

BIBSYS Ask – the architecture

Hans Olaf Gundersen, BIBSYS

BIBSYS Ask - the architecture

- Federated search client
- Built for the Internet
- Focus: easy access to the content
- Aspect oriented search functionality

BIBSYS Ask - the architecture

- Uses key technologies:
 - Domain model
 - RESTful web services
 - JSP (JAVA server pages)
 - Javascript and AJAX client side in users WEB-browser

Domain Model

- Identifies the relationships among all major entities within the system
- Consists of objects with reasonable responsibilities - the domain objects.
- Must be able to complete all tasks for the applications using them.
- The naming of the objects and usage of them should correspond with your business to make it understandable and easy to use and avoid confusion.

For more information, see http://en.wikipedia.org/wiki/Domain_model

RESTful web services

Also called a RESTful web API

- Simple web service implemented using HTTP and the principles of REST
- Collection of resources, with three defined aspects:
 - the base URI for the web service, such as `http://example.com/resources/`
 - the MIME type of the data supported by the web service. This is often JSON, XML or YAML but can be any other valid MIME type.
 - the set of operations supported by the web service using HTTP methods (e.g., POST, GET, PUT or DELETE).

For more information, see: http://en.wikipedia.org/wiki/Restful_web_service

We implement serverside RESTful services as JSP-services

```
<%@page import="java.util.ArrayList"%>
<%@page import="com.thoughtworks.xstream.XStream"%>
<%@page import="com.thoughtworks.xstream.io.json.JsonHierarchicalStreamDriver"%>
<%
//This is a super simple example of a JSON Service
//Defining an inner class to populate with data
class Car {
    private String color="None";
    private int numberOfWorks=4;
    private String brand="Unknown";
    public Car(String _color,int _numberOfWorks,String _brand) {
        color = _color; numberOfWorks = _numberOfWorks; brand = _brand;
    }
}
//Creating a list to put the "Car"-objects into
ArrayList carList = new ArrayList();
//Adding "Car"-objects
carList.add(new Car("Red",6,"Ford")); carList.add(new Car("Yellow",4,"Volvo"));
carList.add(new Car("Blue",4,"Toyota"));

//Using XStream to automatically serializing
XStream xstream = new XStream(new JsonHierarchicalStreamDriver());
String json = (xstream.toXML(carList));

//Setting proper content type and encoding before responding...
response.setContentType("application/json;charset=utf-8");
%><%=json%>
```

Response from server running the JSP-service

```
{"list": [
  {
    "color": "Red",
    "numberOfWheels": 6,
    "brand": "Ford",
    "outer-class": {}
  },
  {
    "color": "Yellow",
    "numberOfWheels": 4,
    "brand": "Volvo",
    "outer-class": {
      "@reference": "../../org.apache.jsp.json.example_005fservice_jsp$1$Car/outer-class"
    }
  },
  {
    "color": "Blue",
    "numberOfWheels": 4,
    "brand": "Toyota",
    "outer-class": {
      "@reference": "../../org.apache.jsp.json.example_005fservice_jsp$1$Car/outer-class"
    }
  }
]}
```

Client code running in users web browser – using AJAX

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8"/>
    <script type="text/javascript" src="/ask2/js/prototype_1_6_1_rc2.js" charset="utf-8"></script>
    <script type="text/javascript">
        function init(_event) {
            //Locating an object in the DOM structure
            var target = $('#target');

            //Setting a status message
            target.appendChild(new Element('li').update("Sending request..."));

            //Creating a request to the example service
            new Ajax.Updater(target,'/ask2/json/example_service.jsp',{
                evalJSON:true,
                method:'get',
                insertion: function(_target,_response) {
                    //Clearing status message...
                    _target.update("");

                    //Parsing the response
                    var dataList = _response.evalJSON().list;
                    //Iterate through every item in the response
                    for (var i=0, data; data = dataList[i]; i++) {

                        //Creating a DOM-object and presenting it
                        var resultItem = new Element('li').update("A "+data.color+" "+data.brand+" with "+data.numberOfWheels+" wheels;");
                        _target.appendChild(resultItem);
                    }
                }
            });
        }
    </script>
</head>
<body>
    <div id="target"></div>
</body>

```

Client code running in users web browser – using AJAX

```
}

    }

});

}

//Init method will be triggered when html-document is completely loaded
Event.observe(window,'load',init);

</script>
</head>
<body>
<ul id="target"/>
</body>
</html>
```

Result in client web browser

A Red Ford with 6 wheels;)
A Yellow Volvo with 4 wheels;)
A Blue Toyota with 4 wheels;)

Sources

All
Library database
 Default
 Unspecified
 Humanities
 Social sciences

Only your library

[i]

java

Search Reset

Hits: 2654

A search for «java» in
 BIBSYS Ask

Link to this search

**Creator**

cadenhead, rogers(11)
 deitel, harvey m(18)
 flanagan, david(22)
 geary, david m(10)
 harold, elliotte rusty(10)
 holzner, steven(11)
 horstmann, cay s(20)
 lewis, john(10)
 liang, y daniel(15)
 mclaughlin, brett(9)
 oaks, scott(10)
 schildt, herbert(12)
 strøm, øyvind(10)
 weiss, mark allen(9)
 zukowski, john(11)

Year

1957 1960 1963 1967 1969 1970 1972 1973
 1974 1975 1976 1980 1981 1984 1985 1986
 1987 1988 1989 1990 1991 1992 1993 1994
 1995 1996 1997 1998 1999 2000
2001 2002 2003 2004 2005
 2006 2007 2008 2009 2010

Bibliography

hamsun(1)
 nordisko(1)

Material

Article E-
Book CDROM Congress Dissertation Internet
 document CD (music) Student paper Thesis

Subject

computer data databehandling indonesia
 informatikk internet internett **java** language
 objektorientert oriented program programmering
 programminngsprak

X

Search Reset

Hits: 2654

JAVA developer's journal

ISSN: 1938-3886
 Material: E-journal
 Source:Bibliotekbasen

[Loan](#)
[Save](#)

/ Bibliotekbasen

Server-side GPS and assisted-GPS in Java

By: Neil Harper
 Year:c2010
 ISBN: 978-1-60783-985-9
 Material: Book
 Source:Bibliotekbasen

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/ Bibliotekbasen

Programming Finite Elements in Java

By: Gennadiy Nikishkov
 Year:2010
 ISBN: 9781848829725
 Material: Internet document
 Source:Bibliotekbasen

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/ Bibliotekbasen

Operating System Concepts with Java

By: Abraham Silberschatz
 Year:2010
 ISBN: 9780470398791
 Material: Book
 Source:Bibliotekbasen

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/ Bibliotekbasen

JavaServer faces 2.0, the complete reference

By: Ed Burns, Chris Schalk, Neil Griffin
 Year:cop. 2010
 ISBN: 978-0-07-162509-8
 Material: Book
 Source:Bibliotekbasen

[Resource](#)
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[Loan](#)
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The screenshot shows a library search interface with two main panels. The left panel displays search filters and facets:

- Sources**: All, Library database, Default (selected), Unspecified, Humanities, Social sciences, Only your library, Show more.
- Search terms**: book_print, flanagan, david, java.
- Creator**: farley, jim(1), flanagan, david(17), mclaughlin, brett(1), petrich, dean(1).
- Year**: 1996, 1997(1), 1998, 1999(17), 2000, 2002, 2004, 2005, 2006.
- Material**: Book (selected).
- Subject**: applet, computer, databehandling, internet, java, javabeans, javascript, language, languages, objectoriented, objektorientert, program, programmering, programmeringsspråk, programming, servers, web, wide, world, xml.

The right panel shows the search results for "java".

Search parameters: Creator: flanagan, david, Material: Book.

Results: Hits: 20

Result 1: JavaScript, the definitive guide
By: David Flanagan
Year: 2006
ISBN: 978-0-596-10199-2
Material: Book
Source: Bibliotekbasen
Subjects: javascript, programming

Result 2: Java in a nutshell
By: David Flanagan
Year: 2005
ISBN: 0-596-00773-6
Material: Book
Source: Bibliotekbasen
Subjects: java, programming

Result 3: JavaScript, pocket reference
By: David Flanagan
Year: 2002, c2003
ISBN: 0-596-00411-7
Material: Book
Source: Bibliotekbasen
Subjects: programming, java, javascript

A red callout bubble points to the search filters on the left with the text: "Narrowing the search using the scan boxes".

This is a beta version; the previous version is still available here.

Log on Norsk

BIBSYS Ask 2 beta

Sources [i]

- All
- Library database
- Default
- Unspecified
- Humanities**
- Social sciences

Only your library Show less

Nora (0)
Library Of Congress (10000)
Norart (0)
Libris (53473)
Deichmanske bibliotek (578)
Bibliotekbasen (38252)

human

Search Reset

Hits: 102303

The human-dimensions of human-computer interaction : balancing the ...
Material: Internet document
Source:Libris

LIBRIS

... in the framework of European Human rights ...
Material: Internet document
Source:Libris

LIBRIS

1199 news /
ISSN: 1090-3089
Material: Book
Source:Library Of Congress

LIBRIS

Link to this search

Search in local and remote databases on the net

This is a beta version, the previous version is still available here: [Beta](#)

Log on Norsk

BIBSYS / Ask 2

Sources [i]

All
Library database
Default
Unspecified
Humanities
Social sciences
Only your library Show less ▾

Nora (0)
Library Of Congress (0)
Norart (0)
Libris (0)
Deichmanske bibliotek (98)
Bibliotekbasen (2654)

Creator

java

java

Search Reset

JavaServer faces 2.0, the complete reference
By: Ed Burns, Chris Schalk, Neil Griffin
Year: cop. 2010
ISBN: 978-0-07-162509-8
Material: Book
Source: Bibliotekbasen
Subjects: jsf jsp webprogrammering java

Resource Copies Loan Save

Bibliotekbasen

Console HTML CSS Script DOM Net

All HTML CSS JS XHR Images Flash

URL	Status	Domain	Size
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	6.6 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	838 B
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	24.5 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	27.6 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	120 B
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	13.4 KB
GET result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	15 KB
https://ask.bibsys.no/ask2/json/result.jsp?cql=cql.serverChoice%20all%20%22java%22&page=0&src=info%3Aboi/notribib/biblioentry/	200 OK	ask.bibsys.no	89 B
GET authority.jsp?cql=cql.serverC	200 OK	ask.bibsys.no	267 B
GET bibsysxProxy.jsp?title=100+!	200 OK	ask.bibsys.no	390 B
GET bibsysxProxy.jsp?title=Indon	200 OK	ask.bibsys.no	310 B
GET books?jscmd=viewapi&bibke	200 OK	books.google.com	482 B
GET bibsysxProxy.jsp?title=JBoss	200 OK	ask.bibsys.no	471 B
GET bibsysxProxy.jsp?title=Lifera	200 OK	ask.bibsys.no	261 B
GET bibsysxProxy.jsp?title=Java5	200 OK	ask.bibsys.no	

A Search with firebug enabled

BIBSYS Ask 2

beta

Sources [i]

All Library database Default Unspecified Humanities Social sciences Only your library Show more ▾

java

Search Reset

JavaServer faces 2.0, the complete reference

Resource The Complete

Console HTML CSS Script DOM Net ▾

XHR Clear Persist All HTML CSS JS XHR Images Flash

URL	Status	Domain	Size
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	6.6 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	838 B
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	24.5 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	27.6 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	120 B
GET result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	13.4 KB
GET result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	15 KB
Params Headers Response Cache JSON			
cql cql.serverChoice all "java"			
page 0			
src info:boi/notrbib/biblioentry/			
GET authority.jsp?cql=cql.serverCl	200 OK	ask.bibsys.no	89 B
GET bibsysxProxy.jsp?title=100+1	200 OK	ask.bibsys.no	267 B
GET bibsysxProxy.jsp?title=3000+	200 OK	ask.bibsys.no	233 B
GET bibsysxProxy.jsp?title=Bali%.	200 OK	ask.bibsys.no	250 B
GET bibsysxProxy.jsp?title=Indon	200 OK	ask.bibsys.no	390 B
GET books?scmd=viewapi&bibke	200 OK	books.google.com	346 B
GET bibsysxProxy.jsp?title=JBoss	200 OK	ask.bibsys.no	482 B
GET bibsysxProxy.jsp?title=Grails	200 OK	ask.bibsys.no	465 B
GET bibsysxProxy.jsp?title=Lifera	200 OK	ask.bibsys.no	471 B
GET bibsysxProxy.jsp?title=JavaS	200 OK	ask.bibsys.no	261 B
GET books?scmd=viewapi&bibke	200 OK	books.google.com	297 B
GET cover.jsp?id=100819524	200 OK	ask.bibsys.no	26 B
19 requests			91.5 KB

Request parameters

URL	Status	Domain	Size
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	6.6 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	838 B
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	24.5 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	27.6 KB
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	120 B
GET scan.jsp?cql=cql.serverChoice	200 OK	ask.bibsys.no	13.4 KB
GET result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	15 KB
GET result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	
Response Headers			
view source			
Date	Fri, 23 Apr 2010 06:06:47 GMT		
Server	IBM_HTTP_Server		
Content-Length	15372		
Keep-Alive	timeout=10, max=96		
Connection	Keep-Alive		
Content-Type	application/json;charset=utf-8		
Content-Language	nb-NO		
Request Headers			
view source			
Host	ask.bibsys.no		
User-Agent	Mozilla/5.0 (Windows; U; Windows NT 5.1; nb-NO; rv:1.9.2.3) Gecko/20100401 Firefox/3.6.3 (.NET CLR 3		
Accept	text/javascript, text/html, application/xml, text/xml, */*		
Accept-Language	nb-no;q=0.8,nn;q=0.6,en-us;q=0.4,en;q=0.2		
Accept-Encoding	gzip,deflate		
Accept-Charset	ISO-8859-1,utf-8;q=0.7,*;q=0.7		
Keep-Alive	115		
Connection	keep-alive		
X-Requested-With	XMLHttpRequest		
X-Prototype-Version	1.6.1		
Referer	https://ask.bibsys.no/ask2/html/		
Cookie	WT_FPC=id:129.241.16.2-684411376.30056269:lv=1265191237360:ss=1265191237360; JSESSIONID=0000eT1Kuc-PdkVOnTe3pk4A0aw:141dp2huc		
GET authority.jsp?cql=cql.serverC	200 OK	ask.bibsys.no	89 B
GET bibsysxProxy.jsp?title=100+4	200 OK	ask.bibsys.no	267 B
GET bibsysxProxy.jsp?title=3000+	200 OK	ask.bibsys.no	233 B
GET bibsysxProxy.jsp?title=Bali%	200 OK	ask.bibsys.no	250 B
GET bibsysxProxy.jsp?title=Indon	200 OK	ask.bibsys.no	390 B
GET bibsysxProxy.jsp?title=JBoss	200 OK	ask.bibsys.no	482 B
GET bibsysxProxy.jsp?title=Grails	200 OK	ask.bibsys.no	465 B
GET bibsysxProxy.jsp?title=Liferay	200 OK	ask.bibsys.no	471 B
GET bibsysxProxy.jsp?title=JavaS	200 OK	ask.bibsys.no	261 B
GET cover.jsp?id=100819524	200 OK	ask.bibsys.no	26 B
17 requests			90.9 KB

Response headers

The screenshot shows the BIBSYS Ask 2 interface. At the top, there is a search bar with the word "java". Below the search bar, a "Sources" sidebar lists categories like "All", "Library database", "Default", "Unspecified", "Humanities", and "Social sciences". A "beta" badge is visible in the top right corner. The main area displays a table of network traffic with columns for method, URL, status, host, and size. Below the table, a JSON response is shown under the "result" key, detailing document records and their properties such as record ID, classification, creators, and language.

Method	URL	Status	Host	Size
GET	scan.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	24.5 KB
GET	scan.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	27.6 KB
GET	scan.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	120 B
GET	result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	13.4 KB
GET	result.jsp?cql=cql.serverChoic	200 OK	ask.bibsys.no	15 KB

result

- documents**
 - 0**
 - allClassification**
 - articleDate**
 - articleEndPage**
 - articleIssue**
 - articleStartPage**
 - articleVolume**
 - creators**
 - edition**
 - isbn**
 - issn**
 - journalTitle**
 - keywords**
 - language**
 - material**
 - note**

```
Object { documents=, more... }
[ Object { recordid="notrbib:100822843", more... }, Object { recordid="notrbib:100822835", more... }, Object { recordid="notrbib:100822827", more... }, 7 more... ]
Object { recordid="notrbib:100822843", more... }
[ [ "LC", [ "Application software", "Java (Computer program language)", "Computer software", "Open source software" ] ] ]
""
""
""
""
""
""
Object { firstName="Francesco", more... }
""
""
""
""
[ ]
"eng"
"electronic"
"Includes index."
"file:///D:/.../index.html?wid=notrbib:100822843"
```

Response from server

```
Ask2 - Beta
Console HTML CSS Script DOM Net
Clear Persist All HTML CSS JS XHR Images Flash

{"result": {
  "documents": [
    {
      "recordId": "notrbib:100822843",
      "title": "JBoss AS 5 development, develop, deploy, and secure Java applications on this robust, open source application server",
      "creators": [
        {
          "relatorcode": "",
          "firstName": "Francesco",
          "lastName": "Marchionini",
          "normalizedName": "Marchionini, Francesco",
          "presentableName": "Francesco Marchionini"
        }
      ],
      "year": "c2009",
      "publicationName": "Packt Pub.",
      "publicationPlace": "Birmingham, U.K.",
      "isbn": "",
      "issn": "",
      "pages": "1 online resource (vii, 397 s.), ill",
      "edition": "",
      "series": [
        {
          "note": "Includes index."
        },
        "keywords": [
        ],
        "allClassification": [
          {
            "LC": [
              "Application software",
              "Java (Computer program language)",
              "Computer software",
              "Open source software"
            ]
          }
        ],
        "openurlRepresentation": "title=JBoss+AS+5+development%2C+develop%2C+deploy%2C+and+secure+Java+applications+on+this+robust%2C+open+source+application+server&author=Marchionini%2C+Francesco&year=c2009&sid=BIBSYS3Aask2&pid=notrbib:3A100822843",
        "language": "eng",
        "material": "electronic",
        "resources": [
        ],
        "physicalform": "n",
        "typeofcontent": [
          "e",
          "v"
        ],
        "articleVolume": "",
        "articleIssue": "",
        "articleStartPage": "",
        "articleEndPage": "",
        "articleDate": "",
        "journalTitle": ""
      ],
      "recordId": "notrbib:100822835",
      "title": "Grails 1.1 web application development, reclaiming productivity for faster Java web development"
    },
    {
      "creators": [

```

Response from server

B Ask2 - Beta

This is a beta version, the previous version is still available here: [Ask 1](#)

Log on Norsk

BIBSYS / Ask 2

beta

Sources

All Library database Default Unspecified Humanities Social sciences Show more▼

Hamsun-bibliografi

henrik i

henrik i christensen
henrik i hansen
henrik i petersen
henrik ibsen
henrik idoff hornhaver
henrik inadomi tek
henrik ingebrightsen
henrik ingemann tementet
henrik ingermann-petersen
henrik ingermann petersen
henrik ingo
henrik ipse tet - offisiell åpning
henrik isager argumentet mot DRM
henrik isdahl like i bokbransjen -

librarian.net

more economic crunching at MA libraries statewide
Queens Borough and SirsiDynix settle
It is just ridiculous how awesome libraries are.
a few stats for tax time
One School, One Library, One Librarian

Biblioteklaboratoriet

Interessant frokostmøte om offentlige data
The Code4Lib Journal, utgave 9
Nye konkurranser!
Udstilling på bibliotekmøtet
Bokelskere
Datautveksling
Biblioteksystemer med åpen kildekode

Console HTML CSS Script DOM Net ▾

XHR Images Flash

Request	Method	URL	Status	Size	Time
1 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 133 B	20ms
2 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 124 B	20ms
3 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 181 B	60ms
4 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 133 B	30ms
5 GET language.jsp?lang=en	GET	language.jsp?lang=en	200 OK	ask.bibsys.no 10.4 KB	50ms
6 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 134 B	10ms
7 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 135 B 70ms	190ms
8 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 134 B	80ms
9 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 393 B	211ms
10 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 369 B	40ms
11 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 485 B 120ms	221ms
12 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 143 B	110ms
13 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 485 B	2.47s
14 GET autocompleteProxy.jsp?quer	GET	autocompleteProxy.jsp?quer	200 OK	ask.bibsys.no 13.3 KB	

14 requests 13.3 KB 2.47s

Autocomplete in action

Advantages

- Services are not tied to one application. Services are targeted for one goal and are reused.
- It is easy to add services
- Layers below the RESTful webservices are independent of the database server
- JSON (JavaScriptObjectNotation) streams are simple and Javascript understands JSON native.

Disadvantages

- Webbrowser might tell you «mixed content» when your application mix secure and unsecure connections.
- Some webbrowser have slow performance or/and bad implementation of javascript.

Questions?

We would love to tell you more about
BIBSYS Ask at our stand no 7 at the
Emtacl10 exhibition

BIBSYS

