Julia Lightning Round
MIT IAP Tutorial
January 15, 2013

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Quitting

- Two ways to quit the interactive session
  - (known as a REPL: Read-Eval-Print-Loop)
- <cntl> D
- quit() ← Need Parens

- Clear the current Command at the prompt:
- <cntl> C

Julia Documentation

- Well written!
  - http://docs.julialang.org/en/latest/
- google: julia documentation

- Much of Julia is written (elegantly!) in Julia – it won't take you long before you start looking at Julia to learn Julia
  - When you are ready: google "julia source" and click on "base" or "examples" and browse around

Indexing: 1 based
Square brackets

- A=rand(5,5)
- A[1,1]
- rand(5,5)[1,1]
- Remember
  - parens for functions,
  - square brackets for indexing

Comprehensions (elegant “array constructors”)

- [i for i=1:5]
- [trace(rand(n,n)) for n=1:5]
- x=rand(10); [x[i]+x[i+1] for i=1:9]
- {eye(n) for n=1:5}
- [i+j for i=1:5, j=1:5]

  - Vision: automatic parallelism

Parentheses also used for multiple outputs

- A=rand(5,6);

- svd(A)
- (u,s,v)=ans
  - Notice that s is a vector
- type<tab> #tab completion
- ndims(u), typeof(u)
- ndims(s), typeof(s)

Ternary Operator

- si(x) = (x>0) ? 1 : -1
- si(x) = (x>0) ? 1 : ((x<0) ? -1: 0) # Chained
  "sign" (Comment: "#")

Complex Numbers

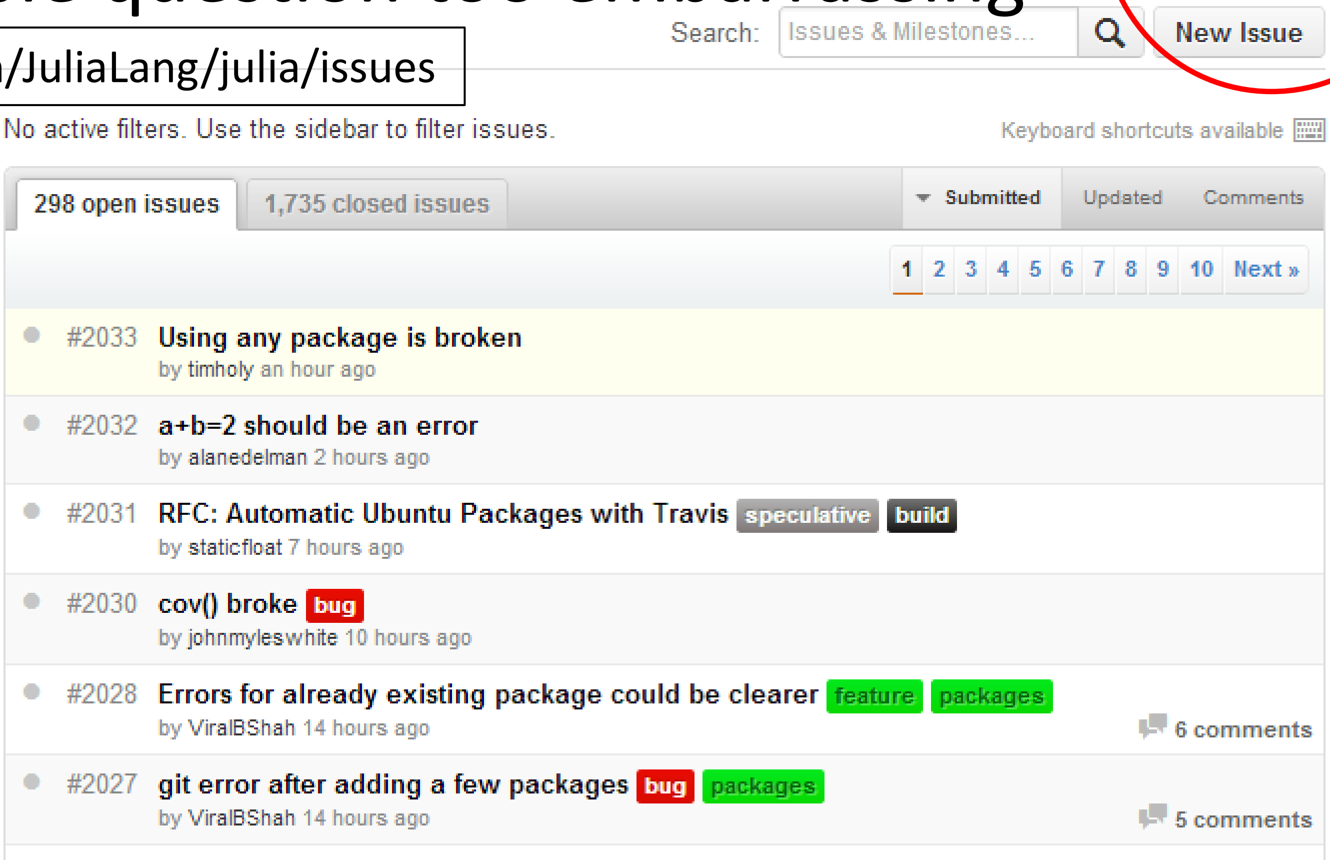
- im
- typeof(2im)
- typeof(2.0im)
- complex(3,4)
- complex(3,4.0) #multiple dispatch (more later)
- sqrt(-1)
- sqrt(complex(-1))

Issues Culture

- Old days: wait for a new release
- Julia: easy bugs fixed at the speed of light, rationale explained
- No newbie question too embarrassing

https://github.com/JuliaLang/julia/issues

Press me: Don't be shy



No active filters. Use the sidebar to filter issues.

#2033 Using any package is broken
by timholy an hour ago

#2032 a+b=2 should be an error
by alanedelman 2 hours ago

#2031 RFC: Automatic Ubuntu Packages with Travis speculative build
by staticfloat 7 hours ago

#2030 cov() broke bug
by johnmyleswhite 10 hours ago

#2028 Errors for already existing package could be clearer feature packages
by ViralBShah 14 hours ago — 6 comments

#2027 git error after adding a few packages bug packages
by ViralBShah 14 hours ago — 5 comments

Vectors

- A=rand(5,5)
- v=rand(5,1) ; w=rand(5)
- typeof(v)   # Array{Float64,1}
- typeof(1.0 : 5) #Range1{Float64}

  w=1.0: 5; A*w; #error (maybe shouldn’t be?)

  w=[1.0:5]; A*w; #ok
- ones(5) #vector!
- eye(5) #matrix (makes sense!)

running a file

- include("file.jl")
  - note that commands without semicolons won't print without "println" (print line)

Deployment

deploy.jl

```
n=int(ARGS[1])
println(randn(n,n))
```

- in shell:
- ./julia deploy.jl 5

- (lots more in “Getting Started” doc)

.. or even better dice

```
#! fullpath/julia
n=int(ARGS[1])
println(randn(n,n))
count=0
for i=1:n
  a=randi(6,3)
  count += (3==length(unique(a)))
end
println(count/n)
```

- in shell:
- chmod +x dice
- ./dice 1000

Outside Calls

- Shell
  - run(`cal`)
  - run(`cal` | `grep Sa`)
- C-function call
  - ccall(:clock, Int32, ())
  - bytestring(ccall(:ctime, Ptr{Uint8}, ()))

Punctuation Review

() Parentheses:
- Function Calls
    - Required! quit(),tic(),toc(),help()
- Output Arguments

[] Brackets:
- Indexing
- Array Constructors
    - Comprehensions

{} Braces:
- Any Arrays

Packages

- check out all the available packages off of docs.julialang.org
- Click, for example, on Calendar and get to the github project page

```
Pkg.add("Calendar")   #Only first time
using Calendar  #Calendar exists now
Calendar.now()
now()
```

Packages (cont)

- now()
- Calendar.<tab>
- quit() # get out of julia and back in
- now   # find line number in source
- #click on “src”
- typeof(now())
- n=now()
- n.tz
- n.millis
- z=convert(Array, @parallel [Calendar.now().millis for x=1:10]);z-mean(z)

Interesting Type

```
strang(n)=SymTridiagonal(2*ones(n),-ones(n-1))
lit=strang(500)
big=full(strang(500))
@time eigvals(lit)
@time eigvals(big)
big+big;
lit+lit;  #watch it break
import Base.+
xdump(lit)
+(a::SymTridiagonal,b::SymTridiagonal)=SymTridiagonal(a.dv+
b.dv,a.ev+b.ev)
lit+lit
```

Tasks (“produce”)
“pause” and “play” later

```
function stepbystep()
for n=1:3
      produce(n^2)
  end
end

p=Task(stepbystep);
consume(p)
consume(p)
consume(p)
consume(p)  #What should happen now?
```

Parallelism (more later)

- julia –p 5 #5 local processes
- julia –machinefile file #hosts in file
- addprocs_local(5) #inside a julia session
- @parallel #execute using every processor

Design Decisions

- Return type should not depend on value
- sqrt(-1) #error
- anothersqrt(x) = x<0 ? sqrt(complex(x)) : sqrt(x)
- [anothersqrt(x) for x=-2:3]