

Trilogy: Re-Architecting the Internet

The aim of Trilogy is to develop new solutions for the control architecture of the Internet that remove the known and emerging technical deficiencies while avoiding prejudging commercial and social outcomes for the different players. The focus is the control functions of the Internet – the neck of the hourglass, but for control.

At A Glance: TRILOGY

Trilogy: Re-Architecting the Internet

An hourglass control architecture for the Internet, supporting extremes of commercial, social and technical control.



Project Coordinator

Mat Ford

BT Group plc

Tel: +44 (0)1875 341678

Fax: +44 (0)1908 860131

Email: matthew.ford@bt.com

Website: <http://www.trilogy-project.org/>

Partners: BT (UK), Deutsche Telekom (DE), NEC Europe (UK), Nokia (FI), Roke Manor Research (UK), Athens University of Economics and Business (EL), Universidad Carlos III de Madrid (ES), University College London (UK), Université Catholique de Louvain (BE), EURESCOM (DE), Stanford University (USA)

Duration: Jan 2008 – Dec 2010

Total Cost: €9.2m

EC Contribution: €5.9m

Contract Number: INFISO-ICT-216372

Main Objectives

Despite the phenomenal growth of the Internet over the last twenty years, we believe that the current Internet is reaching the fundamental limits of its capabilities. Performance and resilience demands are increasing at the same time that operational and business limitations imposed by the architecture are becoming more constricting.

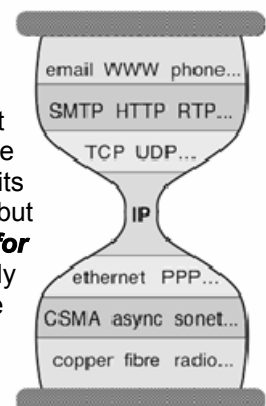
Future growth to meet these challenges will require not only new technologies from the leading edges of networking research, but also architectural changes which may be subtle but far reaching. The Trilogy project has a vision of a coherent, integrated and future-proof architecture that unifies the heterogeneous network, offering immediate deployment rewards coupled with long-term stability.

“Our objective is bold: to re-architect the world’s ICT infrastructure.”

The Trilogy Concept: Architecture for Change

There are two key ideas behind the Trilogy Concept. The first key idea is technical; the traditional separation between congestion control, routing mechanisms, and business demands (as reflected in policy) is the direct cause of many of the problems which are leading to a proliferation of control mechanisms, fragmentation of the network into walled gardens, and growing scalability issues. Re-architecting these mechanisms into a more coherent whole is essential if these problems are to be tackled.

The second key idea is more abstract, but fundamental. It recognises that the success of the Internet derives not directly from its transparency and self-configuration, but from the fact that it is **architected for change**. The Internet seamlessly supports evolution in application use and adapts to configuration changes; deficiencies have arisen

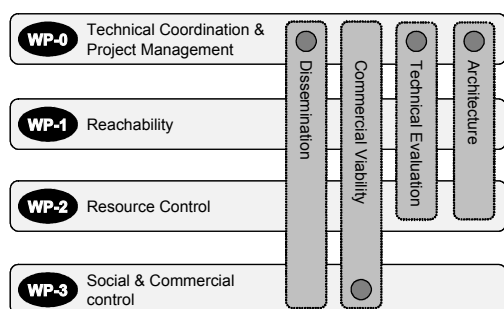


where it is unable to accommodate new types of business relationship. To make the Internet richer and more capable will require more sophistication in its control architecture, but without imposing a single organisational model. Therefore, our key principles are to retain the ubiquity enabled by the hourglass model, and take the self-configuration philosophy one level further: **we seek a control architecture for the new Internet that can adapt in a scalable, dynamic, autonomous and robust manner to local operational and business requirements.**

Technical Approach

At the core of the Trilogy workplan lies the realisation that internetworking functions can be broadly categorised into two classes. First, functions that establish and control a scalable, dynamic, autonomic and resilient internetwork ('reachability'). Second, functions which allow a diverse set of parties to use and share this internetwork to communicate according to their dissimilar needs ('resource control'). Consequently, Trilogy places the emphasis of its work around these two topic areas.

Trilogy explicitly addresses the contention between suppliers and users of internetworking functions through the introduction of a third key topic area. It investigates the socio-economic, commercial and strategic factors that influence the interplay between the technical internetworking functions in order to architect an integrated solution that is 'designed for tussle'. This activity will drive the design of the more technical work in the two main work areas in an ongoing manner, and is key for ensuring that the results of Trilogy will not only operate correctly at a technical level but also satisfy the broader goal of actively enabling changes.



Key Issues

- **Reachability:** The main focus is the problem of inter-domain routing, including policy control but also integrating filtering at trust boundaries (e.g. firewalls, NATs). Key issues include multihoming, scalability and fast convergence.
- **Resource control:** The main focus is how to deliver effective and efficient control of sharing of resource. Key issues include how to share resources fairly and stop cheating, high-speed congestion control and load balancing (traffic engineering).

But further, all this must be under:

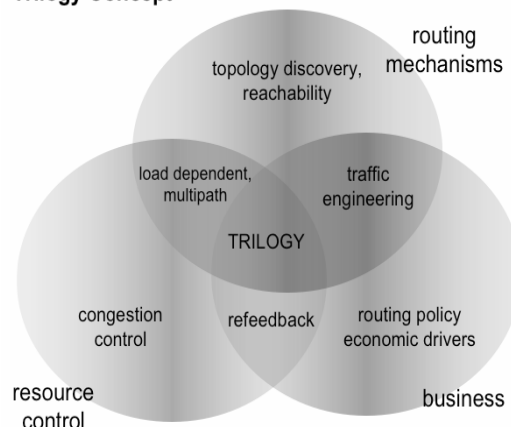
- **Social and Commercial Control:** the architecture will permit conflicting outcomes to coexist and evolve and will not embed assumptions that unreasonably favour certain types of industry player: "designed for tussle".

Expected Impact

Trilogy takes a holistic view of the fundamental design principles for a next generation Internet architecture, derives novel solutions for the dominant technical and economical challenges and disseminates the gained knowledge to the interested and affected parties. In particular, Trilogy will significantly enhance the reliability, robustness, manageability and functionality of the Internet, and will create new and varied business opportunities based around a common core architecture.

The key is to allow the Internet to be different things in different places without hindering interoperability. In enabling tussles to play out within the architectural framework (as opposed to working against the architecture, as often happens today), Trilogy will permit differentiation, allowing greatly increased robustness for customers who really need it and have the means to pay. In addition, the enhanced flexibility and improved manageability will simultaneously allow service providers to reduce costs and provide additional services; two aspects that are critical in a world of falling communications margins where service providers are wondering where the money to upgrade their networks will come from in ten years time.

Trilogy Concept



Trilogy Concept: New Internet Control Architecture

Our objective is bold: to re-architect the world's ICT infrastructure. In order to be credible, we will have to deliver a coherent set of changes solving technical and commercial problems together: a unified control architecture for the Internet that can be adapted in a scalable, dynamic, autonomous and robust manner to local operational and business requirements.