Title: Proactive Mobility, Naming and Caching in Next Network Generation based Mobile service

Abstract

Forthcoming 5G and 6G networks raise an important research issue of seamless mobility management of cellular and non-cellular networks. Adopting Information Centric Networking (ICN) architecture as common mobility management is promising because existing mobility management mechanisms are complicated and incur large signaling overhead. ICN architectures target to substitute present host-centric IP network by an information-centric vision for effective, reliable, and secure information dissemination. It is based on various prominent principles like publish/subscribe model, named content, innetwork caching, and security over atomic information objects. These features allow a data chunk to be cached and retrieved from multiple nodes in the network, and can be validated without building a connection with its host. Though these tenets simplify the mobility problem in ICN, seamless mobility for real-time applications still demands a control plane. It remains to expand the futur complex network architecture capable of conveying this IoT traffic while ensuring that of the other types of traffic in a cost-effective manner and with a sufficient quality of service and Experience. To overcome the aforementioned drawbacks, one alternative solution could be the usage of proactive framework for caching and naming to forecast both user's content request allocation and mobility pattern though having only restricted information on the user's and network's status. Especially in fast changing scenarios where objects/nodes/users' positions are varying due to the mobility. On other hand one of the objectives of this thesis is to expand a mathematical framework to optimize and construe prospective complex systems typified via their wide dimensions, their stochastic aspects, and their being self-organized, like small cell telecommunication networks and/or smart grids.

Description of the main thesis activities:

The objective of the thesis is to develop an architecture and expand a mathematical framework to optimize and construe prospective complex tools to ensure a new proactive naming and caching framework that can accurately predict both the content demand distribution and mobility template of every consumer and, thereafter, cache the best appropriate contents while minimizing resources supporting IoT slices within ICN/SDN distributed controllers.

The candidate will work on three main contributions:

- Distributed implementation of an optimized caching and naming decentralized controller architecture to help with registration and resolution of name/locator mappings

- Proactive resource and mobility prediction and dynamic optimization of ICN over IoT for 5G networks.

> • facilitate mobility in ICN/CCN through the concept of AI/NI Split

> • Seamless mobility is achieved based proactive renew of mobility states to facilitate with re-routing benefit

- Realizing ICN service as numerous interacting virtual slices – Base Mobility, Network, Service slice

Firstly, the candidate will work on the definition of distributed framework optimized caching and naming decentralized controller to dynamically allocate resources to different slices. We will also study the optimal placement algorithms of controllers that permit performance optimization criterion such as minimizing Energy, latency between the controller and switches, maximizing controller connectivity based the proactive mobility plane and so on. As most popular scenarios

– Smart Transportation: Very short Response time Ad-hoc + Infrastructure communication with mobility, secure data collection and exchange

– Smart Healthcare: Security/Privacy/Trust, High Reliability, short-communication latency

Required skills

- A Master's degree or an engineer Computer Science and /or Applied Mathematics or assimilable.

- Good understanding of the fundamental of and network science in general

- Knowledge in optimization theory, machine learning theory, graph theory, stochastic processes, Bayesian networks and/or Game theory are highly desirable.

- Programming potential in various languages (Python, C/C ++,Matlab, Java,...etc).

- A good level of English, sufficient to publish in International journals.

- A strong curiosity in research interdisciplinarity.

Contact Information

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