MODEL OF INFORMATION SYSTEM FOR SUPPORT OF DECISION-MAKING IN LOGISTICS

INFORMĀCIJAS SISTĒMAS MODELIS LĒMUMU PIEŅEMŠANAS ATBALSTAM TRANSPORTA LOĢISTIKĀ

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Summary

XML & Java-based universal model of the software for interoperability of the corporate information resources and support of decision-making in logistics is considered. The model is oriented to ensure coordination of multimodal and inter-modal transportation on international transport corridors and interoperability of railway transit business participants. Integrated solutions for information systems are acceptable along transport logistics chain, as well as for railway chains crossing borders.

Technical barriers continue to impede the competitiveness of Europe's railway sector. The key to solve problems of enhancing railway competitiveness is using innovative technologies of transportation process which provide customers with the maximum quantity of services, comfort and advantages of railway freight traffic against other modes: simplicity of freight traffic formalities, reliability with regard to timely and safe delivery from door to door, variety of information available to the customer providing a proper monitoring of transportation conditions, etc. The rail sector will not be able to compete successfully in the global market economy without efficient support of an integrated corporate information system accessible for all transport business participants.

To organize transportation process, numerous technology models were elaborated with a significant number of automated systems created for decision-making support. Since these systems were developed at different times, their realization was based on the very diverse software/hardware using outdated technologies and therefore they needed to be modernized.

Today XML technology has become standard to create adapted Internet-oriented information systems. This technology supports data presentation format by means of dynamic WEB-pages. XML technology provides:

- **Unified mechanisms to organize exchange of electronic documents as well as exchange of other sophisticated resources of information in the heterogeneous environment;**
- **WEB-access to relative databases in network or wireless systems;**
- **Highest automation when elaborating o using WEB-oriented model to process distributed data.**

Internet, which requires a distributed access to a variety of systems via network screens as well as via numerous wire- and wireless environments, is a perfect environment for XML-documents carrying and interoperability. The key to create WEB-oriented information systems, which is the most needed today, is a three levels data processing model with access to relative database at the server side of the active WEB-site (fig.1).

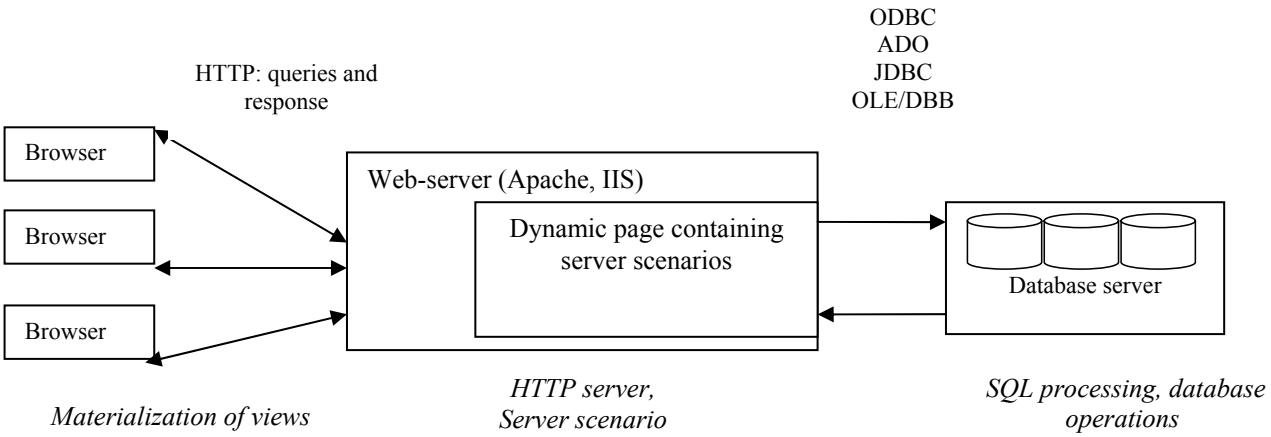

Fig.1. Web-oriented three levels model of distributed data processing with access to databases at the server side

The above architecture allows starting scenarios both on the customer's computer and on the server. The most suitable version for WEB applications is usage of server scenarios to create, reed, renovate and delete views, as well as to initiate saved procedures which realize business logic directly in database.

Within the framework of XML technology, a specialized SQL Servlet tool is offered to automate the creation process of dynamic WEB-pages operated by database. XML & SQL Servlet technology realizes possibilities both of XML universal technology and of powerful Java to organize interoperability with databases in network environment or wireless systems, leaving behind the scenes both XML and Java details and particulars. XML & SQL Servlet minimizes requirements with regard to programmer's level of knowledge, providing an efficient interoperability of information resources in territorially dispersed systems by SQL-queries results.

During processing of distributed data by means of XSQL Servlet, all functions that usually entail great difficulties are offered automatically:

- **Connection to database (to Oracle directly o to any database via JDBC interface);**
- **Analysis of input document (XML Parsers);**
- **SQL-queries processing by means of built-in component XSQL Page Processor and XML SQL Utility;**
- **Transformation of resulting data sets into formally correct XML-documents using XSL Transformation Processor Utility;**
- **Transformation of these formally correct XML-documents into HTML or any textual format using mechanism of styles for output (XSL Transformation Processor Utility).**

Structure of the model of information system using distributed data processing on the basis **of XSQL** Servlet is shown in figure 2.

Practical realization of dispersed data processing in heterogeneous environments on the basis of XSQL Servlet is reduced to solving the following tasks:

1. Installation (Setting up) of Web server supported by Java-Servlet;

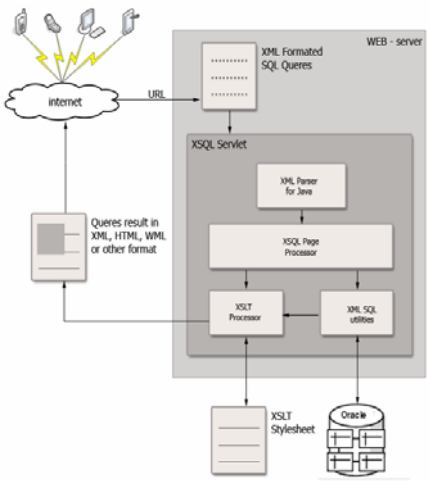

Fig. 2. Structure of the model of information system on the basis of XML & XSQL Servlet

2. Installation (Setting up) of XSQL-Servlet at Web server. Servlet is installed on any Web server, which supports Servlets and is used with any database having JDBC interface;
3. Construction of a dynamic portal by means of creating and placing three special XML documents on Web-server, which are processed by XSQL Servlet-component.

This dynamic portal comprises three special XML documents, which are processed by XSQL Servlet-component.

At the first step of the dynamic portal loading, a XML-file with .xsql XML-document extension is created comprising directives for XSQL-Servlet with regard to connection to database via JDBC interface and formation of XML-data on the basis of SQL-query or initiation of procedures saved in database, which realize business logic..

The example of file with .xsql extension forming XML-data on the basis of SQL-query is given on listing 1-a.

Listing 1-a: file **data1.** xsql

```
<?xml version="1.0"?>

<xsql:query xmlns:xsql="urn:oracle-xsql" connection="" business " >

select id,

fast_name,

from business_ participants

  </xsql:query>
```

Up-to-date complete functional network databases support mechanism of saved procedures, enabling, on the one hand, to place all business logic in database itself in the form of previously compiled saved procedures, and, on the other hand, instead of SQL-query, to apply code initiating these procedures in the file which forms output data from database. The usage of previously compiled and therefore, rapidly performed procedures in place of SQL interpreted by operator, significantly increases capacity and efficiency of information processing. The example of file with .xsql extension forming XML-data on the basis of results of a saved procedure xml_ participants **_data**_xml performance is given on listing 1-b.

Listing 1-b: file data. xsql

```
<?xml version="1.0" encoding='windows-1251'  ?>

<RESULTS xmlns:xsql="urn:oracle-xsql" connection=" business " id="1">

<xsql:include-owa>

xml_ participants _data_xml({@id});

</xsql:include-owa>

</RESULTS>
```

At the second step XML-file with .xsl extension is created, which realizes XSLT transformation of query into required format. The example of XSL-file, comprising styles table used by XSLT-processor to transform XML-data into HTML is given on listing 2:

Listing 2: file CATALOG**.**xsl,

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<CATALOG>
<CD>
<TITLE>Heading 1</TITLE>
```

```
< PARTICIPANT > PARTICIPANT 1</ PARTICIPANT >
<COUNTRY>XX1</COUNTRY>
<PRICE>10.90</PRICE>
</CD>
. . .
<CD>
<TITLE> Heading  26</TITLE>
< PARTICIPANT > PARTICIPANT 26</ PARTICIPANT >
<COUNTRY>XX26</COUNTRY>
<PRICE>8.20</PRICE>
</CD>
</CATALOG>
```

At the last step, on the basis of the data resulting from these two files created before, input XSQL-page is formed (XML-file with .xsql extension). On this page, by means of a reference, a scenario connecting to database and SQL-query processing is called, as well as Servlet is informed about necessity to apply XSL-transformation according to styles table instructions. The example of input XSQL-file, containing the styles table reference and the reference to the file, which generate output XML-data, is given on listing 3.

Listing 3.

```
<?xml version="1.0" encoding='windows-1251' ?>
<?xml-stylesheet type="text/xsl" href=" CATALOG.xsl"?>
<xsql:include-xsql href=" data.xsql." xmlns:xsql="urn:oracle-xsql"/>
```

Operating Oracle database allows constructing specialized XML-pages using Oracle XSQL Pages program product. This program product allows developing user's application without programming almost in all situations. XSQL Pages is a set of standard templates, which allows to automatically collect dynamic pages with data resulting from queries, as well as to transform these pages obtaining the final result in XML, HTML or other format required.

Once an input XSQL-page has been created and loaded in the WEB-server, there is a possibility of sending queries via Internet or Intranet from browser using URL-address.

A procedure of data processing in information system on the basis of XML & XSQL Servlet is the following:

- **User initiates input page from a terminal device;**
- **Input XSQL-file is transmitted to XSQL Servlet for it's processing; Servlet tools provide XSQL- Page Processor with access to the contents of the document;**
- **XSQL Page Processor forms SQL-query and sends it to XML SQL Utility;**
- **SQL Utility sends SQL-query to database;**
- **Database server returns the resulting set of data to XML SQL Utility component, which transmits the results of the query to XSLT-processor;**
- **XSLT-processor transforms data obtained into any format designed by XSLT-processor's style; the user which has made an initial URL-query, can apply various styles at his own choice;**
- **XSLT-processor returns the formed document to the browser, which represents it to the user.**

Conclusions

- Using XML & XSQL Servlet linked technologies to create systems for dispersed data processing enables to automatically realize XML and Java great potential, leaving behind the scene the details and particulars both of XML and Java;
- A practical realization of the model minimizes requirements with regard to the level of knowledge in the specialty of programming, which will allow enlisting services of experienced technologists who are not professional programmers, to develop adaptive systems of decision-making support in the sphere of the management of technological processes;
- When elaborating corporate WEB-oriented information systems on the basis of the above model, XML & Java highly intellectual technologies become really accessible to specialists technologists that are not professional programmers.
- The model of information system on the basis of XML & XSQL Servlet, which realizes universal mechanisms of exchange of information resources in heterogeneous environment, is advisable to use for decision-making support in transport logistics.

References

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Sergejeva L. Informācijas sistēmas modelis lēmumu pieņemšanas atbalstam transporta loģistikā
Apskatīti universālo mehānismu formēšanas metodoloģiskie un praktiskie aspekti, lai apmainītos ar korporatīvajiem informācijas resursiem, izmantojot programmas produkta XSQL Servlet iespējas. Piedāvāts dinamisks sadalīto datu apstrādes modelis heterogēnā informācijas vidē, izmantojot tehnoloģiju XML& XSQL Servlet saiti, kas ir ideāla platforma heterogēno informācijas resursu integrācijai vienotā informācijas telpā.

Sergeyeva L. Model of information system for support of decision-making in logistics
Methodological and practical aspects of universal mechanisms of corporate information resources exchange using XSQL Servlet program product's possibilities are considered. A dynamic model of dispersed data processing in heterogeneous information environment on the basis of XML & XSQL Servlet linked technologies, which is an ideal platform to integrate heterogeneous information resources into unified information environment, is offered.

Сергеева Л. Модель информационной системы для поддержки принятия решений в транспортной логистике
Рассмотрены методологические и практические аспекты формирования универсальных механизмов обмена корпоративными информационными ресурсами с использованием возможностей программного продукта XSQL Servlet. Предложена динамическая модель обработки распределенных данных в гетерогенной информационной среде на основе использования связки технологий XML & XSQL Servlet, представляющей собой идеальную платформу для интеграции гетерогенных информационных ресурсов в единое информационное пространство