Linguaggi & Tecnologie Multimediali:
TV interattiva e mobile TV

Company Vodafone IT

Interactive services on DVB-H

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1 Introduction

1.1 Company
In this three month I have worked for Vodafone Italy, specifically on a part named TSCC, a special part born for a collaboration between Vodafone and Nokia, to work together developing use case and trial about new technology, and applications of them. This part is a sort of Research and Develop, this mean that all of work aren’t for commercial use, but only for the engineering part of Vodafone that take project and develop them. Was a very good opportunity for me, because I have see in which way services for people born on a very big company, starting from section like TSCC, that produce Study of technology, study of possible applications, develop of demos, user experience, trial, and study of costs, for Marketing sections that can or cannot approve each project. I have had the fortune to participate at launch of DVB-H service, that was born exactly on TSCC Lab, to see the way of work of my colleague on a critical situation.

1.2 Television
Television in the most user-friendly media type for any kind of user. The born of digital television will open another page on the develop of television’s services, for the content type and for the way that they are distributes; in addition to that, the possibility of bidirectional return channel enables a component of interactivity that is crucial for the distribution of secure services and personalized content. DVB-H is a new technology, mainly an evolution of DVB-T towards mobile, which allows telephonic broadcasters like Vodafone to distribute Television Content to their mobile devices. The objective of this project is to show how it will be possible to upgrade the experience of Vodafone users, that beyond watching at Vodafone Television can look specifics information, look special content, request a part of content, or interact with programs, show, and all kind of television content.

In order to carry out the project, it is worth to exploit DVB-T technology, and correlation, between user and media that MHP allows for the implementation of Interaction.

Moreover, Return Channel on DVB-T, and then on normal television is very boring to use because normally people don’t have the phone line available near television, and frequently they are not used to connect television to the phone line. On the other hand, DVB-H enables a different scenario as the mobile user are more familiar to use a connection channel, for example to check mail, or to visit a portal like Vodafone Live, to download tones or themes, or to buy a game.

1.3 Project
In such a scenario, a lot of new and different business scenarios are mostly likely to rise in the next few years. The project had to face with several issues:
• comprehensive study on feasibility between different service, mainly dependant on the complexity of the service itself
• limitation from the standards point of view (no standards available)
• the “peculiar” situation in Vodafone Italy that want to find the way for don’t compromise the actual business (for example, a porting of sms service on DVB-H channel, can compromise the actual business of sms service)

It is also worth to carry out a study about actual market situation, to find out the possible kind of services that will look more appealing and to find out the critical point of applications.

As a result of market and technical feasibility study, it has been decided to develop a demo application for football match to give ideas of possible services; the main idea behind is that in normal television one of the most important aspect is to be able to entertain user on a determinate channel because that will cause an increment of share thus an increase of earnings coming from advertisement that are essential for broadcasters business. On the contrary, in the new Mobile Broadcasters scenario, it is essential to be able to push customers to use the return channel, for example to use the sms service or to open an http connection.

1.4 Application
The application is composed by three main sections:

- Statistic
- Video On Demand
- Vodafone plus (Chat, Tones and Themes, shop, bet)

The first one, “Statistics” enables users to look at statistic of current match like, info about course of match, about team and players and it is developed to be only for an informative scope and to entertain user on channel.

The second one, “Video On Demand” is a section where users can choose a part of match to download on his device, and see whenever he wants, like a replay of a suspect action or a goal; in this case DRM of video gives rules about its use. This service is obviously oriented to push user to use the return channel.

The third one, “Vodafone Plus” is a section that includes various services, all oriented to stimulate to use of the return channel:

• “Chat”
• “Download”
• “Shop”
• “Bet”

Every subsection has a determinate scope and orientation.
Chat is a possible service for user that have good familiarity with internet; Download has been studied to leverage on users familiarity with Vodafone Live services; Shop is for supporters of teams while bet for hazard-users.

Each service is oriented to push customers to use return channel and it is simple to imagine the possibility of service that with this technology is possible to create, depending on business model.

Another possibility that is unfeasible with normal television is to create a service for Video On Demand thus creating a service to catalogue preference of user (utilizable to create a play list or just a study of market), or just a Multimedia ESG with little trial Video that describes event.

All these services are connected to the 3G net and should create a multimedia experience.

The entire project has been carried out to find a possible way to merge the dvb-h services with the Umts services; such approach will open a wide range of possibility on new Business Scenarios.

It has to be considered that right now doesn’t exist a standardization for the creation of interactive application on DVB-H, the architecture of J2ME, the problems of CLDC/MIDP profile, and of CDC/PP (see implementation capita), it has been decided to create a user experience allowing users to look at possible services, and possible Business Model.

**STEP 1:**
On the first stage part, work was oriented to find a possible solution and to study DVB-H technology.

**STEP 2:**
Brainstorming, meeting with other entity of market, market research, ideation of service.

**STEP 3:**
Application Development

**STEP 4:**
Creation of work document.

Meeting for presentation of project results and demo.
2 DVB-H Technology and architecture

2.1 DVB-H Aspects

The DVB-H technology is a spin-off of the DVB-T standard. It has been designed to meet the two main challenges present with mobile television:

- Firstly, in order to extend the mobile-receiver battery life, DVB-H cuts power consumption by as much as 90% compared to DVB-T; to do that, it employs the *time-slicing* technology that transmits the data of the different TV programs in bursts instead of continuously, allowing the receiver to switch off between those bursts which are not of interest.

![](image1.png) **Figure 1: DVB-T service transmission**  
![](image2.png) **Figure 2: DVB-H service transmission**

- Secondly, DVB-H ensures stable reception even in difficult environments (like in-building environments) by incorporating an additional error correction code called MPE-FEC, which is not available in DVB-T, without the necessity of an external roof-top antenna. MPE-FEC operates at the Internet Protocol level to allow secure reception even if many packets are lost.

Moreover, the DVB-H standard introduces 4k mode on top of the 8k and 2k used by DVB-T. The new optional mode provides a nice compromise between 2k and 8k, fast enough speeds and large enough single-frequency regions to be economically realizable.

In terms of channel scalability, the DVB-H fixes new figures. This comes out because a large-screen TV program (DVB-T) requires about 4-5 Mbps per program, depending on what kind of program you are watching; an equivalent picture quality can be obtained for the same TV program, but using only 200-300 kbit/s (DVB-H), when a small size screen, like in mobile handsets, is considered. Consequently, on a mobile receiver, in theory, using DVB-H it is possible to provide up to 30-50 programs within one carrier whereas you can have just 4-5 programs using DVB-T.
In the table below, bit rates vs quality and cost are shown for each of the three possible alternatives of digital modulation under discussion by the mobile TV industry.

<table>
<thead>
<tr>
<th>Bit Rate</th>
<th>n. channels</th>
<th>Quality Coverage</th>
<th>Network Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH (64 QAM)</td>
<td>30-50</td>
<td>Very Poor</td>
<td>Very High</td>
</tr>
<tr>
<td>Medium (16 QAM)</td>
<td>15-30</td>
<td>Poor</td>
<td>High</td>
</tr>
<tr>
<td>LOW (QPSK)</td>
<td>10-15</td>
<td>Good</td>
<td>Acceptable</td>
</tr>
</tbody>
</table>

Table 1

Considering a deployment in a real environment (Urban and suburban areas) with a good indoor and mobile usage, the real capability of the system is up to 10-15 programs (QPSK modulation) within one carrier (8 MHz bandwidth).
3.1 Convergence from UMTS services to DVB-H services

The scope of this chapter is to find a way for convergence of UMTS services to DVB-H services thus analyzing the possibility to swap some VLive portal services on the DVB-H platform in order to better allocate radio network resources.

DVB-H broadcast connectivity allows the fruition of content and Multimedia services to mobile consumers with a theoretical band in order of 15 Mbps. UMTS system has been carried out to manage bidirectional interactive traffic with reduced capability (max 2Mbps for single cell).

The services of radio Network and those of the broadcasting network stretch to converge to a single net. The video contents could be transmitted in streaming, that is a transmission in real time of video content that requires a buffering (a memorization of some seconds before can see the content) or it could download a video that receive a television content in background, memorize it and then see it again.

These services are currently delivered through GPRS or UMTS. A problem for these systems is the limited band that involves a limited video quality that television users have accustomed.

Usually on the available band there is the problem of capacity for example for a glut of customers that has to be served in same time at a specific cell. To obviate to these problems the opportunity is to work with the Network of terrestrial televisions, in digital television technology (DVB-H). This would allow the possibility to serve a better number of customers on the same area, with obvious reduction of the costs from part of the operator.

During a search of market made by Vodafone, on focus group of 500 inhabitants more than 70% of the interviewee manifest interests to receive additional information about television programs, and the 47% was for the possibility of vote on the transmitted contents.

Picture 1 shows the appreciation of programs between the consumers involved in the experimentation:

Decomposing the data in function of the age, differences have been noticed. For example, the 68% of teenagers has expressed appreciate for the musical programs. Particular important is the availability to pay, very tall between the young generations: the 90% of the teenagers and the 77% of the young people between 20 and 29 years have expressed the own availability to pay a monthly flat rate. The middle value of the flat rate that would be considered acceptable is around 10.70 Euros.
From the analysis of market has been noticed that the typical use of the mobile television terminal is "during the trips" (91%), but also in situations which “when i doesn't have other to do"(85%), "when I'm around" (68%), "during the free time when I'm not at home" (72%)

Pic.1

It has been analyzed which of the actual services on Vodafone UMTS portal could be possible to port on the broadcast network through the DVB-H. It is necessary to define that in the analysis has not been taken into account costs related to the active services on the network.

From the analysis of the Vodafone live Portal 3G, made on the terminal SHARP 902, it is been identified four principal services categories:

A) Fun& Music comprises the following categories:
   a.1) Live! Music
   a.2) Live! TV
   a.3) Games
   a.4) Photo and Images.

B) Information comprises the following categories:
   b.1) News and weather report
   b.2) Soccer and Sport

C) Lifestyle comprises the following categories:
c.1) Fashion and Gossip (lines of Text)  
c.2) Love and Sex  
c.3) Stars  
c.4) Motors  

D) City and Trips comprises the following categories:  
d.1) Cinema and Shows  
d.2) Traffic and Trips  
d.3) Restaurants and Local  

Aa additional subdivision allows decoupling of categories in classes:  

a.2) Live! TV comprises the following classes:  
a.2.1) Channels TV  
a.2.2) Video  
a.2.3) Other Services  

The class Channels TV is divided in the following subclasses :  
- Camera Cafè,  
- Fashion TV,  
- Rai News 24,  
- sky TG24 live  

There are applications (Video) that could make available in broadcast, because the characteristics of the DVB-H protocol well adjust to the type of service. Always in the Live category TV, particular attention is for the class "Other Services" and particularly to his SKY subclasses (sky TG24-Live, sky TG24-News, sky TG24-Sport, sky TG24-Meteo, Guide Programs, etc. etc.) all formats text that they came in again in the category of information services well been supported from DVB-H.

b.1) News and weather report comprises the following classes:  
b.1.1) TG Video (TG5, TG1, HANDLE)  
b.1.2) Headings of the principal Newspapers and TG (Messenger of at night, Republic, etc.)  
b.1.3) weather report (Forecasts, Forecasts from the Satellite, weather report Foreign City)  

All the classes of this category came in again on services of information well supported from DVB-H.

b.2) Kick and Sport comprises the following classes:  
b.2.1) Soccer  
b.2.2) More Sport (Basket, Volley, G.P Motorbike., Formula 1, Ski)  
b.2.3) Examination and News (Journalistic Sporting Headings)
Between the subclasses of Soccer particularly interesting:
- Live match
- Results and Goal

d.1) Cinema and Shows comprises the following classes:
   d.1.1) Cinema
   d.1.2) Shows
   d.1.3) Active Services

d.2) Traffic and Trips understand the following classes:
   d.2.1) Traffic
   d.2.2) Maps and Trips

In the class Maps and Trips find the subclasses:

1) All City
2) Trenitalia
3) Where Sleep
4) Where Eat
5) Schedule Flights.

d.3) Restaurants and Places have the following classes:
   d.3.1) Where Eat
   d.3.2) Yellow pages
   d.3.3) 2 Night
   d.3.4) City Guide
   d.3.5) Disco Search

Other classes that could to make usable on Broadcast network are: Yellow pages and Search Disk.

In the table below it has been reported the classification of the available services on the portal Vodafone UMTS that could be made available on the terminal with the support of the DVB-H protocol.
<table>
<thead>
<tr>
<th>Family</th>
<th>Category</th>
<th>Class</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fun e Music</td>
<td>Live!TV</td>
<td>TV Channel</td>
<td>Text and Video</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other services</td>
<td>Text</td>
</tr>
<tr>
<td>Information</td>
<td>News and Weather report</td>
<td>Video TG</td>
<td>Video</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Most Important press Journals and TG</td>
<td>Text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weather report</td>
<td>Pic. and Text</td>
</tr>
<tr>
<td></td>
<td>Soccer</td>
<td>Text and Video</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sport Plus</td>
<td>Text and Video</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Examination And News</td>
<td>Text</td>
<td></td>
</tr>
<tr>
<td>City And Trip</td>
<td>Cinema and Show</td>
<td>Cinema</td>
<td>Text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Show</td>
<td>Text</td>
</tr>
<tr>
<td></td>
<td>Traffic and trip</td>
<td>Traffic</td>
<td>Video Pic. and Text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maps and Trip</td>
<td>Pic. and Text</td>
</tr>
</tbody>
</table>
4.1 Introduction about Interactivity

As regards as Interactivity the most difference between DVB – T and DVB – H is the way to interact with web Services; in the case of DVB-T it is difficult that customers insert the telephone connector to the set-top-box. In case of DVB-H Mobile Phone the return channel is embedded in the Mobile phone itself so it is possible to open an HTTP session, or to send a simple SMS.

Of course, services already available on DVB-T can be also addressed on the DVB-H market. For example:

**H – Government**
Services for citizens, like postal services, city-hall or regional services.

**H – Banking**
Services that allows banking transactions.

**H- Commerce**
Possibility to buy in real time (e.g. I am watching a TV advertisement and I can decide to buy directly from the mobile device.

**H – Entertainment**
Applications tied to the transmission of the television that offers information and news on the transmission itself as well as the possibility to interact with the television studies.

It has been decided to focus on the Football Service as it is the new frontier of interactive sport. In fact:

- It enriches your way to follow football.
- Intuitive and simple to use.
- New revenue opportunity for mobile operators:
- It adds value to the content transmitted in broadcast
- It opens new scenarios on the football business

**Primary Use Case**
Enrich the normal vision of football match

**Targeted User Experience**
Users can find a lot of information about their preferred teams, downloads etc.

**Characteristics**
People stay more time on channel (e.g. on the pause users can watch at details about match)
4.1.2 User Actions

- Watch:
  - Match Statistic
  - Team Statistic
  - Player Statistic
  - Information about Team (Story, interesting Data).
  - What are doing the other teams?
- Talk with other supporter.
- See again the goal, or important game’s action.
- Download team’s/player’s themes.
- Download team’s/player’s Tones and choruses.
- Buy match’s tickets Online.
- Contact their Preferred Players.
- Bet on the result of match.

In the following pages, use case diagrams has been included
Start

Mobile terminal start receiving dvb-h signal, exactly a football match.

At the end of the application download, the mobile shows the Vodafone's logo, and describe the way to start the application.

User can decide to open or not the application.

User open Application?

NO

Application wait a determinate time to reappear

YES

The logo disappear

Application takes control of video and shows the first menu.

1 2 3

Match Statistics

Vodafone Video Services

Vodafone Plus
Application Open

- Match Statistics
- Team Statistics
- Player Statistics
- Information About Scores of other team
- Story and curiosity about your team

User look at a list of different information:
- Possession of ball, and general statistics
- More detailed with number of shots, actions, etc.

User look at a list of players, and is able to select a player to see player details.

List of different and general statistics
User can select to see the best action or goal.

A menu shows a list of actions that user can select.

User select a video or press back button?

Open UMTS connection?

YES

Mobile Connects with VLive and Download video file.

At the end of the video download, the mobile stores video file according to DRM rules.

NO

User come back to main menu.
This services need a GPRS/UMTS connection.

A menu when user can select:

A) CHAT
B) DOWNLOAD
C) SHOP
D) BETANDWIN
A little board appear on the screen. And ask

User want to connect Umts?

If chat is in broadcast, user can only see message, else go to the previous menu.

Login to the service

Login is Correct?

User can see the other messages on the screen, and respond to them.

User can write a message Visible for other registered users.
Open a Menu with 2 kind of download, themes and tones.

What choose?

TONES
- Show a list of Mobile to select
- Show a list of tones or choruses to download
- Want to connect to umts/gprs?
  - NO: Come back to the previous menu
  - YES: Download Media, Installation etc.

THEMES
- Show a list of Mobile to select
- Show a list of themes to download by means of a little screenshot, user can select
- Want to connect to umts/gprs?
  - NO: Come back to the previous menu
  - YES: Download Media, Installation etc.
shop

Menù whit list of team.

User choose between ticket or gadgets.

What want to see?

List of gadget to buy

User want to buy?

Came back to main menu

User want connect?

transaction

List of ticket to buy

User want to buy?

Came back to main menu

User want connect?

transaction
User can bet on match before they start.

A menu with a list of matches shows possibilities to the user.

User selects a match.

Do you want to bet?

Do you want to connect?

Configuration of bet and transaction:

When transaction is finished, a SMS advises the user about the correct transaction.

At the finish of the selected match, a SMS advises the user about the result of the bet.
5 Implementation

5.1 The J2ME Technology

La Java™ 2, Micro Edition (J2METM ) es una plataforma para dispositivos embebidos como el teléfono móvil, PDA, TV, Set-Top-Box, etc. La plataforma Java2ME se define como J2EE Enterprise Edition, un conjunto de API estándar definido por el proceso de comunidad de Java que está compuesto por un grupo experto de fabricantes de dispositivos, proveedores de software y servicios.

La plataforma J2ME proporciona la fuerza y los beneficios de la tecnología de Java adaptada para dispositivos embebidos; incluye una interfaz de usuario, una amplia gama de protocolos de red, un modelo robusto de seguridad y soporte para aplicaciones autónomas o client/server.

Las aplicaciones J2ME se escriben solo una vez para múltiples tipos de dispositivos y se ejecutan dinámicamente, basándose en la capacidad de cada dispositivo.

Es la plataforma más utilizada para el desarrollo de dispositivos embebidos.

La arquitectura de J2ME define configuraciones, perfil y paquetes opcionales como elementos para el desarrollo del entorno de ejecución. Cada combinación relativa a una categoría específica de dispositivo se optimiza para:
- Capacidad
- Interfaces

El resultado es una normal plataforma java que puede ejecutarse en todos los dispositivos.

Configuraciones

La Configuración consiste en una Máquina Virtual y un mínimo conjunto de bibliotecas. Proporciona una base de funcionalidad para un rango de dispositivos que comparten características similares como conectividad y cantidad de memoria.

Actualmente existen dos configuraciones:
5.2 Connected Limited Device Configuration (CLDC) and Connected Device Configuration (CDC)

5.2.1 - CLDC is a smaller configuration, engineered for devices with not always connected network and with limited band, small processors with limited capacity of memory. The typical characteristics of this kind of dispositive are:

- Processor at 16 or 32 bit
- 128 KB of memory
- 32 KB of run-time allocable memory
- Small User interface
- Small consumption of energy.

5.2.2 - CDC Profile has been engineered for devices with more capacity of memory, faster processors and a better network resources availability. It includes a complete Virtual Machine and a more large set of API. The typical characteristics of this kind of dispositive are:

- Processors at 32 – bit
- Minimum 512 KB of memory (Typical 2MB)
- Minimum 256 KB of run-time allocable memory
- User Interface with elevate performance

5.3 Profile

To provide a complete run-time environment oriented at specific of dispositive characteristics, the configuration have to combinate with a set of High level API or profiles that defines the life cycle of application, user interfaces and specifics for dispositive access.

5.3.1 MIDP Mobile Information Device Profile
It is engineered for embedded mobile and pda with less capacity; it includes the functionality for management of user interface, network connection and maintenance of data. Combining with CLDC it provides a complete run-time environment reducing use of memory and life battery.

5.3.2 Foundation Profile
It depends on CDC to provide functionality of application based on type of device. The foundation profile is the lower level for the configuration of CDC.
Provide an implementation of CDC suitable for all network for device unprovide of user interface. It can combine with Personal Basis Profile for device that need a graphical user interface(GUI).

5.3.3 Personal Profile
It’s a profile depending on CDC, oriented for all devices that require a complete and functional Graphical interface or that support Java Applet or Java Xlet, such as latest pda and game console.
It includes library of Java Abstract Window Toolkit (AWT) that facilities execution of web-based application projected for run on desktop environment.
Personal Profile substitutes the PersonalJavaTM Technology and provides at PersonalJava application a useful way for the expansion of J2ME Platforms.

5.4 Optional Packages
The J2ME platform can be expand by the combination of a large range of optional packages and him correspondent profile of CDC or CLDC.
Optional Packages are created for specific requirement of market, it use Standard API introducing new technology like Bluetooth, web services, wireless, multimedia etc. Modularity of packets allow manufacturer to include only the need packages.

5.5 CLDC
Objective of CLDC is the standardization of development platform, to make it portable and economic for all kind of devices with scarce resources.
All devices have to respect the previous specifics and preserve an economic use of resources.
Mobile phones are devices product on large scale and for this reason the manufacturer, to maintenance a profit, create mobile with a low cost. For this reason CLDC defines a minimum that includes only the shared characteristics of al device.

5.5.1 Security
The model of security on CLDC is defined on tree levels:

- **Low-Level Security**
  It’s now also with Virtual Machine Security, ensure execution of applications following the semantic of java programming and that eventually malicious class doesn’t allow crash of system.

- **Application – level Security**
  It ensure that the run-time applications can access only at Library, resources of system and other allowed components.

- **End-to-end Security**
It relates to a model that guarantees each transaction from device to remote entity is protected. For example, by means of cryptographic methods.

5.6 MIDP

The Mobile Information Device Profile is a Java 2 Micro Edition profile based on CLDC configuration and is oriented for the development of java applications for wireless devices. It’s composed by a set of API that provides a complete environment. The MIDP library integrates and extends CLDC API allowing the realization, maintenance, and execution of java applications. On particular, MIDP allows:

- Application life-cycle (load-execution-destroy)
- User Interface (input(output device)
- Maintenance of saved data
- Maintenance of Networking

5.6.1 MIDP Architecture

In picture it’s showed the structure of MIDP architecture:
On the base there are the hardware of device and the native software (Operating System and native library).
Just up it is possible to find all the J2ME architecture.
The KVM provide the run-time environment for the execution of applications while CLDC and MIDP provide a complete set of Java API for programming. Moreover it possible to have proprietary library for specific component, that if by one side upgrade the potentiality and the performance, by the other side has some limitation on the portability of code (device-specific applications).

5.6.2 MidLet

It’s an application write on Java2ME MIDP profile. All the applications share the same memory, and the same function.

5.6.2.1 Life-Cycle

A MidLet hasn’t a main method, but must to extends the class javax.microedition.midlet.MIDlet and implement his methods:

- void startApp()
- void pauseApp()
- void destroyApp()

The change of state is controlled by the AMS (Application Management Software) a software application that is a part of MIDP implementation that are the responsible of installations, executions and removing of applications:

- guarantee the possibility of installation and removal
- prepare run-time execution (KVM, CLDC-MIDP library, JSR, JAD, external resources, etc.)
- capture errors that can be verify or on installation phase or on execution phase.
5.7 CDC, Foundation Profile, Personal Basis Profile, Personal Profile

It is a different world of CLDC-MIDP that offers a complex and modular environment:

5.7.1 CDC (Jsr 36)
Provide a complete Virtual Machine compatible with J2SE, and with a subset of standard library (1.3 for CDC 1.0 and 1.4 for CDC 1.1):
- java.lang, java.lang.ref, java.lang.reflect, java.math
- java.io, java.net, javax.microedition.io
- java.security, java.security.cert
- java.text, java.util. java.util.jar, java.util.zip

5.7.2 Foundation Profile (JSR 46)
Complete packages provide by CDC, in order to have a full use of standard Java library 1.3.1.

5.7.3 Personal Basis Profile (JSR 129)
Add the base support AWT for lightweight and introduce the application model based on Xlet:
- java.awt, java.awt.event, java.awt.colo, java.awt.image
- java.beans, java.rmi, java.rmi.registry (for Xlet)
- javax.microedition.xlet, javax.microedition.xlet.ixc
5.7.4 Personal Profile (JSR 62)
Complete the AWT support and the native component
• java.applet, java.awt.datatransfer

5.7.5 Advantages of CDC and PP
• Standard library richer, subset of Standard Edition 1.4 (CDC 1.1).
• Use the performance of PDA and SmartPhone.
• Support of JNI: what on run-time is not support if need can be develop
• Possibility to use native component and use other graphics library (HAVi,DVB).
• It’s a review of PersonaJava.

5.7.6 CDC Tree application model :
Developer can choose the model of application:
• Stand-alone: the main() method define the entry point of application.
• Managed: Defined a Xlet, manager by XletManager, use more concept of MidLet and of Xlet introduced by Java TV(JSR 927).
• Embedded: Applet execute on AppletViewer or a compatible browser.

5.7.7 CDC: Optional API
• J2ME RMI Optional Package; JSR 66
• JDBC Optional Package; JSR 169
• Java TV API; JSR 927
• Java Secure Socket Ectension (JSSE)
• Advanced Graphics and UI (in the future support for SWING, Java 2D, Image I/O); JSR 209.

5.8 Criticality of Virtual Machine on PDA
It, different to a normal Java runtime distribute with a mobile phone, the VM of a PDA is a third part software and can have more criticality
• Less consistence with Look and feel of system, for example is not possible to know the effective dimension of screen.
• Less selfish use of hardware resources.
• Instable Support for JNI.
• Strong dependency at version of Operating system.
5.9 Optional API

- Often CLDC/MIPD and CDC/PP coexist on board of the same device but the Optional Packages are specific for each runtime.
- It is not possible for example have the Wireless Messaging API of MIDP on CDC.
- The presence of JNI on CDC/PP allows to pass more limitation, and access directly at functionality of Operating System.

5.10 CDC Conclusion

- PDA is unique device for usability, power, connectivity and expansibility; they are the ideal solution for more applicative scenarios.

An Example of this architecture are MHP, a configuration born with digital television (DVB-T) to supplies the need of interaction between Broadcasters and Costumers, to extend the normal experience on television.

5.11 MHP

Mhp is a young standard; the first release has been created by DVB Project and then standardized by the ETSI in 2000.

Multimedia Home Platform defines the interface between interactive application and device (Set-top-box).

5.11.1 MHP Architecture

- Resources: MPEG processing, I/O devices, CPU, memory and Display.
- System Software: Java Virtual Machine, APIs, Transport Protocol and Application Manager (that allow maintenance of applications).
- Applications: Interactive application, for example EPG (ESG), information service, T-Commerce, T-Banking.

![MHP Architecture Diagram](image-url)
MHP is based on Java technology and specifically adopts a PersonalJava and a set of API that incorporate Java TV (jsr 927).

The standard is composed by three profiles, to separate the possible type of service:

- **Enhanced Broadcast Profile**: is defined on MHP 1.0, is the base profile and allows the enrichment of content with visible information or images that can be crossed on the screen. This profile does not require particular performance.

- **Interactive TV Profile**: is defined on MHP 1.0 and is the intermediary profile that allows to use a return channel (Modem, ADSL, gprs, Ethernet, etc) to serve a superior grade of interactive. This profile allows to load MHP application by the return channel.

- **Internet Access Profile**: defined on MHP 1.1 and allows to access Internet Content by the return channel. This Profile needs good performance because is indispensable to have an embedded Internet browser and an email client on set-top box

Example of Interactive applications are:
- Electronic Program Guide (EPG).
- News, Interactive TG
- Games
- Services of sportive events
- T-Commerce etc.
- Service for the citizen.
5.11.2 How to Create a Simple Xlet

On the MHP profile, on the base we can find the background layer that can have a particular frame MPEG-2, there is the Video layer that represents the A/V stream. At top level there is the Graphics layer that can have the graphics created by the Xlet with a structure by overlap n-level.

This graphic model is supported by additional package for example Havi. The top container is the Xlet that represent the Frame or Window in normal programming, but with specifics for devices.

MHP support AWT classes but frequently is possible to use the Havi package to provide class like HContainer (like Container of AWT).

Moreover it is possible to use another package named DVB that for example provide the class DVBColor an extension of AWT.Color that allow to use the alpha parameter.

Note: See the code at the end of documents.
6.1 Structure

The first step was to create the structure of application and then to create the UML of class diagram, and develop the code accordingly.

The project is structured in this way:

6.1.1 Package main:
It has only one Xlet that works like main class, creates all view and manages the event listener.

6.1.2 Package view:
It has all the view of application, specifically:

- Launcher
- Menu
- Match Statistics
- Video On Demand
- Vodafone Plus
- Chat
- Download
- Shop
- Bet

6.1.3 Package util:
It includes all class used by the view, an example is the progress bar, that simulates the download of a content from return channel.

Package util.focus:
It includes the classes for manage the focus service, it is a separate class and can work alone.

6.1.4 Package settings:
Is includes a set of static class that define all parameterized variables like dimension of video, dimension of characters, scene, view etc.

Find attached below the UML Diagram.
<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>English</td>
</tr>
<tr>
<td>Font Size</td>
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</tr>
<tr>
<td>Margin</td>
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<td>Background Color</td>
<td>White</td>
</tr>
<tr>
<td>Grid Lines</td>
<td>On</td>
</tr>
<tr>
<td>Show Ruler</td>
<td>On</td>
</tr>
<tr>
<td>Show Numbers</td>
<td>On</td>
</tr>
<tr>
<td>Show Formatting</td>
<td>On</td>
</tr>
</tbody>
</table>

**Application Settings**

- **Language**: English
- **Font Size**: 14pt
- **Margin**: 2cm
- **Background Color**: White
- **Grid Lines**: On
- **Show Ruler**: On
- **Show Numbers**: On
- **Show Formatting**: On
6.2 Functionality

After defining the structure and the uml diagram, it’s simple to make a functional code.

The intention of the application was to create an user experience to provide a general idea of possible interactive services; the main point was not really to make a professional application but to create an user interface that describes the user experience flows.

For this reason application has been divided in two parts:

- Entertainment
- Push on Return Channel

The Entertainment part follows the rules of broadcaster’s business model and specifically the concept of share. For this reason, the created services are informative, like news or in this case (football match) the real state of match, with statistics, tips, and other kind of entertainment.

The other part is oriented to push user to use the return channel with services like video on demand, application download for mobile (tones and themes) and possibility to make a chat with other people or buy a team gadget or ticket or a service for betting. All of this service has a strong relation with service provider, and need a connection (for example a HTTP connection or other).

The application shows a graphics that remembers a Nokia N92 phone.
Below some screenshot of application:

Launcher:

Menu:

Statistics:

Vodafone Plus:
Conclusions

In this three months, I have worked in Vodafone It specifically on the TSCC, a part of this company that is an accord between Vodafone and Nokia; Here people study future technology, analyze them and create trial, user experience and prevision of costs.

I have had the possibility to participate actively at meeting with company like Motorola, and other company that could to be collaborate with Vodafone or that Vodafone want to know;

My work, then was study technology about DVB-H, find a suitable technology to develop applications, and create a user experience for the marketing part of Vodafone, a Front-End that could be open ideas of people about possible services, unfortunately in this time, doesn’t exist a suitable technology to create an application similar to my demo, and meeting with Big company confirm my supposition. It’s possible that DVB could standardized a method to develop application like MHP, but port the technology isn’t a good respond for market.

On this months I have the “fortune” to state on centre of a reorganization, where Vodafone apply technique for increment company business, and upgrade internal organization, that means in some case reduction of employee or moving of employee in other sector of company.

I can affirm that was a very good experience, for my personal growing that can result very good for my professional life.
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