Governance of a federated Science Cloud for 20.000+ Users

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Tertiary education in Baden-Württemberg

Education in Baden-Württemberg

- Nine Universities

- Over 43 different institutions of higher education

→ Est. 360.000 students in winter term 2015/2016

→ Responsibility for educational supervision: The Ministry of Science, Research and Arts

→ There is a significant demand for computational and cloud resources

Baden-Württemberg
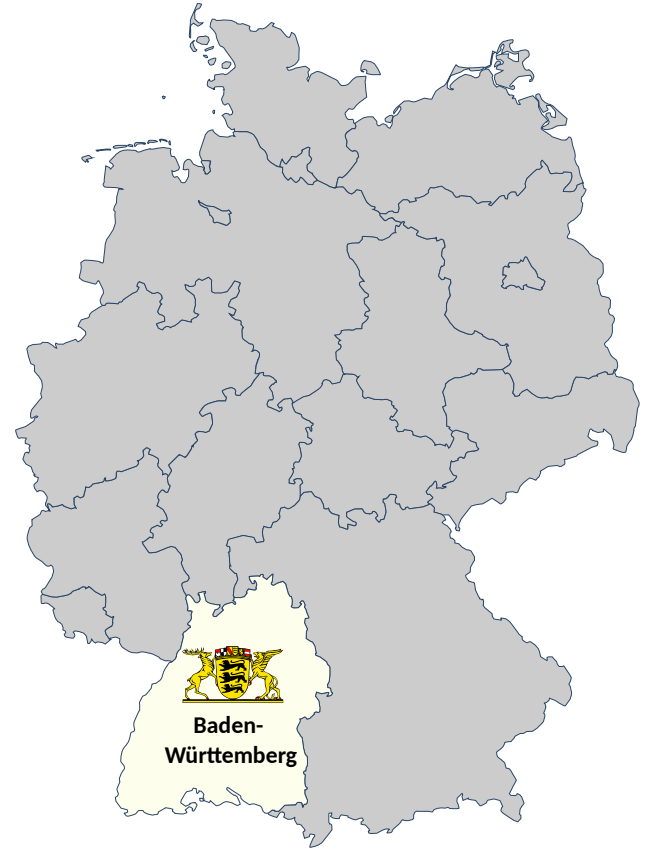
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Initial situation in 2014

- No established infrastructures for deployment of resources

- No self-service functionalities offered by the computer centers

- Creating and operating a (federated) cloud infrastructure is more than a single university computer center can handle
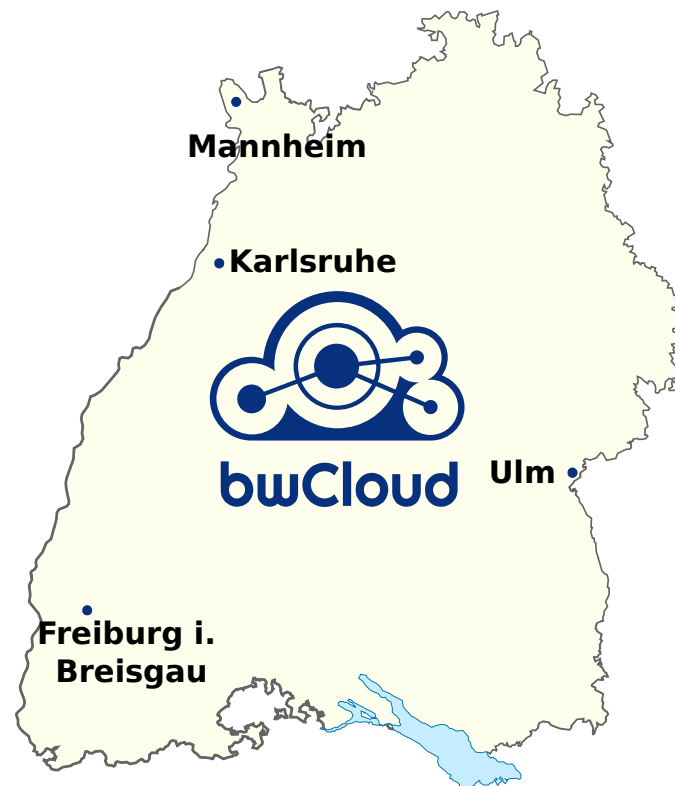
Points to consider

- In research and science, commercial providers often are not primary option

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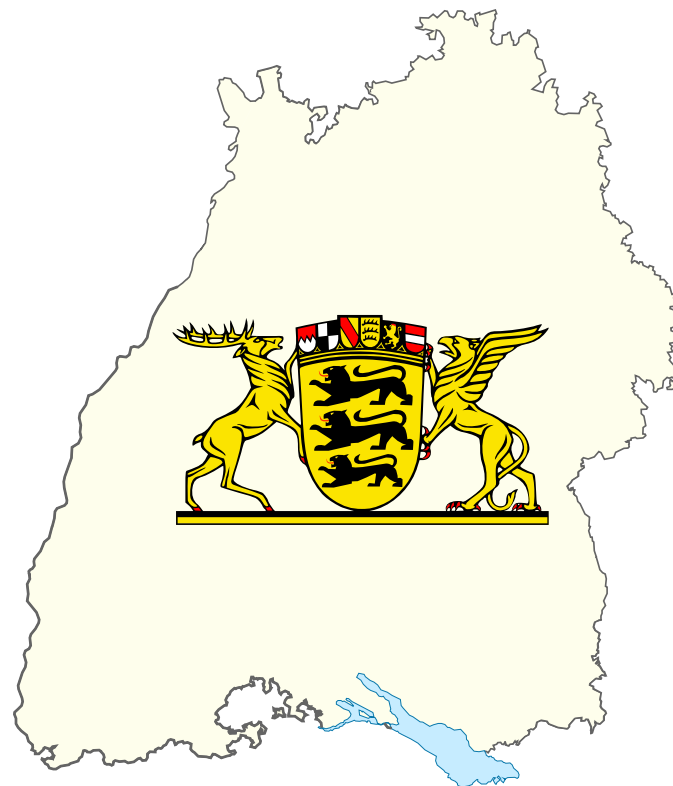
Towards a statewide science cloud

Start of the bwCloud Project in 2014

- Ministry and computer centers decided: "Lets build a federated science cloud"

- Mission: Build a federated infrastructure to offer IaaS to a huge variety of users and use-cases

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Karlsruhe

Ulm

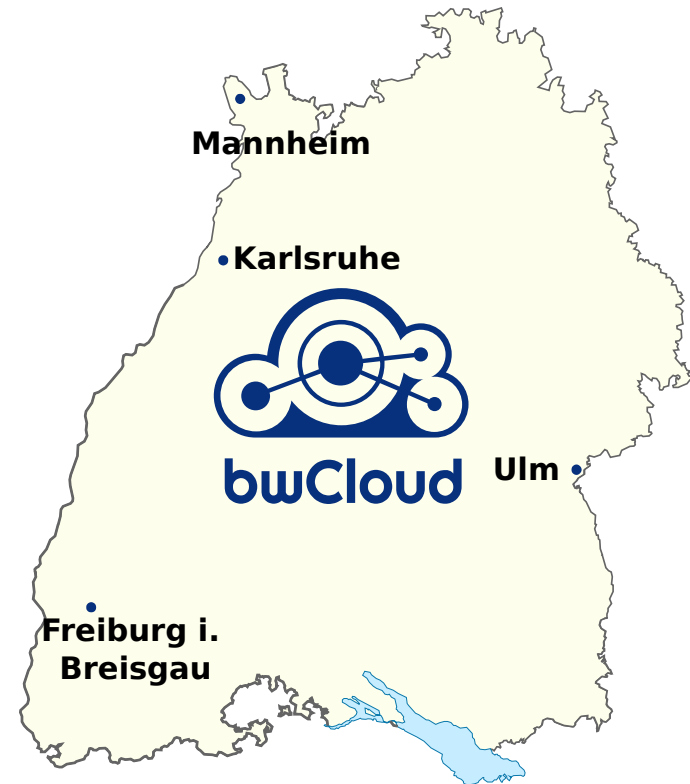Freiburg i. Breisgau

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Points to consider

Start of the bwCloud Project

- Ministry and computer centers decided: "Lets build a federated science cloud"

- Mission: Build a **federated infrastructure** to offer IaaS to a huge variety of users and use-cases

  - Four different operating sites
 - Connected by the dedicated network for educational institutions (BelWü) up to 100 Gbit/s

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Points to consider

Start of the bwCloud Project

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- Mission: Build a federated infrastructure to offer **IaaS** to a huge variety of users and use-cases

- Must work with commodity hardware
- Must support self-service functionality, different storage backends, no license fees,...
- Capable for massive scale up
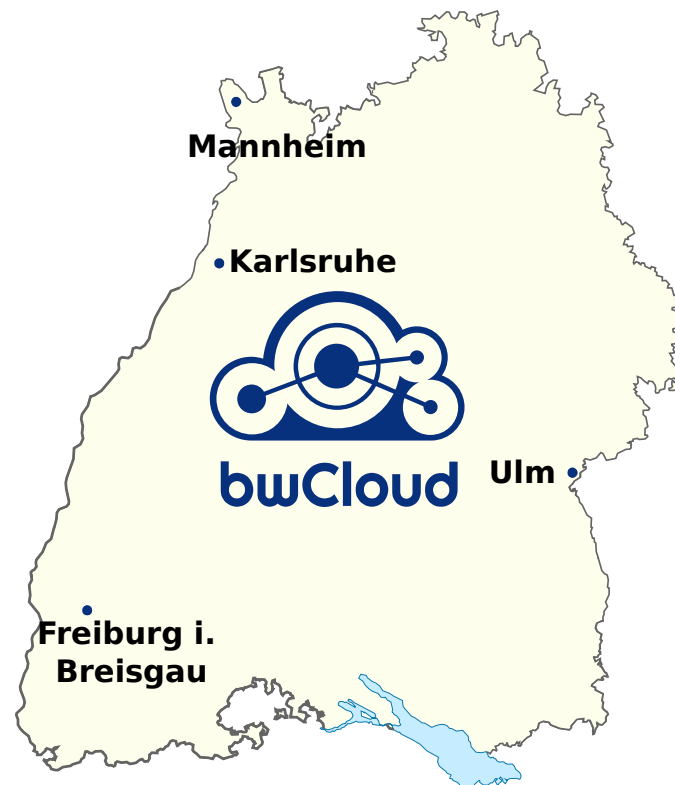
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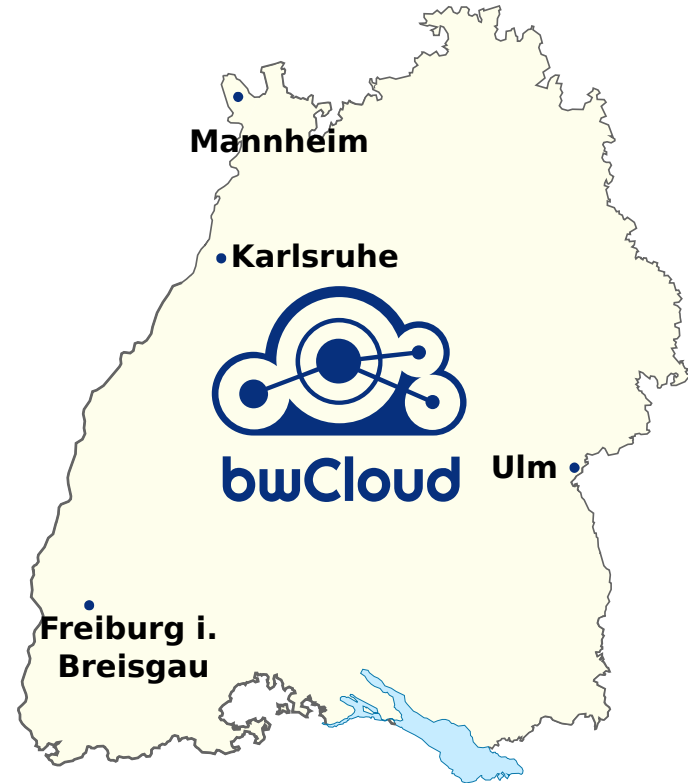
Points to consider

Start of the bwCloud Project

- Ministry and computer centers decided:
  "Lets build a federated science cloud"

- Mission: Build a federated infrastructure to offer IaaS to a **huge variety of users** and use-cases

- Identified 3 distinct user groups:
  - Research and scientific staff
 - Computer centers & employees
  - Students

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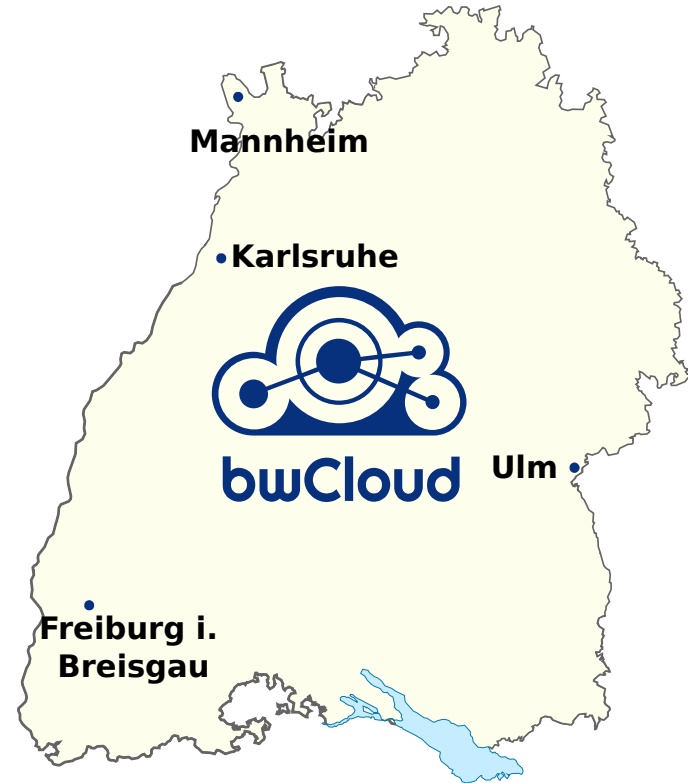
Current bwCloud infrastructure (1)

Details & specs about the bwCloud

- OpenStack (current release "Liberty") with a Multi-Region setup, including 4 different regions

- Shared the Keystone and glance repository which is periodically sync'd with the regions

- Individual public IP ranges

- Users access the bwCloud via central Horizon Dashboard

- We offer standard virtual machines in different flavors
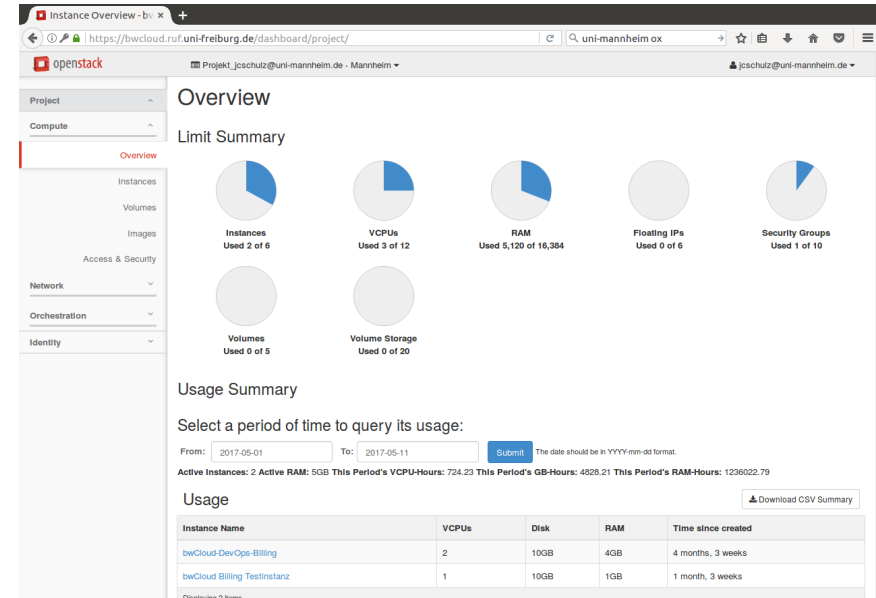
Current bwCloud infrastructure (2)

| Site	# Nodes	RAM	# HDDs	Total HDD storage	# CPUs	# Cores
Karlsruher Institut für Technologie (KIT)	3	755,13 GB	18	47,64 TB	6	48
Kommunikations- und Informationszentrum (kiz)	5 14 Xeon-D	1258,2 GB 1792 GB	50 28	44 TB 52 TB	10 14	80 112
Rechenzentrum der Universität Freiburg	6	564,14 GB	31	25,11 TB	12	88
Rechenzentrum der Universität Mannheim (RUM)	4	1006,48 GB	20	16 TB	8	64
TOTAL	**32**	**4,1 TB**	**147**	**184 TB**	**40**	**392**

First resumee

- bwCloud Project is a cooperation of four different computer centers / universities

- Initially funded by the ministry
  - 1st stage: personnel & hardware
  - 2nd stage: personnel & 50% of hardware

- Technical infrastructure is up and running

- But new challenges arise...

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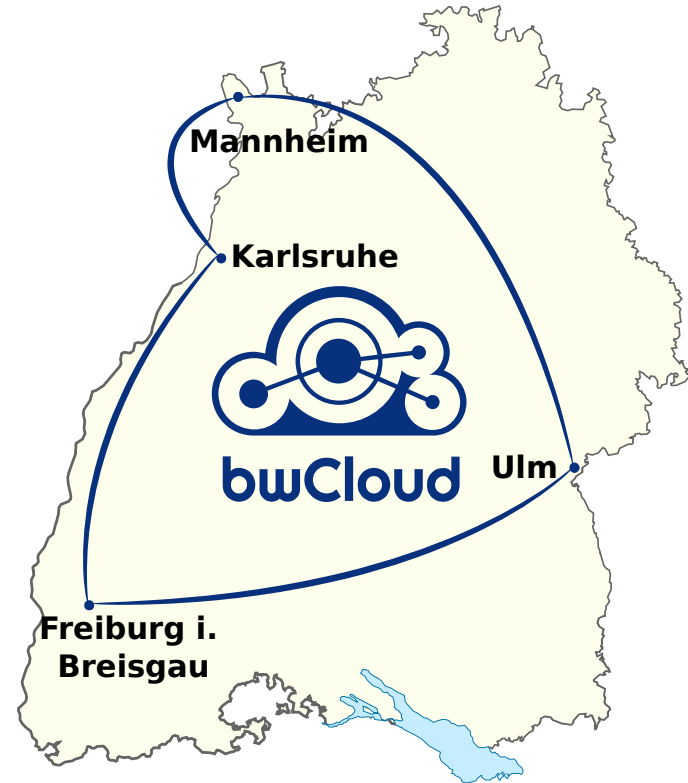
Managing cooperations (2)

Questions to tackle

- How do we organize the distribution of the available resources?

- Who has currently paid the bill?

- Who is going to pay for the future?

- How do we organize the different usergroups and their needs? (e.g. Flavors and their specs, "Rewards" for the operating sites?...)
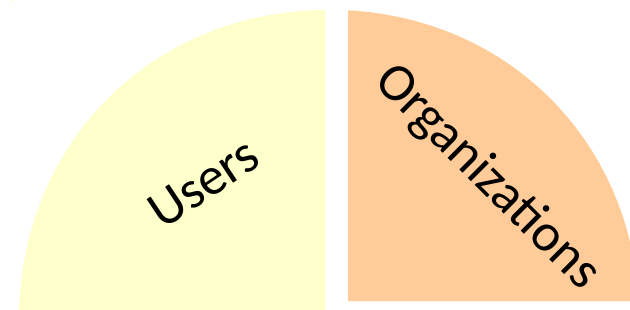
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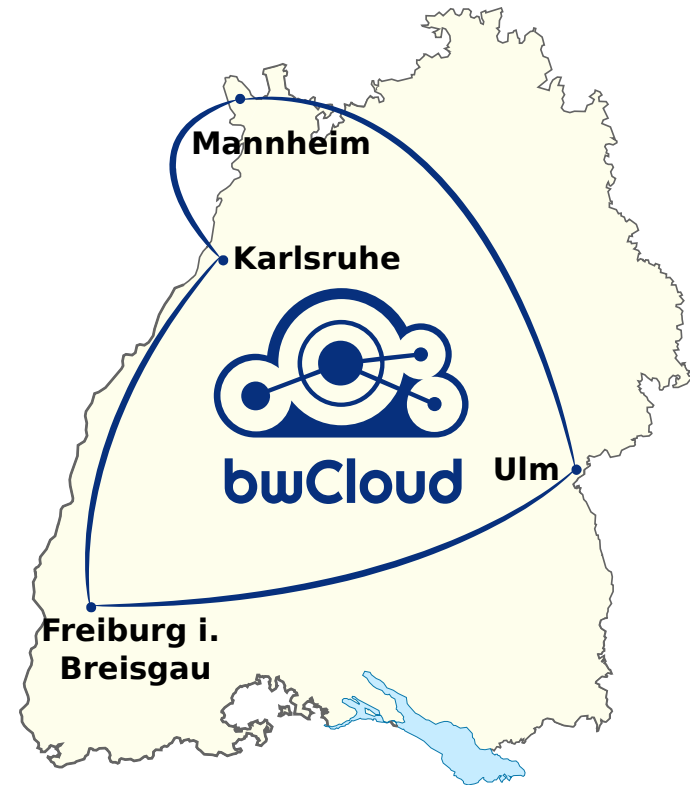
<u>Users</u>

- Open:
  - Get reliable resources as fast as possible
  - Scale up if needed on very short notice
- Hidden:
  - Try to get as much as possible without paying anything

Users

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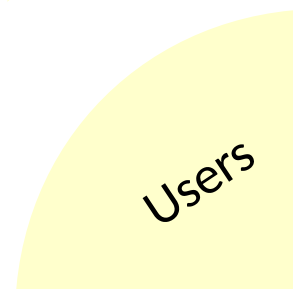
Organizations (universities, colleges,...)

- Open:
  - Provide decent research infrastructure
  - Provide core infrastructures to channel funds into
- Hidden:
  - Try to avoid spending to much money on decentralized, individual infrastructures

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Operators (computer centers)

- Open:

  - Fill a significant gap in science support, get sustainable

  - Create alternatives to virtualization monopolies (dual vendor strategy)

  - Save costs on less important machines / infrastructures

- Hidden:

  - Restructure internal processes (change the "DNA" of the org. unit)
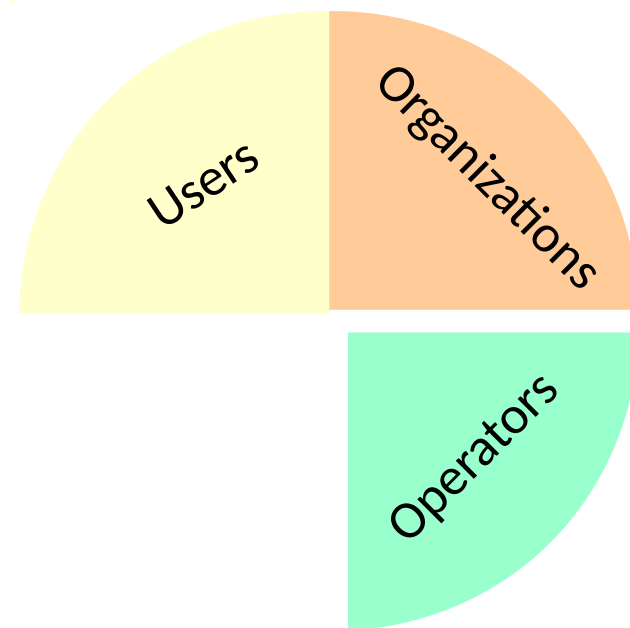
Open & hidden agendas (4)

Funding agencies

- Open:
  - Spend tax payers money on hardware more efficiently
  - Support research infrastructures
- Hidden:
  - Encourage to restructure the computer centers (competition!)
  - Spend money more efficiently, avoid dozens of small scale grant applications on hardware
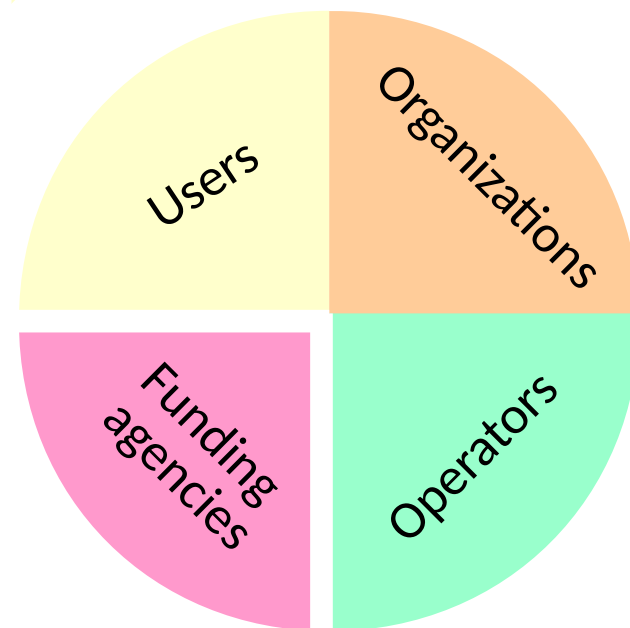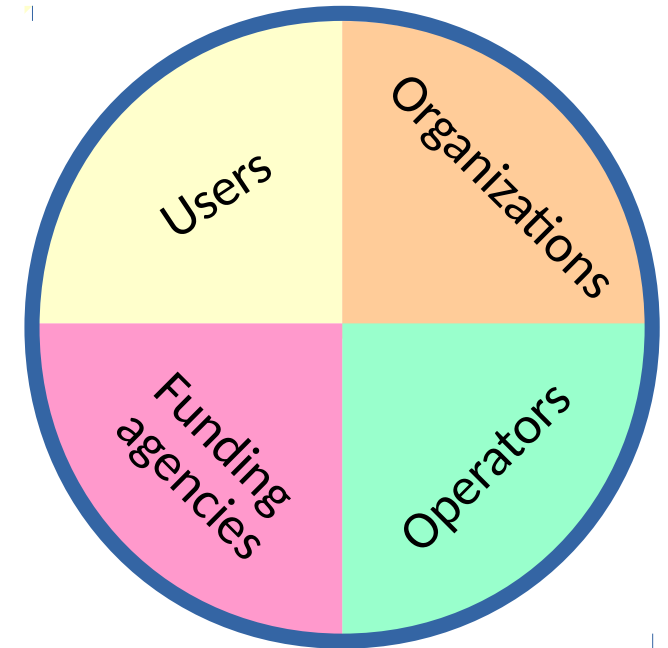
Areas of governance

Handling & management of expectations

- Governance needs to equalize expectations & handle different demands

- Brings in new forms of cooperation:
  - Very few institutional frameworks existing

- Technical solution / infrastructure:
  - Form the basis of all subsequent actions / processes

  - *Here*: OpenStack portfolio fits perfectly the needs

Areas of governance

Money flow and compensation

- Organize external money (third parties (Which amount of resources is getting into the general pool? What is "fair"?)

- Compensation of the operation sites for personnel expenditures

- Researchers & funding agencies:
  - New options for researchers to apply for money for resources → cloud resources
  - *But*: Are they also allowed to buy cloud resources?
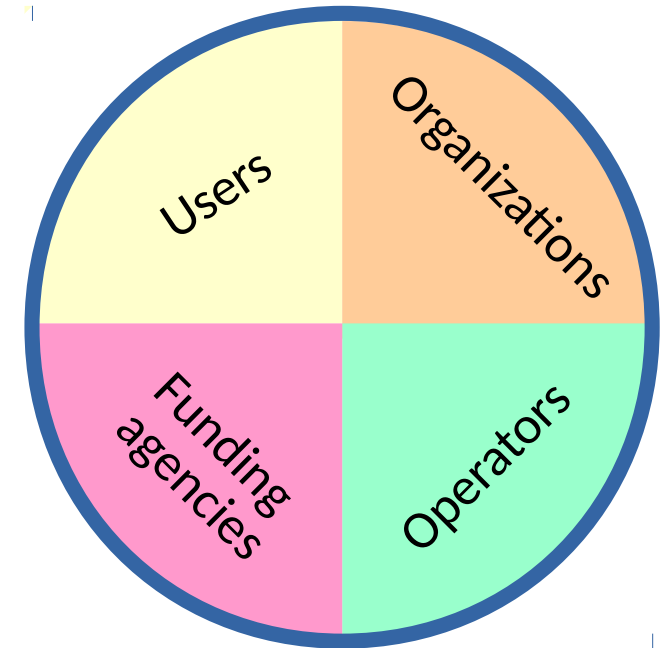
Areas of governance

Money flow and compensation

- Motivate users to free unused resources → billing

- Tight flavor management but individual quota management for "power users", VIPs, …

- Keep the connection with your users:

  - Keep them updated on a regular base

  - Organize meetings / conventions / road show
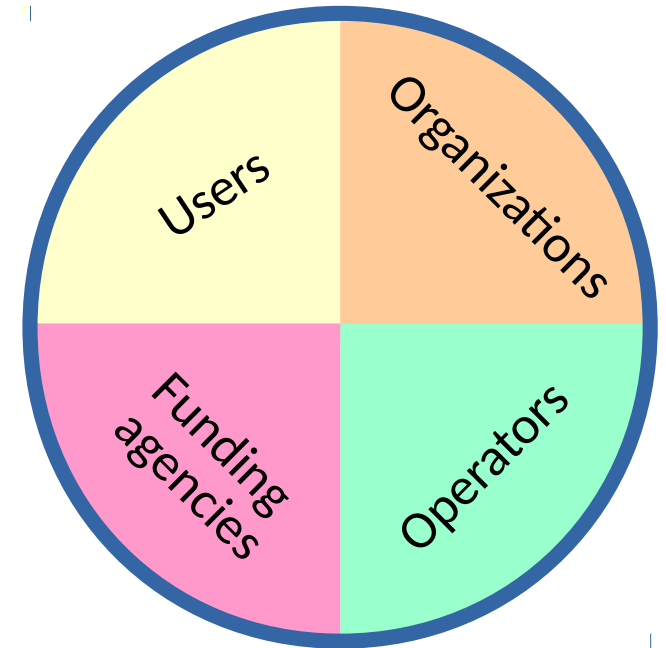
Take-away messages

Cooperations in science and academia

- Unlike many companies, we do have a very open minded users community

- But: paying for services, organizing the money flow is still very complicated

- Once your Ops-Team is in place, lots of technical solutions are available
  → Choose wisely, but technology is often not the main obstacle

- Managing a cooperation / federation means lots of politics, talking, compromises! Lots of it...!

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Take-away messages

Building and running a science cloud

- Do proper plannings before you launch your services

- Calculate some time for evaluation, testing

  → very important: room for errors, mistakes and
  therefore gaining experiences!

- And (of course):

  - Talk to other cloud operating infrastructures,
    companies, projects

  - Do trainings with your DevOps-Team

  - Visit the OpenStack Summits

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