European Collaborative Innovation Centres for Broadband Media Service

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Wireless City – Groningen – Examination of Transferability to Regions of the Weser-Ems District

Case Study

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Wireless City – Groningen – Examination of Transferability to Regions of the Weser-Ems District

Content

1. Executive Summary

This case study is meant to be an attempt of searching the transferability of Groningen´s communication technology to regions of the Weser-Ems District. Therefore possible solutions are: a) Following Groningen´s way of implementation. b) Following Groningen´s way of implementation in parts. c) Not following Groningen´s way of implementation. We came at the end of the year 2009 to the conclusion of point c). As a consequence of our result the last chapter "5. Implementation" cannot be filled with content.

In order to provide the rural regions with broadband internet, the planned cross-linking in Groningen was analyzed. The implementation of this project shall provide an access to network as well as internet from all over the city of Groningen, starting from until the end of 2009. Groningen is a city in the north of the Netherlands, 45.000 of it´s inhabitants are students. The urban network has not been put into operation at the point in time that the analyzation proceeded. Because of this, we were not able to take further steps. The working title has been changed, it is now named as: Wireless City - Groningen - Examination of Transferability to Regions of the Weser-Ems District.

The following examination is based on the information given by affiliates of the Hanze University Groningen, University of Applied Sciences, School of Computer Science. With the help of this information it is now appraised if the project is transferable to the Weser-Ems District.

2. Problem Statement

In order to prepare a meeting in Groningen we, Student Rainer Pagel (RP), staff member Kai-Christian Struß (KS) and Tutor Wolfgang Koops (WK), sent the following questionnaire to Theo Miljoenen (TM) at Hanze University Groningen, University of Applied Sciences, in March 2009. Some days afterwards RP and WK drove to Groningen and met TM, Henk Zwetsloot, Dean of the School of Computer Science, and Business & ICT Professor Hugo Velthuijsen. Additional we conducted a conversation with Froukje van der Vee, International Officer, and informed each other about student´s possible opportunities at Hanze University Groningen as well as at UAS Wilhelmshaven.

Questionnaire

1 DEMAND / NEEDS
1.1 How did you recognize the need for building a public access network?
1.1.1 Did some citizens or officials of Groningen ask for a solution?
1.2 Before beginning the project, did you determine the need for broadband access?
1.2.1 How did you determine the need? Did you make surveys?
1.2.2 How did you interpret the results of the survey?
1.3 How many users did you plan in the first step to connect to the net?

2 HARDWARE / INFRASTRUCTURE
2.1 What kind of Hardware do you use to realize the public network?
2.1.1 WLAN, WIMAX or complete different technology?
2.1.2 Which topology is underlying the wireless network?
2.1.3 How many devices belong to the whole wireless network?
2.1.4 Are special antennas in use?
2.1.5 What are the costs for the hardware?
2.1.6 How did you supply the devices with electrical power?
2.1.7 Did you calculate or simulate radio wave propagation models to fix the optimal positions for the access-points?
2.1.8 Do you have information about noise immunity under operational conditions?
2.1.9 What is the useable average bandwidth for customers?
2.1.10 Are their magnificent decreases of bandwidth under some conditions?

2.1.11 What is the average latency time for a customer?
2.1.12 How difficult will expansion of the network for connecting more customers?
2.1.13 How difficult will be further geographical expansion?
2.1.14 What is the utilization goal related to the network?

3 MANAGEMENT / SOFTWARE
3.1 How do you manage the network?
3.1.1 How do you realize the user access control?
3.1.2 Could you describe the method of adding new users?
3.1.3 What kind of encryption do you use?
3.1.4 It is necessary to make special software trainings for network operators?
3.1.5 Could you evaluate the average operating costs?
3.1.6 Who is the carrier of the wireless partition?

4 ECONOMY
4.1 Did you get incentives for planning and or building the network?
4.2 What was the basis of project financing?
4.3 Are there subcontractors?
4.4 What services are offered?
4.5 What additional services are planned?

5 PROBLEMS
5.1 Did you have topological based problems?
5.1.1 What problems were encountered?
5.2 Have there been juristic problems in relation with running wireless networks?
5.2.1 Which laws have to be respected in Netherlands?
5.2.2 Do you have the same juristic problems as we have in Germany with liability of more users on one connection ?
5.2.3 Do you have to store user Connection-Data for a legislator given amount of time?
5.3 Have there been demurs of residents against radio transmission or against any other aspect of public wireless network?
5.3.1 How could you eliminate such demurs?
5.3.2 Can you give us recommendations?

The contracting authority for the project Wireless City / WLAN Mesh (WLAN - Wireless Local Area Network) is the Wireless Groningen Foundation. This foundation has been set up by the three anchor tenants, the Hanze University, the University of Groningen and the municipality of Groningen. Through a public tender process the foundation has awarded the installation and exploitation of the network to a private company, Unwired Holding. The total of three million euros will be paid for three years from each of the three employersanchor tenants. The private company has to take care of the exploitation of the network in such a way that it can still provide access after the period of three years, e.g. by finding other paying customers.

The project was announced for the purposes of administration and setting up the network. The employers take over the administration of their own user. For those, students and otherwise to the authorities affiliated people, using the WLAN Mesh will be free of charge, also for civil service and the police.

2.1 Motivation

There are several reasons for the urban cross-linking of Groningen. The most important is offering network resources (information from the intranet) and allocating access to the internet for students and for those who are employed principals. There will result even more possibilities, e.g. supporting students which means an improvement to the education. Students could download materials, instructions and information from everywhere in Groningen. Also all sorts of telemetry solutions will become available in public transport, garbage collection, parking control, video surveillance, etc. etc. Another reason is to establish a center of knowledge for the whole region and even a commercial usage of WLAN Mesh. At the moment, this is just an idea and will be concretized after the introduction of the WLAN Mesh.

2.2 Infrastructure

The City of Groningen has already a good fiberglass infrastructure available. The used topology is a ring topology, further information regarding this infrastructure are not on hand. Nevertheless, the existing fiberglass infrastructure provides high up/down rates and is a good base for setting up the urban network. The collaboration between the orderers, City of Groningen as one of them, permits rapid applying governmental approvals at public buildings or lanterns. This proves not to be the case. The network provider has to follow all normal procedures to get approvals to fix antennas on lampposts and buildings. Besides that the electricity on lampposts is completely switched off during the daytime, which raises extra problems.

2.3 Technology

The urban cross-linking in Groningen is done by a WLAN Mesh. The standards for WLAN Mesh can be found in the specification of IEEE 802.11s. IEEE 802.11s describes as a core sentence, that access points will be connected and share data wirelessly to form a radio based

network. Because of the existing fiberglass infrastructure in Groningen, many uplinks can be used, allowing to disperse the overall usage to all accents points. Additionally, latency can be kept low by using only few routes throughout the WLAN Mesh. When you check the application notes of manufacturers like Cisco and Strix, you can see that a maximum of 10 hops over mesh nodes is possible before reaching a POP (point of presence = connection to a fixed network). In Groningen the ratio of wireless access points and pops will be about 20.

Exact information to the used technologies, as well as hard- and software were not to hand to the point the examination took place. A general investigation for providers of these technologies resulted in following: Only few providers have developed own solutions, considering the IEEE 802.11s specifications. One of them is Motorola, who emerged a portfolio for Mesh-networks. The portfolio covers the needs of an urban WLAN Mesh. The equipment will probably be from Strix.

For legal reasons, the general terms and conditions will include paragraphs concerning the usage of the WLAN Mesh.

2.4 Requirements

The contracting authorities developed specifications for realizing the project. The significant and known matters are displayed in table 1.

Criteria	
Down / Up	512 kbps
Guaranteed speed of traffic	5 user in 100 m²
Latency	< 40 ms
Technology	WLAN Mesh
Services	Internet
Scalability	yes

Table 1: Requirements WLAN Mesh Groningen

The transfer rate is half to what “Broadband” is defined as in Germany. This is due to the fact, that the network will not be designed for high demand. Furthermore it shall be possible, to connect to the internet from everywhere, including, but not limited to in and off buildings and moving public transportation. Using an open standard is a further need to realize the project.

2.5 Problems

Before realizing the WLAN Mesh Project, one has to deal with occurring problems. The people of Groningen are concerned about the continuous functionality from medical devices and eventual radiation exposure. These concerns can be reduced by having informative meetings about the project and the used technology, further by processing the facts.

A general problem is liability while surfing the web via wireless local area networks. In general, the subscriber is responsible for all data-traffic. The subscriber is bound to make provisions and thereby preventing the users from acting against the law. This increases the needed administrative efforts for a WLAN Mesh, like in Groningen. To assure the provider of the WLAN Mesh, a regulatory framework has to be set up within the general terms and conditions, which forbids using the web in unlawful ways. An additional precaution is using user accounts, preventing anonymous usage of the WLAN Mesh.

3. Alternatives

According to the aim of this case study we analyze in this paragraph, under which circumstances the project, like it is planned in Groningen, is transferable to other cities, especially in the Weser-Ems District.

Initial point for the determination is to ensure, if a WLAN Mesh is required or not. For the intended usage in Groningen, which is supporting the students during their studies and the cities employees in their daily work, a WLAN Mesh with the requirements (see section 2.4), a WLAN

Mesh is reasonable. In larger cities in Germany a good fiberglass infrastructure for DSL / Cable (Digital Subscriber Line) is available, which allows a broadband internet connection. For mobile services and accessing the internet within cities, the radio masts are equipped with the latest technology.

The additional benefit of a WLAN Mesh, being able to connect to the internet to low charges, would be a concurrence to the existing broadband technologies. The mobile carrier for mobile services paid high investments to upgrade their mobile networks. O_2, for example, expanded their network (mobile and landline) for 3.5 billion euros in 2007. The mobile communication networks will be more and more upgraded in the following years. These costs have to be recovered by - at least - by charging the customer for using these networks, proving that the financial aspect is a matter. In contrast to the free availability of the WLAN Mesh for users in Groningen are the mobile carrier, who have to cover their costs and furthermore gain profit.

These are understandable reasons, why carriers are not interested in setting up a WLAN Mesh. If a city or an economic region should be equipped with a WLAN Mesh, next to existing mobile networks, there are criteria to be fulfilled.

First of all, there are financial aspects. The height of the costs depends on the requirements. The traffic speed in Groningen shall be minimal 512 kilobit per second (kbps), the basis in Germany for traffic speed is the definition of broadband internet. This means, the requirements are higher and therefore more expensive than in Groningen. Another point which raises the costs: the required fiberglass infrastructure. Groningen has already a good infrastructure available, which can be used to fulfill those requirements. That means there are no further investments needed for Groningen.

In other cities, the existing infrastructure has to be examined, if it is capable for the intended purposes. Nevertheless, it is possible to draw conclusions from the VDSL availability information (VDSL - Very high speed DSL) of the German Telekom, respectively hints to an existing fiberglass infrastructure because VDSL relies on fiberglass technology. Areas in the

Weser-Ems Region, where VDSL should be available, are: Wilhelmshaven, Jever, Schortens, Aurich and Emden. These are not 100 % covered areas.

Even in larger cities may be areas, where no appropriate infrastructure exists. If this is the case, the infrastructure needs to be set up, which increases the overall costs of the project. If the 3 million euros for the wireless mesh in Groningen used as comparison, this amount would not suffice in an expansion of the fiber infrastructure.

The project in Groningen has caused concern among the population. These must be detected early so that the population is factually informed about the radiation exposure. Using a wireless mesh in the rural areas of Weser-Ems District suits only conditionally, because smaller, populated areas are far away from each other. The WLAN technology 802.11n allows a distance up to 200 meters, which forces an installation of repeaters between those areas. Interlinking mesh nodes can also be done with directional antennas, allowing further distances. This has the disadvantage that user connectíons may not be possible inbetween. In these less populated areas it is difficult to install radio modules, for there are nearly no lanterns, from which electricity could be used. Furthermore, the traffic's capability lowers between sending and receiving unit.

Another idea is, to use the user itself to setup the mesh. A user would buy an access point, connect it to the network and link it into the WLAN mesh, letting other customers use the unit, resulting in a growing network. The problem here is the secure and reliable administration: the mesh shall be straightforward and controllable which is an opposite to private linked and administrated networks. Having users set up their own mesh node gives the problem of reliability of the network, because no one is responsible for those nodes when the owner switches it off. Also the routing of traffic is uncontrolled because those nodes are not centrally managed.

4. Conclusion

The planned WLAN mesh in Groningen showed backgrounds for an own project, nevertheless our available information were not enough for a full examination. In particular, no measurements for the reception field strengths to verify the city-wide functionality before analyzing the transferability. Finances and infrastructure for broadband internet given, it is possible to set up a wireless mesh in the Weser-Ems District. For a rural supply of broadband internet, wireless mesh technology can be used as an addition, according to the known boundary conditions.

We had a look from Germany to Netherlands in order to see what our neighbor is able to provide its inhabitants and how we can learn from it respectively if we can transfer parts or all of the technical communication solution. From our point of view, at the end of the year 2009, we can not follow Groningen´s way of implementation.

5. Implementation

Due to the last description in chapter “4. Conclusion” we can not follow any implementation yet.