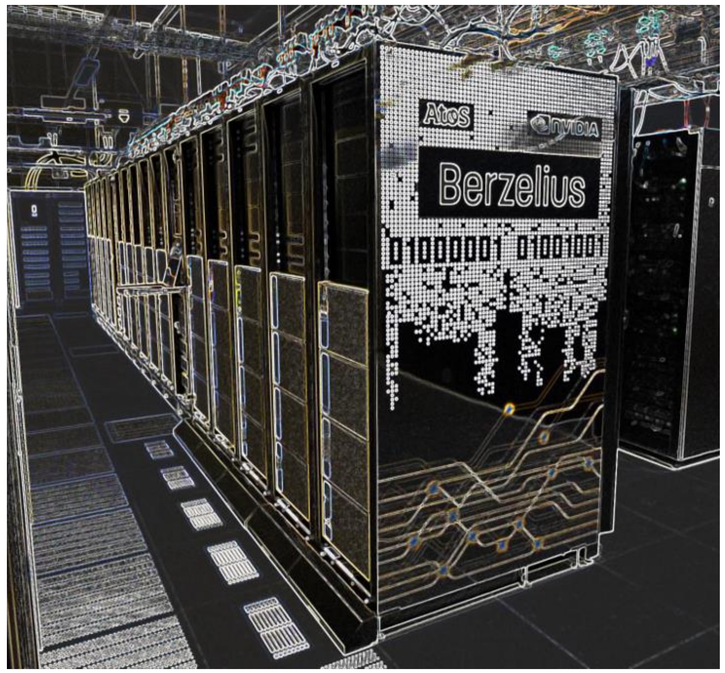
Visual Intelligence

Anders Ynnerman
Norrköping Visualization Center
WASP
Linköping University
Sweden



EXPERIMENT

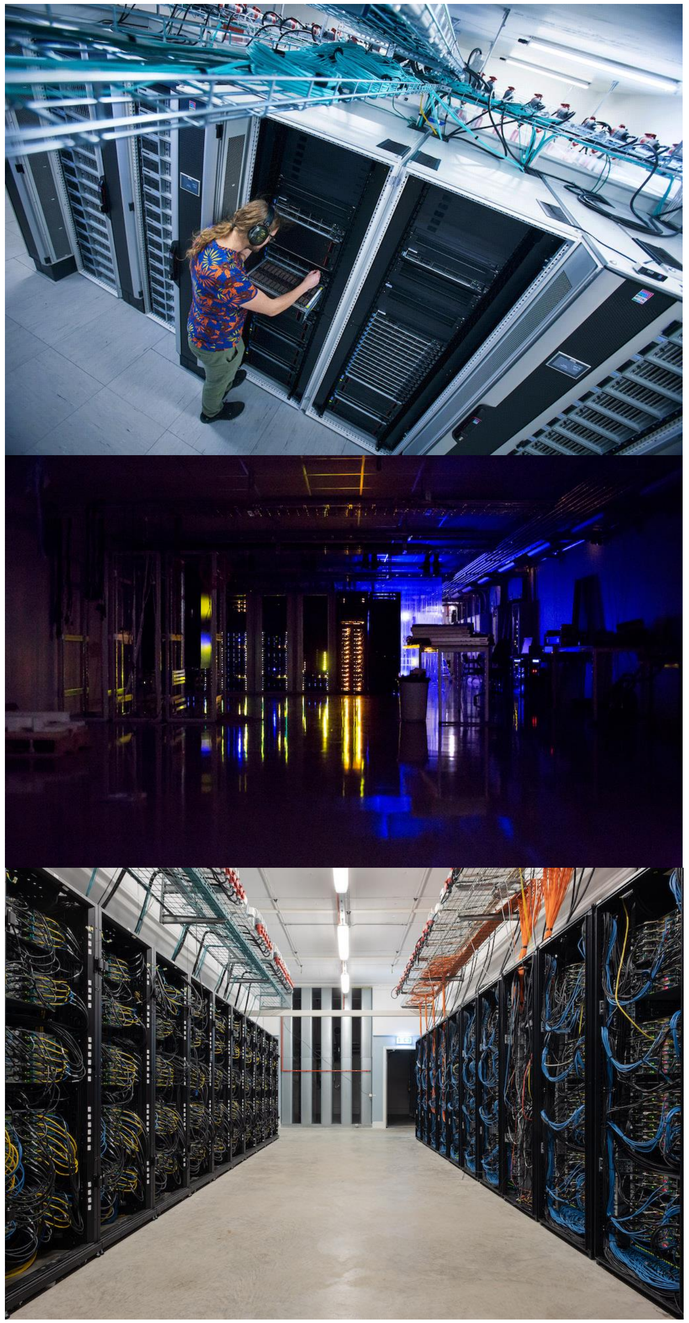
COMPUTE

DATA

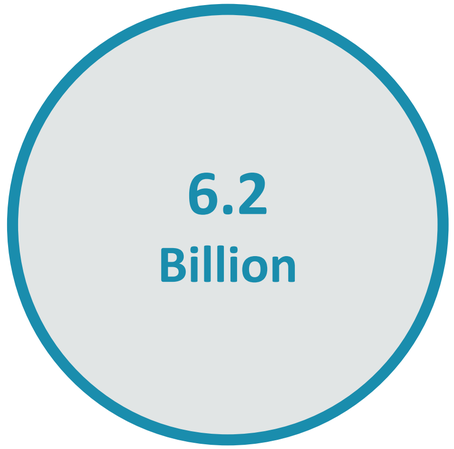
NAISS

National Academic Infrastructure for Supercomputing in Sweden

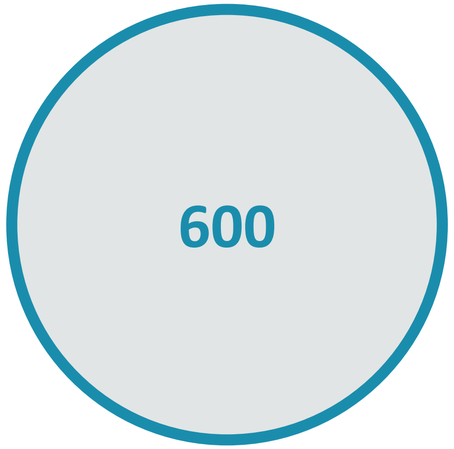
- The new national research infrastructure organisation for HPC in Sweden
- Hybrid model – centralized hardware and distributed support
- NAISS is extending user support and applications expertise across Sweden with branches in partnership with all large universities
- Linköping University is the host, the Swedish research council the main financer



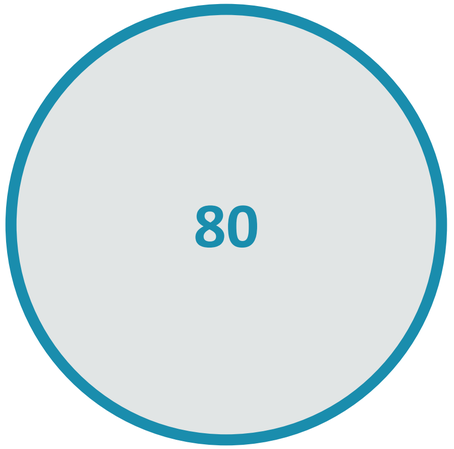
Wallenberg AI, Autonomous Systems and Software Program



6.2 billion SEK for 15 years until 2031



600 Graduated PhDs

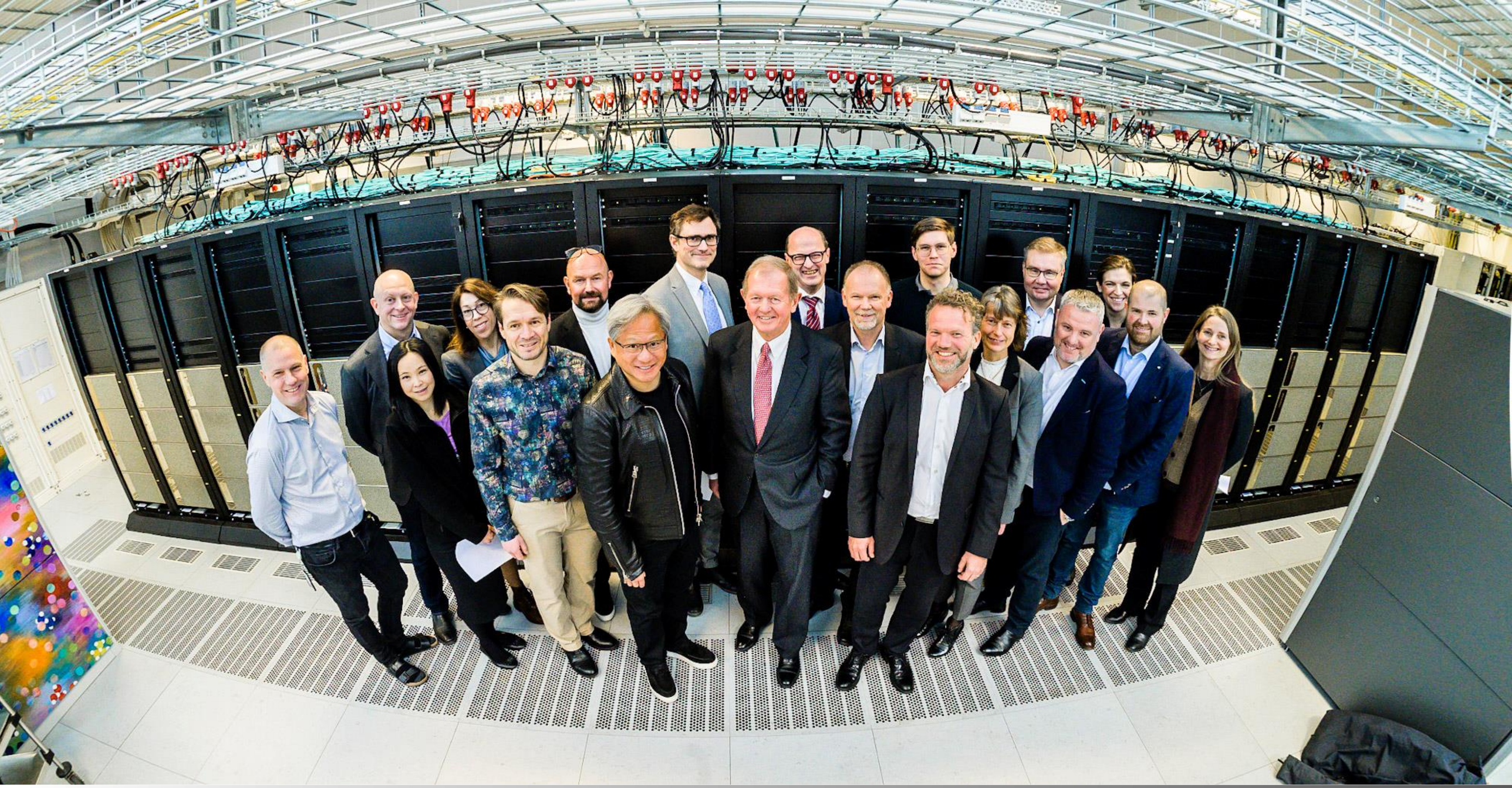


80 Faculty Recruitments

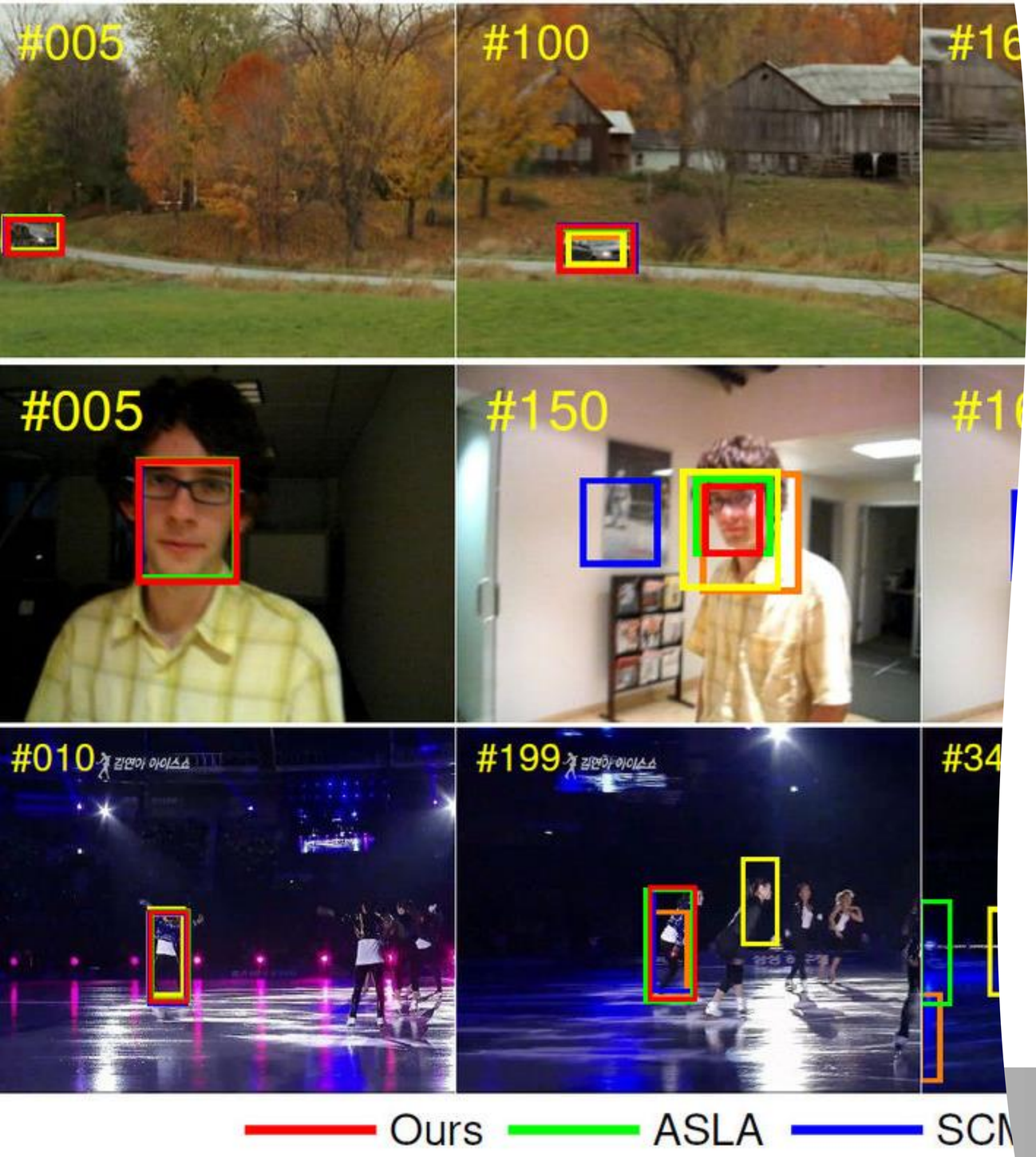
Berzelius - AI Resource

- ATOS - NVIDIA SuperPod
- 94 DGX A100 systems
- 8 A100 GPUs/node
- 5 PetaFLOPS/node
- 1800 Gb/s interconnect
- Hosted by the National Supercomputer Centre (NSC) and integrated in the HPC environment for compute and storage solution

- Fully utilized as of April 2022
  - Natural Language Processing (GPT-SW3)
  - Protein Folding
  - Computer Vision
  - …



WASP | WALLENBERG AI, AUTONOMOUS SYSTEMS AND SOFTWARE PROGRAM



Berzelius and Computer Vision

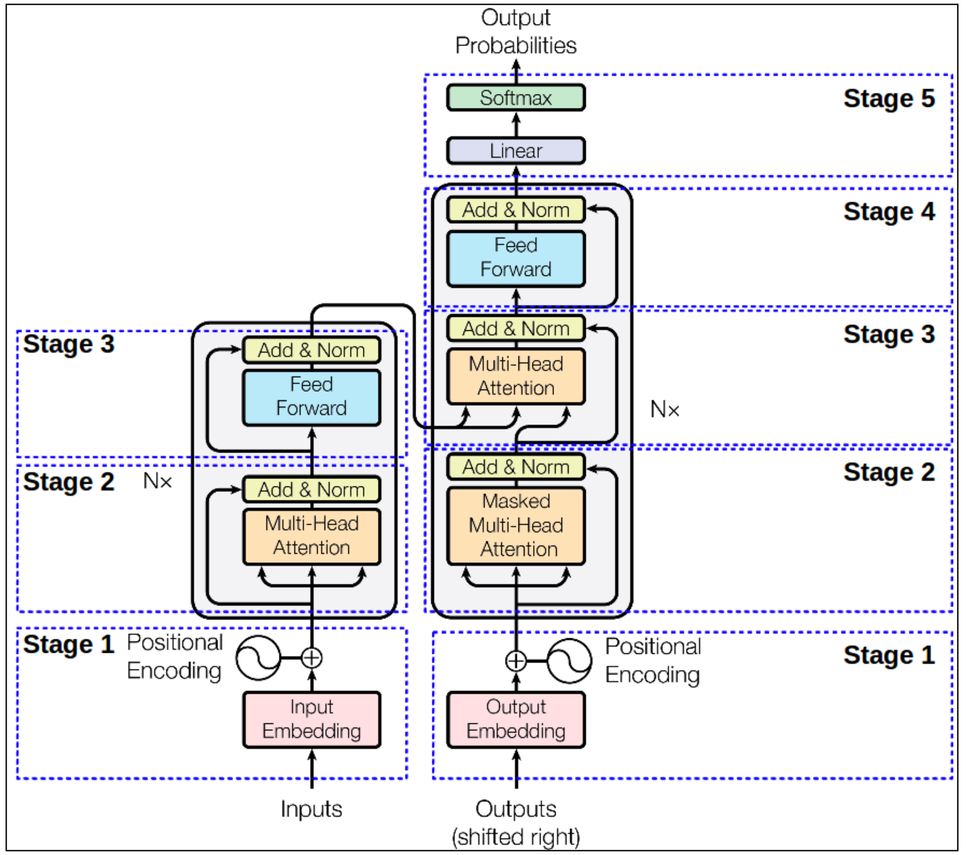
- Berzelius is our backbone for large scale experiments on machine learning for computer vision.
- Data-driven models for detection and semantic segmentation in static image, tracking and segmentation of objects in video sequences, and for solving recognition and segmentation problems on 3D point clouds.
- Leads to publications at top tier conferences in engineering and computer science, such as CVPR, NeurIPS, ICCV, ICML, and ECCV.

Berzelius and Protein Folding

- AlphaFold, an AI breakthrough from DeepMind, is revolutionizing structural biology by predicting protein structures with remarkable accuracy.
- Innovative sampling strategy involving the activation of dropout layers within AlphaFold's neural network.
- The approach led to increased structural diversity, discovering alternative solutions that not only matched the correct answer but were also consistently ranked high by the self-assessment scoring function.

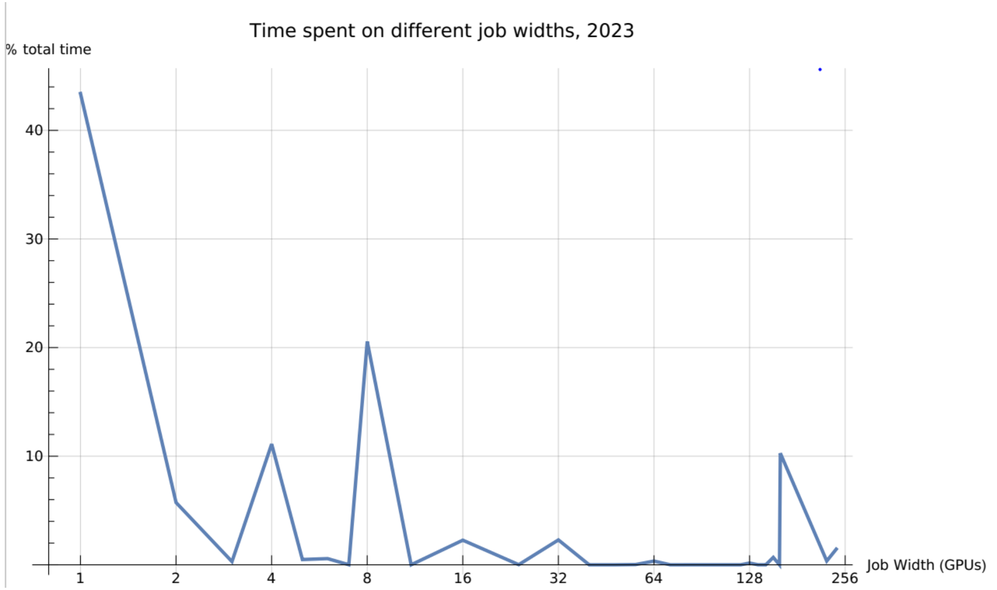
Berzelius and NLP

- Nordic language models of sizes 126m 356m 1.3B, 7B, 20B and 40B on Berzelius.
- “Closed open access”, i.e., on request.
- Trained on The Nordic Pile, a dataset of 1.2TB freely available data in the Nordic languages, collected from e.g. ArXiv, PubMed, Reddit, Flashback, etc.
- The largest model, i.e., of 40B required 9.11 x 10^22 FLOPs for training on Berzelius.
- The value of models are found in the openness and transparency, as well as the competence build-up associated with the work on the models.



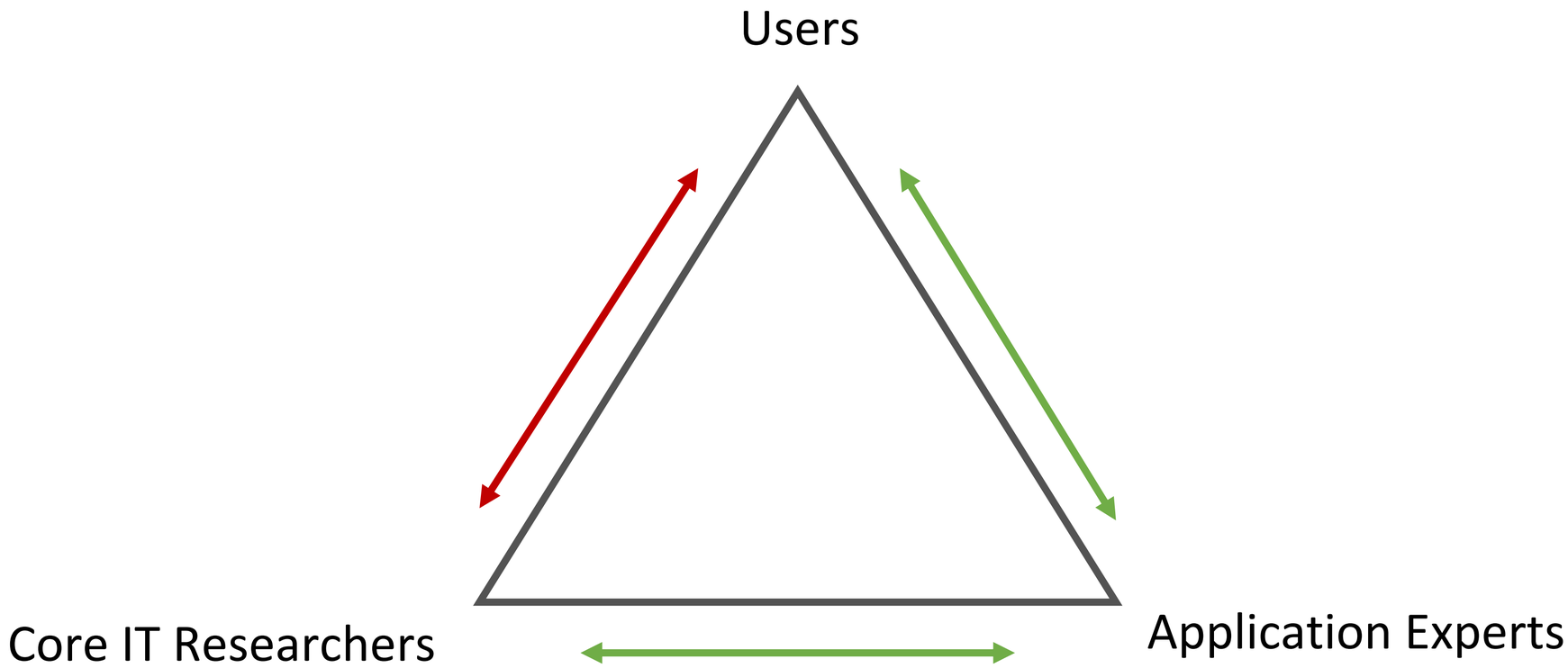
Current situation

- Load varies and peaks during daytime with shorter jobs.
- Shorter and small jobs do not utilize the capacity of the system in terms of scaling and addressing large problems.
- Scaling of jobs to make full use of Berzelius requires user training.
- A new generation of application support staff is needed to address large scale AI problems.



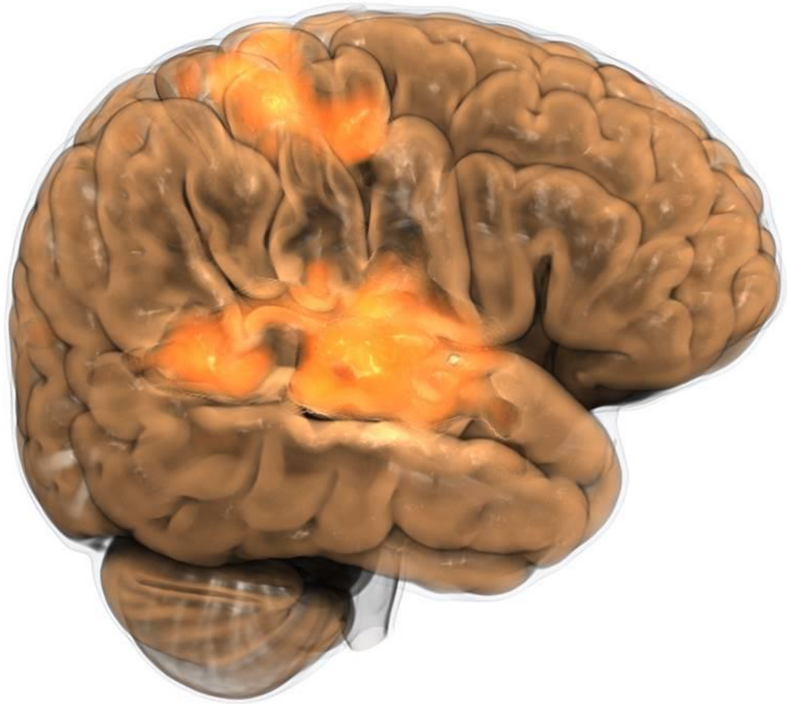
Distribution of job sizes on Berzelius during 2023. Approximately 42% of the used compute time is single GPU jobs

The SeRC Skill Triangle



Swedish e-Science Research Centre

Berzelius - AI Resource



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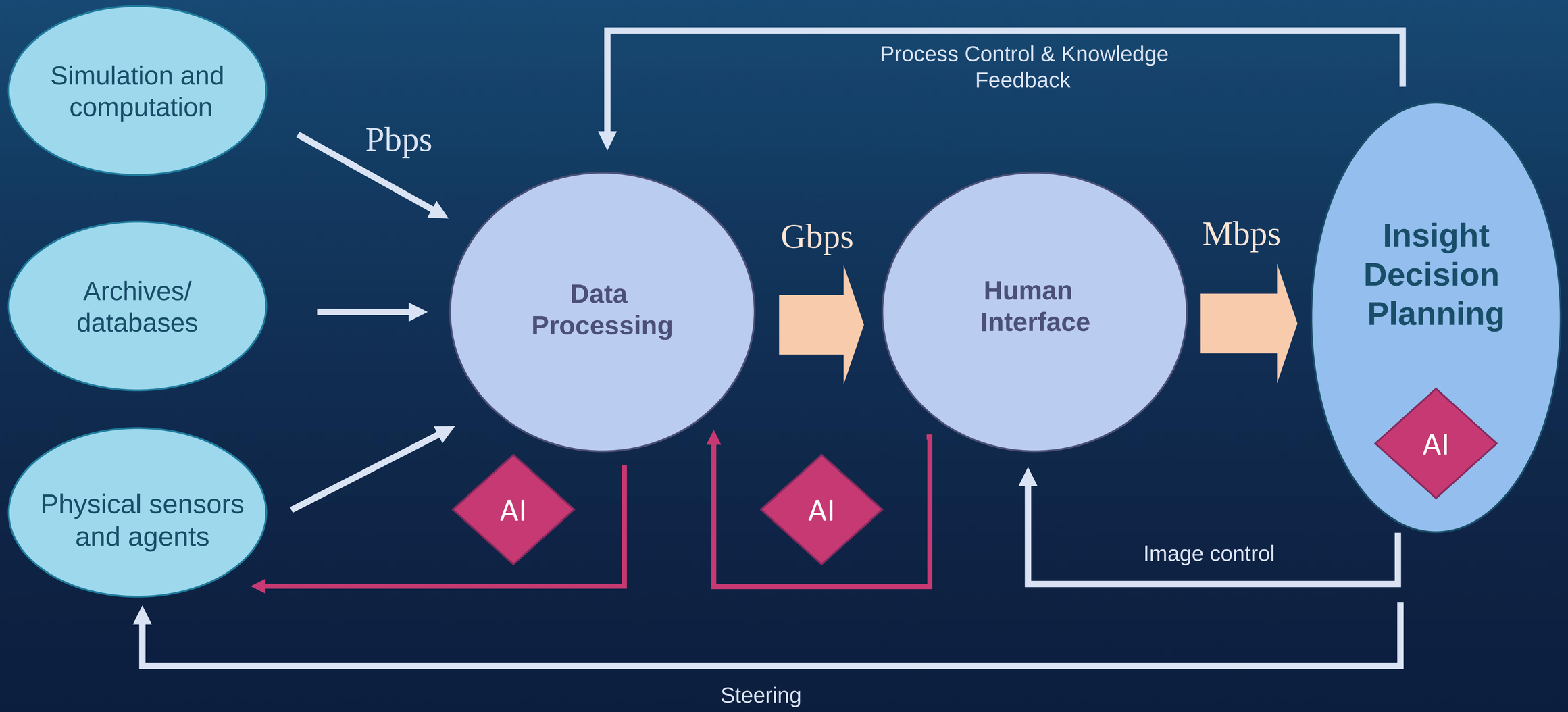
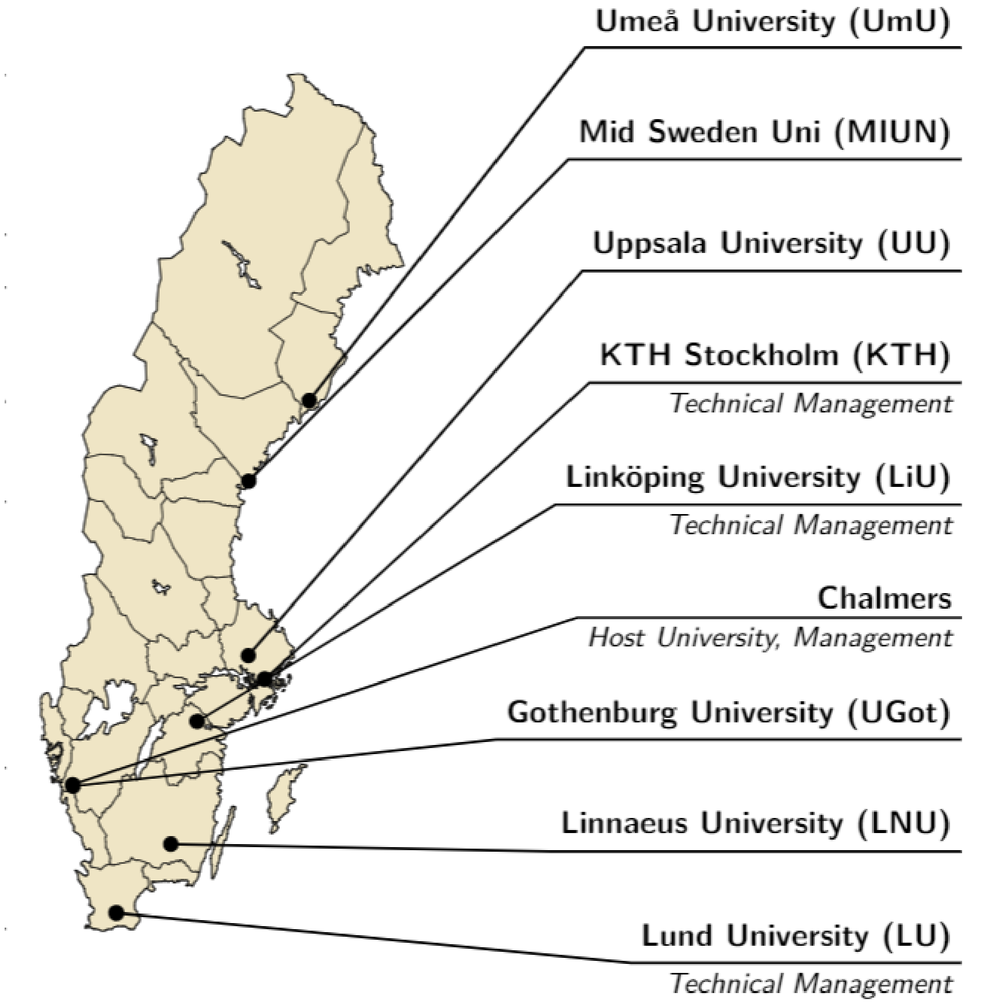
Visual Data Analysis



InfraVis

Supporting Scientific Discovery

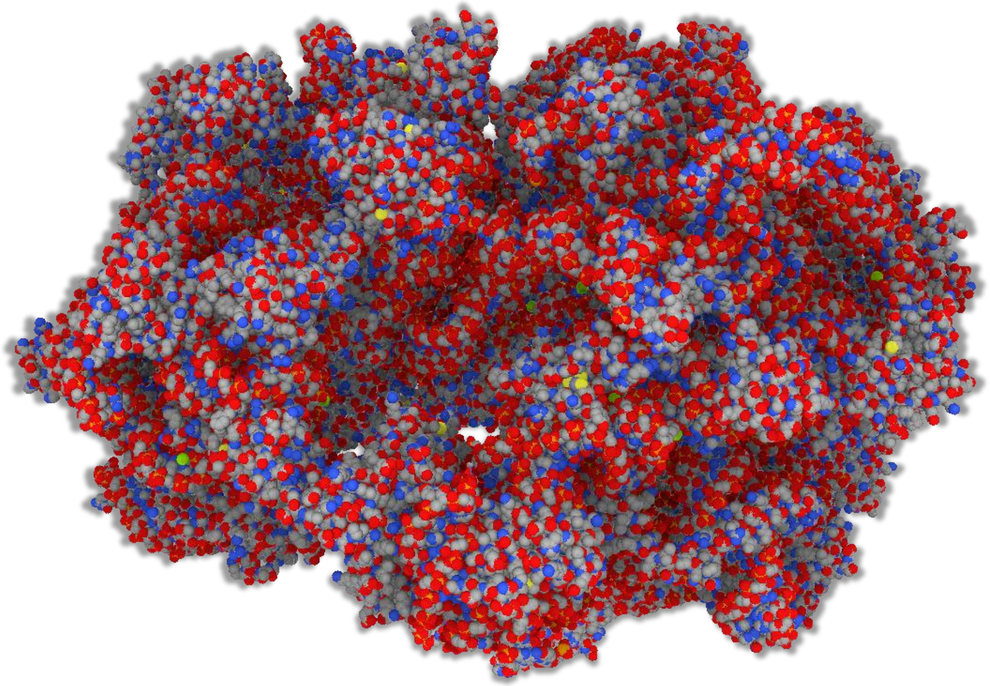
- Visualization Infrastructure
  - Humans
  - Software
  - Services
  - Hardware



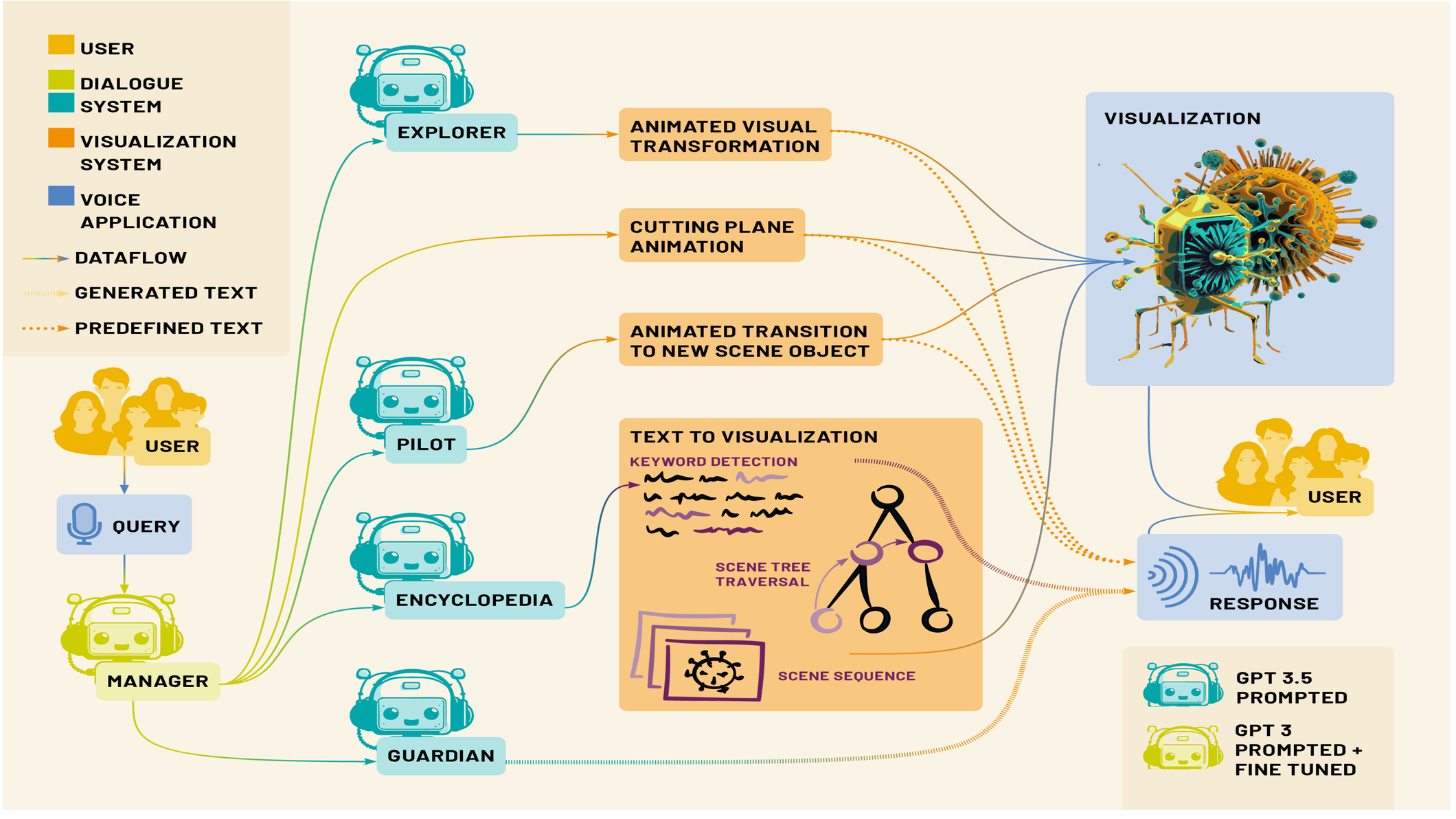
Swedish Research Council
CHALMERS UNIVERSITY OF TECHNOLOGY
UNIVERSITY OF GOTHENBURG
KTH VETENSKAP OCH KONST
LINKÖPING UNIVERSITY
LUND UNIVERSITY
Linnaeus University
Mittuniversitetet MID SWEDEN UNIVERSITY
UMEÅ UNIVERSITY
UPPSALA UNIVERSITET

InfraX4Science

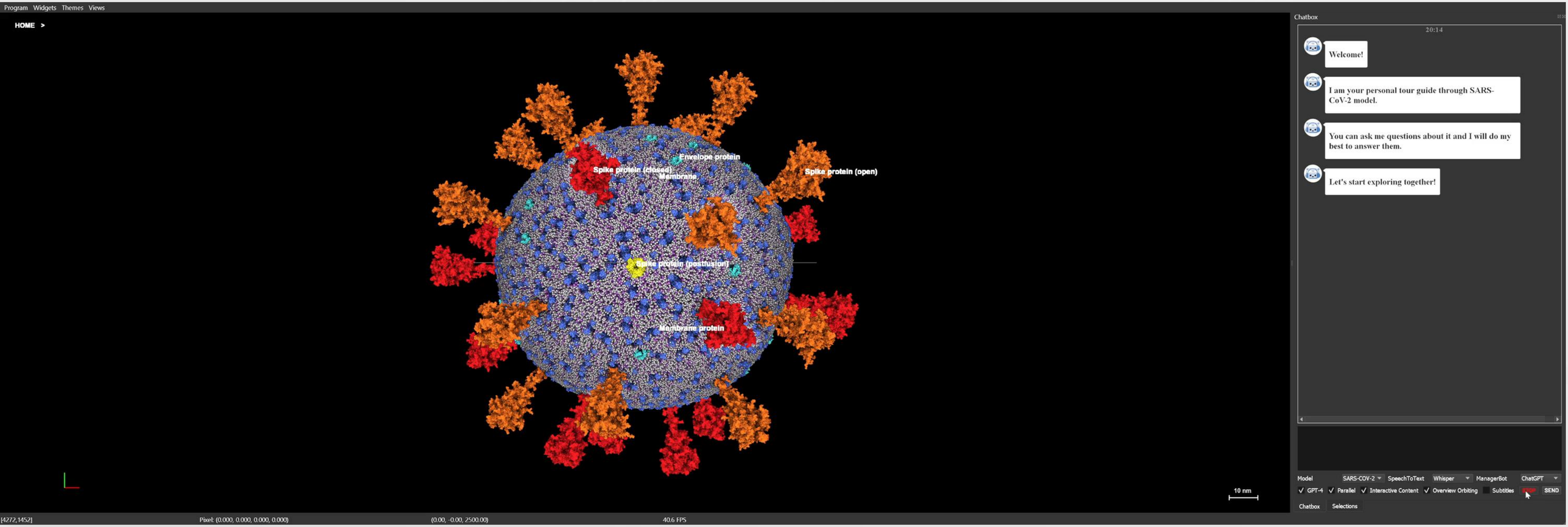
- X tools for data driven scientific discovery
- An infrastructure of application experts is needed with a (new) wider set of skills:
  - large scale ML and AI deployment
  - interactive human in the loop data analysis
  - data collection and curation
  - statistical data analysis
  - interactive and collaborative visual analysis
  - regulatory aspects
  - …



AI-Enabled Conversations



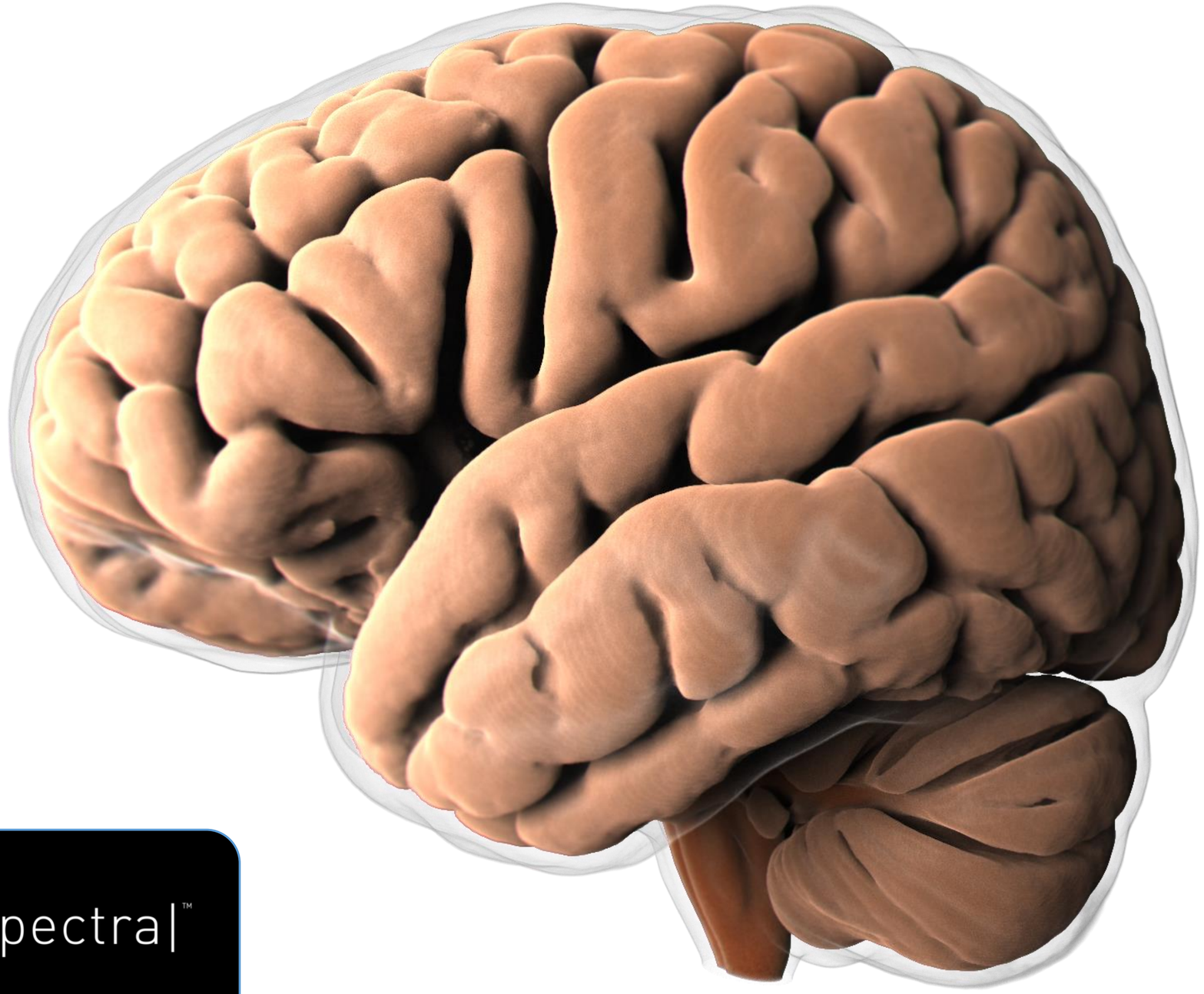
AI-Enabled Visual Conversations



Future Scientific Discovery

AI will fundamentally change scientific discovery workflows and communication of results

- **Reduce data flows**
- **Lower cognitive load**
- **Raise level of abstraction**
- **Enable Advanced interfaces**



Interspectra™

Large Scale Human Data

- **European Synchrotron in Grenoble**
- **Human Organ Atlas**
- **HiP-CT Hierarchical Phase-Contrast Tomograpy**
  - 25 micron resolution (100 times higher resolution than medical CT)
  - Organ overview and cell detail
  - Volumetric rendering by spin-off company Interspectral from Visualization Center C