



AUTOMOTIVE

Networking for Automated Buildings

No implications predicted for these technologies in this industry.

Networking for Engineering

The move towards "fly-by-wire" automotive management systems will draw upon these fundamentals of engineering and network integration. While the actual network and original equipment will be a given in terms of a service and maintenance technicians, problem solving will be critical for the success of the future automotive service person and an understanding of networking protocols more important. Additionally, retro-fitting of devices will become more of a concern in order to ensure the integrity of the mission-critical aspects of the vehicle.

Next Generation Telecommunications Networks

No implications predicted for these technologies in this industry.

Wireless Personal Area Networks (WPANs)

The use of a WPAN is ideally suited to a motor vehicle as the distances between devices within the cab will be limited to an acceptable range and the use of cables to connect devices are cumbersome. For this reason the IEEE 802.15 will be the technology used. Major motor vehicle manufacturers including BMW, General Motors, and Daimler Chrysler are planning to include this technology in 2003¹ and it is estimated that by 2007 between 20 to 42 percent of all vehicles worldwide will be fitted with this technology.² It is important to note that this the sales of enabled devices was .6 million in 2000 and is expected to be 1600 million in 2006. The anticipated estimated working life of the equipment is much shorter than the life of a motor vehicle and compounded with enhancements of software. It is likely that there will be an increase in the number of vehicles that are retro-fitted with IEEE 802.15 enabled "hands-free" systems and this will begin to occur very soon.³

An important note here is that "telematics" is a general term for communications intra- and inter-vehicle in the automotive industry and this may not only include IEEE 802.15 enabled devices but also devices that record and store engine performance for capture by service centres. It will be important to distinguish between IEEE 802.15 systems (for user's voice and data) and vehicle performance monitoring by service managers.

One area termed telematics by US and European manufacturers is a high value service for subscribers that allows for emergency attendance or assistance for the user. General Motors' OnStar service for Cadillac and 35 other models includes features such as voice-activated dialing, navigation, roadside assistance and remote diagnostics.⁴ The OnStar system is an

integrated cellular telephone within the vehicle and is separate to a mobile handset. The demand for these services is yet to be realised in Australia as many individuals hold memberships in automotive clubs that provide road-side assistance and navigation may not be necessary in familiar areas. Voice activated dialing is already a capability of mobile handsets.

Wireless Local Area Networks (WLANs)

The WLAN technologies will be able to provide a radio link of on-board data to diagnostic equipment without the use of cables. In personal automobile servicing may use this method for data transfer⁵ with some estimates stating that 12 percent of vehicles will contain this technology by 2007.⁶ However, the use of this technology will more likely be for fleet management and larger vehicles such as transport equipment or earth moving equipment where physical access and cable length may be more difficult.

There are some installations in place with transport and mining equipment where real-time data is collected via a satellite communications system. While this is a different technology to the WLAN, the principle of data transmission from vehicle to database is the same. For fleet vehicles that return to a depot for transfer of goods, such as courier services, this technology provides a quick method of down-loading client information, content of the vehicle as well as travel distance, fuel consumption and other fleet details.

For larger and more expensive vehicles, monitoring of vehicle performance is more critical in terms of cost efficiencies and maintenance requirements. Reconfiguration of engine attributes is able to be done remotely while the vehicle waits at a service bay and this may depend upon the loading of the vehicle or other aspects. Maintenance is also able to be assessed from on-board data transmitted to a service centre and only those necessary maintenance routines carried out instead of a planned maintenance schedule based upon distance travelled.

Wireless Broadband

Limited application for these technologies apart from mobile telephony. MeshNetworks WLAN does provide for vehicle access as does 3G mobile telephony. Daimler Chrysler has tested a vehicle with the European Universal Mobile Telecommunications System (UMTS) that is specifically designed for vehicles.⁷ Automobile users may adopt for petrol-station based WLANs for access to the Internet or rely upon downloading compressed data via the 3G mobile telephony systems.

Electricity Production and Distributed Generation

As electricity generation is stationary, there is little impact for this industry from this technology.

Micro Gas Turbines and Gas Fired Cooling

As this technology applies to stationary power generation there are no applications expected.

Renewable Energy and Power Electronics

Limited application for this industry in wind and solar energy. Power electronics are likely to become more prominent in automotive electronics.

Fuel Cells

Beginning in 2004, Australia will be testing fuel cell busses. While there may be some proto-typing of private vehicles, the first genuine applications will most likely be in premium power locations such as long-hole mining equipment. Passenger vehicles will continue with petrol-based engines within the time period that this report covers.

Embedded Processing

One third of the embedded processors are used in the automotive industry. This use is expected to increase as automotive manufacturers employ more processing power within vehicles. The move to “fly-by-wire” where electric signals are sent from one device to another (as in accelerator control to the throttle) are expected to increase. The automotive technician of the future will be more of an electronics expert than mechanical.

Field Programmable Gate Array Microprocessors

As demonstrated above, the automotive industry will be one of the major users of this technology. While manufacturers will be providing training early for high-priced premium automobiles, there will be continuing development in down-stream product offerings. This technology will provide enhanced product abilities thus increasing competitive positions but also enable lower costs for manufacturers.

In the commercial and industrial markets this technology has the ability to transform the performance characteristics of the vehicle. This will provide for greater efficiencies in performance that will be able to better suit the local conditions.

Microelectromechanical Systems

This industry current has one of the largest uses of MEMS of all of the Shared Technology industries. The expected increase in use within automotive equipment will require greater awareness and sensitivity to the maintenance and repair of motor vehicles.

BUILDING AND CONSTRUCTION

Networking for Automated Buildings

The move towards more automation and cabling requirements will see the need for increased knowledge and understanding of the networked systems by members of this industry. This includes anticipation of new technologies in the design process, future changes in occupancy requirements, appropriate construction planning, and installation of various devices. The automated building will become a networked system that behaves in a similar way to a Local Area Network (LAN) computer system.

Networking for Engineering

Issues relating to this industry have been more completely covered in Chapter 3 – Networking for Automated Buildings.

Next Generation Telecommunications Networks

Telecommunications is as ubiquitous an essential service as electricity but more technologically up-gradable, members of this industry will need to consider issues such as access to conduit and communications risers as well as refurbishment of existing infrastructure. While electricity cabling provides a single resource, telecommunications will provide many more services and in terms of the utility of the building. Members of this industry will need to provide for greater access to these technologies.

Wireless Personal Area Networks (WPANs)

The review of the literature for this report did not uncover any discussion of WPAN technology. This is not unreasonable as WPAN devices are primarily for mobile applications. There are some emerging applications for a wireless local area network (See Chapter ___) to be used but commercial applications will tend to stay with a cable-based solution for greater reliability and security.

Wireless Local Area Networks (WLANs)

The WLAN technology provides for greater flexibility in communication design. As this technology is wireless and does not need structured cabling in working spaces, WLAN technologies are of benefit where office partitions are frequently reconfigured or where individuals change seating locations. This technology also allows for an easier retro-fit of some sensing devices such as thermostats for HVAC applications as cabling is not necessary.⁸

Architects and builders will need to become aware of the implications of using materials that reduce the efficiencies of WLAN radio transmissions. Collocation of interfering Industrial Scientific and Medical (ISM) spectrum equipment and access points will need to be planned for as devices such as

video security links, lighting and other equipment.⁹ Equally the positioning of the access points has become a major part of commissioning a WLAN system.

Wireless Broadband

Limited impact on this sector as access points and antennas will be added-on to buildings rather than used within the building structure.

Electricity Production and Distributed Generation

Distributed generation will require buildings to be more integrated with power systems including storage tanks for thermal energy. *This needs more work*

Micro Gas Turbines and Gas Fired Cooling

The technologies mentioned here will have a significant impact on the design and construction of integrated HVAC systems. Additionally, retrofit activities can be expected as the energy market becomes more deregulated and peak-load pricing begins to impact upon profitability for industry. The residential market is unlikely to utilise this technology.

Renewable Energy and Power Electronics

New and innovative uses of materials and building design will see an increase in the use of renewable energy systems. The retro-fitting of these technologies and others such as water collection, conservation and treatment to existing buildings will require new skills. Closer integration with electrical technicians will also be required.

Fuel Cells

Few applications of fuel cells are likely for distributed generation and no additional skills will be required in this area.

Embedded Processing

One third of the embedded processors are used in the automotive industry. This use is expected to increase as automotive manufacturers employ more processing power within vehicles. The move to “fly-by-wire” where electric signals are sent from one device to another (as in accelerator control to the throttle) are expected to increase. The automotive technician of the future will be more of an electronics expert than mechanical.

Field Programmable Gate Array Microprocessors

Apart from building automation systems, this technology will have little impact.

Microelectromechanical Systems

This technology is widely used within thermostats and other sensing devices. Continued development is expected that will require the awareness of systems and their interaction with the environment.

ENGINEERING

Networking for Automated Buildings

Limited impact of these technologies in automated buildings. Please see Chapter 4 – Networking for Engineering for a more complete review of applications in the area of networking.

Networking for Engineering

As this chapter has dealt exclusively with engineering, this industry area will be greatly affected by the next generation of networking technologies. Legacy facilities will continue to operate and large vendors will continue to provide proprietary systems into process and manufacturing automation. These vendors will need to continually revise product offerings to ensure that they are matching the flexibility and interoperability of the open systems approach. Conservative decisions regarding new process engineering facilities in recent times has not permitted the adoption of newer fieldbus technologies to be demonstrated. Continued attention needs to be paid to this area.

Next Generation Telecommunications Networks

Benefits to this industry will come in the form of greater access to remote and network connected devices. Individual devices will have Internet addresses to allow for greater communication and interoperability.

Wireless Personal Area Networks (WPANs)

In process control, manufacturing and other structure-based locations, IEEE 802.15 will not be a likely solution. There is the possibility that remote and non-networked devices may be enabled with this technology for intermittent readings.

Wireless Local Area Networks (WLANs)

A structured cable infrastructure will continue to be the preferred option in most instances however the use of a WLAN does have some advantages. As the 802.11 standard is designed to meet the 802.3 Ethernet standard, once the data from a device reaches the wired LAN the data loses the encryption and other WLAN related attributes. Therefore the WLAN is a logical extension to the LAN when appropriate. The major benefit will be for environments where cabling is inappropriate due to frequent reconfiguration of a process or in a manufacturing facility with reconfiguration of the physical layout.

Additionally, where a service person is required to cover large areas within a facility to perform maintenance and troubleshooting, the WLAN provides for easy access to the Internet or the enterprise's intranet or database.¹⁰

Micro Gas Turbines and Gas Fired Cooling

It is unlikely that this industry will see an impact from this technology.

Renewable Energy and Power Electronics

Note to author - need to consider this more carefully

Fuel Cells

Few applications planned for this industry in the time period that this report covers.

Embedded Processing

Members of this industry will need to remain aware of the increasing availability of superior devices. The ability to create an integrated system with increased data recording capacity will be a challenge for those who have not engaged in professional development.

Field Programmable Gate Array Microprocessors

While not present in all process and manufacturing automation installations, some sites will benefit from the ability to be reconfigured for changing requirements. This technology combined with wireless communications can provide for highly flexible and responsive automation design.

Microelectromechanical Systems

This industry has the potential to have many structural changes take place. As much of process and manufacturing automation is based upon digital signal processors, the ability to have both electromechanical and digital process on one silicon chips can create substantial change. Conservative views may have to give way to these newer and highly-sensitive microprocessors.

ELECTRICAL

Networking for Automated Buildings

The move towards a more integrated building especially within residential buildings will require electricians to become more knowledgeable of the various types of cabling requirements. Network cabling testing will require greater levels of attention and performance by members of this industry. Future networks will require testing of cabling to increasingly

faster data rates and poor connections or inappropriate fixing of cables will be noticed by clients demanding these fast data speeds.

Networking for Engineering

The cabling infrastructure for process and manufacturing automation is moving towards high-speed Ethernet and will require greater care and up-skilling in new cabling technologies. Electrical technicians will also need to understand the particular requirements of the network protocol to be installed to ensure that maximum data speeds are able to be realised.

Next Generation Telecommunications Networks

Members of this industry will need to decide where their competencies begin and finish. Infrastructure construction is well suited to this industry but managing communications networks require skills more related to information technology than cabling. An awareness of issues relating to data speeds, interference and testing within and between cabling types and connections will be fundamental to the integrity of the network.

Wireless Personal Area Networks (WPANs)

IEEE 802.15 is unlikely to have many applications in this industry.

Wireless Local Area Networks (WLANs)

Within new construction, system electricians are installing structured cabling and are being called upon to do more of the telecommunications infrastructure as well. As present, most cabling installers are providing cable up to the telecommunications equipment. As the technology becomes more common it is likely that the installer will be attaching WLAN access points to the network as another piece of communications equipment.

Site surveys will need to be undertaken in order to establish the correct location of the access points and to ensure that there is minimal interference with other equipment and access points once the location becomes operational. Additionally, location of the access points becomes important when it is recognised that the signal will travel outside of the physical premises and be available to non-secure locations.

Wireless Broadband

This area is likely to become involved in site-surveys and connection testing. Development of the access point (that is the main transmitter) will most likely remain with telecommunications due to the high degree of installation engineering. Issues similar to those arising in the Wireless Local Area Network (See Chapter 7) will arise as well as combined high-level operations and commissioning with telecommunications engineers.

Electricity Production and Distributed Generation

The expected increase in distributed generation will require the development of skills to install, commission and maintain this new capacity. Operatives will need to ensure that optimum levels of efficiency are being met through advanced control and monitoring systems.

Micro Gas Turbines and Gas Fired Cooling

This industry will install, commission and maintain these systems on an increasing basis. The adoption of this technology will see electricians become involved with connections from the distributed generator to the building and to the grid. Maintenance and remote monitoring will also involve members of this industry.

Renewable Energy and Power Electronics

This industry will be affected by the increase in the numbers of individuals involved in installing and maintaining these systems. Power electronics will become more important in the design and construction of renewable energy systems.

Fuel Cells

While no large scale installations are planned, portable fuel cells will become more popular and will require maintenance. Technical operatives in this area will need to become more familiar with the concepts used in this technology.

Embedded Processing

This industry will need to become more familiar with the capabilities of fitted devices. As the devices increase in number and capacity, operatives will need to ensure that issues regarding compatibility are resolved. Additionally, these technicians will need to be able to advise their clients in relation to the installation of new equipment. This will require continuing professional development.

Field Programmable Gate Array Microprocessors

As Programmable Logic Controllers (PLCs) had a significant impact on electricians, this technology will have a similar impact. While the actual programming is likely to be done by vendors or specialists, the installation and test will need to be done by this type of technician.

Microelectromechanical Systems

This technology has the potential to significantly transform the technology for switching equipment. It may be possible to remove macro-switches and replace these with microprocessors. Technicians in this area will need to be aware of the likely transition from these larger devices to computer-driven microsystems.

ELECTRONICS

Networking for Automated Buildings

Devices installed in automated buildings will contain greater levels of electronic sophistication. The newer network systems will allow for devices to operate in a peer-to-peer relationships without necessarily communicating through a central location. This will present challenges for electronics personnel who will need to problem solve interoperability issues among supposedly compatible devices.

Networking for Engineering

The interoperability of devices connected to the process and manufacturing automation networks will require additional problems to be solved. As these devices are to connected to an Internet-based network, electronics technicians and instrument technicians will need to understand these issues. Not only will data be collected for control purposes but also for management information. This will create new pressures for real-time data to be used in different ways and by different individuals and will create new challenges for electronics and instrumentation technicians.

Next Generation Telecommunications Networks

This industry will play a dominant role in the commissioning and maintenance of telecommunications systems. The nature of the next generation networks will see analogue voice playing less of role and packetised data becoming the predominant technology. In this aspect electronics plays an increasingly important role. The introduction of photonics and micro-electro-mechanical systems (See Chapter ___) into telecommunications requires this industry to further expand the definition of their boundaries.

Wireless Personal Area Networks (WPANs)

Consumer electronics will benefit enormously from this WPAN enabled devices. The interconnectivity within the home with an increase in digitally based devices will see data transfer much more prominent. Currently using infrared communications, owners of personal digital assistants can download software to use the device as a remote control. The possibilities of using the personal digital assistant to download a television schedule and click on a program for digital recording is a highly likely scenario. At present, the impact of this technology on consumer electronics has not been identified to the extent that is possible.¹¹

Wireless Local Area Networks (WLANs)

This industry will find that there will be an increasing number of devices entering that will have WLAN capability. These devices will also have embedded processors that will provide data to networks through a wireless connection. Members of this industry will be at the forefront in problem solving.

Wireless Broadband

Limited impact of these technologies in this area.

Electricity Production and Distributed Generation

Monitoring and control systems will need to be designed that provide for remote administration of these systems. Power electronics will become more instrumental in the development of reliable, real-time network control. Additionally reliability issues and power conditioning for network-connected computing equipment will become more important.

Micro Gas Turbines and Gas Fired Cooling

This industry will not be greatly affected by the adoption of this technology as existing electronic systems have already been developed.

Renewable Energy and Power Electronics

As many of these systems will be driven by the electronics and the number of sites expected to increase, there will be a need for more individuals with diagnostic skills to be involved in this area. Power electronics will play an important role in the management of these systems.

Fuel Cells

Some applications in power electronics will be necessary to utilise this technology. Growing use of power-hungry consumer devices will see micro fuel cells become more popular. Electronics technicians will be called upon to maintain this equipment as they do with computing and communications equipment. The first sales of this equipment will be by computer and mobile telephone handset manufacturers.

Embedded Processing

This industry will drive the design, implementation, commissioning and repair of these devices. Each person working in this area will be required to maintain an awareness of the merging of currently separate devices into single, compact microprocessors. This is likely to include more of a focus on radio frequency issues and network connectivity.

Field Programmable Gate Array Microprocessors

This industry will see the greatest impact from this technology. As the devices containing this technology will be serviced and maintained primarily by these technicians, there will need to be continuing professional development of existing operatives.

When combined with the ability to connect many industrial devices to a network, the assessment and re-configuration of these connected devices will be done increasingly through remote access capabilities.

Microelectromechanical Systems

This industry will see an expansion in the range of devices in consumer electronics and telecommunications that will impact on this industry area. This increase in applications will require technicians in this industry to continue with professional development.

I N F O R M A T I O N T E C H N O L O G Y

Networking for Automated Buildings

Devices installed in automated buildings will contain greater levels of electronic sophistication. The newer network systems will allow for devices to operate in a peer-to-peer relationships without necessarily communicating through a central location. This will present challenges for electronics personnel who will need to problem solve interoperability issues among supposedly compatible devices.

Networking for Engineering

Information technology operatives will play an increasing large role in the implementation of industrial automation. This includes network management, database management and software development.

Network management and administration will become central to these new systems. Enterprises supplying TCP/IP networks are managing the introduction through teams of engineering and information technology staff. As each discipline requires specialist operatives, the combination of both of these skill areas is unlikely to be found in one person. Information technology staff will find the installation of the new networks very familiar to well established computer local area networks.

Database management will become of increasing importance to the success of industrial automation. As the data is more easily captured, there is a tendency by some managers to ask for all available data to be archived for later use. This places increasing demands on database managers with billions of records being collected and stored.

Software applications will continue to drive the value of these new networks. Compared to previous technology where one person was able to manage a set number of controls, new systems will only alert the operator if a process is failing by utilising a “management by exception” approach. Software and smart devices will monitor, adjust and supervise operations without the need for human control and will use graphic descriptions of real-time data than numerical output.

Next Generation Telecommunications Networks

This industry will provide a dominant role in the management of the familiar Internet Protocol (IP) based communications systems with the decreasingly voice-focused and circuit-switched telecommunications network. The move to IP will have profound changes that will continue to

require members of this industry to re-skill. Fortunately, network management protocols will be familiar with the new protocols to be introduced and will find the transition easier than those familiar with traditional circuit-switched telecommunications

Wireless Personal Area Networks (WPANs)

The use of IEEE 802.15 devices has been developed for workplace use with file sharing, printing, and voice communications.

Wireless Local Area Networks (WLANs)

The transfer of files and data from mobile computing devices will continue to be the largest application for this technology. Network administrators and managers will need to ensure that the network remains secure. For cable-based equipment, the manager is able to control which devices are connected to a wired LAN but for wireless devices this is a growing concern not only for security of data but for the integrity of the network as well.¹²

Network managers will need to continually monitor access and integrity of the system even after the introduction of the “more secure” Advanced Encryption Standard (AES) as “un-hackable” systems are unlikely to exist. Network managers will also need to closely monitor data transfer rates as more enabled devices connect to the network and an increase in other devices operating in the 2.4GHz spectrum become more popular.¹³

Applications of this technology will increase in retail, hospitality, services, warehousing and many others with the likely exception of the health industry. Enterprises will wish to ensure that data collected from transient users is managed as well as information relating to the premises is communicated back to the user. This will require development of databases and interfaces that allow the user access to content and other data.

Wireless Broadband

Limited impact of these technologies in this area.

Electricity Production and Distributed Generation

The move to a more integrated network for the electricity grid will see further work being carried for Supervisory Control and Data Acquisition (SCADA) systems including bidding and billing systems. The existing grid needs to be transformed into an electronically controlled smart electricity network in order to handle the escalating demands of these new competitive markets in terms of scale, transactional complexity and power quality.

Micro Gas Turbines and Gas Fired Cooling

There is limited application for this industry. Many of the control systems have already been developed and monitoring of distributed generation is likely to be carried out by technicians from a generation background.

Renewable Energy and Power Electronics

Management systems for remote monitoring of renewable energy sites will be an important part of maintenance and efficient energy production systems. Software programs and web-based applications will need to be written to for ease of management by low-skilled users of these systems through to larger, commercial generators.

Fuel Cells

Apart from use as a battery recharging device, few new skills will need to be learned in this industry.

Embedded Processing

As this industry is familiar with change and processing in general, few challenges other than continuing professional development will affect technicians working in this area.

Field Programmable Gate Array Microprocessors

Skills in loading new programming requirements will become increasing diverse as a result of this technology. Application software will need to be developed to allow for user-friendly approaches that enable the easy interaction of users with these programmable devices.

Microelectromechanical Systems

While this technology is essentially a microprocessor, the information technology industry is unlikely to be greatly affected. The reason for this is that information technology is primarily a static, non-analogue industry and therefore applications are limited.

TELECOMMUNICATIONS

Networking for Automated Buildings

The increasing complexity of the next generation of telecommunications networks will see greater integration with carrier networks and building infrastructure. Moves to bring optical fibre closer to the desktop computer, integration of voice communications through the Internet, and the mobility of individuals throughout a network building will require greater knowledge and skills from members of the telecommunications industry in order to bring these technologies into operation.

Networking for Engineering

Little new technology will be employed in this area with the exception of some wireless technologies. Please also see Chapter 7 – Wireless Local Area Networks for more information.

Next Generation Telecommunications Networks

Obviously this industry will need to plan for skill development. Where this will come is more likely through an information technology path rather than “telecommunications”. The merging of Internet Protocol (IP) with voice communications will lead to single entity of information and communications technology (ICT).

Wireless Personal Area Networks (WPANs)

The IEEE 802.15 is likely to have a significant impact on the adoption of higher data-rate mobile handsets such as General Packet Radio Service (GPRS) or Code Division Multiplex Access (CDMA1x) wireless connections. Each of these will allow for faster data access and with mobile devices and computing devices enabled.¹⁴ The ability to dial-up the Internet becomes a much more realistic possibility with these higher speed connections and with a compatible phone and notebook computer with a larger screen, a user is able to more easily view the content.

Wireless Local Area Networks (WLANs)

The United States have been using this technology for some time and are reaching a mature market. An initial use of this technology was to provide free-of-charge to clients of restaurants access to the Internet through these public access points called “hot-spots”. As the popularity of the technology grows through laptop computers being enabled as a standard, there is the opportunity for telecommunications carriers to start profiting from this popularity. It is for this reason that Wireless Internet Service Providers (WISPs) are beginning to build networks of such hotspots with access to the Internet as part of a subscription for wired Internet access.¹⁵ Some locations believed to be suitable for these “hot-spots” are consumer locations such as hotel lobbies, cafes, airports, petrol stations and other similar venues.

The WLAN technology when used with the WPAN technology (See Chapter 6 – Wireless Personal Area Networks) provides for a entry into another developing technology called Voice over Internet Protocol (VoIP) (See Chapter 5 – Next Generation Telecommunications Networks). This provides voice access through a mobile phone using WPAN technology to a laptop computer enabled with Voice over Internet Protocol software. This means that no call is placed on the mobile network as it is using the WLAN to an access point at a “hot spot” to the Internet. Using this combination of technologies, a pseudo fixed-wired telephone connection is made and calls are part of the down-load volume within a Wireless Internet Service Provider’s account. The result is savings in mobile calls

but the down side is that cell hand over is not possible so the user needs to stay at that location. Quality of Service (QoS) may also be an issue.¹⁶

Wireless Broadband

High level of involvement with this industry as these technologies fit squarely with the Public Switched Telephone Network (PSTN). A high degree of problem solving and interference issues will arise before this technology becomes routine.

Electricity Production and Distributed Generation

Distributed generation systems will rely upon real-time networks reporting data critical to the maintenance of this infrastructure. Additionally, some technologies may require intervention but be geographically removed from a skilled workforce. Therefore robust and reliable communication systems are required to ensure remote access to these sites.

Micro Gas Turbines and Gas Fired Cooling

Many of the installations for distributed generation will be monitored remotely and secure and robust connections will be required.

Renewable Energy and Power Electronics

Remote monitoring systems will need to be devised to allow for efficient operation. This may require the use of satellite communications or other methods to connect to the generation sites.

Fuel Cells

Apart from use as a battery recharging device, few new skills will need to be learned in this industry.

Embedded Processing

The next generation of microprocessors is likely to include more networking and wireless communications features. This increase will have an impact on the telecommunications industry and will continue place it within a software-defined industry.

Field Programmable Gate Array Microprocessors

This industry will continue to benefit from the use of this technology. The dynamics of this industry will continue to experience rapid change and development. The large number of devices that are protocol-specific will need to be up-graded and this technology has already demonstrated that it is suitable for the task. Therefore technicians in this industry will continue to see the application of this technology in a wider range of devices.

Microelectromechanical Systems

The move to an “all optical” communications network will see the need for faster switching capabilities. While this technology is not yet mature in optical switching, the demand for a solution will see vendors pursuing this goal. Additionally, it is likely that current multi-processor devices will compact into single “system-on-a-chip” microprocessors that will combine the current range of digital signal processors. The technician in this area will need to continue with professional development.

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- ¹ Stackpole, B. (2003). *Look ma, no hands!* Electronic Business, 1 February, 2003. Available: <http://www.e-insite.net> Accessed 4 February, 2003.
 - ² Juliussen, E., & Magney, P. (2002). *Technologies for telematics systems: trends, outlook and opportunities*. Minnetonka, MN: Telematics Research Group. Available: <http://www.telematicsresearch.com> Accessed:7 February, 2003.
 - ³ Brown, A. (2002). *Bluetooth and telematics: at the heart of the wireless car*. Gartner. Reference No.: SEMC-WW-DP-0157
 - ⁴ Chatterjee, A, Kaas, H., Kumaresh, T. V., & Wojcik, P. J. (2002). A Road Map for Telematics. *The McKinsey Quarterly, Spring 2002*, pp. 100-110.
 - ⁵ Daimler Chrysler (2002). Data Greetings from Como. *Hightech Report, 2*. pp. 70-71.
 - ⁶ Long, M. (2002). *Bluetooth, Wi-Fi Get Ready to Hit the Road*. E-inSITE. 9 August, 2002. Accessed: 22 January, 2003.
 - ⁷ Daimler Chrysler. (2002). Daimler Chrysler Presents the World's First Vehicle with integrated UTMS Services in Berlin. *HighTech Report, 2*, pp. 72-74. Available: http://www.daimlerchrysler.com/research/research_e.htm Accessed: 17 February 2003.
 - ⁸ Continental Automated Buildings Association. (2002). *Technology Roadmap for Intelligent Buildings*. Ottawa, ON: Author. Available: http://www.caba.org/trm/TRM_English.pdf Accessed: 13 February 2003.
 - ⁹ Hundt, R. E., Newman, S., & Richards, J.E. (2002). Wi-Fi goes to Washington. *The McKinsey Quarterly, Autumn 2002*, pp. 150-152.
 - ¹⁰ Mintchell, G. A., & Yacano, F. (2002). Beam up some information, Scotty. *Control Engineering, 49(5)*. pp. 39-44.
 - ¹¹ Consumer Electronics Association. (2002). *5 technologies to watch*. Arlington, VA: Author. Available: <http://www.ce.org/publications/default.asp> Accessed: 7 February, 2003.
 - ¹² Hiller, K. (2002). *Wireless LANs: An Overview*. Gartner Dataquest. Reference Number: DPRO-88978.
 - ¹³ Australian Communications Authority. (2002) *WLANS Interference Management*. Canberra: Author. Available: <http://www.aca.gov.au/frequency/rlan-im.pdf> Accessed 10 February, 2003.
 - ¹⁴ Hunn, N. (2002). *Bluetooth - saviour of GPRS*. London: TDK Systems. Available: <http://www.tdksystems.com/support/whitepapers> Accessed: 7 February 2003.
 - ¹⁵ Hunn, N. (2002). *The continuing Evolution of the Wireless LAN Hotspots and the Banias Effect*. London: TDK Systems. Available: <http://www.tdksystems.com/support/whitepapers> Accessed: 12 February 2003.
 - ¹⁶ Hunn, N. (2002). *Bluetooth - Saviour of GPRS*. London: TDK Systems. Available: <http://www.tdksystems.com/support/whitepapers> Accessed: 7 February 2003.