

# Using locality properties to improve distributed algorithm

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**Abstract.** The use of computing resources provided by cloud companies has become very common. Cloud providers leverage on big datacenters containing tens of thousands of servers. Designing efficient software that can work at this scale is very complex: fault tolerance, network overhead and synchronization can have a significant cost.

A possible solution to minimize these costs is to consider locality properties: servers collaborate first with close servers from the same geographical site. As a result, collaboration between servers can take into account infrastructure parameters such as bandwidth and response time and can be organized in a totally decentralized manner.

This paper shows the case of a large scale virtual machine scheduling algorithm, DVMS, that have been adapted to take advantage of locality properties by using a vivaldi based network overlay. Results of experiments conducted on the grid5000 tesbed, comparing the chord based versus the vivaldi based algorithm, will be presented in the last section.

**Keywords:** Cloud computing, locality, peer to peer, network overlay, vivaldi, chord, DVMS, virtual machine scheduling

## 1 Introduction

## 2 Background

### 2.1 DVMS

- fundamentals
- limitations

### 2.2 P2P - locality

- Vivaldi
- active/lazy clustering

### 3 Contributions

#### 3.1 Locality based overlay

- clustering
- Vivaldi + spirale

#### 3.2 Dvms + PeerActor + locality

### 4 Experimentations

#### 4.1 Implementation

A prototype of DVMS leveraging locality based overlay has been developed. The current version of DVMS are been developed over the PeerActor abstraction. PeerActor provides network abstraction that enables the design of distributed algorithm that are network overlay agnostic. We have developed two different overlay for the Peer Actor abstraction: Chord and a locality based overlay over Vivaldi.

The strength of this software architecture is that to enable an algorithm (like DVMS) to comply with a given network overlay, it only have to follow the Peer Actor API. This way, we were able to run DVMS over Chord or Vivaldi without any modification in its source code.

#### 4.2 Grid5000' experiments

**Objectives** The prototype has been tested with a various number of experiments conducted on the Grid5000' testbed. The main objective of the experiments was to estimate impact of locality on the performance of a distributed scheduling algorithm. A significant portion of the reconfiguration time is spent in live migration of virtual machines, which depends of network parameters such as latency and bandwidth. One way to improve performance of distributed scheduling algorithm is to promote collaboration between close ressources, which can be reach by maximising this ratio:

$$\frac{\text{number of intrasite migrations}}{\text{number of migrations}}$$

**Experimental protocol** For each experiment, we booked 40 compute servers spread on 4 geographical sites and 1 service server. The compute servers were used to run virtual machines and DVMS while the service node is used to stress several parameters of virtual machines.

Each compute node will host a number of virtual machines proportional to the number of CPU cores it has. In our case:

$$\text{number of virtual machines} = 1.3 \times \text{number of cores}$$

**Results** The impact of locality on DVMS is significant: using a Vivaldi based network overlay leads to an average number of 83% of intrasite migrations while using a Chord based DVMS leads a ratio of 50% of intrasite migrations, as depicted in the following table:

network overlay	average number of intrasite migrations	average number of migrations
Vivaldi	83	100
Chord	40	80

Complete this section with more experimentation results.

## 5 Related work

### 5.1 DVMS

### 5.2 P2P

## 6 Conclusion