Building Smart Buildings bSB.
The AAU position.

SmartHouse Workshop 3.1.2007, Aalborg

Per Christiansson
Kjeld Svidt

A Building Smart Buildings, bSB, platform.   1/2

The 'building Smart Buildings', bSB, platform will act as a vehicle for continuously generating and capturing creative ideas and inventions on new products and services, and new business models within the bSB domain, with support for subsequent design, development, evaluations and high-tech products and business promotion (demonstration, test installations, training, feed-back capture). The platform will provide a living environment and laboratory for end users, companies in particular SME´s, and university research groups with possible inclusion of real smart buildings and parts of smart cities.

PC March 3 2007

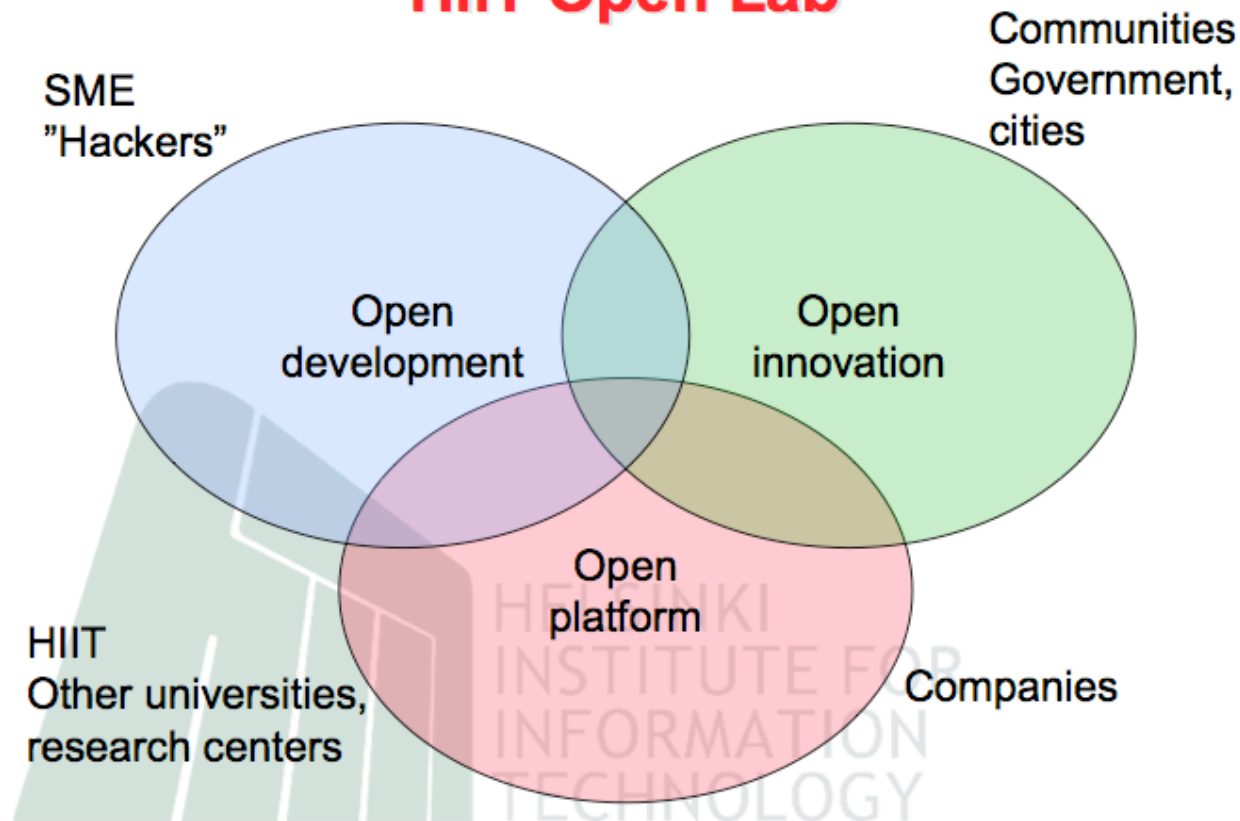# A Building Smart Buildings, bSB, platform.   2/2

- Innovation environment

- Demonstration environment and experimentarium

- Platform for meetings between end-user, customers, producers, and R&D meetings

- The Platform is by nature both VIRTUAL and PHYSICAL

Interacting with:
- Basic Research (models, theories, predictions, deep understanding..)
- Strategic and applied research (platforms, methods, tools...)
- Innovation (Labs, living labs, platforms, meetings, ...)
- Product development

Helsinki Institute for Information Technology
Martti Mäntylä

"Research is making knowledge out of money
- innovation is making money out of research"

Per Eriksson, Director for the Swedish Agency for Information Systems

Project focus domains

Smart Building concept focus domains (platform- project balance)

- End-user needs capture and innovation
- End-user driven configuration of smart buildings
- Services in intelligent cities and buildings
- Visualisation and simulation of building system solutions
- Smart building components and technical systems
- Smart adaptable and context sensitive spaces
- …..

The platform will support the both the *building smart* process (customer driven design, general component design etc.), including the smart global business model (the whole chain of customers and their value and cost attributes) as well as the *smart buildings/cities* (the smart end products).
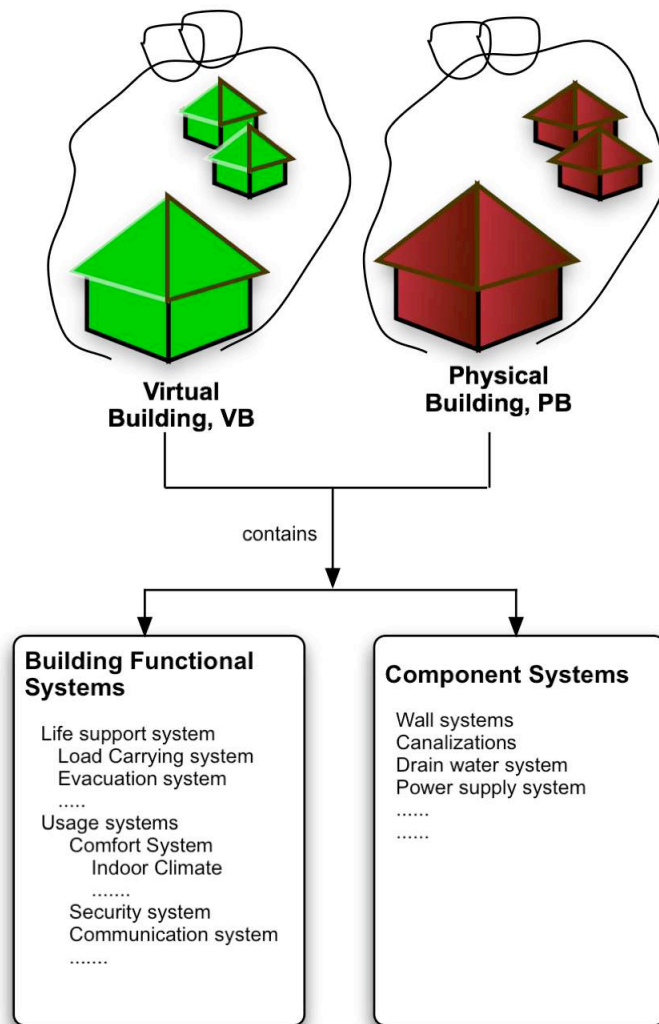
Services area support

The bSB platform could focus on different societal domains such as, *living environment*, *working environment*, *healthcare and safety*, *social meeting environment* and *building/city O&M* supported by Information and Communication Technologies, *ICT*. The following services area can be supported by the platform

- Services for Comfort
- Services for Safety and Security
- Services for Sustainable Performance
- Services for Human/Building/City interaction
- Services for Health and Well-being
- Services for ……

The Building/City functional system view

Virtual Building, VB

Physical Building, PB

contains

Building Functional Systems

Life support system
  Load Carrying system
  Evacuation system
  .....
Usage systems
  Comfort System
    Indoor Climate
     ....
Security system
Communication system
  ....

Component Systems

Wall systems
Canalizations
Drain water system
Power supply system
......
......

Per Christiansson 1.3.2007

The virtual building can be used for simulation and design of new services and user environments, interactive documentation of the ready building to support different services such as O&M activities, location of resources and persons in the building, and
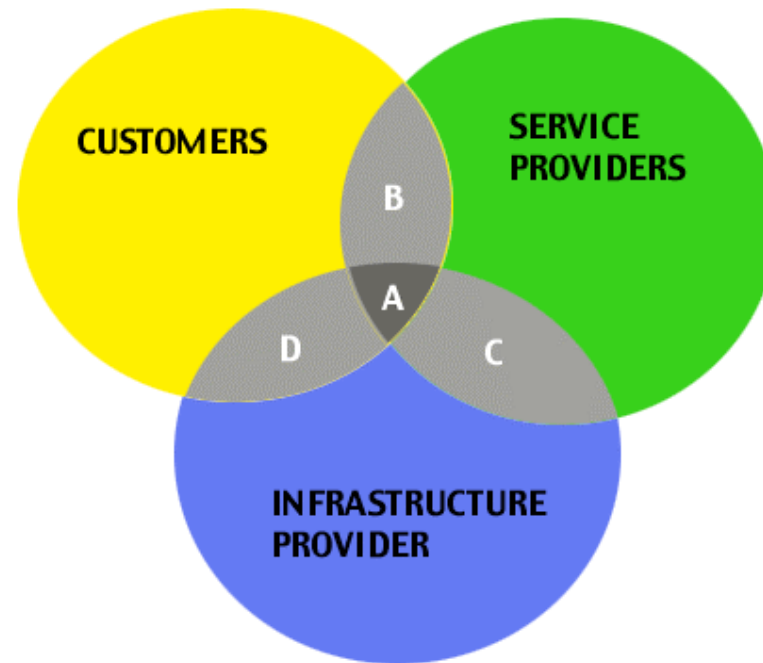
The physical and virtual buildings is more or less *functionally integrated* with other buildings, city areas, and optional global 'neighbourhoods'.

Needs - Services - Resources
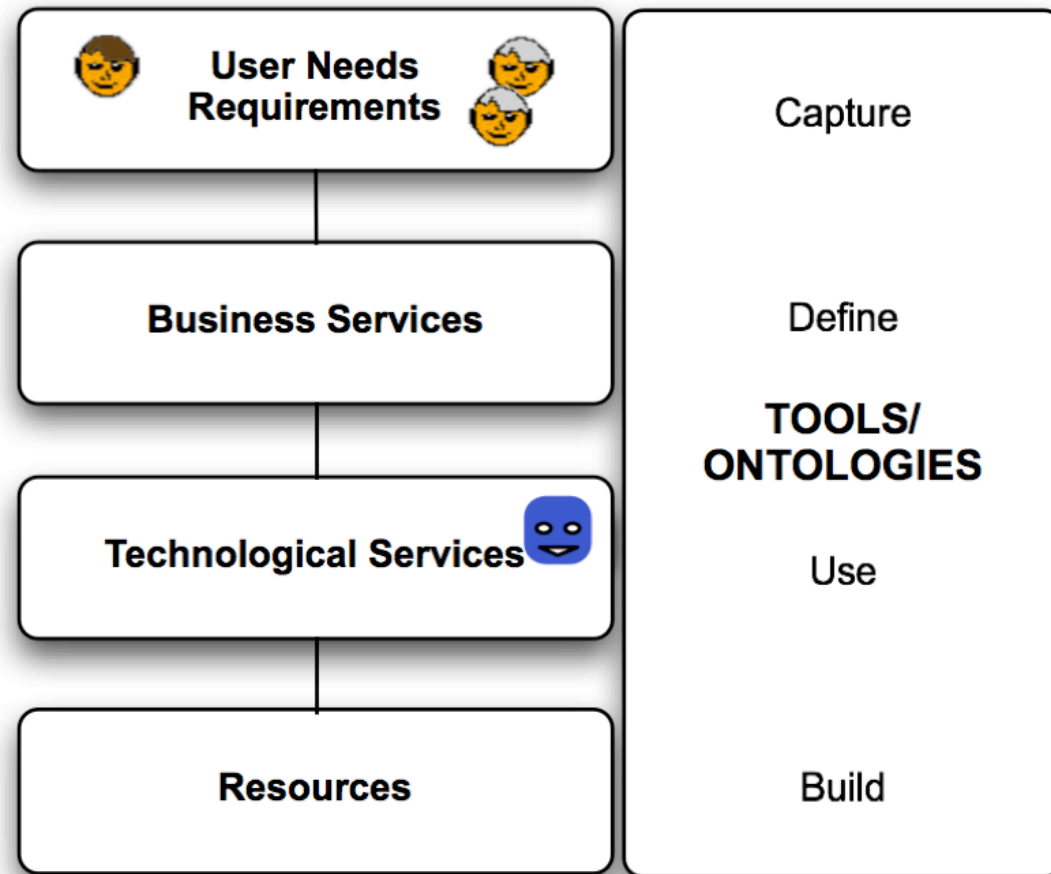
Customer - service - infrastructure

©Per Christiansson 30.8.2000

Relations between main actors - customers, service providers and infrastructure providers - in the digital city.

Services area support

In order to develop the services mentioned above development the platform will support development of a **business models** and number of important **technologies**. For example:

- Development of cheap and reliable *multiparameter sensors*
- Development of new strategies for *technical systems* in buildings
- Development of a personal self-learning *database* covering indoor climate, communication etc. needs and preferences as well as specification and usage descriptions of supporting ICT systems.
- *Model based control* of technical building services and energy systems
- New *context sensitive communication systems* and user environments for human/building interaction
- *Ontologies* management and access to support use, design and implementation of new services. Development of Smart Buildings metrics and standards contribution.
- Smart Building *needs/requirements specification system* to be used by end-users, clients, service and building component providers, etc.

Intelligent Building definition

In 2000 the author made the following *definition:*

"Intelligent buildings are buildings that through their physical design and IT installations are responsive, flexible and adaptive to changing needs from its users and the organisations that inhabit the building during its life time. The building will supply services for its inhabitants, its administration and operation & maintenance. The intelligent building will accomplish transparent 'intelligent' behaviour, have state memory, support human and installation systems communication, and be equipped with sensors and actuators."

Some important characteristics in future Intelligent Buildings can be
- be *flexible* and *responsive* to different usage and environmental contexts
- be able to *change state* (with long and short term memory)
- contain tenant, O&M, and administration *service systems*
- support *human communication*
- accomplish *'intelligent' behaviour* and *transparent intelligence*
- *Integrate* different IB systems to form complex systems

End user needs and requirements capture

There is a great need today to secure development with below specified areas to secure smart buildings to meet future needs from end users and technology providers

- Systematic description of existing and future *application/business services needs* in terms of application domain, functionality, involved actors, organisation, and use contexts.
- Systematic description of existing and future available smart *building/smart city services* in terms of application domain, functionality, and use context.
- Systematic description of existing and future available *resources* that can support provided services.

This is a complex design endeavour that well could be supported by a platform as suggested below, bSB - building Smart Buildings platform.

Virtual Innovation in Construction - VIC project
Brugerinvolvering i Byggeproecessen

VIC-SPACE - Virtual Innovation in Construction
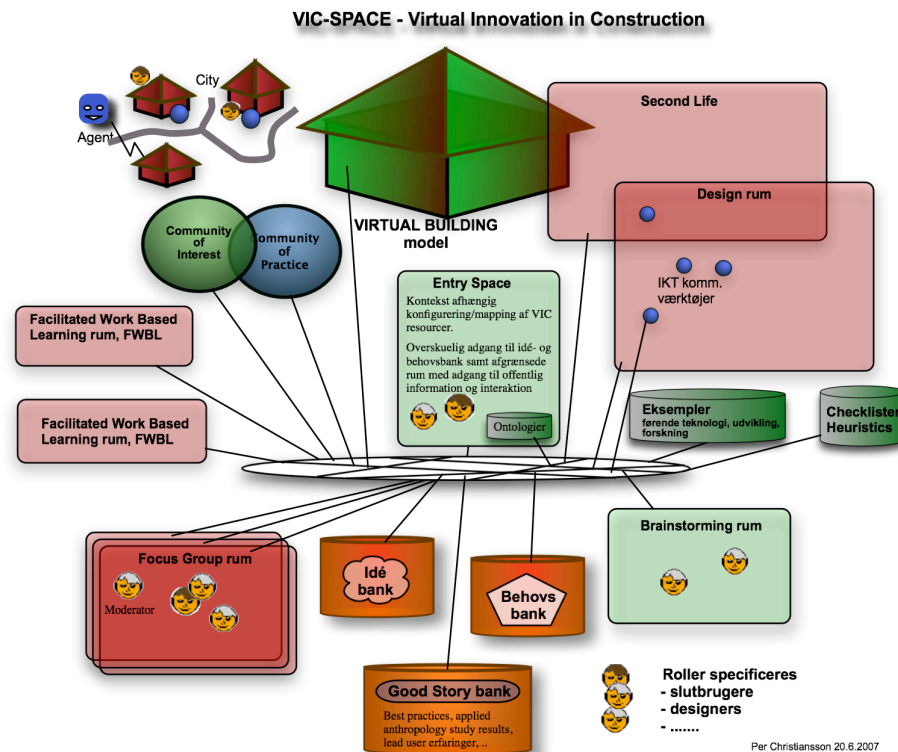
The project goal is to create an ICT supported methodology VIC - Virtual Innovation in Construction, to involve building end user in a creative innovation process together with building designers, to capture and formulate end-user needs and requirements on buildings and their functionality.

An open dynamic innovation space VIC SPACE is created with access from WWW.

Rambøll, Arkitema, AAU

More projects:

New ICT tools. New ways of working and collaboration - NICe
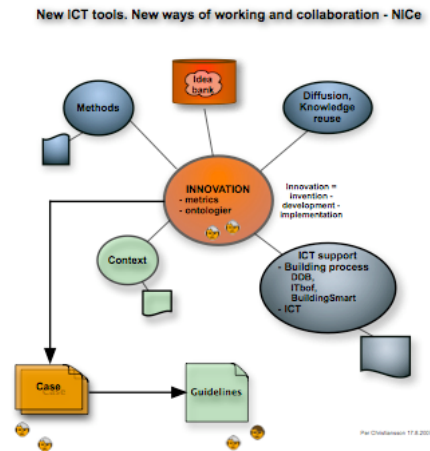
"New ways of working and collaboration "
Increase the possibility of successful implementation and adoption of new ICT tools in the construction sector across the supply chain through increasing the knowledge of how to execute suitable development and innovation diffusion/implementation schemes. The focus will be on context dependent (economic, social, political and practice specific dependencies) mapping of organisations (at various levels) and ICT- demands and how they interact.
Participants: Lund University (Sweden), Selvaag Blue Think AS (Norway), NTNU (Norge), AAU (Denmark)
Nordic Innovation Center, NICe.
Project time January 2008 - December 2008.

Kjeld Svidt will mention other relevant results/projects.

- DIVERCITY - Distributed Virtual Workspace for enhancing
   Communication within the Construction Industry (EU)
- IT på Byggepladsen
- Det Digitale Bygger, DDB
- Modelserver in praksis
- Linking Virtual Models with PhysicalObjects in Construction
- IT in Collaborative Design (semantic web support). PhD report.

Virtual spaces

A Virtual Space (VS) may be defined as a mixed reality environment optionally involving many physical spaces and many virtual spaces.

A VS may be set-up within *one* building or *many* buildings placed in the local community or on the other side of the world.

A VS do *not* have to be *stationary* but can e.g. follow a person defined as the immediate surrounding of that person. In this latter case wireless connection to the space is a necessity and maybe a complication in interaction with stationary spaces.

A virtual space may provide service to support *many* kinds of activities.
We may define virtual workspaces supporting collaboration, home health care space with access to distant doctors, different communities of interest or practice, virtual city space for service discovery and access etc.

The *impact* on social behaviour, economics, and personal values due to virtual spaces introduction should continuously be monitored and taken into account.

The Mixed Reality
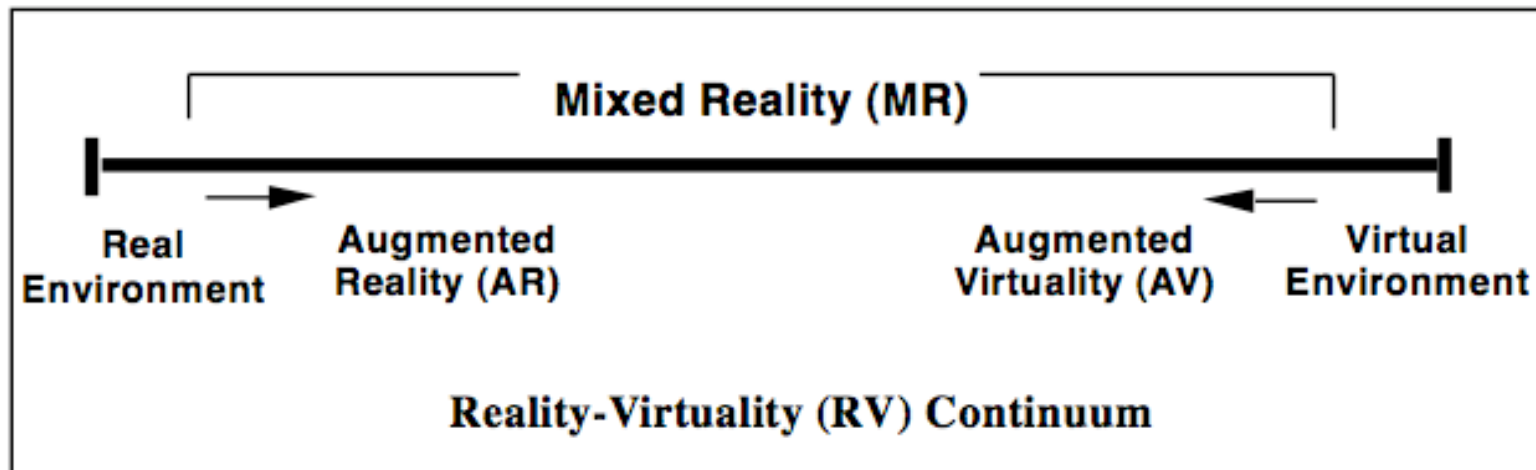
"Simplified representation of a RV Continuum." (Milgram et.al., 1994)

building Smart Buildings, bSB, platform

Per Christiansson 30.1.2007
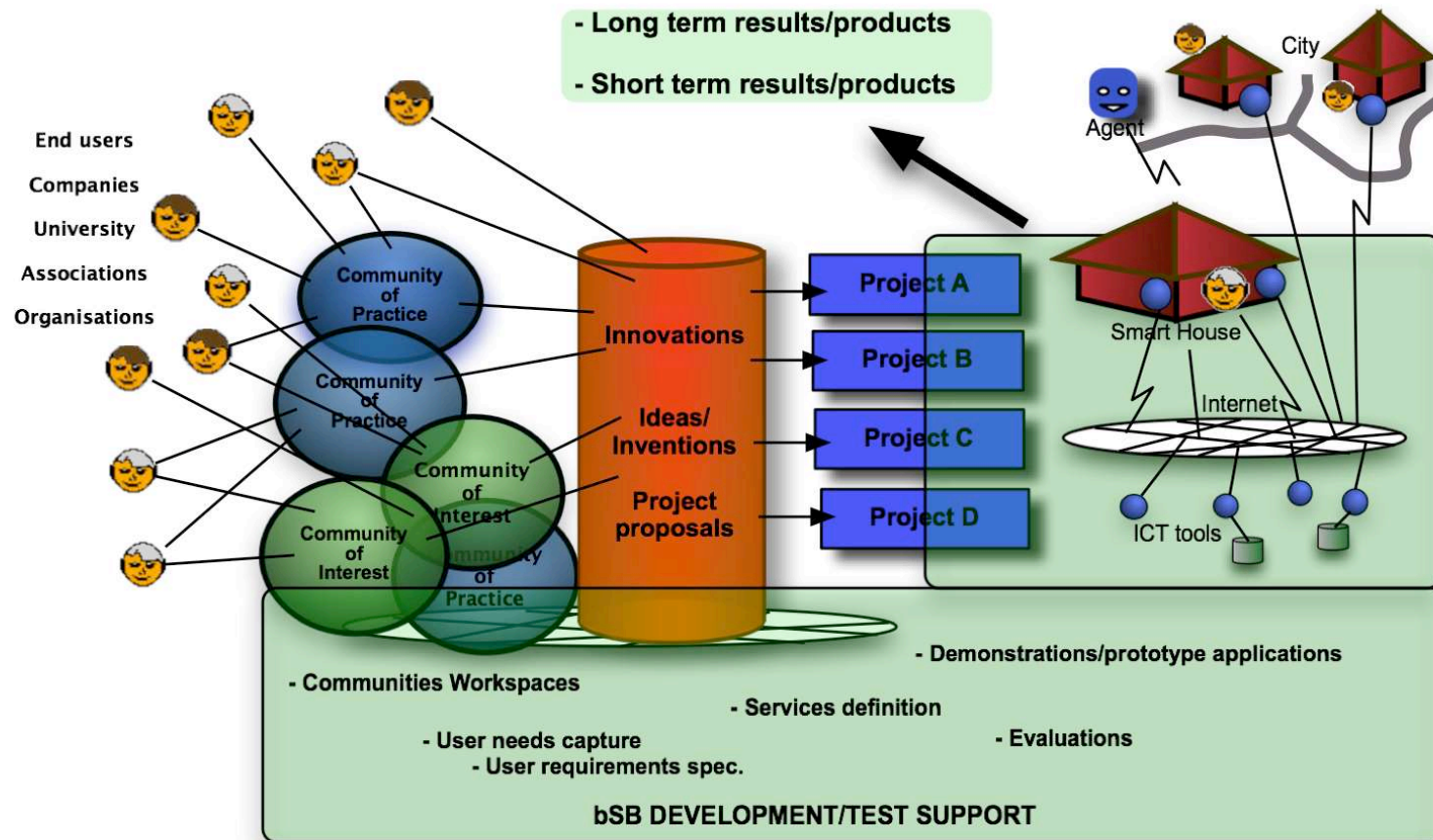
A bSB, building Smart Buildings, platform will actively contribute to the building of smart buildings/cities by providing mechanisms for idea generation and product/services development beyond inventions in isolation.

Results

Important results of the "SmartHouse" project are:

- Efficient *platform tools* and *methodologies*.
- *Raised competences* among partners. General public competence lift.
- Improvement of *holistic design of Smart Buildings/Cities*.
- Generic smart building and smart city *ontologies*.
- Establish foundation for development of *new and improved end-user services and products*, based on Smart House concept beyond invention in isolation.
- *Motivations* for (forming of) *companies* providing new end-user and infrastructure services.
- Better and new end products *fulfilling end-user needs* and requirements.
- New global *business models*.

END

+2 extras

http://it.civil.aau.dk

Helsinki Institute for Information Technology
Martti Mäntylä   (for Discussion)

Methodology

Scope of research program

Basic research:
Phenomena, understanding explanations, models, theories, predictions

Strategic research:
Tools, platforms, enablers, processes, methods

Innovations:
Open labs, experimentation platforms, living labs

Product develop-ment (not in HIIT focus)

Sciences

ICT industry   Application owners

Public actors   SME   Users

SITRA, VC

Basic research funding
Own research funding?

Joint funding (TEKES + industry) EU

Industrial funding
Public funding

Services Ontologies

Intelligent Building/city Servics META ONTYOLOGY

(why, who, what, when, where, how)

describes → describes → describes

Business Systems End user functional systems Ontology

ICT Support Systems Services Ontology

Resources Ontology

uses → uses

describes sub-ontlogies

Services types/Functions
Sub-Services

Functions
Context
Constraints

Who
  person (who, where, when. how,..
  team
  organsation

Spaces
  Home work
  Home Care
    time critical
    not time critical
.....
.....

describes sub-ontlogies

Services

Systems
Sub systems
Components
I/O

SOBA, Service Oriented
Business Architectures

SOTA, Service Oriented
Technology Architectures

describes sub-ontlogies

Physical Building and it's
building parts/components.

Virtual Building model.

City model.

Community information
Weather information
Transport information
Service provider information

External resource ontologies
(e.g. collaboration support)
...
...

LEVELs

Per Christiansson 1.3.2007

An ontology is an explicit formal specification of how to represent the objects, concepts and other entities that are assumed to exist in some area of interest and the relationships that hold among them.

A service request may generate alternative support system actions depending on context and/or other parallel services requests. Worse case is that a critical service will invoke temporary close down of other services.

From Christiansson P. (2007) "ICT Enhanced Buildings Potentials", Proceedings 24th CIB W78 Conference "Bringing ICT knowledge to work". June 26 - 29 2007, Maribor, Slovenia. ISBN 978-961-248-033-2. (pp. 373-378). http://it.civil.aau.dk/it/reports/2007_06_w78_maribor_pc2.pdf