SDSS Web Services

Coding against the Universe

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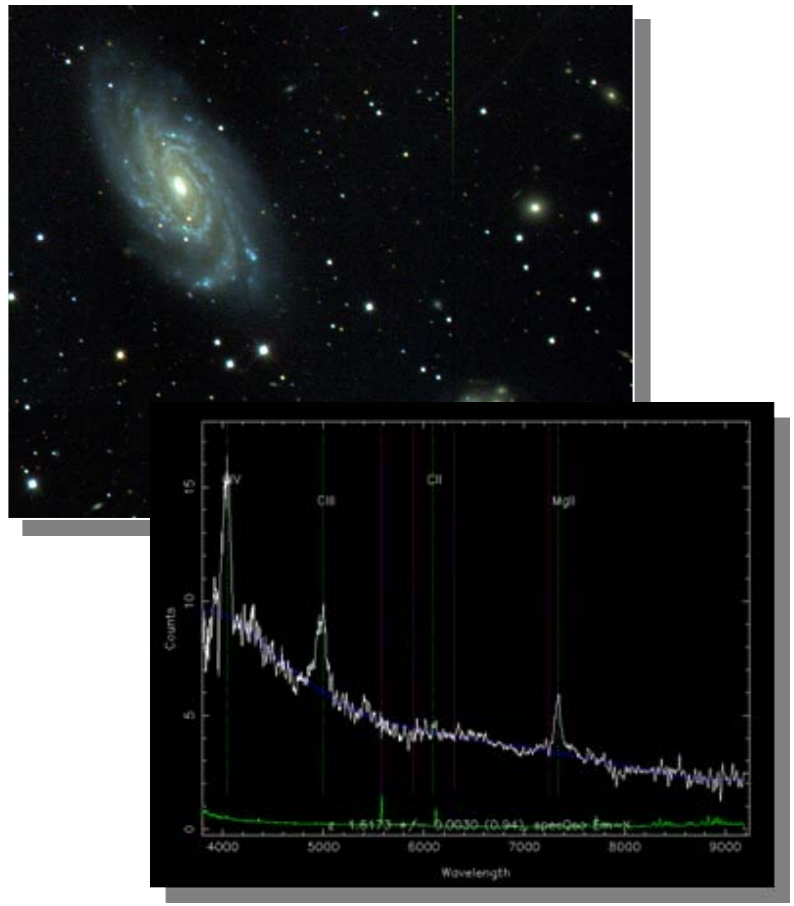
Outline

- SDSS Primer
- Technology
- Web Services
  - Data Access
    - Images
    - Spectra
    - Catalog
  - Higher Level

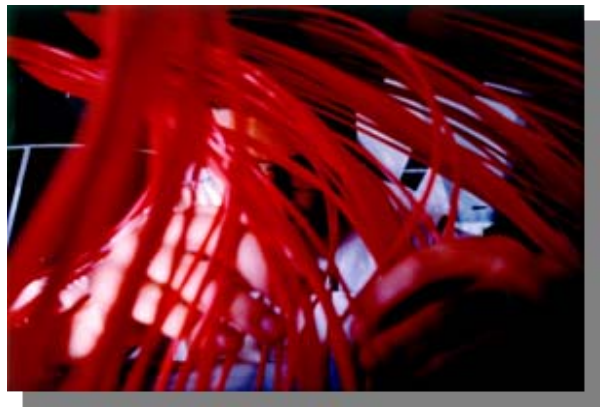


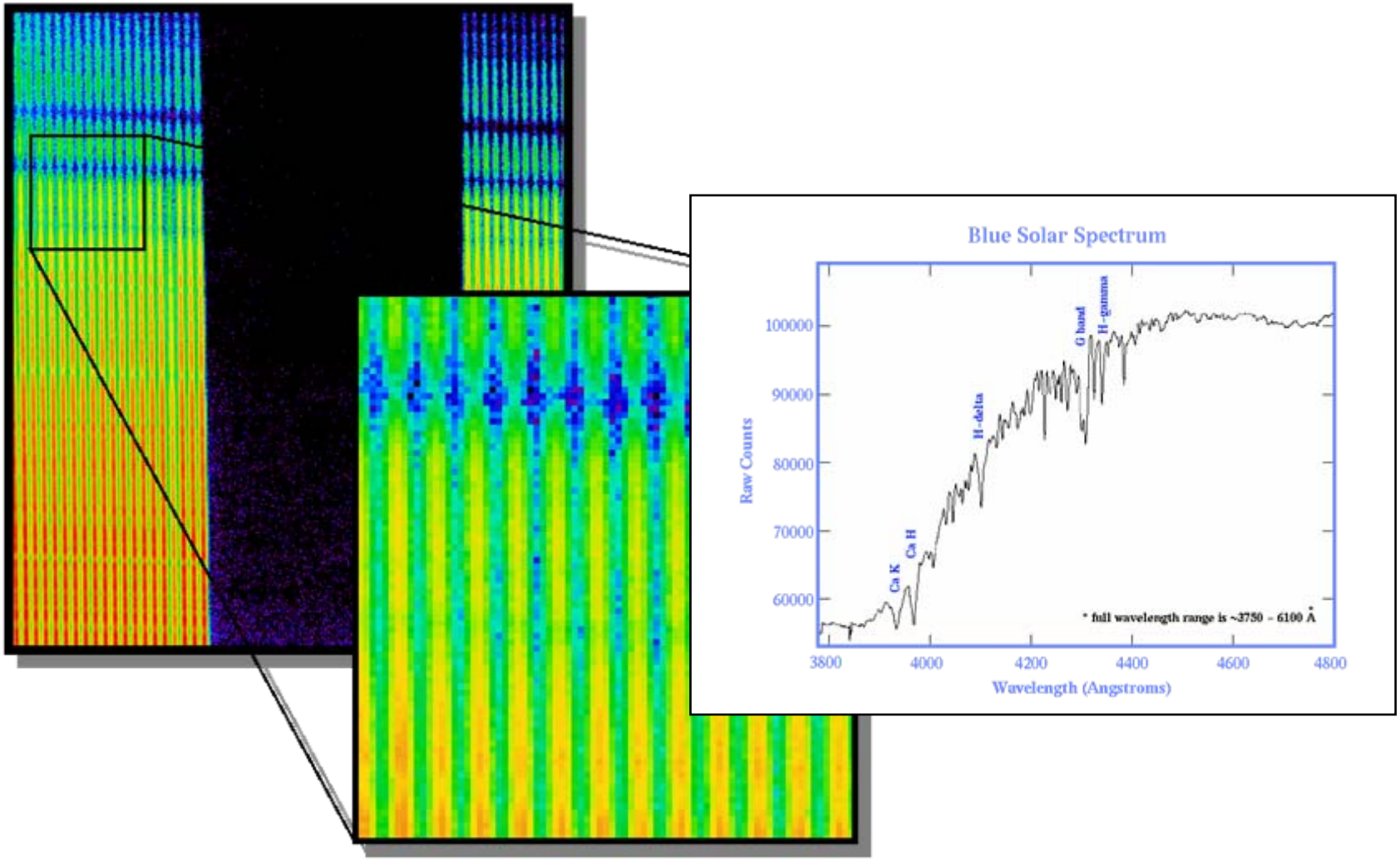
SDSS Imaging Survey

- 2.5m telescope
  - Apache Point, NM
  - 5 photometric bands
  - Drift scan operation
- Photo pipeline
  - 100,000,000 galaxies
  - Automated reduction
  - Catalog archive server

SDSS Spectropscopy

- Two spectrographs
  - Red and blue part
  - Optical fibers
  - 640 in each bundle
  - Plugged manually
- Automatic reduction
  - 2D and 1D pipelines
  - Catalog archive server




Blue Solar Spectrum
Raw Counts
100000
90000
80000
70000
60000
Ca K
Ca H
H-delta
G band
H-gamma
* full wavelength range is ~3750 - 6100 Å
3800
4000
4200
4400
4600
4800
Wavelength (Angstroms)

Developing Web Services

- We chose the .NET Framework
  - The C# programming language
  - Extensive class library (for free)
  - Simple and efficient database access
  - Fast imaging and graphics routines
  - Rapid development in Visual Studio
  - Very easy Web Services programming

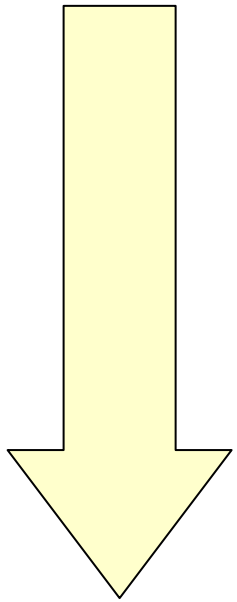
- Use CVS for versioning

Custom Tools and Packages

- Wrapper for CFITSIO by Vivek Haridas (JHU)
  - Access to FITS tables and images from C#
  - XML Web Services return FITS in attachment
- Scientific Plotting
  - Using TeeChart Lite
  - Fast plotting of online data

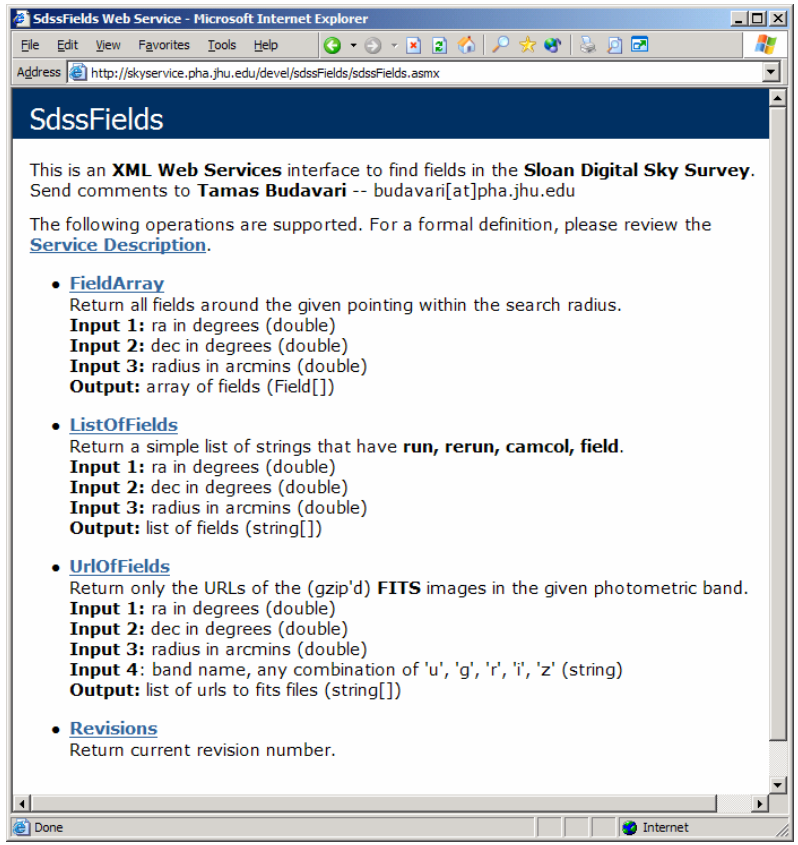
Available Web Services

- SDSS Web Services
  - Field Finder and SIAP
  - SDSS Image Cutout
  - Spectrum and Filter Services
  - Scientific Catalog Archive
  - DensityMap Services
- Other Relevant Services
  - NED Services Wrapper
  - Cosmic Distances



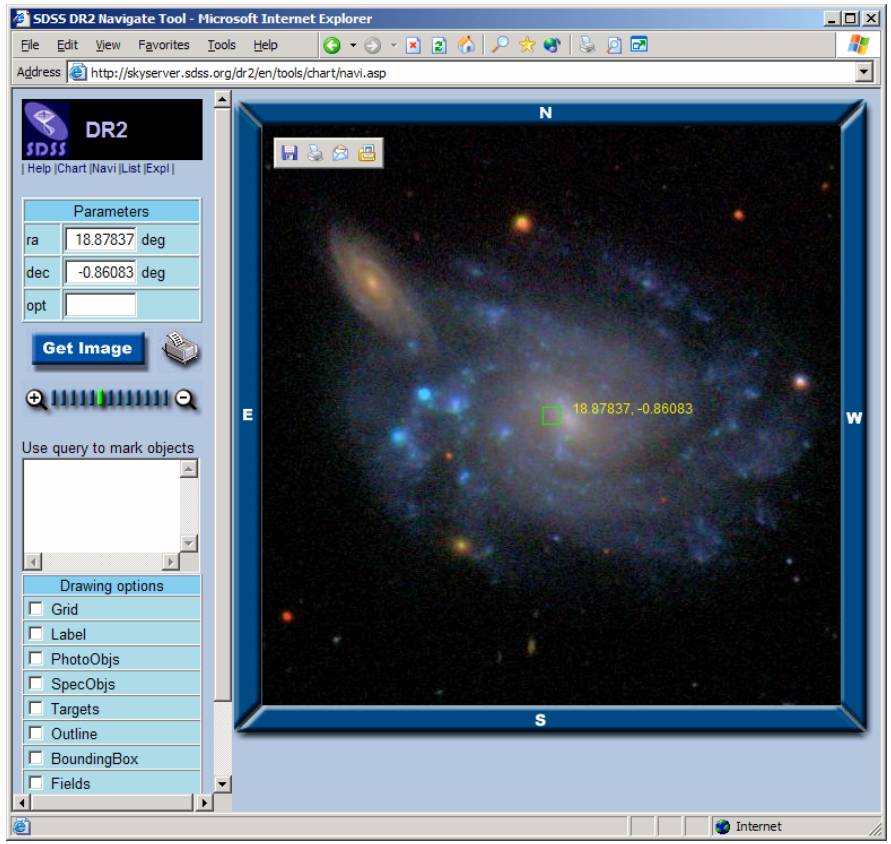
SDSS Fields and SIA

- Field Images
  - Search for fields (HTM)
  - Get all info, e.g. WCS
  - Returns links to FITS
- Simple Image Access
  - Wrapper on top of Fields
  - Returns links in VOTable



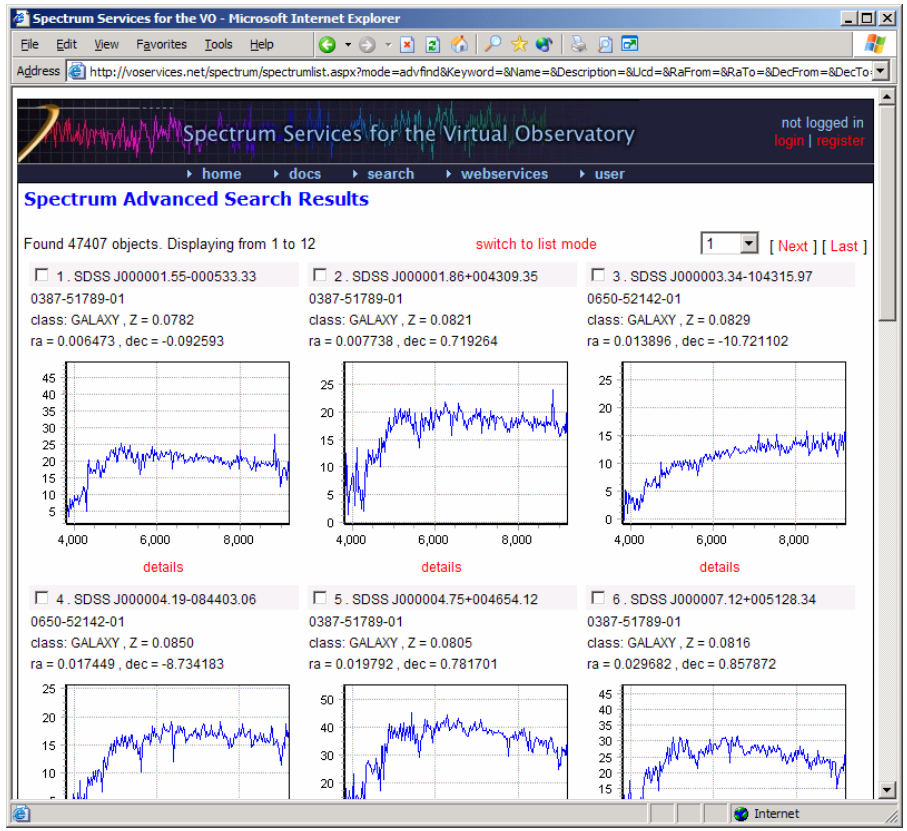
SDSS Image Cutout

- Build JPEG mosaics
  - For given (RA, Dec)
  - Arbitrary zoom levels
  - Overplot catalog data
  - Overplot geometry
  - MapQuest like navigation
  - List of objects
- Proper WS
  - JPEG returned in DIME or byte array



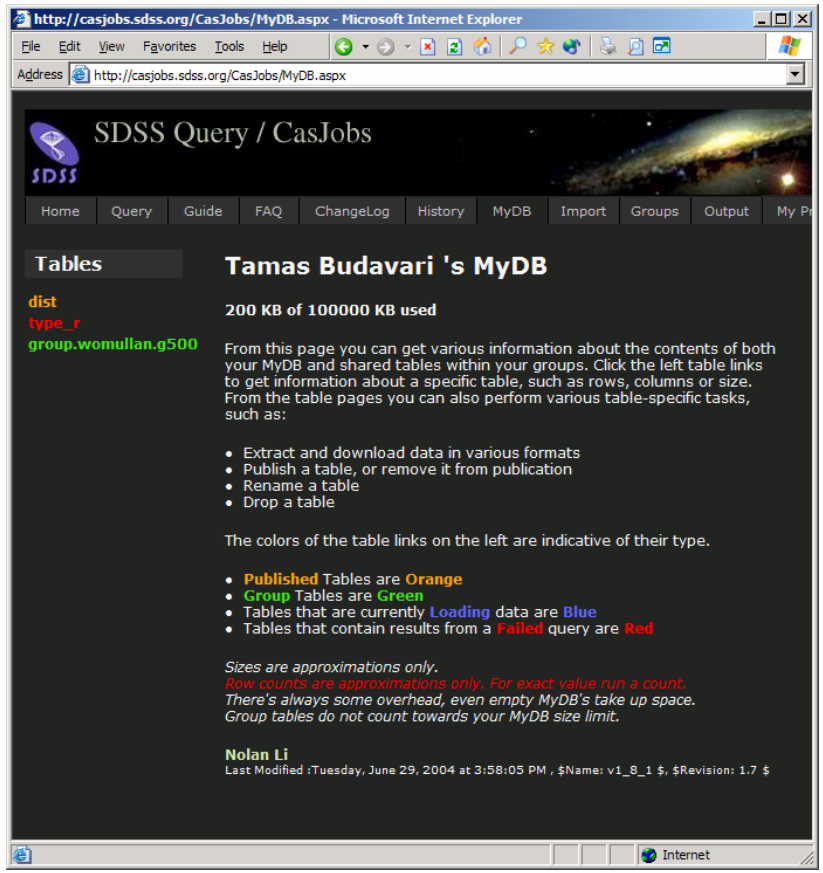
Spectrum Services

- Public repository
  - 500,000 spectra (2B row)
  - Spatial search and more
  - Register & submit yours
- Web site
  - On-the-fly plotting
  - Building composites
- Web services
  - More options and tools



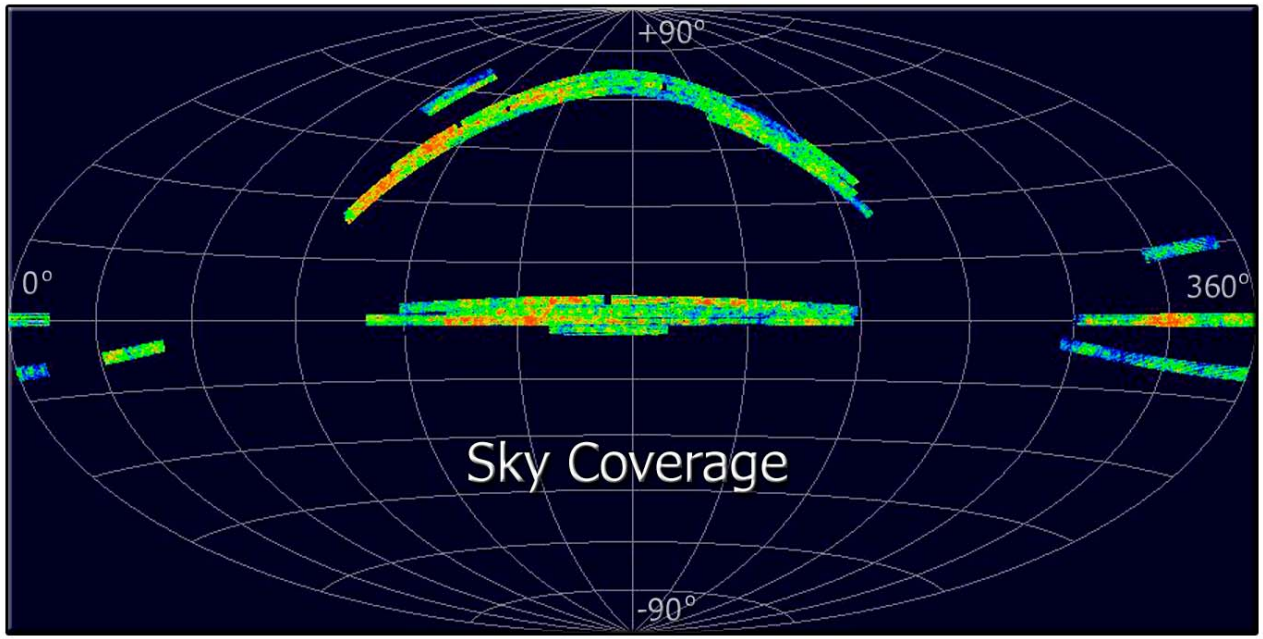
SDSS Catalog Services

- CasJobs
  - Access to a 1TB of data
  - 80M unique galaxies
  - Queue system for SQL
  - MyDB
    - 500MB remote DB
    - Upload and extract
- Web services
  - Web site interface
  - Command-line client



SDSS DensityMap Services

- A SQL query to image converter
  - Select x,y,f and build color coded f(x,y) image



Other Services

- Wrapper for NED
  - Name resolver function
  - Search by coordinate

```
NED ned = new NED();
ObjInfo o = ned.ObjByName("m101");
/* Use o.ra, o.dec, etc… */
```

- Cosmic Distances
  - Various distance measures
  - Using ΛCDM cosmology

```
Distance d = new Distance();
float z=0.1, h=0.7, m=0.3, l=0.7;
float r = d.Luminosity(z,h,m,l);
```

- Available from

http://www.voservices.org

Consuming Web Services

bash

```
elf: budavari$ cat wsclient-howto.txt
========================
HOW TO BUILD A WS CLIENT
========================

STEP 1: Generate classes
cmd> wsdl.exe http://voservices.net/NED/ws_v1_0/NED.asmx


STEP 2: Write client
-->
class NedClient
{
  static void Main(string[] args)
  {
        NED n = new NED();                    // proxy
        ObjInfo o = n.ObjByName(args[0]);  // ws call
        System.Console.WriteLine("Coords: "+o.ra+" "+o.dec);
        foreach(CrossID c in o.ArrayOfCrossID)
           System.Console.WriteLine(c.objname);
  }
}
<--

STEP 3: Compile
cmd> csc.exe client.cs NED.cs

STEP 4: Run it, e.g.
cmd> client.exe m31


elf: budavari$
```

Conclusions

- SDSS Web Services…
  - …provide access to scientific data and tools
  - …are (very) easy to consume
  - …are being used :-)
- Development coordinated w/ IVOA
  - Open SkyQuery for federating archives
  - SDSS Open SkyNode