GreenICN Overview

GreenICN: Architecture and Applications of Green Information Centric Networking

Mayutan Arumaithurai
University of Goettingen

“Research Activities and Future of EU/US/JP ICN projects”
Workshop
Waseda University
Tokyo, Japan, October 2015
Consortium

Georg-August-Universität Göttingen (UGO, Germany) EU Coordinator
Contact: Xiaoming Fu (E-mail)

NEC Europe Ltd. (NEE, UK)

CEDEO (CED, Italy)

Telekomunikacja Polska (Orange Labs, Poland)

University College London (UCL, UK)

Consortio Nazionale Interuniversitario per le Telecomunicazioni (CNIT)

KDDI R&D Laboratories Inc. (KDD, Saitama) Japanese Coordinator
Contact: Shigehiro Ano (E-mail)

NEC Corporation (NEJ, Tokyo)

Panasonic Advanced Technology Development Co., Ltd

University of Tokyo (UTO, Tokyo)

Waseda University (UWA, Tokyo)

Osaka University (UOS, Osaka)
Acknowledgement

• Thanks to the scientific community at large for all the work done, the feedbacks received as reviewers/advisors
  – All these helped shape our ideas in the GreenICN project

• Thanks to the GreenICN team
  – One of the first set of EU-Japan projects
    • Great experience and we learnt a lot from one another
    • Different (working) cultures => good for research
Motivation

• Users are primarily interested in content and not where they retrieve the content from.

• Traditional IP
  – host to host connectivity
  – Not flexible and inefficient

• ICN aims to focus on Information delivery
  – allows the user to obtain content from anywhere in the network.
Main Objectives - I (as in Proposal)

ICN has the potential to solve many issues prevalent in IP such as mobility, security, push based delivery and etc..

- Research on ICN is at an early stage
  - Solutions such as CCN, NDN, COPSS exist
  - many key issues still open, including resource control, migration path, energy efficiency, pub/sub and etc.

GreenICN

- Aim: To provide solutions to these issues
- How: By adopting an application driven approach
  - To help identify requirements and evaluate the design/solution

Note: GreenICN did/does not want to create a new architecture

Vision: Have an ICN based global network that supports all kinds of applications (current and future)
GreenICN attempts to solve ICN issues by focusing on key application scenarios

Disaster Management (the aftermath of a disaster)

- Energy and communication resources are at a premium
  - Base stations, end-devices running out of power

- Presence of fragmented networks with only intermittent connectivity
  - Certain routes not available, servers unreachable, presence of mules, delay

- Critical messages to be efficiently and reliably distributed

**NOTE:** NDN, CCN, COPSS that rely on reverse path forwarding does not work out of the box in a fragmented scenario.

Jan Seedorf will present work done and technical achievements in this space in more detail.
Application driven design

GreenICN attempts to solve ICN issues by focusing on key application scenarios

Non-Disaster (Video, text, voice)

- **scalable, efficient** video delivery
  - large scale dissemination, congestion control[1][2]
- **mobility** (including source, group)
  - efficiently support such mobility
- evolution of CDNs/caches and migration

Ioannis Psaras will present the Hotnets work in more detail

---


Non-Disaster (Video)

**Multipath Scheduling**
Investigating mechanisms to support multiple content sources and delivery paths.

**Routing and Mobility Management**
Investigating mechanisms to support source mobility as well as seamless video handover with client mobility.

**Caching**
Investigating caching strategies for video and energy saving.

**Session Aggregation and Cellular Off Loading**
Investigating mechanisms to aggregate multiple video sessions and utilize cache to deliver multiple users.
Application driven design

We and the ICN community are searching for new application scenarios

- Network management for ICN is also important
- One interesting way to approach this is to view Network Management as an application

What is the role of names in Network management?[1]

- Helps focus on the what (which services are needed) instead of the where
- In the process, we created a name based network management framework that is generally applicable [1]

---

GREENICN: BIG PICTURE
Big Picture

Energy Consumption Model / Energy Reduction Policy

Energy Efficiency will be discussed separately

GreenICN apps (sharing and other use-scenarios)

GreenICN Network (Core functionality)

Disaster
Non-Disaster (video)

Other apps specific N/w
Non-disaster (video) specific N/w
Disaster specific N/w

Other Engines
GreenICN middleware

Security TE
Energy TE

High-level API
Mid-level API
Low-level API

COPSS + CCN/NDN

Function Centric Service Chaining (How ICN can help in Network Mgmt)

30/10/2015

Mayutan: GreenICN Overview
GREENICN: ARCHITECTURAL ENHANCEMENTS
Internames[1]

- A name to name model that details upon the various resolution servers/steps required
  - Object resolution, name resolution, routing resolution, reverse path
  - facilitates interoperability, co-existence, scalability

Orice[2] [3]

- Details upon the object resolution server
- Maps user requests to ICN names

The concepts are not new and in fact what many in the ICN community assume is required

- Our goal is to bring more clarity to these concepts and identify the exact role they play


Conclusion I

• A large part of our work has been published in standardization forums and peer reviewed conferences/journals/workshops/poster-demo and etc.
  – Therefore publically available to the community
  – An indication of the quality of the work done

• Input to ICNRG, ITU, MPEG

• ~66 peer reviewed publications
  – publications in peer reviewed top conferences (28), Journals (13), Workshops (13), Poster/Demonstration/short-papers (13)

• 63 invited papers/technical reports available to the public and a book chapter

• 49 non paper related presentations at conferences (keynotes), invited talks, panels, universities, standardization and ICT events
Conclusion I

- A large part of our work has been published in standardization forums and peer reviewed conferences/journals/workshops/poster-demo and etc.
  - Therefore publicly available to the community

- \ (~66 peer reviewed publications
  - Publications in peer reviewed top conferences (28), Journals (13), Workshops (13), Poster/Demonstration/short papers (13)

- 63 invited papers/technical reports available to the public and a book chapter

- 49 non-paper related presentations at conferences (keynotes), invited talks, panels, universities, standardization and ICT events

Three Best Paper Awards


Conclusion III

• Lot more work to be done by the ICN community to
  – Resolve issues
  – Convince the larger community, the benefits of ICN

• The GreenICN consortium’s aim is to support this effort

• Looking forward to active collaboration and working to make ICN a success
Thank You
Questions?