



COMPUTEROME 2.0

USERS WORKSHOP

CENTER FOR HEALTH DATA SCIENCE (HEADS)
FACULTY OF HEALTH AND MEDICAL SCIENCES,
UNIVERSITY OF COPENHAGEN, APRIL, 2021

*Selected slides from Megan Guertner @Computerome team



PART1

INTRO  DUCTION

BACKGROUND

Established in 2014, The Danish National Life Science Supercomputing Centre, Computerome, is a High-Performance Computing (HPC) facility specialised and securely optimised for life science research.

Our users benefit from the fast, flexible and secure infrastructure and the ability to combine different types of sensitive data and perform analysis.



Users Include

- **Research groups from all Danish universities**
- **Large international research consortiums**
- **Those in the public health care sector**
- **Industry**

MISSION



Computerome's primary focus is dedicated to Life Sciences offering a cutting-edge secure infrastructure, software and scientific tools that are a first-choice for research and clinical users.

Key offerings:

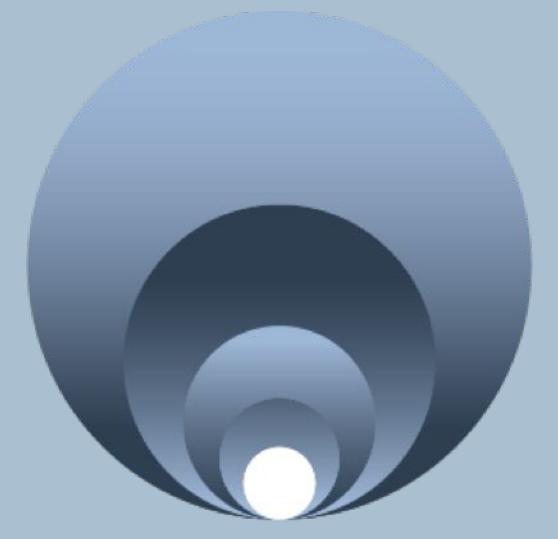
- Large international research consortiums
- Security
- Compliance
- Public
- Customized Capabilities
- Automation Features
- User-Driven Development

I PURPOSE

Being one of the world's most powerful supercomputers dedicated to Life Science research, Computerome plays a vital role in undertaking ambitious research projects, among others in personalised medicine and in the development of new drugs.

Computerome 2.0 meets the current and future increasing demands for secure and faster computing capacity of vast data volumes required by the research communities.





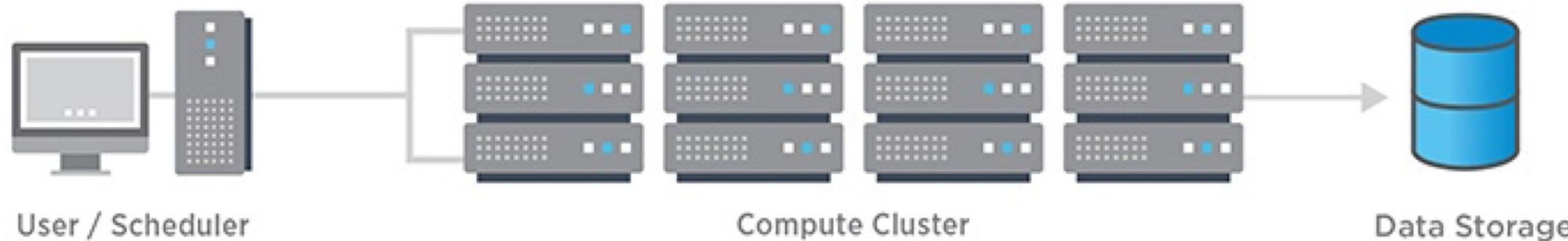
Computerome



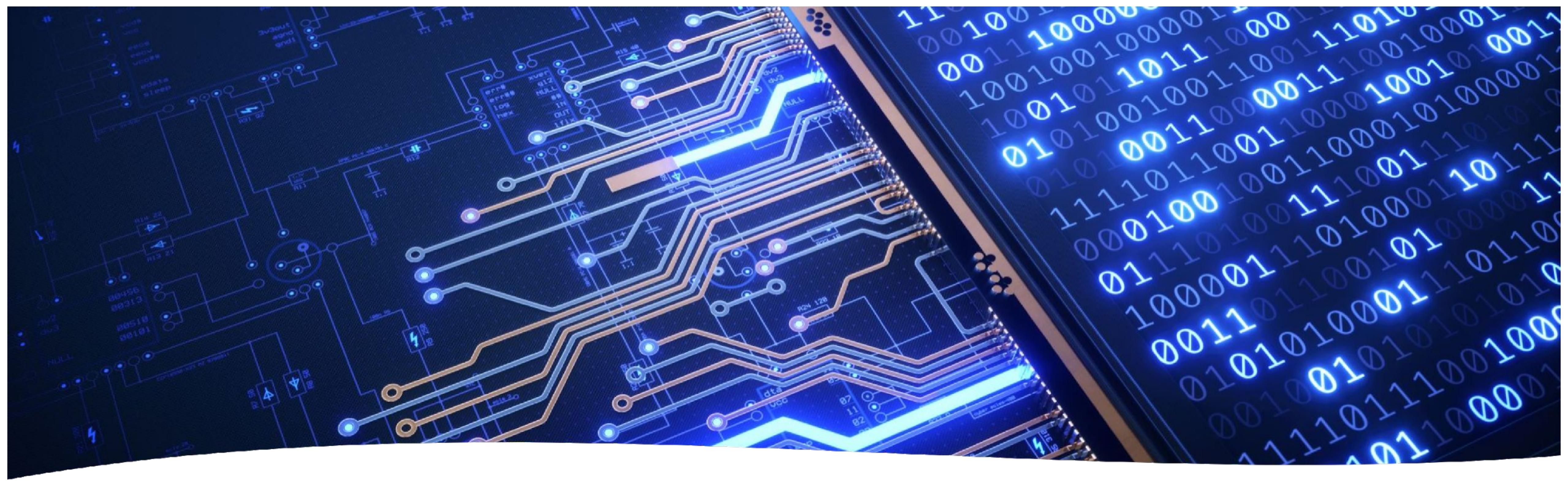


HIGH-PERFORMANCE COMPUTING SYSTEM

- An HPC cluster consists of hundreds or thousands of compute servers that are networked together.
- Each server is called a node. The nodes in each cluster work in parallel, boosting processing speed to deliver high-performance computing.



- !! ONLY run jobs on a HPC when you can't run it anywhere else.



HIGH-PERFORMANCE COMPUTING

Hardware systems

- CPUs, GPUs, storage, secure cloud...

Supports different programming languages

- C, Fortran, Python, R...

Parallel programming paradigms

- Algorithms, shared memory and distributed memory parallelism

Software tools

- Modules, applications, schedulers, debugging tools, etc.

Nodes, Processors and Cores

When working in a HPC environment it is important to differentiate between nodes, processors and cores as these terms are often used interchangeable.



Nodes: The physical server. Each node will consist of multiple processors, shared memory and other hardware.

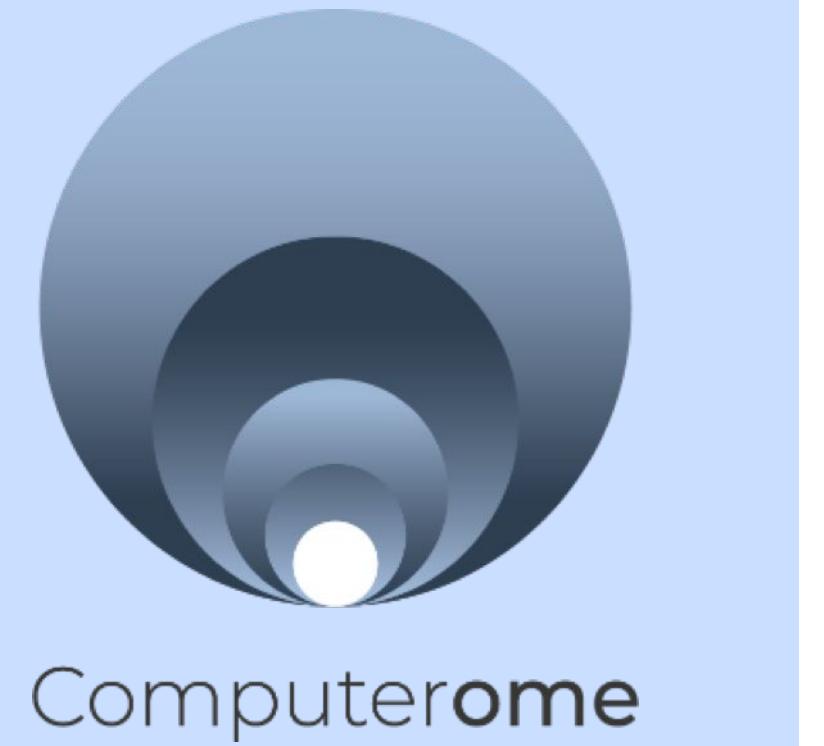
Processor: This is the Central Processing Unit (CPU), each having one or more core.

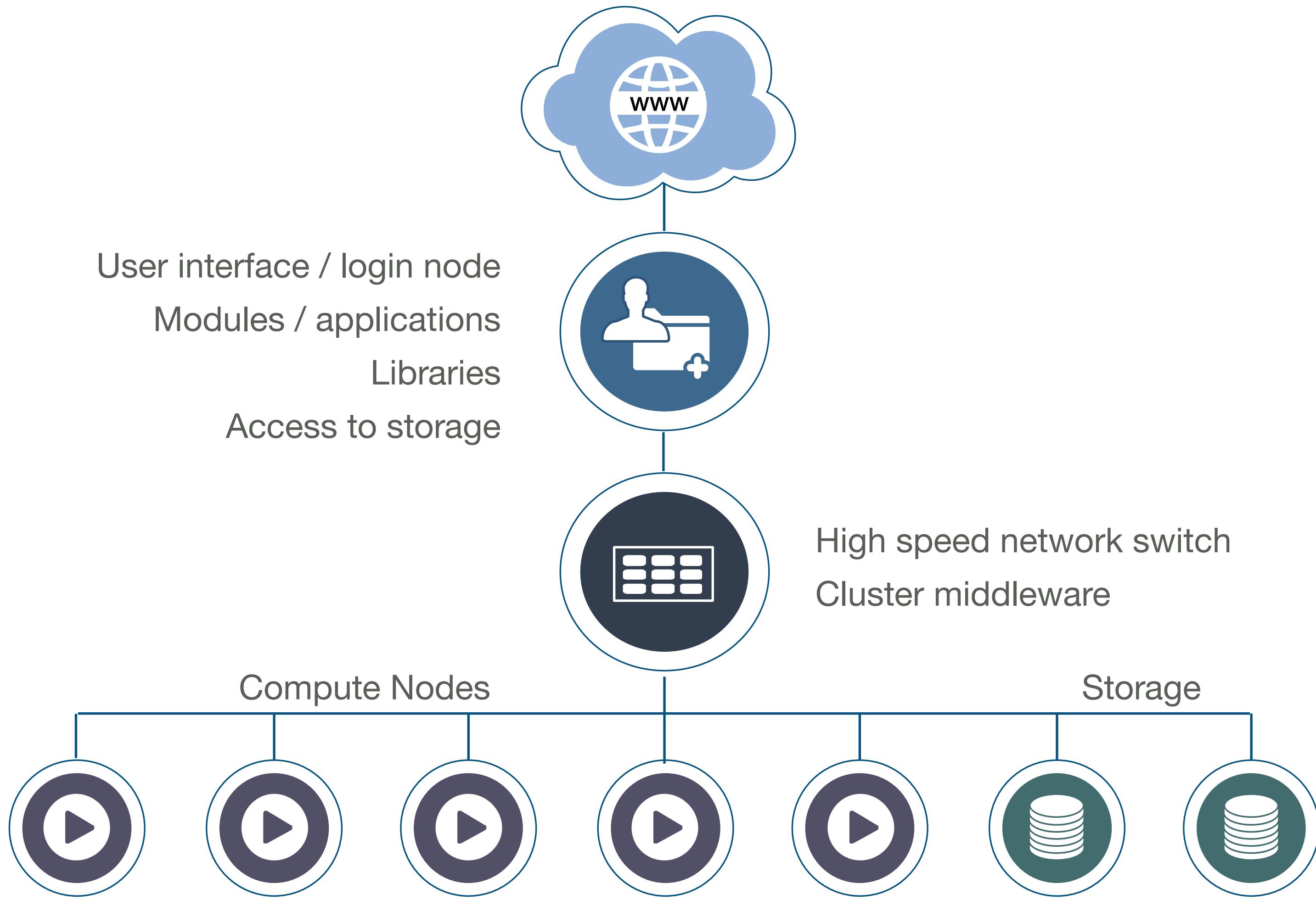
PPN: Term used when scheduling job and describes the number of booked processors per node.

Cores: This is the actual computation unit of the CPU

-> we mostly deal with Nodes and PPNs

Nodes, Processors and Cores



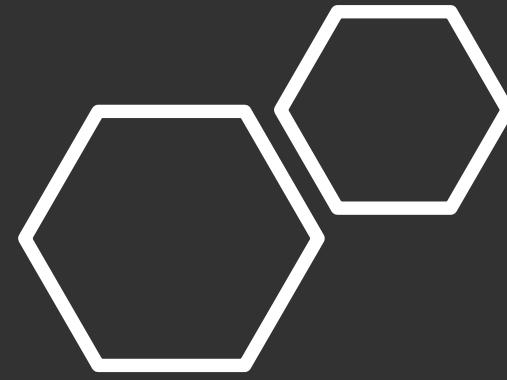


What's available

Category	# of Nodes	Type	# of CPU	Cores/CPU	Cores/node	# of Cores	Memory
Thin nodes	692	2 x HPE XL190r Gen10 Xeon-Gold 6230 (2,1 GHz/20 core/125W) Processor kit	2	20	40	27.680	192 GB
GPU nodes	40	2 x HPE XL190r Gen10 Xeon-Gold 6230 (2,1 GHz/20 core/125W) Processor kit	2	20	40	1.600	192 GB
Fat nodes	55	2 x HPE DL360 Gen10 Xeon-Gold 6230 (2,1 GHz/20 core/125W) Processor kit	2	20	40	2.200	1.536 GB
Login nodes	3	2 x HPE DL380 Gen10 Xeon-Gold 6230 (2,1 GHz/20 core/125W) Processor kit	2	20	40	120	192 GB
Database nodes	3	2 x HPE DL360 Gen10 Xeon-Gold 6230 (2,1 GHz/20 core/125W) Processor kit	2	20	40	120	192 GB
Web Service nodes	4	2 x HPE DL360 Gen10 Xeon-Gold 6130 (2,1 GHz/16 core/125W) Processor kit	2	16	32	128	192 GB
Head nodes	2	2 x HPE DL360 Gen10 Xeon-Gold 6230 (2,1 GHz/20 core/125W) Processor kit	2	20	40	80	192 GB
Total	799					31.928	

- Note the difference between the thin and fat nodes in terms of amount and memory
- Note that you will only be able to book **180 out of the 192gb** memory at a thinnode due to overhead.
- Don't block a fat node unless you need more than 180 GB of memory

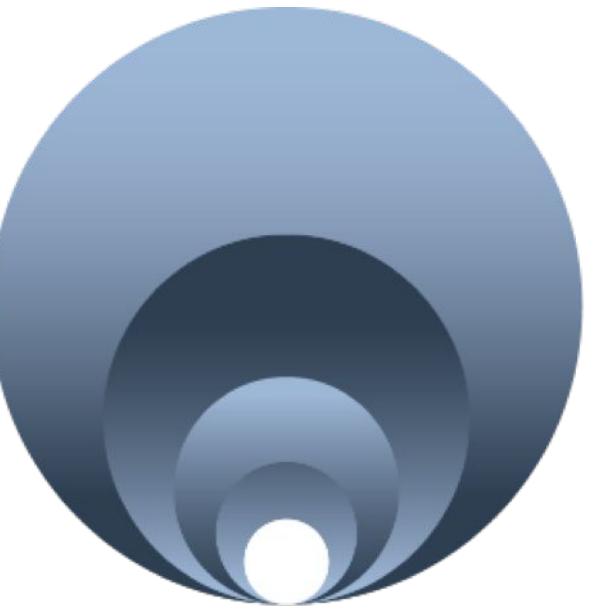
Costs for computing and storage (approx.)



- Note the difference in CPU setup from C1 to C2 (in case you inherit old C1 scripts)
- You are always charged for a full node
- Storage cost are calculated as the highest peak per month

COMPUTEROME 1	COMPUTEROME 2
Features	
CPUs per node: <u>28/32</u>	CPUs per node: <u>40</u>
Memory per thin node: 125gb	Memory per thin node: 192gb
Memory per fat node: 1000gb	Memory per fat node: 1536gb
8PB storage	11.4PB storage
Snapshot backup	Snapshot backup (cd .snapshot in any directory)
Pricing	
Storage: DKK 250 /TB	Storage: DKK 91,70 /TB
DKK 3,08 / thin node hour	DKK 3,87 / CPU node hour
DKK 3,52 / fat node hour	DKK 6,46 / GPU node hour

COMPUTEROME systems



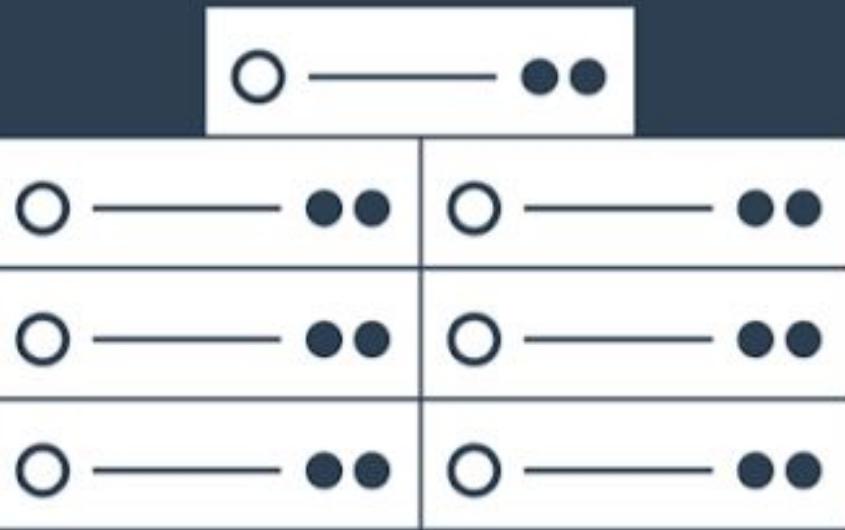
Computerome

3 different systems:

- ‘normal’ computerome (computerome HPC)
- sandbox
- secure cloud

COMPUTEROME HPC

HPC Computing Nodes (600+)



Submit jobs via
the queuing system



Pay as you use

Storage



No predefined quota-
pay as you use



Privacy set via file permissions



Data can be copied in and out
from the login nodes via scp/sftp

Sandbox

Basically Computerome HPC but:

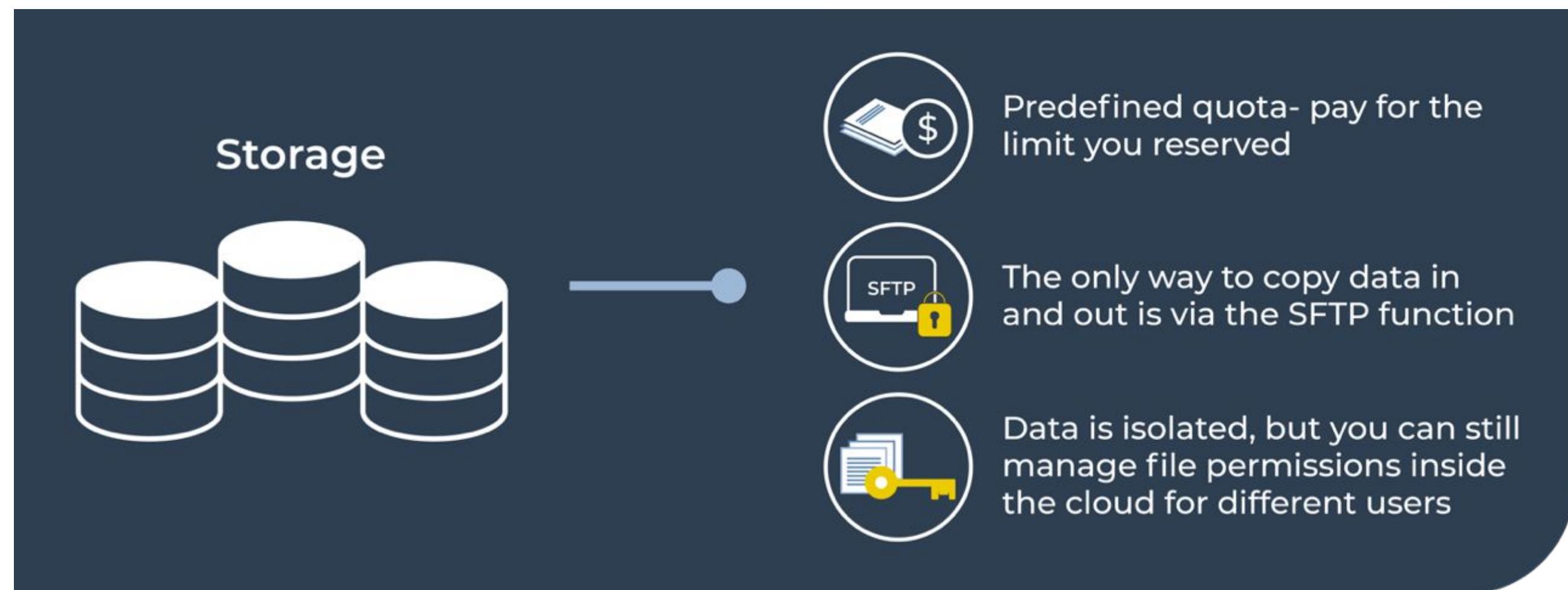
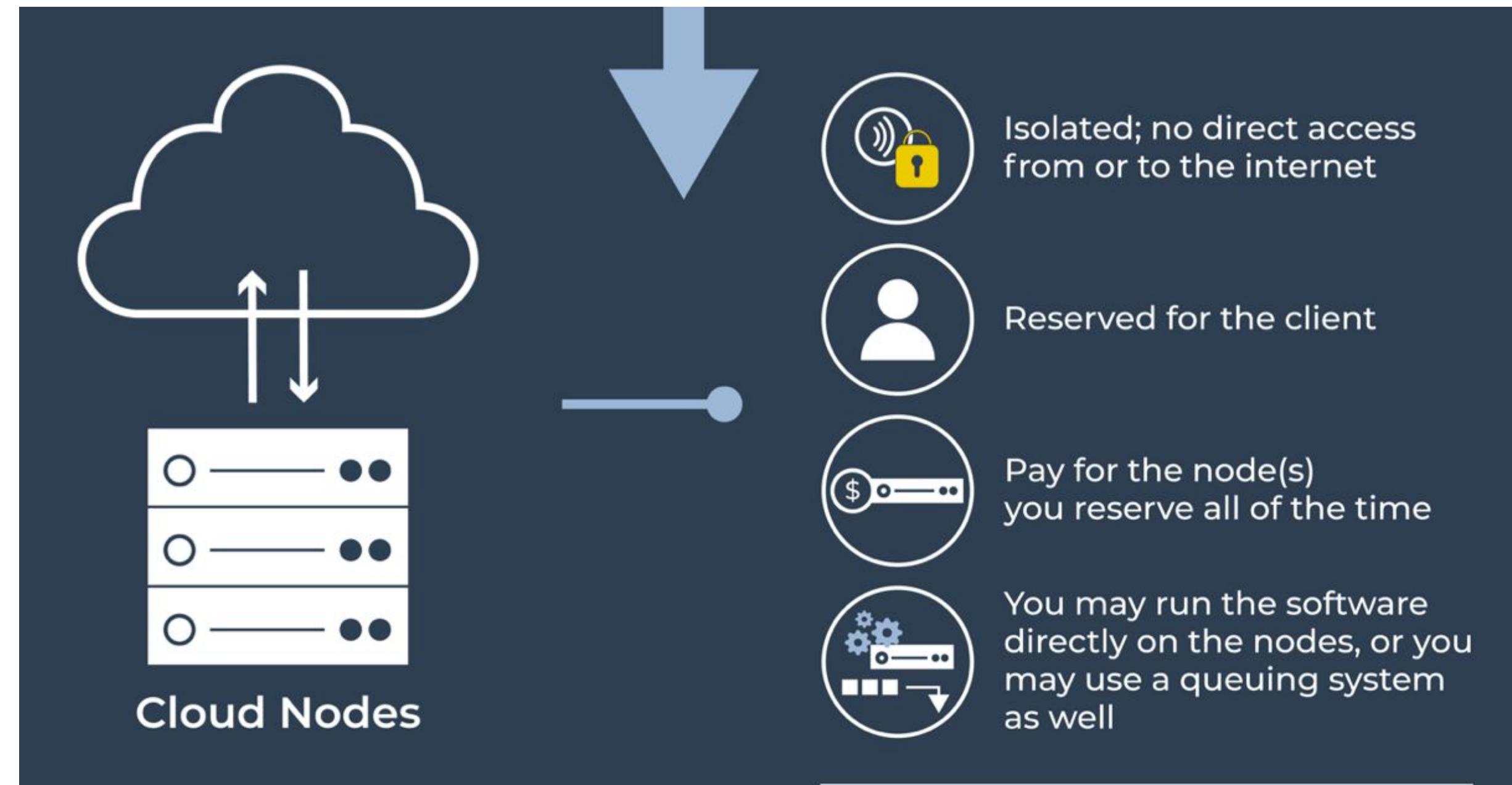
- free
- limited amount of resources
- try stuff out
- time limited account (ca half year)
- this is what we use for the course



- The Computerome Secure Private Cloud is a Platform-as-a-Service providing the user with a private and dedicated virtual supercomputer, configured and optimised to meet the user's specific needs, special requirements and workload.
- Working with health data, sensitive personal data or working with high-value research or confidential data, the Secure Private Cloud is the optimal choice for health care and life science research users.
- The Secure Private Cloud is a 100% containment of the data, users and compute resources within



SECURE PRIVATE CLOUD





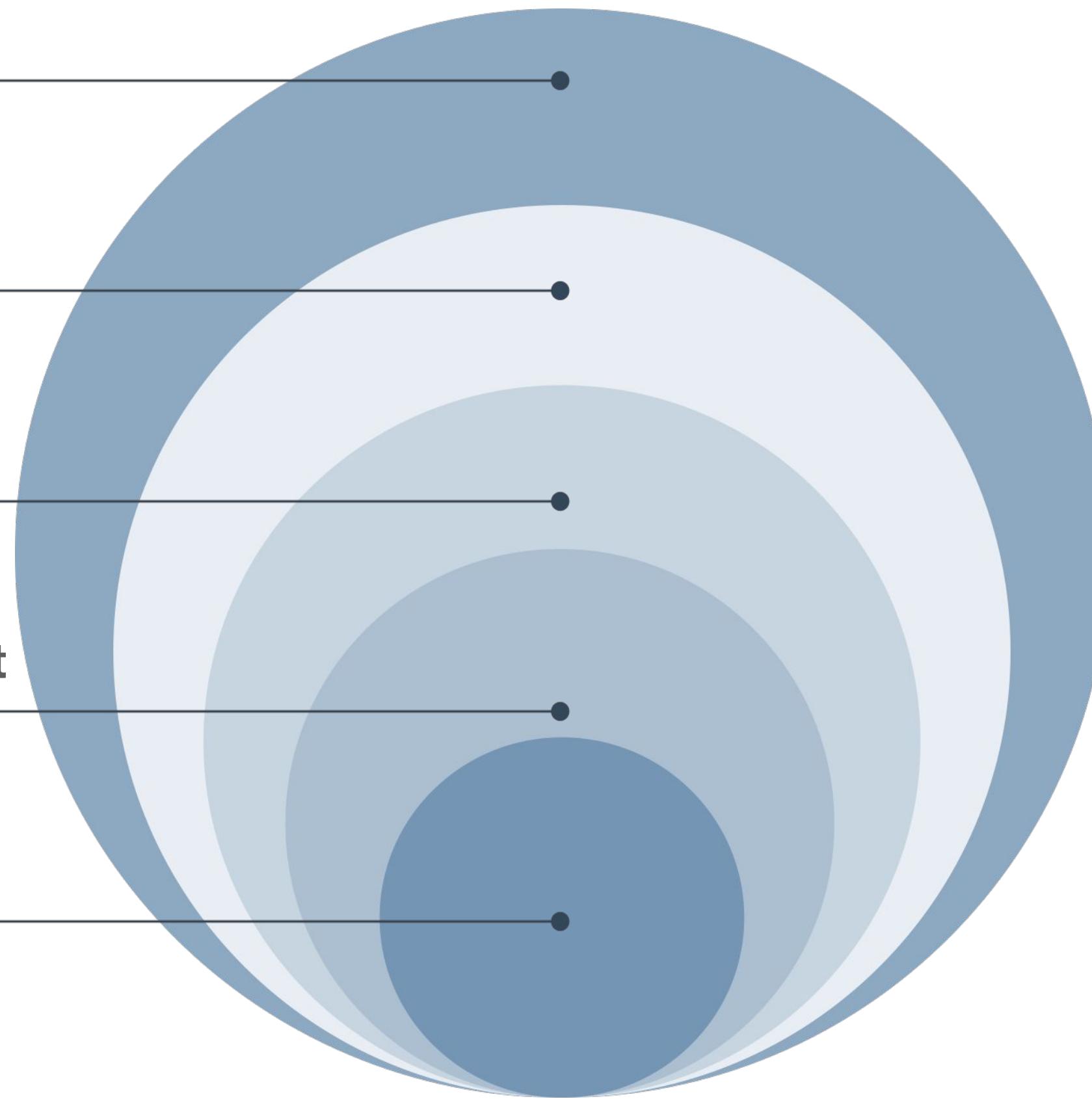
2 Factor Authentication

Computer Firewall

C2 SPC Firewall

ID and Access Management

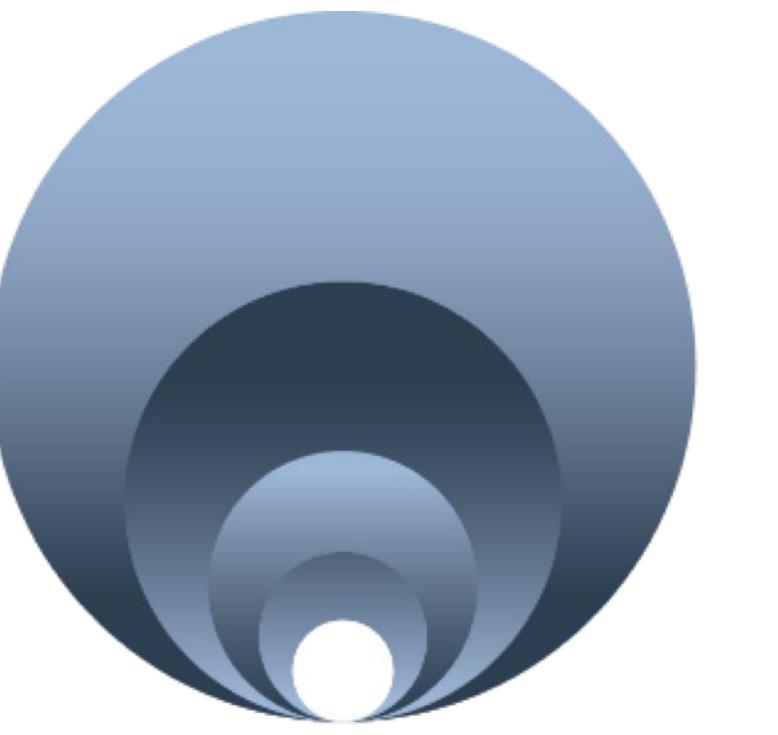
Security by Design



5 LAYERS

**Physical & Digital
Security**

COMPUTEROME CONTACT



Computerome

For further information or inquiries about
Computerome, please write to:

Computerome@dtu.dk

Computerome.dk

They will be happy to assist you.

