

## METHODS OF DEVELOPMENT OF INTERACTIVE WAP APPLICATIONS.

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In this paper interactive WAP applications working with Oracle database building principles are stated. Characteristics of protocol itself are given, data storage solutions and data representation in database are described. Also program code snippets, allowing creation of database structure and fully functional set of application.

### Introduction.

Internet takes the increasing and greater place in our life. With growth of popularity of a world wide web the growing amount of users has complexities with access to their information resources. In most cases it is related to need of possession of transmission device - computer, modem, phone line. Manufacturers of cellular telephones have equipped their devices with modems and browsers (the last now even more often settle down not on the handset itself, but on a phone card) as the decision of the given problem. The special protocol working with a mobile communication facility - WAP (Wireless Application Protocol or Wireless Access Protocol) has been developed.

By development of family of protocols WAP the following principles were used:

- Complete set WAP should provide access to Internet, intranets and information services of mobile operators. Whenever possible, it should be based on existing standards;
- It is necessary, when using WAP not conflict with the basic functions of the handset;
- The architecture of family of protocols should correspond with OSI model; it is necessary to provide scalability and expansion opportunity;
- Protocol should be designed for use in networks with small bandwidth and, probably, the big information transfer delays. It is required to consider also small volume of operative memory and low speed of the central processors of user's terminals;
- It is necessary to take into account, that user's terminals have rather limited opportunities for input of the information by the user;
- In architecture WAP support of various types of wireless networks should be incorporated;
- It is necessary, that the family of protocols WAP provide data protection;
- New application model providing services for data transfer to wireless phones should be developed.

For increase speed of data processing special language WML (Wireless Markup Language) based on known language XML which has in turn taken place from HTML has been developed. Standard HTML has so many different

features, that memory of cellular devices cannot contain an existing set of processing rules. And for small displays of mobile phones many HTML features were an obvious excess. In addition to WML language WMLS has been developed - WML Script. WMLS is adapted variant of language JavaScript.

Now the basic inconvenience for WAP users is insufficient amount of information resources. WAP developers meet tasks in maintenance of services for mobile devices owners. The user who has so many services with Internet cannot be content any more with their limited subset. One of the basic moments here is interactivity and "freshness" of the information provided.

In fact there is no sense to use mobile means to access static and "dead" - unchangeable data. Therefore development of WAP site includes not only providing user with the information, but also simplification of routines for the data responsible person on a site, and also integration tools with other various systems which will provide interactivity to a site.

### 1. Data presentation

For effective work WAP site it is necessary to design mechanisms for maintenance fast, convenient and safe delivery of the data, which further will be given to the end user. For this purpose, first of all, it is necessary to define, where this information will be stored. There are, at least, four variants of the decision of this problem:

- The Information is stored statically on a WAP-site as WML-pages
- The Information is stored in text files
- The Information is stored in operative memory
- The Information is stored in a database

The fourth variant seems to be most convenient for development of interactive systems. It provides, both speed of access, and safety of the stored data. Besides, developers of databases, as a rule, give the interface for DB(database) access, that essentially makes easier work of the programmer. Further in this work as a database we shall understand Oracle product of the version higher than 7.3[1]. In a database the arrived information will be stored in hierarchical treelike structure (fig. 1).

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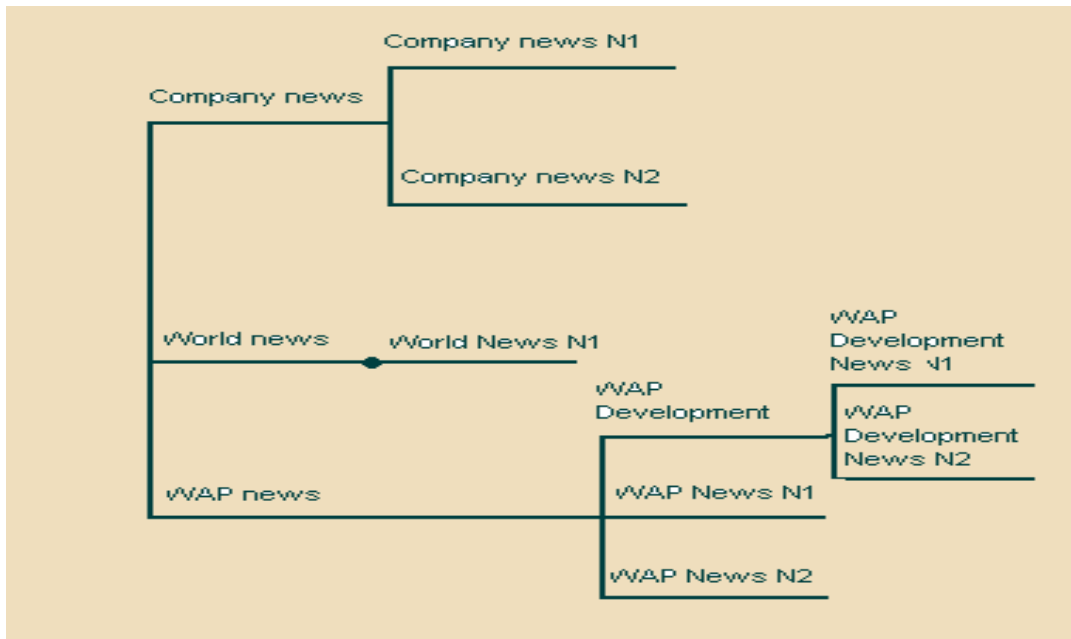


Fig. 1.

Hierarchy is provided by pair of identifiers for each element of a tree: the first - the identifier of the parental element, the second - the serial identifier of the element. At the end-point of the information delivery, uniqueness of last identifier is guaranteed by such built-in Oracle object as sequence. So the static elements submitted on rice 2.1, will have the following identifiers according to the offered scheme:

- (0,1) - Company news
- (0,2) - World news
- (0,3) - WAP news
- (3,4) - WAP Development

Further dynamic elements (data given to the WAP-site) at receipt will receive the following identifiers:

- (1,5) - Company news N1
- (1,6) - Company news N2
- (2,7) - World news N3
- (4,8) - WAP Development News N1

- (4,9) - WAP Development News N2
- (3,10) - WAP News N1
- (3,11) - WAP Development News N2

Certainly in that case when the data will be received in the corresponding order. Besides, for dynamic elements the additional identifier also is necessary to distinguish them from the static data. The static data may be used in system as well for simplification of applications development.

**2. Development of the application**

Now we shall pass to development database structure and an initial code of system itself. We shall start with development of organization of database, and then we shall pass to initial modules directly processing the information. At creation of the database structure it is meant, that we have privileges of the system administrator (SYSADM) in this base. So, the scripts necessary for creation of the table containing data provided to the WAP-site will look as follows[3,4]

```

CREATE TABLE WAP_DATA (
    I_ID          FLOAT,
    P_ID          FLOAT,
    PARAM_1      VARCHAR2 (22),
    PARAM_2      VARCHAR2 (22),
    PARAM_3      VARCHAR2 (22),
    PARAM_4      VARCHAR2 (22),
    PARAM_5      VARCHAR2 (22),
    I_DESC       VARCHAR2 (15),
    I_SELF       VARCHAR2 (2000),
    DATE_1       DATE,
    DATE_2       DATE,
    DATE_3       DATE,
    I_STAT       VARCHAR2 (1));
  
```

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```
CREATE INDEX SYSADM.WAP_DATA_IID_IDX
ON SYSADM.WAP_DATA (I_ID)
TABLESPACE INDX;

CREATE INDEX SYSADM.WAP_DATA_PID_IDX
ON SYSADM.WAP_DATA (P_ID)
TABLESPACE INDX;

CREATE INDEX SYSADM.WAP_DATA_D1_IDX
ON SYSADM.WAP_DATA (DATE_1)
TABLESPACE INDX;

CREATE INDEX SYSADM.WAP_DATA_D2_IDX
ON SYSADM.WAP_DATA (DATE_2)
TABLESPACE INDX;

CREATE INDEX SYSADM.WAP_DATA_I_STAT_IDX
ON SYSADM.WAP_DATA (I_STAT)
TABLESPACE INDX;

GRANT SELECT ON WAP_DATA TO PUBLIC;

GRANT DELETE ON WAP_DATA TO WAP_OPER;

GRANT INSERT ON WAP_DATA TO WAP_OPER;

GRANT UPDATE ON WAP_DATA TO WAP_OPER;
```

Fields *I\_ID* and *P\_ID* form a pair of the hereditary relation about which was spoken above. Fields-parameters *PARAM1*, *PARAM2*, *PARAM3*, *PARAM4*, *PARAM5* can be used under the discretion of the developer, or are not used in general. In a system - example field *PARAM1* will be used for identification of structural recordings and directly information, and field *PARAM\_2* for identification of language of the information. Pair of fields *DATE\_1* and *DATE\_2* define a time interval during which the information is considered to be valid. It is obvious, that these fields make sense only for records, which contain the data, for providing to the WAP-site, instead of the structural information. Whether field *DATE\_3* defines if the information has passed the control of the data by the WAP-operator. And at last the field *I\_STAT* is necessary for emergency removal of the data.

A plenty of indexes is caused that, that in view of small bandwidth of a mobile network, time of references to a database should be minimal. In case of a small amount of the data a part, or even all indexes can be omitted. We shall notice only, that indexes are created in separate space of a database (*TABLESPACE INDX*). Such use of indexes is directed on even more to increase speed of data processing in database.

As on the Internet there is a set various manuals and guides, and taking into account rather simple realization we shall not result here detailed consideration of development static wml pages, and at once we shall pass to realization JAVA servlet carrying out exact search of the data in resulted information structure[2]:

```
System.out.println (" <? xml version = \" 1.0 \"?> ");
System.out.println (" <! DOCTYPE wml PUBLIC \"-
// WAPFORUM // DTD WML 1.1 // EN \"
\" http: // www.wapforum.org/DTD/wml_1.1.xml \"> ");
System.out.println ("<wml>");
System.out.println (" <card id = \" start \" title = \" WAP News \"> ");
System.out.println (" <do type = \" accept \"
label = \" Back \"> <prev/> </do> ");
System.out.println (" <p align = \" left \"> ");
.....
try {
    ResultSet rs = null;
```

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```
Statement stmt=conn.createStatement ();
rs=stmt.executeQuery (" select I_SELF, I_ID,
P_ID, PARAM1 from WAP_DATA where
P_ID = " +p_id + " and DATE1 <SYSDATE and
DATE2> SYSDATE and PARAM_2 = " + lang + " and
DATE3 is not null ");
while (rs.next ()) {
    qryCnt ++;
    rsString=rs.getString (1);
    isLink = rs.getString (4);
    if ("A" .equals (isLink)) {
        System.out.println (rsString);
        System.out.println (" <br> <br> ");
    }
    System.out.println (" <br> <br> ");
    continue;
}
}
catch (SQLException sqle)
{
    rsString = sqle.toString ();
}
}
```

```
.....
System.out.println (" </p> ");
System.out.println (" <p align = \ " center \ "> ");
System.out.println (" <a href = \ " http: // 127.0.0.1/main.wml \ ">
WAP News </a> ");
System.out.println (" </p> ");
System.out.println (" </card> ");
System.out.println (" </wml> ");
```

Thus, we provided basic actions needed for development of real interactive WAP service. Though Oracle is considered to be used in our case, generally any database providing multi-user access can be used as well. The system designed

on the principles stated above has successfully passed approbation in Azercell Telecom JV. Further work supposes implementation of interactive information services on different mediums.

- [1] *T.M. Mukhtarov*. Oracle: Evolution and Perspectives for Database Applications Developers, Thesis's of VIII international conference "Mathematics, Computer, Education", Pushino, 2001, p.74  
[2] *Christoffer Andersson*, GPRS and 3G Wireless

- Applications: Professional Developer's Guide  
[3] *S. Urman*. Oracle 8. Programmirovaniye na yazike PL/SQL M., ЛЮПИ, 1999, p.607.  
[4] *S. Bobrovsky* Oracle 8. Arkhitektura. M., ЛЮПИ, 1999, p.207.

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### **İnteraktiv WAP əlavələrinin işlənməsi metodları**

Məqələdə Oracle verilənlər bazasının idarə olunma sistemi əsasında interaktiv WAP əlavələrinin arxitekturasının quruluşu

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prinsipləri təhlil edilmişdir. Bilavasitə protokol xarakteristikaları göstərilmiş, məlumatların saxlanma və onların verilənlər bazasında əks etdirilmə qaydaları təsvir edilmişdir. Eləcə də verilənlər bazasının quruluşunu və əlavələrin tam sistemini yaratmağa imkan verən mənbə kodlarının fragmentləri təklif edilmişdir.

**Теймур Мухтаров**

**МЕТОДЫ РАЗРАБОТКИ ИНТЕРАКТИВНЫХ WAP ПРИЛОЖЕНИЙ**

В статье изложены принципы построения архитектуры интерактивных WAP приложений на базе СУБД Oracle. Приведены характеристики непосредственно протокола, описаны способы хранения данных и представления их в базе данных. Также предлагаются фрагменты исходных кодов, позволяющие создать структуру базы данных и полноценную систему приложений.

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