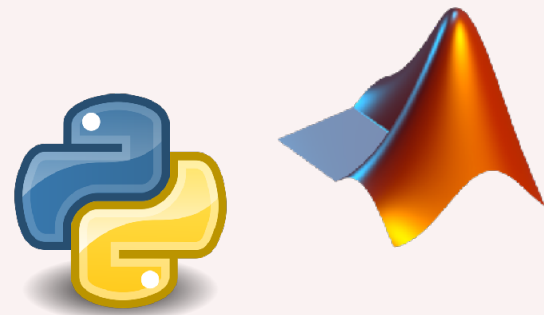


# Introduction to Julia for High-Performance Computing

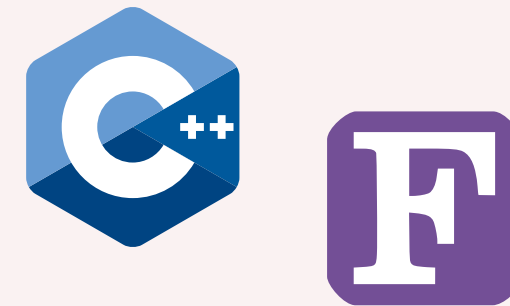
Carsten Bauer @ HLRS, Stuttgart

September 10, 2024

Convenience

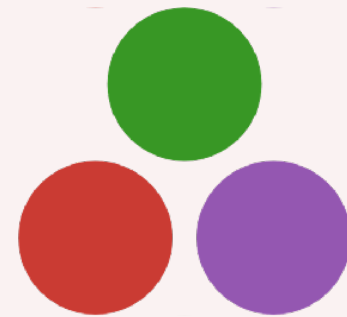


Performance



Language Barrier

Convenience



Performance



Gradual transition

	Tuesday	Wednesday	Thursday	Friday
	Foundations	Core	Node	Cluster
09:00 - 10:45	Intro Onboarding	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	Specialisation & Abstraction	SIMD & Profiling	GPU Computing	Exercises
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**.



# Join us at conferences ...



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



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

## Laptop



```
→ ~/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-570d42b7fbaa"
MKL = "33e6dc65-8f57-5167-99aa-e5a354878fb2"
MPI = "da04e1cc-30fd-572f-bb4f-1f8673147195"

→ ~/myproject
```

## HPC Cluster



```
→ 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
```

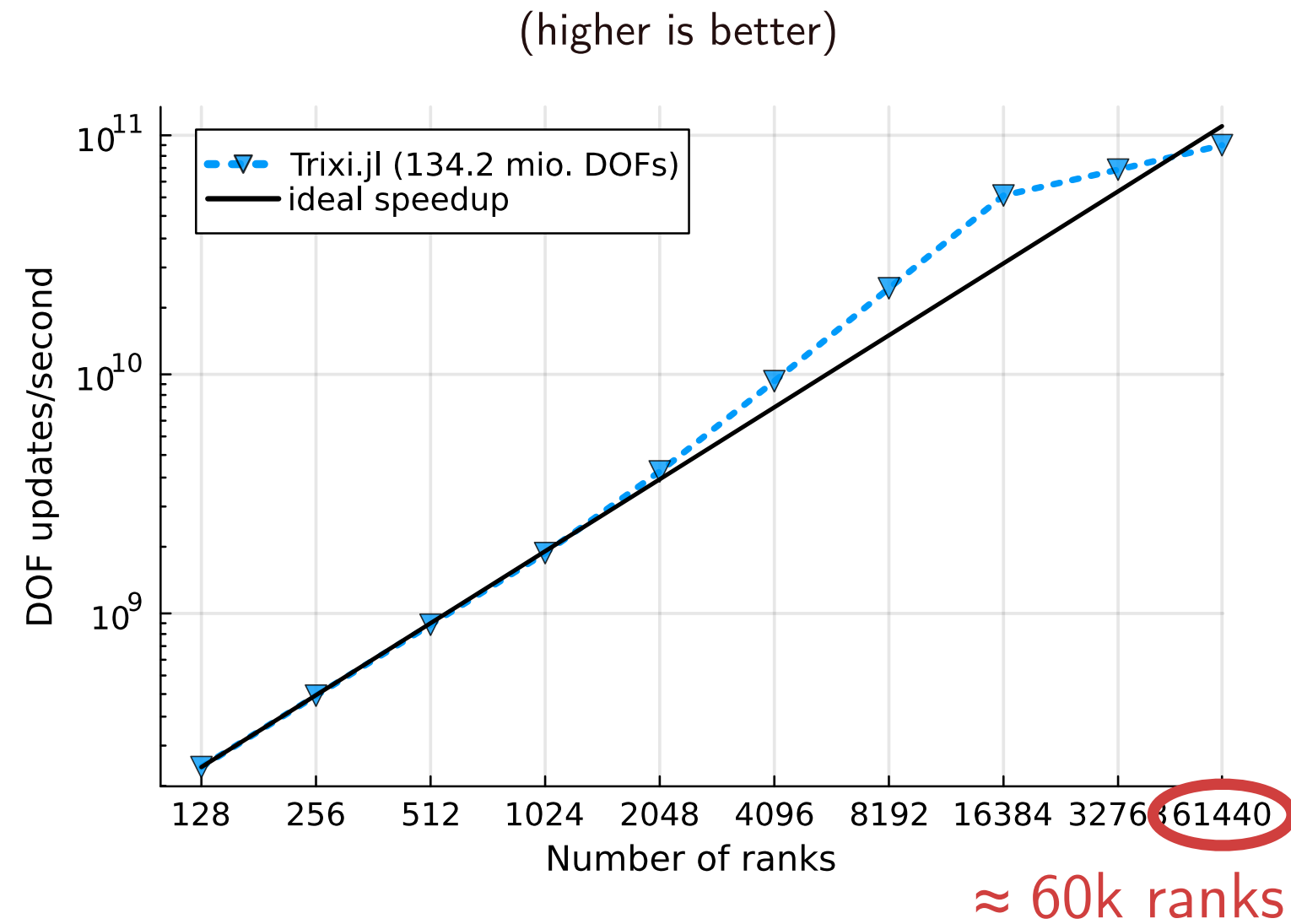
```
(myproject) pkg> st  
      Status `~/myproject/Project.toml`  
→ [052768ef] CUDA v3.11.0  
→ [0c46a032] DifferentialEquations v7.1.0  
→ [33e6dc65] MKL v0.5.0  
→ [da04e1cc] MPI v0.19.2  
      Info packages marked with → not downloaded, use `instantiate`  
to download
```

```
(myproject) pkg> instantiate
```

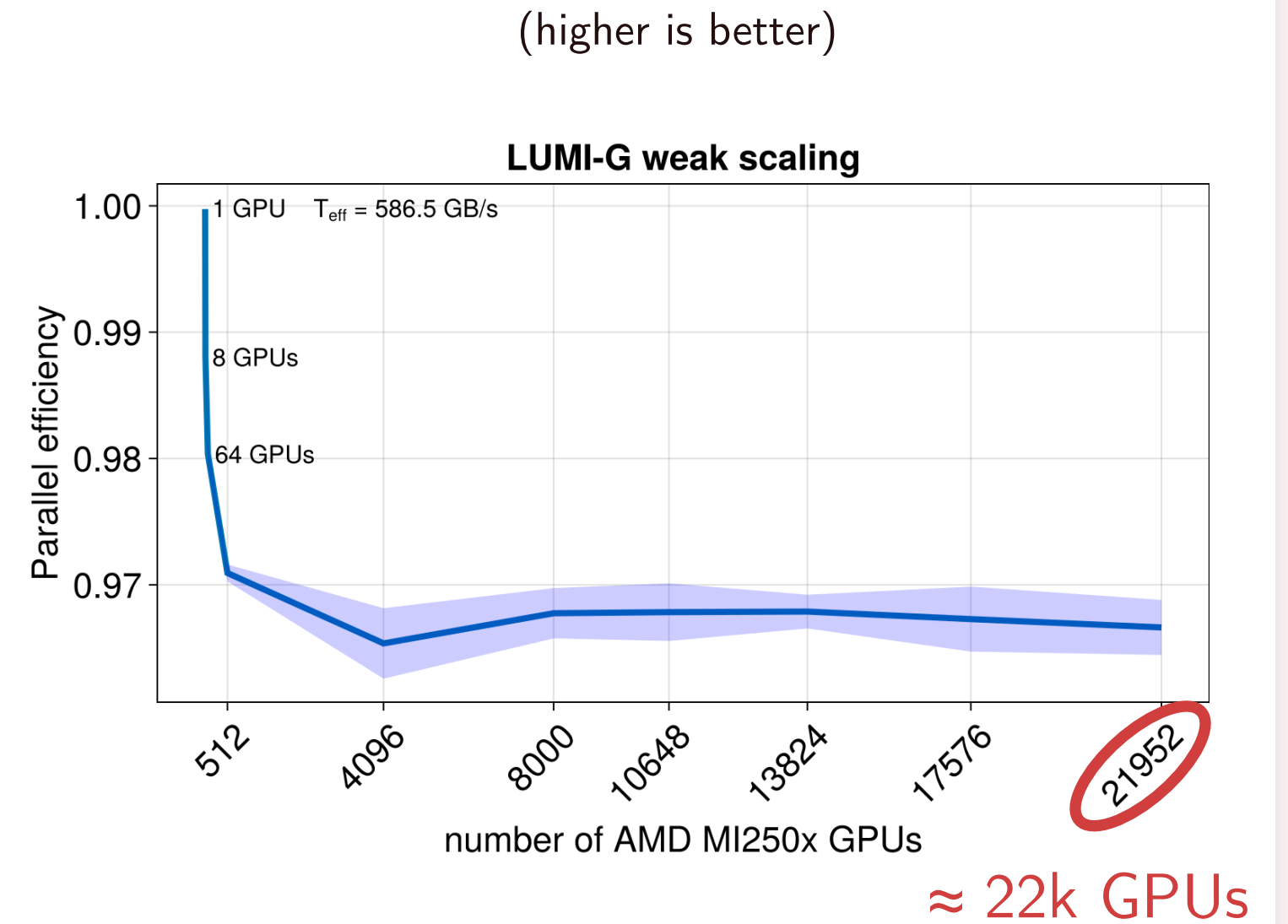


Julia code can be  
**fast** and **scalable**.

# Example: Good scaling of PDE codes



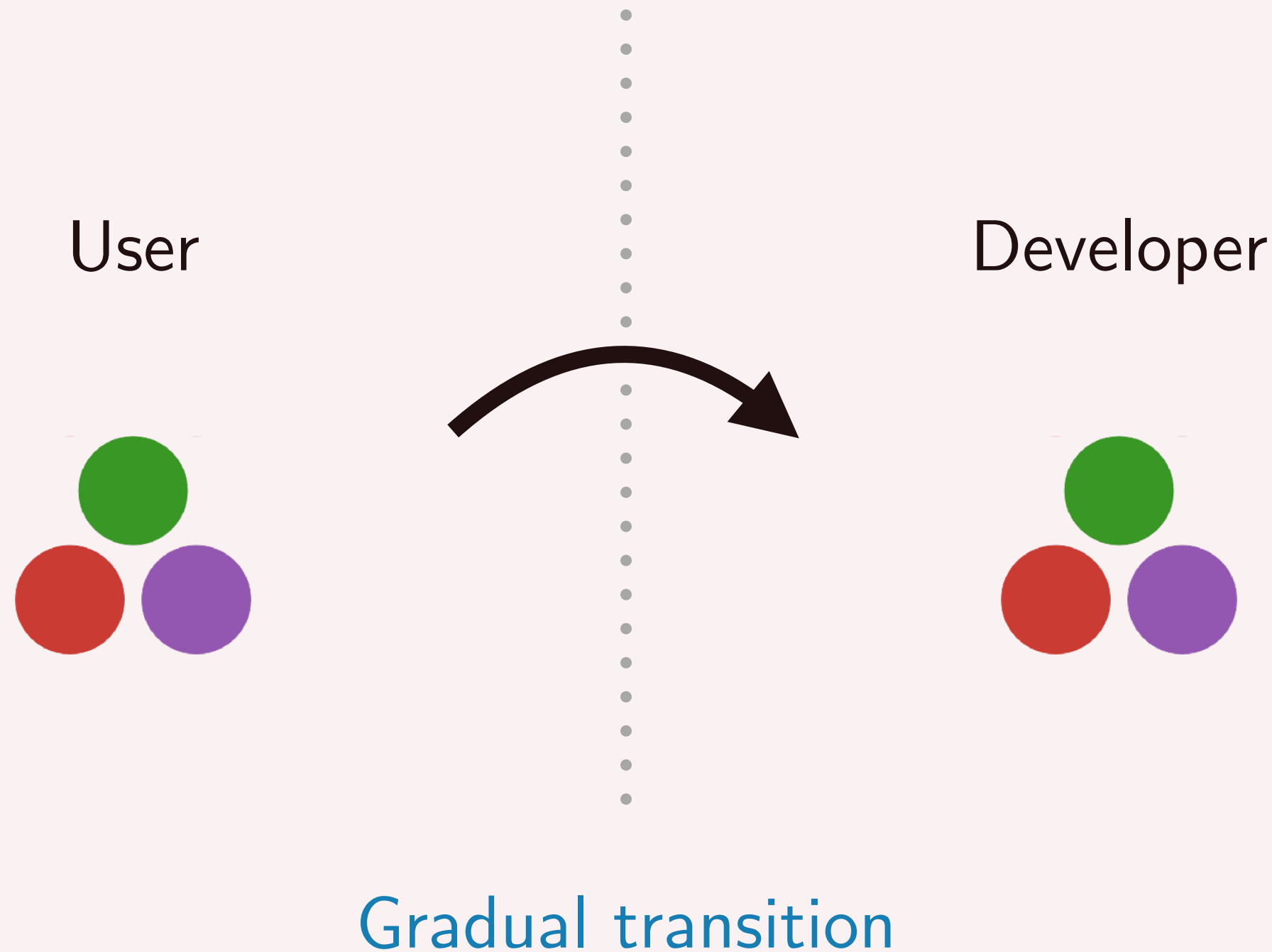
Trixi.jl (Multi-CPU)



ParallelStencil.jl (Multi-GPU)

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

# Julia makes it easier to become a developer.



Let us delve deeper!



