Exploration of secured Workflow scheduling models in cloud environment: a survey.
∗ ∗ ∗Secured Workflow Scheduling: SWS∗ ∗ ∗

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Summary

Background

FIGURE – representation of cloud computing services. (dotnetwise.com windows-azure)

What is the main problem ?

Nowadays Companies

- There is a high increase of data.
- Low storage capacity.
- Low processing capacity.
- Increase of sensitive information.

Advantage of cloud computing

- Cost efficient
- Big size of storage
- Backup and recovery
- automatic software integration
- Easy Access of information
- Quick deployment
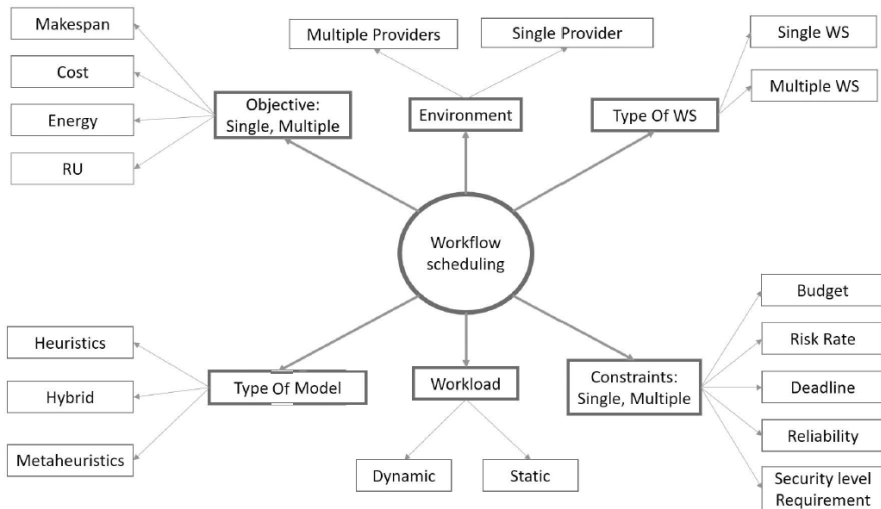- Quick workflow tasks' execution.

Security issues

- Cloud computing is the solution of most of nowadays companies.
- Cloud computing uses a number of Machines to process workflows tasks
- In case of multiple machine, there are data to be transfered so that workflow tasks can be executed.
- During Data transfer they may be intercepted.

Why this is a big issue ?

- Sensitive information that are owned by some companies.
- Health care services using technology.
- Loss that may be caused by the interception od data.

Components of Workflow scheduling

Environment

- Considering the virtual machines from **one provider.**
- Considering the virtual machines from **more than one provider.**

Objectives

- **Single objective and Multi-objective.**
- Optimization of (makespan, Cost,Energy,Resource Utilization)

Constraints

- **Single or Multiple constraints.**
- Budget, Deadline, Risk Rate, Reliability, Security level Requirement

Models/approach types

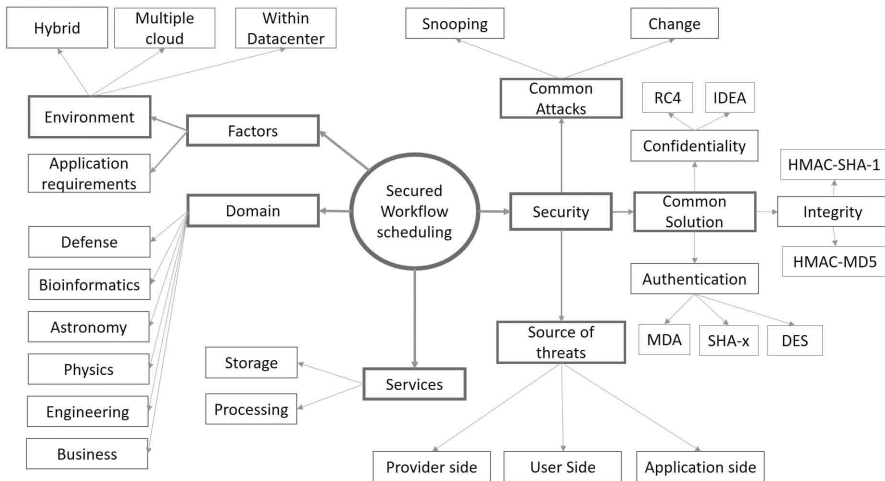- Meta-heuristic
- Heuristic
- Hybrid

Workload

- Static
- Dynamic

Category of WS

- Single workflow scheduling
- Multiple workflow scheduling

Components of Workflow scheduling

Services

- Processing
- Storage

Factors

- **Environment :** Hybrid, Multiple cloud and within Datacenter.
- **Application requirements :** with sensitive information.

Domains

- **Most of the domain with sensitive data**(Defense, Bio-informatics, business, etc)

Security

- **Common attacks :**snooping and Change
- **Common solutions :** Confidentiality, Integrity and Authentication
- **Source of threat :** Providers side, User Side and Application side

Security strength and time overhead differ

- **Confidentiality :** RC4, IDEA
- **Integrity :** HMAC-SHA-1, HMAC-MDS
- **Authentication :** MDA, SHA-x, DES

Secured workflow scheduling

Alto stratus project

- Considered executing workflow tasks in Hybrid cloud(public and private).
- To fulfill **Security Level Requirements :** decided tasks (less sensitive) to be executed in public cloud and the most sensitive tasks to be executed in private.
- **Problem :** all the tasks make one workflow, even if some of them are less sensitive but may be intercepted.*Cost,under Deadline constraint and fulfill Security requirement.*

  D.S.Marcon et al "Workflow specification and scheduling with security constraints in hybrid clouds," 2nd IEEE Latin American Conference on Cloud Computing and Communications.

SOLID

- To reduce the data dependency encryption overhead they have used **task duplication technique. Problem :** generate useless data. *Makespan , cost and fulfill Security level requirement.*

  H.Chen et al "Scheduling for workflows with security-sensitive intermediate data by selective tasks duplication in clouds," IEEE Transactions on Parallel and Distributed Systems.

Secured workflow scheduling

SAWS

- The same as **SOLID** but with main focus on the minimization of start time of each task. *Makespan , cost , Resource utilization and fulfill Security level requirement.*
  X. Zhu et al "Security-aware workflow scheduling with selective task duplication in clouds," in Proceedings of the 24th High Performance Computing Symposium

MOPA

- Uses **divide and conquer technique :** Divide tasks instance into multiple group and then execute each group separately. **Makespan , monetary cost and privacy.**
  Y.Wen et al "Scheduling workflows with privacy protection constraints for big data applications on cloud," Future Generation Computer Systems

Secured workflow scheduling

SCAS

- In other to be able to optimize Multidimensional and Multi constraint problem **SCAS** has employed **PSO. Makespan , cost , deadline budget and fulfill Security level requirement.**

  Z. Li et al A security and cost aware scheduling algorithm for heterogeneous tasks of scientific workflow in clouds," Future Generation Computer Systems.

SABA

- Introduced the concept of immovable dataset. This concept affect the performance and restrict thee movement pf certain dataset due to their cost and security.
- The concept helps in providing short makespan and security service. **Security level requirement, budget and makespan**

  L. Zeng et al Saba : A security-aware and budget-aware workflow scheduling strategy in clouds," Journal of Parallel and Distributed Computing.

Secured workflow scheduling

CEDP

- Provide awareness over big data application in Hybrid cloud.
- Use cost and Energy aware data placement to reduce cost, access time and energy consumption.
- It is better reducing energy and saving renting monetary cost. **Reduce energy , save monetary cost for renting and fulfill Security level requirement.**
  X. Xiaolong et al Data placement for privacy-aware applications over big data in hybrid clouds," Security and Communication Networks.

Common consideration

- **Alto Stratus Project, FFBAT and CEDP :** Considered Hybrid environment. They deal with deciding which tasks to be scheduled in private and which to be scheduled in public environment.
- **FFBAT and SCAS :** considered Risk Rate as the addition constraint.
- **SOLID and SAWS :** both considered task duplication technique.

Challenges

Security attacks and their solutions

- Security attacks like : Alteration, snooping and spoofing can be minimized if **integrity, confidentiality and authentication services** are employed to protect executing workflow.

- Depending on the **level of sensitivity** of his data ; the user may decide to use one of the services, however, the algorithm must be able to provide all of them.

Main Challenge

- Adding **Security Level Requirement** increases the makespan which leads to the increase of the cost.

Required Solution

- The required models must be able to meet the QoS specified by the User and optimize the **security level requirement.**

Need of SWS

High increase

- Increase of data causes need of Powerful infrastructure to process them.
- Increase of users with needs of cloud computing services
- Increase of the number of cloud computing service providers.
- Increase of sensitive information from different domains.

new Technology

- Different type of environment and more assumptions from the researchers.
- Configuration setting that are provided by different providers.
- Diversity of users' requirements.

Conclusion and Future Works

Recall

- Introduced a Secured Workflow Scheduling(SWS) term,
- Detailed the common components/elements of WS and SWS
- Detailed the components of SWS only.
- Mentioned the security challenge in cloud.
- Mentioned why SWS models are needed. we surveyed few of the SWS models.

Future works

- Most of the work done on SWS considered the use of **Idle time** as the factor to help them achieving their goal.
- This gap(idle time) may not be enough which may result in bad performance too.
- We will give our contribution by providing a model that doesn't use idle time.

Q and A