

# Networked Information Systems





		Tasks
<input type="checkbox"/>	<b>1. Vocab</b>	1
<input type="checkbox"/>	<b>2. Digital Systems</b>	1, 2, 3, 4, 5
<input type="checkbox"/>	<b>3. Operating Systems</b>	1, 2, 3, 4, E
<input type="checkbox"/>	<b>4. Local Area Networks</b>	1, 2, 3, 4, 5
<input type="checkbox"/>	<b>5. Wide Area Networks</b>	1, 2, 3
<input type="checkbox"/>	<b>6. Network Communications</b>	1, 2, 3, 4, 5
<input type="checkbox"/>	<b>7. Network Configuration</b>	1, 2, E
<input type="checkbox"/>	<b>8. Network Security</b>	1, 2, 3, 4
<input type="checkbox"/>	<b>9. Encryption Basics</b>	1, 2, 3, E, 4
<input type="checkbox"/>	<b>10. Revisiting Databases</b>	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
<input type="checkbox"/>	<b>11. Sys Dev Project - Introduction</b>	
<input type="checkbox"/>	<b>12. Sys Dev Project - Decision Time</b>	1, 2, 3
<input type="checkbox"/>	<b>13. Sys Dev Project - Empathise</b>	1, 2, 3, 4, 5
<input type="checkbox"/>	<b>14. Sys Dev Project - Define</b>	1, 2
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<input type="checkbox"/>	<b>16. Sys Dev Project - Further Steps</b>	1, 2, 3, 4, 5



The operating system provides us with an easy way to manage the hardware and software on a computer. It's the most important program installed even though it might not always be apparent what it's doing.

To use the analogy of a sports match, a computer begins life like an empty playing field. Adding an operating system is the equivalent of putting up the goals, marking the lines, installing the changing rooms and making sure everyone understands the rules of the game. We are now ready for the match, but the interesting things don't really begin until the teams come out and play. Operating systems are vital to the running of a computer.

**Aim:** To investigate the functionality of, and differences between, various operating systems.

### Task 1 – What Does an Operating System Do?

A good way of getting an idea about the things that an operating system does is to look at the *Settings*, *Control Panel* or *System Preferences* on a device. The image below shows the Control Panel on a Windows 10 computer.



Which of the above utilities do you think would be used to make the following changes:

- Change a login password? \_\_\_\_\_
- Uninstall an application which you no longer wish to use? \_\_\_\_\_
- Set the length of time before the computer turns off automatically? \_\_\_\_\_
- Decide which application should be used to view your photographs? \_\_\_\_\_
- Make changes to your email account? \_\_\_\_\_



## Task 2 – Your Device’s Operating System

In the last task, we discussed five settings in the Windows 10 operating system. Your next task is to work out how to make the same changes using a different operating system or set of controls. For this activity, you may use your smartphone, an iPad or other tablet, a Mac or the *Settings* panel on a Windows computer. Basically, anything other than the Control Panel studied previously. Using your chosen device, complete the following information:

- Device (e.g. iPad, iPhone, Chromebook) \_\_\_\_\_
- Operating System (e.g. macOS 10, Windows 10, Android) \_\_\_\_\_

**Note:** Look for instructions online if you need help. You generally look in system settings then find a link such as ‘About’.

- Write brief notes explaining how you would change each of the settings below. For example, to select a different image viewer, you might run through the following steps ‘Open *Settings*, select *Apps and notifications* / *Chosen image app* / *Open by default*. Tap *Clear defaults* and select a new app next time you open an image’.

a. Change a login password. \_\_\_\_\_

\_\_\_\_\_

b. Uninstall an application which you no longer wish to use. \_\_\_\_\_

\_\_\_\_\_

c. Set the length of time before the computer turns off automatically. \_\_\_\_\_

\_\_\_\_\_

d. Decide which application should be used to view your photographs. \_\_\_\_\_

\_\_\_\_\_

e. Make changes to your email account. \_\_\_\_\_

\_\_\_\_\_

## Task 3 – Investigating Operating System Differences

The list of Control Panel options in Task 1 probably includes some utilities that are not available in the operating system you have been investigating, or that work in a very different way. Select two of the utilities and investigate how they work on your device. Some examples have been given below but you may investigate any that you choose. Perhaps look online for help.

**e.g. 1.** Windows 10 includes a firewall. What is a firewall and how does it work? Is there a firewall on your device? Should it have one? Is it possible to add one?

**e.g. 2.** Windows 10 offers a *Backup and Restore* facility which backs everything up to a single combined file. This file can be stored separately on a backup device if required. If your computer develops a problem which stops it working correctly, you have the option of restoring to any of the backup points recorded in the past. What backup and restore options does your operating system include? How do they work?

**e.g. 3.** The *Mouse* settings in Windows 10 allow you to control the way the mouse works e.g. how quickly double-clicks are registered, the speed of the pointer movement across the screen and what the buttons do. Does your operating system have or need these? What alternative settings are there for user interaction via tapping and dragging etc.?



Networks have traditionally been difficult to set up and manage. Having said this, modern devices have recently made the installation of a small home network relatively easy.

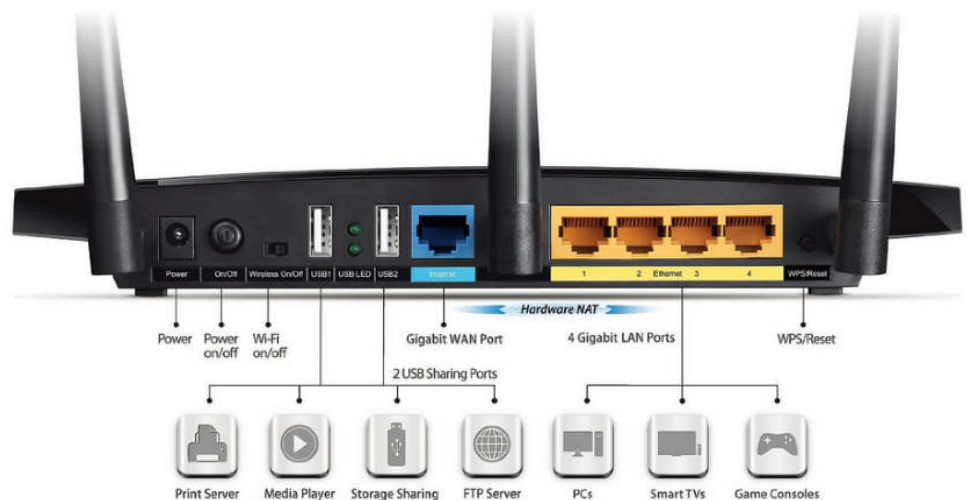
It's unlikely that you will need to set up a network yourself at this moment in time. It's also likely that your school network is protected so that you can't view or make changes to the settings. The best we can probably do is investigate how your home network is configured and discuss how problems might be fixed.

**Aim:** To investigate how networks are configured.

### Task 1 – Investigating Your Home Network Hardware

There was a time when setting up a home network was fiddly and time consuming. Today's modem routers are so good that the task is now usually straightforward.

1. Connect the cable from the WAN port on your modem router (sometimes labelled Line or Internet) to the internet source. The WAN port is usually a different colour to the other ports.
2. Plug in and switch on the modem router.
3. Let your wireless devices find the Wi-Fi and connect using the password given.



### Research

Find answers to the following questions using your own (or a friend's) home network.

- a. What is the make and model of your modem router? This information is usually on the underside. Find out the difference between a modem and a router. *Note: Today's home network devices generally carry out both these tasks and might be called a modem, a router or a Wi-Fi router depending on which aspect of its functionality you are discussing.*
- b. What colour is the WAN port? What is the label used to identify it (e.g. Line, Internet etc.).
- c. Where is the router positioned in the house? Does it offer a good connection to all areas of the home or are there black spots where devices struggle to access the internet?
- d. How many devices are generally connected to the network?
- e. The modem probably has some LAN (or Ethernet) ports; most have four of these. Are any devices connected to the LAN ports via wired connections? If so, what are the devices?
- f. Are any devices connected via USB? If so, what are they?



Encryption is used to convert data from a readable form into an encoded version that appears as meaningless gibberish to human and machine alike. For someone else to make sense of this encrypted code, they must know how to decrypt it.

**Aim:** To look at some basic encryption techniques and guide students through the building of Excel models.

### Task 1 – The Caesar Cipher

Encryption has been around for a long time. Caesar used a simple encryption method to pass on military messages. He did this by shifting the letters three places along the alphabet. The English language equivalent of this is shown below.

**Note:** A cipher (or cypher) is a disguised method of writing something.

For	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Use	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W

- a. Use the Caesar cipher to decrypt the message below.

*QEB ZXB PXO ZFMEBO FP KLQ SBOV RPBCRI*

- b. This type of code might have worked acceptably well a couple of thousand years ago but it's very easy to decipher by today's standards. Even if you shift the alphabet by more than three places it's not too difficult. Complete the cipher below, starting with the letter T. When you reach Z, start again at A. When you have finished, write a 4 or 5 letter word using the cipher and give it to your friend to crack.

For	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Use	T																									

### Task 2 – Creating a Caesar Cipher in a Spreadsheet

The aim of this task is to create a spreadsheet that encrypts a message using a Caesar cipher. The HLOOKUP function will be used to find the encoded letters. The extension tasks involves decrypting the code.

- a. Start by creating the spreadsheet below. Row 1 is simply the alphabet typed out with one letter in each cell. Row 2 is the shifted alphabet, as used above (use the *Copy* and *Paste* functions to make this task easier). Row 4 contains the secret message that you will encode, again with one letter per cell. Use our message for now; you can change it later.

**Note:** The text colours used below just make this message easier to read. They are not necessary.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	A
1	Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
2	Shifted	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
3																												
4	Message	T	H	I	S	I	S	M	Y	S	E	C	R	E	T	M	E	S	S	A	G	E						
5																												



## Task 2 – Creating a Caesar Cipher in a Spreadsheet (cont.)

- b. The first character that we need to encode is the letter 'T'. If you find the 'T' in Row 1 then look below it in Row 2 for the encoded character, you will find the letter 'M'. We will use the HLOOKUP function in cell B5 to find this encoded character.

Make cell B5 active and select 'Formulas / Lookup & Reference / HLOOKUP' from the main menu. Complete the *Function Arguments* boxes as below.

**Note:** In Google Sheets (or Excel) you may type the formula directly: `=HLOOKUP (B4, $B1:$AA2, 2)`

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
2	Shifted	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
3																											
4	Message	T	H	I																							
5	Code		2)																								

Function Arguments

HLOOKUP

Lookup\_value: B4 = 'T'

Table\_array: \$B1:\$AA2 = {'A','B','C','D','E','F','G','H','I','J','K',

Row\_index\_num: 2 = 2

Range\_lookup: = logical

= 'M'

Looks for a value in the top row of a table or array of values and returns the value in the same column from a row you specify.

### What do the function arguments mean?

**Lookup\_value** This is the letter we are going to encrypt. In this case, it is the letter 'T' from cell B4.

**Table\_array** This is the whole range of cells we are using to encode our text (B1:AA2). We've added the dollar signs so that this range is fixed, even when we copy the formula to other cells (see below).

**Row\_index\_num** This is the row in the selected range from which the matching value is returned. Our range includes cells in rows 1 and 2. We want to retrieve the letter 'M' from the second of these rows, so add a '2' in the box.

- c. Click OK to close the window. You should see the letter 'M' appear in Cell B5. If you don't, then (with Cell B5 still selected) click on the *Insert Function* icon as shown on the right and check you have inserted the values correctly.

- d. Copy cell B5 and paste the formula into cell C5. You should see the letter 'A' appear in this cell. This is our encoded version of the letter 'H'.

- e. Click on the *Insert Function* icon and have a look at the new function arguments. Notice that the reference 'B4' in the *Lookup\_value* box has been pasted as 'C4' i.e. it has been shifted across 1 cell. This is a *relative reference*. However, the *Table\_array* has stayed as \$B1:\$AA2 because we have used dollar signs to fix the columns. This is an *absolute reference*.

C5    =HLOOKUP(C4,\$B1:\$AA2,2)

Insert Function

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Alphabet	A	B	C	D	E	F	G	H	I	J	K	L
2	Shifted	T	U	V	W	X	Y	Z	A	B	C	D	E
3													
4	Message	T	H	I	S	I	S	M	Y	S	E	C	R
5	Code		M	A									

HLOOKUP

Lookup\_value: C4

Table\_array: \$B1:\$AA2

Row\_index\_num: 2



Information systems are designed to organise and analyse data. You will likely have used a variety of information systems in your life, sometimes without even realising it. Examples of those that you might have interacted with include:

**Aim:** To create a path through the System Development Project.

- Your school or library management system;
- Self-checkouts in supermarkets;
- Public transport systems, timetables and the tap mechanisms;
- Databases that you might have used in a job, club or society;
- Most modern websites.

You may also have built a database which included tables of data, forms and reports. Your database was a simple information system.



In this *System Development Project*, we are not only going to consider the technology and data contained in an information system but also the people who interact with it and the processes they follow when using it.

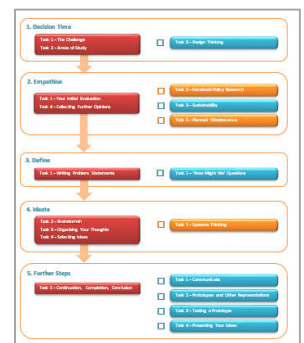
Your goal is to investigate an information system and develop a way of improving how it works. This might involve:

- Improving the usability of the interface;
- Increasing the security and protection of data;
- Changing the configuration of the hardware or software;
- Developing the policies or processes involved;
- Investigating the communication between people and machines;
- Improving the environmental, economic or social sustainability of the system.



Your teacher might have chosen a path for you through the project and checked some of the option boxes on the following page. If not, you can discuss the possibilities and start to think about which areas interest you the most; the people, the processes or the technology?

You do not need to complete all the tasks in the checklist. Some are essential steps in your development but others may only be required if you are working in that area. Having said this, the extra activities will all be beneficial to your overall understanding of how information systems function.



The work is best carried out in groups of two or three.





Essential

Optional

Informational

## Decision Time

Task 1 – The Challenge  
Task 2 – Areas of Study

Task 3 – Design Thinking

## Empathise

Task 1 – Your Initial Evaluation  
Task 4 – Collecting Further Opinions

Task 2 – Facebook Policy Research

Task 3 – Sustainability

Task 5 – Planned Obsolescence

## Define

Task 1 – Writing Problem Statements

Task 2 – ‘How Might We’ Questions

## Ideate

Task 2 – Brainstorming  
Task 3 – Organising Your Thoughts  
Task 4 – Selecting Ideas

Task 1 – Systems Thinking

## Further Steps

Task 5 – Continuation, Completion, Conclusion

Task 1 – Communicate

Task 2 – Prototypes and Other Representations

Task 3 – Testing a Prototype

Task 4 – Presenting Your Ideas



The first step in our development process is to develop a sense of empathy towards the people using the system. You will have your own ideas about the issues involved, but do other people have similar views? It's good to try and understand things from a variety of perspectives and not just your own.

**Aim:** To gather information about the system, policies and users.

### Task 1 – Your Initial Evaluation

When analysing a system in the real world, it's often best to try and ignore your own opinions in order to avoid influencing the outcome of your research. However, in this case, you will learn about the process by carrying out your own evaluation first. You and your partners can each complete the evaluation below, so you will have at least two or three different perspectives.

Have the system interface in front of you and work through the statements. Give each a mark on the scale which shows how much you agree with it. Some of the statements may not be relevant to your information system.

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
	1	2	3	4	5
<b>System Quality</b>					
The information system is easy to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am satisfied with the speed of the system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The user interface is of high quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Information Quality</b>					
The information on the system is up to date.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The information is accurate.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The information is relevant.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Service Quality</b>					
The support staff are technically able.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The support staff are quick to attend to problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The support staff communicate well.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Technological Issues</b>					
The information is easy to find, filter or sort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The system makes my own data easy to upload and update.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The system is secure and protects my personal data.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The system is accessible to those with special needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Self-Efficacy</b>					
I find it easy to use the system because I am quite capable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can find the help I need using the system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>User Satisfaction</b>					
I am satisfied with the overall quality of the system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am satisfied with the overall quality of information from the system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am satisfied with the overall service quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Where you go from this point depends on the information system investigated, the improvements you have decided on and the time you have left available to work on your solutions. Here are some possibilities:

**Aim:** To follow up some of the different possibilities for completing the project.

- Conclude**  
 It might be the case that this project was all about investigating and thinking how you might improve an information system. If this was the case, you might present the ideas you have had so far (see the next page for info).
- Communicate**  
 If possible, this is a great time to start communicating with the people that run the information system. It may be the case that you simply share your suggestions either online or in person (see below). You could ask for a critique of your ideas or possibly work together on further developments.
- Prototype and Test**  
 If you are working with an information system that you have access to, then it might be possible to go further with your Design Thinking. This would require the development of a prototype for your improvements and finding a way to test them.

## Task 1 – Communicate

If you are in a position to, this would be great time to open communications with the managers of the information system. Here are some possible routes:

- Email**  
 A well-worded email can be a non-threatening way to introduce yourself to the people involved with running the system. You will need to be very careful not to cause offence because you are basically suggesting that their systems could be better. The example email below might help you develop a suitable tone for your communications.



*Dear Sir/Madam (or use their name if you know it)*

*We have been working on a year (\*) school project about information systems. We had to analyse an information system and see if we could think of a way that it might be developed. Our particular area of interest was (how the interface works / how people interact with the system / how the system has been built etc.). Obviously, we have only been able to look at your information system from the outside but we have come up with a few ideas that we hope might be useful. We would really appreciate you critiquing our suggestions; it would be fantastic to learn how they relate to the real world.*

*Please let us know if it would be possible to discuss this with you.*

*Yours sincerely*

Note that we have been careful not to criticise and that we haven't included the specifics of our ideas at this point. We have simply given an indication of what we have been working on and asked to take things further.

If you don't receive a response from your email in a week, then you could send a polite follow-up. People get lots of email and it's possible that the recipient simply didn't get around to responding; they might actually be interested. An alternative is that you try a different method of reaching out.