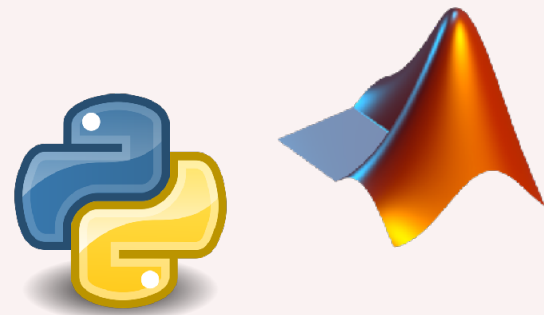


Introduction to Julia for High-Performance Computing

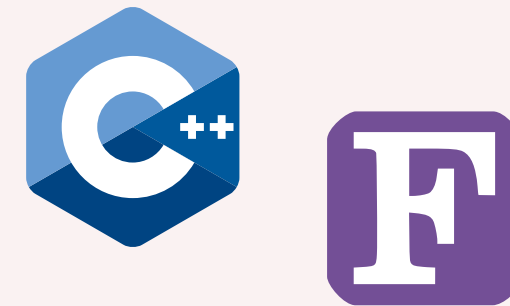
Carsten Bauer @ TU Delft

October 15, 2024

Convenience

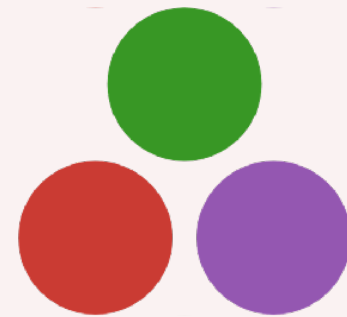


Performance



Language Barrier

Convenience



Performance



Gradual transition

	Tuesday	Wednesday	Thursday	Friday
	Foundations	Core	Node	Cluster
09:00 - 10:45	Getting Started	Type & Memory Optimizations	Multithreading	Distributed Computing
10:45 - 11:00	Break	Break	Break	Break
11:00 - 12:30	Fundamentals	Exercises	Exercises	Exercises
12:30 - 14:00	Lunch	Lunch	Lunch	Lunch
14:00 - 15:30	Compilation	SIMD	GPU Computing	Profiling
15:30 - 15:45	Break	Break	Break	Outro
15:45 - 17:00	Exercises	Exercises	Exercises	

Quick Live Survey

Julia's Weaknesses

HPC with Julia is
currently a **niche**.

Achieving
high performance
can be tricky.

No great way to
produce (small)
binaries.

Julia's Strengths

Julia is **interactive**
and **convenient**.

Julia has a great package manager




```
→ ~/myproject tree
.
├── Manifest.toml
├── Project.toml
└── code.jl

0 directories, 3 files

→ ~/myproject cat Project.toml
[deps]
CUDA = "052768ef-5323-5732-b1bb-66c8b64840ba"
DifferentialEquations = "0c46a032-eb83-5123-abaf-570d42b7fbba"
MKL = "33e6dc65-8f57-5167-99aa-e5a354878fb2"
MPI = "da04e1cc-30fd-572f-bb4f-1f8673147195"

→ ~/myproject
```

```
→ bauerc@n2login3 myproject julia --project
```



```
(-) | (-) |  
(-) | (-) |  
| | | | | | |  
| | | | | | |  
- / - \ - / - \ - / - \  
| | | | | | |  
-- / -- / -- / -- / -- / -- /
```

Documentation: <https://docs.julialang.org>

Type "?" for help, "]"? for Pkg help.

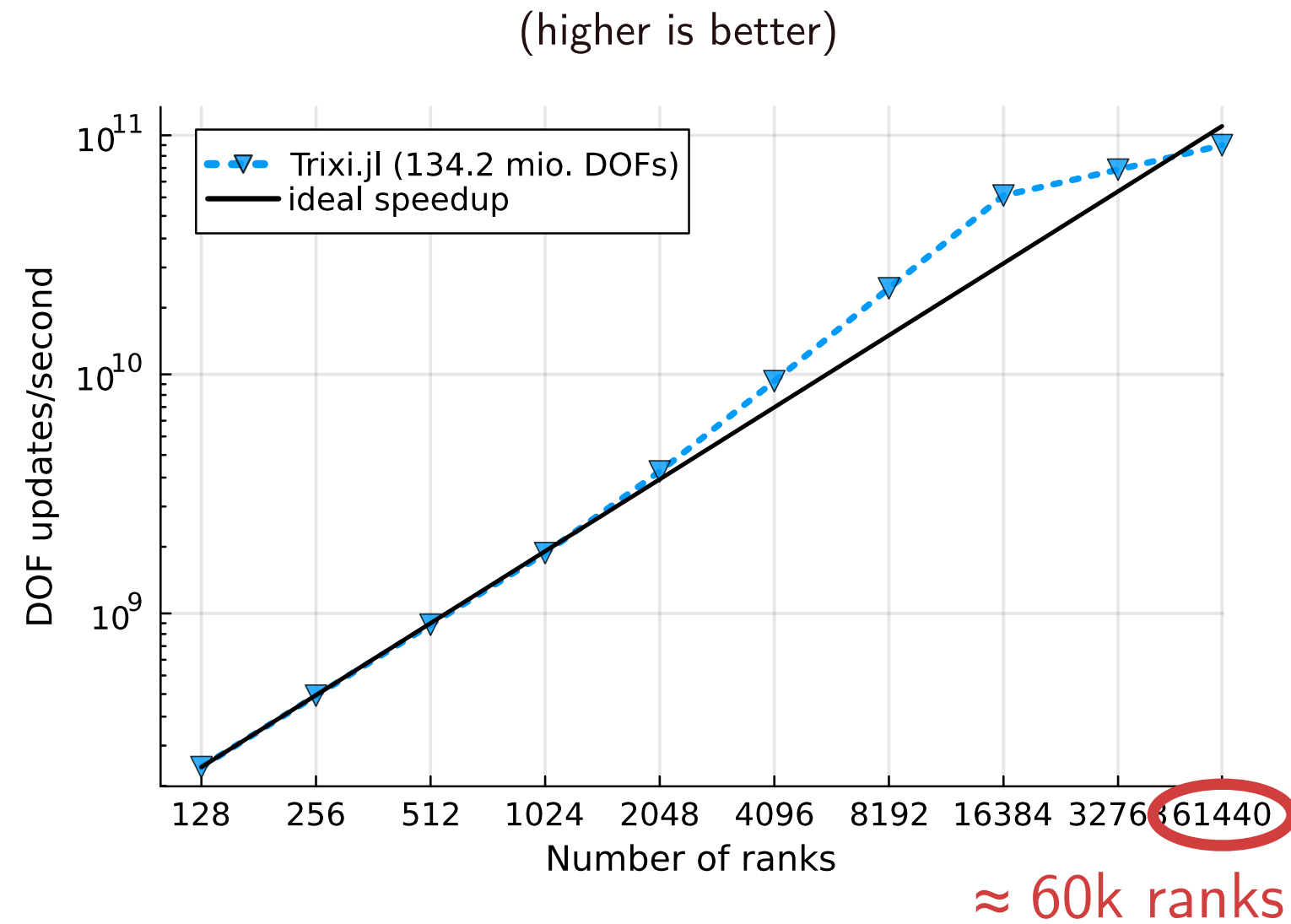
Version 1.7.2 (2022-02-06)

Official <https://julialang.org/> release

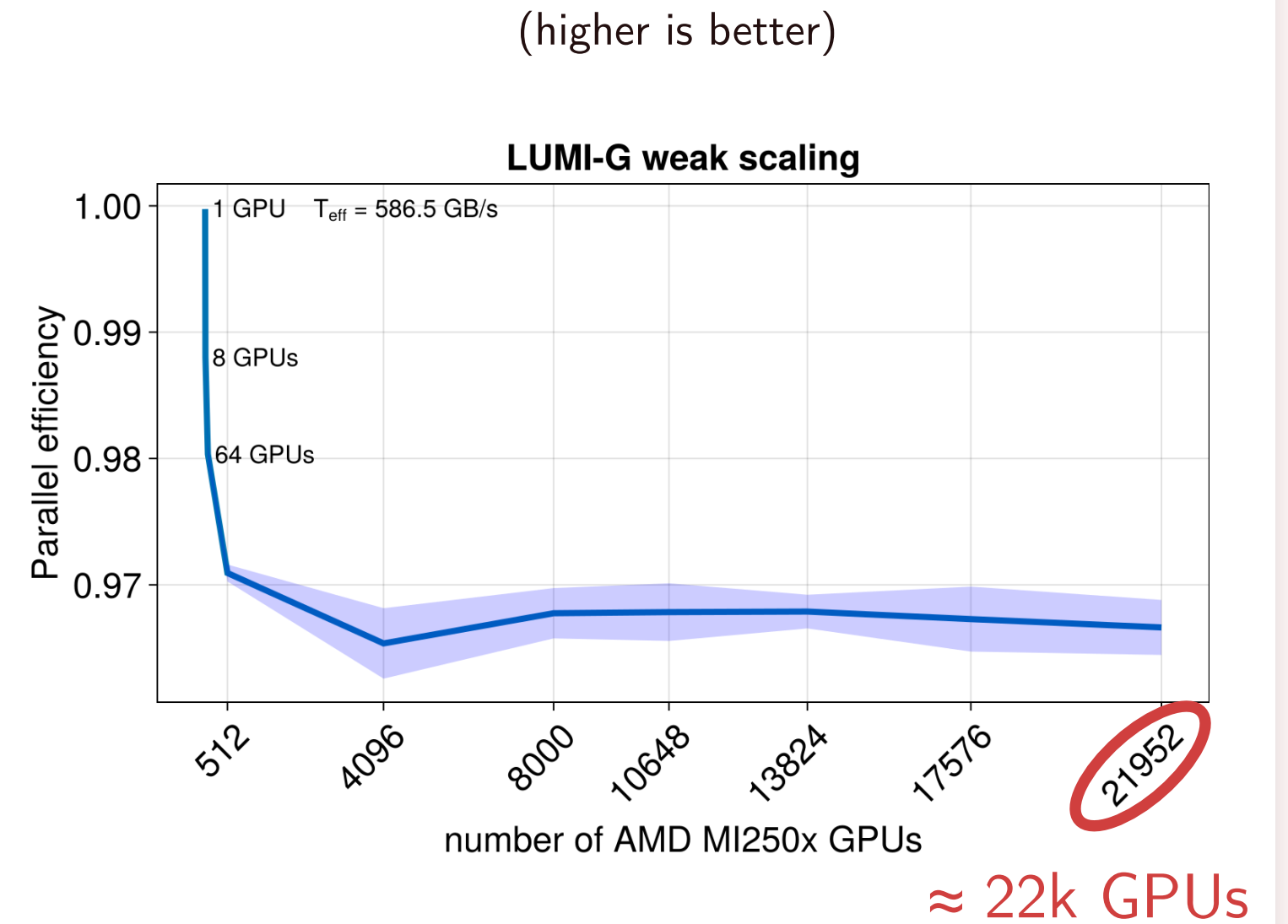
```
(myproject) pkg> st  
      Status `~/myproject/Project.toml`  
→ [052768ef] CUDA v3.11.0  
→ [0c46a032] DifferentialEquations v7.1.0  
→ [33e6dc65] MKL v0.5.0  
→ [da04e1cc] MPI v0.19.2  
      Info packages marked with → not downloaded, use `instantiate`  
to download  
  
(myproject) pkg> instantiate
```

Julia code can be
fast and **scalable**.

Example: Good scaling of PDE codes



Trixi.jl (Multi-CPU)



ParallelStencil.jl (Multi-GPU)

HPC with Julia is
currently a **niche!** 👍

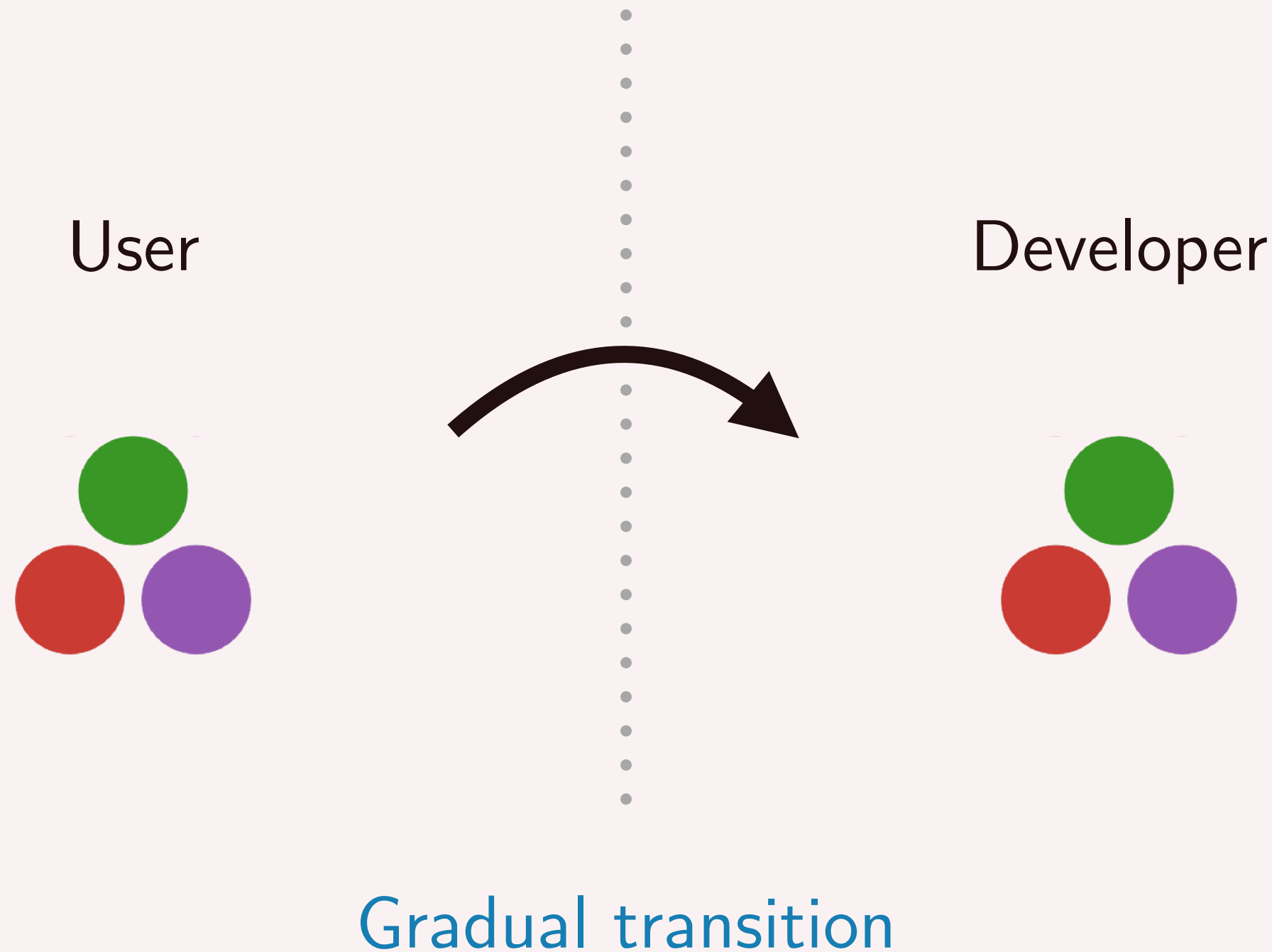
Join us at conferences ...



... or in our monthly Zoom call
(open to everyone!)

Julia invites you to
gradually **delve deeper.**

Julia makes it easier to become a developer.



Let us delve deeper!

