

**Internal Assessment Resource**

**Digital Technologies & Hangarau Matihiko Level 3**

This resource supports assessment against Achievement Standard919051

**Standard title:**  Use complex techniques to develop a network

**Credits:** 4

**Resource title:** Serving up my home

**Resource reference:** Digital Technologies & Hangarau Matihiko3.6A

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| This resource:   * Clarifies the requirements of the standard * Supports good assessment practice * Should be subjected to the school’s usual assessment quality assurance process * Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic |

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| Date version published by Ministry of Education | December 2018 Version 1  To support internal assessment from 2019 |
| Authenticity of evidence | Teachers/kaiako must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.  Using this assessment resource without modification may mean that students’ work is not authentic. The teacher may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |
| *1Achievement standard 91905 is derived from both The New Zealand Curriculum and Te Marautanga o Aotearoa.* | |

**Internal Assessment Resource**

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**Teacher/Kaiako guidelines**

The following guidelines are supplied to enable teachers/kaiako to carry out valid and consistent assessment using this internal assessment resource.

Teachers/kaiako need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students/ākonga against it.

**Context/Te Horopaki**

The assessment activity requires students to use complex techniques to build a refined microcomputer-based network file server. This task will allow students to investigate, select, install (hardware components and software) and then configure and troubleshoot the outcome.

Students will need to build and configure a microcomputer to act as a fileserver. Students will then need to demonstrate their ability to configure both the file server and the other devices’ settings to allow them to connect to the file server. This needs to be done in the context of a network. For example, devices could include a print server, tablets, phones, PCs, a modem/router using WIFI or switches and cabling etc. as required.

This assessment can be added to or modified in several ways; for example, adding a web-based access from outside of the home or configure and manage your microcomputer from another computer on the network through SSH. Other suggested contexts for assessing this standard are given below.

**Conditions/Ngā Tikanga**

It is recommended that students should have at least two identified checkpoints with their teacher as they work through this assessment activity to ensure they have an opportunity to ask questions and gather feedback.

**Resource requirements/Ngā Rauemi**

For this assessment you will need:

**Basic Hardware selection:**

Microcomputer

Wifi dongle or means of connecting to wifi

A router or switch (or similar)

SD card

A suitable power supply

**Basic Software selections:**

An appropriate OS

Monitoring tools software

Scanning tools software

Task scheduling tools software

**Basic configurations:**

Booting the microcomputer

Configuring the microcomputer

Configuring wireless adaptors

Configuring the router/switching capability

Configuring other devices

Download, build, and install monitoring and scanning tools

Download and install a daemon to execute scheduled commands

Other possible contexts:

*Note: If assessors intend to modify the context they will need to also modify the task to ensure that the context will still meet the requirements of the standard.*

* Web server access to home networks through the internet
* 3d printer controller
* IRC server
* Ebook server
* Minecraft or other gaming servers
* Email server
* Home automation
* Network scanner
* Git server
* VPN server
* Samba server
* Voice over IP
* Webcam server
* Digital signage
* LAMP/Apache/PHP server

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**Student/Akonga instructions**

**Introduction/Kupu Arataki**

Your family has a number of devices, but they are finding that when they use a different device they don’t have access to their information. They would like a central repository of their documents, videos, songs etc.

This assessment activity requires you to use complex tools and techniques to create a microcomputer-based file server and to connect it to other devices.

You can access help and are encouraged to do so. This assessment is about your ability to show the how and why of what you are doing and your ability to apply your knowledge to your own context.

Teacher note: Insert due dates and timeframes

**Read this information first**

You will need to:

* Investigate a range of hardware and software that would be appropriate for this project. You will need to consider the purpose and function of both the hardware and software to be used for the outcome and justify your selection of the parts and components, taking into account relevant implications such as accessibility and price.
* Make some software and hardware selections based on how you develop your outcome.
* Use appropriate tools, procedures, protocols and techniques when installing and configuring hardware (including peripherals) and software.
  + Examples of protocols include: SMB, NTP, DNS, IPV4/IPV6, IP addressing and ICMP.
* Diagnose, test configure, and troubleshoot your hardware and software throughout the development process using appropriate testing procedures such as:
  + configuring and booting the computer hardware (router, scanner, and client)
  + configuring wireless adaptors
  + building and installing monitoring and scanning tools
  + installing a daemon to execute scheduled commands.
* Demonstrate understanding of the networking concepts and the underlying OSI framework including:
  + the Open System Interconnection (OSI) model
  + ICMP (Internet Control Message Protocol)
  + data transmission modes (Unicast, Broadcast, and Multicast).
* Show clear evidence of the procedures, decisions and your thinking as you develop this outcome.
* Show that you recognise and address any relevant implications.
* Regularly check in with your teacher to demonstrate your learning.

Teacher note: Edit list of materials to be provided

Your teacher will provide you with a selection of equipment to investigate and select from for this assessment, or you can provide your own.

You will also be expected to:

* + install and configure an appropriate OS
  + configure a networking router
  + configure a file server
  + connect and configure other devices.

You will be assessed on your ability to:

* show an understanding of the parts and components selected, through explaining the purpose, function and behaviour of the parts and components
* explain the networking concepts used to develop the network, including specific reference to the layers of the OSI model and the impact this has on the design of the network
* independently and accurately install, test and configure your selected hardware to ensure the outcome meets end user requirements
* independently and accurately install, test and configure your selected software to ensure the outcome meets end user requirements
* demonstrate that you have considered and addressed relevant implications
* evaluate the findings from the tests and apply this information to improve the quality of your network
* ensure your outcome is fit for purpose by justifying your selection of parts and components (hardware and software).

You may work with others to help generate ideas and develop those ideas. However, you will be expected to show your own thinking and evidence of how you discussed and combined ideas together to write and submit your own assessment evidence.

**Task/Hei Mahi**

You are going to develop a network file server and configure both the file server and the other devices settings to allow them to connect to the file server to allow data to be shared across a network.

You could follow this sequence of steps to complete in order to configure this network file server outcome.

Investigate a range of hardware and software that would be appropriate for this project. You will need to consider the purpose and function of both the hardware and software to be used for the outcome and justify your selection of the parts and components, taking into account relevant implications such as accessibility and price.

At each stage of development identify and explain the relevance this has on the OSI model, why it is relevant, and how this will impact the design of the network. This will be needed as evidence for the presentation of your outcome to your class.

Ensure that at each stage of development you use appropriate testing procedures to evaluate, diagnose and troubleshoot any configuration errors to ensure your outcome will be fit for purpose for the end users.

Configure the microcomputer hardware and boot the selected OS.

Configure the router and any other devices in your network.

Investigate and determine the best way to connect to the WIFI network and give reasons for your selection. Ensure the solution is configured and working.

Configure your microcomputer to enable a number of configurations as set by your teacher. (e.g. assigning a different static IP address, configure DHCP etc.).

Secure your device appropriately.

Install and configure the file sharing software you have selected.

Edit network interfaces.

Connect to the network and carry out standard configuration practices as determined by your teacher. Test on the file server, and test that you can access the data on the other devices in the network.

Ask your teacher to check your network.

Produce a simple presentation that maps your project stages against the OSI model to illustrate how your project links to each stage and allows your teacher or peers to critique your understanding and your process. Your teacher will check your network.

Your presentation should include:

* an explanation of the purpose, function and behaviour of the parts and components used and why you used them
* an explanation of the networking concepts used to develop the network, including specific reference to the layers of the OSI model and the impact this has on the design of the network
* how you used testing procedures to evaluate, diagnose and troubleshoot configuration errors to improve the quality of your file server
* why your outcome is fit for purpose including a justification of your selection of parts and components used (hardware and software)
* how you have considered and addressed relevant implications.

**Assessment schedule/Mahere Aromatawai: Digital Technologies & Hangarau Matihiko 91905 – Serving up my home**

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| **Evidence/Judgements for Achievement/Paetae** | **Evidence/Judgements for Achievement with Merit/Kaiaka** | **Evidence/Judgements for Achievement with Excellence/Kairangi** |
| Use complex techniques to develop a network.  The student has:   * explained networking concepts   **For example (partial evidence):**  *Setting up a static IP address “My IP address was 192.168.1.215. When assigning an IP address, you only want to change the last number. I’m going to change my address to 192.168.1.191. I’ll use a number between 100 and 200. I set the netmask and broadcast to the values from ‘ifconfig eth0’ so that the interface is configured correctly for my home network.”*  *“I configured the Raspberry Pi into broadcast (multicast) mode. IP Multicast is a technique for one-to-many communication over an IP infrastructure in a network.*  wlan0 Link encap:Ethernet HWaddr  inet6 addr: fe80::9380:71d4:4917:9b65/64 Scope:Link  UP BROADCAST MULTICAST MTU:1800 Metric:1  RX packets:7 errors:0 dropped:7 overruns:0 frame:0  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  collisions:0 txqueuelen:1000  RX bytes:971 (971.0 B) TX bytes:0 (0.0 B)  wlan1 Link encap:Ethernet HWaddr  UP BROADCAST MULTICAST MTU:1800 Metric:1  RX packets:0 errors:0 dropped:0 overruns:0 frame:0  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0  *"The snip above shows where I ran an $ifconfig to query the network to confirm I had multicast running. I set it to multicast as we will have lots of video on the our home file server. Simultaneous delivery of high-quality video to each of a large number of delivery platforms will exhaust the capability of even a high bandwidth network with a powerful video clip server (which I don’t have!). This poses a major scalability issue for sustained high bandwidth. This is why I decided to go with multicast networking."*   * used appropriate tools, procedures, protocols and techniques when installing and configuring hardware, software and peripherals   **For example (partial evidence):**  *"I had to set up the Raspberry Pi properly. I configured the Boot the Raspberry Pi 3 and configured SSH, SPI, I2C, and SAMBA. I provided a series of pictures showing this occurring. E.g. On raspberry pi I installed install samba with-*  *sudo apt-get install samba samba-common-bin*  *--shown as a snippit-*     * undertaken a range of appropriate testing, diagnostic and troubleshooting procedures to identify and resolve setup and configuration errors   **For example (partial evidence):**  *"When I downloaded, built, and installed SAMBA as my file server software, it would not run as expected. The RPi is not showing up anywhere within the "Network" area of my Windows machines. I couldn’t access the share by IP, either. I got this message “The mapped network drive could not be created because the following error has occurred: The account is not authorised for log in from this station.” So, I uncommented the security attribute and swapped the value of the encrypt passwords from no to yes - this is a requirement if you wish to access your Samba share from a Windows machine."*   * investigated the parts and components (hardware and software) to be used   **For example (partial evidence):**  *"I did a lot of research and decided to use SAMBA as Samba is a popular freeware program that allows end users to access and use files, printers, and other commonly shared resources on an intranet. Samba is often referred to as a network file system and can be installed on a variety of operating system platforms, including: Linux, most common UNIX platforms, OpenVMS, and OS/2 and Pi. I then looked at..."*  *“I decided to use a Raspberry Pi because there were a lot of tutorials online and forums I could refer to when setting the system up."*   * addressed relevant implications   **For example (partial evidence):**  The student looked at the implications and identified functionality and end user requirements. They explained these and then explained how they addressed them.  *“I decided on SAMBA because Samba has provided secure, stable and fast file and print services for all clients using the SMB/CIFS protocol, such as all versions of DOS and Windows, OS/2, Linux and many others."*  *“My selection of the Raspberry Pi was made due to its compatibility with the Linux OS, which is open source, and that it is discreet, cheap, configurable, and noiseless and power efficient. These were important because...”*  *The examples above are indicative samples only* | Use complex techniques to develop an informed network.  The student has:   * explained the OSI model and the impact of layers in the design of the network   **For example (partial evidence):**  *“I put together a presentation to my class which my teacher recorded. In it I talked about the different stages of my project and where they aligned with the OSI model. One point I made was about the Datalink Layer which ensures that messages are delivered to the networked devices and translates messages from the Network layer into bits for the Physical layer to transmit. I showed that when I configured the File server how it receives requests for files.”*   * evaluated and applied information gained from testing, diagnostic and troubleshooting procedures to inform development and improve the quality of the network   **For example (partial evidence):**  *The student has shown evidence of ongoing testing and troubleshooting, as they progress. They are able to use this understanding to solve problems with the network.*  *“I typed my Pi's IP address into the “search program and files box” from the Windows command prompt (i.e. \\192.168.1.191\public), and typed in my username and password.*  *The folder RASPBERRYPI\public now appears in the Win 10 Network folder, but when I double-click the folder the following error message appears:*  *\\RASPBERRYPI\public is not accessible. You might not have permission to use this network resource. Contact the administrator of this server to find out if you have access permissions.*  *The user name could not be found."*  *“I looked up some information, and I think I didn’t set the permissions / owner on the drives when I mounted them. I reset them as it appears that on the Pi my USB drive has been mounted twice in /media."*   * explained the purpose, function and behaviour of the parts and components (hardware and software) used   **For example (partial evidence):**  "*I have made a table of the components I used and tried to briefly explain about each one and why I think it was fit for purpose."*  The explanations the student provides are not copy pasted, they are clearly understood by the student.  *The examples above are indicative samples only* | Use complex techniques to develop a refined network.  The student has:   * independently and accurately used tools, procedures, protocols and techniques when installing and configuring hardware and software to ensure the network meets end user requirements   **For example (partial evidence):**  *Teacher notes on student observation: I confirm I saw the student configuring the microcomputer to act as a file server, but that the file server is headless, e.g. it does not have a screen or keyboard, so the student connected the microcomputer to the router via a wired LAN cable. To make this work, the student needed to change the settings of the WiFi router (a D-Link DSL-2750U wireless router). The student correctly identified that the router assumed that the cable connection is an internet connection and tried to use this as the internet gateway leading to a loss of internet connectivity. To prevent this from happening, the student decided to disable the Configure the second IP Address and Subnet Mask for LAN under Setup | Local Network | Router Settings.*  *The router also by default set up two separate isolated local networks: one wireless network and one wired network. The student correctly determined that it was wise to uncheck Enable MultiAP Isolation (under Setup | Wireless Basic) to prevent this and force the router to put wireless clients and wired clients on the same local network.*   * justified the selection of parts and components (hardware and software)   **For example (partial evidence):**  *"I used a Raspberry Pi with Raspberrian for this task. I think the Raspberry Pi was appropriate because it is small and compact, it supports Linux, which makes software licensing more accessible. The SD cards make it easy to change functionality and test and trial without reinstalling ... There are disadvantages like the non-compatibility with Windows and ... however for this task it is suitable."*  *"I chose SAMBA for a lot of reasons like access control permission (security). These are important for a file server for distributing content. E.g. A user can access a file through samba only if the user satisfies both the samba permissions and the file system permissions. The samba permissions are set up with read access for guests (anonymous login) but write access only to set up accounts. The samba share is accessible only from the local network, so even these anonymous guests would have to have logged in to the WiFi router."*  *The examples above are indicative samples only* |

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the achievement standard