Public Wireless LAN Service: Mzone
—Broadband Experience in a Wireless Environment—

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NTT DoCoMo launched a public wireless Local Area Network (LAN) service called Mzone in order to implement the more advanced, enriched high-speed data communications service, in addition to the existing mobile multimedia environment brought about by Freedom Of Mobile multimedia Access (FOMA) and other mobile phones.

1. Introduction

NTT DoCoMo implemented the public wireless LAN monitoring service between April 15, 2002 and June 30, 2002 with the aim to verify the technologies and marketability of a public wireless LAN service. Due to the favorable results, NTT DoCoMo started offering a commercial service called Mzone (Mobile multimedia + zone) on July 1, 2002.

Mzone is a service that enables high-speed Internet access based on wireless LAN within DoCoMo service areas situated at hotels, stations and other public places.

Currently, NTT DoCoMo offers a high-speed data communications service at 384kbit/s using FOMA. The launch of the public wireless LAN service Mzone has made it possible to offer a higher-speed data communications service of up to 11Mbit/s in DoCoMo service areas. The aim of Mzone is to improve the amenity and richness of mobile multimedia.

This article reviews the service and the system configuration.

2. Mzone Service
2.1 Overview

Mzone is a service that implements high-speed data communications by radio in DoCoMo service areas such as hotels, stations, convention centers and other public areas . The maximum transmission speed in radio zones is approximately 11Mbit/s, which allows users to enjoy the broadband experience in a wireless environment. At a fixed monthly fee, users can access the Internet without worrying about the data communication
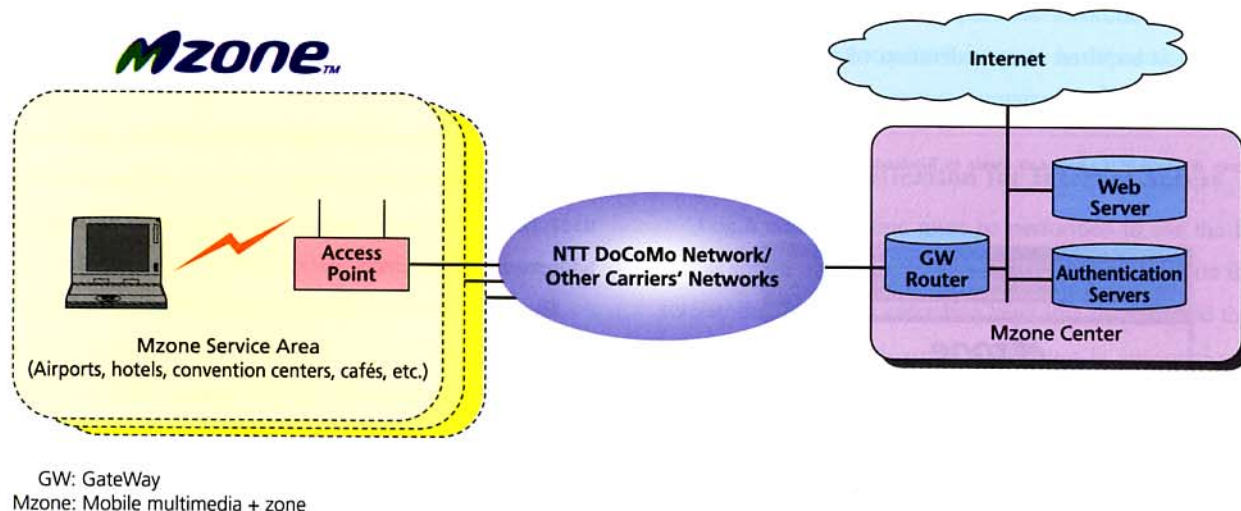
GW: GateWay
Mzone: Mobile multimedia + zone

Figure 1 Network Configuration of Mzone

charges.

While the Mzone service is currently limited exclusively to Internet access, NTT DoCoMo is considering, for the future, the distribution of information such as entertainment information (e.g. movies, music) and regional information, and the implementation of a corporate network access service for office solutions including remote access to corporate Intranets. Mzone's service area covers hotels, cafés and convention centers located in the Tokyo metropolitan area, and NTT DoCoMo is planning to deploy the area in the future.

The Mzone service is expected to be used for Web browsing and mail, harnessing its high-speed transmission, and for downloading large files such as reference materials, photos, video and music.

2.2 Network Configuration

Figure 1 shows the network configuration of Mzone. In Mzone service areas, base stations called access points are installed, which access the Mzone Center from the DoCoMo service areas using NTT DoCoMo's network or other networks. Authentication servers, and other servers are accommodated in the Mzone Center. A user can access the Internet after being successfully authenticated by entering user ID and password.

2.3 How to Use the Service

The following procedures must be taken to use the Mzone service.
(1) Necessary Information at time of applying for Subscription

Register the Medium Access Control (MAC) address assigned to each wireless LAN terminal (e.g. wireless LAN card, wireless LAN-enabled laptop, Personal Digital Assistant (PDA)) at the time of applying for subscription.
(2) User Procedures
① Set the Service Set ID (SSID) and Wired Equivalent Privacy (WEP) for accessing NTT DoCoMo's access point. Activate the Web browser in the DoCoMo service area using a PC or a PDA with a wireless LAN card (inserted or built-in) for which the MAC address has been registered in advance.
② The login authentication screen (**Figure 2**) will be displayed. Enter the user ID and the password.
③ After successful user authentication, the portal screen (**Figure 3**) will be displayed. Access to the Internet is now permitted.

2.4 Radio Access System

(1) Frequency Band

Currently, equipment using the 2.4GHz band is predominant as far as wireless LAN is concerned. Mzone adopts a specification called IEEE802.11b, which uses the band from 2400MHz to 2497MHz. This band is shared and used by industry, science and medical (ISM) equipment, such as microwave ovens and surgical knives. **Table 1** shows the profile of IEEE802.11b.
(2) Interference

Although IEEE802.11b has 14 channels , only 4 channels can normally be used as shown in **Figure 4** (channels 1, 6, 11 and 14 in Figure 4) when they are assigned to avert spectrum overlapping so as to prevent interference with adjacent channels. Therefore, it is necessary to determine if there are any wireless LANs used at the company or at the site and investigate the channel usage status before selecting the channels and

deciding the location of access points. Also, sufficient prior investigation is required in consideration of potential interference with Bluetooth[*] and microwave ovens.

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[*] Bluetooth: Bluetooth™ is a trademark owned by Bluetooth SIG, Inc. and licensed to NTT DoCoMo.

Figure 2 Authentication Screen

Figure 3 Portal Screen

3. System and Authentication Overview

The Mzone service is made available to users accessing Mzone from DoCoMo service areas, provided that they have user ID / password authorization as well as device MAC address authentication.

By this mechanism, Mzone will be able to provide enhanced network security.

Authentication based on this system does not require the installation of any special authentication software in the user's PC, PDA, etc. Authentication can be done as long as a compliant browser is installed.

Table 1 Profile of IEEE802.11b

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Radio Frequency Band	2.4GHz band
Specification Name	IEEE802.11b
Maximum Transmission Speed	11Mbit/s
Transmission Method	DSSS/FHSS
Access Method	CSMA/CA
Communication Range	10 – 150m
Usage Environment	Indoors and Outdoors
Principal Adaptors	U.S., Europe and Japan
QoS Function	None (Best-effort)
Anti-wiretapping Scheme	WEP

CSMA/CA: Carrier Sense Multiple Access with Collision Avoidance
DSSS: Direct Sequence Spread Spectrum
FHSS: Frequency Hopping Spread Spectrum
QoS: Quality of Service
WEP: Wired Equivalent Privacy
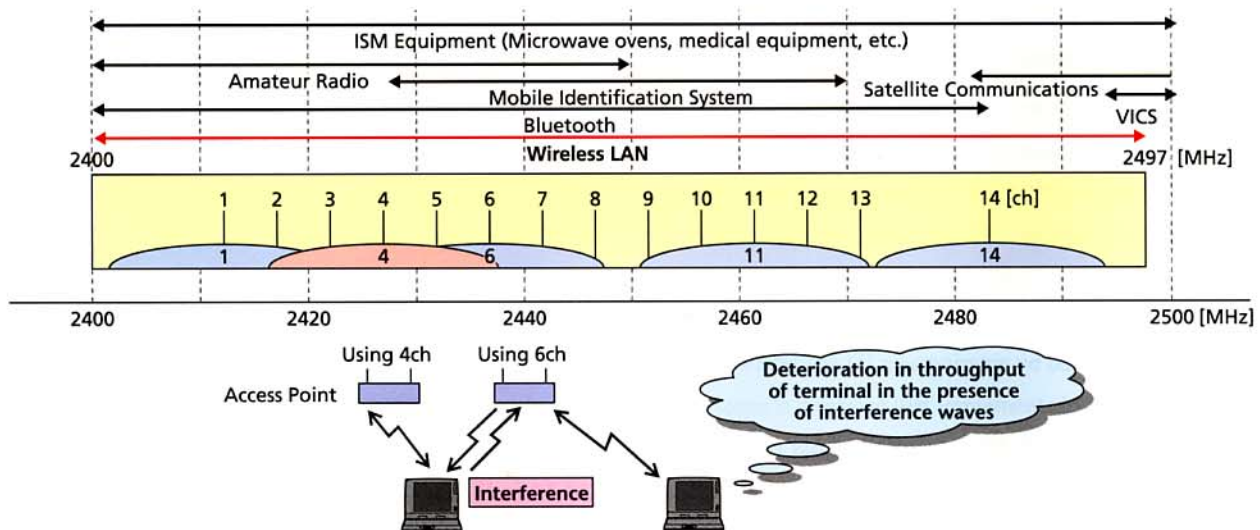
ISM: Industry Science Medical
LAN: Local Area Network
VICS: Vehicle Information and Communication System

Figure 4 IEEE802.11b Channel Assignment and Interference

3.1 System Overview

The Mzone system consists of three components as follows.

(1) GateWay (GW) Router

This controls access to the Internet according to the user authentication results.

(2) Web Server

This sends the login authentication screen to the user, and executes authentication based on user ID and password input.

(3) Authentication Servers

These servers store the contract information and authentication information of users.

3.2 Authentication when accessing from DoCoMo Service Areas (between Access Point and Terminal)

For authentication in the radio zone based on the MAC address unique to the user's wireless LAN card, security is enhanced by assigning an IP address to a terminal with a pre-registered MAC address aimed at denying access by any unreg-

istered wireless LAN card. The authentication is automatically carried out when a request to acquire an IP address is made to the access point as the terminal enters an Mzone service area.

3.3 Login Authentication for Internet Access

Login authentication must be performed to use the Internet access service by entering the user ID and password on the Web screen: the user must enter two keys (the user ID and the password) in the authentication screen that is automatically displayed after successful authentication in the radio zone.

The login authentication screen automatically identifies the terminal being used (PC, PDA, etc.) and adjusts the display size.

3.4 Authentication Sequence

Figure 5 shows the sequences associated with the authentication.

(1) When the first wireless LAN packet is sent from the wire-

Terminal   Access Point   GW Router   Web Server   Authentication Servers

Transmit Packet

(1) Authenticate MAC Address

(2) Acquire IP Address

Activate Web Browser

(3) Output Authentication Screen

Output Authentication Screen

Click on login button after entering user ID and password

(4) Output Authentication Screen

*Transmitted after encoding (SSL)

(5) Login Authentication

(6) Permit Internet Access

(7) Output Portal Screen

Output Portal Screen

User can access Internet

GW: GateWay   MAC: Medium Access Control
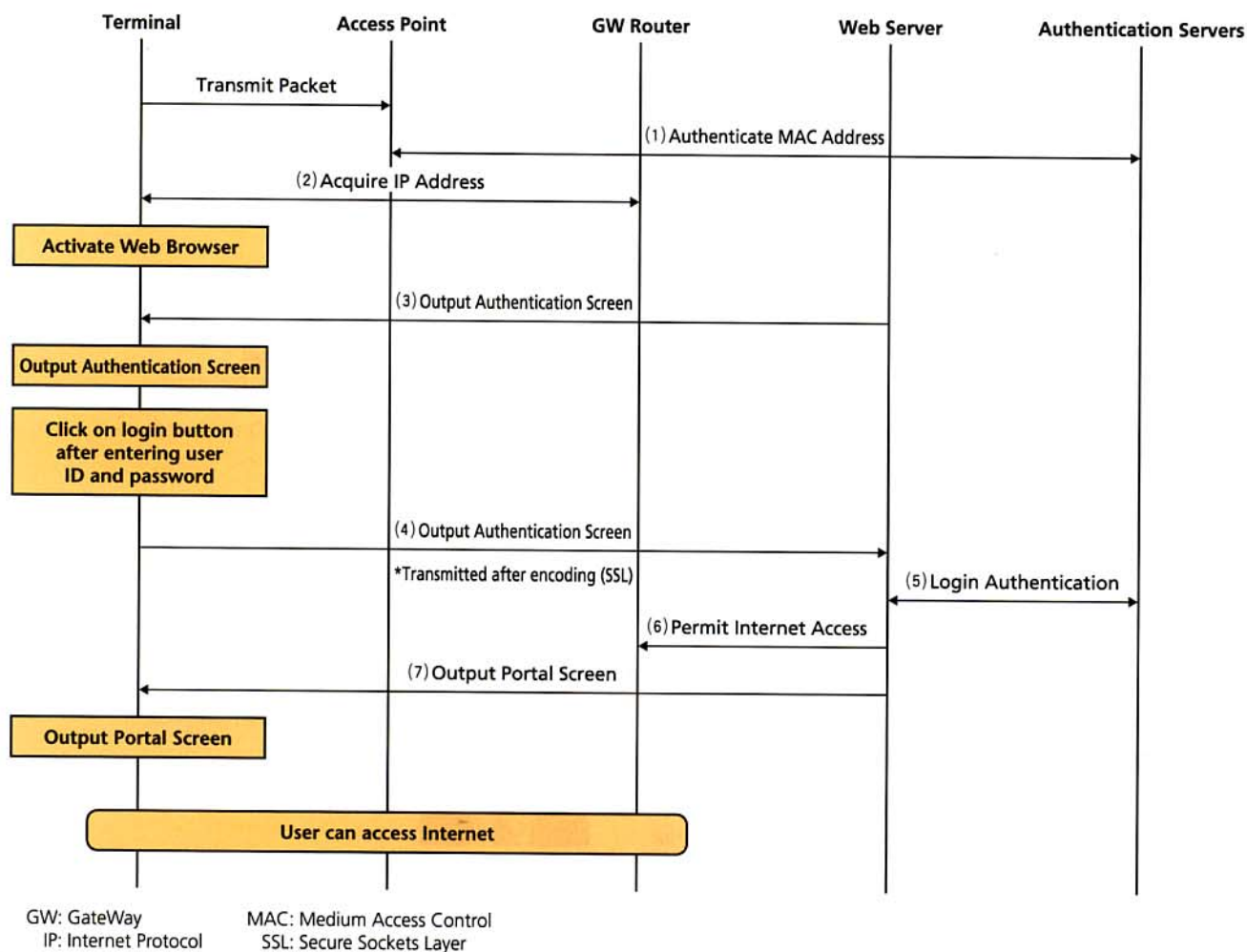IP: Internet Protocol   SSL: Secure Sockets Layer

Figure 5 Mzone Authentication Sequence

less LAN terminal to the access point, the access point requests the authentication server to authenticate the MAC address of the user's wireless LAN card.

(2) After the authentication server successfully authenticates the MAC address, the wireless LAN terminal acquires the IP address from the GW router.

(3) When the user activates the browser, the Web server outputs the authentication screen. On this screen, the user enters his/her user ID and password for login authentication over the Web.

(4) The user ID and password are encoded and sent to the Web server.

(5) The Web server requests the authentication server to execute login authentication based on the user ID and the password.

(6) After successful authentication, the Web server informs the GW router to allow Internet access.

(7) The Web server returns a portal screen to the wireless LAN terminal.

4. Future Service Rollout

NTT DoCoMo is studying a number of new services that might be implemented in the future, such as the distribution of regional information of the DoCoMo service areas, content distribution services harnessing the high-speed data communications of Mzone (e.g. movie information, music information and live video), and even corporate network access services with enhanced security for users.

NTT DoCoMo is also working on supporting other wireless LAN specifications . It will consider supporting IEEE802.11a (a 5.2GHz-band specification with a maximum transmission speed of 54Mbit/s) and IEEE802.11g (a new specification) in light of market trends. For the purpose of enhancing security, it also intends to introduce IEEE802.1x (which enables a high-level security service based on dynamic encryption keys) as early as possible.

While making such service enhancements, NTT DoCoMo is working on expanding the DoCoMo service area into a nationwide scale and offering roaming services in alliance with other carriers, in the hope that more users will use the service.

5. Conclusion

This article reviewed the Mzone service and the system con-

figuration.

The public wireless LAN service Mzone will bring about a mobile environment with an unprecedented level of convenience, when used in conjunction with existing services such as FOMA. NTT DoCoMo intends to work on realizing the mobile multimedia by harnessing the characteristics of this service to the greatest extent possible.

GLOSSARY
CSMA/CA: Carrier Sense Multiple Access with Collision Avoidance
DSSS: Direct Sequence Spread Spectrum
FHSS: Frequency Hopping Spread Spectrum
FOMA: Freedom Of Mobile multimedia Access
GW: GateWay
IP: Internet Protocol
ISM: Industry Science Medical
LAN: Local Area Network
MAC: Medium Access Control
Mzone: Mobile multimedia + zone
PDA: Personal Digital Assistant
QoS: Quality of Service
SSID: Service Set ID
SSL: Secure Sockets Layer
VICS: Vehicle Information and Communication System
WEP: Wired Equivalent Privacy