Introduction to SSGL

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SSGL Overview

- Scalable Sensor Network Infrastructure
- Devices, Firmware, Middleware and Applications
- Low-end and High-end Sensor Devices

Platform properties:

- Decentralised: High-Availability, Redundancy
- Data-flow (data-centric) Oriented
- Distributed Storage and Service System
- Bandwidth Allocation and Real-time Support
- Self-describing/healing/organising/binding
- Interoperable Message Format

Our Vision

SSGL be a:

- Next generation **scalable** sensor networks
- Standard platform for laboratory, industry and home sensor/actuator devices, measurement and control networks, automation
- Unification of low-cost and high-end sensor devices
- SSGL association; integration of partners to build strong community

Existing products

- LonWorks, decentralised non-mesh, industrial buildings
- EIB, now Konnex
- ZigBee, centralised; mesh (?!) *(new sensor network platform not deployed)*

All limited to small non-scalable area networks, address based mapping, common types of messages, etc.

INDEED THERE IS NO DISTRIBUTED SENSOR NETWORK ON THE MARKET, ALL OF THEM ARE HIERARCHICALLY ORGANISED WITH IMPLICIT DATA FORMATS, etc.

Products and Services

Covered by the SSGL association group:

- SSGL Specifications: MAC, Network, Distrubution and Message
- Derived Specifications: SGIB
- General Support
- Sensor Hardware Platforms
- GNU and non-GNU Software (Firmware, Middleware (Libraries) and Applications)
- Research and Development of Hardware/Sensor Devices
- Device verificaton and certification
- Link to 3rd parties

SSGL Advantages

- Non-hierarchical Scalable Infrastructure
- Complete Solution / Specifications *from top (applications) down to bottom (hardware)*
- Integration of low-end (primitive, or reduced) and high-end (intelligent) devices supporting advanced protocols, where intelligent devices **MAY** help primitive devices to organise and operate
- Unique MAC, supporting relative synchronisation, bandwidth allocation, multi-cast priority/redundancy based two-way pipes and variable length header
- Unique Distributed Middleware supporting distributed storage and distributed event based system for real-time interaction
- Completely Self-describing (high-level semantic) using compact redundant-less format - **NO PROFILES** True Plug and Play

SSGL Specifications

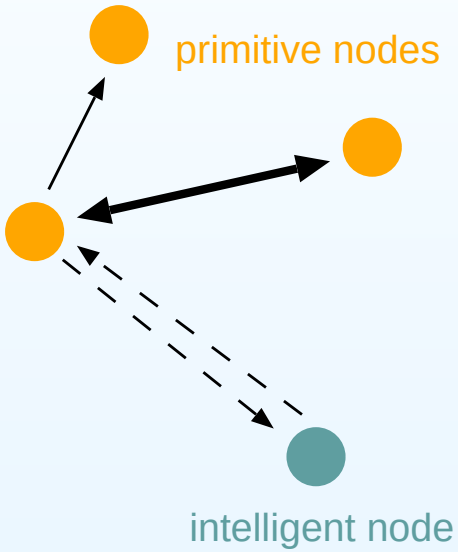
SSGL and standard OSI model:

- Physical Layer, covers various interfaces such as WirelessUSB, PowerLine, I2C, ...
- MAC Specifications cover Data Link Layer and partly the Network Layer by means of transferring variable length messages between two point-to-point devices
- Network Specifications cover complete Network Layer
- Distribution Specification covers Transport Layer and Session Layer where the name was chosen to represent data-flow oriented system model.
- Message Layer provides a self-describing true Plug and Play Presentation Layer with complex semantics to support applications and message transfer capabilities.
- Application Layer provides OO software API, high-level containers, etc.

Physical Layer

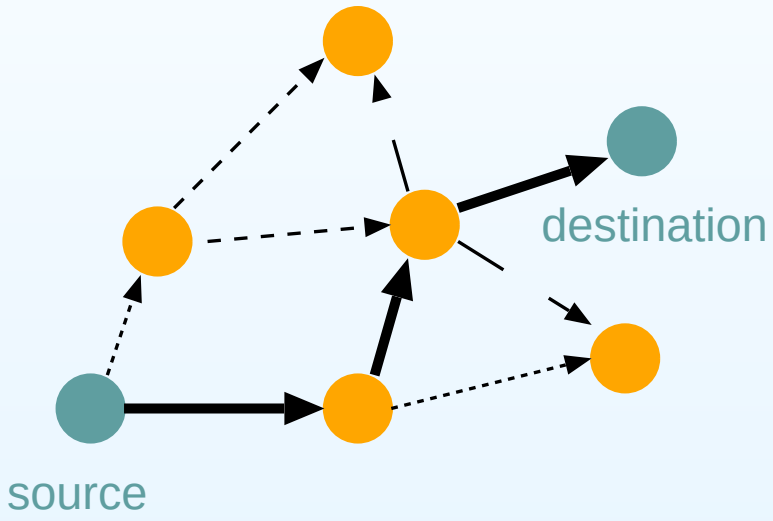
- WirelessUSB
- Power Line Communication
- I2C
- Ethernet
- RS-232
- RS-485

MAC Layer



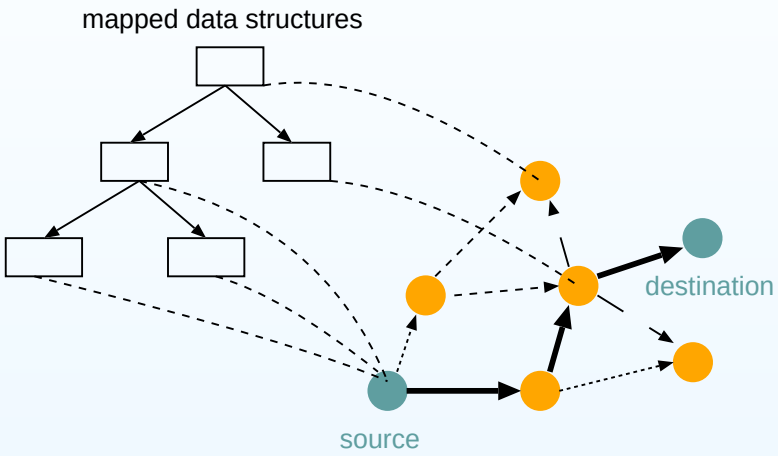
- Interfaces PHY
- Data Link Layer: CRC
- Frame Model (Timing Check)
- Variable Length Header
- Two-way Multicast Pipe
- Relative Synchronisation
- Recommendation, Requirement Model
- Intelligent Helpers

Network Layer



- Non-Hierarchical Gradient-Based Routing
- Covers Redundancy and Advanced Algorithms for Large Sensor Networks
- Unicasting: Any Peer to Any Peer Communication
- Broadcasting and Multicasting: General Message Dissemination
- Convergecasting: Collecting Messages at Single (Redundant) Peers

Distribution Layer



- Distributive Data-centric Model
- Distributive Storage Model
- Real-time Transaction/Event Model
- Redundancy Model

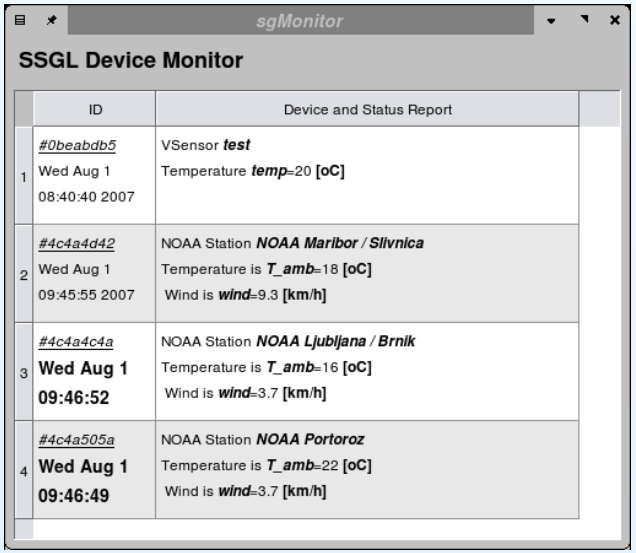
Message Layer

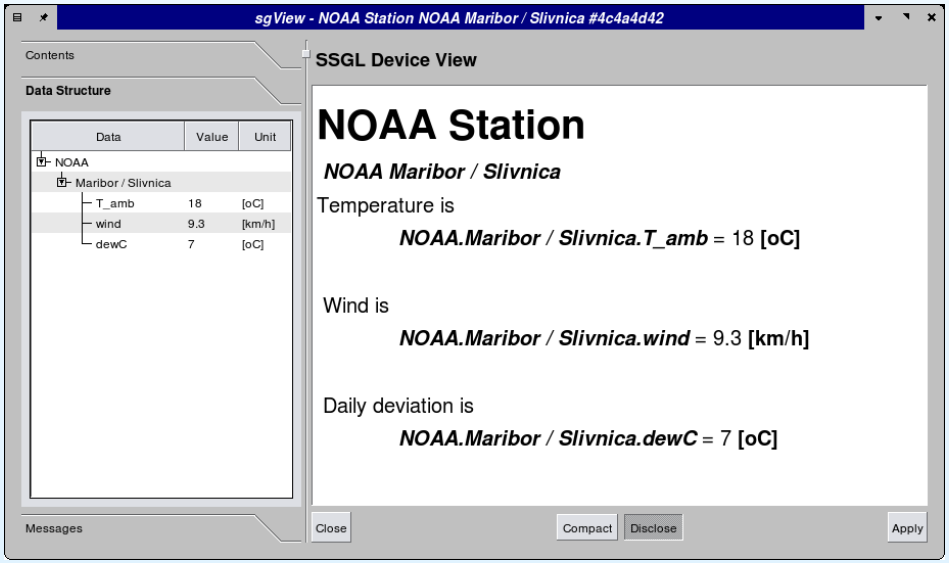
- Self-Describable Message Layer
- Data-Structures
- Multi-Dimensional Variables with Multi-Dimensional Unit Presentation
- Basic Typesetting Format

```
const unsigned char iprot_desc[] = {
        "%t0{diProt} Two Channel Intelligent Protections %{%<LX %hx} %.10s{" DESC_TERMINATOR "\0\x13"

{:E.low{A,B},.high{A,B}}=4{%lu}[Wh]" DESC_TERMINATOR "\0\x0c
        "%t1{Status}"
                " {:load1}={%hx:Emergency Light,Computer,Light,Audio/Video,Washing}"
                " {:status1}={%<hu:On=0,Off=2,Fault=4,Suspend=5,Protection Fault=10};"
                "{:load2}={%hx:Emergency Light,Computer,Light,Audio/Video,Washing}"
                " {:status2}={%<hu:On=0,Off=2,Fault=4,Suspend=5,Protection Fault=10};"
                "Present Power {:P}={3.83*%<U}[W];Total Energy {:E}={2.34e-5*%lU}[Wh]"
                        DESC_TERMINATOR "\0\xA"

        "%{PM=%x}" DESC_TERMINATOR "\0\2"
```

Example Applications

- NOAA Weather Station fetcher
- WirelessUSB Sensor Demo
- PowerLine Sensor Demo
- I2C (SGIB) Demo Platform
- SSGL Device Monitor
- SSGL Device View





Project Status

- DRAFT Specifications for MAC and Message Layers
- Specifications to be released: Network and Distribution Layers
- PHYs: Power-line Comm. 1.2-4.8 kbps, WirelessUSB 16 kbps - 1 Mbps, I2C/RS-232/RS-485
- Demo platforms: SGIB SSGL devices, WirelessUSB Thermometers, Powerline Modem DEMO
- Alpha Middleware (Distribution Layer)
- Design stage: Network Layer
- Applications: Device View and Monitor
- In development: Scope, 3D View, MatLab Interface (Real-time)

Questions and discussion