

Proposal Book [- C3N - All]

Proposal Data

Acronym	CONCERT
Full name	A Context-Adaptive Content Ecosystem Under Uncertainty
Duration	36
Topic	C3N
Keywords	information-centric networking, adaptive media networking, context-awareness, cooperative content adaptation, distributed resource optimisation

Coordinator contact point for the proposal

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Consortium Partners

C/P	Institution	Contact	Other	Country	Legal Status	
C	University College London / Department of Electronic and Electrical Engineering	George Pavlou	Wei Koong Chai	United Kingdom	Public research organisation	Ind.Eff.: 37 Ind.Cost: 460,254 Ind.Bud.: 368,203
P	University of Surrey (UniS) / Centre for Communication Systems Research	Ning Wang	George Kamel	United Kingdom	Public research organisation	Ind.Eff.: 41 Ind.Cost: 395,570 Ind.Bud.: 316,456
P	AAU Klagenfurt / Institute of Information Technology, Multimedia Communication Group	Hermann Hellwagner		Austria	Public research organisation	Ind.Eff.: 63 Ind.Cost: 379,607 Ind.Bud.: 311,567
P	Ecole Polytechnique Fédérale de Lausanne / Electrical Engineering Institute	Pascal Frossard		Switzerland	Public research organisation	Ind.Eff.: 40 Ind.Cost: 300,800 Ind.Bud.: 300,800

Abstract:

The objective of CONCERT is to develop a content ecosystem encompassing all relevant players which will be able to perform intelligent content and network adaptation in highly dynamic conditions under uncertainty. This ecosystem will have as basis emerging information-/content-centric networking technologies which support intrinsic in-network content manipulation. The project will consider uncertainty aspects in the following two application domains: a) social media networks based on user generated content and b) CDN-like professional content distribution. Three dimensions of uncertainties will be addressed: heterogeneous and changing service requirements by end users, threats that may have adverse impacts on the content ecosystem, as well as opportunities that can be exploited by specific players in order to have their costs reduced. In order to manage and exploit the uncertainty aspects, CONCERT defines a two-dimensional content and network adaptation framework that operates both cross-layer and cross-player. First, the decision on any single adaptation action needs to take into account context information from both the content application layer and the underlying network. Second, we consider joint content and network adaptation in order to simultaneously achieve optimised service performance and network resource utilisation. Finally, some complex uncertainty scenarios require coordinated content and network adaptation across different ecosystem players. In this case, inconsistent or even conflicting adaptation objectives and different levels of context knowledge need to be reconciled and are key research issues. In order to achieve adaptation solutions capable of coping with different uncertainties, the project will develop advanced learning, decision-making and negotiation techniques. Learning is required for deriving accurate system behavioural patterns according to the acquired context knowledge. This will then drive decision-making functions for taking the most appropriate adaptation actions to address these uncertainties. Negotiation techniques are required for resolving potential tussles between specific content/network adaptation objectives by different players in the content ecosystem. The project will consider both centralised and distributed approaches in which learning and decision-making processes on adaptation actions can be performed either at the central adaptation domain controller or in a decentralised manner across multiple network elements. In the latter case, emerging information-/content-centric networks will become much more intelligent, with content-aware devices performing self-adaptation according to their own context knowledge but through coordination in order to achieve global near-optimality and stability.

Relevance:

CONCERT addresses the 3rd CHIST-ERA Call Topic 2 “Context- and Content-Adaptive Communication Networks” directly and in its entirety. The call objectives mention new services, better user quality of experience (QoE), improved resilience and maintained quality of service (QoS) while on the move, realised through content-aware network architectures that support network and content adaptation through contextual information and learning to identify patterns and behaviours. This is exactly CONCERT’s target through the adoption of an intelligent information-oriented architecture, enhanced with advanced learning, decision making and negotiation techniques, which will provide concurrent network and content adaptation in a two dimensional framework operating both cross-layer and cross-player. Users will be an integral part of the resulting content ecosystem which will offer more diversity, openness and competition, favouring small market players. The target outcomes include content-, network- and context-aware network architectures that will encompass self-configuration and adopt new approaches to layering for better support of the relevant functionality. CONCERT will target exactly these outcomes through its cross-layer information-oriented architecture enhanced with context-based intelligence. The resulting networked ecosystem will be able to deal with uncertainties in an adaptive, graceful manner, unlocking network capacity, maximising user QoE and paving the way for new advanced content media services.

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Proposal Data

Acronym	DISEDAN
Full name	service and user-based DIstributed SElection of content streaming source and Dual AdaptatioN
Duration	24
Topic	C3N
Keywords	content distribution, media adaptation, content source adaptation, decision algorithm

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C	Politechnika Warszawska	Jordi Mongay Batalla	Wojciech Burakowski, Andrzej Beben, Piotr Krawiec	Poland	Public research organisation	Ind.Eff.: 36 Ind.Cost: 229,200 Ind.Bud.: 229,200
P	CNRS-LaBRI University of Bordeaux	Daniel Négru	David Bromberg	France	Public research organisation	Ind.Eff.: 40 Ind.Cost: 320,320 Ind.Bud.: 124,320
P	Universitatea Politehnica din Bucuresti	Eugen Borcoci	Sorin Zoican	Romania	Public research organisation	Ind.Eff.: 31 Ind.Cost: 191,125 Ind.Bud.: 191,125

Abstract:

The DISEDAN project proposes an evolutionary solution to enhance the content delivery via Internet. It focuses on research in the area of multi-criteria content source (server) selection, considering user and server contexts and requested content. The project proposes two innovative concepts that improve the current streaming systems. The first one is a two-step server selection mechanism which allows for cooperation between Service Provider (an entity offering the content distribution service, but owning or not a network infrastructure) and End User (an entity which consumes the content) making use of innovative algorithms that consider context- and content-awareness. The second concept is a dual adaptation mechanism applicable during media session that combines the advantages of Media adaptation and content server handover in a single solution. The proposed streaming system will be able to function as a standalone client application, without any modifications applied to the Service Provider, as long as the SP is able to provide a list of available and appropriate servers to the client. If, additionally, the SP is able to provide to the client some other additional information helpful for the initial client decision, then an optimised server selection results. Consequently, the project outlines a set of optional Provider side modifications (w.r.t. useful

information and metrics provided by SP to the client) that can further optimize server selection. The design of the system takes backwards-compatibility into consideration, ensuring that both client and Service Provider side modifications work well with the other side using existing content distribution solutions. The project aims to develop clear rules for deciding which adaptation action to perform based on the evaluated current delivery conditions. Possibilities of inferring the optimum adaptation decision by estimating network state from various client measurements will be researched. In the course of work, a prototype implementation of the DISEDAN system will be developed in (1) a form of a library allowing for easy creation of streaming clients that benefit from the introduced enhancements and (2) Multimedia Description server with advanced content source selection algorithm and extended Multimedia Description.

Relevance:

The proposed project fits well into Topic 2: Context- and Content-Adaptive Communication Networks. The two-step server selection algorithm acquires service awareness in the Provider side and context awareness in the client side selection leading to choosing the optimum server. What is more, the automatic dual adaptation mechanism (Media and Content source adaptation) inserted in the client application coupled with research on client side monitoring possibilities ensures that the user is given the stream in the best quality possible under current conditions, taking into account both user context and state of the network. The project will extend fundamental investigation on multi-criteria optimization applied to the selection of content streaming source. DISEDAN is in tune with the research provided in Information Centric Networks but DISEDAN is an evolutionary solution for content distribution, on the contrary of Information Centric Networks which propose forthcoming architectures. At last, the research results of the project will be verified by performing tests of the prototype implementation of the solution. The implementation will be released in a form of open source client library which will allow other institutions to reproduce the results and investigate further possibilities in the future. Simulation models will be elaborated and the associated experiments will complement the tests, in order to assess the scalability of the proposed solutions in the context of large networks and users communities.

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Proposal Data

Acronym	MACACO
Full name	Mobile context-Adaptive CAching for COntent-centric networking
Duration	36
Topic	C3N
Keywords	context-aware networking, pre-fetching/caching, In-network content adaptation, user mobility modeling/prediction, user content demand modeling/prediction, cellular network offloading, mobile social networks, content-centric networks

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Consortium Partners

C/P	Institution	Contact	Other	Country	Legal Status	
C	INRIA	Aline Carneiro Viana	Emmanuel Baccelli	France	Public research organisation	Ind.Eff.: 59 Ind.Cost: 507,218 Ind.Bud.: 149,495
P	Consiglio Nazionale delle Ricerche (CNR)	Marco FIORE		Italy	Public research organisation	Ind.Eff.: 13 Ind.Cost: 0 Ind.Bud.: 0
P	University of Applied Science – SUPSI	Silvia Giordano	Anna Forster	Switzerland	Public research organisation	Ind.Eff.: 58 Ind.Cost: 428,200 Ind.Bud.: 378,200
P	Institut National Polytechnique de Toulouse (INPT-ENSEEIH)/RIT	Katia Jaffrès-Runser	Gentian Jakklari	France	Public research organisation	Ind.Eff.: 64 Ind.Cost: 277,533 Ind.Bud.: 154,024
P	University of Birmingham	Mirco Musolesi		United Kingdom	Public research organisation	Ind.Eff.: 64 Ind.Cost: 481,954 Ind.Bud.: 361,465
P	Federal University of Minas Gerais/DCC	Pedro Olmo Stancioli Vaz de Melo	Antonio Alfredo Ferreira Loureiro	Brazil	Public research organisation	Ind.Eff.: 19 Ind.Cost: 0 Ind.Bud.: 0

Abstract:

Finding new ways to manage the increased data usage and to improve the level of service required by the new wave of smartphones applications is an essential issue. MACACO project proposes an innovative solution to this problem by focusing on data offloading mechanisms that take advantage of context and content information. Our intuition is that if it is possible to extract and forecast the behaviour of mobile network users in the three-dimensional space of time, location and interest (i.e. 'what data', 'when' and 'where' users are pulling data from the network), it is possible to derive efficient data offloading protocols. Such protocols would pre-fetch the identified data and cache it at the network edge at an earlier time, preferably when the mobile network is less charged, or offers better quality of service. Caching can be done directly at the mobile terminals, but as well at the edge nodes of the network (e.g., femtocells or wireless access points). Building on previous research efforts in the fields of social wireless networking, opportunistic communications and content networking, MACACO will address several issues. The first one is to derive appropriate models for the correlation between user interests and their mobility. Lots of studies have characterized mobile nodes mobility based on real world data traces, but knowledge about the interactions with user interests in this context is still missing. To fill this gap, MACACO proposes to acquire real world data sets to model mobile node behaviour in the aforementioned three-dimensional space. The second issue addressed is the derivation of efficient data-offloading algorithms leveraging the large-scale data traces and corresponding models. Firstly, simple and efficient prediction algorithms will be derived to forecast the node's mobility and interests. Then, MACACO has to output data pre-fetching mechanisms that both improves the perceived quality of service of the mobile user and noticeably offloads peak bandwidth demands at the cellular network. A proof of concept will be exhibited through a federated testbed located in France, Switzerland and in the UK. The consortium was carefully constituted to gather partners that are pretty complementary and qualified to address the context-content correlation and related data offloading challenge. The partners of MACACO will combine research and experience in a wide set of areas to gain unique competence, which will be brought forward to other European partners through the dissemination and exploitation activities of the consortium.

Relevance:

The MACACO project addresses the topic: Context- and Content-Adaptive Communication Networks. MACACO is totally aligned with the target outcomes of this topic, intended (1) to design context-aware "[...] in network algorithms and methods to evaluate usage pattern, including human and social behaviours while maintaining privacy [...];" (2) to design "[...] methods and algorithms to aggregate knowledge inside a network and over time (learning) [...]", and (3) to deliver "[...] a scalable solution that fully supports user mobility, and existence of services and content in multiple possibly time varying locations." Moreover, MACACO focuses on the provision of richer platforms for applications by "[...] being service and content-aware [...]" and by "adapting to the context in which they operate, including physical properties such as energy consumption and user perception of behaviours (usage patterns, social sensing), and collecting this information to derive high-level network situations, learn from them, and adapt/regulate the system, all the way from the network itself to the of content being delivered". Thus, MACACO implies (i) moving the data management plane of the whole mobile network towards a content-centric networking paradigm, and (ii) the pervasive adoption of mobile social-context-aware caching decisions at both the wireless infrastructure and the mobile terminals.