



Offre n°2022-04722

Post-Doctoral Research Visit F/M Caching at the Edge: Distributed Phy-aware Caching Policies for 5G Cellular Networks

Le descriptif de l'offre ci-dessous est en Anglais

Niveau de diplôme exigé : Thèse ou équivalent

Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria Université Côte d'Azur center counts 36 research teams as well as 7 support departments. The center's staff (about 500 people including 320 Inria employees) is made up of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrative staff. 1/3 of the staff are civil servants, the others are contractual agents. The majority of the center's research teams are located in Sophia Antipolis and Nice in the Alpes-Maritimes. Four teams are based in Montpellier and two teams are hosted in Bologna in Italy and Athens. The Center is a founding member of Université Côte d'Azur and partner of the I-site MUSE supported by the University of Montpellier.

Contexte et atouts du poste

The research is in the framework of the project "5G Events Labs" to conceive and provide new 5G services in the framework of large-scale events like Olympic games. The project involves also Orange, Ericsson, and CEA.

Mission confiée

Driven by the exponential growth in wireless data traffic, operators are increasingly considering denser, heterogeneous network (HetNet) deployments, overlaying the macro-cellular network with many small cell base-stations (BS). However, CAPEX and OPEX considerations are making the operators turn to cheap, under-provisioned solutions for the backhaul support of small cells, making backhaul capacity a potential new bottleneck. To alleviate this bottleneck, recent work has proposed 'caching-at-the-edge' methods that cache popular content closer to the user to reduce the number of duplicate backhaul transmissions.

While a number of recent works consider the problem of caching at BSs or even user devices, these works are not addressing the complex interplay between caching and advanced communication techniques considered for beyond 4G networks, such as Coordinated Multi-Point (CoMP) transmission. In CoMP multiple BSs transmit the same content concurrently, aiming at diversity or multiplexing gains on the radio interface, at the cost of a significant additional overhead on the backhaul to retrieve the content at all the BSs involved. Hence, for edge caching to facilitate CoMP, the same content must be cached at all cooperating BSs.

We propose to jointly consider and optimize cooperative caching at the edge with cooperative communication technologies. A key goal in this proposal is to perform a first-of-its-kind exploration of the elusive tradeoff between edge caching that reduces backhaul traffic, and caching that improves radio access performance. At the center of this tradeoff lies the question of how caching algorithms can adapt to accommodate potential Coordinate Multi-Point (CoMP) transmission opportunities: caching the same replicated content in multiple nearby caches can exploit coordinated transmissions, but might waste valuable storage space and lead to cache misses; yet storing different contents to improve cache hits might lead to missing CoMP opportunities, and degrade communication performance. To this end, we plan to investigate distributed implementations of our optimization solutions, in order to (a) deal with the high complexity of such cooperative caching problems, and (b) significantly reduce the amount of additional (signaling) information transmitted over the already congested backhaul links.

We started our investigation of the topic during the PhD of Guilherme Lecker Ricardo. His thesis "Design and optimization of cache systems for small cell networks" is available at <https://tel.archives-ouvertes.fr/tel-03574320> and provides many useful pointers to related work. A set of selected references is provided below. Our goal during the postdoc is to extend this research line taking into account the effect of concurrent users' requests and dynamic resource allocation strategies.

Selected references

- A Swiss Army Knife for Online Caching in Small Cell Networks, Giovanni Neglia, Emilio Leonardi, Guilherme Ricardo, and Thrasyvoulos Spyropoulos, IEEE/ACM Transactions on Networking, online,

August 2021

- Caching Policies for Delay Minimization in Small Cell Networks with Coordinated Multi-Point Joint Transmissions, Guilherme Ricardo, Alina Tuholukova, Giovanni Neglia, Thrasyvoulos Spyropoulos, IEEE/ACM Transactions on Networking, online, March 2021
- No-Regret Caching via Online Mirror Descent, Tareq Si Salem, Giovanni Neglia, and Stratis Ioannidis, Proc. of IEEE International Conference on Communications (ICC), June 14-23, 2021
- Online Caching Networks with Adversarial Guarantees, Yuanyuan Li, Tareq Si Salem, Giovanni Neglia, Stratis Ioannidis, ACM SIGMETRICS / IFIP PERFORMANCE 2022, Mumbai, India June 6-10, 2022

Principales activités

Beside pursuing the research directions described above, the postdoc can be involved in supervision of PhD and master students.

Compétences

The working language is English.

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

Gross Salary: 2653 € per month

Informations générales

- **Thème/Domaine** : Réseaux et télécommunications
- **Ville** : Sophia Antipolis
- **Centre Inria** : [Centre Inria d'Université Côte d'Azur](#)
- **Date de prise de fonction souhaitée** : 2022-09-01
- **Durée de contrat** : 12 mois
- **Date limite pour postuler** : 2022-07-31

Contacts

- **Équipe Inria** : [NEO](#)
- **Recruteur** :
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A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 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.

L'essentiel pour réussir

We are looking for a candidate with a strong background on performance evaluation of networks.

Background knowledge on Coordinated Multi-Point transmission techniques is a plus.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

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 défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.