GO/Core

Core Mobility Management Project
Project Plan (version 1.4.0)
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1 Background

IEEE 802.11 standard for wireless LAN was approved in fall 1997 and first commercial products were introduced in mid 1998 with 2 Mbps transfer rate. Since that, new enhancements for this standard have been made to support also 5.5 and 11 Mbps transfer rates. On the parallel path, the GPRS standard was approved in ETSI in March 1998 (and final approval of the year 1997 release features was in June 1998). This means that it is expected to get first commercial GPRS implementations in the GSM networks in 18…24 months after that date (this is typical official ETSI expectation). At the same time, the standardization of the third generation cellular network (UMTS) is speeding up in ETSI. Especially, the GPRS architecture is now under evolution towards UMTS radio networks. Commercially, UMTS is estimated to be available by 2001…2003 time frame. Hence, it can be seen that GPRS architecture, that will have the first commercial (low speed wireless) Internet access services available beginning of the year 2000, shall have a good migration path to the future having high capacity access alternative with megabits per second service in UMTS radio networks.

This results in the future a variety of wireless access technologies that have one common nominator: support for wireless IP access. On the other hand, the underlying mechanisms, such as capacity, coverage area, radio technology, used radio frequencies, access methods, licensed/unlicensed bands, and so on, are very different. Thus, we should play with the rules of the greatest common nominator: IP and IP mobility methods.

For typical IP applications, the mobility management and wireless access provides an access to Internet and all "normal" IP applications (such as WWW, email, FTP) should work with no special complications. This is based on the normal Internet principle that the application does not need to know much about the underlying transmission layers. The key thing is that mobility management allows the mobile terminals to move around from one access point to another while the terminal may send and receive IP packets with the same IP address transparently. The key for the success is the efficient mobility management algorithm.

2 Objectives

The main objectives of this subproject can be divided into two categories: evaluation of various mobility management protocols and a prototype implementation of an efficient mobility management protocol for mobile users that can use data rates from kilobits/s up to several megabits/s.

Evaluation part should look at least the following mobility management methods: GPRS, Mobile IP, VPN (virtual private networks), and IP-IP tunneling, TEP (tunneling establishment protocol). This subproject shall also take into the consideration the impacts of the new IP standard, IPv6. The prototype development part has the following tasks:

- Develop of hierarchical mobility management. This allows us to have several nodes in the path between mobile node and fixed network (in Mobile IP terms: there can be several foreign agents: e.g., MN-FA1-FA2-FA3-HA).
- Develop of multipath routing. This allows a mobile to use simultaneously more than one route to/from mobile node. In practice, the mobile node can establish a second path to fixed network via a second wireless access point before the first one is deleted. Then, when routing data to mobile node, one RTE will create a duplicate of the user packets and deliver data via two paths to the mobile node. When the

mobile node sends data, it can use either of the paths. This multipath routing provides simpler mobility management for applications (e.g., wireless multimedia and IP-telephony) that can't tolerate frequently happening "glitches" due to change of the access point.

- Develop of mobility management "engine" (MME). MME talks with mobile nodes and other mobility management engines. MME controls the routing/tunneling engine.
- Develop of routing/tunneling "engine" (RTE). RTE is developed in phases
  - SW RTE is running in Linux PC where the routing and tunneling is done in SW
  - HW RTE is running in FSR where majority of the routing and tunneling is done using HW

3 Deliverables

This subproject has the following deliverables:

ID	Description	Delivery date
	Analysis part	
D1.1	A document, that analysis the alternative mobility management methods (based on papers and similar projects).	07/1999, done
D1.2	A model for efficient, hierarchical mobility management architecture. Further research still going on. (IPv6)	09/1999, done
D1.3	A model of mobility management architecture including multipath routing support.	05/2000
D1.4	A model of efficient user authentication and a model of interface for electronic payment of the wireless access service with mobility management. (See GO/Sec GO –project plan 3.5.3 D5.3)	05/2000
	Prototypes	
D1.5	First working prototype of mobility management in Linux. A mobility management SW prototype that run in Linux environment and controls SW based PC router/tunneling engine. (FA part)	09/1999, done
D1.6	Second prototype of mobility management in Linux with more efficient mobility management SW. (MN & HA parts)	12/1999, done
D1.7	Third prototype of mobility management in Linux with hierarchical mobility management and multipath routing support.	07/2000
D1.8	Working implementation of mobility management in Linux. A mobility management SW prototype that run in Linux environment and controls HW based FSR router/tunneling engine.	09/2000, We can't get FSR from VTT before summer.
D1.9	Integration of authentication and payment traffic prototype (See GO/Sec GO –project plan 3.5.3 D5.4) to mobility management software.	07/2000
	Publications	
D1.10	Publication(s) on the subject (M.Sc./Lic.Tech/conference papers)	No deadline

4 Schedule

Persons in the subproject have following schedules with their working hours in year 2000.

2000 Persons	Month 1	2	3	4	5	6	7	8	9	10	11	12
Ville Nummela	20h					5pv			2pv			
Timo Ryhänen	2pv					5pv			3.5pv			
Lars Petander	2pv					5pv			2pv			
Jakub Pavelek	2pv					5pv						
Tapio Silander	0.5pv		2pv			5pv						
Marko Myllynen	10h					5pv			3pv			
Jari Välimäki	10h					5pv			3pv			
Linfeng Yang	2pv					5pv		?				
Petteri Johansson	10h					?						

Working part time Working full time

The GO-CORE subproject comprises the following subtasks:

- Task to analyze alternative mobility management protocols
- Task to develop efficient mobility management architecture
- Task to implement mobility management SW in Linux/FSR environments
- Task to implement multipath support in mobility management
- Task to implement mobility management SW in mobile nodes

5 Project Group

This subproject is done in HUT's Telecommunications software and Multimedia Laboratory. The project group contains the following people:

Jari Välimäki	Project Manager
Petteri Johansson	
Marko Myllynen	
Ville Nummela	
Jakub Pavelek	
Lars Petander	
Timo Ryhänen	
Tapio Silander	
Lingfeng Yang	

6 Connections

Other GO subprojects

This subproject is has the following connections within the project:

- GO-PERF: In this subproject, there are two issues connected with the GO-CORE-subproject. First, the performance modeling is tightly coupled with high capacity wireless access and efficient routing of data packets. Second, mobility management information gathered in GO-CORE-subproject can be used in tuning the DLR simulator of Performance engineering subproject.
- GO-FORM: In this subproject, the results of the GO-CORE-subproject can be evaluated.

- GO-SEC: Among other things in this subproject, tools and techniques to handle efficient identification, authentication and authorization are developed. This subproject adopts the prototypes of the TESSA-project and the results can be used also in the efficient mobility management procedures.
- GO-LAP: The results of this subproject can be used in the GO-CORE-subproject in getting higher capacity wireless access over wider range of area.
- GO-MM: In this subproject, the results of the GO-CORE-subproject can be used in providing high capacity wireless access service with mobility.

Other research projects

And links with other projects of TSE-Institute and the research group:

- Calypso-project: In this project, router functionality is developed for FSR HW platform. In the GO-CORE-subproject, some of the management functions and interfaces can be reused when building the mobility management software.
- FSR HW: In the project, FSR HW platform is developed. To support very fast routing of encapsulated data packets, some new features are needed for the HW. These new features will be included in the next release of FSR HW.
- MART-project: In this project, wireless access and routing of equal level nodes are developed. This project has two main outputs: routing protocols for an adhoc networks and wireless access point prototype. This access point prototype provides IEEE 802.11 based wireless LAN access. When using such access points, mobile users can transfer currently 2 Mbps connection and in the future 5.5 and 11 Mbps connections with cell radius of tens of meters indoors and up to 200… 300 meters outdoors.
- TESSA-project: In this project, the certificate technique is developed and the results (developed mechanisms and SW prototypes) can be used in the efficient mobility management.