PREFACE

1997 was the first full year with the new professor team (Laakso started 1.7.1996, Kantola 1.9.96, and Virtamo 1.1.97). Strategies were written, teaching was co-ordinated together with the Communications laboratory and weekly meeting routines were established. In addition to professors, also the research and teaching personnel has kept growing steadily. 11 new members of staff joined the laboratory in 1997, which has kept the laboratory fresh and active.

In this rapidly changing world, the traditions have also been remembered. Laboratory of Telecommunications Technology is one of the oldest in the department, founded in 1943. The rich traditions have accumulated lots of equipment in the storage spaces, and all this was carefully inventoried by members of the Telesenior Club, consisting of old students of the laboratory. Based on this inventory, part of the equipment were decided to be kept in the laboratory, whereas other devices were donated to the Finnish Museum of Technology in Helsinki and the Military Communications Museum in Riihimäki.

The inventory and relocation of the old equipment has paved the way to a new teaching laboratory. A Master's Thesis was completed about how the laboratory teaching has developed in the past 50 years and what should be taught in the future. Based on the conclusions of the thesis, plans were devised and the new laboratory with new desks and up-to-date equipment is currently in the making.

In 1997, contacts to the telecommunication industry were by visits to several companies, including Helsinki Telephone Company Research Center, Finnish Telecom, Nokia Research Center, and Finnish Broadcasting Corporation. The round will continue in 1998. We are grateful for the support of the companies and hope that good cooperation will continue in future years.

Timo Laakso

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1. INTRODUCTION

As described in the preface, the first study year of the new team is over and the laboratory is settling in to a more stable phase of development.

1.1 General

The re-modelling of the laboratory premises has continued. The combined library-kitchen-meeting room was implemented already in the fall of 1996, and it has been followed by reshaping office space to fit more people more comfortably - the lack of office space is a constant problem in the department. The new teaching laboratory is currently being constructed.

The past, present, and future of the broadband networks and their traffic theory were revealed by Jorma Virtamo's inauguration lecture in April 22, 1997, entitled 'The challenges of the traffic management of broadband networks'.

1.2 Research

The research has been growing in 3 main directions: ATM networks and their traffic theory, signal processing for mobile communications, and Internet-based switching and speech transmission. Research contacts have been active both to Finnish and foreign colleagues. Two visiting researchers, David Vazquez from Universidad de La Coruna and Jose Apolinario from the Federal University of Rio de Janeiro spent several months with us in cooperative projects.

1.3 Teaching

Several new important steps have been taken in the development of the teaching. The co-ordination of the curriculum between us and the Laboratory of Communications was implemented in the Study Programme of 1997-98, with the introduction of 5 main study paths the courses of which are produced in co-operation. The work continues on redesigning the basic studies to better meet the needs of a modern communication engineer.

A new position, Specialist teacher, was created to better enable high-quality teaching in the basic communications courses offered by the laboratory. A long-time member of the staff, Lic. Tech. Seppo Uusitupa was appointed in the post.

A new studia generalia type course, Telecom Forum was established by Raimo Kantola where leading experts of the industry gave lectures of their vision of the future of the communication business and technology. The course was a great success not only among the students but also university personnel and participants from the industry.

Professors Paulo Diniz and Mariane Petraglia from the Federal University of Rio de Janeiro gave a 2-week course on adaptive digital filters which was organized together with the Laboratory of Signal Processing and Computer Technology and the GETA Graduate School. More than 30 persons attended and passed the course.

2. PERSONNEL

2.1 Laboratory staff

Laakso, Timo	Dr.Tech., professor, head of laboratory
Kantola, Raimo	Dr.Tech., acting professor
Virtamo, Jorma	Dr.Tech., professor
Rahko, Kauko	Dr.Tech., professor emeritus
Pirinen, Aulis	Dr.Phil., docent
Aalto, Samuli	Ph.Lic., research scientist
Apolinario, Jose	M.Sc., visiting research scientist
Baghaie, Ramin	Lic. Tech. (PhD), senior assistant
Betlehem, Ulf	Research assistant
Brax, Veikko	M.Sc., research scientist
Erke, Tapio	On sabbatical
Hyytiä, Esa	Research assistant
Hänninen, Arja	Department secretary
Ilvesmäki, Mika	M.Sc., research scientist
Karttunen, Petri	M.Sc., research scientist
Kyläkoski, Kaisa	Research assistant
Lassila, Pasi	M.Sc., research scientist
Lindgren, Birgit	Secretary
Luoma, Marko	M.Sc., research scientist
Nupponen, Esko	Senior laboratory supervisor
Nurmi, Jukka	M.Sc., research scientist
Peräläinen, Ilkka	M.Sc., Research scientist
Peuhkuri, Markus	M.Sc., Research scientist
Uusitupa, Seppo	Lic. Tech. (PhD), senior engineer
Voipio, Kirsi	Student adviser
Werner, Stefan	Research assistant
Xie, Dazhao	Research assistant
Yletyinen, Tomi	Research assistant

Figure 1 The personnel of the Laboratory of Telecommunications Technology

Fron from left: Hänninen, Baghaie, Aalto, Nupponen, Luoma, Nurmi, Hyytiä, Virtamo

Back from left: Kantola, Uusitupa, Betlehem, Xie, Werner, Peräläinen, Lindgren, Brax, Ilvesmäki, Karttunen, Lassila, Laakso, Peuhkuri

2.2 Part-time teachers & assistants

Haapanen, Petri	S-38.166	Programming in Electrical Communication
Hallonoro, Paul-Petri	S-38.166	Programming in Electrical Communication
Hirvensalo, Jorma	S-38.166	Programming in Electrical Communication
Kilkki, Kalevi	S-38.105	Principles in Communication Engineering
Koskela, Antti	S-38.166	Programming in Electrical Communication
Mertanen, Pauli	S-38.124	Telecommunications Technology, lab. course II
Närhi, Mika	S-38.166	Programming in Electrical Communication
Salminen, Mikko	S-38.189	Telecommunication Networks
Siltala, Mauri	S-38.166	Programming in Electrical Communication
Suortti, Anssi	S-38.166	Programming in Electrical Communication
Virtanen, Jyri	S-38.122	Telecommunications Switching Technology II

2.3 Guest lecturers

S-38.001 Telecommunications Forum		
Alahuhta, Matti	Alho, Jukka	Aura, Matti
Hara, Veikko	Häggman, Sven-Gustav	Linden, Kaj
Linturi, Risto	Makkonen, Matti	Melamies, Lauri
Skyttä, Jorma	Toivo, Kristian	Vainikainen, Pertti

S-38.102 Sähköinen viestintä		
Kantola, Vesa	Kerttula, Esa	Lehtonen, Kai
Niiranen, Valtteri	Tarkela, Pekka	Soramäki, Martti
Wiio, Osmo		

S-38.122 Tiedonvälitystekniikka II:		
Hamberg, Max	Leppinen, Mika	Niska, Petri
Rautiainen, Aapo		

S-38.166 Televälitysjärjestelmien ohjelmointi: Kämäräinen, Mika ja Rautakorpi, Mika
S-38.189 Tietoliikenneverkot: Hattula, Jussi; Renko, Jari ja Salo, Tommi
S-38.191 Televerkot yrityksissä: Itä-Aho, Sampo
S-38.211 Signaalinkäsittely tietoliikenteessä I: Huuhtanen, Timo ja Nieminen, Jarmo
S-38.212 Signaalinkäsittely tietoliikenteessä II: Ranta, Jukka

3. RESEARCH PROJECTS

3.1 Models for Integrated Telecommunication network Traffic and Architecture (MITTA)

Project leader: Rahko, Kauko
Other researchers: Luoma, Marko; Kankare, Janne; Peuhkuri, Markus

In this project we are concentrating on issues of traffic measurement. And management. Our starting point has been high speed networks (ATM) and problems which they have brought to management of traffic streams. Our assumption has been that 'old fashion' analytical modelling of traffic and sources has reached it's limits and new more novel approaches should be used. Our aim is to find out which are the key factors in the effective traffic management and how they should be adjusted in order to minimise the load of the traffic management. We try to solve problems by using real time measurements and predict what is the traffic distribution by using an estimation from the measured traffic stream. This research is done through the simulations using a commercial and a self made tools. Instrumented version of Linux-kernel which we produced as a tool for analysing effects of OS-processes to network traffic is distributed from web-pages *http://keskus.hut.fi/tutkimus/mitta/abstract.shtml*

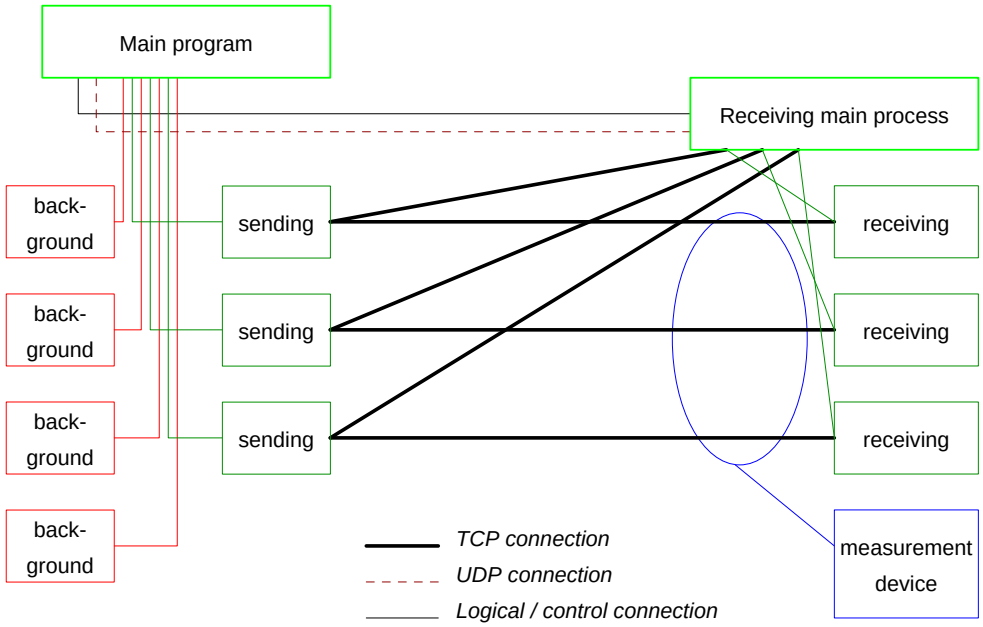

Figure 2 Instrumented kernel measurement system

3.2 Signal processing in digital receivers

Project leader: Laakso, Timo
Other researchers: Xie, Dazhao

In this project pulse shaping digital filter design especially for digital subscriber line applications was investigated. Based on the minimum mean-squared-error criterion, a general iterative technique for simultaneous optimisation of transmit and receive filters was developed, assuming a general linear channel, coloured noise and co-channel (cross-talk) interference with a known power spectrum. The new technique can provide several decibels of better noise and interference attenuation than the standard root-raised-cosine filters.

3.3 Smart antennas in new radio systems

Project leader: Laakso, Timo
Other researchers: Baghaie, Ramin; Karttunen, Petri; Werner, Stefan

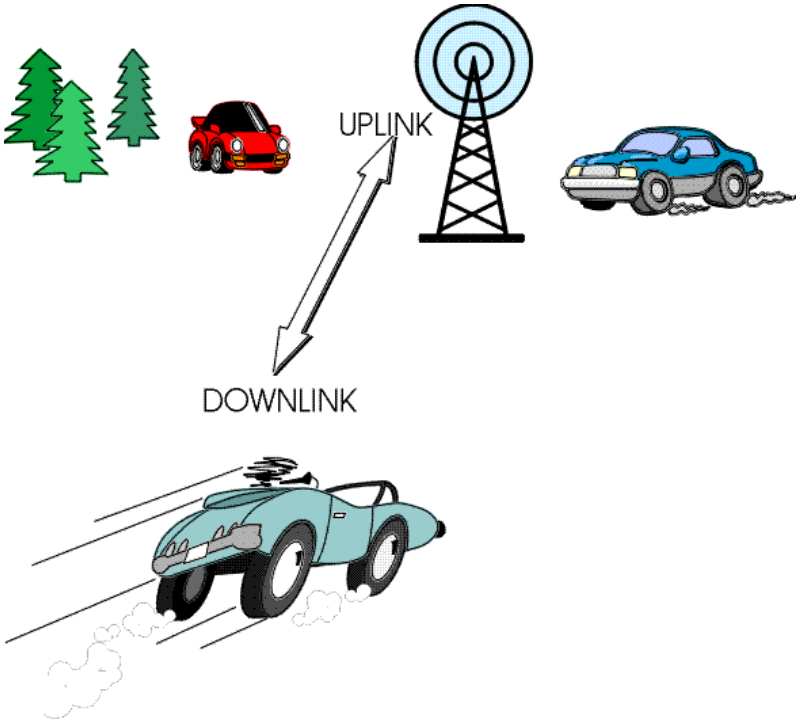

Figure 3 Mobile communication system

In this project, digital signal processing for smart antennas is investigated. The main focus is on CDMA systems provided with multiple antennas. The work has been divided into 3 subprojects. Petri Karttunen has investigated the simultaneous tracking of multiple users with an adaptive beamformer with an adaptive step size algorithm which finds a good compromise between tracking speed and misadjustment noise. Stefan Werner has studied blind adaptive interference cancellation at the mobile CDMA receiver and showed that the use of multiple antennas can speed up the convergence of the adaptation. Ramin Baghaie has investigated efficient implementation of adaptive algorithms using pipelining and transformation techniques. The visiting researcher Jose Apolinario from Federal University of Rio de Janeiro took part in the development of the adaptive algorithms for mobile reception.

3.4 COST 257

Project leader: Virtamo, Jorma
Other researchers: Aalto, Samuli; Lassila, Pasi; Hyytiä, Esa; Kyläkoski, Kaisa

COST 257 is a joint project between the Laboratory of Telecommunications Technology at HUT and VTT Information Technology. It represents the Finnish contribution to the European COST 257 Action, in which laboratories and research institutes from 18 countries participate. At HUT, the project was started in January 1997. The research is mainly funded by TEKES with the support by Nokia Telecommunications and Telecom Finland. The research focuses on developing models and methods for the performance analysis of telecommunication systems. Five problem areas have been addressed:

1) Effective simulation of multiservice loss systems (such as an ATM network considered at the call level). A new method based on the use of Gibbs sampling with an enhanced data collection techniques has been developed. A significant variance reduction was obtained in the test cases.

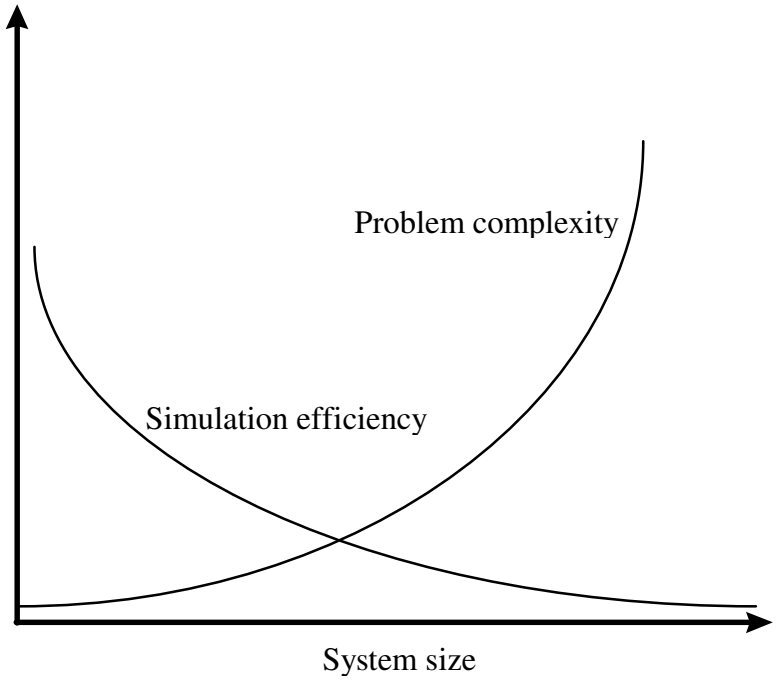

Figure 4 The simulation problem

2) Optimal routing and wavelength assignment in all optical WDM backbone networks. Optimal wavelength assignment is equivalent to the so called graph colouring problem. The basic theory of this problem has been reviewed and several heuristic techniques for finding "good" solutions for the problem have been implemented. Benchmark tests have been made in order to evaluate their effectiveness and computational complexity.

3) Proxy cache algorithms. Caching is an important means for reducing latency times and network costs of www requests. Different modelling approaches for analysing the behaviour of a cache have been studied with the aim of developing algorithms that would improve the cache performance.

4) Resource allocation. Computational methods have been developed for the transient blocking problem whose solution is needed in the optimal VP capacity allocation in ATM networks.

5) Multicast traffic. A generalised Engset model has been applied for calculating the end-to-end blocking probabilities of calls dynamically joining or leaving multicast trees. This work has been done jointly with the Laboratory of Telecommunication Software and Multimedia.

3.5 *Studies in queuing theory*

Project leader: Aalto, Samuli

This study aims at Ph.D. Thesis in Queueing Theory. It consists of two separate parts. In Part I optimal control problems of various batch service queueing systems are

considered, focusing on the case of finite service capacity. The models of this kind have natural applications in the area of transportation systems. In Part II the aim is to characterize the output process of some fluid flow storage models used in the teletraffic theory as burst scale models of multiplexers.

3.6 IP/Voice

Project leader: Kantola, Raimo
Other researcher: Yletyinen, Tomi; Betlehem, Ulf; Nurmi, Jukka

Voice over IP studies the transmission, switching and routing of voice in IP networks and service interoperability of such networks with PSTN/ISDN. The project was initiated in April 1997 and is planned to continue for 3 years. The project is mainly funded by a TEKES grant, it has also four industrial partners (Nokia Research Center, Nokia Telecommunications, Telecom Finland and Omnitele/Helsinki Telephone Research).

Results for the first year include Tomi's M.Sc thesis on Quality of Voice over IP, contributions to ETSI/TIPHON -project on number portability and network scenarios and a presentation on Telecoms Voice & Data Switching conference in London. In addition internal reports and student papers were produced.

3.7 IP / Switch

Porject leader: Kantola, Raimo
Other researchers: Ilvesmäki, Mika; Peräläinen, Ilkka; Brax, Veikko

The project was initiated in April 1997 and is planned to continue for 3 years. The project is mainly funded by a TEKES grant, it has also five industrial partners (Nokia Research Center, Nokia Telecommunications, Telecom Finland, Omnitele/Helsinki Telephone Research and Tellabs).

Although viewed as the prototype of the future Information Superhighway, the current Internet technology has a number of drawbacks including: limited transmission and routing capacity and limited speed, long and variable transmission delays and no support for quality of service. The project is aimed at helping to solve some of these problems by focusing on issues of deployment of ATM to increase the performance of the Internet and to improve the quality of service available to the user.

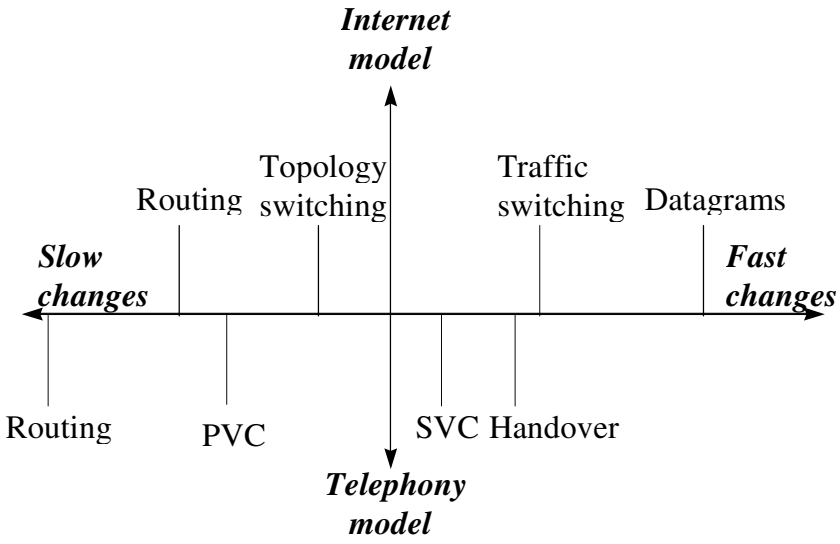

Figure 5 The integrating dimensions of the future Internet

For overcoming the switching capacity shortfall, it has been suggested that the Internet should be boosted by building its backbone using ATM technology and by using cut-through switching in addition to packet forwarding to increase the performance economically. The project studies the different approaches to multi-layer routing, the performance of these schemes and aims at suggesting improvements in the concepts. The project will also develop methodology in Internet traffic measurements and network planning.

Results of the first year include set-up of a IP-switching laboratory, building basic competence in this new research area. Three conference papers and several student reports were published. Several theses are under preparation.

4. TEACHING

4.1 Development of teaching

In the Fall 1997 a new post-graduate level studia generalia course Telecommunications Forum was introduced. The Forum deals with all the hot topics in Telecommunications and facilitates continuous exchange of ideas with the industry by inviting high level business and technology managers to deliver lectures on the development and strategy in Telecommunications. The Forum draw a wide audience of some 200 people and was a huge success.

During the year within the Telecommunications Area the laboratory continued development of course contents in order to achieve a better alignment of courses with the Communications laboratory. Collection of student feedback from all the courses has become a regular practice.

4.2 Courses

The laboratory has given education in 25 courses. The courses can be divided in 6 groups:

4.2.1 Basic courses for all students studying telecommunications

S-38.105 Principles in Communication Engineering (Tietoliikennetekniikan perusteet B)
S-38.118 Principles in Telecommunications Technology (Teletekniikan perusteet)

4.2.2 Courses concerning communications and networks

S-38.102 Principles in Electrical Communications (Sähköinen viestintä)
S-38.116 Information Technology (Teletietotekniikka)
S-38.188 Telecommunication Networks (Tietoliikenneverkot)
S-38.191 Corporate Networks (Televerkot yrityksissä)

4.2.3 Courses on switching and ATM

S-38.110 Telecommunication Switching Technology I (Tiedonvälitystekniikka I)
S-38.122 Telecommunication Switching Technology II (Tiedonvälitystekniikka II)
S-38.164 Broadband Switching Technology (Laajakaistainen välitystekniikka)
S-38.166 Programming of Telecommunication Switching Systems
(Televälitysjärjestelmien ohjelmointi)

4.2.4 Courses on signal processing

S-38.211 Signal Processing in Telecommunications I
(Signaalinkäsittely tietoliikenteessä I)
S-38.212 Signal Processing in Telecommunications II
(Signaalinkäsittely tietoliikenteessä II)

4.2.5 Postgraduate courses

S-38.001 Telecommunications Forum (Telecommunications Forum)
S-38.130 Postgraduate Course in Telecommunications (Teletekniikan lisensiaattikurssi)
S-38.141 Teletraffic Theory (Teleliikenneteoria)
S-38.143 Queueing Theory (Jonoteoria)
S-38.200 Individual Course in Telecommunications (Teletekniikan yksilöllinen opintojakso)
S-38.201 Seminar Course in ATM and Multimedia (ATM- ja multimediaseminaari)
S-38.220 Licentiate Course in Signal Processing in Communications
(Tietoliikenteen signaalinkäsittelyn lisensiaattikurssi)
S-38.350 Research Seminar on Telecommunications Technology
(Teletekniikan tutkijaseminaari)

4.2.6 Other courses

S-38.123 Telecommunications Technology, laboratory course I
(Teletekniikan laboratoriotyöt I)
S-38.126 Telecommunications Technology, special assignment I
(Teletekniikan erikoistyö I)
S-38.127 Telecommunications Technology, special assignment II
(Teletekniikan erikoistyö II)

S-38.300 Thesis Seminar on Telecommunications Technology
(Teletekniikan diplomityöseminaari)

4.3 Degrees

4.3.1 Licentiate of Technology

Pasi Salonen: A Unified Reference Architecture for Intelligent Network and Broadband Integrated Services Digital Network

In the future Intelligent Network (IN) Capability Set 3 (CS3), new capabilities and functions are required to support new services and deployment of service processing in Broadband Integrated Services Digital Network (B-ISDN). A unified IN/B-ISDN reference architecture can be used by the standardisation organisations to achieve the IN and B-ISDN integration within CS3 time frame. The objective of this Licentiate Thesis is to define a unified reference architecture for the Intelligent Network CS3 and B-ISDN CS3, and validate the obtained results.

4.3.2 Masters of Science in Telecommunication technology

Alkunen R.	Modelling of the IP-type value added service system, in Finnish (Palvelujen mallinnus IP-tyyppisille lisäarvopalvelujärjestelmille)	TELE
Dahlblom T.	Combined Services for paging and Cellular Network Operators	TM
Funck R.	Analysis and optimization of the product development process, in Finnish (Tuotekehitysprosessin analysointi ja optimointi)	NTC
Hautanen T.	Distributed media server system	NRC
Heimonen A.	Routing in ATM networks	NTC
Heiskari H.	ATM network requirements on planning of the transmission networks	NTC
Hänninen E.	Automatic testing of ISDN supplementary services in software updates, in Finnish (ISDN-liittymän lisäpalvelujen automaattinen testaus ohjelmistomuutosten yhteydessä)	LME
Juselius K.	Application of combined switching center in the Finnish telephone network	SIE
Karhula R.	Application of an automated defect tracking tool for software measurement and in-process project control	NTC
Karjalainen H.	Subjective testing of quality of video service in ATM network, in Finnish (Videopalvelun subjektiivinen laatu ATM-verkossa)	HUT
Karttunen P.	Comparison of direction of arrival and beamforming methods	HUT
Nurmi J.	Laboratory education in the Laboratory of telecommunications Technology, in Finnish (Laboratorio-opetus teletekniikan laboratoriossa)	HUT

Nyberg K.	Creating an electronic mail short message notifier using Java and Corba	NTC
Paajanen T.	ABR traffic management in ATM network, in Finnish (ABR-liikenteen hallinta ATM-verkossa)	NTC
Permikangas S-K	Functional testing as a part of the software process - a case study in a telecommunications company, in Finnish (Toimintotestaus osana ohjelmistooprosessia -tapaustutkimus tietoliikennealan yrityksissä)	NTC
Pesonen M.	Utilization of network management information in fixing of telecommunications network, in Finnish (Verkonhallintainformaation hyödyntäminen HPY:n puheensiirtoverkon viankorjauksessa)	HPY
Peuhkuri M.	Effects on process scheduling on data traffic, in Finnish (Prosessien vuorottelun vaikutus dataliikenteeseen)	HUT
Renko J.	A client/server ATM Router Application	TE
Ronkanen T.	Service data bases of intelligent networks, in Finnish (Älyverkon palvelutietokannat)	TELE
Sainio S.	Comparison of a rate-based ATM simulator with a cell-based ATM simulator	NTC
Sohlo U.	Integrating voice to the FastNet service, in Finnish (Puheen liittäminen Telen FastNet-palveluun)	TELE
Soininen H.	Intelligent network services for cellular operators	TM
Suokas J.	Enterprise data warehouses as organizations strategic aspect, in Finnish (Konsernitasoiset tietovarastot yrityksen strategisina voima-varoina)	SMG
Tahkokallio T.	Management and utilization of telecommunications networks using a distributed signalling surveillance system, in Finnish (Televerkkojen hallinta ja hyödyntäminen hajautetun merkin-antojen valvontajärjestelmän avulla)	TELE
Talala P.	Development of a network monitoring process	LME
Virtanen J.	Mobile telephone network synchronization	NTC
Väisänen J.	Supervision processes in transmission networks	NTC

HPY	Helsinki Telephone Company
LME	Oy L M Ericsson Ab
HUT	Helsinki Univ. of Techn. / Lab. of Telecom. Technology
NRC	Nokia Research Center
NTC	Nokia Telecommunications
SIE	Siemens Finland
SMG	SMG Finland Oy
TE	Tellabs Oy
TELE	Telecom Finland
TM	Tecnomen Oy

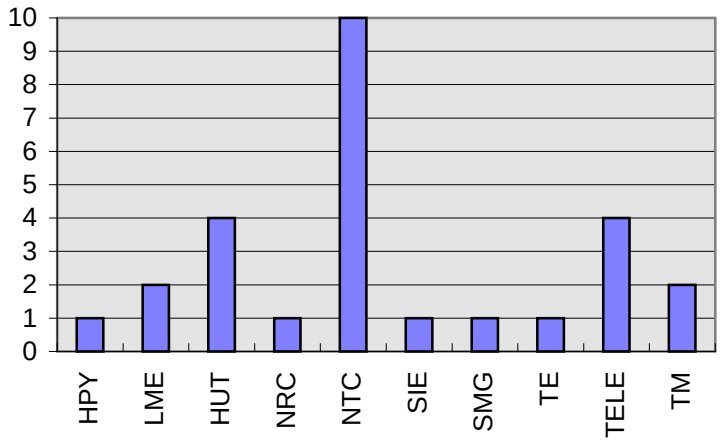

Figure 6 Employers of Masters students

5. ACTIVITIES

5.1 International conferences and meetings

- COST 257 Management Committee Meeting, Leidschendam, The Netherlands, January 22-23, 1997 (Virtamo)
- International Conference on Voice, Video and Data Communications 97. Dallas, Texas (Ilvesmäki, Luoma, Peuhkuri)
- International Conference on Telecommunications, April 2-5, 1997, Melbourne, Australia (Kankare)
- COST 257 Management Committee Meeting, Helsinki, May 27-28, 1997 (Aalto, Lassila, Luoma, Peuhkuri, Virtamo (chairman))
- ETSI meeting, May 20-25, 1997, Sophia Antipolis, France (Kantola)
- The 15th International Teletraffic Congress - ITC 15, June 22-27, 1997, Washington, DC (Virtamo)
- IEEE International Conference on Communications ICC`97, Montreal, Quebec, Canada, June 8-12, 1997 (Baghaie)
- ATM Year 97 conference, Santa Monica, California, June 23-27.1997 (Kantola)
- International Symposium on Information Theory, Ulm, Germany, June 29 - July 4, 1997. (Laakso)
- The Third IFIP WG6.3 Workshop on Performance of Communication Systems, August 20-22, 1997, Ghent (Virtamo)
- Inernational Symposium on Personal, Indoor and Mobile Radio Communications, PIMRC`97, Helsinki, Finland, Sept. 1-4, 1997 (Baghaie, Karttunen, Laakso, Werner)
- COST 257 Management Committee Meeting MC meeting, Dubrovnik, Croatia, September 22-23, 1997 (Lassila)
- IEEE Finnish Signal Processing Symposium, FINSIG`97, Pori, Finland, May 1997 (Baghaie, Karttunen)
- Telecom Voice & Data Switching, November 26-28, 1997, London (Kantola)

5.2 Foreign visitors in 1997

The following persons have visited the Laboratory of Telecommunications Technology during the year 1997:

- MSc Josè Apolinario from Universidade Federal do Rio de Janeiro, Brazil (from August to December)
- MSc David Vazquez Cortizo from Universidad de La Corunna, Facuctad de Informatica, Spain (from September to February 98)
- Professor Paulo Diniz from Universidade Federal do Rio de Janeiro, Brazil
- Professor Mariane Petraglia from Universidade Federal do Rio de Janeiro, Brazil in September

6. PARTICIPATION IN BOARDS AND COMMITTEES

6.1 University boards and committees

- **Timo Laakso**
  - Chairman of the Library Committee of the of the Department of Electrical and Communications Engineering
  - Member of the Course Evaluation Committee of the Department of Electrical and Communications Engineering
- **Jorma Virtamo**
  - Vice chairman of the Steering Committee of the International Centre
- **Raimo Kantola**
  - Vice chairman of the Telecommunications Institute (YVA)
  - Member of the Committee of public relations of the Department of Electrical and Communications Engineering
  - Chairman of the Fitness for Work Committee at the Department of Electrical and Communications Engineering
  - Member of Board of Otaverkko Oy, subsidiary of HUT

6.2 Other boards and committees

- **Timo Laakso**
  - Member of the Digital Signal Processing Technical Committee of the IEEE Circuits and Systems Society
  - Member of the editorial board of Applied Signal Processing (Journal by Springer Verlag)
- **Jorma Virtamo**
  - Vice chairman of the Management Committee of the Action COST 257 "Impacts of new services on the architecture and performance of broadband networks"
  - Member of the Technical Program Committee of the15th International Teletraffic Congress, ITC-15, Washington, D.C., USA, June 23-27, 1997
  - Member of the Program Committee of The International Conference "Performance of information and communications systems", PICS'98 to be held in Lund, May 25-28, 1998
  - Member of the Technical Program of the ITC sponsored seminar, "Teletraffic Theory as a Base for QoS: Monitoring, Evaluation, Decisions", to be held in St. Petersburg, June 1-7, 1998

- Member of the Program Committee of the "Workshop on Modelling, Measuring and Quality of Service" to be held in the 7th Summer School on Telecommunications, August 7, 1998. Lappeenranta

- **Raimo Kantola**
  - Member of the Broad-band Core Networks Group of the TEKES Telecommunications Technology Programme

- **Ramin Baghaie**
  - Member of Technical Committee of IEEE Finnish Signal Processing Symposium, FINSIG`97, Pori, Finland, May 1997
  - Vice-Chair of GETA course

6.3 Referee activities

- **Timo Laakso**
  - External evaluator of the Lic. Tech. thesis by Mr. P. Ranta, HUT
  - External evaluator of the Lic. Tech. thesis by Mr. Heikki Einola, HUT
  - External evaluator of the Dr. Tech. thesis by Mr. Jari Iinatti, Oulu University
  - External evaluator and opponent of the Dr. Tech. thesis by Mr. Markku Juntti, Oulu University
  - Reviewer for the following scientific journals: IEEE Transactions on Signal Processing, IEEE Trans. on Circuits and Systems, IEEE Trans. on Communications, Signal Processing, Applied Signal Processing, Electronic Letters

- **Jorma Virtamo**
  - External evaluator of the PhD thesis by Mr. N. Stol, Norwegian University of Science and Technology
  - Opponent in the Ph.D. dissertation of Mr. N. Stol, Norwegian University of Science and Technology, Trondheim, March 19, 1997
  - External evaluator of the PhD thesis by Mr. S. Manthorpe, Ècole Polytechnique Fédérale de Lausanne (EPFL)
  - Member of the jury in the Ph.D. dissertation of Mr. S. Manthorpe, Ècole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, June 3, 1997
  - External evaluator of the PhD thesis by Mr. M. Grundström, Tampere University of Technology, Tampere
  - External evaluator of the Tech.Lic. thesis by Mr. Shaoji Ni
  - Evaluation of Dr. J. Jormakka for the position of docent, Helsinki University of Technology

- **Raimo Kantola**
  - External evaluator of the PhD thesis by Mr. H. Kari, Helsinki University of Technology
  - External evaluator of the Tech.Lic. thesis by Mr. J. Häkämies, HUT
  - External evaluator of the Tech.Lic. thesis by Mr. M. Loukola, HUT

7. Publications

1. Aalto, S. & Giordano, S. Virtual trunk simulation. ATM traffic symposium. Mykonos, Greece 1997, ACTS project AC094 EXPERT, 13 s.

2. Aalto, S. Optimal control of batch service queues with Poisson arrivals and finite service capacity. Helsinki 1997, University of Helsinki, Department of Mathematics, Preprint 166. 18 s.

3. Annual report 1996. Espoo 1997. 20 s.

4. Harju, P.T. & Ovaska, S.J Optimization of IIR polynomial predictive filter magnitude response. Signal Processing, 1997. Vol. 56, nro 3, pp. 219-232

5. Harju, P.T. Polynomial prediction using incomplete data. IEEE Transactions on Signal Processing, 1997. Vol. 45, nro 3, pp. 768-770

6. Ilvesmäki, M. & Luoma, M. IP switching in a simplified ATM environment. Voice, video and data communications 97. Dallas, Texas 1997, SPIE - The International Society for Optical Engineering, s. 65-76

7. Ilvesmäki, M.; Kilkki, K.& Luoma, M. Packets or ports - the decisions of IP switching. Voice, video and data communications 97. Dallas, Texas 1997, SPIE - The International Society for Optical Engineering, s. 53-64

8. Kankare, J. & Kilkki, K. Recursive Estimators for Traffic Analysis and Prediction. International Conference on Telecommunications, Melbourne, Australia, 2.-5.4.1997. Melbourne, Australia 1997, Monash University, s. 131-135

9. Karttunen, P; Laakso, T. & Lilleberg, J. tracking of mobile users in mobile communication system using adaptive convergence parameter. PIMRC `97. Helsinki 1997, IEEE Communication Society, pp. 989-993

10. Karttunen, P.T; Laakso, T.I. & Lilleberg, J. Adaptive step size method for user tracking in mobile communication system. 1997 Finnish Signal Processing Symposium, Pori, 22.5.1997. Pori 1997, Tampere University of Technology, pp. 6-10

11. Karvo, J; Virtamo, J; Aalto, S. & Martikainen, O. Blocking of dynamic multicast connections in a single link. Espoo 1997, COST257 TD(97)46. 6 s.

12. Laakso, T; Sabel, L.P; Rose, V; Yardin, A. & Cain, G. A new delay Root-Nyquist filter design method for signal corrupted by ACI. In: Wysocki, T., Razavi, H. & Honary, B., Digital Signal Processing for Communication Systems. (1.). London 1997, Kluwer Academic Publishers, pp. 167-176

13. Lassila, P. & Virtamo, J. Regenerative simulation analysis for loss systems: the single link and single service case. Dubrovnik 1997, COST 257 TD(97)43. 11 s.

14. Lassila, P; Virtamo, J. & Aalto, S. Two approaches to simulating loss networks. Espoo 1997, COST257 TD(97)30. 16 s.

15. Luoma, M. & Ilvesmäki, M. Simplified management of ATM traffic. Voice, video and data communications 97. Dallas, Texas 1997, SPIE - The International Society for Optical Engineering, s. 428-436

16. Norros, I; Valkeila, E. & Virtamo, J., An elementary approach to a Girsanov formula and other analytical results on fractional Brownian motions. Helsinki 1997, University of Helsinki, Department of Mathematics, Preprint 133

17. Ovaska, S; Vainio, O & Laakso, T, Design of predictive IIR filters via feedback extension of FIR forward predictors, IEEE Transactions on Instrumentation and Measurement, Vol. 46 nr. 5, pp. 1196-1201

18. Peuhkuri, M., Toolbox to analyze computer-network interaction. Voice, video and data communications 97. Dallas, Texas 1997, SPIE-The International Society for Optical Engineering, s. 560-569

19. Rahko, K., Virtuaalitodellisuus ja tietoliikenne. Hämeenlinna, Aulanko, 4.-5.4.1997. Hämeenlinna 1997, Hämeen kesäyliopisto, Tampereen yliopisto

20. Uusitupa, S, Dataa tien päältä. TeleForum, 1997. Nro 3, s. 12-13

21. Werner, S. Adaptive multiple-antenna receiver for CDMA mobile reception. (1. p.). Espoo 1997, Teknillinen korkeakoulu, Teletekniikan laboratorio, Teletekniikan laboratorion raporttisarja 1997/1. 70 s.

22. Virtamo, J. & Aalto, S. Remarks on the effectiveness of dynamic VP bandwidth management. Espoo 1997, COST257 TD(97)15. 6 s.

23. Virtamo, J. & Aalto, S. Blocking probabilities in a transient system. Espoo 1997, COST257 TD(97)14. 6 s.

24. Voipio, K. Lisää vauhtia - Modeemitekniikan haastajat. Internet, 1997. Nro 11, s. 11-14

25. Voipio, K. Painovirhepaholaisen painajaiset. Tietokone, 1997. Nro 4/97, s. 73-75

26. Voipio, K. Tarrastulostusta kotikonstein - Säilö kesä omin etiketein. KotiPC, 1997. Nro 3/97, s. 42-43

27. Voipio, K. Uudet modeemit haastavat ISDN:n. Tietokone, 1997. Nro 2/97, s. 79-80