2018-00982 - PhD position in programmable networks

**Contract type:** Public service fixed-term contract
**Level of qualifications required:** Graduate degree or equivalent
**Function:** PhD Position

**About the research centre or Inria department**

Inria is a national research institute dedicated to digital sciences that promotes scientific excellence and transfer. Inria employs 2,400 collaborators organised in research project teams, usually in collaboration with its academic partners. This agility allows its scientists, from the best universities in the world, to meet the challenges of computer science and mathematics, either through multidisciplinarity or with industrial partners.

A precursor to the creation of Deep Tech companies, Inria has also supported the creation of more than 150 start-ups from its research teams. Inria effectively faces the challenges of the digital transformation of science, society and the economy.

**Context**

**Scientific context**

Modern factories and industrial system massively rely on cyber physical systems with digital communications (e.g., to allow collaborative robots, for data analytics...). However, industrial networks are still mostly managed and conceived as collections of independent communicating units instead of one unified piece of software.

The reason why the shift of paradigm did not occur yet to industrial digital communication networks is because industrial processes generally impose strong determinism and real-time constraints. As a result, industrial networks have a propensity of being physically segregated to contain potential malfunctions and simplify conception.

With the DET4ALL project, we will apply the concept of network programmability to the world of industrial communicating systems. To that aim, we will construct and prove the essential building blocks that will allow to virtualise industrial networks:

- Algorithms to automatically provision the various components constituting industrial networks;
- Domain Specific Languages (DSLs) to specify real-time communication schemes;
- Mechanisms to update on-the-fly the production infrastructures without service degradation.

The impact of the DET4ALL project goes beyond technological advances; it will also bring a new vision on what production tools can become, namely agile systems in perpetual evolution.

**Administrative context**

This PhD position is in the context of the ANR JCJC DET4ALL Project. ANR JCJC projects are research and innovation research projects funded by the French national Research Agency (ANR) coordinated by young researchers (JCJC)[0]. The DET4 ALL project will start in January 2019 to finish in 2022. The PhD researcher will be jointly supervised by Damien Saucez, the DET4ALL project leader, and Walid Dabbous, head of the DIANA Research Team.

**Assignment**

**Assignments**

The candidate will explore and propose approaches to design, validate, and implement provable real-time network data-plane and orchestration languages, potentially by extending languages such as P4 [1] and Heat [2].

The main expected outcomes are:

- To identify the features required in network DSLs to provide real-time expressiveness.
- To propose network DSLs that support these features.
- To prove the correctness of the propositions.
- To implement functional prototypes of the propositions.

**Collaboration**

The candidate will be a cornerstone of the DET4ALL project and will interact with the other researchers involved in the project, namely a Post-Doctoral fellow, master students, and a senior researcher. The candidate will also have to closely interact with industrial partners.

**Bibliography**


**Main activities**

The candidate will:

- conduct a thorough survey of the state of the art on programming languages, and Domain Specific Languages (DSLs) and their compilers;
- design network DSLs supporting real time and determinism expressiveness and prove their non-ambiguity and their correctness;
- implement a prototype supporting the proposed DSLs;
- empirically validate the results on a hardware target.
**Skills**

Technical skills and level required:
- Good knowledge in network protocols.
- Good knowledge in programming language principles.
- Good knowledge in compiler principles.
- Knowledge in real-time and embedded systems is a plus.
- Strong system programming skills.

Languages:
- Mastery of scientific and technical English.
- Technical French is a plus but not mandatory.

Other valued appreciated:
- Autonomy / Curiosity.

**Benefits package**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

**Remuneration**

Duration: 36 mois
Location: Sophia Antipolis, France
Gross salary: 1982€ (year 1 & 2) and 2085€ (year 3)

---

**General Information**

- Theme/Domain: Networks and Telecommunications
  System & Networks (BAP E)
- Town/city: Sophia Antipolis
- Inria Center: CRI Sophia Antipolis - Méditerranée
- Starting date: 2019-02-01
- Duration of contract: 3 years
- Deadline to apply: 2018-09-30

**Contacts**

- Inria Team: DIANA
- Recruiter: Saucez Damien / damien.saucez@inria.fr

**About Inria**

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

**The keys to success**

The candidate is passionate about computer science, with good knowledge in programming languages principles. A master thesis in the field of industrial network is a plus.

Essential qualities in order to fulfil this assignment are feeling at ease in an environment of scientific dynamics and wanting to learn and listen.

**Conditions for application**

**Defence Security**:
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favorable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavorable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

**Recruitment Policy**:
As part of its diversity policy, all Inria positions are accessible to people with disabilities.

---

**Warning**: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website.
Processing of applications sent from other channels is not guaranteed.