

# WORLDWIDE TECHNOLOGY TREND OF ELECTRONICS PRODUCTS

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**Abstract:** Electronics products have undergone much significant advancement in recent years. Although the development trends have primarily been determined by the developed nations such as United States, Japan and the European countries, these trends have been largely driven by many principal drivers. These principal drivers can broadly be classified in terms of users, technologies and regulatory changes. This paper briefly examines these drivers as well as the technology and product trends in the sectors of telecommunications, consumer electronics and information technology products. Its implication to the training and skill development requirements for Hong Kong will also be examined.

## DRIVERS FOR CHANGES

Many new types of electronics products have emerged in the past few years offering innovative features that are made possible by recent advances in new digital technologies. In order to understand the way that new electronics products have evolved and developed in the past few years, it is prudent to examine the principal drivers for these changes. These principal drivers can broadly be classified in terms of users, technologies and regulatory changes. The changes in user requirements and behaviour have led to the development of many new technologies that in turn create new markets. Regulation changes, such as the introduction of stringent rules, or deregulation, can lead to incentives to develop new technologies or emergence of new products, or both.

In terms of new technologies, it can be broadly divided into five fundamental technology drivers:

1. The continuation of processing power increase following Moore's law
2. Increasing emphasis of Intellectual Property on silicon
3. Transmission technology in speed and connectivity
4. Storage technology in solid states and magnetic media
5. Electronics packaging technology in miniature products

These fundamental technology drivers will continue to dictate the development and trend of the electronics product in the future and by understanding these technology drivers one could better prepare for the technology trend in the coming years.

As a result of these principal drivers, the innovative electronics products are continuing to emerge heading for the following directions:

1. Digitalisation
2. Convergence
3. Connectivity
4. Miniaturisation
5. Standardisation

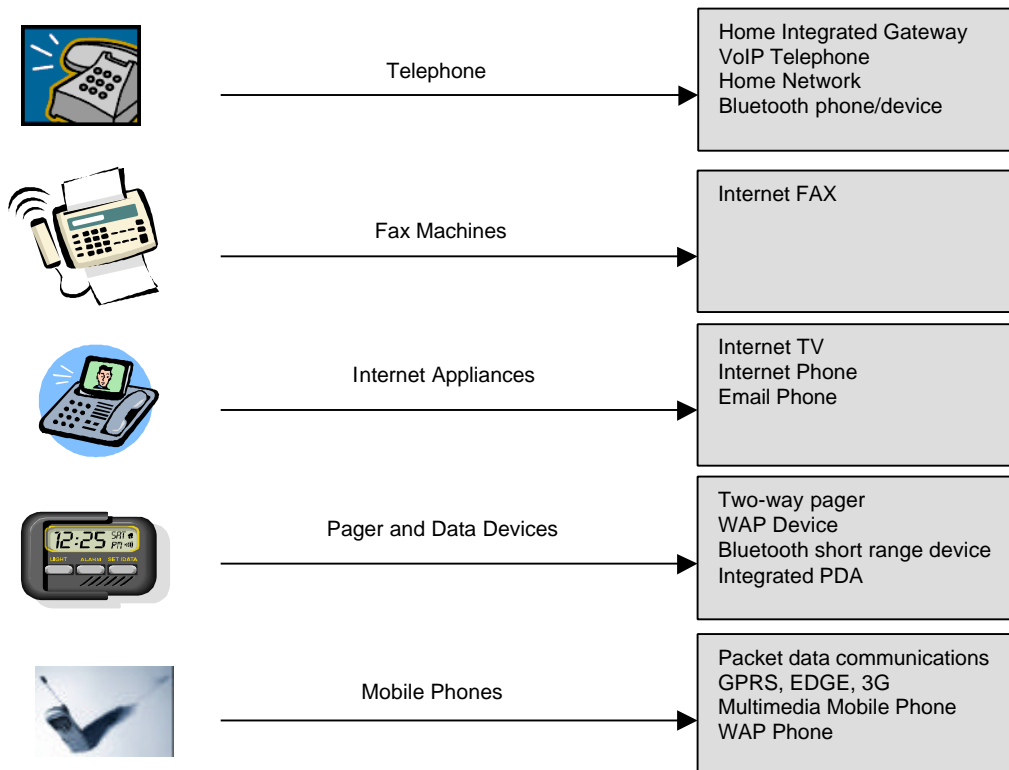
These directions are the attributes of new electronics particularly for a connected society. The pace of the development of these products in different countries will be determined largely by the pace at which the information infrastructure is established. Currently, Internet provides a means by which individuals can make use of innovative electronics products to work more efficiently, to be entertained, to communicate better, and to conduct their day to day personal business.

## TECHNOLOGY AND PRODUCT TRENDS

### Telecommunications Sector

This sector will play a major role in enabling the connected society to be more closely connected. The key areas for development in this sector in the next few years will be in wireless data communications and home applications. Figure 1 shows the major product trend of the telecommunications sector for a number of major product types. The general direction of these product trends are in enabling users to get connected to the Internet while they are on the move, in the office or at home. Some of these products are the result of convergence of the sectors of Information Technology and Telecommunications. Internet Appliances are the prime examples of this type of products.

With the looming introduction of GPRS (General Packet Radio Service), EDGE (Enhanced Data Rate for Global Evolution) and 3G (Third Generation Mobile Phone) over the next three years, users will be able to be continuously connected to the Internet while they are out of their office. With the packet based GPRS, to be available in Hong Kong in the later half of 2000, users will be able to be connected to the Internet continuously without the need to pay the hefty fee as with the current circuit switched GSM data services. The GSM service is currently charging on the time use



**Figure 1: Product Trend of the Telecommunications Sector**

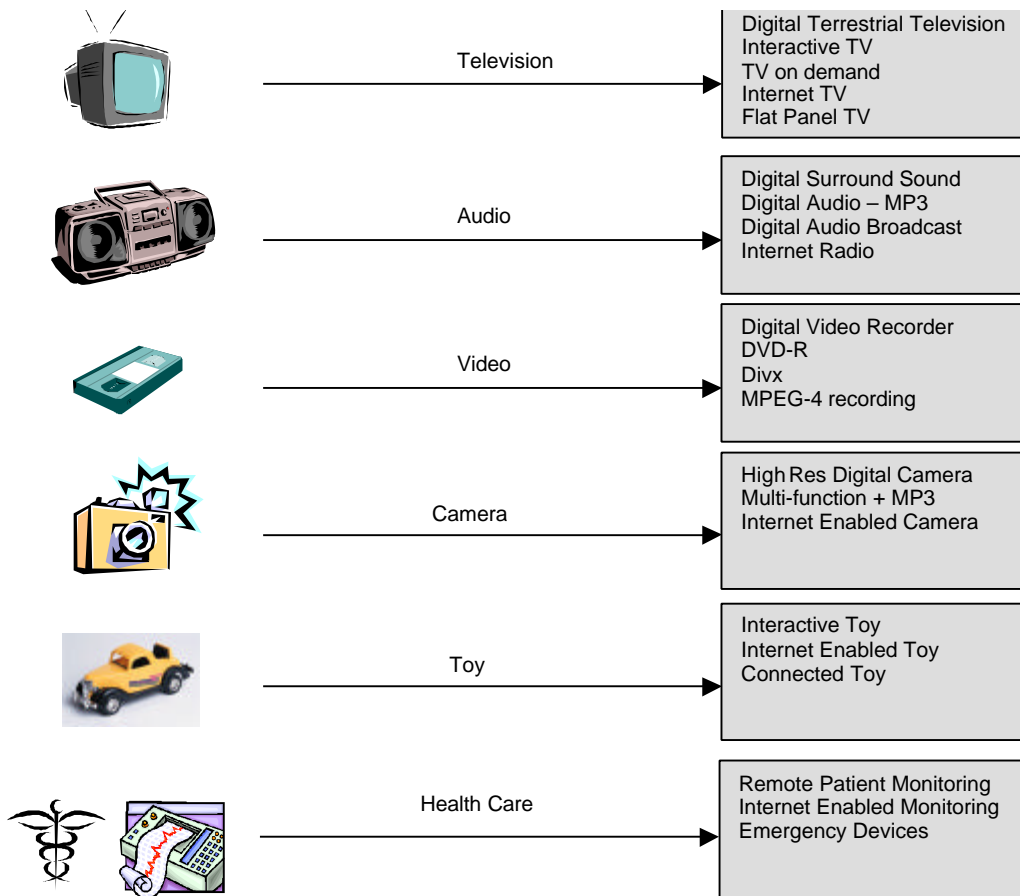
during the entire connection session while GPRS only charges for the bandwidth used in the transmission of data, regardless of the connection time. While GPRS will eventually increase the current connection speed from 9.6 Kbps to 114 Kbps, EDGE technology, to be available in 2001, will push the transmission speed up to 384 Kbps. With the likely increase in user demands on the bandwidth, 3G will offer broad band wireless communications of up to 2 Mbps. Products which are 3G capable are expected to come on to the market in 2002.

On the other hand, Bluetooth will not only bring wireless network connection to the office but also to the home as well. The low cost expected of Bluetooth components will allow many household products to be, "Bluetooth enabled". While inside the home, a home network can be realised by a Bluetooth network, the connection out of the home will also expect to undergo a fundamental change. Home gateway will play a major role. The connection out of normal home will gradually migrate from a normal telephone circuit switched connection to a packet switched data connection. Then, voice, data, Internet, cable TV, Interactive TV and fax lines will all be integrated into one single connection to possible the "Next Generation Network (NGN)" which is expected to replace the current giant telephone exchange networks.

The mobile phone will play a more important role in the connected society than a mere voice-based device. Already, there is the first version of WAP phones on the market which is only the first of this type of mobile phone based data terminal devices in the market. With the increase in available bandwidth with the new GPRS, 3G type technology, mobile phones will have multimedia features allowing not only voice but also video and other types of data to be communicated.

### **Consumer Electronics Sector**

Digitalisation has been a major technology trend of consumer electronics for the past years and it is going to be a prevailing trend for the years to come. Figure 2 shows the major product trend of the consumer electronics sector for a number of major product types. Digitalisation allows more functionality and processing to be performed in the data. For example in video recording, products, such as DVD (Digital Video Disk) players, play back many hours of video in a single disk through the use of compression technology. The compression and decompression technology requires the use of specialised digital signal processor chip to perform the necessary operations. As noted in previous section, intellectual property on-a-silicon is one of the main technology driver for this trend. With the continuous increase in the processing power of DSP and ASIC (Moore's law), more versatile and computational intensive features can be implemented. Many types of consumer products are no longer standalone products. The increase in processing power of the ASIC and processor allows these products to have built in functions to connect to the Internet.



**Figure 2: Product Trend of the Consumer Electronics Sector**

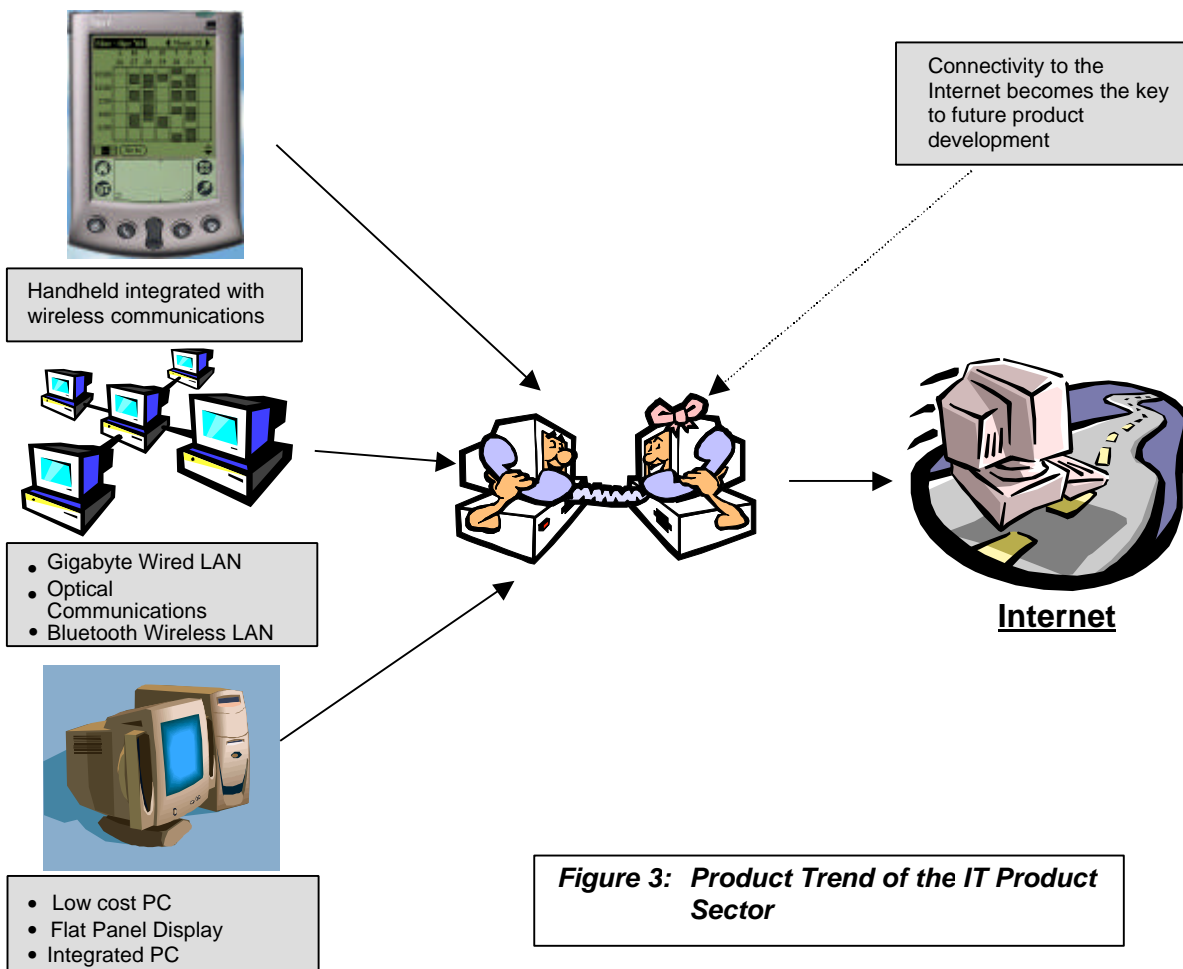
Indeed, connectivity to the Internet is another major technology trend of new types of consumer electronics products. Products such as digital still camera, MP3 players, electronics toy and games, radios and televisions all have their Internet enabled versions. Digital still cameras will have built in TCP/IP stack and modems such that it is able to dial up to the Internet and upload or email certainly pictures to a destination email address. MP3 players now longer will require the PC to download songs while they will have their own WEB browser built-in such that it is able to download songs from the Internet. Already, there are many video games that would make use of the Internet to achieve multi-player operations. ReplayTV and TiVo provide the service in the United States making use of the Internet to regularly update television-programming information and provide the user with a customised on-screen channel guide to make recording of video programs a one-touch operation.

Some products that emerge in recent years are the results of the convergence of the traditional sectors of Consumer Electronics, Information Technology and Telecommunications. For these products, with most of them with the ability to be connected to the Internet, they can no longer be clearly classified into either of the three traditional sectors. In effect, the growing trend is that the barriers between these traditional sectors are breaking down and many new products are expected to emerge. Some classify these products as convergence products.

## **Information Technology Product Sector**

The following adjectives will best describe the product trends of this sector: cheaper, faster, feature packed, connected, broad bandwidth, portable and flat. Figure 3 shows the major product trend of the information technology sector for a number of major product types.

Connectivity to the Internet is the essential product and technology trends of the information technology product sector. With the ever increasing use of the Internet, the demands on LAN and connection to the Internet in turn become a key driver for the growth in this industry. For local area network, the technology trend will head for two separate directions. For heavy traffic LAN, gigabyte or even ten-gigabyte networks will couple with optical fibres connected directly to the computer. The higher transmission speed will imply heavier reliance on optical communications and the proliferation of optical electronics closer to the client end. For most types of LAN, cable replacement Bluetooth technology will be the prevailing trend of wireless LAN. With the initial bandwidth of 1 Mbps and low component cost, Bluetooth technology offers integrated services allowing wireless transmission of both voice and data within the office.



Mobile Computing technology will see significant development in coming years. Wireless data transmission technologies such as GPRS, EDGE and the looming 3G allow handheld computers to be continuously connected. As with the way mobile phones have fundamentally changed the way users communicated by telephones, continuously connected handheld computers will allow users access to the important data in the office. The product trend in this area will be that handheld computer will have built-in wireless data transmission capabilities. First version of this type of handheld units is now available from major vendors such as Palm, Nokia, Ericsson and Motorola. Although many view these first attempts to be too clumsy, vendors will eventually perfect these units through more powerful processors and better packaging technologies.

## **THE IMPLICATION OF THESE ADVANCES**

The five technology directions noted in the first section of this report: Digitalisation, Connectivity, Convergence, Miniaturisation and Standardisation will form the basis for electronics products developed in the next few years with the first two being the major technology trends.

Digitalisation will demand for more powerful processors and versatile algorithms in the development of new products. These new algorithms or intellectual properties will be implemented in the form of ASSP or ASIC where most of the value add of a new product will lie. In the new economy, countries or regions that are able to develop and produce the IP, and subsequently the ASIC, will gain the most from the development of new products. Connectivity to the Internet poises to be the major trend across all three sectors. Following MetCalfe's law, the demand on the network utilisation will increase exponentially with the number of connected parties. The demand on products directly or indirectly related to Internet connectivity will increase significantly. Convergence of traditional sectors of information technology, telecommunications and consumer products will create opportunities for new product ideas.

With these trends being the main focus for technology and product development in the next few years, the implication for Hong Kong can be summarised in two major factors: human resources training and infra-structural support.

With the stronger emphasis on IP development and its implementation as ASIC or ASSP, Hong Kong as yet do not have sufficient infra-structural support in terms of their design and fabrication. Most electronics manufacturers in Hong Kong are system integrators with most major components such as processors, display and memory chips imported from overseas. The fact that Hong Kong manufacturers are merely doing OEM or ODM points to a danger that Hong Kong will lack behind in the new economy where IP is the main treasure. Complex IP (intellectual property) in algorithms and product functions is developed as full custom ASICs and/or firmware into silicon chips. IP on silicon has become the highest value added components in a product, thus allowing the originator to command the largest share of profits. The Silicon Valley phenomenon, then, should continue with more innovations and profits being realised at the chip level. The business prospect of product assemblers—as in Hong Kong—remains weak.

In terms of training, in order to compete with overseas competitors, there will be significantly more demands on skills such as digital electronics engineers, embedded software programmers, ASIC designers, electronics manufacturing and packaging engineers and RF engineers particularly for those having the skills and experience in the high frequency area (above 2 GHz).