establishing a WebRTC connection may in the worst cases exceed even 10 seconds making it a serious bottleneck. However, from the standpoints of memory consumption and CPU load, high-end mobile devices are very capable of running multiple simultaneous WebRTC connections for data transfers. The results of this paper provide new insight to researchers, application and browser developers and WebRTC standardization bodies.
Connection to the project	This paper is the foundation for our research work with WebRTC-based green video streaming/delivery solutions. Based on this preliminary evaluation of generic performance measurements with WebRTC, we can develop more energy efficient solutions for video networking utilizing WebRTC's video streaming capabilities while avoiding some bottlenecks such as slow connection establishment. The evaluation on different file transfer approaches can be utilized for developing more efficient and less energy consuming video-on-demand solutions. Our findings indicate that transmitting data between web browsers using multiple simultaneous data channels can improve the transmission performance. This can reduce also energy consumption as the radio interface needs to be active for a shorter period of time.
Title	RADE: Resource-aware Distributed Browser-to-browser 3D Graphics Delivery in the Web
Authors and Affiliation	Timo Koskela, Arto Heikkinen, Erkki Harjula, Mikko Levanto, Mika Ylianttila,Center for Internet Excellence, University of Oulu, Finland
Event	IEEE International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob 2015), October 19-21, Abu Dhabi, UAE [Accepted]
Abstract	With the introduction of novel standardized web technologies such as WebGL, 3D virtual environments (VEs) are making their way into the web. Concurrently, resource rich mobile devices, such as smartphones and tablets, have become the primary access medium for the web. This paper introduces a method called RADE that enables resource-aware P2P-assisted 3D asset delivery in a web browser using WebRTC. Use of P2P technology in 3D asset delivery can (1) decrease the load on 3D asset servers; (2) decrease the application response times; and (3) reduce the operational costs of VE service providers. The performance and resource fairness of RADE was evaluated in real-life wireless networks using a prototype implementation. Based on the results, RADE can significantly reduce the server load and the 3D asset delivery times especially when 3D asset servers are under heavy load. For instance, with a scarce server bandwidth of 2Mbps, use of RADE resulted in 55% shorter 3D asset delivery times on average. Although RADE has been developed for 3D asset delivery, it is applicable for many types of web applications, including video delivery.

Connection to the project	This paper introduces RADE, a resource-aware approach for distributed data delivery between web browsers using WebRTC. Although the focus of the paper is in 3D asset delivery, the same resource-aware method can be used also for video delivery applications. This is supported by the fact that one of the main and most advertised features of WebRTC is video streaming between web browsers. Resource-awareness is an important factor when designing a energy-efficient distributed video delivery system. Energy consumption can be optimized by preferring the most energy-efficient nodes and battery life can be extended by preferring the nodes with the highest battery levels. We are planning to utilize this approach for video delivery and compare the energy-efficiency to a more traditional client-server based video delivery.

University of Oulu - Center for wireless Communications	
Title	Proxy-based End-to-End Key Establishment Protocol for the Internet of Things
Authors and Affiliation	Pawani Porambage (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. pporamba@ee.oulu.fi), An Braeken (Vrije Universiteit Brussel, INDI, 1000 Brussels, Belgium. an.braeken@vub.ac.be), Pardeep Kumar (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. pkumar@ee.oulu.fi), Andruei Gurtov (Helsinki Institute for Information Technology (HIIT) and Department of Computer Science, Aalto University, FI-00076 Aalto, Finland. gurtov@cs.helsinki.fi), Mika Ylianttila (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. mika.ylianttila@ee.oulu.fi)
Event	IEEE ICC 2015 Workshop on SECURITY AND PRIVACY FOR INTERNET OF THINGS AND CYBER-PHYSICAL SYSTEMS, At London, UK
Abstract	The Internet of Things (IoT) drives the world towards an always connected paradigm by interconnecting wide ranges of network devices irrespective of their resource capabilities and local networks. This would inevitably enhance the requirements of constructing dynamic and secure end-to-end (E2E) connections among the heterogeneous network devices with imbalanced resource profiles and less or no previous knowledge about each other. The device constraints and the dynamic link creations make it challenging to use pre-shared keys for every secure E2E communication scenario in IoT. We propose a proxy-based key establishment protocol for the IoT, which enables any two unknown high resource constrained devices to initiate secure E2E communication. The high constrained devices should be legitimate and maintain secured connections with the neighboring less constrained devices in the local networks, in which they are deployed. The less constrained devices are performing as the proxies and collaboratively advocate the expensive cryptographic operations during the session key computation. Finally, we demonstrate the applicability of our solution in constrained IoT devices by providing performance and security analysis.
Connection to the project	This paper proposes a proxy-based key establishment protocol for resource-constrained networking devices in the context of the Internet of Things. The main objective of deriving this key establishment protocol is to obtain a secure end-to-end communication channel between two completely unknown devices. In Task 4.3, it is expected to develop energy saving mechanisms for security and privacy on terminals. This work is an initial attempt of deriving such lightweight energy security solutions.
Title	Efficient Key Establishment for Constrained IoT Devices with Collaborative HIP-based Approach
Authors and Affiliation	Pawani Porambage (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. pporamba@ee.oulu.fi), An Braeken (Vrije Universiteit Brussel, INDI, 1000 Brussels, Belgium. an.braeken@vub.ac.be), Pardeep Kumar (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. pkumar@ee.oulu.fi), Andrei Gurtov (Helsinki Institute for Information Technology (HIIT) and Department of Computer Science, Aalto University, FI-00076 Aalto, Finland. gurtov@cs.helsinki.fi), Mika Ylianttila (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. mika.ylianttila@ee.oulu.fi)
Event	IEEE GLOBECOM 2015, At San Diego, CA, USA
Abstract	The Internet of Things (IoT) technologies interconnect wide ranges of network devices irrespective of their resource capabilities and local networks. The device constraints and the dynamic link creations make it challenging to use pre-shared keys for every secure end-to-end (E2E) communication scenario in IoT. Variants of Host Identity Protocol (HIP) are adopted for constructing dynamic and secure E2E connections among the heterogeneous network devices with imbalanced resource profiles and less or no previous knowledge

	about each other. We propose a collaborative HIP solution with an efficient key establishment component for the high constrained devices in IoT, which delegates the expensive cryptographic operations to the resource rich devices in the local networks. Finally, we demonstrate the applicability of the key establishment in collaborative HIP solution for the constrained IoT devices rather than the existing HIP variants, by providing performance and security analysis.
Connection to the project	This paper is an extension of IEEE ICC paper (Ref. [1] in paper). In this work, we exploit the well-known Host Identity Protocol (HIP) in a collaborative manner to establish secure end-to-end communication channels between two completely unknown devices. It is proven in the performance analysis that the proposed protocol exhibits a very low energy profile. In Task 4.3, it is expected to develop energy saving mechanisms for security and privacy on terminals. This work derives such lightweight energy security solutions with low energy consumptions. Furthermore, we have described an application scenario for E-health, where the protocol can be deployed to initiate secure E2E connections between scalar and multimedia sensors.
Title	Group Key Establishment for Secure Multicasting in IoT-enabled Wireless Sensor Networks
Authors and Affiliation	Pawani Porambage (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. pporamba@ee.oulu.fi), An Braeken (Vrije Universiteit Brussel, INDI, 1000 Brussels, Belgium. an.braeken@vub.ac.be), Pardeep Kumar (Communication Systems Group, IfI, University of Z¨urich, Binzm¨uhlestrasse 14, CH-8050 Z¨urich, Switzerland. schmitt@ ifi.uzh.ch), Andrei Gurtov (Helsinki Institute for Information Technology (HIIT) and Department of Computer Science, Aalto University, FI-00076 Aalto, Finland. gurtov@cs.helsinki.fi), Mika Ylianttila (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. mika.ylianttila@ee.oulu.fi), Burkhard Stiller (Communication Systems Group, IfI, University of Zürich, Binzm¨uhlestrasse 14, CH-8050 Zürich, Switzerland. stiller@ifi.uzh.ch)
Event	IEEE LCN 2015, At Clearwater Beach, Florida, USA
Abstract	Wireless Sensor Network (WSN) is a fundamental technology of the Internet of Things (IoT). Group communications in the form of broadcasting and multicasting incur efficient message deliveries among resource-constrained sensors in IoT-enabled WSNs. Secure and efficient key management is significant to protect the authenticity, integrity, and confidentiality of multicast messages. This paper develops two group key establishment protocols for secure multicast communications among resource-constrained devices in IoT. The applicability of the two protocols are analyzed and justified by performance and security analysis.
Connection to the project	This paper proposes two group key establishment protocols for securing multicast communication in the context of IoT applications and discusses their performance in different scenarios. It is mentioned in Task 4.3, that one goal is to develop efficient keying algorithms and authentication solutions for secure group communication in multicasting scenarios of Wireless Multimedia Sensor Networks (WMSNs). Our solution provides an answer to the following research question.
Title	Group Key Establishment for Enabling Secure Multicast Communication in Wireless Sensor Networks Deployed for IoT Applications
Authors and Affiliation	Pawani Porambage (Centre for Wireless Communications, University of Oulu, P.o.Box 4500, FI-90014 Oulu, Finland. pporamba@ee.oulu.fi) An Braeken (Vrije Universiteit Brussel, INDI, 1000 Brussels, Belgium. an.braeken@vub.ac.be) Pardeep Kumar (Communication Systems Group, IfI, University of Z¨urich, Binzm¨uhlestrasse 14, CH-8050 Zürich, Switzerland. schmitt@ ifi.uzh.ch) Andrei Gurtov (Helsinki Institute for Information Technology (HIIT) and

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Event	IEEE Access
Abstract	Wireless sensor networks (WSNs) are a prominent fundamental technology of the Internet of Things (IoTs). Rather than device-to-device communications, group communications in the form of broadcasting and multicasting incur efficient message deliveries among resource-constrained sensor nodes in the IoT-enabled WSNs. Secure and efficient key management is in many cases used to protect the authenticity, integrity, and confidentiality of multicast messages. This paper develops two group key establishment protocols for secure multicast communications among the resource-constrained devices in IoT. Major deployment conditions and requirements of each protocol are described in terms of the specific IoT application scenarios. Furthermore, the applicability of the two protocols is analyzed and justified by a comprehensive analysis of the performance, scalability, and security of the protocols proposed.
Connection to the project	This paper is an extension of our work accepted for IEEE LCN (paper #3). The extensions of this work here include the detailed descriptions of mechanisms and schemes along with application scenarios and the discussion of performance, security, and scalability analysis. Similar to paper #3, this work also falls under Task 4.3 of CONVINcE project.

Institut Mines Telecom- Telecom SudParis	
Title	Characterization of Cross-posting Activity for Professional Users Across Major OSNs
Authors and Affiliation	Reza Farahbakhsh(Institut Mines-Telecom, Telecom SudParis), Angel Cuevas(Universidad Carlos III de Madrid), Noel Crespi(Institut Mines-Telecom, Telecom SudParis)
Event	ASONAM 2015
Abstract	Online Social Networks (OSNs) are being intensively used by professional users (e.g., companies, politician, athletes, celebrities, etc) in order to interact with a huge amount of regular OSN users with different purposes (marketing campaigns, customer feedback, public reputation, etc). Hence, due to the large catalog of existing OSNs, professional users usually count with OSN accounts in different systems. In this context an interesting question is whether professional users publish the same information across their OSN accounts, or actually they use different OSNs in a different manner. We define as cross-posting activity the action of publishing the same information in two or more OSNs. In this paper we aim at characterizing the crossposting activity of professional OSN users across three major OSNs, Facebook, Twitter and Google+. To achieve this goal we perform a large-scale measurement-based analysis across more than 2M posts collected from 616 professional users with active accounts in the three referred OSNs.
Connection to the project	The techniques that are used for user profiling and behavior analysis can be reused on the user profiling part of our use case. Also in our use case, we need to understand what amount of information (specifically Video) has been shared in professional users interactions in social networks, which can be extract from this paper results.
Title	Link Prediction for New Users in Social Networks
Authors and Affiliation	Xiao Han(Institut-Mines Telecom, Telecom SudParis), Leye Wang(Institut-Mines Telecom, Telecom SudParis), Son N. Han(Institut-Mines Telecom, Telecom SudParis), Chao Chen(Chongqing University), Noel Crespi(Institut-Mines Telecom, Telecom SudParis), Reza Farahbakhsh(Institut-Mines Telecom, Telecom SudParis)
Event	ICC 2015
Abstract	Link prediction for new users who have not created any link is a fundamental problem in Online Social Networks (OSNs). It can be used to recommend friends for new users to start building their social networks. The existing studies use cross platform approaches to predict a new user's links on a certain OSN by porting his existing links from other OSNs. However, it cannot work when OSNs are not willing to share their data or users do not want to connect different OSN accounts. In this paper, we use a single-platform approach to carry out the link prediction. We explore the users' profile attributes (e.g., workplace, high school and hometown) which can be easily obtained during the new users' sign up procedure. Based on the limited available information from the new user, along with the attributes and links from existing users, we extract three types of social features: basic feature, derived feature and latent Connection feature. We propose a link prediction model using these social features based on Support Vector Machines. Eventually, we rely on a large Facebook data set consisting of 479; 000 users to evaluate our proposed model. The result reveals that our model outperforms the baselines by achieving the AUC value of 0:83; it also demonstrates that each of the proposed social features contributes significantly to the prediction model.
Connection to the project	Part of this approach is to cluster users and find similarity between them based on their profile information. The contribution of this study is related to our use case which is going to keep content near to end users at CDN networks based on similarity between users.

Title	How Far is Facebook from Me? Facebook Network Infrastructure Analysis
Authors and Affiliation	Reza Farahbakhsh(Institut-Mines Telecom, Telecom SudParis), Angel Cuevas(Universidad Carlos III de Madrid, Spain), Antonio M. Ortiz(Montimage, Paris, France), Xiao Han(Institut-Mines Telecom, Telecom SudParis), Noel Crespi(Institut-Mines Telecom, Telecom SudParis)
Event	IEEE Communication Magazine
Abstract	Facebook (FB) is today the most popular social network with more than one billion subscribers worldwide. To provide good quality of service (e.g., low access delay) to their clients, FB relies on Akamai which provides a worldwide content distribution network with a large number of edge servers that are much closer to FB subscribers. In this paper we aim at depicting a global picture of the current FB network infrastructure deployment taking into account both native FB servers and Akamai nodes. Towards this end, we have performed a measurement based analysis during a period of two weeks using 463 PlanetLab nodes distributed across 41 different countries. Based on the obtained data we compare the average access delay that nodes in different countries experience accessing both native FB servers and Akamai nodes. In addition, we obtain a wide view of the deployment of Akamai nodes serving FB users worldwide. Finally, we analyze the geographical coverage of those nodes, and demonstrate that in most of the cases Akamai nodes located in a particular country not only service local FB subscribers, but also FB users located in nearby countries.
Connection to the project	Understanding how a big CDN is deployed and a large customer of CDN is serving its services to end users, is very useful for our solutions which aims to improve the video content delivery in a large CDN.

Orange Labs	
Title	Energy saving in content-oriented networks
Authors and Affiliation	Nicaise Choungmo Fofack, Ali Ridha Mahjoub, Mohamed, Yassine Naghmouchi and Nancy Perrot
Event	CIE'45 proceedings
Abstract	By allowing in-network caching, content-oriented networks may significantly decrease the network congestion, shorten the access delays, and reduce latency when delivering contents. On the other hand, a massive deployment of caches may subsequently increase the operational expenditures (OPEX), and particularly the energy bill of telecommunication operators. In this paper, we address the energy saving problem in content-oriented networks. This consists in determining which caches and which links could be switched off to minimize energy consumption in such a way that all demands are met while respecting capacity constraints. We propose a novel Mixed Integer Linear Programming (MILP) Formulation of the problem to solve the related object caching and traffic routing problem on arbitrary graph-based network topologies. We use CPLEX to solve our model to optimality. Then, we assess several network performance metrics. After all, we develop a routing on shortest path-based heuristic in order to compare our solutions with those given by the standard shortest path-based routing. Finally, we discuss the numerical results. We show that: 1) The metrics of interest provide additional insights on the impact and/or gain of introducing energy-aware caches in a real telecommunication network; 2) The benefits of our model compared to a routing on shortest path-based model: 38.72 % of energy saving is reached using our MILP model.
Connection to the project	The aim of this work is to propose a way to design in-network caching, used to cache videos in the network, while minimizing the energy consumption. It is thus directly connected to the WP3 which is focused on energy saving in the network.

VTT	
Title	REPLICA T7-16-128 - A 2048-threaded 16-core 7-FU chained VLIW chip multiprocessor
Authors and Affiliation	Martti Forsell, Jussi Roivainen
Event	Proceedings of the 48th Asilomar Conference on Signals, Systems, and Computers, November 2-5, 2014
Abstract	Processor-based solutions are getting increasingly popular over dedicated logic/accelerators among embedded system designers due to their flexibility and programmability. The drawbacks - weaker performance and higher power consumption - are usually compensated with multicore and application-specific technologies. Unfortunately, these optimizations - exploiting parallelism and heterogeneity - lead to direction that makes programming difficult and result to less flexible designs. REPLICA is VTT's effort to solve the performance and programmability problems of current multicore processors without tampering flexibility. For performance, it addresses the essence of parallel computing - cost-efficient synchronization, high intercommunication bandwidth and latency toleration - with a new collection of architectural techniques: multithreading, sparse/multimesh network-on-chip and wave-based synchronization. Programmability is made simple by supporting efficient execution of synchronous parallel algorithms and flexibility is provided with parametric nature of the architecture allowing for highly different configurations. In this paper we introduce a 2048-threaded 16-core prototype of the REPLICA chip multiprocessor. The main principles of the architecture as well as the structure of the prototype are explained. Preliminary comparison to current alternatives is given.
Connection to the project	Introduction of the 16-core prototype of VTT's REPLICA architecture that will be used as the baseline for comparison against commercial alternatives and tuned for CONVINcE video computing and energy saving.

ERRICSON	
Title	Hypervisors vs. Lightweight Virtualization: a Performance Comparison
Authors and Affiliation	Roberto Morabito, Jimmy Kjällman, Miika Komu
Event	Workshop on Containers (WoC), IEEE IC2E, March 2015
Abstract	Virtualization of operating systems provides a common way to run different services in the cloud. Recently, the lightweight virtualization technologies claim to offer superior performance. In this paper, we present a detailed performance comparison of traditional hypervisor based virtualization and new lightweight solutions. In our measurements, we use several benchmarks tools in order to understand the strengths, weaknesses, and anomalies introduced by these different platforms in terms of processing, storage, memory and network. Our results show that containers achieve generally better performance when compared with traditional virtual machines and other recent solutions. Albeit containers offer clearly more dense deployment of virtual machines, the performance difference with other technologies is in many cases relatively small.
Connection to the project	Performance overhead measurements with different virtualization technologies.

BTH	
Title	On the Performance of Uplink Transmission in Cognitive Radio Mesh Networks
Authors and Affiliation	Yong Yao, Adrian Popescu
Event	Swedish National Computer Networking Workshop (SNCNW) 2015
Abstract	In cognitive radio mesh networks, the unlicensed users are allowed to use spectrum opportunities under the restriction of protection of licensed users. The transmission operation of unlicensed users packets is typically done through multiple mesh routers. In the case of a large amount of packet retransmissions, the performance of the whole network system may degrade. To solve this problem, a queuing buffer based priority scheme for mesh routers is suggested. Based on this scheme, the uplink transmission performance of unlicensed users in cognitive radio mesh networks is studied under the condition of imperfect spectrum sensing. Numerical evaluation results show the feasibility and effectiveness of the suggested priority scheme.
Connection to the project	This paper is about the transmission performance evaluation of Cognitive Radio Mesh Networks (CRMNs). A new priority scheme is suggested for mesh routers to reduce the total packet retransmission rate along the e2e routing path in CRMNs. While according to the section 4.2.3 in the deliverable D1.1.2, the conclusion is therefore that the suggested priority scheme can reduce the total energy consumed along the e2e routing path in CRMNs.
Title	On Prioritized Uplink Transmission in Cognitive Radio Mesh Networks
Authors and Affiliation	Yong Yao, Adrian Popescu
Event	European Conference on Networks and Communications (EUCNC) 2015
Abstract	In cognitive radio mesh networks, the unlicensed users are allowed to use spectrum opportunities under the restriction of protection of licensed users. The transmission operation of unlicensed users packets is typically done through multiple mesh routers. In the case of a large amount of packet retransmissions, the performance of the whole network system may degrade. To solve this problem, a queuing buffer based priority scheme for mesh routers

	is suggested. Based on this scheme, the uplink transmission performance of unlicensed users in cognitive radio mesh networks is studied under the condition of imperfect spectrum sensing.
Connection to the project	This poster paper proposes a priority scheme for CRMNs by giving priority to the relayed packets over the local SU packets. The numerical results show that the total packet retransmission rate along the e2e routing path in CRMNs can be decreased, such thus reducing the total energy consumed along the e2e routing path in CRMNs.
Title	CONVINcE : Greening of Video Distribution Networks
Authors and Affiliation	Adrian Popescu
Event	3rd International Symposium on Energy Challenges and Mechanics - towards a big picture, 2015
Abstract	CONVINcE is a 2.5 years CELTIC-Plus project started in September 2014 that addresses the challenges of reducing the power consumption in IP-based video distribution networks. An end-to-end approach is adopted in the project, from the Head End, where contents are encoded and streamed, to the terminals, where they are consumed, also embracing access and core networks, Content Distribution Networks as well as Video Distribution Networks. A number of 18 industrial and academic partners from 5 European countries are participating in the project. Project leader is Thomson Video Networks in France and scientific project leader is Blekinge Institute of Technology in Sweden.
Connection to the project	It is the overview presentation of the project with focus on the main research questions considered in CONVINcE.

6 PARTICIPATION TO EVENTS

This section shows events some CONVINcE partners participated in to present project outcomes and results.

	Event Name	Location	Involved Partners	Conducted Activities
1	ICC Conference 2015	UK, London	Lund University	Presentation of a paper (Towards optimal content replication and request routing in content delivery networks), participation in panel discussions related to green computing, and demonstration conducted by industrial participants
2	OMNeT++ Summit 2015	Zurich, Switzerland	Lund University	Presentation of a paper (paper title: A Simulation Package for Energy Consumption of Content Delivery Networks (CDNs)), participation in a panel discussion focused on the implementation challenges of our proposed simulation package in OMNeT++
3	SNCNW 2015	Karlstad University, Sweden	Lund University	Presentation of a poster paper (poster title: Energy Efficient Distribution of Video Contents)
4	Keynote speech in PDP'15	Turku, Finland	VTT	REPLICA — Addressing the performance and programmability problems of CMPs with a high throughput architecture and strong model of computation
5	Asonam 2015	Paris	IMT	To present the accepted paper entitled "Characterization of Cross-posting Activity for Professional Users Across Major OSNs". Discussion with other people working in the domain to see potential collaboration.
6	ICC Conference 2015	London	IMT	To present the accepted paper entitled "Link Prediction for New Users in Social Networks". See the potential of organizing a workshop in ICC'16.
7	Sigcomm 2015	London	IMT	Discussion with people in domains of networking and CDNs for future collaboration.
8	EUCNC 2015	Paris	IMT	Discussion with relevant projects people and evaluate the possibility to disseminate CONVINcE in the next edition of this European conferences as a poster or stand.
9	SNCNW 2015	Karlstad University, Sweden	BTH	Presentation of a paper (paper title: On the Performance of Uplink Transmission in Cognitive Radio Mesh Networks)
10	EUCNC 2015	Paris	BTH	Presentation of a poster paper (poster title: On Prioritized Uplink Transmission in Cognitive Radio Mesh Networks)
11	3rd International Symposium on Energy Challenges and Mechanics'15	Scotland, United Kingdom	BTH	Presentation of an invited talk (title: CONVINcE: Greening of Video Distribution Networks)

Table 3 - Events partners participated in

7 CONCLUSIONS

This report summarizes the current publication activities of CONVINcE project during the first half period of the project. It includes two main parts. The first one is about accepted scientific papers in conferences and journals. The second part shows the participation of CONVINcE partners in relevant events to present their results or discuss about topics addressed by the CONVINcE project.