

Performance Evaluation of Operations in RedSIB with Substitution Mechanism

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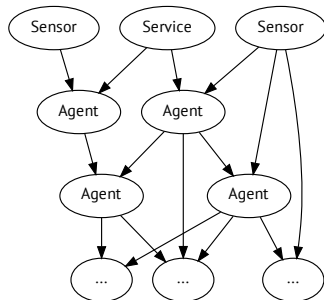


Dataflow Network Model

- IoT is large set of interconnected elements
- The base are data coming from smart devices and sensors

Dataflow network

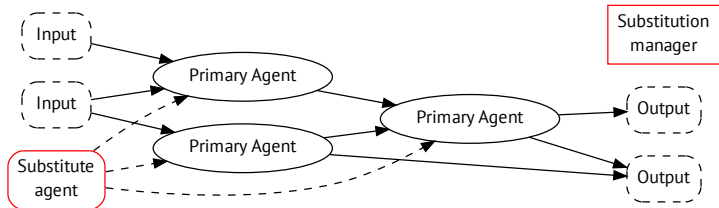
- Multi-step information refinement
- Well-suited for sensor data processing



Agent Substitution Mechanism

- Many units of IoT are mobile devices
 - have a limited power supply
 - use unreliable wireless channels
- Processing unit may unexpectedly disconnect
 - break existing data flows
 - loose accumulated context information

Agent substitution idea



Agent Substitution Mechanism Operations

- Keeping primary and substitute agents registry
 - Agent registration
 - Agent unregistration
- Agent substitution procedure
 - TCP/IP connection failure
 - Explicit substitution request
- Primary agent return
- Store subscription notifications during the substitution

Agent Substitution Implementation Aspects

Substitution mechanism is implemented as a SIB module

- Must detect disconnection as fast as possible
- Must efficiently manage agent context

Mechanism uses special configuration ontology

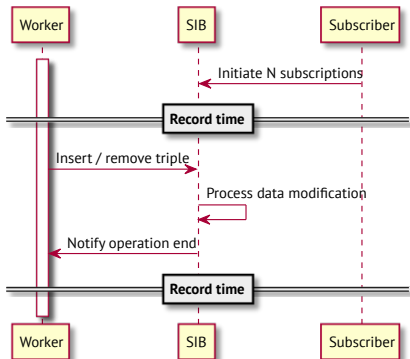
- Any KPI can be used to create dataflow agent
- Uses fixed number of internal subscriptions to track data modifications

Core SIB Operations Testing

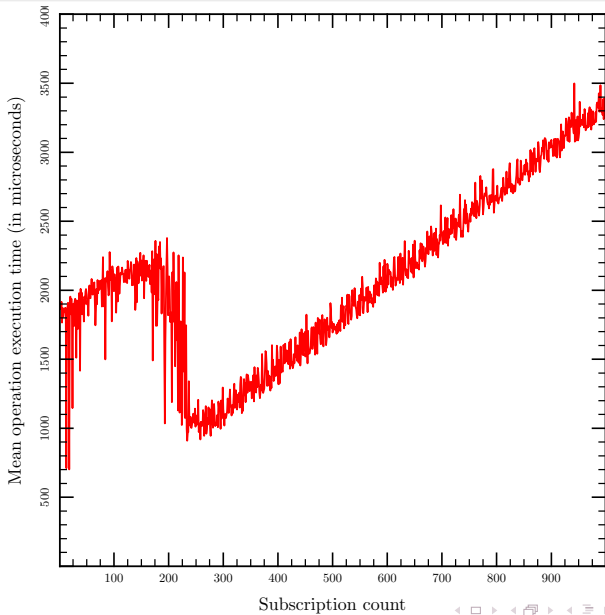
Experiment goal: estimate the mean time of insert and remove operations substitution

Perform 1000 following test cycles, where N is the current cycle number

- Setup N subscriptions to the smart space
- Insert and remove random 50 times (triples do not trigger subscriptions)



Core SIB Operations Testing Results

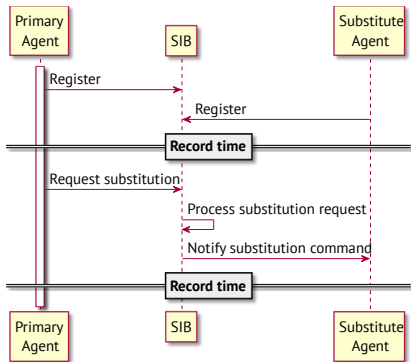


Substitution Performance Testing

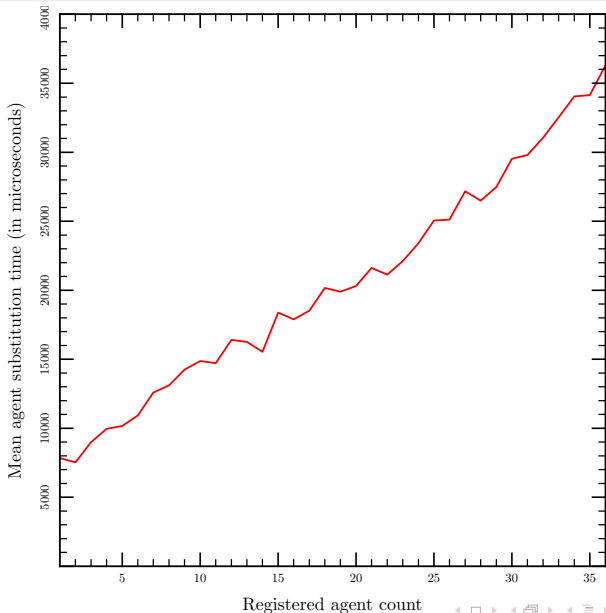
Experiment goal: estimate the mean time of substitution operation execution

Perform 35 following test cycles, where N is the current cycle number

- Register N primary agents and N substitute agents
- Perform voluntary substitution request for primary agents



Substitution Performance Testing Results

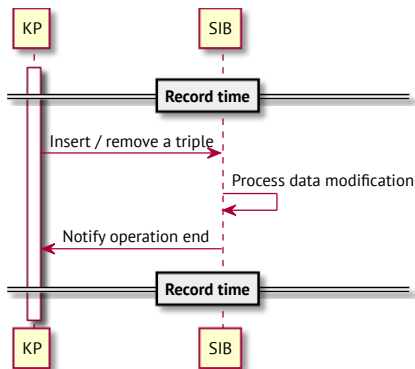


Impact of Substitution on SIB Operations

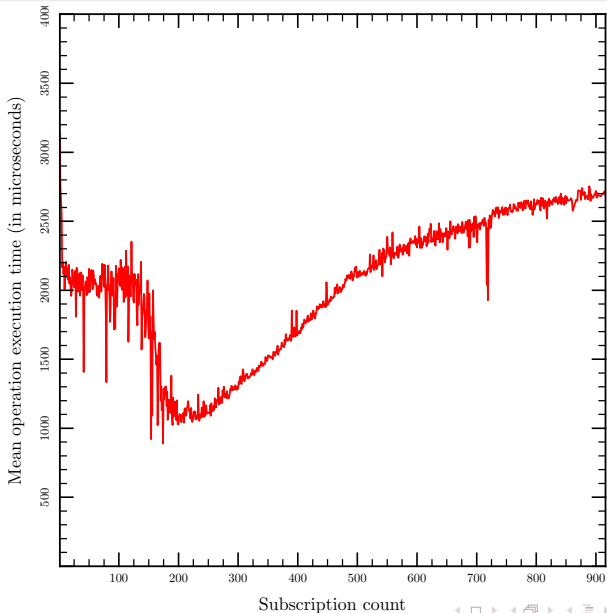
Experiment goal: estimate the mean time of core operations execution during the substitution operation execution

Perform 900 following test cycles, where N is the current cycle number

- Register 10 primary agents and 10 substitute agents
- Initiate N subscription to the smart space
- Simultaneously:
 - Insert and remove 50 random triples
 - Begin substitution for primary agents



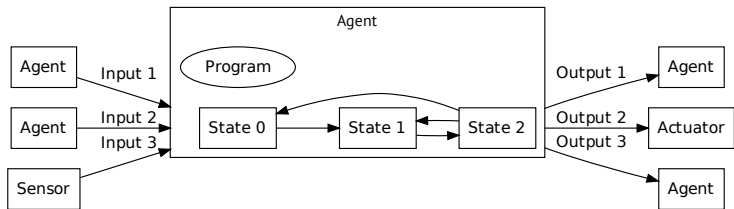
Impact of Substitution on SIB Operations



Conclusion and Future Work

- Substitution mechanism
 - Implemented as a SIB module
 - Uses special configuration ontology
 - Uses fixed number of subscriptions
- Performance considerations
 - Modifications did not impact on core operations
 - Substitution time is small, but should be improved
- Future Work
 - Migration to RedSIB 0.9

Dataflow Agent Model

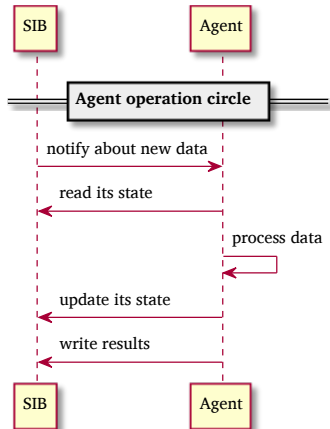


- Dataflow agents are stereotypical entities
- Dataflow agents are KPs conforming to certain rules
- Input channels are subscriptions
- Output channels are modified triples
- Internal state is a set of "private" triples



Dataflow Network Agent Implementation

- Dataflow nodes are KPs
- Context is stored inside SIB
- Inputs are subscriptions
- Outputs are triple modifications



SIB Modules Modification

