Cloud Computing – State-of-the-Art and Future Research Trends

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TALK SUMMARY

Grid Computing vs. Cloud Computing

- Computational and data grids and clouds are **large-scale distributed systems used for serving very large and complex applications**.

- Grids and Clouds performance became more important due to the tremendous increase of users and applications.

Grid Issues

The main idea of Grid Computing:

- To use a large number of distributed high-performance computational resources while minimizing the related operating costs

  in order to solve complex and computationally demanding problems that practically could not be solved on a single resource.

Clouds Issues

Cloud computing evolves from grid computing

Cloud computing is the clear architecture of choice for the bulk of information technology needs of the 21st century

Alexander Pasik, IEEE Roundup,the editors blog 2012.

Cloud Performance - Enterprises

- Several cloud performance issues will play a major role in the adoption of the **Cloud Computing paradigm** as a mainstream commodity **in the enterprise world**.

- Cloud performance should satisfy the requirements of all involved parties:
  - cloud providers
  - enterprises that use the cloud as a platform
  - end-users

B. Prasad Rimal, A.Jukan, D. Katsaros, Y. Goeleven, "Architectural Requirements for Cloud Computing Systems: An Enterprise Cloud Approach", Journal of Grid Computing (2011) 9:3–26.

Cloud Performance – Simulation

Performance Evaluation -Simulation

- The performance evaluation of clouds is often possible only **by simulation** rather than by **analytical techniques**, due to the complexity of the systems.

- Simulation can provide important insights into the efficiency and tradeoffs of scheduling in large-scale heterogeneous distributed systems, such as grids and clouds.

- Synthetic workloads – Traces from real systems.

Cloud Performance - Scheduling

Scheduling manages:

- the **selection** of resources for a job,
- the **allocation** of jobs to resources and
- the **monitoring** of jobs execution.

Cloud Performance – Environment

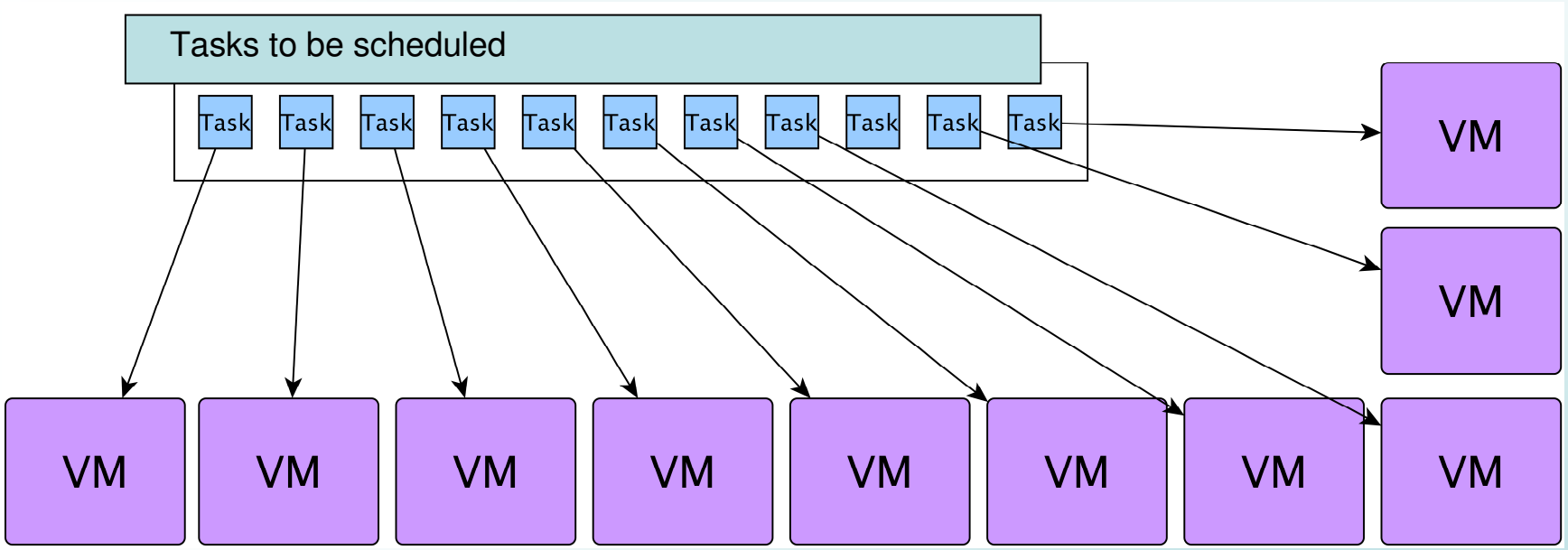
Data Centers – Green Cloud

- Data centers hosting Cloud applications consume huge amounts of electrical energy, contributing to high operational costs and carbon footprints to the environment.

- Therefore, we need Green Cloud computing solutions that can not only minimize operational costs but also reduce the environmental impact.

Anton Beloglazova, et als. “Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing”, Future Generation Computer Systems, Vol. 28, Issue 5, May, 2012, pp. 755-768.

Cloud Scheduling – The Simulation Model



A task assignment model

Cloud Scheduling – Performance / Cost

- The use of the *Cloud* is "**cost- associative**":
  One pays only for the computing time which is equivalent to the total lease time of virtual machines.

- *Cost to performance efficiency* view.

- *Total lease time* (TL) of virtual machines while the system is in operation:

$$LT = \sum_{i=1}^{P_{tot}} T_{lease(i)}$$

Cloud Scheduling - Migrations-Starvation Handling

I. Moschakis and H.D. Karatza, “Performance and Cost evaluation of Gang Scheduling in a Cloud Computing System with Job Migrations and Starvation Handling”, Proceedings of ISCC 2011, June 28-July 1, 2011, Corfu, Greece, pp. 418-423.

Migration and Starvation Handling systems are incorporated to deal with job fragmentation.

Cloud Scheduling – Interlinked Clouds

- **Ioannis A. Moschakis and Helen D. Karatza**, “Multi-criteria scheduling of Bag-of-Tasks applications on heterogeneous interlinked Clouds with Simulated Annealing, Journal of Systems and Software, Elsevier, Vol. 101, March 2015.

- While the use of the meta-heuristics does impose a performance overhead due to their complexity in comparison to simpler heuristics, the experimental analysis shows that only a relatively small number of steps is required in order to achieve an optimized schedule.

Conclusions and Future Directions

- Advances in **processing**, **communicatio**n and **systems/middleware** technologies had as a result:

  -- new paradigms and platforms for computing.

- The **Cloud computing paradigm** promises:

  -- on-demand scalability, reliability, and cost-effective high-performance.