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FEATURES

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Convergence is 30 this year. Join us in Detriot.

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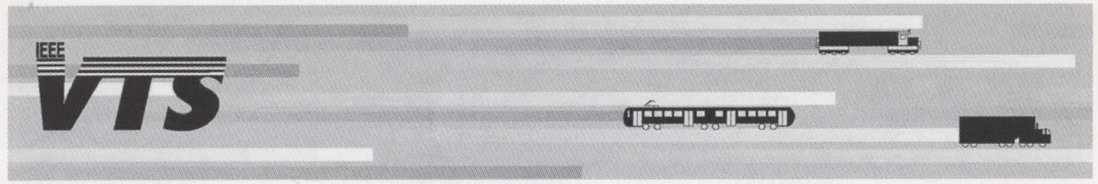

Foreword

James Irvine, Editor

In this issue, we preview Convergence 2004. The Convergence conference reaches an important landmark this year, as it is now 30 years since the first conference was held in Troy, Michigan. The aim of that conference was to bring together engineers from different disciplines – mechanical and electronic – to solve problems and produce better solutions in the automotive electronics sphere. It retains that important role today.

The term 'convergence' also resonates with our mobile radio members, where it is used to refer to the coming together of different information transmission channels, and in particular, broadcast and cellular technologies. Indeed, if you search for a definition of 'convergence' on Google, this is the first meaning it will offer you.

Much of this 'convergence' is, of course, clever marketing - an application of the evangelist's chosen product or solution to a different area of technology. For example, many cellular operators see 'convergence' as an opportunity to obtain more spectrum from broadcasters, or sell broadcast type services, but are a little more reticent about opening up their own customers to broadcasters. However, we shouldn't forget that 'convergence' in the form used by the Convergence Transportation Electronics Association is what engineering is all about – using techniques from one application to solve the problems of another.

VTS President Charles Backof, in his welcome message for VTC2004-Fall in LA, notes that VTS, unlike most other IEEE Societies, is built around a central theme, rather than a single technology. As an example, our second feature on wireless sensor networks, although radio based, has many exciting applications in the automotive or transportation fields. Let your membership of VTS broaden your horizons, and if you have any examples of novel applications, why not let us know? We are looking for more applications papers both for VTS News and VTC.

Finally, on the subject of writing, we are looking for more people to join the VTS News team as part of ongoing plans to move to magazine status, hopefully from 2006. If you have some time to spare and would like to help you profession and have some fun at the same time, please get in touch.

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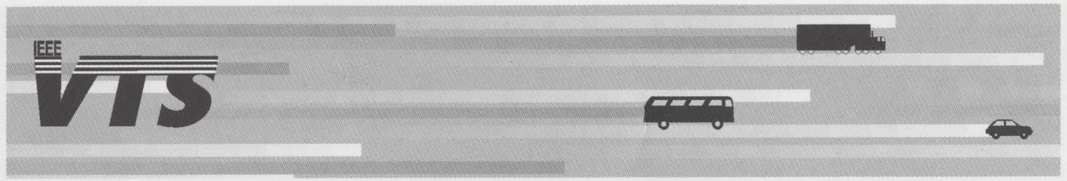


Vehicle Electronics to Digital Mobility: The Next Generation of Convergence

Convergence, or the International Congress on Transportation Electronics Convergence to give it its full title, celebrates its 30th birthday this year, with its meeting at the Cobo Conference and Event Center in downtown Detroit October 18-20, 2004. The theme of this year's conference is Vehicle Electronics to Digital Mobility: The Next Generation of Convergence. Full details can be found on the web at www.convergence2004.org

The Ford Motor Company is hosting the event, which is very apporpriate since it was an initial participant and organizer at the first event in 1974. Ford are a gold sponsor of the event, along with Robert Bosch Corporation, Delphi, DENSO Corporation, General Motors Corporation, IBM, Toyota Motor Corporation and Yazaki North America, Inc.

The Banquet Speaker is William Ford Jr., CEO, Ford Motor Company, and the three-day schedule will include at least six CEO keynote speakers representing the leading edge of the automotive and electronics industries, three electronic-specific panel discussions, and more than 80 technical, state-of-the-art papers addressing the important aspects of automotive electronics.

The last event drew more than 8,900 attendees and 200 media from around the world, and it is hoped to exceed this for Convergence 2004. Many attendees are attracted by the exhibitors, and exhibit space will occupy two and half halls at the Cobo facility with over 190 exhibitors. A full list of these can be found overleaf.

Convergence 2004 Chairman, Dr. Gerhard Schmidt, Vice President of Research and Advanced Engineering at Ford, noted that as in the past, the benefits of Convergence will continue well after the event itself is over. Convergence Transportation Electronics Association (CTEA), the sponsor of Convergence 2004 will donate a significant part of the proceeds to the Convergence Education Foundation, a non-profit organization that supports elementary and secondary school educational programs for future generations of engineers and scientists.

Theme

Convergence has always been envisaged as a bridge between mechanical engineering and electronics, with the next generation use of electronic and mechatronic replacing mechanical systems.

Historically, the electronic engineering impact was primarily independent components or sub-systems related, converting mechanical or hydraulic sub-systems to electronic control. It started with lighting, audio, than engine controls, then instrumentation and moved to brake controls. Today, on many cars all the sub-systems have been converted to electronic control in one way or another. Also, the original electronic controls were analog and in the last two decades have converted to primarily digital microprocessor based controls.

Now that virtually all the sub-systems on the vehicle are converted to electronic control, and have moved from analog to digital, the next step is to interconnect them into one interactive vehicle system. This includes allowing the brakes to interact with the steering, to interact with Powertrain, etc. This is the digital control within the vehicle. However, possibilities don't end here; this intelligent control system can also interact with the non-vehicle electronic systems around it (PDA's, Cell Phones, anything on the internet). With all this capability, the next generation of Convergence will be moving toward the next level – intelligent systems, communication networks – "digital mobility".

Digital mobility is using digital data processing to control all vehicle attributes and functions (ride control, P/T, Navigation). Digital Mobility is using sophisticated, digital, fast, closed loop controlled signals to replace analog, slow, open loop processing. Digital mobility will network all parameters inside the vehicle and between vehicle and the environment allowing for advanced products, bringing us closer to fuel efficient products with zero emissions and no accidents.

History of the Conference

When U.S. government guidelines in the early 1970s mandated improved vehicle safety, fuel economy and emission performance, Detroit automakers turned to electronics to help meet these stricter federal regulations. But when mechanical and electronics engineers began working together disciplines and cultures collided. The accelerated speed of change that typified the computer-based electronics industry starkly contrasted with the longer product cycles of the auto industry. With very little common ground between them, a chasm quickly developed.

To begin building a shared framework from which to work, Trevor Jones and a handful of automotive engineers founded Convergence. Jones, now chairman and CEO of BIOMEC, Inc., and his team launched the first Convergence conference in 1974 in Troy, Mich. Some 300 participants attended that original conference.

Designed as a forum for the two dissimilar groups, Convergence 1974 began a dialogue focused on the challenges facing the automotive industry and how electronics could provide solutions. Since then, Convergence has proved successful in creating shared opportunities between mechanical and electronic engineers, presenting views, discussing needs and capabilities, addressing communication issues and predicting future technology developments and market trends.

Convergence 2004 exhibitors

3SOFT GmbH	EMS-GRIVORY America	Optrex
A-Dat Advanced Data Acquisition	eNGENUITY Technologies	Parlex Corporation
Acapela Group	ETAS	Patni Computer Systems
AccelChip Inc	Fairchild Semiconductor	Peiker Acoustic
Accu-Mold Corporation	First Technology	Philips
Accurate Technologies	Ford Motor - Research & Advanced	Pi Technology
Advanced Test Equipment Rentals	Freescale Semiconductor Inc	PMX Industries Inc
Agilent Technologies	Fujipoly America Corporation	Powertrain International
Alcoa AFL Automotive	Fujitsu Microelectronics	Prodrive Ltd
Altera Corporation	Futaba Corporation of America	QNX Software Systems Ltd
Altia Inc	Green Hills Software	Ramtron International Corp
American Optics Inc	Hamamatsu Corporation	Renata Batteries
AMI Semiconductor	Handy & Harman Electronic Materials Grp	Renesas Technology America Inc
Analog Devices	Hella KGaA	Rohm Electronics
Anritsu Company	Hirose Electric USA	SANYO
Ansoft Corporation	Hong Kong Automotive X'tals Ltd	Sarnoff Corporation
Applied Computer Technologies Inc	IAV Automotive Engineering Inc	Saturn Electronics & Engineering
ARM	Immersion Corporation	Seoul Semiconductor Co Ltd
Arrow Global Programming Services	Infineon Technologies	SEWS-DTC Inc
Atmel Germany GmbH	International Rectifier	Sharp Microelectronics of the Americas
Austriamicrosystems USA Inc	IRISO USA Inc	Sheldahl Inc
Automotive Design & Production	Isotek Corporation	Siemens VDO Automotive
Automotive Engineering International	Jabil Circuit Inc	Silicon Laboratories
Automotive News	JAE Electronics	Silicon Sensing Systems Ltd
Autosplice Inc	Jamicon Capacitors	SMaL Camera Technologies
BAE Systems	Judd Wire Inc	Softing NA Inc / Automotive Electronics
The Bergquist Company	Kemet Electronics Corp	Sokymat Automotive GmbH
Bosch Semiconductors	Kramski North America Inc	Song Chuan USA Inc
Brush Wellman Inc	Kyocera	Southwest Research Institute
BTI Electronics	Laird Technologies	Specialty Coating Systems
Cambridge Silicon Radio	Lattice Semiconductor Corp	SRI International
Chomerics	LeCroy Corporation	SRS Labs
Clarity Technologies Inc	LITE-ON Automotive NA Inc	ST Microelectronics
Co-Planar Inc	Littlefuse	Star Micronics
Conti Temic Microelectronic GmbH	M-Flex	Sumida
Cooper Bussmann	Magneti Marelli	Synopsys
Cosmic Software Inc	Marquardt	Tanaka Kikinzoku International KK
CSI Wireless Inc	The MathWorks	Techtrans International
Curamik Electronics	MBTech Group	Technical Materials Inc
Cyro Industries	Melexis Inc	Tele Atlas
Daetwyler	Mentor Graphics Inc	TES International
Dana Corporation	MetalStamp Inc	Texas Instruments
Danfoss Silicon Power GmbH	Metrowerks	Tilcon Software Limited
Danotek Motion Technologies	Michigan Economic Development Corp	Total Electronics
Dayton T Brown Inc	Micro Stamping Corp	Transera Electronics Inc
Dearborn Group Inc	Microchip Technology Inc	Trico Electronics
DECOMSYS Dependable Computer Systems	Micron Technology Inc	Tricon Industries
Delphi	Micronas Semiconductors	TTTech Computertechnik AG
Deringer-Ney Inc	Microsoft	Tyco Electronics
Digisound - WIE Inc	Mitsumi Electronics Corp	Universal Scientific Industrial Co Ltd
Dolby Laboratories	MKS Inc	Valeo
dSPACE Inc	Motorola Automotive	Varta Batteries Inc
DuPont	MTS Systems Powertrain	VaST Systems Technology
e2v Technologies	Murata Electronics NA Inc	Vector CANtech Inc
ebm-papst Inc	Myntahl Corp	Velcro USA Inc
Electronic Concepts & Engineering Inc	National Instruments	Vishay Intertechnology
Electrovac	NAVTEQ	VTI Technologies Inc
Elgar Electronics Corporation	NDK America Inc	Ward's Communications
Elite Electronic Engineering Inc	NEC Electronics America Inc	Wintek Electro-Optics
ELMOS NA, Inc	Nokia	Wipro Technologies
EMA Design Automation	Olin Brass	WWJ Newsradio 950
Emerson & Cuming	Omron Automotive Electronics Inc	Xilinx Inc
	ON Semiconductor	Yazaki North America Inc

Now, Convergence is marking 30 years of successful collaboration and a tradition of thoughtfully solving a variety of automotive electronic puzzles: from electric and hybrid vehicles to radar brakes and reliability, from electromagnetic interference and powertrain controls to intelligent vehicle highway systems and electronics in heavy-duty trucks, farm machinery, buses and off-highway vehicles.

Convergence 2004 launches the next generation of this premier conference. Keynote speakers, panel discussions and technical sessions will seek to take the next step of successfully connecting automotive electronics into a single interactive vehicle system that takes the driving experience to the next level: intelligent systems, communication networks ... digital mobility.

Technical Programme

Some 86 papers will be presented at Convergence. Abstracts of these papers can be found at http://www.conver-

gence2004.org/pdfdocs/abstracts.pdf, but to give a flavour of the conference, details of the sessions ad paper titles are as follows.

Session #1:
Mobile Digital Entertainment
The digital entertainment revolution has made the transition from the home to the transportation environment. Our homes and offices were once the eminent domain of digital receivers, bright color displays, MP3 digitally compressed music, DVD players, and 64-bit game machines. In just the last few years, however, all of this advanced entertainment content has penetrated the transportation industry, and the pace of mobile digital entertainment innovation is accelerating. In this session we will review the evolution of entertainment electronics in vehicles and investigate the technology and business model trends driving the current digital revolution. Advancements in rear seat video, digital receivers, satellite reception, digital playbacks, high-bandwidth wireless connectivity, and 3D psycho-acoustics will be forecast together with the economic impact on the transportation industry.

Papers to be presented in this session include:

1. Evolution of Car Radio: From Vacuum Tubes to Satellite and Beyond
2. Future Trends in the Rear Passenger Video System Market
3. Three-Dimensional Acoustic Entertainment
4. On Delivering Content to Portable Devices
5. AM and FM's Digital Conversion: How HD Radio® will Spur Innovative Telematics Services for the Automotive Industry
6. A Case for the Trojan Horse – Lessons Learned from the Development and Marketing of Satellite TV Applied to Satellite Radio

Session #2:
Automotive On/Off Board Diagnosis
Within the last 10 years, the use of electronics and mechatronics in vehicles has steadily increased and led to highly complex systems with a multiplicity of electronic control units. The complexity of products in connection with the strengthening of product liability laws and the interests of consumer stakeholders in product quality and safety has become a major concern for automotive manufacturers. In consequence, an advanced on- and off board-diagnosis supported by an effective technical risk management has to be established. Central requirements for the methods and technologies used are a system-wide fault-detection and identification, an effective diagnosis regarding symptoms and history and, in addition, an approach to identify, assess and handle technical risks regarding their probability of occurrence and possible impacts.

Papers to be presented in this session include:

1. Risk-Analysis for Monitoring, Diagnosis and Response
2. Global Diagnostic Challenges and Solutions including the Integration of Existing and Future Standards
3. Onboard Vehicle Diagnostics
4. Diagnosis Concept for Future Vehicle Electronic Systems
5. Diagnostic Challenges in the Automotive Workshop

Session #3:
Supply Chain Management in a Digital World
This session will focus on critical challenges to the supply chain that are a result of the rapid pace of change in the digital world. Reconciliation of extended vehicle life expectations with the comparatively short life cycle of digital technologies requires unique strategies throughout the supply chain. Topics will include: life cycle implications of technology selection; semiconductor industry strategies for providing long-term integrated solutions for rapidly changing technologies; manufacturing strategies to optimize cost, minimize obsolescence and assure supply for extended life requirements; innovative strategies to achieve cost effective after-life service requirements, and; examination of non-automotive sector experiences in adapting rapidly changing technologies.

Papers to be presented in this session include:

1. OEM Reuse Expectations & Implications for New Automotive Electronic Systems
2. Semiconductor Strategies for Providing Seamless Technology
3. Test Development Strategies for Evolving Automotive Electronic Technologies
4. A Sophisticated Approach to Product Change Approval (PCA) & Discontinue of Delivery (DoD) to Cope with Supply chain Management in Order to Assure the Reliability of Electronic Systems
5. Quantitative Methodology as a Means to Ensure Supply Continuity of Service Parts for Automotive Electronics
6. Ensuring Component Supply Through the Product Life Cycle

Session #4:
User Interface Challenges Amid the Increasing Complexity of Automotive Interiors
Automotive designers are responsible for developing ergonomically sound displays and controls to ensure vehicles can be operated in a safe manner. New emerging technologies, such as telematics, have enabled much more information to migrate into the vehicle; thereby significantly increasing human-machine interface design challenges facing electrical, mechanical and human factors engineers. The automotive industry must develop optimized solutions to address these fundamental challenges. This session will explore such issues and suggest potential counter measures.

Papers to be presented in this session include:

1. Model Based Development of Automotive Human Machine Interfaces
2. Voice Recognition Challenges in an Automotive Environment
3. Aligning Human-System Integration and Systems Engineering
4. Driver Distraction, Telematics Design and Workload Managers: Safety Issues & Solutions
5. Developing Safe and Compelling Automotive Human-Vehicle Interaction
6. Strategy and Challenges for an Integrated Human Machine Interface

Session #5:
Optimum Electrical Systems
What are the optimised electrical system architectures for different car platforms? How we can get there? How is the individual car architecture influencing common system developments like engine management or ABS? How does the physical module structure and responsibility influence the electrical architecture?

What will the future concept thinking be:
a) optimum car architecture
b) optimum systems
c) optimum physical module structures

Papers to be presented in this session include:

1. Key Drivers for a Future Automotive Systemarchitecture
2. Technologies and Components for Powertrain Distributed Structures – An Opportunity for Optimizing In-Vehicle EE Architecture
3. The Effect of Solid State Switching Devices on Weight Optimized Wiring Harness
4. Hybrid Electric Vehicle Charge/Discharge Control System Based on Car navigation Information
5. Scalable Modular Architecture (SMA): Analyzing "Electrical Hardpoints" to Realize and Optimum EEDS Architecture
6. Standard Interfaces and Standard Software Architecture as a Means for "Go Fast" Engineering
7. 42 Volts: The View from Today

Session #6:
Impact of Consumer Electronics on Auto Electronics
This session will explore the impact of consumer electronics on automotive electronics as it pertains to entertainment, on/off board communications, software, standards, consumer services, and portable devices vs. embedded devices. The session will also explore the economic and business considerations that consumer electronics have on automotive electronics.

Papers to be presented in this session include:

1. The New Deal of Telematics in Fiat Auto
2. Digital Mobility via Convergence of Consumer and Vehicular Application Data Spaces
3. "Windows Mobile for Automotive:" A Platform for Smart Telematics Systems
4. Plug and Play Personal Telematics
5. Entertainment: The Killer Application of Consumer Electronics in Vehicles

Session #7:
Systems Architecture: Software
The software content of modern vehicles is increasing exponentially. The management of complex functions and software-architectures will become a necessary core competence for the automotive industry. This session will explore the approaches to manage automotive software architectures by addressing the topics of standards, methods, processes, tools support and lifecycle management.

Papers to be presented in this session include:

1. A Strategy for Optimal Design of Embedded Systems with Human Machine Interfaces
2. Model Based Software Development for Automotive Electronic Control Units
3. A Systematic Approach to Testing Automotive Control Software
4. Service-based Software Development for Automotive Applications
5. Intelligent Automotive System Services Requirements, Architectures and Implementation Issues
6. AUTomotive Open System Architecture (AUTOSAR)) An Industry-wide Initiative to Manage the Complexity of Emerging Automotive E/E Architectures

Session #8:
X-by-Wire
X-by-Wire (e.g., braking or steering) has great promise for providing control flexibility, improved functionality, packaging improvements, increased efficiency and enhanced safety. This session addresses those developments necessary for the introduction of x-by-wire systems. Topics in this session will include redundancy and fail-safe strategies, power electronics, economics and the potential for autonomous functionality.

Papers to be presented in this session include:

1. X-by-Wire Functionality, Infrastructure and Performance
2. Application of the Concept of Behavioural and Statis Reliability to the Evaluation of Steer-by-Wire Systems Dependability
3. Smart Electro-Mechanical Actuation for Drive-by-Wire Applications
4. Development of a Fault Tolerant Steer-by-Wire Steering System
5. Safe-by-Wire Plus: Bus Communication for the Occupant Safety System

Session #9:
Business Process Transformations Needed
Good ideas and great technology are not enough to be successful! Often these ideas and technology changes drive changes in our business model and fundamentally the way we organize, the way we operate/collaborate and measure ourselves. This takes significant insight and drive to change the companies/cultures and to adopt the changes to successfully apply these ideas and technology. The Automotive Industry needs to improve its performance record in this area, both as individual companies as well as within their value nets. The session will explore and debate some examples of the past experiences and use the lessons learned to primarily focus on what needs to be done to improve our performance. These also represent the opportunities to differentiate your company from your competitors and to capture value that could get generated from the good ideas and technology. Come and listen to the experts and interact with them on some of the key insights.

Papers to be presented in this session include:

1. Transformational Challenges in the Automotive Infotainment Industry. Are We Up to IT?
2. Collaborative Electronics Supply Chain Models
3. International Truck: Transition to Services Centric Business
4. How to Turn Ideas into Products – Changing Business Models in the Automotive Industry
5. New Telematics Approach by "Diversifying Communication and Customer Opportunity"
6. Your Business Needs to Change to Succeed with Embedded Systems

Session #10:
Active Safety
Active Safety will include accident avoidance, impaired driver, and intelligent vehicle systems.

These would be active systems in the vehicle that are supportive of the driver to make vehicle movement safe in more situations. Some of the common issues are rollover, lane departure warnings, rear vision systems for back-up, detection of an impaired driver, object detection in the forward movement of the vehicle, and basic vehicle stability in varying weather and load conditions. The idea is to split the session into two areas – a 'systems' view of the whole vehicle and a 'hardware' specific view.

The Systems view would emphasize the whole vehicle and could emphasize a specific phenomenon like rollover

and vehicle stability. Included would be Software development for integration of various systems.

The Hardware view would emphasize specific component developments to support the vehicles diagnosis of specific conditions that exists, this would include hardware and software development.

Papers to be presented in this session include:

1. Sensing in the Ultimately Safe Vehicle
2. Accident Statistics and the Effect of Vehicle Dynamic Control Systems
3. Obstacle Detection Systems for Vehicle Safety
4. Laser Sensor for Low-Speed Cruise Control
5. Active Passive Integration Approach (APIA) – The Automotive Safety Electronics Hardware of the Future
6. Active Safety: Bosch Electronic Stability Control (ESP)

Session #11:
Powertrain

Powertrain management systems belong to the first and most sophisticated applications of vehicle electronics. Improved fuel consumption and emissions reduction were originally the most driving forces to introduce electronic control units. Meanwhile additional aspects such as performance, comfort and improved functionality support this development. The interference and data exchange with other vehicle systems is a basis to realize new functionalities to improve customer value.

Direct injection technologies for petrol and Diesel engines are conquering the market. The even in Europe increased rate of automatic transmissions drives the use of new electronic applications.

The session will explore new technologies, solutions and trends in powertrain electronics.

Papers to be presented in this session include:

1. Digital Controlled Powertrain in a Digital Car: New Features, Interactions, Mechatronics and Software
2. High Technology Electronic Diesel Injection Systems for Light Vehicles
3. Trend of Future Powertrain Development and Evolution of Powertrain Control System
4. Fast Transient Torque and Bus Voltage Control Techniques of a Belted Alternator Starter (BAS) Hybrid Electric Drive
5. BMW's Approach of Vehicle Functions and Systemorientation for Developing Innovative Power Trains
6. Analysis and Test Results of a Series Hybrid with a CIDI Engine driven Electrical Power Unit

Session #12:
Balancing Mobility Features w/Cost & Quality

The competitive pressure to enable additional features and functions to respond to regulatory needs, expanded vehicle performance, and exploding info/entertainment opportunities cannot continue without regard to added cost and complexity. New functions need to enter the high volume customer experience so that cost reduction and system simplification can naturally evolve, but without risk to vehicle programs. For new technologies to be successful in the market place, their introduction needs to be flawless at competitive price impact or they risk damaging the longterm future.

Papers to be presented in this session include:

1. Reconfigurable Tactile Display
2. The New Wireless Frontier: Home and Vehicle Connectivity
3. Communicating Outside the Box
4. Quality, Choice and Value – How New Architectures and Interfaces are Changing the Vehicle Lifecycle
5. Highly Scalable and Cost Effective Hardware/software Architecture for Car Entertainment and/or Infotainment Systems

Session #13:
Digital Driving Increases Consumer Value

Electronics have been integrated into the Powertrain and Chassis for emissions, fuel economy and safety compliance. Beyond these mandated uses, the Driver/Consumer has benefited from significant enhancements to the capabilities and performance of today's light duty vehicle. This session will explore some of the advances which have provided visible value to the consumer through the continued integration of electronics into the vehicle's powertrain and chassis systems and look to the next applications to further the enhance customer satisfaction.

Papers to be presented in this session include:

1. Concepts and Functionality of the Active Front Steering System
2. Characteristics of Vehicle Stability Control's Effectiveness Derived from the Analysis of Traffic Accident Data Statistics
3. Fuel Consumption Reduction and Driving Performance: Digital Engine Management Systems Make It Possible
4. Technologies of DENSO Common Rail for Diesel Engine and Consumer Value
5. Driving Assistance Provided by Adaptive Cruise Control
6. Chassis Control: An Overview of the Present and a Look at the Future

Session #14:
Regulatory & Environmental Impacts

Emission requirements have long been an important consideration for powertrain development. Upcoming LEV II and Tier 2 emission standards are driving more sophisticated electronic powertrain controls, plus CARB is continuing their drive towards zero-emission vehicles. Concerns about global warming and energy security are more recent, but are likely to have an increasing impact on powertrain development in the future. This session will explore the business impacts of these regulatory and environmental issues on future powertrain development and the role of electronics in meeting future requirements. Authors will address the future business cases for advanced gasoline engines, diesels, hybrids, and fuel cells and how regulatory and environmental issues and development of electronics impact them.

Papers to be presented in this session include:

1. Vehicle Infrastructure Integration – An OEM Perspective on a Government Initiative
2. Meeting Tomorrow's Challenges: The Role of the Internal Combustion Engine
3. H2-Fuel Cell Vehicles at DaimlerChrysler
4. Hybrid Vehicles – Does Hybridization Enable ICE Vehicles to Strive Towards Sustainable Development?
5. Advanced Electronics and Control Technologies for Fuel Efficient Low Emission Diesel Powertrains

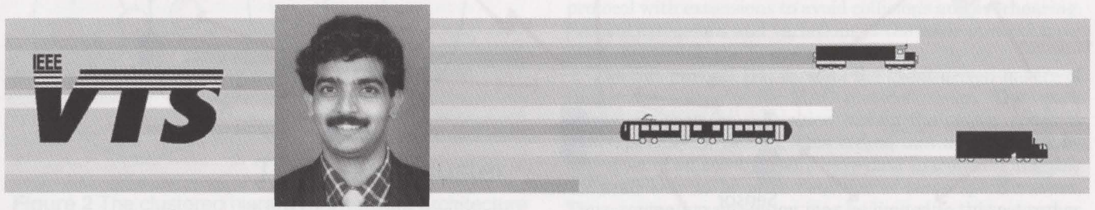
Session #15
Rate of Change in Electronics vs. other Industries

This session will explore the rate of change in different industries, how the industries adapt to the change and how industries with very different rates of change work together. Specifically, Electronics and Software are on technology change curves allowing them to introduce products in 3 to 6 month cycles, and sometimes faster. In contrast, automotive development cycle time is 18 to 24 months with major programs requiring even longer development time. Also automotive electronics need to be supported for several years after the initial introduction in a specific vehicle.

The discussion will explore lessons learned and what lessons may be transferable from one industry to another. This session will also explore what is required when two industries with very different rates of changes work together.

Papers to be presented in this session include:

1. Design Process Changes Enabling Rapid Development
2. The Automotive Challenge: Everything You Also Wanted to Know But Were Afraid to Ask!
3. Supporting Commercial Telematics Products within the Automotive Lifecycle
4. Automotive Electronics – What Makes it So Special?
5. Comparison of Aftermarket and OEM Development Cycles
6. Mating the Elephant with the Fruit Fly: How to Synchronize Engineering Development Cycles in Automotive, Electronics, and Software



Wireless Sensor Networks

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Wireless Sensor Networks is a fast growing and exciting research area that has attracted considerable research attention in the recent past. This has been fuelled by the recent tremendous technological advances in the development of low-cost sensor devices equipped with wireless network interfaces. The creation of large-scale sensor networks interconnecting several hundred to a few thousand sensor nodes opens up several technical challenges and immense application possibilities. Sensor networks find applications spanning several domains including military, medical, industrial, and home networks. This paper presents a brief overview of wireless sensor networks covering network protocols, data management, energy efficiency, localization techniques, security, and application examples.

Introduction

The convergence of rapid technological advances in wireless communications and micro-electrical-mechanical systems (MEMS) has made it possible to develop low cost, low-complexity miniature sensor devices with wireless communication capabilities. Each sensor device is equipped with a wireless transceiver and a reasonably powerful processor capable of signal processing and complex computation, in addition to the sensing hardware. It is possible to conceive applications where hundreds of these inexpensive sensor nodes could be deployed and form a self-organizing wireless sensor network (WSN) [1,2].

Networking these sensors provides several valuable capabilities: the system can cover a wider area of operation and provide desired properties such as redundancy, intelligent sensing, and improved accuracy. However, an important limitation is that the sensors have significantly limited computation, memory storage, communication, and battery power capabilities.

Sensor networks application domains range from military, medical and industrial to environmental monitoring, building and home networks. Several applications based on wireless sensor networks have been already demonstrated [3,4,5]. Further, wireless sensor networks have moved from the research domain into the real world with the commercial availability of sensors with networking capabilities from companies such as Crossbow (www.xbow.com), Dust (www.dust-inc.com), Ember (www.ember.com) and Intel (www.intel-research.net). However, there is still a great need for substantial research innovations and testbed-based experimentation.

Some of the key research challenges in WSNs deal with the design of simple and efficient protocols for different network operations, design of energy-conserving protocols, scalability of network protocols to large number of nodes (1-10 thousand nodes per network), design of data handling techniques including data querying, data mining, data fusion and data dissemination, localization techniques, time synchronization, security and the development of exciting new applications that exploit the potential of wireless sensor networks.

In this paper, we present an overview of the various research problems that have been addressed in the area of sensor networks. We first discuss work on sensor network architectures and medium access control protocols followed by routing and transport protocols. We then present challenges and solutions related to energy efficient network operation. This is followed by a discussion on data dissemination protocols, localization techniques and network security.

Network Architecture

The wireless sensor network consists of a set of sensor nodes and a more-powerful entity called the basestation (BS), as shown in Figure 1. The architecture of a sensor node is quite dependent on the intended application, but typically consists of the sensing hardware, processor, radio transceiver, memory, and battery. The transceiver can be either half- or full-

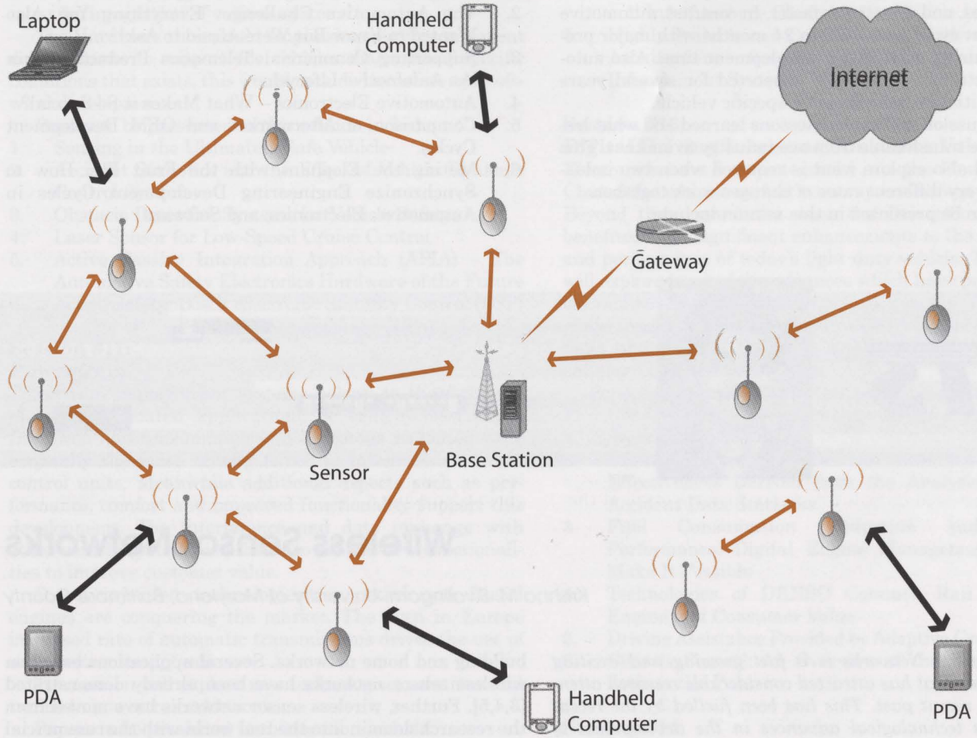

Figure 1 The sensor network architectural view.

duplex with a typical transmission range of 10m to 200m. For example, the MICA2 sensor node from Crossbow, Inc. has a form factor of a U.S. quarter coin's size and is equipped with a 7.7 MHz Atmega 128L CPU, 4KB Configuration EEPROM, 128KB of program flash memory, 38.4 Kbaud wireless transceiver operating at 433 MHz or 868/916 MHz, outdoor range of 500 ft, a 3V coin cell battery and the TinyOS operating system [6].

Each node has a unique hard-coded ID to identify itself to its neighbours and to the base station. The embedded computational device (processor) in the sensor node does the necessary signal and network processing. The basestation is the information gathering point for the network and may act as the interface between the wireless network and a wired network infrastructure, if available. The base station is assumed to have a large transmission range to cover the whole network to reach all the nodes in the network.

Wireless sensor networks are typically organized based on hierarchical clustering or tree-based layered architectures [7,8] as shown in Figures 2 and 3. In the hierarchical approach, nodes are grouped into clusters with one of the nodes serving as a cluster-head [7]. In a two-level hierarchy, a sensor node forwards data to the BS via its chosen cluster-head. The cluster-head can also perform data aggregation and data fusion functionalities to reduce network traffic. Cluster-heads could be specialized nodes with additional battery power, higher transmission range and more computation capability. Alternatively, some architectures consider homogeneous sensor nodes where a node is expected to expend higher power when it serves as a cluster-head. To extend the network system's lifetime, the system could use randomized rotation of the clustering head nodes among all the nodes in the network to evenly distribute the energy consumption.

With the layered (or tiered) multi-hop network architecture, the network nodes that have the same hop-count to the base station are grouped into a layer [8]. Thus, the network consists of a set of layers where the layer closest to the BS is called the first layer (or 1-hop layer) and subsequent layers are similarly numbered. The number of layers and the number of nodes in each layer is determined by the geographical distribution of the nodes, the transmission range and the location of the BS. For instance, when 100-nodes are randomly placed in a 250m ¥ 250m field, we have 4 to 5 layers if the BS is in the centre of the field and 8 to 9 layers if the BS is in a corner. During network topology discovery, each node identities a node in its inward layer (towards the BS) as its forwarding node. A node can choose from one of several possible nodes in the inward layer by using criteria such as the forwarding node's battery power, distance and buffer space. Packets are then routed from one layer to the next inward layer until the packet reaches the BS. In Figure 3, node 9 could select node 3 as its forwarding node and node 3 could select node 2 as its forwarding node, where node 2 can directly transmit to the BS.

Once the network architecture is determined, a suitable network discovery mechanism has to be defined. This is necessary since sensor networks should be self-organized and

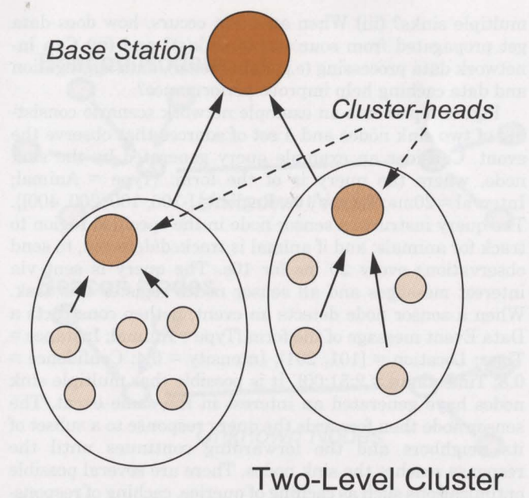

Figure 2 The clustered hierarchical network architecture

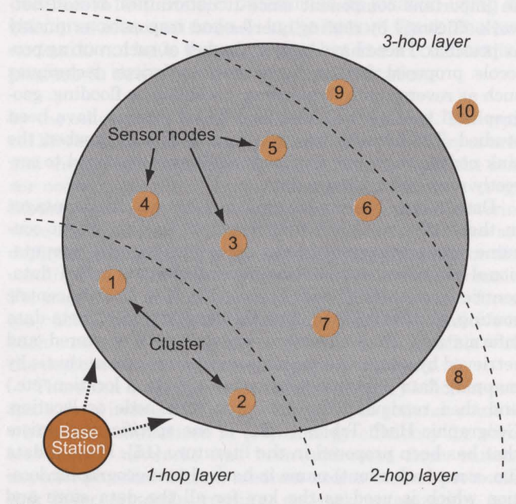

Figure 3 The multi-hop layered network architecture

autonomous with minimal infrastructure support. The important challenges are minimizing the time for network organization, fast reorganization when nodes enter and leave the network, energy-efficient operation and low control traffic overhead.

MAC Protocols

The medium access control (MAC) protocol is required to coordinate access to the shared transmissions channel(s). There has been a fair amount of work on designing MAC protocols specifically for sensor networks. The important challenges are efficient utilization of limited network bandwidth and minimization of packet retransmissions, energy consumption and packet delay.

One of the first experimental results for sensor networks based on the Berkeley motes was presented in [9]. The protocol is based on the classical Carrier-Sense Multiple-Access (CSMA) mechanism and its variants. The paper also presents a rate adaptive MAC protocol designed for multi-hop sensor networks. This protocol allows nodes to vary their transmission rate according to a probabilistic value in order to balance a node's originating traffic with the route-through traffic. The results show that this approach is suitable for small networks, but will result in high packet loss in large networks due to collisions. An energy-conserving protocol called S-MAC (Sensor MAC) is presented in [10], where neighbouring nodes operate in a synchronized sleep-and-listen mode of operation by waking up only at pre-determined times to exchange data with their neighbours. The underlying MAC mechanism is similar to the CSMA/CA protocol with extensions to avoid collisions and overhearing. Several extensions and variations of the basic protocol have been reported in the literature.

The Sift protocol [11] exploits the event driven nature of the sensor networks for MAC protocol design. This work points out that the contention among the sensor nodes is often spatially correlated. This means that at a given time, only a set of adjacent sensors have data to transmit and this is most likely to be after detection of some specific event. Thus, contention resolution may be limited to this set rather than all the sensors in the network. The protocol adopts a typical random access protocol such as CSMA or CSMA/CA and uses a fixed size contention window with a non-uniform probability distribution for choosing the contention slot for a node.

The above protocols are based on random access techniques where collisions are possible. Protocols based on static access (such as TDM scheduling-based) have also been reported in the literature. One of them is the unified protocol framework (UNPF) [8] protocol defined for the layered architecture presented earlier. A Time Division protocol, called Distributed TDMA Receiver Oriented Channeling (DTROC), is proposed as the MAC protocol. The MAC protocol assumes the availability of a number of channels either in the form of a code or a frequency. The receiver of a forwarding node (in the Kth layer) is assigned a unique channel (with spatial reuse possible). The forwarding protocol shares this channel among its client nodes located in layer (K+1). Figure 4 illustrates this organization. Note that

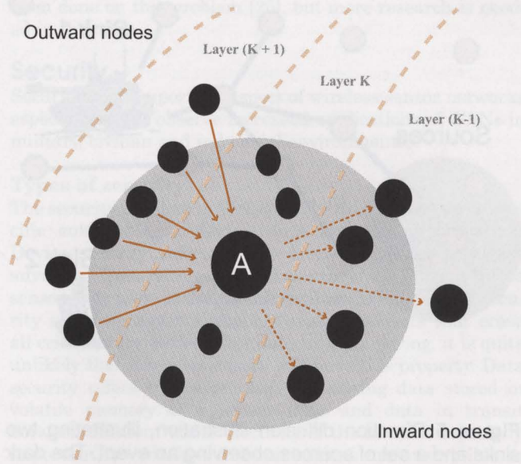

Figure 4 Example layered organization, showing the clients and forwarding node of node A (in the center).

the nodes closest to the BS form layer 1. A forwarding node can use any scheduling scheme to share its pre-assigned channel among its clients.

A comprehensive survey of several other MAC protocols proposed in the literature may be found in [Ch. 5 of 1].

Data Dissemination

The primary purpose of sensor networks is collecting data and then disseminating them to the appropriate data processing entities. There are two major models of data handling in WSNs: data gathering and data diffusion.

In the data gathering model [12], the sensor nodes periodically send the collected data (in raw or processed form) to the data collecting entity (either the BS or some other remote node). Nodes can also involve in cooperative processing such as data fusion where intermediate nodes fuse the data obtained from several sensor nodes and then forward the fused data. The research challenges for this model include developing efficient techniques for data forwarding that reduce latency and energy consumed and for data aggregation that maintain data integrity and reduce network traffic.

In the data diffusion model [13], the sensor nodes observe and record data or system events (such as detection of abnormal activity) but do not send them to a collection node. Instead, there exist special nodes in the network called sink nodes that generate queries about specific network events. The network has the task of propagating these queries to all (or a subset of) the sensor nodes. When a node receives a query and has information in response to the query, it will generate a response that is forwarded by the network to the appropriate sink node(s). Such a model is referred to as a data-centric model since the communication does not deal with individual nodes and instead deals with data queries and responses.

Some of the interesting research issues include: (i) How does a sink express its interest in one or more events? (ii) How do sensor nodes keep track of existing interests from multiple sinks? (iii) When an event occurs, how does data get propagated from source(s) to sink(s)? and (iv) Can in-network data processing (e.g. data fusion), data aggregation and data caching help improve performance?

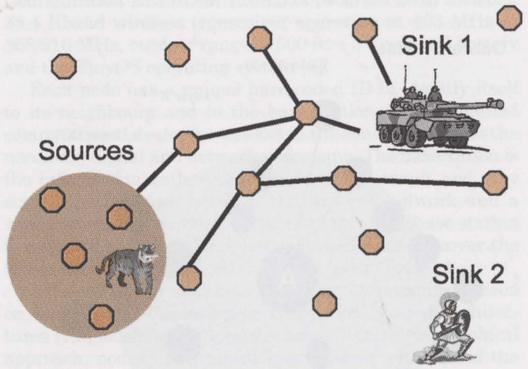

Figure 5 Direction diffusion illustration, illustrating two sinks and a set of sources observing an event. The dark lines show the interest propagation through the network. In this case, the interest reaches two source nodes which will later send response data.

Figure 5 presents an example network scenario consisting of two sink nodes and a set of sources that observe the event. Consider an example query generated by the sink node, where the query is of the form: {Type = Animal; Interval = 20ms; Time = 10s; Region = [-100, 100, 200, 400]}. The query instructs a sensor node in the specified region to track for animals; and if animal is tracked/detected, to send observations every 20 ms for 10s. The query is sent via interest messages and all sensor nodes register this task. When a sensor node detects an event, it then constructs a Data Event message of the form {Type = Animal; Instance = Tiger; Location = [101, 201]; Intensity = 0.4; Confidence = 0.8; Timestamp = 2:51:00}. It is possible that multiple sink nodes have generated an interest in the same event. The sensor node then forwards the query response to a subset of its neighbors and the forwarding continues until the response reaches the sink nodes. There are several possible optimizations such as caching of queries, caching of responses, selecting a subset of sensor nodes to send responses, etc.

In the data dissemination model, the routing protocol is an important component since it determines overall network efficiency by routing queries and responses as quickly as possible. There have been a number of such routing protocols proposed for sensor networks. Various techniques such as reverse path forwarding, probabilistic flooding, geographical routing, and cost-field based routing have been studied. The problem becomes more challenging when the sink nodes are mobile requiring additional overhead to correctly route the response data.

Data-centric routing however has its own disadvantages in that excessive query and response flooding might consume a large amount of precious bandwidth and computational resources. A complementary technique called data-centric storage (DCS) was proposed in [14]. In data-centric routing, routing is based upon the data name (i.e. meta-data information). In data-centric storage, data is stored and retrieved by name. One possible way to implement this is by mapping data names to locations (e.g. node, a location, etc.) and then retrieving the data from this node or location. Geographic Hash Tables (GHT) is one specific mechanism that has been proposed in the literature [15]. Here, a data (i.e. a network event) name is hashed to a geographic location which is used as the key for all the data store and retrieve operations. Data-centric storage is an active area of research and a comparative discussion may be found in [Ch. 9 of 1].

Energy Efficient Design

Energy efficiency is a significant concern in the mobile and wireless environment. This is due to the limited power available from current generation battery technology. Since battery power conservation is even more important in the limited capacity sensor nodes, it deserves closer attention. One of the techniques to conserve energy is by turning off the different components as and when they are determined to be not necessary. A sensor node's lifetime, and thus the overall network lifetime, can be prolonged by turning off one or more of these components: the transceiver, the CPU (controller unit), the sensing hardware, or the entire sensor node itself. For example, a node's wireless transceiver can be in four possible states: transmit, receive, standby and idle. The maximum power consumed is in the transmit state followed

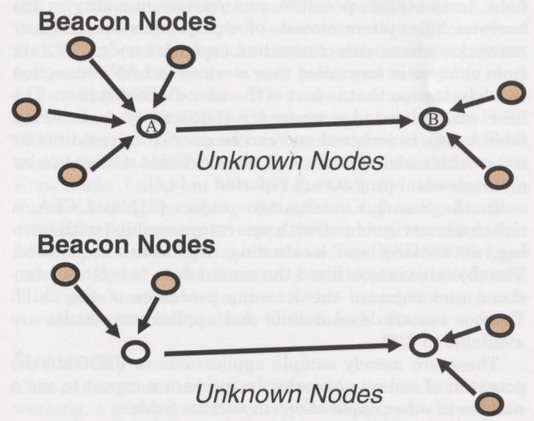

Figure 6 An example of node multi-lateration. In the top figure, node A determines its location from the beacon nodes and then node B determines its location using its beacon nodes and node A. In the bottom figure, the two nodes do not have three beacons but use a collaborative process to determine their respective locations.

by the other states in the listed order [Ch.3 of 1]. The typical lifetime of a sensor node depends upon its battery source and the application it is designed for. For example, the sensor nodes in the Great Duck Island project had an average lifetime of about 20 days and in some cases nodes' batteries were replaced once [Ch 18 of 1]. When nodes' batteries are depleted, the choice of replacing with new batteries or discarding the nodes depends upon the application scenario. For instance, a network deployed in the a desert or a forest may not be amenable to frequent visits and the objective in such a case will be to collect as much data as possible with the deployed nodes until the network is unusable.

There is a large body of research on energy efficient protocols for wireless and ad hoc networks in general, some of which are summarized in [16]. Energy efficiency for wireless sensor networks has been addressed from various aspects: physical design, medium access control protocols, link layer protocols, routing, network organization, and data aggregation.

For example, the S-MAC [10] protocol attempts to conserve power by placing nodes in sleep mode and having them wake up periodically to exchange data. The PEGASIS data aggregation mechanism [12] uses the greedy chain algorithm to minimize energy consumption. Energy-efficient design of modulation schemes is considered in [17,18]. A detailed discussion of energy-efficient design issues may be found in [Ch.3 of 1,19].

Node Localization Systems

It is often necessary that the data generated by a sensor node be accompanied by the node's location information. For example, a target detection system will require the sensor nodes to report their location in order to take appropriate action. Thus, a node localization system is frequently a necessary and integral part of the sensor network depending on the application. The system should be cheap, light-weight, consume less power and reasonably accurate with a low form-factor. A Global Positioning Systems (GPS) based solution is not always feasible since GPS cannot work indoors, in dense foliage, etc., the power consumption is very high, and the size of GPS receiver and antenna will increase the node form factor. Indoor localization systems such as RADAR [20] and Cricket [21] have been developed, but they require significant infrastructure support.

A typical indoor localization system uses a fixed infrastructure with beacon nodes strategically placed to provide coverage. The sensor nodes receive beacon signals and measure various metrics such as signal strength, signal pattern, time of arrival, time difference of arrival and angle of arrival. The nodes use measurements from multiple beacons and use different multi-lateration techniques to estimate location. The accuracy of estimate depends on the correlation between measured entity and distance.

In [22], experimental results are presented for a sensor network localization system. The paper shows that a system using only the Received Signal Strength Indicator (RSSI) of RF-signals can provide ranging up to 10m, i.e. a node should be within 10m of the beacon node to determine its location. However, the location accuracy is lower due to lack of sufficient correlation between RSSI and distance. Hence, they propose a system that uses RF and Ultrasound signals to determine location. The beacon node transmits an RF and an ultrasound signal to the receiver. The time difference of arrival between the two signals is used to measure distance. Studies show that a higher accuracy of 2 cm accuracy is possible but the locationing range is restricted to 3 m. The system uses a combination of atomic, iterative and collaborative multi-lateration that enables most of the sensor nodes to determine their location. For the example network shown in Figure 6, node A is able to determine its location using the four beacons; subsequently, node B determines its location using node A's location and the other two beacons that it hears.

In other related work, a directionality information based approach has been reported in [23]; a range free area based Point-In-Triangulation scheme has been studied in [24]. Given that localization systems do have error-prone estimates, the impact of localization errors on applications needs to be understood thoroughly. Some initial work has been done on this problem [25], but more research is needed in this area.

Security

Security is an important aspect of wireless sensor networks especially as we observe increased applications of WSNs in military, civilian and industrial environments.

Types of security

The security problem in WSNs can be divided into three specific sub-problems: device, data and network security. Device security refers to the problem of preventing an adversary from taking physical control of, tampering with a sensor node and extracting information. While several security solutions assume tamper-resistant sensors that erase all critical information after detecting tampering, it is quite unlikely that low-cost sensors will have this property. Data security refers to the problem of securing data stored in volatile memory of a sensor node and data in transit between different nodes. Security of the latter is especially important, as wireless communications are susceptible to eavesdropping and other attacks. The third sub-problem is network security. WSNs, unlike traditional wired networks, cannot be statically designed and established. Network

security is important to prevent an adversary from mounting a variety of attacks, such as denial of service [26] and traffic analysis during network self-organization and subsequent operation of network protocols. Various attacks that can be mounted against routing protocols for WSN such as Sinkhole, Wormhole and Sybil are discussed in [27].

Solutions to the WSN security problem that can provide network, data and device security are, however, non-trivial. This is because, unlike nodes in wired networks, sensor nodes possess a limited amount of energy and computation power forcing a trade-off between the desired security level (e.g., confidentiality, authentication) and energy consumption.

Key management

Regardless of security trade-off decisions and design goals, any security mechanism requires the use of cryptographic keys. The mechanism may be simple, using a common, preloaded network-wide key shared by all nodes or it could be complicated, distributing a unique key for each pair of sensor nodes. Thus, key management is an integral component of any security solution to establish, distribute, update and delete cryptographic keys. Key management for WSNs is a topic of active research in the community, with several techniques proposed recently [28,29,30].

The various key management techniques can be classified into two types: probabilistic and deterministic schemes.

Probabilistic schemes: In this scheme, a set of keys are pre-distributed to each sensor node with the assumption that any given pair of nodes will share a common key with a certain (presumably high) probability. The desired probability to achieve a given network connectivity can be determined from system parameters such as network size, memory capacity of sensor node, etc. The various schemes in this category focus mainly on the different ways to set up pair wise between sensor nodes.

Deterministic schemes: In this scheme, there are typically no offline steps such as key pre-distribution. The only keys that might be pre-distributed are the individual keys that each sensor shares with the base station. Other keys, such as pairwise keys shared between nodes and group keys, are established after deployment.

Some of the issues that need to be better addressed by the key management schemes are scalability and node mobility. A key management scheme should be scalable enough to support tens of thousand of nodes since practical systems are expected to have large number of nodes. It should not be limited to static sensor networks but also take into consideration mobile nodes and issues arising out of mobility. The effectiveness of the various schemes also needs to be evaluated by experimenting in a testbed environment.

There are several other aspects of security including authentication mechanism design, detection of compromised and aberrant nodes and revocation of node privileges. There is active research on these aspects and we expect to see more mechanisms and implementation studies in the future.

Applications

There have been several applications of wireless sensor networks, some of which are briefly discussed here.

In the Great Duck Island project [3], a joint project by College of Atlantic; Intel and UC Berkeley, a wireless sensor network is used to monitor usage patterns of nesting burrows in the island. The objective is to understand the changes in burrow conditions during breeding season. The sensors are capable of measuring several factors including light, temperature, pressure, and relative humidity in the burrows. The system consists of multiple clusters of sensor networks, where each cluster has a gateway node. The data from clusters is forwarded over a wireless LAN connection to a basestation that is part of the island's field station. The base station provides necessary connectivity to Internet. Sensor data is archived and can be queried in real-time by users with mobile devices and remote clients. Other similar environmental projects are reported in [4,5].

In the Smart Kindergarten project [31] at UCLA, a classroom environment with smart toys enabled with sensing, networking and locationing capabilities is created. The objective is to utilized the sensed data to better understand and enhance the learning processes of the child. Further system level details and application results are available in [32].

These are merely sample applications to illustrate the potential of sensor networks. In future, we expect to see a number of other applications in various fields.

Other Issues

There are a number of other significant challenges in wireless sensor networks, briefly summarized here. These include time synchronization, exposure and coverage.

For a deeply distributed system such as WSN, it is necessary to provide a high precision of pair wise and network-wide time synchronization, of the order of a few microseconds. There has been recent research activity on this problem some of which it is discussed in [33,34].

Coverage is a measure of the quality of service of a sensor network and is used to denote how well the network observes (or covers) a given event such as intruder detection, fire detection, radiation detection, etc. The coverage problem is an important practical one that arises in sensor network design. For example, consider a sensor network designed to cover a stadium using different types of sensors (radiation, chemical, etc.). Coverage depends upon several factors including the range and sensitivity of the sensing nodes and the location and density of sensing nodes in a given region. Two types of coverage problems are defined in [35]: Worst-Case Coverage that denotes areas of breach (lowest coverage) which can be used to determine if additional sensors are needed in parts of the network; and Best-Case Coverage that denotes areas with best coverage and hence could be used by a friendly user to navigate in those areas. Solutions to these problems based on Voronoi diagrams and Delaunay triangulation have been considered.

The exposure determination problem is related to the coverage problem. Exposure may be defined as the expected ability of observing a target in the sensor field and is formally defined as the integral of the sensing function (depends on distance from sensors) on a path from one point in the sensor field to another. The problem of determining the minimum exposure path given a network with randomly placed sensor nodes is studied in [36].

Given the proliferation of sensor types and wireless sensor nodes from various vendors, there is a need for standardization to ensure interoperability and communication between nodes coming from different manufacturers. There are a few standards activities currently in progress that address this need. The IEEE 1451.4 Wireless Smart Transducer Interface Standard (http://grouper.ieee.org/groups/1451/4) will define the protocol and the interface to allow analog transducers to communicate digital information with sensors and actuators. The standard will also define the Transducer Electronic Data Sheet (TEDS) format. The IEEE 802.15 TG4 (http://grouper.ieee.org/groups/802/15/pub/TG4.html) is designing very low complexity, low data rate solutions (from 20 Kbps up to 250 Kbps) for devices such as sensors, smart badges and remote controls with prolonged battery life of up to several months or years. The medium access control protocol is based on the CSMA/CA mechanism used in the IEEE 802.11 standard. A commercial sensor product called Telos available from Moteiv, Inc. (http://moteiv.com) includes a 250 Kbps radio based on the IEEE 802.1.15.4 standard. In Further, the Zigbee alliance (http://www.zigbee.org) has been established to create an open networking standard that builds upon other IEEE standards such as IEEE 802.15.4 and provides logical network, security and application software. The Zigbee standard is designed for low to very low duty cycle environments with hundreds to thousands of active nodes.

Summary

This paper presented an overview of wireless sensor networking, a growing and exciting research area with a number of potential applications. The sensor nodes are equipped with sensing, computing and wireless communication capabilities enabling several hundred to a few thousands of nodes connected to form a network. The paper discussed some of the significant research challenges and proposed solutions. With leading funding agencies such as the National Science Foundation (NSF) spearheading research on sensor hardware and sensor networking, substantial research and innovation is expected in the near future.

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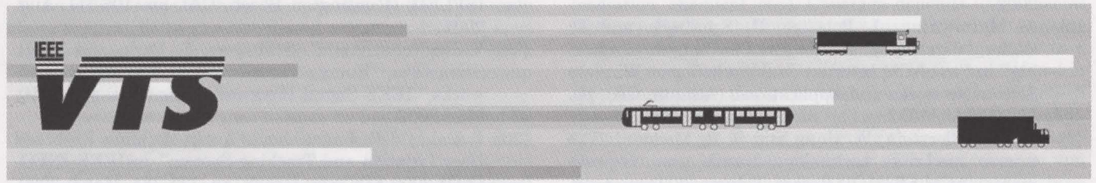

An Overview on COST 273—Towards Mobile Broadband Multimedia Networks

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A brief overview is presented on an European project within the COST framework, COST 273, which deals with radio aspects of mobile and wireless networks. In particular, radio interface, propagation and antennas, and radio network aspects are addressed by the project, grouped into three Working Groups. Within the Working Groups, Sub-Working Groups deal with more specific issues, namely, MIMO systems, antennas for mobile terminals, measurements procedures, and scenarios for network planning and organisation. Detailed information can be found at http://www.lx.it.pt/cost273.

Introduction

There is no doubt today that mobile and wireless communications have an increasing importance in the telecommunications world, and that this trend will continue in the next few years. Moreover, Europe wants to continue to play a leading role in this area, as was the case with GSM (the well known 2nd generation system, which is a worldwide success). This is also expected to be the situation with UMTS (the 3rd generation system, still under standardisation in some aspects, but already in trial/commercial operation in some European countries, and in full commercial operation in Japan), due to its importance to European industry. As a consequence, R&D continues to be a key factor, and issues related to the next generation of mobile and wireless systems, dealing with broadband multimedia communications (with bandwidths, hence, data rates, much larger than the 3rd generation ones), are already being addressed by a large number of people in the European R&D community. It has also been recognised, for many years now, that better and faster results are achieved by joint efforts at the European level, rather than countries conducting their national programmes individually. The RACE, ACTS [1], IST [2] and COST [3] (European Cooperation in the Field of Scientific and Technical Research) frameworks are the result of this recognition, and many projects were, are being, and certainly will be developed in the area of mobile and wireless communications within these frameworks.

The Telecommunications area of COST has already in its curriculum very successful projects, designated as Actions, which dealt with mobile and wireless communications, and have contributed to the development and standardisation of commercial systems:

- COST 207, "Digital Land Mobile Radio Communications", Mar. 1984 – Sep. 1988, which contributed to the development of GSM;
- COST 231, "Evolution of Land Mobile Radio (Including Personal) Communications", Apr. 1989 – Apr. 1996, [4], which contributed to the deployment of GSM1800 and to the development of DECT, HIPERLAN 1 and UMTS;
- COST 259, "Wireless Flexible Personalised Communications", Dec. 1996 – Apr. 2000, [5], which contributed to the deployment of DECT and HIPERLAN 1 and to the development of UMTS and HIPERLAN 2, as well as initial inputs to the next generations of HIPERLAN and 4th generation systems.

For example, COST 207 provided the channel model for GSM, COST 231 defined propagation models for the GSM band that are recommended by ETSI and ITU-R, while COST 259 conducted simulations addressing the dispute over the access techniques for UMTS (TDMA versus CDMA), supporting ETSI on its decision, and established the basis for directional channel models. All these Actions have basically addressed the various areas of wireless/mobile communications for the systems already identified, i.e., propagation and channel modelling, radio system and network aspects, modulation and access techniques, antennas (from a system point of view) and diversity issues, channel allocation strategies, cellular planning tools, protocols, and traffic modelling, among others. Each of these projects has published a Final Report, which constitutes the summary of the main results achieved in it [6], [7], [8].

These areas, together with new topics that in the mean time caught the attention of researchers, e.g., especially, MIMO systems, continue to be the main focus of research in mobile and wireless systems addressing broadband multimedia communications. This constitutes the theme for the current project, COST 273, "Towards Mobile Broadband Multimedia Networks", May 2001 – May 2005 [9], which emerged as a follow-on from the previous projects.

This paper contains a brief overview on COST 273. The following section addresses the objectives of the Action. Subsequently, the organisation and the technical structure of the Action are introduced, and then some topics dealt with in each of the Working Groups are listed. Very brief conclusions are presented at the end.

Objectives

The main objective is to increase the knowledge on the radio aspects of mobile and wireless broadband multimedia networks, by exploring and developing new methods, models, techniques, strategies and tools towards the implementation of 4th generation mobile and wireless communication systems. It considers frequencies ranging from the upper UHF up to millimetre waves, and data rates essentially higher than 2 Mb/s. As a secondary objective, it is intended that it should continue to play a supporting role similar to the one played by the previous Actions in the mobile and wireless communications area. That is, besides giving inputs to the development of systems beyond the 3rd generation, it is also expected that it will contribute to the deployment of systems that are more or less standardised, like UMTS and WLANs.

The activities carried out in the Action will bring benefits not only at a national level but also at the European one. It is expected to maintain, and even increase, the industrial competitiveness of European industry in the mobile and wireless communications area, due to the work on future systems and the assistance in the deployment of existing ones. It includes research work that ranges from the fundamentals of the systems to the more applied aspects, and it addresses the various aspects of mobile and wireless systems, therefore, creating conditions for multidisciplinary work. It brings direct benefits to the countries and institutions involved, since this pan-European activity enables the exchange of information at a level that would not be possible for the researchers individually, just by attending conferences or by conducting bilateral exchanges. It helps to improve the quality and to speed up the results of the performed R&D work in the very competitive area of mobile and wireless communications, because of the permanent collaboration and exchange of information. It supports European standardisation bodies in their work at the more international level, by creating inputs leading to better technically supported decisions: Last, but not the least, the grouping of such a large community of researchers contributing to standardisation provides further stimulation to the growth of the mobile and wireless communications market.

Organisation

The Action is structured into Working Groups (WGs), 3 in total, within which the technical work is carried out:

- WG 1 - Radio System Aspects,
- WG 2 - Propagation and Antennas,
- WG 3 - Radio Network Aspects.

Sub-Working Groups (SWGs) have also been created, devoted to more specific topics, at the moment, being as follows:

- SWG 2.1 - MIMO channel model,
- SWG 2.2 - Antenna performance of small Mobile terminals,
- SWG 2.3 - Channel Measurements,
- SWG 3.1 - Mobile radio networks reference scenarios.

The description of their activities is presented in the next section, Figure 1 showing their interrelation.

The leadership of the Action, and of the several WGs and SWGs, is spread over various countries:

Chairman – Luis M. Correia, Instituto Superior Técnico / Technical University of Lisbon, Lisbon, Portugal
Vice-Chairman – Narcis Cardona, Technical University of Valencia, Valencia, Spain
WG 1 Chairman – Alister Burr, University of York, York, UK
WG 2 Chairman – Ernst Bonek, Technical University of Vienna, Vienna, Austria

WG 3 Chairman – Roberto Verdone, CNIT at the University of Bologna, Bologna, Italy
SWG 2.1 Chairman – Andreas Molisch, University of Lund, Lund, Sweden
SWG 2.2 Chairman – Gert Pedersen, Aalborg University, Aalborg, Denmark
SWG 2.3 Chairman – Pertti Vainikainen, Helsinki University of Technology, Helsinki, Finland
SWG 3.1 Chairwoman – Silvia Ruiz, Polytechnical University of Catalonia, Barcelona, Spain

The Management Committee and the WGs meet three times per year [9], meetings circulating among the participating European countries; SWGs also meet at the same time as the WGs, but additional meetings can occur. Besides administrative matters, which occupy a small fraction thereof, essentially these meetings are used to present and discuss Temporary Documents (TDs), which consist of the technical contributions of each participating institution. A full list of TDs, with abstracts, is available in [9]. Although the documents themselves are only available inside the project, authors can be addressed directly to release their own TDs. Usually, meetings begin with one or two half day tutorials, given by participants, on topics dealt within the project; up to now, the following areas were addressed: "Channel Modelling", "Game Theory", "Propagation Models", "Radio resource management", "Iterative (turbo) MIMO equalisation techniques", "MIMO channel modelling revisited", "Turbo-codes and Turbo Processing". At the end of each project year, a workshop is held, many times in conjunction with other Actions or other bodies, hence, putting together people with interest in a given research area. Previous workshops were devoted to "Opportunities of the multidimensional propagation channel" [10], "Broadband wireless local access" [11] and "Antennas and Related Systems Aspects in Wireless Communications" [12] (this last one, co-organised with COST 284).

At present, 26 European countries have signed the Memorandum of Understanding (MoU), which makes of COST 273 one of the largest Actions in the COST framework: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, The Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, UK, Yugoslavia. Additionally, a few selected highly renowned institutions from 4 countries outside Europe are also participating: Canada, Japan, Taiwan, and United Stated of America. A total of 112 institutions [9] are actively contributing, roughly involving around 400 researchers. Institutions from one of the countries that have signed the MoU are welcome to participate, but they are required to contribute with at least a TD in one meeting per year; in the case of institutions from other countries, their participation is also welcome, but this needs the approval of the Management Committee, and they are required to contribute with at least a TD in two meetings per year.

The regular meetings and the exchange of newest results, sometimes even such that need substantiation before publication, have lead to the spirit of "competitive co-operation". Each group wants to present their latest results on pressing issues ahead of others. Many new ideas spring up just from the comparison of methods.

Basically, the project does not involve any funding to participating institutions. The funding allocated to the Action is essentially to support the secretariat, the annual workshop, and travel expenses in certain circumstances (for a limited number of participants to attend the Management Committee meetings and to exchange researchers between institutions). This means that the results presented at the project, travel to the meetings for most researchers, and so on, are funded by other sources, at the institutions responsibility.

Technical Issues

The technical work is carried out in the Working Groups, as previously mentioned. A description of the topics addressed in each one follows.

The specific areas dealt with by Working Group 1 include:

- MIMO transmission techniques, including space-time codes and spatial multiplexing and their performance on realistic propagation channels;
- smart antennas and beamforming;
- turbo (iterative) processing techniques, and other approaches, applied to equalisation, synchronisation and channel estimation, and multi-user detection;
- multi-user systems and access techniques, including WCDMA;
- development of OFDM systems and techniques, including MC-CDMA;
- modulation and coding techniques, including turbo-codes;
- adaptive systems and adaptation algorithms;
- implementation issues, including computational complexity, and the effect of non-linear amplifiers.

Working Group 2 addresses mainly the following topics:

- physical propagation mechanisms for mobile/wireless radio, at the specific bands of micro- and millimetre-waves; questions of modelling, characterisation and measurements of scattering effects, relevant multipath components, path correlation, path parameters variability, diffraction, and materials characterisation are investigated as well;
- modelling techniques for the characterisation of propagation (e.g., deterministic approaches based on ray-tracing, statistical characterisation, and neural networks), and their assessment by measurements, having in mind signal estimation for planning purposes, and taking into consideration time-variant effects, system bandwidth, elevations and large scale effects; fading prediction over more than a wavelength ahead is a fairly new topic that promises major steps forward in adaptive modulation;
- modelling, evaluation by measurements and implementation in simulators of directional wideband radio channels for adaptive antennas, addressing the various aspects like direction-of-arrival and angular power spectrum, polarisation, and statistical approaches including time-variant effects, including as well the double-directional approach applicable to MIMO systems;
- analysis of propagation channels for the specific scenarios of mobile to mobile and point-to-multipoint; modelling of adaptive antennas radiation, characterisation of various antenna array geometries, and antenna array calibration, accompanied by multi-sensor measurements, and impact on system performance;
- characterisation of handset antennas, including the comparison of the antenna loss in real scenarios with standard ones and 3-dimensional radiation pattern measurements (both spatial distribution and polarisation characteristics) in real indoor and outdoor scenarios and also in the presence of humans and/or phantoms in anechoic chambers.

As for Working Group 3, its areas of activity encompass:

- analysis of techniques for radio network optimisation, not specifically addressing a particular air interface standard, but aiming at the provision of general results;
- development of general methodologies, both analytical and simulative, for the performance evaluation of radio networks; development of simulation techniques at system level for wireless cellular networks, including suitable interfaces with the link level;
- investigation of advanced radio network planning aspects, like automatic reconfiguration and planning using operational information, definition and analysis of network quality concepts (including quality of service), and enhancements by using adaptive antennas;
- investigation on aspects of network optimisation in WCDMA (both TDD and FDD) systems, and on capacity-related issues, namely optimisation of downlink signalling power, soft handover parameters, power control, dynamic channel allocation, mobility management, MAC protocols, link layer control, scheduling, etc.;
- analysis of traffic models and scenarios for 3G (WCDMA) and B3G networks, new applications, and their impact on the design of wireless transmission techniques;
- study of the performance of MAC and networking techniques for packet radio networks, in Wireless LANs or Personal Area Networks, using IEEE802.11 or Bluetooth;
- investigation of networking issues in self-organising networks, such as ad hoc networks.

The purpose of Sub-Working Group 2.1 is to establish a model of the wireless channel that is suitable for MIMO systems. This is the natural continuation of previous COST channel modelling activities. It is planned to establish a suitable categorisation of channels for macro-, micro-, and pico-cellular environments. It will then establish a generic framework for MIMO channels, characterised by a set of parameters. Parallel to this activity, measurement results of the MIMO channel impulse responses will be collected from the participants of the group. By using those measurements, as well as other data available in the literature, suitable values for the parameters in the different environments will be determined.

The aim of Sub-Working Group 2.2 is to establish measuring techniques for antennas on small mobile terminals, as well as establishing performance relations by including information from the propagation environment where the terminals are used. The group is investigating how to make reliable measurements of mobile phones including both transmitter and receiver, as well as the influence from the user. Methods for including the influence of the propagation channel are based on the Mean Effective Gain and special focus is on UMTS terminals.

Sub-Working Group 2.3 aims at developing propagation channel measurement techniques and providing measurement results to support especially the channel modelling work in SWG 2.1, but also the development of future mobile antennas, such as diversity or multi-antenna systems in SWG 2.2. The measurement work includes co-operation in the use of channel measurement systems and their results, and the development of new measurement systems. It is intended to provide measurement results especially in new areas like MIMO and UWB channels.

Finally, Sub-Working Group 3.1 focuses on the definition of some common Reference Scenarios to be used when performing the numerical assessment of radio access techniques, with reference both to Radio Network Planning (RNP) and Radio Resource Management (RRM). Thus, the scope is to provide a means to make more comparable the results of the different approaches used when evaluating RNP or RRM strategies. Owing to the complexity of these Reference Scenarios, it is agreed that two types of scenario elements will be provided: synthetic scenarios, based on simple and regular geometrical lay-outs and simplified models, which make it easy to interpret the results, and real-world based scenarios, where some data is taken from the real world, thus making their definition (and use) more complex but providing the possibility to test radio network algorithms under more realistic conditions. The Reference Scenarios have to satisfy a number of requirements in order to be of practical relevance. Some of them are: ease of use, limited number of cases, defined Interfaces between different parts of the Scenarios, extensibility, and independence of commercial realities. The initiative created in SWG 3.1 towards the standardisation of scenarios has been designated as MORANS (MObile Radio Access Network reference Scenarios).

Working Group 1 has considered primarily the physical layer of radio systems, including in particular transmission and signal processing techniques. In the past three years of the Action, there have been two dominant themes: MIMO systems and iterative ("turbo") techniques. Work on MIMO systems and space-time coding have included the application of coded modulation, application to CDMA, OFDM and MC-CDMA, adaptive MIMO systems and system capacity, among other issues. Iterative techniques have been applied to a wide range of signal processing functions, including detection, equalisation, synchronisation and channel estimation, MIMO detection and multi-user detection. Joint sessions with other Working Groups have encouraged collaboration between signal processing specialists and propagation and network experts: joint sessions with Working Group 2 have considered MIMO channel modelling and the capacity of the MIMO channel and fading forecasting for adaptive systems, among other subjects, and with Working Group 3 sessions have considered the evaluation of network capacity and the interaction of physical and higher layers in standards such as UMTS FDD and HSDPA.

Working Group 2 dealt with several topics already. A thorough investigation about the keyhole effect in MIMO channels revealed that such effects are extremely hard to construct experimentally, pointing to a gross overestimation of this phenomenon in actual propagation situations. Recent contributions yielded valuable information about actual scattering objects (resulting in "clusters") by combining UWB measurements with DOA and DOD information. A totally new concept by a real-time hardware emulation of the directional radio channel on the basis of the COST 259 model has been introduced as well. The popular 'Kronecker' model has been shown to be insufficient for indoor, at least, where coupling of directions of arrival and directions of departure do occur; this has been measured in indoor environments at 2.4 and 5.2 GHz. A novel MIMO modelling framework has sprung up from these measurements, extending the Kronecker model to account for the correlation between TX and RX arrays, and serving as a framework for algorithmic design; as an extension of the "virtual c channel representation" of Sayeed, it decomposes the MIMO channel in a matrix product of the matrix-sized eigenmodes and a coupling matrix in between; the novelty being the use of the RX and TX correlation matrices as basis functions, leading to an intuitively appealing interpretation of the MIMO channel. World-leading MIMO measurements of unprecedented accuracy and detail are being reported in COST meetings, some of them yielding multi-dimensional

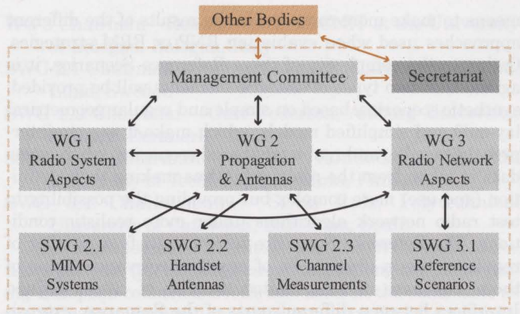

Figure 1 Organisation of COST 273

characterisation of the MIMO channel in real time. Also, SWG 2.2 is driving the international standards for testing of handset antennas in a true, live environment. This has become pressing need because of the requirement to for manufacturers to state the SAR value on the handset. One can reduce the SAR by making the antenna less efficient, which is not the goal of advanced antenna design, of course. SWG 2.2 is in the process of finding a good and fair description of how efficient an antenna is when it is connected to handset in practical use.

Working Group 3 addressed, during the first three years activity, issues related to Third Generation systems and beyond, Wireless Local and Personal Area Network. The main focus was on the Radio Network Planning and Resource Management techniques, aiming at optimising the use of the radio spectrum in cellular systems like WCDMA. In this context, interesting achievements have been obtained regarding pilot downlink power optimisation and the role of soft handover on network capacity. These results have also been reported to the scientific public literature after suitable discussion within the WG. Another relevant result has been achieved within SWG3.1 (the MORANS initiative), which generated an XML-based database of reference scenarios useful for the comparison of the performance of RRM techniques under common scenarios; this result was obtained only very recently, and for this reason it will be used in the forthcoming final year of COST273.

Conclusions

This paper presents a brief overview of the technical activities addressed by COST 273. After an Introduction, where previous COST Actions in the area of mobile and wireless communications are listed, the Objectives of the Action are shown. The internal technical structure of the Working Groups, and their Sub-Working Groups, is addressed, and many of the topics dealt with within each one are listed.

By the time this article is being written, the preparation of the final report has already started, being expected that it will be available by mid 2005. It will include the main results of the project, e.g., a model for MIMO channels assessed by measurements, references scenarios from MORANS for radio network simulation and evaluation, and a proposal for a procedure for the test of handset antennas.

Detailed information on COST 273 can be found at http://www.lx.it.pt/cost273.

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Luis M. Correia was born in Portimao, Portugal, on October 1958. He received the Ph.D. in Electrical and Computer Engineering from IST-TUL (Technical University of Lisbon) in 1991, where he is currently a Professor in Telecommunications, with his work focused in Wireless/Mobile Communications in the areas of propagation, channel characterisation, traffic, services and cellular planning. Besides being responsible for research projects at the national level, he was or is part of various ones within European frameworks (RACE, ACTS, IST and COST). He participated in and was co-editor of the Final Report for COST 231, Chairman, and editor of the Final Report for COST 259, and he is currently the Chairman of COST 273. Supervisor of students at both the M.Sc. and Ph.D. levels, he has authored many papers and communications in international journals and conferences, for which he has served also as a reviewer; he was a co-editor of a special issue of Wireless Personal Communications, and he serves currently as the Editor for Wireless of the European Transactions on Telecommunications. He was the Chairman of the Technical Programme Committee of PIMRC2002.

Narcis Cardona was born in Barcelona, Spain, on November 20th, 1963. He received the M.S. degree in communications engineering from the ETSE Telecomunicacion at the Polytechnic University of Catalunya, in Barcelona 1990 and the Ph.D. in Communications Engineering from the Polytechnic University of Valencia in 1995.

Since October 1990 he is with the Communications Department of the Polytechnic University of Valencia (UPV). Presently he is Full Professor at this Department, heading the Mobile Communications Group.

Prof. Cardona has led several National research projects and is the Vice-Chairman of COST273 Action in Broadband Mobile Networks. He is has published 70 international papers, 6 patents and 5 books on mobile communications technologies. His research interests include mobile channel characterisation, planning and optimisation tools for cellular systems and RRM techniques applied to personal communications systems.

Transportation Systems

Harvey Glickenstein, Senior Editor

Portland opened its Interstate MAX Yellow Line on May 1, 2004. Trips were free that day and over 20,000 people turned out to ride.

The 5.8-mile Yellow Line extension has 10 stations from the Rose Quarter through North Portland to Expo Center. construction on the line started in November 2000 and the line was opened in May 2004, four months ahead of schedule.

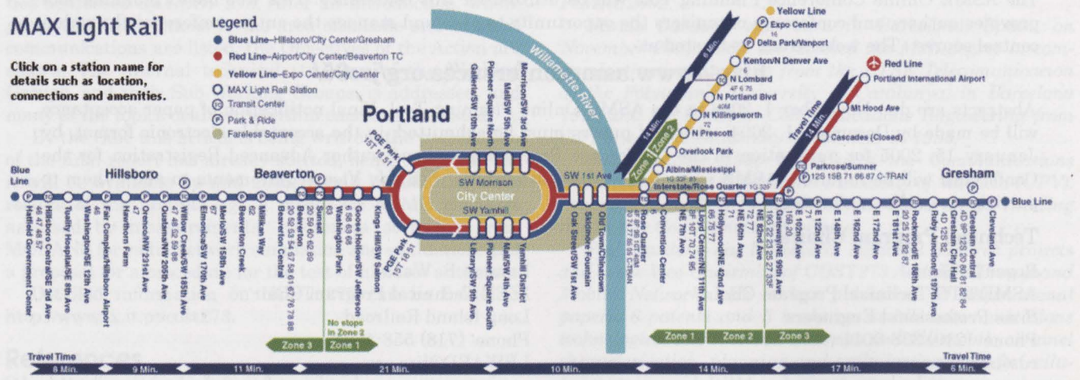
Opening of the Yellow Line brings the Tri-Met MAX Light Rail system to 44 miles with 64 stations. This does not include the downtown Streetcar system owned by the City Portland, but also run by Tri-Met.

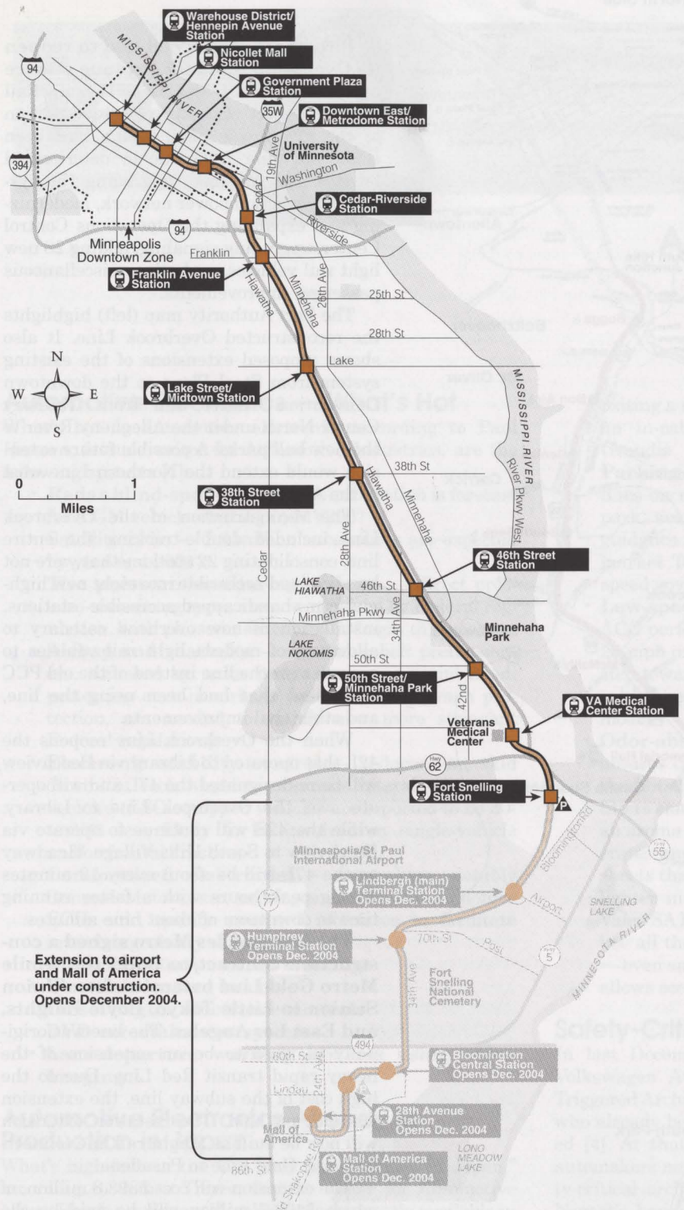
Minneapolis opened its Hiawatha Light Rail Line on June 27, 2004.

This is the first phase of a system that was originally projected to create a 29-mile network of light rail lines. The 8-mile first phase operates from a park-and-ride at Ft. Snelling to the Warehouse District of downtown Minneapolis.

Bombardier Transportation vehicle for Minneapolis

In common with what has become the practice when new light rail lines are opened, no fares were collected the first day. Over 30,000 tried the new service. Ridership is expected to be about 9,500 riders per day for the initial 8-mile line. When the line is extended another four miles to the airport and the Mall of America later this year, ridership is expected to jump to 19,300 per day.





Hiawatha Light Rail Line

The Tasman East/Capitol Light Rail extension to the San Jose light rail line opened on June 24, 2004. This 6.3-mile extension includes 8 stations in the cities of San Jose and Milpitas. This brings the total size of the light rail system to over 36 miles.

A future 6.8 mile extension from downtown San Jose, known as the Vasona Light Rail Extension, is being built in two phases. Phase 1, to Campbell, will be 5.3 miles long and have eight stations. It will open in January 2006. The second Phase to Los Gatos will be 1.5 miles long and have two additional stations. No date has been set yet for opening Phase 2.

Caltrain held public meetings on its Environmental Assessment/Draft Environmental Impact Report on electrification of its commuter line between Gilroy and San Francisco in late April and early May. Written comments were accepted through May 25, 2004. The proposed electrification would convert the existing line, that uses diesel-hauled coaches, to an electrified line using either electrical locomotives or electric multiple unit cars.

Electrification would be at 25 kV 60 Hz using overhead wires. Clearances would accommodate diesel-operated freight service that would continue to use the line.

The proposal calls for three primary traction power substations spaced between 29 and 37 miles apart. Autotransformer feeds would be used, with two switching stations and eight paralleling stations. The switching stations would be located approximately midway between the primary substations.

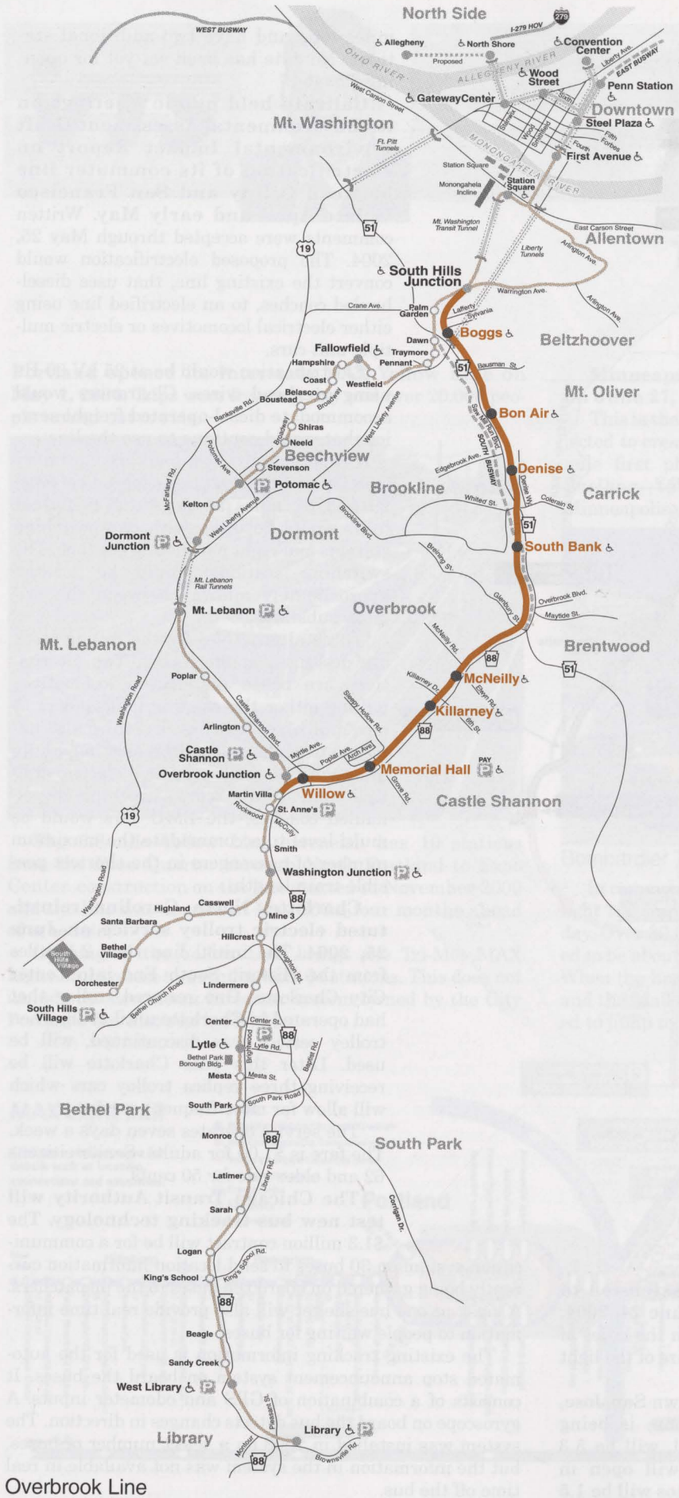
Three alternatives for the rolling stock are described in the report. Two alternatives are based on electric locomotives pulling either the existing gallery cars or new multi-level coaches. The third alternative is to replace all of the existing equipment with new self-propelled electric multiple unit (EMU) cars. Like the diesel-hauled coaches, the EMU cars would be multi-level to accommodate the maximum number of passengers in the shortest possible train length.

Charlotte, North Carolina reinstituted electric trolley service on June 25, 2004. The initial line runs 2.1 miles from the Historic South End into Center City Charlotte. One restored trolley that had operated in Charlotte until 1938, when trolley service was discontinued, will be used. Later this year Charlotte will be receiving three replica trolley cars which will allow for more frequent service.

The service operates seven days a week. The fare is $1.00 for adults. Senior citizens 62 and older ride for 50 cents.

The Chicago Transit Authority will test new bus tracking technology. The $1.3 million contract will be for a communication system on 30 buses to send location information currently being gathered on board the buses to the dispatchers. A kiosk at one bus shelter will also provide real time information to people waiting for buses.

The existing tracking information is used for the automated stop announcement system on board the buses. It consists of a combination of GPS and odometer inputs. A gyroscope on board the bus detects changes in direction. The system was installed in 2003 on a select number of buses, but the information in the system was not available in real time off the bus.



Pittsburgh was scheduled to reopen its Overbrook Line for revenue service on June 2. The 4-year Stage II Light Rail Transit Project consisted of reconstruction of the Overbrook Line, which had been closed in June 1993 due to deteriorated bridges and trackbed, upgrading the systemwide traction power network, modernizing and expanding the Operations Control Center, upgrading signaling, adding 28 new light rail vehicles, and other miscellaneous passenger improvements.

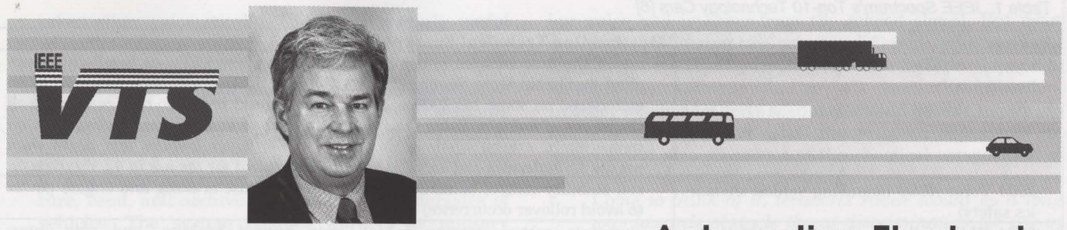
The Port Authority map (left) highlights the reconstructed Overbrook Line. It also shows proposed extensions of the existing system from Steel Plaza to the downtown Convention Center and from Gateway Center North under the Allegheny River to the new ball parks. A possible future extension would extend the Northern Line west to the Airport.

The reconstruction of the Overbrook Line included double-tracking the entire line, consolidating 22 stations that were not handicapped-accessible into eight new high-platform handicapped-accessible stations, installation of new overhead catenary to allow use of modern light rail vehicles to operate over the line instead of the old PCC equipment that had been using the line, and other civil improvements.

When the Overbrook Line reopens the 42L that operated to Library via Beechview will be re-designated the 47L and will operate over the Overbrook Line to Library, while the 42S will continue to operate via Beechview to South Hills Village. Headway on the 47L will be about every 12 minutes during peak hours with a faster running time to downtown of about nine minutes.

The Los Angeles Metro signed a construction contract to build the 6-mile Metro Gold Line extension from Union Station to Little Tokyo, Boyle Heights, and East Los Angeles. The line was originally planned to be an extension of the heavy rapid transit Red Line. Due to the high cost of the subway line, the extension was put on hold. The 8-station extension will now be built as a light rail line connected to the Gold Line to Pasadena.

The extension will cost $898.8 million, of which $490.7 million will be paid by the Federal Transit Administration in accordance with a full funding grant agreement signed on June 1, 2004. The line is expected to open for revenue service in December 2009.



Automotive Electronics

Bill Fleming, Senior Editor

Automotive Electronics — What's Hot

What's hot in automotive electronics according to Paul Hansen, feature writer for Automotive Industries, are the following systems [1]:

- **Radar blind-spot detection** — production is forecast for a GM vehicle starting in MY2007
- Satellite radio — 2.8 million subscribers are expected by year end 2004
- **Tire pressure monitoring systems** — direct pressure-measuring types are now required by Federal regulation, with phase-in scheduled to begin this year
- **Airbag and seatbelts** — resettable belt pretensioners, actuated by radar precrash warning, and head-protection curtain airbags for side-impact crash protection, are needed to satisfy new more stringent Federal regulations
- **Electronic stability control** — independent skid control of each wheel to minimize lateral/spin-out of vehicles (ESC-equipped vehicles are reported to be 30-to-35% less likely to be involved in single-vehicle and/or frontal crashes)
- **Commonized electronics** — carmakers, notably General Motors, are making an effort to commonize ECUs and specify standard interfaces to facilitate interchangeability of parts
- **Electric-motor-powered steering**
- **Electric-actuated brakes**
- **Diesel engine electronic controls**
- **DVD entertainment systems**
- **Lane-departure warning systems using video imaging**

Automotive Electronics Already in Production in Japan

What's high-tech in the U.S. may be "old news in Japan," according to James Treece, feature writer for Automotive News. Here's a rundown of technologies currently available in Japan that have not yet appeared in the United States [2]:

- **Humidity-regulating HVAC** — allows occupants to set their desired cabin humidity level, available on the Toyota Alphard
- **Rain-cleaning side door mirrors** — mirrors are coated, turning raindrops on the mirror surface into a film thereby enhancing visibility, and the mirror surfaces also have a photocatalytic effect that dissolves organic material to prevent dirt buildup, available on the Toyota Premio
- **Blind-corner monitor** — tiny cameras mounted in the front of the car are aimed left and right, and when exiting a narrow alley, camera images are displayed on an in-cabin monitor, available on the Mitsubishi Grandis
- **Parking assist** — rear camera plus colored guide lines on an in-cabin monitor show the driver how to park, available on 24 different vehicle models; voice-guidance is added on the Toyota Voxy; and the Japan-market Toyota Prius automatically parks itself, with speed governed by driver accelerator input
- **Low-speed ACC** — Adaptive Cruise radar Control ACC performance has been extended to speeds below 25 mph or less (in certain cases, as low as 6 mph — a step towards "stop-and-go," congested traffic, adaptive vehicle control), available this fall on a Nissan luxury model
- **Odor-absorbing interiors** — the headliner material absorbs cigarette smoke and other chemical odors in the Mitsubishi Grandis, a ceiling-mounted air purifier filters smoke and pollen in the Toyota Mark II Blit, and an aroma diffuser attached to the rearview mirror generates any of three fragrances associated with aroma sheets that are activated by connection to the cigarette lighter in the Subaru R2 model [2]. French supplier Valeo SA likewise believes consumers should be able to use all their senses when personalizing their vehicles — even smell. A new Valeo air conditioning system also allows occupants to select the aroma of their choice [3].

Safety-Critical Data Bus Choice Update

In last December's VTS News column, the addition of Volkswagen AG (who had bolted from the TTA Time-Triggered Architecture group) to the majority of automakers who already belong to the FlexRay Consortium was reported [4]. At that time it was stated that, "The only major automakers not yet committed to any standards-based safety-critical architecture were Toyota, Honda, and Nissan." Now it's happened — "Toyota, Honda, Hyundai, and Kia have joined the FlexRay Consortium [5]. PSA Puegeot Citroen and Delphi Automotive are also currently considering joining FlexPoint. With the added Asian automakers, FlexRay members now represent 69% of the annual production of new vehicles. Prototype samples of FlexRay silicon devices from Philips Semiconductors and Motorola are expected to be available by year's end for use in safety-critical by-wire steering and braking systems [5].

IEEE Spectrum's Top-10 Technology Cars

The IEEE Spectrum recently selected what they considered to be the 10 most technically sophisticated cars today [6].

Table 1. IEEE Spectrum's Top-10 Technology Cars [6]

Vehicle	Outstanding Technical Features
Hyundai HCD-8 Concept (featuring LED headlights)	- one of the first vehicles to use high-brightness white LEDs as headlights (supplied by Osram Opto Semiconductors GmbH). LED headlights, expected to be introduced on some MY2006 vehicles, will be used because: *they consume half the power of halogen bulbs (and one-tenth that of incandescent bulbs), turn on immediately, exhibit lifetimes exceeding 10,000 hours, require less depth than needed for reflectors and sockets, and are well suited for the use in 42-V systems*
2004 Volvo XC90 (featuring vehicle dynamics safety)	- roll stability control (which can preemptively adjust braking and engine power to avoid rollover occurrence)
2004 BMW 5-Series (featuring vehicle dynamics safety)	- electronic active steering (which goes beyond braking, and also intervenes/overrides steering to improve stability under emergency conditions)
2004 Lexus RX 400H (featuring hybrid-electric powerplant in a SUV)	- the engine uses high-efficiency Atkinson "five-stroke" cycle (*where valve timing simulates a cycle in which the piston moves through strokes of different lengths*) - includes all-wheel electric drive when needed - first SUV to power rear wheels solely by electric motor drive
2004 Toyota Prius (featuring hybrid synergy drive, in a more powerful mid-size car)	- main motor/generator operates front wheels - secondary motor/generator recharges batteries, supplements main motor (via a planetary gear power splitter), and starts/stops gasoline engine at traffic lights - includes the first all-electric air conditioner
2005 Ford Escape Hybrid (featuring hybrid-electric powerplant in a SUV)	- the first hybrid-electric vehicle built in North America - uses Atkinson-cycle high-efficiency engine - developed jointly by Ford, Volvo, and Aisin Industry (affiliated with Toyota)
Ford Hydrogen Hybrid Concept (featuring hydrogen IC engine-hybrid powerplant)	- uses gaseous hydrogen, compressed at 340 atm (5000 psi) and internal combustion engine (*in contrast to hydrogen fuel cell vehicles, an IC engine starts in all weather and requires no warm-up,*) - includes an electric motor drive integrated into the transmission
2005 Honda Inspire and Accord (Japan) (featuring lane-departure warning)	- offers Lane-Keeping Assist System (only in Japan), using windshield-mounted camera and image processing - if "rumble-strip" audio warning doesn't alert driver to take action, the system momentarily takes over the steering of the car, which no other system now on the market can do
2005 Chevrolet Silverado Hybrid (featuring a mild hybrid-electric powerplant in a pickup truck)	- uses 42-V battery pack (three 14-V batteries), and an integrated starter/generator - recharges the battery during regenerative braking - shuts off engine during idling, and runs on batteries - the 42-V battery pack can supply 2.4 kW/20-A/110-V ac power to run hand tools, or to power household appliances during outages. *With the engine running and a full tank of gas, the generator can run for 32 hours, while automatically shutting down when 2 gallons of fuel remain — enough to get to a gas station*
2002 Toyota Crown Royal (featuring a 42-V electrical system)	- introduced in October 2002, including a mild hybrid-electric powerplant - the only production car running with 42-V electric components

Spectrum's choices, in the order they were listed, are summarized in Table 1. (Note that Spectrum omitted the General Motors' hydrogen fuel cell-hybrid powerplant concept vehicle, with electric hub motors, X-by-wire controls, and interchangeable bodies — a U.S. Patent for this revolutionary vehicular concept recently was issued [7]).

Hybrid Vehicle Viability Is Questioned

There's always a dissenting viewpoint. Notwithstanding the fact that 5 of the 10 most technically sophisticated cars today selected by IEEE Spectrum (above) are hybrid vehicles, the editor of Automotive Industries, an industry trade journal, sees things differently. He writes that [8]: "Despite their high efficiency, low emissions, and (heavily subsidized) low prices; today's Hybrid Electric Vehicles (HEVs) are handicapped by:"

- **heavy weight** (extra batteries, electric and engine dual powerplants)
- **space** (to accommodate the extra componentry of electric and engine dual powerplants)
- **seamless operation** (require complex control of electric and engine dual powerplants)
- **cost** (Honda and Toyota are said to be, "selling small volumes of HEVs at subsidized low prices, in order to reap huge PR benefits")

Witzenburg concludes that Honda, Toyota, and other HEV manufacturers, "will not succeed in the long run until they can overcome the weight, packaging, complexity, and high-cost disadvantages inherent to HEVs [8]."

Novel Uses of Vehicular Electronics Technologies

Readers may find the following applications of vehicular electronics technologies – all with "big brother" law enforcement possibilities – interesting.

- **IBM** received a U.S. Patent for a vehicular electronic event recorder which can broadcast encrypted signature and data, thereby leaving behind an electronic version of a "fingerprint" in the event of an accident or traffic violation. The fingerprint, captured by an external data acquisition system, or another vehicle so equipped, provides a history of events related to the vehicle. In a first mode of operation, monitoring stations along the roadways periodically send an interrogation signal, such as when radar detects that the vehicle is speeding. Upon receiving the interrogation signal the smart card transmits the vehicle's signature information to the monitoring station where it is time and date stamped along with the speed of the vehicle — i.e., "automatic traffic ticketing." In a second mode of operation, when a sensor detects a sudden deceleration, such as occurs during a collision, a smart card mounted in each car will exchange signature information automatically. This is particularly useful when the collision occurs in a parking lot when one of the hit vehicles is typically unattended [9].
- **Northrup Grumman** put a new spin on automotive vision technology that uses the roadway to examine the underside of a vehicle. Their surveillance system incorporates a digital line-scan camera, light bar, mirrors, software and sensors which work together to capture, send, and archive color images of undersides of vehicles. The system enables workers at military bases, border crossings, etc. to spot contraband underneath vehicles [10].
- **Matsushita Electric** received a U.S. Patent for what amounts to an automatic traffic ticketing apparatus. The patent states that, "a vehicle monitors its location and speed from a GPS signal. The memory stores map data and traffic regulation data in advance. If it is determined there is a possibility that a driver has committed traffic violations based on the vehicle state information and traffic regulation data on the road where the vehicle is traveling, a traffic violation warning is output via voice and displayed on a display. If it is also determined that the driver continues to commit the traffic violation, the traffic violation details are recorded in traffic violation memory — i.e., this driver is "automatically ticketed" [11].

Where Microwaves Meet Infrared

As an EE engineer, you would think the whole electromagnetic spectrum was covered. You'd be wrong. There exists a gap, centered at 1 trillion cycles per second (or 1,000 GHz, or 1 THz), which has only begun to be bridged. At the low end, silicon speeds today are in the gigahertz band centered on 30-cm wavelengths. But it will take years to ascend to the 300-micron wavelength at 100 GHz, much less the 3-μm wavelength at 1,000 GHz, or 1 THz. At the high end, laser diodes are dipping down toward the terahertz, but today they cease to function well at infrared wavelengths much longer than a micron. The result is, "the terahertz gap," roughly between the wavelengths of 300 and 1 μm or, in frequency, between 100 GHz and 30 THz [12].

Terahertz signals emanate from objects naturally, going through clothes, clouds, skin, plastics, cardboard, semiconductors and even some walls. Thus they enable a dizzying array of "X-ray vision" style applications. Terahertz systems can also work like radar, sending out a harmless nonionizing pulse and imaging from the echoed signal. But most amazing of all, using two or more different terahertz-band frequencies enables a simple Fourier transform to provide an absorption spectrum that reveals chemical composition. In other words, terahertz scanners should be able to provide not only a three-dimensional image of an object and its innards, but also a readout of the chemical composition of hidden objects spotted in the image.

Come to think of it, terahertz radar would go a long way towards obstacle threat discrimination for use in automotive pre-crash and collision avoidance system applications.

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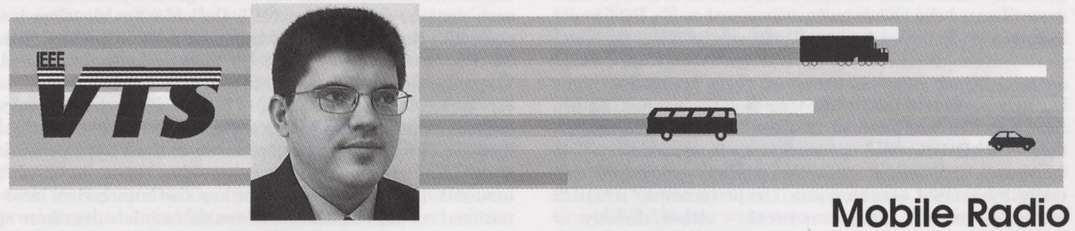


Mobile Radio

Javier Gozalvez, Senior Editor

Heterogenous Wireless Systems

Swisscom Mobile is launching a world first on the Swiss market: Mobile Unlimited. A PC data card jointly developed with Option (OPTI) of Belgium supports all wireless data transmission technologies from GPRS to UMTS and WLAN. Mobile Unlimited is also the first product in the world to enable seamless handover i.e. automatic, uninterrupted switching between different types of transmission technologies. With no action required on the part of the user, Mobile Unlimited switches seamlessly from UMTS to GPRS or WLAN, automatically selecting the fastest transmission technology available in any given location. Customers pur-

chasing Mobile Unlimited receive the Swisscom Mobile NATEL data basic subscription, an Unlimited PC Card and a CD-ROM with the requisite Unlimited Data Manager software. Mobile Unlimited offers transmission speeds of up to 384 kBit/s (UMTS) or 54 MBit/s (Public WLAN). For locations that currently offer only GPRS, transmission speeds between 30 and 40 kBit/s are available. By the end of 2004, Swisscom Mobile intends to have more than 800 WLAN Hotspots in operation and will cover 83% of the population with UMTS.

Alcatel, Ericsson, Motorola, Norwood Systems, IVT, Inventel and MBT have been selected to launch BT's groundbreaking Project Bluephone. BT's Project Bluephone is the first stage of the company's fixed-mobile convergence aspirations. Successful trials have taken place with over 50 users over the last few months and the next wave of beta trials involving 2,000 users is already underway. In a "user centric" world as depicted by Project Bluephone, users can enjoy a single telephone number and handset to make and receive calls wherever they are. The customer will be able to use one device and pay with a single bill. Under Project Bluephone, BT, and its consortium of partners, will give the customer the best connection and the same personalised services irrespective of where they are - at home, in the office, or on the move.

Alcatel, Birdstep Technology and Gemplus have announced an alliance to jointly develop, promote and market, what they claim is, the industry's most secure solution for seamless service continuity between GSM/GPRS/EDGE, UMTS or CDMA mobile networks and WLAN (the alliance will also apply to emerging technologies such as WiMAX). This collaboration will enable users to seamlessly profit from a smart card (SIM) based secure handover between heterogeneous access networks, ensuring the highest data rate, relying on a single subscription. Alcatel will integrate the new Birdstep's intelligent Mobile IP client software into its Evolium multi-access offering. This will enable seamless roaming across multiple access networks, with a SIM enabled client software designed by Gemplus for secured wireless communications and transactions.

Tatara Systems has announced that the company's SIM-based authentication, roaming and service delivery solutions for both aggregators and GSM operators have been proven in a real-world environment. Tatara's SIM-based authentication solutions facilitate easier authentication and delivery of enhanced services to wireless users roaming between WLANs and wireless wide area networks. Tatara demonstrated the end-to-end authentication of a SIM-based user on a Wi-Fi network across VeriSign's SS7 backbone network, in conjunction with an unnamed U.S.-based GSM operator which supplied access to their production home location register (HLR) to further test the service. Tatara Systems offers two products that enable SIM authentication across RADIUS-based networks such as public Wi-Fi 'hotspots'. The Tatara Subscriber Gateway, deployed centrally by a GSM operator, can accept incoming RADIUS messages from a hotspot network - either directly or through a third party aggregator - and complete the authentication with the Home Location Register (HLR) over the GSM MAP protocol. The Tatara Partner Gateway, deployed centrally by an aggregator or wholesale network provider, can also interface directly to SS7 across GSM MAP to complete a SIM authentication.

Quorum Systems has launched what it claims is the world's first single-chip integrated circuit for multi-mode wireless communications. The product, called Quorum Connection (QC) 2530 is an integrated RF transceiver that is able to support WLAN (802.11b/g) and quad band GSM (GSM/GPRS/EDGE) applications simultaneously. The IC uses Quorum's Multi-Access Technology (QMAT), which allows sharing the radio resource and therefore enable multi-mode functionality while reusing passive and silicon real state.

3G News

Orange has launched its 3G network claiming it will have the most extensive integrated 2.5/3G network in the UK, with 66% of the population covered by its high-speed network, ensuring that even if customers move out of 3G coverage, they will not lose their connection to the network. Orange has 3G coverage in major cities including London, Manchester, Edinburgh, Bristol, Belfast, Glasgow, Sheffield, Birmingham, Liverpool, Newcastle-upon-Tyne and Leeds. Orange will be launching its next generation services in France this autumn (2004) with coverage available in over 20 cities. France's SFR has launched its 3G network, although the coverage is initially limited to three cities. Sweden's Tele2 has also launched 3G services with free mobile internet and WAP for the rest of this year as an introduction offer. Vodafone has announced that its Vodafone live!TM will be enhanced by 3G technology in a series of phases throughout Europe. According to the operator, Vodafone is the first mobile operator to bring 3G technology to both business and consumer markets across a number of European countries. Vodafone customers will have access to 3G roaming in the UK, Spain and Portugal, and shortly in France, Holland, Greece, Sweden and Japan too. Later, Vodafone Netherlands and Vodafone Ireland also announced the commercial introduction of UMTS services on Vodafone live! Vodafone KK in Japan has also announced it will conduct a technology trial of Flarion's system for mobile broadband services. The trial will use Flarion's Flash-OFDM PC card modems for laptops and PDAs. The test will include: system performance, user mobility, subscriber scalability, robustness and transparent delivery of applications over an end-to-end IP network infrastructure.

NTT DoCoMo has announced that subscribers to its 3G service has surpassed the three million mark, just two months after reaching two million. The figure goes far beyond NTT DoCoMo's targeted figure of 2.4 million subscribers for fiscal 2003. The number of indoor base stations has increased to 1,600 in order to offer more widely accessible service in major buildings, underground malls and subway stations nationwide. NTT DoCoMo has developed a controller that enables home appliances to be operated with 3G FOMA videophone handsets from virtually anywhere. The controller is equipped for both infrared (IrDA) and cable connection to appliances. It also has a USB port for connection to computers and an I/O port for connection to external sensors. The controller itself connects to the FOMA network via a data card that can be connected to the unit via a PC card slot. The Japanese operator has also launched an international roaming-in service to enable mobile subscribers of DoCoMo's 21 international partners in 19 countries and territories to use DoCoMo's 3G FOMA network while in Japan. DoCoMo has also announced that it has sold its entire 20% shareholding in Hutchison 3G UK Holdings Limited to Hutchison Whampoa Limited.

picoChip successfully demonstrated its ultra-low-cost HSDPA-ready 3G picocell basestation at The Commodity Basestation conference in Bath, UK. According to the company, the PC8212 is the only complete commercial reference design solution available, and the only one designed for HSDPA; it includes radio, flexible baseband, control and backhaul. The picoChip system is fully 3GPP-compliant, has a range of 300m, capacity for 32 users and caters for any combination of voice and data. The upgrade supports HSDPA (with full 15 HS-PDSCH), with an integrated high performance MAC-hs scheduler.

TeliaSonera has announced it has just received the largest allocation to date of IPv6 addresses from RIPE NCC, the Internet organisation responsible for allocation of IP-addresses. The number of addresses TeliaSonera has received is many times the number of addresses currently available on the entire Internet.

Sprint has announced the roll out of CDMA2000 1xEV-DO services. The US carrier's 3G CDMA2000 1xEV-DO high-speed data services will be available to consumers in selected U.S. cities in the second half of 2004 and is expected to reach majority of top U.S. metropolitan markets in 2005. SK Telecom has also launched the world's first high-speed wireless data roaming service between China, Japan and Korea. SK Telecom launched its Wireless Data Automatic Roaming Services in Beijing and Shanghai in November 2003, and recently expanded the service to twelve provinces in China and throughout Japan. Qualcomm has announced the completion and results of a successful CDMA2000 1xEV-DO pilot program with IBM. The three-month trial, involving IBM sales representatives in the San Diego and Washington D.C. regions, equipped with CDMA2000 1xEV-DO-enabled laptops, enabled the sales executives to spend on average 2.9 more hours a week with customers. In a survey conducted by IBM, the sales force reported an increase in productivity and an overall high service satisfaction. More than 75% of sales executives who used the high-speed, high-capacity wireless service reported satisfaction both in how quick and easy a CDMA2000 1xEV-DO connection was established for their devices, and in how the technology improved a demanding, travel-intensive work routine.

Telefónica Móviles México has announced the rollout of EDGE technology on its GSM network, providing the most advanced broadband service in Mexico. Slovakia's EuroTel Bratislava has also launched a EDGE network in selected cities. The EDGE technology implemented supports all available encoding schemes so that data can be transmitted at rates of up to 240 kbps. Alcatel and Orascom Télécom Algérie have also introduced the first broadband EDGE services ever provided on the African continent. Ericsson has achieved what it claims is the world record peak data speed - 235.6 kbit/s across the radio interface - on T-Mobile's EDGE network in Hungary. However, the current commercially available network configuration of T-Mobile Hungary supports only 100 kbit/s peak data rates. TIM, first operator in Italy, has announced the launch of EDGE as a complementary solution to the development of UMTS. EDGE will provide coverage in areas still not served by the UMTS network, thus guaranteeing customers high service quality and providing the bandwidth needed to bring large-band cellular technology to TIM's over 26 million Italian lines. According to a new Visant Strategies report, cellular wireless providers across the globe are looking to EDGE as either a permanent fix for data offerings or as an interim solution to allow more robust data and voice services for the next half-decade. According to the study, EDGE sales are delaying some of the sales of next generation equipment in many parts of the world, with several hundred thousand EDGE-enabled base stations to be deployed by 2009. The chipset market for EDGE components in wireless handsets will run close to $2 billion in 2009 with over $31 billion worth of GSM/GPRS/EDGE -enabled handsets sold that same year worldwide, according to the study findings.

3G Americas has announced the publication of a new white paper, The Evolution of UMTS – 3GPP Release 5 and Beyond, that provides information on the performance and spectral/network efficiency advantages offered through Release 5 (Rel'5), coupled with new service creation opportunities made possible through the IMS architecture. The paper includes an overview of key 3GPP Rel'5 specifications and its features including HSDPA, IMS, and IP UTRAN, which will deliver significant data capacity, performance, and feature functionality benefits.

The CDMA Development Group (CDG) has reported that CDMA added nearly 13.5 million subscribers in 1Q 2004, reaching 202 million users worldwide. In one year, from March 2003 to 2004, the CDMA subscriber base grew by a record 43 million users, or 31%, representing the highest growth for any leading cellular technology, and significantly higher than the 21% gain for the whole industry. CDMA2000 further strengthened its leadership in 3G by adding 13 million users in the quarter to total 86.2 million, including 6.6 million CDMA2000 1xEV-DO users. Over 43% of the global CDMA subscriber base has access to CDMA2000 technologies. Asia remains the largest and most advanced market for CDMA2000, with 19 CDMA2000 networks and 52 million users in 12 countries. CDG has also reported that across Europe, Asia, Latin America, and Africa, there are seven commercial CDMA2000 networks at 450 MHz, five more will launch in 2004 and three trials are taking place. Eight NMT-450 operators have migrated to CDMA2000 and a number of countries, including Brazil, Ethiopia, Indonesia, and Pakistan are deploying or evaluating the technology to advance their universal service goals. Currently, CDMA2000 1X and CDMA2000 1xEV-DO are commercially available and are being deployed in the 450 MHz frequency band, and CDMA2000 1xEV-DV is being developed. The favorable propagation at lower frequency bands (450 MHz) translates to significantly lower deployment and operating costs. CDMA2000 at 450 MHz provides a larger cell size when compared to other frequency bands, and thus requires fewer cell sites and significantly lower capital investment and operational expenses to service vast coverage areas.

KDDI has announced that the number of 3G subscribers to its CDMA network has exceeded 14million in May. On the other hand, after a year of starting its 3G service in Europe, Hutchison Whampoa has announced that it has signed 1.73million subscribers.

According to a study from ABI Research, the deployment of UMTS services in Europe will boost global sales of 3G handsets from 4million units in 2003 to 15million by the end of 2004. A different report from the ARC Group claims that the technologies making the largest immediate impact on the post 3G world will be the upgrades to 3.5G and integration of WLAN into wide area networks. The firm forecasts that there will be 9.1million 3.5G subscribers (including HSDPA, TDD and technologies like Flash OFDM) by 2008.

Spectrum Licenses

Subject to approval from Austria's Telekom Control Commission, T-Mobile Austria will be acquiring a UMTS frequency package of 2 x 5 MHz from 3G Mobile. This will give T-Mobile Austria UMTS frequencies of 2 x 15 MHz in the paired range and 10 MHz in the unpaired range. In

December 2003, Telefonica Moviles had transferred its share of 3G Mobile, including frequency allocations, to Mobilkom Austria, thus withdrawing from the Austrian market. Telenor from Norway and Space Telecom have won two GSM licenses in Pakistan, the sixth most populous country in the world. The two companies bidded $291million for the 15 year license. The joint venture UMNIAH, including Kuwait's Alghanim Group and China's Huawei, has been granted Jordan's third GSM license.

TeliaSonera and France Telecom have agreed a deal by which the Swedish operator will acquire Orange Denmark and will then become the third largest operator in Denmark behind TDC and Sonofon.

3G Americas has published a technical analysis of the issues surrounding spectrum allocations for licensed mobile technologies and unlicensed technologies. The public document, 3G Americas Technical Analysis and Position Paper on the Regulatory Issues Between Licensed and Unlicensed Spectrum, defines an industry position on important recommendations for the continued growth and delivery of wireless services to customers throughout the Americas citing that the use of licensed spectrum by unlicensed devices should be prohibited. Some of the recommendations include: secondary markets and spectrum leasing may offer workable solutions and avoid causing additional interference to licensees; spectrum sharing between licensed and unlicensed devices should be discouraged; underlays that permit operation of unlicensed devices in spectrum bands allocated to licensed Cellular Mobile Radio Services (CMRS) should not be permitted; any new spectrum that is allocated for the primary purpose of unlicensed operation should be above 5 GHz.

Mobile Phones and Health Issues

The Electromagnetic Fields Committee of the Health Council of the Netherlands has issued a report to give its opinion on the scientific quality of the study conducted by TNO in 2003. In this study, TNO claimed that while exposure to GSM-900 and GSM-1800 electromagnetic fields had no effect on well-being, an UMTS-signal has a negative influence on well-being. Although the Committee concludes that the design and execution of the TNO study are of good quality, it has some comments on the interpretation of the data. In particular, the Committee said that the results of the study do not allow to assess whether and to what extent an effect on well-being will be found in normal living environment. In fact, TNO considered an exposure of approximately half an hour but at a relatively high environmental field strength not found in practical implementations of UMTS. The Committee also concluded there is a need for studies that simulate environmental exposure.

Technology and Research News

Motorola has announced its unique Cross-Technology PoC offering that enables subscribers to have "push-to" connectivity across and between GPRS, CDMA2000 1X, and WiFi networks. This is a network-based solution, aligned with Open Mobile Alliance (OMA) standards, that does not require modification to standards-based PoC clients. The solution also will be compatible in the future with EDGE, HSDPA, WCDMA/UMTS, and 802.16 "WiMAX" technologies. It is available for technical trials with selected customers.

Datang Mobile Communications has unveiled what it claims is the world's first TD-SCDMA handset, which includes an integrated camera. The manufacturer aims to start mass production in the first half of next year.

Qualcomm has announced the MSM6280 Mobile Station Modem chipset solution to enable higher data rates in support of advanced data services for High Speed Downlink Packet Access (HSDPA). The MSM6280 solution, that supports peak data rates of 7.2 Mbps, is a multimode solution supporting WCDMA (UMTS)/HSDPA and GSM/GPRS/EDGE (EGPRS). The US manufacturer has also announced the radioOne RFR6275 diversity receive chip to increase network capacity and deliver higher speed data rates for HSDPA. The RFR6275 extends the functionality of the RTR6275 transceiver device to include support for HSDPA receive diversity and Assisted-GPS (A-GPS). The RFR6275 supports HSDPA receive diversity, which uses an additional antenna and associated receive chain to provide improved signal reception, enabling higher data throughput and significant increases in network capacity, especially in dense urban environments. Qualcomm has also announced the RTR6275 device, the wireless industry's first single-chip RF CMOS (Complementary Metal Oxide Semiconductor) transceiver for dual-mode WCDMA (UMTS)/HSDPA and GSM/GPRS/EDGE (EGPRS) terminals. The RTR6275 device integrates a WCDMA (UMTS) transceiver and quad-band EGPRS transceivers into a single-chip, enabling cost optimized, smaller form factor devices for mainstream WCDMA (UMTS) markets.

Lucent Technologies has unveiled its High-Speed Data for the Mass Market (HSDmm) offer, an end-to-end solution incorporating infrastructure, revenue-generating applications, multi-vendor OSS software, professional services and marketing programs. It has also introduced its Accelerate IMS (IP Multimedia Subsystem), a service delivery solution that enables third-generation (3G) mobile operators to simply and cost-effectively introduce new voice over IP (VoIP) and multimedia services. The Accelerate IMS is based on IP core networking standards that have been developed by 3GPP and 3GPP2. At the heart of the Accelerate IMS solution is the Lucent Softswitch, a next-generation switching platform that manages voice and multimedia communications on IP networks. The HSDmm offer and underlying Accelerate IMS solution make it possible for mobile operators to offer "mixed media" services working across various types of networks including 3G mobile, WiFi and wireline.

Researchers from France Telecom have developed operational prototypes of flexible colour screens integrated into clothing. The screen is connected to a mobile phone via a Bluetooth link enabling to send, by MMS, the animations to other users with the same equipment. The mobile handset can also be used as a remote control to activate the screen's functionalities. The electronic components have been soldered on a flexible circuit board and then packaged in a fabric layered sandwich.

Vodafone K.K has announced it will shortly make available the V602SH Sharp mobile phone that includes the world's first mobile embedded camera with an optical zoom function.

KDDI has developed a mobile phone that receives digital terrestrial TV broadcasting and supports linked communications and broadcasting services. The terminal complies with the broadcast makeup language (BML) and is able to share information such as location data between the handset and servers enabling the provision of location data-linked content.

Aperto Networks has introduced its PacketWave 760, a stackable single-sector Broadband Wireless Access (BWA) base station designed to deliver intelligent classification of traffic and per-subscriber link optimization. The base station is designed for the unlicensed and licensed frequency bands of 2.5GHz, 3.5GHz and 5GHz.

MedicTouch and Sun Microsystems have jointly launched the Pulse Meter mobile health solution for Java mobile phones. The product is a health and wellness monitor that allows users to monitor their pulse, view the results in a high-resolution screen on Java technology-enabled mobile phones and transmit the data to a Java compliant server.

Vodafone Ireland has launched a mobile phone with preloaded software capable of audible display to assist the visually impaired. The device replaces text-based services with an audible display.

NTT DoCoMo announced it has achieved a maximum downstream data rate of 300mbps, with an average rate of 135mbps. The data rate was achieved during a field experiment in a car running going at 30km/h at distances between 800m and 1km from 4G base stations. However, the operator said that its planned data rate for 4G services remains at 100mbps. The operator bases its network on VSF-OFCDM and VSF_CDMA. NTT DoCoMo has also unveiled the new mova 506i series of three PDC (2G) i-mode mobile phones. The main characteristic of the handsets, that also feature cameras with effective resolutions of more than one million pixels, is their ability to read JAN Code and QR Code, enabling easy retrieval of data from printed materials, copying information to the phone's address book and saving text as well as pictures and melodies.

Qualcomm and Coding Technologies have announced the integration of MPEG-4 AAC/aacPlus technology into Qualcomm's Qtv and CMX multimedia solutions. aacPlus enables the delivery of the highest audio quality at the lowest possible bit rates. The aacPlus solution uses Spectral Band Replication (SBR) technology to enable audio codecs to deliver the same quality at very low bit rates. The aacPlus solution enables streaming and downloadable multi-channel audio at 128 kbps, CD-quality audio stereo at 48 kbps and excellent quality stereo at 32 kbps. The US manufacturer also announced that the company will integrate the H.264 baseline codec into Qualcomm's Qtv video decoder solution. H.264 is a next-generation codec that provides significantly improved compression capabilities, resulting in higher quality video streaming at lower bit rates. Qualcomm's Qtv solution is a feature-rich software video decoder that enables mobile devices to stream, download and playback multimedia content.

Nokia, MediaCorp Technologies, M1 and the Media Development Authority of Singapore have jointly showcased a live end-to-end mobile phone TV broadcast over a DVB-H (Digital Video Broadcast - Handheld) network. DVB-H is a standard specified by the DVB Organization specifically for the broadcast of TV-like content and data to handheld devices, such as mobile phones, which have unique requirements in terms of power consumption, screen-size and mobility.

Nokia has also announced the availability of the industry's first end-to-end solution for SIP based applications. The 3GPP compliant Nokia IP Multimedia Subsystem (IMS), the key enabling technology for IP multimedia services, is now available for commercial deployments. Combined with the SIP (Session Initiation Protocol) software development kit from Forum Nokia and terminals supporting downloadable SIP clients, Nokia can offer a complete end-to-end solution for richer, dynamic IP multimedia communications. IMS delivers a connectivity mechanism that enables terminals and other SIP capable devices to establish IP sessions between each other.

Cambridge Consultants has introduced new software intellectual property that optimises DECT for use in the license-free 2.4GHz ISM frequency band – making it ideal for worldwide markets including the USA where the usual 1.8-1.9GHz band is unavailable. Cambridge Consultants has added proprietary interference-avoiding technology onto the DECT protocol to optimise it for use at 2.4GHz. It employs a coexistence strategy based on a discovery algorithm that provides information on the current real-time usage of the spectrum by popular wireless systems, to determine the quietest channels.

Freescale Semiconductor is collaborating with the National Telecommunications and Information Administration's (NTIA) testing laboratories at its ITS Laboratory in Boulder, Colorado to study Ultra-Wideband (UWB) emissions. The ITS Laboratory study that commenced in March is intended to provide information on the interference potential of various UWB waveforms, including Direct Sequence Ultra-Wideband (DS-UWB) and Multiband Orthogonal Frequency Division Multiplex Ultra-Wideband (MB-OFDM UWB). The UWB emissions study is measuring and identifying UWB signal characteristics that correlate with performance degradation of existing narrowband equipment such as C-band television receivers exposed to UWB interference. The project, comprised of four phases, will include: UWB signal generation, including white Gaussian noise, gated white Gaussian noise, dithered narrow pulses, DS-UWB, and MB-OFDM; development of measurement methods to characterize UWB emissions and assess receiver susceptibility; and actual measurement of UWB emissions characteristics and interference susceptibility of both digital and analog C-band downlink receivers. Freescale has also announced plans to deliver three advanced UWB product families, including the industry's first 1 Gbps UWB solution, to address the wide variety of performance and functionality required by numerous UWB applications. The manufacturer has revealed that its planned UWB product families will be engineered to deliver 220 Mbps, 480 Mbps and 1 Gbps data transfer rates. Consistent with its current UWB offerings, the planned UWB families will be engineered to support peer-to-peer as well as ad hoc networking for truly mobile wireless connectivity.

Wireless LAN

Broadcom has announced a new chip technology that, according to the chipmaker, allows to increase the range of Wi-Fi by 50%. Broadcom claims that the power amplifier module will enable 54g-based network devices (based on the IEEE 802-11g standard) to operate from the home with a signal powerful enough to enable connectivity at up to 225 feet. The company also claims that this technology will save device manufacturers up to 30% since the new module reduces the number of off-chip components.

Cisco Systems has released a new wireless switching module, the CiscoWorks Wireless LAN Solution Engine (WLSE), designed to integrate a WLAN into an existing Cisco LAN. The WLSE can support up to 300 APs.

Exavera Technologies, a wireless startup, has launched a hardware and software platform, called eShepherd, that combines Wi-Fi and RFID for use in hospitals. The product uses RFID tags for patient and health care worker identification. The tags are read by the platform and the information is sent, via Wi-Fi, to the hospital information system.

iPass has announced it has more than 10,000 active Wi-Fi hot spots active on its Global Broadband Roaming net-

work; as of the end of June, the operator has reported more than 11,179 active hot spots in more than 33 countries.

AirFlow Networks has announced its intention to license its patent-pending WLAN Switch-on-a-Chip (Wi-SoC) technology. The company designed this technology in order to enable transparent mobility without the need for access point-to-access-point handoffs.

Telco Systems has introduced a secure WiFi VDSL Internet access solution that provides broadband backhaul Ethernet connectivity from a Wi-Fi hot spot to a service provider's backbone network over existing copper-pair infrastructure.

According to iSuppli, the WLAN equipment market experienced 82% year-over-year growth in 2003, totalling $2.8billion. Sales of WLAN chipsets went from $436million in 2002 to $760million in 2003. The company also expects that the number of devices embedded with Wi-Fi technology will increase from 14.2million units in 2003 to 167.8million in 2008.

Wireless Data and Multimedia

Qualcomm has announced that wireless subscribers have securely downloaded more than 100 million BREW-based applications since BREW-enabled products and services became commercially available more than two years ago. This achievement marks ongoing momentum for the BREW system within the rapidly expanding global wireless industry as 25 operators in 18 countries have launched commercial BREW-based services. Application downloads have doubled in six months and operators, publishers, developers and device manufacturers continue to realize growing revenues for wireless applications and services. The US manufacturer and LG Electronics have also announced plans to develop new handsets to support Qualcomm's BREWChat push-to-chat solution. BREWChat enables one-to-one and one-to-many communication between subscribers at the push of a button and was designed to seamlessly upgrade to and interoperate with QChat. BREWChat was specifically designed for CDMA2000 1X Release 0 networks. According to Qualcomm, BREWChat offers exceptional call set-up performance and bandwidth savings to operators. BREWChat uses standard VoIP technologies to enable quick push-to-chat functionality on 3G CDMA wireless devices and networks. A similar agreement has been signed with Curitel Communications, a South Korean manufacturer of CDMA wireless phones.

NTT DoCoMo has launched the i-mode FeliCa Service for mobile wallet applications and market the company's first i-mode smart-card handset, the mova P506iC. DoCoMo's revolutionary new service and smart-card handsets may be used for a variety of unprecedented functions, including train travel, debit card (electronic money) and credit card-based withdrawals and transactions, and personal identification. Moreover, the group of i-mode Alliance companies have announced that i-mode users outside Japan exceeded three million at the end of June 2004. This announcement comes just four months after the figure reached two million. DoCoMo and Telstra have announced they have formed an exclusive strategic partnership under which Telstra will launch i-mode in Australia. This agreement came after the Japanese operator signed a similar one with COSMOTE in Greece.

China Mobile has awarded Siemens Information and Communication Mobile the contract to set up a WAP gateway installation. With "Mobile Smart Proxy", the company will implement what is currently the world's second-largest WAP installation in the provinces of Guangdong, Shanghai, Zhejiang, and Sichuan in the southeastern part of China. The system capacity of the Siemens WAP gateway enables more than 2400 transactions per second – in comparison, the worldwide average is less than 100 transactions per second. The capacity of the Siemens solution can also be upgraded at any time.

According to the Mobile Data Association (MDA), over 1.2billion WAP pages impressions were viewed in the UK during February 2004, which represents an increase of over 62million on January 2004 and a daily average of 43million. MDA has also announced that, at the end of March 2004, there were 11million MMS active capable devices, which represents a penetration rate of 24% for the total UK market.

Forums and Industry Alliances

3G Americas and the CDMA Development Group (CDG) have announced the conclusion of their collaboration in a series of joint technical workshops with leading GSM and CDMA operators and vendors to identify key elements necessary to ensure that Multimedia Messaging Service (MMS) deployments will be interoperable within the Americas. The work resulted in the document, Americas MMS Inter-carrier Implementation Guidelines. The core set of technical and service-level requirement guidelines developed by the joint working group cover multimedia routing, MMS relay/server connectivity and multimedia charging for successful MMS inter-working between operators. The intention is that these guidelines will enable MMS deployments in the Americas based on 3GPP Release 5 and 3GPP2 Release 0 and facilitate the exchange of MMS messages between CDMA and GSM customers.

Several wireless operators (including Telefonica Moviles, Orange, NTT DoCoMo, TIM, T-Mobile and Vodafone) have created the Open Mobile Terminal Platform (OMTP) group. The initial aim of the group of to identify the common mobile operators' requirements to establish an open framework for mobile device manufacturers and associated software and hardware suppliers to develop open mobile terminal platform compliant products.

The United Nations ICT Task Force and the Wireless Internet Institute (W2i) have unveiled a program, 'Wireless Internet for Underserved Populations and Local Communities', to promote wireless adoption to underserved populations around the world. Intel and IBM have been named technology partners for the program.

The GSM Association and the TD-SCDMA Forum have signed an agreement to coordinate the development of the two 3G standards and promote interoperability and international roaming between the two technologies. TD-SCDMA is being supported by China since in 2002 the Chinese Ministry of Information Industry allocated 155MHz of spectrum to this technology.

China's Communications Standards Association (CCSA) and the USA's Alliance for Telecommunications Industry Solutions (ATIS) have joined the 3rd Generation Partnership Project (3GPP) as new Organizational Partners.

The Mobile Imaging and Printing Consortium (MIPC) has announced that Nokia, Samsung, and Siemens have become strategic members of the consortium. MIPC is an industry group founded to drive solutions and implementation guidelines for providing consumers with a simple and spontaneous experience when printing images taken with camera phones. The objective of the MIPC is to make these printing guidelines available during the second half of 2004.

Wireless, PMR and Public Safety

NTT DoCoMo has announced that they would separately manage voice calls and data packet transmissions for some handsets to avoid excessive network congestion during major natural disasters. The move is expected to increase the ability to successfully transmit text messages to DoCoMo's i-mode Disaster Message Board service, even if network traffic should rise sharply during a major disaster. Presently, if network traffic were to become exceedingly heavy during a disaster, DoCoMo could be forced to block traffic in selected areas on a temporary basis to prevent serious degradation of network performance. The i-mode Disaster Message Board service, launched on January 17, enables i-mode subscribers in Japan to post text messages on a special i-mode site, rather than making voice calls, to help avoid network congestion.

Ericsson and the Swedish Rescue Services Agency have signed an agreement formalizing their cooperation in disaster relief operations globally. Under the terms of the agreement, Ericsson, through its Ericsson Response initiative, and the Swedish Rescue Services Agency will share information and expertise and will engage in joint research and development activities in the area of disaster response and preparedness.

Renfe has selected Nortel Networks to build a GSM for Railways (GSM-R) wireless communications network for Spain's public rail lines in Bilbao and Santander. Nortel Networks will provide an integrated GSM-R digital radio access network to upgrade current analogue voice systems. The new mobile network will comply with rail industry-specific EIRENE standards. GSM-R provides uniform transmission of voice and data between the train conductor, the train crew and operations management groups, and between the train dispatching staff and station personnel. It can also manage operational, maintenance, motor vehicle and marshalling yard radio communications.

Motorola will be providing Taiwan's Coast Guard Administration with a TETRA digital trunked radio network on PengHu Island. The contract includes the Motorola TETRA communications network, 422 portable radios used by Coast Guard personnel, and 38 mobile radios to be installed in vehicles and vessels. The 380MHz TETRA-compliant digital trunked radio system enables both voice and data communications. It is integrated with an automatic vehicle location system that allows staff at the operations control centre to rapidly track and dispatch the closest vehicle or vessel to the incident scene. The US manufacturer has also been chosen to provide the first Dimetra TETRA network to be implemented in Caucasus and Central Asia, which will be operational by the end of 2004. The Dimetra IP network for the Special State Protection Service of the Republic of Azerbaijan will cover the Apsheron Peninsula, which includes the greater BAKU area.

Telcom has selected the Nokia TETRA system to cover the three main Brazilian cities, São Paulo, Rio de Janeiro and Brasilia. This will be the first TETRA system for professional mobile radio use in the Brazilian market. Telcom serves professionals with critical communication needs, such as public service agencies, municipalities, traffic control, transportation services, public utilities, enterprises, oil and gas companies, and seaport authorities. The Ministry of Interior of the State of Kuwait has also selected Nokia TETRA as its nationwide radio communication solution. Equipment deliveries will begin early in the second half of 2004. The first phase of the system is planned to be in operational use by the end of the year, and the whole network by mid-2005. A consortium, led by Saab and including Nokia and Swedia, has won a contract from the Swedish government to build a professional mobile radio network for the shared use of all Swedish public safety organizations. The consortium will provide and operate a single nationwide TETRA-based network that will replace the large number of separate systems currently in use by the Swedish authorities. The Societé des Autoroutes Paris-Rhin-Rhône, which operates motorways across central eastern France, has signed a contract for the Nokia TETRA system to replace its current analogue systems. Aéroports de Paris (ADP), which manages the largest air-traffic zone in Europe, has also chosen Nokia to provide its digital TETRA professional mobile radio (PMR) system for ground services. ADP is responsible for an area that encompasses all the civil airports within a 50-kilometer radius of Paris, including the Charles de Gaulle, Orly, Roissy and le Bourget airports.

Mobile Satellite

The FCC has granted 3.1MHz of additional spectrum to Iridium Satellite, which the company believes was needed to meet increasing customer demand. Iridium has also asked for another 2.25MHz of additional spectrum.

Two years after filling for Chapter 11 bankruptcy protection, Globalstar is free of debt and has received an important investment from Thermo Capital Partners, its new majority owner. The intention is to expand the operator's services and coverage area with the launch of Globalstar's eight spar satellites into orbit in late 2005 or early 2006.

Capgemini and SFR, the second mobile operator in France have joined the Eurely consortium, formed by Alcatel, Finmeccanica and Vinci Concessions. This consortium is short-listed to become the Galileo concessionaire, the civilian radio-navigation system initiated by the European Commission and the European Space Agency. The Galileo positioning system is based on a constellation of thirty satellites providing global coverage. It will serve both institutional needs and commercial expectations in terms of positioning as well as precise and dependable time. This system will be compatible with the American GPS system. Alcatel and Finmeccanica have also announced the signature of a memorandum of understanding to merge their space activities and form alliances in the space sector through the creation of two sister companies.

Location Technology and Services

TechnoCom has announced that Triton PCS has selected its LocationAssurance Manager (LAM) as its automated wireless E911 location network performance management and reporting platform. The product validates and certifies Phase II E911 service quality by conducting, correlating and summarizing location test and performance data. According to TeleCommunications Systems (TCS), Golden State Cellular is using its E911 Phase II Hosted Position Determining Entity (HPDE) service.

According to Concise Insight, 70% to 90% of location-enabled non-voice traffic is WAP-based. The firm also expects location services could generate in Western Europe $2billion by year-end 2007, up from $285million in 2003.

A new study from ABI Research claims that Location Based Services (LBS) will unlock the market for GPS in the cellular handset. According to the firm, the RF-baseband chip combination for GPS in the handset currently has an average selling price of $7 to $8. This figure should drop below $5 for widespread adoption. According to the author of the study, manufacturer's strategies to lower the cost will

center initially on migrating to smaller geometries and to System-in-Package and System-on-Chip type solutions.

CTIA Wireless 2004

CTIA Wireless 2004 took place from March 22 to March 24 in Atlanta; here are some of the announcements made during the event. Texas Instruments unveiled its third-generation 802.11 solution. The new chipset can be configured for 802.11b/g or 802.11a/b/g operation using different WLAN RF solutions from TI. Sierra Wireless introduced the AirCard 775 PC Card and the MP 775 GPS modem for EDGE networks. The MP 775 GPS rugged vehicle-mount modem provides in-vehicle data solutions while operating over EDGE and GSM/GPRS networks. Research In Motion announced its BlackBerry e-mail device is now being used by more than 100,000 US government personnel. Picostation unveiled its mobile blogging technology for wireless devices. The PicBlogger is an advance device side application that enables users to share access and manage multimedia content from any device.

Nokia Technology Platforms announced a new family of base station modules designed for WCDMA, EDGE and CDMA2000 base stations. The Nokia FlexiTransport operates as an embedded transport node, thereby connecting the base station to the access network. Within a common set of modules Nokia FlexiTransport supports both emerging IP networks as well as existing ATM networks. Siemens mobile announced plans for a complete solution for WiMAX radio networks, which will be available in the second half of 2005. In addition to base stations based upon the IEEE 802.16d standard for fixed wireless broadband, the solution also will encompass integration and service offerings. Nortel Networks demonstrated for the first time its latest CDMA Base Transceiver Station (BTS), the Compact Metro Cell. Nortel Networks Compact Metro Cell is a highly flexible, scalable and power-efficient 3G base station. Compact Metro Cell will be capable of supporting CDMAOne, CDMA2000 1X and CDMA2000 1xEV-DO in the same shelf, and it will have the ability to grow from one to nine carriers in the same footprint. In addition to being highly scalable and flexible, Compact Metro Cell is expected to be the only stackable macro BTS.

Qualcomm demonstrated a host of significant enhancements to CDMA2000 1xEV-DO. The technology enhancements support advanced multimedia services, low latency applications, and enable higher maximum data speeds of 3.1 Mbps on the forward link and 1.8 Mbps on the reverse link. CDMA2000 1xEV-DO Gold Multicast enables operators to greatly improve the efficiency of multimedia content delivery by allowing content to be sent to many users at one time. This flexible and efficient one-to-many network technology provides better ROI than today's unicast (one-to-one) systems when an operator is scaling multimedia services for high consumer demand. Faster forward- and reverse-link speeds are achieved via the IS-856 Rev. A enhancements to 1xEV-DO.

US Mobile Market

In an effort to increase homeland security and improve the efficiency of commercial shipping operations, the Federal Communications Commission (FCC) has adopted a Third Report and Order that allows for the operation of improved radio frequency identification (RFID) systems for use in conjunction with commercial shipping containers. This action is expected to result in lower shipping costs and improved security at ports, rail yards and warehouses in commercial and industrial settings by enabling the contents of containers to be rapidly inventoried. RFID systems use radio signals to identify items. An RFID system consists of a tag mounted on the item to be identified and a device that receives information transmitted from the tag. The Commission's rules permit RFID systems to be operated on a number of frequency bands, subject to limitations on their maximum signal level and transmission duration. These limitations constrain the range and information transfer rates of RFIDs.

The FCC has adopted a spectrum sharing plan for low earth orbit satellite systems (Big LEOs) in the 1.6 GHz and 2.4 GHz bands. The spectrum sharing plan will further the Commission's goal of efficient spectrum utilization by increasing the number of providers offering services to consumers over the same spectrum, and will promote the deployment of more innovative services to consumers. The Commission also issued a Further Notice of Proposed Rulemaking to explore whether CDMA and TDMA MSS operators feasibly could share an additional 2.25 megahertz of spectrum at 1616.0-1618.25 MHz.

The FCC has adopted a Report and Order and Further Notice of Proposed Rulemaking that transforms the rules governing the Multipoint Distribution Service (MDS) and Instructional Television Fixed Service (ITFS) in the 2495-2690 MHz band. The FCC takes a number of important steps to restructure the 2495-2690 MHz band and facilitate more efficient use of the spectrum. First, the Order creates a new band plan for 2495-2690 MHz which eliminates the use of interleaved channels by MDS and ITFS licensees and creates distinct band segments for high power operations, such as one-way video transmission, and low power operations, such as two-way fixed and mobile broadband applications. The Order also expands the original MDS-ITFS band by adding to it five megahertz of additional spectrum from below 2500 MHz, which increases the total size of the band to 194 megahertz. This will provide room for the future relocation of MDS Channels 1 and 2, which are presently located in the 2.1 GHz band.

The FCC has expanded the availability of spectrum leasing to more wireless services and devices, further streamlined the processing of spectrum lease applications and notifications, as well as traditional license transfers and assignments, and clarified certain aspects of the original spectrum leasing rules. The Commission also established a "private commons" leasing option for licensees who wish to provide spectrum access to individuals or groups using advanced devices. The Commission also extended its spectrum leasing rules to certain additional Wireless Radio Services (WRS) in which licensees hold exclusive rights to their assigned spectrum, including the Multichannel Video Distribution and Data Service and the Automated Maritime Telecommunications Systems Services.

The FCC has adopted a plan to resolve the ongoing and growing problem of interference to public safety radio systems operating in the 800 MHz band. Over the long-term, the Commission adopted a new band plan for the 800 MHz band to address the root cause of the interference problem by separating generally incompatible technologies, with the costs of relocating 800 MHz incumbents to be paid by Nextel. In the short-term, the Commission implemented objective technical standards – "Enhanced Best Practices" – for defining "unacceptable interference" to public safety systems operating in the 800 MHz band and procedures detailing the responsibilities and expectations regarding abatement of such interference. To accomplish the reconfiguration, the Commission will require Nextel to give up rights to certain of its licenses in the 800 MHz band and all of its licenses in the 700 MHz band. In exchange, the Commission will modify Nextel's licenses to provide the right to operate on two five-MHz blocks in a different part of the spectrum – specifically 1910–1915 MHz and 1990-1995 MHz – conditioned on Nextel fulfilling certain obligations specified in the Commission's decision. The Commission determined that the overall value of the 1.9 GHz spectrum rights is $4.8 billion, less the cost of relocating incumbent users. In addition, the Commission concluded that it would credit to Nextel the value of the spectrum rights that Nextel will relinquish and the actual costs Nextel incurs for to relocate all incumbents in the 800 MHz band. The Commission's plan will result in an additional 4.5 MHz of 800 MHz-band spectrum, the equivalent of 90 additional two-way channels, becoming available to public safety, critical infrastructure, and private wireless users, including 10 channels for public safety/critical infrastructure interoperability.

The FCC initiated a proceeding to foster the introduction of wireless broadband operations in the 3650-3700 MHz band ("3650 MHz band"). In response to requests by wireless internet service providers (WISPs), the FCC proposed to allow unlicensed devices to operate in some or all of the 3650 MHz band with higher power than currently authorized under Part 15 of the Rules, subject to cognitive technology safeguards. Under the central proposal of this Notice, unlicensed devices would be allowed to operate in all, or part, of the 3650 MHz band at higher power levels than usually permitted for unlicensed services, which should enhance the utility of unlicensed devices and services in rural areas.

The FCC has proposed to allow unlicensed devices to operate in the broadcast television spectrum at locations where the spectrum is not in use by television stations. In order to ensure that no interference is caused to TV stations and their viewers, the Commission proposed to require unlicensed devices to incorporate "smart radio" features to identify unused TV channels.

The FCC adopted several changes to its rules for unlicensed devices to facilitate deployment of advanced technologies and provide operators greater flexibility in deploying their systems. In its Report and Order, the Commission adopts rules to foster introduction of smart antenna technology that can operate at higher power levels without causing increased interference. Smart antennas will allow service to be offered over larger areas with reduced infrastructure costs. Smart antennas also permit a greater number of users to be served within the same spectrum by reusing frequencies in several directions simultaneously. The Report and Order also makes modifications to rules that will facilitate deployment of next-generation Bluetooth devices, which operate at data rates up to three times faster than current devices.

Cingular Wireless, AT&T Wireless, and Triton PCS have announced they have signed a non-binding letter of intent that – contingent on closing of Cingular's acquisition of AT&T Wireless – would give Cingular expanded wireless service in Virginia and Triton PCS added coverage in North Carolina as well as entry into Puerto Rico. Under the terms of the letter of intent, Cingular would receive Triton PCS's network assets and customers in Virginia. Triton PCS would receive certain AT&T Wireless network assets and customers in North Carolina and Puerto Rico, plus $175 million in cash from Cingular. Further, Triton PCS and Cingular will enter into a new long-term, reciprocal roaming agreement, which will allow Cingular and Triton PCS subscribers to benefit from Cingular's extensive nationwide network and Triton PCS's strong regional network. Moreover, Cingular Wireless has acquired 34 PCS licenses from NextWave for $1.4billion in cash.

Verizon Wireless has bought 10MHz PCS radio spectrum licenses from American Wireless License Group, LLC, covering the Arkansas Basic Trading Areas (BTAs) of Little Rock and Pine Bluff. The operator has also announced it will acquire Qwest Wireless' assets for $418million. The agreement includes spectrum licenses (1900MHz PCS frequency range) in 62 markets in 14 western and mid-western states. Verizon Wireless has also announced it has reached the 40million subscriber mark.

AT&T has announced a five-year agreement with Sprint to offer wireless services, although this will not prevent AT&T to strike resale agreements with other wireless carriers.

MetroPCS, a CDMA2000 1X operator, has acquired four additional PCS licenses, each covering 15MHz of spectrum.

Industry Forecasts and Surveys

Gartner has reported that worldwide mobile phone sales totalled 153million units during the first quarter of the year, which represents a 34% increase compared to last year. The Asia/Pacific region and the replacement handsets in mature markets contributed to this increase. Although Nokia still retained the n°1 spot, it decreased its market share from 34.6% to 28.9%. In a different study, IDC said that worldwide mobile phone shipments decreased sequentially by 5.9% in the first quarter of 2004 and increased by 29.3% year-over-year to 152.7million units. The firm expects the mobile phone market to surpass 595million units shipped in 2004. IDC expects sales of 2.5G devices to drive market growth in the coming years and sales of 3G phones to surpass the 100million annual unit mark in 2007. It also expects the converged mobile device market, that will surpass the 20million units shipments worldwide in 2004, to be dominated by Symbian throughout the decade. According to the Yankee Group, the global wireless equipment market had a 2% recovery and it is expected to see a 1% increase in 2004. The company also expects that equipment expenditures as a percentage of total wireless service provider revenue will decline from 11.3% to 6.8% between 2002 and 2007. It also expects the market to decline to $40billion by 2008. In a different report, the Yankee Group is predicting mobile data revenue to reach $50billion worldwide over the next five years, while revenue from voice mobile will stagnate at $124billion.

According to a new report from Analysis, voice services still account for over 80% of ARPU in most markets. The firm has predicted that the need for fixed lines to support internet access will limit the decline in fixed voice channels to a total of 1% from 2004 to 2006. However, Analysis also predicts that the availability of alternative internet solutions could accelerate this decline to almost 10% a year from 2006 to 2009. The firm expects over the next five years a 10% increase of total volume of voice calls in Western Europe and a 94% increase in the case of voice calls by mobile phones; which results in 50% of voice call minutes being generated by mobile phones in 2009. Roamware has predicted that global roaming calls on mobile networks could now be worth in the region of $50billion annually.

ARC has forecasted that the mobile video market will generate worldwide revenues of $5.4billion in 2008 and that close to 250million consumers will use mobile video services, with the biggest application category being video mes-

saging followed by video donwload. The firm expects that technical advances (such as low-power multimedia application processors, high-resolution CMOS image sensors and high-resolution colour LCD screens) will see the mass market penetration of video-enabled handsets by 2006.

A new report from ARC Group is estimating the Java market to have earned operators almost $1.4billion in 2003 and it expects to increase to 15.5billion by 2008. The report finds the Java market to be dominated by entertainment, in particular gaming, which will see traffic raising from 4.3billion events in 2003 to over 50billion in 2008.

According to a report from the ITU, mobile subscribers in Africa have increased by over 1000% between 1998 and 2003 to reach 51.8million. Mobile penetration has reached 6.2% at the end of 2003 in contrast to 3% for fixed line. In a new report, the Yankee Group expects the mobile penetration rate to increase to 13% by 2008, making Africa the fastest growing region in the world, and mobile service revenues to increase to $25billion.

3G Americas has commemorated the one billion GSM customer milestone in the world. Globally, in only twelve years, GSM technology reached the billion milestone that took the PC industry 25 years. It is forecast by some research analysts that GSM will reach the two billion customer mark by 2010.

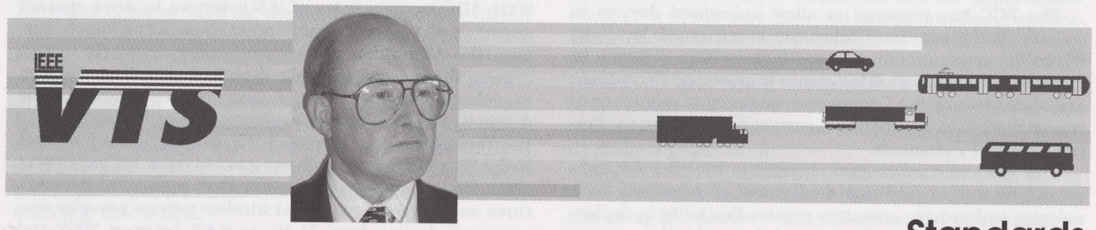
Other News

NTT DoCoMo has established its "Mobile Society Research Institute," which will study the social impact of mobile phone use. At the research institute, which will remain independent from its business, DoCoMo will aim to clarify both the positive and negative aspect of mobile phones. The aim is to focus on enhancing the upside, while minimizing the downside by taking necessary countermeasures. Specific themes of research are as follows: impact on society and culture; legal systems; impact on industry and mobile phone as a social infrastructure.

According to a study carried out by Analysis Consulting, DotEcon and Hogan & Hartson for the European Commission (EC), the EC should promote the introduction of both spectrum trading and liberalisation through the use of appropriate binding measures on Member States. The study, published in the report 'Study on conditions and options for introducing secondary trading of radio spectrum in the European Community', also recommends that many of the details of how spectrum trading is actually implemented should be managed by individual Member States as long as the different national frameworks have certain generic features.

Telefonica, T-Mobile, Orange and TIM have unveiled a joint brand, FreeMove, hoping to offer a seamless service across all its member networks. Although they will initially focus in Europe, the four operators expect to expand the services in America.

The Consumer Electronics Association (CEA) has announced a standardisation project to facilitate the managed use of wireless devices brought on board of commercial aircrafts and used by passengers during flight. The CEA working group involves more than 35 representatives. ARINC and Telenor have announced they will soon market new technology to allow airline passengers to use mobile phones aboard commercial flights.



Standards

Dennis Bodson, Senior Editor

Standards Coordinating Committee 32 (SCC 32) Dissolved

The IEEE-SA Standards Board (IEEE-SASB) took action at their March 24, 2004 meeting to dissolve SCC 32, "Intelligent Transportation Systems." Prior to this action being taken, IEEE-SASB asked the Vehicular Technology Society (VTS) to take these standards under their auspices. The VTS Board of Governors (BOG) approved this action at their BOG meeting on February 7, 2004. The following ITS standardization activities are being transferred effective March 24, 2004:

Project No: P1489
Title: Standard for Data Dictionaries for Intelligent Transportation Systems

Scope: Revise the requirements for the registration of data concepts, messages, and data frames for use in the ITS domain based on experience gained from practical experience using the ITS Data Registry functional operating procedures. The standard serves as the foundation standard for all ITS functional area data dictionaries. Revise the standard so that it contains the description of data concepts, in formal terms, to promote a high degree of "unambiguous data interchange" among ITS components. Provide for extending the standard for global use through the development of relationships among data concepts used in the ITS domain.

Purpose: Incorporate experience gained from the use of and testing the implementation of ITS Data Registry and the field operational test of standards for ITS applications will be used to make the change. Adopt ISO TC204 developed standard that includes basic provisions from IEEE Standard 1489-1999 and IEEE Trial Use Standard 1488-2000. Develop US specific provisions for supplementing the ISO standard that reflects US usage and requirements.

Project No: P1512
Title: Standard for Common Traffic Incident Message Sets for Use by Emergency Management Centers

Scope: This standard will be the base standard for Traffic Incident Management Message Sets which will be used by all response and/or dispatch centers such that the exchange of information will be standard and produce the needed response(s). This standard will be limited to common message sets for use by emergency management centers. Project will incorporate changes to message sets referred to yet defined in other standards.

Purpose: This standard will produce a set of common message sets required for Traffic Incident Management generated and transmitted between emergency management subsystem to all other subsystems and Traffic Incident Management providers. The result will be consistent standardized communications among Traffic Incident Management centers, fleet and freight management centers, planning subsystem, etc.

Project No: P1512.2
Title: Standard for Public Safety Incident Management Message Sets for Use by Emergency Management Centers

Scope: Research, compile, analyze and consolidate information leading to the publication of a standards message set for Incident management specifically covering information transfer concerning Public Safety, comprised of Law Enforcement, Fire and Rescue, Emergency Medical Services, and other related functions and services.

Purpose: Create a standard message set to reduce the duplication of messages among the various subsystems and a common set of message will help providers of services to interact more effectively.

Project No: P1512b
Title: Amendment for Data Elements Found In Standard for Common Incident Management Message Sets for Use by Emergency Management Centers, IEEE 1512-2000

Scope: ASN.1 language syntax; and published in another ITS Standard. The 1512b effort utilizes the prior 1512 documentation, to insure harmonization and data exchange with definitions related to Incident Management. The proposed 1512b standard will provide new recommended definitions, when a definitional change has occurred. In addition to the scope of work identified above, additional revisions and additions to IEEE 1512-2000 will be made to harmonize data concepts throughout the 1512 Family of Standards due to completion the companion volumes (P1512.1, P1512.2, P1512.3, and P1512a).

Purpose: This amendment provides either commentary, new ASN.1 definitions, or both as required to implement foreign data elements used by 1512. In some cases, this is simply to restate the elements as they once existed when the committee included them in 1512. In other cases, as ITS harmonization or the efforts of the other committee have changed things, and new (presumably improved) element has been provided reflecting now current practices of ITS. This amendment also provides commentary and/or new ASN.1 definitions to implement data elements used in common by the companion volumes (P1512.1, P1512.2, P1512.3 and P1512a). Guidance relative to the manner in which each volume within the Family of Standards (1512-2000, P1512.1, P1512.2, P1512.3, and P1512a) will also be included as necessary to facilitate future implementation. After the References and Definitions in Clauses Two and Three, the remainder of this standard (Clause Four) provides revised definitions and guidance for each data element identified and changed. Incident Management costs billions in lost productivity and loss of lives. Message sets for Incident Management ranked sixth out of forty-four on the United States Government ITS America 1996 Survey of Standards Needs for an Intelligent Transportation System. It is a major component of intelligent transportation system. Message sets for Incident Management include all message sets generated and transmitted between the emergency management subsystem to all other subsystems and providers. These include the exchange of information about incidents between different centers responding to the incidents, Fleet and Freight Management, Information Service Providers, other Emergency Management Centers, Planning Subsystem, Traffic Management and Transit Management. Therefore, a standard message set will reduce the duplication of messages among the various subsystems and a common set of message will help providers of services to interact more effectively.

Project No: P1556
Title: Standard for 5.9 GHz Intelligent Transportation System (ITS) Radio Service Security and Privacy

Scope: Develop a draft standard for security and privacy for use in Intelligent Transportation Systems applications using DSRC technology based on the requirements defined by the ASTM 2213-02 (Rev), IEEE 1556 WG, IEEE Draft P1609.1, .2, .3, and the MXME and MAC Extension being planned for the revised IEEE P1609.4 standards for the upper layer DSRC applications as well as the IEEE 802.11a, and IEEE 802 security activities. These applications for DSRC technology are specific to the 5.9 GHz frequency band allocated for ITS use by the Federal Communications Commission (FCC) and are principally focused on vehicle (mobile)-to-roadside (fixed), roadside (fixed)-to-vehicle (mobile) and vehicle-to-vehicle uses related to public safety, public transit, commercial vehicle and cargo safety. These applications may directly use or build upon security services defined in this standard which will provide for a secure communications link and enable secure applications.

Purpose: The purpose is to define the essential protective mechanisms for DSRC applications and communications technology. The main benefit is to offer confidentiality, integrity, and availability protection for the DSRC communications link and offer security services which may enable DSRC applications to offer reliable financial transactions, traveler information, incident notification, and emergency notification and response. The provisions of this standard may be applicable to security and privacy of financial transactions (e.g., toll and fare collection), personal privacy, public safety, and collision avoidance.

Project No: P1609.1
Title: Standard for Dedicated Short Range Communications (DSRC) Resource Manager

Scope: To create a modified version of the Resource Manager standard originally defined in IEEE 1455. The 1455 version of Resource Manager has been adopted and significantly modified by ISO TC204/WG15. This work is continuing and requires coordination with this IEEE committee. The new IEEE standard will be a version of, or reference, this ISO standard rather than an amendment or modification of 1455.

Purpose: The existing IEEE 1455 standard includes a version of the Resource Manager, but reduction to practice has identified numerous changes that are required. In addition, it is now intended for use throughout the world and this also forces significant changes to the existing standard. These changes are underway in ISO TC204/WG15 This project will bring this work back into IEEE in order to satisfy the North American needs.

Project No: P1609.2
Title: Standard for Dedicated Short Range Communications (DSRC) Application Layer

Scope: To create an application layer (L7) standard to be used for 5.9 GHz DSRC. The new 5.9 GHz DSRC standards will support several protocol stacks, including one representing traditional DSRC systems, TCP/IP, and streaming audio/video. The proposed standard will interface with the lower layer standards being developed by ASTM.

Purpose: The existing IEEE 1455 standard includes an application layer for 915 MHz DSRC, but this will not be suitable for the new 5.9 GHz systems. The existing 1455 will be used as a basis, but requires considerable revision for this new class of DSRC.

Project No: P1609.3
Title: Standard for IP Interface for Dedicated Short Range Communications (DSRC)

Scope: The new 5.9 GHz DSRC will support multiple protocol stacks, one for the traditional DSRC, and one for streaming audio/video, and another for TCP/IP. There may also be others; the architecture is still being finalized. The project will evaluate and define the interfaces between these multiple stacks and the lower layer services of 5.9 GHz DSRC (IEEE 802.11a R/A).

Purpose: The existing DSRC upper layers (above L2) are well served by existing or proposed standards. With the new DSRC, additional higher layer communication stacks must be supported, including TCP/IP. An architecture and general interface must be defined to support these multiple stacks and appropriate standards written.

Project No: P1609.4
Title: Standard for Data Dictionary and Message Sets for Dedicated Short Range Communications (DSRC)

Scope: To update the Data Dictionary and Message Set (DD/MS) definitions in the existing 1455 and to make them applicable to the new set of 5.9 GHz DSRC standards. This project will also review and respond to changing DD/MS as a result of the IEEE Data Registry project as well as the expanded range of DSRC applications that will be supported in the future.

Purpose: The existing IEEE 1455 standard includes a set of DD/MS definitions for 915 MHz DSRC as well as the Application Layer and the Resource Manager application. These other portions of 1455 will be removed and published under different document numbers necessitating a modification to 1455. While undertaking this modification, additional changes may be required to make them suitable for the new 5.9 GHz systems.

Project No: P1634
Title: Standard for Common Data Dictionary for Use in Intelligent Transportation Systems

Scope: This standard is the result of an effort to research, compile, and consolidate common data dictionary terms for use in intelligent transportation systems. The standard describes the common data dictionary terms using meta attributes defined in IEEE Standard 1489-1999 and Abstract Syntax Notation 1 (ASN.1). The standard will provide the specification for common data elements such as person, time, date, and location to minimize or eliminate ambiguities and inconsistencies when there are more than one group defining similar data element definitions. The common data dictionary terms are intended to be used with the Intelligent Transportation System (ITS) Data Registry.

Purpose: Experience gained from the use of and testing the implementation of ITS Data Registry and field operational tests of standards for ITS applications has indicated that there is a need for a single definitive data dictionary describing the common data elements. Various technology specific data dictionaries have been developed and often each one has standardized on its own the data elements for common variables such as time. This IEEE standard will attempt to replace these with a single data element, which can be used by all of ITS data dictionaries.

Project No: P14817
Title: Transport information and control systems - Requirements for an ITS/TICS central data registry and ITS/TICS data dictionaries (ISO14817:2002)

Scope: The scope of this PAR is to adopt "Transport information and control systems - Requirements for an ITS/TICS central data registry and ITS/TICS data dictionaries, ISO14817:2002" as IEEE/ANSI/ISO Standard 14817-200x.

Purpose: The US TAG for ISO TC204 and IEEE WG P1489/P1488 contributed significant effort to evolve the IEEE Standard 1489-1999, "IEEE Standard for Data Dictionaries for Intelligent Transportation Systems," IEEE Standard 1488-2002, "IEEE Standard for Message Set Template for Intelligent Transportation Systems," and the "IEEE ITS Data Registry Functional Operating Procedures, 2000," into a single international standard, ISO14817:2002. The intent is to adopt the international standard for use in the US ITS community and as a potential replacement for the IEEE standards. The experts in ISO TC204 agreed that a single international standard for an ITS Data Registry would benefit the global ITS community leading to compatible use of data concepts for developing ITS systems and implementing and operating ITS data registries. The existence of a number of different national standards for a sector-specific data registry is not beneficial for developers and users of ITS systems.

IEEE Standards Board Approves Project Numbering Policy

The IEEE Standards Board has adopted rules for the numbering of all IEEE Standards Association (IEEE-SA) projects, to be applied as Project Authorization Requests (PARs) arrive in the IEEE-SA. The objective of this Numbering Policy are to group families of standards projects and to identify clearly which documents are temporary (i.e., amendments or corrigenda that will be folded into a revision) and which are permanent. The IEEE-SA PAR Numbering Policy can be found at http://standards.ieee.org/guides/par/number95.html

IEEE Standards Board Adopts New NesCom Conventions

The IEEE New Standards Committee (NesCom) has adopted conventions which serve as guidelines to some of the internal procedures that NesCom observes as part of its review and recommendations concerning IEEE-SA PARs. For more in-depth information on the IEEE-SA standards development process, please see the IEEE Standards Board Operations Manual at http://standards.ieee.org/guides/par/nesconv.html

P1616a Project Authorization Request (PAR) Approved by IEEE-SA Standards

The IEEE-SA Standards Board on March 25 approved a PAR for a new standard, P1616a, "Standard for Motor Vehicle Event Data Recorders (MVEDRs) - Amendment 1: Brake and Electronic Control Unit (ECU) Electronic Fault Code Data Elements" This Standard is being sponsored by the Vehicular Technology Society. The purpose of this PAR is to develop a standard for brake and transmission electronic control units that requires units to store a full history of electronic fault codes that are time stamped using a recognized clock synchronized with other on-board motor vehicle event data recording devices.

IEEE 802.11g Named Top Innovative Technology

Popular Mechanics magazine has named IEEE Standard 802.11g (Wi-Fi) the Grand Prize Winner for Computing in its list of the top 2003 technical innovations. The wireless router standard helps improve access to fixed-network local-area networks and boosts speed from 11 megabits to 54 megabits per second. The standard also is backward compatible with IEEE Standard 802.11b equipment.

IEEE 802.15 Multimedia Handbook

IEEE 802 Multimedia: A Handbook to the IEEE 802.15.3 Standard clarifies the IEEE 802.15.3 standard for individuals who are implementing compliant devices and shows how the standard can be used to develop wireless multimedia applications.

The 802.15.3 standard addresses an untapped market that goes beyond 802.11 and Bluetooth wireless technologies. The standard addresses the consumer need for low-cost, high data-rate, ad-hoc wireless connections. Some of these applications include: wireless keyboards and printers, personal video and digital cameras, cordless telephones and intercoms, digital audio players and headphones, gaming (including interactive gaming, multiplayer consoles, handheld multiplayer gaming, digital music, video, and image uploads to handheld games), home theater system and stereo system components, video conferencing, and more.

Navigating through the IEEE 802.15.3 standard to find the required information can be a difficult task for anyone who has not spent a considerable amount of time involved in standards development within the IEEE 802.15.3 Working Group. Written by Dr. James P. K. Gilb, Technical Editor of the IEEE 802.15.3 standard, Wireless Multimedia contains an "insider's view" of the standard in which implementation issues that are not obvious in the text of the standard are highlighted with in-depth explanations.

Wireless Multimedia: A Handbook to the IEEE 802.15.3 Standard brings it all together for those looking to standardize their wireless applications. It introduces and eases the implementation of devices compliant to the IEEE 802.15.3 standard, covering the types of implementations that were anticipated when the standard was developed.

Wireless Multimedia covers three main areas:

- Applications: Applications that would benefit from using IEEE 802.15.3 devices for wireless connectivity, including specific examples of how the unique properties of IEEE 802.15.3 compliant devices enable new applications
- Implementation: Summary of the IEEE 802.15.3 standard, highlighting special areas that are key to successful implementation. Examples are included for implementers who are developing compliant devices.
- Justification: Discussion and reasoning that went into developing the standard, including background information that covers anticipated implementations and key details on architecture.

IEEE to Offer Workshop on Communications Standards for Transportation Incidents

IEEE 1512 Working Group will host a workshop on 15 and 16 June in Salt Lake City, Utah, on the lessons learned in their deployment. The workshop will be preceded on 14 June by a one-day working group meeting to continue the development of these standards, which promote effective communications among agencies and service providers in traffic incidents.

The workshop will include reports from those who have begun to put the standard in place in Washington, D.C., New York City, and the states of Utah and Washington. It also will include presentations from those involved in related data dictionaries at the Department of Justice.

The workshop will give attendees an understanding of what IEEE 1512 standards contain and how to apply them. Attendees will also provide feedback on how to make the existing IEEE 1512 standards more viable, and what is needed in the next standard in the series, IEEE P1512.4™, which will address message sets for in-vehicle needs.

"This will be the fourth IEEE 1512 workshop," says Ann Lorscheider, Chair of the IEEE 1512.1 Working Group and Metrolina Regional Intelligent Transportation Systems Engineer, North Carolina Department of Transportation. "As with our previous workshops, we want to help those in the U.S. emergency community understand how to use these standards so they can respond to traffic emergencies more effectively."

"Each deployment is unique, so the workshop will explore the best practices that have emerged from each one that can be applied elsewhere. The workshop will also seek to help those who plan to integrate their incident communications using IEEE 1512 by addressing such topics as setting user requirements and sharing data among agencies of all sizes."

The Washington, D.C., deployment involves multiple data systems, while the one in New York City integrates incident management systems that exchange information among communication centers and in-vehicle equipment. The Utah deployment integrates six computer-aided dispatch systems, and the one in Washington State integrates incident management with various traveler information systems.

IEEE 1512 Standards for Incident Management

The IEEE 1512 standards effort began in 1997 to foster efficient communications in traffic incidents by creating common message sets so all parties involved interact effectively. These standards aim to reduce congestion, secondary collisions, and the time it takes to clear an incident, as well as to improve interagency coordination and safety for travelers and emergency personnel. The IEEE 1512 standards family includes:

- The base standard, IEEE 1512-2000™, "Standard for Common Incident Management Message Sets for use by Emergency Management Centers," which addresses message sets for traffic management, public safety and hazardous materials incident response in general.
- IEEE 1512.1™-2003, which provides traffic management message sets for transportation and public safety agencies in transportation incident management.
- IEEE P1512.2™, which provides message sets for interagency coordination, dispatching and asset management for transportation and public safety agencies.

- IEEE 1512.3-2002™, which provides message sets for the management of hazardous materials in transportation incidents.

The IEEE 1512 family of standards is being developed by the IEEE Incident Management Working Group (1512) sponsored by the IEEE Vehicular Technology Committee. The IEEE 1512 program is being done under the auspices of the US Department of Transportation. For more information about IEEE Incident Management Working Group (P1512), visit: http://grouper.ieee.org/groups/scc32/imwg/index.html.

IEEE Gains Sector Membership in the ITU Radiocommunication Sector

The International Telecommunication Union has approved Sector Membership for the IEEE in its Radiocommunication Sector (ITU-R), which broadens IEEE's presence as a provider of standards for international use. Sector Membership means that the IEEE can be a direct contributor to standards and other documents developed by ITU-R.

ITU, through ITU-R, coordinates the global use of the radio-frequency spectrum, including the development of binding international treaties governing spectrum use. Its work is based on contributions from its membership towards activities that include developing protection criteria for radio services and allocating portions of the spectrum, including those to be shared among different services and applications.

"Over the years, the IEEE has worked with us to create practices and procedures for radio services," says Valery Timofeev, Director of ITU's Radiocommunication Bureau. "As one of the world's prestigious standardization organizations, the IEEE has offered many contributions that have influenced the development of ITU-R Recommendations. Approval of the IEEE as a Sector Member recognizes the role it has played and sets the stage for further collaboration."

According to Terry deCourcelle, Director of International Standards Programs at the IEEE-SA, "IEEE's ability to contribute as a recognized entity directly to the work of ITU-R is of benefit to those developing wireless standards at the IEEE. Sector Member-ship provides yet another route for IEEE wireless standards to enter the international community."

In addition to its new status with ITU-R, IEEE also works closely with the ITU Telecommunication Standardization Sector (ITU-T). In 2000, IEEE was recognized by ITU-T as an international organization whose work is referenced in ITU-T Recommendations following procedures developed by ITU-T.

Amendment Approved for Allocating Object Identifiers within IEEE 802® LAN/MAN Standards

The IEEE has approved IEEE 802b™, "Overview and Architecture, Amendment 2: Registration of Object Identifiers," a new standard that documents the procedures to use when allocating and registering object identifier values for use in standards for IEEE 802™ local and metropolitan area networks. It also provides documentation of root identifier values.

The IEEE also approved the start of work on IEEE 802.16/Conformance04™, "Standard for Conformance to IEEE 802.16™, Part 4: Protocol Implementation Conformance Statement (PICS) Proforma for Frequencies below 11 GHz." When completed, this standard will describe the capabilities and options within the air interface to be claimed by suppliers of products intended to implement the IEEE 802.16 protocol for devices operating below 11 GHz. These claims will help users evaluate how well a product conforms to their requirements.

IEEE Approves Start of Four Wireless Personal Area Network Standards Projects

The IEEE has approved the start of work on four projects concerning IEEE 802.15(TM) wireless personal area network (WPAN) standards. These projects involve a wireless mesh topology standard for WPAN devices and alterations to the high-rate WPAN standard so it supports new wireless multimedia uses more effectively. Two other projects were started for ultra-low-power WPANs: one will create an alternate PHY and the other will correct and extend the base standard.

IEEE P802.15.5(TM), "Recommended Practices for Mesh Topology Capability in Wireless Personal Area Networks (WPANs)," will provide an architectural framework for interoperable, stable and scaleable wireless mesh topologies for WPAN devices. Mesh topologies can extend network coverage without increasing transmission power or receiver sensitivity.

They also can improve reliability via route redundancy, easier network configuration and longer device battery life. IEEE P802.15.3b(TM), "Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Amendment to MAC Sublayer," will modify IEEE 802.15.3(TM) to improve the ease of implementation and interoperability.

This will include minor optimizations while preserving backward compatibility. In addition, this amendment will correct errors, clarify ambiguities, and add editorial clarifications. IEEE P802.15.4a(TM), "Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Alternate Physical Layer Extension for Low Rate Wireless Personal Area Network (WPAN)," will provide an alternate WPAN PHY to meet evolving user needs for ultra-low-complexity, ultra-low-cost, ultra-low-power WPAN communications. It will provide for precision ranging accurate to one meter or less, improved communication range, improved link robustness and the ability to support mobility. It also will continue to support coexisting networks of sensors, controllers, and logistic and peripheral devices in multiple, compliant co-located systems.

IEEE P802.15.4-REVb(TM), "Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low Rate Wireless Personal Area Networks (WPAN)," will revise the IEEE 802.15.4(TM)-2003 standard to remove ambiguities. It also will extend the base standard by adding a method for shared time-base distribution and supporting new frequency allocations in Europe, China and Japan.

References

1. ETSI Press Release, September 3, 2003
2. ATIS Press Release, February 2, 2004
3. IEEE Press Release, Piscataway, NJ, September 24, 2003
4. IEEE Press Release, Piscataway, NJ, September 19, 2003
5. ITU Press release, November 7, 2003
6. ITU Press Release, November 5, 2003
7. Popular Mechanics Magazine, March 5, 2004
8. IEEE Standards Information Network, April 7, 2004
9. IEEE-SA NEWS, March 17, 2004
10. IEEE-SA NEWS, March, April 9, 2004

IEEE VTS

First IEEE VTS APWCS Asia Pacific Wireless Communications Symposium

Jae Hong Lee, Chair, VTS Korea Chapter

The Seoul and Tokyo Chapters of VTS successfully cosponsored the First IEEE VTS APWCS which was held at Hoam Convention Center, Seoul National University, Seoul, Korea, January 8-9, 2004.

Thirty three papers were submitted: 17 from Korea and 18 from Japan. Each paper was reviewed by two reviewers: one from Korea and one from Japan. All of the submitted papers were accepted and presented in seven oral sessions in a single track. The sessions were OFDM, Multi-Antenna Technology, Network Algorithms and System Performance, MIMO Technology, Optimal Receiver Technology, and Multiple Access Technology. There were two invited talks on Vision & Research Direction on Next-generation Mobile Communication Technology, by Dr. Seung Ku Hwang, Director, Dept. of Radio Transmission Technology, ETRI, and Challenging for Giga-bit Wireless Technology, by Prof. Fumiyuki Adachi, Graduate School of Engineering, Tohoku University.

Youngnam Han (Information & Communications Univ., Korea) served as the Chair of the Organizing Committee. Nak-Myeong Kim (Ehwa Womens Univ., Korea) served as the TPC Chair and Fumiyuki Adachi (Tohoku Univ., Japan) served as the TPC Co-Chair.

There were 23 full and 38 student registrations making total 61 registrations: 10 from Korea and 13 from Japan for full registrations, and 26 from Korea and 12 from Japan for student registrations.

A Second IEEE VTS APWCS is planned for next year, 4-5 August 2005, at Hokkaido University, Sapporo-City, Japan, with Takeshi Hattori (Sophia Univ., Japan) as Organizing Committee Chair, and Fumiyuki Adachi (Tohoku Univ.) as TPC Chair.

IEEE VTS NEWS

Digital Archive Approved: Society Needs Source Materials

At its May 18th meeting, the VTS Board of Governors approved a plan to create a Digital Archive consisting of Transactions and Conference Records published from 1951 through 1987. This information will be uploaded to IEEEXplore. Additionally, the Society will produce DVDs containing all of the above plus materials through the end of 2004.

While this decision is still subject to the approval of the IEEE Technical Activities Board (TAB), the time has now come to solicit any materials that may be available from the membership. The following materials have not yet been secured:

Transactions:
1951 through 1972

Conference Records or Conference Digests:
1966 through 1978, except 1971 and 1972

Newsletters:
1951 through 1978; 1984 through 1989

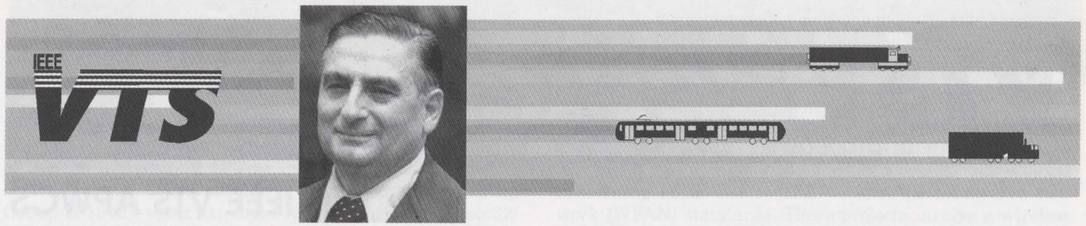
If you are willing to donate any of the above materials, please contact Tom Rubinstein at archive@vtsociety.org .

The Newsletters will not initially form part of the DVD record, but are being sought for use at a later stage.

Assistant Editor: Book Reviews

BOOK REVIEW EDITOR WANTED - An individual with three of four hours to spare each quarter to co-ordinate book reviews for the VTS News. Experience not required, although Internet access would be helpful.

Next year, our Book Review editor, Dirk Pesch, will move to help out as part of a new editorial team to give more comprehensive coverage of mobile radio developments. This will leave us with an opening for someone to co-ordinate book reviews. This involves receiving or requesting books from publishers (VTS has contacts with a number of publishers), sending these on to reviewers, chasing the reviews, and passing on completed reviews to the Editor in Chief for editing and publication. The bonus, albeit small, is a regular supply of free books. If you are interested and would like to get involved with the growing team working on the VTS News, please contact the Editor in Chief, James Irvine, at j.m.irvine@ieee.org



Chapter News and Meetings

Gasper Messina, Senior Editor

New York Section Technology-Sharing Forum
October 14th, 6:00 to 8:00 PM
Hosted by: Cisco Systems, Inc. 5th Floor
One Penn Plaza, New York City

Radio Frequency Identification
Howard Lock, Cisco

Vehicle Telematics Applications
Ralf Hug, Mercedes Benz USA

The presentation by Howard Lock will focus on a new technology to revolutionize supply chain operations, logistics, healthcare, education, consumer goods, national defense, and a host of other industries, including Transportation. Radio Frequency Identification technology can be utilized beyond asset tracking to enhance security and protect transportation assets such as airports, rail, and seaports. By 2010 it will surpass use of UPC or bar-code technologies.

Ralf Hug will present an insight into today's and future suite of safety, communication and entertainment systems for vehicles. He will cover innovative Telematics systems such as Tele Aid, Hands-free Communication System, Satellite Radio, and other new technology systems.

Advance registration is required for admission. There is a $35.00 charge for the forum and refreshments, Checks Payable to IEEE NY Section.

Registration Online at http://www.ieee.org/vtsny or mail
Mr. Chris Pacher
LTK
335 Adams Street, Suite 2702
Brooklyn, NY 11201

IEEE Members and non-members may register for the October forum. If you are an IEEE member, please provide your membership number.

Program specifics and directions are online at the VTS NY Website http://www.ieee.org/vtsny or contact Mr. Joern Fellenberg at 212-672-4052, joern.fellenberg@ieee.org.

IEEE VTS Board of Governors' Meeting, 7 February 2004

The first VTS Board of Governors' meeting of 2004 was held on 7 February 2004 at the Los Angeles Airport Marriott, which is the venue of VTC2004-Fall. Elected Board members Charlie Backof, Dennis Bodson, Tracy Fulghum, James Irvine, Roger Madden, Bob Mazzola, George McClure, Sam McConoughey, Eric Schimmel, Gordon Stüber, Ray Trott and Jim Worsham were present, along with J.R. Cruz (Jr. Past President), Harvey Glickenstein (VP Land Transportation), Glenda McClure (Conference Coordinator and John Reagan (Director, IEEE Division IX).

The minutes of the previous, October 2003, meeting were approved with some clarification of the amendment to the Constitution, to make clear that the restriction on holding conferences requiring security clearance had not been removed.

Treasurer's Report: The final numbers for 2003 were not yet available, but are expected to be in the black. The 2004 budget, approved by TAB in November, has income at $1,260,300, $173,700 more than projected expenditure.

Discussion turned to a request from Tan Wang for money for Editorial support for Transactions on Vehicular Technology. The request is for $40 000 in the form of a donation to the University for administrative assistance and $2000 for software upgrades to Manuscript Central. The $2000 for software upgrades was approved 6 for, 1 against, with 3 abstentions. It was also agreed to pay for attendance to the Panel of Editors meeting in 2004, and for Associate Editor meetings in Los Angeles and Milan VTC's. After some debate, it was decided to approve a $15000 donation to University of Florida to correspond with 6 months of editorial operations for Transactions on Vehicular Technology, beginning November 2003, and to ask the Editor-in-Chief appear before the board prepared to discuss expenses for the remainder of the year.

President's Report: Membership is at around 4600. In December 2003, around 2300 renewed their membership and 433 declined. Survey results for IEEE Society renewals were also presented. The attrition rate in VTS of around 25-30% was higher than the IEEE, but was not out of line with other societies. Circuits and Systems Society for example lost 46%.

Conferences & Meetings: A request is presented from the Ottawa Chapter of VTS requesting $300 for a mini-workshop. This was approved.

VTC2002-Fall in Vancouver has had its final report, its audit is complete, and for all intents and purposes is closed.

The audit for VTC2003-Spring in Jeju has been submitted to IEEE, so it has also effectively been closed out.

VTC2003-Fall: Feedback forms suggested the $575 registration fee was felt to be expensive by many attendees, although the most pressing concern in the feedback was lack of Wi-Fi coverage. The conference space was subject to last minute changes which meant rooms did not match the programme, but this had been caused by the change in venue when the original hotel went bust. Financially, the conference was very successful in spite of the enforced change, with a surplus of about $250 000 expected.

VTC2004-Spring: James Irvine took over the role of TPC Chair last October with the agreement of the TPC, and reviewing was completed on time in November. The full paper deadline was the previous week, and the attrition rate for papers has been less than 10%. The new registration fee structure with a publication charge is allowing us to breakeven. A general chair was still required, and the Board confirmed Dennis Bodson in this position.

George McClure presented the report on **VTC2005-Spring** in Stockholm. There were a few issues. The board was given a MOU for the conference that couldn't be approved due to lack of financial visibility. KTH could only be a co-organizer, not a co-sponsor, and with the costs of the convention centre the registration fee could end up being more than $800. A newly opened hotel in downtown Stockholm, the Clarion, would work out to be much more cost-effective, with a $575 registration fee for 500 people, and the rooms are $215 a night. It was agreed that VTS would be 100% sponsor of the conference, retaining the Technical Program Committee.

George McClure submitted a brief report on **VTC2006-May**, which is currently getting into gear in Australia.

Sumner Matsunaga presented a status report on **VTC2004-Fall** in Los Angeles. Sam Lim followed up with a presentation on the financials. The advance registration fee will be $575, non-advance, $650. Advance registration of 170 people will be required for breakeven in the tutorials.

Ray Trott presented a report on Dallas **VTC2005-Fall**. The MOU has been signed, the Intercontinental Hotel has been signed up for the conference, and they are currently looking for a TPC Chair.

Glenda McClure commented on the site search for VTC2006-Fall and Spring 2007. For Fall 2006, she is targeting states without a sales tax. For Spring 2007, discussions are underway into the possibility of Ireland.

Awards Committee: Ray Trott presented the report. Since only one awardee would be in attendance at the Milan conference, there would likely be no awards luncheon there with all awards being presented in LA. It was also agreed to confer the "Stu Meyer Award" on Kent Johnson.

Publications: James Irvine made the report on **VTS News**. He had been asked to report on possibilities for changing the VTS News to a magazine. This would mean going up from an annual cost of $55K for 4 44 page newsletters to $115K for 4 64 page magazines. However, we would recoup $30K from the archival value of a magazine to IEEE Xplore, and given the experience of other societies, over time we might expect about $20K from advertisements, leaving a net of increased cost of $5K. The magazine would be of increased value to membership, and the quality of the articles will likely improve, due to the increased attractiveness to authors of the archival value of the magazine. It was therefore agreed in principle to change the VTS News into a VTS magazine as soon as practical.

Education Committee: George McClure submitted the report on behalf of Yu-Dong Yao. The committee is actively pursuing on-line learning.

Standards: Dennis Bodson reported on Standards. SCC 32 is being dissolved, and it was agreed that VTS become administrators for these standards.

Eric Schimmel submitted the **CCIP** and **ITU Liason** reports.

Sam McConoughey submitted information on the **CIC/IEEE Global Mobile Congress**. He suggested that we aggressively seek to associate ourselves with those conferences who haven't already associated with ComSoc.

Gordon Stuber reported on the **Fellows Committee**. Eight Senior Members were nominated, of which one Fellow was selected. It is noted that there are Five Fellows on the board who could serve as references as needed.

Other business: Division IX Direction John Reagan made some general comments regarding the TAB and IEEE. The IEEE is generally putting its financial house in order. A new algorithm for conference surplus distribution is being put into place. Later in the meeting, John gave a presentation on "Future Power and Alternate Energy Technologies NTDC Activities". He invited any comments or suggestions going forward from the board.

Tad Matsumoto is pursuing the formation of a Finnish Chapter of the VTS.

To make it easier for Board members to be identified at VTC, IEEE-style badges will be produced and Board members encouraged to wear them at VTC.

There was some discussion over changing the format of the Board of Governors meeting, as it was sometimes difficult to get all agenda items taken care of. The general consensus was to continue to meet as at present, but that extra meeting time to be called for at the President's prerogative.

The next meeting of the Board of Governors will be Tuesday, 18 May 2004 at VTC2004-Spring in Milan, Italy.

Conference of Interest

The following table shows VT-06 sponsored and co-sponsored conferences as well as related conferences not sponsored by the Society. While every attempt was made to ensure accuracy, you should contact the respective conference committee to confirm date and location.

DATE	CONFERENCE	LOCATION	WEB PAGE	
5-8 September 2004	PIMRC2004	Barcelona, Spain	http://www.pimrc2004.org	
20-22 September 2004	ISWCS'04	Mauritius	http://www.uon.ac.mu/events/iswcs04.htm	
26-29 September 2004	VTC 2004-Fall	Los Angeles, CA	http://www.vtc2004fall.org	
3-6 October 2004	ITSC04	Washington, DC	http://www.ewh.ieee.org/tc/its/conf.html	
6-8 October 2004	Vehicle Power and Propulsion 2004	Paris, France	http://www.univ -valenciennes.fr/LA MIH/VPP04/	
18-20 October 2004	Convergence 2004	Detroit, MI	http://www.convergence2004.org	
31 October - 3 November 2004	MILCOM 2004	Monterey, CA	http://www.milcom.org/2004/	
29 November - 3 December 2004	Globecom 2004	Dallas, TX	http://www.globecom2004.org/	
13-17 March 2005	WCNC 2005	New Orleans, LA	http://www.comsoc.org/confs/wcnc/2005/index.htm	
16-18 March 2005	2005 Joint Rail Conference	Pueblo, CO	http://www.asmeconferences.org/jrc05/	✓
11-15 April 2005	European Wireless 2005	Nicosia, Cyprus	http://www.vde.com/ew05	✓
16-20 May 2005	ICC 2005	Seoul, Korea	http://www.icc05.org	✓
29 May – 1 June 2005	VTC 2005-Spring	Stockholm, Sweden	http://www.vtc2005spring.org	✓
19-22 June 2005	IST Mobile & Wireless Summit	Dresden, Germany	http://www.mobilesummit2005.org	✓
26-29 September 2005	VTC 2005-Fall	Dallas, TX	http://www.vtc2005fall.org	
Q2 2006	VTC-2006 Spring	Melbourne, Australia	mailto:fzheng@ieee.org	

Conferences marked '√' have open calls for papers as of 1 September 2004. This list is based upon the conference calendar at our web site, which is updated more frequently than this list can be. To access it go to the following URL: http://www.vtsociety.org/, then click on "Conference List" in the left frame. Corrections and additions to this list are most welcome, and should be sent to Tom Rubinstein at t.rubinstein@ieee.org.