

THE DESIGN OF PDA APPLICATION SCHEMES FOR WIRELESS COMMUNICATION SERVICES

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ABSTRACT

Current researches on PDA are emphasizing the technical issues such as the hardware organization or language for remote communication. However, the details of the wireless PDA services are yet to be defined. We need to know what kind of services can be conducted and what data should be transmitted in what manner in order to complete the service. This research provides a practical application layer design which examines the possible categories of wireless PDA services and, for each category, the necessary data formats designed for conducting the service. The attempt is to figure out an organized and feasible application scheme which, when being employed, makes the wireless PDA services viable.

Keywords: Wireless Communication Services, PDA Applications, Exchange Formats

I. INTRODUCTION

The necessity of remote computing power emerged clearly today when the role of computers become so important in the office and there are over 40% of time people must leave their office for completing his job. Based on that, John Sculley, Vice President of Apple Inc., points out the concept of Personal Digital Assistant (PDA) which provides the user with needed information at any time, any place.

For PDA to be able to transmit messages, it must employ one of the technologies which are available today for wireless data communication. It can be carried via FM Radio, Satellite, Paging, or Cellular. Each of them has its characteristics and suitable area of utilization and there are many existing services based on these technologies.

Current developments of the PDA tools emphasizing on the technical issues such as the hardware organization or language for remote communication. These efforts allow a powerful PDA to be expected in the near future. However, people can only envision the future PDAs to be a tool that can send e-mail, receive fax, talk with someone any where, or arrange his schedule. It is unknown that how exactly these operations proceed and how different kind of applications can employ wireless PDAs or what kind of

services can be completed with it. We need a designed scheme which points out how to utilize all the powerful features of the PDAs in an organized and feasible fashion and allows the manner of proceeding with the PDA services to be clearly pointed out. This research provides a practical approach which examines the possible manners of proceeding the wireless PDA services. The attempt is to figure out a scheme which, when being followed, makes the wireless PDA services viable.

Next section sketches the related important researches in this area. Section three specify the system framework under each category of wireless communications. The fourth section provide the implementation of the specified category with the details of data format. Section five gives the discussion and future direction of researches.

II. RELATED RESEARCHES

Many researches were trying to put the communication capabilities into the PDA. There are many products in the market already, such as GEO of AT&T, Newton of Apple, Simon of Bell South, ThinkPad of IBM, and Envoy of Motorola. The Dragonball of Motorola even includes the wireless communication module in the CPU for efficiency.

There are mobile network communication protocols being established. Mobile-IP[2] is based on TCP/IP by Internet Engineering Task Force. It's main purpose is to allow the PDA to use the Internet. IEEE has 802.11 [3] established in 1990 for wireless LAN.

Many researches have been conducted for using PDA for wireless communication. Such as Indirect TCP [2], InfoNet [3], Video Service to Mobile Clients [4], and Mobile Internetworking [5] are all conducted by academic organizations. Business companies also devoted into this area. The Wireless World Wide Web (W4) of Digital is attempting to connect PDA to WWW environment [1]. The Telescript of General Magic use the concept of Remote Programming (RP) to reduce the loading of network caused by the Remote Procedure Call (RPC) between client and server [7].

There are many PDA software exists today [6]. Each of them has different capabilities and proficiency. However, each of these softwares has its own way of operating and has different ways of working. They need to communicate with each other in a common language. This research is

trying to define a common language that, when employed, will allow different PDAs to communicate with each other and transmit data which is understandable by every PDA.

III. SYSTEM FRAMEWORK

With the technologies currently available, there are many possible ways of conducting the remote communications. In this research, the one who receives messages during the communication is being identified as *Message Receiver*, MR. The messages received by MR are coming either from any organization who provide useful information, called *Services Provider*, SP, or from personal using a PDA, called *Message Sender*, MS. The SP can be large company whose function is designated to provide commercial information or department of the government propagating public prescripts. The MS can be a particular personnel looking for a dialog with his partner or private association asking its members to answer about some discussion issues.

There are many, virtually endless, different applications can be conducted using PDA based communication devices. This research has categorized these possible applications into three different modes: *Broadcasting*, *Service Communication*, and *Direct Communication*. These modes are considered important and feasible for real-life applications. In Broadcasting mode of communication, the *Broadcast Message* is sent from SP to MR. During Direct Communication mode, particular MR is receiving *Direct Message* from a MS. Fig. 1 illustrated the scenarios of these two modes.

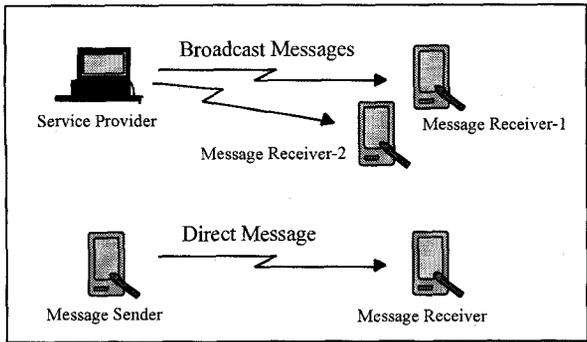


Fig. 1: The scenarios of Broadcasting mode and Direct Communication mode.

The scenario is more complicated in Service Communication mode (Fig. 2) where all of the MS, SP, and MR are involved. The SP in this case is not sending Broadcast Message, it is sending *Service Message* which has special purpose or function. For example, mail-ordering messages can be sent from SP to any customer using PDA who has subscribed the service. The customer, as a MR, can decide if he wants to return a message or not. The reply, called *Reply Message*, will be collected by the SP for completing the service (in this case, report all the mail-orders). This service could be initiated by agreements made by human agents, or it can be requested by a Message

Sender sending a *Request Message*. The SP will send back the *Result Message* after the orders are due. Table 1 summarized these varieties. All these different possibilities points out the necessity of a detailed design of communication pattern which can fulfill the different modes of communication.

Table 1: Different types of messages and their usage.

Communication Mode	Message Type	Usage
Broadcasting	Broadcast Message	Message send to everyone who is set up for receiving the message. No responds needed.
Service Communication	Service Message	Send by SP to all the subscribed MR. Responds desired.
	Reply Message	The message MR reply to the SP. Carry replying data.
	Request Message	MS sends to SP for requesting predefined services.
	Result Message	SP sends the collected data back to MS as the result of the service.
Direct Communication	Direct Message	MS directly passing information to MR. Without intermediate SP.

A. BROADCASTING

The first type of communication is Broadcasting. In Broadcasting mode of communication, the service provider sending broadcast messages without designated receivers. The message can be received by any MR as long as he is willing to receive it and the corresponding settings have correctly initialized. In order to receive the desired information, the SP and the MR must first achieve an agreement and use some identification scheme for recognizing the messages. The screening and filtering of messages is important so that the MR will not receive undesired large amount of garbage messages. The purpose of this type of messages usually is to offer a notice or advertisement that is not requiring any respond. Such as the delivering of public information, traffic report, prescript announcement, or commercial advertisements are

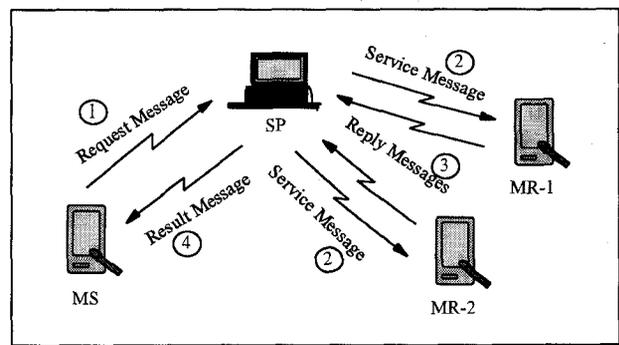


Fig.2: The scenario of messages in Service Communication mode.

all belong to this category. Its area of application is virtually unlimited.

The system construct of the message receiver during messages broadcasting is depicted in Fig. 3. The data is received by the Wireless Device which can be any kind of

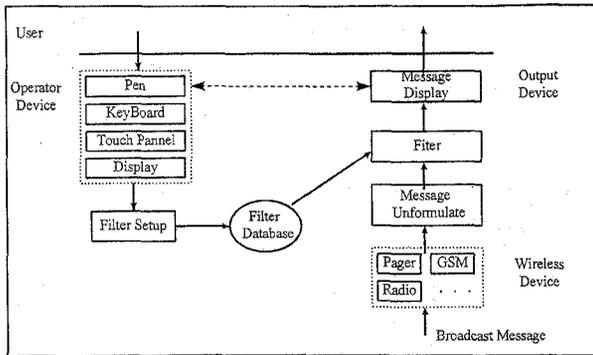


Fig. 3: System structure of the Message Receiver receiving broadcasting messages.

device such as GSM, pager, or radio. The responsibility of the filter is to identify the messages that should be received. The identity used for filtering should be pre-determined by both SP and MR under formal contract.

Since the broadcasting does not require the MR to respond, the SP (Fig. 4) doesn't equipped with mechanisms for receiving any messages. This research assumes that the processing speed is sufficiently coping with the massive number of incoming messages.

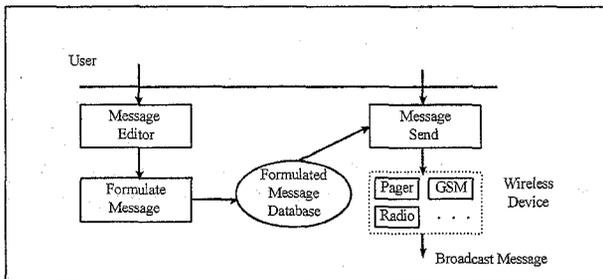
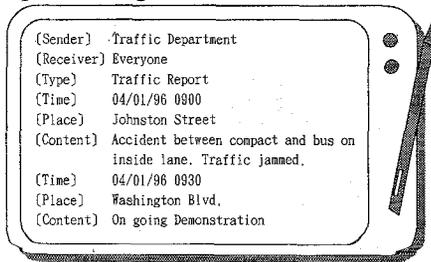


Fig. 4: The system construct of Service Provider in Broadcasting mode.

Public message delivering is usually proceeded in Broadcasting mode. Here is one of the example when traffic report message is delivered to the screen of MR:



B. Service Communication

Service Communication provides a mechanism for delivering messages between subscribed users. Because it is a double directional operation, that means the receiver can send message back, there are more issues should be arranged and resolved. However, when considering the real situation in the future, there are probably too much information must be handled by a Service Provider. For

example, mail ordering services must handle many customers' replying orders which could have a large volume. This practical issue means that we should allow some "agent" to perform the large amount of work instead of loading the overhead on a single PDA. Therefore, according to the amount of information is handled, the schemes are separated into "Service Communication" and "Direct Communication." In Service Communication, a Service Provider must act as an intermediate media between Message Sender and all the Message Receivers and perform intensive processing of information and communications. On the other hand, the Direct Communication offer direct linking between two PDAs, which will be discussed in the next section.

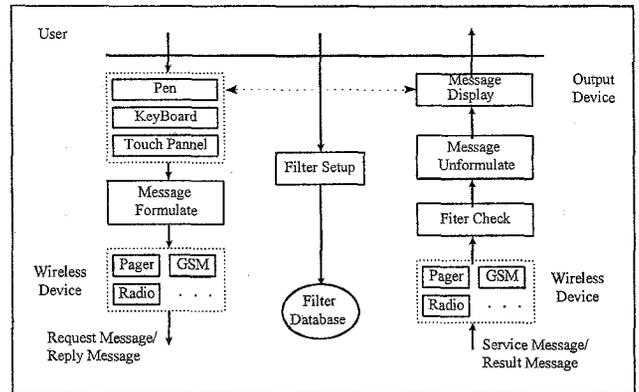


Fig. 5: System structure of Message Receiver and Message Sender under Service Communication mode.

Fig.5 presents the structure of MS and MR in Service Communication mode. They share the same structure because they both need to send and receive messages and their role can be interchanged at any time. It is similar to the MR in Broadcasting mode except that it contains extra device for not only receiving incoming messages but also sending out messages. In Service Communication, the outgoing messages from MS are sending to the Service Provider which in turn sending out further processed information to the clients under the particular application or service. In order to restrict the MR clients to reply in a fixed format, the message sent by the Service Provider must attaches a "form" which is following some predetermined format. When the client reply, he must use the form to fill in proper data in each slot so that he can send the answering message back to the Service Provider in this fixed format. Only in this way the SP can gather all

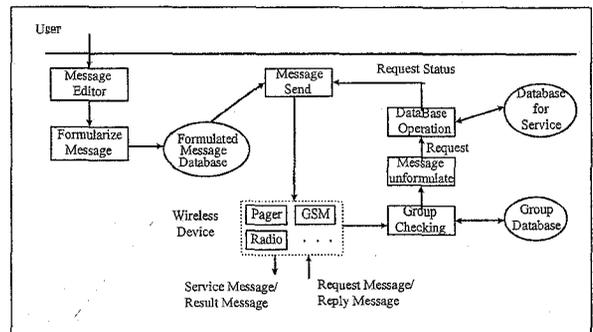
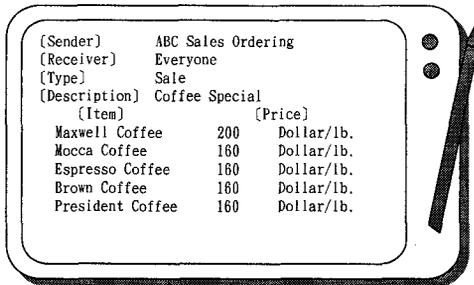


Fig. 6: The structure of Service Provider in Service Communication.

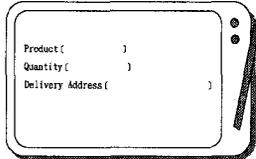
the answers in a disciplined manner which is necessary for the application to proceed.

The structure of Service Provider can be found in Fig. 6. To provide services in Service Communication mode, the system, may be a PC or mainframe, must equipped with both sending and receiving capabilities.

We use mail-ordering application as the example to illustrate these operations. When applied on mail-ordering services, possible contents of the message is showing below. This message received by the person who has an contract with ABC Sales Ordering and had correct setting



on his PDA. If this person decided not to buy it, he just discard the message. If yes, he will enter his personal information and purchase detail following the format provided with Reply Format in the following screen.



The information provided will be sent back to the Service Provider. It's format includes Sender and Receiver which are implicit and not shown on the screen.

C. Direct Communication

Direct Communication is a special case of Service Communication. When a PDA is trying to communicate directly with another PDA, it can send it without the intermittance of a Service Provider. Since the communication is performed between individual PDA, the distance is limited by the power of the PDA. Without the broadcasting power of Service Provider, its still covers a

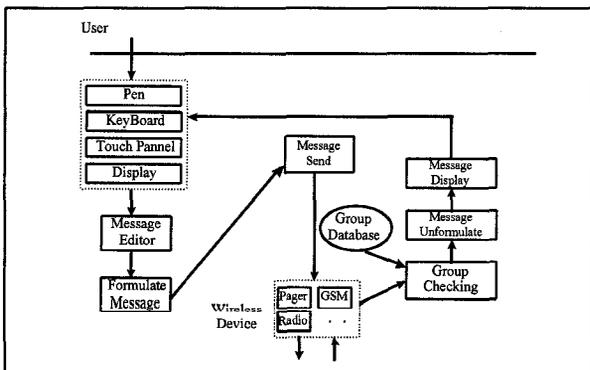
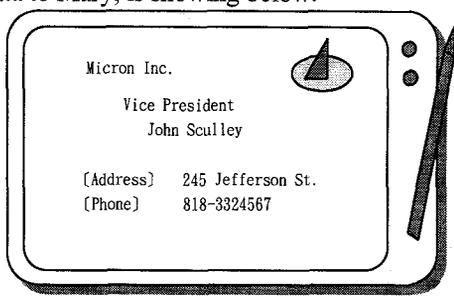


Fig. 7: The system construct of Message Sender or Message Receiver under Direct Communication mode.

wide ranges of application area such as personal messaging, name card exchange, and game playings that requires more than one players.

The system structure of PDA under Service Communication is presented in Fig. 7. In this construct, it is apparent that there is a Message Editor and Formulate Message module which exists only in Service Provider in previous two mode of communications. This is obvious because the PDA must formulate and send its own message to another. The message sent by the originating PDA can include reply format for the receiving PDA to answer its message. As an example, suppose John is sending his name card data to Mary, is showing below.



IV. SYSTEM IMPLEMENTATION

For the service applications mentioned in the previous section can be successfully carried out, there must be a well-defined language which, when being followed, allows each different PDA to understand the message contents and behaves accordingly.

A. Message Exchange Format

In order to verify the possibility of using same communication exchange format on different brand names of PDA, a common message exchange format has been defined (Table 2). As long as the delivered message is under this format, different PDAs can handle it correctly, according to the defined meaning. However, depend on the different APIs, the detail of its treatment might be different. The content of Type should be defined by Service Provider itself according to its service category. On the definition of Sender and Receiver the message is assigning the capability of categorizing.

DataContext is the actual data that are designated for transmission. It encapsulates many separated data item,

Table 2: Message Exchange Format

Name	Length (Bytes)
Header	2
Type	1
Sender	12
Receiver	12
MessageID	6
DataLEN	4
DataContext	Var
checksum	4

each of them in the following syntax:

~ Operator [Option]_n [Data]

The **Operator**, according to the functional difference, can be separated into two categories: *Basic Data* and *Property*. The Basic Data categorizes the operators that introduces simple data, while Property category introduces data that has more sophisticated meaning. Some important operators of the Property category are provided in Table 3.

In order to illustrate the usage of these coding, an example of services and business categorization is provided. Although the actual codings are to be decided when this technology is ready to be utilized in the real world, it is sufficient for demonstration.

Table 3: Operators of the Property category.

Operator	Meaning of following data
Q	Data contains metric value, such as lbs, meters.
lm	Depicts the length of following data.
r	Specifying that Data is a reply message.
L [Y] [X]	Specifying the relative coordinate on the display Data should appear.
C	Data contains variable. Needs to used together with ~tb. For example: ~tb~SName~Cname
V	Means that the previous Option has the value of next Option.
P	The priority of Data.

B. Service Communication Applications

When conducting Service Communication, the message must contain necessary information for MR to prepare for the return message. In the following example, the SP sends out the sales order with succeeding form for filling in ordering information. The output of this message already shown in section III.B.

```
[Header](FFFF) 16
[Type]
[Sender](003001000001)
[Receiver](FFFFFFFFFFFFFFFFFFFFFFFF) 16
[MessageID](000001) 10
[DataLen]
[DataContext]
(~L(1/8,22/48)~SCoffee Special
~L(2/8,10/48)~SMaxwell Coffee~V~L(2/8,30/48)
~N200~L(2/8,36/48)~QDollar/lb.
~L(3/8,10/48)~SMocca Coffee~V~L(3/8,30/48)
~N160~L(3/8,36/48)~QDollar/lb.
~L(4/8,10/48)~SEspresso Coffee~V~L(4/8,30/48)
~N160~L(4/8,36/48)~QDollar/lb.
~L(5/8,10/48)~SBrown
Coffee~V~L(5/8,30/48)~N160
~L(5/8,36/48)~QDollar/lb.
~L(5/8,10/48)~SPresident Coffee~V~L(5/8,30/48)
~N160~L(5/8,36/48)~QDollar/lb.
~P~L(2/8,10/48)~SProduct~r~lm10~S
~L(4/8,10/48)~SQuantity~r~lm10~N
~L(5/8,10/48)~SDelivery Address~r~lm20~P)
[checksum]
```

V. Conclusions

This research has categorized possible applications of wireless PDA services into three different modes: *Broadcasting*, *Service Communication*, and *Direct Communication*. When PDAs working among these different communication mode, they are identified as

Message Sender, *Message provider*, and *Service Provider*. Different kind of messages passing between them are also identified. These categorizations clarify the scheme of services with wireless PDAs.

The PDA services eventually will reach the degree that everyone want to have one for the efficiency and effectiveness of their work. A mature hardware and software technology is the necessary requirement for processing such large amount of messages.

There must be some contracting between the Service Provider and the user of the PDA. Only after the method of subscribing the services and the necessary operation of making the agreements between PDAs are clearly defined, the PDA services can therefore start.

For a PDA to become a powerful tool instead of a fancy toy, it must be easy to use and smart enough to reduce the chores of routine or repetitive operations. Intelligent Agent is a definite direction for this research to be continued.

In order to conduct the designed application scheme, the application layer of different PDAs must be able to recognize a common language. A set of exchange format has been provided in order to allow all the PDAs to speak to each other. This is an ongoing experiment which has a purpose of validating the proposed scheme. Based on the actual requirement of different applications, the exchange format is subject to modification. However, the principle behind this proposed service scheme is not likely to change. With the new technologies evolves so quickly today, the world of wireless PDA employing similar scheme of services will not be too far away.

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