



**Carleton  
University**

**Department of Systems  
and Computer Engineering**

Departmental Seminar:

**DNA-based Nanonetworks:  
Realizing the Internet of Bio-Nano Things**

**Stefan Fischer**

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**Tuesday, May 7, 2024, 4 pm – 5:30 pm**

**Carleton University, Mackenzie Engineering 4463 (Maker Lab)**



**Abstract:**

The Internet of Bio-Nano Things (IoBNT) is an innovative field of research at the intersection of nanotechnology, biotechnology and information and communication technologies. It aims to enable the seamless integration of biological and nanoscale systems into the Internet in order to develop advanced biomedical applications, environmental monitoring sensors and energy-efficient networks. At the core of IoBNT are biocompatible nanodevices that can function in living organisms to monitor or modify specific biological processes in real time. These devices communicate with each other and with the Internet to collect, process and transmit data, opening up entirely new possibilities for health monitoring, disease control, environmental protection and many other areas. By merging biology and nanotechnology, IoBNT promises to push the boundaries of what is technically possible while improving the efficiency and sustainability of technological solutions.

DNA-based nanonetworks are a promising concept and implementation technology for the IoBNT. In this approach DNA is manipulated to form structures known as tiles, which self-assemble to much more complex structures such as nano devices and even full nano networks which function autonomously. Such networks communicate through molecular messages which are, in the very same way, also made of tiles. Such messages are even able to perform computations which can be used for disease detection and treatment.

In this talk, we will give a brief introduction into the IoBNT, but will then mainly concentrate on DNA-based nanonetworks. We introduce the basic principles, especially DNA tiles, self assembly, and in-message computation. We explain, using a few examples, how such networks can be of use in medical applications, e.g. by dispensing medication exactly at the position in the body where it is needed. Finally we present first ideas for wet lab experiments and give an outlook on future work.

**Speaker:**

Stefan Fischer is a full professor in Computer Science at the University of Lübeck, Germany, and the director of the Institute for Telematics. He got his diploma degree in Information Systems and his doctoral degree in Computer Science from the University of Mannheim, Germany, in 1992 and 1996, respectively. After a postdoctoral year at the University of Montreal, Canada, he held positions at the International University in Germany as an assistant professor and at the Technical University of Braunschweig as an associate professor, until he joined Lübeck University in 2004. His research interest is currently focused on network and distributed system structures such as ad-hoc and sensor networks, Internet of Things, Smart Cities and nano communications in these fields. He has (co-)authored more than 200 scientific books and articles.

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