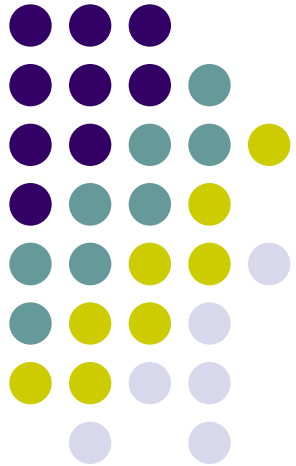
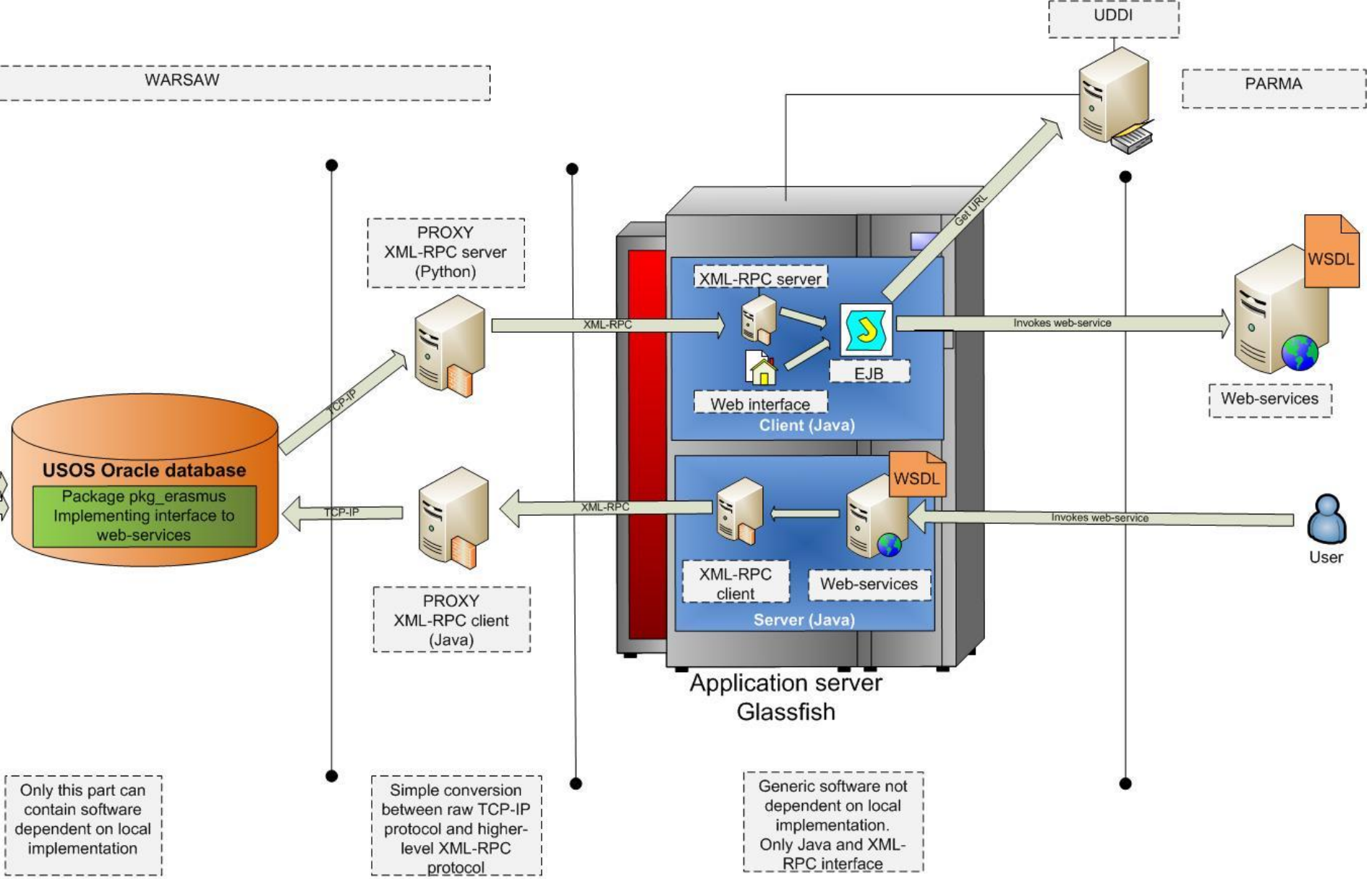
The Bologna Project

Technical Architecture

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(Python)
XML-RPC server
Get URL
XML-RPC
EJB
Invokes web-service
WSDL
Web interface
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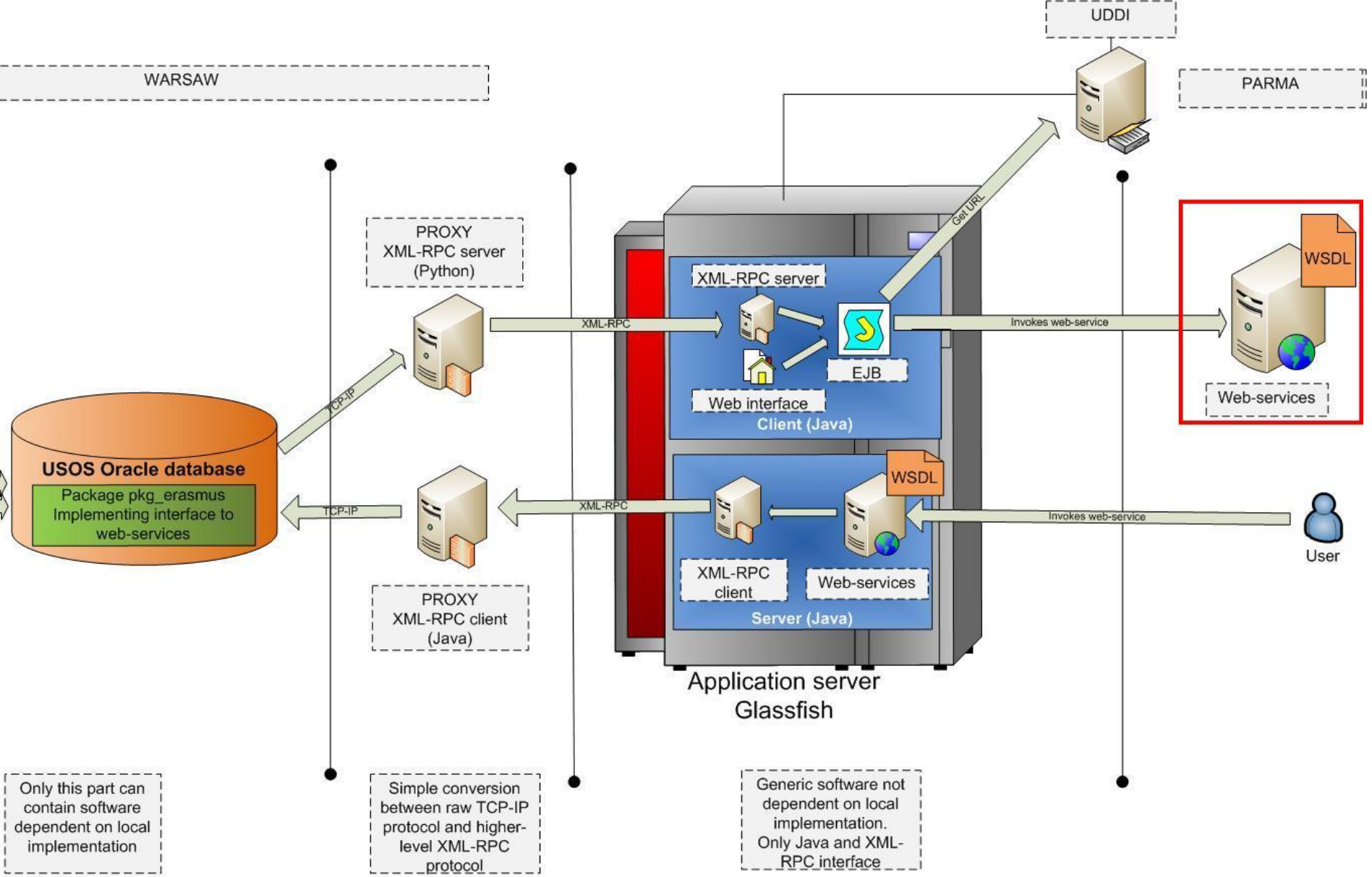
Simple conversion between raw TCP-IP protocol and higher-level XML-RPC protocol
Generic software not dependent on local implementation. Only Java and XML-RPC interface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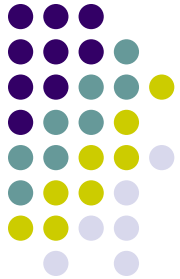
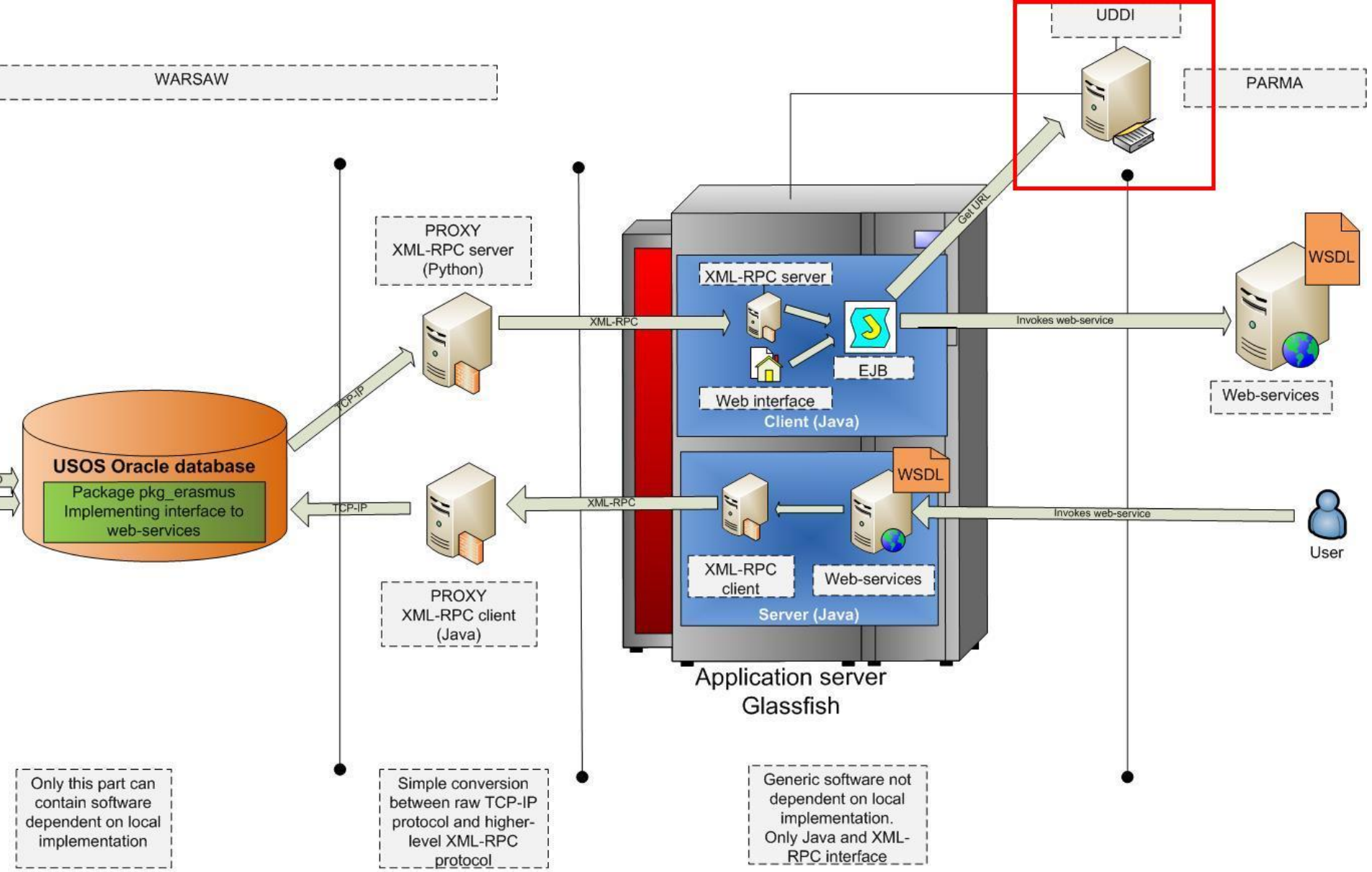
Web Services (WSDL)



- Web Service Description Language
  - Specifies data types (e.g. grade, level of studies) and data structures (e.g. personal data, list of nominated students) that are used for communication
    - This specification can be used for data validation
  - Defines messages (built from previously defined data structures) that are used in methods
    - Pair of services for acquiring and publishing information about HEI's, HEI agreements, courses, students (personal data, courses, grades, arrival and departure dates)
    - Services for inquiring courses list and validating students ID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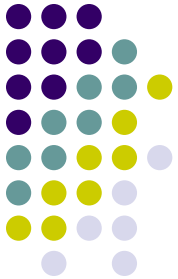
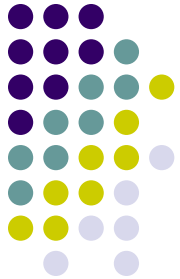
UDDI registry

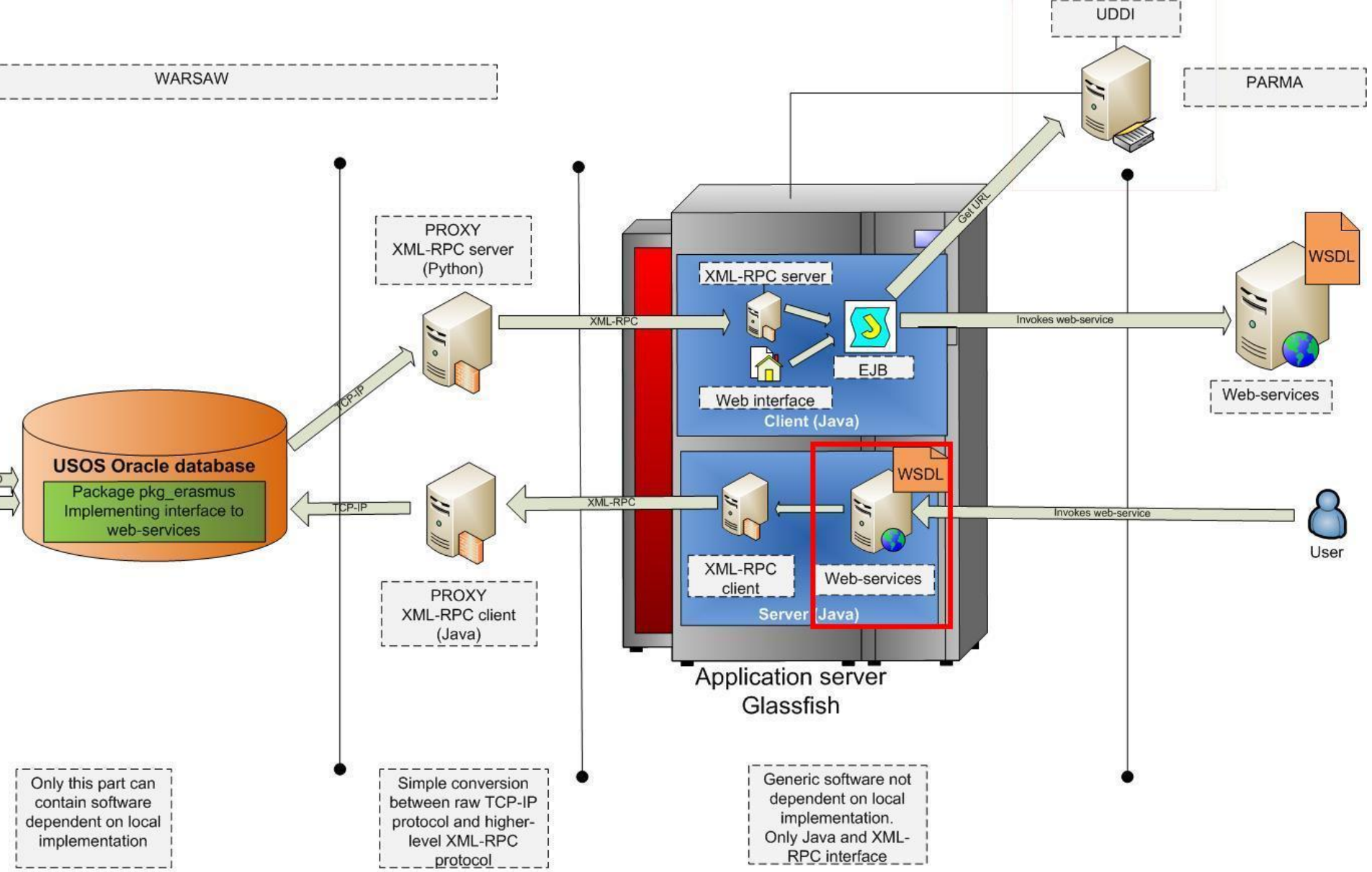


- **Universal Description Discovery and Integration**
  - Registers universities and their WebService servers (points to WSDL with service location)
    - Search by HEI code or list all universities
  - Registry is modified after simple authorization
  - Technology: JUDDI 2.0 rc5
    - Open source java servlet application
    - Requirements: any database, servlet container

UDDI registry (JAXR)



- **Java API for XML Registries**
  - Uniform way to use business registries that are based on open standards (such as ebXML) or industry consortium-led specifications (UDDI)
  - JAXR API is included in JEE5-compliant application servers (for example Glassfish)
  - The choice of the XML registry does not affect the application as it is using only the basic JAXR API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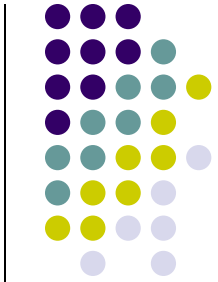
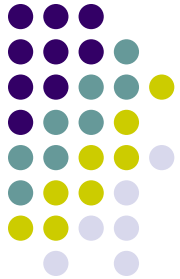
WebService Server



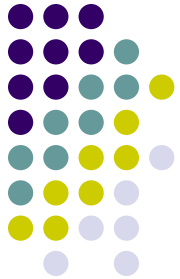
- Implements services described in the WSDL
  - Responds by acquiring appropriate data (in case of get… methods) or stores received data
  - Generic JEE5 enterprise application
    - WebService API is generated from WSDL by wsimport tool as JAX-WS application (Java API for XML-Based Web Services) – top-down approach
      - Generates JAXB annotated beans (Java Architecture for XML Binding) – enables conversion between java classes used in the server application and xml representation

WebService Server (Metro)



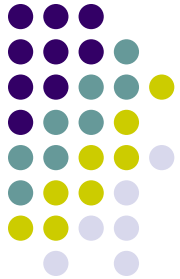
- Java classes correspond to data structures and messages defined in the WSDL
- Generated service endpoint bean defines a webservice on the web application server
  - Metro (open source webservice framework) is part of the Glassfish Application Server (v2.2) but also JBoss, Sun AS, Oracle WebLogic

WebService Server (DAO)

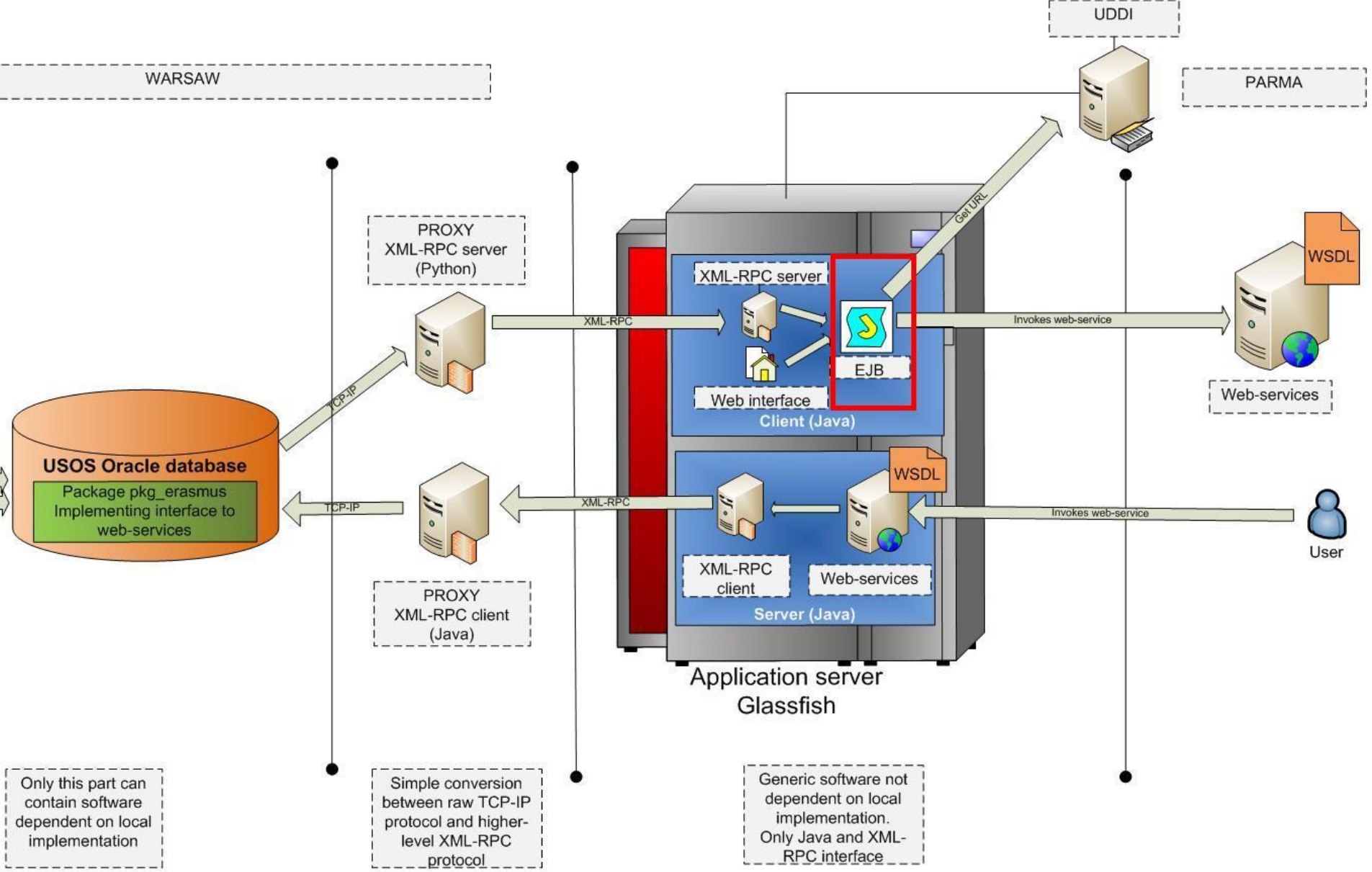


- Every pair of methods corresponds to a java bean that enables access to required data (data access object) for preparing response or storing data specific to the chosen method
  - There is only one API for DAO beans
  - The implementation can be therefore added by writing new bean and updating the configuration xml file (DAO beans are injected using Spring)
  - The basic DAO loads data as a java class xml representation from a appropriate file on the disk

WebService Server (Log)



- All received data is stored in the server logs and added to an array in the server memory (this part does not recover after shutdown)
- The data logged in the memory can be viewed on a server web page
  - The data is logged as a xml representation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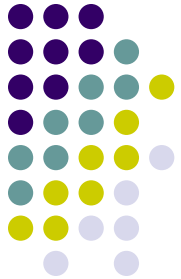
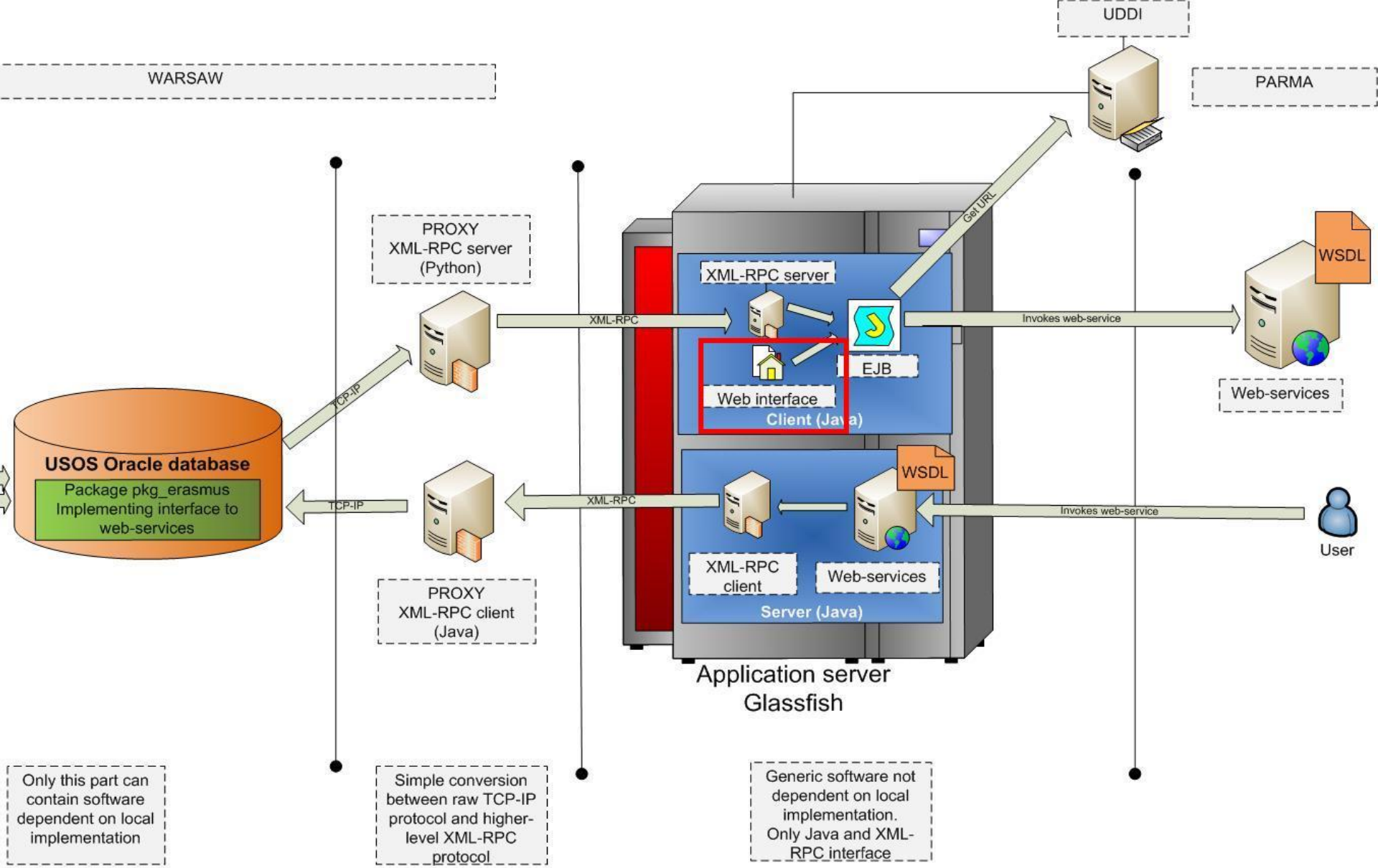
WebService Client



- Java beans responsible for finding the appropriate webservice server (searching by receiver's HEI code) and calling its service
- Can be used by any application to convert simple method invocation to a webservice request (e.g. proxy server, web client)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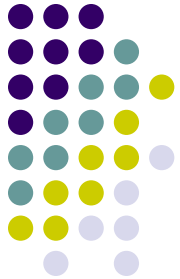
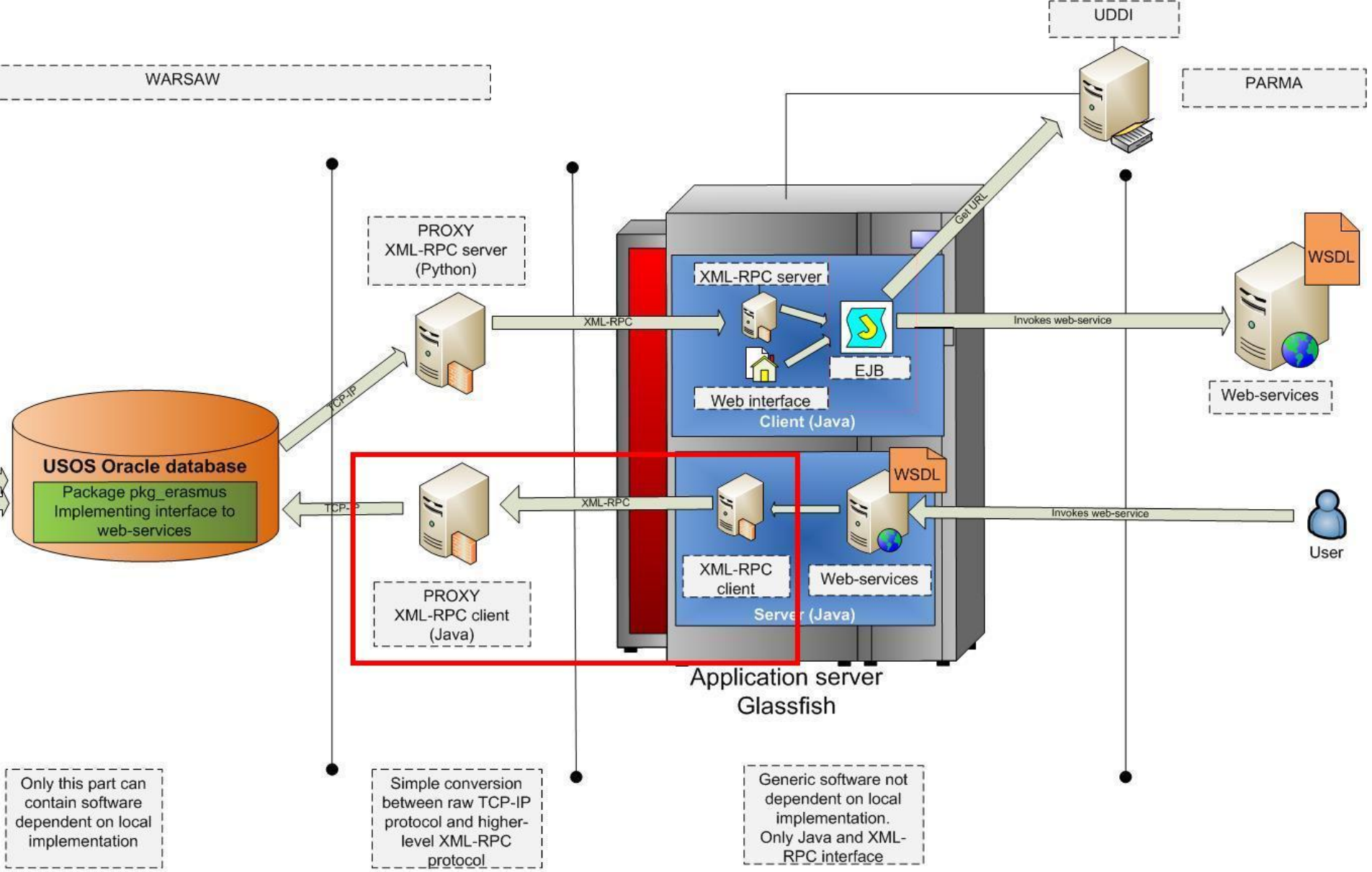
Web Client



- JSF (Java Server Faces) web application
  - IceFaces and Ajax enable to write reponse data and error messages without refreshing the whole page
- Choose the appropriate method from a list and the universities that act as the caller and the receiver
- The complex data is presented in a clear tabular form and can be modified
- The input data is loaded from xml test files depending on the choice of both universities
  - It can than be modified before being send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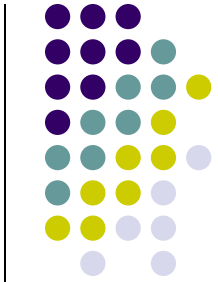
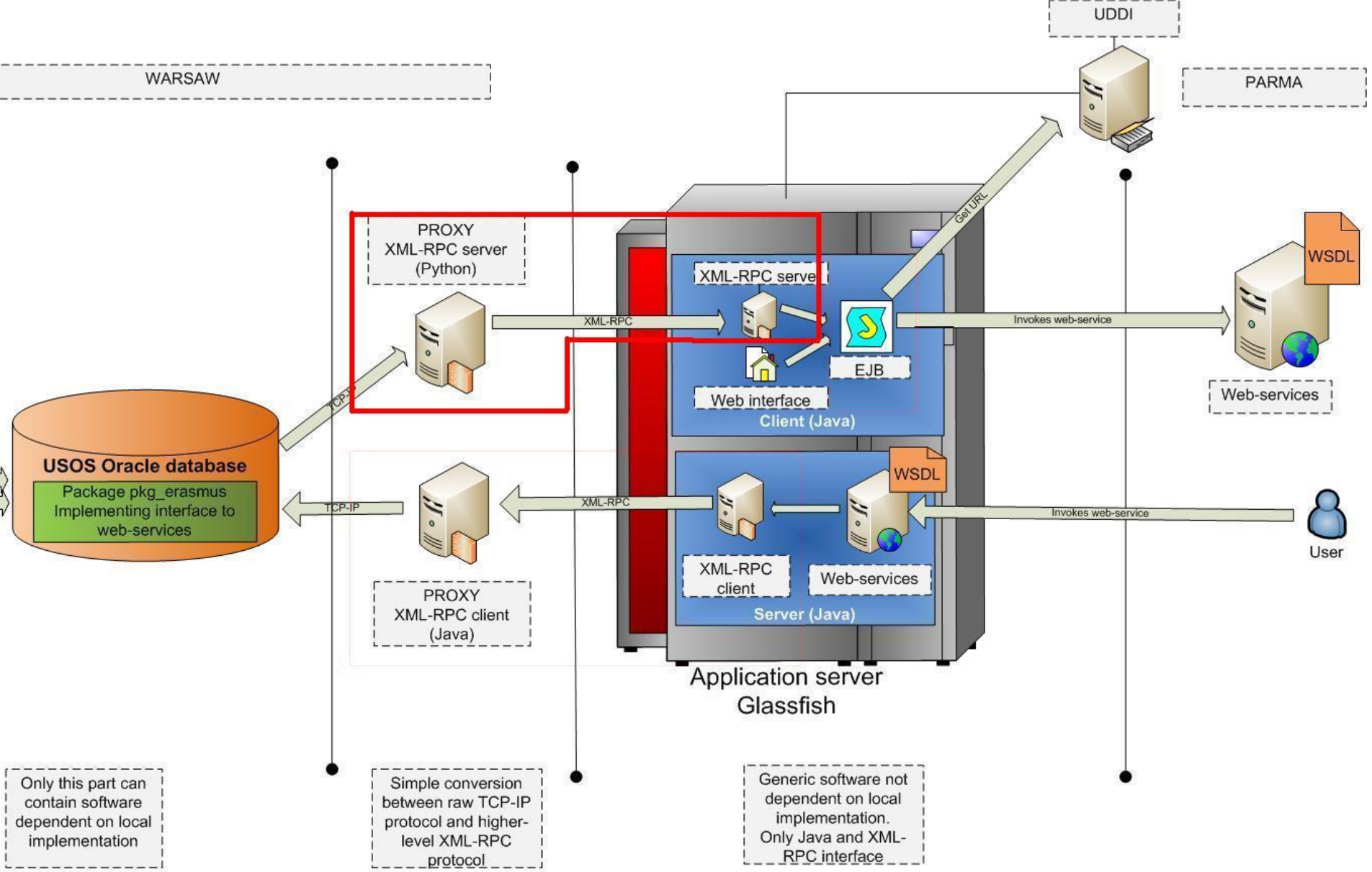
Proxy Client (Java)



- The proxy allows access to database packages that implement the business logic (collect data for a response or store the data in a queuing table)
- The output data from the database procedures is send over XML-RPC and converted to a java class on the server side
  - XML-RPC allows simple types, maps and arrays
  - Other solution is to send a xml-encoded object (in case of received data, it can be stored directly)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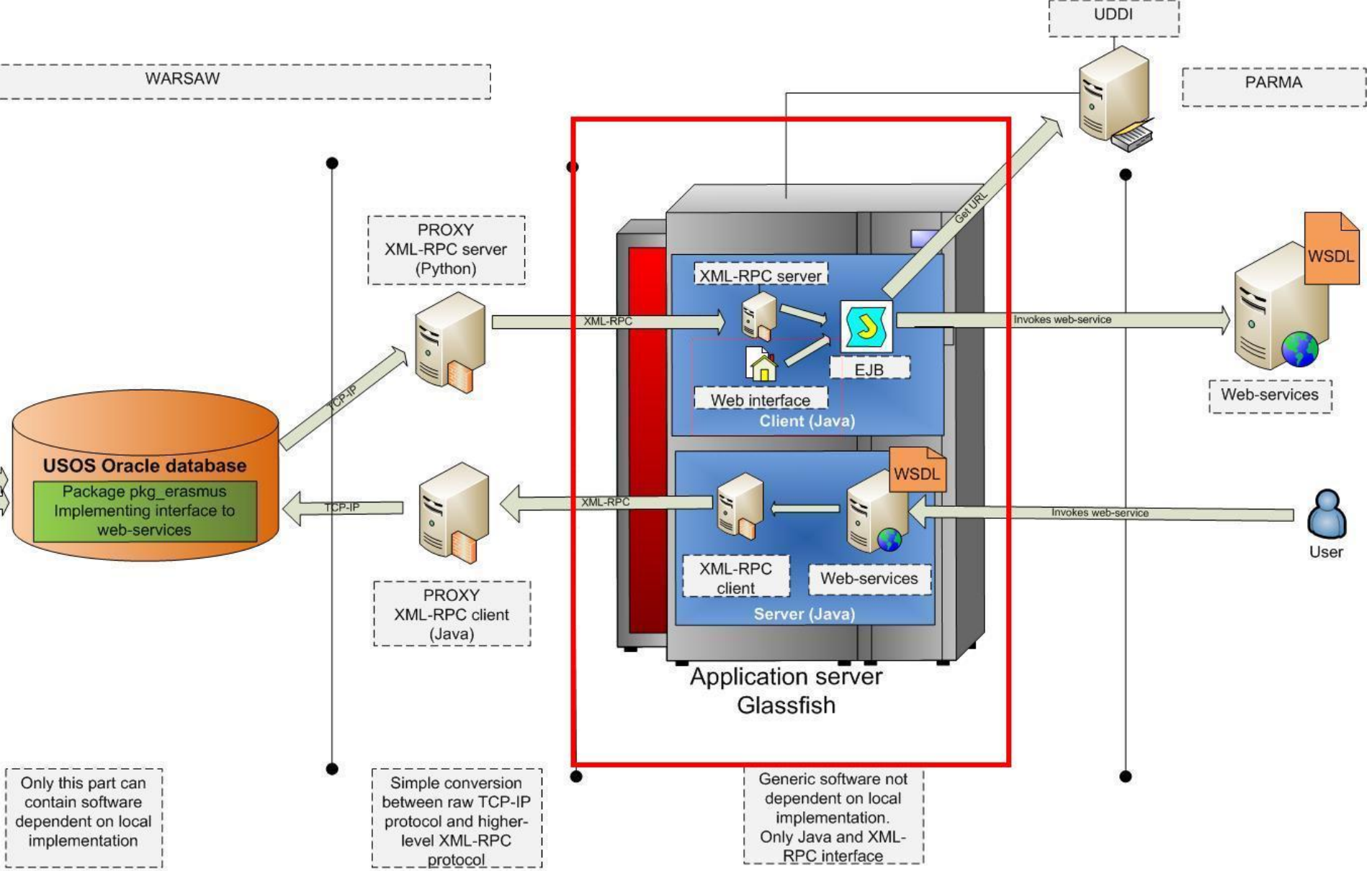
Proxy Server (Python)

- Simple TCP calls from the database forms are being converted to higher level XML-RPC calls (that can easily by processed by the XML-RPC server that is connected to the webservice client application)
- The proxy translates a xml representation of the data into a XML-RPC structured form
- That structured data is than converted to a java class that is used by the webservice client (and by all java applications)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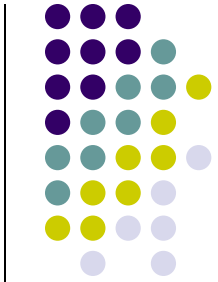
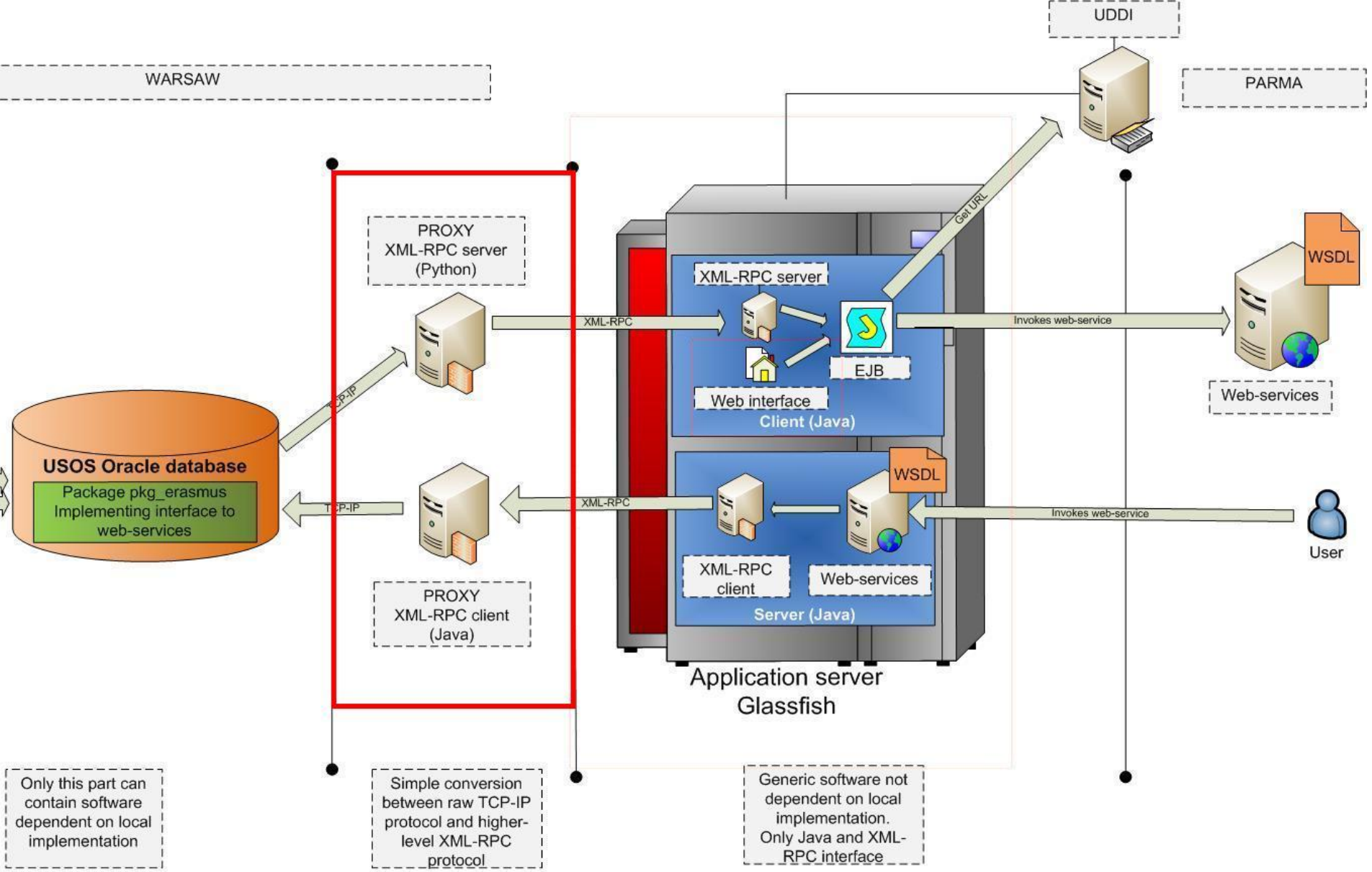
Generic implementation



- The webservice server and client are JEE5 enterprise applications that can be deployed on any JEE5-compliant application server
  - They act as a generic API that translates java bean method call to webservice invocation
  - The part that depends on the technology used in on the specific university (the data access) is managed through java beans that can be easily added as the server DAO (in place of the XML-RPC client/proxy used in this implementation)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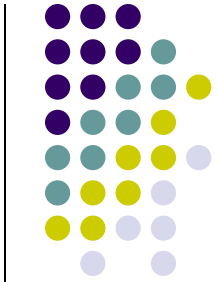

- The access to the database is controlled and limited by routing all data queries through a proxy (over simple XML-RPC protocol)
  - That way only the proxy has rights to execute database packages
  - The application access control is managed by filtering the machines that can call the specified proxy methods
  - The applications are independent of the database configuration so administration is much easier

Discussion

- Thank you for your attention.
- Questions?