

# FOMA Domain Specific Access Control

*Katsuhiro Noguchi, Masashi Kanauchi, Takeshi Kawabata  
and Kota Fujimura*

*Independent access restriction in voice and packet communications for FOMA terminals allows flexible network control in response to each status of communication traffic in emergency situations, and improves the connectivity for i-mode Disaster Message Board and i-mode mail.*

## 1. Introduction

DoCoMo is developing a robust communication network to produce communications in case of emergency in order to satisfy the needs for ‘reliable communication systems’ and ‘ensuring high-priority communications’ for enhancement of network security and reliability. One of the enhancement activities is the provision of the i-mode Disaster Message Board service.

In the event of a large-scale disaster such as a major earthquake, administrative bodies handling disaster countermeasures, and also many users in or out of the disaster area wishing to inform or confirm the safety of family members, relatives etc. in the area affected, make use of the voice phone system. In such cases, a much greater volume of traffic than normal must be handled on the network. Congestion makes establishment of connections difficult, and communications must then be restricted (hereinafter referred to as ‘access restriction’) under network control<sup>\*1</sup> measures.

Mobile communications networks are comprised of networks that handle, for example, Circuit Switching (CS) calls made via voice phones and video phones, and networks that handle Packet Switching (PS) calls involving email and Web browsing. Access restriction on CS and PS calls could not be independently controlled under the 3rd Generation Partnership Project (3GPP) standard specifications, and therefore, even with a low volume of PS call traffic, the access restriction ratio for CS calls (via voice

---

\*1 Network control: Refers to restricted communication on a network when a network congestion may occur due to concentrated communications that greatly exceed the processing capability of communications equipment under emergency, in order to maintain the ability to transmit high-priority communications.

phone, etc.) was also applied to PS calls (via the i-mode Disaster Message Board service etc.), which were consequently restricted to a greater extent than was necessary (Figure 1).

To solve this issue, DoCoMo has added Domain Specific Access Control (DSAC) (Figure 2) function to the 3GPP standard specifications to allow independent CS and PS network control, that is, the separation of access restriction for CS and PS, and accordingly enhanced the control functions for access restriction and mobility management to support implementation. These functions were first implemented in the 902iS Series.

This article describes an overview of these developments.

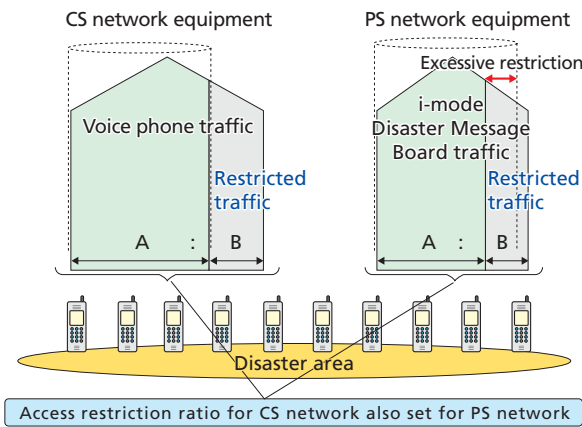


Figure 1 Existing network control

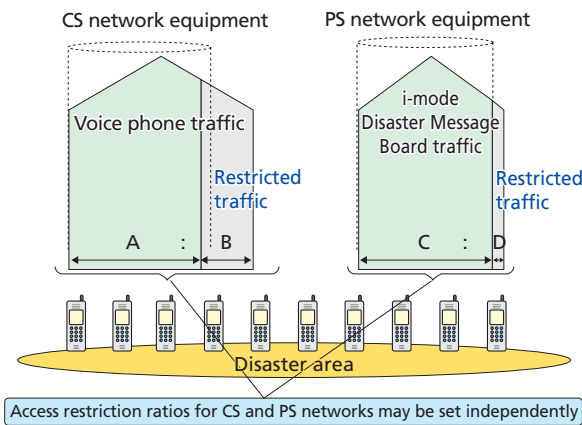


Figure 2 Network control utilizing DSAC

## 2. Enhancement of Access Restriction Control Function

System Information<sup>\*2</sup> include information related to access restrictions (System Information Block Type 3<sup>\*3</sup>), and were previously comprised solely of Cell Barred and Cell Access Restriction information. This Cell Access Restriction information is determined according to the following procedure. The Mobile Switching Centre/Visitor Location Register (MSC/VLR) and the Serving General packet radio service Support Node (SGSN) each report load information to the Radio Network Controller (RNC). The RNC determines the access restriction ratio based on the separately reported load information, and then sets the higher of the two to Cell Access Restriction information. The mobile terminal references this information upon transmitting the initial control signal when attempting to establish a call to evaluate whether transmission is possible. However, since the same access restriction ratio applies regardless of the type of call, both CS and PS calls are restricted in the MSC/VLR and SGSN at the access restriction ratio appropriate for the node subject to higher load.

The standard specifications for System Information Block Type 3 [1] have therefore been expanded, and CS Domain Specific Access Restriction and PS Domain Specific Access Restriction – the CS/PS independent access restriction information area referenced by the mobile terminal in accordance with the DSAC function, are provided in addition to the existing Cell Access Restriction (Figure 3). Thus it is possible to notify mobile terminals of access restriction for CS and PS calls independently, reflecting the traffic status of the each equipment. As a result, the RNC sets the CS Domain Specific Access Restriction according to load information reported from the MSC/VLR, and the PS Domain Specific Access Restriction according to load information reported from the SGSN, and thus optimizes traffic control according to the load status of the node. Even when maintenance personnel perform access control from the Network Element Manage System, it is still possible to set access restriction information independently for Cell Access Restriction, CS Domain Specific Access Restriction,

\*2 System Information: Include location identifier as required in determining whether location registration is necessary for mobile terminals, neighboring cell information, and information for access restriction control, and are sent for each cell.

### 3. Enhancement of Mobility Management Control Function

In order to receive network service in a given area, a mobile terminal runs location registration to notify the network that it is located in that area. In an area where a disaster has occurred, mobile terminals for which DSAC is specified must run location registration on an accessible network in

order to allow the use of such services as voice phones and i-mode Disaster Message Board used for safety verification on an accessible network not restricted by DSAC. When a mobile terminal registers its location in the PS network, the network uses network operation mode #1 (NMO I : Network Mode of Operation I ) for controlling location registration on linked networks (hereinafter referred to as ‘combined location registration control’) to register location in the CS network as well (Figure 5 (a)) via the Gs interface between the MSC/VLR and SGSN. This poses an issue in that the location of a mobile terminal for which access restriction to the PS network is specified cannot be registered in the CS network when using NMO I and DSAC together. The functions for location registration control of mobile terminals under the standard specifications [2] were therefore enhanced to solve this issue.

The enhancement of functions for location registration control of mobile terminals provides mobile terminals for which DSAC has been specified in NMO I with the ability to switch from combined location registration control to independent location registration control for CS and PS networks. This independent location registration control is generally used with network operation mode #2 (NMO II ), which does not support combined location registration control (Fig. 5 (b)).

However, mobile terminals using periodic location registration<sup>\*4</sup> do not run this switching between both types of location regis-

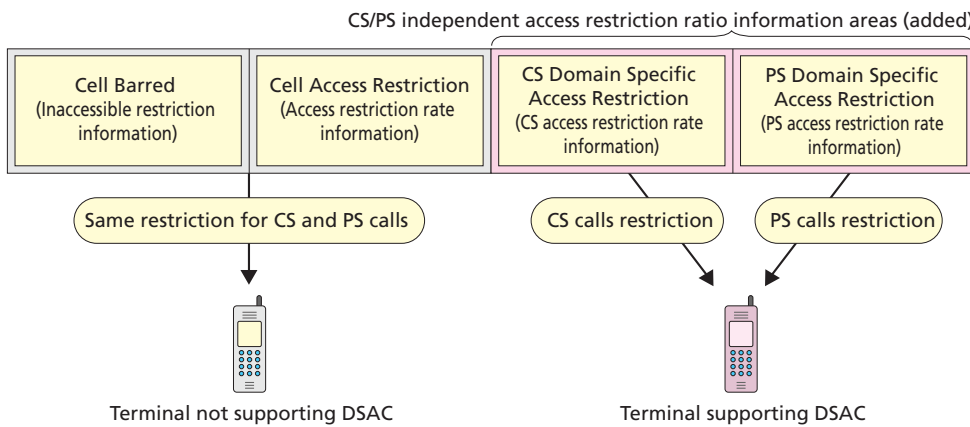


Figure 3 System Information (System Information Block Type 3)

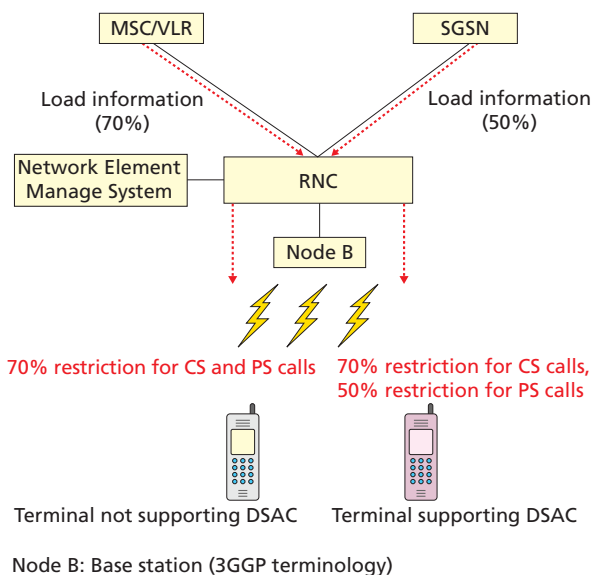


Figure 4 Access restriction control with MSC/VLR and SGSN under high load (example)

and PS Domain Specific Access Restriction. However, since mobile terminals not supporting the DSAC function reference the existing Cell Access Restriction information, both CS and PS calls for mobile terminals not supporting DSAC are subject to the same access restriction (Figure 4).

Cell barred information remains unchanged, and regardless of whether the DSAC function is supported, all mobile terminals reference the same information.

\*3 System Information Block Type 3: Information transmitted in System Information is consolidated in units of system information blocks of Types 1 to 18. System Information Block Type 3 includes information related to access restriction.

\*4 Periodic location registration: Refers to the location registration control periodically run by a mobile terminal according to a periodic timer in order to ensure that the network is able to properly manage the location of the mobile terminal.

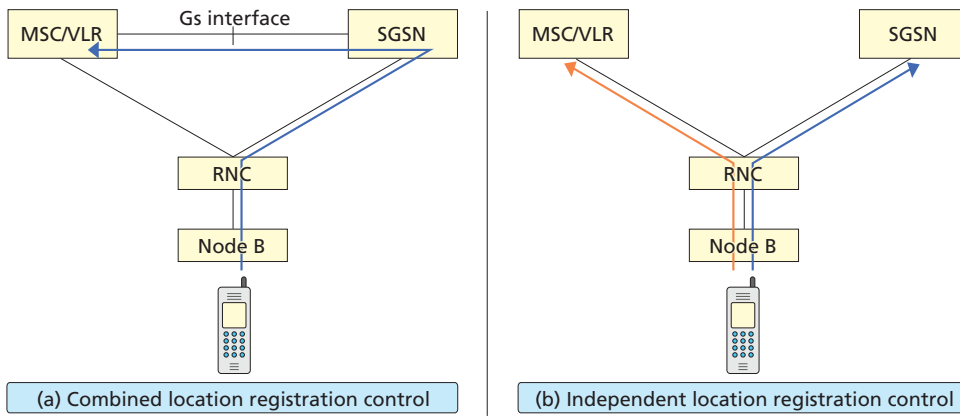


Figure 5 Combined location registration control and independent location registration control

tration control when access restriction is specified by DSAC. This is due to the fact that, should independent location registration control be run when access restriction is specified, all mobile terminals in the disaster area run independent location registration control, resulting in a large increase in network traffic, thereby making connection more difficult. Independent location registration control for the CS network is therefore run for mobile terminals for which access restriction to the PS network is specified upon completion of the combined location registration control timer cycle. Therefore, mobile terminals in a disaster area randomly run independent location registration

location registration control, periodic location registration control is run using the PS network, thus making continuous message transmission possible.

#### 4. Conclusion

This article has described the enhancement of control functions for access restriction and location registration that allow the application of independent network control for CS and PS. Given the expectations for increasingly diverse communication styles in the future, functions will be further enhanced to provide greater flexibility in network control.

control with this method, thus making it possible to prevent a large increase in traffic. Conversely, since mobile terminals for which access restriction to the CS network has been specified are able to access the PS network, periodic location registration is then subsequently run with combined location registration control having already been run. This is due to the fact that, with combined