A wireless network device (1) comprises first and second wireless bridges (2, 3) and a wireless LAN access point (12), each with a respective input/output connection (17, 18, 19) for an antenna (6, 7, 14) to receive and transmit signals over a wireless link (8, 9), a switch (16) that interconnects the bridges (2, 3) and access point (12) to route data either between the two bridges (8, 9) or between the access point (12) and the two bridges (8, 9), and a housing (20) which houses the two bridges (8, 9), the access point (12), and the switch (16). Preferably, the channel frequency of the bridges (8, 9) is different to that of the access point (12), thereby reducing interference between the bridging and access point functions when they are both present. Preferably the device has one or more of the following features: battery powered; solar powered; waterproof housing; and is adapted to be mounted at the top of a pole or to be wall mounted.
WIRELESS NETWORKS

This invention relates to a wireless network device and networks comprising multiple such devices.

Wireless network technology based on the standard IEEE 802.11x is now used to set up wireless LANs and long distance wireless links with high data rates that can support multi-user access to the Internet. A LAN wireless access point has a coverage area sufficient to support connection of multiple users within it’s locality, provided each user has a PC or other device with a suitable wireless network adapter. The access point itself may be connected to an Ethernet backbone or a high speed broadband Internet connection. An access point therefore provides a wireless-to-wired network connection. A wireless bridge allows a line of sight wireless link to be set up with a similar device located up to several miles away, each wireless bridge typically being linked into a local Ethernet network.

An object of the present invention is to facilitate the creation of a wireless network comprising multiple nodes, which might function as bridges (point-to-point or point-to-multipoint) and/or access points for wireless LAN access.

According to the invention, a wireless network device comprises first and second wireless bridges and a wireless LAN access point, each with a respective input/output connection for an antenna to receive and transmit signals over a wireless link, a switch that interconnects the bridges and access device to route data either between the two bridges or between the access point and the two bridges, and a housing which houses the two bridges, the access point, and the switch.

A wireless network device according to the invention has the ability to be configured so that it functions solely as a bridge, routing data via the switch between the two bridges. Alternatively, the device can be configured so that it functions both as a bridge and an access point, simultaneously routing data between the bridges and between the wireless LAN of the access point and either bridge. Thus, multiple such devices can form the nodes of a wireless network with the bridges forming either point-to-point or point-to-multipoint
wireless links, and the access point being optionally configured to support wireless LAN access at any node.

Preferably, the wireless network device according to the invention is configured so that the channel frequency of the bridges is different to that of the access point, thereby reducing interference between the bridging and access point functions when they are both present.

Also, the wireless network device according to the invention preferably has one or more of the following features:-
Battery Powered
Solar powered.
A waterproof housing.
Adapted to be mounted at the top of a pole or to be wall mounted.

The invention will now be described by way of example with reference to the following drawings in which:

Figure 1 is a schematic drawing of a wireless network device according to the invention,
Figure 2 is a schematic drawing showing how the electrical components of the device of Figure 1 are incorporated in a housing,
Figure 3 shows how the device of Figures 1 and 2 is adapted to be mounted at the top of a pole,
Figure 4 shows a network incorporating multiple devices as shown in Figures 1 to 3, and
Figure 5 shows a circuit diagram for the power circuit of the device of Figure 1.

The wireless network device 1 illustrated in Figure 1 comprises a number of component devices integrated into a multifunctional unit. The component device comprise two wireless bridges 2, 3, each with a respective input/ output connection 4, 5 for an antenna 6, 7 (Figure 3) to form a wireless link 8, 9 with a wireless bridge 2', 2" of a similar device 1', 1" located some distance away, typically miles. The bridges 2, 3 conform to the IEEE 802.11x standard. Both bridges 2, 3, are mounted on a common printed circuit board 10, as shown in Figure 2.
The network device 1 also includes an access point 12 which is also mounted on the printed circuit board 10. The access point 12 has an input/output connection 13 for an antenna 14 which is adapted to give wireless coverage for a wireless LAN in the vicinity of the device 1. The access point 12 conforms to the IEEE 802.11x standard, and multiple users having PC's or devices 15 with suitable wireless network adapters are able to communicate via this wireless LAN. The users may communicate with one another or with the internet or other networks under the control of a router 16.

The router 16 is also mounted on the printed circuit board 10. The router has input/output connections 17, 18, 19 on the printed circuit board 10 to each of the bridges 2,3 and the access point 12, and serves to route packets between the input/outputs 4, 5 and 13 according to the packet addressing. For example, users may access the internet from the devices 15 via the access point 12 and the wireless links 8 or 9.

This combination of components has the important advantage that the resulting integrated device 1 can be configured to provide wireless LAN access via the access point, and/or a dedicated wireless link via the two bridges. The dedicated wireless link may be set up to run at the maximum speed to provide the infrastructure backhaul, and the wireless LAN access may be restricted to a lower bandwidth. In order to support these dual simultaneous functions and avoid interference between them, the device 1 preferably operates simultaneously on two or more frequencies. For example, the bridging function and LAN access functions operate on channels at opposite ends of the 802.11x spectrum of 2.412 - 2.462Ghz.

As shown in Figure 2, the device 1 is enclosed within a two-part housing 20 which is sealed to be weatherproof, and which is adapted to be mounted at the top of a communication mast or pole 21. The antenna 6, 7 and 14 may also be attached to the pole 21. The location of the antenna 6, 7, 14 below the housing helps to eliminate solar shadows.
A power supply is provided to power the device 1 and may comprise batteries housed within the housing 20 or located in close proximity to the device 1, for example, in a housing 11 at the base of the mast 21. The batteries may comprise lead acid batteries. Battery power may be supplemented by solar power generated a solar cell array 22 on the upper surface of the housing 20 for maximum exposure to sunlight. The power circuit showing the batteries 23 and solar cell array 22 is shown in Figure 5. A regulator 24 is connected between the solar cell array and the battery 23, and a voltage convertor 25 is connected between the battery 23 and the device 1.

The device 1 is mounted at the top of the pole 21 via a joint 26, which may be angularly adjustable to allow the solar cell array 22 to be orientated at the optimum angle relative to the sun, or which may be fixed at an optimum angle to suit the latitude at which the device is to be deployed.

Multiple devices 1, as described above, may be deployed to form a wireless network over a wide area, as shown in Figure 4. Each device 1 is located at a network node and is configured according to the functionality required, that is, whether or not it is to incorporate an access point, and is to provide a point-to-point or point-to-multipoint wireless link through each of the bridges 2, 3. In the network illustrated in Figure 4, seven of the nine network nodes incorporate an access point and point-to-point wireless links, and two of the network nodes M provide point-to-multipoint wireless links only.

In an alternative embodiment of the invention, a device 1 may be wall mounted instead of being mounted at the top of a mast or pole.
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Claims

1. A wireless network device comprising first and second wireless bridges and a wireless LAN access point, each with a respective input/output connection for an antenna to receive and transmit signals over a wireless link, a switch that interconnects the bridges and access point to route data either between the two bridges or between the access point and the two bridges, and a housing which houses the two bridges, the access point, and the switch.

2. The device as claimed in claim 1 configured so that the channel frequency of the bridges is different to that of the access point, thereby reducing interference between the bridging and access point functions when they are both present.

3. The device claimed in claim 1 or 2 in which the first and second bridges and wireless LAN access point are mounted on the same printed circuit board.

4. The device as claimed in claim 3 in which the switch is mounted on the same printed circuit board.

5. The device as claimed in claim 4 in which the housing is a two-part housing.

6. The device as claimed in any one of the preceding claims in which the housing is waterproof.

7. The device as claimed in any one of the preceding claims in which the antennae are mounted beneath the housing to reduce solar shadows.

8. The device as claimed in any one of the preceding claims which is battery powered.

9. The device as claimed in any one of the preceding claims which is solar powered.

10. The device as claimed in claim 9 in which the housing is adapted to be angularly adjustable to orientate solar cells relative to the sun.
11. The device claimed in any one of the preceding claims adapted to be wall mounted.

12. The device claimed in any one of claims 1 to 10 adapted to be mounted at the top of a pole.

13. A wireless network comprising multiple wireless network devices as claimed in any of the preceding claims.
Application No: GB0404333.7
Claims searched: 1-13

Examiner: Mr Nigel Hall
Date of search: 31 January 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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<td>GB 2389281 A (Hewlett-Packard) See figs 3, 5 and accompanying description</td>
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The following online and other databases have been used in the preparation of this search report:

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