Towards Self-adaptive Software for Resource-constrained Cyberphysical Systems

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Context-Oriented Programming for Cyberphysical Systems (CPSs)

- CPSs need to be adaptable due to environmental dynamics
- Context is a representation of the environment
- Context-Oriented programming provides language abstractions for adaptation
- Context-Oriented programming is using context as a building block

Example: Wildlife Tracking

- Should send location data and health conditions
- Should transmit data if the base-station is in the reach
- Should locally log data in infrastructure-less situations

Context-Oriented nesC (ConesC)

Applications are less complex*

<table>
<thead>
<tr>
<th>Application</th>
<th>Variables</th>
<th>declarations</th>
<th>Functions</th>
<th>Per-Function time (µs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildlife tracking – nesC</td>
<td>6</td>
<td>8</td>
<td>12667.3</td>
<td></td>
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<tr>
<td>Wildlife tracking – ConesC</td>
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<td>2</td>
<td>6231.2</td>
<td></td>
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<tr>
<td>Smart-home controller – nesC</td>
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<td>1</td>
<td>18854.2</td>
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<td>Smart-home controller – ConesC</td>
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<td>1.3</td>
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<td>Adaptive stack – nesC</td>
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<td>Adaptive stack – ConesC</td>
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</tbody>
</table>


Future Work

- Domain-specific model-checking
- Source-code generator
- Context-Oriented programming for other CPS platforms

Overhead is negligible*