APAN Sensor Network WG
- 2nd meeting @ Hanoi -

Group Meeting
(2010/08/10)

Chair: Susumu Takeuchi
(NICT, Japan)
Introduction of SensNet WG

• Chair
  – Eui-Nam Huh (KyungHee University, Korea)

• Co-Chairs
  – Lasse Thiem (FOKUS, Germany)
  – Susumu Takeuchi (NICT, Japan)
  – Basuki Suhardiman (ITB, Indonesia)

• Secretariat
  – Reza Khoshdelniat (MIMOS, Malaysia)

• Initial objective
  – Develop a technical environment to exchange sensing data for collaborating tightly between SN testbeds
  – Exchange technical experiences regarding SNs
Today’s Agenda

• 11:00-12:30 Group Meeting
  – Chair: Susumu Takeuchi

• 14:00-15:30 Workshop Session 1
  – Chair: Eui-Nam Huh
  – Title: SensNet Activities

• 16:00-17:30 Workshop Session 2
  – Chair: Basuki Suhardiman
  – Title: Agriculture Applications
    • Joint-session w/ APAN Agriculture WG
a) Group Meeting

• WG Activity Discussion
  – Share backgrounds and policy of our activities
  – Arrangement of challenging issues and its scope
  – Future Plan
  – AOB

• Design Issues in Global Sensor Data Sharing
  (Eui-Nam Huh, KyungHee University, Korea)
b) Workshop Session 1
- SensNet Activities -

1. IP-USN updates & Activities in KOREA (Hyunho Choi, NIA, Korea)

2. 6LoWPAN Applications and Developments for the Internet Of Things (Reza Khoshdelniat / Gopinath Rao Sinniah, MIMOS, Malaysia)

3. X-Sensor ver.2: a mobile-agent supported sensor network testbed (Tomoki Yoshihisa, Osaka University, Japan)

4. MetroWSN - Metropolitan Area Sensor Networks (Thomas Luckenbach, FOKUS, Germany)
c) Workshop Session 2
- Agriculture Applications -

1. A Sensor Data Gathering Framework for Agricultural-Fields: Implementation and Experiment Report (Hideya Ochiai, Tokyo University, Japan)

2. Invited talk: Application development environment of Sensor Service GRID (Kiyoshi Honda, Asian Institute of Technology, Thailand)

3. Invited talk: Data Integration and Analysis System (DIAS) and Sensor Network for Agriculture (Kiura Takuji, NARO, Japan, et al.)

• Concluding Remarks (Susumu Takeuchi)
2nd WG meeting @ APAN 30th Meeting in Hanoi

GROUP MEETING
Agenda of Group Meeting

1. Review of the 1st Meeting in Sydney
2. Summary of the Core Meeting (Backgrounds, goals, and updated charter)
3. Define Terms of Sensor Network
5. Future Discussion Plan and AOB
Review of the 1\textsuperscript{st} meeting (1/2)

• APAN 29\textsuperscript{th} Meeting in Sydney
  – February 9, 2010 (11:00-17:30)

• Working Group Meeting
  – WG Activity Discussion
    • Sensor data exchange discussion, standard Issues, future plan, etc.

• 2 Workshop Sessions
  – SensNet Infra Technology (4 speakers)
  – SensNet Applications (3 speakers)
Review of the 1st meeting (2/2)

• Impressions
  – Our WG members have **varieties of significant researches** regarding to SNs and its applications, but our backgrounds and objectives are also varies.
  – When we address to federate SNs as the charter, we have to share our backgrounds.

• What should we do?
  – To establish a formal charter
    • The charter at that time was interim one, so we had to develop it to the formal one toward SN testbed federation.
  – To share backgrounds and define the terms
    • Make the requirements of SN testbed users, application developers, and deployers should be clear.
Review of the 1st meeting (2/2)

- Impressions
  - Our WG members have *varieties of significant researches* regarding to SNs and its applications, but our backgrounds and objectives are also varies.
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- What should we do?
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We had a Core Meeting to share our backgrounds and discuss/establish a formal charter.
Agenda of Group Meeting

- Review of the 1st Meeting in Sydney
- Summary of the Core Meeting (Backgrounds, goals, and updated charter)
- Define Terms of Sensor Network
- Grand Design and Challenging Issues
- Future Discussion Plan and AOB
1st Core Meeting

• Date/Time: May 24, 2010 (13:30-15:30)
• Venue: Imperial Palace Hotel, Seoul
• Participants: WG Chairs and Core Members
• Objective
  – Discuss and establish a formal charter for SensNet WG
• Agenda
  – Share backgrounds, policies, steps of our activities
  – Arranging challenging issues
  – Establish a formal charter (if possible)
Background: Motivation for Charter

• Recently, varieties of projects regarding to Sensor Network and its federation are working (e.g., GEOSS Sensor Web).

➤ What will be the characteristics of our WG?
  • We have to make our activity policy clear to develop our activities.

• Go back to the basics, **APAN must be a unique operator community in Asia**, so...
Our Goals

1. Low-cost and easy deployment and management of sensor networks for wide-area coverage
   – Deployment cost is a barrier, but management cost is a more critical barrier to maintain sensor networks.

2. Support crucial sensor network applications in Asia-Pacific region
   – Environmental monitoring (e.g., weather, disaster, pollution, smart grid) would be essential for sustainable development in this region.
SensNet WG Charter (approved in June)

• Goal
  – SensNet WG encourages the collaboration of technical experiences and knowledge regarding SNs, and will develop a scalable, sustainable, and easy-to-deploy technical environment for utilizing collected sensing data among SNs deployed in each country.

• Objectives
  – 1. Encourage SN deployment and federation
    • Exchange SN deployment cases, technical issues and experiences
    • Standardize SN description (access method/policy, specifications, protocols) and application interface (access method, query language) by utilizing external standards
  – 2. Federate for sensing data utilization
    • Develop a federated framework to discovery any resources in heterogeneous SNs for supporting varieties of applications
    • Ensure the scalability of a federated framework that can handle over millions of sensor nodes for realizing low-cost federation
Goal 1: Deployment and Management

• The key notion is a “Federation of SNs”
  – Scalable, sustainable, and easy-to-deploy SN and its federation framework will enable tiny SN testbeds to cover wide-area
    • w/o deploying the massive number of equivalent and/or expensive sensors.
  – This must be the initial concept of our WG.

• But, how are the other SN projects?
  – Do we have another aspect compared to them?
# Comparison of Sensor Network Projects

<table>
<thead>
<tr>
<th>Project</th>
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<td>GEOSS Sensor Web</td>
<td>✓ Hetero</td>
<td>✓</td>
<td>✓ C/S?</td>
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<td>Standard of federation from apps</td>
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<td>✓ Web serv.</td>
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<td>Middleware only</td>
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<tr>
<td>IETF 6LoWPAN, ROLL, CoRE</td>
<td>✓ Homo</td>
<td>✓ REST (CoRE)</td>
<td>- I/F only</td>
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<td>Standard I/F only</td>
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<td>✓ Web serv.</td>
<td>- C/S (hier.)</td>
<td>✓ Hier. query</td>
<td>App testbed</td>
</tr>
<tr>
<td>SENSEI</td>
<td>✓ Hetero</td>
<td>✓ Context-aware</td>
<td>✓ C/S (DS)</td>
<td>- Pub/sub</td>
<td>Standard of federation</td>
</tr>
<tr>
<td>KanseiGenie</td>
<td>✓ Hetero</td>
<td>- testbed</td>
<td>✓ Slice (DS)</td>
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✓: The field on which a project focuses  / -: not mentioned
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Our WG approach must be unique because we have to focus on Resource Management, Data Management, and Deployment.
Goal 2: Sensor Network Applications

• The key application in Asia is “Agriculture”
  – Environmental monitoring (e.g., weather, disaster, pollution) would be essential for sustainable development in Asian countries, but agriculture must be the eventual application of them.
    • Collaboration between APAN Agriculture WG and SensNet WG must be important

• Then, what will be the characteristics of Asian agriculture?
  – Must affect on our collaboration approach
Center Pivot Irrigation
Large-scale farming methods

Not applicable in Asia

Rice Terraces
Small-scale but tolerant farming methods

Common Concepts and Collaboration

• “Distributed” and should be “Federated”
  – Sensor Network
    • Deploy tiny SNs and federate them to cover wide-area
  – Agriculture in Asia
    • Develop small farms and federate them to increase productivity

• What can SN community do for Agriculture?
  – SNs encourage a lot of small farms to maintain easily by monitoring without manpower

➤ Our WG and AG-WG should collaborate tightly to extract requirements for SNs and develop a federated framework
Agenda of Group Meeting

1. Review of the 1st Meeting in Sydney
2. Summary of the Core Meeting (Backgrounds, goals, and updated charter)
3. Define Terms of Sensor Network
5. Future Discussion Plan and AOB
Necessity of Terms Definition

- Definition of a sensor network is ambiguous
  - If you search "sensor network" in Wikipedia, you will be transferred to...
Various Ways of Sensor Networks

• Wireless/Wired Sensor Networks are realized
  – Several Wireless Sensor Network (WSN) is available, but weather sensor that equips multiple functions are also networked.
What will be the Concept of SN?

• General concept for SN should be:
  – Sensors that are connected in the same manner and behaves like a chunk of the sensors will be also called as a **Sensor Network**, *even if they are connected only by wire*
  – i.e., Sensor Network should be a concept that multiple sensors form a network and collect sensing data for a specific purpose by the same manner
Basic Unit of SN: Sensor Network Unit

• Definition of a Sensor Network
  – A SN = one or more Sensor Network Units (SNU)
  – A SNU is a group of sensor(s) that has ONLY ONE data node, and MAY have sensor nodes (motes)
  
    • Data node MUST be accessible from others via network and handle the sensing data from managing sensor nodes

<table>
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<th>#</th>
<th>≥ 1</th>
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<td>Sensor Network</td>
<td>SNU</td>
<td>Data (GW) Node</td>
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Concept

Physical devices
Federation of Sensor Network (1/2)

Collaboration among homogeneous (single architecture) SNU

Federation among heterogeneous (various architectures) SNU

Collaborated SN (Inter-SNs)

Federated SN (Inter-SNs)

Independent SN (=SNU)

Federation steps
Federation of Sensor Network (2/2)

**Ongoing Testbeds**
- Live E! on PIAX (JP)
- X-Sensor version 2 (JP)

**Live E!, X-Sensor (JP)**
- IP-USN (KR)
- CitySense (US)

**Dawn of SNs**

**Independent SN**
- Ad-hoc WSN (ZigBee/WiFi)

**Collaborated SN**
- Limited-area or purpose
- Specific operator
- Monitoring middleware

**Federated SN**
- Extracting meaning for various purposes
- Various operators
- Loosely-coupled framework

Federated Framework
Agenda of Group Meeting

1. Review of the 1st Meeting in Sydney
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5. Future Discussion Plan and AOB
Grand Design (Conceptual Model)

- Environment observation (weather, earth, space)
- Disaster mgmt. (wildfire, water)
- e-Agriculture
- e-Fishery
- e-Forestry

Sensor Applications

Data management (federate independent sensing data)

Application interface (query lang., access method, and AAA)

Resource management (access control and resource discovery)

Resource desc.

Sensor Networks
Collaboration with Other Projects

Collaborating w/ APAN Agriculture WG, Natural Resource WG, and GEOSS Sensor Web

Derived from existing standard, RESTful I/F etc.

Derived from existing standard, OAuth etc

Collaborating w/ industrial area

Networks
Function Blocks and Challenging Issues
Detailed Functions (1/5)

• Resource management
  – Resource Description
    • Describe sensors specification that include data type, observation method and interval, access method, data management method, etc.
  – Discovery
    • Find appropriate sensor(s) based on the sensor ID
  – Access Control
    • Handle an access for each resource according to each domain’s management policy
Detailed Functions (2/5)

• Data management
  – Aggregation
    • Collect sensing data from sensor node
  – Storage
    • Store sensing data in each data node
  – Query Control
    • Retrieve sensing data that is stored in data node
  – Scheme
    • Describe structure, attribute, relationships, etc. of the stored data
Detailed Functions (3/5)

- **Application Interface**
  - **Query Language & API**
    - Provide service description and methods to retrieve sensing data
      - A partial query is delivered to Resource mgmt. layer directly, and others are distributed to Data mgmt. layer
  - **AAA**
    - Provide authentication, authorization, and accounting (if necessary) function to mediate SN users and SN deployers
Detailed Functions (4/5)

• Multiple Overlay Networks
  – Support various kinds of access methods over distributed sensing data *w/o any servers* by constructing structured overlay networks over *data nodes*

• Required access methods are:
  – Single sensor node or data node query
  – Location(region)-based query
  – Country-level query
  – Etc.
Detailed Functions (5/5)

• Network Management
  – Provide transport layer to support several protocols and network-related functions
    • Locator: IPv4, v6, ZigBee, Bluetooth, ...
    • Service Discovery: UPnP, network-monitoring-based routing, mDNS, ...
    • Transmission: store & forward (DTN), flooding, ...
Agenda of Group Meeting

Review of the 1st Meeting in Sydney

Summary of the Core Meeting (Backgrounds, goals, and updated charter)

Define Terms of Sensor Network

Grand Design and Challenging Issues

Future Discussion Plan and AOB
How should we address the issues?

• Ref: Open Geospatial Consortium/AIP Phase 3

Figure 1 – AIP Context in GEO Tasks
Discussion and Organization Steps

Phase 1: Analyze Requirements
(derived from sensor application users and sensor devices inc. already-deployed SN)

Phase 2: Grand Design
(discuss sustainable architecture and arrange challenging issues)

Phase 3: Sub Working Group (each for issues/domains)
- Metadata/API
- Resource mgmt.
- Data mgmt.
- Etc...

Phase 4: Implementation & Deployment
(develop federated framework and SNs, deploy, maintain...)

* Estimated 4 years to accomplish
AOB: Next APAN meeting etc.

• Proceedings of the APAN 30th Meeting
  – Speakers today have rights to submit your papers
    • http://www.apan.net/meetings/Hanoi2010/30th_APAN_Call_for_Papers.php

• Future meetings
  – APRICOT-APAN 2011 (3rd meeting)
    • http://www.apricot-apan.asia/
    • 1 Group Meeting, 2 Workshop Sessions ??
  – Should have 2nd core or small meeting by the next APAN?

• Collaboration means
  – Prepare wiki-based web site (postponed)
  – Please join our SensNet ML and discuss in details
    • http://www.apan.net/wg/sensor.php
Conclusion

• Our WG should:
  – Focus on resource management, data management, and deployment to realize low-cost federation of tiny sensor networks
    ➜ Proposed “Grand Design” will be a good starting point to discuss the federated framework
  – Extract requirements of AG-WG for SNs for supporting crucial sensor network applications in Asia-Pacific region
    ➜ Will have a joint-session as Workshop Session 2
Let’s move on to the next talk...

2nd part of Group Meeting

DESIGN ISSUES IN GLOBAL SENSOR DATA SHARING (EUI-NAM HUH)
Workshop Session 2

CONCLUDING REMARKS OF 2\textsuperscript{ND} MEETING
a) Group Meeting

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  – Share backgrounds and policy of our activities
  – Arrangement of challenging issues and its scope
  – Future Plan
  – AOB

• Design Issues in Global Sensor Data Sharing
  (Eui-Nam Huh, KyungHee University, Korea)
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• Concluding Remarks (Susumu Takeuchi)
FYI: Related Sessions

• 09:00-10:30, August 11 (Wednesday)
  – e-Research Area Discussion
    • Agriculture WG and Natural Resource WG will be integrated as e-Research WG

• 09:00-12:30, August 13 (Friday)
  – Agriculture WG
    • Relationship between ICT and agriculture will be discussed
Proc. and Future Meetings

• Proceedings of the APAN 30\textsuperscript{th} Meeting
  – Speakers today have rights to submit your papers

• Future meetings
  – 2\textsuperscript{nd} Core should be planned by the next APAN
    • Discuss the approach for the next APAN meeting and allocate responsibility each for nation
  – APRICOT-APAN 2011 (3\textsuperscript{rd} meeting)
    • \url{http://www.apricot-apan.asia/}
    • 2 Group Meetings, 1 Workshop Session
      – In the Group Meetings, we have to divide discussions into small groups, and share at the end of the Group Meetings.
Call for Participation

• Collaboration means
  – Prepare wiki-based web site
    • Due to the graduation of the responsible student, the plan is postponed... a volunteer is required 😊
  – Please join our SensNet ML
    • [http://www. apan.net/wg/sensor.php](http://www. apan.net/wg/sensor.php)
    • We will announce the further meetings or discussions.
    • If you would like to contribute our WG, please join it and attend the further discussions!!
THANK YOU FOR JOINING TODAY!
SEE YOU IN HONG KONG!