

Faculty of Science and Engineering

Profile report: Computer Networks (Computernetwerken)

- Discipline: Computer Science
- Level: tenure-track Assistant professor/Associate professor/Full professor
- Fte: Full time (1.0)

1. Scientific discipline

The Internet and computer networks are now ubiquitous and a growing number of computing activities strongly depend on the correct operation of the underlying network. Networks, both fixed and mobile, form a foundation of a modern distributed computing environment, being an important infrastructure element in the areas of Big Data, Internet-of-Things, and cloud computing. Many computing applications that are used today would not be possible without networks.

2. Vacancy

This position is opened by the Board of the Faculty (PT/dja/18/00153) as part of the new Center “Groningen Cognitive Systems and Materials”, which aims to develop systems and materials for cognitive computing. The position will be embedded in the Bernoulli Institute and falls within the framework of ‘Career Paths in Science 3’ (‘Bèta’s in Banen 3’). Please see link for [criteria and conditions](#).

3. Selection committee (BAC)

Prof.dr. J.B.T.M. Roerdink	Scientific director Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence (Chair), and professor Scientific Visualization and Computer Graphics
Prof.dr. B. Noheda	Director Groningen Cognitive Systems and Materials and Professor Nanostructures of Functional Oxides
Prof.dr. A. Telea	Program director bachelor Computing Science and professor Visual Analytics
Prof.dr. D. Karastoyanova	Professor Information Systems
Prof.dr. A. Lazovik	Professor Web Computing
Y. Tijmsma	Student member
prof.dr. J.J. Lukkien	Professor System Architecture and Networking, TU Eindhoven

Advisors:

Prof.dr. M. Biehl	Professor Machine Learning
Prof.dr. L.C. Verbrugge	Professor Multi-Agent Systems
Prof.dr.ir. C.H. van der Wal	Scientific director Zernike Institute for Advanced Materials and professor Nanostructures of Functional Oxides
Dr. J.H.M. van der Velde	Scientific Coordinator Groningen Cognitive Systems and Materials and secretary of the selection committee

HR advisor:
L.A. Boomsma

4. Research area

Network architectures form an important ingredient of computer systems. Important aspects are architectures, network protocols, components, algorithms, structure, security and performance of networks (ACM Computing Classification System, 2012 Revision).

For this position, the focus is on network design for novel cognitive computing applications, with an emphasis on efficient transmission and processing of large amounts of data. Novel computer network technologies are needed that focus on communication and networking of modular neuromorphic units. Within the center, there are strong connections to research on new computer architecture (Bernoulli Institute) and to neuromorphic circuit design (Zernike Institute). The research will focus on different directions involving various aspects of a new computational paradigm: from new advanced network models for efficient communication between electronic “synapses” to new innovative distributed algorithms that fully utilize new computational infrastructure.

5. Embedding: institute (and base unit)

The position will be embedded in the Distributed Systems research unit or one of the other existing research units of the Computer Science department of the Bernoulli Institute, depending on the actual area of the selected candidate. The Distributed Systems group performs research and delivers education in all aspects of distributed information systems with particular emphasis on service-oriented computing, pervasive middleware and energy distribution infrastructures. If a full professor is selected and appointed, the candidate may also be offered to establish and lead a new research unit on Computer Networks within the Bernoulli Institute. The position will play a crucial role within the Center “Groningen Cognitive Systems and Materials” (CogniGron).

The Groningen Cognitive Systems and Materials Center is a joint venture between FSE-institutes Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence, and the Zernike Institute for Advanced Materials. It comprises researchers from materials science, physics, chemistry, mathematics, computer science and artificial intelligence. The center provides structure, coherence, and visibility for a joint research program in the direction of cognitive systems and materials. The main goal of the Groningen Cognitive Systems and Materials Center is to create self-learning materials that will perform the tasks that are now assigned to thousands of transistors and complex algorithms in a more efficient and straightforward manner, hence, forming the basis for a new generation of computer platforms for cognitive applications, such as pattern recognition and analysis of complex data.

The Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence is part of the Faculty of Science and Engineering (FSE). The profile of the

institute centers around modelling, computation, and cognition with a focus on science and technology, keeping a balanced mix of fundamental and applied aspects. The Bernoulli Institute comprises five mathematics programmes, six computer science programmes, and four artificial intelligence programmes. The constituting programmes participate in various national research schools and most of the PhD students are enrolled in an educational programme and take part in other activities offered by these schools. The Bernoulli Institute aims to strengthen the current research portfolio in Mathematics, Computer Science and Artificial Intelligence by expanding both in fundamental areas that have a prominent role in education as well as in directions that are essential for new technological and societal developments.

6. Local and (inter)national position

Locally, the Computer Science Department of the Bernoulli Institute has a strong position in several research areas related to computer networking: pervasive middleware (with applications in the areas of office buildings and smart factories); energy and water distribution infrastructures; architecting of software-intensive systems and object-oriented software design; information systems, middleware and business process management; data science and data engineering, information visualization, and visual analytics, machine learning, intelligent systems. Nationally, most universities have strong research efforts in computer networking, also related to systems architecture and security. The connection of the new position to neuromorphic computing is unique for Groningen.

At the national level the department participates in the School for Information and Knowledge Systems (SIKS), which is the most relevant for the position, in the Dutch computer science research schools Advanced School for Computing and Imaging (ASCI), Dutch Research School in Logic (OZSL) and the Dutch Research School in Programming and Algorithmics (IPA).

At the international level the department is involved in several EU research projects (*e.g.*, Human Brain Project, Smart Homes, GreenerBuildings), has established collaborations with major companies (Philips Research, IBM) and technological institutes (Astron, TNO, NLR, ECN), and has cooperation and exchange programmes with many universities (*e.g.*, Rome, Leipzig, Birmingham, Barcelona, Ghent, ESIEE-Paris, Tampere). In Computer Science, the Bernoulli Institute has a strong position (as evidenced by participation in NWO and EU projects, publications in renowned journals and conferences, memberships of editorial boards and program committees, conference chairing, *etc.*) in intelligent systems (biologically inspired computational modelling, machine learning, morphological image processing); pervasive middleware and energy distribution infrastructures; architecting of software-intensive systems and object-oriented software design; information systems; data and information visualization, and visual analytics.

7. Expected contributions to research

The candidate is expected to initiate and develop an internationally leading research programme in the field of Computer Networks. The research should have a visibility on the national and worldwide level and lead to publications in top journals. Further it is expected, that the new professor will take a leading role in the field of Computer Science within the Netherlands. Obtaining substantial external funding for PhD projects is crucial. Supervision of PhD students is an important part of the research activities. The research is expected to strengthen the existing efforts in the field of Computer Science within the Bernoulli Institute and the Groningen Cognitive Systems and Materials center, and should lead to a strengthening of the international reputation of the group, the research center and the institute.

8. Expected contributions to teaching

The candidate is expected to contribute to the teaching programmes in the bachelor and master degree programs within the Undergraduate and Graduate Schools of Science and Engineering. She/he is expected to participate in the teaching programme of specialized courses in relation to Computer Networks and other related topics, *e.g.* computer architecture, operating systems, information systems, parallel computing, GPU computing, distributed computing, and neural networks. Furthermore, the candidate will be involved in supervising bachelor, master and PhD students. Upon appointment, depending on experience and formal qualifications to date, the candidate may be required to enter a nationally standardized tertiary teaching skills certification trajectory (BKO or Basis Kwalificatie Onderwijs), successful completion of which is a condition for extensions and tenure.

9. Expected contributions to the organization

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of the FSE, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees, in the fields of teaching, research and management. The candidate will participate in relevant national and international organizations.