

Ubiquitous Printing Services

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The Printer and Multi-Function Printer (MFP) product group available from Oki Data is expected to fill the requirements of “shared printers and MFPs that are easy to use with peace of mind for various applications” in office network environments for the ubiquitous network era, in which anyone can connect to any entity at any time and anywhere.

Descriptions of printer solutions and network technologies for the ubiquitous network were provided in Issue 204 of the Oki Technical Review¹⁾.

A summary of a platform embedded with Java[®] applications is provided in this paper, indicating the proprietary developments of Oki Data in order to create printing services in ubiquitous networks, as well as detailed descriptions of an IC card authentication service and a serverless on-demand printing service, achieved through the use of these same technologies.

Embedded Java platform

Frequently our printer and MFP customers require customizations to suit their operating environments and invariably these customers request additional new features.

To immediately improve the convenience and to add the functions that our customers seek we developed a “Java embedded platform” for our printers.

The platform embedded with Java applications, which is mounted on our printers, is described below.

Fig. 1 shows a configuration diagram of the system that incorporates a Java executing environment on one of our printers.

The left side of Fig. 1 represents the controller unit firmware (hereinafter referred to as “CU F/W”), one of the existing features of our printers²⁾ that controls the printing for the entire printer.

The right side of Fig. 1 represents the embedded Java application executing environment. The executing environment for embedded Java applications is comprised of the following components:

① J2ME[®] (Java 2 Micro Edition)

This is a general term for platforms that facilitate the execution of Java applications on real-time operating systems (RTOS). They incorporate the embedded Java virtual machine (Java VM), a class library and various tools for debugging.

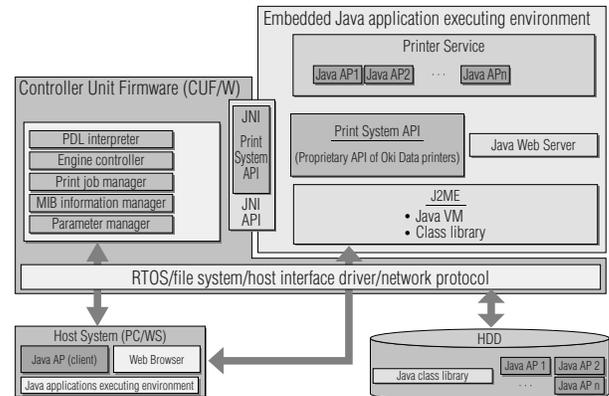


Fig. 1 System configuration of embedded Java applications

② Java Web Server

This server processes web applications that have been developed using Java.

③ Print System APIs

This is a general term used for the Java application programming interface (Java APIs) used by Java applications to access internal data of the CU F/W and print functions. These proprietary APIs are used for the printers of Oki Data incorporating the following APIs:

- APIs used for managing print jobs in the printer (monitoring the status of print jobs, as well as canceling, stopping or resuming print jobs).
- APIs used for setting and referencing the various parameters of the printer.
- APIs that provides input streams for loading the data of print jobs and output streams for issuing responses to the query commands included in such print jobs.

④ Printer Services

These Java applications run in an embedded Java application executing environment. The Printer Services use Print System APIs.

The Java Native Interface (JNI) of the Print System API, used for mutual access between the Printer Service and CU F/W, is loaded in the central portion as shown in **Fig. 1**.

¹⁾ Java, J2ME and J2SE are trademarks of Sun Microsystems, Inc., in the United States and other countries.

Embedded Java SDK

Oki Data provides support for Java application development by supplying business partners with the Java software development kit (Java SDK), which includes an embedded Java application executing environment.

Java SDK is comprised of an embedded Java application executing environment and the various following documents:

- API reference
- Programmer guide
- Sample Java application
- User guide

The aforementioned embedded Java application executing environment is installed into the printer by a Printer Service application developer. The Printer Service is then loaded onto a personal computer or a workstation using the Java 2 Standard Edition (J2SE)^{*1} and the codes are input on a configured printer. Remote debugging is then performed between the personal computer or workstation using the printer via a network, to develop a Printer Service.

We developed various ubiquitous printing services, described in subsequent chapters, using the embedded Java application platform described above.

IC card authentication printing service

An IC card authentication service allows functions to store, print and delete print data in a secure manner, through the encryption of print data using IC card authentication. Java applications and the FeliCa²⁾ card, adopted for the IC card, facilitate this service with the following functions:

① Group printing function

The administrator must first designate a printer group using a job management server. Users can then print their own print data by scanning their IC cards on the printer. Therefore, it is possible to avoid “taking the wrong” printout, as well as documents being “lost”, “peeked at” or “left behind” (Fig. 2).

② Secure printing function

Print data that moves across the network is encrypted by the client personal computer and decrypted by the printer at the time of printing (Fig. 3).

A summary of the process for the IC card authenticated printing service is described below:

Information on the IC card is input into the client personal computer to identify the person initiating a printout.

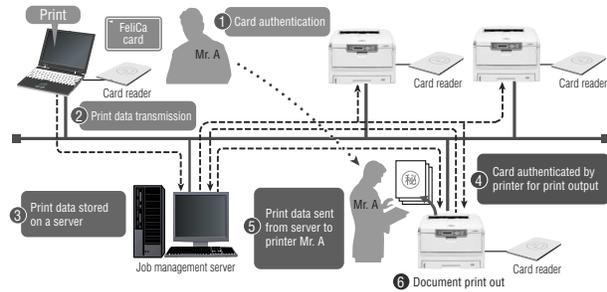


Fig. 2 Group printing feature

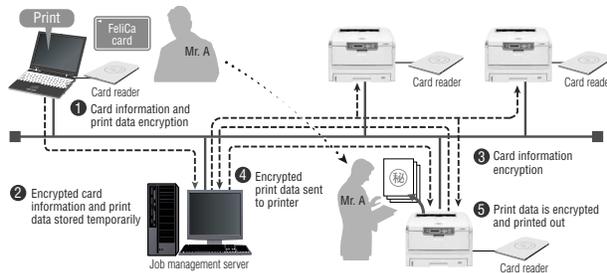


Fig. 3 Secure printing feature

The client personal computer encrypts the print data and unique information on the IC card according to the printing instructions.

The print data and the unique information on the IC card are transferred from the client personal computer and temporarily stored on the job management server.

Once the IC card is scanned by the printer the Java application requests the print data from the job management server and checks the transferred print data to see if it has been tampered with or not before it prints.

The print data that has already been printed out is completely deleted. Furthermore, any print data that remains stored without being printed is deleted automatically.

The IC card authenticated printing service assists in avoiding problems, such as losing printouts, leaking of print data, tampering or printing documents through the manipulation of personal computers by third parties. This means that the risk of information leaks relating to paper-based documents, which could occur when documents are printed out, as well as risks relating to the leaking of data transferred over the network, can be eliminated.

Furthermore, improvements in the security management awareness of all employees can be expected for paper documents through the implementation of the user print limiting functions, linking up with the Print Super Vision (PSV), network management software from Oki Data, as well as with Print Job Accounting (JA), job accounting software.

*2) FeliCa is a registered trademark of Sony Corporation.

Serverless on-demand printing service

Currently we are developing a service system for on-demand printing by applying the embedded Java applications and a form overlay technology to provide a serverless print environment that does not require the use of a personal computer, as shown in Fig. 4.

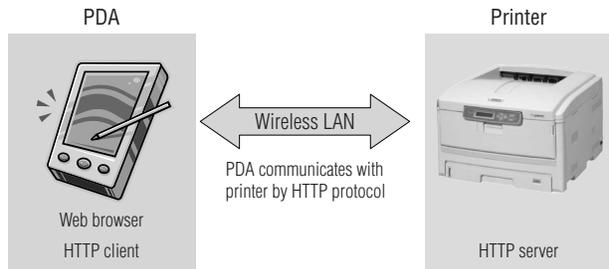


Fig. 4 Serverless on-demand print system

Personal digital assistants (PDAs) and mobile phones can be used as client devices for printing, while directly connected to a printer without any server intervention (a serverless connection). Form overlay templates are stored on the printer prior to printing (hereinafter referred to as "printing templates") so that only the variable data information needs to be sent from the client to the printer to synthesize and print the data on the printer.

A web browser is used as a GUI for the client and the HTTP protocol is used for communications with the printer so that no special or dedicated application or protocol is required. This makes it easier to implement the system and reduce costs since the existing devices, such as PDAs, can also be used.

The configuration of the printer in this system is shown in Fig. 5.

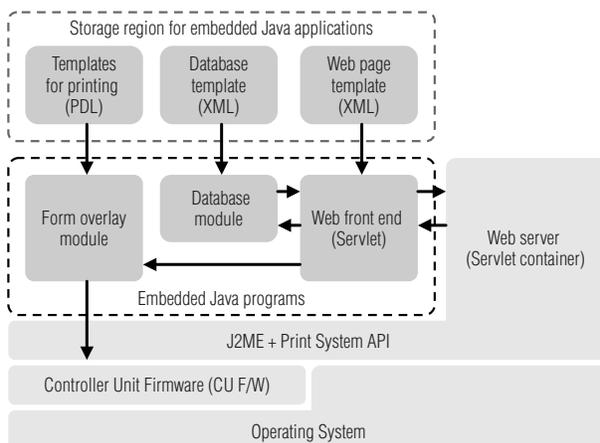


Fig. 5 Serverless on-demand printing configuration

The client makes the template for displaying on a web page, as well as the flow of data entry by the user and the page transition information, using the Extensible Markup Language (XML), before storing them on the printer for future printing.

Java applications on the printer generate web pages for display, which is provided to the client, according to the XML descriptions. In this way customized pages can be generated for various purposes simply by exchanging the XML templates.

Multiple printing templates can be described and stored using a page description language (hereinafter referred to as "PDL") on the printer. A list of available printing templates is displayed when the printer is accessed from a client. The preferred template for use is selected from the list, before a list display of variable data is selected or an entry is made directly, as shown in Fig. 6.

Fig. 6 Web front-end (GUI)

An ID that indicates the location where variable data is stored is embedded in a printing template. The ID for the storage location and variable data are sent as a pair from the client to the printer. The printer searches for the storage location, embeds the variable data and prints.

Since the printing template is described in PDL, there is no need to use any special application to create a printing form and a printing template can be prepared using universal applications, which can be output as a file using a printer driver from Oki Data, making the process of generating a template easy.

Multiple variable data can be stored on the printer for the list display (selections), to which the database system is loaded using XML descriptions.

An estimate preparing system, shown in Fig. 7, was prototyped in order to test the function described above.

The characteristics of the function include the subtotal and total calculating features. The unit prices of products are previously embedded in the templates, however, if a discount is to be applied dynamically on the spot it becomes necessary for changes to be made. The discount price can be entered from a PDA and handled as the new value for the unit price before the values for the subtotal and total are calculated. The ability to customize with a function in such a flexible manner is one of the features of this printing service system.

