

General Web Application Program Interface for Geoinformatics

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Introduction

- C++ language was used for creating web application at department of Mapping and Cartography for many years
- plenty of projects started to by very large–scale and complicated to maintain
- used CGI technology
- projects:
 - internet access to the database of GPS observation via www
 - online transformations

CGI - The Common Gateway Interface (CGI)

- CGI technology defines standard for exchange data between www server and program (CGI program)
- programs are "normal" programs running on the server side - input data for CGI programs are requests from a client (data sent by web browser - HTTP header with other information) from CGI program is sent back to the client (web browser)

CGI example

```
#!/bin/bash
echo 'Content-type: text/html'
echo
echo '<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 3.2//EN">'
echo '<html>'
echo '<title>Current date</title>'
echo '</head>'
echo '<body><pre>'

/bin/date -I

echo '</pre></body>'
echo '</html>'
```

CGI example

```
#include<iostream>
#include<string>

int main()
{
    using namespace std;

    string s;

    cout << "Content-type: text/html\n\n";
    cout <<
        "<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML3.2//EN]>\n";
    cout << "<html>\n<head>\n";
    cout << "<title>Input data</title>\n";
    cout << "</head>\n";
    cout << "<body>\n";
    cout << "<h1>Input data:</h1>\n";
    cout << "<pre>\n";

    cin >> s;
    cout << s;

    cout << "</pre>\n</body></html>\n";
}
```

CGI +/-

- CGI programs can be written in many languages, for example PHP, C++, Python, etc.
- creating CGI programs is pretty easy
- the CGI concept has some limitations:
 - each request is answered in a separate process by a separate instance of CGI program (CGI program needs to be loaded and started for each CGI request)
 - platform dependency
 - lack of scalability

Servlets

- servlet is a Java application that runs within a Web server
- servlets receive and respond the requests from Web client
- class extends `HttpServlet` class
- we have to use servlet container in order to run servlets

Java advantages over CGI

- servlet does not run in a separate process, stays in memory between requests
- there is only a single instance which answers all requests concurrently - this saves memory and allows a servlet to easily manage persistent data
- platform independence
- Java language has very rich libraries for working with HTTP request,HTTP responses, etc.

Servlet example

```
public class HelloWorldServlet extends HttpServlet
{
    protected void doGet(HttpServletRequest req,
                          HttpServletResponse res)
        throws ServletException, IOException
    {
        res.setContentType("text/html");

        PrintWriter out = res.getWriter();

        out.println("<html>");
        out.println("<head><title>Hello</title></head>");
        out.println("<body>Hello world</body>");
        out.println("</html>");

        out.close();
    }
}
```

Design pattern — MVC

Interface is fully object-oriented and using several design patterns. One of the main goals was selection of object oriented model, which would separate computing core from presentation part.

Model represents of the information on which application operates

View renders model into a form suitable for users, typically a user interface element

Controller responds to events, typically user action

WWW system Manala

The general web application program interface for geoinformatics allows adding arbitrary tasks. Those tasks are accessible for the users using well-arranged menu. Currently is possible to add the following three types of tasks into the system:

Java tasks written in Java language, implementing interface `ComputingTask`

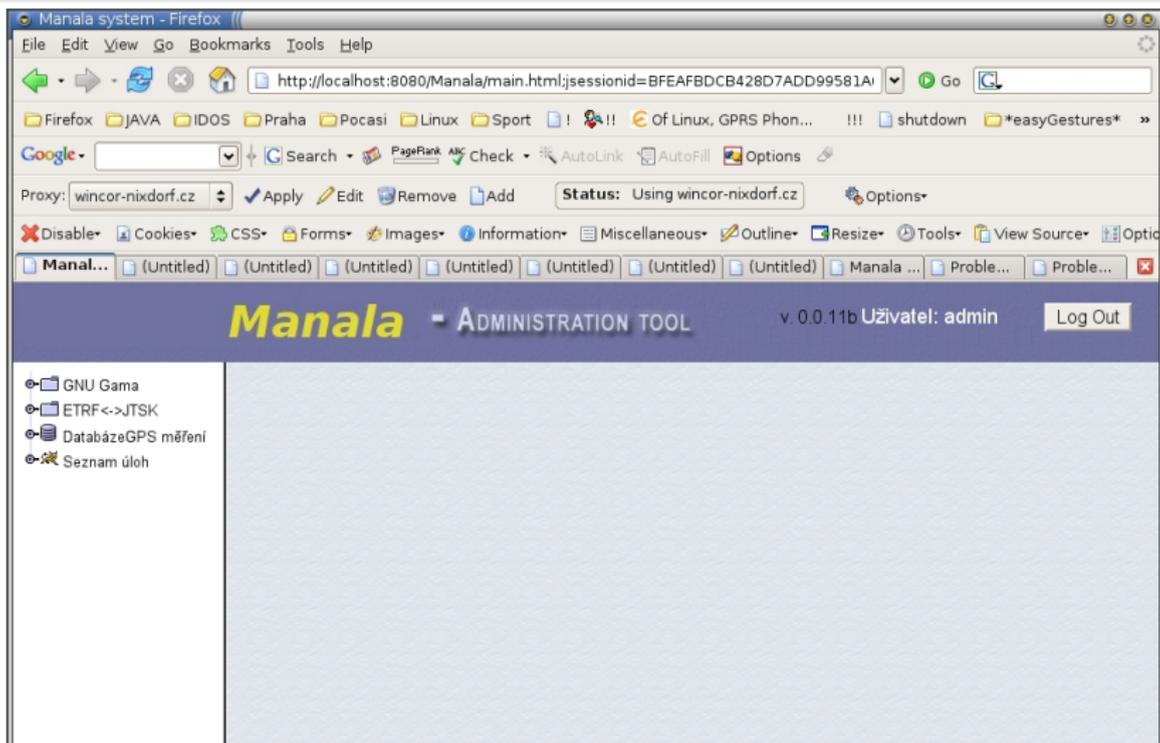
executable programs tasks distribute as standalone executable programs

C++ tasks written in C++ language

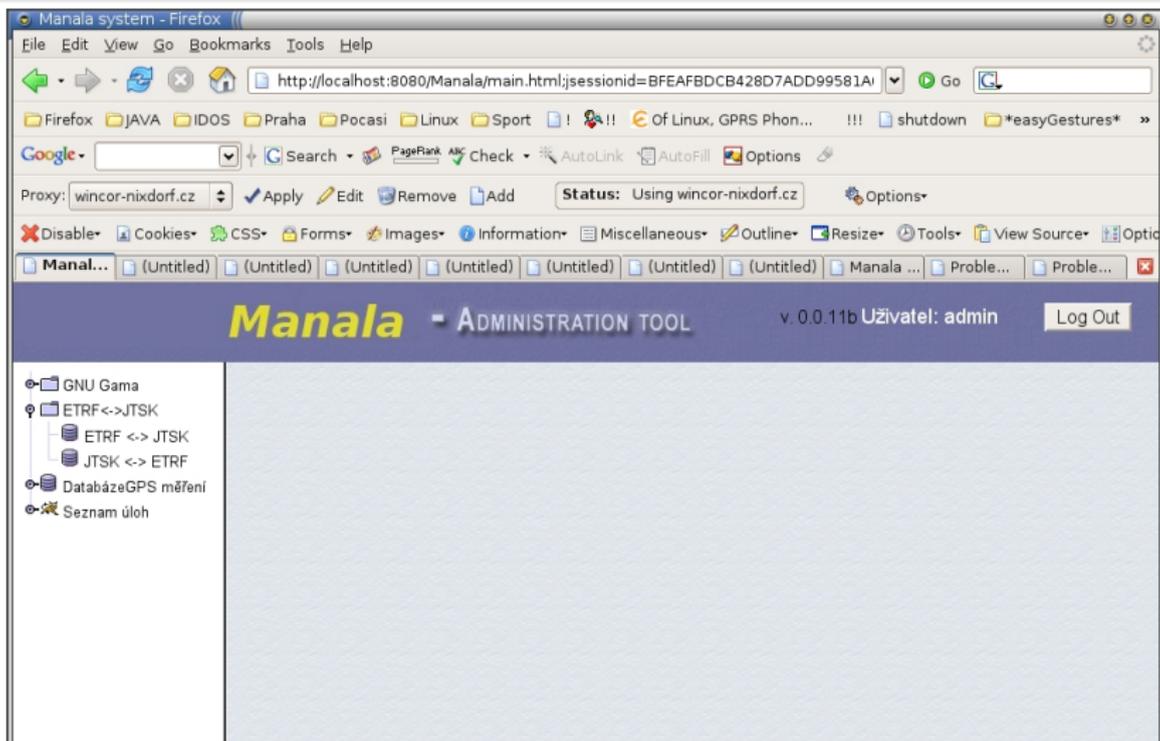
interface ComputingTask

```
public interface ComputingTask {  
    void setParametersMap(Map<String, String> i);  
    Map getResults();  
    OutputStream getResultStream();  
    void compute();  
    boolean wasComputed();  
}
```

Screenshot — 1



Screenshot — 2



Screenshot — 3

Manala system - Firefox

File Edit View Go Bookmarks Tools Help

http://localhost:8080/Manala/main.html

Manala - ADMINISTRATION TOOL v. 0.0.11b Uživatel: admin Log Out

Detail úlohy

Jméno	Popis	Chyba	Začátek	Konec
GNU Gama	Pokusna sit, tetrahedron-1.gkf	ANO	2006-02-02 01:36:32.27	2006-02-02 01:36:32.27

Jméno souboru Velikost

tst-tetrahedron-1.gkf	3048
tst-tetrahedron-1.gkf.1.7.14-svd	14725

Smazat ulohu Zpět na prohlížení

GNU Gama
 ETRF->JTSK
 DatabázeGPS měření
 Seznam úloh

Screenshot — 4

The screenshot shows a Firefox browser window displaying the Manala administration tool. The browser's address bar contains the URL `http://localhost:8080/Manala/main.html`. The page header features the Manala logo and the text "ADMINISTRATION TOOL v. 0.0.11b Uživatel: admin" with a "Log Out" button. On the left side, there is a navigation menu with items like "GNU Gama", "ETRF <-> JTSK", "DatabázeGPS měření", and "Seznam úloh". The main content area is titled "Návod k použití" and contains the following text:

Na základě známých geocentrických souřadnic v ETRF-89 se provádí transformace do S-JTSK. Přesnost je charakterizována střední kvadratickou odchylkou 0.15 m.

Struktura dat vstupu:

číslo_bodu F(st_min_vter.) LAMBDA(st_min_vter.) H(m)
 Vzor: a103 49 54 27.4567 14 17 21 3424 546.85

ve volném formátu s desetinnými tečkami, oddělovačem jsou mezery.

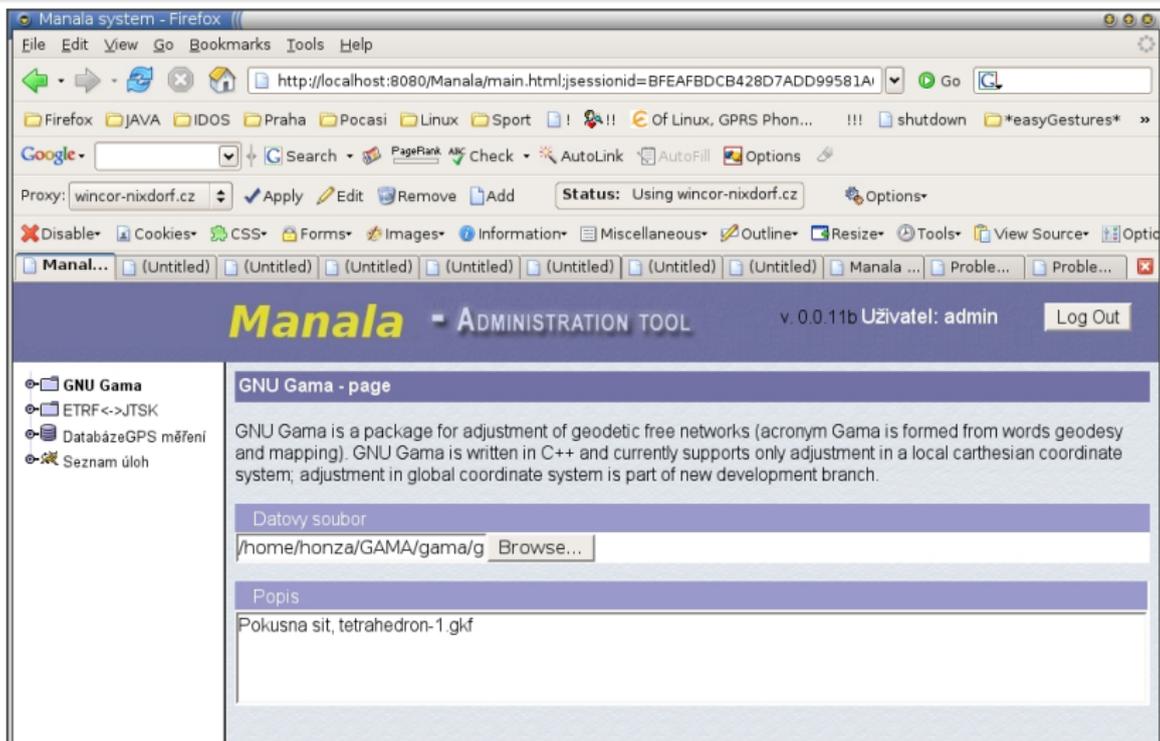
Below the text, there is a form with a "Datový soubor" label, a text input field, and a "Browse..." button. At the bottom of the form, there is a "Data" label.

Screenshot — 5

The screenshot displays the Manala administration tool interface within a Firefox browser window. The browser's address bar shows the URL `http://localhost:8080/Manala/main.html`. The page header features the title "Manala - ADMINISTRATION TOOL" and the version "v. 0.0.11b Uživatel: admin", along with a "Log Out" button. A sidebar on the left provides navigation options: "GNU Gama", "ETRF<->JTSK", "DatabázeGPS měření", and "Seznam úloh". The main content area is titled "Seznam uloh" and includes a search box labeled "Nastav masku". Below this is a table titled "Seznam uloh - detail" with the following data:

Jméno	Popis	Chyba	Start	Konec
ETRF <-> JTSK	Prevod bodu do S-JTSK	ANO	2006-02-02 01:35:40.49	2006-02-02 01:35:40.49
GNU Gama	Pokusna sit, tetrahedron-1.gkf	ANO	2006-02-02 01:35:40.49	2006-02-02 01:35:40.49
GNU Gama	Temelin - zhustovaci sit	ANO	2006-02-02 01:35:40.50	2006-02-02 01:35:40.50
GNU Gama	Hradilek	ANO	2006-02-02 01:35:40.50	2006-02-02 01:35:40.50
GNU Gama	Skalka - 22.10.2003	NE	2006-02-02 01:35:40.50	2006-02-02 01:35:40.50

Screenshot — 6



Screenshot — 7

The screenshot shows a web browser window titled "Manala system - Firefox". The address bar shows "http://localhost:8080/Manala/main.html". The browser interface includes a search bar, proxy settings for "wincor-nixdorf.cz", and various toolbars. The main content area displays the "Manala" logo and a sidebar with navigation links: "GNU Gama", "ETRF<->JTSK", "DatabázeGPS měření", and "Seznam úloh". The main content area is titled "Detail úloh" and contains a table with columns "Jméno" and "Popis". The table lists "GNU Gama" with the description "Pokusna sit, t". Below this, there is a section "Jméno souboru" with links to "tst-tetrahedron-1.gkf" and "tst-tetrahedron-1.gkf.1.7.14.s".

An inset window shows a table of "Adjusted coordinates". The table has the following structure:

```
Adjusted coordinates
*****
i      point  approximate  correction  adjusted  std.dev  conf. i.
      value  [m]          [m]          value      [mm]
-----
1      0.0000  0.0000
8      Z *     0.00000    -0.04819   -0.04819   9.1      18.8
2
2      X *     3000.00000  0.00916   3000.00916  19.3     39.6
3      Y *     0.00000    0.03147   0.03147    47.4     97.2
9      Z *     0.00000    -0.01290  -0.01290   10.4     21.4
3
4      X *     1500.00000  0.00113   1500.00113  26.5     54.3
5      Y *     2598.07600  -0.00289  2598.07311  23.0     47.1
10     Z *     0.00000    0.06109   0.06109    9.3      19.0
4
6      x      1500.00000  0.00963   1500.00963  23.1     47.3
7      y      866.02500  -0.03127  865.99373   24.0     49.3
11     z      2449.49000  -0.02281  2449.46719  19.7     40.4
```

Conclusion

The Java language (servlets) has significantly simplified the development of web applications. As a result, developing cycle was cut down. Because of Java JNI (Java Native Interface) it is still possible to use C++ libraries which are available. Switch development from "typical CGI programming" to "Java servlet programming" is surprisingly easy with amazing benefit.

<http://gama.fsv.cvut.cz/manala>

Thank you for your attention.