VERDIKT-Conference

29 – 30 October 2007
Rica Hell Hotel, Trondheim Airport Værnes

Programme
Core Competence and Value Creation in ICT – VERDIKT
Programme VERDIKT Conference 29 - 30 October 2007, Rica Hell Hotel, Trondheim Airport Værnes
(There might still be some changes in the programme)

Programme Committee:
Geir Øien, Institutt for elektronikk og telekommunikasjon, NTNU
Kjersi Moldekleiv, Telenor ASA,
Gunnar Hartvigsen, Medisinsk informatikk & telemedisin, Institutt for informatikk, Universitetet i Tromsø
Ernst Kristiansen, SINTEF IKT
Paul Vigmøstd, Netview Technology AS

Monday 29 October

10:00 - 11:00 Registration
11:00 - 12:30 Opening session
Chair: Torbjørn Svendsen, Director VERDIKT’s Programme Board
Opening remarks from The Research Council of Norway
Chair: Knut Leislet, Director Board of Division for Strategic Priorities, The Research Council of Norway
Computer Science behind Science - Why Computer Science Matters
Chair: Bernard Chazette, Princeton University

12:30 - 13:00 Discussion in plenum/Poster Session

13:00 - 14:00 Lunch

14:00 - 15:20 Distributed systems
Chair: Lars Vognild
Wireless communication
Chair: Geir Øien
User interface
Chair: Ivar Peter Grette

14:00 - 14:20 DeStore - Decentralized Storage
Njål Borch, NORUT
Joint Iterative Multiuser Detection and Channel Estimation
Pietroj Salvo Rossi, NTNU
Complexity vs. simplicity in universal design
Kristin Skieide Fuglerud Norwegian Computing Center

14:20 - 14:40 Parallel3D - Massive multi-type 3D datasets in parallel Environments
Andre Rijerland Brodtkorb, Universitet i Oslo
QoS in Packet Based Microwave Radios
Bård Hønnlien, Aera Networks ASA
Challenges and solutions for user interface design on mobile devices
Erik G. Nilsson, SINTEF IKT

14:40 - 15:00 High resolution numerical models on a Display Wall
Bård Fjukstad, Norwegian Meteorological Institute, Tromsø
SECOMAS Spectrum efficient communication for aeronautical services
Jan Erik Håkegård, SINTEF
A System for Hybrid Vision- and Sound-Based Interaction with Distal and Proximal Targets on Wall-Sized, High-Resolution Tiled Displays
Daniel Stadlo, University of Tromsø

15:00 - 15:20 Hassle-Free Mirroring of User Selectable Desktop Areas onto Network Accessible Projectors and Displays
Tor Magne Stien Hagen, University of Tromsø
Optimized Video Streaming for Wireless Networks and Mobile Terminals
Haakon Risler, Netview Technology AS
Online Communities
Petter Bae Brandtzæg, SINTEF

15:20 - 15:40 Coffee break

15:40 - 17:00 Video streaming
Chair: Paul Vigmøstd
Sensor networks
Chair: Hilde Erlandsen
Health information systems
Chair: Gunnar Hartvigsen

15:40 - 16:00 Streaming Window Sharing System using Multiple Video Streams
Yang Liu, University of Tromsø
Cross-Layer Optimization in Short-Range Wireless Sensor Networks
Changmian Wang, NTNU
Communication and Information Sharing between Patients and Their Care Providers
Cornelia Ruland, RN

16:00 - 16:20 Estimation of subjective video quality from objective measurements
Wolfgang Leister, Norsk Regnskapstasjon
Scheduling for Energy Efficiency and Delay in Sensor Networks
Kimmo Kansanen, NTNU
Health Assets: An Important Aspect of a Patient-Provider Shared Electronic Health Record
Ann Kristin Rolseth, RN

16:20 - 16:40 Robust Multimedia Streaming Services (ROMUS)
Viktor S. Wold Eide, University of Oslo
Energy and QoS Packet Forwarding in Sensor Networks
Yan Zhang, Simula Research Laboratory
Seamless integration of information systems: the case of the health care sector
Eric Morelino, NTNU

16:40 - 17:00 Temporal Scalable Video Coding for Robust Video Streaming Service (ROMUS)
Pengpeng Ni, NTU
Minimizing Power Using Large Bandwidth PPM Transmission and DPCM Source Coding
Minh-Long Pham, NTNU
Attention and usability issues in computer supported collaboration systems at point-of-care
Die Andreas Allos, NTNU

17:00 - 18:00 Coffee

17:00- 18:00 Poster session
Authors will be available for discussion at their poster

19:00 Conference Dinner
Tuesday 30 October

8:30 - 10:00 Opening session Day 2
Chair: Kjersti Moldeklev

8:30 - 9:30 International Research Cooperation - Some Challenges, Trends and Scenarios
Mr. Juha Saario, Head of Public Research Programs of Nokia Research Center

9:30 - 10:00 Informasjonsteknologiens betydning for samfunnsutviklingen – ståsted 2007

10:00 - 10:30 Coffee break

10:30 - 11:30 Security
Chair: Jan Rasmus Sulebak

Wireless networks
Chair: Ernst Kristiansen

Usability
Chair: Barbara Wsson

10:30 - 10:50 Security and trust in open source VoIP enterprise systems
Ame-Kristian Groven, Norsk Regnesentral

An Adaptive QoS Based Rate Control Scheme for Multi-Hop Wireless Mesh Networks
Geir Egeland, University of Stavanger / Telenor Research and Innovation

Mobile, Secure and Seamless Mobile access to Electronic Health Records (EHR)
Tore Brynh, University of Oslo

10:50 - 11:10 Privacy Enhancing Technology (PET) for Web based Services
Åsmund Skomedal, Norsk Regnesentral

Multi-homing with Load Balancing for QoS-aware Multi-hop Wireless Mesh Networks
Frank Y. Li, University Graduate Center Kjeller

Context sensitive systems for mobile communication in hospitals
Terje Solvø, Norwegian Centre for Telemedicine

11:10 - 11:30 Secure Heterogeneous Information Presentation - SHIP -
Marc Bezem, University of Bergen

Differential Space-Time Coded Cooperation for Decode-and-Forward Wireless Relay Networks
Bahrouz Maham, UnIK/Uio

Can a picture do the talking?
Sigmund Akselsen, Telenor R&I

11:30 - 12:15 Lunch

12:15 - 13:00 Poster session
Authors will be available for discussion at their poster

Parallel session 1

13:00 - 14:10 Networks
Chair: Kjersti Moldeklev

Mobile services
Chair: Åsmund Skomedal

Feature extraction
Chair: Geir Iien

13:00 - 13:20 Improving application delay for thin streams
Andreas Petlund, University of Oslo / Simula Research Laboratory

Locatext: Using locative media to experience literature
Anders Sundnes Lavle, University of Oslo

Attribute detection and knowledge integration for automatic speech recoginition
Marco Siniscalcho, NTNU

13:20 - 13:50 Group communication for distributed interactive applications
Knut-Helge Vik, Simula Research Labs

Between the tag and the screen: Tangible interaction on mobile handsets
Kjell Nordby, The Oslo School of Architecture and Design

Capturing Image Semantics through Collection Information
Randi Karlsen, UiT

13:50 - 14:10 Reducing the Network Latency and Bandwidth Requirements of Parallel and Distributed Applications
Lars A. Bongo, University of Tromsø

WISECAR Intelligent driving assistance systems for improved safety and efficiency in transport
Thomas Engen, SINTEF

Utilizing Context in Ranking Results from Distributed Image Retrieval
Christian Hartvedt, Stipendiat UiB

13:00 - 14:10 Parallel session 4:

13:00 - 13:20 Integrated Reconfigurable Radio Front-end Technology
Bengt Holter, SINTEF ICT

13:20 - 13:50 Multi-port eleven antenna for use in satellite communications terminals
Jungang Yin, NTNU

13:50 - 14:10 RF-based Techniques for Power Amplifier linearization and efficiency Improvement
Marius Utoholdt, NTNU

14:10- 14:30 Coffee break

14:30 - 15:10 Middleware
Chair: Harald Holm Simonsen

Converging internet access
Chair: Åsmund Skomedal

Software and social capital
Chair: Paul Vigmstad

14:30 - 14:50 Autonomous Communication Middleware for Integrated Home Services
Pal Evensen, University of Stavanger

Mobile Fixed Convierge in Multiaccess Environment
Thaich van Do, Telenor ASA Research and Development

Mobilizing social capital in ICT-based global organizations
Tom Erik Juhlrud, Telenor ASA R&D and Torje Osmundsen, NTNU

14:50 - 15:10 Middleware Services for Information Sharing in Ad-hoc Networks
Thomas Plagemann, IFI - Uio

Interactive multi channel support of mobile workers
Shang Gao, NTNU

Social capital in ICT-based global organizations: The role of social software
Andreas Søyland, NTNU

15:10 - 16:00 Closing session
Chair: Torbjørn Svendsen

15:10 - 15:30 IntelliSense RFID – An RFID Platform for Ambient Intelligence with Sensors Integration Capabilities
O. Vermesan, SINTEF ICT

15:30 - 15:50 Service continuity during mobility
Terje Omlhaug, Telenor R&I

15:50 - 16:00 Award for best posters
Torbjørn Svendsen, Director VERDIKT's Programme Board
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Why?
Web centric services and applications are becoming popular due to their low administrative load, their reachability from anywhere and co-operational benefits. Web centric solutions are becoming more advanced, and can allow users to store and work on increasingly large amounts of data. Storing such data remotely (close to the provider of the software or service) is a simple and often used solution. Centralizing storage can however require data to travel long distances to reach the user. With large datasets, such as video and pictures, the additional distance can severely limit the user experience by slow speeds and long latency. This can again severely limit the usefulness of web centric solutions.

What?
DeStore seeks to develop a robust, low cost decentralized data storage system for web centric services. Being decentralized, DeStore can efficiently map onto an underlaying network infrastructure, moving the data closer to the user. This can provide users with a high speed, low latency data storage even within web based applications.

How?
DeStore is based on Peer-to-Peer technologies, providing a self organizing, self optimizing and self healing distributed storage network. By seamless replication and load balancing, a DeStore network can handle hardware failures transparently and automatically, making it possible to run on cheap, off-the-shelf hardware. This also allows DeStore to be run with a very small amount of administration, which is crucial for any low cost distributed system.

The dynamics of Peer-to-Peer organization allows DeStore to be extended by simply adding more disk or more computers. Additionally, new domains (storage points) can easily be created and added to a live system, allowing the network to be built to match the underlaying network infrastructure.

In order to provide access control and security, one or more centralized node can authenticate computers and users, as well as their credentials. This allows DeStore to be integrated with existing solutions without additional user names or passwords.
Project: Parallel3D - Massive Multi-type 3D Datasets in Parallel Environments (180023/S10)

Title: A Heterogeneous Processing Platform

In the recent years, several massively parallel architectures have emerged as commodity level hardware. The two main processors are the IBM Cell Broadband Engine (Cell BE) found in the PlayStation 3 (PS3), and the graphics processing unit (GPU) found in modern computers. They offer extremely high floating point performance, yet lacking most of the advanced logic found in modern CPUs. If we utilize these parallel processors in conjunction with the CPU, we get a heterogeneous processing platform with the logic of the CPU coupled with the raw power offered by the GPU/Cell BE (the Cell BE is, in fact, such a heterogeneous processing platform by itself).

This talk is about using these heterogeneous processing platforms so solve different problems. General concepts will be discussed, such as accuracy and typical performance boosts and inhibitors with main focus on the GPU. The concepts will be exemplified by a black-box MATLAB interface to the GPU.
High resolution numerical models on a Display Wall

Bård Fjukstad\textsuperscript{a} (Statsmetrolog), Otto J. Anshus\textsuperscript{b} (Professor), John Markus Bjørndalen\textsuperscript{b} (Associate Professor)

\textsuperscript{a} Norwegian Meteorological Institute, Tromsø, Norway,
\textsuperscript{b} University of Tromsø, Norway

A typical working environment for a forecaster on duty is a computer with at least two displays where most of the routine work is done. Additional computers and displays for visualization of related information are also usually available. The total resolution from all the displays translates into how much information that can be displayed simultaneously. However, this information is partitioned up between the displays, making it harder for the forecaster to translate it into a forecast.

A wall-sized display with very high resolution is creating new possibilities for weather forecasting. A main advantage of a display wall is the ability to have huge windows with high resolution providing both fine details and overview at the same time. This is very useful in several situations. An example is large convective systems where multiple cells interact over large distances, and the forecaster needs to see both the local details and the overall view.

The display wall we have developed is 220 inches diagonally, and comprised of 28 commodity projectors for a total resolution of 22Mpixels. Each projector is driven by an individual PC. The 28 PCs are also used as a compute cluster to create content for the display wall.

The program used for the meteorological visualization is the DIANA system. Only a small change in one of the supporting libraries was needed for the program to use very large window sizes.

The display wall is so large that several people can work on the wall at the same time, using it for forecasting, research and educational use.
Hassle-Free Mirroring of User Selectable Desktop Areas onto Network Accessible Projectors and Displays

Tor Magne Stien Hagen (Ph.D. student, U. of Tromsø), Yong Liu (Ph.D. student, NFR IKT2010 SHARE), John Markus Bjørndalen (Associate Professor), Otto J. Anshus (Professor)
Department of Computer Science, University of Tromsø

We report on a system supporting cross-platform mirroring of user-selectable regions from one or multiple computer desktops onto nearby network accessible projectors and displays (NADs). The purpose is a hassle-free and flexible use of projectors and displays: The user contacts a display through a web-browser and clicks on a button to use it. The system improves on the following problems: (i) When a projector is physically connected to a laptop: (a) no output may become visible, (b) the resolution of the local display is inconveniently reduced to the external display’s resolution, (c) there is no fine grained control for the user to choose what to display of the local desktop, (ii) there is limited support for using multiple projectors and displays from a laptop, (iii) multiple users can not share the same projectors and displays concurrently, (iv) using an in-room projector-computer rig may result in application compatibility problems, and (v) using a remote desktop to view the user’s desktop implies having a user account, a compatible remote desktop viewer, and a keyboard and mouse on the projector-computer rig.

The system uses a two-phase based protocol to integrate the user’s computer with the NAD. In phase one, the user’s computer is customized by software downloaded on demand from the NAD. In phase two, the customization enables video integration between the user’s computer and the NAD.

The system’s architecture comprises a desktop side and a NAD side. The NAD side comprises three components: An uploader of desktop side software, the actual desktop side software, and the NAD side software. The uploader of desktop side software is an Apache webserver. The desktop side and NAD side software is implemented in Java.

The performance of the system depends on the amount of visual updates in the mirrored regions. To evaluate the performance of the system we have conducted experiments with different visual update frequencies, ranging from a slideshow presentation producing mostly static content to a video producing dynamic content. At a resolution of 800 by 600 pixels the system supports mirroring of dynamic content at about 38.6 fps. At 1600 by 1200 pixels, the refresh rate is 12.85 fps. For static content the system’s bandwidth usage is within the capacity of an 11 Mbit/sec wireless network. For dynamic content a 100 Mbit/sec or faster network is recommended. For dynamic content, the bottleneck of the system is a combination of encoding/decoding of pixels and the network communication, depending on the nature of the mirrored regions.

1 This work has been supported in part by the following NFR funded projects:
NFR 155550 Display Wall with Compute Cluster.
Joint Iterative Multiuser Detection and Channel Estimation

Pierluigi Salvo Rossi (PostDoc) and Ralf R. Müller (Professor)

Department of Electronics and Telecommunications, Norwegian University of Science and Technology
Project 172239, Wireless LANs with High Throughput in Interference Limited Environments (WILATI)

Wireless broadband communications for multimedia applications with quality comparable to wireline technologies are largely required and system design is very challenging due to the intrinsic problems affecting the radio channel as well as to mobility requirements up to vehicular speed. Use of multiple antennas, creating a Multiple-Input Multiple-Output (MIMO) channel, provides capacity gains via multiplexing, by a factor of the minimum number of transmit and receive antennas. Orthogonal Frequency Division Multiplexing (OFDM) has been adopted in several standards, as presents simpler channel equalization compared to single-carrier transmissions via decomposition of a dispersive channel into a set of frequency-flat orthogonal subchannels. MIMO-OFDM systems have shown to combat inter-symbol interference and enhance system capacity simultaneously.

Multiuser detection, i.e. exploiting the structure of multiple access interference at the receiver to approach theoretical performance, is a fundamental but very complex issue for current wireless systems. Iterative multiuser receivers achieve excellent performance with contained complexity: multiuser detection and single-user decoding are decoupled into separate problems, iteratively exchanging each other their results via soft information. Channel estimation, necessary in order to use coherent modulation for better performance, may benefit of the iterative structure.

In [1] we have proposed an iterative receiver for MIMO-OFDM systems in which channel estimation for time-variant channels has been included in the iterative structure. More specifically: (i) multi-user detection is performed via parallel interference cancellation and Minimum Mean Square Error (MMSE) filtering; (ii) time-variant channel estimation is performed via 1-dimensional Slepian expansion and linear MMSE estimation; (iii) single-user encoding and decoding are based on convolutional codes and BCJR algorithm; (iv) extrinsic soft information is sent from the multiuser detector to the single-user decoders and vice versa, while a posteriori soft information is sent from the single-user decoders to the channel estimator. Numerical simulations showed that the Bit Error Rate (BER) approaches the Single-User Bound (SUB) with very few iterations.

In [2] the same receiver has been tested with real MIMO-OFDM channel measurements in presence of interference: simulations showed the presence of a gap between the performance of the multiuser receiver and the SUB. The gap does not vanishes even with increasing fraction of pilots. Analysis of the channel estimator via relative MMSE showed that the problem lies in the frequency correlation that has not been taken into account.

In [3] the channel estimator has been extended to deal with doubly-dispersive channels by means of a 2-dimensional Slepian expansion. Numerical simulations for doubly-dispersive channels showed very promising results compared to the time-variant channel estimator, but higher computational complexity is needed.

In [4] use of turbo codes for single-user channel encoding have been analyzed. The receiver presents a twofold-iterative structure, and the impact of the inner iteration (the turbo-decoding iteration for the single user) is crucial to improve performance at low Signal-to-Noise Ratio and to achieve lower computational complexity. The receiver has been tested with time-variant channels outperforming the one presented in [1] as well as other receivers present in the current literature.

Future work will focus on designing low-complexity approximations for the 2-dimensional channel estimator and consequent integration in the twofold-iterative system. The final system with turbo-codes and with the 2-dimensional channel estimator has to be tested with channel from real measurements. Also, the analysis of how pilot placement in the 2-dimensional time-frequency plane affects the turbo effect between the multiuser decoder and the single-user decoders in real channels is an open problem.

References:


QoS in Packet Based Microwave Radios

Bård Henriksen,
Nera Networks ASA

The ongoing trend in telecommunication networks towards convergence of services and the rapid emergence of new services require future backhaul networks to handle both current heterogeneous traffic and to be prepared for any future services. A multitude of traffic sources with different protocols and QoS requirements have to be forwarded through the same protocol and service independent network. How to ensure QoS to all these different sources in a fair and simple way are a great challenge and the focus of this project.

The heterogeneous traffic may be a mix of voice, real time video, file transfer, streaming, Internet browsing, gaming and many more services, – all with unique QoS requirements. Voice typically have stringent delay requirement, but tolerates moderate packet loss, while file transfer does not tolerate any packet loss but long delays. In wired networks these diverse requirements usually are met by overprovisioning the network capacity. In wireless network overprovisioning is too costly. The bandwidth has to be better utilised. Furthermore, wireless communication channels are inherently unreliable. Unless action is taken, fading may lead to unacceptable packet loss and large delay.

This presentation focuses on maintaining QoS during link rate reduction due to fading in an environment with heterogeneous traffic. We will show 3 techniques to achieve this.

- Lossless fast rerouting
- Active Queue Management
- Advanced Scheduling

Many backhaul networks are built with redundant paths like ring or bubble topologies. Fading on a wireless link is a low probability event, and even less probable to happen simultaneously in two paths. By exploiting the fact that most backhaul topologies are fixed, i.e. don’t change with time, we will design a network where fast rerouting enables lossless protection.

Active Queue Management (AQM) is well known in network routers today, but we will enhance the functionality by also considering link rate variations. The optimal tuning of queue length has to follow the link rate adding additional complexity to AQM. The goal is for any current link rate to achieve close to 100% utilisation of the link capacity.

Packet arrival can be very irregular and appear in high rate bursts even if average rate is well below link capacity. Scheduling is important to smooth out these bursts in a fair and efficient manner. The scheduler will pick packets for transmission according to a number of criteria. In advanced scheduling rate variations should influence these parameters. We will show simulations that verify the importance of dynamic parameters in the presence of link capacity variations.
SECOMAS Spectrum efficient communication for aeronautical services

Jan Erik Håkegård, Tor Andre Myrvoll
SINTEF

1 Background

Air traffic has increased significantly over a number of years. This trend is expected to continue, provided that no restriction to reduce the air traffic for environmental reasons is implemented. Radio communication between aircrafts and flight control centres is basically the same today as it was several decennia ago, with the exception of a limited use of data links recently introduced. Continued increase in air traffic will eventually lead to congestion of the communication systems, risking reduced efficiency, increased impact on the environment, and compromising safety. Hence, improved communication systems must be developed that allow more information to be exchanged between ground and aircrafts. The SECOMAS project considers ways of increasing the spectral efficiency both on link level and on network level.

2 Link level

Communications between cockpit and flight control centres use the aeronautical VHF band between 117.975 and 137 MHz. The channel bandwidth is generally 25 kHz, although support of 8.33 kHz channels is mandatory in Europe above flight level 195 (i.e. about 19500 feet). A large majority of the 25 kHz channels are allocated to protected voice Air Traffic Services (ATS). In addition, a sub-band is allocated to voice airline communications. Finally, a small number of channels at the highest frequencies are allocated to data link communications (VDL2 and VDL4). The frequency planning is currently in the process of being modified, but the plan is to allocate two channels to VDL4 and four channels to VDL2. Each of these channels has an “empty” channel on each side as guard band to reduce inter-channel interference.

The capacity of the aeronautical VHF band could be increased in several ways, e.g.:

- Through link adaptation by making transmit power levels as well as coding and modulation schemes adaptive to the channel conditions. Adequate channel models should be applied in order to be able to estimate and predict the propagation channels correctly.
- Apply inter-channel interference reduction and mitigation techniques.
- Reduce the amount of voice communication, as data communication is more spectrum efficient than voice communication.
- Use VoIP for voice communication, as digital modulation schemes are more spectrum efficient than analogue modulation schemes.

SECOMAS will primarily concentrate on the first two bullets.

At the World Radio Conference WRC-07 later this year, the aeronautical L-band will most probably be opened for communication services. This band is currently allocated to navigation and surveillance services. Currently a number of alternative communication system solutions are considered for this frequency band. Most of these solutions are developments of systems designed for other uses and frequency bands. SECOMAS will consider other schemes for this frequency band.

3 Network level

Communications to and from an aircraft can be categorised into Air Traffic Services (ATS), Air Operational Communications (AOC), and Air Passenger Communications (APC). The different services have their proper characteristics and requirements to Quality-of-Service (QoS). While ATS services consist of short, sporadic messages and have strict requirement on reliability and delay, commercial APC services have low requirements on reliability and delay but can potentially constitute large volumes of data.

On the other hand, aircrafts contain a number of communication systems, from HF- and VHF- communication to satellite communications, and more will be available in the future. This includes aircraft-to-aircraft communication. SECOMAS will investigate how different services may and should be distributed among the various alternative communication systems to optimise the efficiency and at the same time meeting the QoS and security requirements of each service.
Optimized Video Streaming for Wireless Networks and Mobile Terminals

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Abstract
Delivery of video to mobile and wireless networks is a challenge because of fluctuating signal levels that render many fixed network streaming technologies useless.

New video streaming protocols should be designed specifically for mobile and wireless networks, audio and video encoding needs to be more robust and adaptable than what is needed for fixed networks, and error correction is a vital part to protect against minor (but frequent) loss of data due to noise and varying signal quality. In addition, there is also the problem with power consumption and battery capacity on mobile devices.

Project Summary
This project considers various techniques to improve video streaming with regard to the problems that follow from wireless networks and mobile terminals: On the data transport level, timely delivery of data is more important than data integrity, and the design of the transport protocol used in this project is governed by this fact.

To cope with minor (but frequent) loss of data due to signal fluctuations and noise, strategies based on forward error correction and protocols supporting limited retransmission are evaluated. With regard to the former, a comparison between solutions based on end-to-end FEC and FEC on lower network layers is performed.

On the application level, a study of video formats especially designed for mobile and wireless networks will be performed, focusing on Fraunhofer’s new SVC (Scalable Video Codec) extension for H.264 which allows the video stream to be split into several quality layers. Since these quality layers have different priority, this extra flexibility opens up many interesting research challenges in optimal bit-allocation between data and redundancy.

The project also aims to reduce power consumption, and a study will be performed to determine if reduced power usage can be achieved by doing reception and transmission of data more intelligently on the transport level (e.g., by regulating data transfer into bursts that may allow the radio to be switched on and off between bursts). In addition, Scalable Video Coding may also be used to reduce power consumption by permitting devices to decode only parts of the video stream when only low-resolution/quality video is required or possible.

The new technology that is made possible by research in these areas will be implemented and tested in Telenor’s new HSDPA network, which is the next generation communications protocol for Internet on mobile devices.
Complexity vs. simplicity in universal design
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ABSTRACT
The UNIMOD project - Universal Design in Multimodal User Interfaces is directed towards making ICT services usable for all users, and especially users with cognitive disabilities.

Multimodality
Different users in different situations require information in different modalities. A visually impaired user needs information in Braille or audio, while a hearing impaired user needs information in a visual or haptic format. In order to ease the comprehension for people with cognitive disabilities it is commonly advised to make use of several types of modalities [1]. Different modalities are also necessary when designing for changing contexts and situations. For example if there is much noise (e.g. a production room) or preferred silence (e.g. a meeting), a system notification in visual or haptic form (e.g. vibrating mobile phones) might be more suitable than an audio alarm.

Flexibility vs simplicity
Multimodality and flexibility in terms of interacting with the user through different input/output modalities depending on the user skills, abilities, preferences and context is essential to universal design. However, a consequence of the flexible multimodal user interface may be that the user is presented with much functionality and many choices [2]. For example, the introduction of audio often introduces the need for more functionality to interact with the audio, such as repeat, forward, backward, stop, start, adjusting volume, speed, etc. [2]. Adding functionality usually adds to the complexity of the user interface. The challenge lies in how to offer this kind of flexibility without making the user interface too difficult to use.

Personalisation and adaptation
One possible approach to meet the problem of added complexity introduced by multimodality and flexibility is to support individual differences via personalization and layering of interfaces [3]. The users may set up a profile that holds information about what modalities and functionality that best suits his or her individual needs. There are several challenges with this solution. Adding the functionality to personalize and move between interfaces, in itself adds complexity. Experience shows that it is a challenge to get users to personalize web services or applications [4, 5, 6]. Research indicates that those who would gain most from personalisation (e.g. novices or people with cognitive disabilities), seldom are able to do it effectively on their own [7, 8]. Another danger is that personalisation becomes a substitute for good user interface design [6, 9].

A key question is whether it is possible to design ICT products and services that meet the individual user needs without increasing the complexity of the user interface. It is necessary to explore the trade-off between the one-size-fits-all approach and the need for adaptability and personalisation. Many current day examples of personalisation are difficult, cosmetic, time consuming or annoying to the user.

Conclusion
The doctor project will explore the seemingly opposites of flexibility of multimodal universal design on one side and the need for simplicity on the other. Addressing this issue is a central challenge of universal design of ICT.

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Challenges and solutions for user interface design on mobile devices

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The main goal of the FLAMICO (FLexible Applications exploiting Multi modal INteraction and Context) BIP project (176828/S10) is to facilitate Norwegian service and application developers as well as tool vendors in meeting the challenges they face in the next years to come when developing user interfaces on mobile devices. This shall be achieved through finding solutions to some of the major problems facing developers of future mobile solutions. In FLAMINCO, these problem areas are addressed:

1) Handling layout in varying conditions
2) Multi modal user interfaces
3) Adaptive and context sensitive user interfaces
4) Forms based user interfaces (including automatically generated ones)

Issues regarding both user interface design and evaluation methods are addressed in FLAMINCO, but the presentation will focus on the activities in the project addressing user interface design. In the presentation, the four problem areas addressed in the project will be described in more detail, including which challenges that are addressed in each problem area, and how these are founded in the pilot activities conducted by the participating industry partners (Captura, IT liberator, Locus and Teleplan). We will also present preliminary solutions to and promising directions for some of these challenges.

The design challenges and their solutions are documented as design guidelines using a standard user interface design patterns format. The design guidelines being developed in FLAMINCO complement, enhance and extend the design guidelines developed in the BIP project UMBRA (2004-2005). The design guidelines from the UMBRA project was recently presented as a tutorial at an international user interface conference. During the tutorial, information about relevance of the different parts of these design guidelines – as well as relevance and usefulness of selected design patterns – was collected from approximately 40 participants through a questionnaire. The participants have a number of different nationalities, have varying educational and technical background, and work on different platforms. In the presentation, preliminary results from this survey will be presented.
When interacting with wall-sized, high-resolution tiled displays, users typically stand or move in front of it rather than sit at fixed locations. Using a mouse can be inconvenient because it must be carried around, and it will require a surface to be used. Even for gyroscopic mice and other devices that work in mid-air, accuracy when trying to hit small and distal targets becomes an issue. Ideally, the user should not need devices to interact with applications on the display wall.

We have developed a hybrid vision- and sound-based system for device-free interaction with software running on a 7x4 tile 220-inch display wall. The system comprises three components that together enable interaction with both distal and proximal targets: (i) A camera determines the direction in which a user is pointing, allowing distal targets to be selected. The direction is determined using edge detection followed by applying the Hough transform. (ii) Using four microphones, a user double-snapping his fingers is detected and located, and then the selected target is moved to the location of the snap. This is implemented using correlation and multilateration. (iii) 16 cameras detect objects like fingers and hands in front of the display wall. The 1D positions of detected objects are then used to triangulate object positions, enabling touch-free multi-point interaction with proximal content. The system is used on the display wall in three contexts: (i) to move and interact with windows from a traditional desktop interface, (ii) to interact with a whiteboard-style application, and (iii) to play two games.
Online Communities

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What?
One of the three PhD students of the RECORD project focuses in particular on “Emergent patterns of media usage in online communities”. The PhD period is running from March 2007 to March 2011.

This PhD will investigate emerging patterns of media usage in online communities. Firstly, the project will study how new media and in particular online communities is used among different user groups. Secondly, it will investigate how different patterns of media usage influence media users sense of social capital, this in the light of latest change in the new media world where users are taking a more active role in the media chain. The focus will in particular be on use in social networked applications. Thirdly, this project will investigate how a better understanding of emergent patterns of media use and it social impact can benefit in to the design of online communities.

Why?
The use of new media is now thoroughly ingrained in several parts of the western society, but the complexity of their role is constantly changing and deepening. New media is used for a wide variety of purposes and interests, such as surfing for information, playing online games, and chatting: It is changing how people communicate, how they work, and how they leisure. Thus, the most profound and latest change is how the users are taking a more active role in the media chain, this is particular evident in new online communities such as Facebook, Nettby and MySpace. In general, there seems to have been a shift from passive media consumption of mainstream media content, towards active media participation, content creation and sharing.

These trends indicate a need for new knowledge in how people use new media for active participation, content creation and communication in new online communities, and how and which users that are becoming the major media producer and distributor for the future. A finale challenge is how knowledge about the emergent patterns of media usage and it social impact can be utilised in the design process of new online communities.

How?
This project will study the emergent patterns of media usage in online communities in three ways.
1) Study typical patterns of media usage in online communities to get more knowledge about how people use new media and what differences that are shaping typical patterns of media usage.
2) Study how social capital are associated with certain patterns of media usage.
3) Analyse in what way knowledge on both social capital and patterns of media usage can benefit the design of online communities in terms of user requirements.

The empirical data will be taken from the Living Lab facilities developed within the RECORD project. Participants of the Living Lab panel will related to new media services developed by NRK, Telenor and Interactive Sportsschool. The PhD project will follow the same time iterations as in the RECORD project.
Sharing graphical information and windows between various devices like computers, PDAs and smart phones is an emerging demand in distributed collaborative environments. Due to the device polymorphism, window-sharing mechanisms are usually different for different kinds of devices preventing the devices from seamlessly participating in the collaboration.

We present a new streaming window sharing system that allows devices to seamlessly share their graphical information and windows. The new system utilizes standard video stream formats, which are widely supported by such devices, as its communication protocol. Our experiments on up to 28 devices show that the new system achieves good performance for both 2D and 3D applications.
Estimation of subjective video quality from objective measurements

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MOVIS (Performance Monitoring System for Video Streaming Networks)
Project number 168219
When watching streamed video over the Internet, e.g., from a sports event, disturbances in service quality annoy the consumer. In the delivery chain live video content is streamed by a content provider through the network of an Internet Service Provider (ISP) to the consumer's home network, and then shown on a PC. Should a consumer experience reduced quality a variety of reasons can apply along the entire delivery chain. Monitoring service quality can help to identify the reasons for reduced quality. In an assessment process a test panel of people have evaluated video content streamed under various conditions. The MOVIS project identified what to measure, including thresholds and weight factors in order to estimate the experienced quality for the consumer. The results have been implemented in a prototype for measuring and estimating video quality.

Reasons for reduced video quality
Factors that could reduce the quality experienced by the consumer are encoding, streaming, the network, equipment in the consumer's home, and viewing conditions. We focused on encoding and networking, since the other factors cannot be influenced by the content providers. Reasons for reduced quality may be found at the consumer's installation or network. Especially bandwidth sharing with other PCs, and the use of wireless networking devices are known to be problematic. Since the consumers often do not know the technical details of their installation, the MOVIS system can detect these conditions.

Estimating video quality
In an assessment process a test panel at the Institut für Rundfunktechnik (IRT) evaluated video content streamed under various conditions, using the SAMVIQ method, also known as ITU-R recommendation BT.700. Video sequences encoded with the Windows Media 9 codec were assessed with different content, frame rates and bit rates. The project results show that content in CIF resolution requires bit rates above 600 kbps for less demanding content, and 1 Mbps for demanding content. Using SD resolution only fair quality can be achieved at 1.5 Mbps, while good quality requires 3Mbps. We also assessed the influence of the networking parameters delay, jitter (delay variation), and packet loss to the subjective quality. Quality degradations become visible when the jitter value surpasses ten times the typical values for an ADSL connection. To be considered as a quality reduction incidental packet loss must surpass a multitude of the values for a typical ADSL connection.

Prototype of a video quality measurement system
The MOVIS project partner Nimsoft implemented a measurement system for video quality, which was applied to content from the Norwegian TV channel TV2. Software probes are installed on the consumer's computer measuring the current objective values of selected parameters (including CPU load and software versions). These data are reported to the service provider, and shown on the so-called “dashbord” which visualizes the service quality for one consumer, and for entire groups of consumers sharing networking resources. The MOVIS system helps to document networking problems, and to detect the reason for quality reductions in order to give the customers better service.

Project Web Page: http://movis.nr.no/
Robust Multimedia Streaming Services (ROMUS)

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Motivation
Computers and communication networks are becoming ubiquitous, but at the same time more and more diverse. This increasing heterogeneity complicates application development. In addition, on a shorter timescale fluctuations and rather large variations in resource availability occur, due to for example wireless networks and mobile devices. The development of robust applications which are able to operate in such varying environments while taking context dependent user preferences into account is difficult.

Developing multimedia applications for such environments is even more challenging, because of demanding resource requirements (e.g., processing- and networking-wise) and the inherent time constraints (e.g., for audio and video data). Timely behavior necessitates applications which during a session are able to adapt to the currently available resources and also seamlessly take advantage of different networks, maybe even concurrently.

We expect that such robust streaming services will be the basis of many large-scale personalized applications, where everybody may both send and receive media content tailored to individual preferences and context.

Research Challenges
In order to operate robustly in such highly dynamic environments, applications should be self-managed. However, a major challenge is to separate and externalize the general aspects of self-management from the application logic itself.

By handling the general aspects of self-management (e.g., adaptation) outside the application, the development efforts can be reduced.

This project will investigate and develop a planning-based middleware framework that will support adaptation of multimedia streaming services organized as a composition of overlay networks. Here, planning refers to the algorithmic reasoning about which configuration of an application is most appropriate given the current context. This allows applications and services to be specified by their behavior and then planned, instantiated, and maintained by the middleware in such a way that the behavioral requirements are satisfied throughout the application life-time.
Temporal Scalable Video Coding for Robust Video Streaming Service (ROMUS)

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Robust Video Streaming Service (ROMUS)

With the massive growth of digital video data consumption and increasing popularity of video streaming applications, higher level interactivity and flexibility are expected in the next generation of video streaming services. The main goal of our project ROMUS is to develop knowledge on how to develop adaptive multimedia streaming services that can deliver video content independently of network technology and end-device capability while maintaining the best possible video quality according to user's personal preferences.

Heterogeneity of networks and end-devices puts the challenges to developing such a robust video streaming service. Furthermore, the streamed media data itself changes over time, which often translates into variable resource requirements in the terms of available bandwidth, end-device processing capabilities and power availability etc. Our current research related to the ROMUS project is focusing on video coding and processing mechanisms that adaptive resource planning can be built upon. One research question is how to utilize multi-dimensional scalable video coding techniques to efficiently produce video streams which can be truncated or tailored in finer granularity respect to variable resource availabilities.

As some initial steps towards robust video streaming services, we have investigated some coding features of the state-of-art video compression standard H.264/AVC. We have proposed a scalable video coding scheme that fully utilizes the benefits of SP- and SI-frames introduced in H.264/AVC to maximize the temporal scalability of video streams. The flexibility provided by scalable video coding comes often at the price of decreased video coding efficiency. We are therefore developing a new rate control algorithm to find the optimal encoding configurations for balancing the trade-off between video coding efficiency and scalable flexibility. Our temporal scalable coding scheme is useful for implementing VCR-like interactive functionality such as fast-forwarding and reversing. It can be also used to facilitate non-error switching between active video sessions.
In the last year, I have carried the research within the area of wireless sensor networks. In particular, we have focused our search on ad-hoc, short-ranged applications. In many applications, the sensor nodes will be densely deployed to detect certain events or monitor a certain area, and the occurrence of such an event will probably trigger many sensors in the same region. So, the correlations in the sensor node measurement will lead to redundant information flow along the network, which will drain the battery faster than necessary. First, we have explored the possibility of applying low density parity check codes as the channel coding scheme. We use an optimization algorithm to minimize the total energy consumption of both the hardware and the physical link. We have performed a detailed trade-off analysis of the circuit energy consumption, the transmission energy consumption, the transmission time, the QAM constellation size and the channel coding rate over transmission distance and correlation values. We have thus obtained a new optimized transmission schedule with much lower energy consumption than a benchmark scheme. Compared to an optimized uncorrelated uncoded transmission scheme, the total energy consumption may be reduced by more than 83.5% for a correlation value of 0.6 and a transmission distance of 100 meters after optimization. This is significant with respect to increasing the lifetime of a wireless sensor networks [1].

Considering the application scenarios, attention should also be paid to the communication protocols. However, current communication protocols are based on a layered architecture, in which each protocol layer only performs certain actions within that layer and is shielded from the operation of other layers. Such inflexibility and sub-optimality usually result in poor performance in ad-hoc networks, especially when energy is a constraint. This has motivated us to explore further on the optimization on cross-layer issues, especially for short-range wireless ad-hoc networks. Some research has already been done in this area, such as in [2], where a cross layer design method was proposed for route configuration in ad-hoc networks. At the same time, in [3], it is shown that for short-range communication scenarios (typically on the order of tens of meters), the power spent in node circuitry can become comparable to that power spent on transmission. Since [2] does not target short-range communication in particular, circuit power consumption is however not taken into consideration there. We have combined the framework from these two articles with ideas from rate-adaptive transmission, and proposed a cross-layer design for route optimization in adaptive, short-range ad-hoc wireless networks. It can be shown that, joint optimization of adaptive modulation and per-hop power control has the potential of giving large energy savings, as well as improved QoS capabilities, for a given multihop route [4].

References


Scheduling for Energy Efficiency and Delay in Sensor Networks

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VERDIKT Program Workshop 29.-30.10.2007

Abstract

Problems related to delay-energy tradeoffs are central in understanding the behavior of wireless systems. In the context of multiuser systems, there exists many open problems related to multiuser scheduling, interference management, quality of service provision and fairness issues. A sensor network in this context consists of a potentially large number of sensing nodes needing to communicate efficiently to a information sink node.

This work has concentrated on multiuser scheduling approaches in a sensor network where sensors are provided guarantees of transmission rate. Two main approaches have been used, one using a quality threshold scheme and another with a queue back-pressure based scheme.

A simple threshold based scheme that opportunistically schedules all nodes whose channel quality is above a certain threshold has been developed and analysed in the asymptotic case with infinite number of nodes. Optimal multiuser signalling is used for transmission.

An energy-delay tradeoff has been found for the scheme, along with asymptotic behavior at high and low spectral efficiencies. The main results indicate that several dB savings in energy can be achieved with increase in delay of a few timeslots only.

A power optimal scheduling scheme utilizing optimal multiuser signalling and queue back-pressure has been developed. The scheme guarantees a long-term rate and bounded queue size for each node while providing a tuneable average transmission delay.
Energy and QoS Packet Forwarding in Sensor Networks

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(Joint work with R. Yu, Z. Sun and S. Mei at Tsinghua University, China)

Abstract—an energy and QoS aware packet forwarding protocol is proposed in Wireless Sensor Networks (WSN)s. The key motivation is to combine the route planning with the dynamic transmission rate configuration. By trading off the transmission distance and the transmission rate, the communication energy can be significantly conserved with guaranteed end-to-end delay requirements. A dynamic programming optimization is formulated. State space partition technique and state aggregation approximation are developed to generate an approximating optimal value function, which is able to significantly reduce the computational complexity.

I. INTRODUCTION

There is an increasing demand in Wireless Sensor Networks (WSNs) applications that require Quality-of-Service (QoS) guarantees. Typical situations include real-time aggregation of multimedia streams in surveillance systems, critical target tracking in military battle fields, and emergent information reporting in industrial control applications. In all these scenarios, the end-to-end transmission delay of messages should be restricted in an acceptable bound such that timely response can be expected. In addition to QoS level, energy efficiency is another key concern in WSNs to guarantee reliable communications since sensors are normally powered by battery and hence the operation lifetime is very limited by the battery capacity.

In this paper, we consider the packet forwarding issue in WSNs. The objective is to develop a forwarding protocol, which can simultaneously address two challenges: QoS and energy efficiency. In particular, we regard end-to-end delay as the QoS requirement and will find the optimal forwarding path to minimize energy consumption with a dynamic rate configuration mechanism.

II. DYNAMIC PROGRAMMING MODEL AND RESULTS

A WSN is modeled as an undirected graph $G(V, L)$, where $V$ is the set of all nodes and $L$ is the set of all directed links. For an $N$-hop path $(v_0, v_1, \ldots, v_N)$, where $v_0$ and $v_N$ respectively, represent the source and destination nodes. Let $r_i$ denote the transmission time allocated to node $v_i$ to forward the packet. The total energy consumption on the path is given by $\sum e(l_i, r_i)$ where $l_i$ is the distance of link $(v_i, v_{i+1})$. Following the dynamic programming formulation, the optimal forwarding policy is given by

$$\mu^* = \arg \min_{\mu \in P(x)} \left[ g_p(x) + \int_{U(x)} f(x, y) dy \right]$$

where $P(x)$ denotes the feasible stationary policy space; $U(x)$ the decision space; $f(x, y)$ the state transition probability density function under policy $\mu$; $g_p(x)$ the average one-hop energy consumption under policy $\mu$ given the current state $x$. $J^*$ denotes the value function under the optimal policy. Fig. 1 compares the proposed protocol Dynamic Programming Forwarding (DPF) with two energy aware routing algorithms: SP-power [1] and PARO [2]. The end-to-end delay is fixed at 2ms. It is clear that our scheme outperforms the other two. For example, when the end-to-end distance is 100m, DPF will spend about 90% less energy when comparing with SP-power and PARO. In addition, the performance gain becomes more significant with larger end-to-end distance, which equivalently shows tighter end-to-end delay, for a fixed delay requirement.

REFERENCES

Minimizing Power Using Large Bandwidth PPM Transmission and DPCM Source Coding

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To prolong the lifetime of nodes in wireless sensor networks, transmission cost should be minimized and processing power should be optimized. For this purpose, we propose a new direct source channel mapping method which utilizes large bandwidth. The system combines a closed-loop Differential Pulse Code Modulation (DPCM) source coder followed by pulse position modulation (PPM) transmission. To accommodate closed-loop prediction over a noisy channel an additional feedback channel is used without increasing the power consumption in the nodes. Two sequential samples are predicted at a time and combined before transmission, thus reducing transmission cost further. PPM's energy efficiency comes from the fact that only one pulse position per source symbol is transmitted and pulse power required increases slightly with the expansion factor M (in this case, M is equal to number of pulse positions per channel use), which also accounts for the information content of a pulse. The major advantage of the system is that minimum processing is required in the sensor nodes while still achieves significant energy efficiency and robustness to error. The system provides a simple way for bandwidth expansion with high expansion factors which is complicated to achieve with the geometric approach as in [2].

![Graph](image1)

**Fig. 1** – SNR vs Eb for different expansion factors M=256, M=1024 and M=4096.

![Image](image2)

**Fig. 2** – Original image (a) vs. received image (b), with E_b/N_0=6 (dB), M=256.

The feasibility of the system is investigated by simulation. The test is performed on 50,000 samples of an AR(1) input signal with correlation factor 0.95. The channel is additive white Gaussian noise (AWGN). Two sequential input samples are predicted at a time and combined to one transmitted PPM symbol. This nearly reduces the power by a factor of two but increases the bandwidth requirement significantly. The result compares the signal noise ratio (SNR) versus energy per bit to noise power spectral density ratio (E_b/N_0) with different expansion factors M as in Figure 1. The E_b/N_0 does not change much when SNR reaches saturation with different expansion factors.

An image transmission system is established to test the practicality of the system. The result shown in Figure 2 is the comparison between the original image and the received image with expansion factor of 256 and E_b/N_0=6 dB. The quality is almost the same except some edge effects.

**References**

*This research is in the context of the Research Council of Norway funded projects WISENET (176424/I30) and SAMPOS (176875/S10). Minh-Long Pham is PhD student at NTNU. Tor A. Ramstad and Ilangko Balasingham are supervisor and co-supervisor professor.*
Health information systems  15:40 – 17:00

Communication and Information Sharing between Patients and Their Care Providers

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Verdict: grant # 176823/S10

Purpose
Improving Shared Decision Making (SDM) and patient-provider communication, and providing all citizens with equal access to health information has become a high priority health policy goal. In this interdisciplinary, international research collaboration we develop and test CONNECT (Care Online: Novel Networks to Enhance Communication and Treatment), a patient portal that integrates a suite of context-sensitive, multi-modal patient communication and information tools into a patient-clinician shared electronic health record that patients can use seamlessly through heterogeneous networks from different locations (home, hospital, doctor’s office). This abstract addresses two of the 5 specific aims of this project.

Methods
To specify essential features, priorities, user requirements and context of use, we are using a series of methods, including scenarios, workshops, focus groups, interviews and observation. We have established an expert group with clinicians and informaticians / system developers who work with us over time to explore and define needs for patient-provider data sharing to support shared decision making (SDM) and continuity of care, and we have met twice with our other international collaborators. Through this process, that is not completed at this time, we are identifying:

- The type of patient information documented today;
- The data that are important to document and share to support SDM and continuity of care, and in which contexts;
- The common data elements and data fields that need be included in a nursing care plan / medical record and that integrates nursing/medical data with patient reported illness experiences and preferences;
- The data and reports needed to support communication, SDM, illness management and continuity of care;
- How these data are integrated with existing standards and requirements (e.g. data security, data structure, terminology standards).
- The organizational issues take into account when developing a patient-clinician shared EHR.

In addition, we are exploring patients’ needs for information sharing through focus groups, workshops and a set of in-depth interviews with a randomly selected subset of patients who are users of Choice and WebChoice, that are building blocks of CONNECT. Knowledge gained from these sessions is crucial for the development of CONNECT’s interface and functions.

A dedicated team of clinicians and patients are active participants in the development process where we introduce one module at the time. So far, the patient-provider communication tool for symptom assessment (called Choice) has been integrated into the EHR and is being tested as part of ongoing clinical practice in 5 hospital units at RR. Based on clinicians’ priorities we have also identified the functional requirements and developed the first prototype of the next module that will provide clinicians with evidence-based, reliable treatment options tailored specifically to the patients’ reported symptoms. A team of end users, designers and usability experts explores and performs usability tests to design a shared user interface where patients and clinicians together can perform treatment and care planning based on patient data and evidence based treatment options.
Health Assets: An Important Aspect of a Patient-Provider Shared Electronic Health Record

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Abstract

This doctoral study is part of a larger project: “Patient-centered Technologies to Improve Shared Decision Making and Continuity of Care” (VERDIKT, Grant 176823/S10), and will explore clinicians’ and patients’ needs for documentation, information, and data sharing to support shared decision making, illness management, and continuity of care in a shared patient record. Healthcare in general and nursing specifically have been criticized for being overly problem oriented and for lacking subjective information as well as a wellness perspective of health and health outcomes. A problem-based nursing and health care approach is not adequate and sufficient to embrace the realities and wholeness of healthcare today. Nor is it adequate to support patient-centered nursing care or patient-provider communication. Problem-based care fails to reflect the core of health: wellness. A stronger focus on patients’ health assets is important because it can counterbalance the problem-based focus to achieve better health and wellness.

The specific aims of this doctoral study are to:
1. Conduct a concept analysis of health assets.
2. Determine what concepts and terms of health assets a) are communicated and documented today and b) should be communicated and documented in the electronic health record.
3. Evaluate to what extent health assets are included in existing standardized vocabularies.

The doctoral study will use a descriptive/comparative descriptive design, combining qualitative and quantitative methods through the following phases:
  a) Concept analysis of “health assets”
  b) Retrospective secondary analysis of cancer patients’ records.
  c) Retrospective, secondary analysis of patient-provider communication of tape recorded admission interviews conducted at cancer patients’ hospital admissions and outpatient visits.
  d) Transcripts of Internet-based online communications between oncology nurses and cancer patients, and between cancer patients.
  e) Focus group interviews with clinicians in oncology care and cancer patients.
  f) Mapping of health assets terms and concepts to standardized vocabulary (SNOMED).

Descriptive and comparative analysis will be used to analyze the data. A meso-level discourse analysis will be used for analyzing the text and communication data (interviews and e-communication).

This study will contribute to: (a) improving the content of patient-provider shared electronic health records by including health assets, and (b) enrich standardized vocabularies through inclusion of health assets to represent patient care.
Seamless integration of information systems: the case of the health care sector

Prof. Eric Monteiro, NTNU and Assoc. Prof. Gunnar Ellingsen, UiTø
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Verdikt project nr.: 179984/ S10
Verdikt project title: Regional communication within and across health organisations

The health care sector is intrinsically heterogeneous in its organisation. There are distinct, formally independent, organisations or institutions that take part in the delivery of health services: municipalities, counties, hospitals, private health providers, (private and public) laboratories and private pharmacies. Yet, the patients – the proper ‘value chain’ – cuts across these organisational boundaries.

This growing awareness of the importance of non-technical issues focuses predominantly on development and use of new applications, i.e. information systems aimed at replacing or supporting manual or paper-based routines. Less attention is devoted to the integration of information systems. This is unfortunate given the high expectations tied to integration. A key reason for the lack of success for many health information applications is the way these, at best, provide local or sub-optimal effects, but fail to achieve benefits for the work processes as a distributed, collective whole.

Accordingly, the integration of healthcare software systems has remained one of the most prominent issues in healthcare software development. Integration is expected to automate the medical processes, such as patient admission, transfer and discharge, ordering of laboratory and radiological examinations or medication.

There is thus a broad consensus about the aim of improving inter- and intra-organisational communication in the health sector. The approach, however, to how to achieve improved communication flows is fiercely debated.

In our project “Regional communication within and across health organisations” we study key integration strategies through sampled, empirical field studies (observations, interviews, documents, logged use of systems).

The project is starting now looking at “Medisinkort” (medication card), a project with pilots in Trondheim and Tromsø, intended to improve medication practices in the municipality by linking closer with hospitals and general practitioners. A second case is the establishment of an interactive laboratory service at the regional hospital in Tromsø.

An early finding is the big challenge to move from prototype/ restricted solutions to full-scale solutions.
Attention and usability issues in computer supported collaboration systems at point-of-care

Ole Andreas Alsos

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While mobile devices are being established in clinical contexts, little is known about the effect of their introduction on the physician-patient communication. A mobile device may act as a support to the clinician when he communicates with the patient but may also draw the attention of the physician away from the patient – a situation that hereafter will be described as 'attention theft'.

We describe a project that will analyze the problem of attention theft as it is experienced by hospital physicians and apply interface design techniques from the field of Minimal Attention User Interfaces (MAUI) and Context Awareness to design and develop a demonstrator interfaces that is optimized for minimizing attention theft. The project will develop usability guidelines for non-distractive information systems at point-of-care.

The research methods applied to the research objectives are (1) field studies to understand the context-of-use, (2) prototyping to develop proof-of-concepts and (3) usability lab experiment to get user feedback and data on developed prototypes.

The first research results indicate that mobile devices used at point-of-care require much cognitive effort by the physician and disturb her communication with the patient\(^1\).

A preliminary conclusion is that mobile user interfaces used at point-of-care should be designed to minimize the required attention from the physician during patient visits to avoid attention theft.

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Dag 2 Tirsdag 30. oktober 2007
Informasjonsteknologiens betydning for samfunnsutviklingen – ståsted 2007

Ola Nafstad, ECON og Jon Hippe, Fafo

Formålet med analysen er å skape økt innsikt og forståelse i hvordan informasjons- og kommunikasjonsteknologien (IKT) bidrar til samfunnsutviklingen. Denne rapporten dokumenterer prosjektets første del, "ståstedsanalysen".

IKT har endret samfunnet grunnleggende. IKT endrer ikke bare betingelsene for vare- og tjenesteproduksjon, men også hvordan økonomiske, sosiale og leveårsmessige forhold i samfunnet utvikler seg. I ståstedanalysen gis et bilde av hvordan og hvorfor IKT har vært en driver i samfunnsutviklingen siden begynnelsen av 1990-tallet. Samfunnsendringen er knyttet til teknologiske revolusjoner, politiske tiltak og politikkutforming, endringer i hvordan teknologien er tatt i bruk. Ståstedsanalysen drøfter også hvilke samfunnsmessige effekter teknologien har hatt i offentlig sektor, næringsliv og i sosiale relasjoner.

Det kan legges ulike forklaringsmodeller til grunn for disse resultatene. En forklaringsmodell tar utgangspunkt i at vi er et av verdens rikeste land og at velstanden har satt oss i en unik samfunnsmessig posisjon, herunder muligheten til å kjøpe og ta i bruk teknologi som behager oss, og vi liker å innrette oss bekvemt.

Den andre forklaringsmodellen tar utgangspunkt i at det norske samfunnet har vist evne til å holde hodet kaldt. Vi har ikke hoppet på tilsynelatende tiltalende høyteknologiløsninger, men hatt evne til å vente og velge de beste løsningene. Vi har ikke drevet fram produksjon av hardware og software, men har overlatt dette til Kina og India, som blant annet har billigere arbeidskraft.
Security  10:30 – 11:30

Security and trust in open source VoIP enterprise systems

Author: Arne-Kristian Groven, senior research scientist, Norsk Regnesentral
Project no. 180054/S10, “Security infrastructure for the open source EUX2010 VoIP system”

This abstract gives an overview of a BIP-project that started in the spring of 2007 and is planned to last for three years. Keywords in the project are; free and open source software, voice over IP (VoIP), private branch exchange (PBX), security, scalability, quality of service (QoS), and trust.

The open source community has in recent years made progress in the effort of making competitive VoIP systems targeting enterprise needs. By creating an integrated platform for communication, companies can benefit from the possibilities of integrating the voice and video communication with a wide array of productivity systems, like calendars, customer relation systems, archives and journalling etc.

Asterisk is one of the main components in such systems, and hence in the project. Asterisk is a software implementation of a telephone PBX. Like any PBX systems, it allows a number of attached telephones to make calls to one another, and to connect to other telephone services including the public switched telephone network (PSTN). Asterisk is released under a dual license scheme, where the free software license being the GNU General Public License (GPL). Due to open source nature of the software, hundreds of programmers worldwide have contributed to features and functionality.

Today, smaller and medium sized companies, also in Norway, have started to implement and use such systems, but there is still a way to go before governmental organisations and larger corporations will follow. In order to do so, trust has to be established both towards free and open source VoIP software, towards the integration of various system components into a whole, and towards the associated vendors and service providers and their ability to serve a large customer over a long period of time. System security is also seen as one of the main issues to be analysed, and hopefully the project will contribute to improved security in such systems.

The group of Norwegian companies participating in the project ranges from companies making business out of free software in general to VoIP service providers. In the first phase of the project the main topic is description and analysis of various configurations and associated security-, QoS, and scalability challenges. Both the SIP and the IAX protocol are investigated from a security perspective. Experimental environments are also established to perform various type of testing and measurements.

By using the unique opportunity of close collaboration between the industry partners of the project and participating end users in the public sector, the project will also look into how to achieve viable business models and mature products for free software solutions in the area of VoIP and PBX systems. We use international competence, represented by Maastricht Economic and social Research and training centre on Innovation and Technology, UNU-Merit, having experience from various EU-projects of relevance.
Privacy Enhancing Technology (PET) for Web based Services

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Project nr: 180069/S10

Abstract

Goal. The overall goal of the PETweb project is to enable communicating organisations to include Privacy Enhancing Technologies (PETs) in large-scale web-based services for the general public and customers.

Rationale. Systems become highly interconnected and the cost of storage is approaching zero for all practical purposes. This means that there is no longer any pressing need to remove redundant or duplicate data with the result that the volume of stored data is enormous and constantly increasing. The web makes it easy to access data and easy to aggregate and correlate data from numerous different sources. In the long run, access restriction alone cannot suffice to protect privacy using traditional methods of access control. Hence, current privacy techniques become difficult to apply since they do not scale adequately to the increased and aggregated volume of data/information. This makes it necessary to investigate new approaches to privacy enhancing technologies in order to arrive at technologies that are scalable, practical and in accordance with relevant legislation.

Objective. The primary objective is to devise a framework to facilitate development of the next generation of PETs in large-scale web-based services. Hence, the project will; 1) define the requirements for using next-generation PETs, 2) analyse and identify gaps and hindrances to the application of PETs and 3) establish a framework to assist in the development of web-based services that includes this next-generation of PETs. In order to make the framework applicable to real-life services the project includes a case study and validation of the results using the national MinSide service.

Results so far. A set of 14 Privacy Principals have been collected. These serve as a tool to integrate the legal and technical requirements for Privacy. The framework itself consists of the following components (so far); a System Architecture, a Privacy Threat Ontology and a Privacy Threat Impact Analysis tool. We will explain the System Architecture that has been devised to model aggregated web-services. This model is input to a Privacy Threat Impact Analysis tool and we outline how this analysis is done. The tool requires a complex model of Privacy Threats to be projected onto the System Architecture in order to consider how the threats interact with the different components in the system. By performing this analysis in an “ideal” case and the real MinSide case we identify gaps in the privacy measures. For the remaining time the project will concentrate on devising appropriate privacy measures (PETs) and evaluate their efficiency.

Finally, some intriguing questions that the PETweb project may find an answer to:

- What kind of threat to privacy is posed by system developers?
- Is the user a significant threat to himself?
- What are the most efficient things a system owner can do to protect their users’ and customers’ privacy in the future?
Secure Heterogeneous Information Presentation – SHIP –
(heterogeneous contents on heterogeneous platforms)

Marc Bezem,
The Programming Technology Group (PTG)
Department of Computer Science, University of Bergen
August 24, 2007

Context and relevance

The networked society is entirely dependent on the access to and use of information. A typical problem for a user is that the information he is seeking is available but not organised in the way matching his actual needs. E.g., it is in a different format which does not conform to the user’s interface, it has a different logical structure which is not handled properly by the user’s software, the user is not authorised to access it, typically, for some security reasons. By the word “presentation” in the title we mean the general process of information disclosure, exchange and use. It poses problems to the user like those just mentioned, and puts serious demands on the service providers in order to circumvent them.

One can distinguish two complementary aspects of this general situation:

(i). On one hand, the user wants easily accessible information structured for his purposes and tailored for presentation in the format available to him – this is the presentation aspect.

(ii). On the other hand, the information provider must not just ensure the widest possible availability of the stored data, but also their consistency across different presentation forms (the information content should be the same no matter on what platform or in what form it is presented) and their security (preventing unauthorised access, etc.) – this is the security aspect.

Problems related to both these aspects can be, most generally, viewed as originating from heterogeneity: of formats and platforms, of demands and expectations, of user types and information content, of communication channels and security objectives. This project addresses the problem of tailoring content (text, sound, images or video) to the possibilities/limitations of various platforms (terminals, PDA, mobile telephone, laptop computer, home video installation) and the preferences of the user (mute, large font or even braille, black-and-white, only the headlines, etc.).
Wireless networks  10:30 – 11:30

An Adaptive QoS Based Rate Control Scheme for Multi-Hop Wireless Mesh Networks

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Abstract — The QoS features designed in IEEE 802.11e serve as building blocks for upcoming IEEE 802.11s wireless mesh networks. However, the IEEE 802.11e standard is originally not designed for multi-hop wireless networks. In this paper, we propose a novel QoS enabled rate control scheme, based on the consideration that packet drop, if desired, should preferably happen at or closest to the source nodes.

Index Terms — Wireless mesh networks, multi-hop, IEEE 802.11e, rate control, delay measurement

I. INTRODUCTION

A wireless mesh network is characterised by a collection of mesh routers connected by wireless links with dynamic features forming a fully connected network. A packet transmitted by a mesh client will reach all other nodes within the connected network via mesh routers. However, in a multi-hop network topology, a node's transmission signal usually cannot reach all the nodes in the network by one-hop. In order to provide communications throughout the network, a sequence of neighbouring mesh nodes form a path and relay packets in a store-and-forward mode, providing an end-to-end connections between any two nodes.

Mesh network can be viewed as a special case of ad hoc networks where the architecture is characterized by a collection of special high capacity, typically static, nodes, called mesh routers, that facilitate communications. End-users of a mesh network, or i, are expected to use the network of mesh routers to deliver their data to proper destinations.

Given the fact that Quality of Service (QoS) mechanisms in WLANs have been standardized in IEEE 802.11e 00 Medium Access Control (MAC), the upcoming wireless mesh networking standard, IEEE 802.11s 0, assumes that 802.11e is already an integral part of the mesh routers. However, the QoS features of 802.11e are designed to provide packet discrimination on a per-hop basis only, thus making it difficult to ensure any kind of QoS in a multi-hop wireless mesh network.

In multi-hop networks, packets traversing over multiple hops might experience buffering at the network layer of intermediate nodes. Meanwhile, nodes that have a central position in a mesh topology might have to relay a large amount of traffic from its one-hop neighbouring nodes. This can lead to packets being dropped due to buffer overflow at the relaying node, or generally poor performance due to the fact that the relaying node has to contend for channel access with all its one-hop neighbours.

In this paper, we introduce a novel rate control mechanism for multi-hop wireless mesh network.
II. Multi-hop rate control scheme

We introduce an implicit Multi-Hop Rate Control (MHRC) mechanism that aims to prevent a node to overload its relaying mesh router. The idea is that a node should adapt its traffic rate according to the resources available at its relaying mesh router.

The scheme is illustrated in Figure 1. Take node A in this figure as an example. It will overhear and measure the total delay of a packet, $T_B$, from being sent out from A until the packet is transmitted by its one-hop neighbor B. Based on this measurement, it will decide whether it should adjust its source rate.

III. Implementation and Simulation Configuration

In our scheme, every node operates with a MAC parameter set $(CW_{min}, CW_{max}, AIFS, TXOP)$ 0 for each one-hop neighbour. We introduce the Next Hop Rate Parameter (R), which decides the values for these MAC parameters. $R(m, ac)$ is a discrete function that is calculated using:

$$D(m, ac) = \alpha D(m, ac) + (1 - \alpha)T_B(m, t)$$

(1)

$$R(m, ac) = \left\lfloor D(m, ac) > \text{Threshold} \right\rfloor$$

(2)

where $m$ is the next-hop node and $ac$ is the traffic class, $(m, t)$ is the measured delay through node $m$ at time $t$, and $\alpha$ is a smoothing parameters which is set to 0.9. The MAC layer parameters are set according to the value of $R(m, ac)$.

To evaluate the performance of the proposed multi-hop rate control scheme, ns2 0 simulations have been conducted based on a static multi-hop wireless network.

IV. Numerical Results and performance evaluation

We compare the performance of our proposed MHRC scheme versus a pure 802.11e based network with the same configuration, in terms of throughput, delay and packet loss.

As illustrated in Figure 2, the throughput performance of these two schemes is basically the same when the network load is low. On the other hand when the offered traffic load is heavy, the throughput of the highest priority class has better performance under MHRC, at a cost of lower throughput for the lowest priority traffic class.
The MHRC scheme aims to reduce the packet rate transmitted into a network in a congested state, and rather drop packets at the edge of the network and not after already traversed intermediate nodes consuming bandwidth.

Figure 3 shows the ratio of packets dropped by the source nodes due to buffer overflow. As illustrated, the MHRC scheme drops slightly more packets than at the edge than IEEE 802.11e when traffic load is heavy, which is the desired behaviour. As a consequence, smaller number of packets has been injected into the core mesh network. That is, the core mesh network becomes less congested due to this rate control, and the intermediate mesh routers would forward fewer packets consequently. This result explains the results in from Figure 4 which show that less packet drop ratio has been achieved at mesh routers when the MHRC scheme is employed.

Figure 3 Source buffer overflow rate per AC for multi-hop network

Figure 4 Network buffer overflow rate per AC for multi-hop network

V. Conclusions and further work

We have proposed a congestion control scheme that takes into account the congested state of the next-hop mesh router. We argue that this is a more desirable feature in a multi-hop network, than using the state of the local channel as an indicator of congestion. The performance of the proposed scheme has been compared with that of IEEE 802.11e through simulations and we have demonstrated that our proposed scheme reduces the number of packets drop due to buffer overflow.

References
IEEE 802.11 WG, LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: Amendment: ESS Mesh Networking , Draft 1.0, November 2006.

Multi-homing with Load Balancing for QoS-aware Multi-hop Wireless Mesh Networks

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Abstract—While various wireless mesh networks are emerging in both residential areas and university campuses, challenges exist for successful deployment of mesh networks with user QoS satisfaction. This paper presents an approach which uses multi-homing as a means for achieving QoS in wireless mesh networks used for broadband access.

1. Introduction
While diverse application scenarios are emerging for mesh networking, using multi-hop wireless mesh networks as a means for broadband Internet access in municipalities appears as a promising application paradigm. Given the fact that bandwidth decreases dramatically as the number of hops increases in multi-hop wireless networks, how to provide QoS to end-users remains as a challenging task. One of the key techniques to tackle this problem is load balancing, through which various types of traffic inside a mesh network could be re-directed when necessary, in order to ensure flows with QoS guarantees can find the best paths.

One the other hand, multi-homing is regarded as a powerful technique for achieving, for instance, higher system reliability when a network is multi-homed (e.g. with multiple gateways towards other networks), or better flexibility and compatibility when a device is multi-homed (e.g. with heterogeneous interfaces towards other systems). In this paper, we focus on the first case where multi-homing is meant that multiple gateways are available in a mesh network connected to the global Internet. In addition to their roles for achieving higher reliability, the gateways will be used also for achieving better QoS with load balancing. Different from the conventional hop-count based routing which always chooses the shortest path for selecting a default gateway, regardless of traffic status in the network, our approach selects the best gateway in terms of least congestion dynamically, in order to provide QoS to certain flows.

In the following two sections, we describe firstly the QoS framework defined in our approach and then present how multi-homing functions in this framework and its implementation.

2. QoS framework in mesh networks
The QoS mechanisms adopted in our networks include traffic class priority definition, flow identification and classification, traffic load status measurement, Connection Admission Control (CAC), etc. In the following, we describe relevant information to a few aspects.

2.1 QoS class definition
The traffic class definition is tabulated in the following table. These traffic classes are further mapped to four WMM Access Categories, as classes IV and V -> AC 3 (highest priority), III->AC 2, I and VI -> AC 1, and II, VII, VIII -> AC 0 (best effort). One major difference between the conventional QoS definition and ours is the different treatment of high bandwidth-demanding multimedia applications. While the conventional QoS vision puts Application Class VI in the second highest priority class of WMM, (AC_VI), we allocate this traffic typology to the best effort class (AC_BE). In other words, while the conventional QoS definition focuses mainly on delay sensitivity and bit error rate of an application, we have further considered bandwidth requirement of an application, in addition to its delay sensitivity. Moreover, our QoS definition is not node-
based, but flow-based, which means that the traffic flows generated or received by a node may belong to different classes, as time varies.

**Table 1: Traffic Classification.**

<table>
<thead>
<tr>
<th>Class</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Strong latency constraint, small bandwidth (VoIP, chat)</td>
</tr>
<tr>
<td>II</td>
<td>High throughput (transaction processing, file transfer)</td>
</tr>
<tr>
<td>III</td>
<td>Interactive, best-effort (web browsing, e-mail.)</td>
</tr>
<tr>
<td>IV</td>
<td>Routing, battery information</td>
</tr>
<tr>
<td>V</td>
<td>Emergency calls</td>
</tr>
<tr>
<td>VI</td>
<td>High throughput and latency constraint (streaming video)</td>
</tr>
<tr>
<td>VII</td>
<td>P2P applications</td>
</tr>
<tr>
<td>VIII</td>
<td>Unclassified traffic</td>
</tr>
</tbody>
</table>

In more details, applications are classified based on their QoS requirements, as presented in Table II. Application Classes I, II, III are defined based on the conventional QoS classification. Classes from IV to VII have been defined in order to allow finer service differentiation policies. It is also worth noting that our QoS class priority definition gives priority to traffic flows belonging to application Class III services, in normal conditions. When emergency calls occur, nevertheless, priority will be given to Class V traffic.

### 2.2 CAC

The overall goal for using CAC in our framework is to keep the network working in less saturated conditions in order to ensure QoS. More specifically, CAC is done in a distributed manner, i.e. each mesh router makes its decision relying on locally available information. Based on the measured available bandwidth, the mesh router is going to decide whether a request should be accepted or not. However, the CAC procedure applies only to application types not belonging to the essential set of services. To keep the network not saturated, a combination of scheduling and buffer management is used together with CAC.

### 2.3 Load status measurement

In order to implement load balancing, the traffic load status must be measured at each gateway node and each mesh router. This measurement is performed by a software tool installed at these loads and the measurements are conducted periodically.

### 3. Multi-homing for QoS

This section describes the basic idea of our multi-homing approach, its implementation and gives an example for illustration.

#### 3.1 Multi-homing and load balancing

With our multi-homing approach, a mesh router uses a metric-based policy to select its best gateway towards the Internet. These metrics could be for example link and path capacity, traffic load or other QoS parameters. Three types of load balancing have been considered in our network, namely load balancing among channels, paths and gateway nodes. Given that two or more channels co-exist between a pair of nodes, if one channel is close to congestion, another channel should be used. Similarly, if one path is over-loaded, the routing table calculation process will re-calculate a new path. For multi-homed networks, the traffic load status is monitored at each gateway and is disseminated to other nodes inside the network. Once this information is available
at each mesh router, the router could re-route its traffic towards a lighter-loaded gateway. This process needs to be carried out periodically so that the traffic load through the whole network is balanced among available gateways.

### 3.2 Implementation brief

We have implemented the QoS framework described in the above section. Particularly, the multi-homing functionality has been implemented as an enhancement to the Optimized Link State Routing (OLSR) routing protocol. To do so, the following modifications have been implemented:

1. **Load status dissemination.** The measured load status at each gateway as well as each mesh router will be flooded to all routers inside the same network. This information is carried out by a modified Host and Network Association (HNA) message which appends a new field to carry out QoS metrics like load status.

2. **Metric-based routing table calculation.** Based on received load status, each router will decide which gateway as the default gateway to carry out traffic and the best path towards the default gateway.

### 3.3 Multi-homing example

The following figure illustrates a simple example of the implemented multi-homing mechanism, where Nodes A and D act as two gateways and Nodes B and C are going to select their default gateway based on load status.

![Figure 1. A simple example of multi-homing with load balancing.](image)

In the beginning, both gateways announce their GW Status (GWS) values, as 1. In this case, Node B will choose Gateway 10.0.0.1 as its default gateway which is one hop away from it, and Node C will choose Gateway 10.0.0.7 as its default gateway for this same reason.

Now the GW Status Values are advertised as for Gateway 10.0.0.1 as 15 and for Gateway 10.0.0.7 as 10 respectively, as depicted in the figure. As a result, Node B will also choose Gateway 10.0.0.7 as the default gateway by using the Dijkstra’s algorithm.

### 4. Concluding remarks

In this paper, we have presented a QoS framework with its implementation for multi-homed mesh networks which are used for broadband Internet access. In such networks, multiple gateways are deployed for achieving higher reliability and load balancing. Ideally, the QoS routing mechanism works on a per-traffic-class basis so that flows with higher priority could be transferred to least-loaded gateway nodes, in order to achieve best QoS.
Abstract
Estimating channel state information (CSI) in the fast fading conditions is very challenging. In this work, a simple structure for cooperative diversity in decode-and-forward mode is examined, in which the transmitter, the relay and the receiver do not require to know CSI. In this scheme, transmission of information is done in a two phase process. In the first phase, differential modulated signals are radiated from the source. After decoding the received signal in the relay side, the source and the relay collectively send information using differential space-time codes. Thus, we employ the differential modulation based on [Hoc00] in a relay-based system that operates in decode-and-forward (DF) mode. We develop a distributed differential space-time system based on [Mah06] and [Mah07], which uses Alamouti scheme as a unitary matrix.

Decoding at the destination is based on the transmitting MPSK differentially modulated signals in both phases and the source node contributes in transmitting signals in the second phase. Two decoding scheme for the proposed system are employed. While the ML decoding technique, results in optimum performance, it will be shown through simulations that MRC suboptimum detection also achieves close to this optimum performance.

Then, we analyze the pairwise error probability (PEP) of the system. Furthermore, a simple power control scheme based on minimization of PEP is considered. In other words, the optimum power allocation in high SNR scenarios has been obtained using an analytical method. An interesting property of the optimum point is that it is independent of the channel statistics and the position of the relay, which improves its feasibility in the future communication systems. Numerical simulations show the correctness of the analytical results.

References:
Usability 10:30 – 11:30

Mobile, Secure and Seamless Mobile access to Electronic Health Records (EHR)

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Dr. Haakon Bryhni, University of Oslo, Department of Informatics

Purpose
The results reported are results from a technical verification study (aim 2) that is part of the CONNECT (Care Online: Novel Networks to Enhance Communication and Treatment) project. We show how a patient can get secure and seamless access to a subsection of the hospital Electronic Health Record (EHR) using a mobile terminal. Our prototype implementation demonstrates how a context-sensitive, multi-modal patient communication and information tool can be implemented in legacy mobile terminals. A mobile phone, available to most patients, is enhanced using state of the art technologies to ensure adaptation, readability, mobility and security to ensure simple access to personal health records while the user is moving seamlessly through heterogenous access networks, and accessing and interacting with the EHR from different locations.

Method
To verify and solve critical technical issues, we have chosen a prototype implementation approach, where elements of the Choice and WebChoice applications are mobilized using standard mobile terminals enhanced with technologies for device-independent display, fonts and other user interface features, mobility and security technologies.

Key research issues
Key research issues in the project include verification of usability and readability that is needed on a mobile platform with limited display size and diverse user interfaces. We explore how we can create a WebChoice client that has the same user interface and "look & feel" on mobile phones from different manufactures and with very diverse technical specifications, and novel methods for creating a secure authentication and encryption to handle of sensitive information in highly mobile environment?

The Mobile WebChoice prototype
The mobile WebChoice client is an extension to the Web-Based WebChoice system. The Mobile client lets the patient access some of the functionality in WebChoice when the patient is away from home. The mobile client is programmed in Java MIPD 2.0, supported in all recent mobile terminals.

Main functionality in the mobile WebChoice application includes registration of symptoms, access to database for evidence based information and access to chat and forum resources. When using the Web-based WebChoice the patient needs a computer and must be online. When traveling away from home it can be difficult to access the system. Most people today uses a mobile phone and by using this device to access the system we solve the accessibility problem, but are facing other challenges on usability, connectivity, mobility and security challenges addressed in this project.
Context sensitive systems for mobile communication in hospitals

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Abstract for the Verdikt 2007 Conference Project number: 176852/S10

A variety of communication problems are common in current hospital settings. One of the problems is that physicians often only use pagers, both for personal and role based communication, as their main device for mobile communication. The pagers suffer from limitations due to their simplicity, but also have the advantage of limiting interruptions in comparison to wireless phones [1].

The primary research problem we are targeting is how to design a mobile device for physicians that will balance communication availability while limiting interruptions. This device will support both voice and text, and should have interactions forms for text messaging and work role switching. Several issues related to this are role based and individual contact, voice services, text-messages, and paging. The communication system that we will develop in this project will focus on making the work and workflow for the physicians’ easier, as well as the workflow of other people that communicate with them.

Our approach is based on an initial study performed at the Oncology Department at the University Hospital of North Norway [1], and an extensive collection of user needs according to CSCW. In this project we will perform quantitative studies at another department at the same hospital, and have been in contact with several surgical departments, since these departments often is busy and have a high degree of communication needs. The study will be completed in three phases: the first phase will focus on participatory observations and use cases. The second phase will focus on a questionnaire which we will develop from what we learned in the first phase, and then distribute it to the physicians of the department that we will collaborate with. The third phase will focus on the data collected in the previous phases and help us make scenarios which we will present to the users, at a workshop, and then formulate a second questionnaire. The results from the second questionnaire will help us design specifications to develop a communication prototype.

The system has to have a high degree of stability and reliability since every call is a potential emergency call. If one emergency call not reaches its recipient, it could be lifethreatening for the patients involved. Another issue we have to have in mind when designing the system is that some doctors may have resistance of using a new system like this [1]. It is therefore important that our system will work together with the existing telephone and paging system. The doctors should have the opportunity to choose an ordinary pager or DECT phone within the existing telephone or paging system, without any reconfiguration of our system. This could limit our system due to a possible integration problem with the existing hospital infrastructure.

The idea is to equip the doctor with only one device which will act as both a pager and a phone. This device will replace both the personal- and the role- pager, and the DECT phone. The physicians’ should directly on the device make rules on when they are available. These rules can be like “I’m only available when I’m in my office” or “I’m always available, but not when I’m in a patient room”. We could also have a system on the device for switching work roles. The device will also be equipped with a tracking tag, which will tell the system where the device/physician is, and thereby help the system to decide what to do with the call/page.

References:
Can a picture do the talking?
The M2S prototype for studying usability issues of mobile multimedia information retrieval services

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ABSTRACT
The CAIM (Context-Aware Image Management) project introduces image context-awareness as a means of supporting image-based information retrieval in distributed and mobile environments. An image can be associated with structural metadata, context metadata and semantic metadata, and knowledge of this information can enhance the quality of the information retrieval process. By combining structural metadata and context metadata we believe that semantic information can be identified, and possibly contribute to close the semantic gap between user information requests and the shortcomings of current content-based image retrieval techniques.

The CAIM project focuses on research and the development of tools for context-aware image management, where image description, query formulation, retrieval from heterogeneous distributed environments, and ranking are designed for using context information. The project also involves:
Description of scenarios to identify situations and uses where instant access to images from mobile terminals represent value to the customer
Prototyping of mobile services that are described in the scenarios Studies of user acceptance of mobile multimodal information retrieval services. In this paper, we present M2S, an application prototype for mobile phones that supports discovery of services (tourist attractions and facilities) in general, and more specific, provides tourists traveling in a certain region easy access to dynamic updated information about tourist attractions. M2S enables search in a database based on a query formulated as an image and submitted as an MMS. A single picture, taken by a camera phone, initiates an interchange of MMS messages and thereby a dialogue with a service provider (and finally access to relevant information for decision making).

The prototype implementation and testing of M2S has demonstrated the feasibility of a mobile image-based search system that takes images of announcements as queries and finds relevant multimedia content by matching them to similar images in a database. Even in this limited universe the need for further research on CBIR system turns out critical to the success of such system. Our prototype evaluation has in addition pointed to several issues concerning usability that needs to be further addressed, including:
Query formulation and usefulness – A single image constitutes the query, but what kind of query is actually posed when the image is submitted? And is this query in line with the user’s intention? What kind of images will users typically take? What will they expect when sending an image? What kind of images will be on the system? How often will users be happy? Often with IR systems users will get back quirky answers or complete misses.
Query quality and ease of use – Assessment of quality is linked to confidence in and need of high recall and precision. Further, there exist some specific technical requirements related to tourist traveling which the content based image retrieval should consider, including being outdoors, lighting, movement and picture quality.
Response time and interaction speed – In a mobile setting the response time is often critical
Result ranking and presentation – An exhaustive or detailed result presentation might counteract ease of use and efficiency. If a dialog is needed, perceived efficiency might be reduced.

For most of these issues, the utilization of context metadata including location, time and other, might benefit the users and stimulate higher use.
Beyond these issues, studies of information-seeking behavior among image/video users as well as traditional technology acceptance studies addressing ease of use, usefulness and enjoyment of mobile information retrieval solutions need to be done.
Improving application delay for thin streams

Andreas Petlund
Research Fellow / PhD student
University of Oslo / Simula Research Laboratory
Networks and Distributed Systems
Project: RELAY / MiSMoSS

Protocols that provide reliable transfer have retransmission mechanisms that are optimized for greedy traffic (like downloading and high-rate streaming). Many time-dependant network applications, however, exhibit thin-stream traffic characteristics. This means that the thin-stream applications transmit data relatively seldom, and that the packet sizes are small. Examples of such applications are: Terminal services (like Remote Desktop and Citrix), stock exchange systems, IP telephony, sensor networks, control systems and online games. Analysis of such network traffic reveals application layer latency of several seconds when experiencing loss. Such high latency is unacceptable, since many of the applications that have thin-stream characteristics are time-dependant (interactive, with stringent latency requirements).

We investigate mechanisms to reduce the maximum latency experienced for thin-stream applications. This is done by modifying the retransmission mechanisms and by bundling unacknowledged data. The modifications introduce an element of redundancy, but significantly improve application layer latency for thin streams.

Because the thin streams consume such a small amount of bandwidth, the redundancy has very little impact on general network performance, and is therefore tolerable. We develop algorithms to dynamically identify thin streams, and activate the mechanisms only when thin-stream properties are displayed. Thus, the improvements can be integrated in standard network protocols without infringing on fairness.
Group communication for distributed interactive applications

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RELAY (MiSMoSS)
Networks and Distributed Systems
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Abstract:

Distributed interactive applications such as virtual environments and online games currently have millions of users and generate more money than the movie industry. The interactivity in virtual environments imposes restrictions on network latency, especially in highly interactive virtual environments. Considerable attention has been given to latency reduction in distributed interactive applications. Research areas such as graph theory, protocol optimizations, group management and multicast protocols are all necessary for the further enhancements of distributed interactive applications. In our research, we use application layer multicast with a centralized approach to the group management. The groups are organized in overlay networks that are created using graph algorithms.

We investigate many spanning tree problems, for example, steiner minimum tree, minimum diameter tree, bounded diameter minimum spanning tree. The tree problems are combined with constraints on degree and latency. In addition, we investigate dynamic tree algorithms that may insert or remove single nodes from a tree. In contrast, spanning tree problems create trees from scratch, i.e., total reconfiguration. We use core selection heuristics that search for stronger users, to use them as strongly connected forwarding nodes in a tree. Furthermore, we investigate prune algorithms that reduce the number of available links to a tree algorithm. We evaluate how different algorithms handle the dynamicity in terms of total tree cost, average degree and latency, algorithm execution time and tree stability.
Reducing the Network Latency and Bandwidth Requirements of Parallel and Distributed Applications

Lars A. Bongo
Ph.D. student,
University of Tromsø

Often there is a cost or availability incentive for running a communication intensive parallel or distributed application on a platform with lower bandwidth or higher latency than currently required.

To reduce the network latency requirements of parallel applications we adapt these to the application and platform in use. Such adaptation requires performance analysis of a large volume of message traces collected internally in the communication system. We propose a framework for building scalable runtime monitors that do not significantly perturb the monitored application. The contributions are: (i) a monitoring framework. It supports the development of a wide variety of trace based monitors, (ii) Approach for scalable message tracing with a very small memory footprint where message traces are processed at runtime by threads run on the cluster nodes, and (iii) Approach for exploiting underutilized compute and network resources to run a monitor on a cluster with very low perturbation of the monitored application.

To further reduce the latency of collective operations used for global synchronization of parallel application threads on a WAN multi-cluster, we implemented a new operation that has the same latency on a WAN multi-cluster as on a single cluster for most global condition evaluations. Our contribution is: an allreduce operation that can complete for most cases without WAN communication, and that does not change the application result.

Our third approach to reduce the network latency requirements of parallel applications is to overlap communication wait time with computation by overdecomposing a parallel application. The contributions are: (i) method for performance analysis of overdecomposed applications, and (ii) performance study of overdecomposed NAS benchmarks run on the first generation processors supporting SMT.

Our approach for reducing the network bandwidth requirements of distributed applications is to divide the transferred data into segments and then eliminate redundant transfers of segments. Previous approaches do not work well for compressing multi-dimensional data, such as 2D pixels in remote data visualization and high-dimensional scientific datasets. In addition, large segments are required to achieve a high compression ratio. Our contributions are: (i) a framework for global compression using two-level fingerprinting and application specific segmentation, such that the same compression engine can be used with different application specific segmentation methods, (ii) two-level fingerprinting protocol for efficiently encoding unique segments, such that smaller segments can be used to improve redundancy detection, (iii) a novel 2-dimensional content-based segmentation approach for remote visualization data, (iv) design and implementation of a very large cache on disk for storing previously sent segments, and (v) a network bandwidth optimized, platform-independent remote visualization system using two-level fingerprinting to reduce end-to-end latency of screen updates.

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2 This work has been supported in part by the following NFR funded projects:
NFR 159936/V30, SHARE - A Distributed Shared Virtual Desktop for Simple, Scalable and Robust Resource Sharing across Computer, Storage and Display Devices, NFR 155550 Display Wall with Compute Cluster, and NFR 164825 Dynamic Adaptive Architecture - Princeton and Rutgers Visit

3 In collaboration with Otto Anshus, John M. Bjørndalen, Tore Larsen (University of Tromsø), Kai Li, Olga Troyanskaya, Grant Wallace (Princeton University), Brian Vinter (Copenhagen University)
Mobile services 13:00 – 14:10

Locatext: Using locative media to experience literature

Anders Sundnes Løvlie
Research fellow the INVENTIO-project
University of Oslo

The development of multimedia-capable cell phones with high speed internet connection and GPS receivers opens up exciting new possibilities. Content can be tailor-made to be relevant for a specific user at a specific location - such as a historic square in a city, a “point of interest” on a highway route or an item at an outdoor exhibition. Opportunities for innovative new travel guides, museum/exhibition-presentations and personalized (and potentially intrusive) advertising are easy to imagine. But can the locative technologies affect our experience of text itself, and give birth to new forms of text? The Locatext project aims to investigate this question by means of a series of prototypes for locative media texts. The first one, which will be described in this presentation, focuses on the experience of literature.

The technology of writing made it possible for literature to be freed from its original context in time and space (the oral tradition of literature). Even so, literature has always been concerned with describing places and locations, often in great detail and with much effort and creativity. Such descriptions have often come back to influence the space itself: A walk through the old parts of Prague, for instance, reveals a large number of references to the literature of Franz Kafka, often surrounded by tourists walking in the writer’s footsteps.

Locative technology makes the opposite experience possible: Instead of searching for a place described in literature, one can search for the literature describing a particular place. The Locatext project uses a database of literary excerpts connected to a variety of physical locations in a relatively small part of Oslo. Walking through this area with a GPS-capable cell phone and the project software, a user can “surf” through a variety of literary texts describing or commenting on the locations the user is passing by. A relatively simple Java program is used to collect location data from the GPS receiver and retrieve appropriate literary samples from an SQL database online. The literature can be experienced as visual text on the screen, or as streaming sound, allowing the user to keep her eyes on the road.

Judging by the attention given to local writers in local media (at least in Norway), the interest in high literature among the public at large is – unsurprisingly – highly increased whenever the literature is related directly to our local environment. It might therefore be presumed that a localized experience of literature may help gather interest among pupils in an educational setting, as well as the general public.

The presentation will include a detailed model of the program and the database used in the project, as well as a virtual demonstration of the server-side part of the system (in an early version; the system is expected to still be under development at the time of the conference).

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This question is valid both for verbal text and multimodal text, but in this presentation the focus will be on verbal text – either in the form of print (screen text) or voice recordings.
Between the tag and the screen: Tangible interaction on mobile handsets

Kjetil Nordby
The Oslo School of Architecture and Design
PHD student

Supervisor Andrew Morrison, Assoc Prof. Intermedia, UiO/Prof II AHO
The PhD is part of the Touch project (Verdikt 171888/S10).

The term 'near-field technology' describes very short range radio transmitters that can read and write information to small, wireless tags known as Radio Frequency IDentification (RFID) tags. Near-field enabled devices afford a type of interaction that appears to require contact between a device and the RFID tag, often described as touch interaction. The touch interaction form has received much attention since it can provide near-field enabled mobile phones with instant access to contextualized services. We consider touch interaction to be within the domain of tangible interaction. Hornecker and Buur describe tangible interaction as an umbrella term dealing with systems relying on embodied interaction, tangible manipulation, physical representation of data, and embeddedness in real space.

Research dealing with near-field enabled mobile phones has focused on the screen as output and the keypad as input for interactions after the initial touch interaction has been performed. The tangible nature of touch interaction has been largely overlooked. Inspired by previous work within tangible interaction this work aims to create a detailed understanding of the tangible mechanisms present in touch interaction on near-field enabled mobile phones. To do so we ask:
(1) Can we create models that can elevate the understanding of the tangible parts of near-field enabled mobile phones?
(2) Can we create concepts that can inspire and inform the development of new touch interaction systems?

Our approach involves experimental design based research. Moving between creation of interactive prototypes and reflection on them is central to our process. This allows us to construct a model of touch interaction and new interaction concepts on near-field enabled devices out of an applied experimental frame.

The current results of this ongoing project indicates potential richness and complexity within touch interaction techniques. Our results will inform the creation of new near-field enabled applications and provide the research community with a better understanding of this domain.

The PhD consists of 3 cases with practice-based research experiments and a final contribution contextualizing and reflecting on the findings within the emerging field of interaction design.
WISECAR Intelligent driving assistance systems for improved safety and efficiency in transport

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ABSTRACT
There are numerous available ICT based products and services for road users and the growth has been extensive. Such products could be supplied by the car manufacturer. However, an increased amount of products are supplied by small and medium sized enterprises, competing on small niche markets. Mobile ICT solutions, telecommunication and next generation positioning techniques enable a considerable market for new and improved products and business opportunities.

This paper presents a Norwegian research initiative; the WiseCar project. The project aims at developing mobile ICT products and services for improved safety and efficiency in transport.

KEYWORDS
ADAS, product development, innovation, evaluation methodology.

BACKGROUND
Technological development opens up for increased communication between vehicles in motion and between vehicles and infrastructure. The CALM standard (Continuous Air Interface for Long and Medium range) will enable such communication. Thus, CALM could also contribute to increased traffic safety and efficiency by enabling increased dynamic traffic information to the drivers and to the driving assistance systems. This opens up for improvement of existing products and for developing new products. Real time updating of input data in products like navigation tools and ISA products (Intelligent Speed Adaptation) is a challenging task, which has not been solved yet. CALM will represent a significant technological shift toward solving this task.

Numerous driving assistance systems are available. Such systems provide positive contributions for both safety and efficiency in transport, and can also be regarded as comfort adding systems. However, with the exception of positioning data, such systems have to a limited degree built in features with dynamic updating of data. Customization and adaptation of driving assistance systems for use in Norway represent an additional challenge, due to our topography and lack of real time data available for product suppliers.

Developing and utilizing wireless communication solutions are essential in order to refine existing products and develop new ones. For the Norwegian situation, an additional essential factor is to develop a dynamic traffic information database, which is available for product and service suppliers.

THE WISECAR PROJECT
The WiseCar research project aims at developing mobile ICT products and services for improved safety and efficiency in transport. This shall be obtained by fulfilling the following sub goals:
1. Specifying functional and technological requirement specifications for wireless infrastructure enabling automatic communications between mobile units
2. Developing common information platform for traffic data, enabling both public and private data suppliers and users
3. Developing and testing mobile ICT products, which utilise the above mentioned wireless infrastructure and information platform
4. Developing evaluation methodology for HMI, safety and efficiency effects
5. Dissemination of results by commercializing products and services, scientific and popular science publications at both a national and international level
The project period is 2007 – 2011, and the project is funded by the Norwegian Research Council and the participating partners.

WiseCar is based on three foundation pillars;
- Developing and adjusting technological platform
- Developing methodology of evaluation
- Product development

The project and its pillars are illustrated in Figure 1.

![Figure 1: The WiseCar foundation pillars]

**TECHNOLOGICAL PLATFORM**
There is a need for research and test of wireless communication with and between vehicles in motion. Research needs cover open standards, capacity in regional digital net, data security, interface with the vehicles internal systems and systems for operation and administration of communication. CALM will represent an important premise for realization of products and services which are based on dynamic updating and real time information. The project aims at developing a system for handover within the same communication medium; handover between base stations in a WLAN network. This represents an important research challenge.

A common information platform which integrates traffic data with information relevant for traffic safety will be developed. This platform should be available for both private and public partners in order to support product and service development and refinement. Several national databases will be of importance; databases which cover static information about the infrastructure, dynamic information about incidents, digital maps with point of interests, etc. Two main challenges will be to provide access to the information platform for SMEs and including data from numerous small information suppliers.

The main challenges in this task are:
- Wireless communication
- Information carrier
- CALM
- Common information platform for traffic data
- Digital map

**METHODOLOGY OF EVALUATION**
There are no complete established and common accepted methodology for testing and evaluating products and services for use in traffic. Some guidelines for evaluation of Human-Machine-Interface are used both in EU and USA. These are however somewhat superficial.
Thus, there is a need for developing a methodology which covers both efficiency and traffic safety consequences of products and services. It is not sufficient for products to have a good and intuitive interface if the product on the other hand distract the driver too much and thus creates possible unsafe situations. Important evaluation measures are behavioural consequences of using the products and services, and how this behaviour affects the efficiency and traffic safety. These evaluation measures are important in order to estimate the products’ market potential in early phase innovation.

A methodology which takes these considerations into account will be developed within the WiseCar project. The methodology will provide tests for HMI, efficiency and safety effects. This requires professional skills and laboratory facilities in several areas, among them:

- Traffic; performance, efficiency, etc.
- Human factors; HMI, mental capacity, risk factors and handling, etc.
- Methods for measuring and investigating behaviour

The WiseCar methodology will employ the behavioural laboratory at SINTEF and NTNU, which consists of a driving simulator for both private and heavy goods vehicles, an instrumented personal vehicle and road side traffic registering equipment.

PRODUCT DEVELOPMENT
The WiseCar project aims at developing mobile ICT products and services for improved safety and efficiency in transport. Thus, product development will be an important part of the project. We have developed a unique cooperation model for facilitating the creative process. SMEs, public bodies and research partners cooperate in this model. The SMEs are partly competitors and partly operating at different levels in the value chain

Based on the development of the presented technological platform, numerous new and refined products and services can be realized. Product examples are:
Driver training products - E-learning products - CALM products - Location based services - Intelligent Speed Adaptation products - Infotainment products

It will be a main objective to include dynamic elements in existing products in addition to the development of new products. The WiseCar project is in its early stage. However, the first product has already been introduced in the Norwegian marked. This product, VIIsa, is a Norwegian ISA product.

PROJECT PARTNERS
The WiseCar project will be carried out by a Norwegian consortium consisting of partners from industry, research institutes and public sector. The partners are:

- Q-Free ASA: Industry partner
- SINTEF: R&D partner
- Norsk Navigasjon AS: Industry partner
- Leksvik Teknologi: Industry partner
- MapSolutions AS: Industry partner
- P4 Radio Hele Norge ASA: Industry partner
- VegInformatikk AS: Industry partner
- Public Roads Administration: Public partner

In order to fulfil the main goals, WiseCar should in addition cooperate with international partners and projects. We will try to establish a close relationship with the ongoing EU projects CVIS and SAFESPOT, and will in addition establish a new consortium which aims at the applying for a new EU project based on the WiseCar model.
Feature extraction  13:00 – 14:10

Attribute detection and knowledge integration for automatic speech recognition

Marco Siniscalcho and Torbjørn Svendsen,
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Abstract:
Current state-of-the-art automatic speech recognizers have error rates that are at least one order of magnitude higher than human error rates on a wide range of tasks. The availability of increasing amounts training data show evidence of giving less returns in terms of performance, and it is a growing agreement in the research community that new approaches are needed to bridge the performance gap between machines and humans. It has long been postulated that humans determine the linguistic identity of a sound based on detected evidence that exists at various levels of the speech knowledge hierarchy. This evidence is collectively termed speech attributes.

A major goal of the SIRKUS project is to develop a detection-based paradigm to automatic speech recognition (ASR) based on attribute detection and knowledge integration. Some of the basic concepts of attribute detection have been applied to build a continuous phone recognition (ASR) system.

Fig. 1 below shows a block diagram of our detector-based system which consists of three main blocks, (1) a bank of speech event detectors, (2) a event merger, and (3) a evidence verifier. In this figure, we show also a set of front-ends since different speech parametric representations may be eventually used for each detector. The evidence verifier may output either the best decoded hypothesis, or a lattice of hypotheses. The latter could be used for further refinement steps, such as lattice rescoring. In this work, the evidence verifier provides only the first best hypotheses.

In this bottom-up, knowledge-rich modeling paradigm the goal of the bank of attribute detectors is to produce consistent detection results, even in adverse condition; the goal of the event merger is to combine low level events (articulatory and/or acoustic phonetic events) into higher level evidence, such as phones or words; and the goal of the evidence verifier is to generate a lattice of event hypotheses that can be optionally sent back to the event merger. We build each detector using a feed-forward artificial neural network (ANN) with one hidden layer and 500 hidden nodes. The ANN is trained by classical back-propagation algorithm with cross entropy error function. The softmax activation function is used in the output layer, and the ANN produces the posterior probability that a speech event happened during the frame being processed.

The event merger is implemented using a single feed-forward ANN with one hidden layer and 800 hidden nodes. The softmax activation function is used in the output layer. The ANN is trained using classical back-propagation algorithm with cross entropy error function and classify phone states (3 states for each phone).

The evidence verifier is a decoding network which consists of a set of context independent phone models layered in parallel and with uniform entrance probability. A 3-state left-right hidden Markov model (HMM) with uniform transition probabilities models a single phone. The HMM state likelihood is the phone posterior probability of the event merger scaled by the prior phone probability. We assume equal prior probability for all phones. The Viterbi algorithm performed over the decoding network provides the decoded sentence.
The system has been evaluated on the TIMIT corpus. Experimental results show that the system achieves a phone error rate of 25% which is superior to results obtained with either (HMM) or conditional random field (CRF) based recognizers. We believe the system's inherent flexibility and the ease of adding new detectors may provide further improvements.

The proposed architecture encourages collaboration. Detectors can be provided by different sites world-wide, and added to the system. Cross-disciplinary efforts can generate a universal phone recognizer e.g. by a phonetician may defining a universal phone set encompassing all languages, and a speech researcher building a set of acoustic phone models for each element of the universal set.

Figure 1: Detector based phone recognizer
Capturing Image Semantics through Collection Information

Randi Karlsen and Joan Nordbotten
CAIM project,
Project number: 176858

A rapidly increasing number of image collections are available over the Internet for browsing and searching by information seekers. Unfortunately, current techniques for image retrieval have shortcomings that make it difficult to search for images based on a semantic understanding of what the image is about.

Information seekers typically describe their information need in terms of the semantic content they want in the image(s) retrieved. However, current image retrieval techniques have only rudimentary ability for interpreting the semantic content of an image. We believe that an extended use of image context information can enhance automatic identification of image semantics and thus may contribute to closing the semantic gap between user needs and the current capabilities of image retrieval system.

There are multiple forms of image context information, ranging from the date/time and place when the image was created to the context(s) of its use. We here focus on using Usage Context information to support capture of image semantics. A Usage Context is the environment in which the image is used, typically in an image collection or as an illustration in a text document. An image collection represents a context for every image within the collection, and may as such give an indication of the semantic perspective of its images. In our work we investigate how information about multiple situational contexts can be combined to provide enhanced knowledge of the semantics of individual images.

We propose a language, CTXT, for context specification and demonstrate how Usage Context information can be represented so that the characteristics of each context type can be sustained and made available for use in image retrieval.
Utilizing Context in Ranking Results from Distributed Image Retrieval

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University of Bergen
CAIM - Context Aware Image Management
NFR project #176858

Selection and ranking of relevant images from image collections remains a problem in content-based image retrieval. This problem becomes even more visible and acute when attempting to merge and rank multiple result sets retrieved from a distributed database environment. The way in which different database systems represent images digitally is perhaps the most serious challenge when retrieving images from several different systems. Current CBIR systems rely on similarity alone when performing content-based queries, and most systems operate without taking the degree of image relevance into consideration. This paper presents findings from a project that investigated if combining text and image retrieval algorithms with the use of image context could help reduce the problem of merging and ranking distributed results [1].

The hypothesis underlying the project was that a combined score approach using normalized scores provided by the text and image retrieval algorithms would improve the result set presented to the user with regards to relevance. The problem forming the base for this project is the semantic gap, i.e. the discrepancy that exists between the information currently possible to extract from visual data and the interpretation the same data has for a user in a given situation [2] when using low-level features to correspond to high-level abstractions.

Our approach sought to investigate if any improvements in narrowing the semantic gap could be made by searching for images using both high-level text and low-level image features. The hypothesis underlying this project was that combining the two image retrieval methods would improve search results with regards to relevance. An experiment using a distributed environment and two different ranking approaches was set up to test the hypothesis.

The evaluation of our approach implemented in a system called CAIRANK (Context-Aware Image Ranking), a prototype utilizing similarity scores from both image and text retrieval in generating a new global score, shows that retrieving and ranking images using the combined-score approach returns significantly better results than a more traditional ranking approach based on using DBMS-normalized image similarity scores alone using a traditional Raw Score Merge method.

References
Next generation communication systems will face new challenges in terms of miniaturization, flexibility and performance, and one of the most promising emerging technologies to address these challenges is known as RF MEMS (Radio Frequency MicroElectroMechanical Systems). The basic technology utilized in such systems has been developed since the 1970s for use in pressure and temperature sensors, accelerometers and other sensor devices. Today, it is further developed and adapted to a wide range of application areas such as telecommunication, car-industry, biotechnology, air-traffic and astronomy. However, it was not until after about 2000 that the first commercial components for use in micro- and millimeterwave circuits became available on the market. These are BAW (Bulk Acoustic Wave) filters, miniature inductors, and different kinds of mechanical switches. Due to their targeted use in RF circuits, such components have become known as RF MEMS components. Utilization of the RF MEMS technology in telecommunication offer possibilities for new functionalities, better performance, miniaturization, mass production, low production cost, and better integration with the rest of the electronics.

SINTEF ICT is currently conducting a research project with user participation (KMB) entitled "Integrated Reconfigurable Radio Front-end Technology" (IRRFT). This is a four year project that started January 2004 and ends December 2007. The aim of the project is to explore new possibilities offered by the RF MEMS technology in reconfigurable antennas and microwave circuits, targeting the frequency range of 1–32 GHz. In particular, the objectives are (1) demonstrate the concept of reconfigurability of RF front-end circuits using existing state-of-the-art RF MEMS components and (2) develop knowledge and experience to design, process and fabricate an in-house RF MEMS switch for use in microwave circuits and systems. With respect to objective no. 1, reconfigurability is demonstrated by using discrete RF MEMS switch samples from Radant (USA) in the design of microstrip reconfigurable matching networks for a Low Noise Amplifier (LNA) and in the design of microstrip phase shifters for use in a 2x2 microstrip antenna array. With respect to objective no. 2, a capacitive RF MEMS switch targeted for the frequency range 10–40 GHz has been designed and fabricated at SINTEFs MinaLab facility during summer 2007.

In 2006, a double 2x2 patch antenna array capable of operating at L-band (1.5GHz), S-band (2.2GHz), or both bands simultaneously was fabricated. In 2007, a revised version of this antenna that includes RF MEMS microstrip phase shifters has been designed such that the main lobes at both L-band and S-band can be switched independently to ±15 degrees off broadside. The performance of the antenna and its inherent RF MEMS phase shifters will be presented at the conference.

In addition to the patch antenna array, a reconfigurable LNA has also been designed. The LNA utilizes RF MEMS switches to achieve operation at either L-band (1.5 GHz), S-band (2.2
GHz), or C-band (5.8 GHz). This is carried out in such a way that the noise figure and return loss are minimized at the same time as the gain is maximized. The LNA is expected to be characterized during the late autumn of 2007.

Since 2004, studies have been conducted on how to design and develop an in-house capacitive RF MEMS switch. Considerable work has been done in the planning of the set-up and methodology for switch characterization. Initial test results of this switch, which is the first RF MEMS switch ever to be produced in Norway, show that with an especial adapted actuating voltage, it works properly during the tested period of time. More detailed results will be presented at the conference.
Multi-port eleven antenna for use in satellite communications terminals

Jungang Yin(1), Jon Anders Aas(1), Per-Simon Kildal(2)

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The Eleven antenna is a new wideband feed that can cover a decade bandwidth up to 13 GHz (within Ku-band) so far. With its major advantages in terms of ultra wide band, constant phase centre and low profile, it has been developed as feed for reflector antennas and in particular for radio telescopes.

Parallel folded dipole pair being half-wavelength apart and above a ground plane, is the basic element of this logarithmic-periodic antenna. In theory, there will be no limit to its operational frequencies. In practice, however, there is a limit at high frequencies due to difficulties in manufacturing and mounting tiny structures relying on conventional materials and concurrent mechanical technologies. The investigation is thus of interest on the partial flat version evolved from the original Eleven antenna, i.e., a version in which one or more dipole pairs at high frequencies may be bent flat in order for ease of manufacturing and mounting while its performance is maintained.

Another topic regarding the Eleven antenna is to further develop it into a multiport antenna with tracking capability for use in satellite communications terminals. As we all know, tracking is inherently called for by many land-mobile and maritime communications terminals to avoid degraded satellite links. The monopulse tracking technology has obvious advantages in many applications over other technologies, such as conical scan, step track, etc, since it was reported with very good tracking accuracy, fast dynamic response as well as comparatively low requirement on system signal-to-noise ratio, and has been utilized widespread in many of the large earth stations, ship-borne terminals and satellite-to-satellite communications. This tracking technology is in principle to obtain information concerning the relative angular location of a scattered or a transmitted beacon signal, e.g. from a satellite, by comparing amplitudes and phases of received signals from several simultaneous antenna beams. Antennas with monopulse tracking capability typically produce three different beams, a sum beam and two difference beams, one for azimuth and the other for elevation tracking. The difference beams detect the angular error of the direction to the satellite while the sum beam acts as a phase reference, with which the direction of the angular error can be determined. The Eleven antenna with four-port has intrinsic capability of forming the three beams necessary for the monopulse tracking, through different combinations of excitations from these ports. The paper describes the design and development of a laboratory model of the multiport Eleven antenna and explains how the difference patterns are generated in this model. The paper also introduces a practical method for finding the total scattering parameters of an antenna with multiple ports, when it is excited for both sum and difference beams, without using a power divider with sum and difference ports. Its tracking performance has been investigated through both simulation and measurement, and a good agreement of the simulated and the measured results is achieved. The monopulse tracking capability may open up interesting opportunities for using the Eleven antenna in satellite communications over one or more of the L-, S-, C-, X- and Ku-bands.

Moreover, there are a number of future topics of great interest relevant to the multi-port Eleven antenna, which may include, studies of its radiation efficiencies in the Reverberation Chamber at Chalmers, a possible reconfigurable antenna evolved from it with both good directive beam and MIMO performance, and so on.
RF-based Techniques for Power Amplifier linearization and efficiency Improvement

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The power amplifier’s main task is to convert dc-input power in to significant RF/microwave power. The power amplifier is a critical component in a wireless system since it represents a major part of the total cost and the total power consumption.

The main issue for the designer is the trade-off between linearity and efficiency. Modern communication schemes require linear power amplifiers to fulfill communication standards. In handheld terminals the power amplifier consumes most of the battery power and in base stations more efficient power amplifiers require less cooling and reduce electricity bills. The trade-off is a consequence of the fact that a traditional amplifier has the best efficiency where it is most nonlinear (as illustrated in figure 1).

![Figure 1: Output power and power added efficiency](image)

There exists a great variety of different techniques for improving linearity and efficiency in power amplifiers. The goal of this research project is to develop new techniques, combine different or improve existing techniques. Circuits will be designed, manufactured and measured. The designs are made in MMIC’s and with discrete components.

Critical to good power amplifier design is a good model that predicts the behavior of the active component in the circuit with sufficient accuracy. Two models (VBIC and FBH) for HBT-transistors in MMIC are extracted on the basis of DC- and RF-measurements. These models ensure simulation convergence and good performance.

An active bias circuit is developed for linearity improvement in an HBT power amplifier. With this method the 1 dB compression point has increased by 2 dB compared to a class A amplifier, and as a consequence the linearity and efficiency has improved significantly. In addition different ways of biasing a class AB amplifier has been investigated and designed. MMIC’s with these designs have been manufactured but not yet measured.

Parallel to the MMIC designs some discrete amplifier designs have been made. A pHEMT transistor has been used and promising results have been measured. A DC to RF efficiency of more than 65 percent is obtained with this transistor with a design only based on small-signal measurement at a given bias point. The manufacturer of this transistor does not provide a large-signal model for this transistor so in order optimize the design it is necessary to extract parameters for a chosen model that is available in our design software. This requires accurate measurements and there is still work to do to get the necessary accuracy at high frequencies.

This transistor and the “home made” model are planned to be used in an ongoing collaboration with Nima Safari where the objective is to design a power amplifier optimized for maximum efficiency and with a bias network optimized for the best performance in respect of memory effects. A power amplifier optimized for best efficiency usually has bad linearity performance. But with Nima Safari’s methods for digital predistortion this can be compensated for. Little memory effects are critical in order to achieve good results with digital predistortion, and these effects are very much dependent on the bias network. This work combines digital and analog design, and by doing this we hope to achieve better results than if we were optimizing the analog and digital design separately.
Autonomous Communication Middleware for Integrated Home Services

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What: Lyse Tele currently offer a set of entertainment services, often called triple-play services. These services include IP TV, Video on Demand, Internet and VoIP, and are provided to customers over a single fiber.

Why: The IS-Home project seeks to expand the range of services that can be delivered to customers to include utility services, such as medical data collection, automatic meter reading and alarm functionality. These services will exploit the fiber infrastructure currently available, but will also look into alternative infrastructures to ensure robustness to failures.

How: The project aims to provide utility services through a common middleware platform for autonomic communication with emphasis on robustness to failures and scalability to a large number of users and services. Autonomic communication middleware enables self-management of various system components. The platform will be tailored for developing IP-based (integrated) services where the data originates from network entities such as sensors, actuators, computers and set-top-boxes in the home environment. The network entities communicate with the home access gateway using either wired or wireless communication channels. Low-level data (e.g. from sensors) are encapsulated into IP packets, and routed to the service handler associated with the packet in the middleware platform. Integrated services will use ontology to define a common semantic/interpretation of low-level data formats, thereby simplifying service development by abstracting away from low-level data formats. The middleware platform for autonomic communication in the home environment should be developed with the following objectives:

1. It should be scalable and robust; it should support multiple services and be scalable to at least 100,000 or more customers.
2. Support ontology-based integrated services.
3. Self-configuring: Installation and configuration of a service should be automatic.
4. Self-adapting: Runtime changes (e.g. dynamic updating of services) should not need human interaction.
5. Self-healing: Reconfiguration due to failure of network entities; exploit backup path(s).
6. Self-testing: Test the installation/configuration to verify the desired level of redundancy. Give a warning when the redundancy level is too low. Implementation of services, such as an intruder alarm, mandates application specific development, whereas the autonomic features will be handled by the middleware framework. Although some generic hardware and middleware can ease the workload, many components, especially sensor and actuator nodes may still need to be tailored according to the requirements of the service. The project plans to implement at least two integrated home services using the middleware platform discussed above. In conclusion, the services offered by Lyse Tele to its customers today (with the exception of VoIP) are mainly focused on entertainment services. With the ISHome project, we seek to expand the range of services Lyse Tele can provide to its customers to include utility services, such as medical data collection, remote meter reading and alarm functionality.
Mobile ad-hoc networks (MANETs) enable setting up communication infrastructures on the fly and are therefore for example very important for emergency and rescue operations. However, developing a distributed application running over MANETs is very hard because of their unpredictability with respect to available resources, connectivity etc. We have developed in the Ad-Hoc InfoWare project a set of collaborating middleware services that are especially designed to address the peculiarities of MANETs, in order to simplify the development of applications. The four PhD students in the project have solved major challenges in the areas of security, resource management, event notification and knowledge management, which form the foundation for their PhDs. Highlights from the project include:

- Efficient solution to create trust in a MANET among all devices carried by personnel from different organizations.

- Non-intrusive resource management that allows to predict future disconnection and supports optimal service placement in sparse MANETs, by observing the local routing tables only.

- Flexible and highly available distributed event notification that can adapt to current density and mobility patterns in the network. Even in the advent of frequent and long term disconnection, subscription and notifications can be transported to their destination through techniques for delay tolerant networks.

- Knowledge management system that allows to keep track of which information is where in sparse MANETs through especially designed metadata management.

- Development of an evaluation environment for the project comprising a MANET emulator and mobility traces that come as close as possible to reality.

It should be noted that the proof of concept for all these highlights is implementation and evaluation through emulation and also test on real world devices. Several Master Students are and have been involved in Ad-Hoc InfoWare research topics, and insights from the project are used in our lectures. Some results of Ad-Hoc InfoWare are used in the MIDAS project (EU IST FW6) and further follow-up projects are being proposed.
**Converging internet access 14:30 – 15:10**

**MOBILE FIXED CONVERGENCE IN MULTIACCESS ENVIRONMENT**

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**Abstract**

The main goal is to provide unified user management and service continuity for an IP Multimedia System deployed on a fixed mobile convergent multi access environment. In the effort to realize the vision of fixed mobile convergence, the telecom operators found very compelling to extend the usage of 3GPP IP Multimedia Subsystem, originally intended for the 3G mobile network to fixed broadband networks like xADSL, cable TV, IPTV, etc. However, there are many challenges that must be solved before the fixed mobile convergence vision based on IMS can be realized. In fact, a mobile phone equipped with an IMS client will not be able to operate in a wireless LAN environment. It is not only because of the differences between IMS and the standard SIP (Session Initiation Protocol) but also because of the differences in terms of subscription fundament between the mobile world and the fixed one. Indeed, in the mobile world, each user is associated to one subscription while in the fixed network, a whole household with many users can share one subscription. The authentication schemes used in for the WLAN hotspots vary very much and are different to the one used in the mobile network. Consequently, due to the lack of seamless access, the IMS services will not be working in the WLAN hotspots.

The Mobicome project will analyse, design, implement and test the solutions that enable:

- Seamless access to the different wireless technologies like UMTS, EDGE, Wireless LAN; etc.
- Unified identification, authentication and authorization of the users
- Unified service offering and provisioning in:
  - Both mobile networks and fixed broadband networks
  - Both on mobile terminals and stationary computers
- Service continuity when the user is roaming from mobile networks to fixed networks and vice versa.

The Mobicome project will also built demonstrators that visualize the fixed mobile convergence features that are realized in the project.

The Mobicome project will also have activities on the business side aiming at elaborating sound business models that can be adopted in commercial exploitations. In the project, there will also be built up exploitation plans for the partners of the project.

Last but not least, the Mobicome project is aiming at broad dissemination that explains the advantages of fixed mobile convergence not only for the users but also for networks operators, service providers, software vendors, hardware manufacturers, etc. The project will have a considerable number of publications at international conferences and journals.
**Interactive multi channel support of mobile workers**

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**Abstract**

Along with the development and utilization of wireless applications, mobile work is more and more common in the business world. Current information and communication technology (ICT) provides a variety of approaches to access information systems and to utilize different services available on the internet. Mobile data networks (UMTS and WLAN), positioning systems (GPS), mobile phones and personal digital assistants (PDA), and Radio Frequency Identification (RFID) are just some of the new mobile technologies that participate into building an ubiquitous computing environment, which make it possible to offer online services to people on the move, wherever they are.

It is common to predict that the future work would be becoming more wireless and ubiquitous. Information systems access would be possible from any location, at any moment, with a variety of devices. Work will not be tied to the office only, but will consist of continuous collaboration, communication, and co-ordination on the fly among distributed actors [1] [2].

Today, the mobile workers have considerable demands for better interactive process supports on the top of multi channel telecommunication services. However, the traditional information systems, which is not efficiently enough interactable and adaptable at real time, and primarily supporting routine processes, seems not flexible enough to support emergent processes. The overall objective of this doctoral thesis project is to develop a model-driven process support system for multi-channel mobile work, based on interactive modeling [3] that deal with unstable and unclear work processes and with unstable, unclear and sometimes inconsistent requirements at the user, group and organization levels.

Initially, it is important to get a good overview of the state of the art in the field. Currently, we are working on the investigation of the existing technologies and methodologies for process modeling, multi channel support, and model driven approach. Then, on the basis of current technologies, we will develop a process support system prototype specifically tailored for the needs of knowledge workers on a multi-channel platform. In order to evaluate the practical usefulness of the proposed system prototype, some pilot applications will be carried out either in industry or envisioned scenarios at the latter phase of this doctoral thesis project.

In order to address the issues mentioned above, we proposed the following research questions:

**Q1.** What are the major differences between traditional information systems and mobile information systems?

- Analyze from different perspective: Access, Device, Context (Infrastructure), Technology, Organizational level (Return on Investment), Security, Trust, Privacy, etc.
- How do traditional IS and mobile IS support work processes respectively?

**Q2.** To what extend can existing modeling technologies and methods be used for developing a process support prototype for mobile worker on multi channel platforms?

- Which factors are relevant or important on multi channel platforms?
- Which languages can be used for developing system prototype?
- What are limitations and drawbacks of existing modeling method?

**Q3.** How can we develop a model-driven process support system for multi channel mobile work? Specially, the investigation will be concentrated on

- Utilizing interactive model to deal with unstable and unclear work process
- Utilizing the interactive support system on a multi channel platform

**References:**


This research work is part of the Model-driven support for Multi-channel Mobile Work (M3W) project funded by Norwegian Research Council. The Project number is: 172278.
Mobilizing social capital in ICT-based global organizations

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prosjekt nr. 179972/S10

The purpose of the MOSCITO project is to increase our understanding of how ICT’s can be used to increase the social capital in organizations and groups. Social capital is a concept that refers to the assets people has access to through their relations with other people. Social capital is important both at an individual and organizational level because it can enhance an individuals ability to achieve effective results, and may improve information sharing, decision making, and coordination across the organization.

Distributed organizations are dependent on achieving smooth coordination and cooperation between people who are located in different places. This type of cooperation is increasingly dependent on the use of different information and coordination technologies. And while we do know that good cooperation with others is dependent on shared understanding and trust, we know less how this is affected by the use of ICT’s. Creating a sense of shared understanding and developing relations based on trust is dependent on face-to-face communication, but cooperation mediated by ICT’s may have also other advantages. Moreover, the possibilities for face-to-face communication are necessarily limited in globally distributed organizations.

An obvious advantage of using ICT’s is that it improves cooperation across distance, but it also makes it possible to cooperate with larger groups, streamline information flows, improve coordination, store experiences and best-practices, and ensure that continuity is less dependent on single individuals. ICT’s may also give us new possibilities directly related to developing and maintaining social capital. We can maintain relations to others more efficiently, interact with others sporadically and when the need arises (just-in-time interaction), and identify persons that are useful and get introduced to these faster and more efficiently (just-in-time social ties). Even though earlier research has identified some important connections between social capital and ICT use, this is still a field which is under-explored. The MOSCITO project aims increase our understanding of this field through studies of ICT use in Norwegian and foreign enterprises. Our foreign colleagues (England, Netherlands, and the U.S.) will contribute with empirical studies from their countries, while we in Norway will concentrate on cases from Telenor and StatoilHydro.

At the VERDIKT conference we will present our main research questions, and our approach to the empirical studies. Furthermore, we will shed light upon the concept of social capital by presenting a few of the Norwegian cases. This includes the newly established research department of StatoilHydro where employees from Trondheim, Porsgrunn and Bergen will work closely together. These employees were earlier employed in either Statoil or Hydro, and a challenge for the company is how the new organization will be able to integrate these different employees and localities. That is, creating new social ties across both geographical and organizational boundaries. Within Telenor, one of the cases is an international project which is working on evaluating and choosing technology strategy for the Telenor Corporation worldwide. The project includes employees from most of the subsidiaries, e.g. Pakistan, Malaysia, Hungary and Thailand. The project is dependent on developing, establishing and actively mobilizing social capital in order to be successful. In this manner, we will relate the presentation of the MOSCITO project to concrete challenges that Norwegian companies currently face.
As fixed and direct relationships are being replaced by more open and flexible systems of coordination throughout society, organizational researchers have come to emphasize the importance of informal organization and how it shapes organizational conduct. While hierarchical organizational structures remains important and necessary in most cases, the intangible and implicit forms of organization are increasingly recognized as central to factors such as performance, innovation and knowledge sharing. The theory of social capital acknowledges this by considering networks of relations a valuable resource (i.e. “capital”) that individuals and groups may invest time, money and other resources in, as well as draw upon for a wide range of benefits. As collaboration across organizational, cultural and physical boundaries become increasingly widespread, many enterprises are entering uncharted territory regarding the consequences and opportunities for social capital mobilization – not least because of the constant development of available information and communications technologies.

Lately a new breed of technologies have evolved, seeking to facilitate personal interconnections by supporting and improving mainstream social practices that go on both offline and online. Social software is still a collective term with no agreed-upon definition, in its widest sense relating to all software that allows groups to communicate and collaborate. However, a more useful understanding is as technologies that intentionally support the desire of individuals to affiliate and to be pulled into groups to achieve their goals. In addition to somewhat traditional tools like discussion groups and Instant Messaging, this includes new types of group filtering and recommendation systems, web sites designed to connect people (for business, dating or other common interests), and group publishing software such as blogs and wikis. These have yet to receive much attention in organizational research, but are gaining momentum due to their inherent support for the informal relationships through which knowledge circulates, collaboration occurs and identities are formed.

There is clearly a need to generate empirically based insight and practical organizational knowledge as to how the use of social software may affect the development, maintenance and utilization of social capital. This will be the main goal of the project, although it will also be necessary to investigate what social liabilities the use of such technologies may entail. A mixed methods approach will be deployed, including qualitative enquiries, quantitative questionnaires and social network analysis of different cases in Telenor and StatoilHydro, all of which face challenges as described above and are dependent on the active mobilization of social capital in order to succeed in a globally competitive environment.
IntelliSense RFID – An RFID Platform for Ambient Intelligence with Sensors Integration Capabilities

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The “Ambient Intelligence Society” is the vision of a future where it is assumed that people will be surrounded by low cost wireless devices carrying context information. Radio Frequency IDentification (RFID) is the key technology for local connectivity and an early vehicle for readying these future proactive computing systems. RFID devices are the main candidate to implement such distributed networks thanks to their promising low cost. An RFID device will be associated to a product, person or a location through a simple ID and will be capable to sense, measure, acquire and monitor physical, chemical, and biological environments through sensing of temperature, pressure, humidity, etc. Nanoelectronics allows the mass production of such new silicon RFID devices with sensing capabilities and this makes massive and low-cost tagging of objects feasible. The whole infrastructure of “readers-RFID devices” will form the future “Internet of Things” that will be one of the main element of the “Ambient Intelligence” and “Ubiquitous Information” society.

In this context, the aim of the IntelliSense RFID project is to develop multi-protocol RFID devices with built-in sensing capabilities, operating at multi-frequency bands. The device can be associated with an object, a person or a location through a simple ID and is capable of measuring and acquiring data about the user's behaviour and his environment (such as temperature T, pressure P, humidity H, pH), thus creating a smart environment based on surrounding “invisible intelligent devices”.

The project is devised into two phases:

• **Phase 1: Technology specification, requirements definition, research and block design:** Deliver the detailed RFID requirements and specifications required to perform the intended functions, and study the means to meet such specifications. The devices will combine the ISO 15693 (18000-3) HF standards at 13.56 MHz and the ISO 18000-6c (EPC Class 1 Gen 2) UHF standards that work from 860 to 960 MHz. The third frequency band – 2.45 GHz supporting the 18000-4 standard will be developed later.

• **Phase 2: Integrated design implementation, evaluation and testing:** Deliver and test a first demonstrator at the end of 2007. This demonstrator will be used to validate the main technological choices, with a reduced complexity and reduced environmental specifications. The project research and innovative aspects can be summarised by the following project results:

  • **RFID platform:** novel, passive/semi passive RFID platform with a generic mixed signal interface for sensors
  • **Multi band antennas:** two new antenna concepts for multi-band operation were demonstrated for covering the relevant ISM bands at 13.56 MHz, 869MHz, 915 MHz and 2.45GHz. The first antenna type is a combination of inductive coil at 13.56 MHz and electromagnetic multi band antenna PIFA (planar inverted F antenna) designed for covering the European UHF band 865.6-867.6 MHz and American UHF band 902-928 MHz. The second antenna type is a multi-band Minkowski fractal optimized for 2.45GHz and 868 MHz operation.
  • **RFID front ends and protocols:** low power/low voltage RF front end circuit with the capability of operating at different frequency bands, digital control and communication protocol supporting multi-band operation and sensor data management are evaluated. An optimized system (blocks sharing) combining multi-band RF front end (13.56 MHz and 869 MHz), logics was designed, simulated and processed with UMC 0.18µm. Simulations on the multi-band and multi-protocol tag showed a power consumption of 30 µW for the front end, 20 µW for the HF logic (ISO 14443-A) and 100 µW for the UHF logic (EPC Gen 2). Measurements on the processed packaged chips confirmed the simulations.
  • **Generic sensor interface:** a sensor interface based on a successive approximation register (SAR) analog digital converter (ADC)
implementation that consumes 20 µW with a temperature dependency of 50 ppm/°C was designed and simulated. In the read out circuit a switched capacitor charge integrator was used to compare the sensor capacitance to a reference capacitor and convert the capacitance variation into a voltage variation that is then digitized with an analog to digital converter. Two architectures for the ADC based on resistive network and a charge redistribution capacitor array were designed. The simulation results and the preliminary measurement results for the resistive implementation show that the power consumption is less than 10 µA with an accuracy of 8-10 bit and a sampling frequency of 10 kHz. The resolution (8-10 bits) obtained was adapted to the operation mode and the power consumption requirements. In order to have very low power consumption, the system operates in a switched configuration.

• **MEMS/micro sensors**: Four individual capacitive sensors (pressure, temperature, humidity and pH) were designed in the project. The pressure and temperature sensors are surface micromachining sensors with a honey comb configuration. The capacitive humidity sensor is based on the principle that a humidity sensitive polymer absorb or releases moisture and the dielectric properties (permittivity) change as a function of the relative ambient humidity. The sensing principle of the pH sensor is based on the changes in the dielectric properties and/ volume change of a sensitive polymer film due to pH change. Interdigitated electrodes are used and on top of these electrodes a sensitive polymer is applied.

• **Near field communication**: A symmetrical rectangular antenna was implemented on a demonstrator tag and similarly on the reader side and experiments show that power can be transferred accordingly. Evaluation of a combination of 868 MHz as the communication frequency between reader and tag and 2.45 or 5.8 GHz as the return link is pursued (Dual mode operation: Tag powering using UHF/Communication at ISM band). IntelliSense RFID is a 2 years project that started in 2006 and involves SINTEF (Norway) as the institute leading the project, VTT (Finland), Chalmers University of Technology (Sweden), and IMEGO AB (Sweden). The NORDITE programme aims to support research institutes and universities from Sweden, Norway and Finland to enhance state of the art research in the fields of SW radio, wireless sensors, short-range wireless networks and RFID or MEMS utilising RF technology.
Service continuity during mobility

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Abstract: The objective of the SUMO project (Service Ubiquity in Mobile and Wireless Realm) is to investigate new solutions for offering customers ubiquitous access to content and services. The vision is to provide continuous access to personal content and free or subscribed services from communication or broadcast service providers, utilizing the best possible network connection and available terminal, wherever the user may be. E-mail, as an example, used to be a service that one could reach only from one’s stationary PC at home or at work, whereas now it can be accessed from any hot spot on your lap-top, or via cellular networks on your mobile. The SUMO idea is to generalize this possibility to encompass any service, utilizing ambient communication resources. This requires that the services are adapted to the capacities of the network and the available terminal. A video stream would have to adjust to the speed of the e.g. a 3G connection and the size of the smart phone.

Part of the SUMO idea is also that the ubiquitous access should be dynamic, i.e. that an ongoing session like a conference should be maintained as the user is moving from one location to another, and then may have to shift from e.g. fixed broadband connectivity to WLAN, and further to GSM. The components of the session should then also be adapted. What started as a video conference may sometimes only be maintained with voice communication.

A system is required that is aware of available access networks at the user’s location, so that the preferred network can be employed. The networks may be owned and operated by different actors, and be fixed or of different wireless technologies. The system must also be able to adapt the service to the capabilities of the available network and terminal.

To approach these issues, the project has studied two scenarios: communication and streaming services in a public environment, and entertainment services in a home environment. The first scenario concentrates on service transport with seamless network to network and terminal to terminal handovers, whilst the second scenario puts greater emphasis on the service and content adaptation aspects to provide the best user experience. The paper describes solutions for implementing the two scenarios, showing the technical viability of the SUMO concept. Furthermore, an analysis of the business viability of this service concept is presented. Two value systems describing possible constellations and interplay between business actors are discussed and compared. Both make good that the SUMO concept may provide value to the customers and profitability for the commercial players.

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About VERDIKT
The VERDIKT's vision is that Norwegian ICT research will put Norway at the forefront of the development and application of knowledge to enhance interaction, innovation and value creation in the ICT-based network community. The primary objective of the program is to generate and apply new technology and knowledge in the area of ICT-based innovation and interaction in the networked community.
More information:
www.forskningsradet.no/verdikt

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