PROGRESS OUTCOME 6

Farm connections: Further extending the network

Context

The school farm has been operating with an established computer network in the shearing shed (see Snapshot 8). The farm manager now wishes to expand data collection and analysis across the farm to monitor soil moisture, humidity levels and water trough levels using recently purchased Wi-Fi-enabled technologies. The redesigned network must also further improve student safety and connectivity while ensuring that students are not able to 'hack' the system.

In consultation with the farm manager and the school network manager, Callum has been given access to computer equipment no longer needed by the school.

Insight 1: Planning the outcome

This was a large job, so, in discussion with my teacher, we agreed that I would enhance the existing network to take on the Wi-Fi technologies and another student would develop the monitoring solution.

I sketched out a plan of components, hardware and software for a working network and how the devices would connect with each other. I discussed the plan with the network manager and farm manager. We identified that the network needed to recognise and communicate with a range of devices and that these would require a reliable way to connect to the network.

Insight 2: Developing the wider network

I set up wireless devices to communicate with the network and configured the IP addresses assigned by the DHCP (Dynamic Host Configuration Protocol). I then found that the network topology was inadequate for this setup because the devices could not connect with a reliable signal.

I researched my options and decided that a different network topology was required because of the farm's unique environment. I carried out a site survey and began mapping, using Google Earth™ to place mesh nodes above water and away from animal interference.

Insight 3: Refining my understanding

I realised that in order to have this large and complex network function reliably, I needed to consider the layout as a whole. I researched the OSI (Open Systems Interconnection) model and found that its goal is the interoperability of diverse communication systems with standard protocols. This model allowed me to structure my network within a seven-layer system so that others could easily track my process and setup.

I developed a schematic that showed the different parts of my project against these seven layers – that is, the physical, data link, network, transport, session, presentation, and application layers. I decided to set up a VLAN (virtual local area network) to manage this connectivity using Ethernet bridging.

Insight 4: Implementing a mesh network

Now it was time to set up the mesh network that would communicate via different sensors situated around the farm. I set the sensors up and configured their settings to ensure connectivity. One sensor would not establish a connection, so I manually assigned an IP address to it. This worked, so I reset it to 'dynamic' and restarted the server, which resolved the issue.

Insight 5: Testing the functionality

I decided to configure ICMP (Internet Control Message Protocol) on this network because it allows computers on a network to share error and status information. I wanted ICMP for network discovery and mapping and decided there was little risk of cascading ping floods, so I changed the configuration setting to allow for this.

I used a variety of tools and techniques to make sure that the network was functioning as it should. I ensured that all the IoT (Internet of things) clients were sending data to the server, and I checked aerials, power and water tightness on devices that were not sending data.

All mesh nodes were operational and communicating. I completed some simple diagnostics, including powering components off and on to make sure that the network would still function if one of the nodes went down.

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