**Projects**

**Software Cluster**
SCC participates in the Software Cluster projects EMERGENT and InDiNet, sponsored by the Federal Ministry of Education and Research. The concept of “Emergent Software” plays a significant role when addressing future enterprise software solutions.

**B2B in the Cloud**
The THESEUS project, funded by the Federal Ministry of Economics and Technology, addresses the on-demand creation of B2B integration services. The service allows end users to specify their desired B2B partners/endpoints and then automatically creates and configures the needed servers and software.

**Peer Energy Cloud**
This trusted cloud project intends to create a new type of marketplace for peer-to-peer power trading. This will, for example, distribute sensor and power data for reliable value-added services, enabling it to be used for purposes such as improving building service value networks.

**OpenCirrus**
OpenCirrus is an international cloud computing testbed to support systems research, sponsored by HP, Intel and Yahoo!

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Research Group Cloud Computing

Building on compute and storage virtualization, and leveraging the modern web, cloud computing provides scalable, network-centric, abstracted IT infrastructures, platforms, and applications as on-demand services that are billed by consumption. The Research Group Cloud Computing at SCC performs research and technological development with the mission to spur novel services in innovative research fields, such as for example High Performance Computing as a Service.

Everything as a Service

Infrastructure, Platform, Software

The cloud offerings are delivered as infrastructure, platform or software services. Special services for high performance computing, visualization as well as simulation and optimization could be created. SCC develops its own in-house clouds as infrastructure services (IaaS) and architectural concepts to build and optimize new cloud applications based on cloud platforms (PaaS). Products such as the cloud management service KOALA developed at SCC are widely known. Of special interest are solutions to deliver scientific software as a service in the cloud (SaaS).

Cloud Management as a Service

Federation of hybrid Cloud Resources

KOALA (Karlsruhe Open Application for Cloud Administration) is a management tool for cloud platforms realized as a software service. Public cloud services such as Amazon Web Services (AWS) or Google Storage and private cloud services based on Eucalyptus, Nimbus and OpenNebula are currently supported. KOALA itself can be installed and run either on the public cloud platform service Google App Engine or on the basis of a private PaaS like AppScale or typhoonAE.

HPC as a Service

Flexible and scalable HPC Systems

High Performance Computing as a Service (HPCaaS) provides high performance compute resources on-demand over the Internet. The service is beneficial not only for end-users but as well for companies and organizations wishing to offer flexible computing environments. Using a self-service Web portal, the provisioning of resources takes minutes rather than months.

HPCaaS dynamically sizes computing environments appropriate for each individual workload, speeding up the execution of time-critical tasks. An important actual topic of research concerns the integration of special technologies like GPUs and InfiniBand based high performance interconnects into cloud architectures.

Hadoop as a Service

Large Scale Data Analysis

Hadoop is an open source software platform, which allows to easily store, process and analyze very large data sets in a commodity cluster. Hadoop can for example be used to solve tasks like Web indexing, data mining, log file analyses, machine learning, finance analyses, scientific simulations, or research in the bioinformatics field. The Research Group Cloud Computing develops and offers innovative Hadoop services to support the activities of the Large Scale Data Facility at SCC. For this purpose a Hadoop cluster with 2 name nodes HP DL360 and 58 data nodes HP DL370h with currently some 128 TB disk space has been set up. There is an option to dynamically upgrade the disk space to a Petabyte upon actual need using the latest generation of large and cheap SATA disks.

OpenNebula

In order to enhance the cluster functionality, OpenNebula has been concurrently installed with Hadoop. OpenNebula is an open source toolkit to manage Infrastructure as a Service (IaaS) environments. The product supports private, public and hybrid clouds in a modular way and provides interfaces to both, the OGF OCCI standard and Amazon Elastic compute Cloud (EC2).

With the OpenNebula based cloud platform, the Research Group Cloud Computing is able to provide a sophisticated, easy to deploy and manage private cloud that fulfills the requirements of scientific users regarding scalable resources and flexible software environments. Current applications come for example from the areas cloud systems research, semantic search engines, distributed complex event processing, energy research, and particle physics.