Computer Networks Group

Overview

Research topics in this group focus on:

- **Wireless Sensor Networks and the Internet of Things:** We investigate run-time support for wireless sensor networks (WSN) and the Internet-of-Things (IoT). We are particularly interested in Medium Access Control (MAC) protocols, routing protocols, high-level operating system abstractions for WSN and IoT, and low-power operation in all system layers, from applications to the operating system to hardware. We work on both software and hardware layers, being EPOS and EPOSMote, respectively, the software and hardware counterparts usually employed in our projects.
- **Smart Networked Systems:** We investigate the integration of WSN and IoT into smart networked systems by building applications using software and hardware developed by the EPOS Project. Research in this area includes smart energy harvesting from the environment (through a partnership with the LabSolar group), and control of smart environments (SmartCity, SmartBuildings, and interaction with the SmartGrid).

Current Research Activities

- **Low-power operation of (real-time) networked embedded systems:** Specially for WSN, low-power operation is of paramount importance to prolong system lifetime by lowering battery discharge rate. Even greater enhancements to operation time may be achieved if such WSN systems feature rechargeable batteries and mechanisms for harvesting energy from the environment they are in. Additionally, more sophisticated techniques can be applied that do not only lower battery discharge rate but also take into account real-time metrics and/or predict system operational parameters such as workload and availability of energy for recharging batteries. We are interested in low-power operation mechanisms in all layers (from application software to hardware) and on scheduling mechanisms and/or optimization processes that take complex constraints into account for prolonging battery lifetime of individual nodes or of the whole network.
- **Communication protocols for WSN and IoT:** Efficient and context-aware communication protocols enable the exploration of several system-dependent characteristics that, in turn, allows for the deployment of more efficient systems. For instance, context-aware routing or MAC protocols in a WSN may be benefic to the system energy consumption and/or network quality, and an adaptable TCP/IP stack may enable tiny embedded devices to be connected to the Internet of Things (IoT). Our research group have been working on efficient and configurable implementation of MAC protocols (see CMAC), adaptable routing protocols (see the ADHOP), and configurable TCP/IP stacks. We are interested in exploring cross-layered protocol implementations where information on different levels (link, network, transport, application) may be integrated in order enhance system metrics (e.g., energy consumption, packet loss). Also, we are exploring context-aware communication in wireless sensor network through Named-Data Network protocols.
- **Hardware platforms for smart networked systems:** The development of specific state-of-art Hardware to be used for the communication protocols and energy harvest algorithms gives the user a flexible development platform. Using a ZigBee SoC, with an ARM7 core and a radio transceiver, a complete low-power wireless platform called EPOSMote II was built, along with it's daughter board equipped with sensors and actuators. A new system is in it's way, using the power line as it's physical interface for communication, the EPOSPLC will be used in smart-buildings for home automation systems. We are interested in integrating challenging, not traditional hardware components to our WSN platform, such as bio-sensors and organic circuits.

- **Applications:** Applicability of our research developments are validaded in several applications. These applications include:
  - monitoring of electricity grid (funded by CELESC);
  - telemetry of UFSC's solar boat (partneship with LabSolar);
  - SmartBuilding automation (partneship with LabSolar);
  - Monitoring level and pollution of urban rivers (in the CIA2 Project).
  - We are interested in implementing any application that represent a challenge to the developments described herein. We are specially interested in applications that address important issues such as: WSN and IoT applications for health-care, monitor and control of environmental situation (e.g., air quality, radiation), and integration of complex sensoring systems (e.g., bio-sensors).

If you want to join us, please refer to available work plans and send us an email.

Group Meetings (click)

Publications

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http://www.lisha.ufsc.br/pub/index.php?key=NET

People

Professors

- Prof. Dr. Antônio Augusto Fröhlich
- Prof. M.Sc. Arliones Hoeller Jr

Ph.D Candidates

- Arliones Hoeller Jr

Master's Students

- João Gabriel Reis

Undergraduate Students

- Davi Resner

Former members

- Alexandre Massayuki Okazaki
- Alexandre Lúcio Gontijo da Silva
- André Paulon
- Cládio Martins
- Gustavo Roberto Nardon Meira
- Ingrid Cezário
- João Gabriel Reis

- João Zeni
- Leonardo Maccari Rufino
- Leonardo Kessler Slongo
- Marcelo Ribeiro Xavier da Silva
- Marcos Pereira
- Peterson Oliveira
- Rodrigo Valceli Raimundo
- Rodrigo|Rodrigo Steiner
- Vagner Guadagnin