

TRAVEL INFORMATION SYSTEM

FIELD OF INVENTION

The present invention relates to the distribution of multimedia content in a wireless environment and in particular but not solely, to the distribution of multimedia content to vehicles in a public transport system.

PRIOR ART

Multimedia distribution system are known. The use of floppy drives, CD Roms and DVDs to distribute multimedia content is known. Wireless communication systems and specifically wireless networking systems are known. Such wireless networking systems require a long contact time for downloading large files in one session. This requirement creates a difficulty for mobile endpoints moving around a wide geographical area. Therefore a need exists for a networking environment that allows mobile endpoints moving around a wide geographical area to download multimedia content in a short period of time.

More specifically there is a need for a system capable of delivering multimedia content and other large files to trains in mass transit system which are only within wireless coverage when stopped at railway stations.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a communications system which meets the abovementioned needs.

Accordingly in one aspect the invention consists in a communications system to facilitate the wireless transmission of large message files to mobile clients which in operation are frequently outside the coverage area of a base station comprising:

- a plurality of geographically spaced base stations,
- a central server which stores said large message files,
- a wide area network to which said server and said base stations are connected,

said central server assigning to each message a unique and sequenced message number,

said at least one mobile client storing the number of the last message it has received,

said central server sequentially multicasting messages from time to time onto said wide area network,

each base station receiving and storing said messages, and each mobile client when entering the coverage area of a base station requesting that any messages having message numbers higher than the last stored message number be downloaded from the base station.

In a second aspect the invention consists in a communications system for a mass transport system to facilitate the wireless transmission of large message files to mobile clients comprising:

a plurality of base stations located in railway stations,

a central server which stores said large message files,

a wide area network to which said server and said base stations are connected,

at least one train-borne mobile client,

said central server assigning to each message a unique and sequenced message number,

said at least one mobile client storing the number of the last message it has received,

said central server sequentially multicasting messages from time to time onto said wide area network,

each base station receiving and storing said messages, and each train-borne mobile client when stopped in a railway station in the coverage area of a base station requesting that any messages having message numbers higher than the last stored message number be downloaded from the base station.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a diagram showing the distribution system according to the preferred embodiment of the present invention.

Figure 2 is a diagram showing the fields of the messaging packet according to the preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The distribution system of the present invention is generally illustrated in figure 1. It consists of a plurality of endpoints 101 that move around a wide geographical area, a plurality of wireless access points 102 spread throughout the geographical area, a plurality of base station servers 103 each base station server 103 responsible for at least one access point 102, and a central server or servers 104 that provide the information to be transported to the plurality of base station servers 103 and thence to the plurality of moving endpoints 101.

In the preferred embodiment the endpoints 101 are rapid transport system trains but it will be seen that the present invention could be used for other mobile endpoints such as buses, and even people as they move around. In the preferred embodiment the distribution system will be used to provide information and entertainment to the passengers travelling on the trains. The system could also be used for other purposes such as fare collection, maintenance management, and supervisory and control systems. Each endpoint 101 consists of a program controlled CPU, memory, at least one display, permanent storage facilities and a unit for sending and receiving data over a wireless network.

Wireless access points 102 in the preferred embodiment will be within rapid transport system train stations in close proximity to where rapid transport system trains stop to allow passengers to embark and disembark but could be in any location that the endpoints come into the vicinity of. Access points 102 consist of a program controlled CPU, memory, a unit for sending and receiving data over a network and a unit for sending and receiving data over a wireless network. Access points 102 are connected

to the base station servers 103 by a network, in the preferred embodiment this network uses fibre cables but any network, including wireless would be suitable.

Base station servers 103 in the preferred embodiment are housed in the rapid transport system station cable distribution room and are connected to wireless access points 102 and to the central server 104 by networks. Each base station 103 server consists of a program controlled CPU, memory, permanent storage facilities and a unit for sending and receiving data over a network. The base station servers 103 may also control at least one display used to provide information and entertainment to those waiting at the stations.

The central server 104 in the preferred embodiment is connected to the base station servers 103 using a ring network topology. However any network typology that connected the base station servers and the main central servers would be satisfactory. In the preferred embodiment only one central server 104 is used but more than one server could be used to provide redundancy. This could be done using for example the hot standby routing protocol. Each central server 104 consists of a program controlled CPU, memory, permanent storage facilities and a unit for sending and receiving data over a network.

The network of the preferred embodiment uses network hubs, switches and routers to enable communication between the central server 104, and base station servers 103 but any type of network that enabled the servers to communicate would be suitable.

The distribution system of the present invention enables information to be transported to the base station servers 103 and the moving endpoints 101. The present invention solves the difficulties of current distribution networks to mobile endpoint. Such difficulties include, speed of transmission, reliability and cost.

The information is transported using a global unified sequence message (GUSM) container. GUSM containers have various fields. Figure 2 show the fields are: start of message marker 1; GUSM number 2; message type 3; submessage type 4; time stamp 5; valid until or defer execution of message time 6; retry type 7; retry time

8; routing medium 9; destination 10; extended sub message 11; message body data length 12; end of message heater marker 13; message body 14; end of message marker 15; and checksum 16.

The start of message marker 1 is used to mark the start of a message, the GUSM number 2 ranges from 0 to 256k, together with the time stamp 5 field used to signify the time the message is generated by the central servers, uniquely identifies each GUSM message. The message type field 3 is used to indicate what type of message this is it could for example be messages and controls, direct text, ad hoc messages, externally fed data or media related files. The sub message field 4 is used for categorising the sub type of the message. Valid until or execution time field 6 is used to indicate the time until the message should no longer be considered valid, for example the fact that the 5.15 am train will; arrive late at 5.30 am is only relevant until 5.30 am. Execution time can be used to delay the execution of a message until a set time so that all displays controlled by the base station servers or endpoints show the same information at the same time.

Retry time 8, and retry type 7 are used to control how the base station servers 103 and endpoints 101 re request message. Routing medium 9 and destination 10 are used to indicate where the message is to be forwarded and the destination of the message respectively. The extended sub message field 11 is used to indicate whether the message is larger than the size of the GUSM and has been split into parts called filets for transmission to the base station servers 103 and endpoints 101. The message is contained in the message body field 14 of the GUSM container. The end of message marker 15 is used to indicate the end of the GUSM message. A checksum field 16 is provided so that the base station servers and the endpoints can check that the GUSM container that is received is valid.

All data is distributed from the central server 104, the central server 104 is programmed to create the GUSM containers and transmits the GUSM containers to the base station servers 103 using a multicast transmission protocol. The central main server 104 will send the next GUSM whenever it has something to send. If it has

nothing to send, it will repeat the latest GUSM as a heart beat regularly to maintain system wide synchronization. The use of a multicast protocol reduces the overall network traffic load on the network. Reducing the network load means that the cost of creating and maintaining the network is reduced.

There is a null GUSM message type for initializations. The central main server maintains an 'oldest' GUSM number that a base station server 103 or endpoint 101 can recover completely. The central server 104 is additionally programmed to transmit or retransmit any GUSM upon request by any base station server 103. The GUSM number exists in all GUSM containers and any endpoints 101 or base station servers 103 must check to see if the GUSM number has already been received and if the GUSM number has already been received discard the message. The responsibility for keeping track of the messages successfully downloaded to the base station servers 103 and the mobile endpoints 101 is with the base station servers 103 and the endpoints 101 and it is not the responsibility of the central server 104 to check that the base stations 103 or the endpoints 101 have received a particular GUSM number. In the normal working situation, all the base station servers 103 will be in synchronisation with the central main server 104. If a base station server 103 gets out of sync they can resynchronise themselves by sending their last valid GUSM number. The central server 104 then resends all GUSM messages from this number forwards. All GUSM messages are sent by the central server 104 in broadcast mode and any base station server 103 receiving a redundant or already received GUSM container will simply discard the container.

The mobile endpoints 101 will communicate with the base station servers 103 through a wireless access point 102. Mobile endpoints 101 will continually send out probe messages and wait for a response from an access point 102. All the base station server 103 LAN's have the same IP addresses and therefore the mobile endpoints 101 are able to send a probe to the same destination address to build a connection.

As all the base station server 103 LANS have the same IP addresses there is a need for the base station server 103 LANS to be uniquely identified by the central

server 104. In order to accommodate the requirement that all the base station server 103 LANS use the same IP addresses the routers 105 connecting the base station servers 103 to the central server 104 perform network address translation. Network address translation allows the central server 104 to see each base station server 103 as a unique IP address while enabling each base station server 103 to appear to the moving endpoints 101 to have the same IP address.

When a train (endpoint 101) pulls into a station, it will report the last GUSM that it had received previously to the base station server 103. The base station server 103 will send all GUSM containers from that GUSM onwards to the latest number.

Large files are broken up into pieces and dispatched as multiple parts called filets. Each filet that is sent is tagged with the GUSM number to identify the GUSM it belongs to. Each filet additionally has a sequence number which is related to the total number of filets the original file was broken into. A receiver is thus able to create the original file by merging the filets based on the GUSM tag and sequence number embedded within the filets.

The central server 104 hashes the data contained in the filet before dispatching. The hash pattern is applied to recover the filet. A hash is used because multimedia files transmitted over a network have inherent sequences that result in transmission failure.

Endpoints 101 and base station servers 103 can request and re request an individual filet or a range of filets from the respective servers where a filet is not yet received. Base station server 103 request and re-request the filets from the central server. Mobile endpoints 101 request and re-request the filets from the base station servers. Such requests do not use multicast protocol but result in a session between server and client. The central server 104 may set a time for the base station servers 103 and the access points 101 to download the filets by setting field 6 in the GUSM to delay the download.

CLAIMS

1. A communications system to facilitate the wireless transmission of large message files to mobile clients which in operation are frequently outside the coverage area of a base station comprising:

- a plurality of geographically spaced base stations;
- a central server which stores said large message files;
- a wide area network to which said server and said base stations are connected; and
- at least one mobile client,

wherein:

- said central server assigns to each message a unique and sequenced message number;

- said central server subdivides each large message file into a series of shorter sub-message files and inserts into each sub-message file a sub-message file sequence number in addition to the number of the message to which it belongs,

- said central server multicasting said sub-message files from time to time onto said wide area network;

- said at least one mobile client storing the last message and the last sub-message sequence numbers it has received;

- each said base station receiving and storing said sub-message files;

- each mobile client when entering the coverage area of a base station requesting that any sub-message files having message and sub-message file numbers higher than the last stored message and sub-message numbers be downloaded from the base station; and

- each said mobile client assembling sub-message files belonging to the same message in order of sub-message file sequence number to thereby construct said message files.

2. A communications system according to claim 1 wherein each said base station comprises:

- a local area network connected to said wide area network

- a base server connected to said local area network; and

at least one access point connected to said local area network,
said base server storing and forwarding messages between said central server and
said access points.

3. A communications system according to any one of the preceding claims wherein
said large message files are multimedia files and including one or more display devices
connected to each mobile client for displaying the visual content of said multimedia files.

4. A communications system according to any one of the preceding claims for
delivering media content to passenger vehicles in a public transport system wherein at
least one said mobile client is located in each said vehicle and said base stations are
located at places where said vehicles stop.

5. A communications system for a mass transport system to facilitate the wireless
transmission of large message files to mobile clients comprising:

a plurality of base stations located in railway stations;

a central server which stores said large message files;

a wide area network to which said server and said base stations are connected; and

at least one train-borne mobile client,

wherein:

said central server assigns to each message a unique and sequenced message
number;

said central server subdivides each large message file into a series of shorter sub-
message files and inserts into each sub-message file a sub-message file sequence number
in addition to the number of the message to which it belongs;

said central server multicasting said sub message files from time to time onto said
wide area network;

said at least one mobile client storing the last message and the last sub-message
numbers it has received;

each said base station receiving and storing said messages;

each train-borne mobile client when stopped in a railway station in the coverage area of a base station requesting that any sub-message files having message and sub-message file numbers higher than the last stored message and sub-message numbers be downloaded from the base station; and

each said train-borne mobile client assembling sub-message files belonging to the same message in order of sub-message file sequence number to thereby construct said message files.

6. A communications system for a mass transport system according to claim 5 wherein each said base station located in railway stations comprises:

a local area network connected to said wide area network

a base server connected to said local area network; and

at least one access point connected to said local area network,

said base server storing and forwarding messages between said central server and said access points.

7. A communications system for a mass transport system according to any one of the preceding claims wherein said large message files are multimedia files and including one or more display devices connected to each train-borne mobile client for displaying the visual content of said multimedia files.