SERVICE-ORIENTED ARCHITECTURES WITH WEB SERVICES' DEPLOYMENT

NIKOLAI ZAKHARCHENKO

Odessa Academy of Telecommunications

ANDRIY LUNTOVSKYY

Dresden University of Coop. Education

Annotation. *Service-oriented architectures (SOA) based on Web Services (WS) are examined. The technology can deploy multiple available platforms but there is still the following important problem-triad: performance-security-implementation complexity. The extensions WS-*, RESTful WS, which can the presented problems solve as well as up-to-date research fields are discussed.*

Аннотация: *Рассматриваются сервис-ориентированные архитектуры (SOA) на основе Web-сервисов (WS). Технология позволяет развернуть несколько доступных платформ, но есть еще следующие важные проблемы-триады: производительность-безопасность-сложность реализации. Представлены и обсуждаются расширения WS-*, RESTful WS, которые могут решить эти проблемы.*

INTRODUCTION

Since decennia deals the advanced information-telecommunication networks with installed inside of them distributed systems realizing the concepts of EAI (Enterprise Application Integration) and B2B (Business-to-Business). There is a lot of well-known for their developers technologies like CORBA, J2EE etc. offer but only partial solutions of the both imperatives. The attempt to create an overview what it the SOA is indeed carries out to some antagonisms and blurring [1-3].

I. A CLEAN SOA DEFINITION

SOA is not based only on the single specification like CORBA or EJB, otherwise SOA relies on the lot of independent specifications (Fig. 1) of the forums W3C, OASIS and IETF like UDDI, SOAP (XML-RPC), WSDL etc.
1. The clean definition might be as follows:
2. Web Services are based on a Service Oriented Architecture. Time and costs factors as well as complexity of EAI projects in KLOC (kilo-lines of code) can be reduced via deployment of a SOA significantly. But use of Web Services don't lead mandatory to a SOA.
3. Similarly there are no "SOA pure", SOA offers conformity to existing middleware platforms and application servers. Among them are Apache AXIS, Jakarta Tomcat, Novell Mono, MS. NET, SAP Web Application Server and NetWeaver, Java Web Services Development Pack, Oracle Application Server, IBM WebSphere, DotGnu, BEA WebLogic, Macromedia ColdFusion, Cordys WS-AppServer etc. They delivery extensive and wide-spread inter-operability [1-3].
4. The mostly important novelties for SOA are established via existing Web Service-Standards.
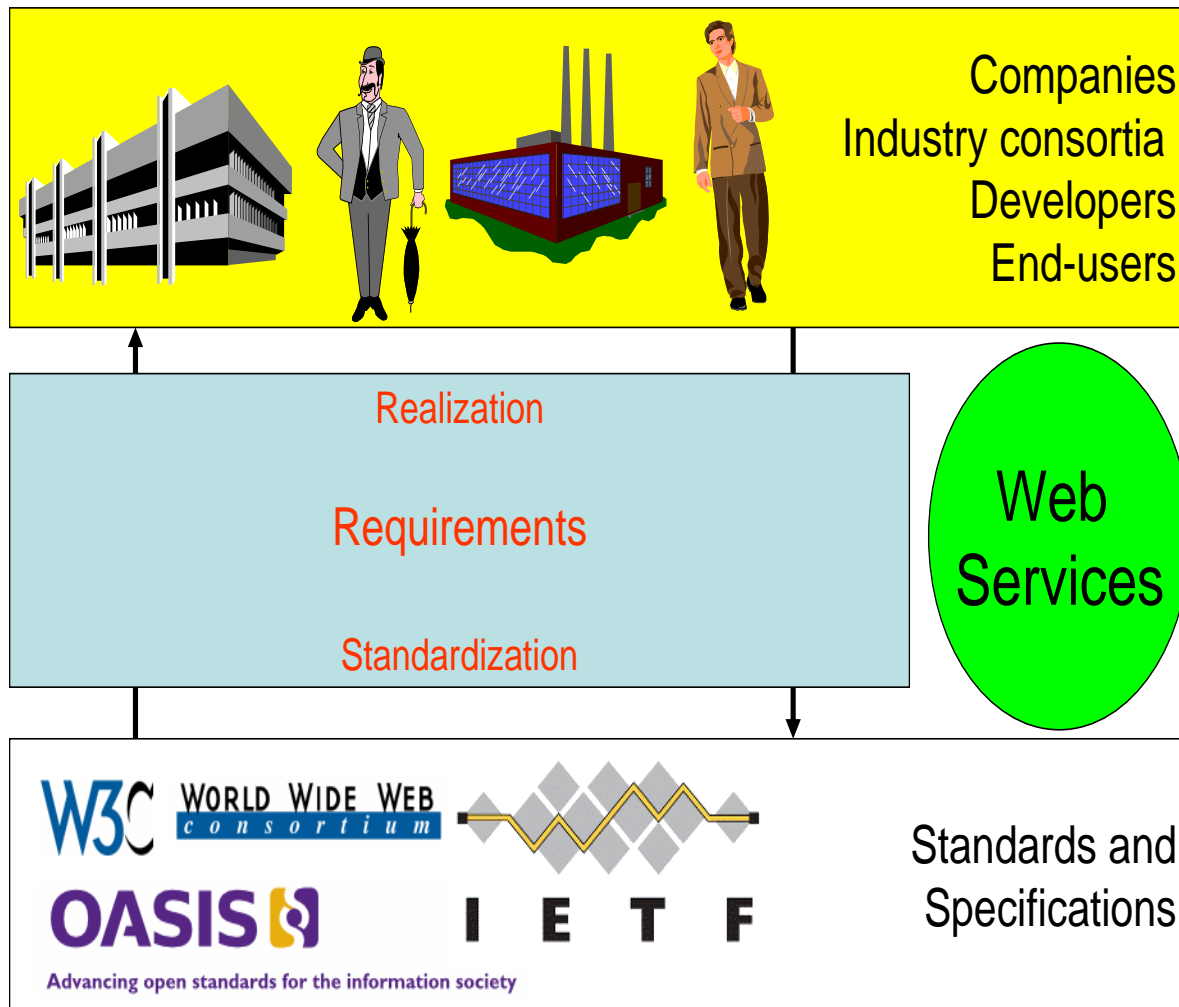
Figure 1 - SOA development trends

II. SOA ADVANTAGES AND PROBLEMS

SOA based on Web Services possess the following profitable advantages:
1. Web Services offer spread platform intendancy for EAI and B2B solutions.
2. Web Services use open standards and protocols, their expressiveness is recently simplified due to XML-deployment.
3. Use of HTTP 1.1 and advanced interaction models AJAX, COMET facilitates B2B-intercommunication through the company firewalls.

Nevertheless as the disadvantages correspondingly the recent problems act as follows:
1. The mostly important complication by deployment of SOA on Web Services relies to security aspects. The transport of Web Services into the intranet area has to be definitively authenticated

and encrypted. The HTTPS vs. XML-Signature and XML-Encryption can be as possible options discussed.

2. The next one is the performance that is considerable and negatively affected via significant overhead contained in multiple XML-descriptions, as well as via parsing of long XML-documents.

3. The further problem is management of available Web Services with specified QoS and gain of required programming know-how for SOA deployment (e.g. DOM-XML processing).

III. THE EXTENSIONS, ALTERNATIVES AND RESEARCH FIELDS

The outlined problems can be solved via the newly elaborated extensions of Web Services, so called RESTful WS and WS-* (Fig. 2). The extensions WS-* use the basis components and built the efficient service-oriented applications on classical Web, Semantic Web and Web 2.0 [6-11]: reliability, security, messaging, semantics, transactions and co-ordination can be achieved.

- Reliability
  - WS-Addressing, WS-Reliability, WS-Message Delivery
- Messaging
  - WS-Eventing, WS-Notification
- Security
  - WS-Security, WS-Trust, WS-Privacy, WS-Federation, SAML (Security Assertion Markup Language)
- Transaction, Co-ordination, Context
  - WS-Transactions, WS-CAF (Composite Application Framework)
- Semantic Web Services
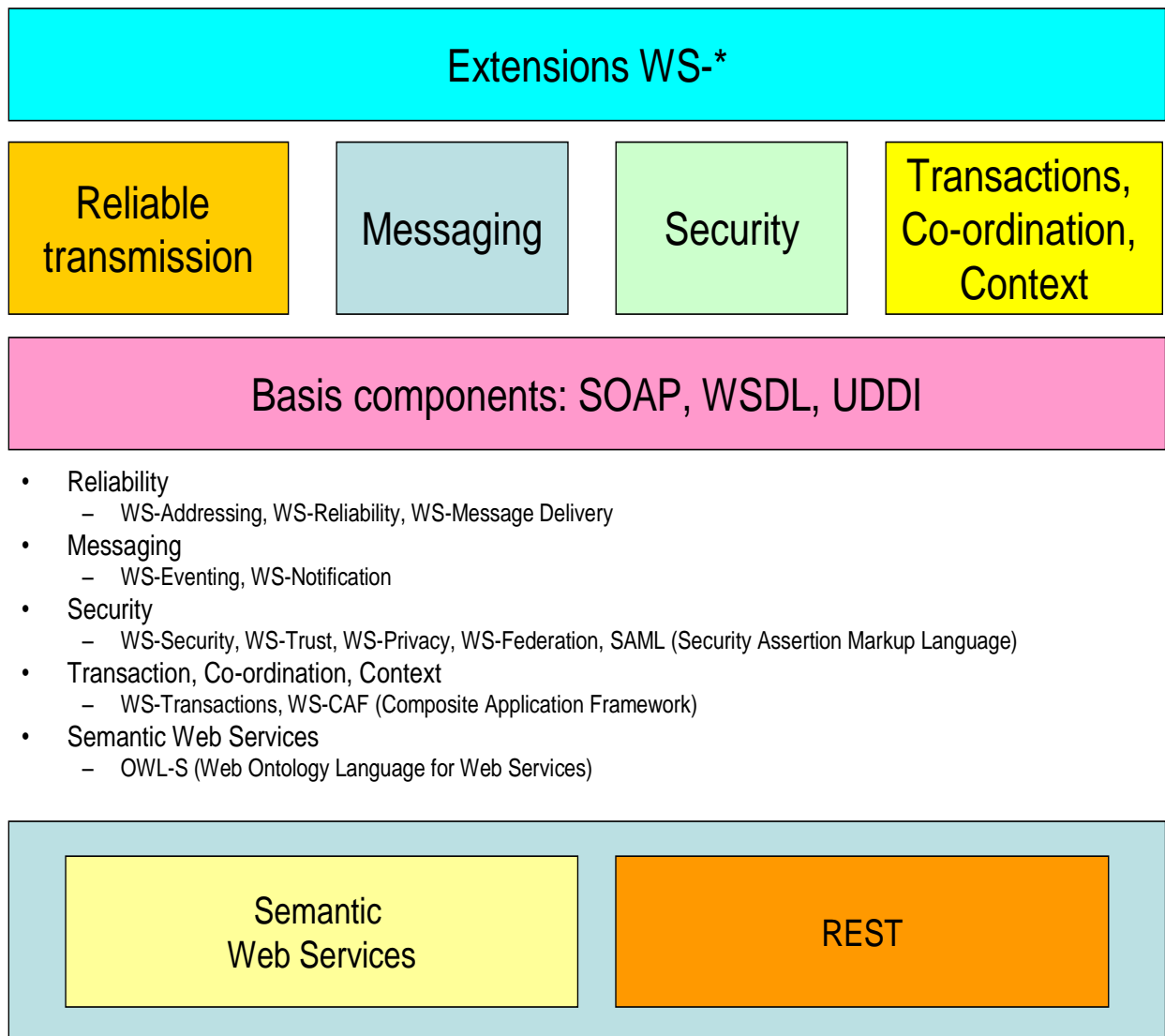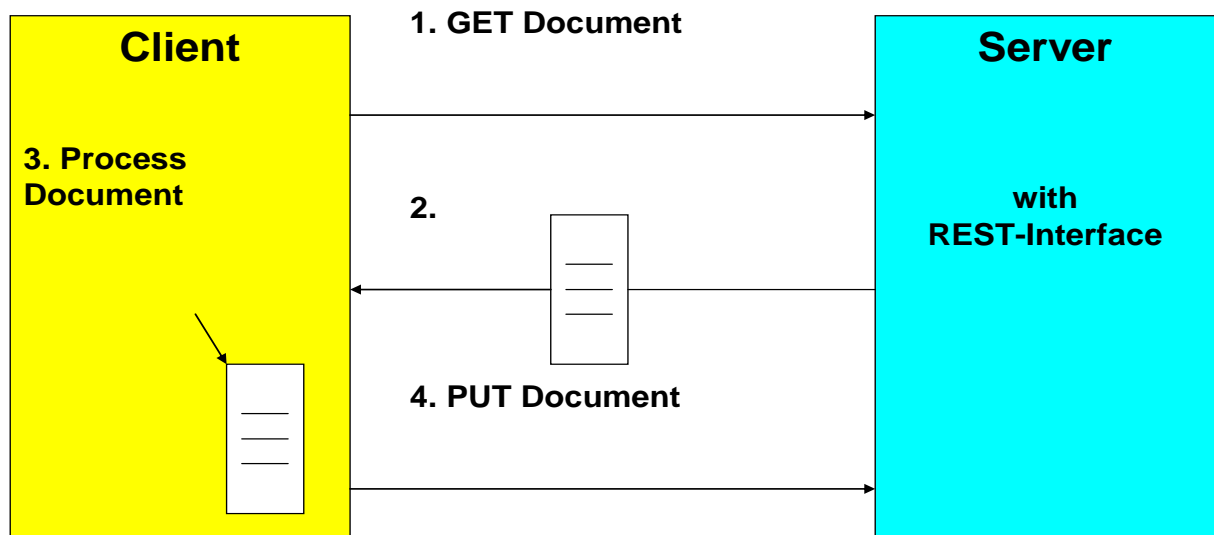 - OWL-S (Web Ontology Language for Web Services)

Figure 2 - Extensions WS-* and alternatives

Based on the REST-model (Fig. 3) performance can be recently increased. RESTful Web Services are based on REST, Representational State Transfer, offered by R. Fielding in 2000 [4]. RESTful Web Services act in some measure as an antagonism regarding to SOAP and XML-RPC. Such Web Services themselves and on them based further applications can be described accordingly to mentioned architecture style only via URIs and HTTP v1.1.

The RESTful Web Services are stateless, contain necessary context themselves and are operated only via simple {GET, PUT, POST, DELETE} - functionality. Such sparingness [4, 5] lets more consistency by use of established W3C-standards; the SOA performance is increased but nevertheless for account of flexibility decreasing.

```
       Client                1. GET Document              Server

  3. Process                                                with
  Document                         2.                   REST-Interface


                              4. PUT Document
```

- Distinguishing features:
  - no RPC
  - direct requests on resources and documents (URI)
  - use of a generic interface
  - standard semantics
  - stateless communication protocol

Figure 3 - Representational State Transfer

Furthermore the area Semantic WS is completely addressed via extensions of SOA per semantics (RDF, RDFS, OWL-S, SPARQL), which the "Discovery-Selection-Invocation"-triple realizes together with main ideas of Semantic Web and Web 2.0. As each new technology [6, 7], they had its period of hype, when a lot of such services and applications appeared. However, the large wave has gradually declined due to the saturation of market and user interests. This means that the new start-ups in Semantic Web and Web 2.0 should plan their activity as well as business models very thoroughly.

CONCLUSIONS

Contemporary SOA-concepts are mostly focused on EAI and B2B surround. However mapping of business processes as well as services orchestration and composition (e. g. via WS-BPEL) is still inelastic and associated with higher developer-site complexity. Therefore elaboration of new concepts is

an imperative. The concepts have to include not only new marketable ideas, but also the analysis of costs and benefits. Among them the following research and development fields might be mentioned [10, 11]:

1. Ad-hoc-use of Web Services in flexible B2C-area.
2. Dynamic composition of service complexes on modern service market places and malls.
3. SLA (Service Level Agreement) negotiation functionality between user and provider (in flexible B2C-area).
4. RESTful Network Management applications on SNMP overriding intra- and extranet [8, 9].
5. And the last but least: creation of a dedicated SOA-specification (Fig. 4).
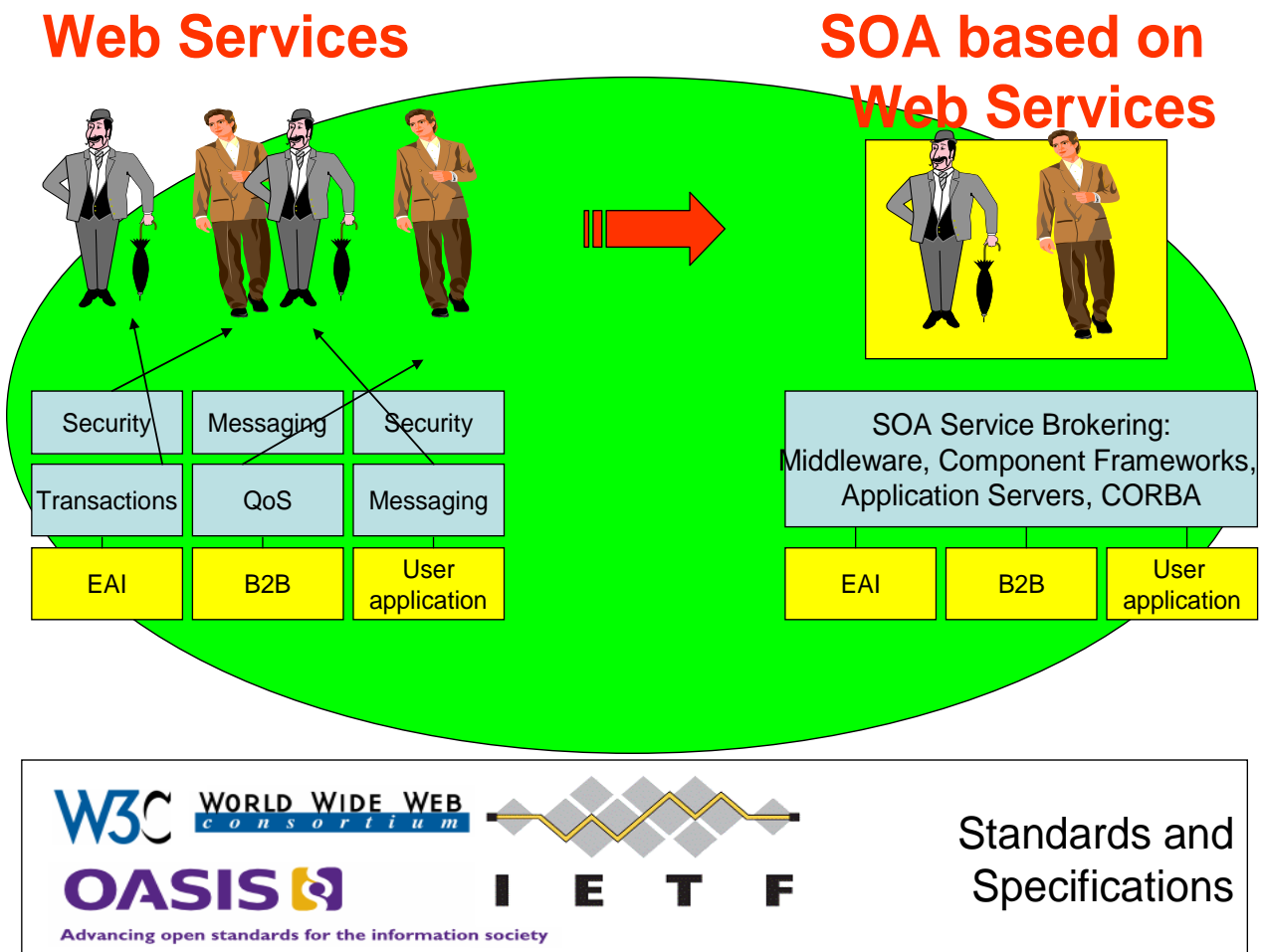

Figure 4 - Towards a dedicated SOA-specification

So, some companies have been incorporated aimed to the further standardization and creation of a SOA-Blueprint [12] that illustrates exemplarily implementation of a SOA for an imaginary company titled GeneriCo (Fig. 5).
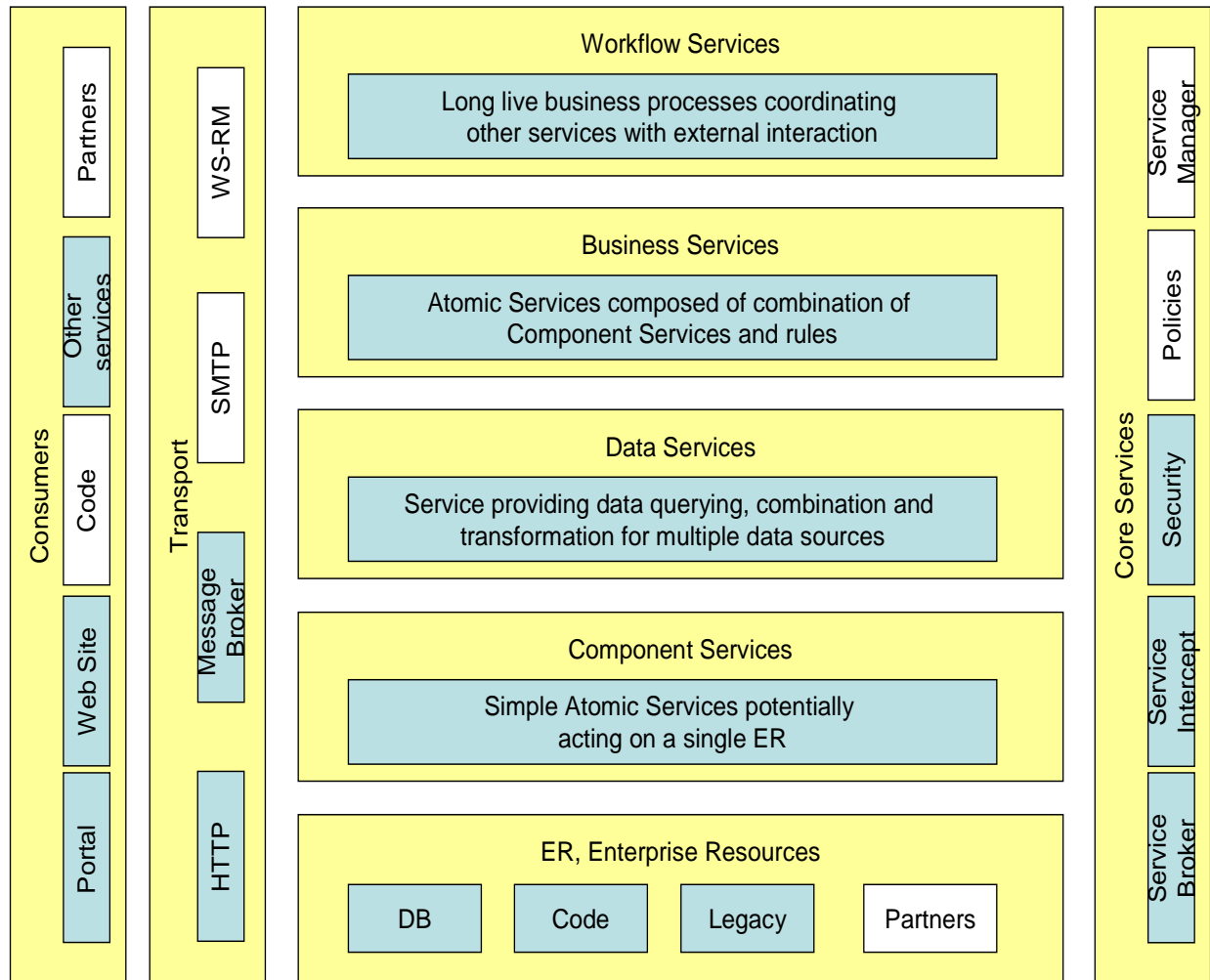
Figure 5 - A SOA-Blueprint

With the mentioned initiative the following goals become really reachable:

- Firstly, a collection of "best practises" has to be built, which can be operated by each suitor in own the best way.
- Secondly, the software vendors can demonstrate via this exemplarily implementations of this „best practises", how their products are usable for SOA-constructions.
- The essential constituents of the SOA-Blueprint are fine-granularly functionalities beginning by e.g. authentication up to important planning of Human Resources (HR).

LINKS

1. Schill, T. Springer. Verteilte Systeme - Grundlagen und Basistechnologien; Springer-Verlag Berlin Heidelberg 2007, ISBN: 978-3-540-20568-5, eXamen.press (in German)
2. R. Oechsle. Verteilte Systeme und Entwicklung verteilter Anwendungen, s. 405-443, 6.Auflage, Hanser Verlag, 2007 (in German)
3. M. Papazoglou. Web Services: Principles and Technology. Prentice Hall, Essex 2007
4. R. Fielding. Architectural Styles and the Design of Network-based Software Architectures, Thesis, 2000
5. L. Richardson, S. Ruby. Web Services mit REST, O'Reilly, Köln 2007 (in German)

6.   Luntovskyy, S. Uhlig. Web Application Security: Technological and Legal Aspects, in Magazine "Electronics and Communication" at NTUU KPI accredited by Superior Attestation Commission of Ukraine "VAK Ukraine", Issue 1 (48), 2009, pp. 67-75

7.   Luntovskyy, M. Feldmann, V. Vasyutynskyy. A Semantic Web Application for Coordination of Combined Networks Design; IEEE CriMiCo Conference, Sevastopol, 8-12 Sept. 2008, paper ID=122, pp.364-367 (ISBN: 978-966-335-166-7) (IEEE Xplore)

8.   Luntovskyy, M. Feldmann, A. Schill. Web Services based Network Management, Magazine "Electronics and Communication", Ukraine, XXVIII Int. Conference - Problems of Electronics, Kiev, April, 15-17, 2008, Special Issue "Problems of Electronics", Vol.1, pp.176-184

9.   Luntovskyy, S. Uhlig, M. Feldmann. Network Management Architectures; 4th International Conference for Modern Information and Telecommunication Technologies COMINFO-2008 Crimea, Livadia (Yalta), 15-19. Sept. 2008 (published in special issue of Magazine "Bulletin DUIKT" Ukraine), pp. 19-21

10.   Luntovskyy, V. Vasyutynskyy, A. Schill. Quantitative Models for Web 2.0 Systems, Int. Conference ACS-2009, Szczecin, Poland, 16-18 October 2009, published in Polish Journal of Environmental Studies, ID=021

11.   Luntovskyy, V. Vasyutynskyy. Modeling Web 2.0 Systems in Scientific Subject Magazine "Electronics and Communication" at NTUU KPI accredited by Superior Attestation Commission of Ukraine "VAK Ukraine", Issue 2 (49), 2009 (in publishing)

12.   The Middleware Company. SOA Blueprints Initiative Definition (Online 2009): http://www.middlewareresearch.com