
AWS
re:Invent
NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

ENU401

Ephemeral HPC to accelerate energy and utility workflows

Kyle Jones (he/him)

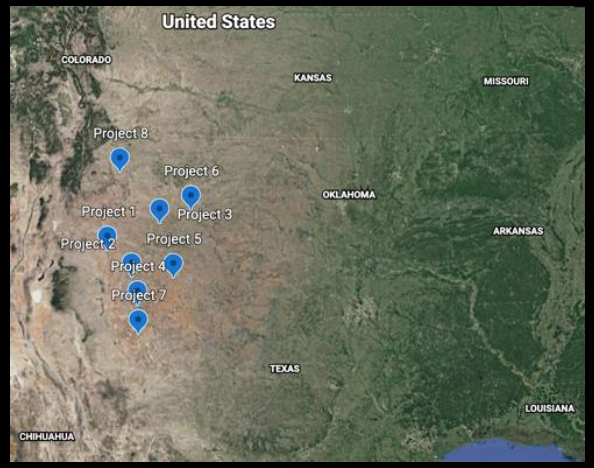
Sr. Manager, Solutions Architecture
AWS

Abhishek Naik (he/him)

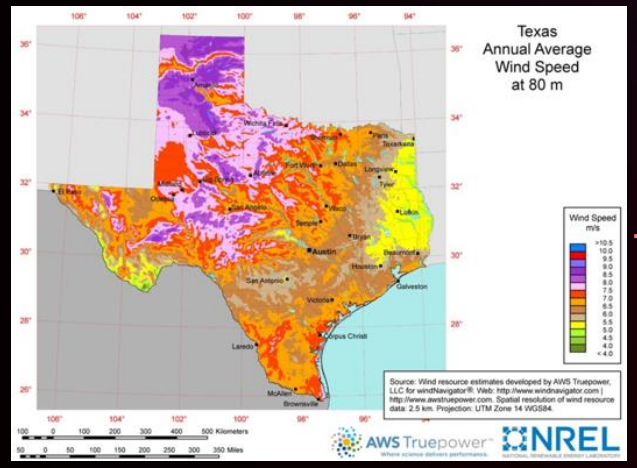
Sr. Solutions Architect
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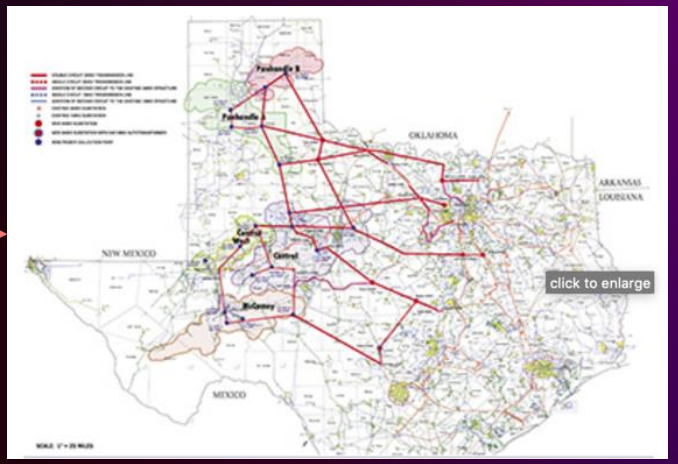
Wind farm development phases



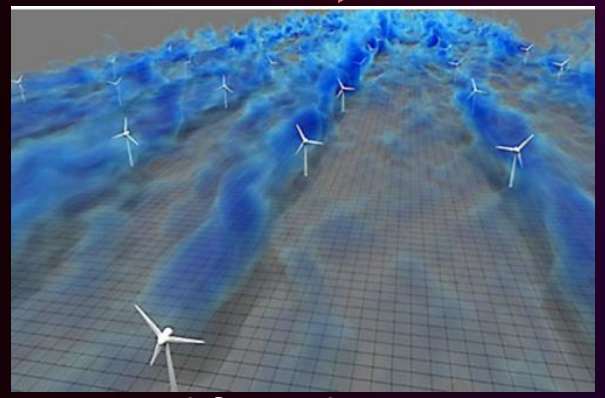
Prospecting



Wind resource assessment



Interconnection & transmission



Wind farm design

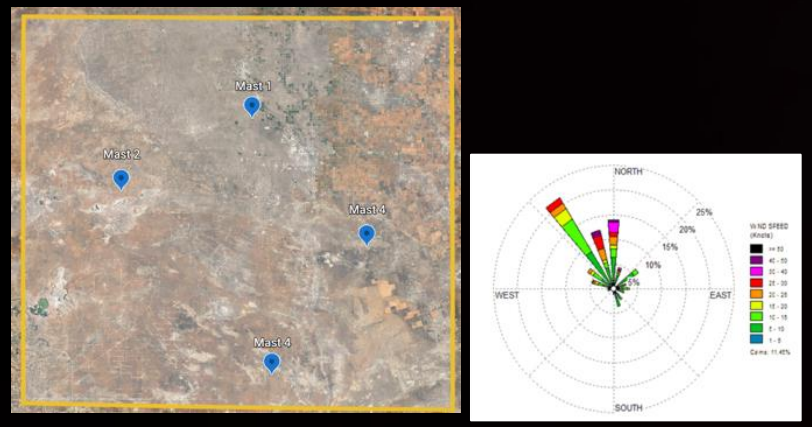
Financing
PPA



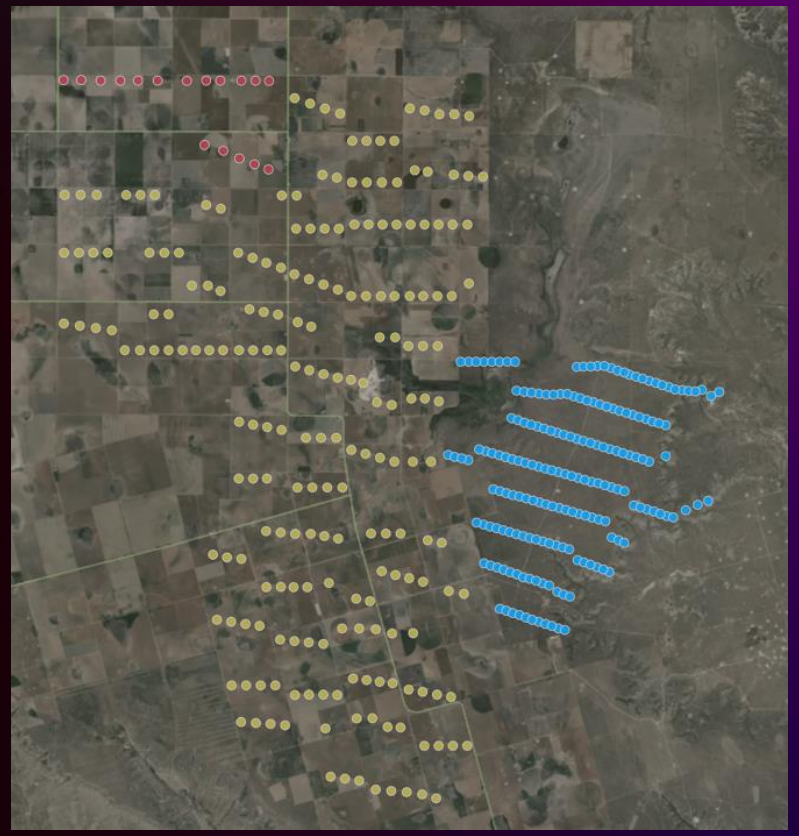
Operations

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Wind resource and wind farm modeling



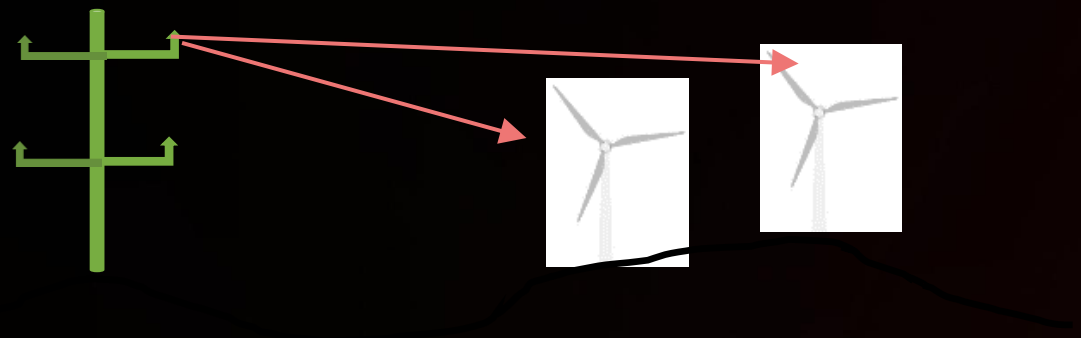
Proposed wind farm with met masts



Final wind farm with turbines

Measurements at masts

Predictions at turbines

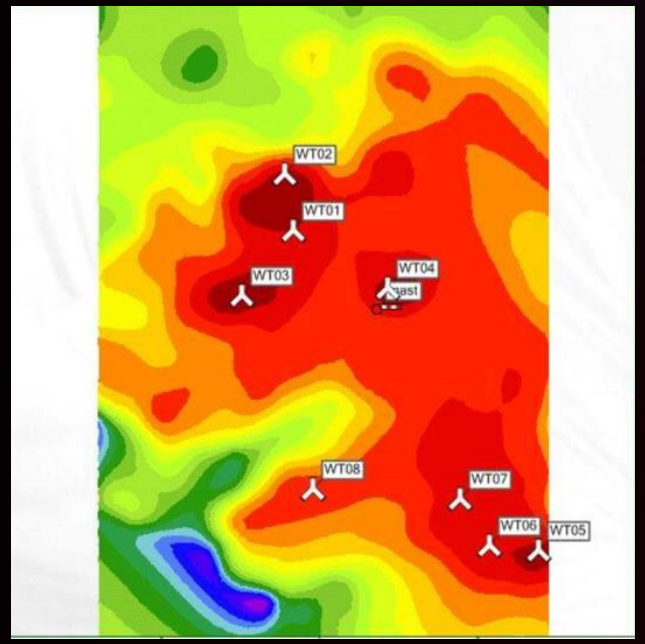


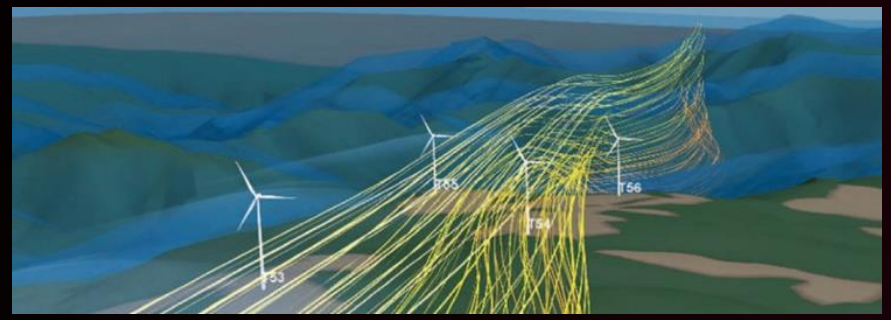
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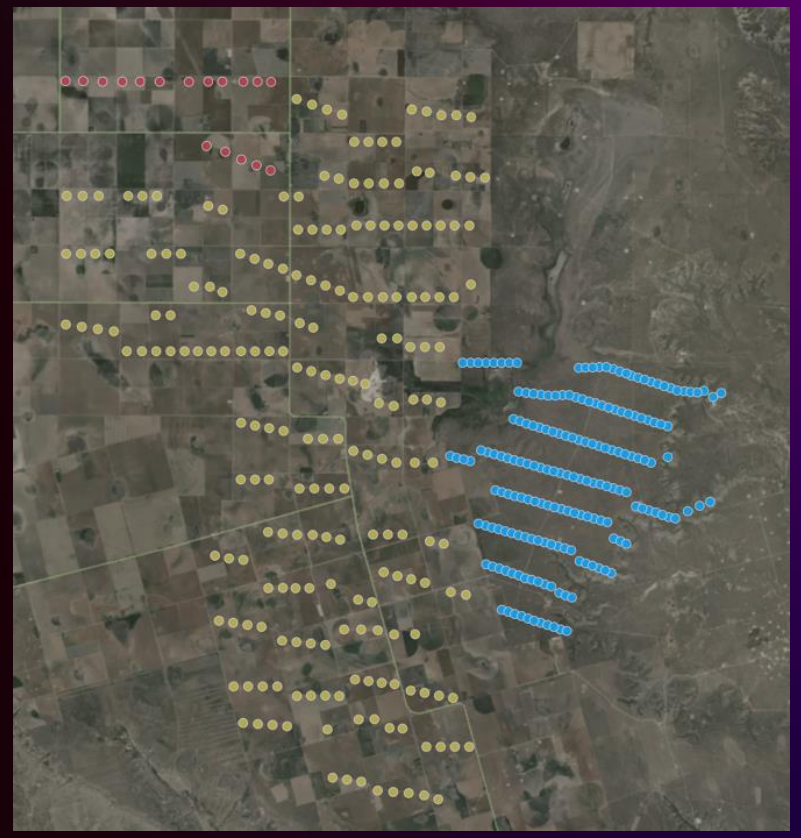
Wind resource and wind farm modeling



Proposed wind farm with met masts





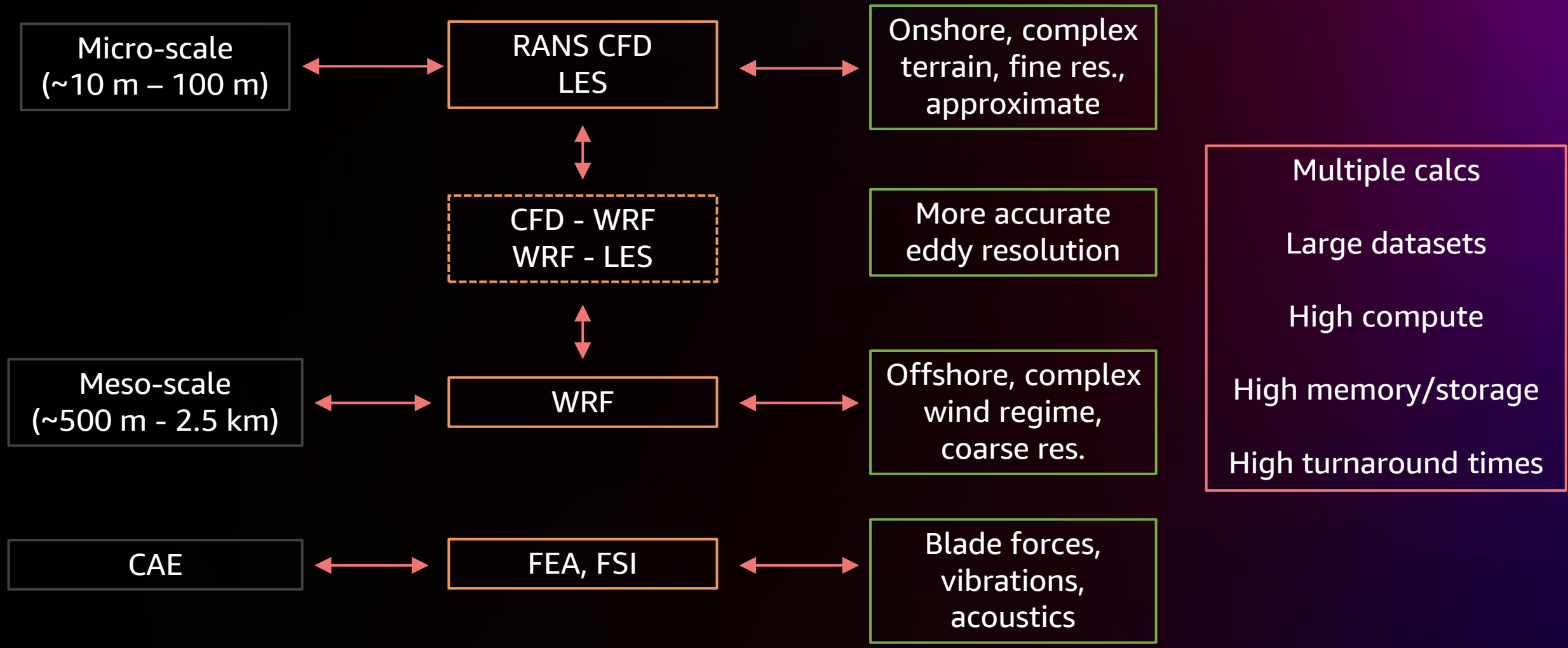


Final wind farm with turbines

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Models

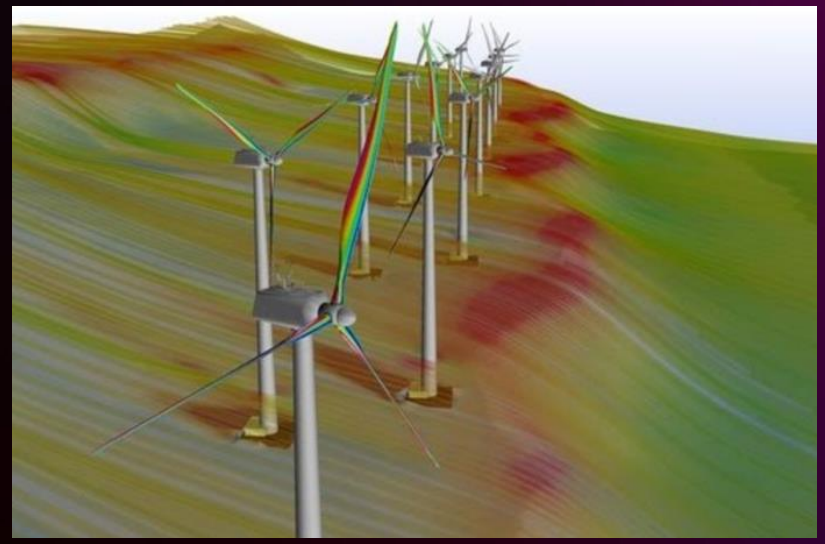


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Wind energy HPC workloads

Pre-construction:

- Wind resource assessment
- Wind farm modeling
- Site suitability
- Offshore – wind/wave interaction (FSI)



Operational:

- Wind turbine aerodynamics/aeroacoustics
- Gear box, tower, platform – heat transfer, multi-body dynamics, fatigue, vibration
- Load predictions, turbine wake modeling
- Wind farm control



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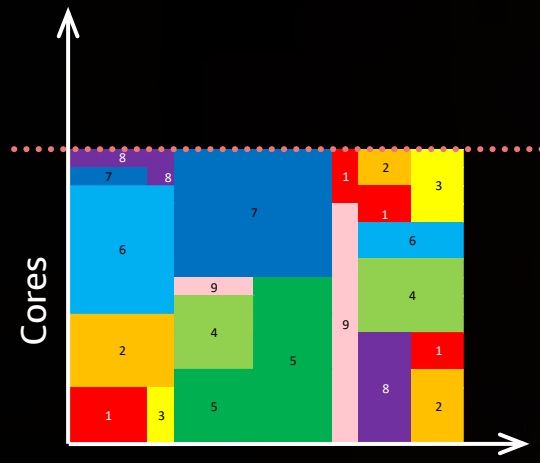
Challenges

Limited computing resources	I am stuck in the queue	→	Can IT increase my job priority?
Limited memory	I am out of disk space	→	Can I have 1 TB more?
Outdated technology	Fixed on-premises hardware	→	Fixed simulation time
Reduced innovation	Reduced collaboration	→	Limiting jobs running at the same time

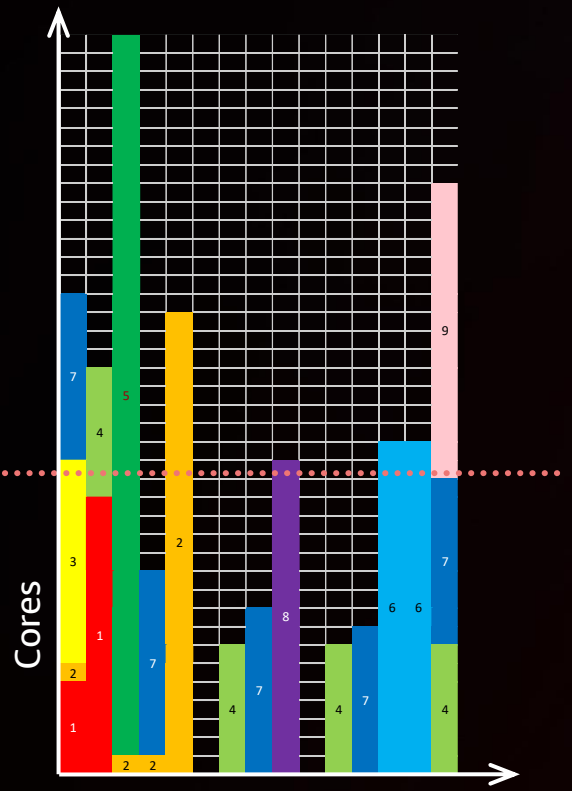
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Overcome hardware bottlenecks



Finite capacity, usually with long queues to wait in



Massive capacity when needed to speed up time to results, and agile environment when additional hardware and software experimentation is needed

Fixed data center capacity limit

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AWS global infrastructure



27 AWS Regions

A Region is a physical location in the world where we have multiple Availability Zones

85 Availability Zones

Distinct locations that are engineered to be insulated from failures in other Availability Zones

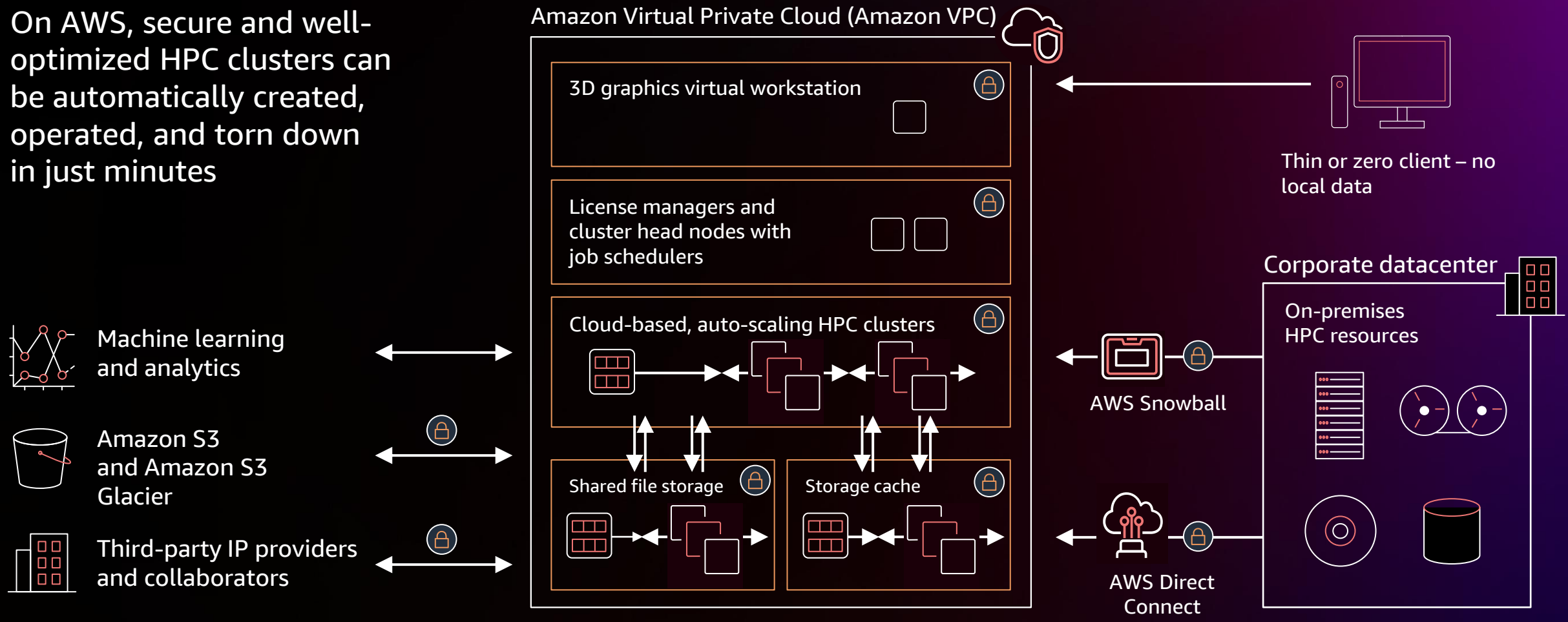
Coming soon

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High performance computing (HPC) on AWS

On AWS, secure and well-optimized HPC clusters can be automatically created, operated, and torn down in just minutes



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Wide choice of CPU, memory, architectures

General purpose

Burstable

Compute-intensive

Memory-intensive

Storage (high I/O)

Dense storage

GPU compute

Graphics-intensive

+

Capabilities

Choice of processor
(AWS, Intel, AMD)

Fast processors
(up to 4.5 GHz)

High memory footprint
(up to 24 TiB)

Instance storage
(HDD and SSD)

Accelerated computing
(ASIC, GPUs and FPGA)

Networking
(up to 400 Gbps)

Bare Metal

Size
(Nano to 48xlarge)

+

Options

Amazon Elastic Block Store
(Amazon EBS)

Amazon Elastic Graphics

Amazon Elastic Inference

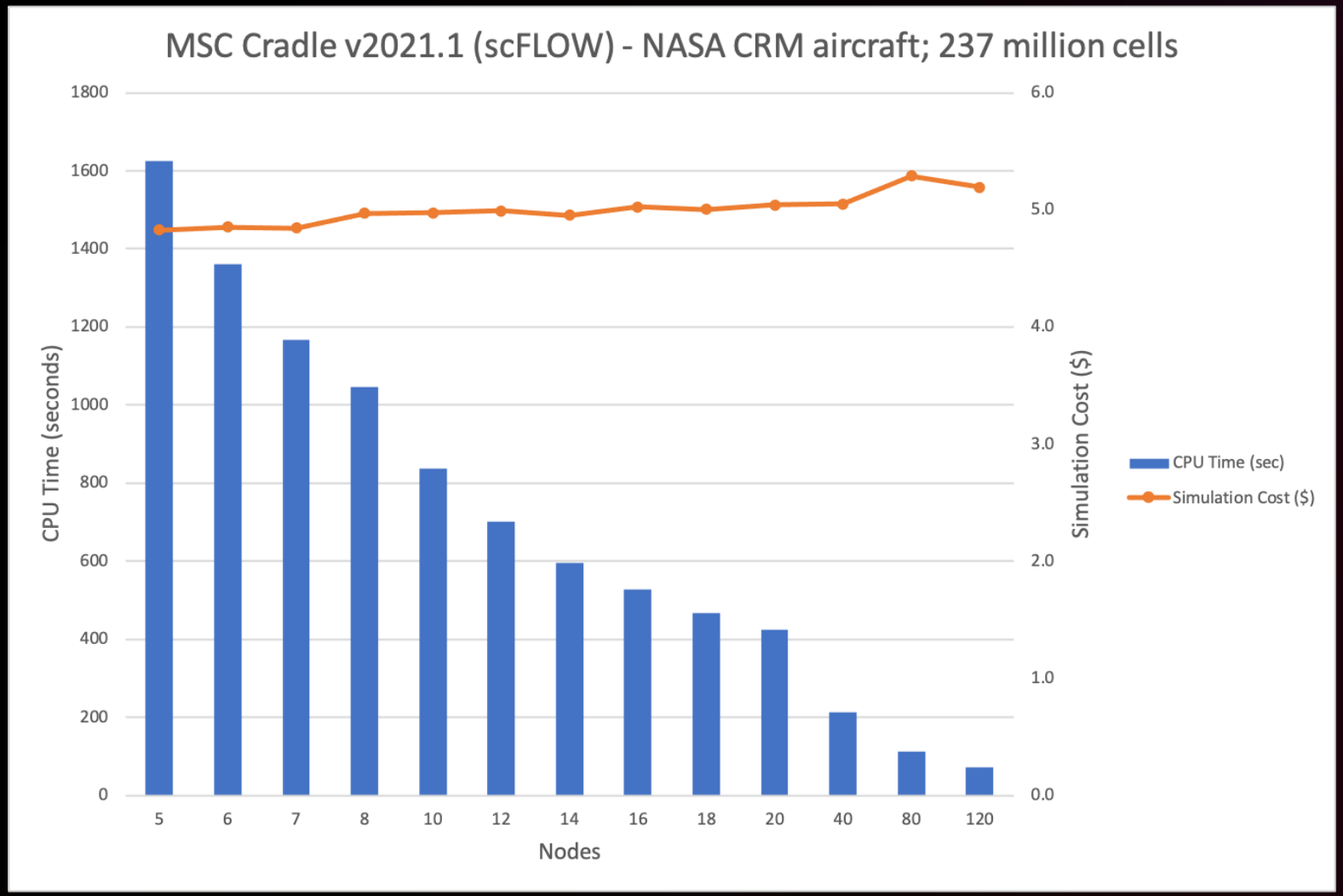
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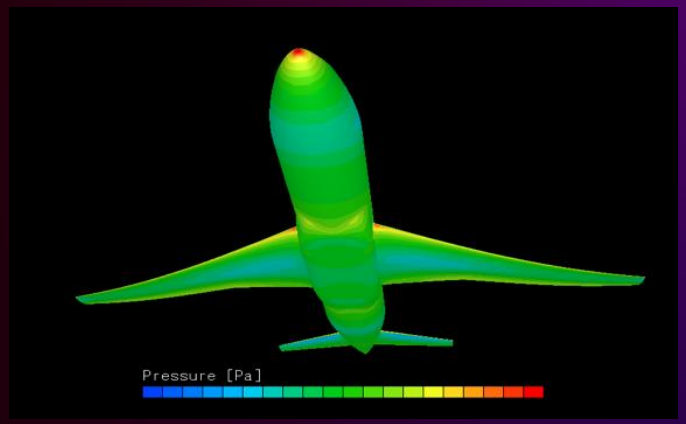
400+

instance types

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Scaling MSC Cradle



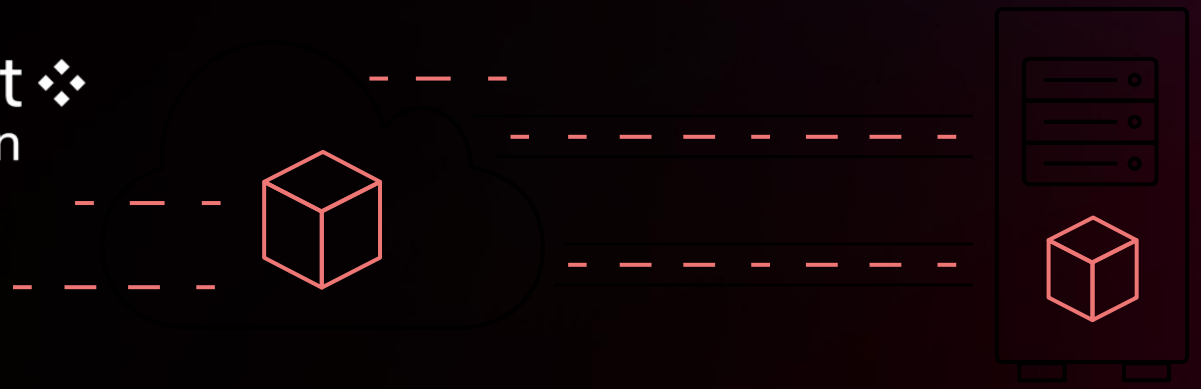


Costs correspond to the us-east-2 (Ohio) region

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AWS ParallelCluster

intel select solution



One-stop shop to set up your HPC cluster

Integrated with AWS services you need

Amazon FSx for Lustre

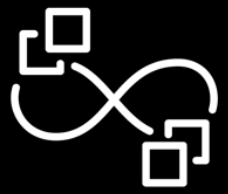
Amazon EC2 instances

EFA

NICE DCV

AWS Batch

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AWS ParallelCluster deployment

```
pip3 install "aws-
parallelcluster<3.0" --upgrade
-user

aws configure

pcluster configure

pcluster create -c ./config
mycluster

pcluster delete mycluster
```

```
[aliases]
ssh = ssh {CFN_USER}@{MASTER_IP} {ARGS}

[global]
cluster_template = default
update_check = true
sanity_check = true

[cluster default]
key_name = msc-demo
scheduler = slurm
master_instance_type = c5n.large
base_os = alinux2
vpc_settings = default
queue_settings = compute,mesh
s3_read_write_resource = *
dcv_settings = default
fsx_settings = fsxshared

[fsx fsxshared]
shared_dir = /fsx
storage_capacity = 1200
deployment_type = PERSISTENT_1
storage_type = SSD
per_unit_storage_throughput = 100
daily_automatic_backup_start_time = 00:00
automatic_backup_retention_days = 30

[dcv default]
enable = master

[vpc default]
vpc_id = vpc-XXXXXX
master_subnet_id = subnet-XXXXXX
compute_subnet_id = subnet-XXXXXXX
use_public_ips = false

[queue compute]
enable_efa = true
placement_group = DYNAMIC
```

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HPC partner community

Technology Partners





























Consulting Partners







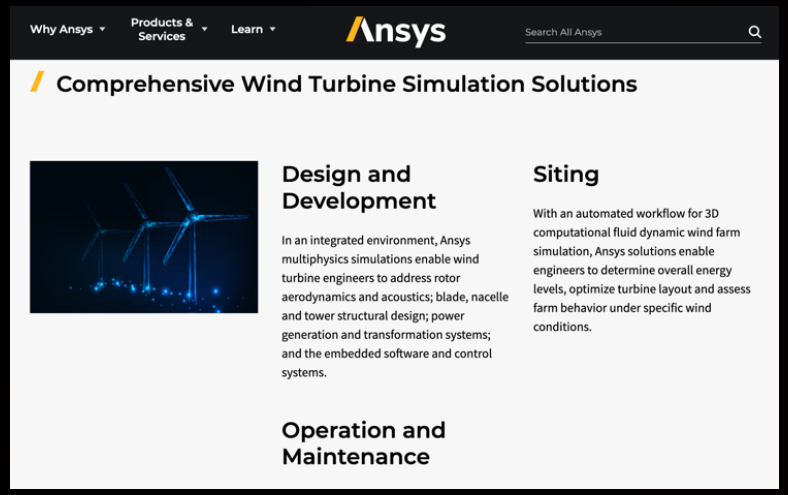




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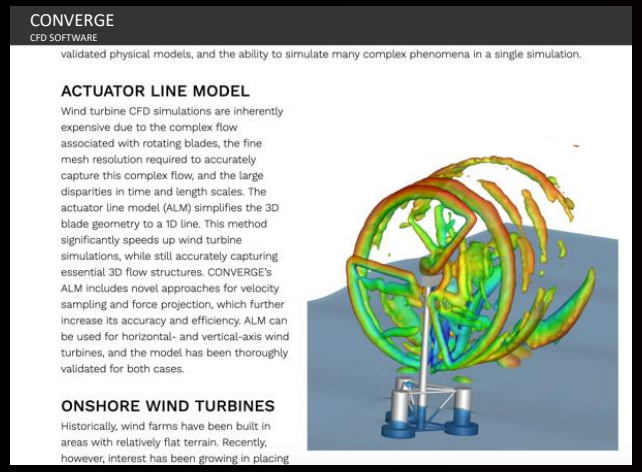
AWS HPC collaborators – Wind energy solutions



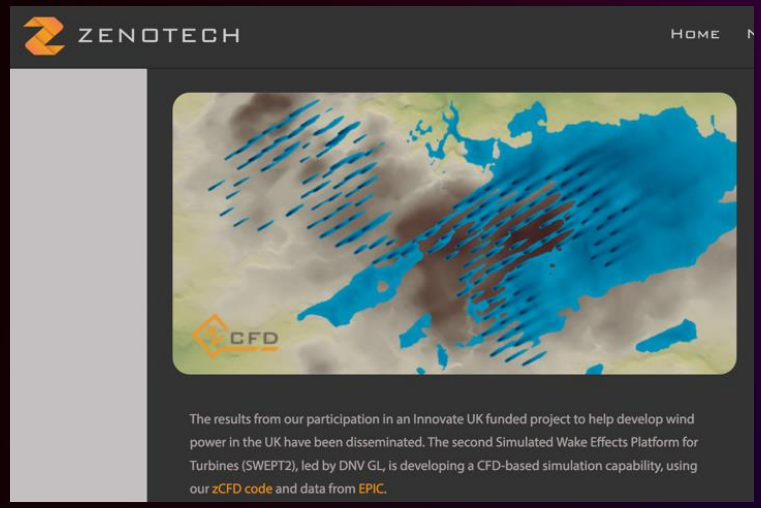
ANSYS, Inc.



MSC Software



Convergent Science



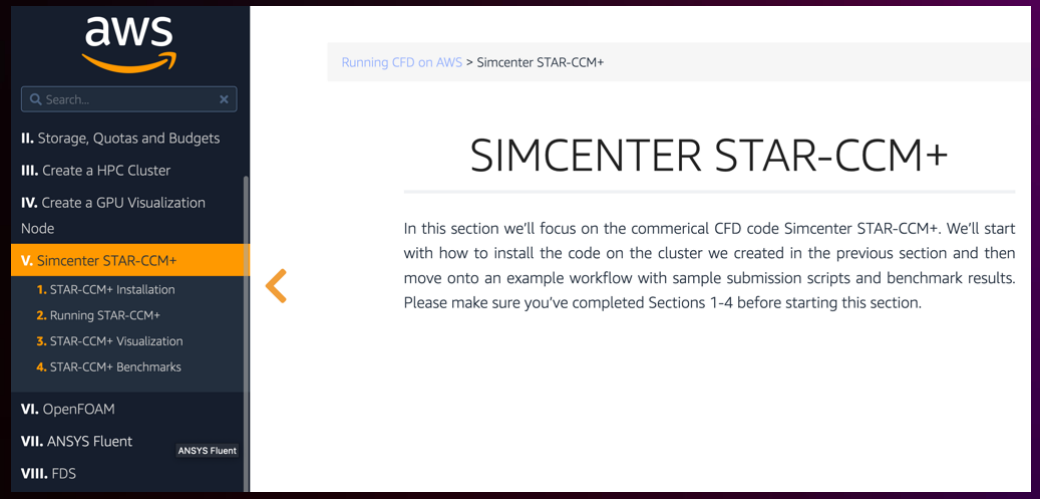
Zenotech Ltd

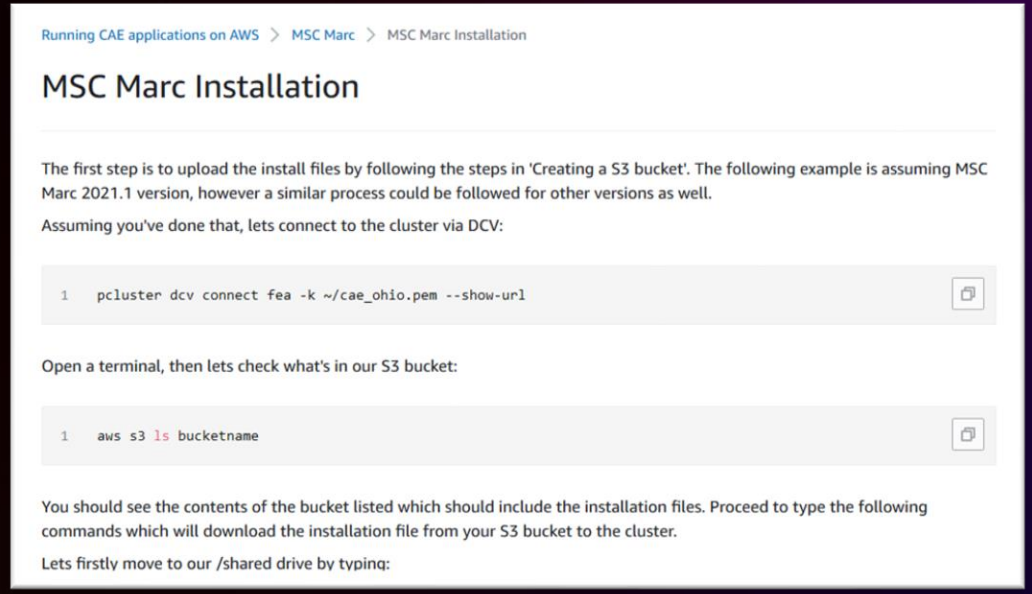
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Running HPC applications on AWS – AWS resources

AWS workshops:

- HPC workshop
- Running CFD applications on AWS
- Running CAE applications on AWS





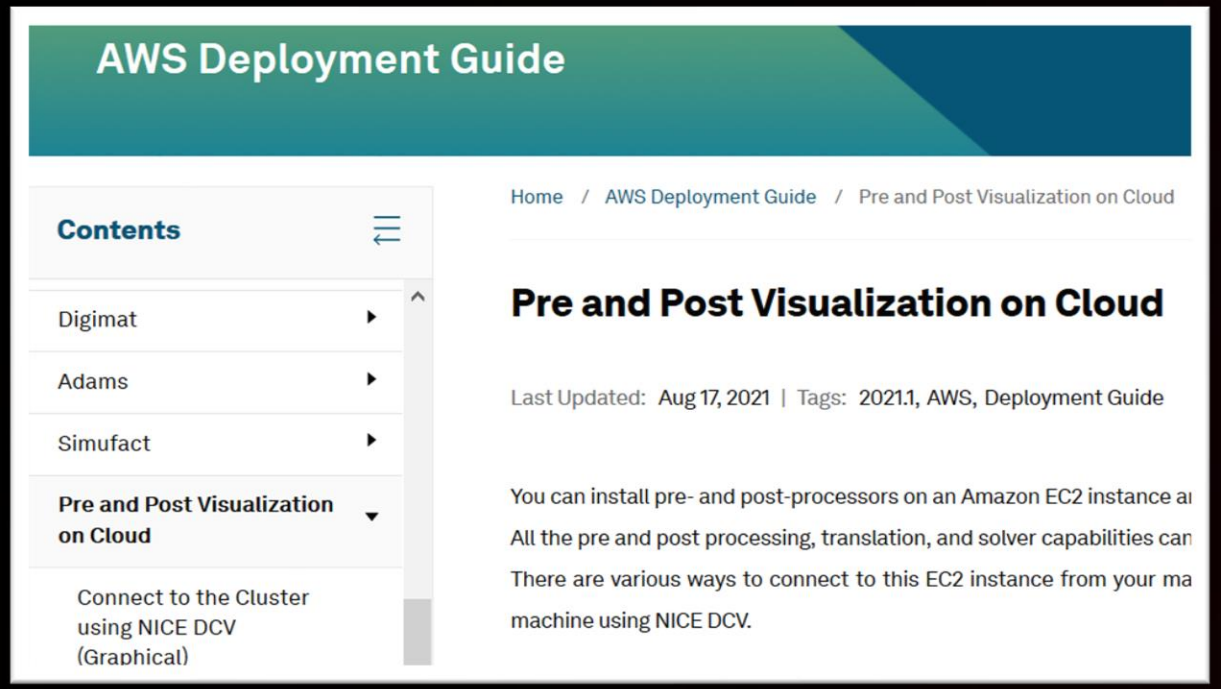
Blog posts covering:

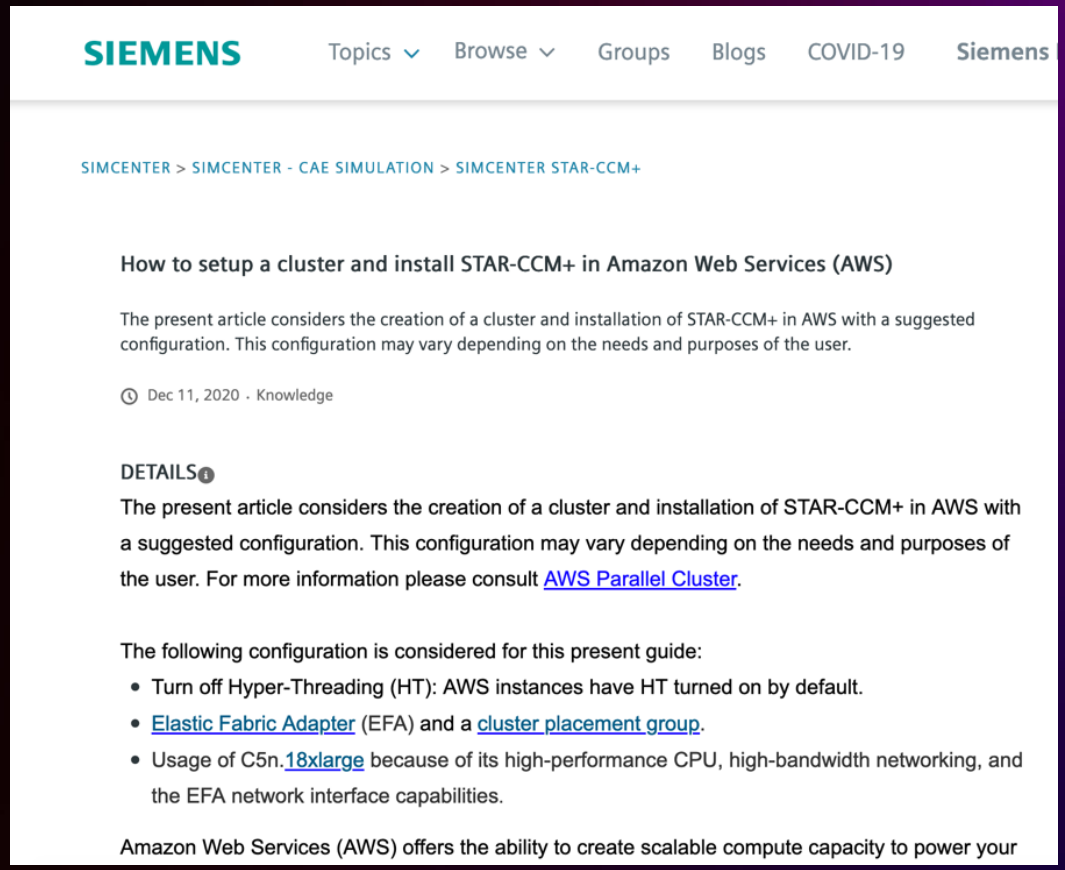
- Ansys Fluent, LS-DYNA
- Simcenter STAR-CCM+, Nastran
- Open source – OpenFOAM, WRF
- Convergent Science (work in progress)

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Running HPC applications on AWS – Partner resources







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Thank you!

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