

Supporting Heterogeneity in Data Driven Sensor Network Macroprogramming

Mahanth K. Gowda, Animesh Pathak

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Supporting Heterogeneity in Data Driven Sensor Network Macroprogramming

Mahanth K Gowda Institute of Technology, BHU, India

Challenges

depending upon their type?

Routing Overview

no etc)

the routing table

Room = 1

RegionScope

Room0

mahanth.gowda.cse06@itbhu.ac.in

· How to execute an integrated application on nodes with different

· How to write an efficient macroprogram compiler to generate

appropriate code for nodes in the heterogeneous network,

lower level protocols for communication and task execution?

• at the higher laver, we have both Base stations and PCs

Target nodes for data delivery are specified through the Logical

RegionScope - Part that specifies physical scope (Room no, Floor

• Routing at the lower layer is done with matching for LNScope in

· Routing at the higher laver is done with matching for

RegionScope. Upon such a matching, the routing is delegated to

(Room = 1, Task = 1, AttachedSensor = Light)

LNScope

Illustration of Routing

The network is organized as a two level hierarchy

For heterogeneous network routing, we divide LN into

• at the lower laver, we have Sun SPOTs.

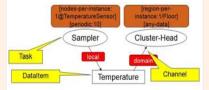
Neighborhood (LN) specification

• LNScope - the entire LN specification

the lower laver in that corresponding region.

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.



ATaG for building temperature management

Heterogeneous Network Description

Our heterogeneous network consists of:-

Sun SPOT sensor nodes

• PCs (ex. Laptops and Desktops)

• Base Stations (PCs attached with Sun SPOTs configured as base-stations)

There were two types of network:-

• IP based (for communication from PC to PC or Base Station)

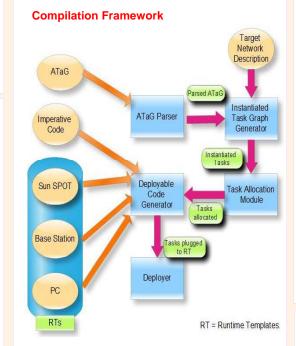
• IEEE 802.15.14 based (from SPOT to SPOT or Base Station)



Target Heterogeneous Network

Animesh Pathak INRIA Paris–Rocquencourt, France

nesh.pathak@inria.



Phases in Compilation

• Inputs: ATaG, Target Network Description, Imperative Code. • Outputs: Deployable code for nodes in the network.

The various modules in the framework:

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.

Integration with our Macroprogramming toolkit (Srijan)



ATaG specification with Srijan

Srijan is a toolkit to,

- Specify macroprograms
- · Compile them, and
- Deploy the generated code.

The work with supporting heterogeneity in data driven macroprogramming is successfully integrated with Srijan. We now have a Macroprogramming toolkit to specify, compile and deploy code on a heterogeneous network.

Experimental Results

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.

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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