

RESTful Web Services in Science

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CGI Programs

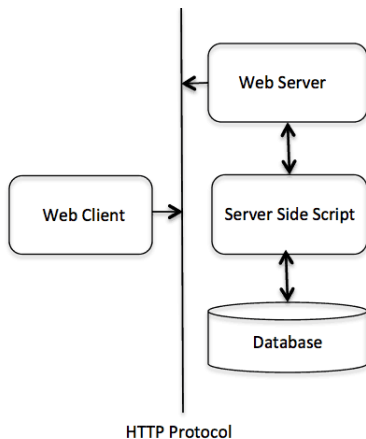


Figure: Perl/Python web program back in the good old days of CGI

Example: `https://bar.utoronto.ca/efp_arabidopsis/cgi-bin/efpWeb.cgi`

Web 2.0

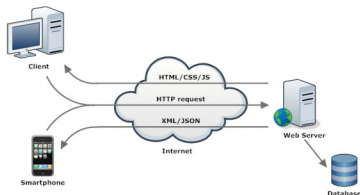
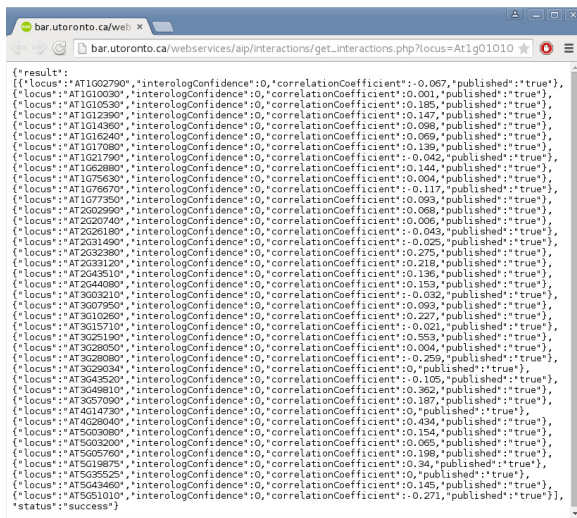


Figure: Modern REpresentational State Transfer

- ▶ Input: HTTP GET request
- ▶ Output: XML, JSON, SVG, png

Source: <http://di-side.com/di-side/services/web-solutions/rest-webservice-symfony/>

AIV: Database and webservice



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  ],
  "status": "success"
}
```

Figure: The Web Service called for At1g01010

Toy Example of REST

- ▶ All `http://services.groupkt.com/country/get/all`
- ▶ CA `http://services.groupkt.com/country/get/iso2code/CA`
- ▶ CAD `http://services.groupkt.com/country/get/iso3code/CAN`

Python Code Demo

RESTful Web Services

Some service providers in Biology

- ▶ Reactome <http://reactomews.oicr.on.ca:8080/ReactomeRESTfulAPI/ReactomeRESTFulAPI.html>
- ▶ ATTED-II <http://atted.jp/help/API.shtml>
- ▶ BAR <https://bar.utoronto.ca/webservices/>

Searching and demystifying output

- ▶ JSON Lint: <http://jsonlint.com/>
- ▶ Most database websites have REST web services described in API documentation section

Working example

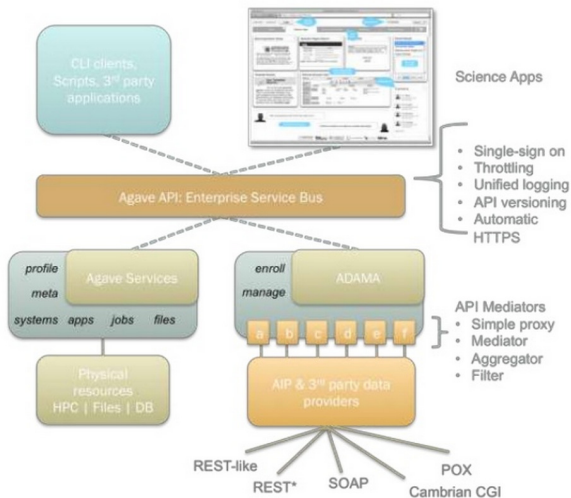
- ▶ TAIR for Plant Biology
- ▶ Araport being made by The J. Craig Venter Institute, Texas Advanced Computing Center, and University of Cambridge
- ▶ <https://www.araport.org/>
- ▶ Community extensible Science Apps
- ▶ We (BAR at University of Toronto) are also working on Science Apps

Science Apps On Araport

- ▶ Web Apps must be written in HTML5/CSS/JavaScript
- ▶ Araport allows developers to develop fully functional apps in their local development environment and test them on Araport site
- ▶ Developers can also develop Araport Data Mediator API (ADAMA) adaptors to access web services on 3rd party websites
- ▶ The ADAMA adaptors (Python clients for RESTful web services) can be called by using Agave API from web apps

(Krishnakumar V. *et al.*, 2015)

Araport Architecture



Source: Araport workshop tutorial

Web Application Development Stack

The following are used to develop Araport webapps

- ▶ Yeoman application generator
- ▶ Grunt task runner
- ▶ Bower package manager
- ▶ npm (node package manager)
- ▶ OAuth 2.0 for Agave API access
- ▶ HTML5/CSS/JavaScript
- ▶ Swagger-js for API documentation

Arabidopsis Interactions Viewer

An interactions Viewer was developed for Araport

- ▶ Interactions database is on the BAR
- ▶ RESTful web service gets data from database on the BAR
- ▶ ADAMA medicator (in Python 2.7 and YAML) on Araport workspace to access the web service from Araport
- ▶ Interactions displayed using Cytoscape JS plugin
- ▶ Developed using HTML5/CSS/JavaScript
- ▶ Hosted on GitHub
- ▶ Backend: https://github.com/asherpasha/AIP_interactions_webservice
- ▶ Frontend: https://github.com/asherpasha/AIP_interactions_viewer

(Geisler-Lee J. *et al.*, 2007)

AIV: Screenshot

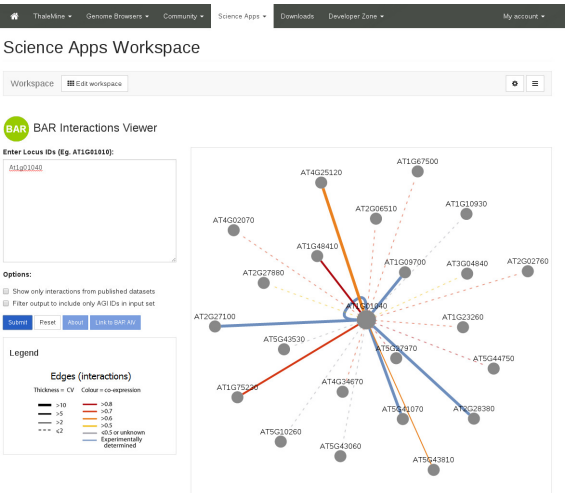


Figure: Interactions viewer running on Araport

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