Overview of Research and Development on Smart Spaces and Internet of Things in Petrozavodsk State University

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Smart Spaces and IoT in PetrSU: Project Structure 2014 - 2016

- Fundamental Research

  1. Methods of creating, maintenance and control for information content of smart spaces. Russian Fund for Basic Research

  2. Programming methods of service-oriented intelligent systems based on ontological models for interaction in heterogeneous IoT computing environments. Basic part of state research assignment of Ministry of Education and Science (Russia)

- Applied Research

  3. Ontology-driven development and intelligent Internet technologies for semantic services of historical tourism . Project part of state research assignment of Ministry of Education and Science (Russia)

  4. Development of technology for making intelligence in localized IoT computing environments with personalized service construction and proactive delivery . Federal Target Program "Research and development on priority directions of scientific-technological complex of Russia for 2014-2020":

    (1) e-Tourism, (2) Collaborative work environments, (3) m-Health, (4) Industrial Internet

Localized IoT Environments

- The Internet of Things (IoT) supports ubiquitous connectivity property of surrounding digital devices and Internet hosts

- Spatial-limited physical environment
  - Place centric
  - Person centric

- Multiple data sources:
  - Physical and Information worlds
 - Users generate content
  - Derived information

Smart Spaces

- Surrounding devices can be active information producers and processors
  - local services

- High fragmentation of exiting Internet services
  - low communication and interoperability
  - manual service puzzle solving

- Hub organizes shared information content
  - Nearby server
  - Remote server in the Internet
  - Broker IoT device (Wi-Fi router, Raspberry PI)

Smart Environment

Agents

Hub

Information World

Physical World

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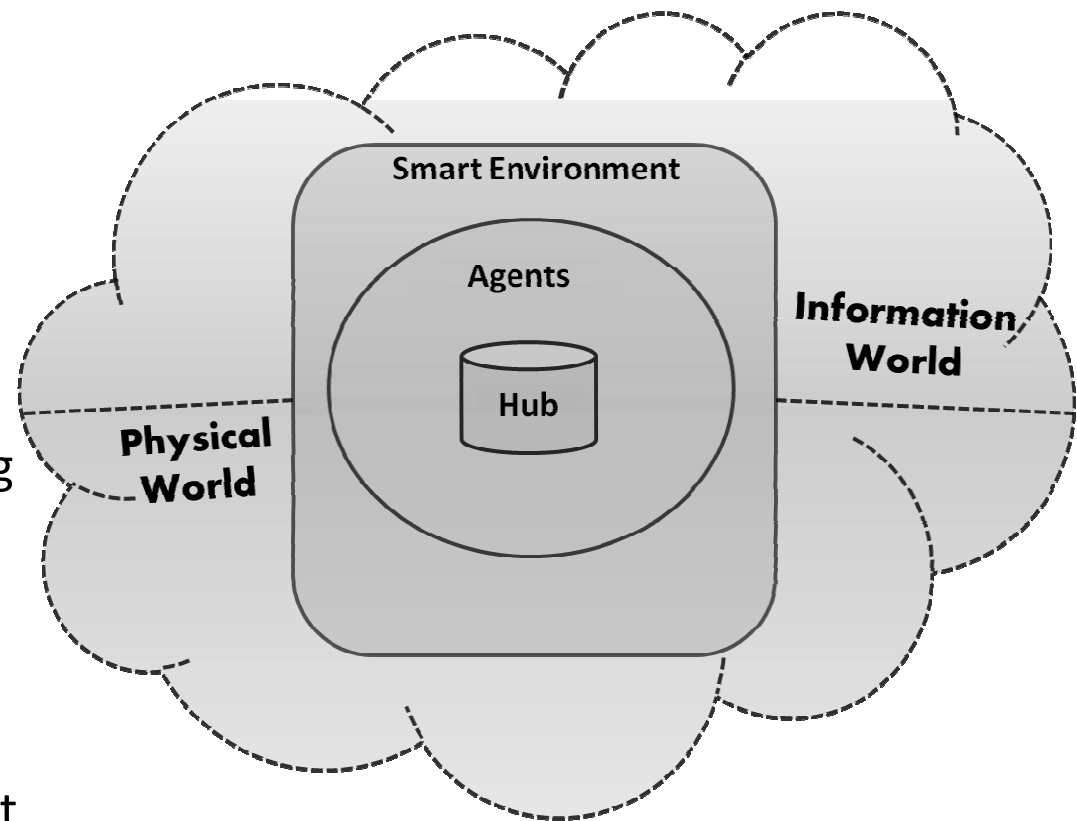
Smart Space Application (SSA)

- Application = Service Provider

- (Intelligent) Operation over all resources available in the computing environment to construct services sensitive to the users, their needs, and context

- Distributed system of agents (knowledge processor - KP) hosted in IoT environment

- Smart properties of SSA:
  1. Understanding the situation where the application is used and by whom
  2. Interpreting the semantics of shared information
  3. Tolerating uncertainty at development and run time

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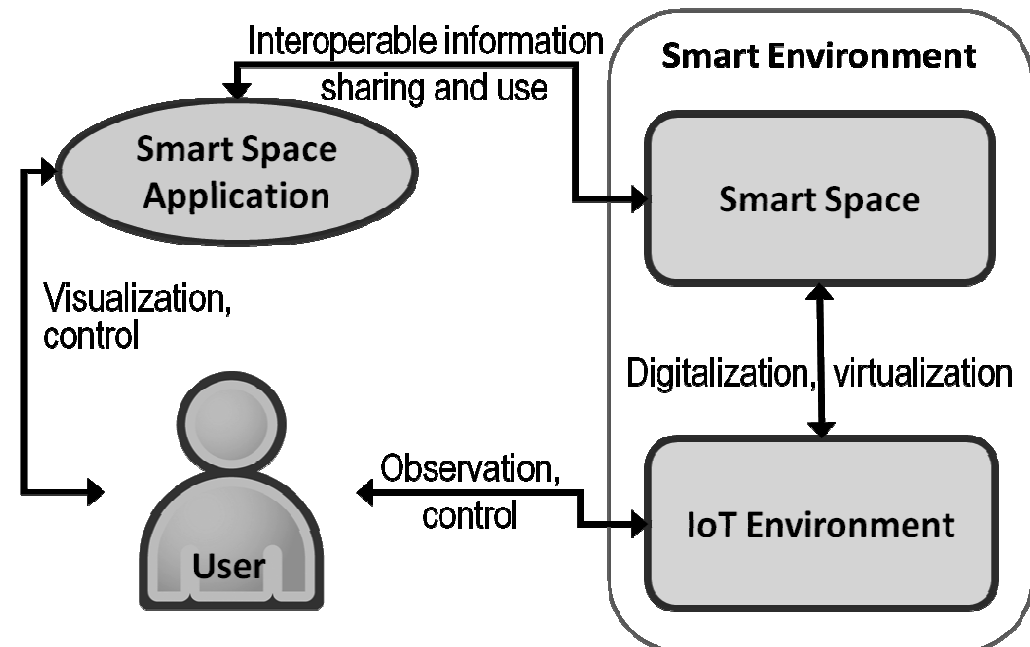
Enabler Models and Technologies

- IoT: Diversity of participants (ubiquitous connectivity, network interoperability)

- Blackboard model: indirect interaction, by information sharing

- Semantic Web (knowledge-driven support):
  - RDF model for machine-interpretable data representation
  - OWL ontology for model-driven programming
  - Reasoning over "linked data" (SPARQL)

- Publish/Subscribe model: event-driven programming

- Smart-M3 platform: open source for research prototyping
  - sourceforge.net/projects/smart-m3/
  - M3 = Multidevice, Multidomain, and Multivendor
  - **Technology of making intelligence in localized IoT computing environments**

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Emerging Application Domains

- e-Tourism

  - Oksana Petrina: *Smart e-Tourism Services*

- Collaborative work

  - Sergey Marchenkov: *SmartRoom System
    and its Use for Collaborative Work and e-Tourism*

- m-Health

  - Yulia Zavyalova and Nikolai Lebedev: *Overview of R&D activities for
    Mobile HealthCare in Petrozavodsk State University*

- Industrial Internet

  - Not presented at this seminar