Facility Information Access Protocol (FIAP): Generalization of Access Gateways, Storages and Applications for Internet-Based Sensor Networking



Hideya Ochiai The University of Tokyo / NICT 2010-02-09 in APAN Sydney

Activities and Experiences on Federal Sensor Networking



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- Introduction of Projects
 - Live E! Project
 - Green University of Tokyo Project (GUTP)
- Live E! System Design and Operation
- Problems on GUTP Testbed Operation
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- Summary



Live E! Project (2005~) -- Goals and Objectives --



- To establish an infrastructure of Environmental information of the Earth
- Main activities
 - Design and implement a data sharing platform
 - Setup weather stations (at schools)
 - Provide those data for multiple purposes/businesses.
- Current status
 - 100 sensors are deployed.
 - 10 data servers are operated.





Green University of Tokyo Project (2008~2010) -- Goals and Objectives --

- To make a standard protocol for energy-aware facility networking.
 - Energy-saving by ICT × Popularization

Standard Mass-production Popularization Total Energy Saving

- Main activities
 - Interoperable system design and implementation.
 - Testbed operation on EngBldg2., Univ. of Tokyo.
 - Trial for energy reduction.
 - Protocol standardization activity



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Live E! System Architecture



Live E! Sensor Deployment Status



Live E! Internet Weather Station

Weather Station

Temp, Hum, Pressure, Rain, Wind, CO2



Live E! Server Network



In Japan:

The University of Tokyo

Keio University

Nara Institute of Science and Tech.

Hiroshima-city University

Tottori University of Env. Studies

International:

Taiwan:

Taiwan Network Information Center (TWNIC)

National I-lan University (NIU)

Thailand:

Prince of Songkla University (PSU)

Loei Rajabhat University (LRU)

Live E! Multi-Domain Sensor Systems over the Internet



(1) Sensor system setup by organization



(2) Networking of multi-organizations



(3) Sensor search



(4) Data retrieval User in Org. C Organization A API Live E! server Data transfer from the server Response AP API Live E! server Live E! server 5 Profile **Organization C Organization B** Sensor

Live E! Multi-Domain Sensor Systems over the Internet



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Prototype operation in Univ. of Tokyo



Identified problems on the system

Data Access Level

- Storage access (Large-delay or Timeout)

- Semantic Level
 - Description format of data points
 - Expression format of values
 - Sequential differences

<< Data Access Level >> Pitfall in Remote Procedure Call (RPC)-based Designs



<< Semantic Level (1/3) >> Description of the same room by different operators

<u>Administrator</u>	<u>Point</u>	
CiMX	<u>102B1室内機-1 電力集計値</u>	
Panasonic	<u>10F江崎研実験室102B1-冷蔵庫</u>	
Yokogawa	<u>102B1江崎研究室電流</u>	
Yamatake	<u>10F江崎研究室 温度(1)</u>	
PEW	<u>学生室照明①電力量</u>	

All of the points were associated to the room 102B1. But, the description syntax were quite different.

<< Semantic Level (2/3) >> Expression of data by different systems

Expression manner is not generalized.

<u>Administrator</u>	<u>Point</u>	<u>Time</u>	<u>Value</u>
Yokogawa	<u>91A4客員教授室ロスナイ状態</u>	2009-04-20 10:48:09	true
Yokogawa	<u>91B1会議室ロスナイ状態</u>	2009-04-20 10:48:09	false
Ubiteq	<u>3階 231講義室前 廊下-照明</u>	2009-04-20 10:48:01	Т
Ubiteq	3階機会系会議室前廊下-照明	2009-04-20 10:48:01	F
Yamatake	<u>EHP-B-8 運転状態</u>	2009-04-20 10:47:59	運転

Yokogawa uses true/false to describe the status. Ubiteq uses T/F, and Yamatake uses "運転"/"停止".



Measure by 0.01kWh

Summary from the initial setup; Measure by 0.01kWh

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Facility Information Access Protocol (FIAP)



Architecture



Protocols and Use Cases



Currently Untouched Items in FIAP

- Semantics definitions and management
 - How to define semantic space.
 - How to bind data points to semantic space.
- Security
 - Access control
 - Mutual exclusion
 - Encryption
- Lightweight-ness (assuming 6LoWPAN)

FIAP Current Status

- Standardization activity
 - Discussion in ASHRAE, BACnet people
 - XML Working Group

- Prototyping
 - Reference codes are already working.
 - FIAP protocol stack
 - Sample Storage, sample GWs, sample APPs

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- Live E! Distributed Sensor Database
- Facility Information Access Protocol

 Based on Live E! protocol
 - Discussion with ASHRAE BACnet WG for standardization