2019-01529 - PhD Position F/M [CORDIS2019-NEO]

Content-aware caching in Multi-access Edge Computing (MEC) architectures

Type de contrat : CDD de la fonction publique
Niveau de diplôme exigé : Bac + 5 ou équivalent
Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria Sophia Antipolis - Méditerranée center counts 37 research teams and 9 support departments. The center's staff (about 600 people including 400 Inria employees) is composed of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrators. 1/3 of the staff are civil servants, the others are contractual. The majority of the research teams at the center are located in Sophia Antipolis and Nice in the Alps-Maritimes. Six teams are based in Montpellier and a team is hosted by the computer science department of the University of Bologna in Italy. The Center is a member of the University and Institution Community (ComUE) "Université Côte d'Azur (UCA)".

Contexte et atouts du poste

The PhD will join INEO project-team. https://heim.inria.fr/neo/

NEO is positioned at the intersection of Operations Research and Network Science. By using the tools of Stochastic Operations Research, the team members model situations arising in several application domains, involving networking in one way or the other. The aim is to understand the rules and the effects in order to influence and control them so as to engineer the creation and the evolution of complex networks.

The research activity will be supervised by Giovanni Neglia http://www-sop.inria.fr/members/Giovanni.Neglia/

Mission confiée

CONTEXT

Global mobile data traffic is expected to increase by seven times in the next 5 years [Cos17]. The growth is due to the development of the Internet of Things (IoT) with 30 billion of connected objects by 2020 [Nor16], and to the shift from connection-centric communications, such as phone calls, to content-centric communications, such as video streaming, fueled by the surge of users' generated contents spread through social networks. In the near future Augmented Reality (AR) services can put further strain on the wireless infrastructure: it has been estimated that, at high human density places, wireless networks should be able to deliver up to 100 Gb/s/m2 to support such services, a rate that is far from achievable with current technologies [Kri17]. Virtual reality applications are even more demanding in terms of rates and latencies [Che16]. Wireless network densification, with the introduction of small cells ranging from micro- to pico- and femto-cells, increases transmission capacity per area unit by enhancing frequency reuse, but it risks to move the bottleneck from the radio access to the Mobile Operator (MO) backhaul and core network.

At the same time the Multi-access Edge Computing (MEC) industry initiative [MECIA] is pushing a new network infrastructure where IT and cloud-computing capabilities are located within the Radio Access Network (RAN) in close proximity to mobile subscribers. The initiative envisions a MEC server closely managing a set of small cells. MEC will enable the development of low-latency context-aware and context-optimized applications, which can tap into real-time information about local-access network conditions exposed by the base stations. Moreover, by opening the radio network edge to third-party partners (e.g. Mobile Virtual Network Operators, MVNOs, or Content Providers, CP) MEC platforms will enable new value-added services and then potential new revenues for operators, vendors and third-parties.

The goal of this project is to investigate how to allocate and exploit edge storage and computation resources in a multi-tenant, MEC-enabled cellular network in order to reduce backhaul traffic and address the challenges of new application services (in particular IoT ones).

References related to the project


Informations générales

- Thème/Domaine : Réseaux et télécommunications
- Ville : Sophia Antipolis
- Centre Inria : CRI Sophia Antipolis - Méditerranée
- Date de prise de fonction souhaitée : 2019-09-01
- Durée de contrat : 3 ans
- Date limite pour posterler : 2019-05-05

Contacts

- Équipe Inria : NEO
- Directeur de thèse : Neglia Giovanni / giovanni.neglia@inria.fr

À propos d’Inria

Inria, l'institut national de recherche dédié aux sciences de l'ingénierie, promeut l'excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général comptées avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l'interface d'autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

Consignes pour posteruler

Application file Applications must be submitted online on the Inria website. Collecting applications by other channels is not guaranteed.

The position is open to:
- Inria internal mobility, remuneration according to statutory conditions
- mobility from other public body, by posting for a period of three years, renewable, remuneration according to statutory conditions
- in short term contract from service fixed-term

Before applying, it is highly recommended to contact the scientific officer preferably before 07 april

Sécurité défense :

Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel favorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du contrat de mission.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les candidats doivent être déposées en ligne sur le site Inria. Le traitement des candidatures
A usual assumption in caching systems like Content Delivery Networks (CDNs) is that the cachable objects have been defined elsewhere (e.g. by the content provider) and caching decisions are oblivious to the actual information objects store. In this project, we pursue a radical shift from mainstream research proposing to “look inside the content.” Many objects currently cached in the network are often strongly related because they are i) different versions of the same content (e.g. webpages and videos adapted for the capabilities of different user terminals or different access technologies), ii) partially substitute contents (the list of related videos suggested by Youtube, or IoT sensor data related to close-by time instants) [Spy16], iii) pieces of the same larger content (e.g. different chunks of the same video), or more in general iv) complementary contents, i.e. contents for which popularity changes are positively correlated (e.g. the episodes of the same serie, or the contents of the same Youtube channel) [Spy16]. Nowadays, MOs cannot take advantage of such relations, because they ignore what is the actual information in the cached object. In MEC, caching will be a service that can be managed by the Content Provider (CP) itself, and then relations among different objects can be effectively exploited. While current caching policies react to requests for a given object A, by simply deciding if storing A and which other objects should be evicted to make space for it (if needed), content insight significantly enlarges the space of possible options. Requests for object A can lead to store it but also to prefetch the complementary object B, or can lead to store object C from which object A can be produced after some computations, or to store object D that is a lower-quality, smaller-size version of object A, or finally to merge content A to content E already stored in the cache (like in IoT data fusion). The design space becomes then richer: computation joins network capacity and storage as an additional resource to be traded off, and the quantification of user’s satisfaction may include the possibility to use only partially substitute contents. A new family of caching strategies need to be designed. While motivated by the new opportunities offered by the MEC technological paradigm, this research line is intrinsically fundamental and likely to have scientific impacts on other application scenarios.

**Principales activités**

Research activity.

**Compétences**

A solid background on probability, networking, and mathematical modeling is essential. Solid programming and IT skills are necessary (Python, bash, version control systems), along with strong communication abilities.

**Avantages**

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

**Rémunération**

- Duration: 36 months
- Location: Sophia Antipolis, France
- Gross Salary per month: 1982€ brut per month (year 1 & 2) and 2085€ brut/month (year 3)