European Commission

FUSION: Future Service Oriented Networks

FUSION will develop a new networking architecture designed to natively support efficient provisioning, discovery and execution of service components distributed over the Internet. Today's cloud computing architectures are centralised and network-agnostic. This makes them unfit for geographically distributed services with tight QoS constraints and high bandwidth and computation demands.

At A Glance: FUSION

Future Service Oriented Networks

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Duration: *Jan. 2013 – Dec. 2015*
Funding scheme: *STREP*
Total Cost: *€4.2M*
EC Contribution: *€2.8M*

Contract Number: *CNECT-ICT-318205*

Main Objectives

FUSION will enable highly-demanding and personalised services to be flexibly deployed across the Internet. Many resource-demanding services – including personalised real-time video, games or processing of high bandwidth streams for safety and health-care monitoring – are not suited to being centralised in a relatively small number of remote data centres where high network delays and low throughput can have a serious impact on QoE experienced by many users.

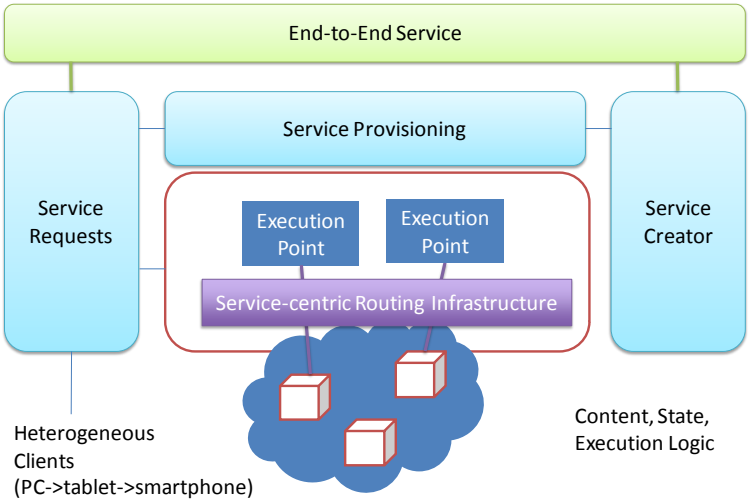
We envision a fusion of service deployment and execution technologies with native service-centric routing capabilities throughout the network.

Data centres and cloud-computing infrastructures have not been designed with such decentralised, bandwidth/processing-intensive, real-time applications in mind. In-network processing nodes need to be strategically positioned closer to the users of the services they deliver to provide faster application responsiveness and to reduce traffic within and between ISPs. A new networking paradigm is required to break down the barriers between data centres/server farms and the wide-area networks that interconnect them.

Up until now service deployment and data networking issues have always been treated in isolation by the research community as well as in the commercial reality of deployed products and services. We envision a ***fusion*** of service deployment and execution technologies with native service-centric routing capabilities throughout the network to provide a service-oriented network ecosystem for delivering a wide range of novel data- and processing-intensive services that have so far been impossible to deploy at large scale over the Internet.

Technical Approach

FUSION foresees a situation where large numbers of service nodes are distributed throughout the Internet: in access points close to the users; collocated with routers within an ISP's network; in local data-centres owned and operated by ISPs; and in traditional data-centres and service farms operated by cloud and service providers. Given this rich set of resources, FUSION will enable services to be flexibly deployed over this distributed service-execution platform and will optimise the location of individual service component instances according to the performance requirements of the application, the location of its users and according to the experienced demand. Replicas of service components may be provisioned according to predicted load levels and furthermore they can be instantiated on-the-fly to deal with demand elasticity.



To meet performance targets and to support resilience in case of service node failure or network or service-level congestion there will be many replicas of the same service component instance running throughout the Internet and the users, the service providers or the network itself must be able to select an appropriate one. FUSION adopts a service-centric networking approach and will deploy a service-anycast capability in the network so that service instance selection can be optimised on the grounds of proximity and network load, maximising their availability. Furthermore, FUSION will develop lightweight protocols to also allow server load to be taken into account so that load balancing algorithms running in service-centric routers can discover the best service instances to route user request towards.

Key Issues

To make this vision a reality, new service-routing protocols are required at the network layer. FUSION will develop anycast routing and forwarding paradigms based on service names to achieve this goal. A major research challenge is how to achieve service routing and the exchange of routing information on the state of individual service-component instances in a scalable manner. Novel algorithms are also required at the service layer to decompose data- and processor-intensive applications into a set of service components and to optimise server selection and component placement across such a distributed environment.

Cooperation between the service and network layers is a key component of the FUSION approach and the project intends to innovate in this area too. Network-driven instantiation and replication of service components to reduce network congestion and adapt to highly dynamic fluctuations in usage patterns will be developed. In addition, FUSION will research and develop a service-node execution platform leveraging the state-of-the art in novel, container-based virtualisation technologies that simplify network-driven session instantiation, replication and migration.

Expected Impact

Delivering the technology for service-centric networking will cause an enormous impact in terms of the range and type of networked services it will enable and the business opportunities it will offer for application developers, service providers and network operators alike.

Many of the priorities identified in the European Digital Agenda intersect with the project's work programme. Provision of eHealth and eGovernment services are just two examples of possible scenarios where FUSION technologies would increase efficiency and lower implementation costs. The ability of network providers to develop computation-rich services will provide new avenues of revenue generation that are desperately needed to financially support the rollout of next generation access. Finally security and trust can be significantly improved when we fuse networking and services: resilience, flash crowds and denial of service can all be mitigated when the network can control the amount and location of service replication.

The project plans to promote its service oriented networking architecture, APIs and protocols to relevant European and global standardisation bodies.