

PhD Progress Review: Towards a Cognitive NEMO and Applications to Mobile and Vehicular Networking

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December 3, 2009



Outline

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Research Scope

- Mobile devices and vehicular networks (MIP/NEMO)
- Two type of communications
 - with a remote host over a managed infrastructure (M/V2I)
 - with a similar peer over a self-organizing network (M2M/V2V)
 - Uncertainty of the trustworthiness of the self-organizing nodes
 - or combinations of both, M2M being the most general case
- Varying conditions along the end-to-end (unicast) path
 - Mobility-induced disconnections (how long before it should break?)
 - Improvement/deterioration of characteristics
 - Change of medium
 - Doppler effect? (unlikely)
 - Generic metrics: e2e goodput and delays
 - possibly changing rapidly
- Heterogeneous traffic
 - Infotainment: web, chat, VoIP, VoD
 - Traffic efficiency: driver/pedestrian advice
 - Traffic safety: road condition report, warning
 - Variable properties: priority, e2e requirements, adaptability, security

PhD Objective

Make the best use of the network resources when they are available, degrade gracefully when they are scarce

- Adaptable network stack components
- Local (and e2e) conditions sensing
 - some relevant conditions only observable by other nodes of the NEMO
- Valuation of the adaptable parameters of the stack
 - based on priorities and requirements of the applications

Proposed Solution

- Adaptive transport
 - Cope with mobility-induced disruptions
 - Adapt to changes to the end-to-end path
- Cognitive NEMO
 - Inspired by Cognitive Networks
 - within the NEMO
 - not all nodes equipped (MR, HA, AR?)
 - interaction w/ other MR/MN better but not necessary
 - Node-local but stack-global decision
 - “Cross-Layer” design with contextual knowledge
 - Optimize stack parameters
 - Learning
 - Distributed sensing
 - Sharing of information within the NEMO
 - Context Management System
 - Information and policy exchange with the HA

Current Status

- Adaptive transport: Freeze-DCCP
 - Cope with mobility-induced disruptions
 - **TODO** : kernel implementation and experiments
 - Adapt to changes to the end-to end path
 - **TODO** : work with Andrés Arcia (Telecom Bretagne) on TCP, adaptation to DCCP
 - **TODO** : article on both aspects with real measurements
- Cognitive NEMO
 - Node-local, stack-global, decision
 - **TODO** local information collection and CP-based decision (M. Maher, Nicta)
 - **TODO** (if time) other decision approaches
 - **TODO** work with Baptiste Gaultier (Telecom Bretagne) on CMS-based information sharing
 - **TODO** Integration within the CALM Manager for ITS stations
 - **TODO** Evaluation methodology
- Experimental platform based on RTMaps
 - Log all network traffic
 - **TODO** RTMaps components
 - **TODO** Collect MR status

Contributions

- Adaptive transport: Freeze-DCCP
 - Olivier Mehani and Roksana Boreli. “Adapting TFRC to Mobile Networks with Frequent Disconnections”. In: [CoNEXT 2008](#)
 - Olivier Mehani, Roksana Boreli, and Thierry Ernst. “Analysis of TFRC in Disconnected Scenarios and Performance Improvements with Freeze-DCCP”. In: [MobiArch 2009](#)
- Cognitive NEMO
 - Olivier Mehani, Roksana Boreli, and Thierry Ernst. “Context-Adaptive Vehicular Network Optimization”. In: [ITST 2009](#)
- Experimental platform based on RTMaps
 - [Current focus](#)
 - Manabu Tsukada, Olivier Mehani, and Thierry Ernst. “Simultaneous Usage of NEMO and MANET for Vehicular Communication”. In: [TridentCom 2008](#)
- Other contributions:
 - Terence Chen, Olivier Mehani, and Roksana Boreli. “Trusted Routing for VANET”. In: [ITST 2009](#)
 - Ported various *ns* – 2 extensions (Freeze-TCP, MobiWAN, ...)

Roadmap

December 2009–January 2010 Experimental platform

Dec. Development

Jan. Validation

February–May 2010 Cognitive NEMO

Feb.–Mar. Local decision and adaptability

Apr.–May. Distributed Context information within
NEMO

Overall Integration within CALM

June–End of 2010 Concluding work and dissertation writing

- Finish work on transports
- Experiments with the system
 - Mobile platforms at Nicta
 - Vehicles at Inria