

Fastticketing for PDA

SBB AG

Fastticketing

Projectdocumentation

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II. Record of Changes

Filename	Version	Date	Description / Author
Document1	1.1	11.10.01	Christoph Bürki

III. References

Rapport 5340 Evaluations- Dokument	Fastticketing Konzeptbericht Evaluation für Palm Applikation
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IV. Abbreviations

EJB	Enterprise Java Beans
GNU	GNU stands for "GNU's not Unix". It is a system for producing and distributing free software that's upwardly compatible with Unix.
GUI	Graphical User Interface
m- ticketing	General expression for ticketing solutions which are accessed and handled principally with mobile devices (i.e. PDAs, mobile phones)
PDA	Personal Digital Assistant
SMS	Short Message Service. Transmission of short messages via GSM networks to mobile phones. There are normally a maximum number of 160 characters per message.
WAP	Wireless Application Protocol
XML	eXtensible Markup Language

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1 Business View

1.1 Overview

This project is based on the existing order environment "fastticketing" for ordering tickets by mobile phone and by desktop computers. Due to a high acceptance and a strong spreading of mobile phones and PDAs in Switzerland the Swiss Federal Railways (called SBB in this documentation) decided to develop a prototype for testing in real life. The centralisation of railway stations and the transition from a federal institution to a restructured private industry company demand innovations in selling tickets like vending machines and ticket orders by internet. Fastticketing allows ordering tickets from everywhere by a person directly to a mobile phone or to a PDA. By showing the mobile device to the controller the ticket will be stamped immediately and can be checked for validity (card number, photography of the holder). M-tickets are handled like classical paper tickets and support checking the same ticket for several times on long distance travels.

Fastticketing for PDA completes an important and missing functionality to the existing application: Online ticket ordering for new tracks. Till today ordering tickets by mobile phone was limited to pre-defined / pre-booked tickets. The user added favourite tracks in the application for desktop computers and ordered one of the pre-defined tickets. Fastticketing for PDA is a flexible application and can be extended with new features like journey guides and point-to-point tickets.

Fastticketing is not limited to mobile phones and PDAs. The research for printing tickets at home to standard paper is in progress and will be released soon.

1.2 Requirements

1.2.1 Customer

- Customer registration on the sbb.ch portal site
- Ticket order by internet, voice server and SMS, call center, WAP enabled phone or PDA
- Printed ticket, SMS ticket, virtual ticket on PDA
- Transaction overview
- Secure payment
- Data protection

1.2.2 SBB

- Registered customer and safe payment
- Limited collection of railway stations
- Unforgeable tickets and personal (individual) tickets
- Safe and unique ticket stamping process
- Electronic payment transactions and accounting procedures

1.2.3 Ticket Check

- Available ticket information (SMS, printed ticket, PDA display)
- Simple verification process
- Short validity check process
- Various control states
 1. Simple control by view
 2. Partially control of the ticket code
 3. Full control of the ticket code

1.2.4 Device Requirements

Customer: Internet access and WAP enabled mobile phone or Palm PDA with internet access (PDA application runs on all Java enabled devices which support J2ME¹ standard)

Controller: iPAQ with Internet access

1.3 Functionality

1.3.1 Base Functionalities

The main objective of Fastticketing on Palm is to order a ticket in a fast and easy way. There has to be a clear separation of the main functionality and the extended functionalities without disturbing the graphical user interface.

- Secure ticket transactions
- Ordering a ticket
- Pre-defined tickets
- New created tickets
- Choosing railway stations (stored in a PDB file, update via www)
- Showing Ticket(s)
- Synchronisation with ticket server (synchronisation of stamping information)

1.3.2 Extended Functionalities

Extended Functionalities should be deployed in a special menu (for later software updates and additions) or directly on the corresponding screen.

- Synchronisation between PC Desktop and Palm (ordering at home an uploading via HotSync to Palm)
- Ordering different ticket types with one account (e. g. ½ price and 1/1 price)
- Fare quotations (online)
- Journey guide for the selected ticket (online)
- Store more than one ticket
- Automatic authentication (no login procedure because of "Palm is for personally use")

Special Extensions on HTML Tier:

- Monthly ticket report
- Yearly ticket report

1.3.3 Ticket Specification

Every ticket has to be stored to the Palm Device. During the valid period of time of a ticket (1 day), the ordered ticket can be resubmitted to the Palm again and again (Data loss on Palm side or misfunctionalities of NATEL networks do not erase a ticket. A ticket consist of

- Ticket code (server-side unique generated)
- Ticket information clear text (valid period, track, class, one way/two way)
- Personal information (Name, Subscription number e.g. "Half-fare card number")

¹ J2ME: Java 2 Micro Edition. J2ME is a programming language from Sun Microsystems especially for devices with limited resources like PDAs, mobile phones, settop boxes, telemetric systems...

1.4 Order Process (Palm PDA)

After a one-time sign up on the SBB portal site sbb.ch the user is able to order tickets on different ways. A description of the order process by PDA is described below and a graphical flowchart diagram is printed in Figure 1.



Authentication

The authentication on Palm PDA is done by entering simply a login and password. This procedure stores personal informations local to the Palm device. Because of the very personal use of mobile phones or PDAs it is conceivable that the user already protect his device with password on startup.

The authentication initiates a connection to the server via http (https) thus a connected mobile phone or an alternative wireless connection to the Internet is provided.



Pre-booked tickets

After the correct login procedure the server sends back immediately the complete list of prebooked tracks. Displaying the list of tracks the user can choose between previewing the selected ticket or create a new track.



Previewing a ticket

The preview screen shows all informations referring to the chosen ticket.

- Track description (departure, destination)
- Fare / ticket price
- Ticket date
- Subscription card holder name
- Subscription card number
- One way / two way
- Class (1 or 2)

After previewing the ticket the user can buy the ticket or return to the prebooking list.

Buy a

Submitting the account and via http to the server and can be stored local file on the controller connection.



ticket

ticket information charges the user sends back a verification message to the Palm. The new ticket will be stored locally until the valid period of expires. The ticket is also stored to a local file on the PDA because viewing the ticket to does not require an online



Create a ticket

If the user creates a new track he has to enter the following data.

- departure
- destination
- class
- one way ticket / roundtrip
- payment method



Show a ticket

The ticket is presented in large characters to the controller. It contains all the necessary informations like

- Ticket code
- Track description
- Valid date
- Price
- One Way / roundtrip
- Class
- User data (name, card number)

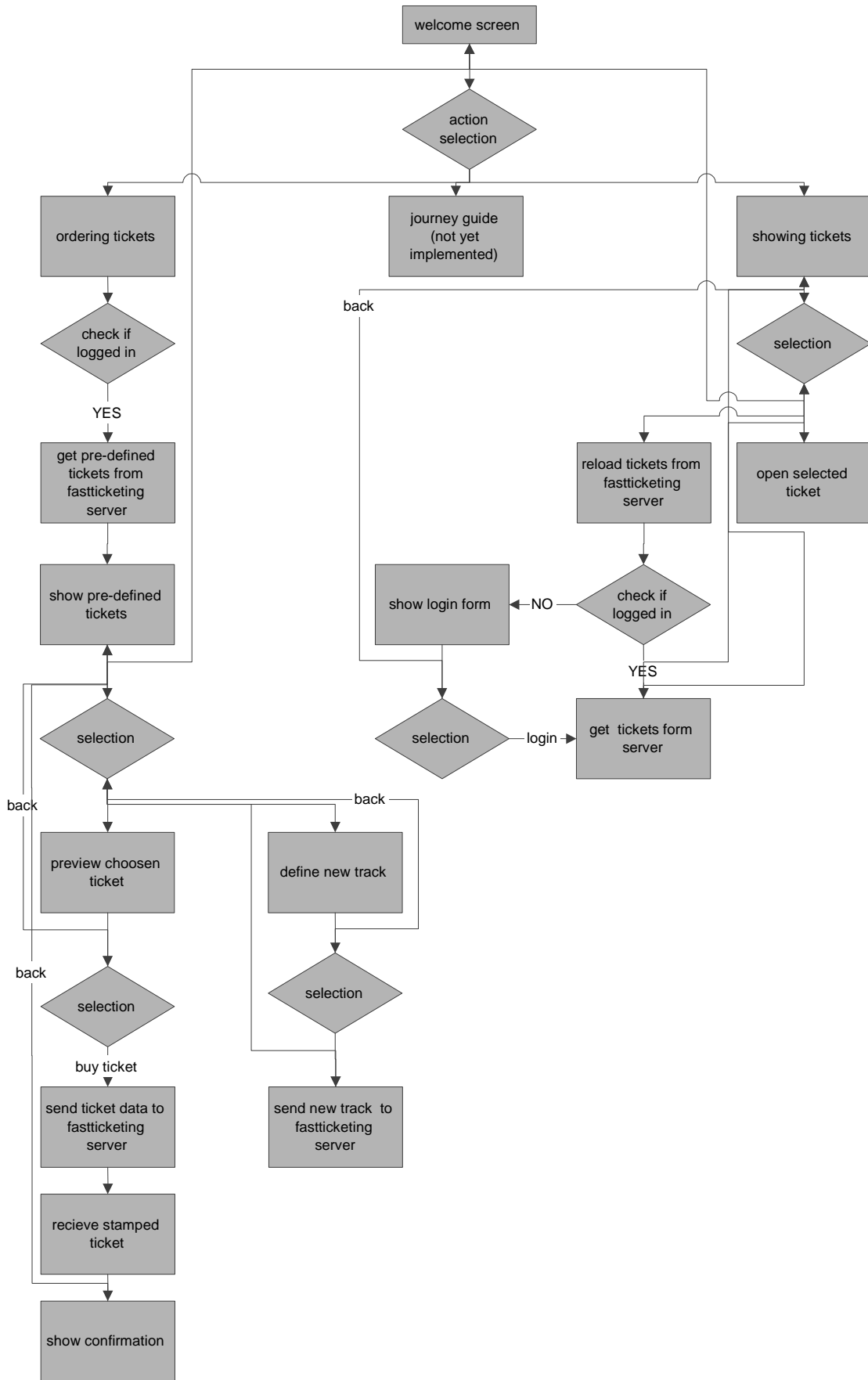


Figure 1. Ticket order process on Palm PDA

1.5 Control Process (Customer View)

Showing a ticket

Travelling with a virtual ticket is as simple as using a "normal" paper ticket. To show the bought ticket to the controller the user only has to select the valid ticket and show it to the controller.



Figure 2. Ticket view

If the controller stamp the ticket on his control device the ticket is not deleted because of a controller change the ticket is still valid and can be checked again. The ticket rests on the customer Palm PDA until he resubmits his tickets.

2 Technical View

2.1 Overview

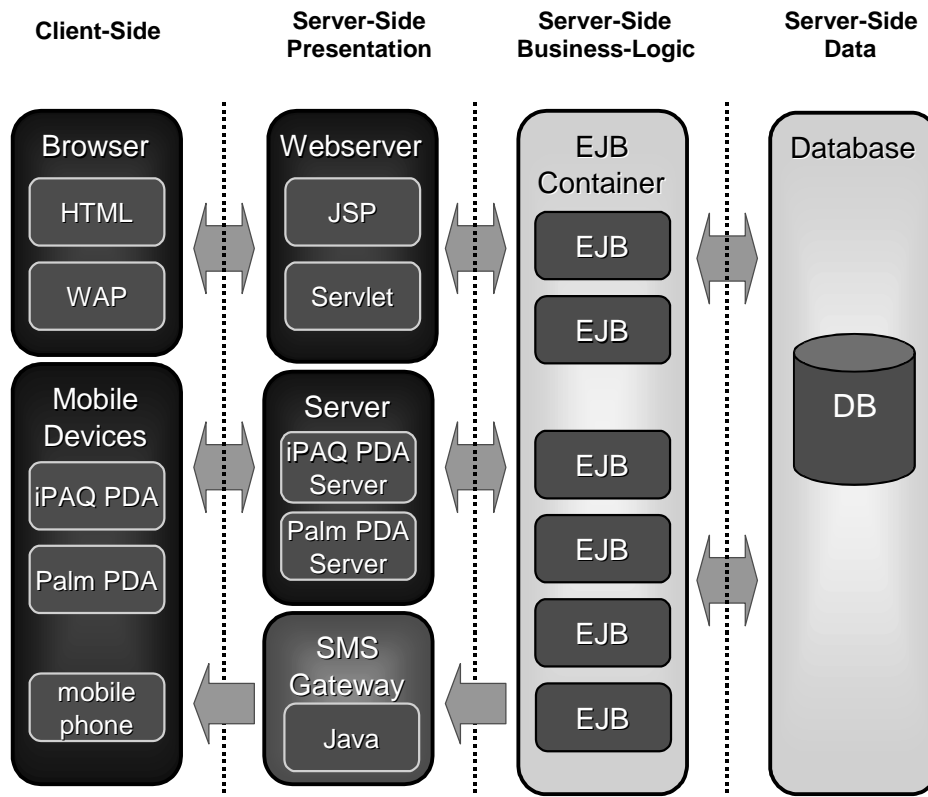


Figure 3. 3-Tier Architecture (Server)

To follow the universalised design scheme the server side application is developed in a three-tier architecture. The SMS Gateway is used to send back the ticket code to the mobile phone.

2.2 Server-Side

2.2.1 Presentation Logic

2.2.2 Business Logic

EJB Container

The EJB container holds the business logic which is developed in Java (Java 2 Enterprise Edition). Enterprise beans are divided up into entity beans and session beans and they are used to access the database and handle the internal structure of the application. For example the "Person" bean represents as an entity bean the virtual database row of a specific person and can be accessed through business methods like "getName()".

2.2.3 Data Logic

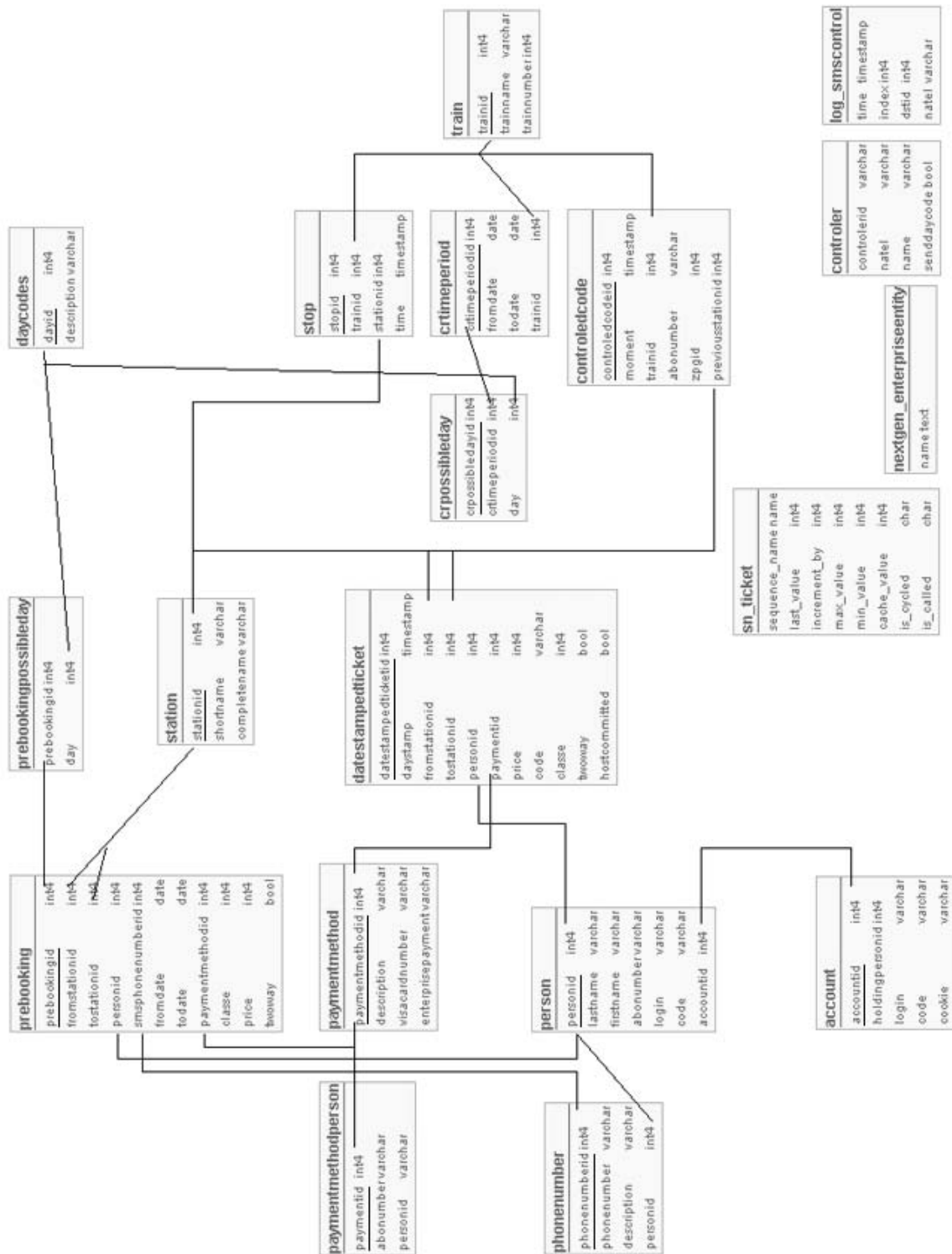


Figure 4. Fastticketing Database Scheme

The data logic layer should not be accessed directly from any client because of a guaranteed data consistency. There are enough business methods deployed in EJBs to access all necessary data from the database system.

2.3 Client-Side (Palm PDA)

2.3.1 Overview

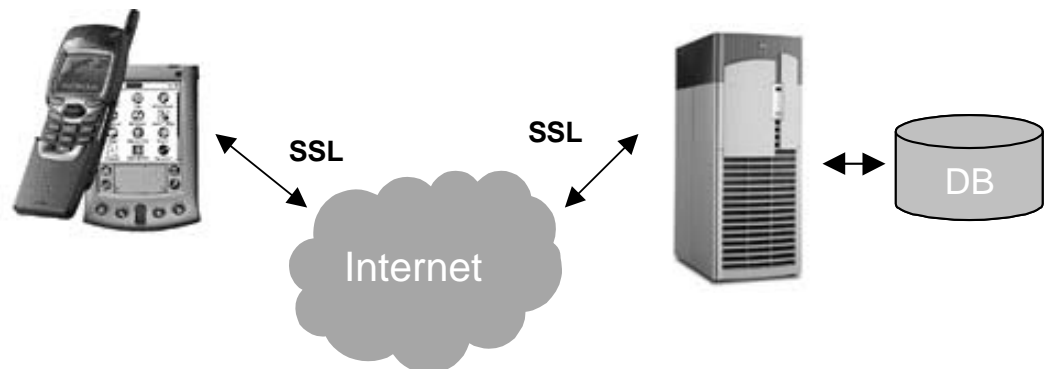


Figure 5. Communication Path

Actually there is no implementation of SSL in the official Sun VM and in the official IBM VM J9. Esmertec² offers a complete development package that includes also a SSL 3 API. The main problem developing an SSL package for mobile devices is the handshake process while connecting to a secure site. Mostly there are slow processors in mobile devices, which complicate the de-/encryption process. Sun measured about 28 seconds for a full handshake process and develops now a faster process by minimizing the request and response number during the whole authentication.

Like the server-side fastticketing application the client-side Palm PDA J2ME application comes in a three-tier design. This design pattern ensures a simple maintenance and portability to other PDAs and J2ME enabled devices.

A schematic overview of the client three-tier architecture is showed in Figure 6.

2.3.2 Presentation Logic

By choosing the IBM J9 VM the compatibility with other J2ME devices was broken up in the presentation Logic. The given GUI functions from J2ME targeting on a wide range of mobile devices thus displaying the few widget classes are optimized for small displays and do not allow proper positioning. J2ME offer defining individual widgets by constructing these on a low-level construct and one consequence is that this slows down the speed. Using native methods from IBM J9 VM opens important functionalities like colour support. Programming in Java for Palm PDA using GNU Tools like PiIRC³ for creating the user interface is also supported and speeds up the development process.

To make the existing Palm PDA application fully compatible to the current J2ME reference implementation only the forms classes have to be changed to a new GUI.

² Esmertec: Swiss software company. www.esmertec.ch. The youtrade stock exchange application from Credit Suisse has been developed with esmertec package.

³ PiIRC: Resource Programming Language under the GNU Public License. www.ardiri.com/palm/piirc/

2.3.3 Business Logic

Submitting data like stamped tickets, new track definitions, user authentication data and pre-defined tracks list are consolidated in XML. Making the application more flexible requires an implementation of multiple connection types. Actually the Palm PDA application is prepared for establishing connections to the server by socket connections, HTTP POST⁴ connections and HTTP POST connections with session/cookie management. The business logic also handles all access to the virtual and local databases on Palm PDA.

All needed datastructures for abstract object definitions (ticket, station, user information, payment methods, pre-booked tickets and errors) were consolidated in correspondent files.

2.3.4 Data Logic

To present a user-friendly and simple to update application the Palm PDA solution has been developed with two different data storages:

RMS⁵

A RMS data handler manages all data access to the system independent and fully J2ME compatible data storage. All stamped tickets and user informations are stored in a RMS data logic. In contrast to the PDB the RMS only can be read from the application itself and is protected against unauthorised access.

PDB⁶

Actually the PDB access is only a Java simulation. Sharing PDB files on Palm PDA makes updating the station list of railway stations easy for every user. He only has to download the new station PDB file and transferring it to the device.

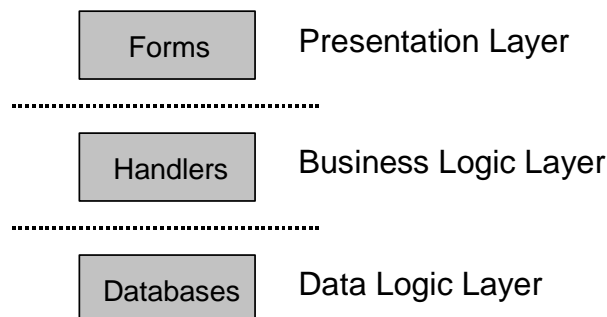


Figure 6. 3-Tier Architecture (Client)

⁴ HTTP POST: HyperText Transfer Protocol. POST stands for a data transferring method that first sends the header informations for the HTTP and then sends the data to transfer.

⁵ RMS: Record Management System. RMS is used in J2ME (also Java) to store persistent data without database and system independent.

⁶ PDB: Palm DataBase. A standardized file protocol to save database like files on Palm PDA.

3 Organisational View

The current fastticketing application was developed for demonstration purposes and the main target was to show functionality of a working m-ticketing solution that can be used for different customers with a minimum of changes.

One of the main aspects was to use system independent components to guarantee a simple portability of all application parts.

3.1 Software

3.1.1 Server

EJB Container

Deploying EJBs was realised with ORION EJB Container. ORION manages live EJB deployment which does not need to restart the server after making some code changes. The migration from i.e. LINUX to Windows is as simple as copying the file structure to the other operating system.

The pricing structure is moderate because developing and non-commercial deployment is for free. Commercial deployment costs \$1500 per deployment server.

Useful Internet addresses:

<http://www.orionserver.com/>

<http://www.orionsupport.com/>

<http://www.jollem.com/orion-primer/>

<http://www.jollem.com/orion-cmp-primer/>

Webserver

Accessing the HTML forms for registration and producing WAP response to mobile phones is organized by JAKARTA TOMCAT 3.2 Server. TOMCAT comes with a webserver, servlet⁷ container and JSP⁸ compiler. The JAKARTA TOMCAT project is the reference servlet/JSP implementation from Sun but is developed by an open-source community.

JAKARTA TOMCAT is for free for non-commercial and commercial use.

Useful Internet addresses:

<http://jakarta.apache.org/tomcat/>

<http://java.sun.com/products/jsp/tomcat/>

<http://java.sun.com/products/servlet/>

PDA Server / GPRS Server

In a first release the PDA Server and the GPRS Server act as a Socket Server listening to open ports. Future development should concentrate to web-applications that are deployed directly to the EJB Server because they care about user management, load balancing and session management.

Useful Internet address:

<http://java.sun.com/docs/books/tutorial/networking/sockets/>

⁷ Servlet: A Java program that runs on a web server and has to be compiled first. Often it is used to separate business and presentation layer without using EJBs.

⁸ JSP: Java Server Pages. JSP are used as a scripting language. They support to insert Java commands directly in HTML code. The JSPs are compiled on runtime.

3.1.2 Database

Fastticketing data is stored on a PostgreSQL object-relational DBMS⁹ database supporting almost all SQL constructs, including subselects, transactions, and user-defined types and functions. It is one of the most advanced open-source databases available anywhere. Fastticketing consists of 19 tables and 20 foreign keys.

There are no fees using PostgreSQL as a non-commercial or commercial DBMS.

Useful Internet addresses:
<http://www.postgresql.org/>
<http://jdbc.postgresql.org/>
<http://www.pgsql.com/>

3.1.3 Compatibility

Server

Fastticketing runs on all operating systems that support Java. PostgreSQL RDBMS¹⁰ is available for most of UNIX and Windows systems:

AIX, BeOS, BSD/OS (x86, Sparc), Compaq Tru64 UNIX, Digital UNIX, FreeBSD (x86, Alpha), HP-UX, Linux (x86, Alpha, ARM, MIPS, PowerPC, Sparc, S/390), Mac OS X, NetBSD (x86, Alpha, ARM, m68k, PowerPC, Sparc, VAX), OpenBSD (x86, Sparc), SCO OpenServer, SCO UnixWare, SGI IRIX, SunOS 4, Sun Solaris (x86, Sparc), Windows 2000/NT/95/98/ME

Client (Palm PDA)

The client application was developed in J2ME and uses the IBM J9 VM. Except the GUI and the PDB the client is fully compatible with the Sun KVM reference implementation and the MIDP and CLDC standards.

Useful Internet addresses:
<http://www.embedded.oti.com>
<http://java.sun.com/j2me/>
<http://java.sun.com/products/cldc/>
<http://java.sun.com/products/midp/>
<http://java.sun.com/products/midp/palmOS.html>
<http://java.sun.com/products/cldc/>

3.2 Hardware

3.2.1 Palm PDA

The client prototype of fastticketing for PDA runs on a Palm m505 colour version and was tested with the Palm emulator IIIc and Palm OS 3.5. Due to the IBM J9 VM specification the Palm model has to run on Palm OS >=3.3.

⁹ DBMS: Database Management System

¹⁰ RDBMS: Relational Database Management System

3.3 Development

3.3.1 Server-Side

JBuilder 4 Enterprise Edition was mainly used for development. For simpler understanding the PDA Server works with the same non-validating XML parser as the PDA Client (kXML).

Useful Internet address:

<http://kxml.enhydra.org/>

3.3.2 Client-Side

Integrated Development Environment

All parts of the fastticketing application for Palm PDA were created with Visual Age Micro Edition (VAME) from IBM. VAME supports linking native Palm resource files, pre-linking, powerful debugger and full support for POSE¹¹. Since version 1.4 Visual Age comes with a full J2ME compatible MIDP/CLDC package.

XML Parser

Interpreting the communication flow between client and server a XML parser was used. Because of a lack of memory and speed on PDAs a special version of a XML parser was chosen which assumes "well-formed" XML code and which is not validating. kXML is a lean XML API with optional WBXML/WML support for the Java 2 Micro Edition (J2ME). kXML provides namespace support, a pull-based parser for simplified parsing of nested / modularized XML structures, WAP support (WBXML / WML) and a lean document object model (kDOM).

Emulator

There are many complicated steps to deploy an application on a mobile device. In interaction with VAME and POSE the development process is simplified enormous for quick testing and demonstration purposes. POSE needs original ROM files and skins to operate and is available for Windows, Mac OS and UNIX.

Useful Internet addresses:

<http://www.embedded.oti.com/>

<http://www.palmos.com/dev/tech/tools/emulator/>

<http://www.palmos.com/dev/>

¹¹ POSE: Palm OS Emulator

4 Appendix A – Who is Who

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