ITU Kaleidoscope 2014

Living in a converged world - impossible without standards?

# Dynamic Mobile Sensor Network Platform for ID-based Communication

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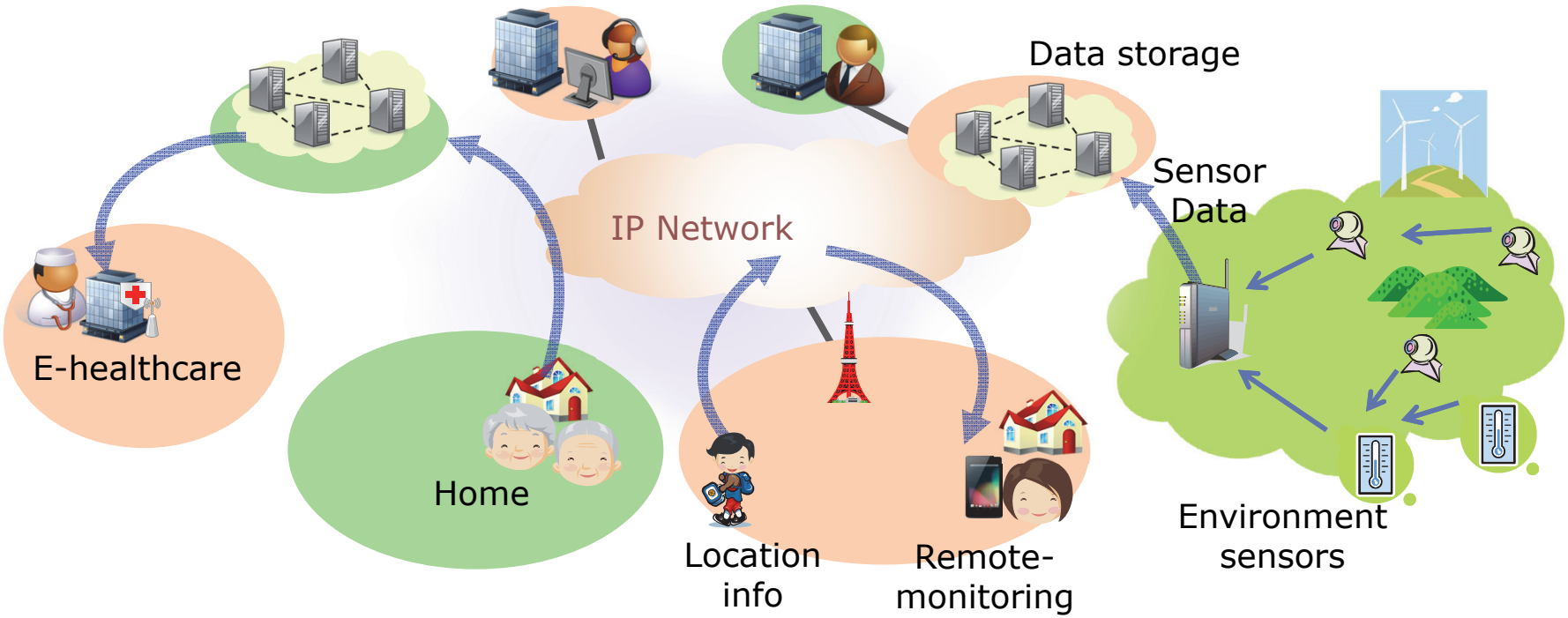
# Outline

- Motivation
- Dynamic mobile sensor network platform
- Approach – proposal and extension of HIMALIS
- Implementation
- Operation scenarios
- Conclusion

*HIMALIS: Heterogeneity Inclusion and Mobility Adaptation through Locator ID Separation

# Motivations – Limitations of current sensor networks



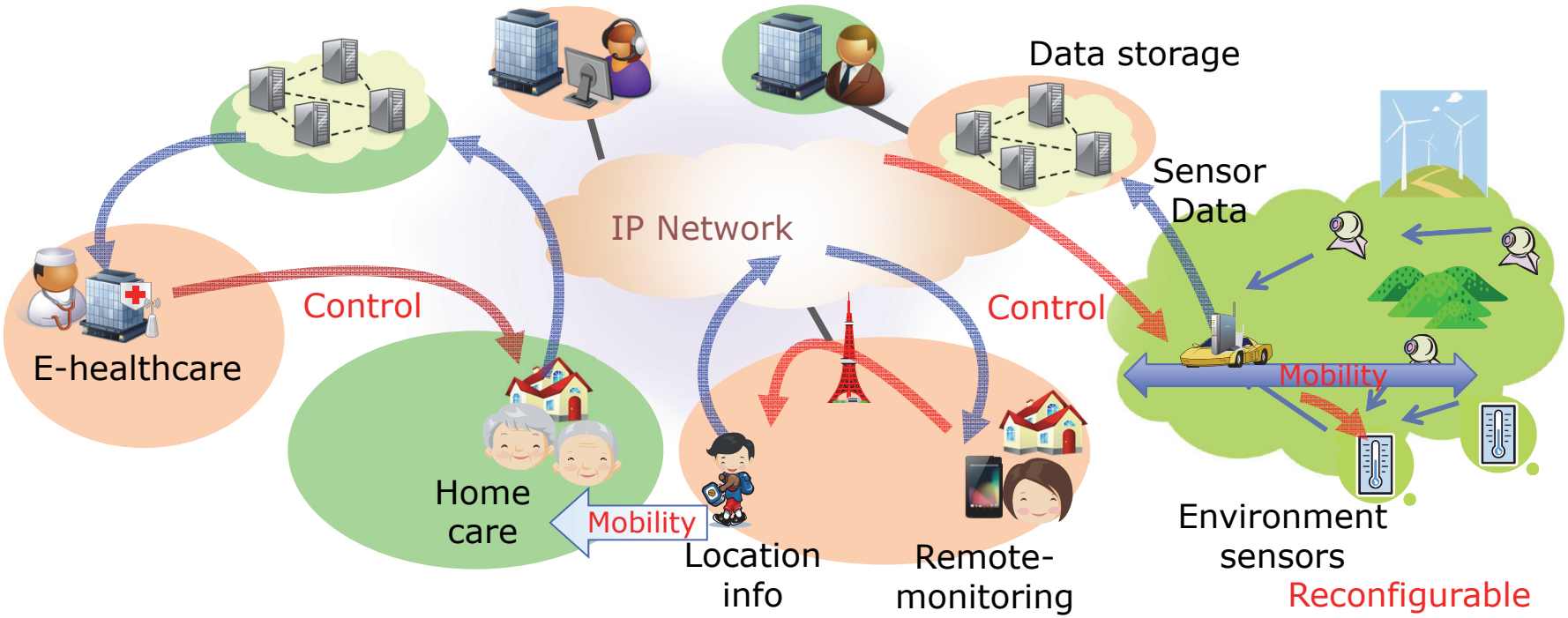

- Application-specific

  Network protocols and applications are in a package - difficult to change or add new applications

- Static configuration

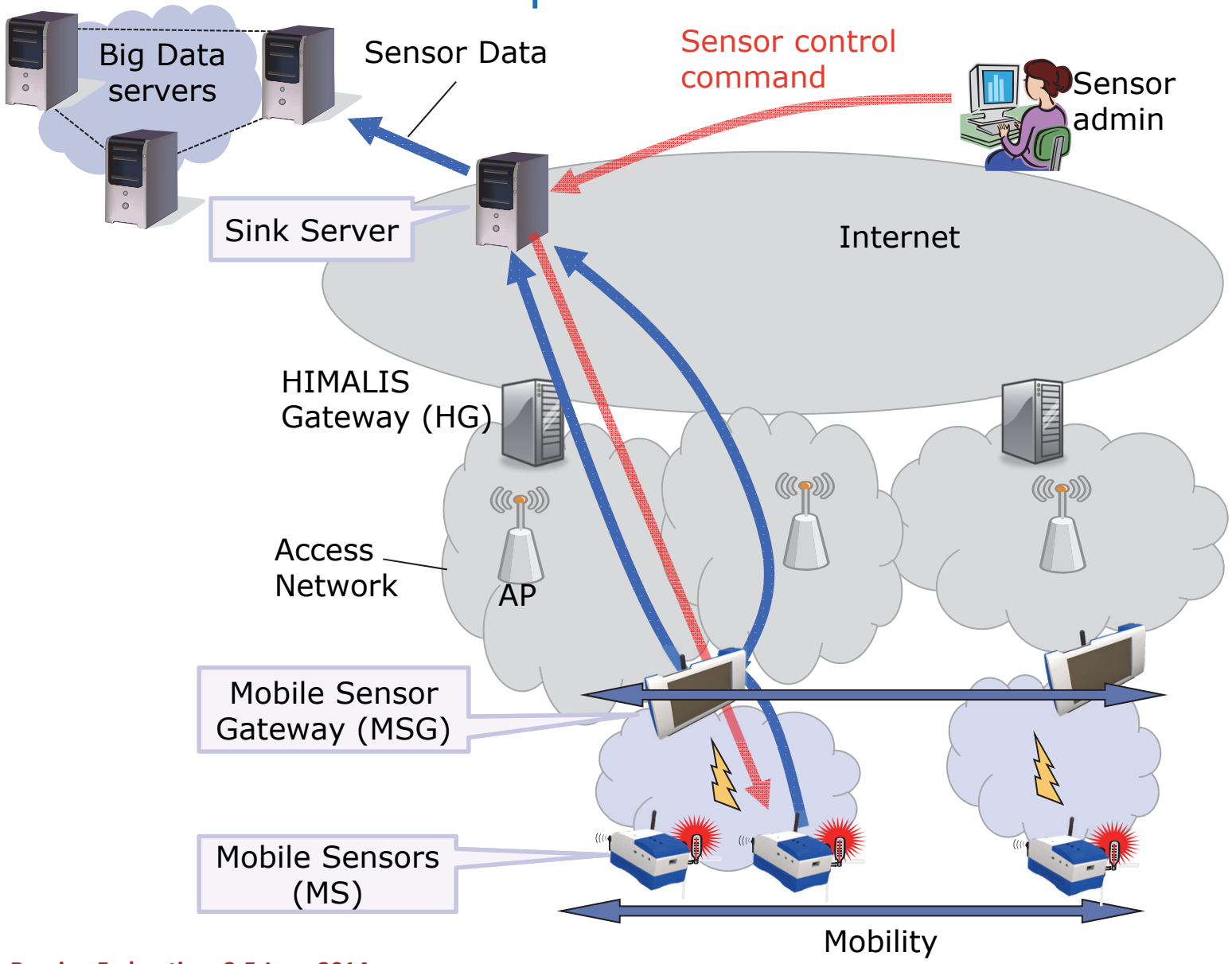
  Difficult to change configuration after deployment: e.g., sensor data tx rate, reliability, security-level, access control

# Concept – Dynamic mobile sensor networks




- General-purpose: Open API; easy to develop and use app, better interoperability, **remotely reconfigurable**
- Better connectivity: **Mobility**, multihoming support
- Better control: Access control, authentication, data **security**

# Components – Proposed dynamic mobile sensor network platform



# Approach – Extended HIMALIS architecture to sensors

HIMALIS overview –

- Introduction of **identity sublayer**
- Application and transport layers are independent of network layer
  - **Mobility**, **multihoming**, **heterogeneity** support
- Access and data **security**

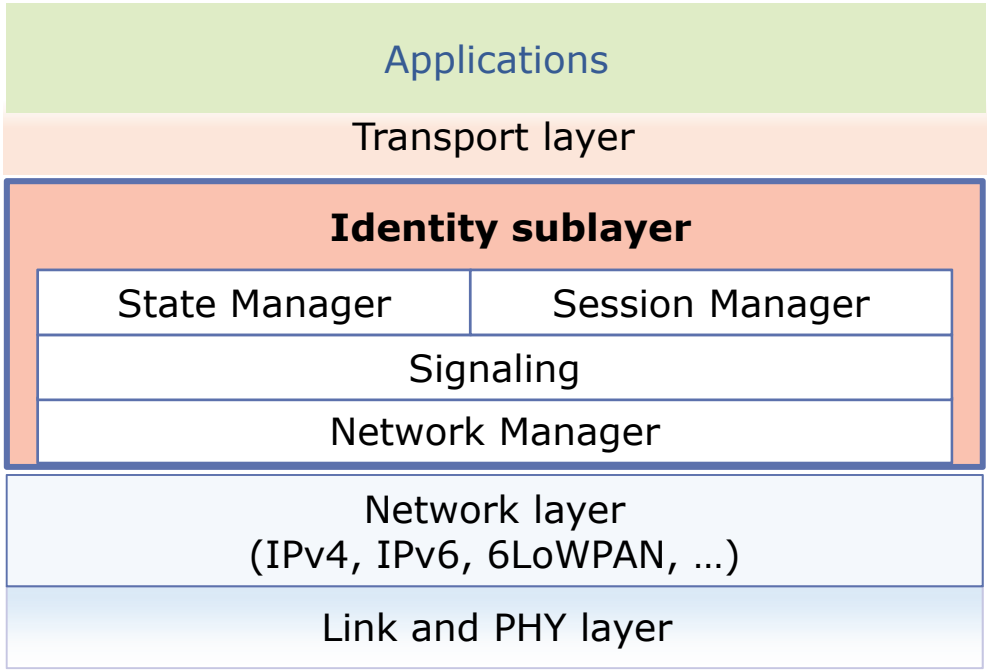
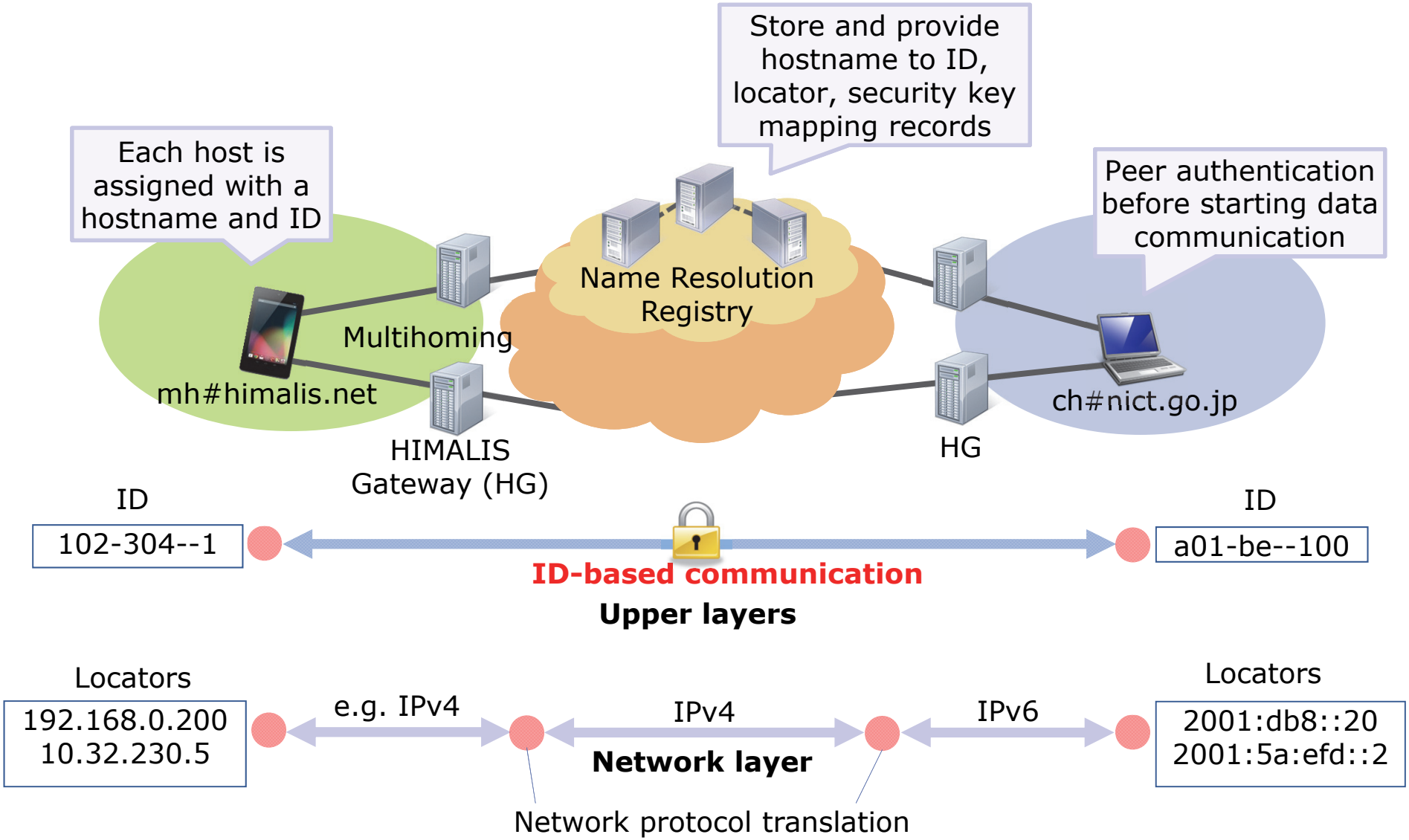


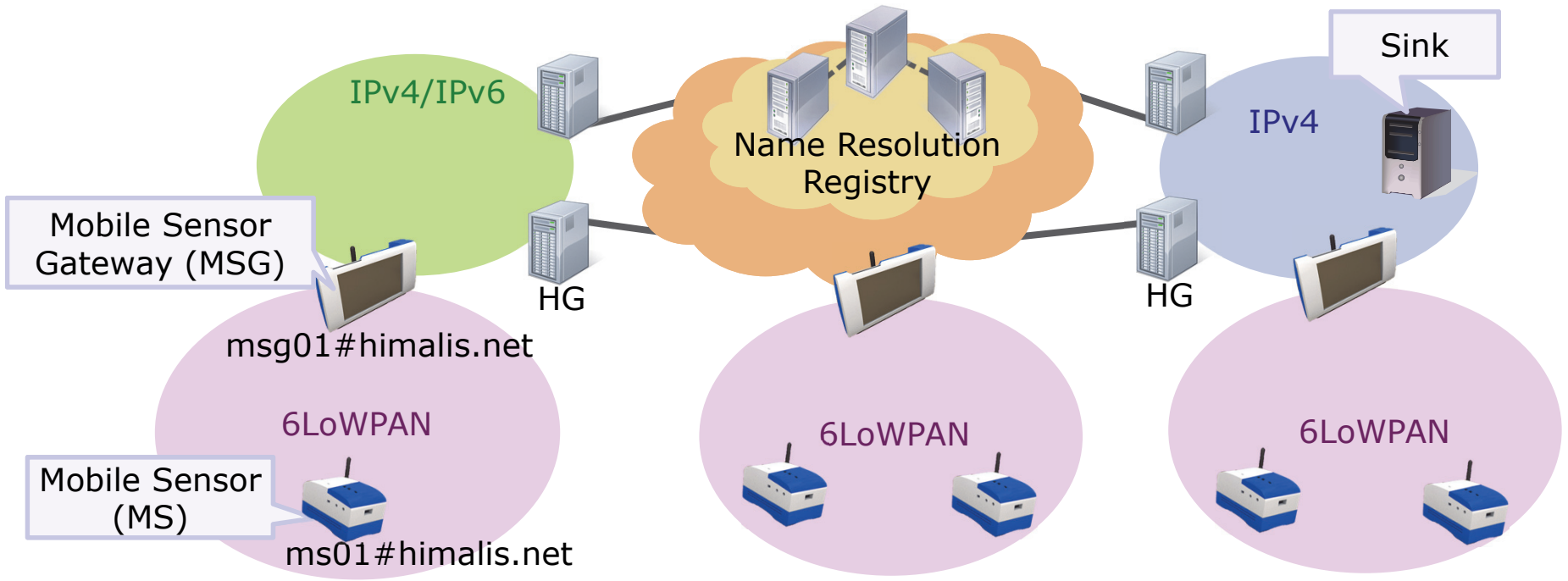

Figure - HIMALIS Protocol stack

[3] Kafle et al., "HIMALIS: Heterogeneity inclusion and mobility adaptation through locator ID separation in new generation network," *IEICE Trans. Commun.*, vol.E93-B no.3, pp. 478-489, Mar. 2010.

# HIMALIS ID-based secure and reliable communication

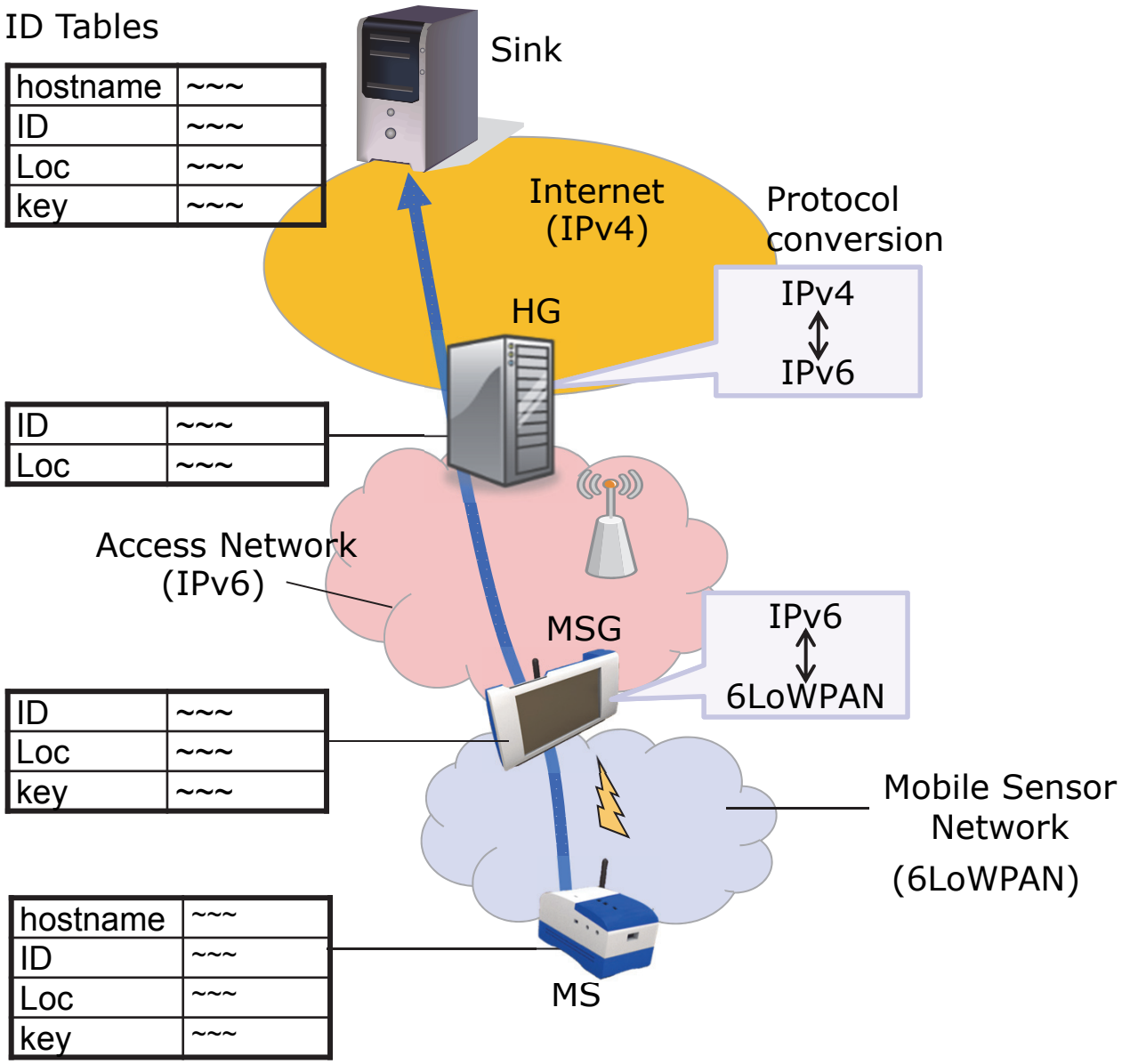


# HIMALIS extension to dynamic sensor networks

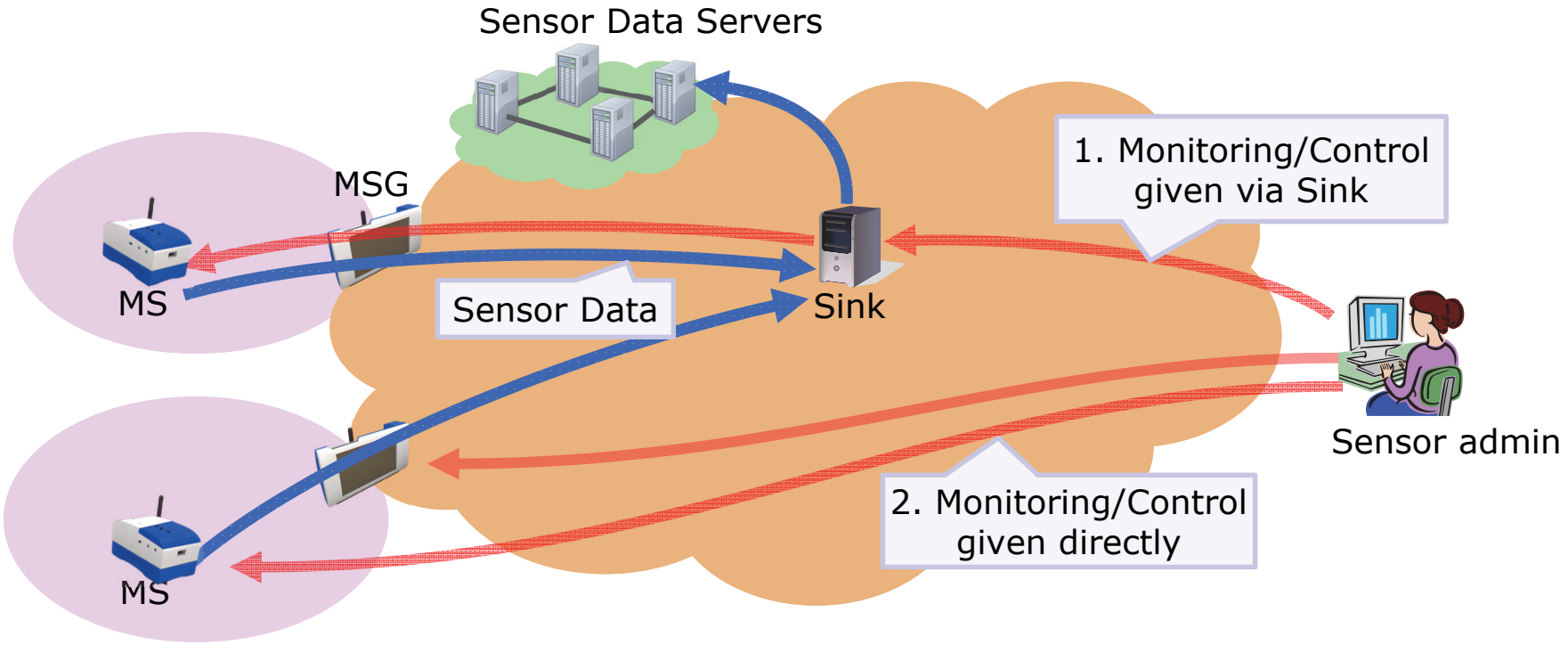



- HIMALIS protocol stack in MS and MSG
  - For enabling ID-based communication in heterogeneous protocols (e.g., 6LoWPAN, IPv6, IPv4)
  - For remote control, configuration securely
  - For mobility support

# ID-based communication in heterogeneous networks

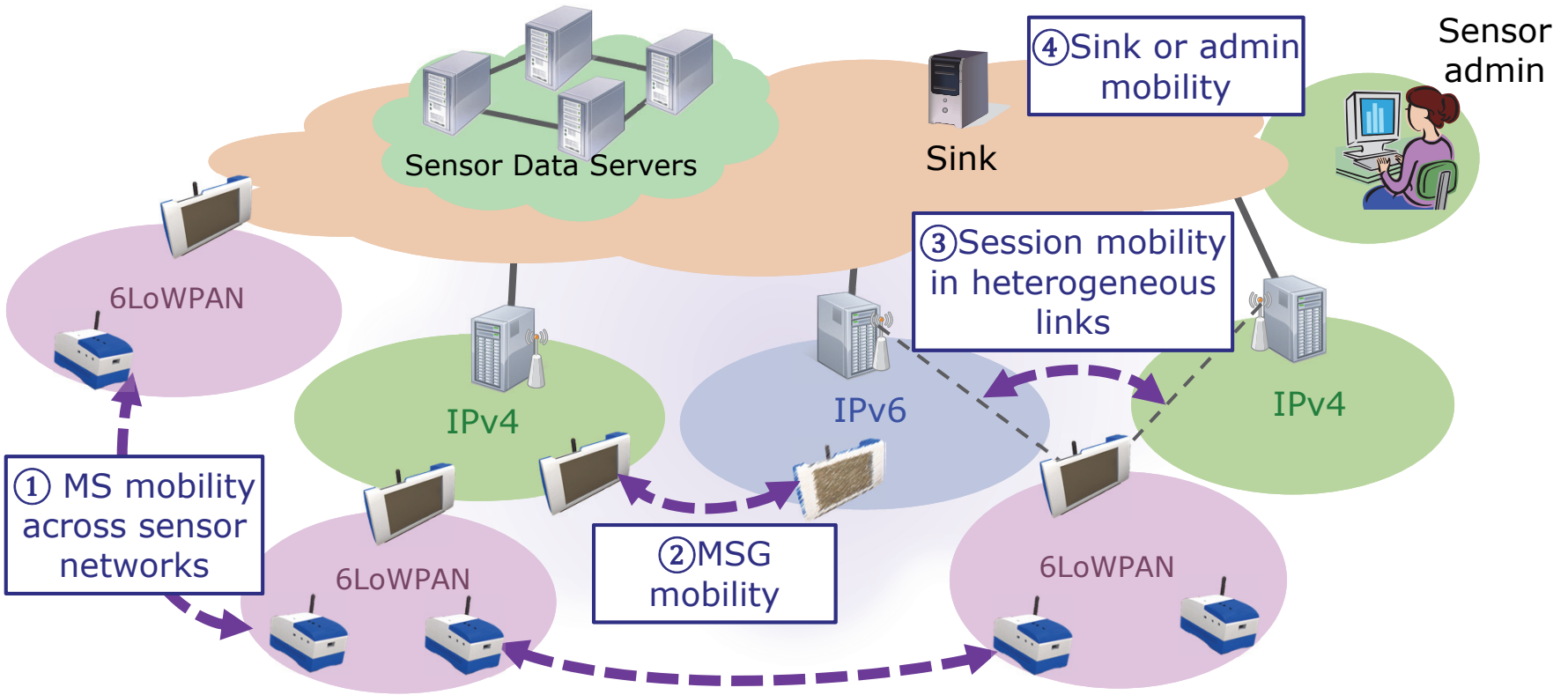


# Remote control/configuration of mobile sensors




- Commands for status monitoring (e.g., sampling rate, tx rate, current reading, power-level), reconfiguration
- Sensor admin can send control commands in two ways:
- 1. via sink server (sink acts as a security hub, common control)
- 2. directly (by using HIMALIS secure communication)

# Four mobility scenarios supported




① MS can move between MSGs

② MSG can move alone or with MSs

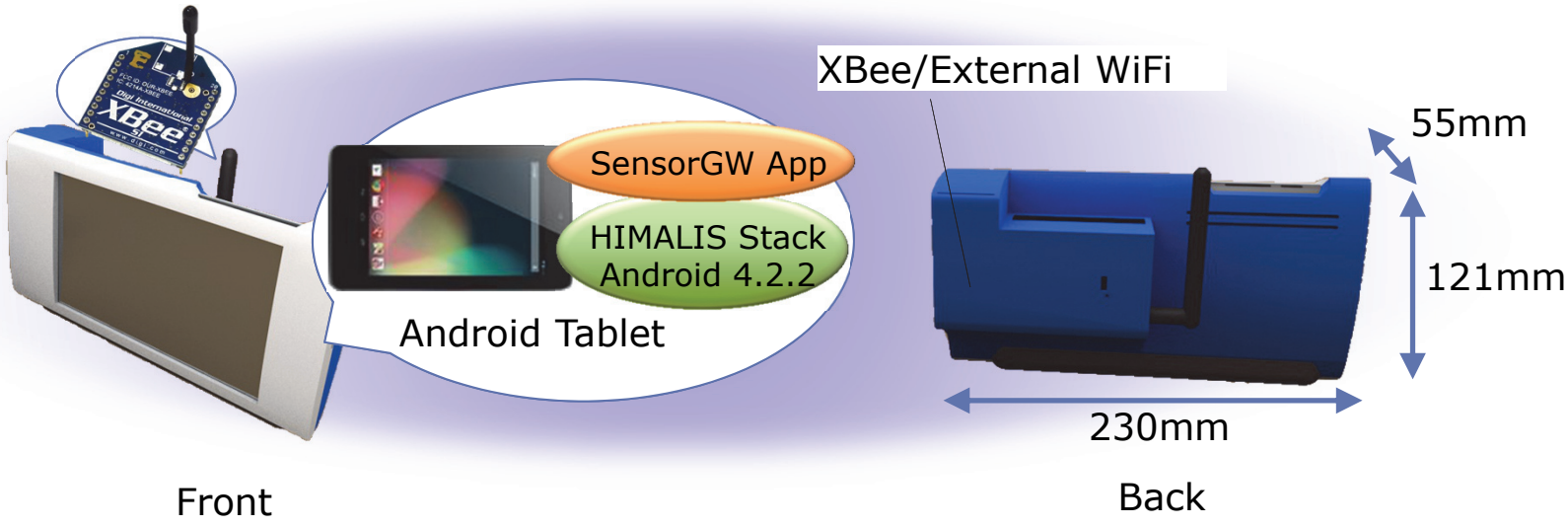
③ MSG (multihoming) can switch links in heterogeneous networks

④ Sink or admin can move while getting sensor data or sending control commands

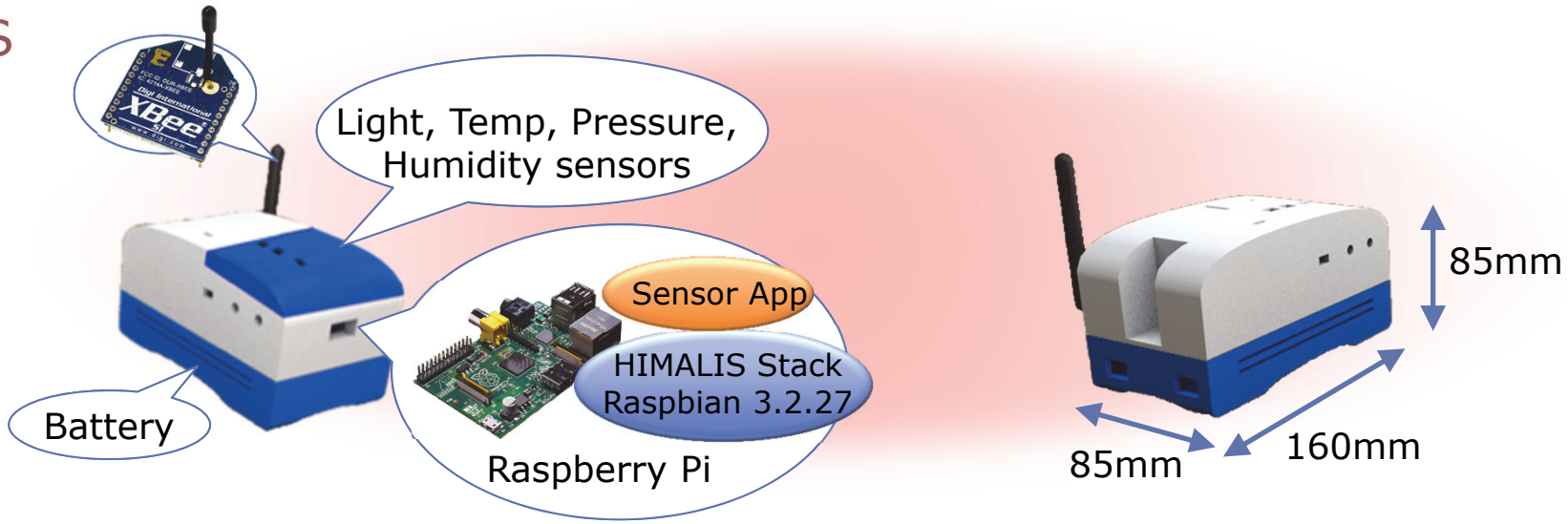
# Implementation and operation

# MS, MSG prototype development

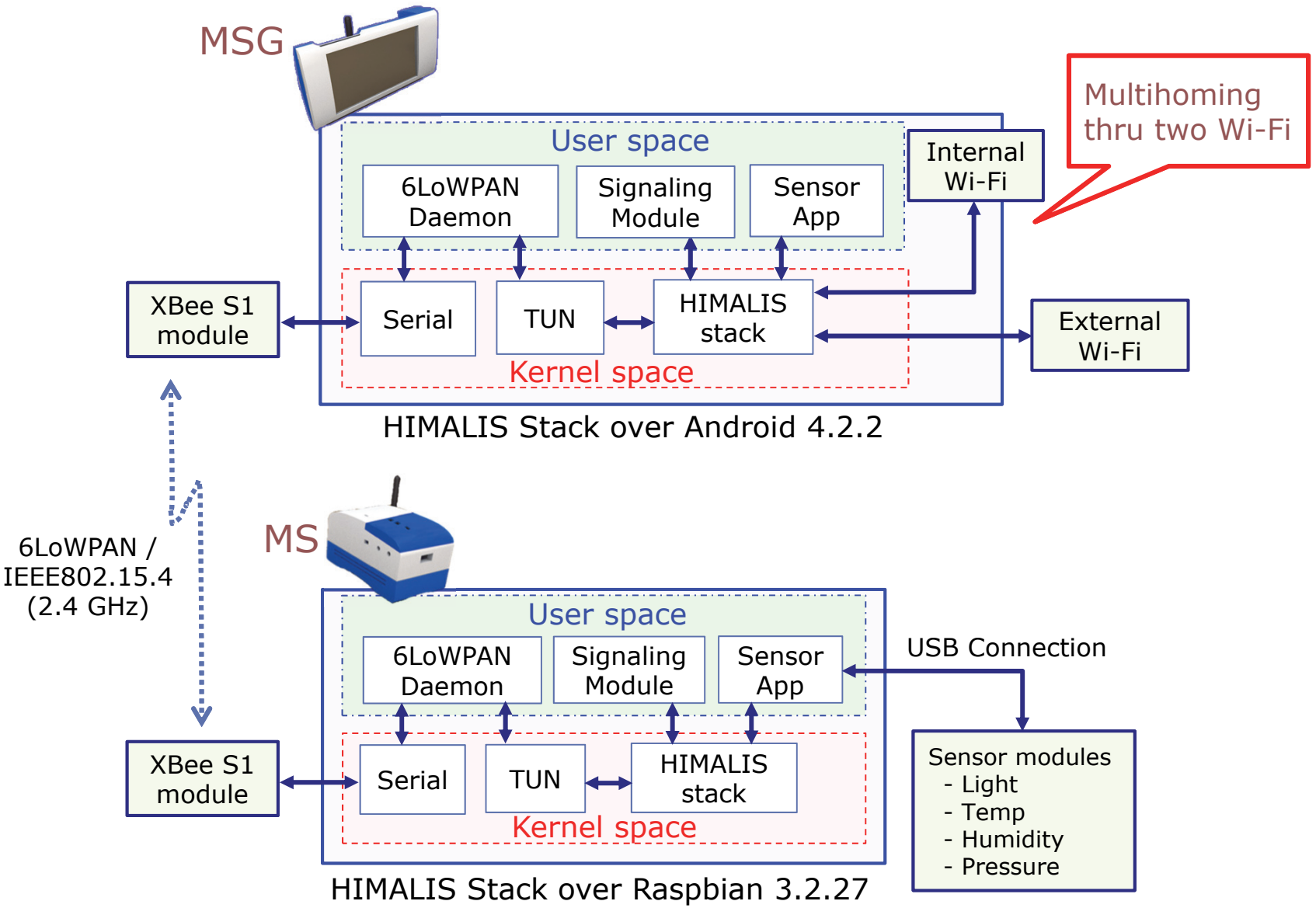
MSG



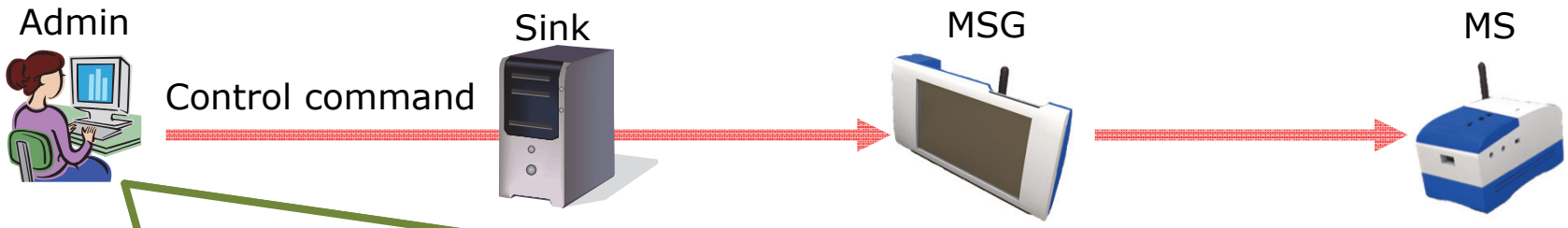

MS



# MS, MSG software modules



# Sensor control panel




Search | Start | Stop | View

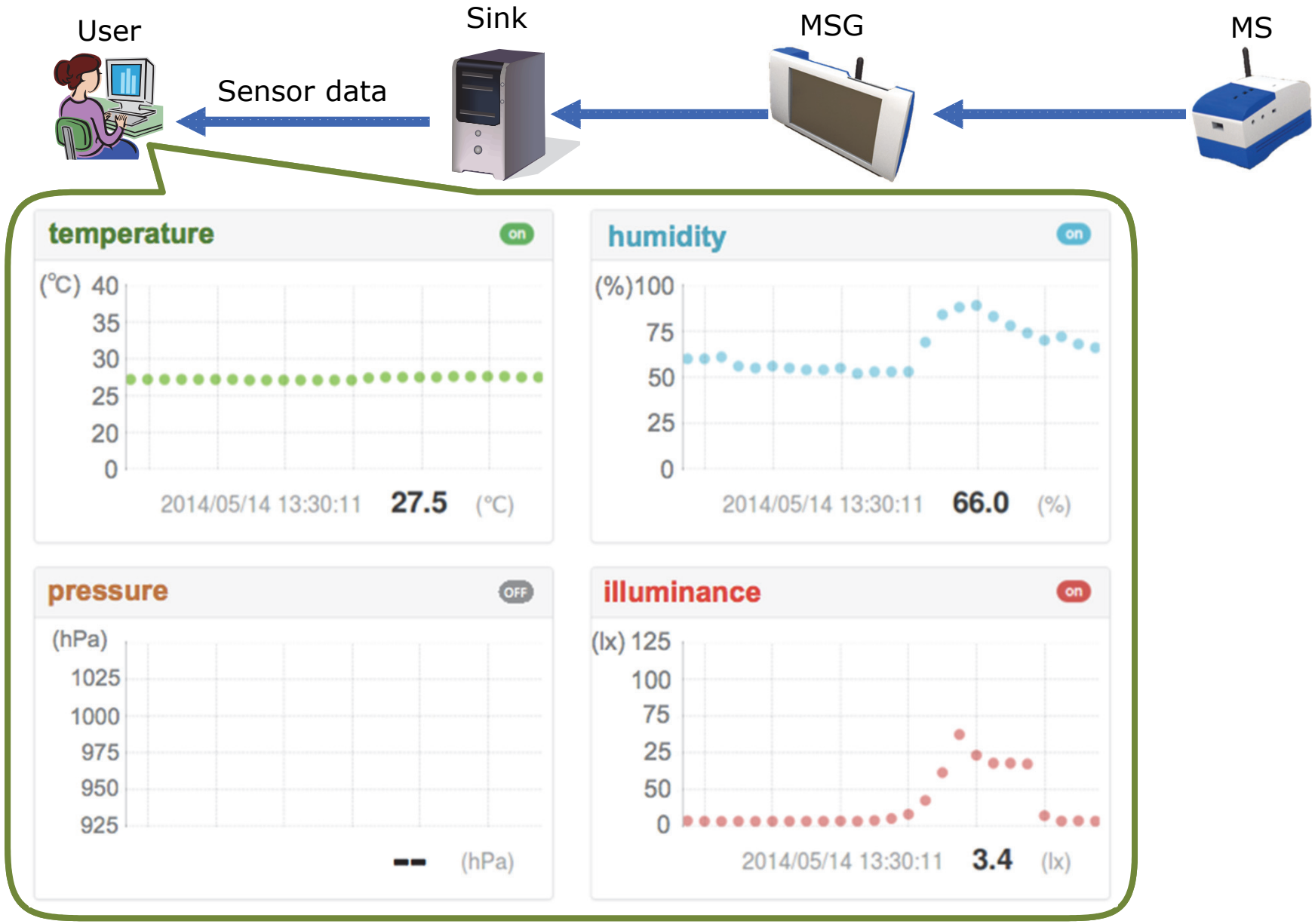
## Start Sensor Data Uploading

Input

| | | | |
|---|---|---|---|
| **Hostname** | mobilesensor14#hnr.tr1.himalis.net | | |
| **SamplingRate** | 3 | (sec) | |
| **Temperature** | ON | 3 | (sec) |
| **Humidity** | ON | 9 | (sec) |
| **Pressure** | OFF | | |
| **Illuminance** | ON | 3 | (sec) |

Start

# Sensor data viewer



# Conclusion and future work

Presented the design and implementation of the ID-based communication supporting dynamic mobile sensor network

New features:

- **Remotely reconfigurable** sensor network
- **Reliable connectivity** through mobility and multihoming
- General-purpose **open API** in sensor nodes

Future work

- **Standardization**, optimization, application development

# Related standards and potential new topics

Related standards:

ITU-T Y.3001 (FN objectives and design goals),
ITU-T Y.3031 (ID-based communication framework in FN),
ITU-T Y.3032 (ID and locator mapping mechanism in FN),
ITU-T Y.2221 (USN application and services requirements),
IEEE 1888 (sensor data storage format)

Potential new topics for standardization:

1. Interfaces between sensing, computation and communication units
2. Light-weight authentication and access control methods for mobile sensors
3. Methods for ID-based communication in heterogeneous network protocols, e.g., extension to ITU-T Y.FN-heteronet (WP3/13)

# Thank you !

We are open to collaborate with partners for research, development and standardization of ID-based communication in mobile sensor networks.

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