

# The embedded systems Swiss knife

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## ABSTRACT

Current corporate environment are somehow not open to information and functionalities presentation to other channels than the World Wide Web. For ISP's this is quite common were the main distribution channel is the world wide web, forgetting most popular channels such as TV and the emerging web enabled mobile devices. This document aims to present the currently project undergoing on ZON Multimédia, the major Portuguese cable operator, where the self-care solution is being prepared to be used in web either by PC, or any embedded device (phone, pmp's, stb's, etc...). This work aims to design a simple, seamless process to allow easy deployment of web application from the pc environment to embedded devices, and also support the evangelization process of the company decision maker's by the architect, by so building a truly Swiss knife for the system architects.

## Categories and Subject Descriptors

D.2.2. [Design Tools and Techniques]: Programmer workbench and Features – *system analysis, information integration, system design.*

## General Terms

Algorithms, Design, Human Factors.

## Keywords

Algorithms, Design, Human Factors, Embedded Systems, System Analysis, Information Integration

## 1. INTRODUCTION

Traditionally corporate environment has a global difficulty of envisioning innovation that may sprout from the system designers, or even from the teams closest to the clients. During a long partnership with ZON Multimédia, I was able to identify the ZON desired to allow their clients to access the existing customer care infra-structure using embedded devices. (TV, video-game consoles, mobile devices, etc ...)The first problem encountered was the fact that corporate decision makers didn't have the technologically awareness of embedded devices to have the right perception of what it should be done, in order to pursue the objectives they had in mind. In order to attend this desired objectives of ZON Multimédia it was needed to devise a working strategy that would allow the proper evangelization of the decision maker, on the subject of designing solution for embedded devices, and also a solution on what process should be followed to design and implement a platform that supported multiple distribution channels of several functionalities

## 2. GLOBAL STRATEGY

In order to solve this problem the adopted strategy was:

1. System analysis: Gain knowledge of the overall system to be supported in the embedded systems, and identify the targeted embedded systems.
2. Usage modeling: Gain knowledge from the clients that uses the system identifying what are the major functionalities used by them, and what functionalities they expect to be available in a embedded system.
3. Design interface strategies for the identified embedded systems
4. Design construction processes
5. Test strategies
6. Usage Evaluation

Step 1 aim's to evaluate the system to be ported on to the targeted embedded systems, mapping all the functionalities that are available to users. Step 2 evaluates the overall system usage, identifying what are the most used functionalities by the clients. These results will allow identification of the most likely candidate functionalities to be available in the embedded systems. Considering that on embedded environments it can be easily identified a direct relation between overall system functionalities and global system acceptance, looks that adopting the most used functionalities will be a good strategy. Another fact must be considered when designing embedded systems, it states that the simpler the interface is the easier is the user acceptance of the application (this fact simply states that if an interface is simple, the less cognitive effort it requires, then is much easier to the user to learn the interface mechanics). Summing this we will have a relation that tells us the bigger the usage of existing functionalities that are transported for the embedded system, and the bigger simplicity in which those are presented, most likely the system is going to have wide acceptance on the target users.

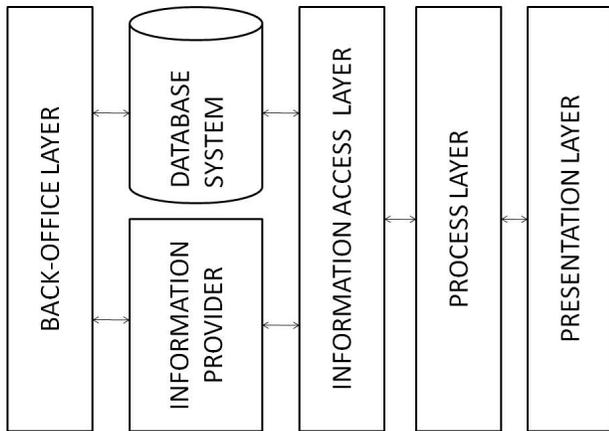
Step 3 presents the strategies that application and interface designer's need to follow when building interfaces for embedded systems.

On step 4 the development pipeline is the target of the investigation, on how the development process should be managed.

Step 5 and step 6 describes how the platform is tested prior to live launch and post launch evaluation on platform usage.

### 3. SYSTEM ANALYSIS

After some initial analysis of the overall ZON Multimédia self-care platform the following architecture was identified:



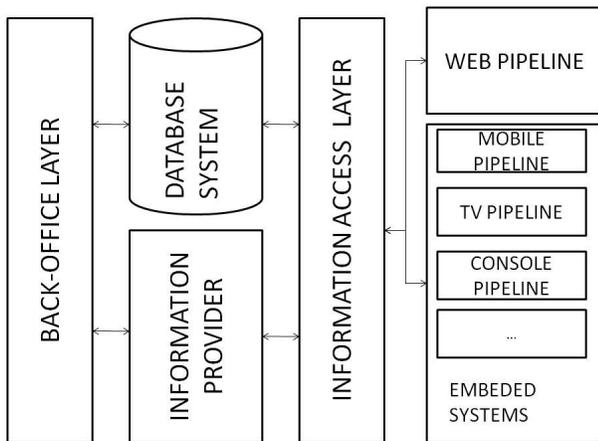
**Figure 1: Client's initial self-care system**

Basically the client's platform is built in a 3 layered schema where there is a layer responsible for information retrieval, another one to implement business processes and finally a presentation layer responsible for rendering of information on to the web environment.

This design reveals clear concerns from Zon Multimédia architects in allowing easy maintenance and evolution of each of the components.

The first aspect of the designed platform that should be dealt with is the fact that it only supports only one distribution channel (World Wide Web over pc) so in order to support other ways to distribute functionalities it is required to change the paradigm from one distribution channel to multiple distribution channels.

The overall aspect of the platform should be:



**Figure 2 : Architecture Proposal for new self-care environment**

This proposal will allow supporting several ways of functionality distribution allowing then to build a truly networked environment where you can manage your client portfolio from the phone, request movies from your web enabled PMP, check your product spending on you TV (these are some of the recommendations).

The target embedded systems for this project and by request of ZON Multimédia are the portable multimedia phones that support http1.0 and the set-top boxes currently in the client's homes.

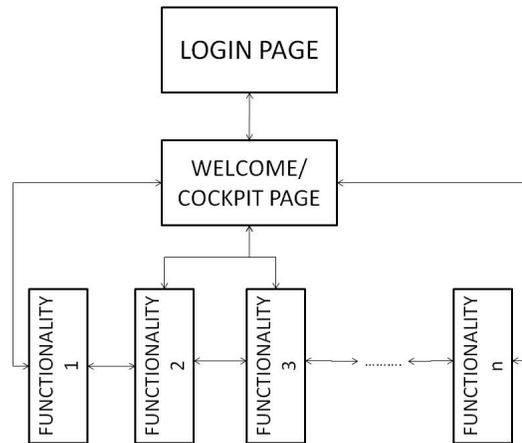
### 4. USAGE MODELING

The functionalities elected to be used on the embedded systems was done with some caution because the usability paradigm is quite different from the regular web environment, and may even differ between different types of devices. In order to do the choice, it was identified the need to evaluate what are the most used functionalities by the users. Considering that the ZON Multimédia has a base of 500k net clients, so a sample of 1k clients was used to answer a set of questions, oriented to identify what are the usage patterns of self-care solution.

The presentation layer follows a structure in where exist a first login, followed by a dashboard page (identified as the cockpit), followed by a highly horizontal structured of a list of functionalities.

The cockpit page is a dashboard of predefined overviews of several functionalities (chosen by the user) applied to the client portfolio (Traffic consumption, email management, institutional news, E.P.G favorites, payment information, etc ...).

The overall structure can be schematized in the following Figure.



**Figure 3: Self-Care simplified navigational diagram**

It was revealed by enquire, that the functionalities present on the cockpit represent 80 percent of the most used portal functionalities. When enquired on the possibility of having the same functionalities using a different interface such as an embedded device, the clients revealed high expectations on the simplicity of the interface, fast access times to the information and navigation that requires the least effort possible to access the information.

## 5. EMBEDDED SYSTEM INTERFACE DESIGN

### 5.1 Mobile Devices

Designing for Mobile devices required that the architect to consider the following:

- Target platforms identification
- Average screen size admitted
- Content weight on connections and device memory
- Client Application profiling

In the context of the project it was devised that:

- The target is all HTML enabled devices (with web browser), this allowed broader range of devices to be supported
- Average size of 200px width by whatever height the page requires, allowing vertical navigation and stretching contents in the horizontal plane.
- Design pages no bigger than 20k in order to make them small enough to have faster loading times on the device
- Always have a navigational buttons allowing fast navigation between sections
- Build clear connected navigational graph for simple and clear navigation on the user side

### 5.2 TV Dependent Equipments

Designing for TV dependent devices required that the architect to consider the following:

- Color usage based on flickering avoidance, contrast enhancement and taking in account older display systems.
- Interface design based normal reading model for TV (Z model reading), and large and simple interface elements.
- Fast loading times
- Easy navigational elements, based on vertical design of pages, least effort needing use the equipment interface (STB remote, videogame console control pad, etc ...)

Based on this, it was devised:

- Avoid flickering colors, pushing a simple and contrasting interface.
- Low weight pages, using a few number of elements to be loaded in order to avoid slow load times
- Build clear connected navigational graph for simple and clear navigation on the user side

## 6. TEST DESIGN

The test design take in account two stages:

- Pre-launch: where tests look for interface errors and functional errors that are evaluated based on test chart were the functionalities are listed
- Post-launch: these tests aim to evaluate click path and cross information between usage and available

functionalities, allowing detection of architectural flaws in the click path designs

## 7. CURRENT PROJECT STATUS

Currently the project has the web pipeline and mobile devices pipeline currently working and on production environment.

Platform usage evaluation allowed noticing that:

- Near 67% of users followed all the possible graph navigations, visiting all the available options.
- Average session time is 2,5 minutes were the most used functionalities are E.P.G. listings and payment information
- Client test groups identified 60% of the functionalities as being useful, and easy to use
- From the post mobile device launch 44% of the enquired person question when the TV version would be available for them to manage many things such as premium channels subscription, VOD request management, global payment management and more detailed EPG information.

At this stage of work it also possible to acknowledge that involving the decision makers on step1 and step2 of the process proved to be a profitable decision because it made the decision makers much close to clients desires and even made them more aware of the impact that some devices have on clients life, and by so providing them a better view of embedded devices reality. (For mobile devices)

The above described preliminary results are quite promising exposing the following relevant information:

- Building short click paths in the navigation design, proved to reflect a site navigation that had good acceptance and will also allow to segment marketing strategies when selling advertisement spaces over the pages.
- Early identification of most used functionalities, allowed a correct identification of the application context and by so improving the acceptance in the embedded device users.
- The development process as a viable one to use in a corporate environment.

The TV dependent devices interface is currently being built.

## 8. ACKNOWLEDGMENTS

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## 9. REFERENCES

- [1] Ding Regan, T. and Todd (2004) Media Center Buddies: Instant Messaging around a Media Center, In Proc. Nordi CHI 2004 141-144

- [2] Nielsen Jakob 2000 Designing Web Usability: the practice of simplicity. New Riders Publishing, Indianapolis ISBN: 1-56205-810-X
- [3] Nielsen Jakob. <http://WWW.useit.com>
- [4] Microsoft Corporation, <http://www.microsoft.com/Mediaroom>
- [5] Opentv Corporation, <http://Opentv.com>
- [6] Springett Mark, Griffiths Richards Accessibility of Interactive Television for Users with Low Vision: Learning from the Web EuroITV 2007 ACM
- [7] Nguyen, Hung Q, Johnson, Bob Hackett, Michael Testing Applications on the Web: Test Planning for Mobile and Internet-Based Systems 2003 Wiley Publishing
- [8] Yates, J. Frank Decision Management – How to assure better decisions in your company Michigan Business school 2003 Josey Bass Printing
- [9] Park, Glen M. Team Players and Teamwork New Strategies for Developing Successful Collaboration 2008 Wiley