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Title
Hierarchy of Reconfiguration in Sensor Network Software Systems

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Hierarchy of Reconfiguration in Sensor Network Software Systems

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**Problem Description:** Need for multi-level reconfiguration

- Re-tasking the system
- Customizing to deployment environment
- Sharing the system among a few concurrent users and missions
- Upgrades, bug fixes, feature additions

**Proposed Solution:** General framework to support reconfiguration hierarchy

**Introduction:** Spectrum of techniques for in-situ reconfiguration of sensor networks

**Levels of reconfiguration**
- **Parameter Tuning**
  - Read and set system parameters
  - SNMS – Sensor Network Management System
- **High-level Script Updates**
  - Domain specific interpreter
  - ASVM - Application Specific Virtual Machine
- **Modular Binary Updates**
  - Run-time linker and loader
  - SOS - Static kernel and dynamic modules
- **Full Binary Updates**
  - Thin networked bootloader
  - Deluge - Upgrading complete TinyOS image

**Advantages at each level**

- **Parameter tuning**
  - Inflexible, but lowest-energy for update
- **High-level Scripts**
  - Compact code
  - High-level instructions, easier to program
  - VM provides environment for safe code execution
- **Binary Modules**
  - Update most system components
  - Balances flexibility with cost
- **Full Image**
  - Arbitrary changes to the complete system functionality

**Cost Flexibility Trade-off**

**Supports multi-level reconfiguration**

- **Dynamic Application Specific Virtual Machine (DASVM)**
  - Fine-tunes the parameters for both the loadable modules and the SOS kernel
  - Provides the ability to select modules according to application requirements
- **Loadable modules**
  - Provides environment specific algorithms, which can be upgraded in runtime
- **Loadable SOS kernel**
  - Provides device drivers, scheduler and memory management

**DASVM architecture**

- **Bytecode Dispatcher**
- **Bytecode Storage**
- **Bytecode Loader**

**BasicLib**

**MathLib**

**RagoLib**

**SOS architecture**

- Dynamic Application Specific Virtual Machine (DASVM)
- Dynamic Memory
- Message Scheduler
- Dynamic Linker
- Kernel Components
- Sensor Manager
- Messaging I/O
- System Timer
- SOS Services
- Device Drivers