

Technology Reports

Telephone Extension Solution

Telephone Conference Service

Office Link

The “Office Link Voice Conferencing Service” —A New Telephone Conferencing System Using the Office Link Platform—

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As one of its voice communications services for business-use, NTT DOCOMO provides “Office Link” for extension service between the fixed telephone lines and business-use mobile phones of corporate users. This service has been well received not only for the availability of PBX extensions within companies, but also its availability in FOMA/Xi (VoLTE) areas. As an addition to the service, NTT DOCOMO developed the “Office Link Voice Conferencing Service” as a new telephone conferencing system incorporated into the Office Link platform. This article describes an overview of the service and some of its technical aspects.

1. Introduction

From September 2010, NTT DOCOMO began providing the “Office Link” service to connect corporate Private Branch eXchange (PBX)*1 with its FOMA network and to make in-house telephone extensions accessible from DOCOMO mobile telephones [1]. Just as the name says, the service makes it possible to use a company’s telephone extensions in locations outside the office. In addition to

one-to-one communications between telephone extensions, recent years have seen growing needs for systems to handle “many-to-many” conferencing. Thus, NTT DOCOMO developed new telephone conferencing service functions for its Office Link in-house telephone extension service system, which has already been established as a network service, and began providing its “Office Link Voice Conferencing Service” as a service for simultaneous broadcast on both external lines and in-house extensions.

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*1 PBX: An enterprise private branch exchange. It has functions for both extension and external line connections.

To implement this system, NTT DOCOMO included rich functionality with the Web Customer Control^{*2} to improve user convenience, and made efforts to reduce facility division loss when processing conferences with large numbers of people on one server to maximize facility efficiency. This new system holds promise for deployment as a telephone extension solution with high added value.

This article describes an overview of the Office Link Voice Conferencing Service, and how it is realized.

2. Details of the Office Link Voice Conferencing Service Provision

2.1 Service Overview

NTT DOCOMO began providing the Office Link Voice Conferencing Service as an additional Office Link service available with in-house extensions and with nationwide FOMA/Voice over LTE (VoLTE)^{*3}. Conventionally, the Voice Meeting^{*4} service provided by NTT DOCOMO only handled participation in conferences via external lines, whereas this service makes use of the Office Link platform to provide availability to in-house extensions as well. The service makes it possible for customers to engage in simultaneous broadcast with an extension number no matter where they are in Japan, and since communications fees are included

in the flat Office Link rates, it also offers savings on the communication fees associated with conventional calling of external numbers. **Table 1** shows the characteristics of the Office Link Voice Conferencing Service and the Voice Meeting service.

2.2 Functions Provided with the Office Link Voice Conferencing Service

The Office Link Voice Conferencing Service can be used as a participant-calling-type or system-calling-type telephone conferencing system, and enables connection with telephone extensions used in offices as well as ordinary external mobile and fixed phones. We describe the participant-calling-type and system-calling-type conferencing offered by this service as follows.

1) Participant-calling-type Conferencing

Participant-calling-type conferencing is a form of conferencing in which members participate by calling a conference number. The conference host uses the Web Customer Control to book the conference in advance. When it is time to call the conference, the conference host performs operations to open the conference. Methods of opening the conference include the conference host calling the conference number from their terminal, or opening the conference from the Web Customer Control screen. Once the conference has been opened, participants can join by calling the conference number notified

Table 1 Office Link broadcast service, Voice Meeting service

Service name	Conference type	Terminal type	Max. number of participants
Office Link Voice Conferencing Service	Participant-calling-type/ system-calling-type	In-house telephone extensions/ external phones	200 persons
Voice Meeting service	System-calling-type	External phones	200 persons

^{*2} Web Customer Control: A Web site (Web Customer Control Site) on the Office Link platform accessible from a PC, smartphone or i-mode browser, which enables users to make and edit settings for conferences and holding conferences from a Web screen.

^{*3} VoLTE: A function to provide voice services over LTE using

packet switching technologies.

^{*4} Voice Meeting: A service that enables simultaneous broadcasting with external line calling. The service has been providing participant-calling-type telephone conferencing from January 7, 2019.

beforehand from their terminals (their mobile phones or in-house telephone extensions, etc.). The flow for usage is described in **Figure 1**.

Participant-calling-type conferences do not require participants to preregister and participants can join a conference from any terminal. Thus, this type can be used for regular meetings or conferences where participants are not fixed in advance.

2) System-calling-type Conferencing

System-calling-type conferencing is a form of conferencing in which preregistered participants are called when the conference starts. The conference host uses the Web Customer Control to book the conference in advance and register conference participants. When it is time to call the conference, the Office Link Voice Conferencing Service system calls the terminals of all the participants on the participant list. Then, participants join the conference by responding to the call. In the same way as participant-calling-type conferencing, methods of opening the conference include the conference host

calling the conference number from their terminal, or opening the conference from the Web Customer Control screen. The flow for usage is described in **Figure 2**.

Because preregistering participants is required with system-calling-type conferencing, it can be used for conferencing in which the participants to be called are clearly defined such as meetings for emergency information sharing.

3. Office Link Voice Conferencing Service System Overview

3.1 System Configuration

Figure 3 shows the structure of the Office Link Voice Conferencing Service system.

To realize this service, the Office Link platform system (1), which manages extension services, uses the conference server (2) and conference information management server (3) to provide the telephone conferencing service with accessibility from both in-

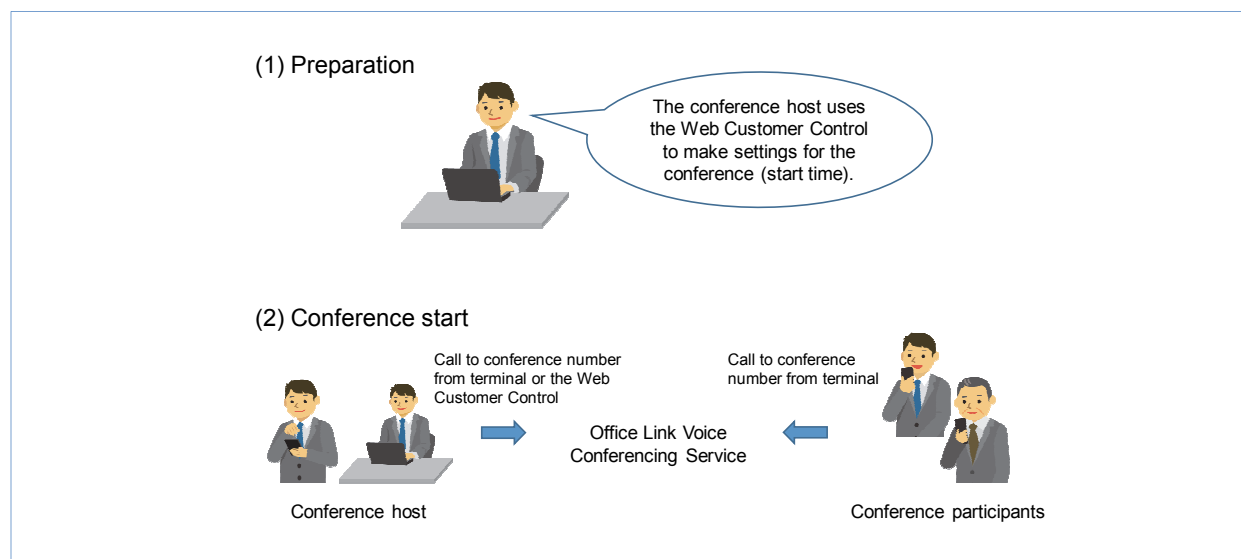


Figure 1 Flow of usage for participant-calling-type conferencing

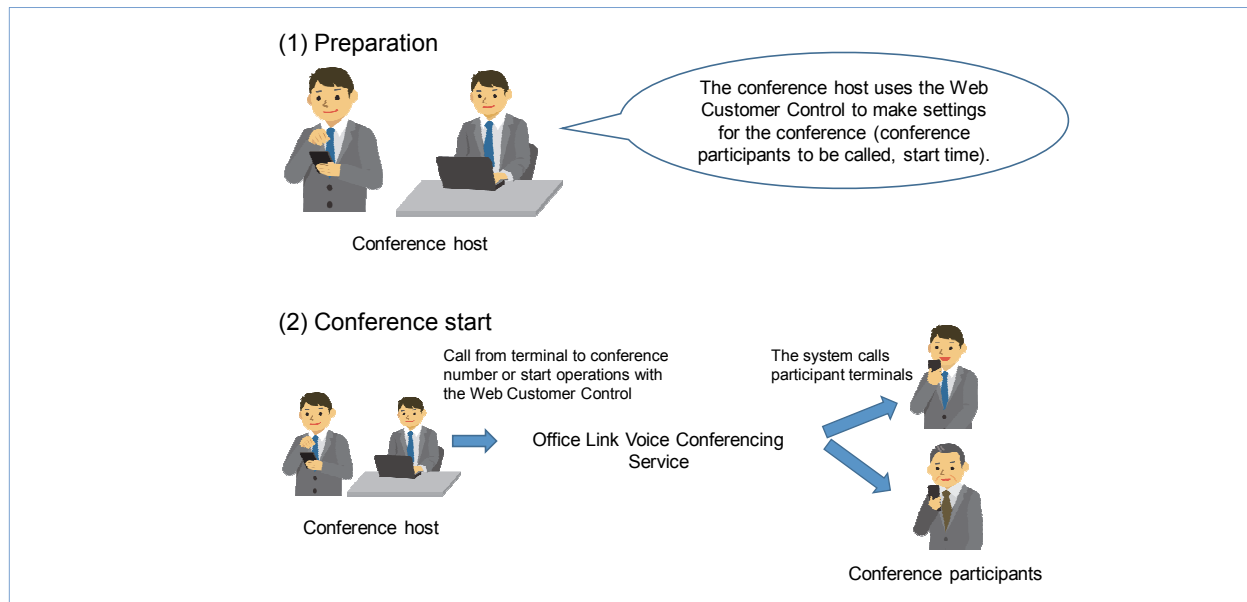


Figure 2 Flow of usage for system-calling-type conferencing

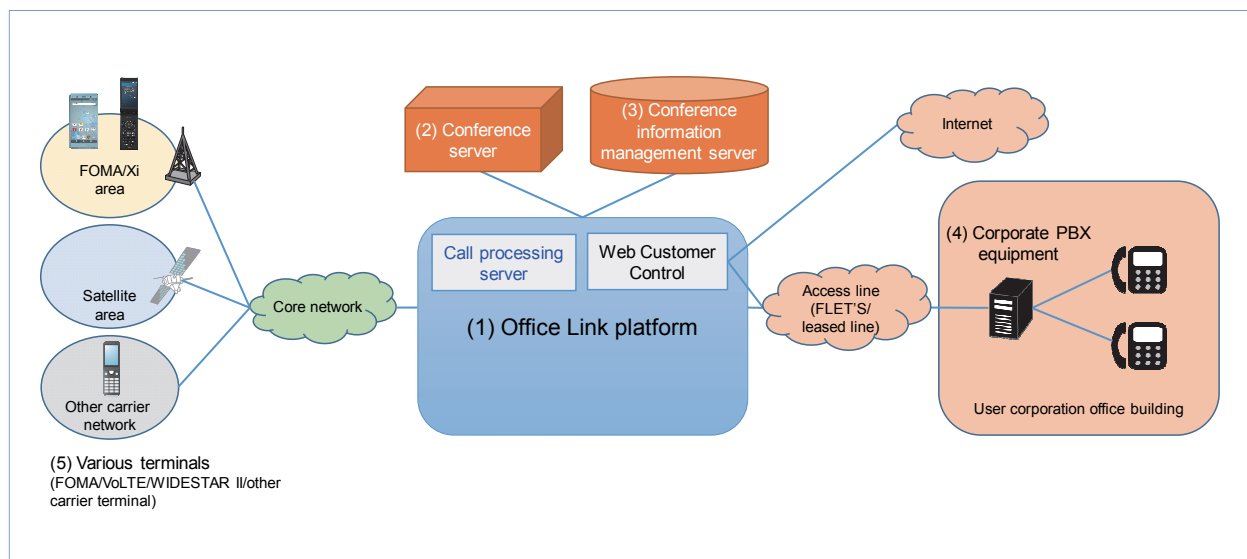


Figure 3 Overview of the Office Link Voice Conferencing Service system configuration

house extensions and external lines. The telephone conferencing service call control and voice transfer uses the core network^{*5} in the same way as the conventional Office Link, while the conference server performs voice mixing and distribution for

the connected terminals.

3.2 Function Distribution

(1) Office Link platform

Incoming/outgoing call and voice transfer

^{*5} Core network: A network consisting of switching entities and subscriber information management equipment, etc. Mobile terminals communicate with the core network via the radio access network.

control functions provided with the call processing server of the Office Link platform are also provided with the Office Link Voice Conferencing Service. Also, in participant-calling-type conferencing, conference settings such as registration of participant lists are provided over the conventional Web Customer Control functions on the Office Link platform.

(2) Conference server

The conference server manages telephone conferencing, receives requests to reserve conferences, and commences conferences. After a conference starts, the conference server performs voice mixing and simultaneous distribution to participant terminals, and detects Dual-Tone Multi-Frequency (DTMF) tones^{*6} with the Office Link Voice Conferencing Service as telephone conference U-Plane^{*7} processing.

(3) Conference information management server

The conference information management server performs management and approval of conference information based on reservations made by the conference host with the Web Customer Control, and orders the call processing server to call participants based on participant lists.

(4) Corporate PBX equipment

The corporate PBX equipment connects to the Office Link platform via an access line and makes it possible to use the Office Link Voice Conferencing Service by using IP telephone extensions within customer premises.

(5) Various terminals (FOMA/VoLTE/WIDESTAR II^{*8}/other carrier terminal)

When using the Office Link Voice Conferencing Service, connection to the conference server through incoming/outgoing calls to terminal numbers and conference operations (acquiring speaking rights, etc.) through DTMF tone transmissions are performed from various terminals. Both of these are available with existing telephone functions. FOMA/VoLTE terminals on the DOCOMO network can also originate and receive calls with Office Link extension numbers. All communications between various terminals and the Office Link platform are VoIP. Non-VoIP communications such as those using circuit switching are terminated in the core network and converted to VoIP communications.

3.3 Conference Server Cascade Connection Method

The voices of participants in a conference are mixed in the Office Link Voice Conferencing Service. However, since up to 200 people connect simultaneously with this service, if only one conference server is used and the number of people exceeds the number of spare channels, the conference cannot start. Furthermore, if a conference is held in which the number of participants exceeds the spare channels of a single conference server it is difficult to fully utilize the spare channels which degrades the facility usage rate.

To address this issue, we made it possible to hold conferences using cascade connections to multiple conference servers if the channels required for the number of participants in a conference cannot be

^{*6} **DTMF tone:** Also referred to as a push signal. The tones can be used to send a total of 16 different signals using four combinations of the numerals 0 through 9 and the asterisk(*), pound sign (#), and high and low tones from A to D.

^{*7} **U-Plane:** In contrast to the C-Plane, which carries signaling traffic and is responsible for routing, U-Plane is used for the transmission of user data. On the Office Link platform, user data refers to VoIP calling audio (RTP/RTCP).

^{*8} **WIDESTAR II:** The name of a satellite telephone service provided by NTT DOCOMO.

covered by a single conference server. **Figure 4** shows this connection method. In this method, a few spare channels in multiple conference servers are used with cascade connections to enable provision of large conferences, which enables the maximum usage rate of conference server connection channels and prevents the rejection of conferences due to a lack of connection channels.

4. Method of Achieving New Services

4.1 Mixing Extensions and External Phones in the Same Conference

It's possible to set conference phone numbers used for telephone conferencing with the Office Link Voice Conferencing Service. The conference phone numbers are call destination numbers with participant-calling-type conferencing, and original caller

numbers with system-calling-type conferencing.

The conference phone number is any extension number set by the user for each conference or a 050- number temporarily issued to users by NTT DOCOMO. Conference participants can set extension numbers from the conference settings screen of the Web Customer Control. This makes it possible for participation in a telephone conference from both extensions and external lines, to suit the various terminal types of the conference participants.

4.2 Participant-calling-type Conferencing System Operations

Figure 5 shows the sequence for holding a participant-calling-type conference. The sequence of holding a conference is the same for all types of terminals because all terminals that can connect

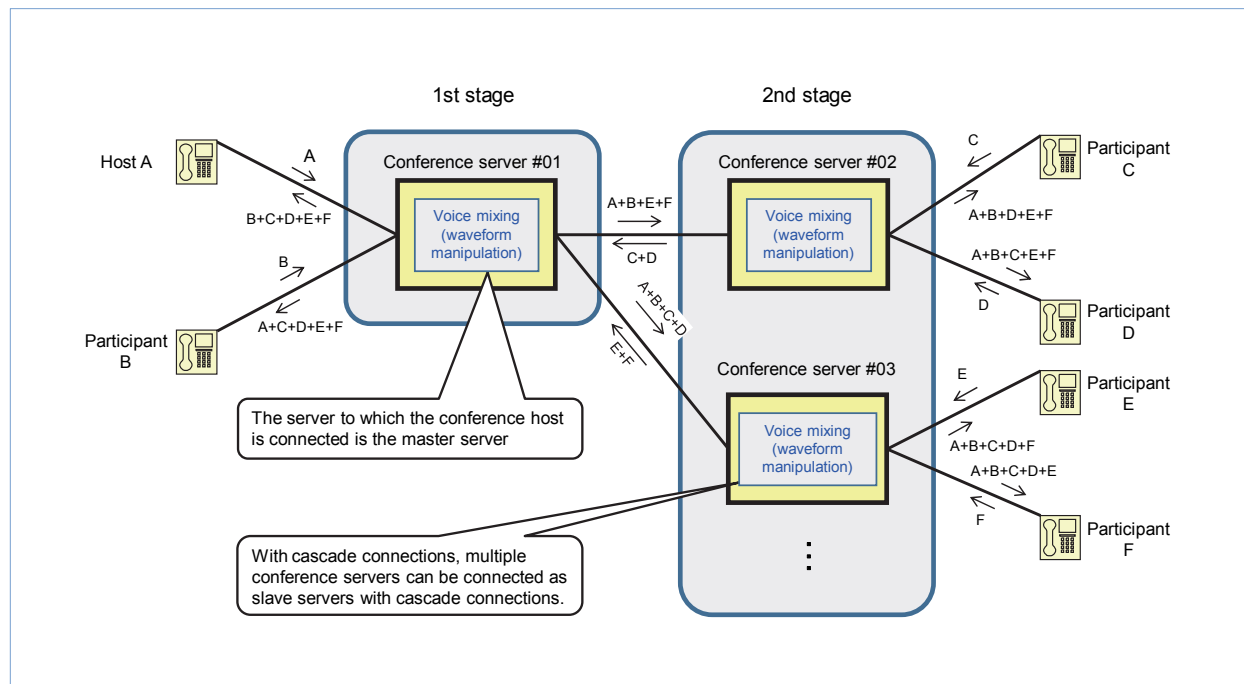


Figure 4 Cascade connection method

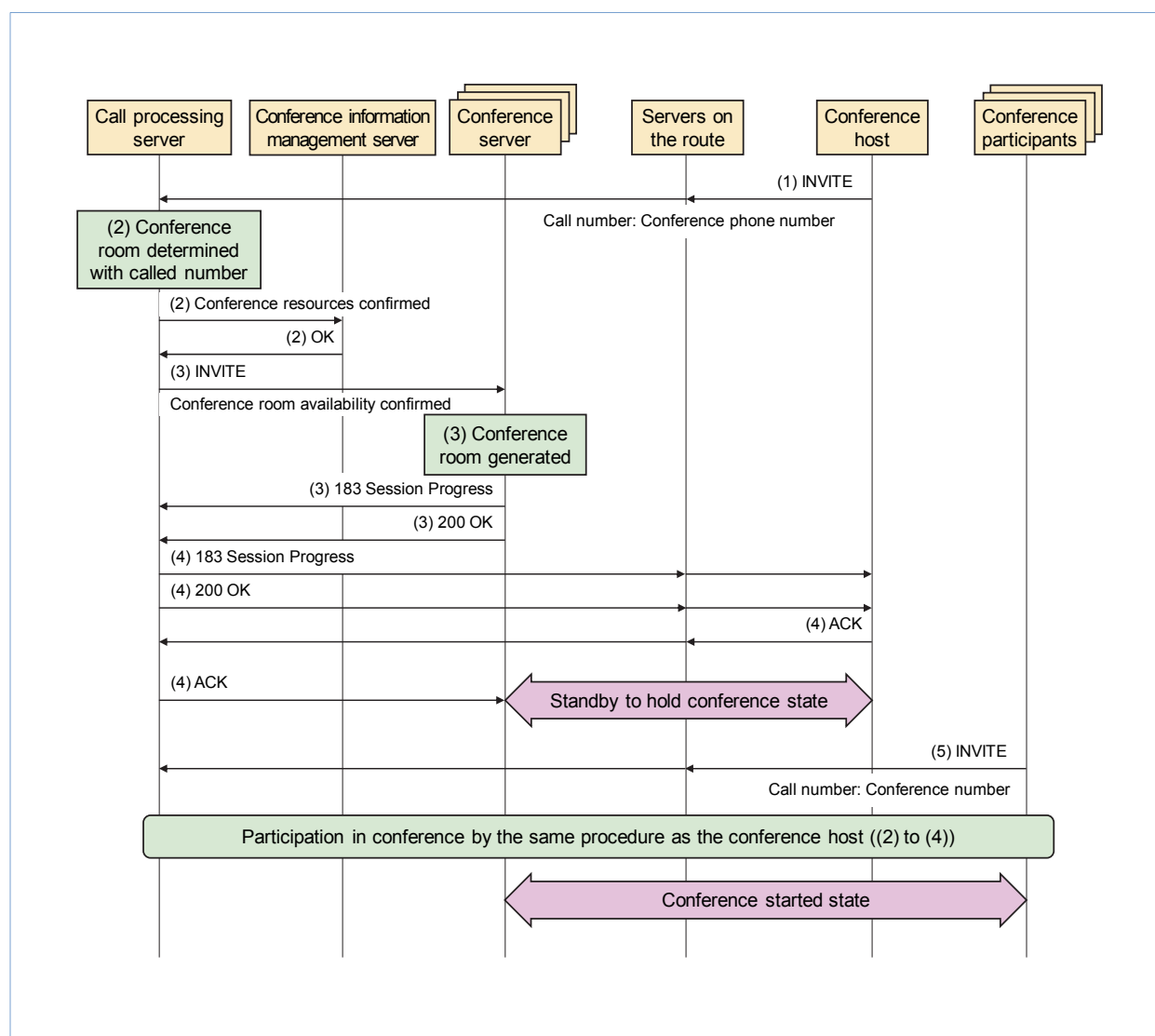


Figure 5 Sequence for starting a participant-calling-type conference

to the Office Link Voice Conferencing Service are processed with VoIP on the Office Link platform.

- (1) When the conference host calls a conference number, a Session Initiation Protocol (SIP)^{*9} signal INVITE (start session^{*10} request) arrives at a call processing server in the system.
- (2) The call processing server that received

INVITE confirms whether the conference was booked in advance based on the conference information (conference phone number) notified in the INVITE. After confirmation, if the request can be processed, the conference information management server confirms the availability of conference resources.

- (3) If resources are available, the call processing

^{*9} SIP: A call control protocol defined by the Internet Engineering Task Force (IETF) and used for IP telephony with VoIP, etc.

^{*10} Session: A virtual communication path for transmitting data or the transmission of data itself.

server sends a request to confirm the presence of a conference to the conference server. Since the conference was not yet generated when the conference host calls, a conference is generated and a SIP signal 183: Session Progress/200: OK is sent to the call processing server.

- (4) The call processing server that receives the signal sends the same signal to the conference host, and a connection is established between the conference host and the system when the conference host responds to the signal.
- (5) After the conference host establishes the connection, conference participants call the conference phone number and participate in the conference through the same procedure as the conference host.

4.3 System-calling-type Conferencing System Operations

With system-calling-type conferencing, conferences can start on a date specified when the conference host generates the conference or be held immediately with the Web Customer Control (hereinafter referred to as "Web Customer Control-generated"). With the former, the sequence of operations is the same as the participant-calling-type conference until the connection is established between the conference host and the system. After that, the call processing server calls the conference participants on the preregistered participant list, who can participate in the conference simply by responding.

Figure 6 shows the sequence for holding a Web Customer Control-generated conference. With this type of conference, the call processing server calls

both the conference host and participants.

- (1) The conference host presses the start conference button after inputting conference information with the Web Customer Control to initiate processing in the system.
- (2) The server that provides the Web Customer Control functions (Web Customer Control server) checks conference information to confirm that conditions to hold the conference are satisfied. If conditions are satisfied, conference reservation information is written into the conference information management server by the Web Customer Control server, conference resources are confirmed, and if available the call processing server calls the conference host.
- (3) Then, the call processing server asks the conference server if there is a conference, and because a conference has not been generated at this point, the conference server generates a conference.
- (4) If a conference has been generated, the call processing server sends INVITE to the conference host, and a connection between the conference host and the system is established when the conference host responds.
- (5) After that, the call processing server references the participant list stored in the conference information management server, and then calls participants and starts the conference when they respond.

5. Conclusion

With the growing diversity of DOCOMO's in-house telephone extension services for business-use,

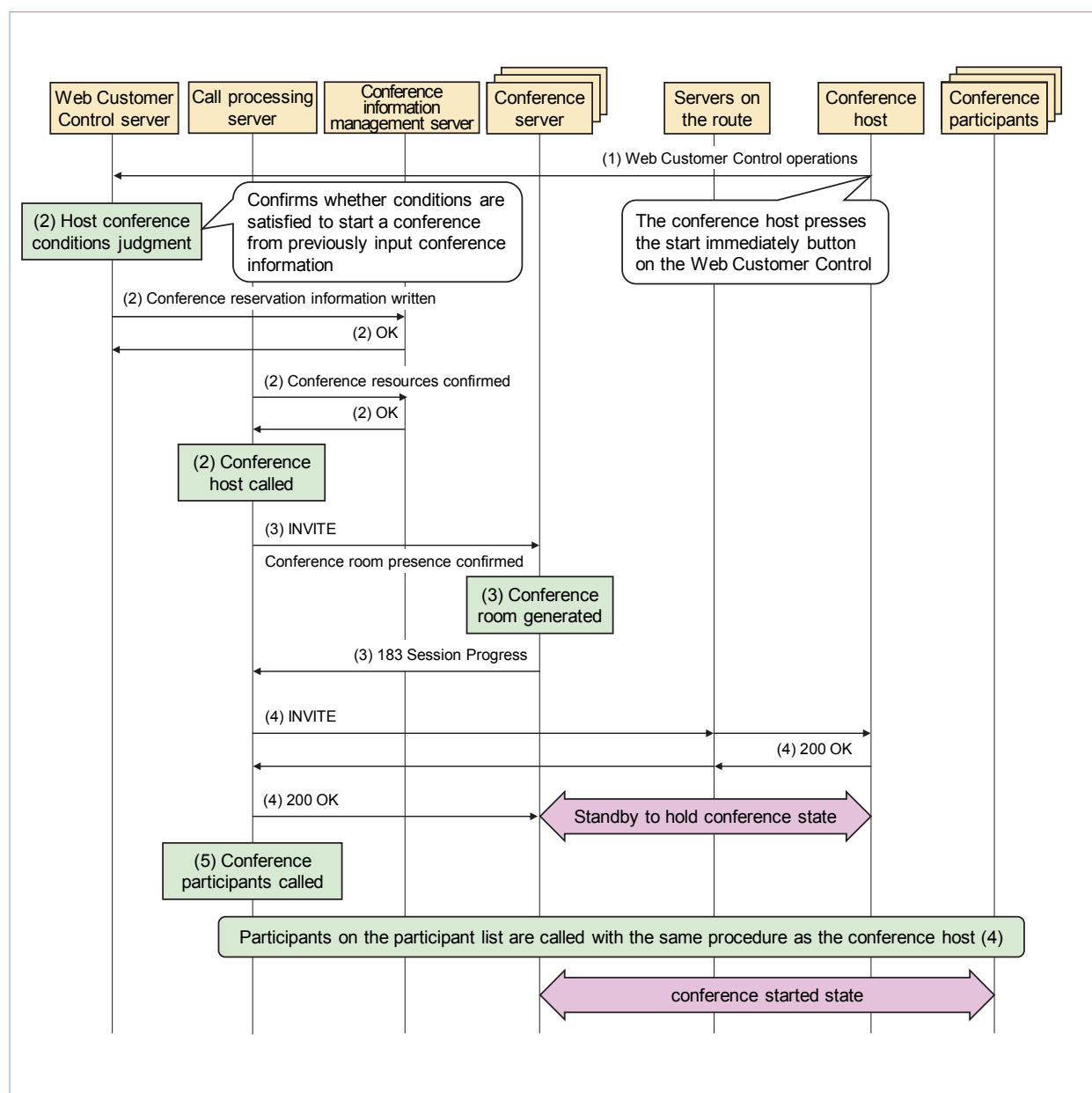


Figure 6 Sequence for holding a system-calling-type conference (Web Customer Control-generated)

NTT DOCOMO enhanced the Office Link platform and began providing the Office Link Voice Conferencing Service as a service enabling simultaneous broadcast even for in-house extensions. This has enabled new telephone conferencing using the

in-house telephone extensions of users with Office Link subscriptions, and enables business support across a wide range of corporate user scenes.

Going forward, to promote DOCOMO's "+d^{*11}" midterm strategy of co-creating value with partners

*11 +d: The name of an NTT DOCOMO initiative for creating new value with partner companies.

such as linking the Office Link system with third parties, we will develop corporate services with even more value by advancing the system to enable linkage of services both in and out of NTT DOCOMO with the Office Link platform.

REFERENCE

- [1] S. Koga et al.: "Office Link System for FOMA Internal Line Connection," NTT DOCOMO Technical Journal, Vol.11, No.4, pp.33–38, Mar. 2010.