Introduction

The purpose of this assignment is to discuss the factors determining network specification for a small business. A small manufacturing and design company has recently moved to new premises and require a network to be implemented, successfully connecting two buildings together. My job is to recommend an appropriate networking specification, detailing the required networking media and technologies required.

Task 1. Networking Media

Table 1 (attached) describes the different types of networkin g media, drawing comparisons, Depending on the factors:

- Maximum segment length (distance before attenuation)
- Cost
- Type of connector
- Advantages - such as cost, rate of data transfer
- Disadvantages – such as interference, usability

Analysing the different types of networking media will enable me to choose the appropriate cable configuration, as explained further on in task 2.

General Categories of Transmission Media: Coaxial, Twisted Pair, Fibre Optic
Refer to Table 1 for summary of information and compariso n.

Coaxial Cable

Coaxial cable is inexpensive and offers similar features to UTP and STP, in that it can transmit data at up to 100Mbps. It is advantageous compared to UTP and STP in terms of the distance it can travel before attenuating – 500 metres. This is five times the distance of UTP and STP. Coaxial cable is not as cheap as UTP, but still remains fairly inexpensive. It is also fairly flexible which means it can easily fit round corners, making many twists and turns. So, why not use coaxial cable? Although coaxial has various benefits over UTP and STP, it also has major problems. Coaxial cable uses a larger form of connector than either UTP or STP, called a BNC connector. This results in coaxial media taking up more space for installation. Workstatio ns are not ready-prepared for BNC connectors, meaning hardware would have to be upgraded.

The major problem with coaxial cable is that it has to be grounded prior to installation. Grounding is done by ensuring that there is a solid electrical connection at both ends of the cable. Because technicians often fail to do this, this results in poor shield connection and consequently, electrical noise that interferes with signal transmission. For this reason, coaxial is not appropriate for the proposed network.

Twisted Pair

UTP

Unshielded Twisted Pair is a type of cabling that is used for telephone communications and most Ethernet networks. The cable consists of a pair of wires which forms a circuit that can transmit data. The pairs are twisted to provide protection against crosstalk, which is the noise generated by adjacent pairs. Twisting the wires enhances the cancellation effect. This occurs when two wires are close together in a circuit a circular magnetic field is created. Because the two wires have opposite magnetic fields, they cancel each other out. The twisting of the wires is a 'self-shielding' method, which makes the wires less susceptible to noise.

Unlike STP, UTP does not have extra shielding, and therefore relies solely on the cancellation effect to reduce noise and limit signal degradation cause by electromagnetic and radio frequency interference.

UTP offers many advantages when used for an Ethernet network. Its small size makes cabling easier than other forms of cabling. UTP cable is easy to install and is less expensive than other types of networking media.

The only disadvantage associated with UTP when compared with STP is the fact that UTP does not have extra shielding. As described previously, this makes it more susceptible to noise and interference.

UTP is rated under different categories based on the number of twists and rate of data speed – Table 2.

STP

Shielded twisted pair is very similar to UTP, but combines the techniques of shielding, cancellation and wire twisting to improve its resistance to noise and interference. Each pair of wires is wrapped in a metallic foil and then the four pairs of wires are wrapped in a complete metallic braid or foil.

Although STP is more resistance to noise and interference, it does have its disadvantages. Due to the fact that the wire comprises additional shielding methods, it is more expensive than UTP. It is also more difficult to install as it is not as flexible, and has to be grounded at each end. This results in the installation of the media taking more time, thus increasing labour costs. If the media is improperly grounded, this results in more problems; the shield acts like an antenna and attracts unwanted signals.

Fibre Optic

Fibre Optic cable transmits data using modulated light transmissions. Compared to other forms of networking media, fibre optic is the most expensive. The reason it is more expensive is due to the fact that it is not susceptible to interference like coaxial, STP and UTP and is capable of higher

data rates than any of the other networking media discussed. Fibre Optic is also resistant to environmental issues which make it a good choice for future growth.

Even though light is an electromagnetic wave, light in fibres is not considered wireless because the electromagnetic waves are guided in the optical fibre. Fibre optic is therefore considered a form of guided media, like STP, UTP and coaxial.

Fibre Optic is available as multi mode and single mode. Multi mode uses multiple streams of LED (laser emitting diode) light whereas single mode uses one stream of laser generated light.

In terms of material structure, a fibre optic cable consists of glass fibre and cladding (the light guiding parts) which are covered by a plastic shield, Kevlar reinforcing material and then an outer jacket. It is connected by a multimode connector which is fairly small. The Kevlar material is used as a protector.

Fibre Optic provides many advantages over the other forms of cabling, but is inappropriate for this situation due to the fact that it is expensive, difficult to install and difficult to terminate. The business does not require data rates as fast as fibre optic cable offers; it is therefore not justifiable to pay the extra money for improved security and better resistance to interference. However, the multi mode 100baseFX can be used as the backbone to connect the two buildings that are 150 metres apart. This will enable faster rate of data for access to the web servers, internet and email from the design and engineering workgroup server to main facility in the other building (PoP).

Cabling Configurations

After evaluating the information present in Table 1, I have concluded that the most appropriate type of networking media to be used for this particular scenario is UTP and STP. UTP and STP offer many of the same features, but STP is slightly advantageous by being more resistant to interference than UTP. UTP and STP are appropriate for the small manufacturing and design company for the following reasons:

- UTP and STP are easy to install – they can fit around corners and are fairly flexible.
- The premises occupy 30x35m^2 each. UTP and STP can cover up to 100 metres without attenuating.
- UTP and STP are fairly inexpensive, UTP being the cheapest. Obviously, reducing costs is a priority for any small business.
- They use RJ45 connectors which most workstations can accommodate without upgrades – this is providing each workstation has a network interface card.
- Operate at speeds of up to 10 - 100Mbps – this is appropriate for the small manufacturing and design company as they are not sharing a great amount of data and are not running highly demanding programs.

- Operate on Ethernet networks.

Cat 5e UTP is now the current standard with more twists to reduce crosstalk. I, therefore, suggest this media to be used in each floor of each building for connecting user workstations to the Patch Panel and switches in the wiring closets. Cat 6 UTP is more reliable; having more twists than Cat 5e, but consequently, is slightly more expensive. Cat 6 UTP is currently the medium for 1000base TX; if future growth is to be considered Cat 6 is more reliable, though obviously cost will be higher.

In the next task I will compare the two forms of twisted pair cable and make a decision on which is the most appropriate to use.

Analysis of the current situation

The new premises consist of two identical buildings. Each building is 30m x 35m, consisting of two floors.
The area is therefore as follows:

Building 1 - 30 x 35m = 1050m^2
Floor area 1050 x 2 = 2100m^2

Building 2 – 30 x 35m = 1050m^2
Floor area 1050 x 2 = 2100m^2

Distance between the two buildings = 150m

Number of people in each building = 30

Hardware and Software analysis

Number of workstations = 30
Total number of workstations = 30 x 2 = 60

The system is currently used mainly for access to a shared database. However, 40% of the employees use design and graphics software.

Peripherals
1 printer on each floor – 2 printers in each building - 4 printers in total.

Networking specification

It is planned to set up a client/server wired network with access to internet and shared use of a printer on each floor. The printer therefore has to be a workgroup printer. The business is also considering wireless networking as an alternative to wired.

Summary of client specifications

Number of buildings to be networked: 2
Area to be networked in each building: 2100m^2
Number of users: 60
Number of workstations: 60
Number of printers: 4
Access to:

- Multi-user database
- Internet
- Graphics and design software

Technology to be used

After analysing the client's specification, I have come to the decision that an Ethernet technology should be used for the following reasons:

It is the most commonly used technology and is an inexpensive and flexible option when building a network on a small scale. Most Ethernet networks support speeds of 10 to 100Mbps although this can be increased using Gigabit Ethernet at an extra cost.

See table 3 for further information on comparing Ethernet media and speed available.

- 10/100 Mbps Ethernet is the most popular and widely used network specification.
- An Ethernet network uses UTP cabling which, already suggested as being:
  - cheaper than other forms of cabling
  - practical – easy to install
  - Uses RJ 45 connectors which is the standard connect or currently used in all computers.
  - Can run up to 100 metres without attenuating – this is suitable for the scenario as each floor is 35x30 metres.

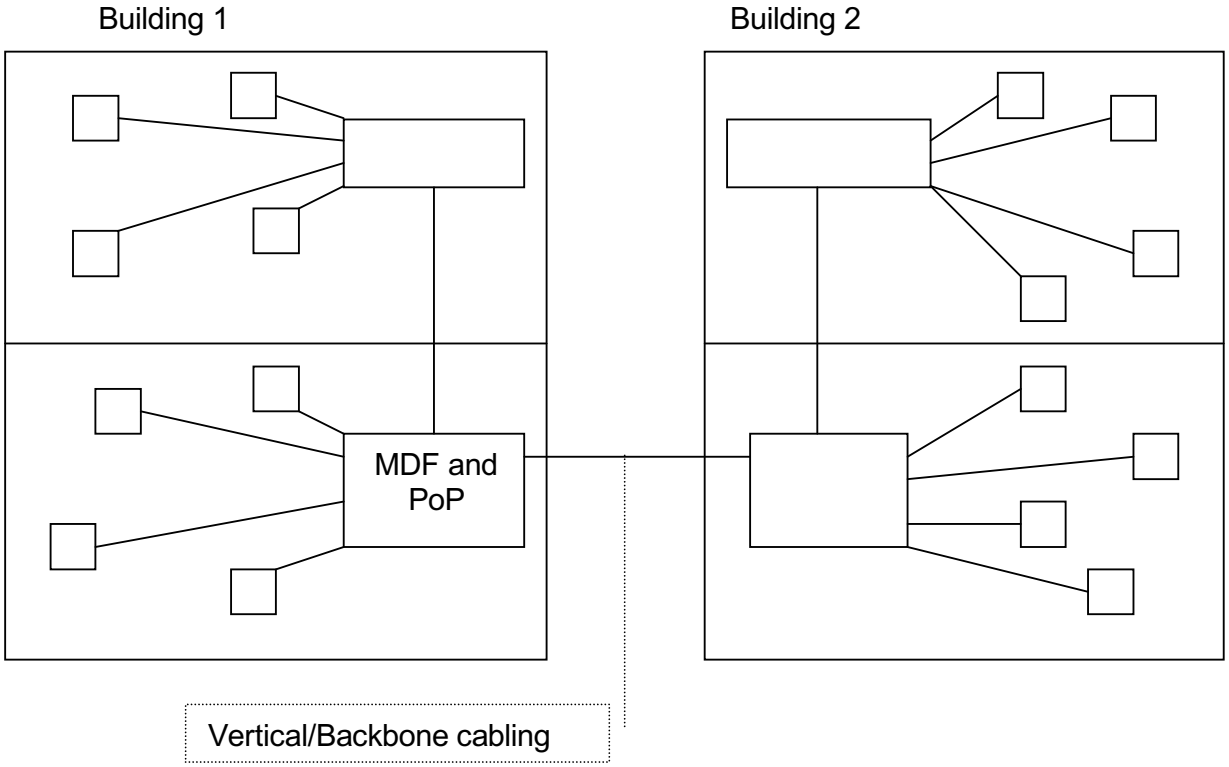
STP and UTP cable are both categorised as twisted pair and have been used for an Ethernet network.

Which topology to use

Due to the fact that the network consists of two buildings, the most appropriate topology is an extended star. A star topology is not suitable as it can only cover areas of 100x100 metres. The area the network needs to cover is greater than 1000m^2 and therefore an extended star is required.

An extended star topology uses hubs/switches to connect the clients together; an extended star is basically a number of stars connected together. In the instance of the manufacturing and design compa ny, there will be one star in

one building which is connected to the star in the other building. These stars will then be linked by a backbone cable.



IDF – Intermediate Distribution Facility
MDF – Main Distribution Facility

Backbone cabling

In order to efficiently serve the two buildings, I propose that a fibre optic cable be used as the backbone for the network. Fibre optic cable provides fast data rates and susceptibility to interference/crosstalk. Copper cable could be used but as data can only travel for 100m in Cat5e cable before attenuating, repeaters would have to be installed. Cat5e cable is twisted pair, and is therefore susceptible to interference and environmental conditions which is another reason it should not be used. Fibre optic cable, however , allows a signal to travel up to 60 miles before attenuating. Fibre optic will also allow the company to increase their bandwidth if required in the future, whereas copper cable is limited at gigabit Ethernet, and can only reach full potential if carefully installed to its delicateness.

4.

a) The standards and operations of modems (pass criterion 5)

Operation of modems

A modem (modulator-demodulator) is a device used primarily to communicate over telephone lines. A modem modulates an analog signal to encode digital information and then demodulates the signal to decode the transmitted information (digital – analog – digital). The overall objective of a modem is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data. In short, modems enable computer communication over telephone lines. However, modern and faster modems can transmit and receive data over cable lines.

The image below shows how a modem allows a computer to connect to the internet. The computer dials into the telephone network using a modem, the telephone network then connects to the ISP (Internet Service Provider) via another modem, the terminal then transmits back to the computer through the telephone network.

Modems can be internal or external and can be distinguished and compared by the following characteristics:

Speed: This is measured in bits per second (bps) or at very slow speeds, baud rate. The higher the number of bps, the faster the modem and transmit and receive data. Baud rate indicates the number of signal changes per second and is not always equal to bps.

Voice/data/fax: Most modern modems support both data and voice. When a modem is in voice mode, the modem acts like a regular telephone. Modems that support fax enable auto-answer, which is a technique used to answer calls when the user is not present.

Data compression: Modems that support data compression can send data at faster rates due to the data being transmitted in fewer bits. The CCIT's

compression standard for modems is V.44- which compresses data 25% more effectively than the previous compression standard – v.42bis.

Standards

Modems are also classified according to connection standards. The most widely available standard is V.90, but the latest standard is V.92. V.92 allows information to be sent more quickly and utilizes call waiting technology, enabling users to take a voice call, and then return to th e Internet without having to redial. Some ISPs do not support many of the standard features of V.92.

Standards exist to enable modems to be able to talk to each other. Listed below* are the standards for dial up modems:

- **Bell 103M** & **212A:** Older standards, Bell 103 transmits at 300 bps at 300 baud and 212A transmits at 1200 bps at 600 baud.
- **V.21:** Capable of only 300 bps, it is an international standard used mainly outside of the U.S.
- **V.22:** Capable of 1200 bps at 600 baud. Used mainly outside the U.S.
- **V.22bis:** Used in the U.S. and out, it is capable of 2400 bps at 600 baud.
- **V.23:** Used mainly in Europe, it allows the modem to send and receive data at the same time at 75 bps.
- **V.29:** A one-way (half-duplex) standard that is used mostly for fax machines. Capable of 9600 bps.
- **V.32:** A full-duplex standard capable of 9600 bps at 2400 baud. V.32 modems automatically adjust their transmission speeds based on the quality of the lines.
- **V.32bis:** A second version of V.32, it is capable of 14,400 bps. It will also fallback onto V.32 if the phone line is impaired.
- **V.32terbo:** The third version of V.32, capable of 19,200 bps.
- **V.34:** Capable of 28,000 bps or fallback to 24,000 and 19,200. This standard is backwards compatible with V.32 and V.32bis.
- **V.34bis:** Capable of 33,600 bps or fallback to 31,200.
- **V.42:** Same transfer rate as V.34 but is more reliable because of error correction.
- **V.42bis:** A data compression protocol that can enable modems to achieve a data transfer rate of 34,000 bps.
- **V.44:** Allows for compression of Web pages at the ISP end and decompression by the V.44-compliant modem, so transmitting the same information requires fewer data packets.
- **V.90:** The fastest transmissions standard available for analog transmission, it is capable of 56,000 bps.
- **V.92:** Transmits at the same speed as V.90 but offers a reduced handshake time and an on-hold feature.

*list of standards taken from webopedia.com

b) the operation of ISDN and ADSL (pass criterion 6)

ISDN

ISDN is an acronym for Integrated Services Digital Network and is a digital telephone service that provides fast rates of data transmission. ISDN is capable of data transfer rates up to 128kbps (twice the speed of a standard dial-up modem).

ISDN operates using channels, of which there are two types:

B-channel: The 'bearer' channel is a 64kbps channel which can be used for voice, data, video or multimedia calls.

D-channel: The 'delta' channel can be either 16kbps or 64kbps and is used for signalling between switching equipment on an ISDN network.

ISDN is delivered to the user in one of two configurations; either BRI (Basic Rate Interface) or PRI (Primary Rate Interface):

Basic Rate Interface is a standard connection used mainly in the home or small business. BRI consists of two 64kbps B -channels and one D-channel for transmitting control information.

Primary Rate Interface, however, is a connection used mainly in large organisations which require a more demanding service. PRI offers 30 channels (of 64kbps each), giving a total of 1920kbps. Similar to BRI, each channel can be connected to a different destination, or combined to provide a larger bandwidth.

ISDN has the following benefits when compared to standard dial -up (56kbps) connections:

- It's fast – ISDN calls typically dial and connect in 2 seconds.
- It's digital – each B channel is guaranteed 64kbps.
- It's multimode – each B channel can carry data, voice, fax or video.
- It concentrates calls – a PRI connection offers 30 channels (equivalent to 30 calls) through one cable, a BRI connection offers 2 channels .
- Multiple telephone numbers can be associated to the same line, thus saving the cost of separate, multiple telephone lines.

Key ISDN advantages are therefore:

Faster connection

Concurrent internet and phone use
Telephony with multiple users
Video conferencing

ADSL

ADSL is an acronym for Asymmetric Digital Subscriber Line, and is another form of high speed internet access through an ordinary telephone line. Data travels downstream faster than it travels upstream -- hence the name "asymmetric." Like ISDN, ADSL allows telephone use whilst being constantly connected to the internet. ADSL is a fixed charge usually paid monthly which allows unlimited internet use. Compared to ISDN, ADSL is a much faster method of accessing the internet – at best, even 100 times faster.

The following advantages are associated with ADSL:

- Always online – there is no need to dial up to access the internet
- Fixed charge – Users can stay online for as long as they wish without worrying about call charges.
- Concurrent use of telephone, fax and internet.
- High speed – Faster download of web pages, streaming audio and video. In theory ADSL allows download speeds of up to 9 megabits per second and upload speeds of up to 640 kilobits per second.
- Convenient and simple – ADSL does not require new wiring; it uses the phone line already available.

However, there are disadvantages associated with ADSL:

- Connection is faster for receiving than sending.
- Service is limited in certain geographical regions.
- Works best when close to the provider.

c) principles of two high bandwidth technologies for accessing the internet (merit criterion 3)

The two most popular high bandwidth technologies are **ADSL** and **cable**. These are usually referred to as 'broadband' technologies. ADSL is often used where cable is not available, as it works through a normal phone line. Cable internet however, has to be installed by an engineer and is generally only available in cities.

How ADSL works

Put simply, ADSL works by exploiting the extra capacity on a phone line to carry information.
ADSL is a distance-sensitive technology: the further the modem is from the service provider, the more the signal quality decreases and the connection speed goes down. Normal telephone calls are not affected by signal attenuation because they use small amplifiers called loading coils. Unfortunately this does not work for data – in fact, loading coils present between the point of ADSL connection and service provider will disrupt the service.
There are two standards for ADSL – CAP (carrierless amplitude phase) and DMT (discrete multitone). DMT is the official ANSI standard and is the most commonly used today – CAP was mainly used on the early installations of ADSL.

How CAP works

CAP works by dividing the signals on a telephone line into 3 bands – voice, downstream data and upstream data. The voice band operates on the band between 0 and 4KHz (kilohertz), upstream data (sending from user's computer to server) operates between 25 and 160KHz, downstream data (user's computer receiving from the server) operates from 240KHz and continues up to a point that changes depending on a number of conditions including line length, line noise and number of users, generally up to a maximum of 1.5GHz. The three channels are widely separated to avoid interference.

How DMT works

DMT works similarly to CAP, in that it divides the signals into separate channels; however, it varies from CAP in that data is split into 247 channels, each of 4 KHz. Each channel is monitored and data is consequently sent or received through the best possible channel. Some of the channels are bi-directional, meaning they allow both upstream and downstream data to travel simultaneously. Due to the fact that DMT uses 247 channels, it is more complex to implement than CAP, but offers greater flexibility and overall, a better service.

When installing ADSL, all telephone outlets used for voice have to be altered with the addition of a filter. These filters are known as 'low-pass filters' and are used to prevent the data signals from interfering with normal voice conversations. These filters block all signals above 4 KHz, which is above the maximum range for voice calls.

To make use of an ADSL service, the user must have a DSL transceiver, which connects the user's computer to the service. The transceiver usually connects via USB or 10BaseT Ethernet. The service provider has a DSL Access Multiplexer (DSLAM) to receive user connections.

Cable

Access to the internet using a cable modem is mainly provided by companies offering cable TV services. Unlike ADSL, cable works through a coaxial or fibre optic cable instead of a regular telephone line. Although this makes it harder to install and doesn't offer the flexibility of Cat5 UTP/STP cable, fibre optic cable is less susceptible to interference and consequently provides a better service. Theoretically, cable modems can be 100 times faster than standard dial-up connections, operating at speeds of 5 million bits per second (Mbps). However, most cable companies offer cable internet at speeds of 512kbps, 1Mb and 2Mb.

Signals sent over a cable wire are given a 6MHz channel. Internet information sent over a cable wire therefore travels in a 6MHz channel, just like a regular TV channel. Cable separates downstream and upstream data into different channels – downstream is received in a 6MHz channel, whereas data travelling upstream is sent in a 2MHz channel, due to the fact that is generally accepted that users download more than they upload (send).

In order to receive cable internet, the customer/user requires a cable modem. A cable modem comprises many components:

- A tuner – receives the modulated signal and passes it to the demodulator. If used with cable TV, also consists of a splitter which separates the internet data from cable TV channels.
- A demodulator – converts the analog signal to digital. (A-D converter)
- A modulator – converts the digital signal to analog for transmission on radio-frequency signals. (D-A converter)
- A MAC (media access control) device – the interface between the hardware and software network protocols.
- A microprocessor – Some MAC functions are assigned to the microprocessor.

At the cable provider's end, a cable modem termination system (CMTS) is used to manage incoming traffic. A CMTS will allow as many as 1,000 users to connect to the Internet through a single 6-MHz channel. A key advantage of cable over ADSL is that service is not compromised by the distance between the service provider and user. One disadvantage is that many users share the same channel, which can degrade performance below the theoretical maximum.

5. Compare the performance and cost of a wired network and a wireless network (distinction criterion 2)

Most small businesses use wired networks although wireless is growing in popularity. Wired and wireless technologies claim advantages over the other, and both are viable for local area networks for small businesses.

Performance of wired networks

Wired LANs offer excellent performance. Traditional Ethernet connections start at 10Mbps and can be upgraded to 100Mbps (fast Ethernet) for a small amount more. Wired networks operate using Ethernet cables, hubs and switches which are extremely reliable. The only common problem associated with wired networks is loose or damaged cables. An internet connection can be shared using a hub or switch. Switches provide better performance as they regulate the traffic on the network – ensuring the network doesn't slow down when users utilise the network simultaneously.

Performance of wireless networks

Wireless networks operate on a number of standards, which vary in facilities – mainly speed.

- 802.11b was the first standard to be widely used in WLANs.
- The 802.11a standard is faster but more expensive than 802.11b; 802.11a is more commonly found in business networks.
- The newest standard, 802.11g, attempts to combine the best of both 802.11a and 802.11b.

A wireless network operating on the 802.11b standard theoretically has a maximum speed of 11Mbps. This is approximately the same as traditional Ethernet, which has a maximum speed of 10Mbps. 802.11a and 802.11b networks operate at maximum speeds of 54Mbps – half the bandwidth of wired fast Ethernet. Like ADSL, wireless is a distance -sensitive technology, meaning the further away a computer is from the access point, the more the performance will degrade. Performance also degrades as more users utilize the network simultaneously.

Cost of wired networks

The networking components used in a wired network are relatively inexpensive. Some examples of wired networking components and prices:

Netgear 16-port 10/100 Mbps Switch £65.66

3Com OfficeConnect Ethernet Hub 16-port 10/100 £82.13

Cat5 Patch Leads £10.70 for 20 metres

The main disadvantages associated with costs in a wired network are that additional hubs and switches need to be purchased to accommodate extra computers. If the business plans to expand and employ more staff, this should be considered when first purchasing the networking equipment, as each component has a limited number of ports. Wireless networ ks, however, can accommodate a computer instantly as long as it has a wireless network card.

Cost of wireless networks

Wireless networks are slightly more expensive than wired but offer greater flexibility. Some examples of wireless networking components:

Linksys Wireless PCI 802.11g 54mbps network card Price: £37.97

D-Link Wireless Access Point 802.11g 54Mbps Price: £58.74

U.S Robotics 100Mb wireless turbo access point and router

Price: £61.26

Netgear Integrated ADSL Modem and 802.11g firewall router with 4 port switch

Price: £92.72

In comparison, wireless networking components are not a great deal more expensive than wired. However, wireless networking should be considered if flexibility is an important aspect of how the business operates. If staff are going to remain in one office on the same desktop every day of the week, spending money on a wireless network is not needed. However, if a large amount of employees use a laptop and would like the option of moving from one office/room to another easily, a wireless network should definitely be considered.

Each computer already owned by the company will be ready for wired networking, as they will all be fitted with a 10/100 Network Interface Card. If the company wishes to invest in a wireless net work, each computer will have to be fitted with a wireless network card (preferably 802.11g) at an approximate cost of £30 each. For 50 employees this works out at an extra £1500 initially. However, implementing a wireless network saves costs on installation and network medium – wires do not need to be purchased, engineers do not need to spend time wiring, holes do not need to be drilled in walls and the network will be ready to use in a much quicker time.

When considering whether to purchase a wireless o r wired network, there are many other factors (besides performance and cost) to be taken into consideration:

<u>Installation</u>

In a wired network, Ethernet cables must be run from each computer to another computer or to a central networking component – such as a hub. Running cables through walls and around corners can be time consuming and complex, especially when working with computers in different rooms.

Wireless networks can be configured in two ways:

- "Ad hoc" mode allows wireless devices to communicate o nly with each other – e.g. from one computer to another.
- "Infrastructure" mode allows wireless devices to communicate with a central component/device that in turn can communicate with wired components on that LAN – e.g. printer sharing, modem sharing etc.

Infrastructure mode is used mainly for businesses. In addition to a wireless NIC card for each device, a wireless “infrastructure” network requires an access point. This access point must be able to connect wirelessly with all dependent devices (usually 10 0 feet).

Security

Wireless networks have been subject to doubts on security for a long time. Due to the fact that wireless communication signals are unguided media, they travel through the air and can be easily intercepted by unwanted intruders. To combat this issue, WEP (Wired Equivalent Privacy) was introduced, which encrypts data sent wirelessly. WEP comes in different forms depending on the level of encryption. 64 bit encryption was the original implementation of WEP but proved too easy to decode - most wireless networks use 128 or 256 bit encryption.
Wired networks are generally more secure than wireless, and can be further protected using a firewall. Firewalls detect incoming traffic and make decisions on whether it is harmful or not.

Reliability

Wireless networks suffer from more reliability problems than wired, mainly because of signal interference on 802.11b and g networks. Because the performance of a wireless network is distance sensitive, performance will degrade on computers further away from the access point. Performance also degrades the more clients there are connected to a wireless network.

Because wireless networking products are newer than wired, it is inevitable that more reliability issues will be encountered on a WLAN.

Wired LANs have been around for more than 20 years and have therefore been constantly improved and updated to increase standards of reliability and performance. The most common problems encountered in a wired network are loose cables, which can prove to be an anno yance when equipment has to be moved around. Newer components for wired LANs such as broadband routers also face reliability problems, but this is generally because they have been developed more recently.

The table below summarises the findings of this ta sk:

	Wired	Wireless
Installation	moderate	easier

Cost	less	more
Reliability	high	good
Performance	very good	good
Security	reasonable	reasonable
Mobility	limited	easier

In conclusion, if cost is your main issue and you are not too concerned about the flexibility of your network, a wired LAN is probably the best option. However, the cost of building and implementing a wireless network is decreasing as technology becomes more advanced, so is definitely worth considering if prepared to pay a small amou nt more. Security on both types of networks is moderate – ultimately, regardless of whether you go for wireless or wired, your network will be as secure as you are prepared to make it, with the introduction of firewalls etc.
Both type of networks perform well and are generally similar in terms of reliability, although it is important to be aware of problems with newer hardware. Installing a wired network is more time consuming and costly, due to amendments to furniture/walls to accommodate cabling.