Digital Technologies – 9 and 10_ Digital systems

	STRAND	Knowledge and understanding				Processes and production skills															
		Digital Systems		Representation of data		Collecting, managing and analysing data				*Creating Digital Solutions by:*											
										Investigating and defining		Generating and designing		Producing and implementing		Evaluating		Collaborating and managing			
	Content Description	Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems (ACTDIK034)		Analyse simple compression of data and how content data are separated from presentation (ACTDIK035)		Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements (ACTDIP036)		Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data (ACTDIP037)		Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs (ACTDIP038)		Design the user experience of a digital system by evaluating alternative designs against criteria including functionality, accessibility, usability, and aesthetics (ACTDIP039)		Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases (ACTDIP040)		Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language (ACTDIP041)		Evaluate critically how student solutions and existing information systems and policies, take account of future risks and sustainability and provide opportunities for innovation and enterprise (ACTDIP042)		Create interactive solutions for sharing ideas and information online, taking into account social contexts and legal responsibilities (ACTDIP043)		Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability (ACTDIP044)	
Sequence of Lessons / Unit	**Approx. time rq'd**	**Year A or B**	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #
Networks and data	7	9	☑	1	☐		☐		☐		☐		☐		☐		☐		☐		☐		☐		☐	

Years 7 and 8 Achievement Standard	**Years 9 and 10 Achievement Standard**	
By the end of Year 8 • Students distinguish between different types of networks and defined purposes. (1) • They explain how text, image and audio data can be represented, secured and presented in digital systems. (2) • Students plan and manage digital projects to create interactive information. (3) • They define and decompose problems in terms of functional requirements and constraints. (4) • Students design user experiences and algorithms incorporating branching and iterations, and test, modify and implement digital solutions. (5) • They evaluate information systems and their solutions in terms of meeting needs, innovation and sustainability. (6) • They analyse and evaluate data from a range of sources to model and create solutions. (7) They use appropriate protocols when communicating and collaborating online. (8)	By the end of Year 10 • Students explain the control and management of networked digital systems and the security implications of the interaction between hardware, software and users. (1) • They explain simple data compression, and why content data are separated from presentation. (2) • Students plan and manage digital projects using an iterative approach. (3) • They define and decompose complex problems in terms of functional and non-functional requirements. (4) • Students design and evaluate user experiences and algorithms. (5) • They design and implement modular programs, including an object-oriented program, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities. (6) • They take account of privacy and security requirements when selecting and validating data. (7) • Students test and predict results and implement digital solutions. (8) • They evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise. (9) • They share and collaborate online, establishing protocols for the use, transmission and maintenance of data and projects. (10)	

Topic: Digital systems
Units

Year 9	**Year 10**
Connected via a network : 7 hours Examine different types of networks, protocols and the role of software and hardware plays.	**Data: controlled and secured 7 hours** Explore how data can be secured through access controls, virus checking, and encryption.

Connected via a network

Students should develop and understanding that digital systems must be robust and reliable. They understand that a computer network enables computers to exchange data and they explore protocols such as HTTP, TCP, IP and SMTP. Investigate the compression of files to reduce file size and the advantages of this process as well as compare the end quality. Investigate the potential of IOT and how it all works.

Flow of activities				
Questions to guide exploration	*How do computers communicate via networks?*		*How are emails sent and received?*	*How do we handle transmission of large files?*
Short text	Network protocols Review and identify different types of networks and protocols that govern the internet.	Browsing the internet Identify the hardware of software used and what happens when you navigate to an URL.	Email and file sizes Discuss the way emails are sent via the internet. Examine ways to reduce file size.	The internet of things (IoT) Investigate the potential of IoT and how it all works.
AC Alignment	*Digital Systems (ACTDIK034)*	*Digital Systems (ACTDIK034)*	*Digital Systems (ACTDIK034)* *Representation of data (ACTDIK035)*	*Digital Systems (ACTDIK034)*
What's this about?	A computer network is a telecommunications network which allows computers to exchange data. There are different types of networks including Local Area Network (LAN) and Wide Area Network (WAN). The internet is a network of networks cooperating with each other to exchange information following a set of rules called protocols. Protocols are used to create an agreed process which all devices follow to be part of the internet. All internet communications require IP addresses. Each computer has a unique IP address that allows other computers to find it and send data to it. Transmission control protocol (TCP) and Internet Protocol (IP) work in tandem to transmit data across the internet. TCP is the protocol that ensures reliability of the data being transmitted. We need to ensure there is no loss of packets, that the packets are in the right order, that the delay is minimal, and that duplication of packets is avoided. The HyperText Transfer Protocol (HTTP) is the most common protocol in use on the internet. The protocol's job is to transfer HyperText (such as HTML) from a server to a computer.	A web browser is a software application for retrieving, presenting and navigating information resources on the internet. An information resource is identified by a Uniform Resource Locator (URL) that may be a web page, image, video or other piece of content. Commonly used web browsers are Chrome, Edge (replaced Internet Explorer), Safari, Opera and Firefox.	Every day, people all around the world send and receive email messages. Emails are composed using software such as Outlook or a web-based email service like Gmail. After hitting 'send', the email is transferred to your email server. Message transfer between email servers is done using Simple Mail Transfer Protocol (SMTP). There is a file size limit to what can be sent via email. Compression of files lets you reduce the overall number of bits and bytes in a file so it can be transmitted faster over slower internet connections, or take up less space on a disk. Lossless compression lets you recreate the original file exactly where the file is broken into smaller bits and put it back together at the other end. Lossy compression eliminates 'unneeded' bits of information, resulting in a smaller file. A common use of this compression is reducing the file size of bitmap pictures.	People's access to technology and their attitudes towards using technologies and advances in technology has in part driven IoT. IoT is about connecting the unconnected – driven by data and developing realtime insights into asset and human performance; using the data to make informed decisions using artificial intelligence (AI); and finally being able to execute automated actions leading to new business models making a safer and more efficient world. IoT has been driven by advances in technology, enabling more physical objects to be connected to the network either by wireless or wired means. It has also rapidly advanced due to the collective view that data sharing leads to deeper insights. IoT allows users to automate aspects of their daily lives and integrate with bigger systems. Often the term 'smart' is associated with IoT, for example, smart cities, smart homes, smart farms, smart appliances. 'Smart' relates to the enhancement of aspects of our lives with the power of data collection, artificial intelligence algorithms, and networks. Sensor technology enables the integration of physical devices to send and receive data via a network.
The focus of the learning (in simple terms)	Define, investigate and compare Local Area Network (LAN) and Wide Area Network (WAN). Discuss the advantages and disadvantages of the various types of computer networks. Relate the IP address to binary number system, for example, IP addresses are just 32-bit binary numbers. The address 255.253.253.0 in binary: 11111111.11111101.11111101.00000000 Explore Internet Protocols (IP) and how they relate to the hardware in the network. Explore the question: 'Why do we need an IP address?' and discuss potential security threats. Discuss what students know about the different types of protocols. HTTP is one with which students may be most familiar. Ask students what HTTP stands for and where they have seen it. Refer to the way we are able to access website information, the browsers commonly used and the role search engines play in enabling users to locate information.	In small groups, brainstorm the ways students use the internet on a typical day. Look for ways to group common types of usage, such as social interaction/communication, entrainment and information. Compare ideas and use data to compare to worldwide usage. Identify the common web browsers used by students in the class. Conduct a straw poll to gather data about the most commonly used. Discuss a typical experience such as browsing Facebook, using a smartphone, and being connected to the home Wi-Fi. Indicate the hardware and software used and how they interact. Ask students to draw and explain how they think that occurs. Use a relevant resource to show how the packets are send and received via the internet.	Examine email communication and how it works. Discuss the interaction between the user, software and the hardware. Refer to a visual representation to describe the process. Students could create their own flow chart of the process. Discuss file size limits and programs such as Zip files to reduce file size. Examine other ways to share large files over the internet, such as Dropbox, WeTransfer or a similar secure file transferring application. Students who have experience with development boards such as Arduino or Galileo can follow a tutorial to send and receive simple email messages from the development board. Discuss the limitations of such modelling and note that it's not an exact replication of what occurs. Practise writing an email. Use LMS or an email application.	Brainstorm ways in which different types of physical devices could be connected to a network and how automating actions from their data could positively change lives. Discuss the advantages and disadvantages of IoT. Some points may include: reduce waste, richer experiences, lead to improvements in technology, and increased level of data that informs and provides insights into people's behaviours. The negatives include security and privacy issues. Discuss the use of sensors in IoT applications. Students in small groups identify a type of sensor and explain some potential uses in IoT applications. For example, carbon monoxide sensors linked to smoke detector and the user receives a notification. Join the CISCO course of IoT. Use the resources to explore IoT and in particular model how a smart home operates refer to (Home IoE Implementation).

	Students with knowledge of editing and running Python programs and setting up a programming board such as Raspberry Pi could build a simple network and use it to communicate via a network chat program. Central to this task is assigning an IP address for the device.		Students could explore various methods of compressing data (lossless and lossy) for audio, images, video and text; and methods for checking the reliability of data when it is compressed, transmitted and retrieved. Comparisons can be done using image, video and audio files to investigate compression by reducing data from files.	Use an electronic kit that has capabilities to enable students to make their own internet-connected creations that automate a process. LittleBits is a suitable kit that has a cloudBit which enables students to make their own 'smart' projects.
Supporting resources and tools and purpose/context for use.	Computer networks This lesson plan is about defining network types. 'The Internet: IP Addresses & DNS' This video can be used to explain the role of an IP address and how networks talk to each other. 'The Internet: HTTP & HTML' This video provides a detailed description of how the Internet works using HTTP and HTML. CS Unplugged: Field guide: Network Communication Protocols Lesson 1 – How do computers communicate? In this lesson students will build a simple network and use it to communicate, via a network chat program. The students will learn how to network two Raspberry Pis, and then write a small program in Python that allows them to send messages to each other.	A typical day in the life of the internet An infographic showing the internet usage on a typical day. Packet Tracer – Navigation Tutorial Introduction to IoT course Create a log in to register for free. Packet Tracer – Packet Switching Simulation Use CISCO's Packet Tracer as a modelling tool for network representations. Use the simulation to explore how packets are created and sent across the network travelling from source device to destination device using Facebook browsing as the example. Lab – Mapping the Internet Use route tracing to determine the path or routes as well as the delay across an IP network. Some schools 'networks may not permit Ping and traceroutes to be undertaken. What really happens when you navigate to a URL Use this article if you want to take a deeper look at the sequence of events that take place when you visit a URL, using Facebook as an example.	How Does Email Work? A Simple (Illustrated) Explanation Explains how Simple Mail Transfer Protocol (SMTP) is used in sending and receiving email. How to Send Large Files Over Email Many email servers refuse to accept email attachments over a certain size. This blog discusses ways to send large files over the internet. Connecting to the outside world (Page 61) This activity sends an email from your Galileo when you run the program. It makes use of the Simple Mail Transfer Protocol (SMTP) to send the email. The SMTP protocol is the protocol used by the majority of all mails that are transferred around the internet. DIY - How to Use the Arduino Uno to Send an Email, SMS and Make a Voice Call This tutorial video provides a step-by-step process to send emails, SMS messages as well as make voice calls using the 3G/GPRS shield by libelium Communication. CS Unplugged: Field guide: Coding – Compression An online resource for teaching students about compression. Seeing the big picture This practical lesson sequence examines lossy and lossless techniques of data compression. Students perform comparisons of various compressions on a variety of images. CS Unplugged: Text Compression Use these activities with your students to explore how a computer stores information as efficiently as possible. Audio Converter online This free software lets you explore changing bitrates to hear the difference in quality of an audio track that you upload from your computer.	Internet of Things – Quick Guide 10 Real World Applications of Internet of Things (IoT) – Explained in Videos Packet Tracer – Home IoE Implementation **littleBits projects** Remote Pet Feeder Wireless Lighting
Assessment	Approach with a one-line prompt **Suggested approaches may include:** Presentation or demonstration, Adapted worksheet, Artefact analysis, Labelling diagram, Text, Digital capture, Design plan. **Achievement standard** **Explain** the control and management of networked digital systems and the security implications of the interaction between hardware, software and users.	Approach with a one-line prompt **Suggested approaches may include:** Presentation or demonstration, Adapted worksheet, Artefact analysis, Labelling diagram, Text, Digital capture, Design plan. **Achievement standard** **Explain** the control and management of networked digital systems and the security implications of the interaction between hardware, software and users.	Approach with a one-line prompt **Suggested approaches may include:** Presentation or demonstration, Adapted worksheet, Artefact analysis, Labelling diagram, Text, Digital capture, Design plan. **Achievement standard** **Explain** the control and management of networked digital systems and the security implications of the interaction between hardware, software and users.	Approach with a one-line prompt **Suggested approaches may include:** Presentation or demonstration, Adapted worksheet, Artefact analysis, Labelling diagram, Text, Digital capture, Design plan. **Achievement standard** **Explain** simple data compression, and why content data are separated from presentation.