European Commission

Architecture and Applications of Green Information Centric Networking

Information Centric Networking (ICN) is a new paradigm for future Internet where the network provides users with named content, instead of communication channel among hosts. Research on ICN is at an early stage, with many key issues still open, including naming, routing, resource control, security, privacy and a migration path. GreenICN, an EU-JAPAN project, attempts to solve these issues by focussing on two key application scenarios: Disaster Management and Video Delivery.

At A Glance: GreenICN

Architecture and Application of Green Information Centric Networking

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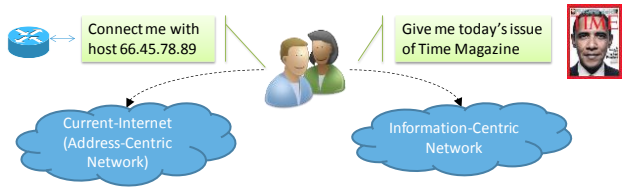
Main Objectives

Information Centric Networking (ICN) is a new paradigm where the network provides users with named content, instead of communication channels between hosts. Users are primarily interested in content and not where they retrieve the content from. ICN aims to focus on Information delivery, instead of the traditional host to host connectivity in IP, thereby allowing the user to obtain content from anywhere in the network. ICN has the potential to solve many issues prevalent in IP such as mobility, security, congestion and etc. Research on ICN is at an early stage, with many key issues still open, including naming, routing, resource control, security, privacy and a migration path from the current Internet. Also missing for efficient information dissemination is seamless support of content- based publish/subscribe. Further, and importantly, current proposals do not sufficiently address energy efficiency. GreenICN aims to bridge this gap, addressing how the ICN network and devices can operate in a highly scalable and energy-efficient way.

GreenICN: A Future Internet architecture that focusses on Information centricity and looks beyond IP to deliver information.

The project will exploit the designed infrastructure to support two exemplary application scenarios: 1) The aftermath of a disaster e.g., hurricane or tsunami, when energy and communication resources are at a premium and it is critical to efficiently distribute disaster notification and critical rescue information. Key to this is the ability to exploit fragmented networks with only intermittent connectivity.

2) Scalable, efficient pub/sub video delivery, a key requirement in both normal and disaster situations. GreenICN will also expose a functionality-rich API to spur the creation of new applications and services expected to drive EU and Japanese industry and consumers into ICN adoption. Our team, comprising researchers with diverse expertise, system and network equipment manufacturers, device vendors, a startup, and mobile telecommunications operators, is very well positioned to design, prototype and deploy GreenICN technology, and validate usability and performance of real-world GreenICN applications, contributing to create a new, low-energy, Information-Centric Internet. Our expertise and experience in standardization will enable us to make major contributions to standards bodies. Our efforts will foster continued close cooperation between both industrial and research communities of Europe and Japan.



Technical Approach

GreenICN is organized as a STREP project. The planned duration of the project is 36 months, which are judged necessary to achieve its ambitious objectives. The work plan comprises six WPs, which have been further divided in tasks. Each task is then split in sub-tasks, each of which is led by a Japanese partner or by an EU partner.

At the core of the GreenICN work plan is the awareness that applications, which are the driving force to realize our objectives, are decomposable into two horizontal layers (mapped to WP2 and WP3). This is done to distribute the problem space into well-defined, manageable set of parallel activities where people with similar skills and expertise work together. Each WP includes both the design of specific applications and the design of functionality specifically required by that scenario. This organization of work is beneficial to focus technical activities, however these WPs are also meant to complement each other. For instance, Disaster recovery mechanisms developed in WP2 can exploit video delivery mechanisms developed in WP3 to deliver videos during disaster situations.

Key Issues

The Key issues this project aims to address in the ICN space are:

1) Design and implement **a mature ICN architecture**, by leveraging, refining and, above all, completing approaches to ICN proposed so far.
2) Define a **smooth migration path** from the current network towards a new, low-energy, Information-Centric Internet. In GreenICN, content will be accessed using ICN style of operation which will be coexisting with the IP network, to maintain full backwards compatibility and protect current investment.
3) Develop ICN-enabled end-systems and **a new interface (API)**, which complements the TCP-UDP/IP socket and offer ICN features to applications. GreenICN will expose such a functionality-rich API to spur the creation of new applications and services, expected to drive EU and Japanese businesses and consumers into ICN adoption.
4) Create a **middleware** platform that provides functionality too complex to be implemented at line-speed in the network layer, and expose rich functionalities allowing end user applications to fully exploit ICN potentials.
5) Maximize the **efficient use of energy** in the network and end-devices. Energy saving is necessary not only to reduce operation costs but also for much more critical needs, such as disaster management situations.
6) Design a **network able to operate both** in **normal conditions and in disaster situations**.
7) Exploit the defined infrastructure to support **two exemplary application scenarios**: 1) The **aftermath of a disaster** e.g., hurricane or tsunami, wherein energy and communication resources are at a premium and it is critical to **efficiently distribute disaster notification** and critical rescue information to various groups and organizations. 2) Scalable, efficient pub/sub **video delivery**, a key requirement in both normal conditions and disasters. Even during the 2011 East Japan Earthquake, many videos generated by consumers were uploaded into the Internet.

Expected Impact

The project is expected to Foster co-operation between Europe and Japan in both industry and research communities and advance the state of the art of ICN. A major impact of wide-scale ICN deployment will be improvements in the way new services and service infrastructures will be developed and operated. GreenICN research will allow application developers to better abstract away location and address related issues for information delivery, so that developers can concentrate on developing service logic. These developments will create new business opportunities and increase the quality of life and economic activity for European and Japanese citizens.