Embedding R within the Apache Web Server: What's the Use?

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http://biostat.mc.vanderbilt.edu/twiki/bin/view/Main/ApacheRproject/

Interfaces to R exist:

- Network: Rserve, RSOAP
- Languages: Perl, Python, PHP, Ruby

R as Web Language

- Rweb, Rcgi, Rpad, Rho, CgiwithR, others...

Motivation for Embedding R in Apache

Allow statistician to use a familiar language

Eliminate overhead of interface langauge run-time

Hides cost of R startup and initialization

Useful code bases for other projects:

- Apache Portable Runtime Libraries
- Multi-Processing Modules
- Custom Protocol support

A gentle introduction to R

Hello World

```
----------http.conf-------------+---------test.R-------------------------
                                |
LoadModule R_module mod_R.so    |  handler <- function(r){
                                |      apache.write(r,"<h1>Hello World!</h1>")
<Location /test/hello>          |      OK
    SetHandler r-handler        |  }
    Rsource /var/www/html/test.R|
    RreqHandler handler         |
</Location>                     |
                                |
--------------------------------+----------------------------------------
```

Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://localhost:8181/test/hello

Hello World!

Examples: Test Handler

```
handler <- function(r)
{
    # Grab all incoming HTTP request data
    args <- apache.get_args(r)
    post <- apache.get_post(r)
    cookies <- apache.get_cookies(r)
    uploads <- apache.get_uploads(r)

    # Test if the GET variable called was set
    if(is.null(args$called))
        called <- 1
    else
        called <- as.integer(args$called) + 1

    # Set a cookie with the incremeted called value.
    # expires in 100 seconds.
    apache.add_cookie(r,"called",called,expires=Sys.time()+100)

    apache.write(r,"<HTML><BODY><H1>Hello from mod_R</H1>")

    # Write out the form for capturing GET,POST, and file uploads
    apache.write(r,
        '<form enctype=multipart/form-data method=POST action="/test/R?called=',
        called,'">',
        sep="")
    apache.write(r,
        'Enter a string: <input type=text name=name value="',
        post$name,'"><br>',
        sep="")
    apache.write(r,
        'Enter another string: <input type=text name=name value="',
```
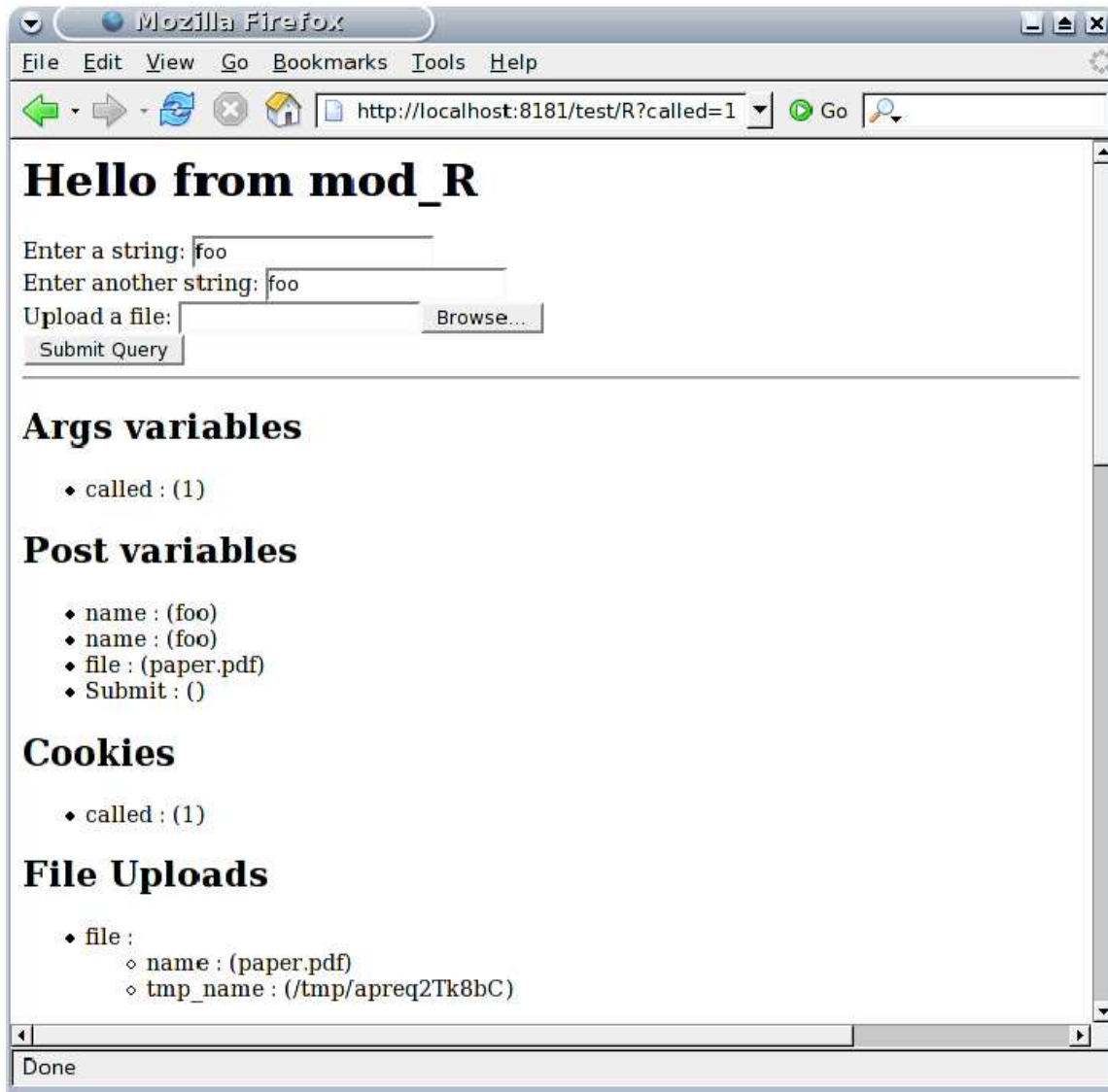
```
        post$name,'"><br>',
        sep="")
apache.write(r,
        'Upload a file: <input type=file name=file><br>')
apache.write(r,"<input type=submit name=Submit>")

# Now write out everything we saw
apache.write(r,'<hr>')
apache.write(r,"<h2>Args variables</h2>")
apache.write(r,as.html(args));
apache.write(r,"<h2>Post variables</h2>")
apache.write(r,as.html(post))
apache.write(r,"<h2>Cookies</h2>")
apache.write(r,as.html(cookies))
apache.write(r,"<h2>File Uploads</h2>")
apache.write(r,as.html(uploads))
apache.write(r,"<h2>Request Record</h2>")
apache.write(r,as.html(r))
apache.write(r,"</BODY></HTML>")

OK
}
```
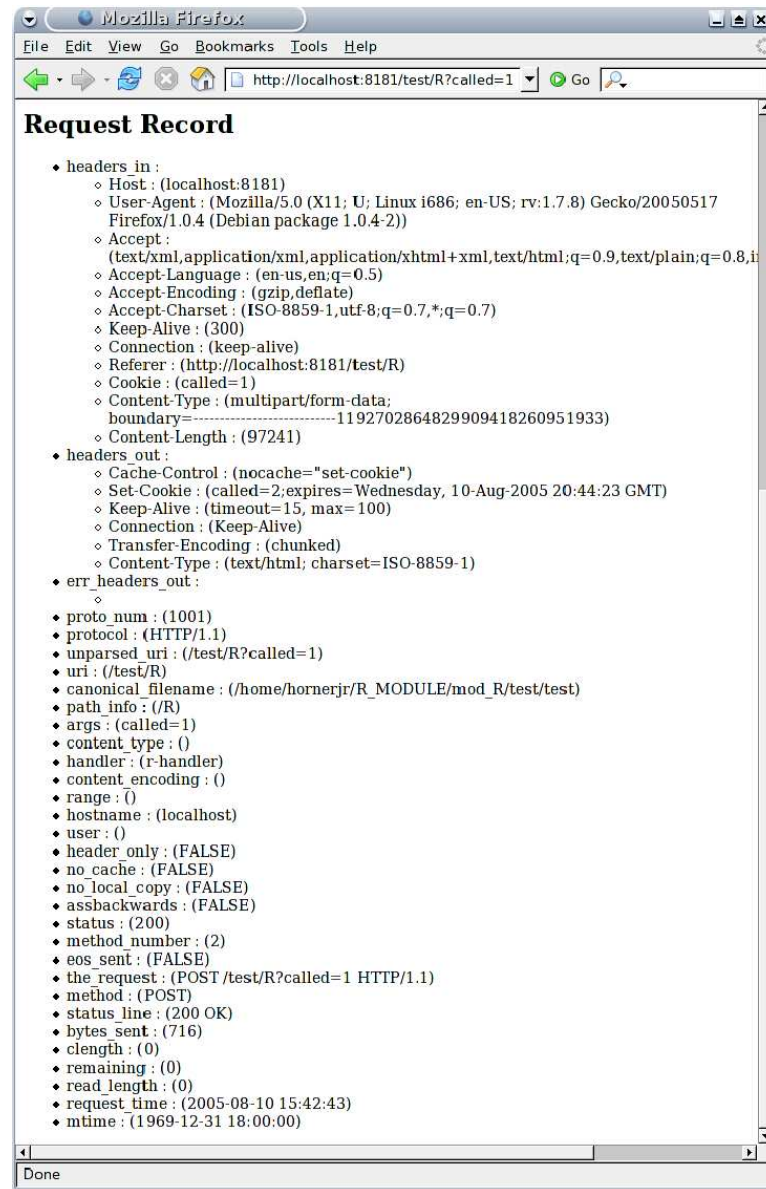
Examples: Test Handler Output 1

Examples: Test Handler Output 2

Examples: GD/NRart Handler

```
library('GDD')
library('NRart')
r2 <- function(r)
{
    step <- 2
    args <- apache.get_args(r)

    if(!is.null(args$t)){
        pstep <- as.integer(args$t)
        if (pstep > step && pstep < 121)
            step <- pstep;
    }

    apache.set_content_type(r,"image/png")

    GDD(ctx=apache.gdlib_ioctx(r),w=500,h=500,type="png")

    nr.movie(x^3 + .28 * tan(x + t) + cos(x + 2*t)*.3i - 0.7,
                't', seq(0, pi, length=121)[step],
                extent=1, steps=3, points=400,
                col=rainbow(256), zlim=c(-pi, pi))

    dev.off()
    OK
}
```
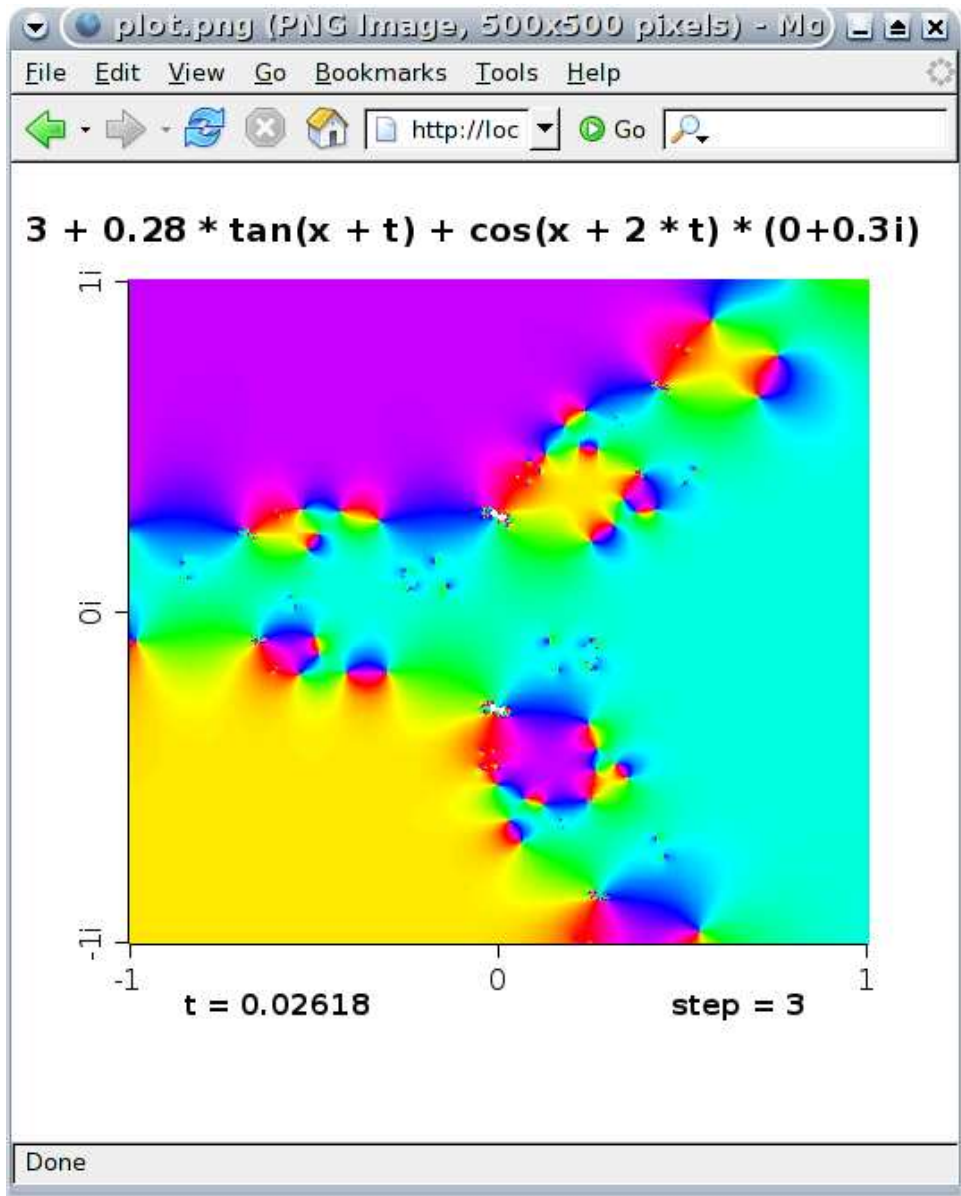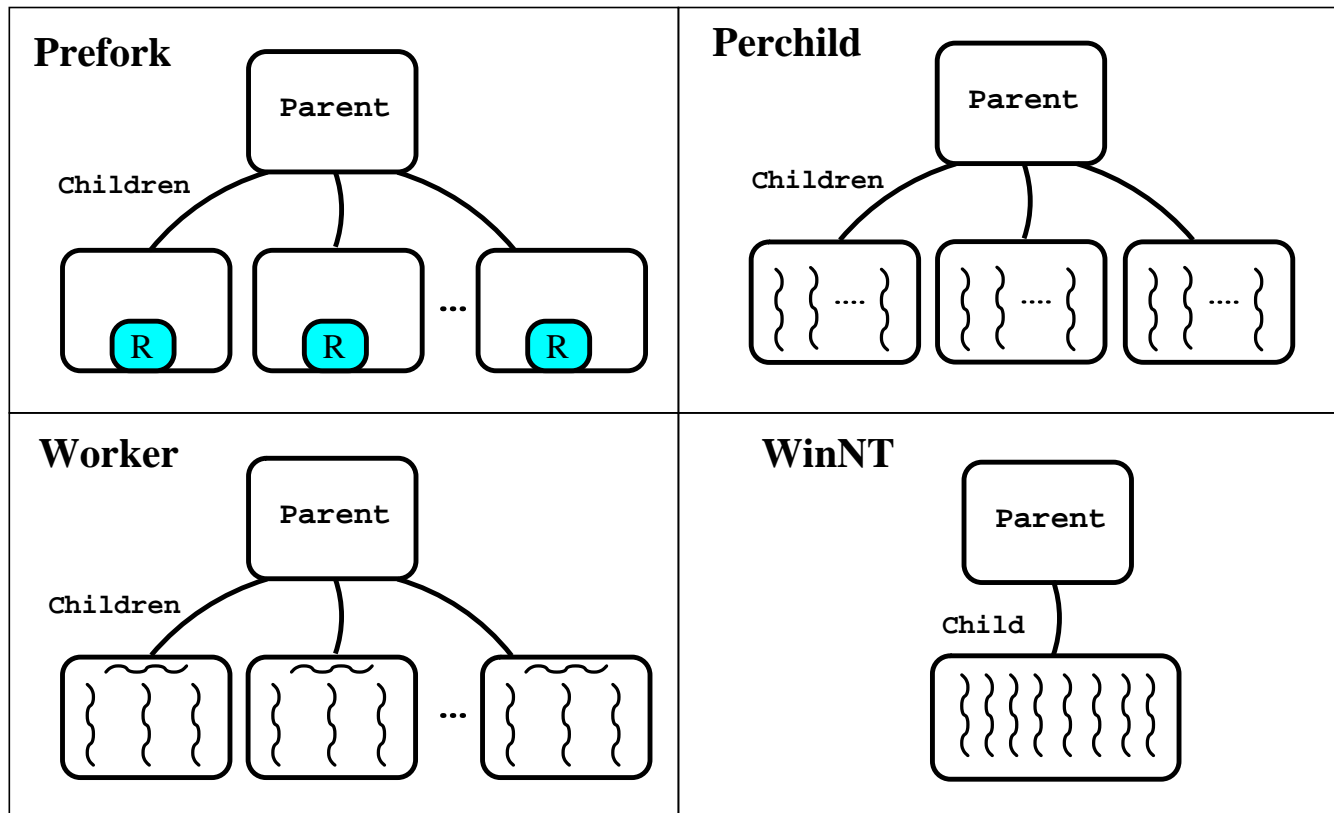
Examples: GDD/NRart Handler Output.

Biggest Challenge: Maintaining State

Apache 2.0 Multi-Processing Modules.

Future Work

Find solutions to State Problem

- `memcached`
- database connections
- file connections with file locking

Custom Apache Multi-Processing module for R

- Implement sessions allowing web request to talk to same R interpreter
- Rbatch: Allow interactive R session to communicate with R slave sessions

Work with other R projects

- Rpad: email discussion already under way
- Rserve, RSOAP ?

Extensions to R

- Package level Connection interface
- `attach()` external data stores to search path