TITLE: DISTRIBUTED NETWORK COMMUNICATION SYSTEM WHICH ENABLES MULTIPLE NETWORK PROVIDERS TO USE A COMMON DISTRIBUTED NETWORK INFRASTRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to network communications, and more specifically to a system and method enabling a network infrastructure to support multiple network providers and/or customers of multiple network providers. The invention also relates to a system and method enabling different access levels within a wired or wireless network system.

2. Description of the Relevant Art

Various types of wired and wireless infrastructures are being developed to service users of computing devices, such as portable computing devices (PCDs). Currently, numerous providers are attempting to install wireless network infrastructures in various locations, such as airports, hotels, office buildings, etc. for use by various users. However, when two or more providers install a wireless network infrastructure in a single location, such as an airport, the providers may begin to oversubscribe the RF domain. In other words, the electromagnetic spectrum usable by these wireless networks is limited, and if two or more wireless networks are installed in the same location, this may result in inadequate RF bandwidth for use by each of these networks. Currently, only 3 non-overlapping RF channels are available for different network providers. Once these channels are used, no further bandwidth, or limited bandwidth, may be available for other providers.

IEEE 802.11 defines the IEEE standard for wireless Ethernet. IEEE 802.11 is designed to support multiple overlapping wireless local area networks (LANs) in a given coverage area. Each wireless local area network will typically include one or more access points which communicate in a wireless fashion with a corresponding computing device of a user, which typically includes a wireless Ethernet transceiver. IEEE 802.11 currently uses a System ID (SID) to "select" which LAN to use and which access point with which to associate.

However, due to the problems associated with multiple wireless infrastructures installed in a common area, it may be desirable to provide a single wireless (or wireless and wired) infrastructure which may be used by two or more different network service providers. Therefore, it would be desirable to provide a system and method which enables a common wireless network infrastructure to be used by two or more network service providers. This would allow a plurality of service providers to utilize a common set of access points to provide service to a potentially overlapping set of customers. This would also provide subscribers or users with the ability to more fully utilize the existing network infrastructure. It would further be desirable to provide a distributed wireless network system which can selectively provide different access levels to users of the system. It would further be desirable to provide the above features in a wired network service system.

SUMMARY OF THE INVENTION

One embodiment of the present invention comprises a system and method for providing access and/or multiple service provider features on a distributed network system. The network system includes a plurality of access points coupled to a network. The network access points include wireless access points and may also include

wired access points. Access points (APs) for the network may be widely distributed in various facilities, such as airports, mass-transit stations, and various businesses, such as business offices, restaurants, and stores, e.g., coffee shops or restaurants at an airport. The network may couple to a wide area network, such as the Internet. A plurality of network providers (also called wireless service providers) may provide network services, such as Internet access, over the network infrastructure.

In one embodiment, a user, also referred to as a subscriber, may access the network system through a portable computing device (PCD) using, for example, a wireless (or wired) network interface card. When in sufficiently close range to an access point, the PCD may wirelessly access the network system, or the PCD may be directly connected to a wired connection. In one embodiment, the APs are arranged at known geographic locations and may provide geographic location information regarding the geographic location of the AP or the mobile user.

Each PCD may store network provider identification information (also called "identification information") which may uniquely indicate at least one network provider of a plurality of possible network providers. The identification information thus may designate the network provider (or providers) to which the user of the PCD is a subscriber. The identification information may take various forms, such as a System ID (SID), MAC ID, or other identification which may be used to identify the network provider to which the user has subscribed. When the PCD becomes close to an access point, the PCD may provide the identification information to the access point.

In one embodiment, each of the access points are operable to "listen for" or detect identification information, e.g., System IDs, associated with numerous different providers. Alternatively, each of the access points may be operable to broadcast requests for identification information, e.g., broadcast recognized System IDs to the PCDs, wherein the PCDs may respond to this broadcast by providing the identification information. When the access point receives the identification information from a PCD of a user, the access point may determine the network provider for the portable computing device using the identification information. Thus, the access point is able to recognize and process identification information which identifies any of the plurality of possible network providers. In other words, the access point is able to accommodate subscribers associated with a plurality of different providers. In one embodiment, the APs answer all queries from all PCDs, even if the identification information from the PCD does not match the information available to that particular AP, e.g., even if an unknown SID is received.

In one embodiment, the network system may include a memory medium which stores a list of identification information that maps to a corresponding list of the plurality of possible network providers. The memory medium may be comprised in one or more of, or all of, the access points, or may be comprised in one or more other devices connected to the network, such as a computer system. In this embodiment, determining the network provider for the portable computing device includes accessing the memory medium and using the received identification information to determine the network provider. For example, the access point or other device may use the received System ID to index into a table to determine the appropriate network provider.

The memory medium may also store associated access information. For each of the network providers, the access information may include access methods for providing user data to the respective network provider, such as a destination IP address of the network provider. The appropriate access method may be used based on the identification information and/or the determined network provider. Thus, the identification information may be

used to determine the appropriate provider as well as be used to automatically route network packets or data from/to that PCD to the appropriate provider.

The access information stored on the memory medium may also include an access level which indicates the user's access rights or privilege level. Thus, the local network may provide various local resources which are available to all users regardless of access level, and users with a higher access level may in addition be entitled to Internet access. In other environments, all users may receive Internet access, and users with a lower access level may not be entitled to view or utilize certain or all local network resources on the network. Thus, depending on the access level, the user may be simply provided solely with external Internet access, or only local network access, or may be provided with no network services. The access level may also possibly depend on the known geographic location of the AP or the user. For example, the access level for each user may vary depending on the known geographic location of the AP to which the user is currently associated.

In one embodiment, one or more of the identification information (network provider ID) and the access information may be provided by the PCD of the user. Thus, an access point or other device on the network may not be required to perform a look-up to determine this information, but rather this information may be provided by the PCD.

When the portable computing device communicates with the access point, the network access may be provided to the portable computing device through the determined network provider. For example, the access point may provide the data to a destination based on or specified by the determined network provider, e.g., may provide or route the data to the determined network provider's site, e.g., to equipment provided by the network provider. The network provider may then provide Internet access and/or provide other network services. The network provider will also typically charge a fee for this service. The access point preferably provides the data to the destination in a secure manner to prevent the data from being unintentionally provided to third parties, such as other providers.

Thus access points of the network system are useable by subscribers of each of the plurality of possible network providers, thereby enabling subscribers to "roam" on various networks, including networks maintained by other providers. For example, the plurality of access points may be maintained by a first network provider, and a subscriber of a second network provider may be recognized and allowed use of the network. Alternatively, the plurality of access points may be maintained by an independent third party, and subscribers of any of various network providers may be recognized by access points and allowed use of the network. Network providers may charge subscribers for access regardless of who operates or maintains the network. In addition, the network system may selectively provide different access levels to network resources depending on the access or privilege level of the user. This allows visitors or non-members of a network system to be allowed certain network services, such as Internet access, without compromising other private network resources.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which:

Figure 1 is a block diagram of one embodiment of a wireless network system;

Figure 2 is a more detailed block diagram of one embodiment of the wireless network system of Figure 1;

Figure 3 is a block diagram of another embodiment of the wireless network system of Figure 1:

Figure 4 is a flowchart diagram illustrating operation of allowing access to a wireless network system using a roaming model;

Figure 5 illustrates an example of a data structure which stores network provider and access information; and

Figure 6 illustrates selectively allowing access to a wireless network system using various access levels.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figure 1 - Network Communication System

Figure 1 shows one embodiment of a distributed network communication system 100. The network system 100 may include one or more access points 120, preferably a plurality of access points 120. At least a subset of the access points 120 are wireless access points (APs) 120 which communicate with a portable computing device (PCD) 110 in a wireless fashion. Each wireless access point (AP) 120 may have a wireless connection or transceiver (e.g., an antenna) and may operate according to various wireless standards, such as wireless Ethernet (IEEE 802.11), Bluetooth, etc. One or more of the access points 120 may also be wired access points which communicate with a portable computing device 110 in a wired fashion.

Each AP 120 may be coupled to a network 130. The network 130 may comprise a wired network, a wireless network or a combination of wired and wireless networks. For example, the network 130 may be a standard "wired" Ethernet network which connects each of the wireless (and wired) access points 120 together. The network 130 may also be a wireless network based on IEEE 802.11. The network 130 may form part of the Internet, or may couple to other networks, e.g., other local or wide area networks, such as the Internet.

The network 130 may also include or be coupled to other types of communications networks, (e.g., other than the Internet) such as the public switched telephone network (PSTN), whereby a user using PCD 110 may send and receive information from/to the PSTN or other communication network through a network provider. The network 130 may also include, or be coupled to, another wide area network 130, such as a proprietary WAN. The network 130 thus may be, or be coupled to, any of various wide area networks (WANs) or local area networks (WANs), including the Internet.

The access points (APs) 120 may be widely distributed in various facilities, such as airports, mass-transit stations, hotels, shopping malls, restaurants and other businesses, such as business offices, law firm offices, retail stores, etc. For example, where the access points 120 are distributed in an airport, one or more access points 120 may be distributed throughout various terminals in the airport, in an airline club, and in coffee shops, restaurants or rental car counters at the respective airport. The access points 120 may thus be primarily designed to service mobile users, wherein it may not be known ahead of time which mobile users will be accessing the network from

which locations. Thus the network system 100 is preferably a distributed network system, with access points placed in locations to service mobile users. This differs from a conventional fixed LAN, where it is generally pre-configured as to which pre-determined users will be using which nodes in the fixed LAN on a day-to-day basis, and the relative access levels that these pre-determined users have is also pre-configured.

Each access point 120 may comprise information used to identify or select a network provider (also called wireless service provider) for a particular user, as well as related access information to enable the network provider to provide access. Each access point 120 may comprise information used to enable network access through a network provider of a plurality of possible network providers. Thus each access point 120 may support a plurality of different network providers. When in sufficiently close range to an access point 120, or when the PCD 110 is directly coupled to an access point 120 in a wired fashion, the PCD 110 may access the network utilizing a particular network provider, as discussed further below.

A user operating a portable computing device (PCD) 110 may communicate with one of the access points 120 to gain access to network services, such as Internet access. The portable computing device (PCD) 110 may have a wireless communication device, e.g., a wireless Ethernet card, Bluetooth wireless interface, etc., for communicating with a wireless access point 120. The portable computing device (PCD) 110 may instead have a wired communication device, e.g., an Ethernet card, for communicating with a wired access point 120.

The portable computing device 110 may be any of various types of devices, including a computer system, such as a portable computer, a personal digital assistant (PDA), an Internet appliance, a communications device, or other wired or wireless device. The PCD may include various wireless or wired communication devices, such as a wireless Ethernet (IEEE 802.11) card, Bluetooth logic, paging logic, RF communication logic, a wired Ethernet card, a modem, a DSL device, an ISDN device, an ATM device, a parallel or serial port bus interface, or other type of communication device.

The PCD 110 preferably includes a memory medium which stores identification information indicating a network provider to which the user has subscribed. The indicated network provider may be one of a plurality of possible network providers that provide Internet access or other network services in a network system such as that shown in Figure 1. The identification information may be a System ID (an 802.11 System ID), a MAC ID of a wireless Ethernet device comprised in the PCD 110, the name of the network provider, or other type of information that uniquely identifies one (or more) network providers. Where the wireless network is IEEE 802.11 wireless Ethernet, the identification information or System ID may be a SSID (Service Set ID), an ESSID (Extended Service Set ID) or possibly a BSSID (Basic Service Set ID). Where the wireless network is Bluetooth, the identification information may be an IP address. The identification information may be contained in a digital certificate, which may be stored in a web browser or other location of the personal computing device 110.

Where the access point 120 is a wireless access point 120, the wireless communication may be accomplished in a number of ways. In one embodiment, PCD 110 and wireless AP 120 are both equipped with an appropriate transmitter and receiver compatible in power and frequency range (e.g., 2.4GHz) to establish a wireless communication link. Wireless communication may also be accomplished through cellular, digital, or infrared communication technologies, among others. To provide user identification and/or ensure security, the PCD 110 may use any of various security mechanisms.

Where the access point 120 is a wired access point 120, the wired connection may be accomplished through a variety of different ports, connectors, and transmission mediums. For example, the PCD 110 may be connected through an Ethernet, USB, serial, or parallel transmission cables, among others. The PCD 110 may also include various communication devices for connecting to the AP 120, such as wired Ethernet cards, modems, DSL adapters, ATM adapters, IDSN devices, or other communication devices. For example, a hotel may have Ethernet connections in the restaurants, shops, and guest rooms. An airline club, e.g., an airport Admiral's Club, may also have both wireless and wired connections for mobile users. A user may connect to a wired access point 120 through the use of a laptop computer (PCD 110), an Ethernet network card, and a network cable. This connection may have the same impact as a connection made to a wireless AP 120 as discussed above. In other words, a user using a wired PCD 110 is able to "roam" on various network infrastructures in the same manner as a user using a wireless PCD 110.

One or more network providers may each have an associated network device 160 coupled to the network 130. For example, Figure 1 illustrates network devices 160 associated with three different network providers. The network devices 160 may take any of various forms, such as a computer system, router, bridge, etc. It is noted that network providers may provide network services at a location without being required to locate any equipment or bandwidth at a network location. For example, a network provider may combine VLANs and IP tunneling to avoid having to locate any equipment or bandwidth at a particular network location.

A user operating a portable computing device 110 will typically have previously subscribed with one (or more) network providers, also called Wireless Service Providers (WSPs). Examples of network providers include Wayport, MobileStar and Softnet, among others. As discussed further below, when the PCD 110 of a user communicates with an AP 120, the respective network provider to which the user is subscribed is determined. If no previous affiliation with a network provider is detected, a default network provider may be selected. After the network provider is determined or selected, network access or services may be provided through that network provider. For example, data or packets from the respective PCD 110 may be routed to a destination designated by the respective network provider, such as the respective provider's network device 160. This effectively allows a plurality of network providers to each offer access on a common network infrastructure, i.e., on common access points. Thus a single access point can support multiple different network providers, i.e., can support subscribers of multiple different network providers. This also allows subscribers of various network providers to "roam" on other networks, such as networks installed and/or maintained by other providers, or networks maintained by independent third parties.

The network system 100 may also include a management information base (MIB) 150. The MIB 150 may be a mechanism, such as a memory, which may allow the persistent storage and management of information needed by network 130 to operate. For example, in one embodiment of the invention, the MIB 150 may store a data structure, such as a table comprising a list of identification information and a corresponding list of the plurality of possible network providers. The data structure may also store access information, which may comprise associated methods for providing data to the respective plurality of possible network providers. The access information may further comprise access level or privilege level information. Thus, the data structure may comprise a table having a plurality of tuples, with each tuple having the identification information, e.g., a System ID, the corresponding network provider, and access information containing a method of access to the provider, possibly including a

destination IP address or other methodology for accessing the provider's site. In an alternate embodiment, as noted above, the data structures which store this information may be comprised in each of the access points 120, or may be provided in various other locations. Each tuple may further include wired transport information, such as a VLAN tag, indicating a channel to be used on the wired network to which the AP 120 is coupled.

As discussed further below, when a portable communication device 110 of a user begins communication with an access point 120, the portable communication device 110 may transmit network provider ID information, and the network provider for the portable computing device 110 may be determined using this data structure. The memory medium containing the data structure may be accessed, and received network provider identification information from the respective portable computing device 110 may be used to index into the data structure or table to determine the network provider. The appropriate access method may also be accessed and used for enabling the network provider to provide network services, e.g., the access method may be used for providing the data from the respective portable computing device 110 to the determined network provider. For example, wired transport information may also be used to determine how to transfer packets on the wired network. Access level information may also be retrieved and used to determine a user's access to local network resources or Internet access.

The MIB 150 may store other information, such as a directory of all the elements (e.g., APs, PCDs, etc) in the network, the topology of the network, characteristics of individual network elements, characteristics of connection links, performance and trend statistics, and any information which is of interest in the operation of the network 130. For example, the MIB may store the precise longitude, latitude, altitude and other geographic information pinpointing the location of each access point.

One or more service providers 140 may also be coupled to the network 130 or other networks to which the network 130 is coupled, such as the Internet 170. As used herein, the term "service provider" is intended to include various types of service and information providers which may be connected to the network 130. The service provider 140 may take any of various forms and may provide any of various services or information. Each service provider 140 may include one or more computers or computer systems configured to provide goods, information, and/or services as appropriate for the service provider. The one or more service providers 140 may couple to the network in a wired or wireless fashion.

The network communication system 100 may be geographic-based. In other words, the network communication system 100 may provide information and/or services to the user based at least partly on the known geographic location of the user, e.g., as indicated by the access points 120 or as indicated by geographic information (e.g., GPS information) provided from the PCD 110. In one embodiment, the APs 120 are arranged at known geographic locations and may provide geographic location information regarding the geographic location of the user or the PCD 110. In another embodiment, the PCD 110 may provide geographic location information of the PCD 110 through the AP 120 to the network 130. For example, the PCD 110 may include GPS (Global Positioning System) equipment to enable the PCD 110 to provide its geographic location through the AP 120 to the network 130, such as to a service provider 140 coupled to the network 130.

Memory Medium and Carrier Medium

One or more of the systems described above, such as PCD 110, access points 120, MIB 150, and network providers 160 may include a memory medium on which computer programs or data according to the present

invention may be stored. For example, each of the access points 120 and/or the MIB 150 may store a data structure as described above comprising information regarding identification information, corresponding network providers 160 and access information such as associated data routing methods. Each of the access points 120 and/or the MIB 150 may further store a software program for accessing these data structures and using the information therein to properly provide or route data between users (subscribers) and their corresponding network providers, or to selectively provide or route data depending on the access information.

The term "memory medium" is intended to include various types of memory or storage, including an installation medium, e.g., a CD-ROM, or floppy disks 104, a random access memory or computer system memory such as DRAM, SRAM, EDO RAM, Rambus RAM, EPROM, EEPROM, flash memory etc., or a non-volatile memory such as a magnetic media, e.g., a hard drive, or optical storage. The memory medium may comprise other types of memory as well, or combinations thereof. In addition, the memory medium may be located in a first computer in which the programs are executed, or may be located in a second different computer which connects to the first computer over a network. In the latter instance, the second computer provides the program instructions to the first computer for execution. The memory medium may also be a distributed memory medium, e.g., for security reasons, where a portion of the data is stored on one memory medium and the remaining portion of the data may be stored on a different memory medium. Also, the memory medium may be one of the networks to which the current network is coupled, e.g., a SAN (Storage Area Network).

Also, each of the systems described above may take various forms, including a personal computer system, mainframe computer system, workstation, network appliance, Internet appliance, personal digital assistant (PDA), television system or other device. In general, the term "computer system" can be broadly defined to encompass any device having a processor which executes instructions from a memory medium.

The memory medium in one or more of the above systems thus may store a software program or data for performing or enabling roaming or selective network resource access within a network system 100. A CPU or processing unit in one or more of the above systems executing code and data from a memory medium comprises a means for executing the software program according to the methods or flowcharts described below.

Various embodiments further include receiving or storing instructions and/or data implemented in accordance with the present description upon a carrier medium. Suitable carrier media include memory media as described above, as well as signals such as electrical, electromagnetic, or other forms of analog or digital signals, conveyed via a communication medium such as networks and/or a wireless link.

Figure 2

Figure 2 is a more detailed block diagram illustrating a portion of the wireless network system of Figure 1. Figure 2 illustrates an embodiment having three access points 120 which each couple through a respective VLAN, labeled VLAN1, VLAN2 and VLAN3. Each of VLAN1, VLAN2 and VLAN3 in turn couple to respective routers 160, labeled router A, router B and router C, which are provided by the respective network providers A, B and C respectively. These routers in turn couple to the Internet. As shown, one or more access controllers, e.g., computer systems configured to determine or control network service access, may be provided for each of the network providers. The access controllers operate to verify user or subscriber access to the respective provider's network. Figure 2 illustrates access controller A, access controller B and access controller C. As shown, access controllers A

and B are coupled to router A and router B respectively. However, the access controller may be located outside of the local network 130, e.g., may be comprised on any of various locations on the Internet, as shown with respect to access controller C.

In this embodiment, the data structure may store an identification information / VLAN tag mapping, e.g., an SID / VLAN tag mapping, which operates to map the user to the appropriate VLAN of the user's network provider. Thus, on the wired network to which the access points 120 are connected, the use of a different VLAN for each network provider operates to separate data traffic on the wired network for each of the network providers.

As shown, each of VLAN1, VLAN2 and VLAN3 may be supported in one or more Ethernet switches which support tagged VLANs (IEEE 802.1q). In addition, the switch may also support IEEE 802.1p, which provides various quality of service (QoS) metrics. This enables the switches to enforce certain predefined quality of service metrics to any given port or virtual port contained within the network. As shown in Figure 3, it is also noted that a router may be present on more than one VLAN. As shown, Figure 3 includes an 802.1q switch which couples to three access points referred to as access point 1 (AP1), access point 2 (AP2), and access point 3 (AP3). As shown, a router labeled router C may be coupled to two or more VLANs as shown.

Using VLANs, each access point 120 preferably has the ability to transmit/receive on one or more VLAN IPs to one or more network providers. This permits, but does not require, that each network provider use its own network numbering plan. At most, each network provider may have an access controller and a router at each coverage location. As shown in Figure 3, the access controller is not required to be physically located at the coverage location, but rather may be located anywhere.

Figure 4 - Network Access using Roaming

Figure 4 is a flowchart diagram illustrating operation of allowing roaming access and/or selective access to a wireless network system. In one embodiment, as described above, the PCD 110 includes network provider identification information (called "identification information" herein), preferably comprising a System ID, stored in the memory of the PCD 110. The identification information may store information which identifies one (or more) network providers to which the user of PCD 110 is a subscriber. As noted above, the System ID may be an IEEE 802.11 SSID or ESSID. The network provider identification information may also be an IP address in a Bluetooth wireless network.

The network access method of the present invention may be operable to receive and use the identification information to facilitate roaming, e.g., to allow a particular network provider of a plurality of possible network providers to be selected and used for a user operating on the network. As discussed further below, the identification information may also store access level information which may be used to indicate a network access or privilege level. This stored access level information may be used to selectively allow user access to different parts of the network.

As shown, in step 202 the user connects to the network (e.g., to an access point of the network). For example, the user may be walking in an airport with a portable computing device and may connect in a wireless fashion to an access point located at the airport. In another scenario, the user may enter a hotel room and connect in a wireless fashion to an Ethernet port in his/her room which is connected to the network. In another scenario, the user may enter an office of a business, such as a law firm or corporation, and may connect in a wireless or wired

fashion to an access point located in that office. Thus, the user may connect to the network or an access point of the network in any of various locations in a wireless or wired fashion.

In step 204 the personal computing device (PCD) 110 of the user may transmit network provider identification information (ID information) to an access point (AP) 120 of the network. The identification information may take any of various forms. In one embodiment, the identification information comprises a System ID (SID) according to IEEE 802.11. As discussed above, IEEE 802.11 (wireless Ethernet) is designed to support multiple overlapping wireless LANs in a given coverage area. IEEE 802.11 uses the System ID (SID) to "select" which LAN to use, and thus which access point with which to associate. In this embodiment each System ID may be uniquely associated with a respective network provider, and thus the user may configure the System ID on his/her PCD 110 to uniquely identify the network provider to which the user has selected or subscribed. The identification information may also or instead be a MAC (media access controller) ID which is comprised on a wireless Ethernet card of the personal computing device used by the user. The MAC ID may perform a similar purpose in selecting the network provider. As noted above, the identification information may take various forms. For example, the identification information may simply comprise the name of the respective provider and the appropriate access information, which may be contained in a digital certificate. The identification information may comprise other types of network provider identification as desired.

In prior art systems, access points are only able to "listen for" one System ID which corresponds to one network provider. According to one embodiment of the invention, each access point 120 is operable to "listen for" or "detect" a plurality of different sets of identification information, e.g., a plurality of different System IDs, which may correspond to a plurality of different possible network providers, or which may correspond to unknown network providers. Thus, each AP may be set up to "listen" for all types of identification information, e.g., listen for all SIDs, and to answer all queries from PCDs 110, even if the identification information or SID is not recognized by the particular AP 120. Alternatively, each of the access points may be operable to broadcast requests for identification information. For example, each of the access points may periodically broadcast requests for SIDs. Alternatively, each of the access points may periodically broadcast recognized System IDs to the PCDs, i.e., broadcast the sets of SIDs the access point supports, wherein the PCDs may respond to this broadcast by providing the identification information.

In step 206 the access point 120 to which the user has connected may transmit known geographic location information to the network (e.g., to a network provider on the network). This known geographic location information may originate from the AP 120 or from the PCD 110 of the user. As discussed further below, this known geographic location information may be used in various ways. For example, the geographic location information may be used in selecting among two or more possible network providers to which the user has previously subscribed, or may be used in selecting the default provider.

The geographic location information may also be used in determining the network services or access privileges of the user, or used in determining charging aspects of the use. For example, this known geographic location information may be used to determine whether a third party pays for the network access of the user. As one example, an employer of the user (employee) may have previously directed that the employer will pay for network access of the employee if the employee is located in an airport or hotel, but not if the employee is located, for example, in a bar. The known geographic location may also be used to determine a charge rate, based on

various incentive or sponsorship programs of which the user is a member. For example, the user may receive a discount if he/she uses network access from certain locations, such as a certain business, a certain airport club, etc. The known geographic location information may also be used to selectively provide different access or privilege levels based on the geographic location, e.g., a user may have greater privilege/access levels at a first geographic location than from a second different geographic location. This known geographic location information may further be used to provide services to the user which are dependent upon the geographic location of the user. For more information on the use of geographic location information for providing geographic based services, please see U.S. Patent No. 5,835,061, referenced above.

In step 212 the network provider may examine the received identification information, e.g., the System ID, or other identification information and determine whether the received identification information is known or recognized. In step 212 the method may also determine if other id information is valid. If the identification information is determined to not be known, e.g., the System ID is unknown, then in step 222 the method may perform processing to account for the unknown identification information. Step 222 may also involve performing processing for an unknown or incorrect digital certificate or other unknown information.

In step 222, where the identification information is determined to not be known or recognized, the method may select a default network provider for the user for network access. The default network provider may be the provider who maintains the wireless network system being used, or may be a randomly selected provider. In step 223 the user may be required to register with this provider to gain network access. This provider may then arrange for ad hoc billing of the user, such as by credit card. For example, the provider may present a web page on the user's PCD 110 requesting the user to enter credit card information for access to the network. Operation then proceeds to step 232.

Also, if the identification information is determined to not be known, the access or privilege level of the user may be set to the lowest possible level. This, for example, may allow the user to only have access to certain limited local resources, but no external access, e.g., to the Internet. Thus, for example, where the APs 120 are located in an airport, the user having a low access level, e.g., the user whose identification information is not known, may be granted access to certain local resources, such as coffee shops, bookstores, and advertising on the local LAN at the airport, but may not be provided with Internet access. Access to local resources may be allowed since this does not require the use of external facilities and hence does not consume off-property bandwidth, and thus is relatively inexpensive to provide. Alternatively, if the identification information of a user is determined to not be known, the system may provide some form of external access, which may be billed separately by an external Internet provider, without the user being able to view or use any local network resources.

If known identification information is determined to be received in step 212, then in step 216 the method may determine the network provider which corresponds to the identification information (e.g., the System ID). In the preferred embodiment, a data structure comprising network provider information is stored in each of the access points 120. In this embodiment, the respective access point with which the user is communicating receives the identification information and uses the identification information to obtain the appropriate or corresponding network provider to which the user of the PCD 110 is subscribed. In step 218 the respective access point 120 may also access the data structure to determine the appropriate access method or access level for providing data or packets to the respective network provider. For example, the respective access point 120 may access the data

structure to analyze the respective SID / VLAN tag to determine the VLAN tag to use for the respective network provider. The respective access point 120 may instead access this information from a separate data structure stored in MIB 150.

In an alternate embodiment, the PCD 110 of the user may provide all of this information to the access point 120. In this embodiment, the data structure containing the network provider data and access information may not be required to be stored in the access points 120 or on the network. Alternatively, data may be stored on the network 130, e.g., in the access points 120 or in the MIB 150, which is used only to validate this information received from the user.

As discussed above, the data structure is preferably a table comprising a plurality of three-tuples wherein each tuple stores a set of identification information, the corresponding network provider associated with that identification information, and access information associated with that network provider and/or the user. An example of this data structure is shown in Figure 5. The data structure shown in Figure 5 includes five different sets of three-tuples. It is noted that the data structure may take any of various forms.

The access information may include an access method, possibly including a destination address or other method by which data packets are routed to/from the respective site of the network provider or other method which directs that network access be provided by that network provider. The access information may also include a SID / wired transport mechanism mapping, such as a SID / VLAN tag mapping. The access information may also include an access level or privilege level that indicates which network resources that the user may access, e.g., whether the user is only allowed access to resources on the local network 130, or is only or in addition allowed external access, such as Internet access.

Thus, when the access point 120 receives the identification information, the access point may simply use the identification information to index into a table containing this information to determine the appropriate network provider and the respective access method and/or access level.

It is noted that each of steps 212, 216 and 218, and 222 may be performed as one action or a series of related actions. In other words, when the access point 120 receives the identification information, if the identification information does not index into any of the entries in the data structure or table, then the identification information or System ID is determined to be unknown or not associated with a respective network provider as determined in step 212. In this case, the default provider and default access level may be selected as performed in step 222. If the identification information does index properly into an entry of the table, but the corresponding network provider does not have the necessary equipment to accommodate the user, then this may also be treated as unknown identification information, where another provider or the default provider may be selected as performed in step 222.

If the identification information properly indexes into the table, then in steps 216 and 218 information from the respective entry of the table is accessed and used to determine a corresponding network provider which can accommodate the user's network access, as well as the associated method and access level for providing network access using the network provider.

After the network provider and associated access method / level have been determined in each of steps 216 and 218, then in step 232 network access or network services may be provided to the portable computing device 110 through the determined network provider. For example, in step 232 the access point 120 to which the user is

communicating may operate to provide data to/from a destination specified by the determined network provider using the method specified by the determined network provider, e.g., the method comprised in the table or data structure. In one embodiment, the access point 120 may operate simply as a bridge or router which operates to forward or route packets to the appropriate destination, e.g., to the network provider's network device 160 or to the provider's site. As noted above, the network provider may provide a network device 160 such as a router, which operates to route packets to the provider's site or otherwise simply allow Internet access to the user. Thus in step 232 the method allows the personal computing device of the user access to the network using the user's provider.

In another embodiment, the access point 120 itself operates as a router to route packets to the determined network provider's site, which may be located on the Internet. Thus, in this embodiment, the network provider may not be required to provide any type of network device 160 to enable network access for its respective subscribers. Rather, data packets from the PCD 110 of the user may be routed to the network provider's site on the Internet, which may be located in any location.

In step 232 data is communicated between the PCD 110 and the respective destination specified by the network provider preferably using a secured technique. Examples of possible secured techniques include Layer 2 forwarding; various tunneling protocols such as PPTP, IPSEC, GRE, and IP-in-IP; and tagged VLANs (IEEE 802.1q), among others.

In one embodiment, in step 232 the access point 120 operates to direct PCDs 110 to an available communication channel, e.g., an available RF channel or other wireless channel, possibly based on information received from the PCD 110. Thus the access point 120, not the PCD 110, may assign channels for communication. For example, the an access point 120 may operate to direct a PCD 110 to an available communication channel (e.g., an RF channel) based on the identification information, e.g., the SID, received from the PCD 110. The access point 120 may also operate to direct the PCD 110 to an available communication channel based on other types of identification or authentication information, or on the determined access level of the PCD. This allows an access point 120 to separate the communication traffic onto different channels based on the network provider being used, or based on the access or privilege level of the PCD 110. For example, the access point 120 may assign a PCD 110 a communication channel based on whether the PCD 110 has access to private portions of the network.

In step 234 the selected network provider may record charges for the network access. In one embodiment, each of the network provider's respective devices 160 may maintain separate charge/billing information for each of their respective subscribers. Thus, the network device 160 of the selected network provider may record charges for the network access of the user. Alternatively, a computer system coupled to the network 130, such as the MIB 150, or another computer system, may receive information from the wireless access point 120 as to the determined network provider, and the computer system may maintain billing/charging information for each of a subset or all of the network providers. In one embodiment, billing information for the user may be stored on the PCD 110 and may be provided to the AP 120.

As noted above, network charging information may also be based on known geographic information, as well as, for example, sponsorship or demographic information of the user, which may be provided to the access point in a digital certificate.

As noted above, the data structure or table containing network provider information may be stored in each of the access points 120. Alternatively, the data structure may be stored in a separate computer system, such as the

MIB 150. In this latter instance, each of the access points 120 may operate to forward the identification information to the MIB or other computer system 150, and this computer system performs steps 212, 216 and 218 of determining the appropriate network provider and corresponding access method, or selecting the default provider. Once the network provider and access method have been determined in this embodiment, this information may be forwarded to the respective access point 120 for proper routing, or the respective access point 120 may forward data received from the PCD 110 of the user to the MIB 150 or an associated router for proper routing to the respective network provider's device 160 or to the appropriate site on the Internet.

Thus, in step 232 the PCD 110 of the user is allowed to obtain network access through his previously chosen network provider, i.e., through the network provider to which the user has previously subscribed. As noted above, the network provider, may operate to maintain billing/charging information through its equipment 160, at its site, or through a shared resource such as MIB 150. As also noted above, the billing information may be stored on the PCD 110 of the user, e.g., in the user's digital certificate. In this case, if the AP 120 answers the query of the PCD 110 and allows access after confirming the identification information, the system allow for roaming and billing. This effectively allows users to roam on various network infrastructures, e.g., allows a user who is a subscriber of network provider A to roam on a network infrastructure operated and maintained by network provider B. Alternatively, certain portions of the network infrastructure may be built and maintained by a third party who is not a network provider, and subscribers of each of the various network providers may be able to roam onto this network, perhaps with a small fee being paid to the manager of the network infrastructure in addition to the fee normally paid to the network provider for network access. Further, users who have never previously subscribed to a network provider may be allowed to communicate with an AP 120 and select a network provider, or be assigned the default network provider, for access.

Different Access Levels

As noted above, in one embodiment, the data structure or table may store one or more different access methods depending upon an access level received within the identification information. Thus, referring back to Figure 1, the network 130 may provide certain local network resources as well as external Internet access which may be both available to users having a first access level. Users with a second lower access level may not be entitled to external access, but may be simply able to view or utilize certain local network resources on network 130. Users may also be selectively allowed to make 802.11 voice calls using the network, depending on access level.

For example, in an airport scenario, a non-recognized user, or a user paying a lower fee, may have an access/privilege level that only allows him/her local content such as various airport advertising, airport information such as the layout of the airport, including where the restroom, restaurants, etc. are located, flight information, etc., but does not allow the non-recognized user external access, e.g., access to the Internet. A non-recognized user would of course also not have any access to private corporate LAN's maintained on this network, such as the corporate LANs of airlines located at the airport.

If the wireless network system provides a mechanism for the user to register or subscribe to a network provider, then the user may do so and receive Internet access through that selected provider. As another alternative,

the network system may provide a mechanism for the user to register or subscribe to an external network provider, e.g., and external ISP, perhaps with a small referral fee paid to the maintainer of the network system.

Alternatively, the network 130 may provide various local resources as well as external Internet access which are both available to users having a first access level, and users with a second access level may not be entitled to view or utilize these local network resources on network 130, but may be simply provided some form of external access, such as external telephone access using VoIP or possibly a pathway to the Internet.

For example, where the network 130 and one or more wireless access points 120 are comprised in an airport, one or more airlines may maintain various computing resources on the local network 130 which are usable solely by airline employees and personnel. In this embodiment, PCDs 110 of airline employees may comprise identification information which indicates an access level that allows them access to the various computing resources on the network 130. Thus, employees of a first airline such as American Airlines may have first access level information stored on their PCD 110 that entitles them to utilize certain American Airline computing resources on the network 130, whereas employees of Delta Airlines may have second different access level information stored on their PCD 110 which enables use of only Delta Airlines computing resources located on the network 130 etc. For those users who are not airline employees or personnel, these users may have access information stored on their PCD 110 which only allows them external access toward the Internet and use of certain non-private local resources, but does not allow them to view or use any of the private computing resources on the network 130. Thus, PCDs 110 of users may store various access level information comprised within the identification information which selectively allows access to certain resources on the local network 130. This effectively allows private and public portions of the network 130.

As another example, consider an office, such as a law firm office or business which maintains one or more wireless or wired access points 120. Employees of the office may have first access level information (possibly of varying degrees) stored on their PCD 110 which enables them access to selected resources or all resources on this network 130. However, visitors to this office which do not have this privilege or access level may be detected by a wireless or wired access point and not be allowed to view or use any of the resources on the local network 130, but rather may simply be provided a port for complementary (or billable) external access to the Internet. Thus, a visitor or customer of the business who is physically present in the office and desires Internet access may utilize his PCD 110 to gain access to the Internet through the local network of the office 130, without the visitor or customer being able to view any of the computing resources, file servers, etc. of that local network 130. In addition, if the user's corporate intranet is web-based, the user may be allowed access to his own LAN computing resources remotely. This allows businesses to provide customers and visitors with Internet access through its network 130 without compromising the security of the network 130.

As noted above, in one embodiment, the known geographic location information may also be used to selectively provide different access or privilege levels based on the geographic location, e.g., a user may have greater privilege/access levels at a first geographic location than from a second different geographic location. For example, where the network 130 and one or more wireless access points 120 are comprised in an airport, a user may have a greater access level and hence access to more network resources from, for example, an airline club such as an Admiral's club, and the same user may have a lesser access level and hence access to fewer network resources from an airline gate. Thus the access level of a user may be based at least partly on the geographic location of the

user. This may possibly based on various agreements negotiated by service providers to "reward" users who are present at their geographic location, in a similar manner to which the network charge rate may also be based on the geographic location of the user.

Thus, in step 218, where the method determines an access method for the network provider, the method may also determine one or more access levels or privilege levels contained within the identification information to determine whether the should be provided with Internet access or should only have access to local resources on the network. The method may also determine the known geographic location of the user to aid in determining the access level as described above.

In step 232 the access point 120 or MIB 150 or other device operates to provide or route data depending upon this access level. Thus, users with the appropriate access level may have Internet access as well as be able to view and use resources on the network 130, while users lacking this necessary access level may simply be provided with certain local network resources and not have any Internet access. Alternatively, users having a lower access or privilege level may be provided some form of external access, such as local telephone access using VoIP, 802.11 voice calls, or possibly complementary Internet access, without being able to view or use certain private network resources.

Figure 6 illustrates one exemplary embodiment, where a PCD 110A of a first user comprises identification information having an access level which indicates that the user has access only to the computing resources on the local network 130. In this instance, once this access level has been verified as determined by a lookup in the table or data structure, data or packets from the PCD 110A may be routed to various computing resources on the local network as shown by the arrows designated "1". In contrast, PCD 110B of a second user comprises identification information which includes a greater access level which encompasses accessing local resources on network 130 as well as Internet access. In this instance, in addition to local network access, data or packets may also be routed from the PCD 110B through the access point 120 and directly out to an external access port for Internet access. Thus, the user who does not have the appropriate access or privilege level is able to view or use any computing resources on the network 130, but cannot gain Internet access through the network 130. As noted above, the system can also be configured whereby the user who does not have the appropriate access or privilege level is only allowed Internet access, and users with higher privilege levels are able to view or use computing resources on the network 130.

Thus, the present invention enables two or more network providers to utilize a common set of wireless or wired access points to provide their respective services to a potentially overlapping set of customers. This allows use of a single network infrastructure, which minimally impacts the wireless spectrum available at a location while allowing the maximum possible number of network providers to offer their network access services. In addition, the system and method described herein allows subscribers of a network provider A to be able to use the network access service provided by network provider B in a location otherwise not serviced by provider A without necessarily providing any relationship with provider B and vice versa. This allows a confederation of network providers to offer network access to a larger footprint of locations, which offers more value to each of their respective subscribers.

The system may thus allow network access from multiple different providers. For example, one communication service may be referred to as a Wayport network (Wayport is a Registered Trademark of Wayport,

Inc. of Austin, Texas). A Wayport network may be compatible with other types of similar networks maintained by other companies. For example, if Wayport networks are installed in the Austin-Bergstrom International airport and similar 'XYZ' networks are installed in a hotel in downtown Austin, a user that has subscribed to Wayport networks may be able to use the services offered at the downtown hotel by XYZ. More specifically, a user that has registered with a Wayport network (e.g., has entered demographic data and agreed to pay transaction costs) may not need to register with XYZ. The user may use other network providers (e.g., XYZ networks) and still only be billed from one company (e.g., the provider of the Wayport network with which the user is registered). This may be accomplished through agreements established between different network providers.

For example, a Wayport network-registered user attempts to connect to a XYZ network in the downtown hotel. In the embodiment described herein, the access point 120 maintained by the XYZ network still answers or communicates with the PCD 110, even though the PCD 110 provides identification information that is different from, and possibly not even recognized by, the access point 120. In this example, assume the XYZ network notices from the PCD ID information that the user is not registered on the XYZ network, but is registered on the WAYPORT network. The XYZ network may perform a verification of the PCD ID by querying a database of registered PCD IDs on the WAYPORT network. The XYZ network may acquire demographic information on the credentials of the user. If the credentials of a user are not acceptable, access to the XYZ network may be denied. If the credentials are acceptable, the XYZ network may grant the user access to various goods, information and/or service providers. The XYZ network may inform the user (via a message on the user's PCD) that there is an additional cost for accessing the XYZ network as a non-registered user. The user may then have the choice of paying the additional fees for the services or disconnecting. In addition, the user may have the option of registering with the XYZ network to avoid paying 'roaming' fees.

Wireless AP Usage of Multiple Channels

A wireless access point 120 can use one of a plurality of different RF (radio frequency) channels for communication with portable computing devices of users. For example, a wireless access point 120 can use one of RF channels 1 through 11. As is well known, RF channels 1, 6 and 11 are non-overlapping, with the remainder of these channels being partially overlapping with other channels.

According to one embodiment of the present invention, each wireless access point can communicate on one or more, e.g. a plurality of or all of, the available wireless channels, e.g., the available RF channels. Furthermore, each access point 120 can control which channel the portable computing device 110 of a client is able to use. In one embodiment, each portable computing device may scan each of the RF channels until it detects a wireless access point 120 at one of the channels.

In one embodiment, one or more of the wireless access points may each utilize a plurality of the RF channels, e.g., may use each of the non-overlapping channels 1, 6 and 11 to effectively provide up to three times the channel capacity. Thus, the wireless access point 120 may be able to control allocations of a plurality or all of the respective RF channels to selectively obtain higher bandwidth when appropriate, or to simply accommodate a greater number of subscribers. Thus, if a wireless access point using only one RF channel could only handle fifty PCD's 110 on that respective channel, the wireless access point may operate to use all three non-overlapping RF channels to effectively triple this capacity to a total of 150 simultaneous PCD's 110.

As another example, if the wireless access point 120 is only communicating with one portable computing device 110, then the wireless access point 120 may optionally or selectively use each of the three non-overlapping RF channels to produce effectively three times the bandwidth for this communication. As additional portable computer devices come into communication with the respective wireless access point, 120, the wireless access point 120 may selectively allocate different channels to different ones of these PCD's as needed. Further, if more than three PCD's are communicating with the respective wireless access point, the wireless access point 120 may partition one or more of the respective channels for the respective users, such as using wireless Ethernet Collision Sense Multiple Access/Collision Detection (CSMA/CD) or other multiple access schemes such as TDMA, FDMA, or CDMA, among others.

In one embodiment, as described above with respect to step 232, the access point 120 operates to direct PCDs 110 to an available channel, possibly based on information received from the PCD 110. Thus the access point 120, not the PCD 110, may assign channels for communication. For example, the an access point 120 may operate to direct a PCD 110 to an available communication channel (e.g., an RF channel) based on the identification information, e.g., the SID, received from the PCD 110. The access point 120 may also operate to direct the PCD 110 to an available communication channel based on other types of identification or authentication information, or on the determined access level of the PCD. This allows an access point 120 to separate the communication traffic onto different channels based on the network provider being used, or based on the access or privilege level of the PCD 110. For example, the access point 120 may assign a PCD 110 a communication channel based on whether the PCD 110 has access to private portions of the network.

While the present invention has been described with reference to particular embodiments, it will be understood that the embodiments are illustrative and that the invention scope is not so limited. Any variations, modifications, additions, and improvements to the embodiments described are possible. These variations, modifications, additions, and improvements may fall within the scope of the inventions as detailed within the following claims.

WHAT IS CLAIMED IS:

1. A method for providing access to a network system, wherein the network system includes a plurality of access points coupled to a network, the method comprising:

a first access point receiving identification information from a portable computing device, wherein the identification information indicates a network provider of a plurality of possible network providers, wherein said first access point includes a memory medium which stores a data structure comprising a list of identification information entries each indicating at least one network provider of the plurality of possible network providers;

determining the network provider for the portable computing device after receiving the identification information, wherein said determining the network provider for the portable computing device includes accessing the memory medium and using the received identification information to determine the network provider;

the first access point receiving data from the portable computing device;

providing network access to the portable computing device through the network provider determined in said determining.

2. The method of claim 1, wherein said providing network access comprises providing the data received from the portable computing device to a destination based on the determined network provider.

3. The method of any of the preceding claims, wherein the first access point is useable by subscribers of each of the plurality of possible network providers.

4. The method of any of the preceding claims, further comprising:

maintaining and storing a usage amount by the portable computing device;

wherein the determined network provider charges for access by the portable computing device to the network.

5 (Cancelled)

6. The method of any of the preceding claims, wherein the data structure further comprises associated methods for providing data to the respective plurality of possible network providers;

wherein said determining the network provider for the portable computing device includes accessing the memory medium, using the received identification information to determine the network provider, and using an associated method for providing the data to the network provider.

7. The method of claim 6, wherein the data structure stores a destination address indicating a destination specified by the network provider;

wherein said providing the data comprises providing the data to the destination specified by the network provider.

8. The method of any of the preceding claims, wherein the plurality of access points are maintained by a first network provider;

wherein the identification information indicates a second network provider.

9. The method of any of the preceding claims, wherein the identification information comprises a System ID of the portable computing device, wherein the System ID uniquely identifies the network provider of the plurality of possible network providers.

10. The method of any of the preceding claims, further comprising:

the first access point receiving identification information from a portable computing device, wherein the identification information indicates a first network provider of the plurality of possible network providers;

determining the first network provider for the portable computing device after receiving the identification information;

the first access point receiving data from the portable computing device;

providing the data received from the portable computing device to a destination associated with the first network provider;

the first access point receiving identification information from a portable computing device, wherein the identification information indicates a second network provider of the plurality of possible network providers:

determining the second network provider for the portable computing device after receiving the identification information;

the first access point receiving data from *the* portable computing device; and

providing the data received from the portable computing device to a destination associated *with* the second network provider.

11. The method of any of the preceding claims,

wherein the plurality of access points are arranged at known locations in a geographic region, the method further comprising:

the first access point providing geographic location information indicating a known geographic location of the portable computing device:

wherein said providing network access comprises selectively providing network access to the portable computing device based on the known geographic location of the portable computing device;

12. The method of any of the preceding claims, wherein the data structure further comprises a list access levels, the method further comprising:

determining an access level for the portable computing device after receiving the identification information, wherein said determining the access level for the portable computing device includes accessing the memory medium and using the received identification information to determine the access level;

the first access point receiving data from the portable computing device; and

providing the data received from the portable computing device to a destination based on the determined access level.

13. The method of claim 12, wherein said providing the data comprises:

providing the data to one or more resources on the network to allow the portable computing device access to the one or more resources on the network if the access level is a first access level;

providing the data to a destination for external access out of the network to only allow the portable

computing device access to other networks if the access level is a second access level;

wherein, if the access level is the second access level, the data is not provided to the one or more resources on the network.

14. The method of any of the preceding claims, wherein the first access point communicates with the portable computing device in a wireless fashion.

15. The method of claim 14, further comprising:

assigning a wireless communication channel for communication between the first access point and the portable computing device.

16. The method of claim 15, wherein the first access point assigns the wireless communication channel for communication between the first access point and the portable computing device.

17. The method of claim 15, wherein said assigning comprises assigning the wireless communication channel based on the identification information received from the portable computing device.

18. The method of claim 15. wherein said assigning comprises assigning the wireless communication channel based on the determined network provider.

19. The method of claim 14, further comprising:

determining an access level for the portable computing device after receiving the identification information; and

assigning a wireless communication channel for communication between the first access point and the portable computing device based on the determined access level.

20. The method of any of the preceding claims, wherein the first access point communicates with the portable computing device in a wired fashion.

21. A network system comprising a plurality of access points, wherein the network system is operable to implement a method according to any of the preceding claims.

22. The network system of claim 21, the network system comprising;

a network;

a plurality of access points coupled to the network, wherein each of the plurality of access points is operable to communicate with a portable computing device, wherein each of the plurality of access points is configured to receive identification information from the portable computing device indicating a network provider of a plurality of possible network providers, wherein each of the plurality of access points includes a memory medium which stores a data structure, wherein the data structure comprises a list of identification information entries and corresponding network providers, wherein each entry indicates a respective network provider of the plurality of possible network providers;

wherein each of the plurality of access points is operable to determine the network provider indicated in the identification information;

wherein in determining the network provider for the portable computing device, each of the plurality of access points is operable to access the memory medium and use the received identification information to determine the network provider;

wherein network access is provided to the portable computing device through the indicated network provider.

23. A network system. comprising:

a network;

a plurality of access points coupled to the network. wherein each of the plurality of access points is operable to communicate with a portable computing device, wherein each of the plurality of access points is configured to receive identification information from the portable computing device indicating a network provider of a plurality of possible network providers, wherein each of the plurality of access points includes a memory medium which stores a data structure, wherein the data structure comprises a list of identification information entries and corresponding network provider, wherein each entry indicates a respective network provider of the plurality of possible network providers;

wherein each of the plurality of access points is operable to determine the network provider indicated in the identification information;

wherein in determining the network provider for the portable computing device, each of the plurality of access points is operable to access the memory medium and use the received identification information to determine the network provider;

wherein network access is provided to the portable computing device through the indicated network provider.

24. An access point in a wireless distributed network system, wherein the access point is operable to communicate with a portable computing device, wherein the access point is operable to receive identification information from the portable computing device indicating a network provider of a plurality of possible network providers;

wherein the access point comprises a memory medium which stores a data structure, wherein the data structure comprises a list of identification information entries and corresponding network providers, wherein each entry indicates a respective network provider of the plurality of possible network providers;

wherein the access point is operable to determine the network provider indicated in the identification information, wherein in determining the network provider for the portable computing device, each of the plurality of access points is operable to access the memory medium and use the received identification information to determine the network provider;

wherein the access point is operable to provide network access to the portable computing device through the determined network provider.

25. The access point of claim 24, wherein the access point is useable by subscribers of each of the plurality of possible network providers.

26. The access point of claims 24 or 25, wherein the access point is operable to provide data received from the portable computing device to a destination based on the determined network provider.

27. (Cancelled)

28. The access point of any of claims 24 through 27, wherein the access point implements a method of any of claims 1 through 20.

29. A method for providing roaming features on a wireless network system, wherein the wireless network system includes a plurality of access points coupled to a network, the method comprising:

a first access point receiving identification information from a portable computing device in a wireless manner, wherein the identification information indicates a network provider of a plurality of possible network providers, wherein said first access point includes a memory medium which stores a data structure comprising a list of identification information entries each indicating at least one network provider of the plurality of possible network providers;

determining the network provider for the portable computing device after receiving the identification information, wherein said determining the network provider for the portable computing device includes accessing the memory medium and using the received identification information to determine the network provider;

the first access point receiving data from the portable computing device in a wireless manner;

providing the data received from the portable computing device to a destination based on the determined network provider.

30. The method of claim 29, wherein the wireless network system is a distributed wireless network system.

31. A method for providing access to a wireless network system, wherein the wireless network system includes a plurality of access points coupled to a network, the method comprising:

a first access point receiving identification information from a portable computing device in a wireless manner, wherein the identification information indicates a network provider of a plurality of possible network providers, wherein said first access point includes a memory medium which stores a data structure comprising a list of identification information entries each indicating at least one network provider of the plurality of possible network providers;

determining the network provider for the portable computing device after receiving the identification information, wherein said determining the network provider for the portable computing device includes accessing the memory medium and using the received identification information to determine the network provider;

the first access point receiving data from the portable computing device in a wireless manner;

providing network access to the portable computing device through the determined network provider.

32. A method for providing selective access to network resources in a distributed wireless network system, wherein the wireless network system includes a plurality of access points coupled to a network, the method comprising:

a first access point receiving identification information from a portable computing device;

determining an access level for the portable computing device after receiving the identification information;

the first access point receiving data from the portable computing device; and

providing the data received from the portable computing device to a destination based on the determined access level.

33. The method of claim 32, wherein said providing the data comprises:

providing the data to one or more resources on the network to allow the portable computing device access to the one or more resources on the network if the access level is a first access level;

providing the data to a destination for external access out of the network to only allow the portable computing device access to other networks if the access level is a second access level;

wherein, if the access level is the second access level, the data is not provided to the one or more resources on the network.

34. The method of claim 1, wherein at least a subset of the identification information entries each indicate one or more virtual local area networks (VLANs).

35. The method of claim 34,

wherein each virtual local area network (VLAN) specifics a network provider.

36. The method of claim 35, wherein said providing network access comprises using a VLAN specified by the identification information.

37. The method of claim 1,

wherein the data structure further stores a respective network provider for each identification information entry:

wherein said determining the network provider comprises indexing into the data structure using the identification information to determine the network provider stored in the data structure corresponding to the identification information.

38. The method of claim 1, wherein said identification information comprises a known geographic location of the portable computing device.

39. The method of claim 1, wherein the plurality of access points are arranged at known locations in a geographic region, the method further comprising:

the first access point providing geographic location information indicating a known geographic location of the portable computing device.

40. The method of claim 1, wherein said identification information comprises a digital certificate.

41. A method for providing access to a wireless network system, wherein the wireless network system includes a plurality of wireless access points coupled to a network, the method comprising:

a first wireless access point receiving identification information from a portable computing device in a wireless manner, wherein the portable computing device and the first wireless access point communicate using wireless Ethernet, wherein the identification information indicates a VLAN, wherein the first wireless access point is operable to implement a plurality of possible VLANs;

the first access point receiving data from the portable computing device in a wireless manner;

the first access point using the indicated VLAN to provide the data received from the portable computing

device to a destination.

42. The method of claim 41, further comprising:

determining a first network provider for the portable computing device after receiving the identification information;

wherein the first access point provides the data received from the portable computing device to the destination based on the determined first network provider.

43. The method of claim 42,

wherein the first network provider is determined based on the indicated VLAN.