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(54) **WIRELESS COMMUNICATION NETWORK SYSTEM AND METHOD**

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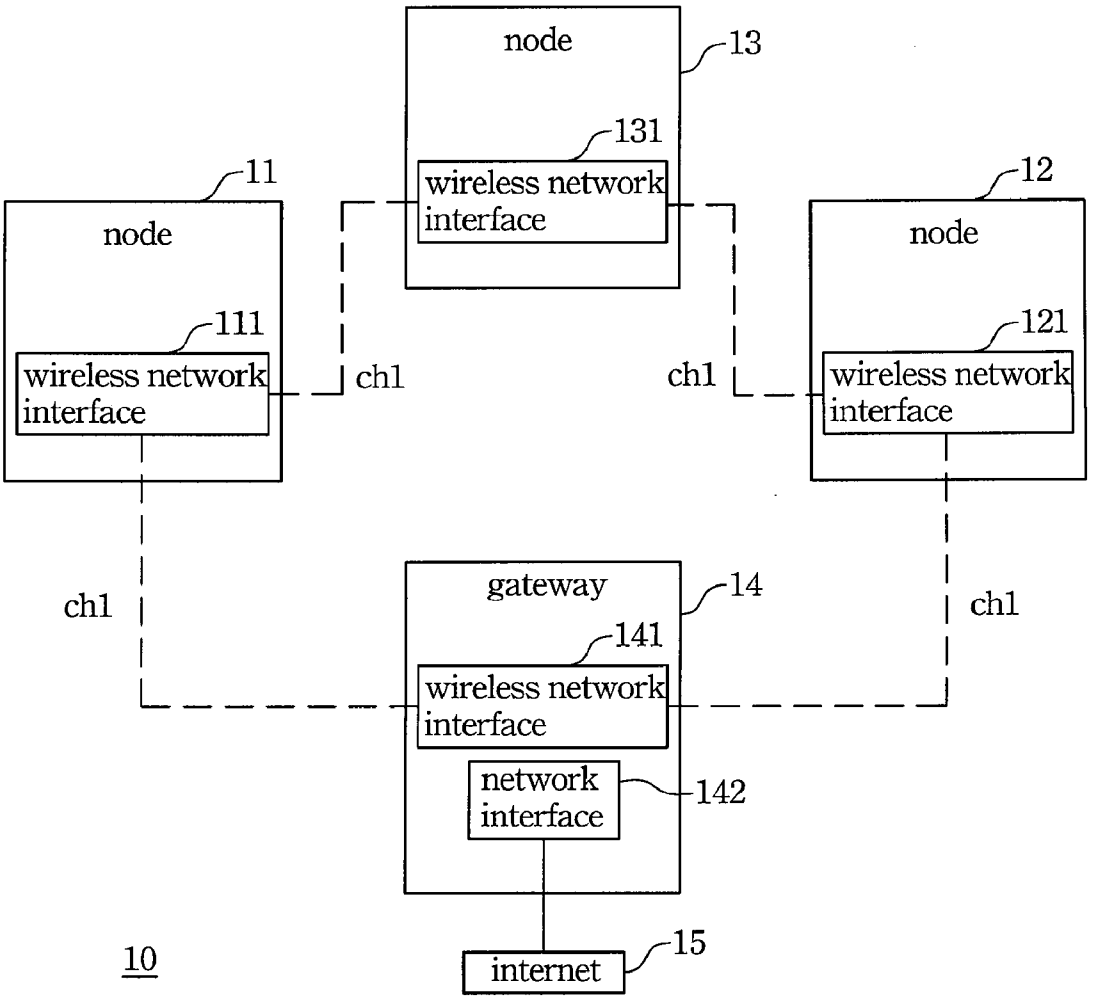
(57) **ABSTRACT**

A system for wireless communication network is disclosed. The system includes several nodes and at least a gateway. Each of the nodes includes several first wireless network interface. Each of the first interfaces utilizes one of channels to send, receive or forward signals. Wherein the first interfaces of the same node utilize different and non-overlapping channels to send, receive or forward the signals at the same time. Each of the gateways includes a network interface and several second wireless network interfaces. The network interface connects to the Internet to receive or forward the signals. Each of the second wireless network interfaces utilizes one of the channels to receive or forward the signals. Wherein the second wireless network interfaces of the same gateway utilize different and non-overlapping channels to receive or forward the signals at the same time.



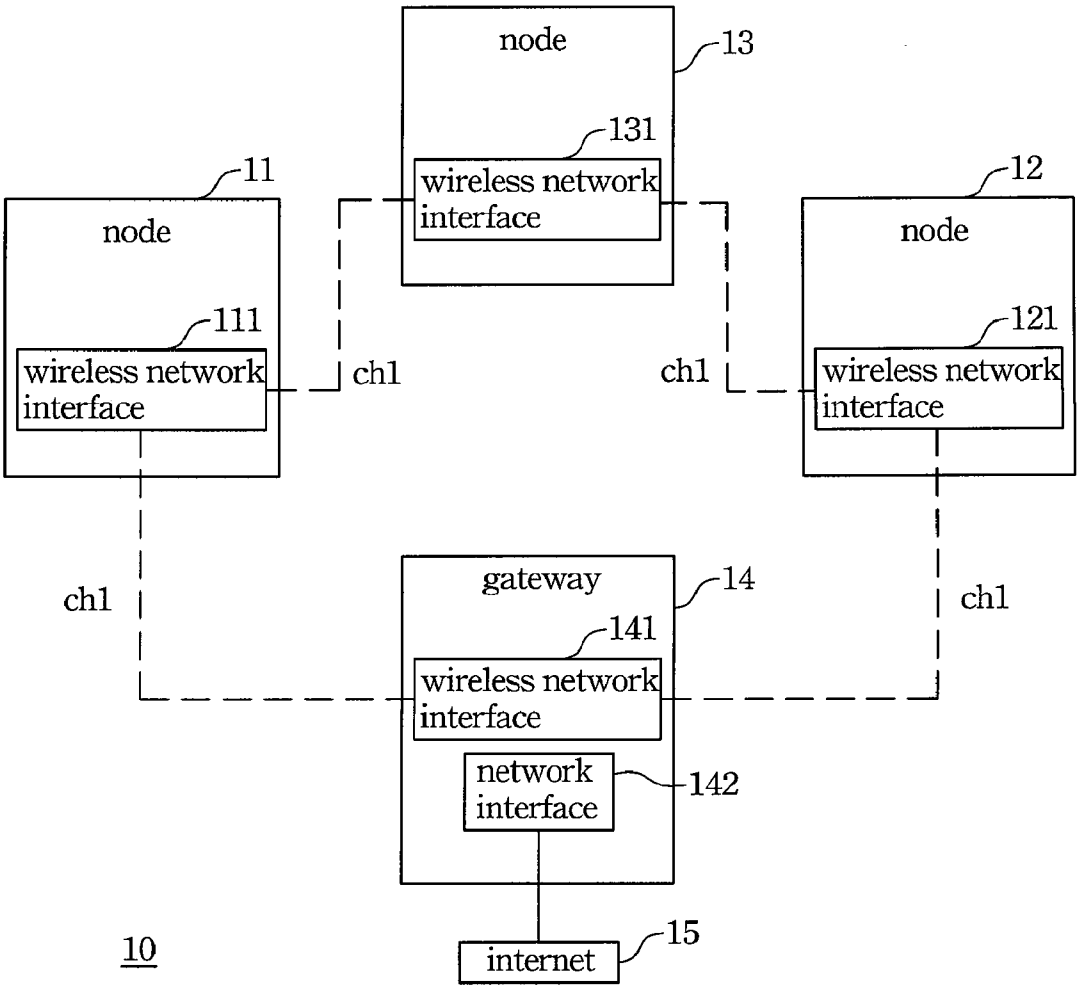

node
13
131
wireless network interface
11
node
111
wireless network interface
ch1
ch1
12
node
121
wireless network interface
ch1
ch1
gateway
14
141
wireless network interface
network interface
142
10
internet
15

Fig. 1

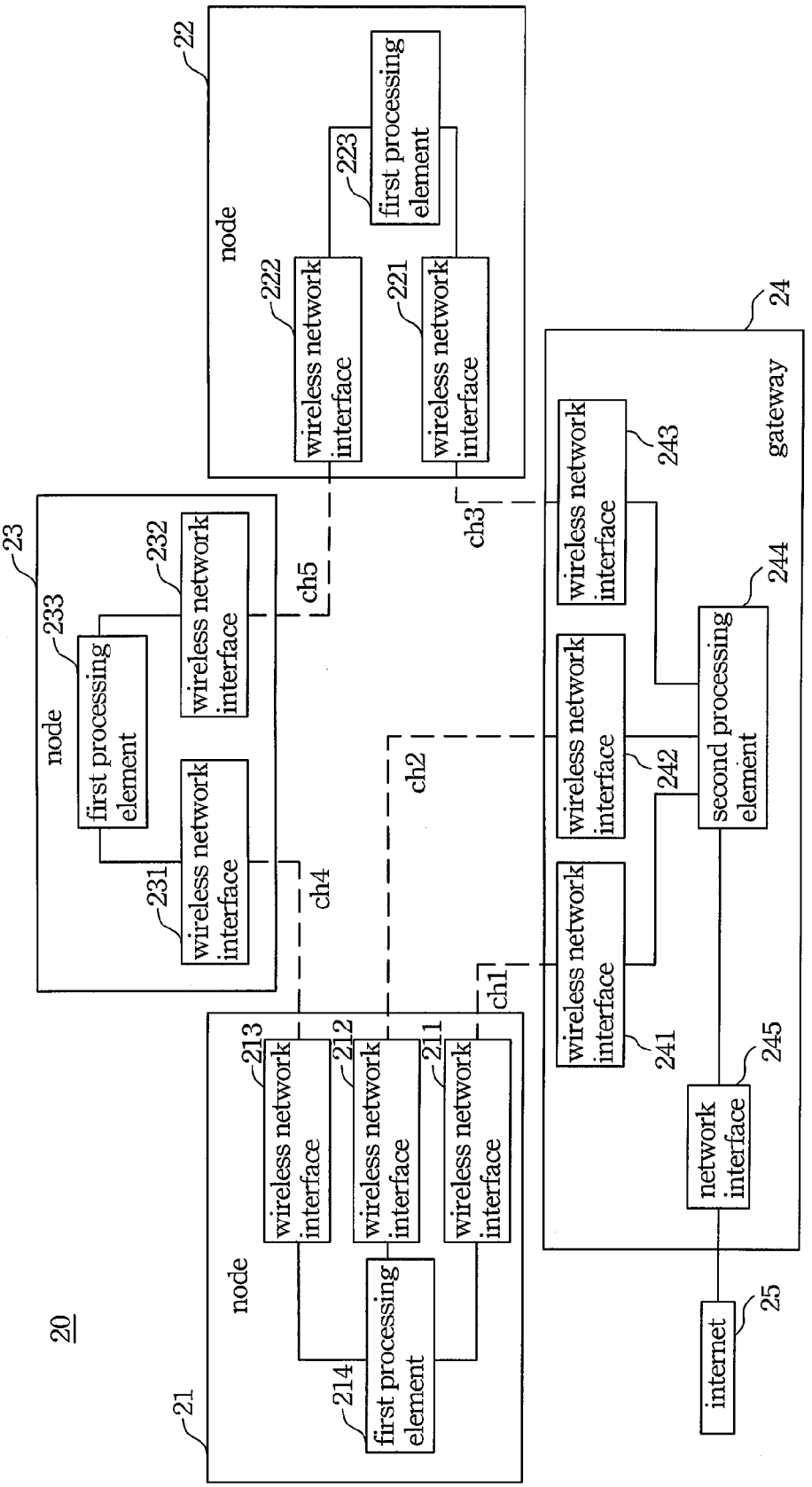

20
21
node
214
first processing element
wireless network interface
213
wireless network interface
212
wireless network interface
211
ch1
ch2
ch3
ch4
ch5
23
node
233
first processing element
231
wireless network interface
232
wireless network interface
22
node
222
wireless network interface
223
first processing element
221
wireless network interface
24
gateway
241
wireless network interface
242
wireless network interface
243
wireless network interface
244
second processing element
245
network interface
25
internet

Fig. 2

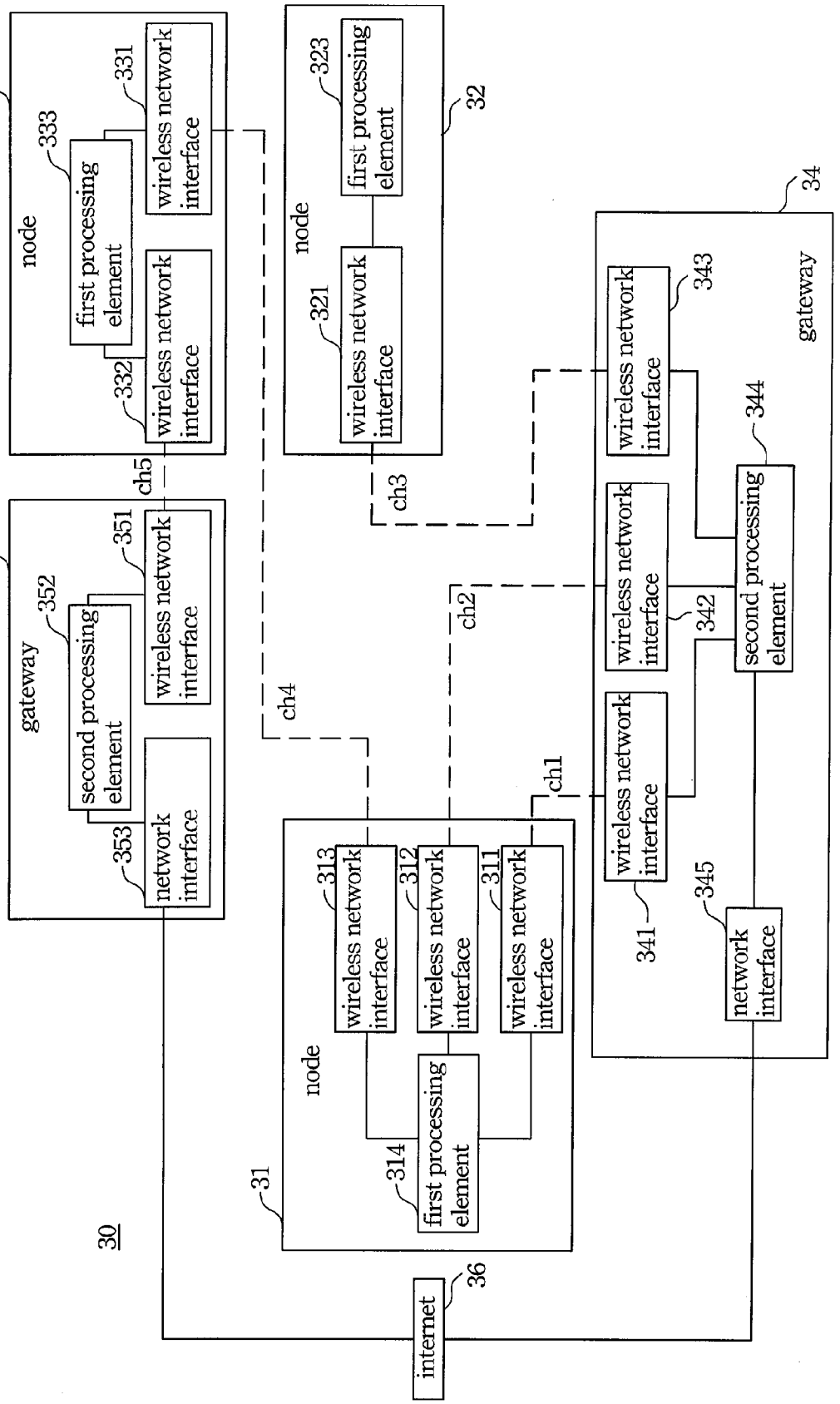

30
internet
36
node
31
wireless network interface
313
wireless network interface
312
wireless network interface
311
first processing element
314
ch1
ch2
ch3
ch4
ch5
gateway
35
second processing element
352
network interface
353
wireless network interface
351
node
33
first processing element
333
wireless network interface
332
wireless network interface
331
node
32
first processing element
323
wireless network interface
321
gateway
34
wireless network interface
341
wireless network interface
342
wireless network interface
343
second processing element
344
network interface
345

Fig. 3

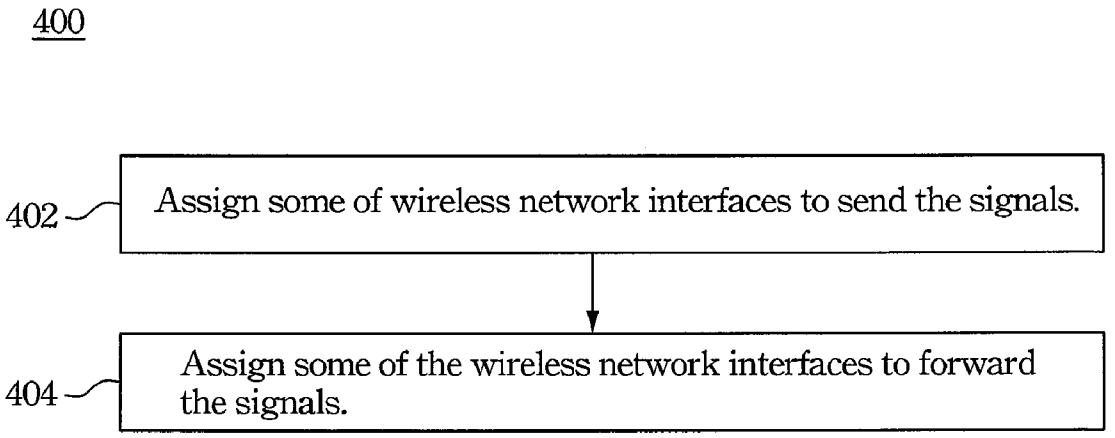

400
402
Assign some of wireless network interfaces to send the signals.
404
Assign some of the wireless network interfaces to forward the signals.

Fig. 4

WIRELESS COMMUNICATION NETWORK SYSTEM AND METHOD

BACKGROUND

[0001] 1. Field of Invention

[0002] The present invention relates to a wireless communication network system and method. More particularly, the present invention relates to a wireless communication network system and method communicating with several interfaces through several channels.

[0003] 2. Description of Related Art

[0004] FIG. **1** illustrates a conventional single-channeled wireless communication network system **10**. Referring to FIG. **1**, the single-channeled wireless communication network system **10** comprises several nodes **11**, **12**, **13** and a gateway **14**. The node **11** has a wireless network interface **111**, the node **12** has a wireless network interface **121**, and the node **13** has a wireless network interface **131**. The gateway **14** has a wireless network interface **141** and a network interface **142**. The network interface **142** connects to the Internet **15**. The wireless interfaces **111**, **121**, **131**, **141** utilize a single channel ch**1** to send, receive or forward signals. The channel ch**1** follows IEEE 802.11 (such as 802.11 a/b/g). However, only one wireless network interface **111**, **121**, **131**, **141** at a time can send signal to prevent collisions. Therefore, the bandwidth of the single-channeled wireless communication network system **10** is limited by the bandwidth of the channel ch**1**, which does not efficiently use the bandwidth between the network interface **142** and the Internet **15**.

[0005] Above all, there is a need for a method and a system for a wireless communication network to utilize the bandwidth between the gateway and Internet efficiently.

SUMMARY

[0006] A wireless communication network system is provided. The wireless communication network system includes several nodes and at least one gateway. Each of the nodes has several first wireless network interfaces. Each of the first interfaces utilizes one of channels to send, receive or forward signals. The first interfaces of the same node utilize different and non-overlapping channels to send, receive or forward the signals at the same time. Each of the gateways includes a network interface and several second wireless network interfaces. Each of the network interfaces connects to the Internet to receive or forward the signals. Each of the second wireless network interfaces utilizes one of the channels to receive or forward the signals. The second wireless network interfaces of the same gateway utilize different and non-overlapping channels to receive or forward the signals at the same time.

[0007] A wireless communication network method is also disclosed. The wireless communication network method includes the following steps. A process unit of a device assigns some of wireless network interfaces of the device to send the signals at the same time through different and non-overlapping channels. The process unit assigns some of the wireless network interfaces to forward the signals at the same time through different and non-overlapping channels.

[0008] These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description and appended claims. It is to be understood that both the foregoing general description and the following detailed description are by examples, and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:

[0010] FIG. **1** is a conventional single-channeled wireless communication network system;

[0011] FIG. **2** illustrates a multi-channeled wireless communication network system according to a first embodiment of this invention;

[0012] FIG. **3** illustrates a multi-channeled wireless communication network system according to a second embodiment of this invention; and

[0013] FIG. **4** is a flow diagram of a multi-channeled wireless communication network method according to a third embodiment of this invention.

DETAILED DESCRIPTION

[0014] Reference will now be made in detail to the present embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0015] FIG. **2** illustrates a multi-channeled wireless communication network system **20** according to a first embodiment of this invention. Referring to FIG. **2**, the multi-channeled wireless communication network system **20** comprises several nodes **21**, **22**, **23** and a gateway **24**. The node **21** comprises several wireless network interfaces **211**, **212**, **213** and a first process unit **214**. The node **22** comprises several wireless network interfaces **221**, **222** and a first process unit **223**. The node **23** comprises several wireless network interfaces **231**, **232** and a first process unit **233**. The gateway comprises several wireless network interfaces **241**, **242**, **243**, a second process unit **244** and a network interface **245**. Channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** can transmit the signals in the multi-channeled wireless communication network system **20**. Wherein the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** follow IEEE 802.11 (such as 802.11 a/b/g). Also, the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** are non-overlapping.

[0016] The first process unit **214** connects to the wireless network interfaces **211**, **212**, **213** respectively. The first process unit **223** connects to the wireless network interfaces **221** and **222** respectively. The first process unit **233** connects to the wireless network interfaces **231** and **232** respectively. The second process unit **244** connects to the wireless network interfaces **241**, **242** and **243** and the network interface **245**. The network interface **245** connects to the Internet **25**. The network interface **245** connects to the Internet through a cable modem, Asymmetric Digital Subscribe Line (ADSL), Integrated Services Digital Network (ISDN), T1, T2, T3, T4, E1, or Fiber Optical Network.

[0017] The wireless network interfaces **211**, **212**, **213**, **221**, **222**, **231** and **232** send, receive or forward signals through channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5**. The wireless network interfaces **241**, **242** and **243** receive or forward signals through the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5**. The wireless

network interfaces **211**, **212**, **213**, **221**, **222**, **231**, **232**, **241**, **242** and **243** can transmit signals to each other utilizing the same channel.

[0018] The first process unit **214** assigns the wireless network interfaces **211**, **212** and **213** to send, receive or forward signals. The first process unit **223** assigns the wireless network interfaces **221** and **222** to send, receive or forward signals. The first process unit **233** assigns the wireless network interfaces **231** and **232** to send, receive or forward signals. The second process unit **244** assigns the wireless network interfaces **241**, **242** and **243** to receive or forward signals. Therefore, the signals of the nodes **21**, **22** and **23** or the gateway **24** can be transmitted at the same time through several wireless network interfaces by the assignment. For example, the signals of the node **21** can be transmitted by the wireless network interfaces **211** and **212** at the same time to the gateway **24** through the assignment of the first process unit **214**.

[0019] Also, the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** can be assigned previously to the wireless network interfaces **211**, **212**, **213**, **221**, **222**, **231**, **232**, **241**, **242** and **243** to maximize the bandwidth of the multi-channeled wireless communication network system **20**. Therefore, the bandwidth of the network interface **245** can be utilized more efficiently. Take FIG. **2** for example, since the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** are non-overlapping, the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** can transmit the signals at the same time. Therefore, the maximum wireless network bandwidth of the multi-channeled wireless communication network system **20** is the total bandwidth of the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5**.

[0020] In the first embodiment, the multi-channeled wireless communication network system comprises several nodes and a gateway. Each of the nodes disposes several wireless network interfaces to transmit signals through several channels at the same time. The gateway disposes several wireless network interfaces to transmit the signals through different channels. Therefore, the bandwidth of the multi-channeled wireless communication network system increases, which makes the bandwidth between the gateway and Internet utilized efficiently.

[0021] FIG. **3** illustrates a multi-channeled wireless communication network system **30** according to a second embodiment of this invention. Referring to FIG. **3**, the multi-channeled wireless communication network system **30** comprises several nodes **31**, **32**, **33** and several gateways **34**, **35**. The node **31** comprises several wireless network interfaces **311**, **312**, **313** and a first process unit **314**. The node **32** comprises a wireless network interface **321** and a first process unit **323**. The node **33** comprises several wireless network interfaces **331**, **332** and a first process unit **333**. The gateway **34** comprises several wireless network interfaces **341**, **342** and **343**, a second process unit **344** and a network interface **345**. The gateway **35** comprises a wireless network interface **351**, a second process unit **352** and a network interface **353**. Channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** can transmit the signals in the multi-channeled wireless communication network system **30**. The channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** follow IEEE 802.11 (such as 802.11 a/b/g). Also, the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** are non-overlapping.

[0022] The first process unit **314** connects to the wireless network interfaces **311**, **312**, **313** respectively. The first process unit **323** connects to the wireless network interfaces **321**. The first process unit **333** connects to the wireless network interfaces **331**, **332** respectively. The second process unit **344** connects to the wireless network interfaces **341**, **342**, **343** and the network interface **345**. The second process unit **352** connects to the wireless network interface **351** and the network interface **353**. The network interfaces **345** and **353** connect to the Internet **36**. The network interfaces **345** and **353** connect to the Internet through cable modem, Asymmetric Digital Subscribe Line (ADSL), Integrated Services Digital Network (ISDN), T1, T2, T3, T4, E1, or Fiber Optical Network.

[0023] The wireless network interfaces **311**, **312**, **313**, **321**, **331** and **332** send, receive or forward signals through channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5**. The wireless network interfaces **341**, **342**, **343** and **351** receive or forward signals through the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5**. The wireless network interfaces **311**, **312**, **313**, **321**, **331**, **332**, **341**, **342**, **343** and **351** can transmit signals to each other utilizing the same channel.

[0024] The first process unit **314** assigns the wireless network interfaces **311**, **312** and **313** to send, receive or forward signals. The first process unit **323** assigns the wireless network interface **321** to send, receive or forward signals. The first process unit **333** assigns the wireless network interfaces **331**, **332** to send, receive or forward signals. The second process unit **344** assigns the wireless network interfaces **341**, **342**, **343** to receive or forward signals. The second process unit **352** assigns the wireless network interface **351** to receive or forward signals. Therefore, the signals of the nodes **31**, **32** and **33** or the gateways **34** and **35** can be transmitted at the same time through several wireless network interfaces by the assignment. For example, the signals of the node **31** can be transmitted by the wireless network interfaces **311**, **312** to the gateway **34** at the same time through the assignment of the first process unit **314**.

[0025] Also, the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** can be assigned previously to the wireless network interfaces **311**, **312**, **313**, **321**, **331**, **332**, **341**, **342**, **343** and **351** to maximize the bandwidth of the multi-channeled wireless communication network system **30**. Therefore, the bandwidth of the network interfaces **345** and **353** can be utilized more efficiently. Take FIG. **3** for example, since the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** are non-overlapping, the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5** can be utilized to transmit the signals at the same time. Therefore, the maximum wireless network bandwidth of the multi-channeled wireless communication network system **30** is the total bandwidth of the channels ch**1**, ch**2**, ch**3**, ch**4** and ch**5**.

[0026] In the second embodiment, the multi-channeled wireless communication network system comprises several nodes and several gateways. Each of the nodes disposes several wireless network interfaces to transmit signals through several channels at the same time. Each of the gateways disposes several wireless network interfaces to transmit the signals through different channels. Therefore, the bandwidth of the multi-channeled wireless communication network system increases, which makes the bandwidth between the gateways and Internet utilized efficiently.

[0027] FIG. **4** is a flow diagram of a multi-channeled wireless communication network method **400** according to a third embodiment of this invention. The multi-channeled wireless communication network method **400** begins with the step **402** in which a process unit of a device assigns some of wireless network interfaces to send signals at the same time through different and non-overlapping channels. In the step **404**, the process unit assigns some of the wireless network interfaces to forward the signals at the same time through different and

non-overlapping channels. Wherein, the device may be a node or a gateway with several wireless network interfaces.

[0028] In the third embodiment, the signals of the device are assigned to several wireless network interfaces. Besides, since the assignment of the signals is much faster than the wireless network transmission rate, the signals can be transmitted by several wireless interfaces assigned by the process unit through different channels at the same time. Therefore, increase the transmission rate of the signals.

[0029] Above all, each of nodes or gateways disposes several wireless network interfaces. In addition to assignment of wireless network interfaces, signals can be transmitted by several wireless network interfaces through several channels at the same time.

[0030] Although the present invention has been described in considerable detail with reference to certain embodiments thereof, other embodiments are possible. Therefore, their spirit and scope of the appended claims should not be limited to the description of the embodiments contained herein.

[0031] It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims.

What is claimed is:

1. A wireless communication network system, comprising:

a plurality of nodes, wherein each of the nodes has at least a first wireless network interface, each of the first wireless network interface utilizes one of a plurality of channels to send, receive or forward a plurality of signals, and the first wireless network interface of the same node utilizes different and non-overlapping channels to send, receive or forward the signals at the same time; and

at least a gateway, wherein each of the gateway comprises:

a network interface connecting to the Internet to receive or forward the signals; and

at least a second wireless network interface, wherein each of the second wireless network interface utilizes one of the channels to receive or forward the signals, and the second wireless network interface of the same gateway utilizes different and non-overlapping channels to receive or forward the signals at the same time.

2. The wireless communication network system of claim **1**, wherein each of the nodes further comprises a first process unit connecting to the first wireless network interface, and each of the first process units assigns at least one of the first wireless network interfaces to send, receive or forward the signals at the same time.

3. The wireless communication network system of claim **1**, wherein each of the gateway further comprises a second process unit connecting to the second wireless network interface, and the second process unit assigns at least one of the second wireless network interface to receive or forward the signals at the same time.

4. The wireless communication network system of claim **1**, wherein the network interface connects to the Internet through Cable Modem, Asymmetric Digital Subscribe Line (ADSL), Integrated Services Digital Network (ISDN), T1 Line, T2 Line, T3 Line, T4 Line, E1 Line, or Fiber Optical Network.

5. The wireless communication network system of claim **1**, wherein the channels follow 802.11.

6. The wireless communication network system of claim **1**, wherein the channels follow 802.11a, 802.11b, or 802.11g.

7. A wireless communication network method, comprising the steps of:

a process unit of a device assigns some of wireless network interfaces of the device to send the signals at the same time through different and non-overlapping channels; and

the process unit assigns some of the wireless network interfaces to forward the signals at the same time through the different and non-overlapping channels.

* * * * *