

*CSC VISION 2015 : Pioneer in
the sustainable development
of ICT services*



CSC Data Center in Kajaani

About CSC



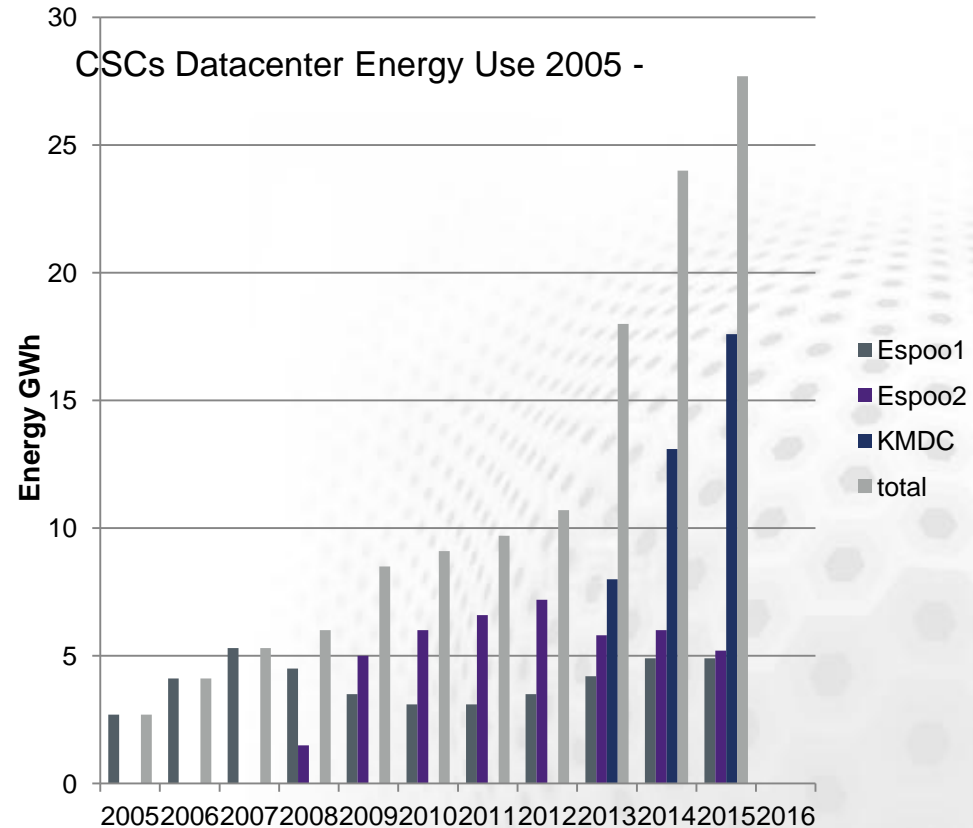
- CSC - IT Center for Science Ltd. is a state-owned, non-profit company
 - administered by the Ministry of Education and Culture, founded 1971
- CSC offers IT -support and resources for research, education and culture. Connect Finland to the Internet in 1988
- CSC provides Finland's widest selection of scientific software and databases and Nordic's most powerful supercomputing environment that researchers can use via the Funet network
- www.csc.fi



Drivers for new CSC data center



- Capacity limiting growth
- Geographical distribution
- Costs increasing
 - Tax
 - Energy

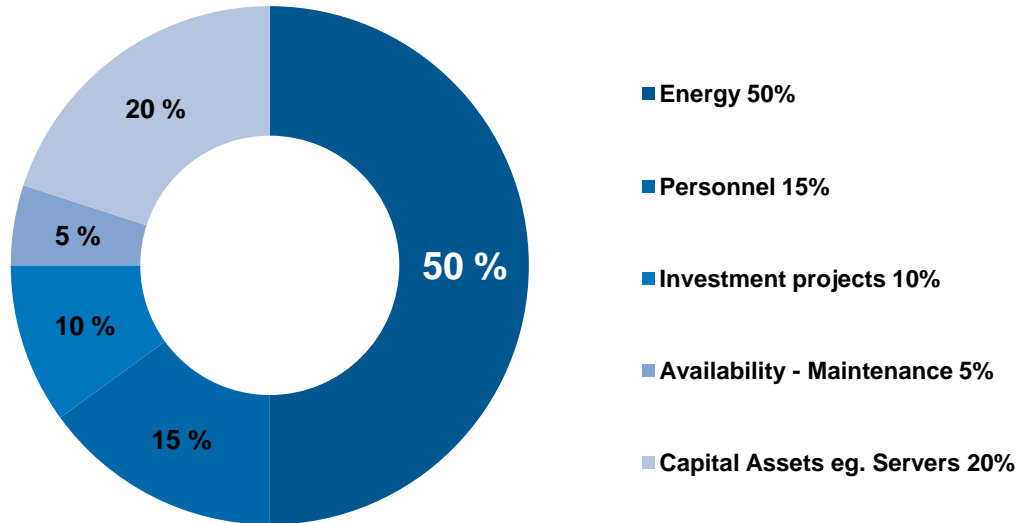


The Challenge



Energy Efficiency

- **Energy is the fastest-rising cost element** in a data center.



Operational cost structure of a data center

Approach for new DC site

- Multi-MW facility with PUE < 1.2
- Only 100kW UPS from day one
 - < 5% of load
 - Core network, management, automation
- No generators day one, option to add 100% UPS and generators in any time
- Free cooling year round
- Use modular to right-size and scale quickly
- ISO27001 certificate
- Green
 - Certificate for carbon neutral energy
 - 100% hydro power

Why Kajaani selected

- Airline connection
- Weather conditions
- Electricity availability, reliability and price
- Funet network
- Existing business park for DC operators
- Geologically stable and safe environment
- Local involvement

Beg - 2012



Opening for CSC Kajaani Data Center was in 10/2012



Kajaani DC



15.9.2014

Tiedosta osaaminen

CSC Kajaani Data Center



Cost-efficient data center solution in line with sustainable development

- 3 000 m² (4 000 m² option)
- Modular, easy to expand
- 2 x 10 MW, option to expand
- 120 kW UPS and no generators
- Air&Water-cooling and certified hydropower
- Carbon footprint is almost zero



Data Center CSC Kajaani is located in the Renforsin Ranta Business Park.

CSC Kajaani Data Center



Cost-efficient data center solution in line with sustainable development

- Data Center CSC Kajaani was granted the ISO 27001 certificate in 2013
 - **ISO 27001** It is a specification for an information security management system.
 - 'Big Players' like Yahoo, Google, Microsoft
- CSC services from Kajaani DC
 - Computing and Data services
 - Cloud and IaaS services
 - DC Hosting
- #1 eco- and cost-efficient technology solutions



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Kajaani DC production

2.4 MW combined hybrid capacity

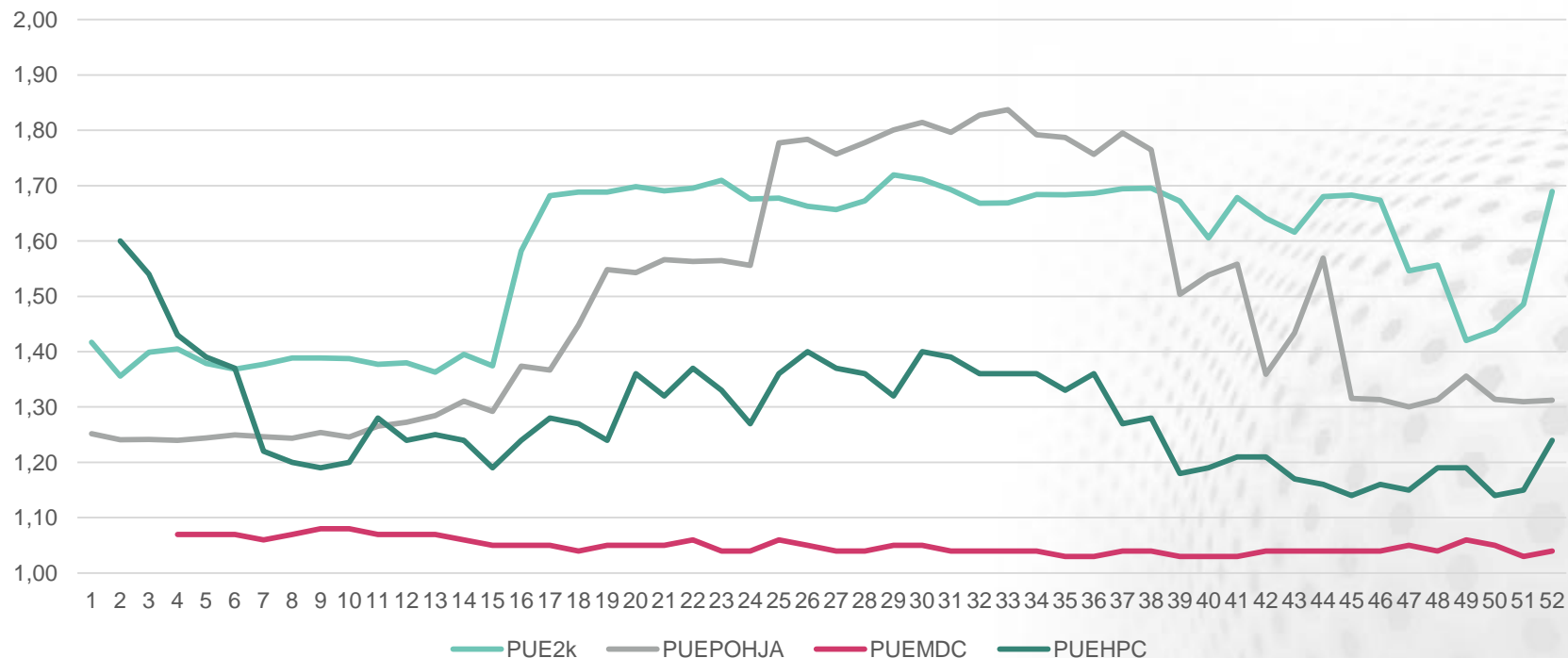
- 1.4 MW modular free air cooled datacenter
 - Upgradable in 300-700kW factory built modules
 - From order to acceptance in 5 months
 - 35kW per extra tall racks – 12kW common in industry
 - **PUE 1.06**
- 1MW HPC data center
 - Optimised for Cray XC30
 - Hosting new Bull system
 - 90% Water cooling
 - PUE 1.28

$$\text{PUE} = \frac{\text{Total Facility Energy}}{\text{IT Equipment Energy}}$$

CSC DCs PUE figures in 2013



CSC PUE arvot



15.9.2014

Tiedosta osaaminen

Data Centres and Sustainability: A Weak Link?

- *European Perspectives in Addressing Sustainability Aspects of Data Centres* –

Colette Maloney , Head of Unit Smart Cities and Sustainability, European Commission



Challenging but Feasible Targets!



Example:
Kajaani data
centre, Finland

- Powering, cooling through renewables
- PUE: 1.15

Slide courtesy: CSC, Finland

Sisu (CRAY XC30), THE SUPERCOMPER CSC



15.9.2014

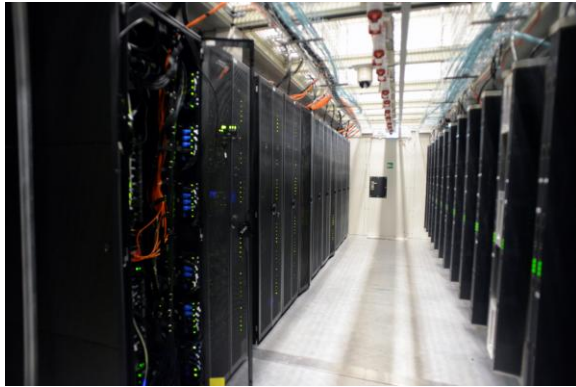
Tiedosta osaaminen

Sisu (CRAY XC30)



- Sisu supercomputer is the most powerful supercomputer in Nordics and one of the most powerful in Europe.
- Sisu targeted for applications that can effectively run on thousands of compute cores in parallel.
- The currently installed second phase of Sisu consists of nine cabinets, over 40000 cores and total theoretical peak performance is 1,7 PFlop/s

TAITO (HP Supercluster)



- Taito supercluster is intended for serial (single core) and medium-size parallel jobs. There are also several "fat nodes" for jobs requiring a large amount of memory.
- The currently installed first phase of Taito consists of nine cabinets (9216 cores), with a total theoretical peak performance of 180 TFlop/s
- 2nd phase of Taito is coming 2H/2014

BULL

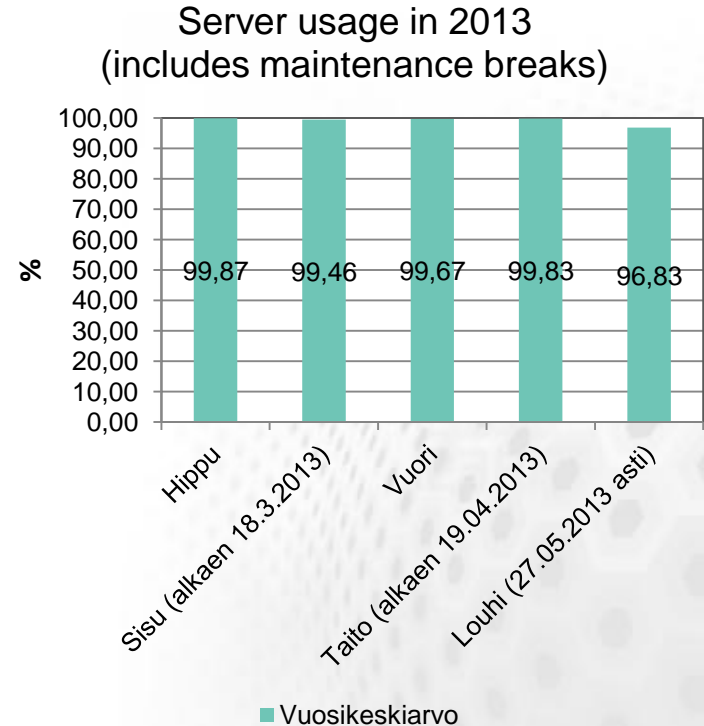


- Warm water cooled supercomputer prototype which is dedicated for PRACE usage.
- Latest versions of CPU and GPU processors
 - Intel Xeon Phi 7120X
 - Nvidia Tesla K40
- Very energy-efficient, cooling direct to the board
- Performance 240 Tflop/s
- First in the world to integrate a combination of Intel® Xeon Phi™ coprocessors and Nvidia® Tesla™ K40 GPUs

CSC resources availability and usage



- Sisu and Taito supercomputers usage % was 99,5
- Availability in 2014 has been 90%



Pouta - Cloud service



- CSC has released a new cloud service called Pouta
- New IaaS (Infrastructure as a Service) offering from CSC
- Run your own virtual machines on CSC's supercluster (Taito)
- Permits direct connection to the internet
- It allows users to solve computational challenges which have not previously been possible to run on CSC's other systems (applications with a browser-based user interfaces)

FORGE



- ➊ FORGE Service Lab is a development laboratory for digital services
- ➋ Cloud service and forum – with the very latest technologies
- ➌ Service development community will also be assembled around the laboratory
- ➍ Started in 2013, CSC is providing framework and service hosting for this

New expansion



Why this is needed

- Universities have intense collaboration in IT service design, procurement and production. Joint infrastructure services are seen as an area where collaboration is beneficial
- Finnish universities have some 160 local datacenters with an average life time of 10 years => 16 DC renewal projects a year
 - University IT organizations' core competencies do not typically include heating, plumbing, air conditioning (HVAC) nor electricity competencies => external consultancy services are needed in order to mitigate risks.
- Old datacenters are not always energy efficient
- Energy costs are the biggest run-time cost element. Joint DC service production is estimated to give hundreds of thousands of EUR savings / year

Data center for higher education institutions

- Development project (together with KUAS) with *European Regional Development* –funding
- An eco- and cost efficient datacenter:
 - Max total 750kW
 - Full supported with UPS power
- Modular expansion to the existing DC facility
- Project schedule: Available 11/2014
- Potential customers: Universities + State of Finland

Greetings from Italy

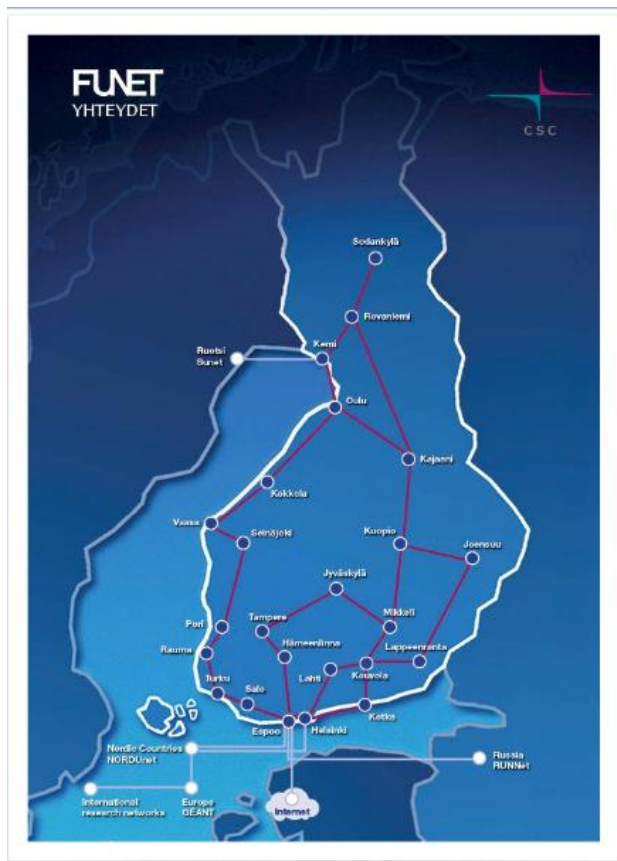


Does an efficient datacenter guarantee high quality data services?

No, but it can make them superior due to competitive cost structure, flexibility to expand and robustness in operation.

Appendixes

Funet Backbone Network



- The Funet hybrid backbone network provides reliable, high-capacity IP services and lightpaths.
- Funet backbone provides reliable and high-capacity connections for all *Funet member organizations* in Finland. Funet is connected to international academic networks via *NORDUnet* (Nordic academic network collaboration).
- **Funet IP Backbone Network**
 - Funet IP backbone supports advanced services like *IPv6* and *IP multicast*. Link speeds towards member organizations range up to 10 Gbps.
 - Connectivity to international academic and commercial internet is provided by and via NORDUnet.
 - .Capacity of backbone links between routers is 10 Gbps.
- **Funet Optical Backbone Network**
 - Funet optical backbone network is based on leased dark fiber between and inside major Finnish university locations. NokiaSiemens hiT7300 is used as DWDM equipment. The configuration enables up to 40 optical channels, each with the capacity of up to 40 Gbps.
 - The optical backbone network makes it possible to offer **light path** service in major university locations in Finland.

Prefabricated Data Centre advantages . . .

Flexibility and Scalability

- Defer capital expenses and minimize over sizing.
- Adjust quickly changes in your demand, up or down.
- Build in smaller, more granular phases

Faster Deployment

- Shorten planning cycle and reduce complexity
- Simplify build process
- Delivery in 16-20 weeks or less (upon design sign-off and receipt of PO)

Predictable Performance

- The density, availability and efficiency you expected
- The cost you were promised
- Less “hands” involved, less changes to design

. . . vs. traditional data centres