Cloud Computing Evaluation from a Nordic eScience User Perspective

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About Me

- Helmut Neukirchen
- Associate professor
  Computer Science
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- Research fields:
  - Software Engineering
  - Distributed Systems
About Cloud Computing

• Historic example: Amazon invested into hardware to handle Christmas shopping peak.
  – Now, Amazon sells idle CPU time (“pay as you go”).

⇒ Cloud computing: Provide computational resources on demand and access them via a network.
  – Users do not need to invest into hardware.
  – Users can scale on demand.
  – Don’t care about underlying hardware (virtualisation).
  – Cheaper (economy of scale, averaging, multiplexing, energy, ...).
Classification of Clouds

• **Public cloud**: Offer paid resources via the Internet.
• **Private cloud**: Use virtualisation in own datacenter.
  – E.g. to ease changing underlying hardware:
    • If machine needs to be replaced or rebooted: just move seamlessly Virtual Machine image from one machine to another.
  – E.g. allows to give users superuser privilege.
    • Can install their own software within virtual machine sandbox.

• **Hybrid cloud**: Scale from private into public cloud.
  – Seamlessly if private cloud uses same cloud management API interface as public cloud.
About the NEON (Northern Europe Cloud Computing) project

- Funded by NDGF – the Nordic DataGrid Facility.
- Partners from Sweden, Norway, Denmark, Finland, Iceland.
- **Goal: Reviewing the cloud promises**
  - What can cloud computing give to the Nordic eScience community?
    - Only using cloud for non High-Performance Computing considered!
- **through hands-on experiments.**
  - Obtain real user experience, get real cost data.
- **Evaluation included:**
  - Private cloud software stacks: Eucalyptus, OpenNebula.
  - Public cloud: Amazon Elastic Compute Cloud (EC2).
Gap Analysis: Private Cloud

- A pain (or even failed) to set up.
  - Even worse: rapidly evolving \( \Rightarrow \) many updates.
- Not feature complete.
  - Typically, pure computing virtualisation only.
    - Tendency towards Amazon API.
  - Cloud storage services just starting.
- No integration with existing authentication \& authorization infrastructure (AAI).
Gap Analysis: Public cloud

- Easy to use, instantly available.
- Feature rich.
  - Computing, storage, data base, load balancing…
  - But: no automated means to control costs (i.e. quota management).
    - Not in the interest of public cloud provider!
    - Third party software (RightScale) helps.
- Privacy concerns or even legal restrictions.
- No integration with existing AAI.
Cost Analysis: Private cloud

• Still moving target:
  Administrative costs not yet predictable!

• In contrast to public cloud:
  No extra costs for network transfer in/out of cloud.
Cost Analysis: Public cloud

- Prices (CPU hour) highly competitive.
- No upfront hardware investment needed.
- Need to pay for network transfer in/out.
  - Data lock-in: expensive to transfer data.
    ⇒ Data/Storage intensive applications not suitable.
- “Economic Denial of Service”.
  - If cloud identity is subject of theft, high costs might get created.
Conclusions

- **Public cloud offerings:**
  - Mature.
    - Recent Amazon EC2 outage puts question mark on availability.
  - Competitive prices.

- **Private cloud software stacks:**
  - Not mature, yet. Expected to be in 2012. ⇒ Wait with private clouds!

- **Approx. 20% of the jobs running in Nordic HPC centers suitable to be off-loaded to public cloud.**
  - Jobs with small memory requirements, not I/O or data intensive.
    ⇒ Would make these 20% available for “real” HPC jobs.

- **Users will anyway use public cloud, so stay ahead.**
  ⇒ National contact points for users (support, better pricing).
• Thank you for your attention!
• Any questions?

• Further readings from the NEON project:
  → http://uni.hi.is/helmut
    → Publications
      → Articles in Conference Proceedings (2011)
      → Technical reports (2010)

• Want to experiment on your own?
  – Amazon grants very easy to get!