

GNS Systems

Taking Engineering to the Next Level

New performance dimension for extremely large CFD simulations with OpenFOAM and Azure Cloud: Reduce computation times by 80 percent and increase result quality at the same time

GOFUN 24.03.20121



Our vision: Enabling engineers to unleash creativity

Our mission: The best hybrid IT infrastructure for your workflows

Company Overview

IT Services for Engineering



GNS Systems - who we are!

GNS Systems: The Experts in Simulation IT

Located in Germany - Worldwide Service

GNS Group

250 IT Specialists and Simulation Experts Worldwide

OEMs and Suppliers

for Automotive, Life Science, Manufacturing, Chemistry as Customers

Dedicated Cloud Expertise

Microsoft / AWS
Partner

Independent Specialist

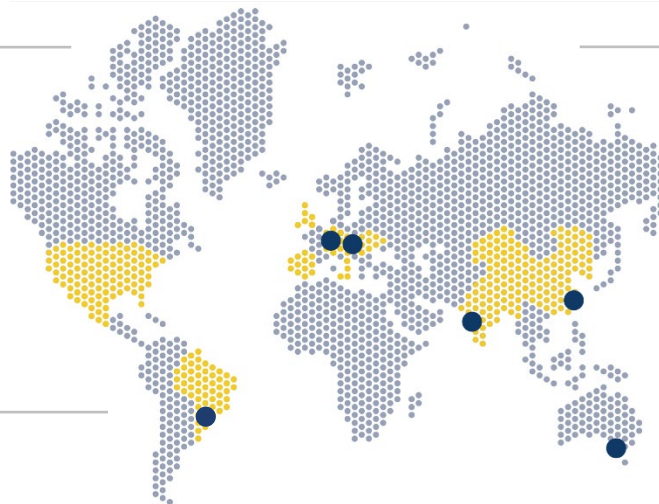
for value added HPC and Big Compute

800 years

Aggregated Big Compute Experience

100.000 h/a

professional CAE + HPC operations in cloud + on prem





IT for Virtual Engineering

By GNS Systems



Digital Engineering Center:
The Easy Way of Cloud-
Based Engineering



Autonomous Driving:
Reliable Infrastructure,
Reliable Software Engineering



**CAE/CAD Data
Management & Analytics:**
The Intelligent Use of Data



HPC & JGen:
The Ultimate Workflow
Engine



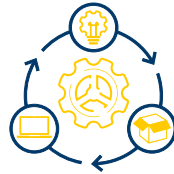
Silver
**Microsoft
Partner**

Competence for Workflows

Overview



- Skripting
- Software-Engineering
- Systems integration



- Workflow automation
- RichClients
- Web Front-End
- Web Back-End
- Data bases
- Optimization
- Sensitivity analysis



- HPC
- Pre/Post/Solver
- Cloud



- Agile Methods
- Scrum
- DevOps

The challenge: Better Products in Less Time

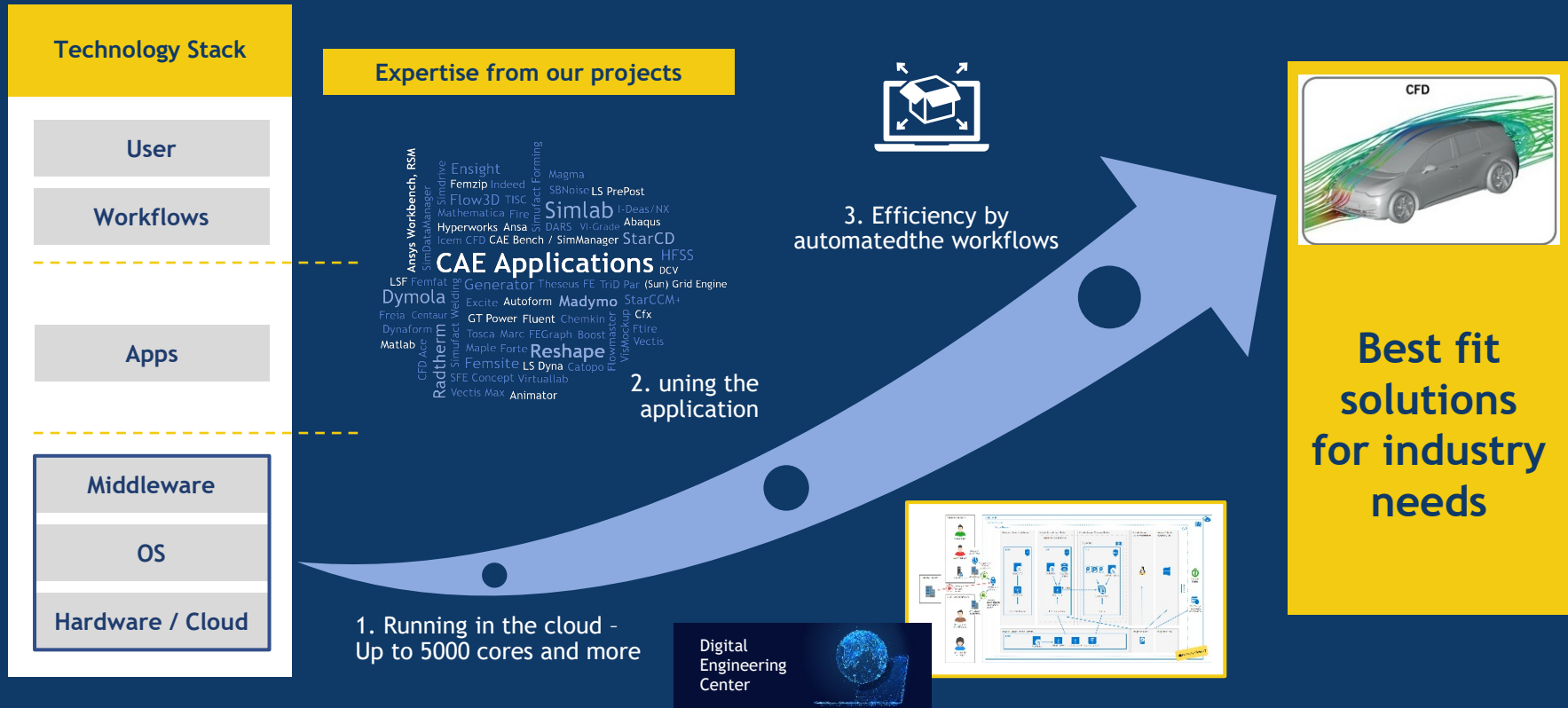
High Performance Computing und Simulation



How to get results ... faster?

Improving OpenFoam on All Layers

We Want to Run OpenFoam as Quick as Possible



Step 1: Moving to the Cloud

The Whole World of Virtual Product Development - Anytime and Anywhere

Azure DEC - Your Digital Engineering Workplace in the Cloud

Cloud-based Simulation Workplace
with HPC on Azure, AWS, OCI



Linux

Remote Desktop



Construction CAD

Simulation Data
Management

Product Lifecycle
Management

Meeting the requirements of
simulation-driven design

**Enhanced worldwide
collaboration**

Shorter design cycles, **faster
time-to-market**

Reduced administration costs



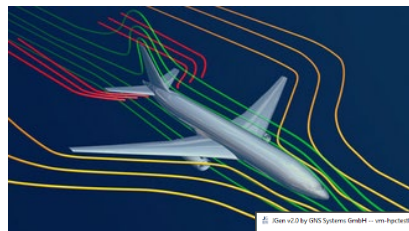
Step 2: OpenFoam Tuning

CAE Process and Performance Tuning

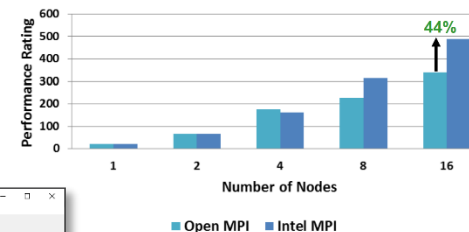


"The **complex requirements** of the OpenFOAM program and its various fields of application have become a transparent, **very robust and easy-to-use process**. The successful implementation was achieved in particular due to the professional, application-specific and technical expertise of the GNS Systems team."

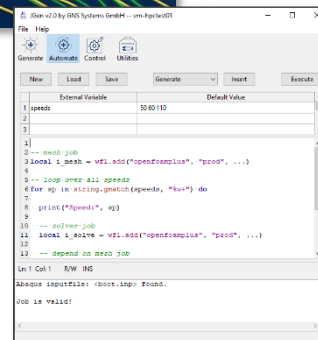
Customer statement



OpenFOAM Performance
(Lid-driven Cavity)

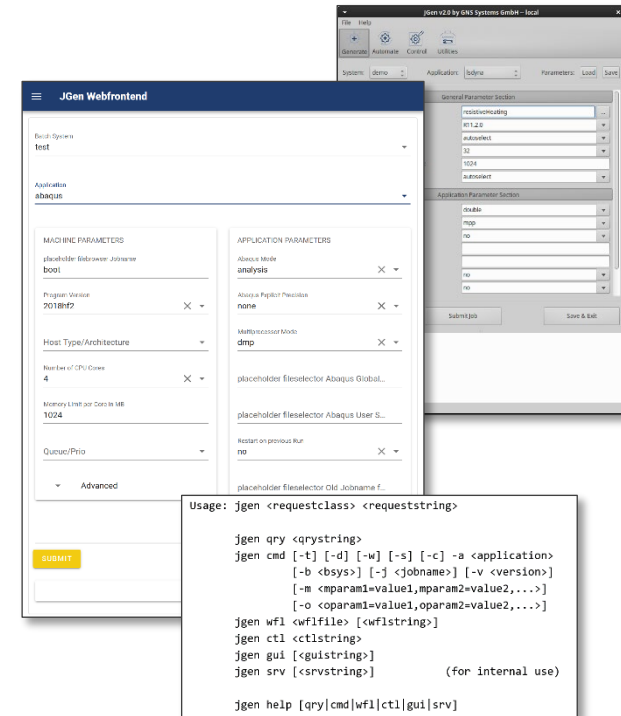
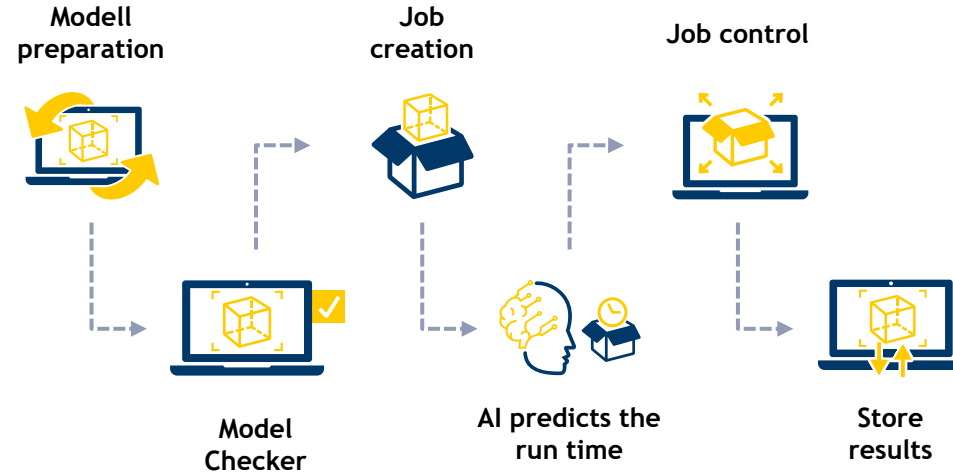


Source: https://www.hpcadvisorycouncil.com/pdf/OpenFOAM_Analysis_and_Profiling_Intel_2680v2.pdf



Step 3: CFD Automation

Integrate IT with Your Workflow



```
Usage: jgen <requestclass> <requeststring>

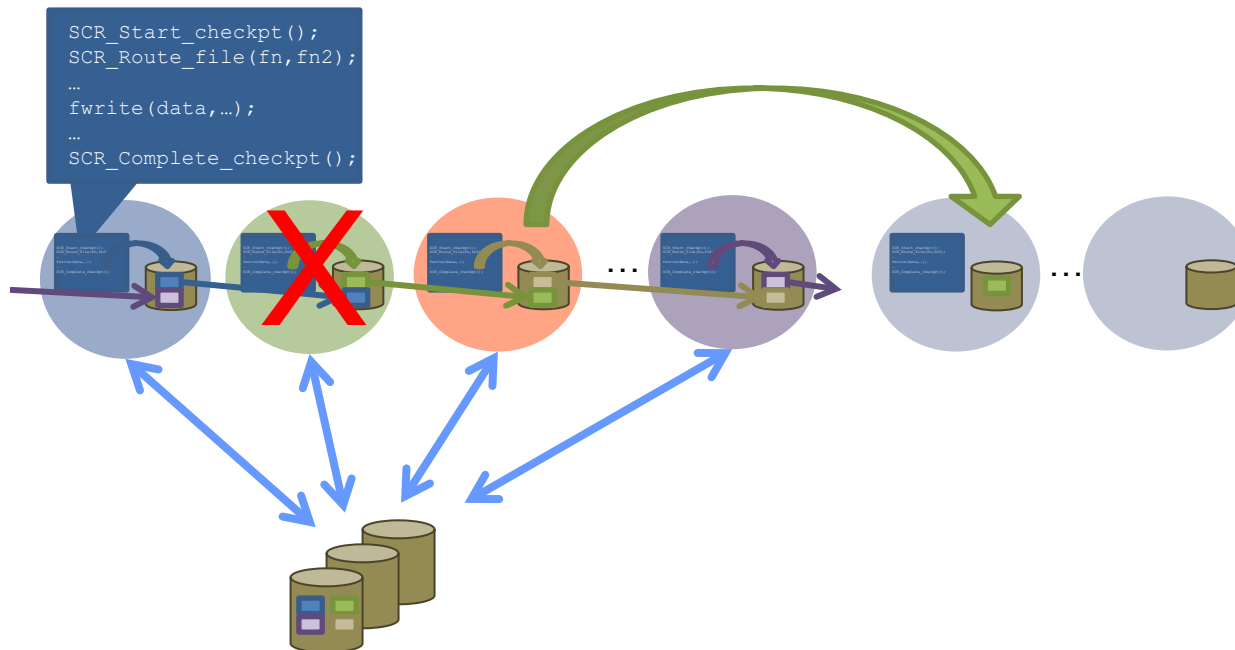
jgen qry <qrstring>
jgen cmd [-t] [-d] [-w] [-s] [-c] -a <application>
        [-b <bsys>] [-j <jobname>] [-v <version>]
        [-m <mparam1=value1,mparam2=value2,...>]
        [-o <oparam1=value1,oparam2=value2,...>]

jgen wfl <wflfile> [<wflstring>]
jgen ctl <ctlstring>
jgen gui [<guistring>]
jgen srv [<srvstring>] (for internal use)

jgen help [qry|cmd|wfl|ctl|gui|srv]
```

Step 4: Make it Stable (If You Like)

Less Stress, if You Know It Will Not Fail



Benchmark



Welcome to the „real“ world



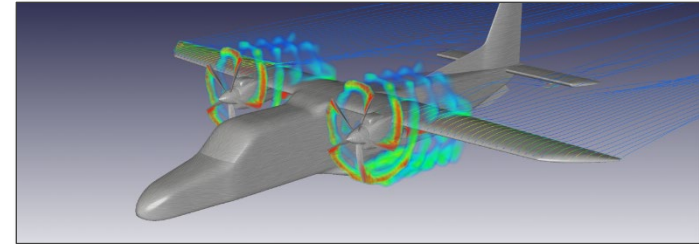
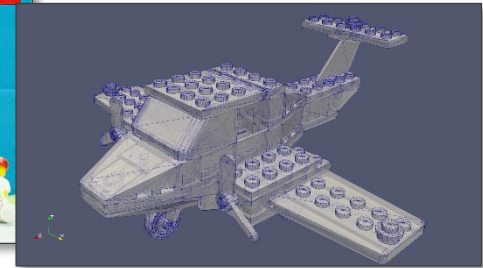
But Let's Have a Bit More Fun

We Create Our Own „Real“ World

- We thought LEGO is more fun!
- Can “this one” really fly?
- Let's check!
- Our aim: Inflight simulation with turbulence model behind the propeller

Tasks:

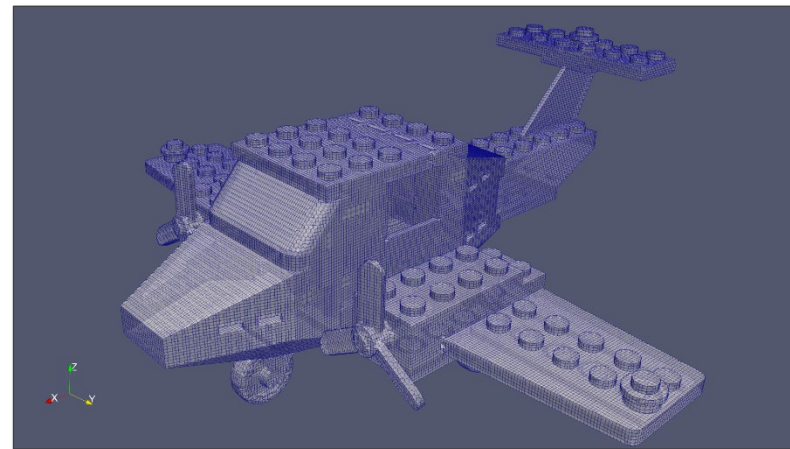
- Pre-processing
- Solve (up to 10.000 cores)
- Post-processing



Our Roadmap

... and Where We Are

- ✓ • Setup our IT infrastructure:
 - OpenFoam automated workflow
 - Job submit engine Jgen
 - Virtual Linux workstation mit ParaView
- ✓ • Create „small“ modell
 - CAD, meshing, simple CFD modell, computation, preprocessing
 - Run it in one cloud on AMD Epyc
- ✓ • Study performance with known test case
- Create „big modell“
 - CAD, meshing, simple CFD modell, computation, preprocessing
 - Run it really large



Ongoing for Q2 2021

Engineers Arrived in the Azure Cloud

Computing and Workflow Infrastructure

Secure Remote Access

- VPN
- Data Encryption
- NiceDCV
- Terradici

Workstations

- NV6 Series with NVIDIA
- JGen
- ParaView

Supercomputing

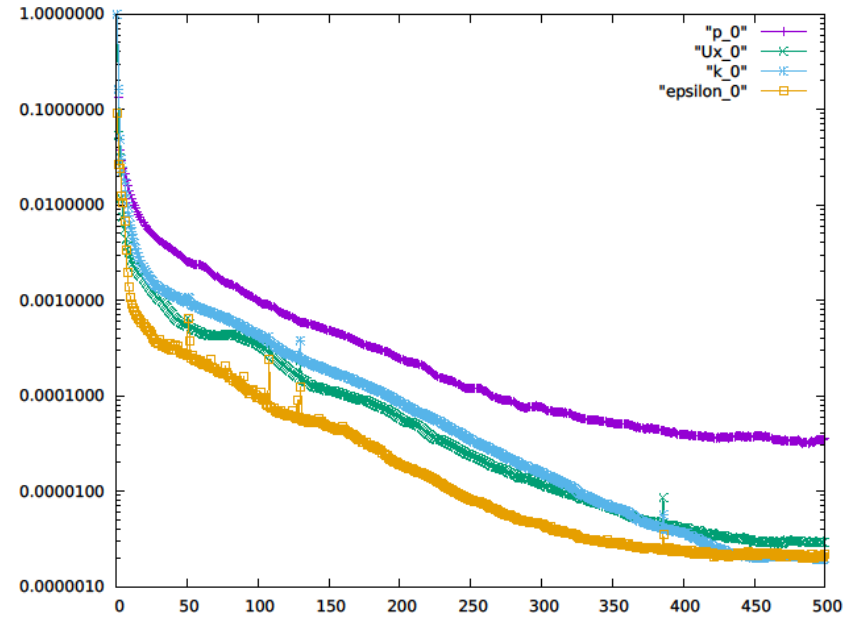
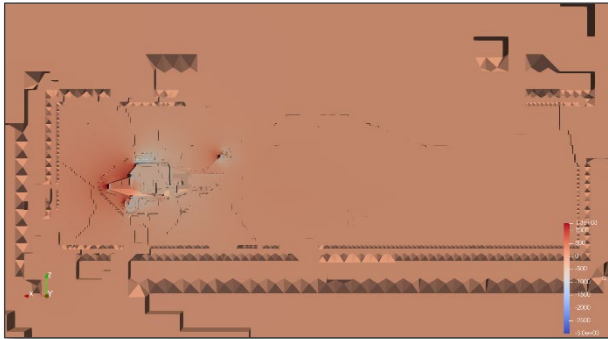
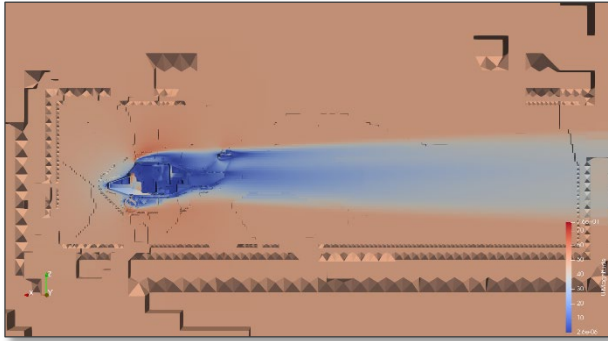
HPC HB120 Nodes:

- OpenFoam
- AMD Rome
- 120 Cores/Node
- local disk and central high-speed storage

Empowerment

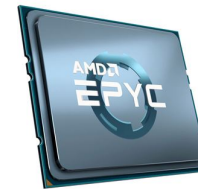
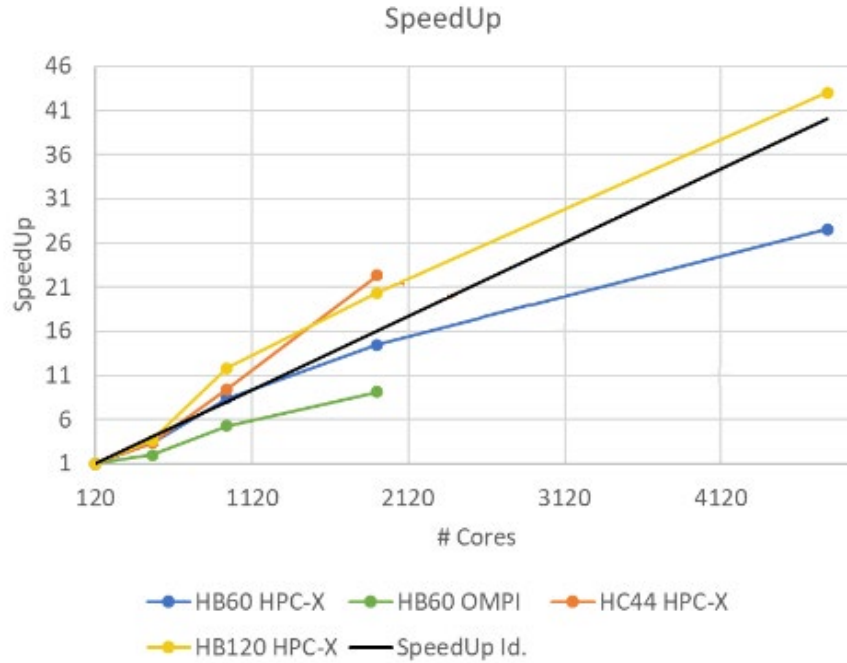
- Workflows
- Benchmarking
- Scaling

Our „Small Baby“





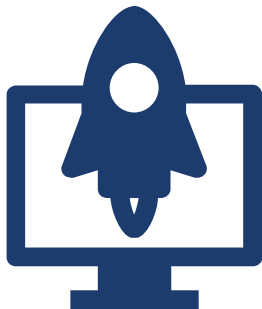
Reaching High-Performance



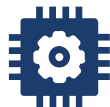
Speed - Better Products in Less Time

x32

753 sec/time step → 30 sec / time step



PARAMETERS



CLOUD:

1.5 times faster in Node vs. Node comparison



TUNING:

2,6 time faster: HPC-X vs. Open MPI



SCALE within the workflow:

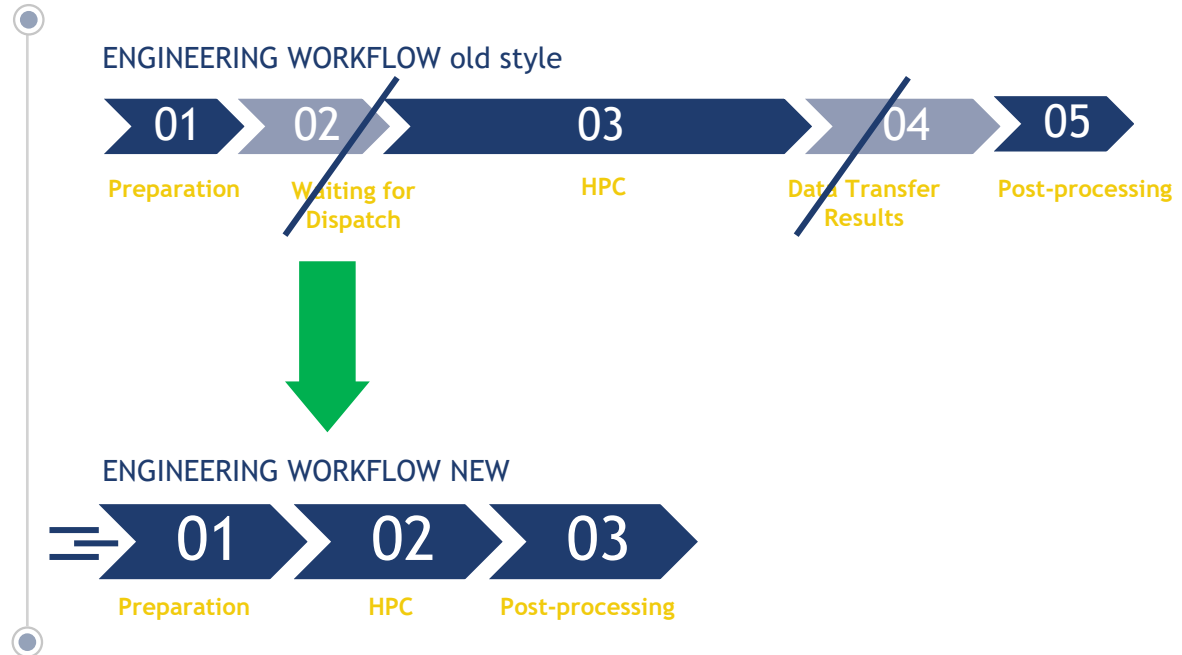
8,3 time faster through 10 times more CPU cores

Speed - Better Products in Less Time

32x Faster per job

3x More efficient through automated workflows

100% Ready for the „BIG ONE“



GNS Systems Scales OpenFoam in the Cloud



Conclusion

Fazit

HPC and OpenFoam at Large Scale: (Almost) Available for Everyone

- ✓ • **Cloud computing:**
YOU can access 10.000 cores+ for less than 1.000 \$
- ✓ • **OpenFoam is easy to access:**
Pre-built workflows help you
- ✓ • **You are in control:**
Costs in the cloud as pay-as-you-go



Questions ?

Raise Your Hand or Post in the Chat

Taking Engineering to The Next Level

HPC and OpenFoam for the Age of the Digital Twin

Thanks for your attentions!

GNS Systems

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