Publish-Subscribe Internet Routing Paradigm

The project aims to develop, implement and validate an internetworking architecture based on the publish-subscribe paradigm, which appears to be one of the most promising approaches to solving many of the biggest challenges of the current Internet. The consortium consists of nine partners: Bulgaria (IPP-BAS), Finland (TKK-HIIT, LMF, NSNF), Germany (RWTH Aachen), Greece (AUEB-RC), Hungary (ETH until end of 2008), and United Kingdom (BT, UCAM since 2010).

PSIRP

Publish-Subscribe Internet Routing Paradigm

PSIRP
PUBLISH-SUBSCRIBE
INTERNET ROUTING
PARADIGM

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Duration: January 2008–September 2010

Total Cost: €4.1m

EC Contribution: €2.5m

Contract Number: INFSO-ICT-216173

Main Objectives

Despite its success, the Internet suffers from several major shortcomings, motivating a fundamental reform of its paradigms and core technologies. A fundamental shortcoming in the design of the current Internet is its imbalance of powers in the favour of the sender who is overly trusted.

This has led into increasing problems with spam mail and distributed denial of service (DDoS) attacks, forcing companies and users to conceal their E-mail addresses and place their systems behind firewalls. The worst consequence of this is that the Internet's full potential is not being realized.

The PSIRP project will design a new internetworking architecture based on the publish-subscribe paradigm.

For almost 30 years the Internet has been coping with ever increasing traffic and new types of applications, including voice and video, while retaining its original architecture, drafted almost 40 years ago. Finally experts all over the world are beginning to agree that a fundamental reform is needed to cope with the challenges of the new millennium.

In light of the ever increasing importance of ICT in all areas of society and the role of the Internet as the central component of ICT, it is vital for Europe to be actively involved in creating the future Internet. This will give Europe an opportunity to influence the design that will affect the lives of every person in the world. It will also give European companies a good starting position to offer products and services of the future.

The PSIRP project has produced a new internetworking architecture based on the publish-subscribe paradigm. Many of today's applications already are publish-subscribe by nature and the new architecture supports them efficiently.

The architecture has been implemented and validated. The validation includes testing the implementation with real applications as well as trying to break it, subjecting it to DoS and other types of attacks. Experiences gained were used to improve the design and implementation in an iterative way.

The prototype implementation has been made available under BSD and GPL licenses. This enables the open source community to carry on the work and give SMEs the opportunity to use the results of the project as a basis for their product development. In the original spirit of the Internet ("rough consensus and working code"), the PSIRP project believes in *good ideas implemented well*.

Technical Approach

PSIRP bases its work on the publish-subscribe paradigm, which currently appears to be one of the most promising approaches to solving the main problems of the current Internet.

The work was divided into the following five work packages (WP leaders in parentheses):

WP1 Management (TKK-HIIT)

WP2 Architecture Design (TKK-HIIT)

WP3 Implementation, Prototyping and Testing (LMF)

WP4 Validation and Tools (BT)

WP5 Dissemination and Exploitation (NSNF)

The consortium includes two leading European telecom vendors, one of the largest telcos and several highly rated academic institutions. The project also collaborates with the International Computer Science Institute (ICSI) at UCB, which gives it the necessary connection to related work being done in the United States.

Architecture design started with a State-of-the-Art (SoA) survey. Among others, this early phase produced the terminology used in the project. The eventual concepts of the architecture are illustrated in the diagram at the bottom of the page.

Every partner participated in every work package and largely the same people were involved in designing the architecture and implementing it. However, validation was performed by people that were not too deeply involved in design and implementation.

Key Issues

Among the issues that PSIRP will have to address are scalability and security.

Efficient distribution of massive amounts of information, including video, mandates the use of multicasting and caching. In the new architecture, multicast is not the exception but the norm.

Security cannot be treated as a separate entity but as an integral part of the design and implementation. Among the most difficult security chal-

lenges are protection against unsolicited traffic (spam) and denial of service (DoS).

The figure below illustrates the three layers of the architecture (from top to bottom): rendezvous, topology management, and forwarding.
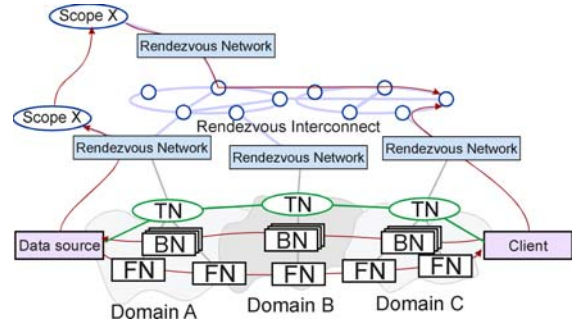
The project produced two implementations: a clean-slate approach, where also the lower layers are redesigned, and an overlay design built on IP.

Expected Impact

The project is expected to have the following impacts:

- Increase European understanding of the publish-subscribe architecture and its possibilities.

- Affect the standardization of the future Internet giving Europe a possibility to influence its direction.

- This will help bring better ICT-based services for education, business, care of the sick and elderly, and leisure for the European people.

- European telecom vendors and telcos will get a head-start in providing products and services for the future internet.

- The published results and open-source implementation will give SMEs a chance to enter the future Internet market.