

Proceedings



ACM MSWiM 2004
POSTERS of the

**7th ACM International Symposium
on Modeling, Analysis and Simulation
of Wireless and Mobile Systems**

October 4-6, 2004, Venice, Italy

Edited by

Sotiris Nikolettseas

Sponsored by



IEEE

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ISBN 960-406-886-5



9 789604 068869

The 7th ACM International Symposium
on Modeling, Analysis and Simulation
of Wireless and Mobile Systems (MSWiM)

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Poster Paper Proceedings

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CTI Press / Ellinika Grammata
Greece

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A MODEL FOR GROUPING DEVICES FOR WIRELESS AND MOBILE WEB PORTALS DEVELOPMENT

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Abstract This paper describes an approach for developing wireless Web applications that can be accessed by different types of i-Mode, WAP or Web User Agents. The approach is based on the concept of building cluster of "markup-properties" and mapping these clusters to classes of wireless devices.

The proposed model serves as a guide for the development of applications, that can be used with different server configurations and software development technologies. This model has as input the data related to each of the devices and the properties for which Web content is to be generated, it generates as output the amount of Web versions of the application, and the characteristics that should be developed. Starting with these groups it will be possible to continue with the process of logical and conceptual modelling, with the implementation of scripts and stylesheets that interact with the purpose of generating the appropriate output for each device.

Keywords: Pervasive Portals, Wireless Web

Introduction

The ever expanding market of "web enabled" devices has created diverse challenges related to the difficulty of visualizing content in a unified form to diverse clients, while at the same time taking into account the capacity differences of these devices. It is not feasible to develop a separate application for each of these devices, simply because the number of different devices is already too high and is still growing.

Different mobile devices support different properties (graphic capabilities, markup languages, etc. On the other hand, the developers are facing problems like constant change in the markup languages and the lack of standardization, the variations in the protocols on which their applications must be executed.

The paper has been organized in the following way: section 1 describe the available solutions for pervasive content generation (theoretical and commercial proposals). In section 2, the proposal generated in this paper in relation to the form in which a series of devices can be grouped have been described. Finally, section 3 describes an example that uses the real data of 7 real mobile devices. In the same way, the form in which these devices should be added to the data structures associated to the proposal is presented.

1. Available Solutions For Pervasive Content Generation

One proposal for pervasive content generation is Capability Classes [1], where the designer defines a series of device classes and the restrictions to handle device profiles. This mechanism makes groups of devices into classes with similar characteristics, these can be registered in a file that contains the restrictions and logic expressions that allow the creation of groups. Capability classes are the main conceptual proposal that has been found in relation to the grouping of devices that allow device independency. Nevertheless, and as far as this study goes, it cannot offer a proposal for the form the designer can adopt to create these groups.

Capability Classes have been demonstrated in DELI (Delivery Context Library), an Open Source Java API to process device profiles developed by HP Labs. With DELI it is possible to define device classes and the restrictions to handle the profiles.

On the other hand, the Mobile Internet Toolkit (or Mobile Controls) proposal has been developed by Microsoft within the general framework known as Dot Net[4-5]. Another available commercial solutions are Oracle 9i -10g [6]and IBM Websphere Transcoding Publisher[2-3].

A common disadvantage of these commercial approaches is dependency on the manufacturer. Using these solutions would result in any future platform change being a costly and painstaking process.

2. Grouping Devices

This section describes the proposal generated in this paper in relation to the form in which a series of devices can be grouped, the characteristics associated to those groups, and from where it is possible to initiate a modelling and development process of an application based on different versions by device groups.

This proposal is focused on the challenge of finding a way that permits some systems to produce presentation data that can be rendered on a target device. As we have said before, for presentation accessibility we have device-specific markup languages (e.g: PCs, and Pocket PCs support HTML, but Docomo mobile phones only support CHTML, Compact HTML).

The presentation quality is affected by different screen sizes (e.g: PC screen size is above 800x600 pixels, Pocket PC screen size is around 320x240 pixels), all of them varying according to specific models.

Starting from the grouping process described as follows, a device grouping is to be carried out, in a way that will determine the number of groups to be created, and the characteristics of each group. To approach the above problem this mapping technique will look for:

- First, find a number M of groups or clusters of devices defined by similar characteristics and priorities of design in relation to properties that are considered of greater relevance. Starting from the result obtained in this grouping process, it will be possible to have an initial idea of the number of applications to be developed, and their basic individual characteristics.

- To identify devices that belong to each group and the minimum characteristics associated with each device group, in order to be able to create an appropriate mapping between the characteristics supported by each device group of and the adapted content that will be sent from the server.

- Detailed study of the target devices as well as the basic characteristics that will be sent to each device, defining a single set of properties that will be used for that device (a markup language on which the contents will be developed, the image format that will be used, support or not of colors, etc).

In this context this approach will be optimised for these characteristics (in a way similar Web applications, where we can see in some web applications the message "Version optimised for X resolution"). This process of recommended characteristic definition would have to be accompanied by the contributions of at least a graphic designer or an interface expert.

A second element of the proposal is based on the definition of a tolerance index, which we will call *indtol* from now on, for the representation of information based on resolution information (wide high x). A value of 0,1 in the index will indicate that it would be acceptable to display content of a device with a height equal to 100 and a width equal to 200 in one whose width is 110 and

DEVICE	MARKUP	IMAGE	RESOL
1 Nec N21i (iMode)	<u>IHTML</u> - WML1.2	Gif/wbmp	120x130
2 Toshiba TS21i (iMode)	<u>IHTML</u> (only)	Gif/wbmp	128x121
3 SonyEricsson T68/R-201(WAP)	<u>WML</u> 1.3	Gif/Jpeg/wbmp	101x80
4 Panasonic GD87 (WAP)	<u>WML</u> 1.3	Gif/Jpeg/wbmp	132x176
5 Sharp GX12 (WAP)	<u>WML</u> 1.3	Gif/Jpeg/wbmp	120x160
6 PDA IPAQ 3970	<u>HTML</u> 3.2	Gif/Jpeg	240x320
7 PDA T-Mobile MDA	<u>HTML</u> 3.2	Gif/Jpeg	240x320

Table 1. Device capabilities for the example

maximum group height, but the width of the device must be greater than the minimum width, in a value equal to the percentage indicated by tolerance, and the height of the device is greater than the minimum height, in a value equal to the percentage indicated by the tolerance. This can be formally expressed as follows: $(H_d > H_{max})$ and $(W_d > W_{max})$ and $(H_d \leq (1 + indtol) * H_{min})$ and $(W_d \leq (1 + indtol) * W_{min})$.

In this case, the group values of maximum width and height must be updated, with the indicated values of width and height of the new device.

- Case #3: The width of a device is less than (or equal to) the minimum group width, and the height of the device is less than (or equal to) the minimum group height, but the maximum width must be greater than the width of the device in a value equal to the percentage indicated by the tolerance, and the maximum height must be greater than the height of the device in the same value as the percentage indicated by tolerance. This can be formally expressed as follows: $(H_d < H_{min})$ and $(W_d < W_{min})$ and $(H_{max} \leq (1 + indtol) * H_d)$ and $(W_{max} \leq (1 + indtol) * W_d)$.

In this case, the minimum values of width and height of the group must be updated, with the indicated values of width and height of the new device.

In case of there being more than one subgroup in which a device can be included, the criteria to be taken is to include the device in the group where there is a lesser difference in absolute value in relation to the maximum and minimum values, or human intervention could be considered to make the decision.

2.2 Description of the proposal by means of an example

Supposing that content is desired to be generated for the following devices: (See Table 1) In the markup and IMAGE columns of table 1, the properties which are considered the preferred version values for each device have been underlined in each of the devices. For example, device #3, WML 1.3 and the image format WBMP have been defined as preferred values.

Starting from the first device on the list, the Nec N2li, the analysis carried out to create an initial device tree is as follows: From the two markup languages that it supports, (IHTML, WML 1.2) IHTML has been defined as preferred version and this will be the one registered at the time the tree is created (this decision can depend on joint analysis of the device properties and can be accompanied by the criteria of an interface designer).

Following a similar process for the other devices, and adding the last level of resolution, the tree that would initially be created, without any type of grouping. To add the first device, the starting point is the inclusion of the preferred markup language, which according to Table 1, corresponds to IHTML. Afterwards, in the next level a child node corresponding to preferred image format GIF is added.

If other properties of interest exist, they in turn would be added as child nodes, in this way adding a property to each tree level. Next an identifier corresponding to the first group would be added, since this node forms a first group. Additionally, a first node in the multilist is created, with the first group identifier as well as the initialisation of the minimum and maximum group resolution, with its corresponding value.

To add the second node -and any additional node- the process is similar, in this case the properties are IHTML, GIF image format and 128x121 resolution. Keeping in mind that the resolution corresponding to this device does not fulfill the criteria defined to add a node to the only existing group in the last sub tree, so a new node in the multilist has to be created.

The third device is added to the tree and to the list according to the values of its preferred properties; markup WML 1.3, image format WBMP and 128x80 resolution. To add this device to the multilist, a new group is created, since in the subtree markup language WML 1.3 there was no pre-existing subgroup.

The properties corresponding to the fourth device are: markup WML 1.3, image format GIF and 132x176 resolution. It can be observed how the resolution of this device cannot be represented by the existing resolution within the existing group in the subtree based on markup WML 1.3 and the WBMP format. Therefore, this device will correspond to a new node in the multilist.

The properties of device number 5 are: WML 1.3 markup, image format GIF and 120x160 resolution. To add it, these are taken as the comparison basis for sublist groups corresponding to WML 1.3/GIF. Group number 3 has a minimum and maximum resolution of 101x80, with which the resolution of device number 5 (120x160) could not be represented in this group.

Group number 4 has a minimum and maximum resolution of 132x176, with which the resolution of device number 5 (120x160) could be represented in this group. In this case the node must be added to this list and the value of minimum resolution must be updated.

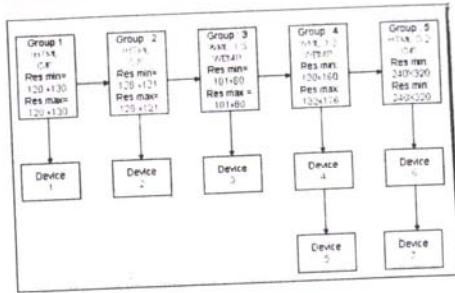


Figure 1. List with the fifth group and seventh device

The sixth device is added parting from the following properties, markup HTML 3.2, image format GIF and 240x320 resolution. The properties corresponding to the seventh device are: HTML 3.2, GIF and 240x320 resolution, with which a new tree node is not generated, since a leaf with identical properties exists. The multi-list representation corresponds to what is described in figure 1.

Carrying out a comparison with the initial tree representation and parting from the observation of the list in figure 1, we can see that the number of groups is 5, which indicates that 5 new versions of the application should be created for the 7 devices.

In this way, the objective of counting on a number of versions lesser than the number of devices is reached. The characteristics of each version could be obtained by tree route starting at the root node until reach each group, or consulting the properties registered in each subgroup in case these values in each node were stored.

In the process of creation of the tree and the list, the computational cost for each device with M properties is $O(M)$, and for all of the devices is $O(N*M)$, since it is necessary to process the N devices to add them to the tree and list as nodes.

Conclusions

In this paper a model for grouping devices has been proposed. Its use avoids the development of as many applications as destination devices there might be in the process of developing an application. With this mechanism device groups and their properties can be found, making it easier to develop formats (based on style sheets) for these device groups but not individually. The proposed grouping mechanism can be used in different types of pervasive web

applications. Our novel proposal has been tailored to a set of mobile devices and has been tested in the design and development of different projects related with mobile intelligent transport systems.

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