OULUN SEUDUN
AMMATTIKORKEAKOULU

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OUAS UBI CAMPUS

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Master's thesis
Spring 2011
Degree program of Information Technology
Oulu University of Applied Sciences

ABSTRACT

Oulu University of Applied Sciences
Degree programme in Information Technology

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Title of thesis:OUAS UBI campus
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Term and year when the thesis was submitted:May 2011 Pages: 49

This Master of Engineering Thesis is done for OUAS (Oulu University of Applied Sciences) IM (Information Management) department. The goal was to introduce UBI-networks and –technology in the city of Oulu for IM. Also visions of UBI-campus architecture were the work subjects.

PanOULU (public access network)OULU WLAN open network and Oulu University and City with co-operation corporations' valuable publish, research and development works are described in this thesis. The visions of UBI OUAS campus area are described in this thesis well. Hopefully this thesis will help IM department to create and publish UBI-campus system very well.

Keywords:

Ubiquitous computing, UBI – UrBan Interactive – wireless networks

ABBREVIATIONS

AP	Access Point (vs. Base station)
BT	Bluetooth
CPU	Central Processing Unit
DUI	Distributed User Interface
FLW	Flash video (Adobe Flash player)
GPRS	General packet radio service
GW	Gateway
HCI	Human Computer Interactions
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
ISP	Internet Service Provider (27)
IRC	Internet Relay Chat
JW player	Player for flash in Internet
J2ME	Java Platform micro edition for developing applications
LCD	Liquid Crystal Display
6LoWPAN	Low Power Wireless Personal Area Networks

MIDlet	Software layer
MIDP	Mobile Information Device Profile
Middleware	Middle layer program
Mesh	Network (5, p. 4)
MSP	Multimedia signal processing
NFC	Near Field Communication
Node	Connection Point interfacing network with different protocol (24)
OUAS	Oulu University of Applied Sciences
panOULU	public access network OULU
QR code	Quick Response code (26)
RAP	Root Access Point
RFID	Radio Frequency Identification
RSS/Atom	WLAN-API router Identifier
SLAP	Street Level Access Point
SMSC	Short Message Service Center
MMSC	Multimedia Service Center
UBI	UrBan Interactions
UI	User Interface

URL	Uniform Resource Locator
WiFi	WLAN-products by WiFi alliance qualified
WGN	Wireless Global Network
WLAN	Wireless Local Area Network
WSN	Wireless Sensor Network
XML	eXtensible Markup Language
XMPP	eXtensible Messaging and Presence Protocol
XSPF	XML Shareable Playlist Format (free, open)

CONTENTS

INTRODUCTION

This work is done for the OUAS Information Management department where people are interested in UBI (UrBan Interactions) technology and services. They like to know how easily it could be applied to the needs of the educational institute campus: what investments, resources, systems, devices and changes it needs and how UBI-service works, what services could be applied and designed for the use of the OUAS-campus.

For intelligent environments it is usually true that automatic functions happen in an embedded way without people doing anything. Information technology in public spaces is all the time easy, fast and everywhere in use. Public spaces can be considered as a neutral ground which is open to all. Also they are considered as an individual usage and social interactions influenced by many factors, including how the spaces connect and how design, maintenance and management (of the natural) are built. Using policy is also meaningful. An embedded logic drive user can continue logically. Public spaces are social open-air-living-rooms, outdoor leisure centres and well-being residents for people of all ages. People are in global virtual groups by social media applications (Facebook, YouTube). UBI technology changes the social communication ways. For educational life it is possible to learn by new ways and to product own knowledge. (1, p. 13.)

In developed countries UBI technology in open public urban spaces is a fast growing infrastructure. Information and communication technology of all trades via solutions and applications offer an interesting interactive interface to research, science and personal development for the citizens' community in a core city area. The widespread multidisciplinary research is centralized in core communities where there are market places, libraries, cafes, educational institutes, local companies, hotels and other public places. They are also good places for social, physical and visual spaces which are combined together to a seamless, wireless network.

This all gives a unique opportunity for every citizen to join the development and evaluation and learn new skills by using offered living labs, test-beds and real solutions in core city places. Also, at the same time it offers researchers a possibility to see the effects, adopts and meanings. One of the goals is to help citizens in their normal life too. Via UBI-services it is possible to use the information and communication interactive technology such as mobile phones, PCs and Internet connections.

The prevention of human and machine failures and checking of remote and control systems have been developed. The used interfaces are often open public displays that offer advertisements, advices, interactive services, city news, map services etc. To build UBI-infrastructure, networks and displays is a very expensive and enormous project, which means that financial treatment has to be handled well. Sometimes it comes from partial commercial use such as advertisement, but it limits the real offer and use. How to balance and organize it and make it useful for every area are good questions.

Somewhere in the world there have been attemps to build the infrastructure from the beginning artificially into the real empty fields. Thus, urban spaces are developed according to Mark Weiser's visions, which he designed at Palo Alto USA for Rank Zerox in the 1980s for UBI smart environment, and new technologies are taken in use with compatible, wireless and interactive talent devices. (2, p. 2.)

1 UBI BACKGROUND

UBI means ecological information and communication ways to offer open public costless interactive services everywhere in city centers or other places over the world for every citizen. Information flow and offering is exact and useful. It is easy to use UBI-services by touching screen and open mobile phone connection via BT (Bluetooth). Using phone connection needs only BT in it. Information and communication networks, PCs, mobile devices and sensor networks are compatible with each other completely. Personal information is continuously in hand. This environment is called UrBan city area. (2, p. 1-3.)

The big urban public displays are built both indoor and outdoor for commercial and multimedia information distribution. Also the devices and ways to distribute information can be different. All kind of sensors are assembled, such as meteorologic stations, monitoring cameras and traffic accumulator. Generally a control and collecting information flow is very important to know.

International development in UBI-fields is increasing more and more all the time. The famous research projects are for instance Urban/Social Tapestries in the UK (United Kingdom), Urban Atmosphere in the USA and Tokyo Ubiquitous Technology Project in Japan. In Southern Korea there is a UBI-city project, which handles the whole urban infrastructure design on an artificial isle, where there are no constructions before. It makes it possible to create exactly new forms of UBI-networks. (2, p. 1.)

Also in Sapporo, Japan there are ten large public screens installed (due to be launched in the beginning of April 2011) in the space, displaying user-generated videos about various aspects of the city and a real-time map that visualises the users' interaction with the city. The application aims to engage the general public inhabitants by functioning as a unique social-cultural and technological interaction and make the space lively, where people can have meaningful experiences with people and places of Sapporo through mobile

phones (keitai) and public screens. Figure 1 illustrates the SWW (Sapporo World Window) architecture. (3, p. 4.)

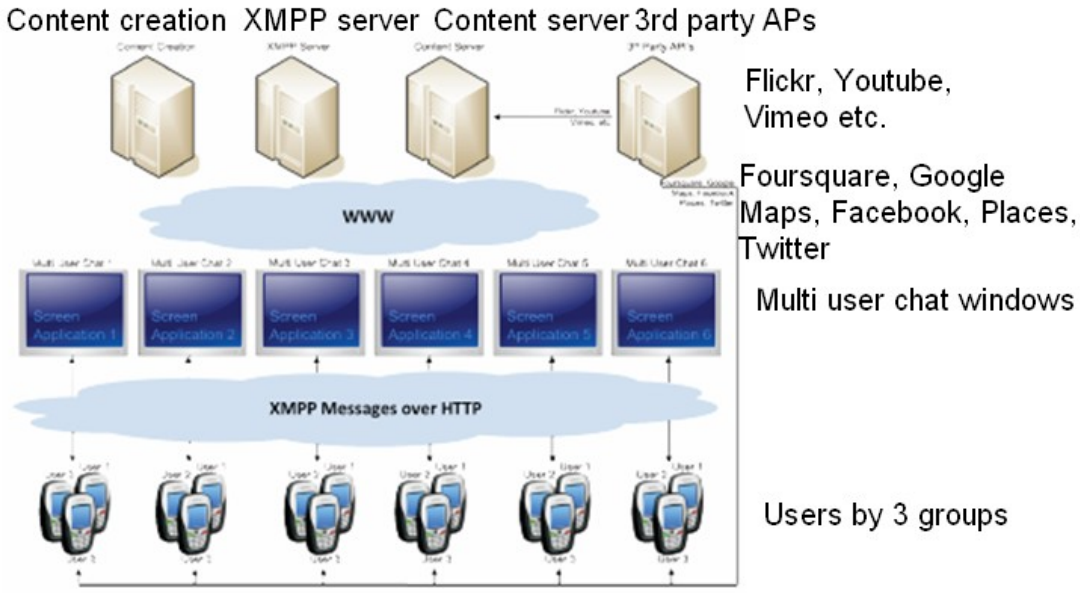

FIGURE 1.SWW Sapporo World Window architecture (3, p. 4)

Ten large public screens and speakers are to be installed in the underground passageway. Four eastside screens display the map of the Sapporo (divided into four sections) showing the real-time visualisation of people who use the application today. Videos, images and twitter post can be uploaded around Sapporo. SWW utilise the XMPP (eXtensible Messaging and Presence Protocol), which is an open standard enabling to send and receive fully customisable XML (eXtensible Markup Language) strings such as HTML5 (Hypertext Markup Language). HTML5 makes it possible to visualize different media types such as images and films. Each screen has an individual standardised QR (Quick Response) code generating property, which is ubiquitously used in Japan. Using QR codes allows the use of mobile camera phones for uploading files from displays. (26)

There are also indoor public displays in libraries, cafes and other public places. An example of indoor open public displays is shown in Figure 2.

FIGURE 2.Example of indoor public displays (2, p. 1)

1.1 Benefits

UBI-services help a citizen to get the needed information, for instance bus timetables, if she/he is going to go by bus somewhere. People can use their waiting time usefully by looking at news and other information. They save steps by looking at advice, maps etc.

A widespread sensor network and control environment is continuously growing and can send information automatically to places where it is needed. If for instance a water pipe is broken, the information about it conveys to the waterworks and the defect can be repaired very fast. The same concerns electrical defects, street repairs etc. as even in those cases the knowledge goes fast to the repairers.

The USA, Japan, Australia and Korea are forerunners in developing UBI-technology. Big scrolling digital signs on the side of a bus change depending on its location and time of the day in New York, USA (Figure 3).

FIGURE 3.The digital sign of a bus in New York (4, p. 6)

1.2 Disadvantages

A big disadvantage is that UBI-services are not available outside cities. Also, there are no standards to build an infrastructure and networks.

2 OPEN URBAN COMPUTING TESTBED IN OULU

In this chapter UBI Oulu University research, applications, devices, infrastructure, finance, experiences and risks are presented.

The building blocks of the city urban testbeds are seen in Figure 4. In the infrastructure layer “VLAN” is a virtual local area network.

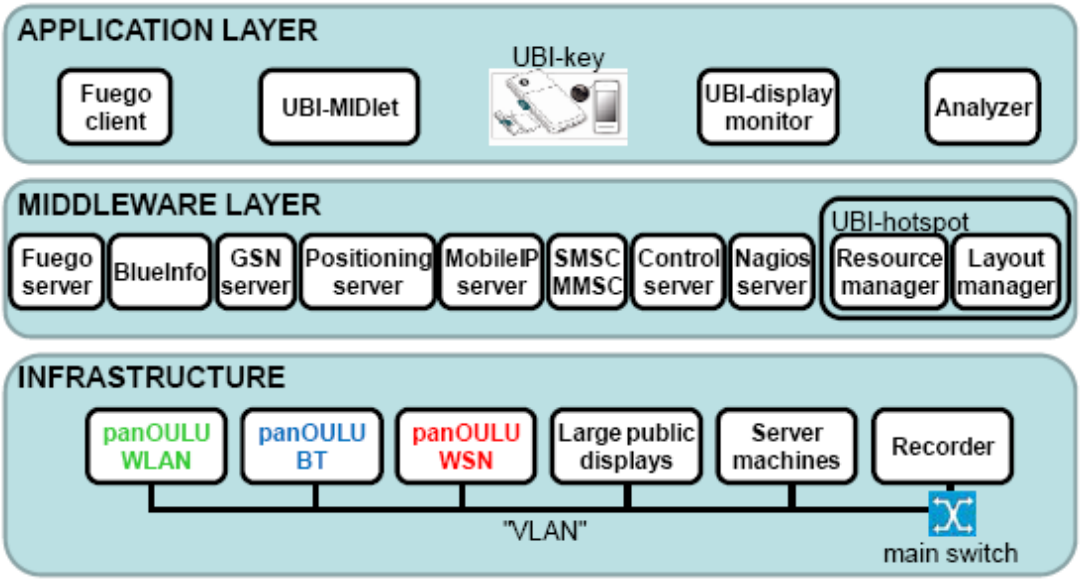

FIGURE 4. The building blocks of testbed (5, p. 3)

The UBI main philosophy is to offer open free public interactive information and communication services everywhere in the city centers such as in main libraries, market places, cafes, swimming pool entrances etc. UBI information and communication services are embedded Internet and mobile phone connections as well as PC-functions. BT-connections happen between mobile phones and hotspots displays via embedded sensor network, community based services and user interface applications (Figure 5).

FIGURE 5. UBI-infrastructure and services (6, p. 33)

Services offer open maps, bus-timetables, restaurants food lists, files for mobile downloading, weather conditions, broadcasting etc. In addition, they offer advices for citizens, city news, interactive functions and mail services etc. As mentioned earlier, panOULU WLAN network services are offered in an embedded way in the hotspot display user interfaces (Figure 6). Pan-OULU connection appears automatically for citizens opening a laptop PC.

FIGURE 6. A large public hotspot display at downtown Oulu (7, p. 2)

2.1 PanOULU

PanOULU (public access network Oulu) WLAN displays communicate with RM (Resource Management) components through a publish/subscribe network, with each other and with the mobile clients. Publish/subscriber networking are utilized in the resource discovery and at the reservation level and in Bluetooth at the authentication level. The aim of the first prototype was to facilitate the discovery and reservation of large displays in a smart space (8, p. 3).

Figure 7 illustrates the architecture of panOULU network. City and Region areas are separated in the diagram.

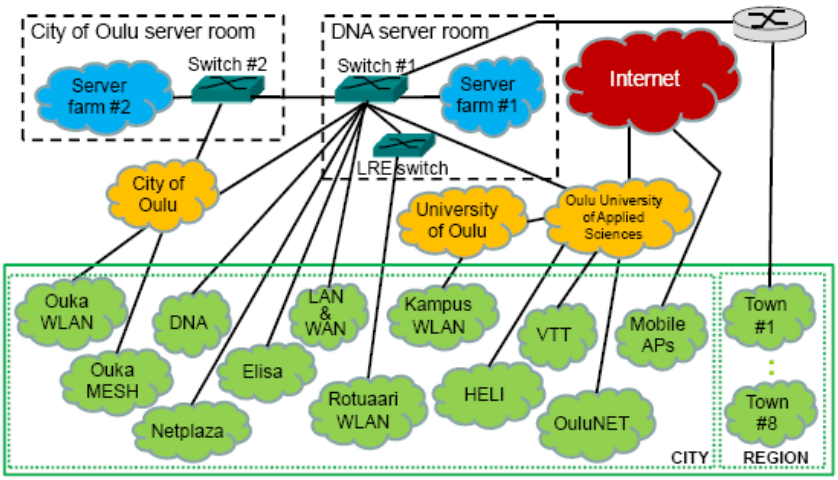

FIGURE 7. PanOULU network architecture (5, p. 4)

The “CITY” comprises of two types of WLAN zones. They are a campus and five public organizations: Oulu University, City of Oulu, OUAS, Heli ry (Hengitysliitto, i.e. Pulmonary Association), VTT (Valtion Teknillinen Tutkimuskeskus, i.e. Technical Research Centre of Finland) and the panOulu subscriptions sold by ISPs (DNA Oy, Elisa Oyj, Netplaza Oy and LAN&WAN) (22). ISP (Internet Service Provider) (27) is a product, which allows any organization to acquire panOULU hotspot, mobile APs and network without any additional client software.

The “REGION” subnet is comprised of eight nearby municipalities. The municipalities allow the locations of the WLAN-zones consisting of 1200 access points (APs). They provide both indoor and outdoor coverage in places deemed relevant for a public access. The coverage is provided with a WLAN mesh network in the city center and the surroundings, otherwise in a hotspot manner. (5, p. 4.)

PanOULU offer in its authentication area the wireless wideband Internet-connection for every willing citizen.

PanOULU WLAN system includes devices such as open WLAN base stations (WLAN radio), antennas, server SMS, (Short Message Service), logs and routers. The services are SMS messaging, IRC (Internet Relay Chat), news, GPRS (General Packet Radio Service) map service. PanOULU net-

work needs a WLAN (based on the IEEE 802.11s standard) compatible PC, handheld computer or mobile phone. The part of the base station network is a mesh-network. It is a type of network where each node must not only capture and disseminate its own data, but also serve as a relay for other sensor nodes and must collaborate to propagate the data in the network. An example of mesh-network is the Internet (Figure 8).

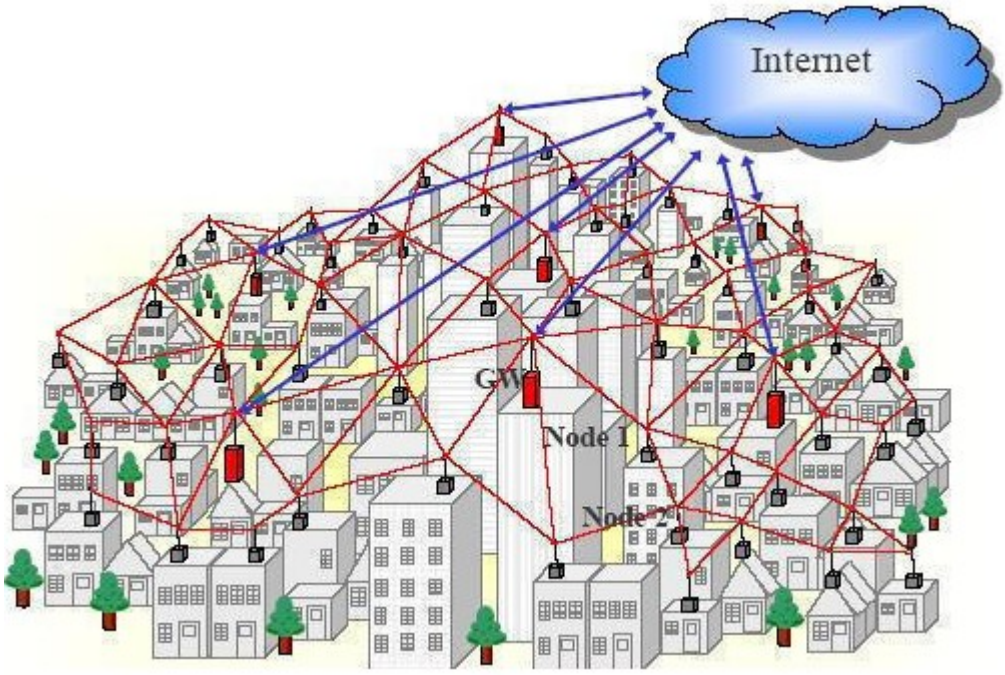

FIGURE 8. mesh-network (9; 23; 24)

Mesh-network is based on the SLAP-base stations (Street Level Access points) that make a network and search the best connection straight to RAP-base stations (Root Access points). The RAP-base stations have a fixed net-connection but SLAP-base stations do not. Another part of the base stations are WLAN-type networks.

PanOULU WLAN is working in healthcare centres and libraries only in the countryside near Oulu.

The structure of panOULU WSN-network (Wireless Sensor Network) (Figure 9) includes sensors, APs (Access Point) (same as base stations) and GSN-server (Global Sensor Network) working with clients on the Internet.

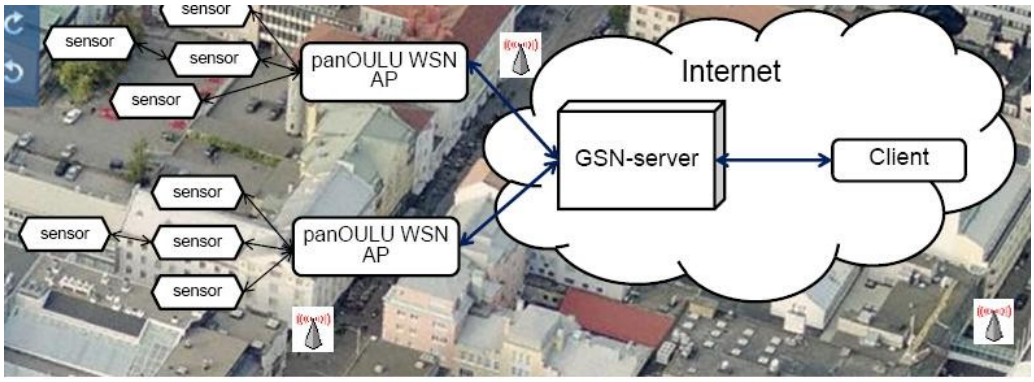

FIGURE 9. The structure of panOULU WSN network (10)

PanOULU WSN –network APs are based on the IEEE 802.15.4 standard according to the technology with the 6LoWPAN (Low Power Wireless Personal Area Network) protocol stack multihop half-duplex information transfer to less power consumpting sensors (10). PanOULU WSN APs route sensors collect data further from the GSN-servers and change it to a suitable form for clients.

2.2 Oulu University research

Oulu University researchers have developed UBI-services under the UBI Interactions program since the year 2009. The Computer Engineering Laboratory and the Department of Electricical and Information Engineering have been the main designers of the services. UBI projects are UbiLife, RealUbi, UbiCity, UbiGo, UbiAntropos (25), Urban Flows and Networks. The research goal is how ubiquitous computing solutions can be utilized in an urban environment in order to provide better services for city inhabitants. The published services are embedded solutions and devices, WSN (Wireless Sensor Network) and public open hotspot displays installed in the center of Oulu city.

2.3 SW & HW implementations and SW-management

For remote monitoring and management few tools have been developed, which are used for cheaper update, faster repairing and human error control of the UBI constructions. Both SW and HW infrastructure of the DUI (Distrib-

uted User Interface) component is called The Open Urban Service Network (OUSN).

2.3.1 SW Implementations

Oulu University Media Team published the Open Source Software UBI Life Middleware and pilot applications 16 September 2010. The applications were tested in public in the year 2009. Acronics True Image Software installation allows a fast system setup and eliminates human errors. Automatic SW-updates are displayed.

Nagios is one kind of open source software tools. It reports important metrics such as CPU (Central Processing Unit) load, memory usage and network services. It automatically gives notifications if service and host problems occur.

Full HD (High Density) LCD-panels (Liquid Crystal Display) in hotspot displays are on power-save-mode at nights (1.00 - 7.00 AM) in order to extend the life-time of them. The panel is turned on if someone touches it or starts an interactive session. A boot or reboot happens automatically for the hotspot display every morning before 7.00 AM.

The periodic screen capturing and storing was implemented in the local web server. The quick glance for the system administrator can obtain a comprehensive overview of the panels in the hotspot in order to see if the system is indeed happy. “Happy Page” in Figure 10 is browsable anywhere on the Internet. Not every failure can be monitored.

FIGURE 10 . A collage of screenshots of hotspots, “Happy Page” (11, p. 4)

2.3.2 SW-management

UBI-hotspot SW-management coordinator and control servers are described in the section exactly. They are for instance RM (Resource Manager), Lay-out Manager and different kind of servers for control and management func-tions. Figure 11 illustrates the UBI-hotspot SW-management tools by the diagram.

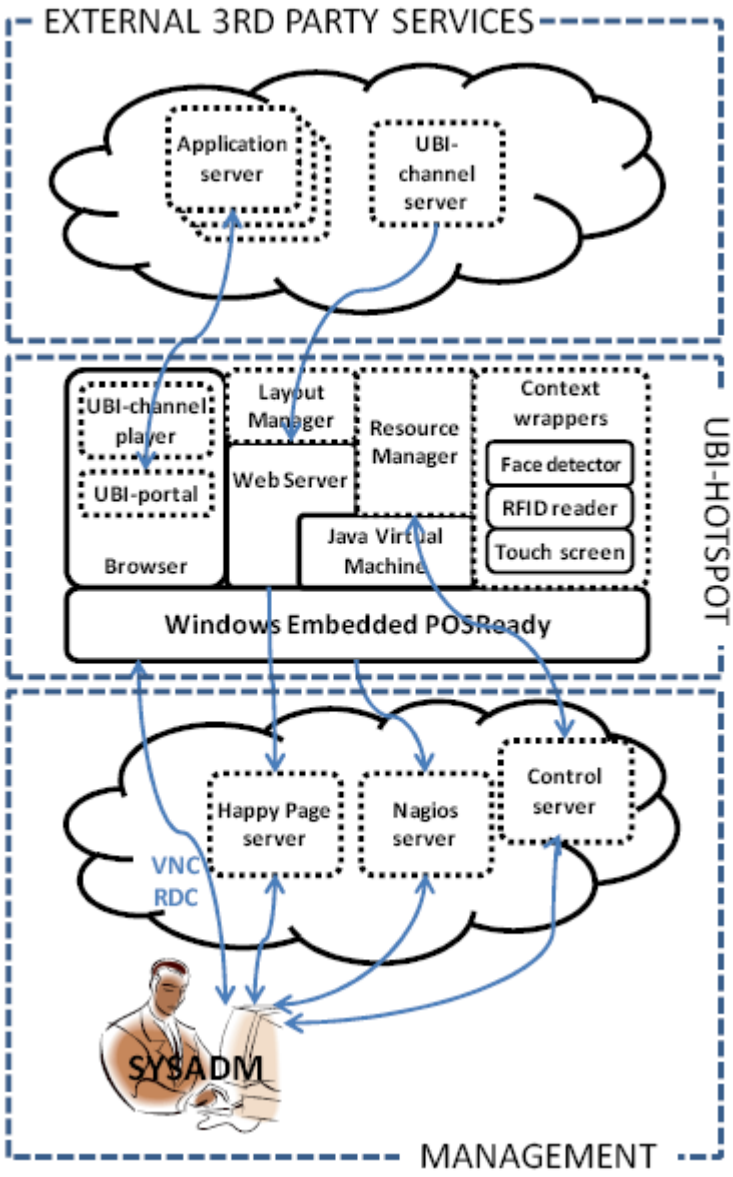

FIGURE 11. Hotspot management (11, p. 3)

RM (Resource manager) is a central coordinator and displays the UI (User Interface). Layout Manager controls the spatial access to the screen estate. It serves an interface for triggering state changes and assigning visual web applications of URL. (5, p. 7-8.)

The control server takes care of runtime service discovery, user authentication and hosting of application metadata. The application layer is responsible for the application development and monitoring of the testbed. The Nagios server takes care of the remote monitoring of computers, reports of the metrics and supports the notifications of service or host problems. The “Happy

Page”-server informs if the system is happy. UBI MIDlet is a lightweight SW layer with J2ME (Java platform Micro Edition developing applications), which provides a native service support in implementing session control, authentication and transparent integration with RM for UBI mobile service applications.

The OS (Open Source) Fuego server makes it possible to publish an event and routes it to the subscriber/client. The GSN (Global Sensor Network) server comprises of a receiving module, database module, web-based query and external web services module.

The positioning server keeps track of the current location of the nodes.

The mobile IP (Internet Protocol) server provides commercial mobile client licences and utilizes the management of vertical handovers between different access networks.

The SMSC/MMSC (Short Message Service Center/Multimedia Service Center) server for mobile clients serves the supported access by commercial message service.

The UBI display monitor periodically takes snapshots from the UBI hotspots screens and renders them as a collage on a web page.

The analyzer summarizes the packet-data presentations collected by Recorder. It makes it possible to see the high level analysis of the complicated events and the time consuming when handling an enormous amount of data.

2.3.3 HW Implementations

The hotspots of the HW implementations such as displays are illustrated in Figure 12.

FIGURE 12. Illustration of the hotspot (12, p. 6)

The locations of the indoor and outdoor hotspots are illustrated in Figure 13.

FIGURE 13. Indoor and outdoor hotspots (21, p. 6)

The HW-structure of the indoor UBI-hotspot includes devices such as camera, LCD-panel, touch screen, control PC, disk, NFC/RFID-reader (Near Field Communication) (Radio Frequency Identification), APs (Access Point) for panOULU WSN, WLAN and BT (Figure 14).

FIGURE 14. Structure of indoor UBI-hotspot (11, p. 2)

2.4 Applications

Applications where UBI-solutions are used in panOULU network, and Oulu city center indoor and outdoor hotspots are presented in this section. UBI Open Urban Service Network (OUSN) building blocks are shown in Figure 15.

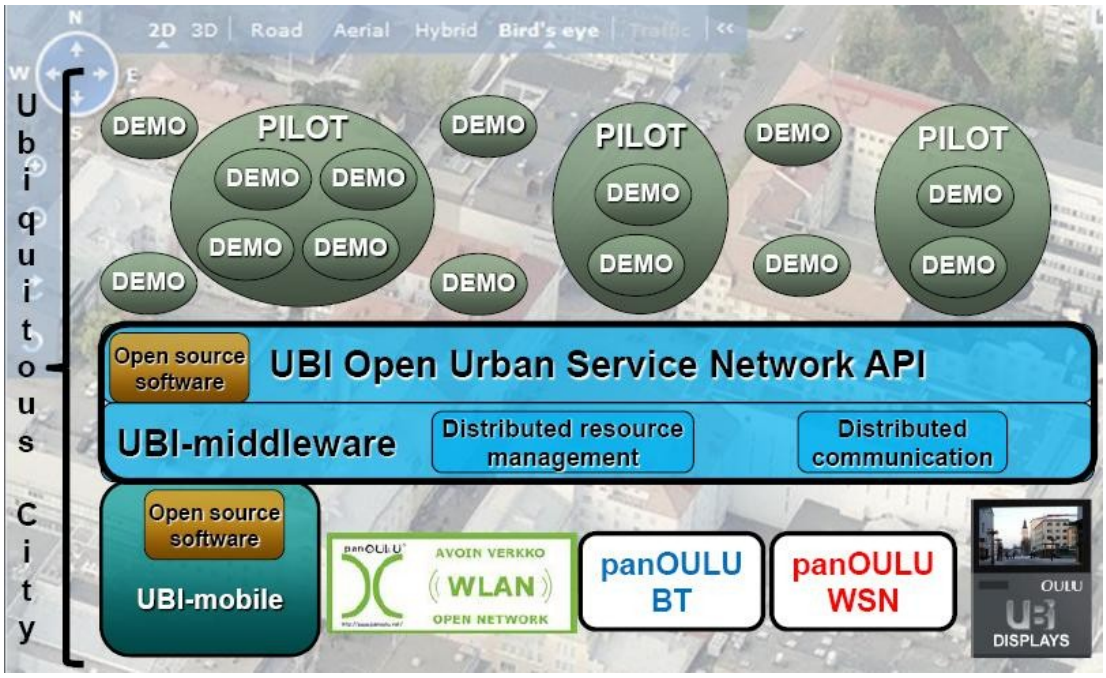

FIGURE 15. Building blocks of UBI-services (6, p. 5)

2.4.1 UBI-AMI-service

AMI (Advanced Metering Infrastructure) service in panOULU network is made by sensors. With sensors it is possible to collect metering information about temperature, lightning and electric consumption of the states. The multihop WSN sensors give info to panOULU WSN routers in the web interface in a suitable form for consumers. Consumers can use home service to connect on/off the temperature easily via the web interface (Figure 16).

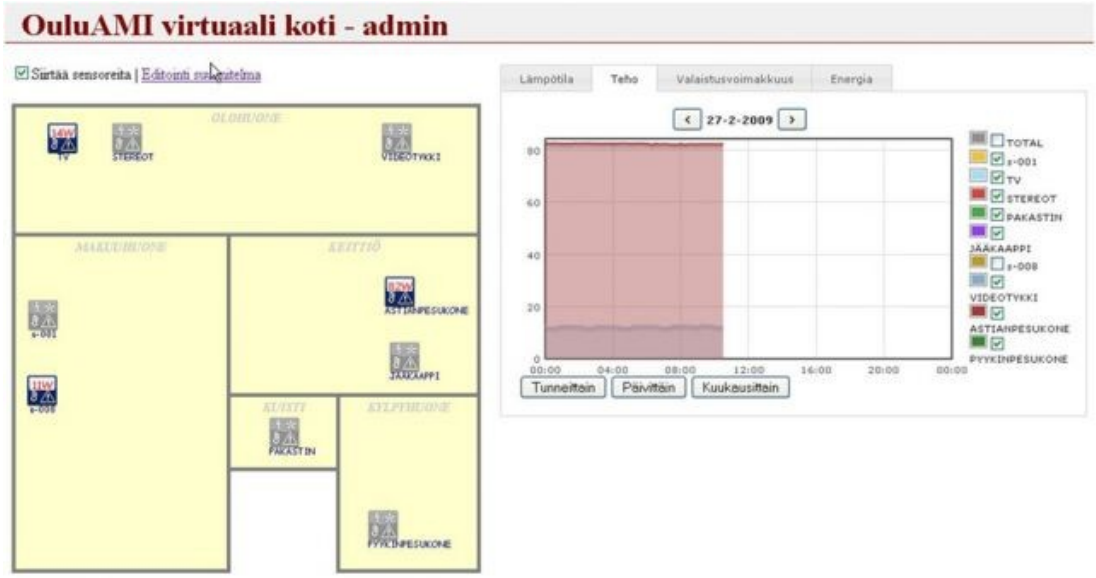

FIGURE 16. UBI-AMI virtual home connection (13)

UBI-AMI-service pilot with seven households in Oulu region are test users in the test commenced in January 2010.

2.4.2 UBI-portal and UBI-channel

In the passive broadcast mode the whole display is allocated to a digital service UBI-channel. In the interactive mode the display is partitioned between UBI-channel, a touch screen portal called UBI-portal and a window reserved for mobile services (Figure 17).

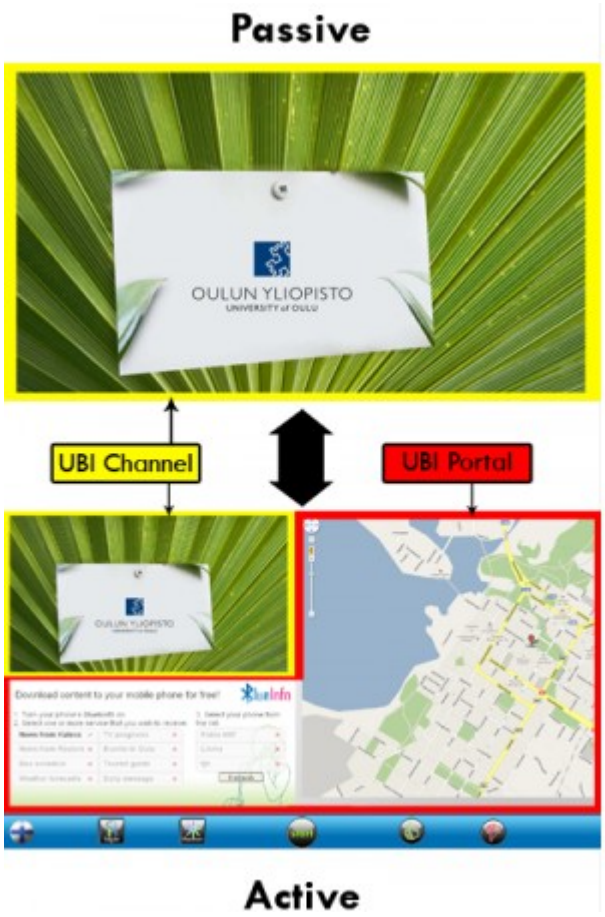

FIGURE 17. UBI display in passive mode for UBI-channel, interactive mode partiotined UBI-channel and UBI-portal, 2011 (14, 15)

An example of UBI-channel and UBI-portal screen partitioning to different functions as UBI-channel, mobile applications and bus-stop schedule is illustrated in Figure 18.

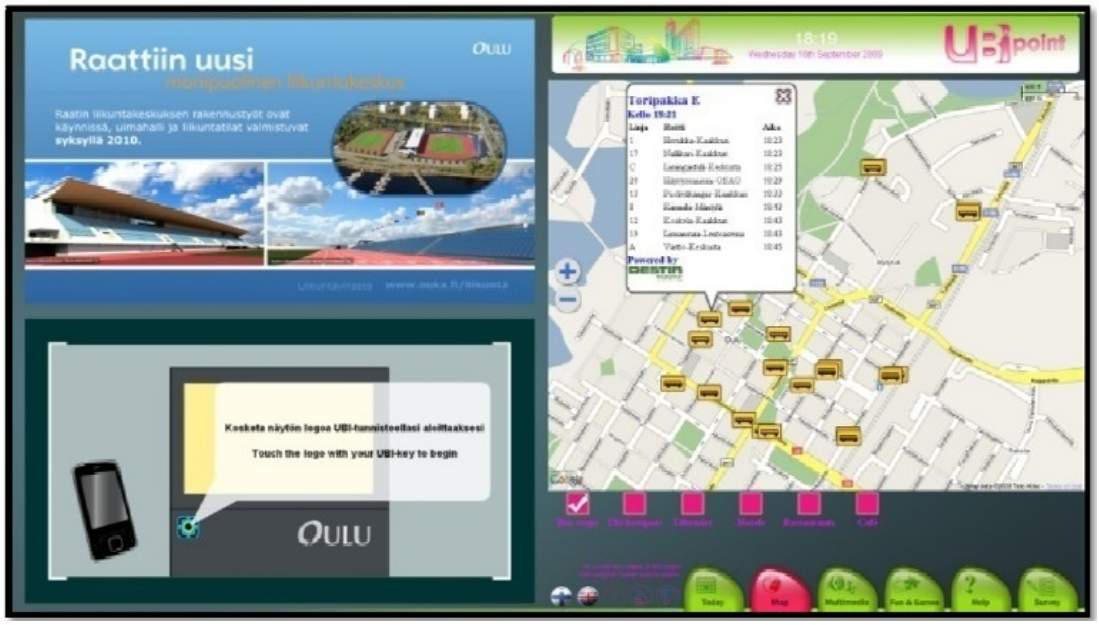

FIGURE 18. UBI-hotspot screen in interactive mode. Upper left UBI-channel, mobile application lower left and UBI-portal right showing bus-stop schedule (12, p. 8)

Inside the UBI-channel there is the list concerning 50 spots, which events can be open in a 12 seconds lasting picture (jpg-, pang- or gift-format) or video-clip (FLV-format, Adobe Flash Player). UBI-channel is implemented as a separate web-page containing an open source JW-player (For Flash on the Internet). It loads a playlist from an XSPF (XML Shareable Playlist format) feed generated by the layout manager. All media files are hosted by the local HTTP- (Hypertext Transfer Protocol) server.

UBI-portal is a web-portal of various information and leisure services. The pages on the portal are referenced by URL (Uniform Resource Locator) and can reside on any web server on the public Internet.

2.4.3 UBI-mobile services and panOULU BT-services

The user-driven innovation enabling users to develope mobile multimedia interactive applications are possible for the open source software Toolkit-program library in multimodal user interfaces such as mobile, web and public display combining to one total interface (16).

Final users are in valuable roles when testing new applications, usability and benefits and they can give useful feedback for system developers. UBI-mobile is the access point and service interface in the UBI-hotspot. It displays the available services and handles the negotiation and control of the leases with the resource manager (17).

The service offers an interface to access for a mobile user with an implemented J2ME (Java Platform Micro Edition) SW player into UBI MIDlets (underlaying light SW player application developer). It makes possible the native service support and implementing mobile interface. Authentication and transparent integration in the communicate sessions happen with server components via MIDP 2.0 (Mobile Information Device Profile) Push Registry mechanism (17).

PanOULU BT is building a BT base station network in the city center of Oulu. A transparent bridging of WAN (Wireless Access Network), such as Internet and WPAN (Wireless Personal Area Network) is working by the BT base stations in the city center via mobile device services. BlueInfo-services belong to the UBI mobile services.

2.4.4 BlueInfo-services

BlueInfo services offer free and costless web services near the base stations without loading open source SW program into the mobile device. BlueInfo service (Figure 19) searches the wanted web pages on the public Internet and changes it to a suitable form for mobile devices. In this moment the service offers news, bus-timetables, weather conditions, movies in theatres, TV-programs, event schedules etc.

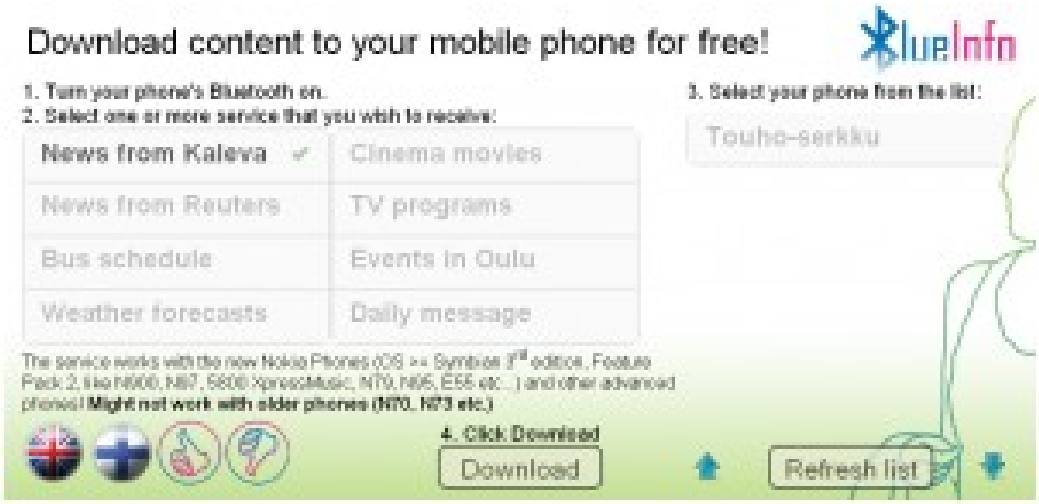

FIGURE 19. BlueInfo services (18)

2.4.5 Bluetooth place messaging

People can leave messages into the info-tables via a BT connection. Each hotspot has its own Place Messaging Board, thus enabling place-based messaging. A bulletin-board service allows people to post notes containing text and images from their mobile phone to the display.

2.4.6 UBI album

In the UBI album people can save take-away photos and pictures via BT and look at them on the UBI-hotspot display screen. The users allow to manage the content they have uploaded into the displays, add/remove tags from photos, videos etc.

2.4.7 PanOULU Luotsi services

PanOULU Luotsi offers location-based information for users. The XML-program (eXtensible Markup Language) content is in various forms and the RSS/ATOM (Really Simple Syndication/ATOM) feeds providers are automatically merged into the Luotsi database. It allows the mapping information without any changes to the application source. A user's wireless device is connected to the WLAN API router identifier by the positioning server.

2.4.8 Example of commercial applications

One commercial application of the UBI-channel is a blood service publication of SPR (Finnish Red Cross). SPR uses the UBI-channel to provide more visibility of its function, information about current blood reserve situation and shows the nearest donor center on a map. “Oulun Liikekeskus ry” (Business Center of Oulu) and Oulu University Media Team are published the qualified service contents (19).

2.5 Experiences, management and challenges

After the piloting, experiences and challenges were gathered about UBI-services. It was found out what is good and what is worth repairing or developing for the next version of the interface and services. Also, service management has challenges to be reorganized.

2.5.1 Experiences and management

The hotspot displays are LCD 57-inches large, indoor and outdoor placed in the city center of Oulu. The devices which make a network are base stations, sensors and displays.

The first application used an RFID- based (Radio Frequency Identification) UBI-jewel for log in by a mobile phone, but it did not work properly. Now it uses only BT (Bluetooth) connection for logging and for instance when loading pictures or files from the UBI-hotspot to a mobile phone with a BT-function. Usually every mobile phone has a BT-function in it.

The first UBI-display application was like a post on the wall and not so intelligent. Piloting and living lab testbeds started in the city centre of Oulu three years ago. The City and University of Oulu own 12 indoor and outdoor displays.

University researchers offer displays, contexts, programs and developed services and they also make repairs, updates and control management.

The goal of the UBI-city, which is an Oulu University project, is to build the infrastructure for the UBI Life project during the years 2009-2011. This project makes it possible to develop test applications, services and technology. It makes it possible to collect information, virtual world and smart area interaction applications and services.

UBI-research needs commercial sponsors and co-operative corporations to get finance treatment for development and devices.

2.5.2 Challenges

The management of the UBI-services can be a big challenge and the part of it is solved by enabling some monitoring and management tools. The research challenges can be dynamic management and distribution of the resources for competitive processes, automatically collecting optimal resources from the available ones.

A very big challenge is to find functional solutions between the UBI-spaces and the users for interactive utilization.

To cover the financial treatment of the research, development and maintenance of the UBI-services and devices, the university has to sell a portion of the capacity of hotspots for commercial use, which limits the research use. The demand for high quality engineering needs an expensive renewal of the outdated infrastructure in the future.

Also balancing traditional academic, educational, economical and technological studies are very big challenges.

Urban space planning, visualization of the hotspots and interactive mobile connecting offer totally different challenges and possibilities for developers and researchers.

2.5.3 Risks and problems

The problems are router algorithms in the sensor networks to handle the wide-spread giant data amount and the common use of mobile and static sensors inside mobile phones. The components are not generally known before. Now in the complicated communication systems, messages are routed in a scattered environment according to the subscribers by application services requirements. A remarkable part of the context is routed to a logical or physical place to the markets for people who have been there 10 minutes.

Financial treatment is a big risk. If the university researchers do not get money for the planned UBI projects, they will not become true. UBI applications, devices and network building are so expensive. Some kind of vandalism to the hotspots is a very big and expensive risk. Somewhere unknown people have destroyed displays. It takes much money to repair them again and again. It transfers a new system assembling.

The commercial interest to advertising can disappear if the advertisements on the displays are too expensive or there is some lack of functionality.

The risk can be effects the research slowdown and it is not worth doing or it is not interesting any more. If the prices of the UBI material and devices do not become cheaper all the time, it can stop or hold up the development and the enabling applications.

Updating Google-maps and adding new maps is a risk and problem for the UBI map-service availability and usability. It is the same problem with the Internet and navigators. A map database of Oulu region does not exist or it is old. The Oulu University researchers had a large subproject for creating such an database with open interfaces, but it was axed by public financiers.

The scrutinity and carelessness of people can be a big risk for the development and research work. If people do not care about the mistakes and do not actively use the living lab, the idea of the usage of it will not become true.

The open source software program Nagios (20) is deployed for automatic monitoring of the key processes in the hotspots. If the scrutinity of using the hotspots themselves is not become true, a member of the trial team starts to fiddle in a lonely hotspot and it will gather citizens around him/her.

The research of “making the urban space a better place for people” is still far away from the best result. It is difficult to achieve the satisfaction state because there are no universally accepted metrics and the lab studies are not sufficient for assessing the real-world system.

3 OUAS UBI CAMPUS 2011 VISIONS

In this chapter the detailed visions for the UBI OUAS campus applications are described. The applications are needed in order to be in time with the requirements of the new technology institute. The new UBI-application is the better one and helps the staff, students and visitors with the information flow in the whole campus area.

3.1 Why is UBI-campus vision needed?

Some problems for students can occur if they come in or go out from the institute via another entrance than the main entrance. The door can be locked or the lift may not work. Students need appointments with teachers and they may not know where she/he is sitting or they may not know her/his schedule. In addition, students and visitors may not know where certain classrooms or laboratories are and how to meet a doorman to ask important questions. The class meeting can be cancelled because of the teacher's sickness or other reason. Students, visitors and staff sometimes need bus timetables or maps to go somewhere. People sometimes have to update their own schedules in their mobile phones. People travelling inside the institute need information and communication and it is not available in an easy way. Usually the information point is only by the main entrance of the institute and there are other entrances close available for people. Usually people have to know the weather conditions and google-maps of the places. On the Internet there can be available general services for everyone who can use computer services. To update one's own schedule via mobile services can be a possible function in a new UBI services.

3.2 Student application visions

Student applications could include the guide services of how to get information about important matters. Guide services could consist of the maps of

the institute, classrooms, libraries, laboratories and auditoriums. Information about a physical connections such as bus route maps of the city and bus-timetables could be available in the service. Information about the staff (subject, room, phone number or contact information) could also be found in the services. Student services could also include short messaging and general alarm, feedback and mobile phone upload services. The upload information can be short text files, maps, videos and pictures.

3.3 Staff application visions

Staff applications could include fast short messaging about important matters. It is needed if machines such as video, presentation or computer functions are broken in a classroom, auditorium, laboratory etc. They may use the display near the place they are and they need not go to their own rooms or other places (such as IM) to solve the problems.

3.4 Visitor application visions

Visitors who do not know the institute need some information services. They like to know where the courses or events are situated and how to go there.

3.5 Hardware

The first vision of the screen looks as is shown in Figure 20.

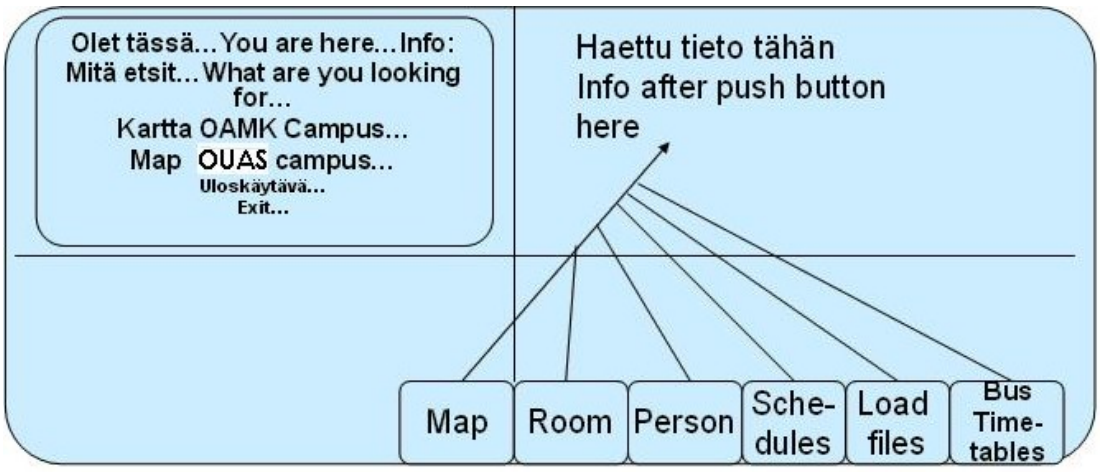

FIGURE 20. Possible OUAS UBI-display screen 4 November 2010

The main idea is that the application is useful and only the needed information is included, no entertainment info center is available. Displays can be as large as possible to present certain information clearly and exactly. Displays can include embedded push-buttons which work with a touch screen. The displays can be available in every entrance and close to the stairs on every floor in the institute. The new idea is that people can use table computers and iPhones for uploading services with a mobile phone.

Displays are needed when something is presented. Some networks, applications and programs are needed to present something on a display screen. The network, WLANs, APs, sensors etc. are needed, if the intelligent services are offered.

The fast short search advice such as EXIT-places could be in the own frame easily click (for instance in upper left frame) (Figure 20). In the lower left frame could be BT log by mobile device.

3.6 Software

The new system needs software and programs to be realized. This solution can be applied with open source free software and programs. The screensaver can be installed with scrolling information such as event cancellations and student advices. “Skype”-calling program installed for free calls is available there. Remote controlling can be handled by the same systems as UBI-city services. The covering of the needed applications can very well be realized with inside and outside APs, antennas and network devices.

3.7 Vision of the architecture

The vision of the architecture of UBI OUAS is presented in Figure 21.

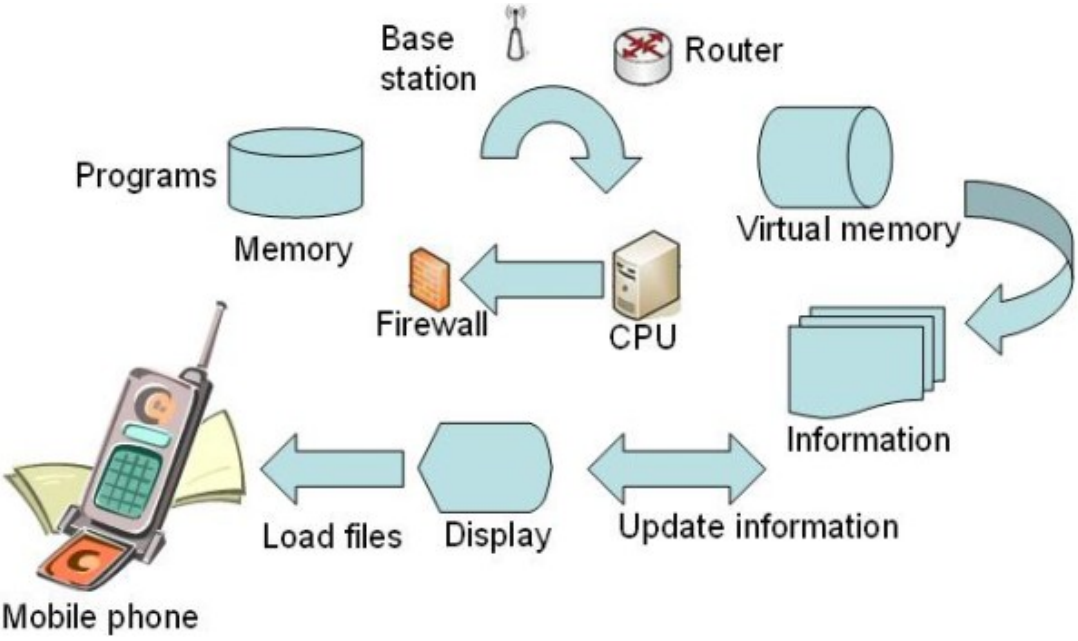

FIGURE 21. The vision of the architecture of UBI OUAS

The solutions depend on the intelligence of the functions of the presented services. The new UBI-services of the OUAS campus can be based on the web services now available on the Internet. As mentioned before some additional functions can be available via UBI-services. The automatical file form changing for the mobile service uploading can also be embedded in the UBI-services of the city.

All free resources existing in the institute and city (university) could be taken into use in the UBI OUAS campus, both SW and HW resources.

3.8 The visions of the locations of the displays

The visions of the locations of the displays on the first floor of the institute are illustrated in Figure 22.

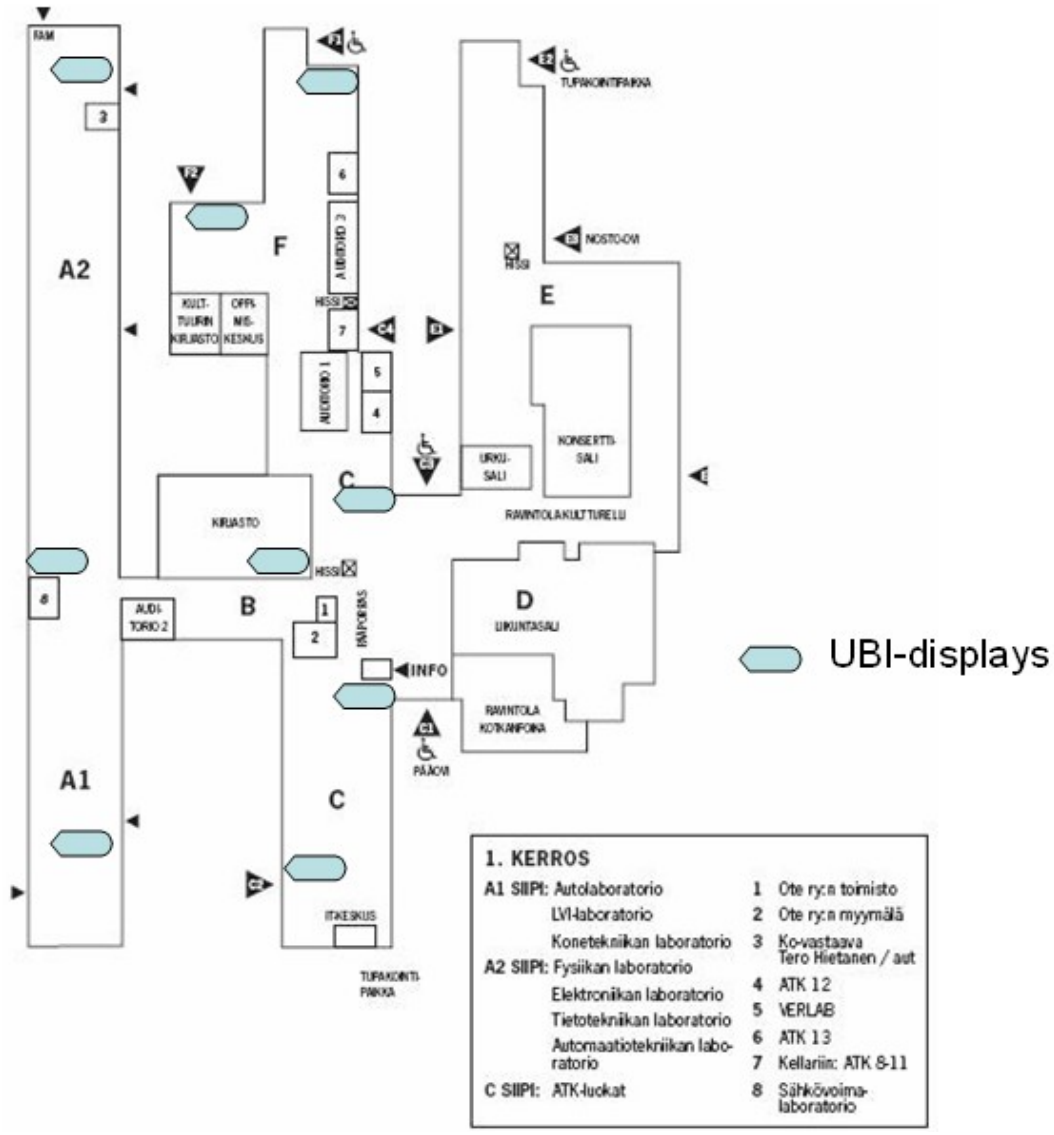

FIGURE 22. The vision of the locations of the displays on the first floor

UBI-displays could be close to the entrances, library area, laboratory area, computer-class area, auditorium area etc. The displays could be at the suitable distances from each other and at the same places on every floor.

The visions of the locations of the displays on the other floors are illustrated in Figures 23 and 24.

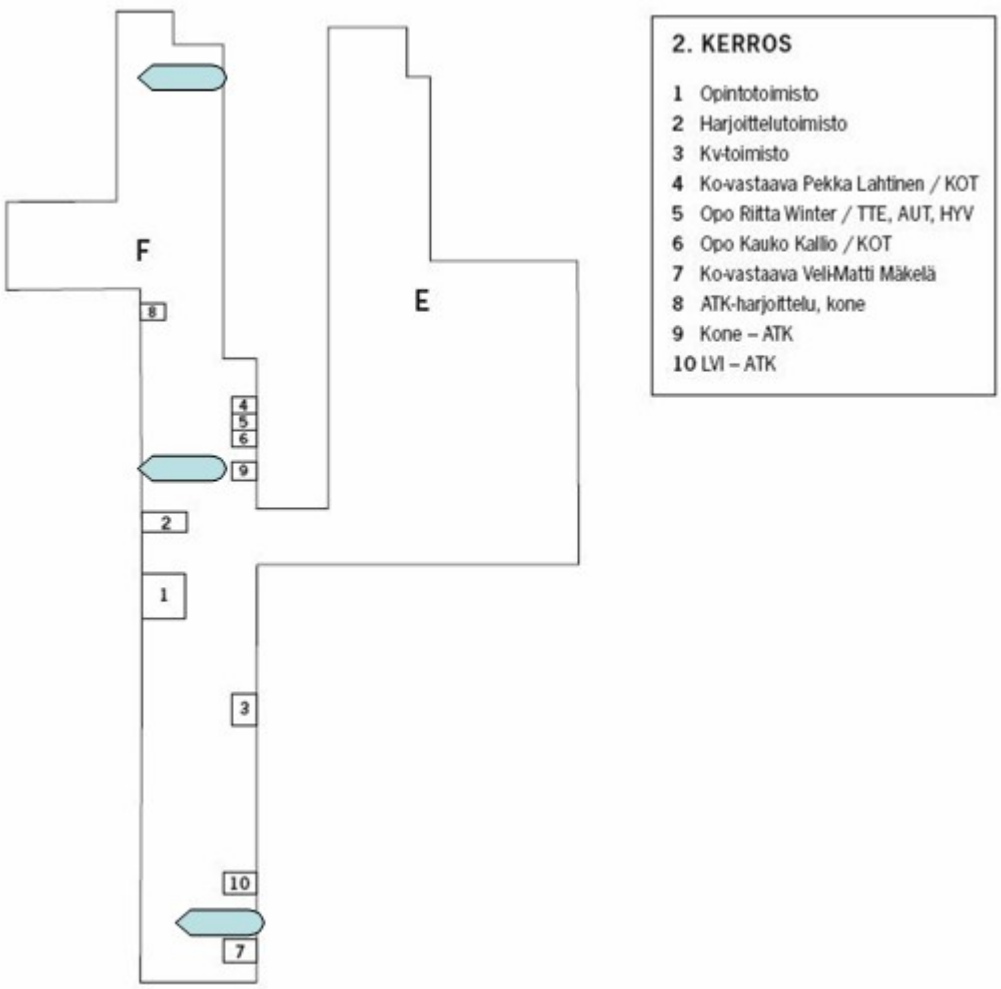

FIGURE 23. Second floor displays (vision)

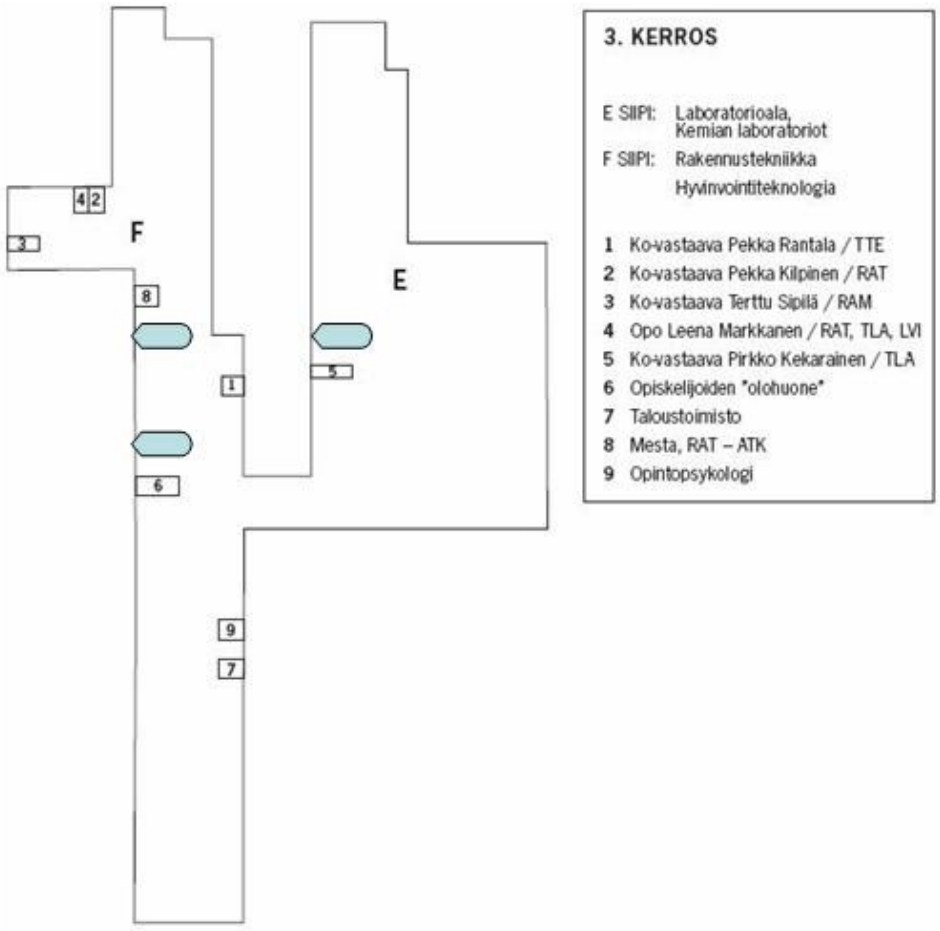

FIGURE 24. Third floor displays (vision)

The locations of the displays could be added if these plans realize.

3.9 Other functions for controlling

The access control inside the traffic could be made by sensors, and even other controls could be made for heating system, labs, class doors etc. The control system surely needs sensors to be adjusted in the building. Sensors collect information and the process unit handles it and makes the adjusting of the devices. What kind of extra devices and sensors are needed depends on the institute's estate statement. 6lowpan technology is a good system for inside control because of its safety properties.

4 CONCLUSIONS AND DISCUSSION

The goal was to introduce UBI-services generally and present visions of the UBI-services in the OUAS campus area. I chose to present panOULU network of the city of Oulu and the hotspots made by Oulu University and City of Oulu in co-operation. After I had seen the presented networks and displays, I made visions for the OUAS UBI-campus displays.

The results are not exact because of unknown requirements in such a large network.

I think that I succeeded very well in visioning the content of the presentation of the services. My goal was that there would be useful information only, and no information for entertainment purposes. The system will be useful for many users: students, staff, visitors etc.

The research results are quite reliable because of the first beginning low base proceeding to the small steps. The project taught me much.

The instructions for IM (Information Management) department are: Plan the content and network carefully, using extended systems and devices (for instance sensors, APs, displays).

The Internet pages of the OUAS are a very good source of information in the content planning. Mobile uploading files and images are small and not complicated, for instance advices, news etc.

Open source software and free programs are very usable.

A very important step is to design and find a fast and faithful messaging system which is easy to use.

The extended technology, for instance city hotspots and networks, the university's existing research results and the published material in Oulu, could be useful to know.

I think that many new things have happened after the parliament's published opinion in the year 2009 and that ubiquitous computing is a danger for independent data security (Reijo Aarnio, data securing delegate). The best substitutor of the new UBI-technology is Oulu University. In the Oulu city remarkable work has been done by the University researchers in the City of Oulu. Many international conferences have used of our technology city. The University people and co-operators have made our community famous in the world.

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