

Adaptive Computing

Patrik Floréen

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Adaptive Computing group

- Our group conducts research on **modelling and optimisation** in resource-constrained distributed environments
- Our work concentrates on
 1. **ad hoc and sensor networks**
 2. data analysis, probabilistic modelling and component-based development for **mobile context-aware systems**
- **Collaboration with industry** important

People

- Group leader:
 - Doc. Patrik **Floréen**
- Doctoral students and project researchers:
 - Petteri **Nurmi**, Michael **Przybilski**, Jukka **Suomela**,
Taneli **Vähäkangas**
- Research Assistants:
 - Sourav **Bhattacharya**, Fredrik **Boström**,
Marja **Hassinen**, Joonas **Kukkonen**,
(Eemil **Lagerspetz** in civil service), Tianyan **Liu**,
Topi **Musto**; summer trainee Tiina-Kaisa **Oikarinen**
- Affiliated researcher:
 - Dr Petteri **Kaski**

Project portfolio at a glance

	Past	Present
Ad hoc and sensor networks (ADA)	NAPS 01/03-12/05	Geru 01/07-12/09
Context-aware computing: Data analysis and probabilistic modelling (ADA)	MobiLife 9/04-12/06	Stepwise 9/06-8/07
Context-aware computing: Component-based software development (FI)	Space4U 7/03-6/05	Trust4All 10/05-12/07

Ad hoc and sensor networks



Overview of the ad hoc and sensor network research

- Past project **NAPS** (Networking and Architecture for Proactive Systems) 01/03-12/05
- Present project **Geru** (Optimising Data Gathering in Resource-constrained Networks) 01/07-12/09
- Both funded by the Academy of Finland
- We work on combinatorial algorithms for **optimising energy-constrained** ad hoc and sensor networks
- Collaboration with TKK (Orponen and Virtamo)
- In addition, Petteri Nurmi works on **game-theoretic modelling** of routing
- In addition participation in PASCAL (EU FP6 IST NoE) 12/03-11/07

Geru

- Objective: “fundamental algorithmic research on **data gathering in sensor networks** ... to establish how sensor networks should be **deployed** and **operated** in order to maximise the expected **utility**” in specific classes of applications
- Researchers: **Jukka Suomela**, Patrik Floréen, Petteri Kaski, Topi Musto

Example result: Sleep scheduling

- A **localised, distributed approximation scheme** for sleep scheduling in sensor networks for a family of realistic graphs
 - Jukka gave a talk about this in the HIIT Seminar on 23.3.2007
 - “A distributed approximation scheme for sleep scheduling in sensor networks,” to appear in SECON 2007

Game-theoretic modelling of routing

- Objective: understand and model routing behaviour of devices when they are selfish and resource constrained
- Researcher: Petteri Nurmi
- Example result: applicability of reinforcement learning to routing in resource-constrained settings (under certain assumptions)
 - Petteri gave a talk about this in the HIIT Seminar on 30.3.2007
 - “Reinforcement learning for routing in ad hoc networks,” WiOpt 2007

Context-awareness



Overview of the context-awareness research

- We study mobile context-aware systems
- Here we have **two tracks**:
 1. Data analysis and probabilistic modelling
 - In HIIT's ADA programme
 2. Component-based software development
 - In HIIT's FI programme
- We will here discuss only the first track (other is in FI)

Data analysis and probabilistic modelling for mobile context-aware systems

- Past project **MobiLife** (Mobile Life), EU FP6 IST IP, 9/04-12/06
- Present project **Stepwise** (Semantic Interpreter Widened Experience), Nokia subcontract, 9/06-8/07
 - Objective: “provide a new level of user experience interpreting the user's intentions”
 - Researchers: **Petteri Nurmi**, Patrik Floréen, Fredrik Boström, Joonas Kukkonen, Tianyan Liu

Example result: Location clustering

- Identifying meaningful locations for the user, **combining GPS** coordinates **and GSM** cell identifiers
 - More accurate than mere GSM based clustering
 - Less resource consuming than GPS based
- P. Nurmi, J. Koolwaaij, “Identifying meaningful places”, MobiQuitous 2006

Example result: BeTelGeuse

- A tool for sensor data gathering over Bluetooth
- Runs on mobile phones and PDAs
- Available under GPL license through www.hiit.fi
 - > Adaptive Computing >
 - Publications and other outcome

