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Introducing Software Performance Antipatterns in Cloud Computing Environments: Does it Help or Hurt? [Vision Paper]

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» Goal: envision the key challenges in SPE research on the basis of the following two key words

How to use software performance antipatterns for improving the QoS of cloud computing environments?

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- Cloud computing environments offer a variety of solutions and services while performing the **service provisioning**, i.e. the capability of acquiring and releasing resources on demand, but…

- New **issues** and **challenges** arise: the heterogeneity of the services makes the process of identifying a deployment solution that minimizes costs and guarantees Quality-of-Service (QoS) very complex

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» Why is it important? Also **industry** is interested, in last years many EU projects were targeting cloud environments and their quality assessment:

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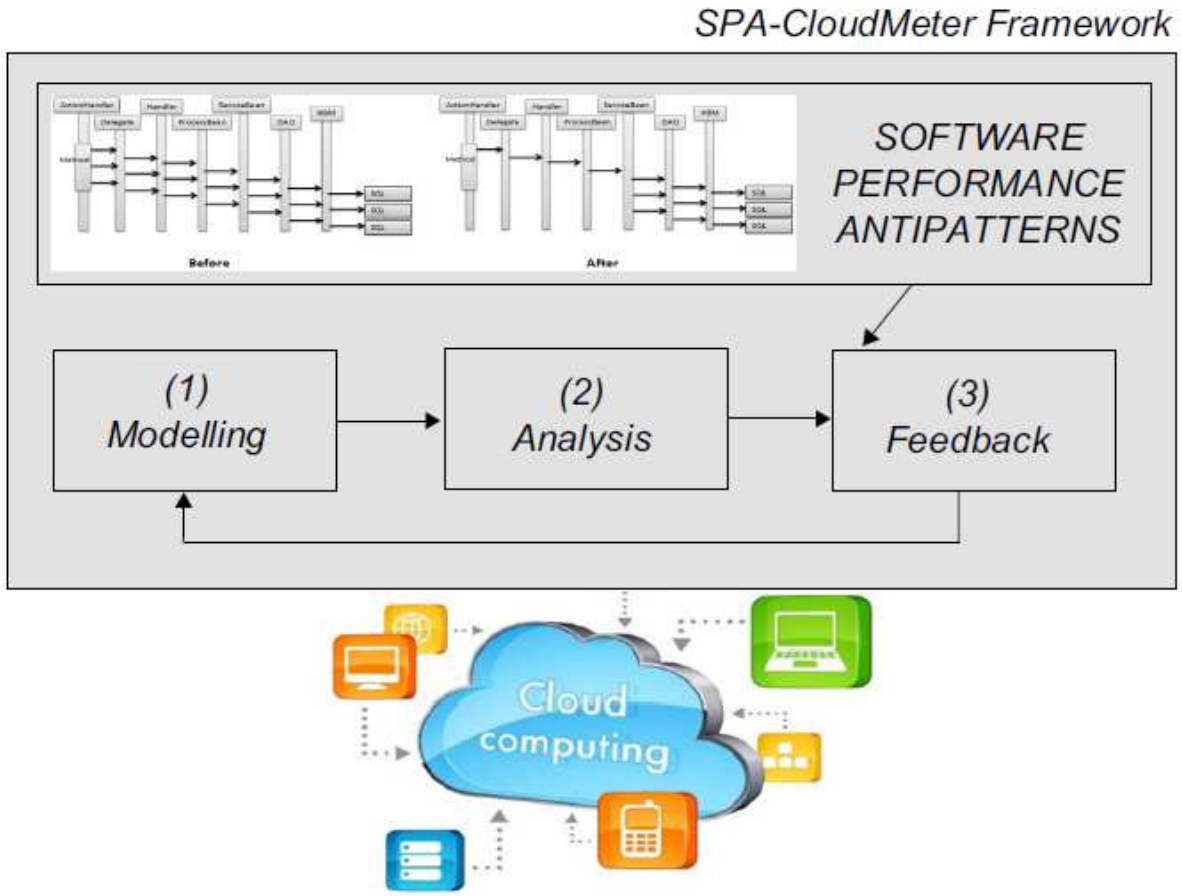
» GOAL: introduce **software performance antipatterns** for improving the QoS of big data applications deployed on cloud environments



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Software Performance Antipatterns (PA) in literature:

…textual description… so what?!??!

Antipattern		Problem	Solution
Unbalanced Processing	Concurrent Processing Systems	Processing cannot make use of available processors.	Restructure software or change scheduling algorithms to enable concurrent execution.
	"Pipe and Filter" Architectures	The slowest filter in a "pipe and filter" architecture causes the system to have unacceptable throughput.	Break large filters into more stages and combine very small ones to reduce overhead.
	Extensive Processing	Extensive processing in general impedes overall response time.	Move extensive processing so that it doesn't impede high traffic or more important work.
…		…	…
The Ramp		Occurs when processing time increases as the system is used.	Select algorithms or data structures based on maximum size or use algorithms that adapt to the size.

C. U. Smith and L. G.Williams. "More new software performance antipatterns: Even more ways to shoot yourself in the foot", 2003.

- A preliminary step consists in the **specification of cloud-related antipatterns**. In fact, practitioners continuously highlight more advanced pattern problems, e.g. for **Hadoop** and **Cassandra**.

- Specification of QoS properties, in the context of big data applications deployed on cloud environments, e.g. **performance** and **security** are related by a **trade-off** relationship.

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» SPA-CloudMeter framework:

> **Modelling**: an application model is built to design the software and hardware artifacts for a big data application deployed on a cloud platform

CHALLENGES: what are the application's software and hardware resources (e.g. software components, active virtual machines, hypervisors, etc.) and their expected resource demand or consumption?

Key features: volume, variability and complexity of software services as well as the dynamic behaviour of hardware services that scale workload peaks.

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» SPA-CloudMeter framework:

> **Analysis**: a QoS model is built to monitor the software and hardware cloud resources employed by the big data application to monitor QoS results of interest

CHALLENGES: what is the most suitable granularity of performance indices to detect flaws in cloud environments?

Key features: performance modelling notation, assumptions, cloud-based specific settings (e.g., for map/reduce functions) and analysis method.

- SPA-CloudMeter framework:
  - **Feedback**: the QoS results are interpreted and, if necessary, antipattern-based refactoring actions are devised with the goal to improve (from a performance perspective) the application under study

CHALLENGES: what are the most suitable refactoring actions to solve flaws in cloud environments?

Key features: the solution of performance antipatterns may hurt with cloud computing policies, e.g. CTH antipattern avoids data spreading whereas Hadoop applications partition large data sets across a number of mapper tasks, etc.

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» Contributions:

- > envision a model-based framework that makes use of software performance antipatterns to optimise the quality of big data applications deployed on cloud environments.
- > modelling, analysis, and feedback activities have been discussed to highlight the current open issues of the domain

» Future works:

- > implement the SPA-CloudMeter framework for the performance assessment of real cloud-based systems, thus to estimate its effectiveness

Thank you!

This work has been developed in the context of the **Microsoft Azure Research Award** for the project DESPACE (DEtecting and Solving Performance Antipatterns in Cloud Enviroments). See more details: http://cs.gssi.infn.it/catia.trubiani/download/DESPACE/DESPACE-overview-web.pdf

Questions ?

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