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Lappeenranta University of Technology
A Communication Middleware Quality Enhancement with Qt Framework

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Goals

- Study feasibility of Qt framework and Qt Mobility for communication middleware use.

- Advantages and disadvantages of using Qt framework

- What kind of changes the Qt causes to existing system architecture
PeerHood Middleware

- PeerHood is peer-to-peer service sharing middleware for mobile environment
- Transparent communication between PeerHood devices
- Device monitoring on network neighborhood
- Network implementations are dynamic plugins
Qt Framework and Qt Mobility
- Used Technologies -

Qt Framework
- Qt Core
  - Event system
  - Signals and Slots
  - Containers
  - Data streams
  - Timing
  - Settings
- Qt Network
  - TCP and UDP sockets (and TCP server)

Qt Mobility
- System information
  - Network signal strength monitoring
- Bearer management
  - Available network types and configurations
Qt Based PeerHood Design and Implementation

PeerHood available at http://www.gitorious.org/peerhood

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Qt Based PeerHood Design and Implementation, contd.

- Implemented almost fully with the Qt framework
  - Not support for ICMP ping implementation

- Almost all PeerHood requirements are implemented in the new PeerHood implementation
  - Connection roaming was left out of scope

- WLAN and Localhost network plugins implemented
  - GPRS and Bluetooth were not implemented in this study

- Qt event loop is used instead of multithreading
  - Multithreading can be enabled later on if needed
Evaluation

- Static Code Analysis with SourceMonitor

- Reliability test with test set by performing common PeerHood functionalities in loop.

- Memory Usages
  - Valgrind massif tool
  - Exmap tool

- CPU Usages
  - time command
Evaluation, Static Code Analysis

Kiviat Metrics Graph: Project 'PeerHood1'
Checkpoint 'Baseline'

% Comments = 41.3
[15-25]

Avg Complexity = 3.19
[2.0-4.5]

Method/Class = 8.13
[4.20]

Avg Depth = 1.60
[1.0-2.5]

AvgStmts/Method = 10.5
[5-10]

Max Depth = 9+
[3-6]

Max Complexity = 44
[2-8]

Kiviat Metrics Graph: Project 'PeerHood2'
Checkpoint 'Baseline'

% Comments = 25.2
[15-25]

Avg Complexity = 3.19
[2.0-4.5]

Method/Class = 7.24
[4.20]

Avg Depth = 0.97
[1.0-2.5]

AvgStmts/Method = 4.7
[5-10]

Max Depth = 5
[3-6]

Max Complexity = 8
[2-8]
Memory Usage

PeerHood1 Memory Usage

PeerHood2 Memory Usage

Memory Usage of Different Qt Libraries

PeerHood available at http://www.gitorious.org/peerhood

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Memory Usage, Contd.

Used Heap Size

<table>
<thead>
<tr>
<th>kB Heap Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH1 Daemon</td>
</tr>
<tr>
<td>PH2 Daemon</td>
</tr>
<tr>
<td>PH1 Passive Client</td>
</tr>
<tr>
<td>PH2 Passive Client</td>
</tr>
<tr>
<td>PH1 Active Client</td>
</tr>
<tr>
<td>PH2 Active Client</td>
</tr>
</tbody>
</table>

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CPU usage

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Conclusions

- The Qt framework offers a large set of tools for communication middleware programming

- The use of Qt framework increases resource usage of the PeerHood implementation a much
  - However, memory and CPU usages are in usable level

- The Qt framework provides excellent portability for the PeerHood

- The signals and slots mechanism enables flexible and robust system design
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Questions?

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PeerHood is available for use and contribution

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