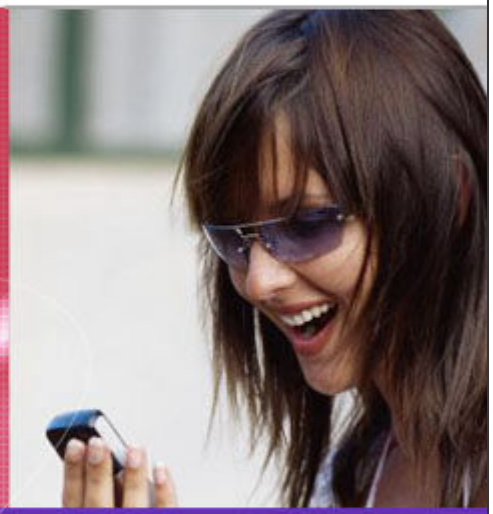
Performance comparison between a 2 phases and a 3 phases Negotiation protocol



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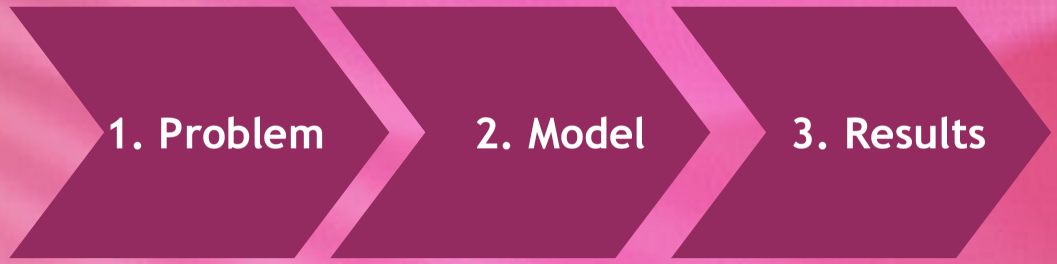
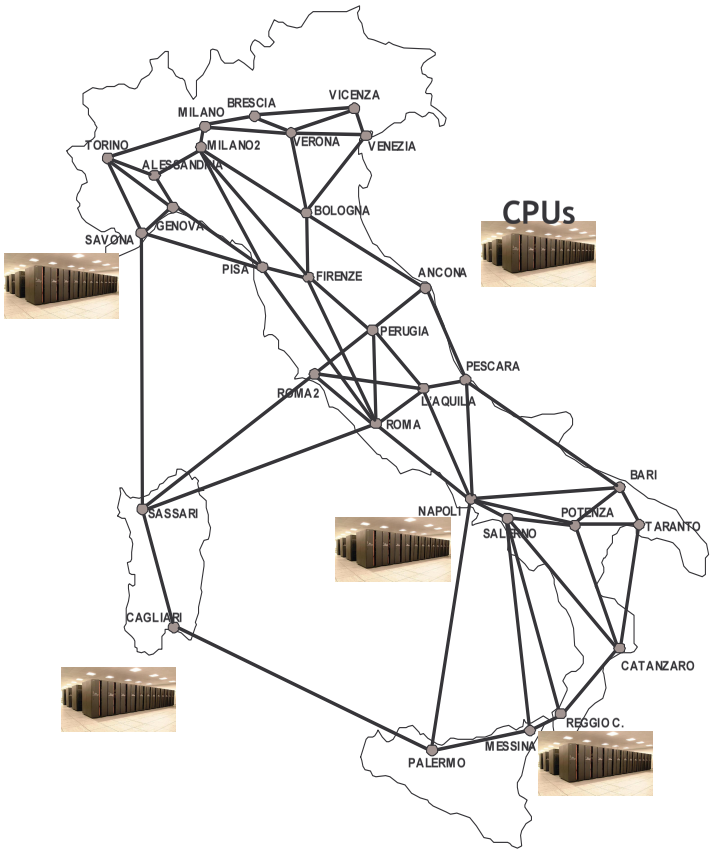
April, 2007

Agenda



1 The Problem

The context : Co-allocation



Multiple Computing farms

A (G)MPLS network

How to reserve two (or more) resources at the same time ?

I.e. : A network connexion & a CPU

Solutions

- VIOLA like (2Phases commit protocol)

- WS-Agreement based Negotiation (3Phases Commit Protocol)
  - Cf O. Waeldrich & W. Ziegler draft @OGF18

3 Phases Commit Protocol vs 2 Phases

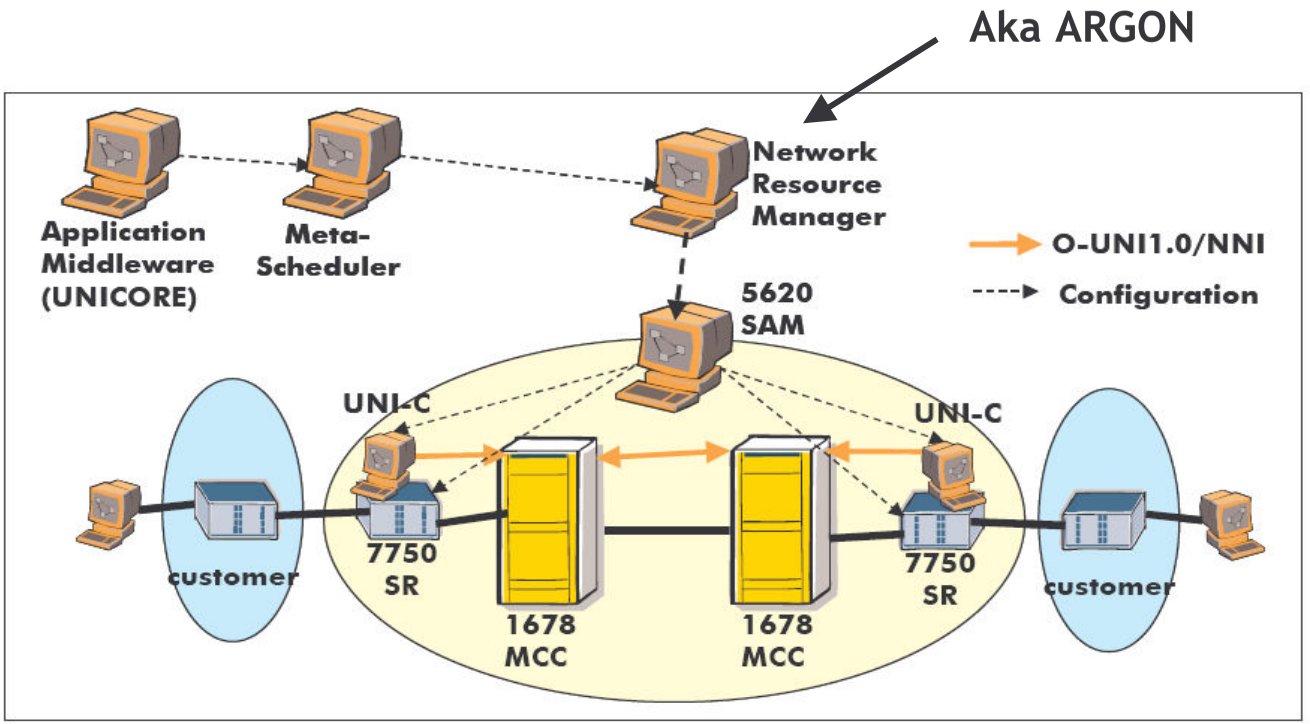
- Capability and availability check

Phase 1

- Pre-reservation
  - Resource are reserved with short reservation lifetime
    - (No penalties if reservation is cancelled at this stage)
- Commitment
  - Resource are reserved whenever needed
    - (penalties if cancelled)

Phase 2

VIOLA architecture



VIOLA reservation process

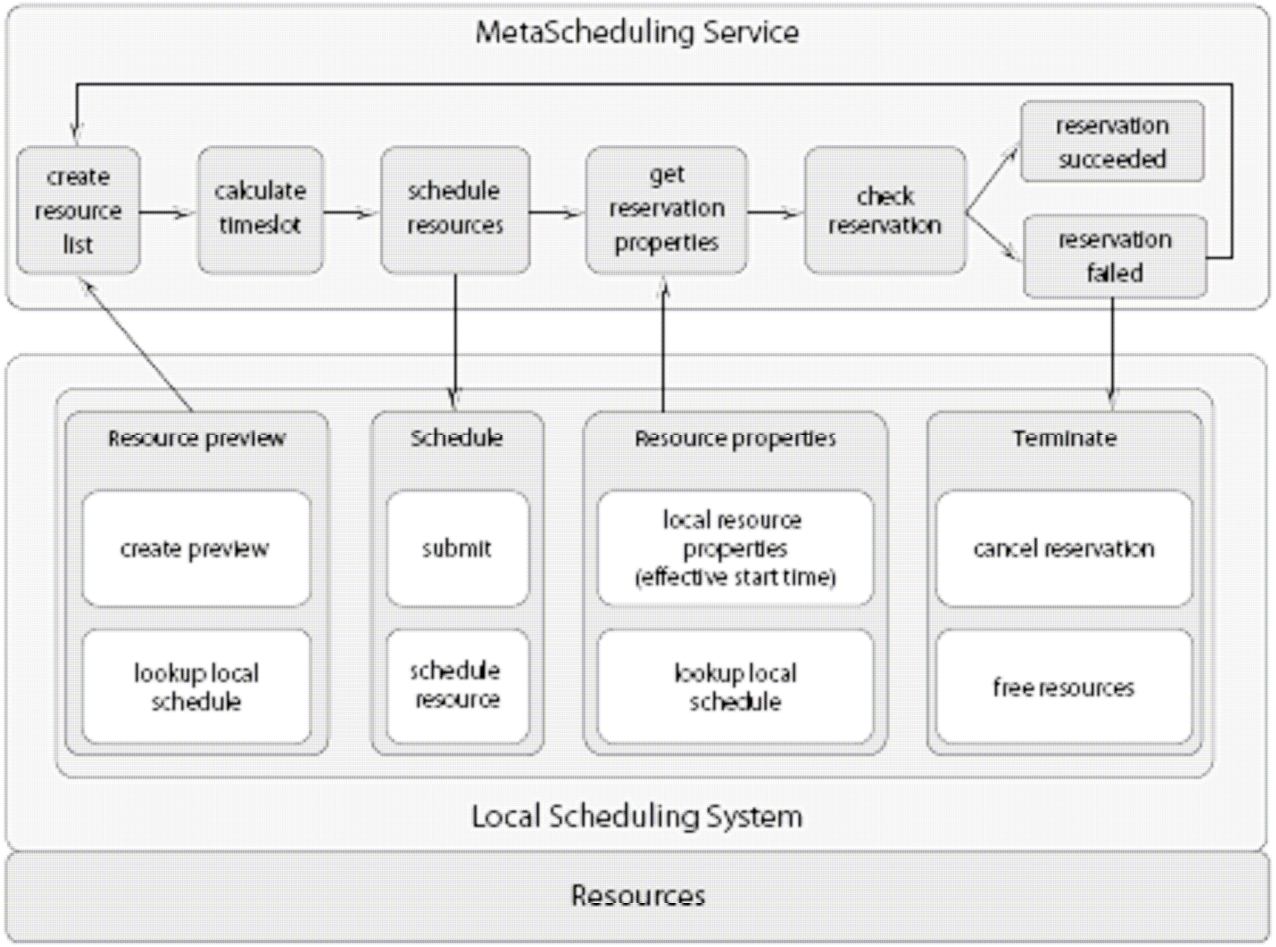
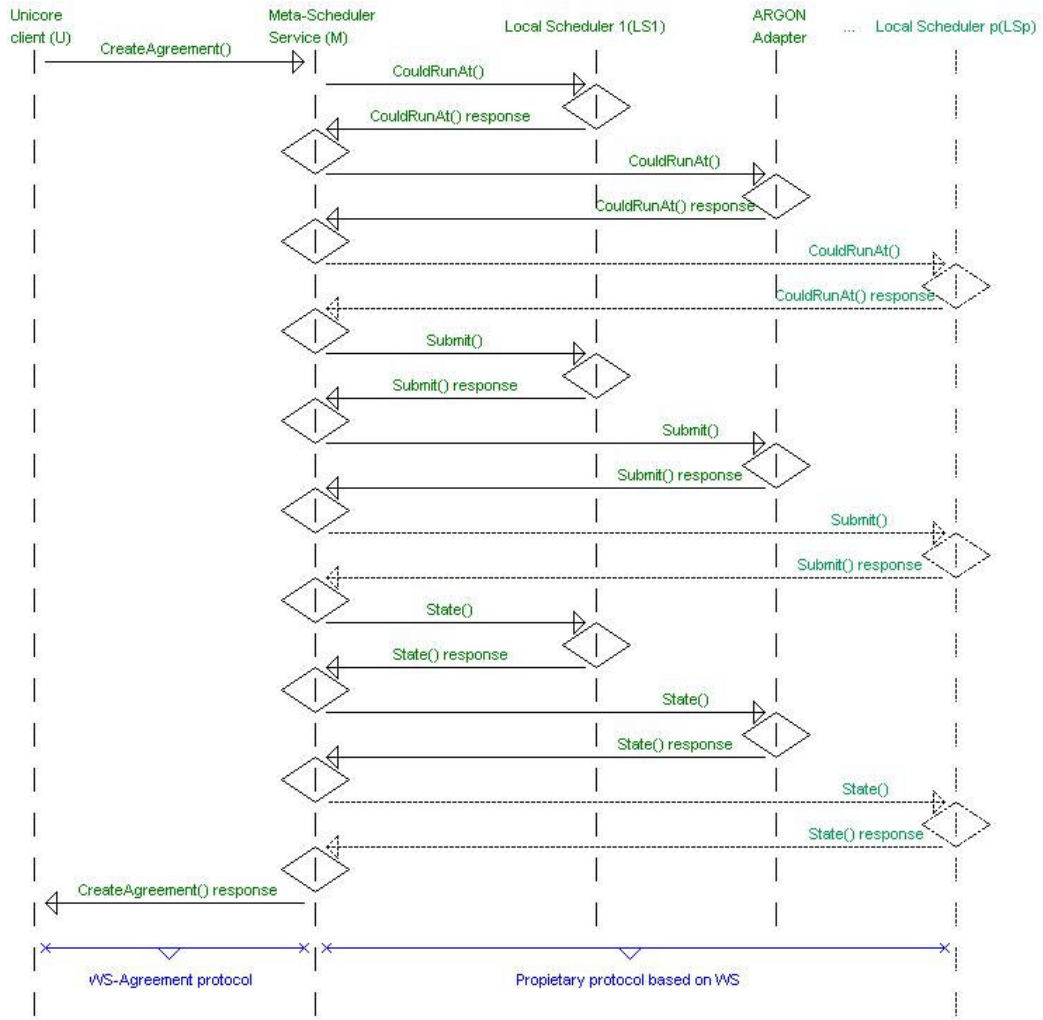


Figure 1: The negotiation process

VIOLA's Meta-Scheduler reservation



2 The Model Explained

Model origin

Gurbani V.K., Jagadeesan L., Mendiratta V.B.,

"Characterizing session initiation protocol (SIP) network performance and reliability",

International service availability symposium, April 2005

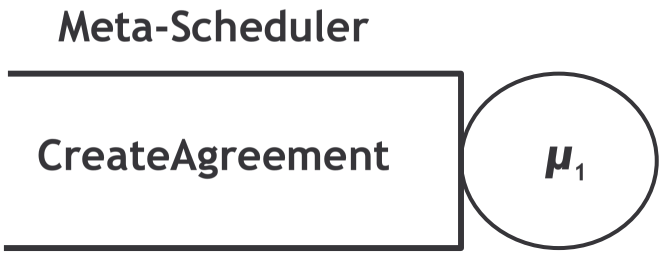
Model explained (1)

Job requests ⇔ Clients of the queuing network

Time spent in a waiting queue ⇔ Time spent in a state **inside** the MS

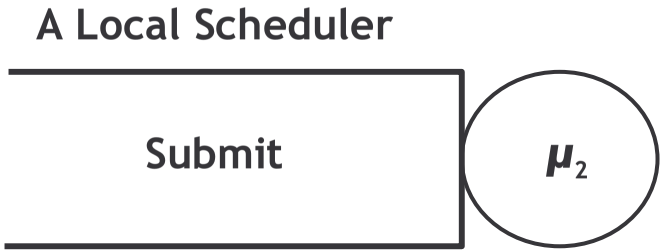
A queue ⇔ A state **inside** the MS

Model Explained (2), Notation convention



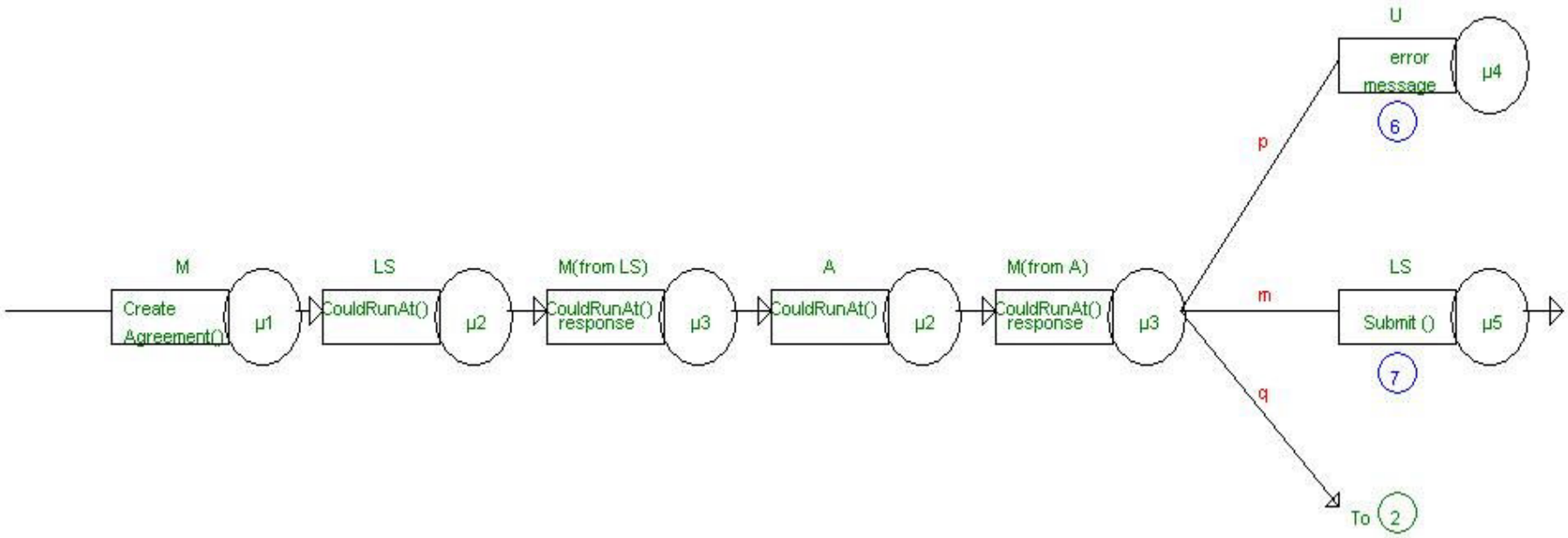
$1/\mu_1$ is the average time taken by the Meta-Scheduler to

- receive the CreateAgreement message,
- process it, and
- take action



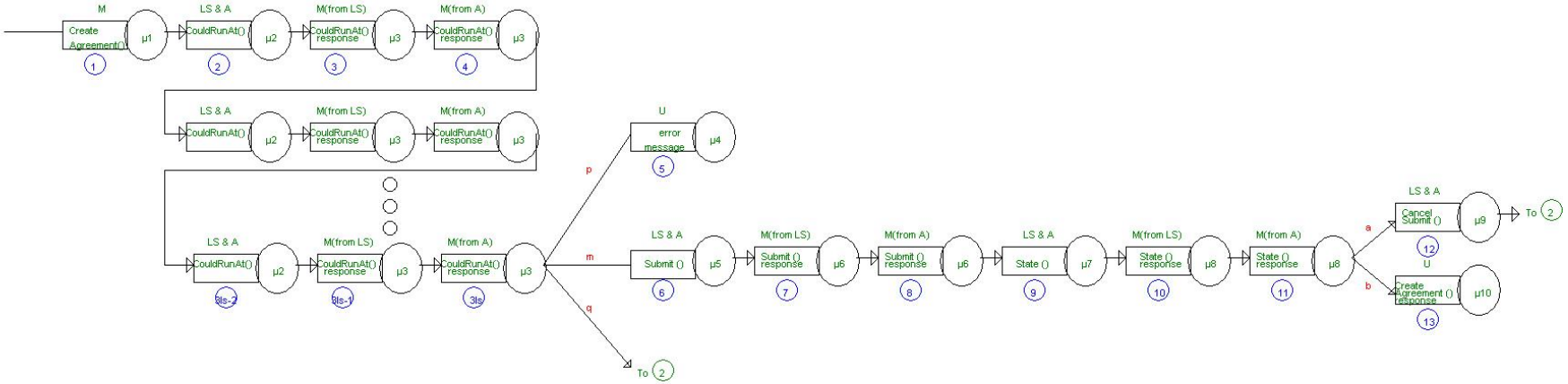
Model Explained (3), Example

Example synchronous

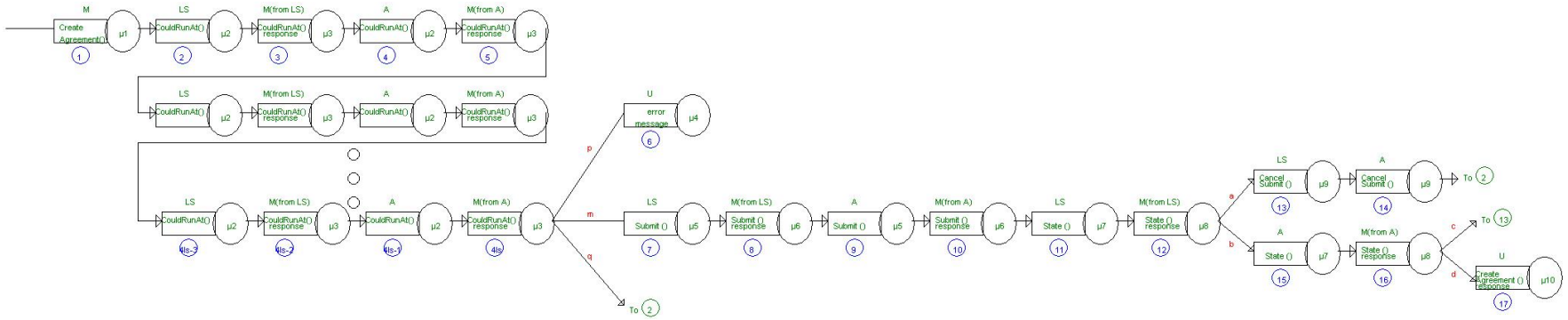


2 Phases Negotiation protocol Model

Asynchronous

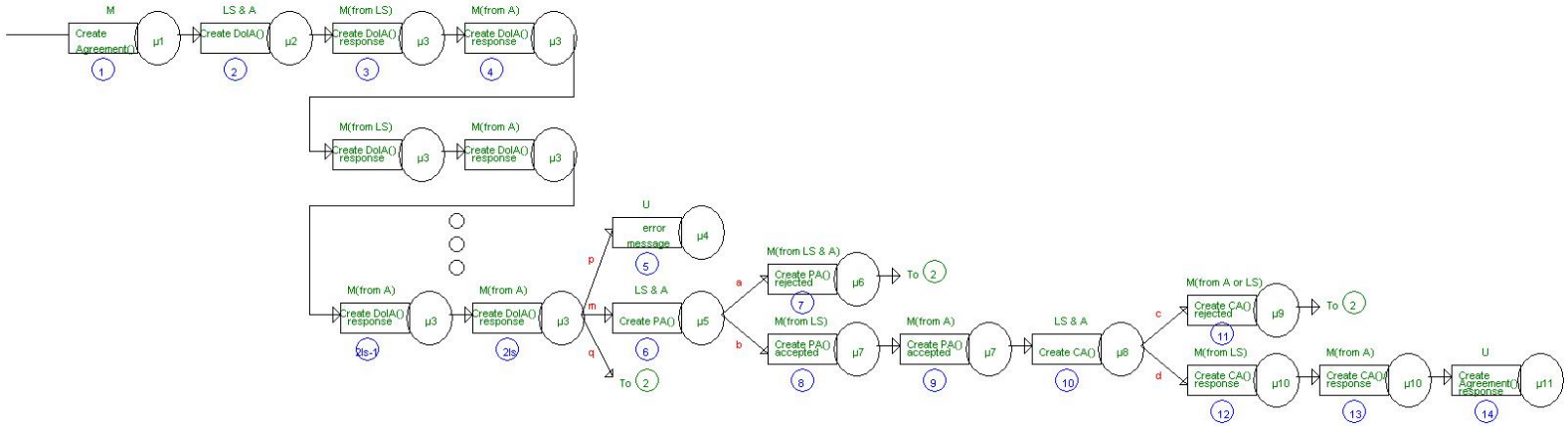


Synchronous

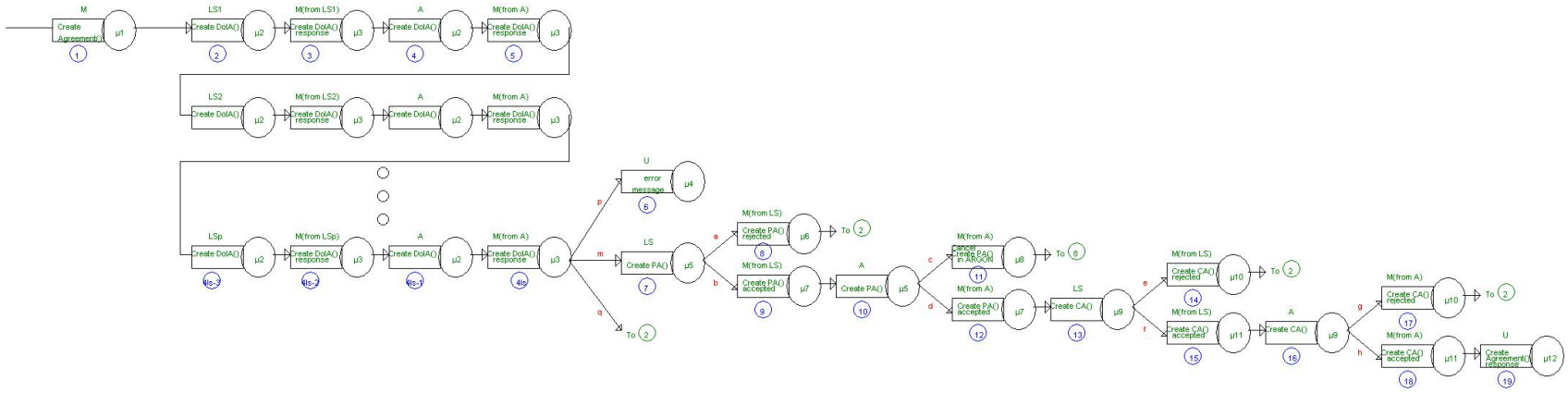


3 Phases Negotiation protocol Model

Asynchronous



Synchronous



Service Time & Error Probability example

After a few measures on a P4@2.8GHz

- Receive an XML message ..... 1 ms
- Check message validity..... 0.002 ms
- Parse the message ..... 0.715 ms

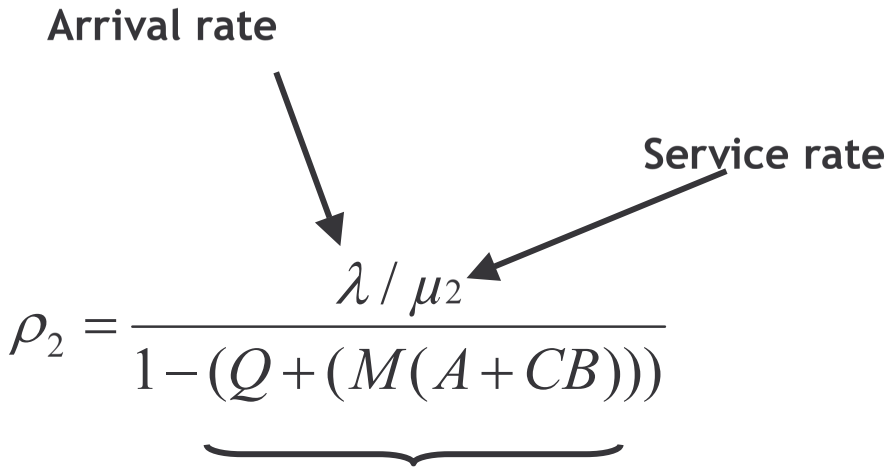
+1.717ms

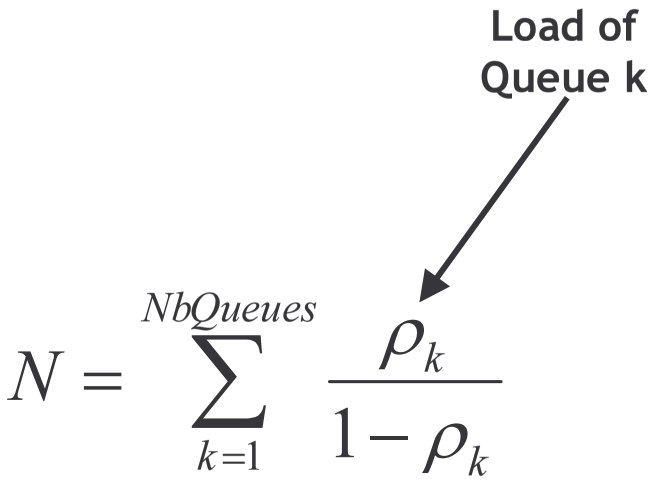
Probability to cancel a reservation : 10%
Probability to need to look after scheduling horizon : 10%

Those values can be modified to take more realistic values.

Limiting Queue

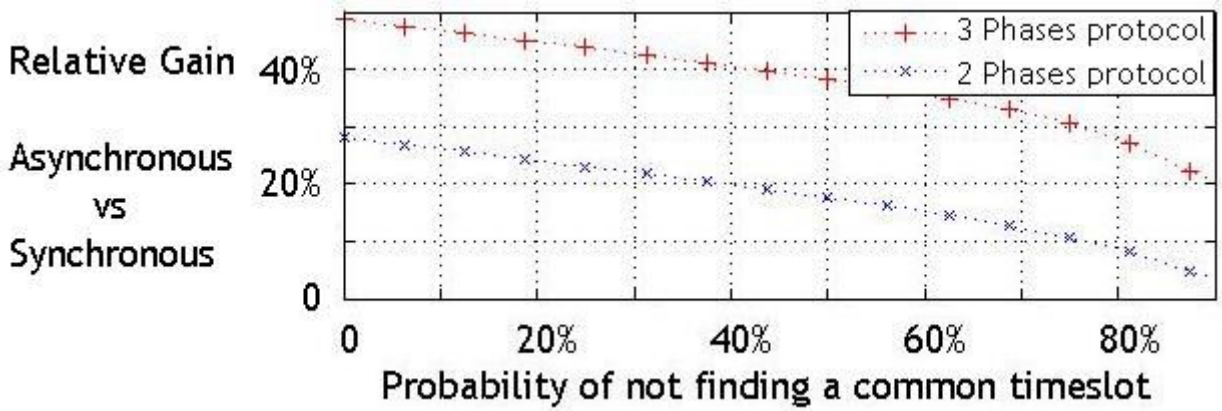
For example (3 Phases Asynchronous) :



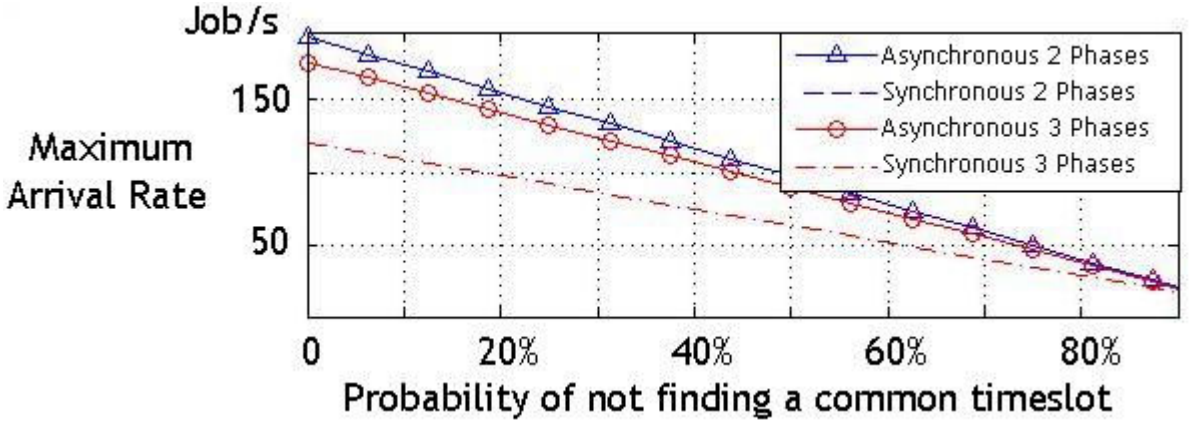


3 Results

Maximum Job request Arrival Rate in the Meta-Scheduler

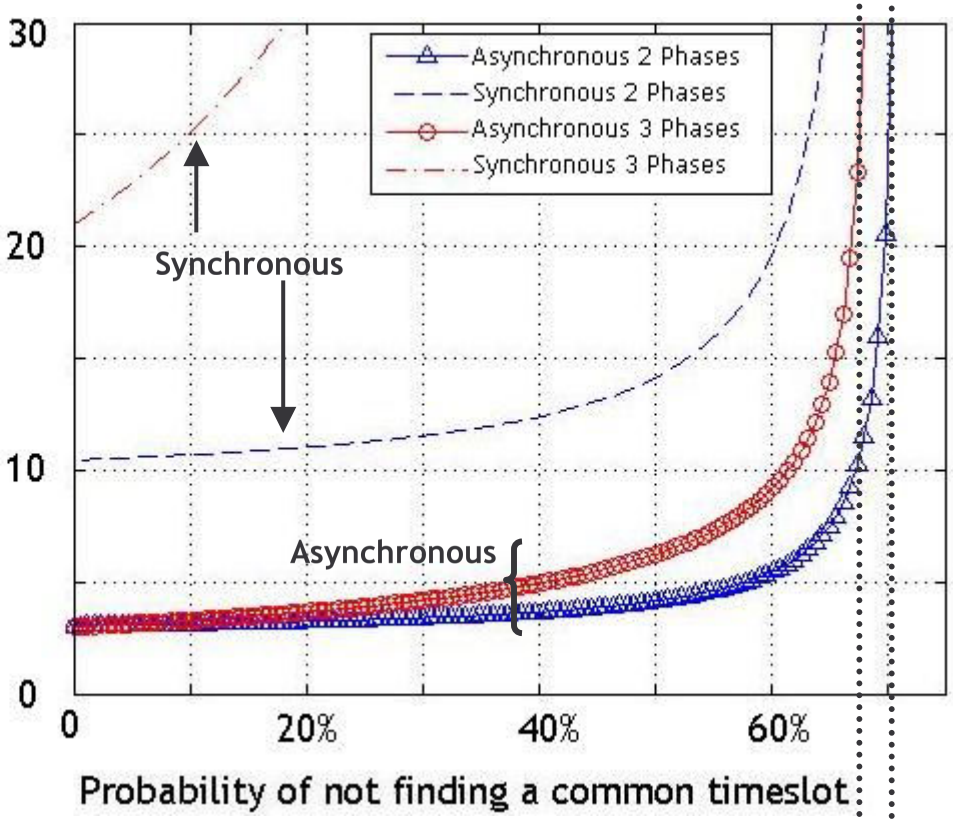


NEED for ASYNCHRONOUS Implementation



Almost NO IMPACT on Arrival Rate

Mean number of Jobs in the Meta-Scheduler



Performance loss of 3PNP over 2PNP

Less than 50%

Threshold 2 Phases

≈

Threshold 3 Phases

Arrival Rate = 63 job/s

Delay ~ 240ms

xPNP : x Phases Negotiation Protocol

Conclusions

Need for an Asynchronous implementation (obvious)

Performance loss of a 3 Phases over a 2 Phases Negotiation protocol is

- less than 10% on the maximum job request arrival rate
- less than 50% on the total job request processing delay and memory requirement

References

Article to be published soon…

by the end of the year

For a similar model used in a different context :

Gurbani V.K., Jagadeesan L., Mendiratta V.B., “Characterizing session initiation protocol (SIP) network performance and reliability”, *International service availability symposium*, April 2005

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