

Special Article on Mobile Multimedia and ITS Vehicle Operation and Management System Based on DoPa

All commercial freight companies dream of centralizing the management of their vehicles in a single office. There have been systems developed with PDC and MCA radios, but the former is too expensive and the latter too limited in coverage.

This article introduces a vehicle operation and management system based on DoPa as the solution to both, and describes its features and future trends.

Hideki Ohue

1. Introduction

DoPa is DoCoMo's packet communication service, which interconnects data terminals with the network of the PDC Mobile Packet Data Communication System (PDC-P), as well as with the Internet, corporate LANs and other external networks through PPP.

As users are charged by data transfer volume, DoPa is widely popular in the fields of telemetering systems and machine communications.

DoPa is designed for frequently exchanging small volumes of data, rather than constantly transferring large volumes of data (like Web browsing). This dramatically reduces communications costs to levels much lower than what was possible under the conventional Personal Digital Cellular Telecommu-

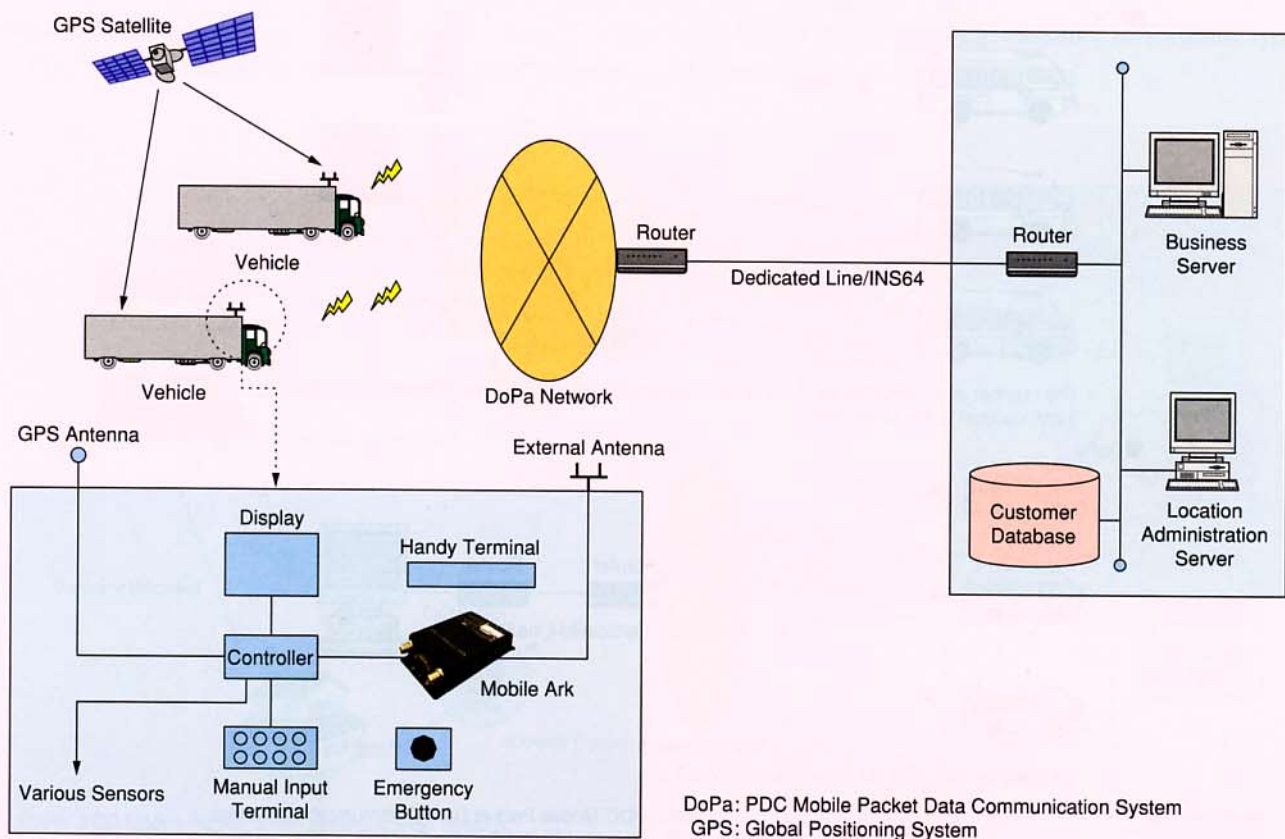


Figure 1 Configuration of Vehicle Operation/Administration System

nication System (PDC).

This article provides an introduction to one of the most potent applications of the DoPa applications family: a vehicle operation and management system.

2. System Overview

2.1 Overview

A vehicle operation and management system manages the status of all vehicles at a single center. The status of vehicles refers to information about the vehicle's location, information from sensors, etc. MCA radios and PDC systems, which were once dominant in this field, are quickly being replaced by DoPa. Figure 1 shows a system image of DoPa.

2.2 Features

The following is a description of DoPa's features in comparison to PDC.

(1) Fees

DoPa's charge system is not concerned with connection time or distance. Users are charged by data transfer volume, meaning that no fees will be charged if there is no data trans-

fer. This makes it the optimal solution to users who transfer small volumes of data frequently. In a vehicle operation and management system, the data transmitted can be broadly divided into three groups: location information, vehicle ID, and time. The connection fee charged upon sending the data is:

- PDC ... 10-20 yen per transfer.
- DoPa ... 0.2-0.6 yen per transfer.

(It should be noted that the communication fee depends on the software that controls the communication.)

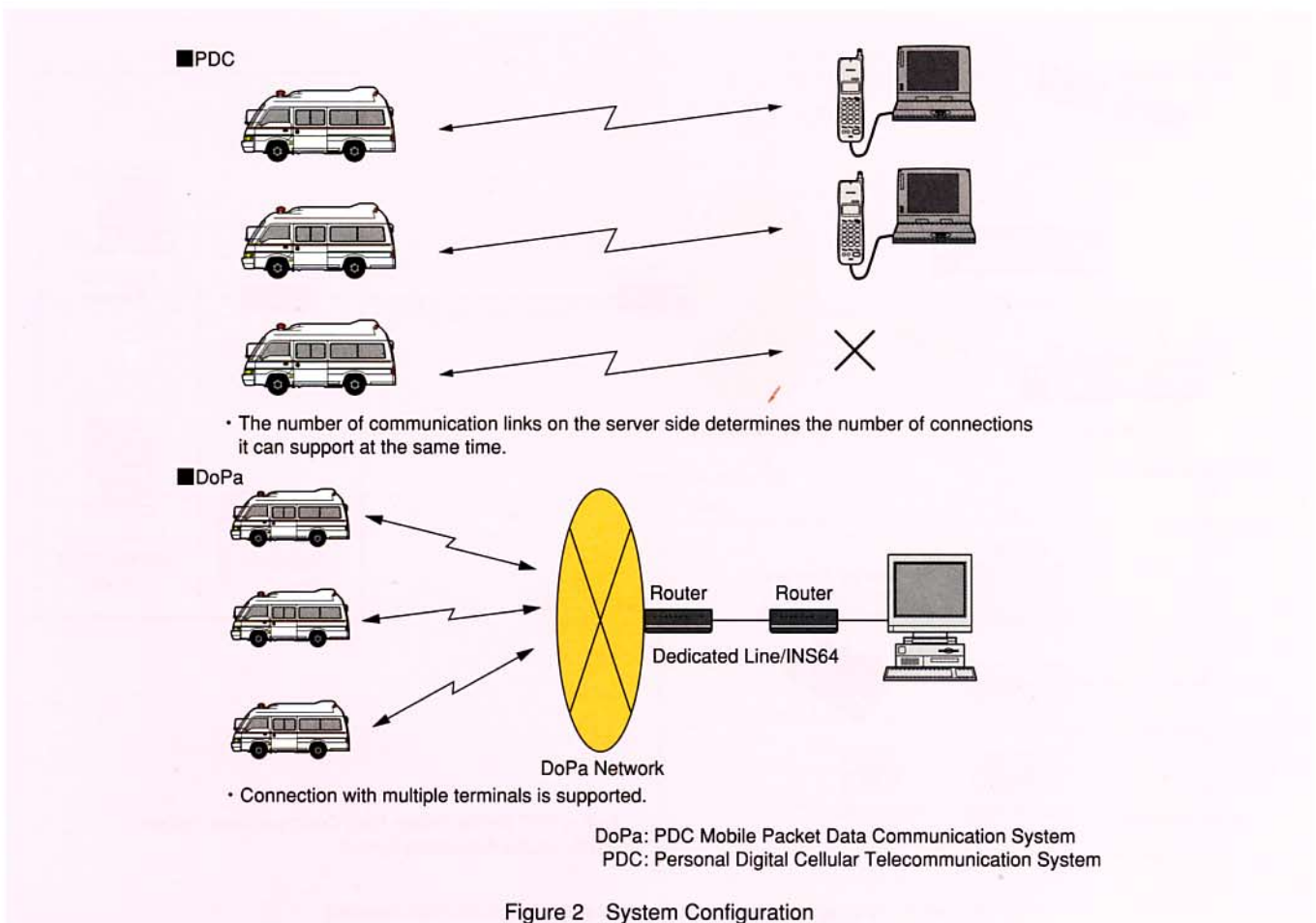
(2) Communication Time

As DoPa uses the TCP/IP protocol, it does not have to negotiate with any modem. The time taken to start and complete communication is extremely short, making the communication virtually real-time. When a car terminal makes a connection request, the communication will be completed within:

- PDC ... Approx. 30 seconds
- DoPa ... Approx. 10 seconds

(3) System Configuration

DoPa's adoption of TCP/IP makes 1: n communication possible. It can smoothly operate large systems consisting of



thousands of terminals. The system configuration is illustrated in Figure 2.

- PDC... The number of connections it can make at once is limited by the number of links on the server side. This causes problems in large systems, where lines become congested.
- DoPa... TCP/IP connection enables connection with multiple terminals at once and enhances reliability. Initial investment costs are lower because no extra land-lines need to be installed on the server side.

(4) Out of Range Operations

DoPa is capable of sustaining communication for a certain period even if the terminal goes out of range. This makes it optimal for systems that experience rapid changes in wave reception conditions.

- PDC... Disconnection occurs as soon as the terminal goes out of range. Reconnection will be required to transmit data again.
- DoPa... Connection is sustained even if the terminal goes out of range. Data can be transmitted again immediately, making real-time communication possible.

(5) Billing

As already described in(1), DoPa users are charged by data transfer volume. The merits of not having to worry about connection time are:

- PDC... Users are billed by connection time, forcing

them to disconnect every time the data transmission is over. If they decide to send data again, they will have to reconnect while they are in range. Much time is wasted in this process.

- DoPa... Users are billed by data transfer volume. By sending location information on a regular basis, the user can always transfer data efficiently without disconnecting.

3.Examples

(1) Delivery Vehicle Management System

The center manages all the information about the location of each delivery vehicle, parcel, etc. This allows the center to optimize the distribution of vehicles upon pickup, improving the efficiency of vehicle operation. Also, customer service is enhanced by the disclosure of administrative data, which enables customers to trace where a parcel is. Figure 3 shows a system image.

- ① Data transmitted from vehicle to center
 - Delivery slip data (barcode)
 - Report of completed delivery and pickup
 - Information about vehicle's location
- ② Data transmitted from center to vehicle
 - Pickup information (e.g, customer information, type of parcel)

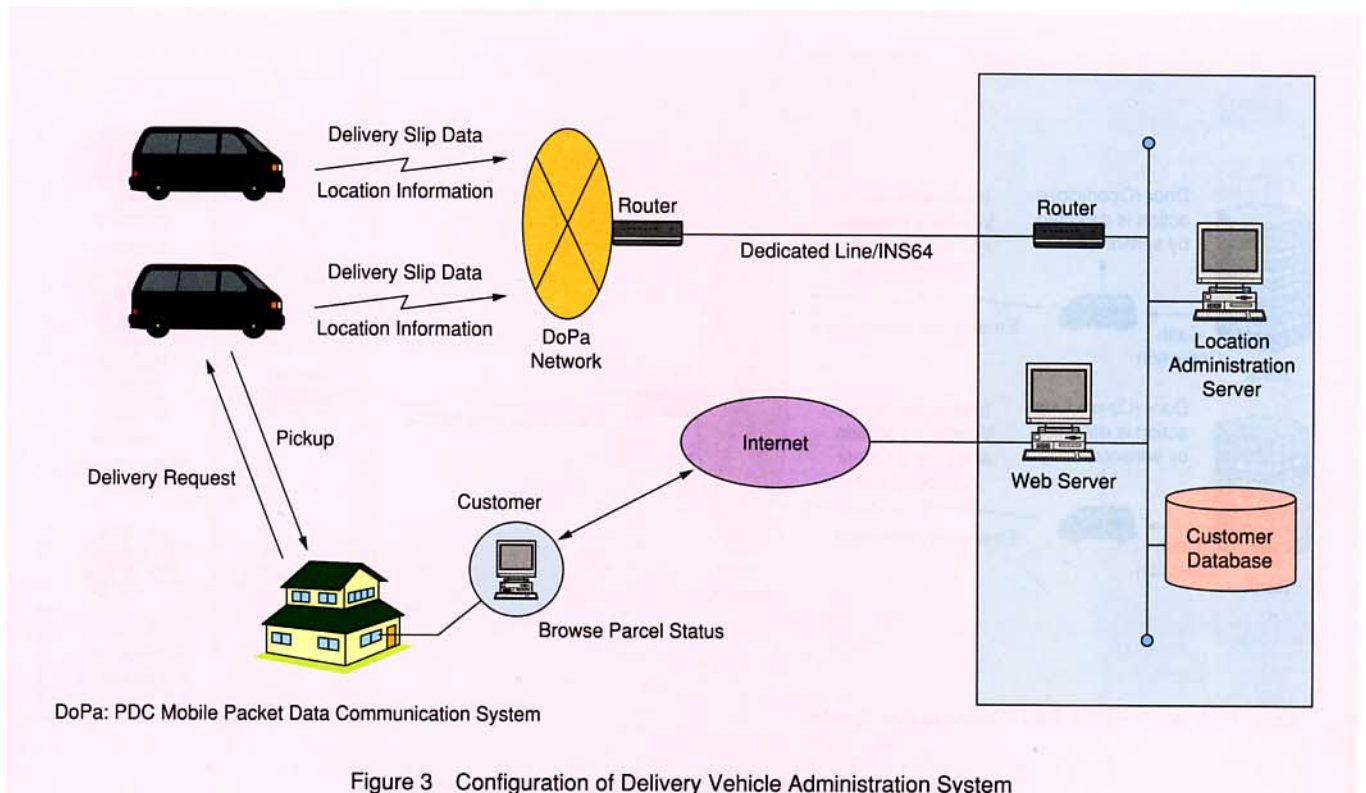


Figure 3 Configuration of Delivery Vehicle Administration System

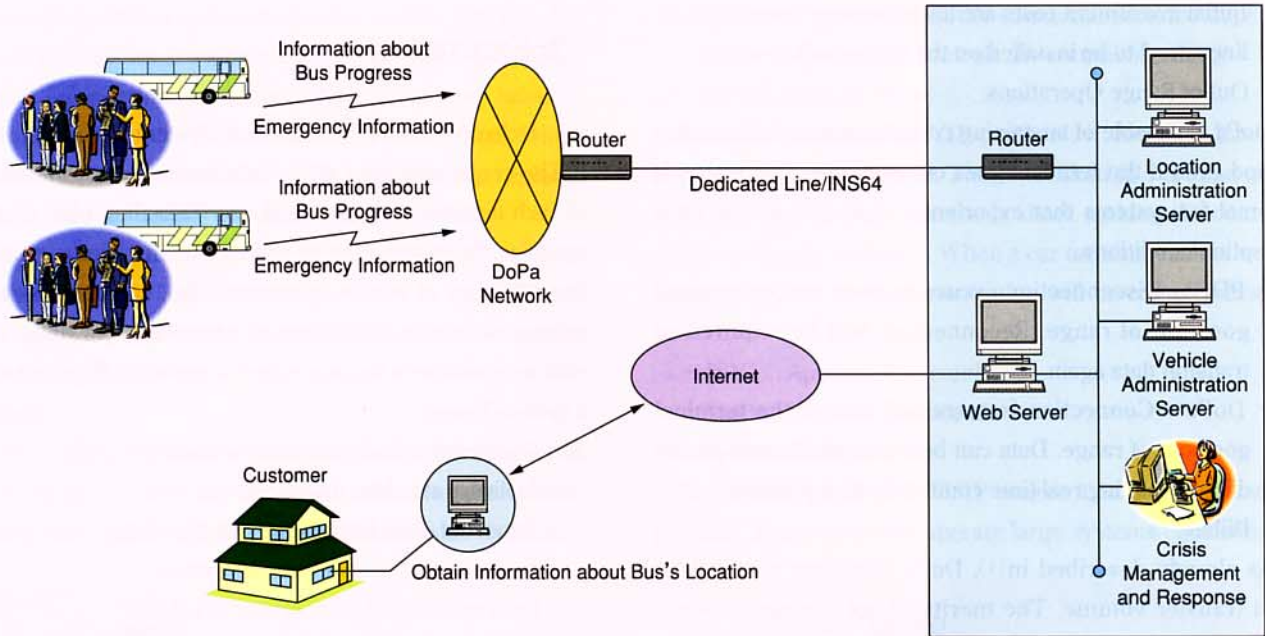
- Instructions to driver

(2) Bus Location System

The center manages the location of all buses. Customer service is improved based on its ability to locate buses real-time. By adding optional functions such as emergency buttons, the status of vehicles can be constantly monitored.

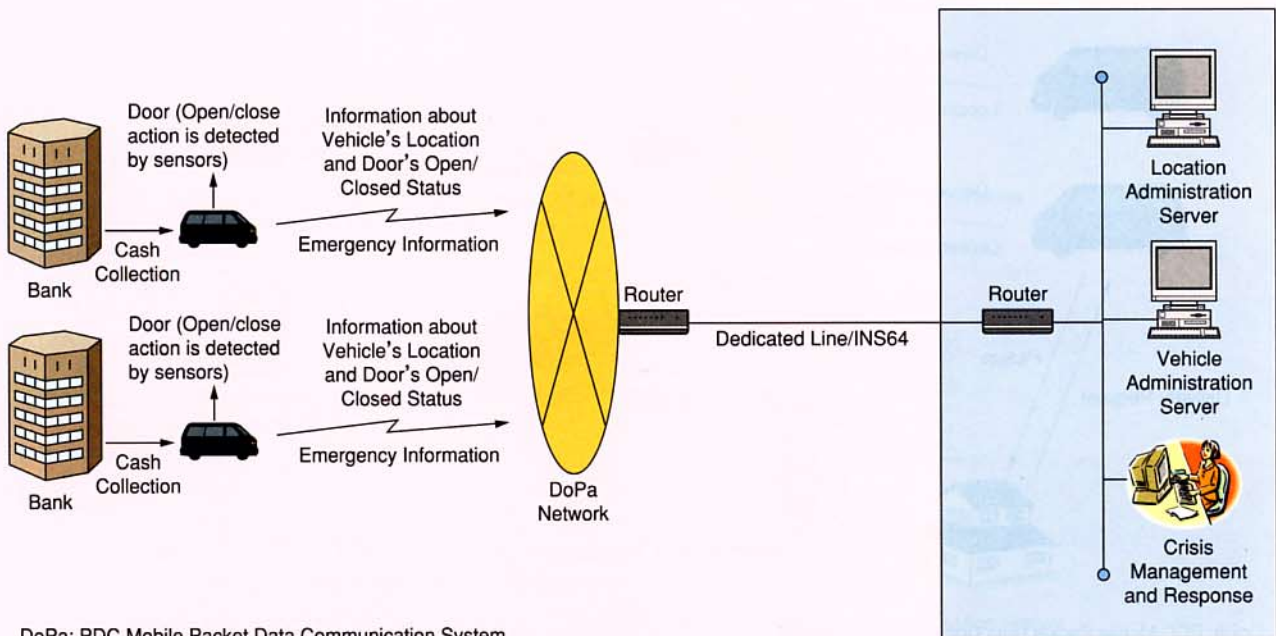
Figure 4 depicts the system image.

- ① Data transmitted from vehicle to center
 - Information about buses passing through a bus stop
 - Information about an emergency situation arising
- ② Data transmitted from center to vehicle
 - Instructions to driver



DoPa: PDC Mobile Packet Data Communication System

Figure 4 Configuration of Bus Location System



DoPa: PDC Mobile Packet Data Communication System

Figure 5 Configuration of Bank Transport Truck Administration

(3) Bank Transport Truck Administration System

The center manages the status of all bank transport trucks. By attaching sensors to doors and other parts of the truck, the center can detect when and where the truck collected cash, and in the event of any unexpected diversion from the normal route, it can display an alarm notice. Installing an emergency button also reinforces the crisis management system. The system configuration is shown in Figure 5.

- ① Data transmitted from the vehicle to center
 - Information about the vehicle's location
 - Information about the door's open/close status
 - Emergency information
- ② Data transmitted from center to vehicle
 - Instructions to driver
 - Information about customers requiring cash collection

4. Conclusion

This article introduced a vehicle operation and manage-

ment system based on DoPa, as one of the services for the Intelligent Transport Systems (ITS). As mentioned in the beginning, DoPa is becoming dominant in vehicle management systems. DoPa-based systems have been developed and are sold by more than 20 system integration companies at present. The diversifying needs of end users require ways to improve optional functions, such as the combined operation of Car Navigation Systems and handy terminals. We intend to enhance our technical support, as further developments are expected in this field.