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1. Introduction

As stated earlier, the purpose of this book is to provide you the reader with a good top level understanding of the various pieces of the technology jigsaw, which most organisations need to employ these days in order to increase their ability to succeed. It is only after an organisation identifies the need to investigate the potential offered by technology that the full complexity of the interrelated issues becomes apparent.

Before going any further I feel it is necessary to explain what is meant by technology in the context of this book. In today's modern world most organisations have three basic needs for technology. These are separate to any technologies, which an organisation may be using as part of their core activity, and it is these three, which form our description of technology.

Telecommunications

Probably the piece of technology that most people are familiar with given the everyday use of the telephone both fixed line and mobile. Most people associate telecommunications with being able to dial a number and either talk to somebody, send them a fax or as is becoming very popular being able to send them a text message, but telecommunications has many more uses. For instance it can provide the ability to connect two or more computers together regardless of where they may be physically located. Many other uses exist for telecommunications, which we will look at later, but for the moment I will summarise telecommunications as being the carrier on which voice and data traffic is moved from one location to another.

Computerisation

The newest of our three forms of technology. Most people consider computerisation to be the box that sits on their desk with a screen, mouse and keyboard attached. It is these devices which they use to either enter information into a computer or to get information out, by way of the screen display or a printout. While this is computerisation, other forms also exist, many of which have greater abilities and while we will look at these later, at the moment I will summarise computerisation as being the

ability to accept data from a number of sources, review it, manipulate it or interact with it for the purpose of a user specified end result.

Connectivity

This technology was a subset of telecommunications until the arrival of computerisation and has since become a technology in its own right. This is because in the early days it was passive meaning that it only indicated what was occurring as telecommunications was being used (i.e. audible ringing tone, engaged tone, unobtainable tone, etc.).

But in modern days it has become active in that it can now be responsible for the establishment, negotiation and maintenance of a connection between two points for the purpose of sending and retrieving data. While we will look at this subject in more detail later, for now I will summarise connectivity as being the method by which two or more devices can be linked.

Even in my explanation of technology, as we are considering it for this book, words are being used, which may be unfamiliar to you the reader so, as these words appear, explanations will appear in *italics* directly after the word and they will also appear in the glossary at the back.

An example of how this will work is:

> *(Voice: Human speech, which has been converted into an analogue signal).*
>
> *(Data: Information, which has been converted into an analogue or digital signal).*
>
> *(Traffic: Means analogue or digital signals that are being moved from one point to another using some form of telecommunications connection).*

Other words appear such as analogue or digital signals and these will be explained in the section dealing with “Technology and its Development”. It is important that this section be fully read and understood before a reader moves to any of the other sections, as a failure to understand this section may lead to difficulties in other sections of the book. This is not to say that the subject matter of this book is very difficult, it more that the readers fear factor of the subject needs to be conquered, thus making understanding a lot easier. It is important that a reader believes in their own ability to understand the subject matter at its top level for they do not need to know what goes on in the lower levels as this is the responsibility of a technology specialist.

What a reader does need to know is:

What do I want technology to do for me or my organisation?

What are the general capabilities of technology?

What are the main components of technology I may need?

Once a reader has answered these questions he/she can begin to piece together what, in general terms, is best for their organisation and set about, with the aid of a technology specialist, preparing a technology implementation/review plan for their organisation. The need for such a plan is critical to the success of any organisation in today's commercial world, given the central role that is played by technology in completing most organisational tasks.

A technology plan is not just about ensuring the implementation of the correct systems and processes to meet the needs of an organisation it is also about providing guidelines on their correct operation, and about the processes by which their operation should be reviewed. As important as ensuring the existence of a visionary technology roadmap for the organisation as it looks to the future it is equally important that a technology plan should not concentrate solely on the physical elements of technology it should also contain projections regarding the financial cost of running the system both capital and current. Possibly sitting above all of these legitimate concerns is the fact that a technology plan must contain due consideration for the system users, for without their co-operation and proper use of the system, all the sensible planning contained within a technology plan could be rendered useless.

2. Technology and its development

Ever since modern man has evolved he has found the need to communicate and has developed many different methods to achieve it. Where once he used a very limited vocabulary, he now uses a two million plus word vocabulary spoken in many different languages. Where once he used simple drawings carved on rocks, he now uses many simple and complex ways of relating his message through imagery. From the earliest time, man has constantly striven to improve his method and reach of communicating. He has used methods such as torch telegraphs, as in the case of the fall of ancient city of Troja in 1184 BC, to water telegraphs in 364 BC as described by "Aeneas the Tactician" in his book, "The Art of Beset". In 1600, one of the biggest forward leaps occurred due to the investigative work of Dr. William Gilbert into the relationship between amber and magnets. His work led to the first appearance of the word electricity, which derives from the Greek word "elektron" meaning amber. Following on from his work were people such as Benjamin Franklin, Luighi Galvani, Alessandro Volta and Michael Faraday. The combined work of these men in the field of electricity and the work done by people such as William Fothergill Cooke, Samuel B Morse, Charles Wheaterstone, in the field of telegraphy and telephony laid the foundation stones of our modern day methods of communications. The work done by these men allowed for the creation and completion of the first transatlantic telegraph line in 1866 and the completion of America's first transcontinental telegraph line in 1869. It was not long before a whole network of global telegraph lines was established and the world began to embrace the new technology and more importantly the opportunity presented by it. At the time of the work being done by those men mentioned, a number of others such as Phillip Reiss, Alexander Graham Bell and John Carthy were working in the area of voice telephony and it was in 1876 that Alexander Graham Bell demonstrated and patented the first commercial telephone.

From that date, the rate of development was phenomenal with the first experiments in optical fibres beginning in 1887. By 1892 manual exchange switching was being replaced by automatic exchange switching, which was invented by Andrew Strowger, an American funeral undertaker

who's business was being affected by the fact that his rivals wife was the manual switchboard operator in the town and was redirecting his calls to her husbands business. By the early 1900's new automatic exchanges were being developed and it was Sweden which opened the first Step-by-Step exchange in 1926. While every country was developing its own national telephone infrastructure, primarily using the worlds emerging standard equipment and connecting their infrastructure to that of its neighbours which gave us continental connectivity, transatlantic connectivity was not achieved until 1956, when the world's first transatlantic telephone cable linking Clarenville, Newfoundland, and Oban, Scotland was completed.

Even back to the earliest days of the developments in electricity and telecommunications, development work was being carried out on what we now call computers. In 1882 an English mathematics professor, Charles Babbage, invented the world's first computer. The machine he invented was called "The Difference Engine" and it was powered by steam and was used to solve differential equations. From that date in 1882, much work was carried out by many men and women who used mechanical devices to solve various problems often inventing new theories or using previously invented ones such as Boolean logic.

(*Boolean logic: A system of logic, which stated that any mathematical equation can be stated as either true or false. Invented by George Boole in 1854).*

While many of these people made huge strides towards modern day computing it was not until 1940 that a professor and his understudy developed the first all electronic computer. These men, Professor John. V. Anascoff and Clifford Berry, used Boolean logic in electronic circuitry and presented the world with its first electronic computer.

By stepping back from everything, it is possible to see the developments that were taking place in a number of industries, which at the time were unrelated, but by 1960 the convergence of the telecommunications and computer industries was undoubted.

A major endorsement of this convergence was the decision by US President Dwight D. Eisenhower to create a new agency known as the Advanced Research Projects Agency (ARPA). ARPA was created as the American response to the Soviet Unions launch of Sputnik.

(Sputnik: First artificial earth satellite launched in 1957).

In 1962 the head of ARPA, Dr J.C.R Licklider, decided to base ARPA in the universities rather than in the military establishment, and to coincide with this move, the project was given a new name, ARPANET. This decision paved the way for the rapid development of what we now know as the Internet.

In 1969 the first multi point transmission took place between three US universities and in 1972 it was launched into the public arena at an international conference on Computer Communications. Since that day the Internet has been with us, and while only a handfull of people in the early days used the Internet these same people continued to develop new protocols by which it should operate.

(Protocols: A set of rules of behaviour).

These new protocols have given rise to new methods of telecommunications such as Packet Switching, ISDN, Frame Relay, Broadband Communication, ADSL, HDSL, VDSL and many more.

Along with giving rise to new methods of telecommunications they have also given rise to many new industries and to many new terms. While the industries may have converged and created new ways of doing things, it should be remembered that the same basic principles and protocols underpin them all and that these will never change regardless of the task.

When considering the use of technology, as was defined for the purpose of this book, the tasks most often undertaken, are the receipt of data, the review or manipulation of the data for the purpose of producing information and then either the storage or forwarding onwards of the information / data. Regardless of the task, it is worth remembering that a central part of any of these tasks is a computer and how it handles data.

To help understand this, let us first look at the physical computer and understand its main components. The vast majority of computers are made up of four primary parts:

- base unit.
- screen.
- keyboard.
- mouse.

The base unit is normally made up of a case in which there is a chassis. Sitting on the chassis is the motherboard, which is the central part of any computer, as it provides for the inter connection of all other devices which make up a computer.

(Motherboard: A physical board on which a complex series of electronic circuitry has been laid using a soft metal known as solder).

These devices divide into three categories; system devices, input devices, and output devices.

System devices include the processor, memory board, hard disk, hard disk read / write heads, graphics card, etc.

Input devices include the keyboard, mouse, data loggers, etc.

Output devices include the screen, floppy disk drive, writable compact disk drives, printers, etc.

To facilitate this interconnection the motherboard has, as part of its design, a number of slots or ports into which the devices plug. System devices are usually plugged in internally within the base unit and input and output devices are usually plugged in externally (except for the floppy disk drive).

The ports for these external devices are usually found on the back of the base unit and the common array is one keyboard port (usually coloured purple) one mouse port (usually coloured green), one parallel port (a female connector offering 25 pins, usually used to connect a printer), two serial ports (a male connector usually offering 9 pins but can be 25 pin, mostly used to connect a modem or a joy-stick) and one screen port (a female connector with 25 pins arranged in three rows. Other ports such as Universal Serial Bus (USB) and Scussi do exist and while during this book we will not make much mention of them it is important to say that the USB is fast becoming very popular given that it is extremely flexible as it has no fixed use.

Once plugged into their correct port each device then has its own function with the keyboard and mouse allowing for the input of data through typing or clicking on a task to activate it. While the output devices show the results of the action, in the case of the screen, or to allow for a copy of the data to be taken, as in the case of the floppy disk drive.

Now that you have a basic understanding of the physical elements of a computer let us examine how it works. In order to begin this we must first understand that a computers function is to process data. So if data is a computer's raw material let us first examine, what is a piece of computer data and how does a computer see it?

All computer data is based on the use of two binary number values, each value is known as a “bit” and a “bits” value can either be a one or a zero.

In order to make up a single character eight “bits” are packaged together and collectively they are known as a “byte”. It is easier to understand this by looking at an example. Let us take the word “information” and look at the way a computer sees it.

I	N	F	O	R	M	A	T	I	O	N
0100 1001	0100 1110	0100 0110	0100 1111	01010010	0100 1101	01000001	0101 0100	0100 1001	0100 1111	0100 1110

If you take the letter “I” you can see that the “Byte” which represents it is 01001001 and it is only in this form that a computer can read it as “I”. (Note: Uppercase “I” and lowercase “i” have a different byte value). To allow for users to see data in one form (i.e. “I”) and computers to see it in another form (i.e. 01001001), special translation code is run in the background by the computers system devices, which converts what we see into binary format, so that the computer can recognise what it is. Henceforth we are now going to say that data in binary format is also known as data in digital format. This we can say because digital data is also represented by the use of ones and zeros.

In Summary: A computer sees data in the form of ones and zeros or “bits”, with a single character being represented by a “Byte” and this format is known as digital.

Now that a little more is known about computers and the way in which they use binary number values, it should be possible to accept the statement that, the operation of all computers is digital and that the data they process is always in digital format.

The term “digital format” is not something owned by a single company or the copyright of any one person or organisation. It is simply the name given to describe the way something is. In this case it is data that is represented by a series of ones and zeros. So, when we talk about digital photography or recording it is all the same.

When we talk about computers and how they can be connected to each other, there are many different ways this can be achieved. But regardless of which method is used, they all have the same purpose and that is to move data from one location to another. The movement of this data is called the transmission of data.

When dealing with computers, two types of transmission exist and these are known as analogue and digital. Analogue transmission is where the data is converted at the sending site into wavelengths, sent to its

destination, and then converted back at the receiving site into its original form. Digital transmission is where the data to be sent is represented by ones and zeros, and is sent in is original form from the sending site to the receiving site. In technology terms the difference between the two types of transmission is primarily speed and this can be put down to the fact that the data conversation process does not need to take place for digital transmission.

In order to be able to transmit the data, it is necessary to have what are called carrier systems. A close analogy to a carrier system would be a country's road system where in order for a car to get from one location to another in must have a road on which it can be driven.

(Carrier system: Can be physical pieces of equipment, like an organisation's telephone system which has a network of cables attached to it or it can be a pair of wires, such as the copper wires that supply telephone service to an organisations premises).

Many forms of carrier systems exist, and when we talk about digital transmission, the most common carrier systems used are, the cables that connect your computer network together, or any of the digital telecommunications lines such as ISDN or Frame Relay.

At this point in the book it is hoped that a realisation has occurred that digital is the common format right across the whole technology jigsaw and that a picture is forming as to how the pieces of the jigsaw begin to fit together. One exception does exist and that is where a "Digital Signal" has to be converted into an "Analogue Signal" for the purpose of transmission. This is not a difficult thing to understand but it is worth understanding.

In order to understand why this needs to be done, we must go back to the first telephone lines that were developed.

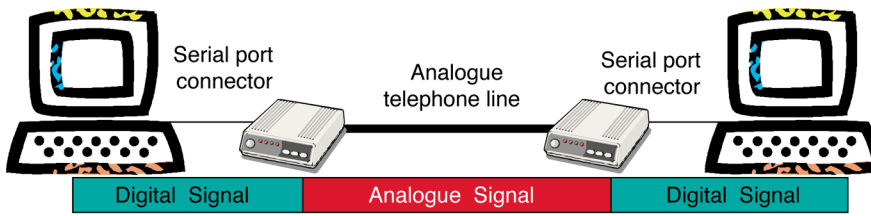
Telephone lines were first invented to allow for the transmission of human speech over a long distance. In order to be able to transmit human speech from one location to another the speech first had to be converted into some form of signal. The signal invented was given the term "analogue signal" and the transmission protocol invented was called "analogue transmission" with the word analogue having its origin in the work carried out by researchers in the area of sound. The choice of name is due to the fact that human speech is sound which travels in wavelengths, so the protocol invented had to be capable of carrying a signal in wavelength form. Unlike human speech, which we now know

travels in wavelengths, digital data travels in a straight line and this is known as “digital signalling”. The transmission protocol which was created to carry this type of signal is known as “digital transmission”. In the early days of computerisation no digital carrier systems existed so it was necessary to invent a device which could convert the “Digital Signal” from a computer into an “Analogue Signal” thus allowing it to be carried by an analogue line. The device created was known as an analogue modem.

(Analogue Modem: A device, which converts a computers digital signal into an analogue signal thereby allowing a transmission to take place between two computers using an analogue telephone line).

It is important to note that during a transmission between two computers the only time the signal becomes of the analogue type, is during the transmission stage between the two analogue modems.

Fig 2.1 Diagram of signal types during transmission using analogue lines.



The use of analogue signalling does not affect the validity of the statement that, all transmission between computer devices is digital, as the conversation of the signal, albeit for a short period, actually enables the statement to be true.

So let us re-cap on what we now know to be true:

- *All computer operations are digital.*
- *All computer data, even though we do not see it in digital form is digital.*
- *All transmission between computer devices is digital.*

By now a picture should be forming in your head that a common working platform, digital, exists within the whole technology jigsaw and all that needs to be done is to make the pieces fit and work together. This is not necessarily your function, but rather the function of a technology

specialist who knows the workings of each of the different pieces of the technology jigsaw, can understand your needs and can work with you to provide you with a technology plan to meet your organisations needs.

3. Technology and its role in your business

Yes it is true to say that technology has advanced our ability to do business in many new ways but it must also be stated that, save for a few exceptions, technology is a tool which improves an organisation's ability to carry out its core activities. No matter if your business is different to Dairy Tales, which delivers milk to it's customer's doorstep or Investsure, which manages the financial affairs of its clients, technology does have a role to play in your organisation but the key for you is to define what is that role? To begin the process of defining its role, it is essential that you take the time to ask, and answer, some basic business questions such as:

Q. What is your core business?

Q. What do your customers expect from you?

Q. If your customer's expectations are realistic, are you meeting them?

Q. If you are not, where are the blockages?

Q. If you are, can you improve and go beyond, thereby begin to create a competitive advantage over your competitors?

Q. Are you getting value for money on your technology spend?

Q. If not, can you improve your systems to deliver more value for money?

Q. Are you prepared for the future?

These are some of the questions that must be answered, but there are many more. For example while pondering the question of:

Are you prepared for the future?

You should not only consider your customer's interaction with your organisation but your organisation's interaction with other organisations of which you are a customer and how prepared are you for changes that they may make in the future which could affect you business. One example of this are the changes being considered by the Revenue Commissioners in the area of the collection of taxes.

By going through this Q&A session it should then be possible to begin creating a technology roadmap for your organisations future and allow

you to start identifying primary needs and secondary needs which will then allow you to start deploying resources in a very focused and timely way. As stated earlier, it does not matter if your business is delivering milk to a customer's doorstep or managing a clients financial affairs, technology does have a role to play. For example, regardless of the work you may do for a customer, you will need to maintain a record of their personal details and their account. You will need to maintain your own accounts to assist you in receiving payments, paying salaries, making payments to suppliers, preparing your management accounts, and a host of other functions such as making payments to the Revenue Commissioners. While this can all be done using traditional pen and paper, you should consider the added value if the work is done using technology. It would, for example, allow Dairy Tale to automatically send "special offer" notifications to it's customers at seasonal times, such as cream for "Pancake Tuesday", or if their dairy supplier decides that it is going to offer a reduced purchase price for orders received via the Internet it would be able to take advantage of this offer. Just as advantages exist for the small delivery service operator so too do they exist for the larger service operator such as Investsure. Retail and commercial banks have already understood, and taken advantage of the power which can be gained by the use of technology, but companies such as Investsure can also benefit hugely by its use. This type of company relies heavily on its ability to service its customer's needs and has to have a number of competitive advantages, to set them apart from their competitors. A company like this needs to have an exceptionally good Customer Relationship Management (CRM) system.

CRM system: A system for recording details of a companies clients and the interaction between the company and its client).

It must also have an exceptionally good financial management system, which has the ability to move monies quickly with a total trace history. It also has to have exceptionally good connectivity to the outside world so that it can monitor changes in world trade in order to be able to act quickly in the best interest of its clients. But what it must also have is good connectivity coming inwards so that it's clients can come in, virtually, at a time that suits them in order to see how their investments are performing. Like the opportunity presented to Dairy Tale for "Pancake Tuesday" new opportunities will be presented to Investsure, or your organisation, if you invest in the right technology. It is, I believe, very important to stress that, while the investment you make may be large or small, there is no point in making the investment unless you ensure it is fully embracement by all concerned within your organisation.

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