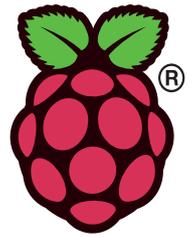


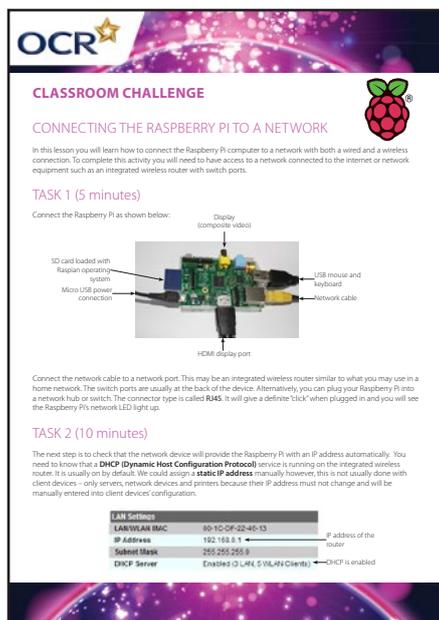
CLASSROOM CHALLENGE: INSTRUCTIONS AND ANSWERS FOR TEACHERS

CONNECTING THE RASPBERRY PI TO A NETWORK



These instructions should accompany the OCR resource 'Connecting the Raspberry Pi to a network'

This activity allows learners to use the Raspberry Pi to connect to a wired and a wireless network. They will learn how to check that the connection has been successful and how to troubleshoot a non-functional link. If an internet link is available, they will be able to test that web pages can be loaded. These tasks will reinforce learning concepts by practical activity.



CLASSROOM CHALLENGE

CONNECTING THE RASPBERRY PI TO A NETWORK

In this lesson you will learn how to connect the Raspberry Pi computer to a network, with both a wired and a wireless connection. To complete this activity you will need to have access to a network connected to the internet or network equipment such as an integrated wireless router with switch ports.

TASK 1 (5 minutes)

Connect the Raspberry Pi as shown below:

Diagram labels: Display (composite video), SD card loaded with Raspian operating system, Micro USB power connection, USB mouse and keyboard, Network cable, HDMI display port.

Connect the network cable to a network port. This may be an integrated wireless router similar to what you may use in a home network. The switch ports are usually at the back of the device. Alternatively, you can plug your Raspberry Pi into a network hub or switch. The connector type is called **RJ45**. It will give a definite 'click' when plugged in and you will see the Raspberry Pi's network LED light up.

TASK 2 (10 minutes)

The next step is to check that the network device will provide the Raspberry Pi with an IP address automatically. You need to know that a **DHCP (Dynamic Host Configuration Protocol)** service is running on the wired and wireless router. It is usually on by default. We could assign a **static IP address** manually however, this is not usually done with client devices - only servers, network devices and printers because their IP address must not change and will be manually entered into client device configuration.

| | | |
|---------------|----------------------------------|--------------------------|
| LAN Settings | | |
| Link/IPv4 MAC | 90:10:0F:02:45:13 | IP address of the router |
| IP Address | 192.168.8.1 | |
| Subnet Mask | 255.255.255.0 | |
| DHCP Server | Enabled (G_LAN, S_VL4/4 Clients) | ←DHCP is enabled |

Expected approximate duration:

Task 1 - 5 minutes

Task 2 - 10 minutes

Task 3 - 10 minutes

Task 4 - 10 minutes

Additional activities - 40 minutes

To complete this activity the following resources are required:

- Raspberry Pi model A or B (B recommended)
- Raspian Wheezy system image on SD card (download: www.raspberrypi.org/downloads)
- HDMI or composite video cable and monitor
- Micro USB power supply
- USB keyboard and mouse
- 802.11n or g USB wireless network adapter
- Integrated wireless router
- Cat 5e/ Cat 6 UTP straight through network cable

TASK 1

The first task involves learners connecting the monitor, power, keyboard and mouse to the Raspberry Pi. They will also connect a wired link to the router via the switch ports. There are many integrated wireless routers that would be suitable that can be simply set up using the manufacturer's instructions. A hub or switch would also be suitable to link devices. These devices would not require any prior configuration to be added.

TASK 2

The integrated wireless router will need to be running a DHCP (Dynamic Host Configuration Protocol) service to provide the Raspberry Pi with an IP address for use on the network. All modern integrated wireless routers will support this service and it will normally be turned on by default. Although the address could be statically configured on the Pi, this is not a realistic mechanism for client configuration on a large LAN therefore the use of DHCP is preferable. Most integrated wireless routers will have a default configuration that automatically uses DHCP with a range within the 10.0.0.0 or 198.162.0.0 networks. The Raspberry Pi will automatically send out DHCP request packets so should be assigned an address without further intervention from the user. The address assigned can be verified using the `ip addr` command in an LX Terminal window. It is helpful for learners to see both ends of the connection: both the configuration of the Raspberry Pi and the wireless router. The latter will have a web based configuration page that could be viewed in a browser window on the Pi or using a laptop connected via a second cable. It will be beneficial for learners to view this page and to have access to the manufacturer's setup instructions.

It would be valuable to discuss other significant network terms with more able students such as **default gateway, subnet mask, broadcast, DHCP, DNS, server, client, MAC address** and it may also provide an opportunity to discuss IPv6.

TASK 3

This task allows learners to test their connection. If an internet connection is not available, connectivity can be tested by pinging the router from the Raspberry Pi. If the router does not use an IP address of 192.168.0.1 then the correct address should be shared with students prior to them starting the activity.

Ensure that network cables used are functional before beginning the tasks as this may be difficult for the learners to detect unless a cable tester is also provided.

TASK 4

The final task in this sequence is to configure the Raspberry Pi to connect to a wireless network. An 802.11n or g USB wireless adapter should be connected to the Raspberry Pi. Learners should be able to view the wireless router configuration page. It is recommended that initially, the network should be setup with open authentication. If a successful connection is established, WEP or WPA can then be configured. Learners will need to ensure that they type the key in correctly.

ADDITIONAL ACTIVITIES

Task 4 could lead to an interesting discussion about network security and the relative protection afforded by WEP, WPA and WPA2 as well as the general risks associated with wireless communication.

The production of a troubleshooting guide will allow learners to reflect on their experiences and to recall problem solving techniques that they employed or that could be used if they did not encounter any problems. Learners should test their network in a structured way using a test plan which should show expected and actual outcomes. Encourage them to work through the most likely causes to locate faults.

Typical issues will be:

- Broken or unplugged network cable
- Interference on a wireless network link
- Incorrect wireless network key entered
- Incorrect wireless network authentication or encryption method configured
- DHCP not configured correctly
- Incorrect IP configuration
- DNS service not running/not available