Réunion Track Finding 13-15/12/23

Calcul COMET-France (Tracking) le 14/12 au cc-in2p3

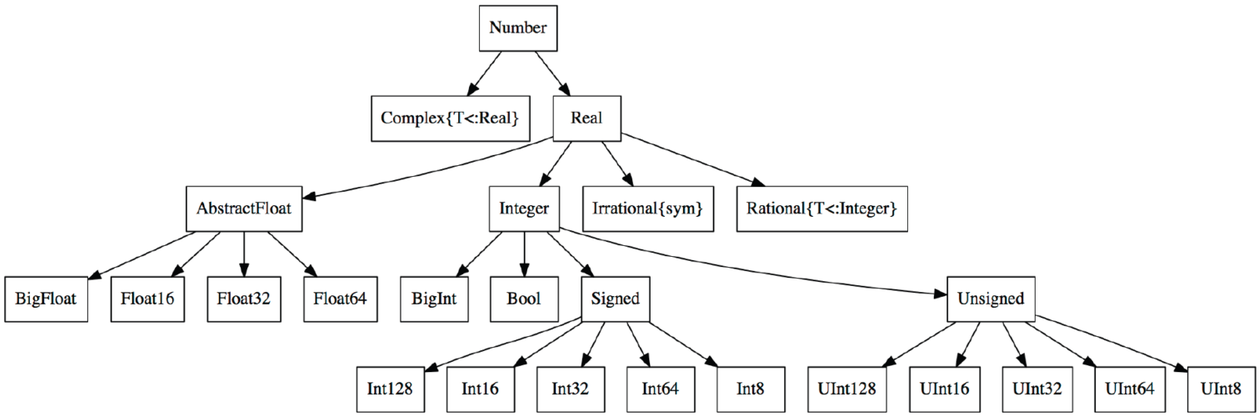
> *https://indico.in2p3.fr/event/31543/*

Julia au CC: Environnement de Base

Documentation julia: https://docs.julialang.org

Langage: T**yped** with Total D**ispatch**

Exemple pour les nombres:



Exemple de dispatch avec la fonction sqrt():

```
julia> sqrt( <TAB>

sqrt(x::Union{Float32, Float64}) in Base.Math at math.jl:590

sqrt(A::StridedMatrix{T}) where T<:Union{Real, Complex} in Lin
earAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/
stdlib/v1.8/LinearAlgebra/src/dense.jl:853

sqrt(J::LinearAlgebra.UniformScaling) in LinearAlgebra at /pb
s/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/Linea
rAlgebra/src/uniformscaling.jl:173
```

```
sqrt(A::LinearAlgebra.UpperTriangular) in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/triangular.jl:2301

sqrt(A::LinearAlgebra.UnitUpperTriangular{T, S} where S<:AbstractMatrix{T}) where T in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/triangular.jl:2302

sqrt(A::LinearAlgebra.Hermitian{T, S} where S<:(AbstractMatrix{<:T}); rtol) where T<:Complex in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/symmetric.jl:840

sqrt(A::Union{LinearAlgebra.Hermitian{T, S}, LinearAlgebra.Symmetric{T, S}} where S; rtol) where T<:Real in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/symmetric.jl:829

sqrt(A::LinearAlgebra.UnitLowerTriangular) in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/triangular.jl:2321

sqrt(A::LinearAlgebra.Adjoint{<:Any, <:AbstractMatrix}) in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/dense.jl:881

sqrt(D::LinearAlgebra.Diagonal) in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/diagonal.jl:674

sqrt(A::LinearAlgebra.LowerTriangular) in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/triangular.jl:2320

sqrt(A::LinearAlgebra.Transpose{<:Any, <:AbstractMatrix}) in LinearAlgebra at /pbs/throng/comet/Julia/julia-1.8.5/share/julia/stdlib/v1.8/LinearAlgebra/src/dense.jl:882

sqrt(x::BigInt) in Base.MPFR at mpfr.jl:596

sqrt(a::Float16) in Base.Math at math.jl:1352

sqrt(::Missing) in Base.Math at math.jl:1374

sqrt(a::ComplexF16) in Base.Math at math.jl:1353
```

```
sqrt(z::Complex) in Base at complex.jl:516
sqrt(x::BigFloat) in Base.MPFR at mpfr.jl:588
sqrt(x::Real) in Base.Math at math.jl:1369
```

Compilation Just In Time (LLVM)

Installation de Julia

THRONG_DIR (/pbs/throng/comet). Actuellement:
/pbs/throng/comet/Julia/julia-1.8.5

```
cd /pbs/throng/comet
du -sh julia-1.8.5
16G        julia-1.8.5
cd /pbs/throng/comet/Julia/julia-1.8.5/share #directory where the external packages are installed
du -sh julia
15G        julia
```

HOME de chaque utilisateur de Julia:
.julia *(créé automatiquement)*

Variables env. importantes à connaitre par l'utilisateur de Julia
Lieu de chargement et d'installation des packages

```
JULIA_DEPOT_PATH
JULIA_LOAD_PATH
```

Environnement SHELL
utilisation de module: module load julia

```
cd /pbs/throng/comet/modulefiles
ls
Programming_Languages  README  module  modulerc
```

```
cat README
#To add the comet modules to module (command interface to the
Modules package):
rm -rf $HOME/.module
ln -s /pbs/throng/comet/modulefiles/module $HOME/.module
rm -rf $HOME/.modulerc
ln -s /pbs/throng/comet/modulefiles/modulerc $HOME/.modulerc

cat modulerc
....
# Add alias to a module. It acts as a shortcup name to call a
module.
#module-alias name modulefile
module-alias julia          Programming_Languages/julia/1.8.5
module-alias julia-admin    Programming_Languages/julia/1.8.5a
module-alias julia-1.7      Programming_Languages/julia/1.7.0
...
module-version Programming_Languages/julia/1.8.5   latest
...

cd module
ls
default
cat default
module use --append {/pbs/software/centos-7-x86_64/modules/mod
ulefiles}
module use --append {/pbs/throng/comet/modulefiles}

cd ../Programming_Languages
ls
julia
```

```
cd julia
ls
1.8.5  1.8.5a


cat 1.8.5
/pbs/throng/comet/modulefiles/Programming_Languages/julia(0)>cat 1.8.5
#%Module 5.0
#
#  JULIA module for use with 'environment-modules' package:
#
proc ModulesHelp { } {
        puts stderr "julia/1.8.5- sets the Environment for Julia 1.8.5 installed by Patrice in $THRONG_DIR"
}
module-whatis   "Sets the Environment for using Julia 1.8.5 (private comet install)."
conflict                    julia
prepend-path                PATH            /pbs/throng/comet/Julia/julia-1.8.5/bin
#prepend-path                 LD_LIBRARY_PATH /pbs/throng/comet/Julia/julia-1.8.5/lib:/pbs/throng/comet/Julia/julia-1.8.5/lib/julia:/usr/local/cuda/lib64:/usr/local/cuda/lib64/stubs
prepend-path                MAN_PATH        /pbs/throng/comet/Julia/julia-1.8.5/share/man
setenv                      JULIA_BIN        /pbs/throng/comet/Julia/julia-1.8.5/bin
setenv                      JULIA_DIR        /pbs/throng/comet/Julia/julia-1.8.5
setenv                      JULIA_NUM_THREADS 4
```

Environnement Notebook Jupyter

Kernels

```
cd /pbs/throng/comet/Julia/kernels
ls
README julia-1.7  julia-1.8  julia-1.8-admin  julia-1.8-sys-cairo  julia-1.8-sys-plots
cat README
...
#users can copy and paste the following lines to have the kernels available in jupyter notebook.
rm -rf $HOME/.local/share/jupyter/kernels/julia-1.8
ln -s /pbs/throng/comet/Julia/kernels/julia-1.8 $HOME/.local/share/jupyter/kernels/julia-1.8
...

cd julia-1.8
ls
kernel.json  logo-32x32.png  logo-64x64.png  logo-svg.svg
cat kernel.json
{
  "display_name": "Julia 1.8.5",
  "argv": [
    "/pbs/throng/comet/Julia/julia-1.8.5/bin/julia",
    "-i",
    "--color=yes",
    "--project=@.",
    "/pbs/throng/comet/Julia/julia-1.8.5/share/julia/packages/IJulia/Vo51o/src/kernel.jl",
    "{connection_file}"
  ],
  "language": "julia",
```

```
  "env": {"JULIA_NUM_THREADS":"4"},
  "interrupt_mode": "signal"
}
```

```
cd ../julia-1.8-admin
cat kernel.json
{
  "display_name": "Admin Julia 1.8.5",
  "argv": [
    "/pbs/throng/comet/Julia/julia-1.8.5/bin/julia",
    "-i",
    "--color=yes",
    "--project=/pbs/throng/comet/Julia/julia-1.8.5/share/julia/environments/v1.8/Project.toml",
    "/pbs/throng/comet/Julia/julia-1.8.5/share/julia/packages/IJulia/Vo51o/src/kernel.jl",
    "{connection_file}"
  ],
  "language": "julia",
  "env": {
      "JULIA_DEPOT_PATH": "/pbs/throng/comet/Julia/julia-1.8.5/share/julia",
      "IRODS_PATH": "/pbs/software/centos-7-x86_64/irods/3.3.1/bin",
      "PYTHON": "/pbs/software/centos-7-x86_64/jnp/3.8.5/bin/python"
},
  "interrupt_mode": "signal"
}
```

```
"display_name": "Julia 1.8.5 CairoMaki",
```

```
  "argv": [
    "/pbs/throng/comet/Julia/julia-1.8.5/bin/julia",
    "-i",
    "--sysimage=/pbs/throng/comet/Julia/julia-1.8.5/sysimageCairoMakie/sys_cairo.so",
    "--color=yes",
    "--project=@.",
     "/pbs/throng/comet/Julia/julia-1.8.5/share/julia/packages/IJulia/Vo51o/src/kernel.jl",
    "{connection_file}"
  ],
  "language": "julia",
  "env": {},
  "interrupt_mode": "signal"
}
```

STARTUP files
~/.julia/config/startup.jl

```
#exemple:
cd ~/.julia/config
ls
startup.jl
cat startup.jl
# This file should contain site-specific commands to be executed on Julia startup;
# Users may store their own personal commands in `~/.julia/config/startup.jl`.
print("My private startup: ")
import Pkg
if Pkg.API.project().name == nothing
```

```
   println("As admin of julia by security the Empty project is activated")
   Pkg.activate("Empty", shared=true)
else
    print("project name is "); printstyled(Pkg.API.project().name, color=:blue, bold=true); println(".")
end
function template()
    @eval begin
        using PkgTemplates
    Template(;
           user="patrice",
           host="gitlab.in2p3.fr",
           dir=".",
           authors="Patrice Lebrun",
           julia=v"1",
           plugins=[
               Git(; manifest=false, ssh=true, ignore=["*.~", "*.jld2", "*.png", "*.output", "*.save", "*.svg", "*.C", ".ipynb_checkpoints", "/Output", "/Plots"]),
               GitLabCI(),
               Documenter{GitLabCI}(),
           ],
        )
    end
end
```

/pbs/throng/comet/Julia/julia-1.8.5/etc/julia

```
cat startup.jl
# This file should contain site-specific commands to be executed on Julia startup;
```

```
# Users may store their own personal commands in `~/.julia/con
fig/startup.jl`.

#println("For any issue or question about this version of juli
a please contact lebrun@in2p3.fr")

#if "JULIA_DEPOT_PATH" in keys(ENV)
#   printstyled("Warning Admin mode: ", color=:red, bold=true)
#   println("The JULIA_DEPOT_PATH is $(ENV["JULIA_DEPOT_PAT
H"])")
#end

ENV["JULIA_PKG_USE_CLI_GIT"]=true
ENV["PYTHON"]="/pbs/software/centos-7-x86_64/jnp/3.8.5/bin/pyt
hon"
```

`julia --startup-file=no` # pour ne pas executer les startup.jl

Notebook Jupyter

https://notebook.cc.in2p3.fr
https://notebook.cc.in2p3.fr/user/lebrun/lab/tree/Presentation/Untitled.ipynb

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Probleme

Pour les demonstrations comme j'ai les droits d'écriture dans les repertoires d'installation de julia, il est possible que tous ne soient pas reproductible par les autres utilisateurs
et surtout que je ne puisse pas voir les problèmes qu'ils peuvent rencontrer.

Pour palier a ce probleme il faudrait faire l'installation de Julia sous un autre compte

- cometmgr ?
- creation d'un compte adminjulia ???

...

Other Important Subjects (for the future):

BinaryBuilder.jl

https://docs.binarybuilder.org/stable/

Exemple with Geant4:

https://www.dropbox.com/scl/fi/ek8a5mc6tt73f9alcjcj8/Geant4.jl-20231109.pdf?rlkey=1pzywr2u58szi4rljseczlp25&dl=0

https://github.com/JuliaPackaging/Yggdrasil/tree/master/G/Geant4


Yggdrasil/G/Geant4 at master · JuliaPackaging/Yggdrasil • github.com

https://github.com/JuliaInterop/CxxWrap.jl


GitHub - JuliaInterop/CxxWrap.jl: Package to make C++ libraries available in Julia • github.com

https://github.com/grasph/wrapit


GitHub - grasph/wrapit: Automatization of C++--Julia wrapper generation • github.com

Exemple de Project.toml

https://github.com/JuliaHEP/Geant4.jl/blob/master/Project.toml


Geant4.jl/Project.toml at master · JuliaHEP/Geant4.jl • github.com

PackageCompiler is a Julia package with three main purposes:

1. Creating custom sysimages for reduced latency when working locally with packages that have high startup times.
2. Creating "apps" which are a bundle of files including an executable that can be sent and run on other machines without Julia being installed on that machine.
3. Creating a relocatable C library bundle form of Julia code.

https://github.com/JuliaLang/PackageCompiler.jl


GitHub - JuliaLang/PackageCompiler.jl: Compile your Julia Package • github.com

Passage à Julia 1.9.4 ??? (attendre peut être maintenant 1.10.x)

https://julialang.org/downloads/

Discussion about ICEDUST

- Docker stuff

https://gitlab.in2p3.fr/comet/ICEDUST_packages


Sign in · GitLab • gitlab.in2p3.fr

NOTES:

```
/pbs/throng/comet/Julia/julia-1.8.5/share/julia/artifacts(0)>du -sh * | grep G
```

```
1.9G        913584335ab836f9781a0325178d0949c193f50b
1.6G        b0757335df76c8a6732f8261b705210afd7d2583


/pbs/throng/comet/Julia/julia-1.8.5/share/julia/packages/CUDA/
BbliS(0)>grep b0757335df76c8a6732f8261b705210afd7d2583 *toml
Artifacts.toml:git-tree-sha1 = "b0757335df76c8a6732f8261b70521
0afd7d2583"
Artifacts.toml:git-tree-sha1 = "b0757335df76c8a6732f8261b70521
0afd7d2583"
```

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il was my very first Julia benchmark:

https://notebook.cc.in2p3.fr/user/lebrun/lab/tree/JuliaBenchmark.ipynb