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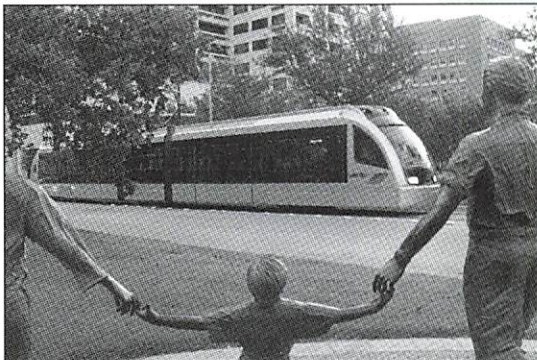
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A new era for Houston, which opened its first light rail line on January 1. The electorate approved revenue bonds to fund extensions last November, even though the line had not yet started operating. (Photo Metropolitan Transit Authority of Harris County)

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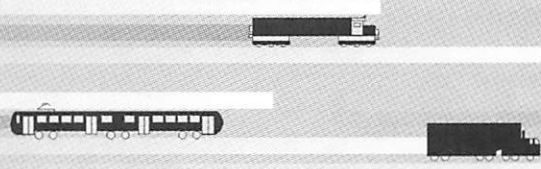
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Foreword

James Irvine, Editor

March 2004 has been a very interesting month for 3G watchers. The good news is that NTT DoCoMo's 3G FOMA service surpassed the three million subscriber mark at the end of the month, just two months after reaching two million. They attribute this rise to new 900i series handsets with high-capacity Java-based applications, HTML email, two megapixel cameras and avatar-capable video and well as 'standard' 3G video and audio calling in a package weighing only 115 grams, and most importantly, with standby times equivalent to 2G handsets. Clever marketing should see growth continue, with a flat rate monthly charge for unlimited *i*-made access planned for later in the year.

Europe, on the other hand, is lagging behind a bit. March also saw the first anniversary of the '3' network in the UK, which by the year end had reached 360,000 subscribers. 3 is competing mainly on price in an effort to gain a foothold in the competitive UK market. The sense of this strategy may be proved by an online Harris Interactive Europe Poll at the beginning of the month that found European consumers distinctly lukewarm on 3G. The poll was conducted in the UK, France, Germany, Spain, Italy and Belgium. 49% of consumers polled in the said that 3G was of no interest to them and that current technology "completely satisfies their needs". 44% can't see themselves using mobile phones for anything other than voice, and worryingly, in the UK, where 3G has been heavily promoted, that figure rose only to 54%. Over half (52%) agreed that "the mobile industry has completely failed to explain what 3G is all about and why it is worth having", while 55% felt that 3G would be overpriced,

and 51% felt that operators would damage their reputation by over-promising and under-delivering. This might not just be recollection of the WAP 'surf the Internet' debacle, but 3's practice with its early handsets of enclosing a second battery to compensate for appalling battery life.

However, all is not lost on the European front. March also saw a Telia study of managers in Sweden which reported that almost one in three believes their companies will use 3G services on a daily basis within one year, rising to 85% within a three-year period. Key services are e-mail and Internet browsing. Interestingly, when Vodafone and T-Mobile launch their 3G networks in the UK, they will be targeting business users with 3G data cards. Anticipating another threat, T-Mobile's cards will also support Wi-Fi. KPN's launch of UMTS services in June in Germany and Holland in July will also be focussing on business users.

European operators can't afford to ignore the consumer market. A report by Virgin observed that UK consumers spend an estimated £11.4 billion each year on mobile phone bills, with 14% of 16-24 year olds admitting to shelling out £50 or more each month on their phone, about as much as the average household spends on heating and lighting their home. Cynical though they may be of 3G, they are loyal – the same report found that 47% have never changed mobile package – and trusting – 13% (almost 5 million people) admit to not reading their mobile phone bill. Japan is proving, yet again, that it can be done. Whether European operators can rise to the challenge remains to be seen.

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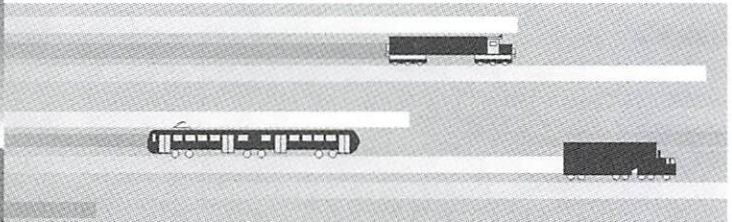
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Mobile Commerce: Introduction, Current Status, Challenges and Future

Upkar Varshney, Georgia State University

In the recent years, mobile commerce has attracted some attention among users, service providers, content developers, and researchers. Some of the reasons behind this attention include the potential of m-commerce to transform business and consumer processes. In this article, we discuss issues in mobile commerce including current status, major challenges and future.

1. Introduction

Mobile commerce can be defined as a set of business activities conducted over mobile and wireless networks using applications on handheld devices. Mobile commerce not only includes e-commerce applications, but also many new and innovative applications that have become possible due to the mobile and wireless networks. Due to its potential, mobile commerce has attracted significant attention among users, service providers, vendors, content developers, businesses, and researchers [1].

mobile middleware, servers, and databases. Here a typical m-commerce transaction could involve several components. A request is forwarded to a transaction server, which checks with an authentication server. Once the transaction is authenticated, preference and pricing databases are accessed. Also, to locate other users and servers, a location database is contacted. If the transaction requires a group session, then a multicast server is contacted. M-commerce transactions could also be supported in ad hoc wireless networks, where users, devices, and servers are mobile. In an environment with unrestricted mobility, completing a complex and possibly long session before a node moves out of the range will become a challenging task.

There are many m-commerce applications such as mobile financial applications, mobile and locational advertising, location-based services, mobile inventory management, proactive service management, mobile auction, mobile entertainment services, multiparty interactive games, mobile office, and wireless data center [2]. Some of these applications are shown in Figure 2. This is not an exhaustive list of m-commerce applications and many more applications can be included. These applications utilize one or more functions of wireless and mobile networks. For example, location-based services and mobile inventory management rely on location management functions, while mobile auction and multiparty games require support for multicast communications with active user participation. Applications such as mobile entertainment services and wireless data center would require substantial resources from wireless networks and could require a limit on the number of simultaneous users unless more effective ways can be deployed for content and data distribution.

For the interested reader, more information can be found as follows: introduction and m-commerce framework [1], wireless networking requirements [2], an m-commerce framework based on the Java Intelligent Network Infrastructure (JINI) and Wireless Applications Protocol (WAP) [3], an implementation of an architecture for end-to-end m-commerce applications [4], m-commerce service discovery in ad hoc environment [5], a security framework based on technological and economic incentives [6], group-oriented mobile services [7, 8], location management [9-11], mobile payments [12-15], ubiquitous database for m-commerce applications [16], and emerging directions [17-19].

Mobile commerce has the potential to transform the ways business is conducted from many different angles. Many of the B2B (business to business) m-commerce applications can improve the efficiency of business processes, improve the quality of services to users and other businesses, and create many new opportunities and markets. For example,

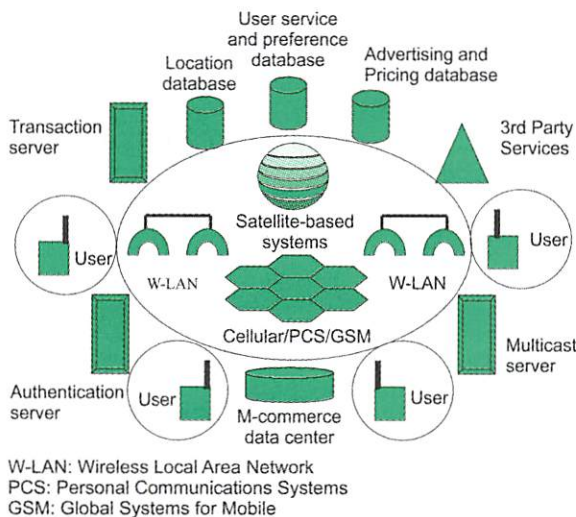


Figure 1 An Architecture for Mobile Commerce

A possible architecture for m-commerce is shown in Figure 1, where functions and roles of different players are included. Three major entities in m-commerce are:

- 1 Users and user infrastructure such as devices and applications
- 2 Network infrastructure and multiple service providers
- 3 Content providers and 3rd party service providers

As shown in Figure 1, the infrastructure for m-commerce includes devices and user interface, wireless networks, mo-

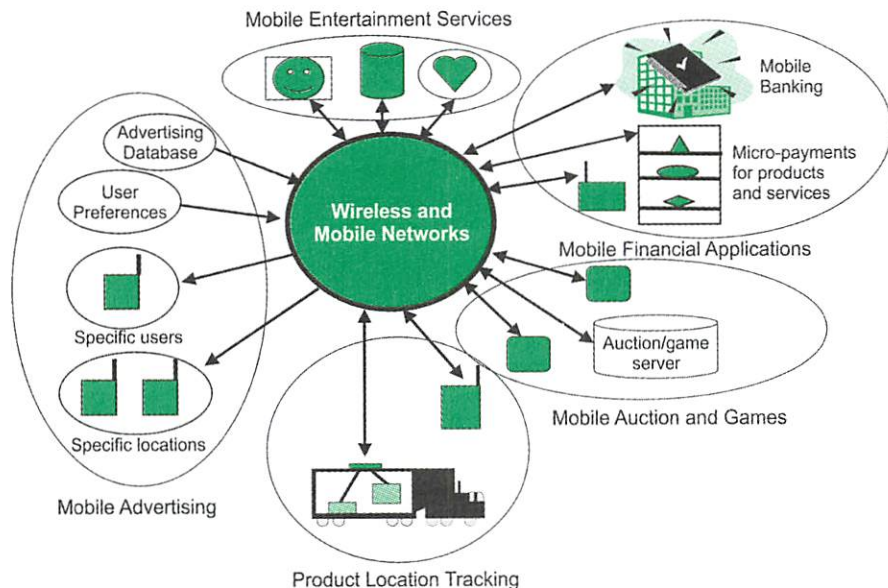


Figure 2 Several M-commerce Applications

Japanese wireless carrier DoCoMo has attracted 40 million customers for content and data services, resulting in multi-billion dollar a year revenue in addition to the revenue from voice services. DoCoMo also collects parts of the revenues generated by 3rd party content providers that are given exclusive access to its subscribers. In some European countries with high levels of wireless adoption, mobile commerce is already generating billions in revenue from mobile financial services, games, tickets, mobile parking, mobile coupons, mobile advertising, and mobile shopping. The estimates for future markets range from tens of billions to a few hundred billion dollars per year. Whether these numbers are realized or not in the future will depend on many challenges that must be overcome by m-commerce. These challenges include identifying suitable applications and services, addressing security and privacy concerns, providing support for mobile payments, utilizing the capabilities of wireless infrastructure and implementing new business models.

In this paper, we address current status of m-commerce in Section 2, several m-commerce challenges in Section 3, and discussion of m-commerce future in Section 4.

2. The Current Status of M-commerce

Several m-commerce applications have been proposed [1-4, 7-9, 17], however, only few of these such as mobile content services, mobile financial applications, mobile advertising and location-based services are beginning to be offered by wireless service providers. Due to different perceptions of m-commerce, some wireless providers are still determining what applications users really want. In addition, many users are not sure about the usability and usefulness of applications that have not been offered yet. This along with perception of significant risks in offering m-commerce services has led to a “wait and see” attitude, at least in US, where only a few providers are willing to take “first mover” advantage.

Mobile Content Services

Worldwide many wireless carriers are offering mobile content services. These include ring tones, news, and video and image downloads. Some of these services are facilitated due to an increasing number of devices with digital cameras,

which also allows photo messages along with sound and text attachment. Such devices have also raised privacy issues in many commercial, public and private environments. Currently, one of the most successful mobile content services is downloading of ring tones, which generated worldwide revenues of \$3.5 billion in 2003. The average price was 60 cents per download and total revenues are divided among artists, music labels and wireless carriers. It should be noted that the market for ring tones may have reached saturation and with reducing rates, revenues might not continue to grow significantly. Many vendors and providers, such as Sony Ericsson and Turner Broadcasting, are offering Cartoon Network contents for mobile phones as wallpapers, and screensavers. The mobile contents services are still in their infancy and more work is needed to bring live and high quality contents to mobile phones and devices.

Mobile Financial Applications

These consist of mobile banking and brokerage services, mobile money transfer, and mobile payments. These could transform a mobile device into a highly personalized tool, replacing bank, ATM, and credit cards by letting a user conduct financial transactions with mobile money [2]. It is projected that the number of users making mobile payments will reach to a total of 285 million in Western Europe, Asia and North America by 2005. Many banks in Europe are supporting basic mobile financial applications to reach to a large base of mobile and wireless users. National bank of Kuwait (NBK) and Vodafone are offering m-payment service allowing NBK bankers and Vodafone customers to pay their bills via SMS. Mobile payments would be one of the major requirements of m-commerce as many applications and services will require the ability to make payments among users, content providers, 3rd party providers and wireless service providers. Localization, personalization and instant gratification that could be supported by m-payments are likely to fuel the growth of m-payment solutions from multiple providers (Figure 3) [15].

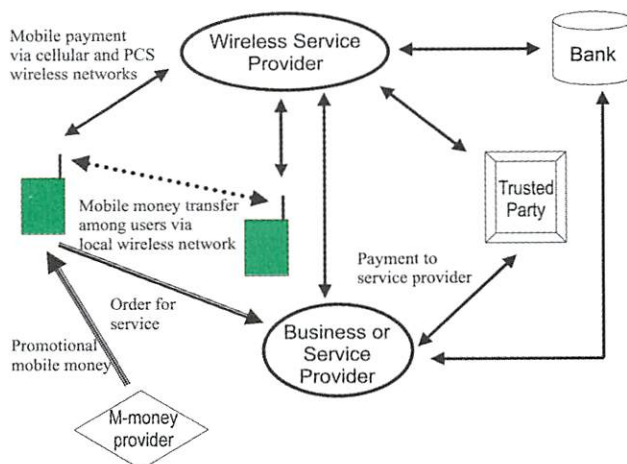


Figure 3 Mobile Payments

There have been some progress in mobile payment services, including Vodafone's mobile payment service in England, Germany, and Italy based on user authentication (PIN), device authentication, and e-wallet processing. Also, US Sprint and eONE have announced a mobile payment network in the US for micro-payments and would also support macro-payments in future [13]. Another example is PayCircle, which is established by HP, Lucent, Oracle, Sun, and Siemens. The proposed and current m-payment services would be significantly benefited if interoperability of payment systems could be achieved where users with a variety of devices in countries with diverse wireless networks can make m-payments involving multiple currencies.

Mobile Games

These are being offered by wireless carriers and third party providers. Most of these games are single user games where a user downloads an application that allows him/her to play a game on a mobile phone or device when needed. These are not multiparty interactive games involving a large number of users. Such games would require continued connectivity and close co-ordination of user inputs to create a real-time experience for mobile users.

The potential value of games has also attracted many 3rd party providers such as Parlay entertainment and WinwardCasino.com, which are now offering Parlay's real-time wireless suite of online casino games, and Chipmaker ATI, which is working on bringing 3D games for mobile phones. Wireless carriers are also allowing mobile users to follow live sports via specialized applications. There has been some progress in offering personalized wireless dating service that supports profiles, messages, chat, and e-mails among interested individuals.

Location-based services

These include location and user-specific advertising and offering of specialized contents to mobile users.

By keeping track of user's purchasing habits and current location, very targeted advertising can be performed [2]. In one possible scenario, a user could be informed about various on-going specials in the vicinity or a selected area of interest. These messages can be sent to all users who are currently in a certain area (identified by advertisers or even by users) or to certain users in all locations. Depending on interests and personality types of individual users, advertisers could decide whether "push" or "pull" form of advertising is more suitable. It should be noted that there are issues of privacy and sharing of user information with other providers. It is likely that an "opt-in" approach would be implemented where explicit user permission is obtained before "pushing" any advertising content.

Location content services utilize location information to provide specialized contents to m-commerce users. These contents could include information on desired restaurants, devices, users, and products. A user could be interested in knowing availability and waiting time at one or more restaurants close to his current location. Another user would like to be alerted when one of her friends is in the same general area. Location information of fixed entities can be kept in separate databases for each area, while location tracking of mobile and portable entities could be performed as and when needed (on-demand). When a user enters a designated area, user information from previous networks and locations will be accessed. This will also allow a determination of location-aware services the user has subscribed to or is authorized to access. Currently, there are a few examples of lo-

cation-based services, not necessarily personalized or user-specific. These include mapping, routing, and list of places in users' vicinity [10]. Although not m-commerce offerings have become instant successes, there is considerable interest among users and businesses.

In addition to the basic versions of these applications, more sophisticated applications involving increased user personalisation and context awareness must be offered. Although it is difficult to suggest a "killer" application for m-commerce, we believe that mobile games, personalized contents, entertainment services, mobile auction and trading, and product recommendation systems could give a boost to m-commerce deployment and adoption. Mobile and multiparty games could become major drivers of m-commerce, especially if group connectivity for wireless users can be maintained even under periods of intermittent connectivity and brief dis-connectivity. Entertainment contents will attract some users especially if the contents can be tailored to different user groups and interests. Other applications such as mobile office, mobile distance education, and wireless data center (application where a large amount of stored data to be made available to mobile users for making "intelligent" decisions) could add value to m-commerce services [2]. Besides designing new applications, some efforts must be made in studying the adoption of m-commerce applications in different countries, identifying and analysing factors that influence success or failures of m-commerce services, understanding the role of 3rd party providers and wireless service providers in applications and contents development.

3. M-commerce Challenges

There are several challenges that must be overcome before m-commerce could become a major success story. These challenges include identifying suitable applications and services, addressing security and privacy concerns, providing support for mobile payments, utilizing the capabilities of wireless infrastructure and implementing new business models. These important issues are not necessarily independent. For example, security and privacy relate to m-payments, while infrastructure limitations directly affect applications and services.

Infrastructure Requirements

One major challenge is how to support diverse requirements of m-commerce applications by using the functionalities and capabilities of wireless infrastructure. The first step is to derive specific infrastructure requirements of m-commerce applications, and then attempt to match these to specific capabilities of current and emerging mobile and wireless networks. From a detailed analysis of several m-commerce applications, some important m-commerce requirements have been derived [2]. In this paper, we discuss location management, wireless dependability, multicast, and interoperability and scalability requirements. These requirements are shown in Table 1 and possible wireless networks are included and discussed.

Location management

Many m-commerce applications, such as location-aware services and mobile inventory management, require location information of users, devices, servers, products, and services. Additionally, these applications have widely different location precision, response time, and scalability requirements. This becomes a challenge, as current wireless networks are not designed for location-based applications.

Requirements	Attributes	Candidate Networks
Location Management	Location accuracy and response time	Satellite-based network (higher accuracy, slow response time) Cellular and PCS networks (location support not available everywhere) Wireless LANs (low accuracy but better response time)
Wireless Dependability	Availability and survivability	Current wireless networks support availability between 90 and 98%. Increased dependability is possible using fault-tolerance and back-up components in wireless networks.
Multicast	Group membership and connectivity	Satellite-based networks can support multicast using broadcast technologies Cellular and PCS systems do not support network or physical multicast M-commerce applications could support multicast at application layer
Interoperability	Ability to use multiple networks	Difficult to achieve as most wireless networks differ considerably in protocols, frequencies, power and interface requirements Multi-network access possible by using several interface cards

Table 1 Specific Wireless Infrastructure Requirements

The locational information is increasingly supported by cellular/PCS/GSM networks, however the support for location management is not available universally. A multi-network architecture for supporting location-aware mobile commerce is shown in Figure 4. In addition to supporting location management requirements, some research efforts must also be directed towards location co-ordination among multiple wireless networks, location negotiation protocols for m-commerce, prioritization of location requests based on applications requirements, context (emergency, anxiety etc), and processing delays. Several architectures and schemes for location management for m-commerce can be found in [9].

Wireless dependability

M-commerce transactions would be significantly affected by the dependability problems of wireless networks. The situa-

tion could become even more complex in the emerging “3rd generation and beyond” wireless networks as increased heterogeneity and inter-carrier roaming will lead to the whole wireless infrastructure becoming highly dependent on the weakest link(s). An increased interconnectedness of wireless networks would also lead to a higher degree of fault propagation. Additionally, these emerging wireless networks will support group-oriented m-commerce applications; thus impact of dependability problems could propagate to multiple locations serving wireless users. One way to address the dependability of wireless networks for m-commerce transactions is to deploy fault-tolerant architectures to isolate and/or bypass failures. The cost of deployment for fault-tolerant architectures could be reduced by a more “selective” fault-tolerant design, where only certain components are provided a degree of fault-tolerance. The fault-tolerance would allow m-commerce transactions to be

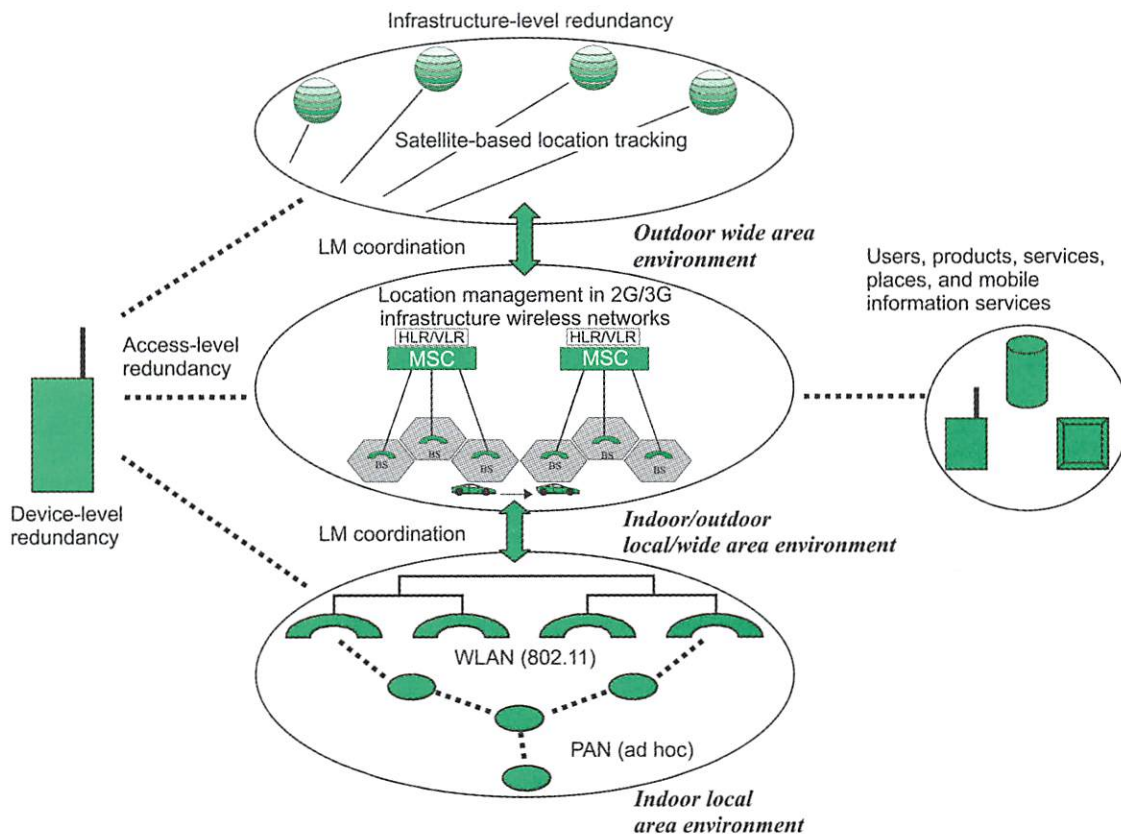


Figure 4 A Dependable Location Management Infrastructure for M-commerce

executed even when there are one or more failures. Certainly more work is needed in designing dependable solutions for m-commerce that are scalable in terms of number of users, transactions, and network size.

Wireless Multicast

Some group-oriented m-commerce applications such as mobile auction and interactive mobile games would require continued connectivity. Although the group communications can be supported by using wireless multicast, where information sharing is supported by efficient routing in wireless networks, the challenge for m-commerce is in maintaining continued communications with user mobility and variable quality of wireless links.

This combined with brief dis-connectivity or intermittent connectivity could lead to a loss of user input, thus affecting the outcome of applications such as mobile auction [7, 8]. Therefore, more work is necessary in supporting group-oriented m-commerce application by adding flexibility in the applications, handling connectivity and mobility problems in the middleware, and designing protocols for coordinating user inputs for group applications.

Wireless Interoperability and Scalability

There are several wireless networks that can be used to support one or more m-commerce services based on the functionalities offered. These include 1G analog cellular networks (9.6-19.2 kbps), Short Messaging Service (variable bit rate) using 2G Global System for Mobile Communications (GSM), DoCoMo's iMode service (9.6-28.8 kbps) in Japan, Enhanced Data rates for GSM Evolution (up to 384 kbps) as 2.5G system, and multiple 3G networks offering a range of bit rates to different set of users. Also, proprietary wireless WANs (28.8-128 kbps), multiple wireless LANs (802.11 LANs at 1-54 Mbps, HIPERLAN2 at 54 Mbps in Europe), satellite systems (9.6-400 kbps, possibly higher) and wireless local loops (1-10 Mbps or even higher) can also find their roles in m-commerce. The existence of multiple wireless networks would offer access support in hot-spots, places where traffic exceeds the capacity of a single carrier. On the other hand, since these networks differ considerably, interoperability becomes a major challenge. One way to use more than one of these wireless networks is to use a multi-adaptor device (e.g. phone-satellite combination). Even among a common standard for a wireless network, implementations from different vendors do not necessarily interoperate well.

Security and Privacy

One of the biggest challenges of m-commerce is (perceived) lack of security and privacy. Although, many basic security problems are same as those in wireline networks, however, additional problems arise due to the nature of devices, wireless links, and networks. These include inability to authenticate users and devices by non-GSM networks, and some inherent weaknesses of wireless channels. Individuals and businesses are unlikely to conduct important transactions or put mission-critical data on wireless networks that are either not very secure or "perceived" to be insecure. For a variety of reasons, including compromises in setting up standards, strong security has not been implemented in some wireless networks. For example, IEEE 802.11 have received a significant media coverage on possible security weaknesses such as breaking of private encryption key and many instances of not even turning on WEP (Wired Equivalent Privacy) protocol. Many of these problems have been ad-

ressed. Even with these changes, it is likely that the level of security would vary considerably from network to network and from location to location. This would affect some m-commerce transactions, especially the ones involving multiple wireless networks, due to possible changes and deletion of information and denial of service attacks.

Privacy is another critical issue as many users are uncomfortable with the idea that their location and personal information could be shared with third party providers. At this point, it is not clear who owns all this information although a lot of this information is collected and stored by wireless service providers and businesses. An "opt-in" approach should be implemented where explicit user permission is obtained before sharing such information with other parties and also before "pushing" any advertising contents to the user based on purchasing habits and current location.

There has been some progress in enhancing security and protecting privacy of m-commerce users. The GSM standard supports both user (PIN) and device authentication (SSL). Wireless PKI (Public Key Infrastructure), a system to manage keys and certificates that also requires a user to enter 2 PINs (authentication and digital signature), is used in WTLS to support 2-way authentication (anonymous: class 1, server: class 2, user: class 3). In a trial of mobile financial services, it has been shown that by using dynamic proxy configuration, end-to-end encryption is possible [14]. Although WAP 1.0 provides security by using Wireless Transport Security Layer (WTSL), but it does not result in the end-to-end security. The translation between SSL (Secure Socket Layer) and WTSL occurs at WAP gateway, which is vulnerable to DoS (Denial of Service) attacks. WAP 2.0 overcomes this problem by not requiring proxy or gateway for protocol translation, unless push operation, improved services and optimized communications are needed.

Due to the nature of m-commerce, there are possibly new ways to address security problems. These could include user location as a determining factor for the monetary value of transactions, in addition to type of user, history of payments, type of wireless network in use, and credit availability. Security support will become a major competitive advantage for wireless carriers and 3rd party providers. Financial incentives resulting from an increased number of users and new sources of revenues, such as charging for secure channels as required for some m-commerce transactions, could lead to adequate security for m-commerce users [6].

Business Models and Strategies

In general terms, m-commerce involves applications developers, content providers, wireless service providers, location service providers, mobile payment providers and third party providers. One major reason behind the slow deployment of m-commerce is the challenge of pricing m-commerce services and revenue division among multiple players. Pricing has been considered a major issue for most users and possible options are flat rate pricing, per transaction pricing, and subscription-based. The pricing scheme must also be clear to a common user. This has been one factor behind the success of NTT DoCoMo's iMode service where pricing is simply based on the amount of information sent or downloaded (such as 300 screens worth of data for \$1). Another challenge is revenue division among multiple players, where number of users and services and thus the total revenue could fluctuate significantly. A business model for m-commerce should address

- ◆ Cost of providing services from user's point of view such as what upgrades are needed to support sophisticated

m-commerce services. Could the same device be used with some added functions or even better could a user download some application just before conducting m-commerce transactions?

- ♦ Cost of building m-commerce services and return on investment
- ♦ Type of services to be offered to different types of customers (age, income levels) using different payment schemes (pre-paid, post-paid, per unit per view)
- ♦ Division of revenue among multiple players
- ♦ Pricing and role of micro-payment aggregators (to reduce large number of micro-payments)

It is difficult to suggest a business model that could work everywhere, however many regional differences must be accommodated including the level of competition among wireless carriers, the types of services and contents covered, economic and cultural factors, and user demography. One of the business models considered successful is the one adopted by DoCoMo and involves a "selective" set of content and application providers that are allowed an exclusive access to users in exchange for a fraction of revenues to DoCoMo. Certainly, carriers in other countries would have to modify such model due to regulatory and local differences.

One major obstacle in the deployment of m-commerce, especially, in US, is lack of strategies and understanding among multiple players. Among potential business customers, many view m-commerce as just the good old e-commerce packaged slightly differently, while others view wireless infrastructure as just another channel to do the regular business. Additionally, there are three major obstacles, perceived by many businesses in m-commerce services, are coverage, reliability and security of wireless access. Each one of these must be a part of overall m-commerce strategy for service providers and business users.

4. Conclusions and Future of Mobile Commerce

M-commerce has the potential of utilizing instant access of devices, flexibility and convenience of wireless networks, and offer personalization and location-awareness of mobile applications. These could lead to a new level of user-empowerment not seen or observed before. Many new applications, services and markets are becoming real. For fully realizing the potential of m-commerce, we believe that several challenges related to suitable applications and services, strong security and privacy, support for mobile payments, wireless infrastructure limitations, and new business models, must be addressed. Some efforts must also be spent towards devices and middleware, user interface design, and introduction of context-awareness in m-commerce applications. On a happy note, we observe that some of the challenges raised in this paper are beginning to be addressed by researchers in technical, management, and social science communities.

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The 42 V PowerNet Story – Challenges of an International Collaboration

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International agreement on 42V as a standard automotive voltage was the consequence of an innovative and productive collaborative process. Starting with a small group of strangers representing 8 companies meeting in a neutral setting, the 18 month process overcame obstacles of individual agendas, intellectual property and diversity of opinions to produce a set of recommendations that was quickly and enthusiastically embraced by the industry. This paper will describe the process and lessons learned that will be helpful in addressing future questions requiring industry consensus.

Introduction

The time constant of technological innovation is shrinking, primarily due to advances in electronics, sensors and communication, advances which provide products or systems with new or improved functionality. The resulting challenge for the auto industry is that the economics of new technology often requires that its introduction be preceded by agreement on its parameters, e.g., protocols for communication networks. The process leading to the international adoption of 42 V as a new system level voltage possibly provides a new paradigm for the auto industry to rapidly achieve consensus on parametric aspects of new technology, thereby accelerating its introduction.

In the Summer of 1994 Mercedes Benz asked the MIT Laboratory for Electromagnetic and Electronic Systems (LEES) to organize a forum of automotive industry representatives to address the need for a higher voltage in future vehicles. Mercedes was seeing increasing pressure on the present 14 V system caused by the anticipated introduction of new electrical functions as well as the electrification of old mechanical functions. It was also clear that as a small company Mercedes had little leverage with which to alone establish a new standard voltage. The buy-in of the "big 3" (or at least the "big 2") was essential.

The first "Workshop on Advanced Architectures for Automotive Electrical Distribution Systems" was held October 25 and 26, 1994 at MIT. Attendance was by invitation to individuals selected for their expertise and decision making positions within their organizations. The targeted industry segments were OEMs, harness/connector manufacturers and electronics suppliers. To assure the interaction necessary for a workshop, attendance was limited to less than 15

people. The organizations represented at this first workshop were Mercedes Benz, United Technologies, Delco Electronics, Ford, Packard Electric, General Motors, AMP, ElectroWire and MIT.

Subsequent meetings of this group were held at four month intervals. By early Fall 1995, after three two-day meetings and considerable communication between meetings, a consensus had been achieved on a number of questions, the most significant being that 42 V (36 V battery) be recommended as a standard. At about this time Mercedes Benz organized the Forum Bordnetz, a working group of principally German OEMs and suppliers. The conclusions of the MIT working group were presented to the Forum Bordnetz in October 1995, along with the supporting arguments. These were adopted by the Forum Bordnetz which also assumed the lead in establishing a formal international standard.

The process which led to consensus on such an important issue in such a remarkably short time is the subject of this paper. While process alone did not guarantee success, absence of the right process could have guaranteed failure.

Context

The MIT Workshop was formed against the backdrop of the SAE Dual/Higher Voltage Study Group which was established in 1989 and issued its recommendations in 1992 [1]. The primary conclusion reached by this study group was that whatever battery voltage was chosen, it should not exceed 50 V. In the same year Ward's published the results of a survey (Fig. 1) showing that 70% of respondents thought 24 V should be the next battery voltage. Only 13% thought it should be 36 V.

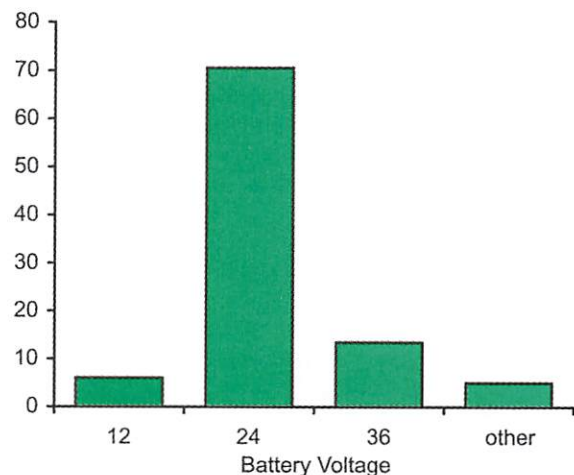


Figure 1 1992 survey of automotive engineers regarding future battery voltage. (source: Ward's Auto World, 1992).

Workshop Format

From the outset there were several parameters of the workshop that were considered necessary for its success:

- ✦ Limited size
- ✦ Diversity of perspectives represented
- ✦ Sufficient duration to establish collegial, trusting and respectful relationships
- ✦ Participants with significant responsibilities in their organizations
- ✦ Continuity of participants
- ✦ Structured agenda
- ✦ Assignment of agenda responsibilities
- ✦ Significant opportunities for social contact

These were all designed to maximize the probability of reaching consensus on issues, and then having that consensus supported by the participants' organizations. Although some of the participants knew one another, most found themselves among strangers from competitor or customer companies. Thus it was necessary that the workshop format engender relationships based on trust and respect. The choice of MIT, a neutral and objective organization, to host and facilitate the workshop was made to help build trust.

The physical format of the workshop was an important element in both supporting free discussion and building trust and respect. A U-shaped arrangement of tables and seating was made possible by the small number of attendees and provided visibility for everyone. The room selected was also large enough to support coffee breaks which were designed to encourage informal discussion which contributed significantly to personal trust. Of absolutely critical importance was the social event, including dinner, planned for the evening of the first day of every workshop meeting. The venue was chosen for its ability to host an informal "walking around" reception before dinner. The value of this event was clearly evident during the second day of the first workshop. At the end of the first day my MIT colleagues and I were pessimistic about ever achieving consensus on any issue. During the second day it was clear that relationships had been lubricated the previous evening, and that everyone felt considerably more at ease and enthusiastic about the mission of the group.

The Agenda

A critical element of any meeting is its agenda. Since this was to be a series of workshops it was essential that the first agenda be very thoughtfully structured to raise issues in such a way that "solutions" are avoided and action items for future meetings evolve. The agenda, shown below, for the first workshop held on October 25 and 26, 1994, was very successful in doing this. Each agenda item was expanded with a series of questions to guide the discussion, and each item was assigned 10 days prior to the workshop to two attendees from different companies. This assignment along with a progress check by MIT at 5 days before the meeting, assured preparation and encouraged pre-meeting discussions between participants. Note the conspicuous absence of any item addressing the question "What should the new voltage be?"

1. Historical perspective:

Why have previous studies resulted in maintaining the 12 V design? What forces are motivating new electrical system designs today? What forces are hindering the implementation of a new system?

2. Ac vs. dc and voltage level:

What are the advantages of ac or higher voltages? What problems do they create? How are components affected –

relays, fuses, motors, lamps, etc.? What considerations will determine frequency in an ac system?

3. Communication and control strategies:

What are alternatives for power control? Centralized (dashboard or cockpit) or point of load switching? What are the alternatives (e.g., fiber optic, power line carrier, dedicated wire, etc.) for communication of component monitoring and load control signals? Are there new technologies that have influenced, or might influence, these choices?

4. Present wiring systems:

What are manufacturing costs? What are fusing criteria? Are there alternatives to fusing? What types of connectors are used in today's wiring systems, and what are their limitations (e.g., voltage, current)? What is the reliability of today's wiring/connector systems relative to other automotive electrical components? What are connector failure modes?

5. Safety and standards:

Are there standards or recommended practices that represent "hard" constraints to the design of the system and choice of voltage and frequency? If not, what are the issues that must be addressed to assure acceptance by manufacturers? Which national market will prove the most severe in terms of establishing safety practices?

6. Manufacturability, economics and cost:

What methodologies can be applied to address this question? What are the economic constraints when a new technology is in the transition phase, i.e., when costs are high because volume is low and infrastructure is absent? How might this change with increased application of the new technology? How can manufacturability be quantified economically, including, for example, issues of maintainability?

While it was inconceivable that all these questions would be answered, they served the purpose of facilitating dialog at this first meeting and establishing a very solid framework for the workshop's future agenda. The goals of the first meeting were to: 1) define the problem; 2) reach a consensus that the problem was real and important; 3) establish a high level of commitment from attendees to continue to collaborate in future workshops; and 4) assign to individuals responsibility for agenda items at the next meeting. These should be considered generic goals for the initial meeting of any group attempting to address a challenge complex enough to require a series of meetings.

Equally important to the successful launch of this collaboration was an initial focus on attributes of the problem rather than on solutions. "Solutions" are generally easily elicited from people, who often become so enamored of their idea that they become obstacles to progress. The benign sounding second question under agenda item 1 belies the important role it played in the first meeting. We considered what the electrical system presently did and would have to do in the future rather than how to do it. This stage of the process, reaching agreement on attributes, took considerable time since it required technology, regulatory and feature forecasts, as well as an accurate understanding of historical precedents, such as the change from 6 V to 12 V batteries. But it greatly accelerated a consensus on the solution because there were no pre-conceived "solutions" on the table.

The Workflow

Momentum is the primary requirement for any process to reach a conclusion. Momentum is generated first by a shared belief in the importance of the effort, and then by constant attention to the meeting agendas to assure that they not only maintain but

increase the momentum. The first working group meeting defined the shared belief by producing as tangible output a mission statement which acknowledged the importance of both the effort and the need to recognize the competitive relationship among participants' companies. In the context of a higher voltage system, the relevant sentence in the mission was "to support economically efficient production [i.e., manufacturing] by establishing a commonly accepted set of system parameters while preserving the opportunity for competitive, independent development of system designs."

Subsequent meetings of the working group built upon the questions raised, addressed, but by design not answered at the first meeting. These issues were arranged in a logical order, that is, an order that appeared capable of providing some early successes to keep the momentum going, and assigned as primary topics for future meetings. At this point experts from outside the original group were invited to participate to provide realistic perspectives and opinions on very specific topics. For example, the group recognized that the practicality of using semiconductor devices in the car was going to be strongly influenced by a higher voltage. So Alfons Graf of Siemens Semiconductor (now Infineon) and Randy Frank, then of Motorola (now On Semiconductor) but presently at IR, both with extensive experience in support of the auto industry, were invited to provide an overview of current technology and an assessment of what could be achieved in cost and performance if the system voltage were higher. The point to take away here is that topical experts providing specific domain knowledge were brought "into the fold" only after the broad workshop agenda and workflow were determined. That is, after the questions to be answered were pretty well defined. This created an extremely efficient and productive dialog among the experts and the other participants. The experts continued to participate after their introduction to the workshop. After 18 months the number of regular participants had risen to 25.

The 18 month decision target was the recommendation of a new system voltage. Because of the many issues under discussion (as illustrated by the agenda for the first meeting) this highly visible, easily defined target was essential to keeping deliberations focused. It quickly became apparent that the economics of semiconductor devices and concerns for safety would dominate this decision. Questions about semiconductors could be answered objectively. Safety, however, was a very subjective issue. Different parts of the world had different standards for safety, and their bases were often obscure. As it is no longer possible to use human subjects for experiments, safety related decisions have to be based upon an interpretation of a relatively small number of studies on human subjects published prior to about 1960. Semiconductor economics and a careful analysis of electrical safety standards from Japan, Europe and the US lead to the consensus decision to recommend a system level voltage of 42 V. Note that the battery voltage was not specified as it was agreed that to do so would have assumed a particular chemistry. For a lead-acid chemistry, this specification implies a 36 V battery.

The workflow leading to this recommendation encompassed many of the issues outlined in the first workshop agenda and formulated during that meeting. Though safety and semiconductor economics were decisive issues, this was only because all the other subjects of discussion, while not necessarily resolved, had been carefully addressed to assure they were not major obstacles.

Dissemination of Recommendations

Establishing a plan to disseminate the recommendations of the WG was a major milestone. Two challenges had to be met

here. The first was to get permission from the companies represented in the WG to have their names attached to the recommendations. The second was to select appropriate forums in which to release the recommendations. The first challenge was met with surprising ease, principally because the participants had been keeping their companies apprised of progress for over a year. The IEEE and the SAE were identified as the appropriate organizations through which to publicize the recommendations. An article was written for the *IEEE Spectrum*, and a paper was submitted to *Convergence 98* [2, 3]. The *Spectrum* article was the cover feature of the August 1996 issue, and the *Convergence* paper received the conference's "Best Paper" award. These publication events, establishing unambiguous recommendations, initiated significant 42 V development activity within the industry.

Internationalization

The question of how to achieve international cooperation on establishing a new standard voltage was of concern to the working group from its inception. Through Mercedes Benz we had access to some of the thinking in Europe on the subject, but there was little awareness of any activity in Japan or Korea. The approach taken to internationalization of the group's work was to first achieve consensus with the European automakers, and then worry about Japan and Korea. However, in developing the attributes of the problem there was a high degree of sensitivity to constraints that might arise due to varying regulations, standards or social norms of different countries. It was not sufficient to simply recognize that there might be variation among countries. The specifics of the variations had to be identified.

One year after the MIT Working Group's first meeting Mercedes Benz organized a German workshop, the "Forum Bordnetz" (FB), with participants from German OEMs and suppliers. The necessary consensus on the recommendations of the MIT Working Group was achieved at the second FB meeting. A representative of the MIT WG presented the recommendations at this meeting, along with their supporting arguments, and the FB adopted them verbatim. Subsequent to this meeting the FB expanded participation to OEMs and suppliers in the rest of Europe.

At this point there remained two challenges. The first was to engage the Japanese and Korean auto industries in the 42 V activity. The second was to begin the process of establishing a formal international standard for 42 V through the International Standards Organization (ISO). Responsibility for the first task was assumed by MIT, while the FB assumed the task of shepherding the recommendation through the ISO standards setting process. This cooperative arrangement was essential because it kept both continents engaged in necessary but different activities and maintained the need for continuing dialog between the MIT WG and the FB.

The agreement to establish 42 V as an international standard initiated the second phase of international cooperation. This second phase consisted of the creation of a consortium of OEMs and suppliers to begin the job of investigating a number of technical issues related to the implementation of 42 V systems. Among these were issues such as the performance of fuses and connectors, the economics of motors and actuators, the practicality of idle-stop operation and energy management. MIT responded to this need by establishing the Consortium on Advanced Automotive Electrical/Electronic Components and Systems. The consortium provided the vehicle for finally engaging the Japanese and Koreans in a meaningful way. As Mercedes served to cata-

lyze activity in Europe, so did Toyota in Japan. In response to the consortium initiated 42 V activity in Japan, the JSAE reestablished its higher voltage working group which has become the forum for Japanese OEMs and suppliers to resolve specification issues. Hyundai took the lead in Korea.

Once again success was predicated upon a compelling belief that the goal of the collaboration was important. It was this belief combined with the high degree of respect accorded Mercedes Benz, Toyota and Hyundai which convinced the industry in Europe, Japan and Korea to participate.

Present Status

The MIT consortium, which has become the primary vehicle for coordinating technical activity and providing a forum for the dissemination of information and topical discussions on 42 V, now numbers over 50 members from the auto industry. The membership is approximately evenly divided among the US, Europe and Southeast Asia. Though the current economic climate has dampened the enthusiasm for a rapid introduction of new 42 V technology into production vehicles, the momentum of development activity has been maintained by the frequent and heavily attended meetings of the consortium.

Lessons Learned

1. The timing has to be right. In this case the initiation of the MIT workshop coincided not only with a recognized need, but also with the start of a period of extraordinary economic strength. Consequently resources such as travel budgets, time and vision were obtainable without difficulty.
2. Coordination and facilitation of deliberations by a neutral, disinterested but technically knowledgeable party, in this case MIT, creates the trust and respect necessary for willing and open discussion.
3. Participants in the collaboration should possess a reasonable degree of decision making authority within their organization.
4. The opening gambit should be designed to reach agreement on the attributes of the problem, not its solution. Preconceived answers are of little value and can substantially impede progress (n.b., the Ward's survey).
5. A specific target for the results of a collaboration should be agreed upon early in the process.

6. An environment and process that encourages the development of positive interpersonal relationships is essential. The importance of the physical format of meetings and the opportunity for informal social interaction should be recognized.
7. Active participation by all parties to the collaboration should be assured by carefully structuring meeting agendas and assigning well defined responsibilities that are seen as relevant to meeting the established target.
8. Issues that are likely to be divisive should be recognized early and either avoided or structured in a way that maintains harmony. In this case concepts perceived to have competitive advantages were avoided.
9. Consensus among a large group (in this case the world-wide automotive industry) is best achieved in a stepped process starting with a smaller body that defines the major issues and puts forward a proposal that serves to structure the dialog and work of the larger body.
10. Critical to the success of a collaboration affecting many is the broad dissemination of conclusions, recommendations or other results, preferably in a forum that permits reaction and constructive dialog.

Conclusions

The evolution of the 42 V PowerNet standard is a case study in consensus building that can serve as a paradigm for collaborative activities. Key elements of the process were the presence of an objective organizer/facilitator, the selection of participants, the structure of the agenda, an initial focus on attributes of the problem and maintaining momentum. The lessons learned from this experience should prove valuable to future collaborative activities within the auto industry.

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Towards the Intelligent Power Network

Randy Frank

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ment of transport electronics technology and the support of mathematics and science education.

The transition of the vehicle from mechanical to mechatronics systems is encountering some technology toll-booths. The increasing number and level of vehicle electrical loads cannot be met with the existing automotive electrical

system and will eventually require the vehicle's primary voltage to increase to 42V to minimize current, copper cost, wiring harness size and weight, and even di/dt. At the same time, the increasing power requirements for newer loads that range from 1 to 20kW limit the use of existing semiconductor techniques to control these loads.

Automakers have already started to implement or plan for the changes in the vehicle's architecture. Automotive electronic suppliers have designed systems to provide power management. However, non-automotive systems that are in production may have features that could be emulated in the automotive environment. Adapting the behaviors of other industries could also provide benefits of reduced time to market as well. This paper will discuss the challenges that increasing power consumption, power generation and power data communication pose for future vehicles. Examples from other industries as well as announced automotive activity will be provided.

Introduction

The rising demand for power in vehicles will require new strategies to provide and control power. The use of electronics in vehicles to provide more precise control or to obtain a function that was not feasible with mechanical or hydraulic systems was initiated over 30 years ago. Since that time the average vehicle's loads have almost tripled. Projected trends for mechatronics - the combination mechanical and electronic design - show a critical level of power being required in this decade that will demand the vehicle's distributed power bus to operate at a higher voltage to minimize the current. Increasing the regulated voltage from 14V to 42V can reduce the current by one third for a given vehicle load.

This increasing amount of power is occurring concurrently with increasing digital control. Consequently, power must become part of the communications architecture that links vehicle systems. Power system information must be among the data that are handled on the communications bus. Information such as load status, load current, voltage, battery state of charge, battery state of health and faults are among the variables that will be communicated in the power management system.

Power Management

The increasing loads are impacting the vehicle's power generation and energy storage systems. This has already resulted in power distribution control in the form of energy/power management to improve battery charge-balance and provide load shedding under critical conditions in some vehicles. With power distribution control, non-essential

loads can be turned off during maximum or excessive power conditions to avoid improper operation of critical systems such as electrical power steering or the anti-lock brake system. Situations that would result in continuous excessive current or even complete battery discharge can be detected quickly and problems avoided by charge balance and intelligently disconnecting certain loads.

Figure 1 shows the interrelation of the elements in a power management system [1]. The thin lines represent data communication and the thick lines represent power. The power management unit receives data from various elements and depending on the strategy, can turn off non-essential loads. The data links can be bi-directional and in the case of a 42V to 14V dc-dc converter, the power could be bi-directional.

Fault detection is a key part of the data communication in the power management system. Power removal for protection or remediation is part of the power distribution. Fault detection philosophy and reactions depend on system level strategy. Ease of fault detection starts at the component level and is frequently a built-in design element of many semiconductors, especially smart power ICs or intelligent power switches (IPS). Fault detection as part of the power management system can simply monitor or diagnose the fault, report the fault to other systems, or provide remediation, failsafe operation or some level of redundancy.

Other functions of an intelligent power system include prognosis and avoidance. With sufficient intelligence, the prediction of a pending battery failure could provide sufficient warning to the driver to avoid a dead battery and the inability to start the vehicle. The current leakage during prolonged key-off periods such as parked at the airport will be even more critical in the future as the number of stand-by loads and the number of semiconductors used to control these loads increase.

The Change in Vehicle Loads

The typical load in today's vehicle is less than 10 amps (steady state) and well below 500 watts. However, as shown in Table 1, the power and current levels of some of the future automotive loads greatly exceed those in today's vehicles. Today's vehicles use brush dc motors for functions such as moving seats, windows, windshield wipers, mirrors and closing doors or trunks. The high power loads in future vehicles will be either brushless dc motors or possibly switched reluctance motors. These more complex motor architectures are being used in other markets and can provide some insight to future designs for automotive applications.

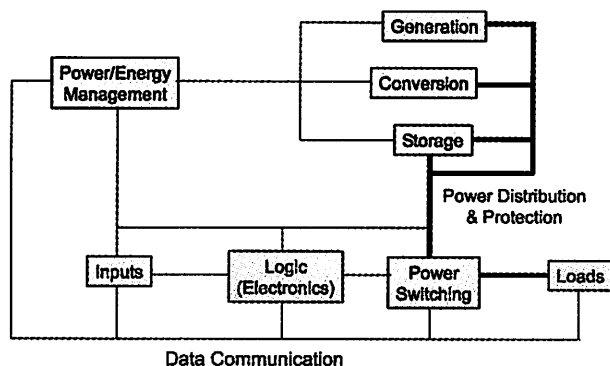


Figure 1 Power/energy management unit uses data from various elements in the system to control power and provide protection. After [1].

Table 1 Potential Loads in Future Vehicles

	Power (Max) (Watts)	Current (Max) at 14V (Amps)	Current (Max) at 42V (Amps)
Heated windshield	2500	179	60
Catalytic converter preheat	3000	214	71
Electrohydraulic brakes	2030	145	48
Electrical a/c	2800	200	67
Active suspension	5320	380	127
Electromechanical brakes	4480	320	107
Electrical power steering	1400	100	33
Electric fan(extended)	1400	100	33
Electromagnetic valves	2800	200	67
Regenerative braking	-6300	-450	-150

Motor Drive Architecture

The design of modern motor control systems requires an in-depth understanding of control systems algorithms, digital signal processing, sensor signal measurement, A-D and D-A converters, interface and gate drivers, and output power stages. An approach that has been used in industrial motor control to simplify designs is shown in Figure 2 [2].

This approach partitions the motor drive into well-defined architecture elements with standardized interface protocols. The design methodology combines intelligent partitioning, standard interface protocols and enhanced power management functions. The software is approached from a hierarchical level. This eliminates the need to program the motor drive functions at the bit level for pulse width modulation (PWM), dead time generation and compensation, diagnostics

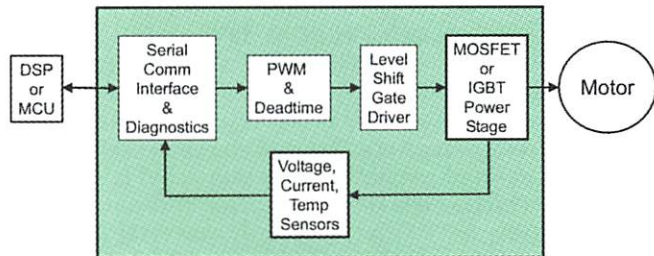


Figure 2 Simplified block diagram of intelligent motor drive architecture

and protection, as well as voltage, current and temperature measurements interface. Table 2 shows common functions that could be implemented in software to simplify the design of AC and brushless DC motor control systems. These same functions are required in automotive motor controls.

In this architecture, all of the detailed power management functions are performed within the chipset and the results are stored in periodically updated memory locations. A block diagram of the motor control system's communications paths is shown in Figure 3. Gate drivers and current sensing outputs provide fault management. The 12-bit parallel data is converted to serial input. The state machine and control logic convert the serial data to parallel for PWM generation. Sampling frequencies range between 3.6 KHz and 29 KHz and include high frequencies able to replace analog PWM generators. The higher-level software is simplified by requiring only table look up of data to and from the chipset.

Table 2 Power management options for software

<ul style="list-style-type: none"> ◆ Soft start ◆ PWM ◆ Programmable dead time ◆ Forward/Reverse/Brake/No-brake (freewheel) Command ◆ Match speed ◆ Diagnostics ◆ Match torque

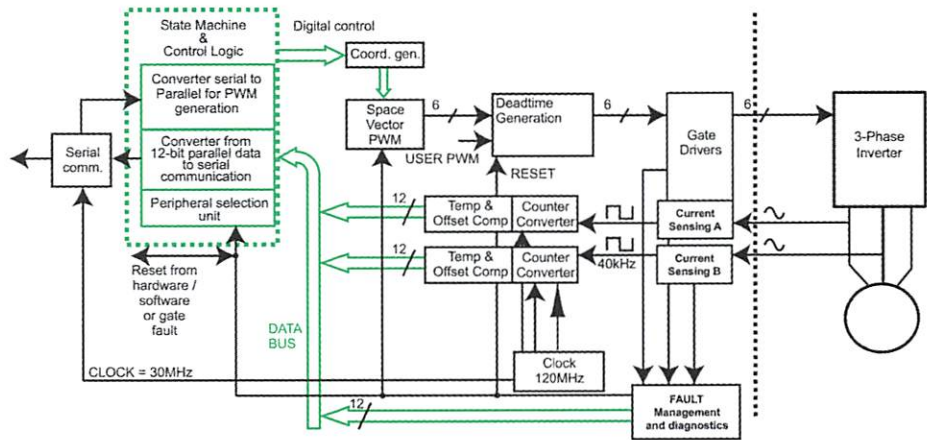


Figure 3 Motor control block diagram showing data communication. [2]

Future enhancements that are possible with this approach include: advanced dead time compensation, ripple-free current sensing, power switch temperature sensing, trip-free over-current limit control and histogram-based power diagnostics. These enhancements could provide a 10X improvement in usable speed range due to accurate dead time compensation using feedback.

The availability of an industrial solution utilizing this approach could reduce time to market for automotive customers – especially during the design feasibility phase.

Power Supplies

Power supplies in many non-automotive applications provide both component and system architecture examples. Some of these are already being considered for automotive implementation.

DC-DC conversion is performed frequently in desktop computers. Over six different voltage levels are required for memory, displays and various peripherals. DC-DC conversion instead of linear power regulation is being considered for many new vehicle modules. The 48V power levels used in telecommunications gear is frequently cited when the automotive 42V PowerNet is discussed. An interleaved design methodology common in non-automotive applications has been proposed for a 42V dc-dc converter. With their expertise in making cost effective power supplies in high volume, many telecommunication power supply manufacturers are considering automotive applications as a new market with high potential.

Lighting

Even lighting loads are combining software with hardware for greater efficiency and more precise control of lighting in buildings. The microcontroller/lamp driver combination and signal communication is shown in Figure 4 for a lamp ballast [3].

The Digital Addressable Lighting Interface (DALI) is an international standard communication protocol and method to interface lighting units on a 2-wire network. This interface includes 256 levels of brightness and a logarithmic dimming curve. The use of this curve in a digital control allows for better control at lower light levels where the human eye is more sensitive. The DALI protocol is 16 bits and supports addressing up to 64 ballasts individually, 16 groups or broadcasting to an entire lighting network. The interface

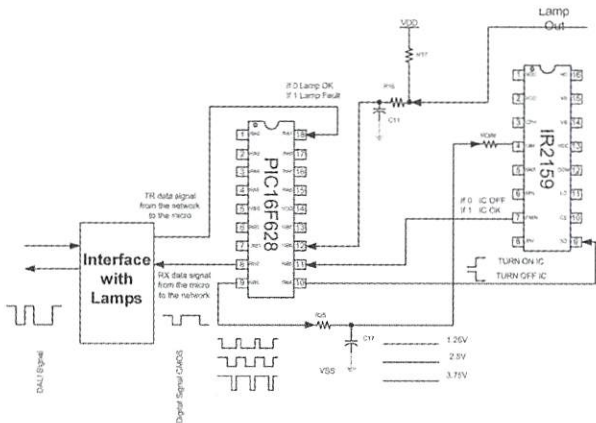


Figure 4 Microcontroller and lamp ballast driver communication

supports fading, logarithmic dimming, scenes and fault detection. The DALI allows for a complete lighting environment to be controlled and managed efficiently.

Communication between the microcontroller and the IR2159 high voltage integrated circuit (HVIC) ballast controller is done with four signals that perform digital dimming, turn on or turn off of the ballast and fault detection.

Vehicles do not use lamp ballasts but do have incandescent, high intensity discharge (HID) and other types of lighting for both the interior and exterior. The DALI may not be directly applicable to automotive applications but some aspects of fading, logarithmic dimming, scenes and fault detection may be modified or considered as an initial proposal for vehicle usage.

Automotive Applications

A combined communications and power architecture has already been defined by several vehicle manufacturers. Three examples will be provided in this section of activity that has already been initiated by three different manufacturers. Finally, an architecture will be presented that shows how the key elements of 42V and 14V power could be implemented with a variety of communication protocols in future vehicles.

Volvo's Active-On-Demand all wheel drive (AWD) system selectively delivers power to the rear wheels when it detects that the front wheels have lost traction and have begun to spin [4]. The differential electronic module communicates with the engine control module and brake control module through a CAN bus. A stepper motor and control valve provide the power for the system. Intelligence in the system is provided by measuring front wheel spin, throttle position and other data. Data communication through the CAN bus linking the AWD to ABS, traction control and Dynamic Stability Traction Control provides optimized AWD performance under all driving situations.

The first implementation of a 42V system, Toyota's 2002 Crown model, demonstrates intelligent power management for future vehicle architectures [5]. The inverter for the belt-driven integrated starter-alternator, the dc-dc converter for 42V to 14V and the electronic control unit are co-packaged. The unit controls the magnetic clutch to disengage the pulley system from the engine for electrical driven accessories when the engine is off at idle. The system detects an idle stop mode and disengages the pulley system. When the engine is running, the pulley is re-engaged.

Looking further into the future, General Motors AUTONomy concept vehicle has a universal docking port in the center of the skateboard chassis that connects all of the body systems to the chassis [6]. The docking connection is a 42V power distribution port for the x-bywire functions of steering and braking as well as climate control. The control is provided by a centralized unit for telematics as well as the power systems of the docking unit. The control connection between the body and the chassis is only through software.

A Power & Communications Architecture

The motor control architecture discussed previously can potentially be used for controlling brushless dc motors in electronic power steering (14V or 42V) or 42V integral starter alternator applications. Some aspects of the lighting example may prove useful in automotive applications as well. Non-automotive dc-dc expertise may play a key role in 42V-14V converters. Figure 5 shows the various aspects of power and communication that could be present on future vehicles. The integral starter alternator (ISA) and the battery are 42V units. A dc-dc converter provides power for traditional 14V loads. Newer x-by-wire systems are powered by 42V and also use a time-triggered architecture (TTA). The TTA will be discussed further in the next section.

Besides operating at 14V, traditional vehicles loads would be connected by a CAN bus. At a subsystem level, such as a

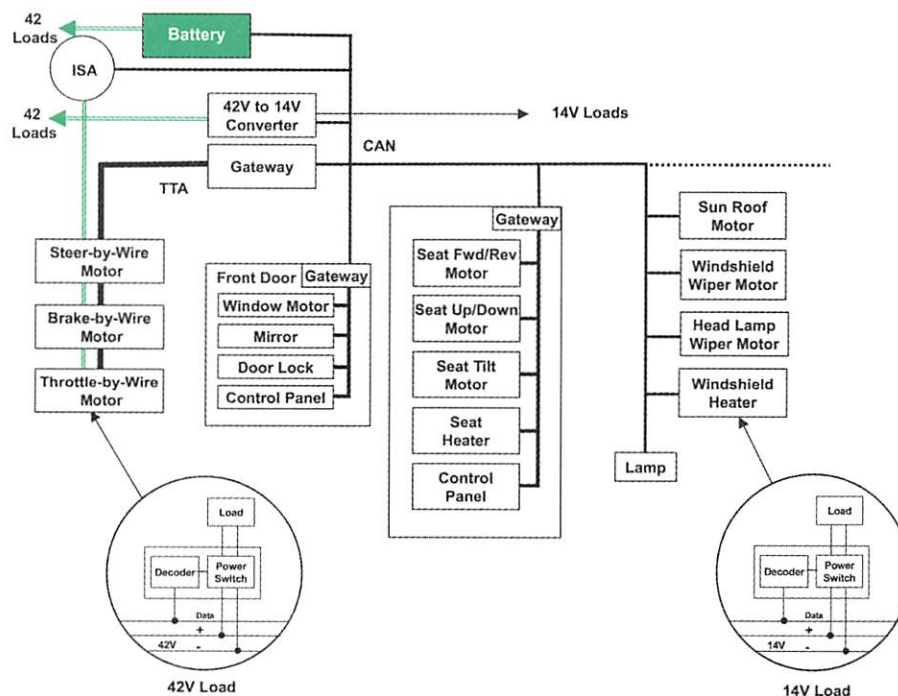


Figure 5 Power and Communications in the 42V/14V Intelligent PowerNet

seat module, other protocols such as LIN (Local Interconnect Network) can be used with a gateway providing the transition point. A gateway also provides a transition to the TTA used in the safety critical systems.

Impact on Power Semiconductors

Among the consequences of a higher voltage bus in the vehicle are higher voltage rated power MOSFETs, power ICs and other semiconductors that connect directly to the higher voltage bus. The need for improved efficiency and lower cost will continue just as it has for these components in the past. However, the higher power levels will change the kind of semiconductor technology used in vehicles.

Both simple two and three terminal power semiconductors such as diodes and MOSFETs will still be used for lower power loads but if they are on the 42V bus they will need higher voltage ratings. In the case of power MOSFETs, this would normally be a rather straightforward portfolio development for semiconductor manufacturers. Voltage levels that are common on today's vehicle of 40V, 55V even 30V will go to 75V and 100V to survive on the 42V bus. However, a transition is occurring in power MOSFET technology from planar to trench technology in this same timeframe. Fortunately, the new automotive electronics systems that are being developed will directly benefit from the increased efficiency that can result when trench is used instead of planar MOSFETs. If the trench process is optimized for automotive applications, avalanche capability required for reliable operation in automotive applications does not have to be sacrificed to obtain this improved efficiency. For example, a frequently used figure of merit for the technology capability of power MOSFETs is the lowest on-resistance that can be obtained in a TO-220 package. Until recently, this has been 4 milliohms for 40V rated planar MOSFETs used in 14V systems. With trench technology, 2.3 milliohms is the new benchmark. This high level of efficiency is accompanied by avalanche capability of 670 mJ - limited only by maximum junction temperature. For 42V systems, the maximum on-resistance of planar 75V MOSFET in a TO-220 is reduced from 7 milliohms to less than 5 milliohm with trench technology - a reduction of over 25%.

For integrated circuits including power ICs or intelligent power switches (IPS), the situation is quite different. Process technology for IPS products has to be extended to higher voltages and new designs created on these processes. This has already started but will take years to have the comparable product availability that exists today for 14V systems. An exception occurs for high voltage (>500V) gate drivers. These products have proven cost effective and reliable in several 14V systems and are rated well above the voltage required for 42V vehicle systems. Both IPS and high voltage gate drivers will be required to provide the diagnostics and cost-effective control for the increasing use of power and increasing power levels that future vehicles will require.

Communications for Power

Today's vehicles frequently use CAN and LIN for communicating instructions and receiving diagnostic information. Drive-by-wire architectures will require a safety-critical data bus with inherent fault tolerance and higher bandwidth. Currently, the Time Triggered Protocol (TTP) and FlexRay are vying for automakers attention. The time-triggered technology in both of these protocols is viewed as essential to ensure that important message always gets through on the data bus. The combination of intelligence communicated on this bus and next generation power semiconductors to control the increasing number of vehicle loads will be required to provide safety and customer satisfaction for future vehicles.

Powerful Reasons

As consumers expectations rise for more features on vehicles that involve supplemental heat, motion, or lighting, the strain on the vehicle's available energy and the power systems will continue. The 42V PowerNet provides the solution to increasing power consumption with standardized voltage limits and flexible architectural possibilities. However, the loads on future vehicle will not only have to be efficient but will have to be managed through an intelligent overall vehicle network where the PowerNet is an integral part of the overall vehicle electronic systems architecture.

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Definitions, Acronyms, Abbreviations

CAN Controller Area Network
DALI Digital Addressable Lighting Interface
HVIC High Voltage Integrated Circuit
IPS Intelligent Power Switch
LIN Local Interconnect Network
TTA Time-Triggered Architecture
TTP Time Triggered Protocol



Report on VTC2003-Fall

Edward Brown, James Irvine & Alisdair McDiarmid, University of Strathclyde

The 58th IEEE VTS Vehicular Technology Conference was held in Orlando, 6-9 October 2003, in the Hilton in the Walt Disney World Resort. This was not the original venue - with less than a day's notice, and only 3 weeks before the conference, the original venue at the Hyatt went bust. All the stops were pulled out by IEEE Conference Services and the VTS Conference Steering Committee, and an alternative venue secured in very short order.

Orlando was a popular venue. Almost 2400 papers were submitted to the conference - twice the previous record. In order to accommodate as many good papers as possible, over 700 papers were accepted, a record for VTC.

A controversial aspect of VTC2003-Fall was the fact that it implemented an IEEE recommendation that each paper published has to be accompanied by a full registration fee. This led to the withdrawal of a small number of papers, but quite a bit more discontent. As reported elsewhere, the BoG meeting held at the conference instituted a publication charge for additional papers, which will hopefully allow a more satisfactory compromise between keeping the full registration fee low but not penalising groups which submit several papers. However, it has to be said that attendees were more aggrieved by the lack of Wi-Fi coverage, an unfortunate omission for the premier mobile conference.

With more than 700 papers, it is impossible to report fully on the event here. However, to give you a flavour of the proceedings, we report in some detail on the two panel sessions. Presentations from the panels and from the opening plenary are available on the conference web site, <http://www.ieeevtc.org>, and following on the VTC2003-Fall link in the left hand plane.

Evolution of 3G standards (HSDPA and 1xEV-DV) and their enabling technologies Panel

Chaired by Gibong Jeong of Texas Instruments, this panel consisted of some of the leading experts in the field of 3G technologies: Hyeon Woo Lee of Samsung, R. Thomas Derryberry of Nokia, Rob Dalglish of Nortel, Young C. Yoon of Ericsson USA, and Erik Dahlman of Ericsson Sweden.

The panel started with Dr Jeong giving an overview of the current state of affairs in 3G, focusing on the next few years' expected enhancements. He concluded that 3G market penetration will not truly take off until there is affordable flat-rate access for broadband data transfer. Part of this relies on handset manufacturers, but the evolving standards which enable the technology are more important.

Dr Lee introduced the High Speed Data Packet Access (HSDPA) enhancement to UMTS. The focus here was on some key features of the standard, such as fast link adaptation due to adaptive modulation/coding, and throughput improvements from fat-pipe scheduling algorithms. Dr Lee

also touched on the new Hybrid ARQ, which combines incremental redundancy FEC with N-channel stop-and-wait. Most interestingly, insights were given into the reasoning behind various trade-offs in the standard.

The panel then moved to R. Thomas Derryberry's introduction to 1xEV-DV, emphasising the improvements to the reverse link made in cdma2000 release D. The design goals of 1xEV-DV were outlined: primarily, extending functionality to enhance the user experience, while maintaining or improving all IS-2000 voice and packet features. One particular feature which was a requirement was the ability to have concurrent voice and high-speed data transfer, something expected in the next generation of handsets. Similarities between HSDPA and 1xEV-DV were highlighted by the juxtaposition of the two talks: both use similar channel quality feedback, HARQ, fast scheduling, and link adaptation.

Rob Dalglish's presentation outlined some of the reasons for moving from GPRS/EDGE to HSDPA, from the network operator perspective. He used simulations with a statistical traffic model to demonstrate that the improvements were only seen in throughput for email, web access, and file downloads; voice/video performance is barely altered. This data was coupled with projections for data usage to suggest that it may be as late as 2006 before it becomes worthwhile to deploy HSDPA in networks which already have EDGE capability. However, the upgrade may well be software only, lowering the potential cost.

Another more general presentation on 1xEV-DV was then made by Young C. Yoon. His experience in the standards process gave further insight into motivations behind design decisions. Yoon suggested some interesting open research issues; in particular, the fact that near-optimal scheduling, call admission, and reverse-link load estimation algorithms are yet to be found. He concluded by proposing that the next revision of 1xEV-DV may focus on using smart antenna technologies, with a spatial channel model.

The panel presentations were wrapped up by Erik Dalman's review of 3G's current steps and possible future steps. Potential user applications for the increase in throughput were described: music files or instant sports highlights videos could be sent in a far more reasonable timeframe using HSDPA versus EDGE or UMTS. The next step for both HSDPA and 1xEV-DV is likely to be enhancing the uplink to reduce delay, which will have a huge benefit in improving TCP's slow-start performance. More speculatively, the future may hold MIMO processing, further improved broadcast, or even wider bandwidth.

Wrapping up the evening, the panel took several questions from the audience.



Awards Chairman Ray Trott presides over the Awards Luncheon



J. R. Cruz receives the Stuart F. Meyer Memorial Award from VTS President Charles Backof



Robert L. French receives the VTS Outstanding Service Award



Giuseppe Caire, Italy receives the 2002 Jack Neubauer Memorial Best System Paper Award



Elisabet Pérez, Spain receives the VTS 2002 Best Land Transportation Paper Award



David J. Goodman, USA, awarded the James R. Evans Avant Garde Award



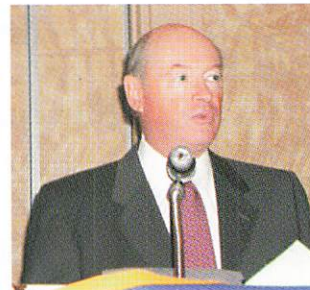
Henry Bertoni, USA also awarded the James R. Evans Avant Garde Award



Chapter of the Year Award was the Ottawa Chapter, Canada. Ahmet Safwat accepted the award



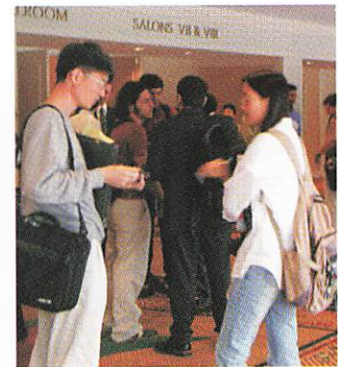
David Love, USA, received the Noble Fellowship, presented by Zara Hyatt of Motorola



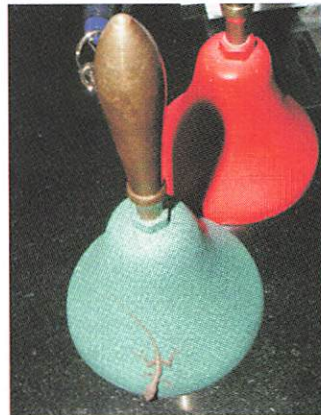
Plenary speaker Jim Stinehelfer, President of AirCell Inc



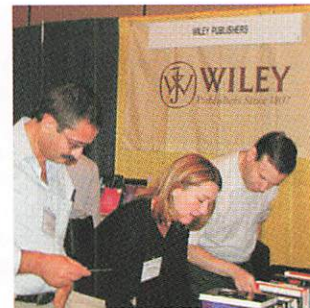
Discussing the posters



Networking in the breaks



Timekeeping bells - as a speaker, you didn't want to hear these. Note the local wildlife



The exhibitors did good business over the conference



Enjoying the sun at the Pizza and Beer event before the panel



Vita Feuerstein, Senior Conference Planner, IEEE Conference Management Services, and Glenda McClure, VTS Conference Coordinator, discuss strategy

Beyond 3G – The Future of Wireless – Fixed and Mobile Communications Technologies

Dr. William Lee kicked off the panel with his talk on *The Future Variations of CDMA Systems*, commenting on the advantages of Time Division Duplexing (TDD), namely its simple design, the spectrum required is cheap (particularly in Europe and Asia) and the fact the up and down link uses the same frequency. However TDD also has a major weakness, inter cell interference. Reducing this is key to TDD's success as it will allow capacity to be increased. To overcome this, smart codes would have to be integrated into the TDD system. This will form a new form of duplexing, Code Division Duplexing (CDD).

Currently the market for home Wireless Land Area Networks (WLANs) is growing at a higher rate than for business WLANs. In the second talk, Dr. Jack Winters discussed *Integration of Cellular Systems with WLAN and Internet* and showed some of the issues that must be overcome before cellular systems can be integrated with the WLAN networks currently available. One major problem is that at the moment the range of WLANs is not large enough to adequately support a cellular phone. As the major use of WLANs is for data they must be redesigned so that they can handle voice and new cellular applications such as music and video. The capacity and interference of the networks must also be improved. One solution is to use MIMO. These should be implemented in WCDMA in 2-5 years, but will be available for WLANs in the near future.

The capacity of a cellular network is related to the resistance of the network to multipath fading, power efficiency and the capability of the network to reject/suppress interference. Innovations in vocoders can help to increase capacity along with MIMO technology. In his talk, *Innovations to Increase Capacity*, Dr. Rao Yallapragada showed that by using

MIMO in conjunction with the SMV-1 vocoder can increase capacity from 26 to 52 Erlangs/Carrier.

The fourth talk was *Impact of Nano Technologies on Future Wireless Communications* by Professor Bruce Gnade. Professor Gnade spoke about how his group's work at the University of Texas at Dallas could be used in future mobile systems. Their work is mostly in conjunction with the military. This has resulted in the production of electronic textiles which could be used to make clothing with in-built cellular technology.

In LDPC Code, Application to the Next Generation Wireless Communications Systems, Dr. Lin-Nan Lee talked about the advancements of coding theory since the introduction of Turbo codes. His talk concentrated on Low Density Parity Check (LDPC) codes. It has been proposed that they are used in the new Digital Video Broadcasting (DVB) standard, DVB-S2. Dr. Lee explained that efficient use of RAM is essential to a good LDPC design. The parity matrix must be designed with structure while retaining randomness. The code proposed for DVB-S2 offers a 2.5dB-3dB power advantage, or up to 30% throughput improvement over DVB-S. The code can come within 0.6 to 0.8dB of the Shannon limit.

The final talk was on *Mobile Ad-Hoc Networks*, by Prof. Izhak Rubin of University of California in Los Angeles. Mobile ad-hoc networks offer the following advantages: no fixed infrastructure; they are fault tolerant; have a lower energy consumption than standard networks and are dynamic. However they also have many issues that are still to be resolved in a real network. One problem is that if an intermediate node changes position it must be tracked by the network or handed off to an adjacent stable node. Power control of the network is an important issue, as if low power is used then the number of intermediate nodes is increased and consequently the chance of failure is increased.



2003 VTS Awards

Ray Trott, Awards Chairman

Awards Luncheons were held during the VTC2003-Spring and VTC2003-Fall conferences to present awards for 2003. The VTS recognizes those who contribute to & support VTS in an exceptionally worthy manner. There are several awards and fellowships that VTS considers in expressing its appreciation to members of the Society. Although all of these awards are considered, not all are awarded annually. These awards also have differing prizes: Plaques, Certificates and/or money.

Stuart Meyer Memorial Award – This is an award that recognize those members of the Vehicular Technology Society who have both served their Society and also have contributed to the development of radio technology and science in an outstanding and exemplary manner.

This award was presented to **J. R. Cruz**, University of Oklahoma, USA.

Outstanding Service Awards are given to members to recognize outstanding service to the Society. For 2003, the

awardees were **Robert A. Mazzola**, USA, and **Robert L. French**, USA.

A **VTC Chairman's Award** was given to **Arthur Greenberg**, USA, who was Chairman of VTC2001-Fall in Atlantic City.

The **2002 VTS Best Automotive Electronics Paper Award** which recognizes the best paper relating to Automotive Electronics published in the *Transactions on Vehicular Technology* went to **Carlo Regazzoni** and **GianLuca Foresti**, both from Italy, in the September 2002 issue of the *Transactions*.

The 2002 Jack Neubauer Memorial Best System Paper, presented to the best Systems Engineering paper published in the *Transactions on Vehicular Technology* was awarded to **Riccardo De Gaudenzi**, Netherlands; **Javier Romero**, Spain; **Antonio Vernucci**, Italy; **Gennaro Gallinaro**, Italy; **Robert Lyons**, Canada; **Michele Luglio**, Italy; **Dan-**

iel Boudreau, Canada; Giuseppe Caire, Italy; Giovanni Emanuele Corazza, Italy; and Hanspeter Widmer, Switzerland, whose paper *Wideband CDMA for the UMTS/IMT-2000 Satellite Component* published in the March 2002 issue of the Transactions.

2002 Neal Shepherd Memorial Best Propagation Paper Award – This is to recognize the best paper relating to Propagation published in the *Transactions on Vehicular Technology*.

This award was presented to Matthias Pätzold, Norway; Arkadius Szczepanski, Germany; and Neji Youssef, Tunisia, for their paper *Methods for Modelling of Specified and Measured Multipath Power-Delay Profiles*, in the September 2002 issue of the Transactions.

The **2002 VTS Best Land Transportation Paper Award** went to Elisabet Pérez, Spain and Bahram Javidi, USA for their paper *Multisensor Data Fusion for*

Autonomous Vehicle Navigation in Risky Environments, also in the September 2002 issue.

James R. Evans Avant Garde Award – This is an award to recognize leadership and other contributions in promoting new technology in the fields of Vehicular / Wireless Communications, Vehicular Electronics and Land Transportation.

This award was presented to Gordon Stüber, USA; Henry Bertoni, USA; and David J. Goodman, USA.

Chapter of the Year Award – This award is presented to recognize the outstanding Chapter of the Vehicular Technology Society. To be eligible, a Chapter must submit to IEEE Headquarters the meeting attendance report form, L-31. The award is a plaque.

The 2002 winner was the **Ottawa Chapter**. The award was presented to **Ahmet Safwat** on behalf of Chapter Chairman **Hugh Reekie**.

Finally, the **Noble Fellowship** was awarded to David Love, USA, and presented by Zara Hyatt of Motorola.



IEEE VTC 2004 – Fall

Wireless Technologies for Global Security

SEPTEMBER 26–29, 2004 LOS ANGELES, CALIFORNIA

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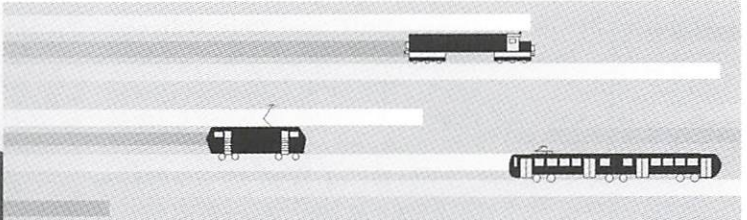
The IEEE Vehicular Technology Society and The Aerospace Corporation invite you to participate in the Vehicular Technology Conference 26–29 September 2004 (VTC 2004–Fall) in exciting Los Angeles, California, U.S.A. This will be the 60th Vehicular Technology Conference, and with over 40 countries represented, it is sure to be one of the best.

The VTC– 2004 Fall international conference provides a forum for communications, sensor, and power experts to exchange ideas and to discuss their work on wireless technologies and systems that enhances global security. The conference will consist of approximately 1000 quality technical papers and posters along with a variety of distinguished panels, excellent tutorials, and numerous exhibits and demonstrations. A plenary session, luncheons, and dinner banquet will feature guest visionary speakers from industry, academia, and government.

From the moment you arrive in Los Angeles, you will enjoy the beauty and glamour, the wonderful weather, and a variety of entertainment options in the area. Our committee will be working hard to ensure a world-class conference so that your visit will be memorable. Please mark your calendars for 26–29 September 2004.

See you in Los Angeles...

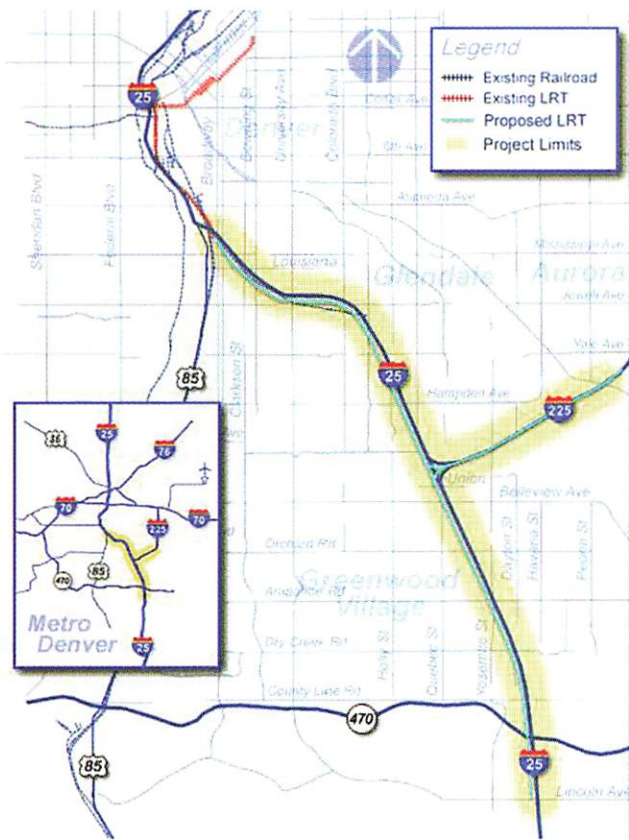




Transportation Systems

Harvey Glickenstein, Senior Editor

In November, the residents of Lone Tree voted overwhelmingly to join the Denver Colorado RTD and pay a 0.6 percent sales tax for transit. This will fund bus service to the end of the southeastern extension of the light rail that is presently under construction.



Extension of the light rail line south of Lincoln Avenue into Lone Tree will await approval of a future referendum that would raise the transit district tax from 0.6 percent to 1 percent in order to fund a \$4.8 billion dollar expansion.

Trenitalia, the Italian State Railway, has ordered 12 Pendolino trains from Alstom for 240 million. The seven-car trains have seats for 430 passengers each plus 2 wheelchair places.

Some of the trains will be operated by Trenitalia and some by Cisalpino. Cisalpino is a rail company that is jointly owned by Trenitalia and SBB, the Swiss Federal Railways. It operates trains between Italy, Switzerland, and Germany.

The Trenitalia trains are designed for both 3 kV dc and 25 kV ac, while the Cisalpino trains can operate on 15 kV ac as well.

The Pendolino trains use an active hydraulic tilting system to allow higher speeds on curves.

Both sets of trains will be equipped with ERTMS Level 2 signal technology. The Trenitalia trains will be equipped with one additional type of signal system, while the Cisalpino trains will be equipped with four additional types of signal systems to allow operation on all of their existing lines.



Artist impression of the Trenitalia Pendolino

Houston opened its first light rail line on January 1. The 7.5-mile line runs north from Reliant Stadium through the Texas medical Center, the Houston museum district, and on to downtown Houston. Even though the line had not yet started operating by Election Day in November 2003, the electorate approved a ballot proposition to float up to \$640 million in revenue bonds to fund extensions.



Houston's first light rail opening



Route of the Houston light rail

South Korea opened its new conventional high speed line from Seoul to Pusan. Top speed on the new line is 186 mph. The high speed line has cut the journey time between Seoul and Pusan almost in half, from four and a half hours to two hours and forty minutes. Actually, although the high speed service runs between Seoul and Pusan, the southernmost third of the line, between Daegu and Pusan, and will actually use existing electrified tracks. A new high speed line is being built between Daegu and Pusan.

France is proposing a major expansion of its high-speed rail network. France will use highway tolls for a substantial portion of the funding for the rail network, unlike the United States where the use of highway tolls and gasoline tax revenue is mostly restricted to highway maintenance and construction. The highway tolls would be funneled into an infrastructure finance organization that would fund canal, port, and airport projects as well as highway and rail projects. The proposal will limit the highway projects to about 25% of the funds, with rail receiving almost half of the available funds.

The California High-Speed Rail Authority released its Draft Program Environmental Impact Report and Environmental Impact Statement for a high-speed network from San Diego to San Francisco, Oakland, and Sacramento. The Report was released for public comment in January. After public hearings on the report are concluded in May, a Final Report will be issued. Due to California's budget problems, a bond issue to fund construction of a high-speed network has been deferred.

The draft report compared no-build and modal alternative (potential improvements to highways and airports serving the same territory) with high-speed rail and recommended the high-speed rail alternative.

Although the report recommends three northern terminals for the high-speed service, it identifies several options for

reaching these terminals. The line basically follows the existing railroad alignment from Sacramento to Bakersfield through the San Joaquin Valley. The method of crossing the Coastal Mountain Range between the Central Valley and the Bay Area has generated a great deal of controversy. The recommendation is to use the Pacheco Pass to Gilroy and then follow the existing railroad right-of-way to San Jose with a leg on the west side of San Francisco Bay to San Francisco and one on the east side to Oakland. Proponents of using the Altamont Pass are pushing that route instead of Pacheco Pass.

Two options are shown for the portion between Bakersfield and Los Angeles, a section that presently has no Amtrak rail service. Amtrak has a dedicated bus that operates over the mountains to carry passengers between Bakersfield and Los Angeles. One of the options is to follow Interstate 5, while the other option is follow an existing rail corridor through Soledad Canyon and Antelope Valley. The second option would allow the trains to serve the Palmdale Transportation Center. Although it would be around 35 miles longer than the I5 route, it would require less tunneling.

The route from Los Angeles to San Diego is shown running east from Los Angeles through Ontario Airport to Riverside and then south to San Diego. Potential improvements to the existing coast route from Los Angeles through Anaheim, Irvine, and Oceanside are also shown. The Coast Route is shown as being electrified as far south as Irvine with diesel service remaining south to San Diego. The main route from San Diego to Los Angeles and San Francisco, Oakland, and Sacramento would be electrified, with top speeds of 200 mph.

China has decided to use conventional high speed rail technology rather than maglev technology for its Beijing to Shanghai high speed line. The first maglev system placed in revenue service was the one between Shanghai and its airport. This 18-mile line, using German Transrapid technology, went into revenue service in January. It was supposed to be a demonstration of the technology for use on the proposed 750-mile Shanghai to Beijing line as well as an extensive network of high speed lines to be built in the future.

The first application of Transrapid technology for inter-city high-speed transportation was to be a line between Berlin and Hamburg. The system was successfully demonstrated in Germany, however, after review of costs and expected ridership, the German government cancelled the project in 2000.

In the United States, the federal government sponsored a competition for a pilot high-speed maglev line. Routes that competed for federal funding for this technology included Baltimore to Washington, Los Angeles to Las Vegas, and a line in the Pittsburgh area. Los Angeles has just voted to provide up to \$563,000 toward the feasibility and environmental study of a 50-mile line between Los Angeles and Ontario International Airport. The federal government has pledged \$2.5 million toward the study. The City of Ontario and the San Bernardino Associated Governments have also provided local matching funds.

Old Dominion University in Virginia bought a system from the suppliers of a demonstration system in Florida. The line, which was to serve the campus of the University and was too short to reach the speeds of 200 to 400 mph that are the usual justification for using this new technology, was built but has not yet been opened to revenue service. *Spectrum Magazine* described some of the problems encountered at Old Dominion in a recent issue. At this time there is no money to correct the deficiencies so that the system can be placed in passenger service.

Japan has been testing maglev for many years, but has not yet decided to build a commercial line. The first application for maglev in Japan would be in the Tokyo to Osaka corridor.



Automotive Electronics

Bill Fleming, Senior Editor

New General Motors Electronics Systems

General Motors showed off two new electronics technology systems. One example is rear electric brakes, which GM called another step toward the by-wire vehicle. Electric calipers are only used on rear wheels, and they provide direct computer control of braking on these wheels [1]. This facilitates integration with adaptive cruise control, and with regenerative braking on hybrid or fuel-cell vehicles. The electric calipers also retract the brake pads after a stop, eliminating brake drag for improved fuel economy.

Electronic steering, a second example, not only provides driver-selectable response, but it also serves as another means to improve/implement vehicle-stability-control systems [1]. GM's electric steer isn't yet a by-wire system — the actuating motor (either electric or electrohydraulic) is built into the steering column, between the steering wheel and the rack.

Vehicular Satellite Communications Antennas

Effective receiver links between geostationary satellites and moving vehicles are challenging. A common solution utilizes a vehicle-borne circularly polarized antenna with a minimum gain of 3 dBi in the direction of the satellite regardless of the orientation of the vehicle (*3 dBi means that the antenna's gain is 3 dB above isotropic field strength*). A new low-cost antenna for this application includes an array of circular patches together with an array of square antenna patches, with two feeds per patch providing circular polarization [2].

Driver-Vehicle Electronics Interface

Electronics has enabled carmakers to create more controls, but drivers can become overwhelmed by the resulting complexity. While some carmakers are wed to aircraft-like interiors with a switch or button for every control, there is a growing trend toward automotive interiors dominated by a display screen of menus for such functions as navigation, cell phone, and infotainment [3]. A big question today is not whether to combine functions in a single display, but what sort of human-machine interface should control the menu screen. The challenge is to provide the function of a computer mouse with minimal distraction for the driver.

Voice control — the general solution a few years ago — is being replaced/supplemented by a variety of mechanical approaches. BMW's 7-Series is planning to add buttons to simplify menu manipulation (one example is a button shortcut to the homepage), along with haptic/tactile feedback on its joystick menu-control selector. A similar interface is under development by Audi. Jaguar uses a touch screen. The VW Phaeton has scores of buttons and switches, whereas the Renault Megane has implemented (fairly complex) controls on the steering wheel.

Automotive Software Costs More Than Steel or Glass

Today, "software is a bigger cost factor in automotive design than steel or glass — it's now more than a third of total auto production design costs. Software development costs currently average 38% of production design costs, up from 26% four years ago [4].

Next Generation Head-Up Displays

A new generation of head-up automotive displays is coming. BMW will roll out a multicolor Head-Up Display (HUD) on its 5-Series, and General Motors said that HUD equipment installations on its Chevrolet Corvette have climbed from 25% in 1999, to 90% in 2003. Hot, parabolic, overhead-projector-type bulbs are being replaced with efficient cool-operating LEDs. In addition, breakthroughs in windshield optics have also occurred [5]. New features will be offered such as integration with GPS inputs to allow HUD display of street-named turn-by-turn driving directions, or red icon alarms to warn drivers of fast approaching vehicles or obstacles detected by onboard radar.

New HUDs will automatically brighten and darker according to background ambient light levels. By pushing a button, drivers can change the display to project selected IP instrument data such as a HUD display of the tachometer to better select gear shift points — the 2004 Pontiac Grand Prix and Chevrolet Corvette already have this feature. In total, GM reports that it now offers HUDs on nine different vehicle models [5].

Battery-Less, "Energy-Harvesting," Wireless Sensors

Wireless sensor networks are becoming an attractive solution in a wide variety of applications, however one aspect of the approach — how to wirelessly generate power — tends to cancel out its advantages. Either batteries have to be changed, a high-maintenance job, or the sensors need a wired power source. A new answer to this problem is "energy harvesting," where wireless nodes are powered directly from ambient energy in the environment [6]. The combination of improved energy-harvesting methods, smart energy-management strategies and accepted standards for wireless sensors is expected to greatly expand the application of wireless sensing networks.

The most likely energy sources for harvesting are light, heat and mechanical vibration — of which vibration is more abundant and consistently available in automobiles. Moreover, in automobiles, wireless sensor networks offer significant advantages due to the elimination of wiring. This would especially be advantageous for sensors installed on moving parts in the automobile; e.g. torque sensors on rotating shafts, power-seat-mounted sensors, steering wheel sensors, and on-wheel tire sensors. Both Microstrain Inc. [6]

and Millennial Net/Ferro Solutions [7] are harvesting mechanical vibration/strain, using piezoelectric generators to provide energy to remotely mounted wireless sensors.

In a similar way, researchers from the Univ. of Massachusetts reported the development of a wireless self-energized sensor to monitor injection mold pressure [8]. Electrical energy is again piezoelectrically generated by the applied pressure, then an output signal is also piezoelectrically produced, and this signal is ultrasonically transmitted to an externally mounted receiver.

A related development is underway for actuators — actually it's for microactuators. Capacitive coupling of electrostatic power is delivered to untethered, steerable, microactuators [9]. The microactuators travel using piezoelectric elongation-contraction "scratch drives" that step their way along a substrate. Reference [9] cites the following applications for microactuators:

- ♦ microscale operation of remote-operated vehicles, or microrobots
- ♦ manipulation and assembly of microsystems
- ♦ security and surveillance
- ♦ exploration of hazardous environments
- ♦ biomedical research

Gasoline-Electric Hybrid Vehicles — Pro and Con

The editors of *IEEE Spectrum* picked DaimlerChrysler's plug-in hybrid electric van as a "winner" technology because it offers the flexibility of operating either as a pure electric van, or as a hybrid gasoline-electric van [10]. But in the next month's issue, a reader wrote that "the whole concept of a plug-in hybrid electric van is probably a loser when it comes to public acceptance." The reader [11] pointed out that the no-plug-required 2004 Toyota Prius already allows total electric operation under conditions chosen by the driver. "Why would anyone want to have the bother of connecting and disconnecting to an external electricity source which itself has its own emissions problems?"

Then *IEEE Spectrum* editors picked General Motor's Hy-Wire hydrogen fuel cell car as a "loser" technology because its success depends on development of a hydrogen-fueling infrastructure which is out of GM's control [12]. *Spectrum* may well be correct on this call, but for a different reason. Fuel cells require intake air filters and are sensitive to contamination of their proton exchange membranes. Contaminants in everyday city air can overload air filters and poison fuel cell membranes — and this may yet turn out to be a show stopper [13]. Either better air filters, or contamination-resistant membranes, must yet be developed to last the life of the vehicle.

Hybrid Vehicle News

An interesting, utilitarian, feature built into new gasoline-electric hybrid pickup trucks is a residential-type 110-V ac power outlet. General Motors will soon sell a truck with integrated starter/alternator capable of providing 2,400 W of ac electric power, enough to run power tools, compressors, etc. [14]. In fact, when a power outage occurs, this truck can hook into a house circuit to run a sump pump and keep a refrigerator going (*don't forget the great "blackout" in the northeast U.S. last year, during which time electricity was unavailable for 2-to-3 days*). In anticipation of this application, the truck is equipped with a large 26-gal (98-L) fuel tank which automatically sounds an alarm, and then shuts off when 2-gal of fuel remain to avoid stranding the user. Dodge goes further, providing 5,000 W of ac power in both

110- and 220-V outlets — the 220-V outlet is capable of running heavy-duty welders and compressors [14]. Dodge's electrical generator option costs more, but is said to be comparable to the combined cost of separately purchasing an unequipped truck, and a 5-kW gas generator.

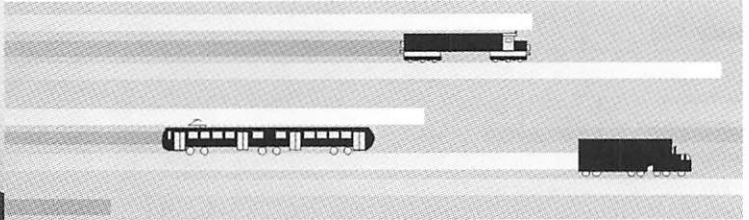
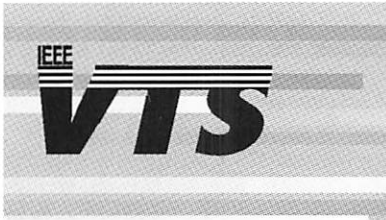
Another promising innovation is WaveCrest's electric wheel-motor which consists of a multi-phase dc brushless motor arranged so that the rotor rotates around a center-mounted stator [15]. Four independent wheel-motors allow full vector control; e.g., stability control systems (that suppress vehicle spin-out) wouldn't have to rely on vehicle braking. And since electric motors can turn backwards; by powering wheels in different directions, maneuvering into tight spaces could be better accomplished. And possibly, electric motors could stop the car, eliminating the need for brakes.

Have You Heard of It?

Chrysler and General Motors are presently introducing new engine technology that will conserve more gasoline than hybrid powerplants over the next few years. Have you heard of it? Maybe not — it's called cylinder deactivation [16]. "It's far more practical than expensive gasoline-electric hybrid technology (which adds \$3000-to-\$4000 to a vehicle's cost, and whose real-world fuel savings are overrated by the EPA test). Meanwhile, cylinder deactivation costs about \$100 per engine and promises to improve fuel economy 6%-to-20% on America's thirstiest vehicles. Ultimately, cylinder deactivation may be coupled with other fuel-saving technologies for even greater benefits."

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Mobile Radio

Javier Gozalvez, Senior Editor

3G News

Vodafone has announced the commercial launch of its 3G services in Europe. The first service from Vodafone will be the Vodafone Mobile Connect 3G/GPRS datacard, with data rates up to 384kbps. The datacard is available in Germany, Italy, the Netherlands, Portugal, Sweden, Spain and the UK. When outside of 3G network coverage, the datacard automatically switches to the company's GPRS network. The Vodafone Group has also announced it will extend the design of testing protocols for 3G device acceptance, carried out by Indra for Vodafone Spain, to the rest of its operating companies throughout the world. The project, developed in Spain, included the standardisation of a 3G device "quality certification". T-Mobile will also start selling UMTS services in Germany, Great Britain and Austria in May. Maximum speeds of up to 384kbps will be provided and the company expects in the future to offer a full-service for mobile voice and data communications via UMTS, GPRS and WLAN in what the company calls TM3, T-Mobile multimedia. Telestet has also launched Greece's first WCDMA network with speeds of up to 384kbps. The launch is initially taking place in Athens, Thessaloniki, Patra and Irakleion areas. Telekom Malaysia has also commercially launched its 3G services. The service is provided in various parts of the Multimedia Super Corridor and Klang Valley. Hutchison-Whampoa has also commercially started providing 3G services in Hong Kong. Verizon Wireless has reported the completion of the company's 1XRTT National Access high-speed wireless data network across North Dakota. Average data transmissions speeds of the network are between 40 and 60kbps with bursts up to 144kbps. Hutchison 3G UK completed its first full year of commercial operation last March. The operator said that it has successfully completed the build and integration of its 5000th base station, which means the company is covering 70% of the population in the UK with its video mobile service and 98% with its voice service through roaming agreements. The company's subscriber base as of March is 361000 users with 150000 customers added since December 2003. Hutchison 3G UK also announced in December an ARPU of \$82.24 with 14% of revenues being from data. Hutchison 3G Australia has attracted over 100000 customers in ten months of operation. NTT DoCoMo has announced that subscribers to its 3G FOMA service has surpassed two million in January, two years and four months after the service was launched. FOMA subscribers have doubled in the last four months (from January) reaching the 2million mark about two months ahead of DoCoMo's forecast. By the end of March, service coverage reached 99% of Japan's population and indoor base stations increased to 1600. The expansion service of FOMA's coverage area for indoor base stations is four times faster than that of PDC.

Sonaecom has announced two of its companies would partner to launch UMTS TDD service. Clix has launched a market trial in Lisbon in order to offer Portuguese consumers an alternative to DSL. The solution will be launched in partnership with the cellular operator Optimus, leveraging its cellular infrastructure and unpaired UMTS spectrum. Speeds of up to 3Mbps are expected.

Nokia has unveiled the new Nokia 6620 imaging phone, the first smartphone for the Americas market optimized for use on new high-speed EDGE networks. Sony Ericsson Mobile Communications has also unveiled the Z500, the company's first phone featuring EDGE technology, which provides fast access to wireless data, content downloads, messaging and interactive online gaming. The Z500 is also enabled with Push to talk over Cellular (PoC) that allows two-way radio style communication. Sony Ericsson also unveiled two new additions to its family of EDGE products - the GC83 and GC85 EDGE PC Cards. The triple band (GSM 850, 1800 and 1900) GC83 specially targets the American Markets. GC83 works in the Americas, as well as Europe and Asia (where above networks are available). The GC85, also a tri-band (GSM 900/1800/1900) EDGE PC Card, targets the European and Asia Pacific markets. The GC85 provides global coverage in all five continents. Texas Instruments has released its first complete EDGE chipset and reference design. Utilizing the company's industry-leading OMAP™ platform, TI is first to introduce a complete EDGE smartphone chipset and reference design.

Radioplan, a supplier of 3G radio network planning solutions, has announced that their WiNeS UMTS optimization solution has cut the cycle time for tuning the radio access network of a large city by over 80%. The tool cuts redundant steps from the optimization process by bridging the gap between planning and measurement data and by integrating the stages required into a single platform.

A report from The Shostek Group claims that by expanding traffic exponentially, UMTS will reduce the full costs per byte by 3.5 to 5.2x below those of GSM-GPRS. According to the firm, the most profitable services maximize AMPU (Average Margin Per User) not ARPU (Average Revenue Per User). Apart from enabling improved services, UMTS will also lower the cost of delivery. According to a report from Visant Strategies, there are close to 80,000 WCDMA base stations live as of 1Q 2004 and shipments of WCDMA infrastructure will continue to rise. The firm also says that although currently ARPU for WCDMA services is 30% higher than that of 2G services, this is unsustainable for a mass-market acceptance. A survey commissioned by Telia has revealed that almost one out of every three managers believes their companies will use 3G services on a daily basis already within one year and as many as 85% believe their companies will use 3G services within a three-year period.

Spectrum Licenses

Orange is selling its UMTS license in Sweden to Svenska UMTS-nät AB, a company jointly owned by TeliaSonera and Tele2. This Swedish company already owns a joint license. Telefónica Móviles is also selling its 3G license in Austria to mobilkom. According to the Austrian operator CEO, mobilkom holds after the transaction a total of four packages with 19.8MHz (FDD). Although, the takeover has already been approved by the Austrian regulatory authority, mobilkom will have to sell one of the four UMTS blocks it owns by 31 January 2005. In Germany, MobilCom has handed back its UMTS license to the country's telecom regulator. The German operator will now be able to offer 3G services as an MVNO. The Estonian National Communications Board has announced it will offer a fourth 3G license, based on the WCDMA standard, after the three incumbent GSM operators were offered licenses last year. The starting price for the license tender is \$5.7million, with licenses lasting for 10 years. The French Finance Ministry will request GSM operators about \$30.8million a year plus a 1% tax on sales for the licenses to be renewed. GSM licenses of Orange and SFR are set to expire at the end of March 2006. The Russian Ministry of Communications and Informatization has granted a GSM 900/1800 MHz license for the Ekaterinburg and Sverdlovsk regions to the operator Uralsvyazinform. The company has to provide service since June 2005 and the license will last until the end of 2013.

GSM operators Asia-Cell and Iraqna have started providing service in Iraq. Asia-Cell's license is for Iraq's Northern region where as Iraqna's initial network deployment is providing coverage to Baghdad using 36 sites. Vietnam's Vietel has been granted the country's fourth GSM license. The Republic of Sierra Leone has awarded a GSM license to Datatel GSM. The operator is expecting to start services in Freetown in the second half of the year to later extend the coverage to the provincial areas. AT&T Wireless has been awarded a four-year wireless license in Jamaica for \$5.9million. The operator expects the network to be available in some parts of the country by the end of 2004.

Technology and Research News

Toshiba has announced the development of a 0.85-inch hard disk drive (HDD). The new drive, only a quarter of a 1.8-inch drive and with an initial capacity of 2 to 4 GB, could be used within mobile phones as a replacement for memory cards.



SK Telecom's Home Security Robot

South Korea's SK Telecom, in cooperation with Most-I-Tech, an artificial intelligence solution developer, is planning to launch a moving home security robot that can be controlled by a mobile phone. This service will allow customers to receive text messages or pictures regarding any emergency situation at home. This real-time notification is transmitted by a camera and sensor-equipped robot.

Andrew Corporation and IPWireless have jointly developed a duplexer that enables wireless operators to deploy UMTS FDD and UMTS TDD systems using a single antenna. According to the companies, the duplexer has already been proven in a number of trials and will be used by Sonaecom (Portugal) for a UMTS TDD deployment.

According to Cypress recent tests, Cypress Semiconductor's WirelessUSB LS radio system on a chip performs reliably at 10 meters in the presence of heavy interference from multiple 2.4 GHz devices. The devices employ a unique approach for handling 2.4 GHz wireless data packets that has been developed by Cypress to ensure reliable data communication in electrically "noisy" environments. This patent-pending approach combines bi-directional Direct Sequence Spread Spectrum (DSSS) data transmission techniques, pre-defined pseudo-noise codes, and dynamic channel switching to create a frequency-agile solution with excellent processing gain for guaranteed wireless data delivery. The technology is embedded in Cypress's complete line of WirelessUSB products, including its recently announced WirelessUSB LR line, which features an operating range of up to 50 meters or more in industrial settings. Cypress's tests show that WirelessUSB LS is able to maintain its robust 10-meter range while in close proximity to three 802.11 networks and two Bluetooth devices continuously transferring files, two cordless phones in operation and an active microwave oven.

Fujitsu Laboratories Ltd. has announced the development of a new fuel-cell material technology that enables the use of 30% methanol — highly concentrated methanol — as a fuel source, as well as a prototype power unit that incorporates the technology. This technology enables much higher power capacities for passive micro fuel cells and realizes longer runtimes for mobile devices such as notebook PCs, PDAs and mobile phones. Micro fuel cells, envisioned for use in mobile devices, generally use alcohol solutions as fuel. In terms of energy density, these fuel cells offer up to 5-10 times the power per unit weight of a Li-ion battery. Fujitsu developed a new material technology for the membrane electrode assembly (MEA).

Antenova has unveiled its Quadnova antenna for cellular handsets, smartphones, and PDA applications. The Quadnova covers the AMPS 800, GSM 900, DCS 1800, and PCS 1900 bands and is suitable for Asia, European, and American (CDMA/TDMA 800 and 1900) handsets, smartphones, and PDA applications. With a volume of less than 3.5cc, and according to the company, this antenna is the smallest quadband in the world and offers over 50% average terminal radiation efficiency over all four bands. The Quadnova is a hybrid solution with a combination of ceramic and PIFA (Planar Inverted F Antenna) technology and can be customised to suit individual customer requirements.

TSI Telecommunications Services and Belgacom have announced an agreement to launch bi-lateral signalling services and interstandard SMS between GSM and North American ANSI-41 carriers using CDMA and TDMA protocols. TSI will provide the SS7-to-SMPP network protocol translation required for interstandard SMS.

The U.S. Defense Advanced Research Projects Agency (DARPA) has selected Lucent Technologies to receive a one-year, \$11.5 million award to research, develop and demonstrate an ultra-high capacity, highly-secure communications system for DARPA's Mobile Networked Multiple-Input, Multiple-Output (MIMO) program, also known as MNM. MIMO is a communications technique that uses multiple antennas to send and receive wireless signals at ultra-high speeds. Bell Labs will use MIMO technology called BLAST (Bell Labs Layered Space Time), to develop the world's first tactical, continually moving and self-forming MIMO mobile network called "Packet BLAST." Packet BLAST will provide immediate and substantial enhancements to the military's communications including vastly expanded capacity within defence radio frequency bands; much higher data rate communications in non-line-of-sight environments like urban areas and forested terrains; and improved stealth communications to avoid detection and jamming attempts by adversaries. The overall program goal is to deploy the first MIMO-based mobile ad hoc network showing a 20 times increase in spectral efficiency. In late Fall 2004, Lucent will deploy the network using 20 sport utility vehicles at the Naval Air Engineering Station in Lakehurst, N.J. These vehicles will be fully equipped with mobile communications gear that incorporates the Packet BLAST solution. The Packet BLAST mobile radios will be subjected to constantly changing urban and rural environments, as well as stress-inducing capacity demands.

Texas Instruments has announced details of what it claims is a radical new approach to wireless chip design that applies digital technology to greatly simplify radio frequency (RF) processing and dramatically cut the cost and power consumption of transmitting and receiving information wirelessly. The Digital RF Processor (DRP) architecture has been successfully integrated on two Bluetooth products, as well as a GSM/GPRS digital transceiver in TI's lab. The Digital RF Processor technology combines TI's years of signal processing architecture expertise with advanced semiconductor manufacturing capability to perform analog functions with low power, digital CMOS logic. Since large blocks of CMOS logic can now operate at multi-GHz frequencies, sampled-data processing techniques, switched-capacitor filters, oversampling converters, and digital signal processors can take over the role of analog amplifiers, filters, and mixers. Rather than an inefficient implementation of analog blocks in a digital process technology, with the DRP, the analog signal is oversampled and processed in the digital domain. Since radio signals at the antenna are always analog, a small amount of analog processing is included in the DRP between the input and the first sampling function. Once in the sampled-data domain, digital signal processing takes over. Texas Instrument has also announced the sampling of the industry's first single-chip, dual-band WCDMA RF transceiver for advanced 3G mobile devices. The TRF6302, which supports both 800MHz and 2100MHz band operations, combines functions of TI's proven TRF4150 single-chip WCDMA transmitter and TRF5150 single-chip WCDMA receiver.

The Open Mobile Alliance has announced the release of the OMA DRM 2.0 Enabler Release, designed to protect high-value content produced and distributed by a wide range of content and service providers.

Ericsson, Motorola, and Siemens have announced the first joint interoperability tests for Push-to-Talk over Cellular (PoC) technology. The tests are designed to help provide network operators with easy integration, interoperability

and a competitive environment in which to deploy commercial PoC service. The PoC function enables mobile phones to be used like walkie-talkies, providing communication at the touch of a button. The first technical standard specification for Push-to-Talk – PoC Phase One – was submitted to the Open Mobile Alliance (OMA) in August 2003. Ericsson, Motorola, Siemens and Sony Ericsson are promoting a final version of the PoC standard through the OMA. The first interoperable products and solutions are expected to be introduced in Q2 2004. Motorola has also announced that it has made its standards-based PoC client software available for license to third party GSM/GPRS and UMTS handset manufacturers and software developers. Motorola's PoC software client is designed to run on a mobile phone or voice-capable PDA or laptop personal computer, and permits a subscriber to communicate with a quick, one-touch connection to one or many users. Nokia has also started an initiative to enable operators to use leading manufacturers' push to talk terminals with Nokia's push to talk infrastructure solution, and at the same time guarantee a smooth network software upgrade path to the upcoming Open Mobile Alliance standard for PoC.

Orange has said its Talk Now push-to-talk service will debut in the UK and France in the second quarter, expanding to ten countries by the end of the year. The company's target is 1million subscribers in the coming year.

Following the agreement signed by Nokia, Philips, Universal Studios Networks Germany and Vodafone Pilotentwicklung, the Vodafone research centre in Germany, on August 29, 2003 to form the bmco project group, the first pilot convergent platform to support delivery of broadcast content to mobile devices is being developed. The platform combines mobile communications based on GPRS and digital terrestrial broadcast, both DVB-T and the emerging DVB-H (Digital Video Broadcast - Handheld) standard, which uses time-slicing techniques to send data in bursts, extending the battery life of mobile devices. The pilot will be used to explore the opportunities for new services that this form of convergence of mobile and broadcast may provide. Within the bmco project, user requirements, as well as the business, technical and regulatory requirements for such new applications will be examined.

Nextel is planning to start a wireless broadband service trial using Flarion Technologies' FLASH-OFDM technology. The trial, which is scheduled to run for a minimum of six months, is expected to provide average downlink speeds of up to 1.5Mbps with burst rates of up to 3Mbps.

BT is conducting four radio-broadband trials in rural parts of the UK using WiMax. The trials use a version of WiMax known as 802.16d but a more advanced version, 802.16e, is also under development.

Wireless LAN

Ericsson and TeliaSonera are employing Ericsson's standards based SIM card log on solution for WLAN in international roaming trials between TeliaSonera GSM/WLAN networks in Finland and Sweden. These are the first such trials to be conducted according to the guidelines of the GSM Association. The Ericsson EWAS (Ericsson WLAN Authentication Server), featuring the latest 3GPP standards, is used to connect the HomeRun WLAN network and the GSM network and to authenticate the user based on the same trusted security mechanisms as used in the GSM systems. The necessary standards have been developed by 3GPP and are scheduled for formal release by mid-year 2004. When this technology is introduced commercially, the same GSM

SIM cards that are used in mobile phones can also be used for WLAN, significantly simplifying access to the Internet. In addition to simplifying the use of WLAN, SIM card sign on for WLAN also increases the security of the WLAN service. The user of a WLAN equipped laptop only needs to insert a SIM card in the laptop. The network carries out the necessary signaling to make sure that the user is allowed to use the network; and after the user has concluded his/her session, bills it to the user's monthly GSM phone bill.

NTT DoCoMo and Singapore Telecom Mobile (SingTel Mobile) have announced that they will conduct a trial to test international roaming between their Wireless LAN services. During the trial, DoCoMo and SingTel Mobile will share access to their respective Mzone and "Outdoor Wireless Surf" WLAN services. DoCoMo's Mzone service is currently available at 216 locations in Japan and SingTel Mobile's Outdoor Wireless Surf service is available at more than 230 locations in Singapore. The trial will be conducted from April to June 2004.

T-Mobile has said it will start an integrated Wi-Fi and 3G service in spring 2004. The operator has 700 Wi-Fi hot-spots in Europe and 4000 in the US. Moreover, T-Mobile USA and AT&T Wireless have agreed to allow Wi-Fi roaming for Denver International, Philadelphia International and San Francisco International airports. The customers will be able to roam using their existing ID and password.

Reports say that Intel and Broadcom have announced they stop selling Wi-Fi chips in China at the end of May after the Chinese government imposed an encryption standard (WAPI, Wired Authentication and Privacy Infrastructure) developed and controlled by Chinese companies.

According to a report from Synergy Research Group, the overall revenue for Wi-Fi networking gear increased in about 40%, to \$2.5 billion, during 2003. The consumer market experienced the highest increase 66% compare to the enterprise sector (9%). The top three market sharing companies would be: Linksys (22.3% of the market), D-Link Systems (17.9%) and NetGear.

In a new study from Forrester Research, the firm claims that only about 20% of the 818 companies Forrester surveyed said they have completed or were in process of rolling out WLAN. Approximately 15% of these companies said they have completed or were in process of rolling out VoIP systems.

Wireless Data and Multimedia

Comverse has successfully demonstrated MMS interoperability between CDMA and GSM networks. Comverse Multimedia Messaging Service Center (MMSC) delivers advanced features and functionality on an open, flexibly configurable and easy-to-deploy platform. Comverse MMSC's rule-based transcoding capabilities deliver uncompromising MMS terminal interoperability. Ericsson has also demonstrated cross-technology MMS, sending and receiving multimedia messages between a GSM/GPRS device in France and a cdma2000 handset in Sweden.

Silicon Village Mobile has announced new versions of its Fortress SMS encryption series of applications which include the ability to send encrypted MMS messages between handsets, independent of operators and mobile to email encrypted MMS.

Alcatel demonstrated a powerful MMS platform that processes at least 150 MMS/second at a sustained rate with the complete MMS cycle on a Linux-powered Intel configuration featuring three dual-processor Intel Xeon CPU boards. This represents more than half a million MMS processed

per hour, a new industry record. This new performance exceeds from benchmarks published in 2003 showing performance of at least 50 MMS/second on a single dual-processor Intel Xeon CPU board.

NTT DoCoMo has revealed that i-mode users outside Japan exceeded two million at the end of January 2004 and continue to grow rapidly. Services are currently available through seven i-mode operators outside Japan: BASE NV/S.A (Belgium), Bouygues Telecom (France), E-Plus (Germany), Far EastOne Telecommunications Co., Ltd. (Taiwan), KPN Mobile (The Netherlands), Telefónica Móviles España (Spain), WIND Telecomunicazioni S.p.A. (Italy), representing a market of over 60 million cellular phone users. In addition, COSMOTEL - Mobile Telecommunications S.A., Greece's leading mobile telecommunications operator, is scheduled to launch i-mode services prior to the ATHENS 2004 Olympic Games. European i-mode operators already achieve average revenue per i-mode user (ARPU) of 6-10 Euros per month, and an average of two-thirds of operators' i-mode subscribers are active users on a monthly basis. In addition to the operators, i-mode also cooperates with over 1,000 content providers in markets outside Japan.

Mobile Phones and Health Issues

After reviewing the work on health effects from radiofrequency transmissions published since the Stewart Report of 2000, an independent UK Advisory Group on Non-ionising Radiation (AGNIR) has released a report in which it says that there is no biological evidence for mutation or tumour causation by RF exposure, and epidemiological studies overall do not support causal associations between exposures to RF and the risk of cancer, in particular from mobile phone use. However, research carried out so far has limitations and mobile phones have been widely used for a relatively short time. As a result, the Group concludes there could still be a possibility of health effect from exposure to RF fields below guideline levels. More information can be found at: http://www.nrp.org/advisory_groups/agnir/

The Australian Communications Authority (ACA) and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) have published information on what is known about the effects on human health of electromagnetic radiation produced by 3G base stations and handsets. According to ACA's chairman, "the emission levels produced by 3G transmitters are considered to be low, with an average radiated power of around 3 watts, which is significantly lower than the power levels of some other common types of transmitters", "for example, on average, a 3G mobile phone base station antenna radiates a little more than one tenth of the power of a taxi's two-way radio".

KPN and the University of Amsterdam's Academic Medical Centre (AMC) have started a pilot project intended to make intensive care (IC) mobile. Using GPRS and UMTS, KPN will ensure that critical information regarding an IC patient's state of health is continually made available, anywhere. Intensive care doctors will thus be able to monitor a patient's condition in transit. The trial is set to start in the summer first considering the use of GPRS network during intensive care transfer in an ambulance. Further expansion to the project is planned from the beginning of next year with the transmission of live video images over the new UMTS network.

Forums and Industry Alliances

Leading companies from the mobile industry have signed a memorandum of understanding to apply for a mobile Top Level Domain ("mobile TLD") from the Internet Corp. for

Assigned Names and Numbers (ICANN). If the application is successful and the mobile TLD is granted by ICANN, the industry leaders have agreed to form a new joint venture to manage the mobile TLD. A mobile TLD on the Internet creates the opportunity to streamline the deployment of new Internet sites optimized for mobile usage. The participating companies are Microsoft, Nokia, Vodafone, 3, GSM Association, HP, Orange, Samsung Electronics and Sun Microsystems. Under the terms of the memorandum of understanding, the companies intend to form a registry company to manage the distribution of the new mobile TLD names.

The Global UMTS TDD Alliance, sanctioned by the GSM Alliance, has been founded by members of the UMTS TDD community. Among the founding members of the Global UMTS TDD Alliance are 18 operators from five continents and vendors such as Andrew Corporation, Axcera, Fastcomm, InCode Telecom, IPWireless, MRiC, Possio, Samsung, and UTStarcom. Specific goals of the alliance are to: create greater awareness of UMTS TDD technology as the leading standard for mobile broadband and other high-speed packet based services in the market; offer a forum for information sharing among members; support collaborative technology development, interoperability testing, and certification; educate the market about the many successful reference cases and sensible economics of UMTS TDD deployments; provide a resource for information on TDD solutions.

The Wireless Performance Prediction (WPP) study group has been established to help standardize the metrics and methods which describe Wi-Fi's performance. The WPP's members include individuals from such leading organizations as Intel, Hewlett Packard, Texas Instruments and Broadcom, regulatory agencies FDA and NIST, and authoritative independent testing organizations such as the University of New Hampshire's Interoperability Labs (UNH-IOL) and Iometrix.

Royal Philips Electronics, Nokia and Sony Corporation have established the Near Field Communication (NFC) Forum to enable the use of touch-based interactions in consumer electronics, mobile devices, PCs, smart objects and for payment purposes. Touch-based interactions will allow users to access content and services in an intuitive way by touching smart objects and connecting devices just by holding them next to each other. The new forum will promote implementation and standardization of NFC technology to ensure interoperability between devices and services. NFC technology evolved from a combination of contactless identification (RFID) and interconnection technologies. NFC operates in the 13.56 MHz frequency range, over a distance of typically a few centimetres. NFC technology is standardized in ISO 18092, ECMA 340, and ETSI TS 102 190. Further information is available at <http://www.nfc-forum.org>

Wireless, PMR and Public Safety

Motorola has announced the release of its latest Project 25 compliant system offering – ASTRO 25 Trunked Integrated Voice and Data System. This system release features Integrated Voice and Data (IV&D) capabilities. The new ASTRO 25 Trunking system improves communications security by providing encryption key assignment over system radio channels (Over the Air Re-keying) and enhanced network security tools. The ASTRO 25 Trunked system currently operates in the 700MHz for voice-only operation and 800 MHz, UHF and VHF frequency bands for voice and data operation, supporting up to 7 zones and 20,000 data users. Motorola has also announced a contract to build, own and

operate an ASTRO 25 advanced digital communications network for emergency services in the State of Victoria. The new Metropolitan Radio Network will provide emergency communications during the 2006 Commonwealth Games in Melbourne. The network is expected to be built by April 2005, after which it will be operated by Motorola for a period of seven years. The US manufacturer has released its first public safety mobile digital video solution, Mobile Video Enforcer (MVE), designed to address the growing need for in-vehicle video recording during public safety incidents. The Mobile Video Enforcer consists of a Mobile Digital Video Recorder (MDVR) mounted in an officer's vehicle and a Digital Video Management Solution (DVMS) located at the police department. The MDVR captures full-motion, DVD quality video using MPEG-2 video. The MDVR functions as a standalone unit but can also be interfaced with a Motorola MW800 or ML900 rugged computing device which provides full control of the MDVR through the mobile data terminal display, including displaying video.

Nokia has been chosen to provide Ningqi Railway Co., Ltd. with a digital TETRA professional mobile radio network for its new rail line between the cities of Nanjing and Qidong in Jiangsu province. The entire network will be put into operation in June 2004.

NTT DoCoMo has launched an i-mode Disaster Message Board service beginning from January 17, allowing i-mode subscribers in Japan to post personal messages at a special i-mode site in the event of major calamities such as high-magnitude earthquakes. The message board is an electronic bulletin board service that will enable subscribers within a disaster area to post messages on their personal safety and circumstances. Under the present network system, there may be instances in the case of a major disaster where the flow of both voice calls and data packet transmissions would have to be controlled.

3GSM World Congress 2004

The 3GSM World Congress took place in Cannes (France) between the 23rd and 26th of February. 29,000 visitors attended the event, which represents a 12% increase compared to 2003. During the event, Nokia announced a corporation agreement with IBM to bring its applications to mobile phones, starting with the 9500 Communicator, a new mobile device for enterprise. Nokia and Samsung also announced a cooperation agreement on push to talk. Samsung plans to introduce push to talk in several of its mobile terminal products during 2004 and 2005 based on Nokia's push to talk technology. Philips launched its 'Snap, Tag & Send' concept for sending personalised photos, drawings and handwritten notes by MMS messaging through a built-in touch screen. Alcatel announced its partnership with Eurosport to boost mobile access to sports events, and a partnership with Universal Media to develop mobile multimedia services. Alcatel and Fujitsu joined forces to establish a FOMA live demonstration environment at NTT DoCoMo's booth. FOMA 3G mobile communication services showcased in Cannes include live video calls between Cannes and Japan, as well as M-stage, V-Live, a video streaming service that transmits a variety of live and archived video content using circuit switched 64 kbps data transmission. Alcatel and SK Telecom, the largest mobile operator in Korea, introduced the world's first photo-music-video (PMV) service. With this service, end users can produce and send personalized video content to mobile phones or an email address. The two leading companies in mobile applications tested and integrated SK Telecom's PMV service with Alcatel Mobile Multimedia

Service (MMS) platform in Alcatel's 3G Reality Centre, an end-to-end 3G environment, in both France and Korea. SK Telecom launched trial PMV service in Korea in December 2003 and plans to launch the service commercially in April, as one of its key multimedia messaging services.

Qualcomm announced a digital rights management (DRM) solution for its secureMSM security suite, enabling operators and content developers to deliver copyright-protected digital media over wireless networks. Cisco unveiled an enhanced Cisco Mobile Exchange portfolio that links the radio access network to IP networks and delivers value-added, content-based IP services. HP announced plans to add Cambridge Positioning Systems Matrix technology to its HP location solution. CPS Matrix is said to offer 100m accuracy, reliable coverage in all environments and rapid location time-to-fix. In-Fusion announced a deal with the TIM Group to supply the Italian operator with Java-compatible games for download from its WAP portal. Philips Semiconductors launched its Single Instruction Multiple Data (SIMD) ultra-high-performance processor, which, according to the manufacturer, decreases cost per channel by up to 70%. Siemens Mobile presented the walkie-talkie function of mobile phones (PoC) on the basis of IMS (IP-Multimedia Subsystem) in the GPRS network. IMS is the new standardized multimedia switching technology for packet-oriented networks. Siemens also showed for the first time fleet management and tracking solutions based on Assisted GPS (A-GPS). With A-GPS, the locations of mobile phones in a mobile network can be determined with much greater precision than with previous cell ID-based systems. Siemens presented for the first time the new "FlexCU" (Flexible Carrier Unit), a module comprising two GSM/EDGE transceivers (transmission and reception units) that can be used flexibly. FlexCU gives network providers two options for making their mobile networks even more efficient, namely increasing capacity and range. FlexCU can handle twice as much voice traffic as a conventional GSM transceiver. Since it needs exactly as much space as a normal carrier unit, the capacity of the Siemens base stations is doubled to up to 24 transceivers per rack. In EDGE operation, a FlexCU can even handle up to six times as much data traffic as a standard GSM transceiver. Alternatively, FlexCU can link its two transmission and reception units for a greater level of effective transmission and reception sensitivity. The increased range enables network providers to provide mobile services with fewer base stations.

Location Technology

Qualcomm has announced its new QPoint solution, which leverages the power of Qualcomm's BREW solution and the Company's gpsOne hybrid Assisted GPS wireless location technology for mobile phones to provide, what the manufacturer claims is, the most complete end-to-end mass-market LBS solution available today. With QPoint, Qualcomm provides operators with flexible delivery options for Location-Based Services (LBS) — either through a hosted model or through channel partners. The QPoint solution enables a variety of location-based applications, including peer-to-peer, locating points of interest, asset monitoring, mobile commerce and gaming applications.

Alcatel has announced general availability of the Alcatel 8607 A-GPS (Assisted Global Positioning System) Positioning Server for GSM Networks. Building on the existing relationship with Qualcomm, Alcatel is the first mobile solutions vendor to provide a proven and commercially ready

A-GPS location server solution for GSM that is compatible with Qualcomm's location solutions. According to Alcatel, this collaboration positions both companies as market leaders in A-GPS to implement new Open Mobile Alliance (OMA) LBS standards activities associated with A-GPS technologies. Alcatel also is expanding its A-GPS pre-launch assistance program, which helps service providers shorten their time to revenue, improve their cost-effectiveness and ensure the quality of their A-GPS location based services.

According to a study from Strategy Analytics, interest in using a mobile phone to get directions has increased from 15% in 2001 to 45% in 2003.

CeBIT 2004

CeBIT 2004 took place in Hannover from the 10th to the 16th of March. 510,000 people attended the event, with an average of 3,400 more visitors per day compared with last year. At the end of the show some 57 percent of exhibitors viewed the economic outlook for their sector as "favorable" to "very favorable" — or a good six percent more than at the start of the event. The level of optimism expressed was definitely higher than last year, when only 40 percent responded so positively.

Motorola announced the launch of the Motorola M900 GSM Fixed Mobile Car Phone. The Motorola M900's voice activation key is a distinguishing feature of the phone, which enables the use of spoken commands to activate phone functions. Motorola also presented its Integrated Hands Free system with Bluetooth wireless technology. The latest Motorola in-vehicle system will automatically connect securely to a driver's Bluetooth enabled mobile phone, whether the conversation was initiated before or after starting the vehicle, all without wires or connections. The Motorola Integrated Hands Free system with Bluetooth wireless technology features intuitive user controls and is designed to help drivers keep their eyes on the road and hands on the wheel. The Motorola Integrated Hands Free system supports the latest Hands-Free 1.0 Profile (HFP1.0).

Lucent Technologies announced contracts worth more than US\$300 million to provide fixed line and mobile service providers with next-generation services and solutions at CeBIT 2004. In particular E-Plus, O2 Germany and T-Mobile in Germany will deploy 3G UMTS high-speed data cards developed by Lucent and Novatel Wireless. Telefonica Móviles España also selected Lucent's network management software for roll-out of mobile data services.

Nokia unveiled an array of products and solutions, including the Nokia 7610 smartphone, Nokia's first mega-pixel imaging device which offers convenient image capture, printing, storing and sending. Nokia unveiled a number of complementary imaging enhancements like the Nokia Image Album and Nokia Image Viewer, a new advanced car kit. In addition, Nokia launched Pocket Kingdom: Own the World, the world's first global massively multiplayer online mobile game, only on the N-Gage platform. The manufacturer also introduced the Nokia Mobile RFID (Radio Frequency Identification) Kit, the first GSM phone integrated product offering with RFID reading capability. The Nokia Mobile RFID Kit extends the mobility of field force personnel by integrating RFID reader technology to a familiar portable device. Simply by touching a smart object, the user can initiate tasks in their Nokia phone - call and send text messages or access databases and record new data entries.

Samsung introduced the new SGH-Z105 camera phone supporting UMTS networks and featuring WAP, Java and



Siemens PenPhone

streaming video. The manufacturer also released two new CDMA2000 EV-DO devices, with the SPH-V4400 featuring a 2 megapixel integrated digital camera.

At CeBIT, Siemens presented the new PenPhone, the first ever tri-band mobile phone housed in the unusual shape of a pen and offering all the features of a standard mobile phone. The 140 mm long PenPhone recognizes handwriting for dialing numbers and writing text messages directly into the mobile phone – no matter what surface you write on. Even if no writing surface is available, built-in voice recognition means you can activate the PenPhone.

Siemens also showcased the new Qwerty Virtual Keypad. Using special laser technology, a keyboard can be projected onto any flat surface to let you write text messages quickly and easily. Your message automatically appears on the mobile phone's display and gives you the advantage of a laptop keyboard even if you have the most compact mobile phone.

US Mobile Market

Cingular Wireless has announced an agreement to acquire AT&T Wireless, creating the premier wireless operator in the US. The combined company would have 46million customers, with spectrum in 49 states, coverage in 97 of the top 100 markets and annual revenues exceeding \$32billion. Under the terms of the agreement, shareholders of AT&T Wireless will receive \$15 cash per common share or approximately \$41billion. Cingular has also announced it has completed the acquisition of 16,000 Louisiana customers as part of a \$27.6million deal with US Unwired. Cingular also acquired spectrum and operations in Louisiana, Texas and Arkansas.

With a Report and Order, the Federal Communications Commission (FCC) has reallocated spectrum in the 76-81 GHz frequency band and the frequency bands above 95 GHz to conform the United States Table of Frequency Allocations with recent changes to the International Table of Frequency Allocations maintained by the International Telecommunication Union (ITU). Specifically, this realignment of allocations will achieve consistency with the international allocation changes made at the World Radiocommunication Conference (Istanbul, 2000) (WRC-2000). The primary intent of the WRC-2000 realignment of allocations in the 76-81 GHz band and bands above 95 GHz was to place scientific services, such as the Earth-exploration satellite service (EESS) and radio astronomy service (RAS), in spectrum better suited to their needs. Regarding the 76-77 GHz band, the FCC is adopting a primary RAS allocation and secondary space research service (SRS) allocation that will share this band with unlicensed vehicle radar systems. The FCC is not, however, implementing the proposed secondary ama-

teur-satellite allocation in this band due to anticipated interference concerns with vehicle radar systems. To protect passive services in the 55.78-56.26 GHz band, the FCC is adopting a limit on the maximum power spectral density that can be delivered to a fixed service transmitter antenna. The FCC believes that the rule amendments set forth with this Report and Order will promote future developments in technology and equipment, position scientific services to increase our understanding of physical phenomena, and provide consumers with access to new products and communications services.

The FCC has also adopted a Notice of Proposed Rulemaking and Further Notice of Proposed Rulemaking relating to protecting consumers from SPAM and unauthorized telemarketing calls on their mobile phones. The FCC is asking for comments on how to best protect consumers and businesses from the costs, inefficiencies and inconveniences of receiving unwanted electronic mail messages on wireless devices such as mobile phones.

Qwest Communications International, the 4th US local phone company, has launched a national wireless network using Sprint PCS's voice network. The company has said the new service is intended for residential and small business customers in its 14-state region.

US Cellular has deployed a broadband echo cancellation and voice quality system from NMS Communications. NMS's new Mercury 14K voice enhancement system provides a highly cost-effective option for broadband terminations and substantial cost savings.

According to a study commissioned by the National Emergency Numbering Association, only about half of the public safety answering points in US will be E911 Phase II capable by the end of 2005. The study also found that only 80% of the US will have access to E911 Phase II capable public safety answering points by the end of 2007. According to representatives that compiled the study, there is a shortfall in funding since almost \$1.5billion is needed to fund the effort every year.

A study by InStat/MDR forecasts that by 2008, nearly a third of all US wireless subscribers won't have a landline phone in their home, which highlights the "cord-cutting" phenomena. The firm also found that "cord-cutting" is most popular among young adults.

Industry Forecasts and Surveys

According to Gartner, worldwide mobile phone sales totaled 520million units, which represents a 20.5% increase from 2002 sales. Demand for 2004 is expected to also be strong and the firm has already increased their market estimate for 2004 to 580million units. Nokia is still at the top spot with a 2003 market share of 34.7%, followed by Motorola (14.5%), Samsung (10.5%) and Siemens (8.4%). Sales in emerging markets such as China, India, Russia and Brazil continued to surpass expectations; e.g. 18million handsets were sold in India during 2003. IDC estimates 2003 worldwide shipments in 533.4million units, up from 432.7million in 2002. In the fourth quarter, worldwide shipments grew 21.8% compared to the previous quarter. Shipments of converged devices reached 9.6million by the end of the year.

A study from InfoTrends Research projects that worldwide sales of camera phones will reach nearly 150million in 2004, which would represent over a quarter of all mobile phone sales. The sales of camera phones are expected to experience a Compound Annual Growth Rate of 55% to reach 656million units in 2008. The firm expects an additional 29billion digital images captured this year. Japan was the leading region for camera phone sales in 2003 with a market share of more than 50%, although a major shift is expected

from this year. In a different report, IMS Research said that over 2.5 times as many camera phones were sold in 2003 as in 2002. Camera phone sales reached close to a tenth of world cell phone shipments. The firm expects that by 2006 over 40% of all terminals shipped will be fitted with a camera unit. Strategy Analytics estimates that by 2008, over 150million users worldwide will be wirelessly accessing video clips, generating revenues of just under \$4.7billion.

Two reports from Alexander Resources conclude that the use of new wireless technologies for machine-to-machine (M2M) communications will create significant new revenue opportunities for cellular, WLAN and WPAN manufacturers. According to these reports, the number of cellular M2M connections will overtake the number of cellphones in North America, Western Europe and Japan in eight years.

ON World claims that more than half a billion nodes will ship for wireless sensor applications in 2010 for an end user market worth at least \$7billion. According to representatives of the firm, the lack of standards is the biggest limitation since there are over one hundred proprietary sensor protocols. Wireless sensors can reduce the cost of wiring by up to 80% and reduce energy consumption by as much as 50%.

A study from ABI expects the market for in-building wireless solutions based on Distributed Antenna Systems (DAS) to top \$1billion annually by 2010. DAS use fiber cable to distribute signals to a network of small antennas throughout a building. According to ABI, larger companies in the industry include Andrew, LGC Wireless and LGC Allgon, with companies to watch including Inner Wireless, Mobile Access and Radio Frame.

The ARC Group estimates mobile services to be worth \$126billion worldwide by 2008. According to the company, messaging, music and games will be the key revenue drivers for mobile services over the next five years. Third party revenue sharing represents a significant growth area of the market.

According to Baskerville's Global Mobile Forecasts to 2010 report, the global mobile market is set to expand by over 800million customers by 2010, reaching the 2billion mark in 2008. 60% of all the new customers will be in the Asia Pacific and almost 80% of these will be in India and China. The firm also expects that 10% of the world customers (i.e. 250million) will be using 3G services by end-2007. Baskerville also expects prepaid cellular users will reach over 1.35billion users by 2009 with a 59% share of the total global wireless market.

Global revenues attributable to GSM totalled \$277 billion in 2003 according to a newly published white paper from Deutsche Bank. This socio-economic study of the impact of GSM worldwide further forecasts that GSM revenues will grow to \$500 billion in 2005. The Deutsche Bank paper, "Brilliant Past, Bright Future", describes the evolution of mobile over the last decade from a niche business to one of the largest and most important industries in the world. The report examines the impact that GSM can have in developing economies through case studies on Nigeria and Afghanistan. The paper is available from <http://www.gsmworld.com/GSM%20White%20Paper.pdf>

Other News

Telefónica has reached an agreement to acquire Bellsouth's Latin American cellular operations. After this agreement, Telefónica Móviles will become the world's fourth largest wireless operator. The Spanish operator will add 10 companies in 10 countries. Telefónica Móviles' Latin America customer base will account 41million in 14 countries. Under the

signed agreement, the transaction values 100% of the companies acquired (firm value) at \$5,850 million.

China Ministry of Railways and Nortel Networks have signed an agreement under which Nortel Networks will provide a GSM for Railways (GSM-R) digital wireless communications network for trial on the world's highest rail line – the Qinghai-Tibet Railway. GSM-R is a radio-communications system that expands on the GSM digital wireless standard to provide additional features specifically intended for railway operations. A landmark project for China's West Development Strategy, the Qinghai-Tibet GSM-R trial is expected to be one of the first in China. More than 84 percent of the 1,142-kilometer Qinghai-Tibet Railway is 4,000 meters or more above sea level. Nearly half is built on perennially frozen earth, requiring advanced technology and extensive experience in network deployment, operation and maintenance. Plans call for the Qinghai-Tibet Railway trial to cover 186 kilometers. It is expected to be the first test track in Asia supported solely by GSM-R – with no analogue radio system for back-up. It is also expected to be the first in Asia to use GSM-R to transmit safety data for train control, and the first to adopt double coverage solutions to enhance system availability. Nortel Networks GSM-R infrastructure includes GPRS for data applications and supports wireless LANs and location-specific services.

According to 3G Americas, more than one billion people, almost one in six of the world's population, are now using GSM mobile phones. This historic milestone has been reached only 12 years after the launch of the first networks. Now adopted by more than 200 countries and territories, GSM has become the only global standard for mobile communications. As the choice of 80% of all new mobile customers, GSM has driven wireless take-up to the extent that mobile phones now outnumber fixed telephone lines globally. 3G Americas has also reported 100% annual growth for GSM in 2003, giving GSM by far the largest percentage gain of any wireless technology in the Western Hemisphere. Based on data from EMC, GSM is outpacing all other wireless technologies in Latin America, increasing its subscriber base by nearly 150% in 2003, almost six times more growth than the next most popular wireless technology. The rapid deployment of GSM/GPRS on a nationwide basis in Canada and the U.S. contributed to GSM's 77% growth in the North American market in 2003.

The CDMA Development Group (CDG) has reported that CDMA added a record 14.5 million subscribers in 4Q 2003 to total 188 million users worldwide. In 2003, the CDMA subscriber base grew by more than 42 million users, or 29%, representing the highest growth for any leading cellular technology, and significantly higher than the 20% gain for the whole industry. According to the organisation, CDMA2000 further strengthened its leadership in 3G by adding more than 10.7 million users in the quarter to total 75.4 million, or 97% of all 3G subscribers. Nearly 40% of the global CDMA subscriber base uses CDMA2000 networks, up from 20% one year ago. There are 4.4 million CDMA2000 1xEV-DO advanced users.

Addison-Wesley Professional has announced a joint project with Nokia to publish a mobile developer book series. The series will focus on application development guidelines, tools, and best practices using Nokia's software platforms for mobile developers. Nokia engineers, key mobile developer industry leaders and members of Forum Nokia, the company's mobile developer community, will write, review and contribute to the books. The first book in the series will be "Developing Series 60 Applications: A Guide for Symbian OS C++ Developers" by authors from EMCC Software, Ltd.



Standards

Dennis Bodson, Senior Editor

ETSI Publishes Technical Updates to Voice Band Analogue Interface TBRs

The requirement to comply with the ETSI non-radio TBRs (Technical Basis for Regulation) has long since passed because the European regulation regime (R&TTE directive) has removed interworking and network protection as essential requirements. The regime has also moved from a "Type Approval" regime to a "Declaration of Conformity" based regime. To ensure interworking and network protection, the new rules now require network operators to publish technical specifications on publicly offered interfaces.

However, as Technical Report TR 101 844 shows, an increasing number of National Authorities and organizations worldwide still use the TBRs - for regulation and procurement purposes. For that reason and due to the particular popularity of TBR 21 and its importance as "the harmonized" standard for analogue low cost voice band interfaces for new and old technology systems, the ETSI Technical Committee AT (Access and Terminals) decided to maintain the technical content of TBR 15, TBR 17, TBR 21 and EN 301 437. The committee has recently completed work on a 3 part Technical Specification providing up-to-date information on basic attachment requirements for terminals connected to analogue interfaces of telephone networks. ETSI has just published these as TS 103 021-1, TS 103 021-2 and TS 103 021-3.

ATIS Responds to VoIP Challenges in Reaching 911

Advanced Technology Industry Solutions (ATIS), the leader in communications and information technology standards development—announced that its Emergency Services Interconnection Forum (ESIF) launched a new IP Coordination Committee to contribute to the planning, development and architectural design of an overall IP-based Enhanced 911 (E911) system. Through the "IP Coordination Ad Hoc Committee," the ESIF will coordinate with the National Emergency Number Association's (NENA) VoIP Packet Technical Committee to develop a technical solution that would allow VoIP customers to reach 911 call centers in an emergency.

"One of the major challenges facing VoIP services is the lack of technical standards in place that allow customers to initialize calls to the proper 911 call center," said Susan M. Miller, president and CEO of ATIS. "ATIS, through its Committee ESIF, is accelerating the pace to develop the much needed IP-based standards through the launch of its new technical committee, and by actively engaging the industry and public safety community in the process."

Tim Barry, AT&T 911 Program Manager, and Nate Wilcox, Enhanced 911 Systems Administrator for the State of Vermont serve as co-chairs for the committee, and noted that one of the goals for the committee is to have a positive impact on

VoIP standards development. Wilcox added, "It's important that we resolve the difficulties associated with VoIP 911 call delivery to the correct Public Safety Answering Point with no disruption of services or capabilities. Additionally, it is possible that the correct solution will actually enhance the 911 call delivery mechanism for all telecommunications services."

The ESIF was formed to facilitate the identification and resolution of technical issues related to the interconnection of telephony and emergency services networks.

New VT Project Authorization Requests (PAR) for Standards Approved

The IEEE Standards Association Standards Board met in Piscataway, NJ on Feb 27, 2004. The following new VT PARs were approved:

P1653.1 (VT/RT) Standard for Traction Power Rectifier Transformers for Substation Applications up to 1500 Volts dc Nominal Output. This standard covers design, manufacturing, and testing unique to application of power rectifier transformers intended to operate in dc supplied transportation substation applications up to 1500 volts dc nominal output. At the present time there are no suitable standards governing all requirements for traction power transformers. This standard will provide requirements specific to traction power rectifier transformers supplying power to dc supplied transportation equipment.

P1653.2 (VT/RT) Standard for Uncontrolled Traction Power Rectifiers for Substation Applications up to 1500 Volts dc Nominal Output. This standard covers design, manufacturing, and testing unique to application of uncontrolled semiconductor power rectifiers for dc supplied transportation substation applications up to 1500 volts dc nominal output. At the present time there are no suitable standards governing requirements for traction power rectifiers. This standard will provide requirements specific to traction power rectifiers supplying power to dc supplied transportation equipment.

P1653.4 (VT/RT) Standard for dc Traction Power System Field Testing and Acceptance Criteria for System Applications up to 1500 Volts dc Nominal. This standard defines field testing and acceptance criteria for transportation system applications powered by a dc traction power system up to 1500 volts nominal. The purpose is to ensure that the installed equipment will function as intended by the plans and specifications, thereby providing reliable service for the anticipated life of the equipment.

The following revised PAR was approved through Continuous Processing¹ on December 10, 2003:

¹ This program reduces the maximum time needed to process a PAR from approximately 90 days to 25 days using email and the Web. The time reduction is made possible through the electronic dissemination of PARs and accompanying documents via e-mail to NesCom members

P1474.1 (VT/RT) Standard for Communications-Based Train Control (CBTC) Performance and Functional Requirements.

Original Scope: This standard establishes a set of performance and functional requirements necessary for enhancing performance, availability, operations, and train protection using a CBTC System. —**Revision:** There is no change to the words of the scope. The revisions allow for driverless train operation, including automatic people movers.

Original Purpose: There are currently no independent standards defining the performance and functional requirements to be satisfied by CBTC systems. This standard will enhance performance, availability, operations, and train protection, and will facilitate new CBTC applications. —**Revision:** There is no change to the purpose.

The following standard was reaffirmed through Continuing Processing on December 15, 2003:

1477-1998 (VT/RT) IEEE Standard for Passenger Information System for Rail Transit Vehicles. Rail transit vehicle passenger information system interfaces with the vehicle's carbody, train crew, control system, power system, and passengers are described in this standard. The physical, logical, and electrical interfaces of the passenger information system for rail transit vehicle systems and subsystems are specified.

ITU Standardises New Higher Capacity Optical Transmission Systems

The International Telecommunication Union (ITU) has reached agreement on a new global standard that quadruples capacity of the optical transmission systems which link the nodes of telecommunication networks. The new standard, which allows a transmission speed of 40 Gbit/s, has been developed for carriers to be able to bring down the cost per bit (of data carried) and the costs of network maintenance and management.

The standard - ITU-T Recommendation G.959.1 - increases the capacity for optical interfaces from the present maximum of 10 Gbit/s to 40 Gbit/s. The completed work goes hand-in-hand with other work by ITU in optical transport networks, which encourage a fair market for manufacturers and operators, and ultimately encourages better service for consumers. It is already finding its way into optical interfaces developed to exploit the demand for high capacity Internet routers. The standard follows extensive field trials between a number of service providers and manufacturers.

Moving to higher bit-rates will reduce the number of optical systems required in a network. "Historically", says Peter Wery, Chairman of the ITU-T group responsible for the standard, "each fourfold increase in data speed has multiplied costs by just two and half times, leading to lower cost per bit. If this historical precedent holds true, 40 Gbit/s technology will reduce systems equipment costs by up to 40%."

New ITU Standards Make Fat Pipes Fatter

The standard — ITU-T Recommendation G.695 — applies to a technology called Coarse Wave Division Multiplexing (CWDM), used most often in metropolitan networks. In today's cost-conscious telecommunications market CWDM is seen as a cheaper and simpler alternative to DWDM (Dense Wavelength Division Multiplexing). Less expensive uncooled lasers may be used in CWDM products because of wide channel spacing. These lasers require less precise wavelength control, as well as lower-cost passive components.

Experts estimate that carriers with sufficient deployed fiber could make savings of up to 30 per cent deploying a CWDM solution compared with the Dense Wave Division Multiplexing (DWDM) alternative. The growing demand for bandwidth in this area has created a need to better utilize existing infrastructure and for a new standard to ensure interoperability. Operator interest and investment in CWDM is already significant.

Peter Wery, Chairman of ITU-T Study Group 15 responsible for the Recommendation: "CWDM systems have the flexibility to be deployed in point-to-point connections and in rings. Their suitability to carry Ethernet traffic and to interconnect Storage-Area-Network (SAN) islands makes these systems of interest to large and medium-sized carriers, but also to cable TV companies and for enterprise network operators."

ITU-T G.695 aims to promote vendor interoperability by specifying transmitter/multiplexer characteristics at one end of a CWDM link and the demultiplexer/receiver at the other end. ITU-T G.695 complements the existing ITU-T G.694.2 Recommendation which defines a wavelength grid with 20 nm channel spacing which includes 18 wavelengths between 1271 nm and 1611 nm. CWDM solutions standardized in ITU-T G.695 can be installed both on the already laid and widely deployed single-mode G.652 optical fibres and on the recent 'water peak free' versions of the same fibre. The type of fibre used will have an impact on the reach of the systems and on the number of allowed optical channels.

In order to respond to the needs of the market the new standard foresees flexible and scalable solutions moving from 8 to 16 optical channels using two fibers for the two directions of transmission and from 2+2 up to 8+8 optical channels using only one fibre for the two directions. Support for a bit rate of 1.25 Gbit/s has been added, mainly for Gigabit-Ethernet applications. This is offered alongside support for 2.5 Gbit/s. Two indicative link distances are covered in G.695: the first is for lengths up to around 40 km and the second one for distances up to around 80 km.

ITU-T Recommendation G.695 (Optical interfaces for coarse wavelength division multiplexing applications) is the most recent in the G-series which specify physical layer attributes of optical interfaces. Other Recommendations in this series include:

- ♦ **ITU-T G.691-2000** - Optical interfaces for single channel STM-64, STM-256 systems and other SDH systems with optical amplifiers
- ♦ **ITU-T G.692-1998** - Optical interfaces for multichannel systems with optical amplifiers
- ♦ **ITU-T G.693-2001** - Optical interfaces for intra-office applications
- ♦ **ITU-T G.959.1-2003** - Optical transport networks physical layer interfaces
- ♦ **ITU-T G.694.2-2002** - Spectral Grids for WDM Applications: CWDM Wavelength Grid

ITU-T G.695 provides optical interface specifications for multichannel CWDM systems on target distances of 40 km and 80 km. Unidirectional and bidirectional applications are included in the Recommendation. Applications use all or part of the wavelength range from 1270 nm to 1610 nm. The main deployment is foreseen on single mode fibres as specified in Recommendation G.652.

IEEE 802.3ak Standard

The IEEE has approved a standard that adds a copper cable interface to 10 Gb/s Ethernet. Before approval of this standard, 1 Gb/s was the fastest available Ethernet rate over copper cabling. The new standard, IEEE 802.3ak™-2004,

provides an economical way for Ethernet switches and server clusters located within 15 m of each other in equipment rooms and data centers to be interconnected at 10 Gb/s. The new standard complements the standards for 10 Gb/s Ethernet fiber optic cable interfaces approved in 2002.

IEEE 802.3ak, "Physical Layer and Management Parameters for 10 Gb/s Operation, Type 10GBASE-CX4," is based on the 10 Gigabit Attachment Unit Interface (XAUI) chip-to-chip interface and specifies signals for transmission over balanced, shielded-copper cabling. Connections for 10 gigabit Ethernet that require runs of more than 15 m will be served by 10 Gb/s fiber optic cable under the IEEE 802.3ae™ standard.

"The availability of 10GBASE-CX4 copper-based interface should accelerate the deployment of 10 Gb Ethernet," said Bob Grow, Chair of the 802.3 Working Group and a Principal Architect at Intel. "10GBASE-CX4 will be an easy addition to 10 Gigabit Ethernet systems because of its similarity to the XAUI interface."

According to Dan Dove, Chair of the 802.3ak Task Force and Principal Engineer, HP ProCurve Networking Business, the standard seeks to make 10 Gb/s performance more economical. "Cost effectiveness is critical for technology adoption," he said. "We reused portions of IEEE 802.3 and other standards to simplify and lower the cost of implementation."

"For instance, 10GBASE-CX4 specifies the same type of connectors and cables now used with 4X InfiniBand," said Dove. "It will allow implementers to incorporate 10GBASE-CX4 capability directly within highly integrated chips. It also minimizes design, installation and maintenance costs by preserving IEEE 802.3 network architecture, management and software features. As a result, we expect installation costs for copper 10GBASE-CX4 interconnections to be one-tenth that of comparable 10GBASE-optical solutions."

ITU Expands Partnership with Waseda University, Japan

The International Telecommunication Union and Waseda University of Tokyo, Japan have established a research centre at the ITU-Waseda ICT Centre to support work in the area of radiocommunications, particularly in the fields of radiofrequency spectrum, digital broadcasting, mobile services and regulatory issues.

The ITU-Waseda Radiocommunication Research Centre, will hold workshops on policy, regulation and emerging technology issues in mobile and radio communication for government officials and telecommunication operators from

the developing and developed world. The Centre will also conduct a series of research projects. One such project will focus on the use of broadband mobile interactive communication systems in public safety, security and emergency response for situations such as earthquakes and terrorist attacks. The Centre will also launch a research project to develop content and applications for mobile telephony 'beyond 3G' (third generation mobile technologies).

"The ITU-Waseda ICT Centre extends ITU's commitment to Waseda University, which has provided us with a valuable presence in a region of the world with an international reputation for innovation in the area of information and communication technology (ICT) development," said Mr Valery Timofeev, Director of ITU's Radiocommunication Bureau.

The establishment of the ITU-Waseda Radiocommunication Research Centre is in fulfilment of a Memorandum of Understanding that was signed between ITU and Waseda University in 2001. This agreement has already resulted in the establishment of the ITU-Waseda ICT Human Resource Development Centre in conjunction with ITU's Telecommunication Development Bureau and the ITU-Waseda ICT Research, Development and Standardization Centre with ITU's Telecommunication Standardization Bureau. "The new centre will provide a global focus for networking among major universities and institutions in research and development for radiocommunication in ICTs," noted Mr Timofeev.

The ITU-Waseda ICT Centre is "an important contribution by Japan to the activities of ITU and will help us to fulfil our University's commitment to joint research and educational training programmes that bring together academia and international organizations," said Professor Toshio Obi, Acting Director, ITU-Waseda ICT Centre. "This partnership with the ITU Radiocommunication Bureau bolsters our commitment to bringing together industry and research to meet the challenges of developing state-of-the-art information and communication technologies for today's information society."

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. IEEE Press Release, February 27, 2004

IEEE VTS Board of Governors' Meeting, October 8, 2003

The third and final VTS Board of Governors' meeting of 2003 was held on 8 October 2003 in Orlando during VTC2003-Fall. Elected Board members Charlie Backof, Dennis Bodson, Mark Ehsani, Bob French, James Irvine, Roger Madden, Tad Matsumoto, George McClure, Sam McConoughey, Tom Rubinstein, Eric Schimmel, Gordon Stüber, Ray Trott and Jim Worsham were present, along with J.R. Cruz Jr. (Past President), Tracy Fulghum (Secretary), Kent Johnson (Past President), Glenda McClure (Conference Coordinator) and Yu-Dong Yao (Education Committee Chair).

The meeting started by approving the minutes of the May teleconference and the Secretary's report.

Treasurer's Report: George McClure reported that the society was a little under budget (to the tune of about \$14.5k) at this point. The Rhodes conference had closed with a surplus of \$19,557.05. This meant that all conferences up to and including the Spring conference of 2002 (Birmingham) had closed, leaving only Vancouver, which is in audit, and Jeju outstanding. However, it was projected that over the full year the surplus would be down slightly (\$232k rather than \$265k).

President's Report: Charles Backof reported on the June TAB meeting. He had a chance to speak with representatives of the ITS, and they want to turn the ITS Council into a society.

Society membership is down 10%, which is in line with other societies. People are maintaining IEEE membership but are dropping societies.

He briefly reviewed a survey of the VTS made by the IEEE. The survey seems to indicate that most members are satisfied, and the members saying that they would renew their membership was consistent with a 10% attrition rate. Further, the survey indicated that while most members do read the Transactions on Vehicular Technology, a large number of them do not attend VTC's.

Roger Madden has retired from the position of liaison to ITSC and Bob Gottschalk was appointed as his replacement.

Tan F. Wong was proposed for the position of Editor-in-Chief of the Transactions on Vehicular Technology, subject to the approval of his department chair.

J.R. Cruz presented the results of elections to the Board of Governors. 448 ballots were returned, with Tracy L. Fulghum, Robert A. Mazzola, George F. McClure, Gordon L. Stüber and Raymond C. Trott elected.

Awards Committee: Ray Trott gave a review of the awards for the year. He is working with Bob Mazzola and Mark Ehsani on the Convergence Fellowship, and may change the name to reflect the new arrangements.

Publications Committee: James Irvine reported on the *VTS News*. At the previous BoG meeting, he had been asked to prepare a report on moving to magazine status, and one intermediate step was to start to pursue advertising. It was agreed to approach IEEE Media and see if they will sell advertising for *VTS News*.

The Transactions Editor's report was summarized by the BoG Secretary Tracy Fulghum. As the Editor is leaving the position, he had developed with the associate editors a set of guidelines for editors, outlining responsibilities and giving general guidance (these will be on file with the new Editor). The page budget for 2004 is 2000 pages, up from 1750. Submissions are up 31%.

Constitutional Review Committee: Dennis Bodson presented the proposed changes to the VTS constitution. In addition to the changes reported in the last *VTS News*, it was also proposed to amend article six to alter to restriction that the VTS not allow classified sessions at its conference to allow it to hold classified sessions as long as they form only a small proportion of the conference. After much debate, the motion was amended to remove this change, leaving the ban on classified sessions. The remaining changes affected the number of people required to petition a change in the constitution (up from 50 to 100), although giving the Board to option of calling for a vote from all members on changes in the constitution even if fewer than that number petition for it.

Education Committee: Yu-Dong Yao presented the education committee report. He proposed adding an education link to the VTS web site, and an education section to the *VTS News*. These were agreed. A further proposal on on-line learning resources was considered, and Yu-Dong Yao was asked to re-investigate this, and to report back on cost and benefits of online learning.

Conferences and Meetings: Mark Ehsani presented a proposal for a **Vehicular Power and Propulsion Symposium**, citing the need for a separate forum for the topic, apart from VTC. The scale of this symposium would be on the order of 100 attendees with a 40000 Euro gross, and would be held in the mid-September 2004 time frame. This was agreed, with VTS providing up to \$5000 in sponsorship.

VTC2003-Fall: James Irvine began the report on Conferences and Meetings with a summary of the Orlando VTC. Charles Backof thanked James Irvine, Dennis Bodson, and

George McClure for their great contribution to the success of the conference. Noteworthy about VTC2003-Fall was the fact that the number of papers submitted was over twice the previous record. The acceptance rate of these papers was 33%. Many papers were "no-shows" due to difficulty in obtaining visas, and the fact that the rules had been changed on visa waiver travel to the US only a week before. While these changes had been postponed at very short notice, by that time many people had cancelled their flights.

There was discussion about what were legitimate expenses for committee members to make in relation to VTC, and the primary purpose of their trip. As a result of this, some claims from the general program chair were disallowed.

Current VTS policy was that Board members be allowed free attendance at VTC. Concerns were raised about the application of this policy, in particular to Board members with papers in the conference, some of whom paid the registration fee and had their expenses covered by their institution, and some who attend as BoG members. There are possible tax issues if the primary purpose of the trip is not VTS business. It was agreed to discuss this further at the next meeting in February, since the next VTC was not until May.

Standing Technical Programme Committee: James Irvine proposed a motion to establish a standing TPC to support all future VTCs beyond those which have already been agreed. This would allow consistency of approach and corporate memory of the reviewing process to apply from VTC to VTC, but Gordon Stüber noted that it would reduce local input and flavour for each VTC, and the TPC Chair's ability to choose people he could work with. After discussion, a motion was passed as follows:

The VTS resolves: (1) to create a standing Technical Program Committee to be responsible for the technical program at future Vehicular Technology Conferences; (2) to set up a Working Party, to consult with current VTC Technical Program Chairs, to propose guidelines for the operation of the Standing Technical Program Committee and for the selection of papers, and for the membership of the Committee.

VTC2003-Spring: Jae-Hong Lee made a presentation on the status of VTC2003-Spring. 588 papers from 33 countries had been accepted, an acceptance rate of 56%. 657 people had registered, but due to SARS, 155 did not attend. Even with SARS, the conference expected to make a surplus in the order of \$89,000.

VTC2004-Spring: Michele Morganti gave a presentation on behalf of the organizing committee for VTC2004-Spring 2004. Dennis Bodson reported that it had been decided to move the conference from Genoa to Milan in order to save costs in the face of the rising value of the Euro, which would raise the registration fee for Genoa from the planned \$575 to \$900. In the light of this, the Organizing Committee was resigning, but would only do so after their obligation to review all submitted manuscripts. The President asked if there was any compromise at hand, and the TPC chair stated that he did not believe there was. The President thanked the TPC Chair for his and the Organizing Committee's efforts and apologized for any misunderstandings.

VTC2005-Fall: The Chair for VTC2005-Fall, Bob Shapiro, made a presentation on the proposed conference. Ray Trott was appointed as the Board's point of contact for the Organizing Committee.

VTC2004-Fall: Sumner Matsunaga, chairman of VTC2004-Fall, reviewed the status of the conference organization. Some concern was expressed by the board of the use of the term "homeland security" in the conference, since

it gives the impression that VTC is a U.S. conference rather than a global conference.

VTC2005-Spring: Erik Ström made a presentation of the status of VTC2005-Spring. The representatives from the organizing committee expressed a desire to have the registration fees established in Swedish Kroner, and this would be looked in to further.

VTC2006-Spring: The Chair for VTS2006-Spring Fu-Chung Zheng presented a short summary of their status report. Some brief discussion arose as to whether this conference could rightly be called a spring conference, as it will be in the *Southern Hemisphere* around May.

Conference Registration Fees: There was intensive discussion around the issue of VTC registration fees, which was raised via email since the last board meeting. VTC2003-Fall had followed the IEEE recommendation of requiring a full registration for each paper published. However, this had caused a good deal of concern amongst conference attendees. Lajos Hanzo (VTS Member, and regular author at VTC) spoke to the board, expressing concern about the fact that multiple registration fees were required to present multiple papers, and made a plea for the board to reconsider this issue. A motion was proposed whereby full registration at the conference would cover N papers, with the

discussion focussing on the value of N . However, there was no consensus behind this approach, which would require a significant rise in the full registration fee. $N = 3$ was most popular, but it did not find majority support. After further discussion a motion *That for Vehicular Technology Conferences, a policy be established to allow one paper per full conference registration and be charged a page charge on the order of \$200 for each additional paper presented* was agreed by a vote of 6 for and 5 against.

COST273: Dr. Luis Correia of the Technical University of Lisbon made a presentation on COST273. They were interested in a relationship between COST273 and the VTS, with some publication of meetings, etc., in the *VTS News*. An article on COST273 will be published in an upcoming *VTS News*.

Board Elections: The existing officers – President: Charlie Backof; Executive Vice President: Dennis Bodson; Treasurer: George McClure; Vice President – Mobile Radio: Eric Schimmel; Vice President – Motor Vehicles: Bob Mazzola; Vice President – Land Transportation: Harvey Glickenstein – being eligible for re-election, were re-elected by acclaim.

The next meeting of the Board of Governors is to be held at the Los Angeles Airport Marriott, Los Angeles, CA, USA, on Saturday, 7 February 2004.



Assistant Editor: Conferences

WANTED - An individual with one or two hours to spare each month to co-ordinate conference coverage for the *VTS News*.



Experience not required, although Internet access essential.

As part of an ongoing process to move the *VTS News* towards magazine status, we are reorganising the coverage of society activities, which will lead to the requirement for a number of Assistant Editors to support a new Senior Edi-

tor for Society Activities. The first of these will be to co-ordinate conference coverage, which will include keeping the conference calendar updated, liaising with the publicity chairs of VTC conferences to ensure that calls for papers and participation are received, and co-ordinating the reporting of past conferences. If you are interested and would like to get involved with the enthusiastic team working on the *VTS News*, please contact the Editor in Chief, James Irvine, at j.m.irvine@ieee.org

Conference Information Email List

The Vehicular Technology Society has launched a new email list to keep members updated on the latest news about VTC and other VTS conferences. To join, go to www.ieeevtc.org and click on 'Get email updates' on the left hand frame. This address - www.ieeevtc.org - is also the place to go for information about past and present VTCs.



Chapter News and Meetings

Gaspar Messina, Senior Editor

Society Speaker Program

Two new speakers have been added to the Society Speaker Program. They are Professors Lajos Hanzo from the University of Southampton, UK, and Mehrdad (Mark) Ehsani from Texas A&M University. Details of their topics are as follows:

Lajos Hanzo

Adaptive Wireless Transceivers
OFDM and multicarrier spread spectrum



During his 25-year career in telecommunications Lajos Hanzo has held various research and academic posts in Hungary, Germany and the UK. Since 1986 he has been a member of the academic staff of the Department of Electronics and Computer Science, University of Southampton, UK, where he currently holds the Chair in Telecommunications. As a member of the TRUST and JOCO multinational European consortia and funded by the European Community as well as the Engineering and Physical Sciences Research Council (EPSRC) UK, he is currently conducting research towards the next generation of wireless multimedia systems. He published widely in Wireless Multimedia Communications, including ten books and in excess of 400 research papers, organised and chaired conference sessions, presented overview lectures and was awarded a number of distinctions. He manages an academic research team and he is a member of the IEE and senior member of the IEEE. He also conducts research under the auspices of the Virtual Centre of Excellence in Mobile Communications in the UK. For further information on research in progress please refer to <http://www.ecs.soton.ac.uk>

Mehrdad (Mark) Ehsani

Hybrid Electric Vehicles
Advanced Vehicle Power Systems
Vehicle Power Electronics
Vehicle Motor Drives



Professor Ehsani has been at Texas A&M University, College Station, Texas since 1981 where he is now a Professor of electrical engineering and Director of Texas Applied Power Electronics Center (TAPC). A VTS Avant Garde Awardee, he has 13 granted or pending US and EC patents. His current research work is in power electronics, motor drives, hybrid vehicles and their control systems. Professor

Ehsani has been a member of IEEE Power Electronics Society (PELS) AdCom, past Chairman of PELS Educational Affairs Committee, past Chairman of IEEE-IAS Industrial Power Converter Committee and past chairman of the IEEE Myron Zucker Student-Faculty Grant program. He was the General Chair of IEEE Power Electronics Specialist Conference for 1990. He is the chairman of the IEEE VTS Vehicle Power and Propulsion and Convergence Fellowship Committees, and is the associate editor of IEEE Transactions on Industrial Electronics and IEEE Transactions on Vehicular Technology. He is a Fellow of IEEE, and in addition to VTS, is a Distinguished Speaker for the Industry Applications Society and the Power Engineering Society.

The other distinguished lecturers are:

Jack Winters, AT&T Labs, Middletown NJ

- ◆ Adaptive antennas
- ◆ Propagation measurements
- ◆ Smart antennas

Bharoti Sinha, Univ of Roorkee, India

- ◆ Antennas for handsets
- ◆ Interaction of EM energy radiated by handset with human body

Linda Sue Boehmer, Clairton PA

- ◆ Microprocessors in Rail Transit Controls
- ◆ Computer Training
- ◆ Multi-Media Training

William J. Fleming, TRW, Washington MI

- ◆ Automotive sensors and actuators

Society speakers are available to any IEEE entity in need of a society speaker.

To request a speaker either contact the speaker directly or the coordinator.

Gaspar Messina

9800 Marquette Drive
Bethesda MD 20817
Tel: 1 (202) 418-1348
Fax: 1 (202) 418-1412

There is a subsidy for speaker travel/lodging expenses available from Society, but this requires advance approval.

Conference of Interest

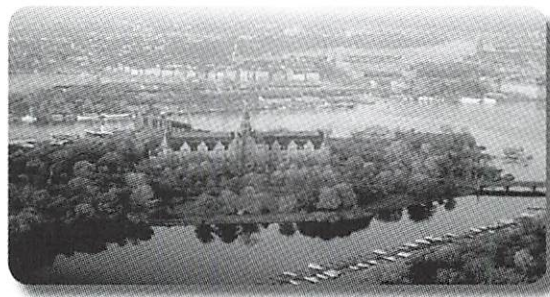
The following table shows VT-06 sponsored and co-sponsored conferences as well as related conferences not sponsored by the Society. While every attempt was made to ensure accuracy, you should contact the respective conference committee to confirm date and location.

DATE	CONFERENCE	LOCATION	WEB PAGE	
14-17 June 2004	IEEE Intelligent Vehicles Symp	Parma, Italy	http://www.ieeeiv.org/	
20-24 June 2004	ICC 2004	Paris, France	http://www.icc2004.org	
27-30 June 2004	IST2004	Lyon, France	http://www.mobilesummit2004.org	
30 August - 2 September 2004	IEEE Int. Symp on Spread Spectrum Techniques & Applications	Sydney, Australia	http://www.isssta2004.org/	
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	✓
16-20 May 2005	ICC 2005	Seoul, Korea	http://www.icc05.org	✓
29 May - 1 June 2005	VTC 2005-Spring	Stockholm, Sweden	http://www.vtc2005spring.org	✓
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 June 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.

IEEE 61st Vehicular Technology Conference VTC2005-Spring: Paving the Path for a Wireless Future

29 May - 1 June 2005 Stockholm, Sweden



Welcome to Stockholm, the beauty on water, set on fourteen islands each with a charm of its own. The conference will focus on the current state and trends of the wireless industry and research communicaties. Technical papers and posters and tutorials will be presented in (but not limited to) the following list of topics:

Transmission Technology

Source and channel coding • Modulation • Equalization • Synchronization and channel estimation • Transceiver design • MIMO systems • Software defined radio • Iterative Receivers

Wireless Access

Radio interfaces • Ultrawideband (UWB) • Spread-spectrum and CDMA • Multicarrier and OFDM • Multiple access and multiplexing • Mobility management • Radio resource management • Affordable wireless infrastructure • Interaction between fixed and wireless networks

Mobile Networks

Wireless Quality-of-Service • Ad-hoc networks • Ambient wireless networks • 3G evolution • 4G scenarios • Mobile satellite systems • Mobile network security • Scheduling in wireless networks • Cross-layer interaction

Antennas and Propagation

Radio propagation • Antenna systems • Channel modeling • Smart antennas

Mobile Applications and Services

Location dependent services • Adaptive mobile services • Service platforms and networks • Mobile gaming and entertainment • Navigation services

Transportation

Intelligent transport systems • Energy conversion and electrical traction systems • Telematics and infotainment • Vehicular on board and off board electronics • Intelligent vehicle safety and security systems • Advanced vehicle diagnostics • Fuel cells for vehicle and mobile applications • Advanced railway safety and communication systems • Maritime and airborne information and communication electronics

Abstracts due **15 September 2004** See www.vtc2005spring.org for details