

COAST

1st Year Publishable Summary

In the Future Internet age, where everyone may be a content producer, manager/mediator and consumer, **COAST aims to build a Future Content-Centric Network (FCN) overlay architecture able to intelligently and efficiently link billions of content sources to billions of content consumers, and offer fast content-aware retrieval, delivery and streaming, while meeting network-wide Service Level Agreements (SLAs) in content and services consumption.** In short, COAST is expected to deliver an FCN overlay network, where the users will just specify which content or service they need, and the COAST framework will find the desired or the most relevant data and forward it to the users in an efficient, timely and network-friendly way.

Today, the vast majority of Internet usage is data retrieval, data delivery/streaming and Web services access, where the user cares about content and is oblivious to their location. That is, the user knows that s/he wants news from CNN, videos from YouTube or weather information, but does not know or care on which machine the desired data or service resides. The above functionality is realised by the network architecture as shown in Figure 1. The initial step is **Content Discovery by the Search Engines**: the Search Engines crawl the Internet to find, classify and index content or services. Alternatively, users may publish content and manually inform the search engine. The second step is **Content Discovery by the User**: the user queries a Search Engine and gets as feedback a number of URLs, where the content is stored. The last step is **Content Delivery/Streaming**: the user selects a URL and the content is delivered or streamed to him.

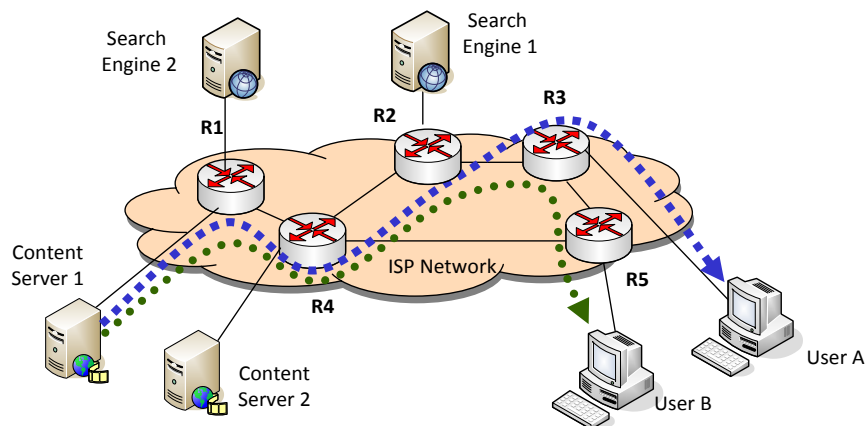


Figure 1: Today's Network Architecture, Content Discovery, Retrieval and Streaming

To realise the above vision in a more efficient way, COAST takes advantage of the ever increasing device/edge processing power and network bandwidth, move intelligence in the network and implement the necessary architectural and technological advances by focusing on three key innovation pillars:

- **"On the fly" identification and distributed "on-line" discovery.** COAST creates a content-centric/ content-aware network of intelligent nodes (edge routers, home gateways, terminal devices), which a) **"on the fly" (at wire speed) identify/classify content and identify Web services** via inspection of the traffic that flows through the nodes and b) **discover "on line" (in a distributed manner), where services are located and content is located/cached**, in order to optimal match users' requests with availability.
- **Content-Aware Delivery Network Architecture.** COAST *discovers the underlying network infrastructure* as well as the **user terminal devices** and the **user needs** considering the (possibly variable) **capacity and quality** (especially variable with mobility), the actual foreground (multimedia distribution) and background (other traffic) load, and **construct content-aware overlays** to offer distributed and network-/service-provider friendly content delivery with optimal utilisation of the networking topology.
- **Future media content adaptation and enrichment.** COAST provides for scalable, high-definition **3D video over http**, which is on-the-fly adapted, enriched and optimized to the user preferences, network and terminal characteristics and conditions and optimal streamed over dynamic constructed overlays.

Finally, COAST combines **a) the content identification/classification/discovery, b) the web-services identification/discovery awareness and c) the network topology/load awareness with new distributed network overlay techniques to incrementally deploy intelligent services with the aim of optimizing the end-user experience for networked applications and meeting network-wide SLAs in content consumption.**

COAST will test/validate the developed technologies over two interconnected testbeds: a) a large scale testbed, through the FIRE (Future Internet Research and Experimentation) facility, and via that also gain access to the world-wide extended Network testbed PlanetLab/GENI and b) a user experience FTTH services testbed, through the TID's "User Experience Lab" and the "Digital Home Lab".

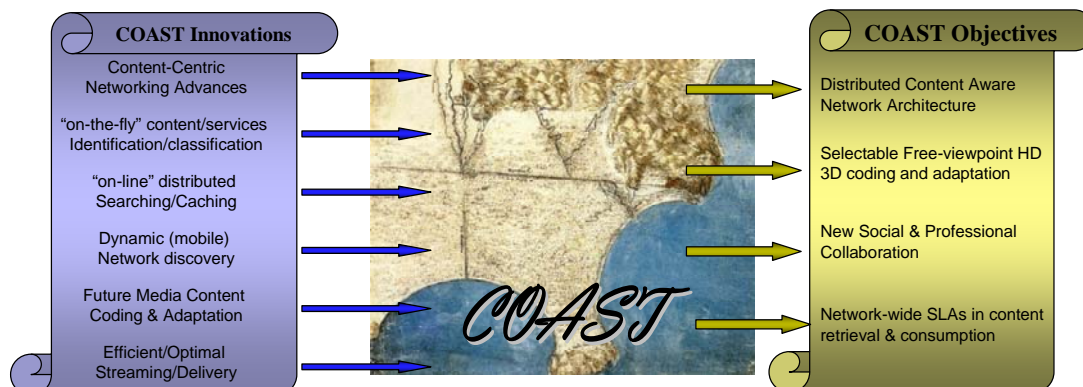


Figure 2: The COAST Concept




The COAST concept is shown in Figure 2. From the user point of view, COAST will add intelligence in the network, so that it will be able to find and suggest services and content based on the user's requests and enhance the Perceived Quality of Service (PQoS) of the streaming sessions. From the *network operator's* point of view, COAST will offer better utilisation of the available resources and avoid unnecessary traffic replication. From the *service provider's* point of view, COAST will offer a strong service differentiation platform compared to traditional networks, which will be able to dramatically increase service revenues. From the *EU citizens'* point of view, **COAST will provide the technological innovations for intelligent and efficient A/V content distribution, training and edutainment.**










1.1. Achievements in this period

Within the period 01/02/2010-31/01/2011, a number of objectives have been achieved. In more details:

- 1) **Major Technical Achievements.** COAST has successfully met all major technical milestones. In more details the major technical achievements of this period are:
 - Defined use case scenarios combining the content-aware network of intelligent nodes, the awareness of the network infrastructure and scalable 3D multimedia content.
 - Described the functional specifications and the overlay network architecture, and outlined the functions each network component should perform within the COAST architecture.
 - Defined a COAST URL (CURL) structure which uniquely identifies the content in the network/caches, and it is backwards compatible with normal URLs.
 - Analysed multi-stakeholder business and market scenarios relevant for the COAST scenarios and identified the potential market structure for the researched scenarios.
 - Defined a high-level architecture of the COAST search engine and metrics for the evaluation of the search engine performance.
 - Evaluated machine-learning techniques for document assignment and sources of URLs such as toolbar
 - Developed the basic search engine infrastructure and we are currently populating servers in one location with data (fetching content and indexing)
 - Analysis of processing and storage requirements of proposed DPI algorithms, and analysis of the testing environment and the traffic patterns.
 - Monitoring of the relevant EC directives and national laws and comparison with the national laws.
 - File storage and transport of novel layered media formats such as MVC and SVC and adequate file format and transport signalling requirements have been studied.
 - The GStreamer framework has been chosen as an integration platform for the final implementation of the COAST streaming system. Dynamically linked libraries (DLL), aka "shared object libraries", which are loaded at runtime by a plug-in mechanism will be used to protect the individual intellectual property of each partner.
 - Development of a simulator based on Omnet++ aiming at quantifying the benefits of topology-awareness in achieving better network proximity of content provided by a content delivery network.
 - Investigation of the additional benefits resulting from ALTO-guided content replica placement.

- Identification of the most suitable p2p-based overlay engine to optimize the content delivery process over the COAST network, and investigation of policies for hybrid p2p-CDN delivery networks.
 - Design of the overlay topology for content delivery among the CEPs with a P2P approach, and metrics for the optimal exploitation of a hybrid CDN-P2P system.
 - Implementation of a P2P application for live content distribution among CEPs, based on erasure codes.
 - Development of solutions to use the MP4 File Format to prepare novel layered media types for http streaming.
 - Identification of signalling requirements for media transport allowing for on-the-fly adaptation.
- 2) **Knowledge Dissemination.** Apart from the Web site, where a number of public documents can be downloaded, COAST has published a number of papers in refereed conferences/workshops and made a number of poster presentations. More papers have been submitted and they are still under review. COAST has actively participated in the Fall 2009, and the Spring and Fall 2010 Networked Media Concertation meetings.
 - 3) **Contributions to standards.** COAST has been quite active participating and contributing in a number of relevant standardization forums. COAST delegates have participated and/or contributed to IETF and MPEG standardization activities.
 - 4) **Project Liaison.** COAST has start liaison activities with the projects P2P Next, OCEAN, COMET, Envision and iSearch. Moreover, COAST has started liaison activities with FIRE initiative.
 - 5) **Future Internet Activities.** COAST has played an active role in the Future Internet Activities, organized a session dedicated to searching in FIA Ghent and actively participates in the Future Media Internet Architecture Think Tank (FMIA-TT) and the Future Internet Architecture (FIArch) group.

Project acronym :		COAST 		
Project name :		COntent Aware Searching, retrieval and sTreaming		
Project URL :		http://www.coast-fp7.eu		
Project LinkID :		http://www.linkedin.com/groups/COAST-2850982		
Project Type & Reference :		STREP ICT-248036		
Project duration		30 months (01/02/2010 – 31/01/2011)		
Total budget :		4,997,504 € (including own contribution)		
Project Co-ordinator :		Technical Co-ordinator :		
Agostino Galluzzo STMicroelectronics S.r.l. Stradale Primosole 50, Catania, Italy Tel: +39095 7405357 Email: agostino.galluzzo@st.com		Theodore Zahariadis, PhD Synelixis Solutions Ltd 10 Farmakidou Av., Chalkida, GR34100, Greece Tel:+302221061309, +306932495045 Email: zahariad@synelixis.com		
COAST Consortium				
Company Name	Logo	Type	Country	Role
ST Microelectronics		Industry	Italy	<ul style="list-style-type: none"> • Project Administrator Coordinator • Responsible for the User Requirements & Network Architecture (WP2 Leader) • Responsible for the application layer adaptation and content enrichment • Responsible for the streaming and the efficient overlay forests creation
Synelixis		SME	Italy	<ul style="list-style-type: none"> • Project Technical Coordinator • Responsible for the “on-the fly”

				<p>content/traffic inspection (WP4 Leader)</p> <ul style="list-style-type: none"> • Contribution to the COAST on the fly content enrichment. • Responsible for projects Liaison
Yahoo! Iberia		Industry	Spain	<ul style="list-style-type: none"> • Lead the Distributed Discovery and caching (WP3 Leader). • Lead the Query processing/caching activities. • Participate at the Content Indexing..
Telefonica I+D		Industry/ Operator	Spain	<ul style="list-style-type: none"> • Lead the Integration, validation and optimization (WP6). • User requirements, scenarios and user centric design of services. • Integrate and validate the designed scenarios on TID's testbed and user Experience lab.
NEC Europe Ltd		Industry	UK	<ul style="list-style-type: none"> • Lead the exploitation, dissemination and standardization activities (WP 8 leader) • Lead the DPI process • Network-awareness and traffic localization. • Lead the project standardisation.
Fraunhofer HHI		Research Institute	Germany	<ul style="list-style-type: none"> • Responsible for the Multi-layer/view Video coding and delivery (WP5 Leader) • MVC encoder/decoder, signalling and transportation. • Responsible for the MPEG/JVTG and the IETF standardization.
Politecnico di Torino		Research Institute	Italy	<ul style="list-style-type: none"> • Lead the Network Awareness and Content Delivery activities (WP6) • Feasibility study and cost-performance evaluation of DPI algorithms • Development of efficient content enrichment techniques and overlay streaming protocols;
Technische Universität Berlin		Research Institute	Germany	<ul style="list-style-type: none"> • Technical context of communication • Capacities and features of the communication links as well as the estimated mobility/activity of the user. • Cross layer optimization of the delivery.
Fundacion Barcelona Media		Research Institute	Spain	<ul style="list-style-type: none"> • Lead the Content-aware network architecture specification & Interfaces) • Lead the distributed indexing activity • Collaborate with Yahoo in distributed content/services discovery.
University of California, Los Angeles		Research Institute	USA	<ul style="list-style-type: none"> • Scientific Advisor on Networking • Creation of optimized overlay forests supporting rich media such as SVC/MDC/MVC; • Support large scale testing
Seoul National University		Research Institute	Korea	<ul style="list-style-type: none"> • Scientific Advisor on content awareness • Mapping between the content identifier and the location of the content. • Tree structures & P2P structures as the basic elements for better performance.