Supporting Heterogeneity in Data Driven Sensor Network Macroprogramming

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Introduction
Support for heterogeneity has been incorporated within a Macroprogramming framework. Policies for handling runtime and data routing for communication between nodes in a heterogeneous network were designed and implemented. Then, Macroprogramming support was added to compile Macroprograms and generate code for the heterogeneous network.

Challenges
- How to execute an integrated application on nodes with different lower level protocols for communication and task execution?
- How to write an efficient macroprogram compiler to generate appropriate code for nodes in the heterogeneous network, depending upon their type?

Routing Overview
The network is organized as a two level hierarchy
- at the lower layer, we have Sun SPOTs
- at the higher layer, we have both Base stations and PCs

Target nodes for data delivery are specified through the Logical Neighborhood (LN) specification

For heterogeneous network routing, we divide LN into:
- RegionScope – Part that specifies physical scope (Room no, Floor no etc)
- LNScope – the entire LN specification

Routing at the lower layer is done with matching for LNScope in the routing table
Routing at the higher layer is done with matching for RegionScope. Upon such a matching, the routing is delegated to the lower layer in that corresponding region.

Compilation Framework
With the toolkit, we were able to specify a WSN application, compile and deploy successfully on a network consisting of 2 Sun SPOTs, 2 Base stations(A laptop attached to a Sun SPOT configured as base station) and 1 PC (laptop). Code was generated for larger networks too.

Phases in Compilation
- ATaGParser: Parses the ATaG application specification.
- Instantiated Task Graph Generator: Instantiates copies of each unique task in ATaG specification, ready for assignment.
- Task Allocator: Assigns the instantiated tasks to nodes in the network.
- Deployable Code Generator: Assigned Tasks are plugged into appropriate runtime templates corresponding to nodes. This creates code ready for deployment.

Conclusion
- LN routing algorithm was modified for rapid routing in higher layers of heterogeneous network.
- Macroprogram compilation was reworked to support heterogeneous networks as targets for code deployment.
- Currently, work on energy optimizations in the routing protocol is under progress.

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