LUMI

The pan-European supercomputer of the North

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The EuroHPC Initiative

- The **EuroHPC Joint Undertaking** will pool EU and national resources in high-performance computing (HPC)
  - o**acquiring and providing a world-class supercomputing and data infrastructure** for Europe's scientific, industrial and public users
  - osupporting an ambitious **research and innovation agenda**
- The EuroHPC declaration has been signed by **32 European countries**
- The first generation of EuroHPC systems announced in June 2019
  - o3 pre-exascale systems to Finland, Italy and Spain
  - o5 petascale systems to Czech Republic, Bulgaria, Luxembourg, Portugal and Slovenia

LUMI Consortium

CSC Datacenter in Kajaani

- Unique consortium of 10 countries with strong national HPC centers

- The resources of LUMI will be allocated per the investments

- The share of the EuroHPC JU (50%) will be allocated by a peer-review process (cf. PRACE Tier-0 access) and available for all European researchers

- The shares of the LUMI partner countries will be allocated by local considerations and policies – seen and handled as extensions to national resources

LUMI Datacenter in Kajaani

100% hydroelectric energy up to 200 MW

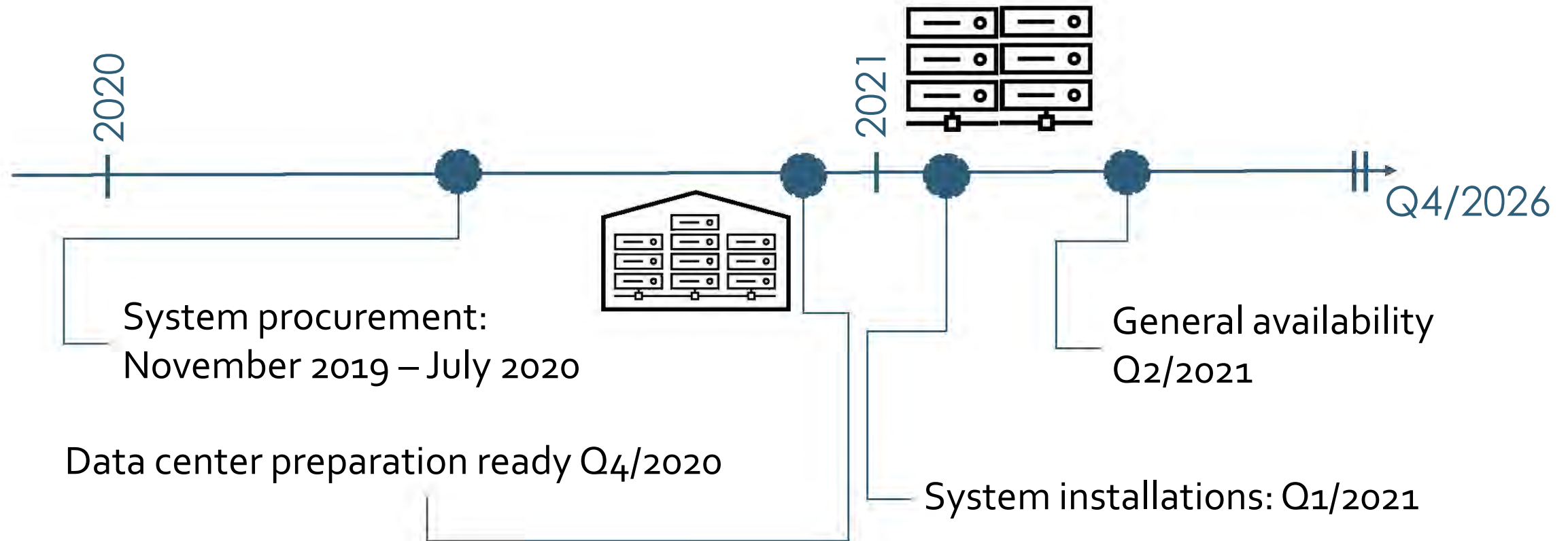Very reliable power grid: Only one 2 min outage in 38 years

100% free cooling available, PUE 1.03

Waste heat reuse: effective energy price 35 €/MWh,
negative CO_2 footprint: 13500 tons reduced every year

Extreme connectivity: Kajaani DC is a direct part of the Nordic backbone.
4x100 Gbit/s to GÉANT in place, can be easily scaled up to multi-terabit level

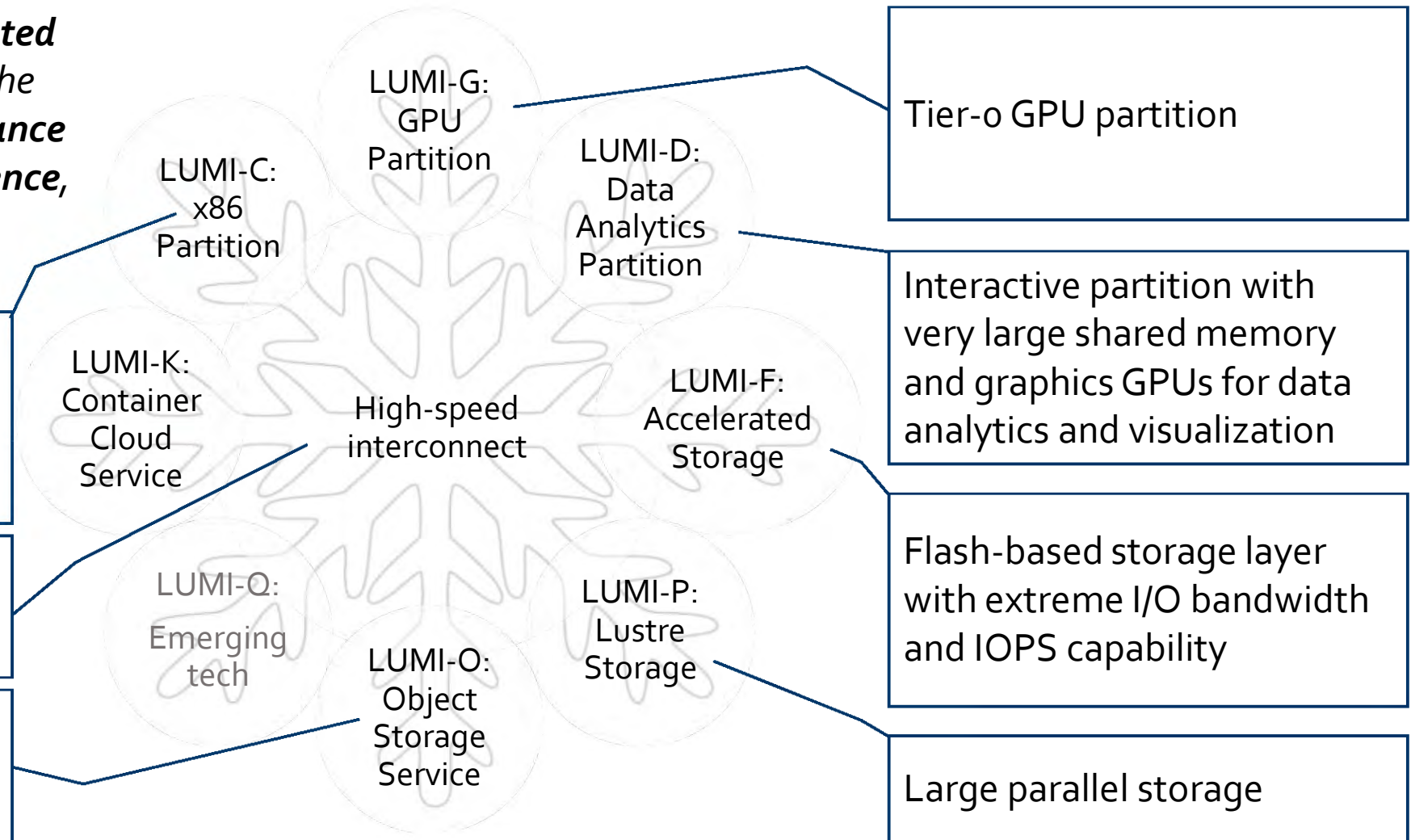Elevated security standards guaranteed by ISO27001 compliancy

LUMI Timeline

2020

2021

Q4/2026

System procurement:
November 2019 – July 2020

Data center preparation ready Q4/2020

System installations: Q1/2021

General availability
Q2/2021

LUMI System Architecture

LUMI is a Tier-0 **GPU-accelerated supercomputer** that enables the convergence of **high-performance computing**, **artificial intelligence**, and **high-performance data analytics**.

- Supplementary "Tier-1" CPU partition
- M, L and XL memory nodes

Possibility for combining different resources within a single run

Encrypted object storage (Ceph) for storing, sharing and staging data

LUMI-C: x86 Partition

LUMI-G: GPU Partition

LUMI-D: Data Analytics Partition

LUMI-K: Container Cloud Service

High-speed interconnect

LUMI-F: Accelerated Storage

LUMI-Q: Emerging tech

LUMI-O: Object Storage Service

LUMI-P: Lustre Storage

Tier-0 GPU partition

Interactive partition with very large shared memory and graphics GPUs for data analytics and visualization

Flash-based storage layer with extreme I/O bandwidth and IOPS capability

Large parallel storage

Enhanced user experience

- Large and highly skilled User Support Team harnessing the competences across the LUMI Consortium

- In addition to traditional command-line interface, we support high-level interfaces on LUMI

  o i.e. seamlessly integrate Jupyter Notebooks, Rstudio and similar to back-end to LUMI-G and LUMI-C

- A rich stack of pre-installed software, both community and commercial

- Datasets as a Service: curated large reference datasets available and maintained

LUMI user support

- User support and a centralized help-desk by the distributed LUMI User Support Team

- The model is based on a network of dedicated LUMI experts: each partner will provide one full-time person for the task

- LUMI User Support Team will also provide end-user training, and maintain the software portfolio and user documentation of the system

- "Level 3" support (e.g. application enabling, methodology support) via EuroHPC Competence Centers

How to prepare for Lumi?

- Thinking projects and use cases for Lumi
  - Cases for Tier-0 grand challenges
  - Combining simulation and AI methods within the same workflow
- Modernizing applications and GPU-enabling them
  - "even if it works, fix it"
  - There is a vast pool of GPU-enabled community codes
  - Remember the possibility of combining CPU and GPU nodes within one job – perhaps only part of the application needs to be GPU-enabled
- LUMI is a "Swiss army knife", and not only about Tier-0 simulation
  - LUMI-D or data-management services may be the value-add for many use cases

Concluding remarks

- **EuroHPC era: Unprecendent amount of computational resources and capabilities** available for European research & innovation
  - Complemented by competence building and user support activities
- **LUMI, the Queen of the North**: leadership-class resource designed for a broad range of user communities and workloads, with an enhanced user experience
  - **LUMI will be a GPU system**, which needs some preparatory work – but it will be a robust production system, and not experimental or esoteric in any manner
- **Modernizing HPC applications** for harnessing the largest systems is not trivial, and needs a lot of focused effort – but it will pay off
  - It is time already to start preparing for the LUMI era

LUMI

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EuroHPC
Joint Undertaking

Leverage from
the EU
2014–2020

European Union
European Regional
Development Fund

Kainuun liitto