Administration in the Cloud

Ashraf Aboulnaga
University of Waterloo
Software Services in the Cloud

- How is administration different?
- More resources available for administration
  - Number of instances is small
  - Many users per instance
  - Many administrators per instance
  - But still many users per administrator
- Administration mistakes can have a huge impact
  - Complex distributed system
  - Many machines per administrator
  - Failure of an instance is very visible
Software Services in the Cloud

- More frequent software releases
  - Easier to make changes and fix bugs
  - Easier iterative improvement of administration
- Administrators close to developers
  - Better cooperation on administrative goals
  - Easier problem determination
- *How does this change administration?*
  - Monitoring and dashboards are important and non-trivial
  - Automation is essential
  - Experimentation to collect data and test administrative changes
  - Iterative administrative changes as the workload evolves
  - Other???
Learning from Each Other

- **Database Systems**
  - Working on data without loading it first
  - Scalability and fault tolerance

- **MapReduce**
  - Specialized algorithms depending on data
  - Increase in the number of parameters is expected
  - Make parameters meaningful and robust
  - Do not force user to tune opaque low-level parameters
  - Automatically understand workload (experimentation)
  - Auto-tune of parameters based on workload
MapReduce Tuning

- **Parameters that are easy for a user to set**
  - Locations of different files
  - Level of detail in logged execution data
  - Degree of replication for fault tolerance
  - Global resource allocation (e.g., number of machines, memory per machine, disk space budget)

- **Parameters that can be auto-tuned**
  - Number of threads of different types
  - Number of nodes per job
  - Local resource allocation
Example: Hadoop Scheduling

Given a batch of Hadoop jobs
- How many nodes to give to each job?
- How to schedule the jobs to minimize total completion time?

Solution approach:
- Experimentation to learn workload characteristics
- Formulate scheduling problem as an optimization problem and solve using standard combinatorial search techniques

Saved up to 30% of total completion time compared to sequential execution on entire cluster
Workload Characteristics

![Graph](image)

- **s-srt Act**
- **s-srt Est**
- **s-kmns Act**
- **s-kmns Est**

**Execution Time (seconds)** vs **Hadoop Nodes**
Scheduling Results

**W1**: 2 sort, 2 k-means, and 1 inverted index

**W2**: 2 sort, 1 k-means, 1 inverted index, and 1 doc sim

**W3**: 3 sort, 2 k-means, 1 inverted index, and 1 doc sim