

# Supporting Heterogeneity in Data Driven Sensor Network Macroprogramming

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## Supporting Heterogeneity in Data Driven Sensor Network Macroprogramming

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Challenges

depending upon their type?

**Routing Overview** 

no etc)

the routing table

Room = 1

RegionScope

Room0

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· 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.

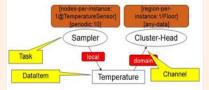
Neighborhood (LN) specification

• 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)

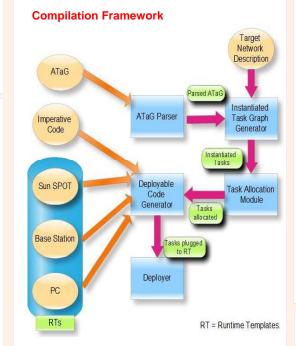
• IEEE 802.15.14 based (from SPOT to SPOT or Base Station)



Target Heterogeneous Network

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#### 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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Room1