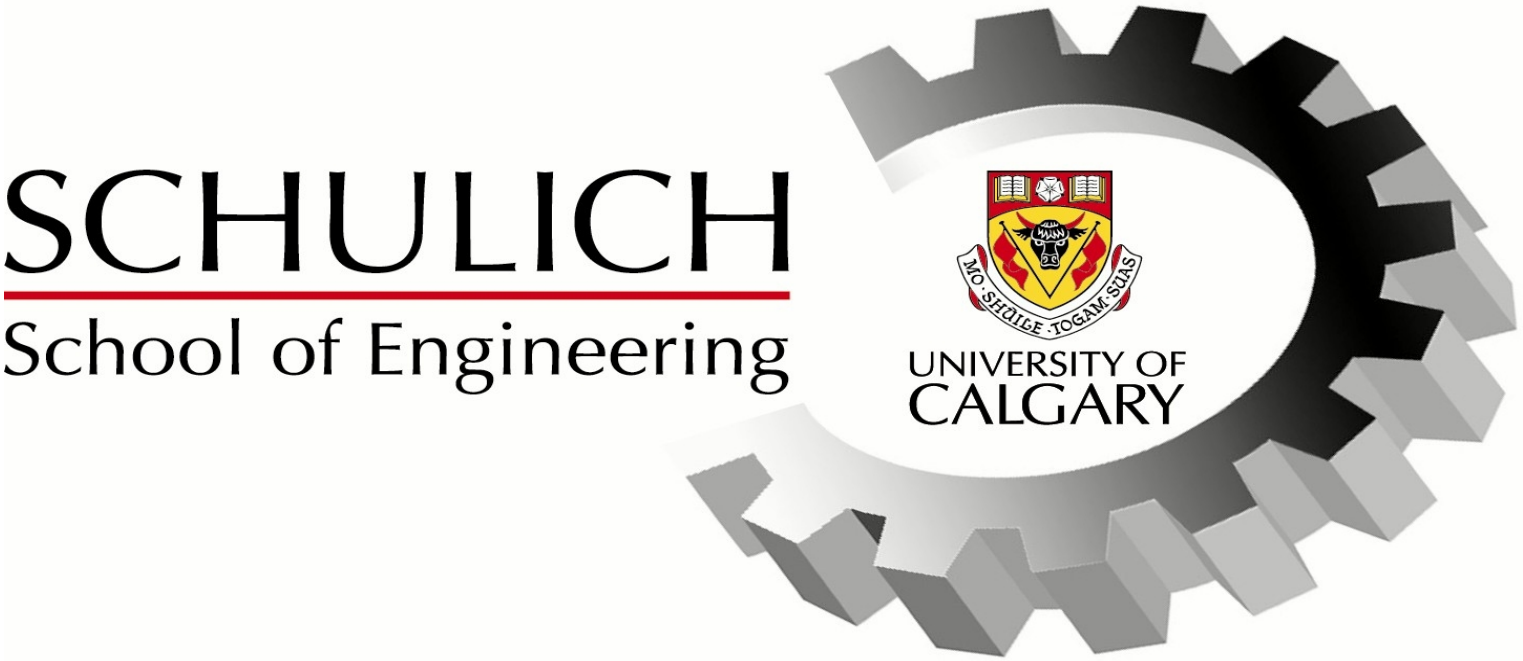

Distributed Intelligent Sensing and Control (DISC) for Automotive Factory Automation.

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Distributed Intelligent Sensing and Control (DISC) for Automotive Factory Automation.

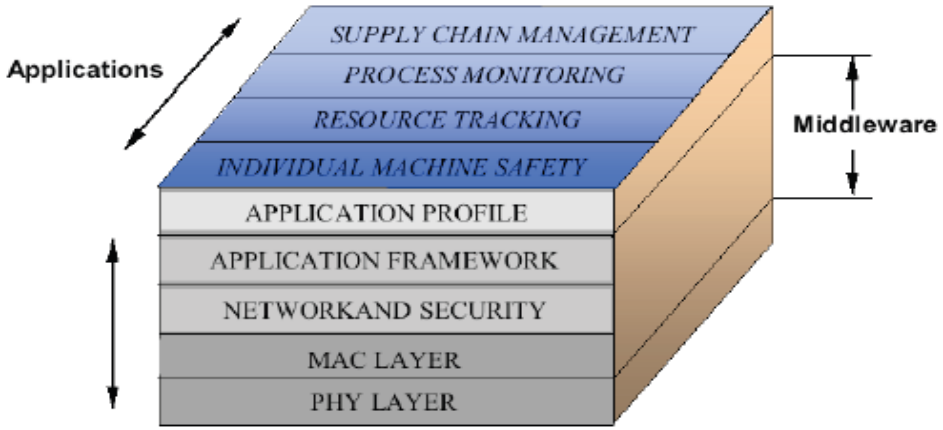
- This project is part of the Canadian AUTO21 Networks of Centres of Excellence: a nation-wide, interdisciplinary research effort that is focused on automotive research. Our contribution to AUTO21 is a collaborative venture between researchers at the University of Windsor, the University of Calgary, and the University of Western Ontario and spans the disciplines of micro-sensor design, embedded real-time control, and agent based systems.

DISC: Definition & Challenges

- An application of WSN to the lowest level of factory automation systems,
  - How to exploit IEC61499 to integrate WSN with extant systems that monitor and control shop floor resources.
- Challenges:
  - Harsh, uncertain, dynamic shop conditions.
  - Integration with new control software approaches to realize the flexibility and responsiveness of the whole system.

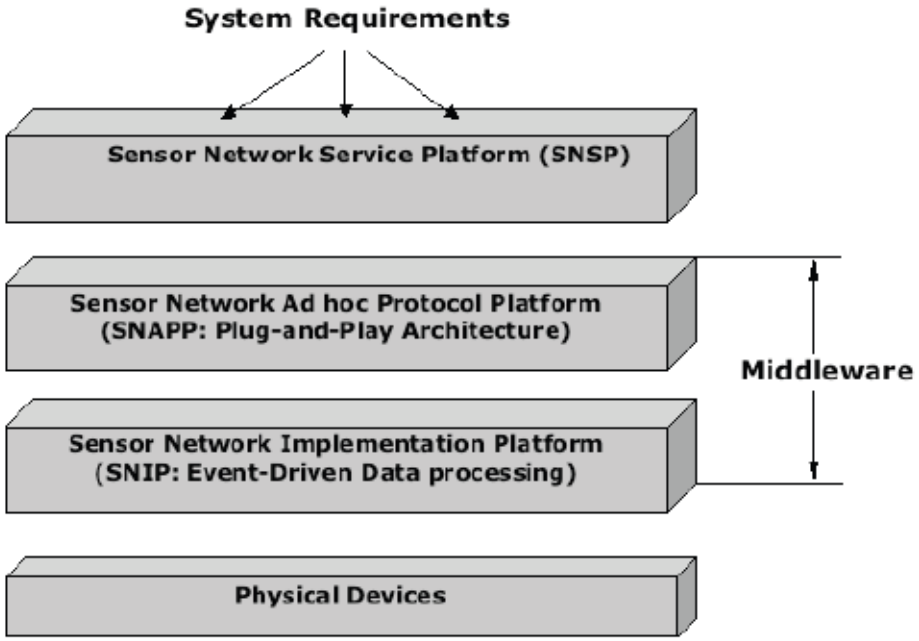
THE WSN MIDDLEWARE

- The integration of WSN technology with extant factory automation systems is of key importance.
- An interface or *middleware is required that can help*
  - *hide the complexity and* heterogeneity of the underlying hardware and network platforms,
  - ease the management of system resources,
  - and increase the predictability of applications.
- It basically bridges the gap between the application level and network standards



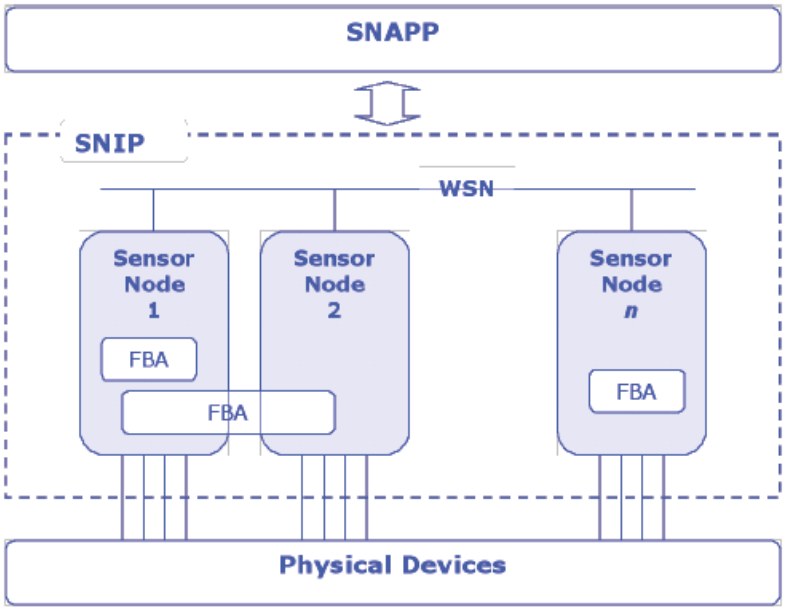
A distributed intelligent sensing and control (DISC) architecture for factory automation

- The middleware is built in two platforms:
  - sensor network ad hoc protocol platform
  - sensor network implementation platform
- Key features desired for these two platforms are:
  - the plug-and-participate architecture
  - event-driven data process



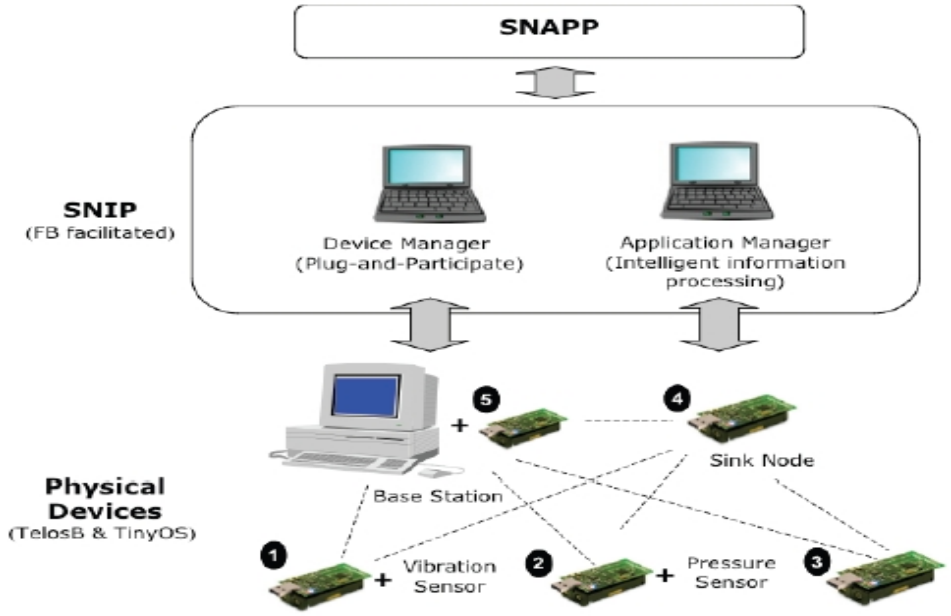
SNIP Level and IEC61499

- There is a direct mapping between IEC 61499 devices and WSN sensor nodes:
  - At the sensor node implementation platform (SNIP), sensor nodes are represented by IEC 61499 devices that are linked by a WSN.
  - Embedded node intelligence is supported by IEC 61499 function block applications (FBA).



TESTBED IMPLEMENTATION

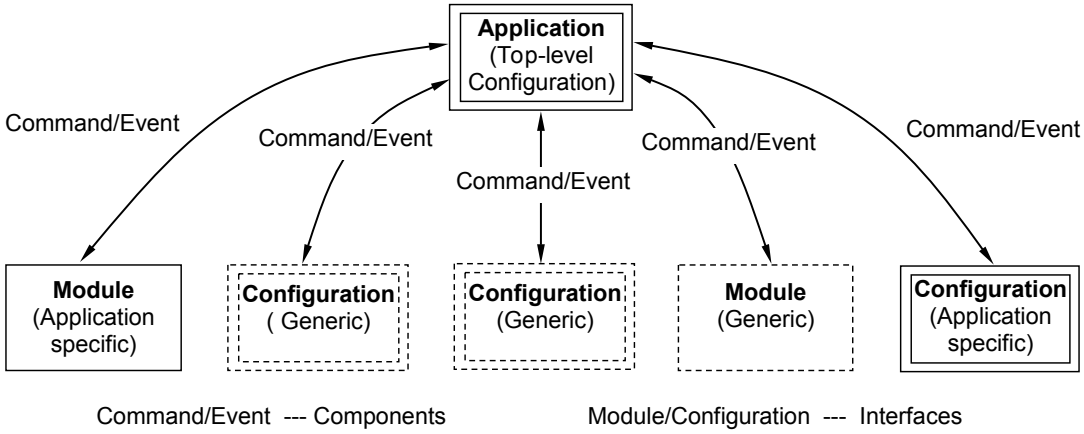
- To validate proposed DISC approach for factory automation and algorithms at SNIP level, a testbed implementation is being conducted at University of Calgary using:
  - TelosB wireless sensor motes,
  - TinyOS-2.x open source operating system,
  - and IEC 61499 function blocks

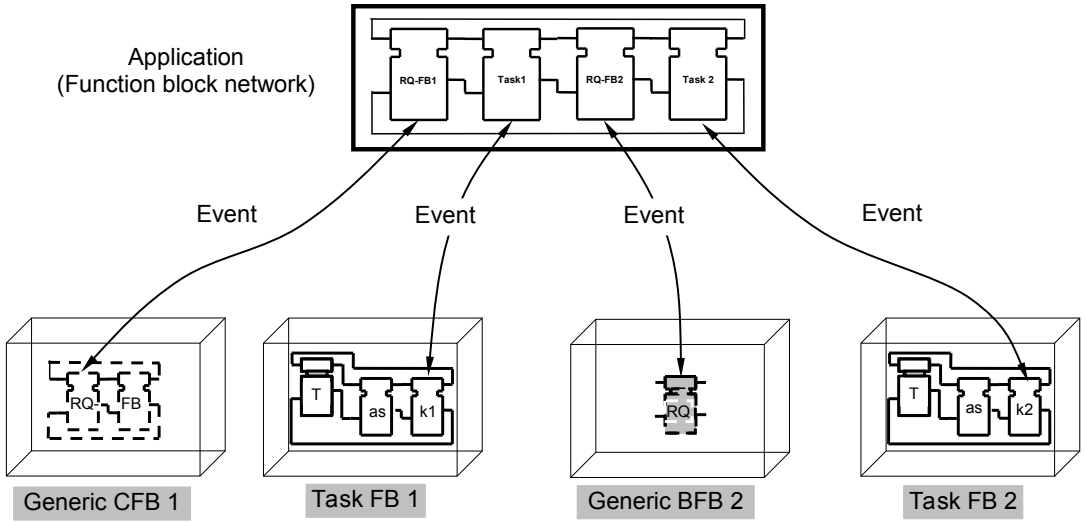


Platform-level Information Processing

- Device Manager and Application Manager are designed to responsible for Plug-and-participate and Event-driven data processing respectively.
- To implement these two task modules, we propose the IEC 61499 function block model for distributed process measurement and control.
- Even-driven and modularity features of the TinyOS at the physical device level combined with IEC 61499 function blocks at platform level appears to be a logical match.
- More specifically, TinyOS nesC (network embedded system C) components have a direct parallel with IEC 61499 basic function blocks:
  - both encapsulate state and couple state with functionality.
  - As well, like the IEC 61499 execution model, nesC is event-driven.

FB vs. TinyOS


Application
(Top-level
Configuration)
Command/Event
Command/Event
Command/Event
Command/Event
Command/Event
Module
(Application
specific)
Configuration
(Generic)
Configuration
(Generic)
Module
(Generic)
Configuration
(Application
specific)
Command/Event --- Components
Module/Configuration --- Interfaces


Application
(Function block network)
RQ-FB1
Task1
RQ-FB2
Task 2
Event
Event
Event
Event
RQ
FB
T
as
k1
RQ
T
as
k2
Generic CFB 1
Task FB 1
Generic BFB 2
Task FB 2