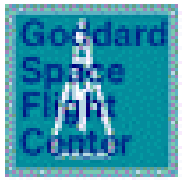

On Representative Spaceflight Instrument and Associated Sensor Web Framework

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Agenda

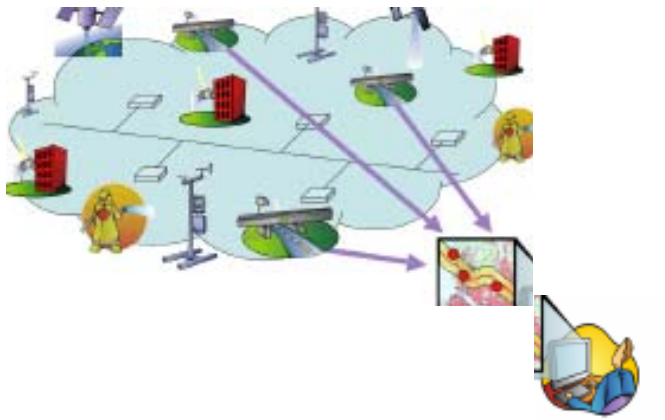
- Introduction
- Heritage sensor web architecture
- Proposed Instrument Sensor Web (ISW) architecture
- Examples of applications
- Summary

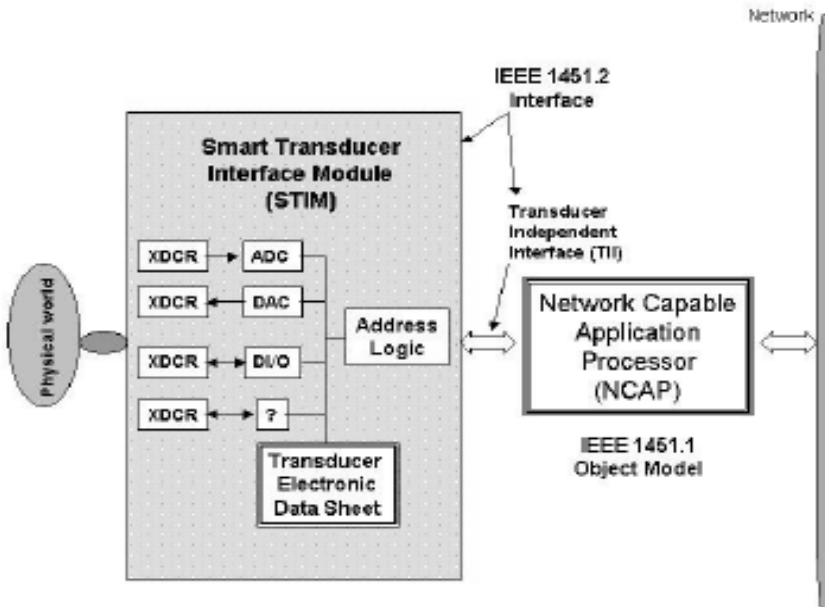
Introduction

- A Representative Instrument is an instrument of sufficient complexity, such as that of OCEaNS and MMS FPI (See Acronyms), to be considered as a sensor web platform.
- Need for reconfigurable, intelligent, low cost, redundant, data processing, reusable SpaceIP
- FPGA, as well as other programmable logic technology, applicable for ***on-board reconfiguration*** or adaptation of flight structures
- New approach for Instrument Sensor Web that is scalable and spaceflight worthy

Heritage Sensor Web

- Collection of sensor nodes [2]
- Distributed GIS





The figures above are taken from [3]-[6] with permission from authors.

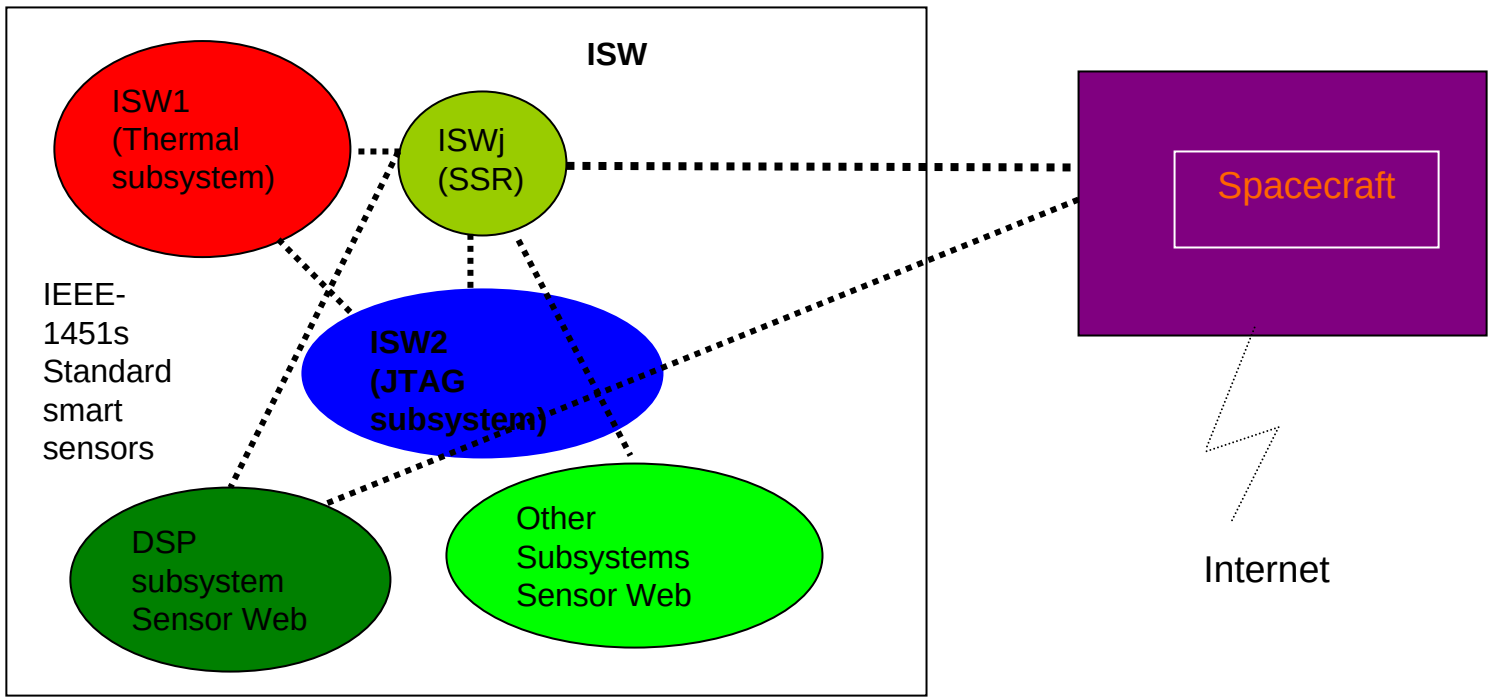
Heritage Sensor Web Shortcomings

- Transmit specific
- Long time range detection, ground based
- Not real-time

Proposed ISW Architecture

- Bi-directional digital communication
- Real time, on-orbit extraction of data
- Time stamping of signals at source (vs. at destination)
- Battery and on-demand powered sensors
- Self describing smart sensor architecture
- Internet connectivity of ISWs [7]-[8]
- Heritage sensor web with portability, reconfigurability

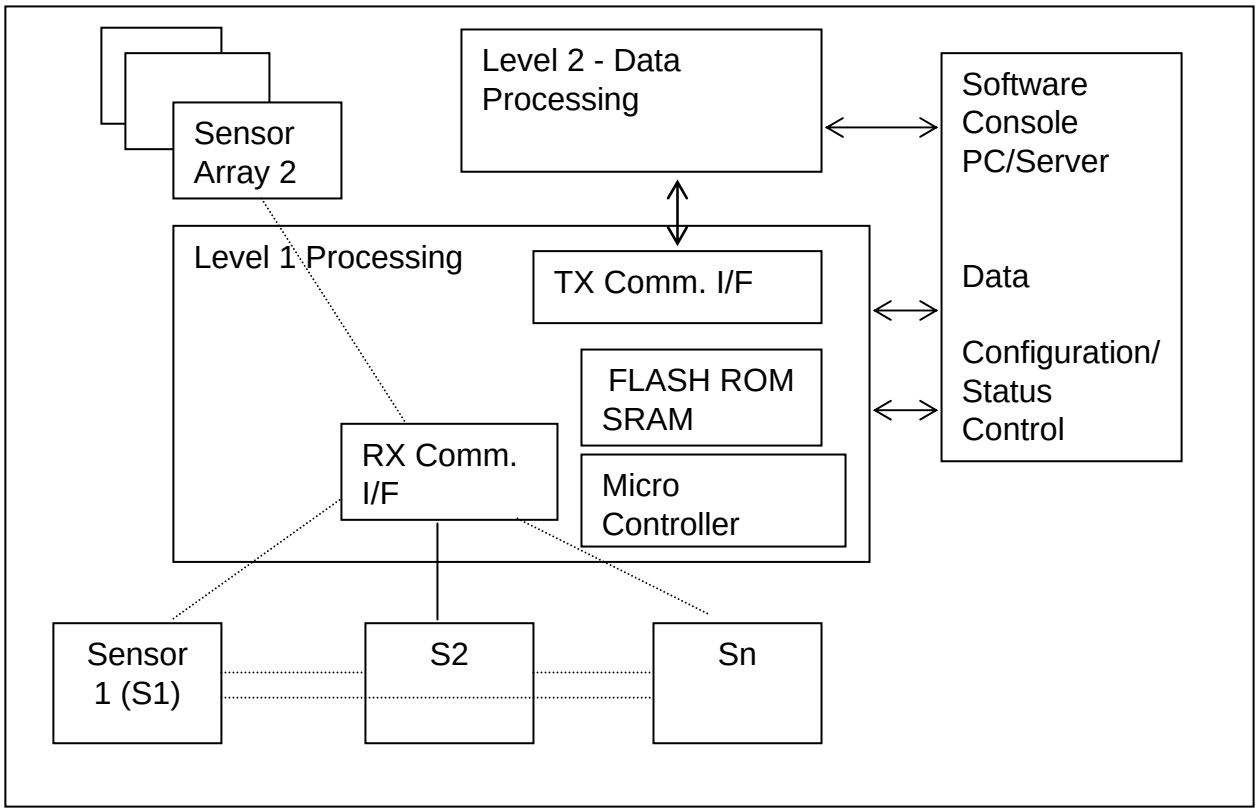
Spaceflight Instrument Sensor Web



ISW scenarios

- Heritage sensors or instruments on ICs or electronics can be networked with a programmable SNR and programmable number of data channels, and flexible instrument configuration
- Heritage instruments reconfigured for new ISW sub-webs
  - Thermal subsystem
  - Integration and Test subsystem
  - Focal Plane subsystem
  - Solid State Recorder (SSR) subsystem

Adaptable ISW System Level Diagram



Summary

- Reconfigurable and Adaptable ISW is important for future spaceflight instruments
- Possible to implement with ROIC, FPGA, DSP
- Future Work – Development of ISW Theoretical Framework along [1] and [3]
- Immediate upgradeable systems
  - LISA, MMS with complex instruments and identical electronic instances are perfect
  - ROMPS-based Robotics
  - OCEaNS
  - Any spaceflight where redundancy and reusability and on-board real-time reconfiguration is of value.

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Acronyms

ISW	Instrument Sensor Web
FPGA	Field Programmable Gate Array
GIS	Geographical Information System
SSR	Solid State Recorder
JTAG	Joint Test Action Group
DSP	Digital Signal Processor and Processing
SNR	Signal to Noise Ratio
ROIC	Read-Out Integrated Circuit
ROMPS	Robot Operated Material Processing System
LISA	Laser Interferometer Space Antenna mission
MMS	Magnetosphere Multi-Scale mission
OCEaNS	Ocean Carbon Ecosystem and Near Shore mission