Predicting the Performance of Virtual Machine Migration

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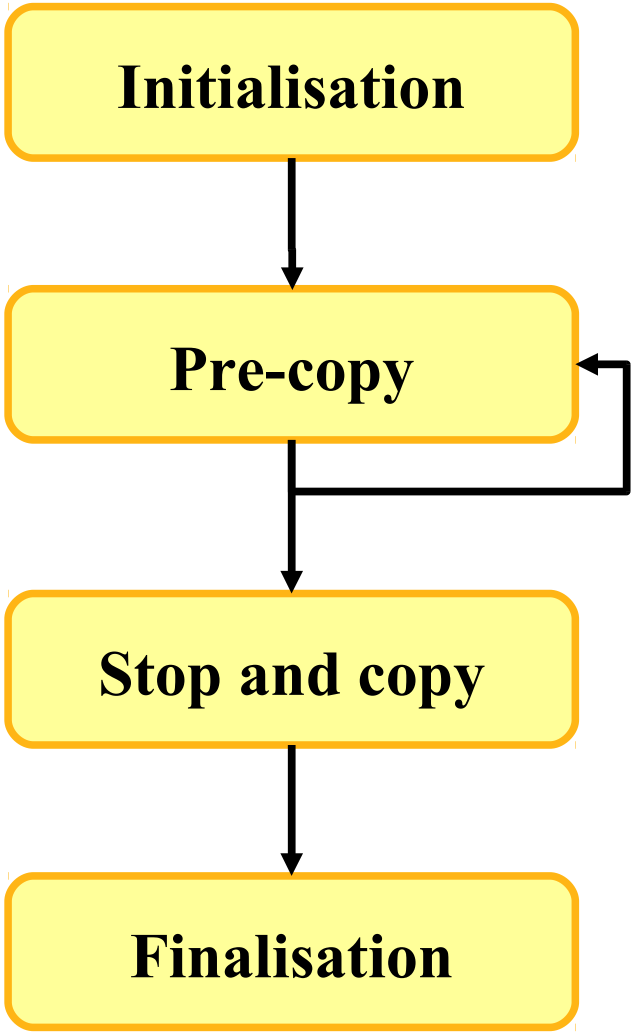
Live migration moves a running virtual guest to a new physical host

http://picasaweb.google.com/lh/photo/uAPf5hbH9pHE_L2KvjcGpw

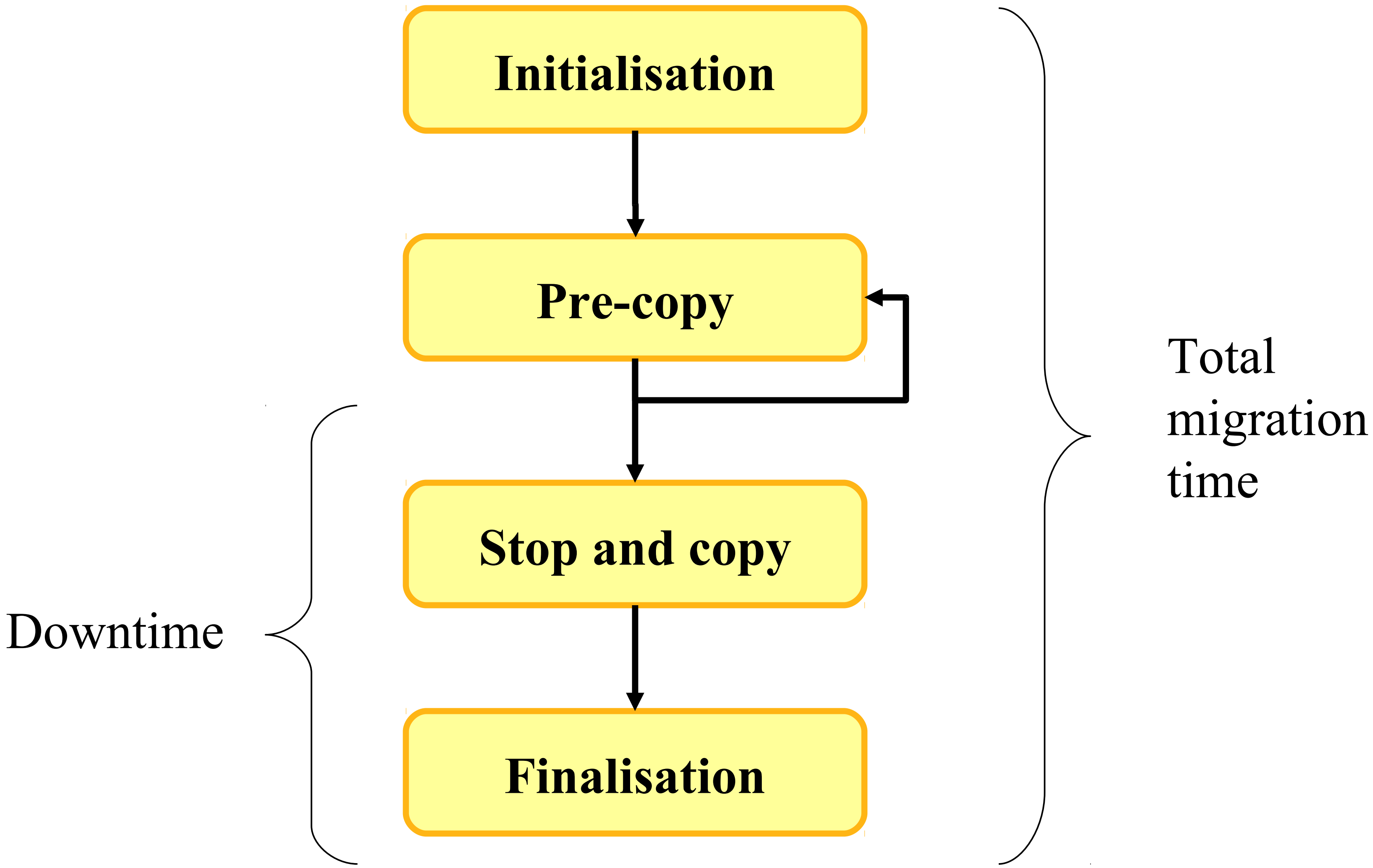
Downtime is the period of time for which the domain is stopped

Migration time is total duration of the movement process

The migration algorithm causes times to vary with workload



The migration algorithm causes times to vary with workload



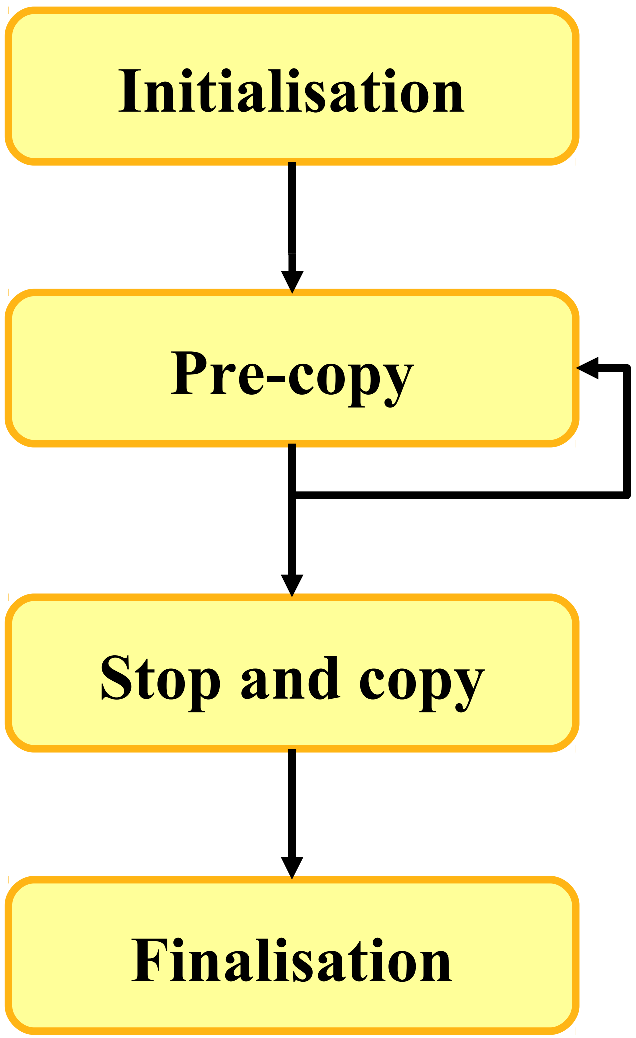
Administrators need advance knowledge of **downtime**

How frequently can I migrate this domain without violating the Service Level Agreement?

Administrators need advance knowledge of **migration time**

Is it worth consolidating workloads and switching off hardware?

Heuristic stop conditions are used to terminate the pre-copy stage



Stop if:

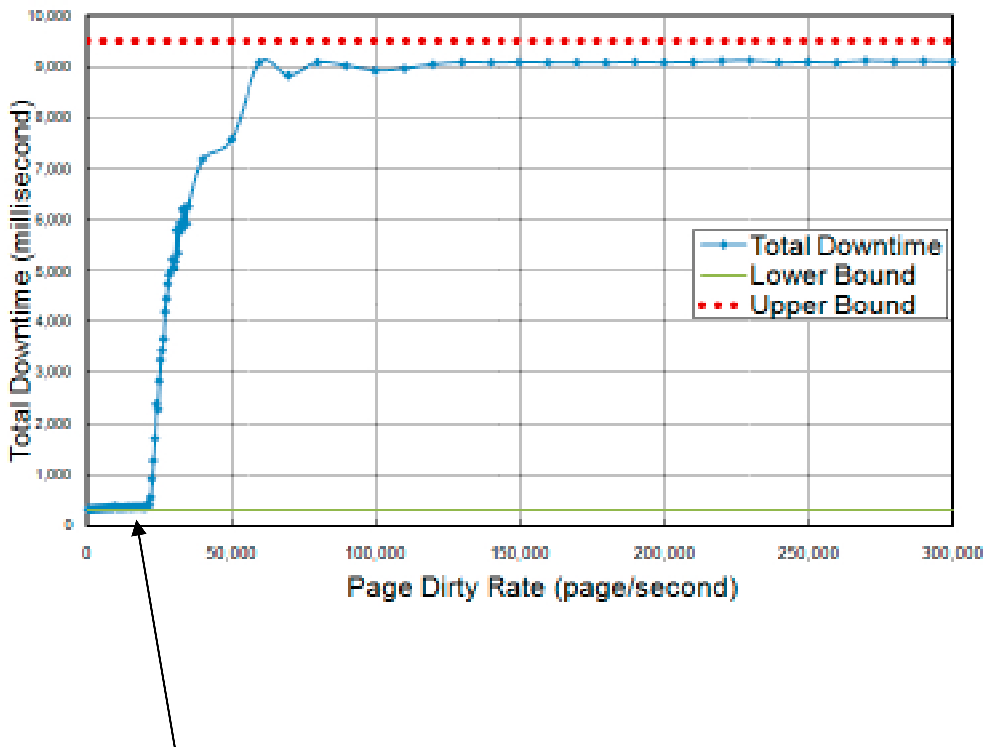
Fewer than 50 pages dirtied during last iteration

More than 3 times total RAM has been copied

29 iterations have been carried out

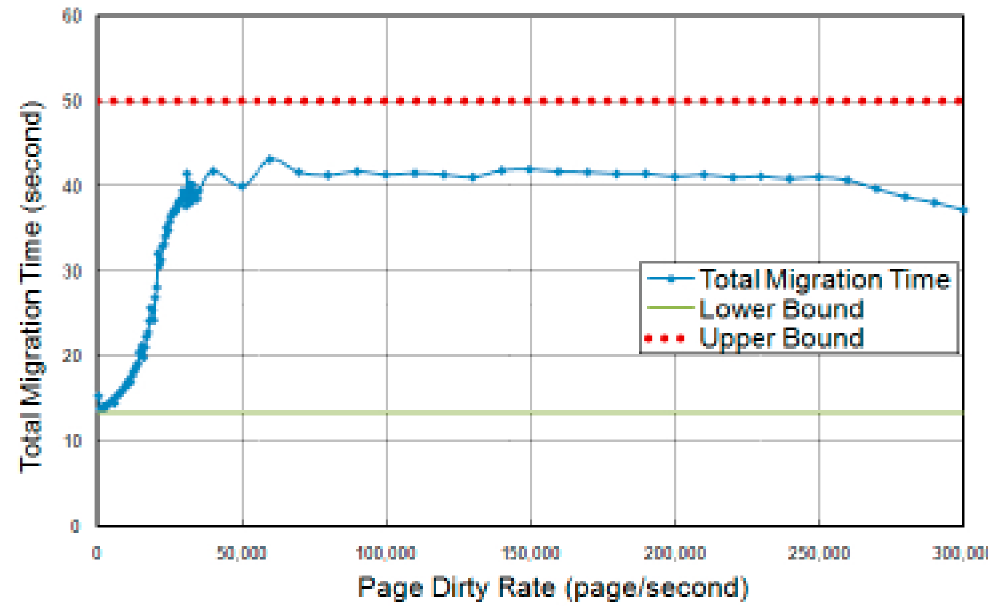
Key parameter 1: **page dirty rate** has a non-linear effect

Downtime



314ms

Migration time



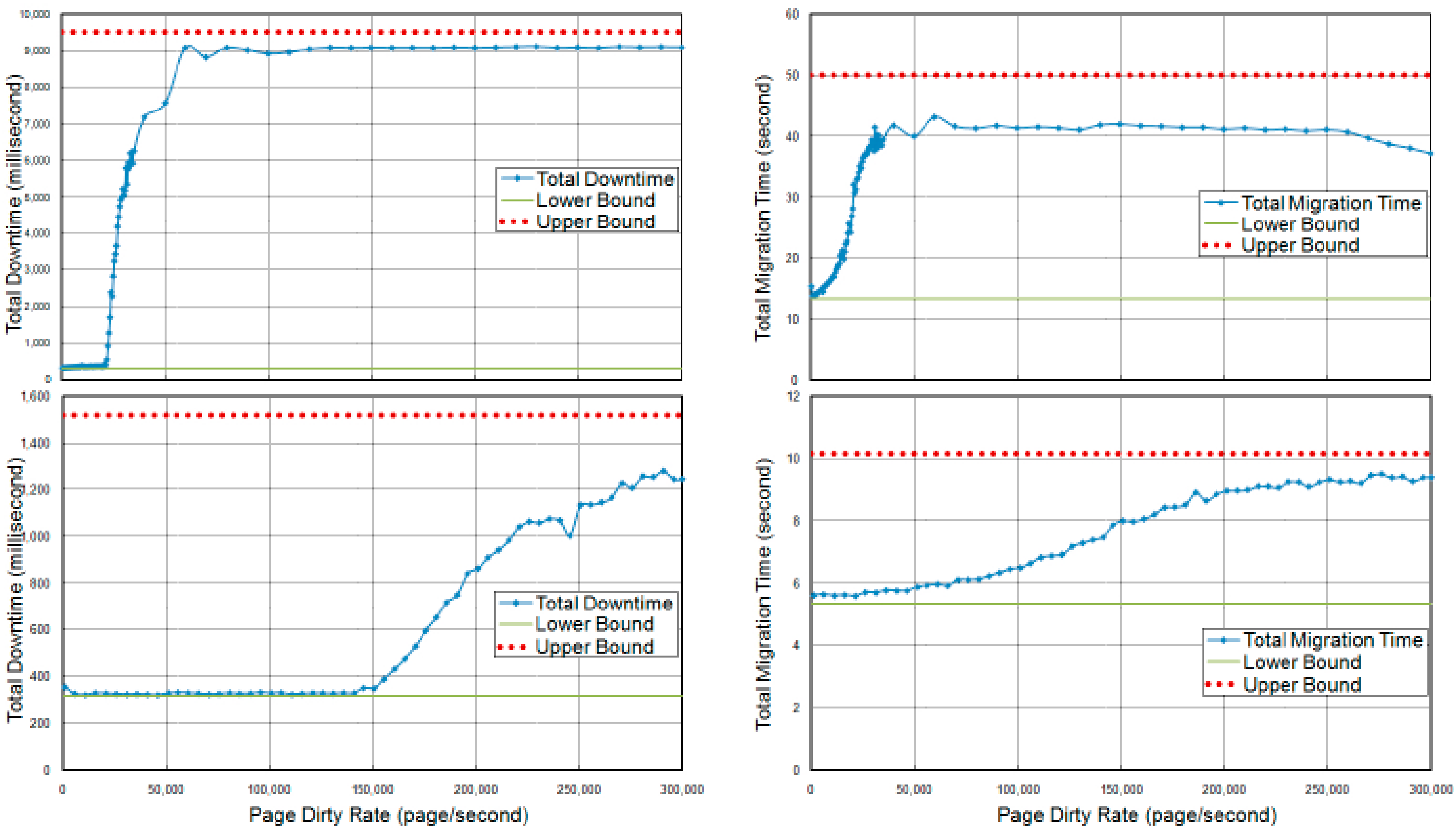
Page dirty microbenchmark, 1Gbps link

Key parameter 2: **Link bandwidth** has a non-linear effect

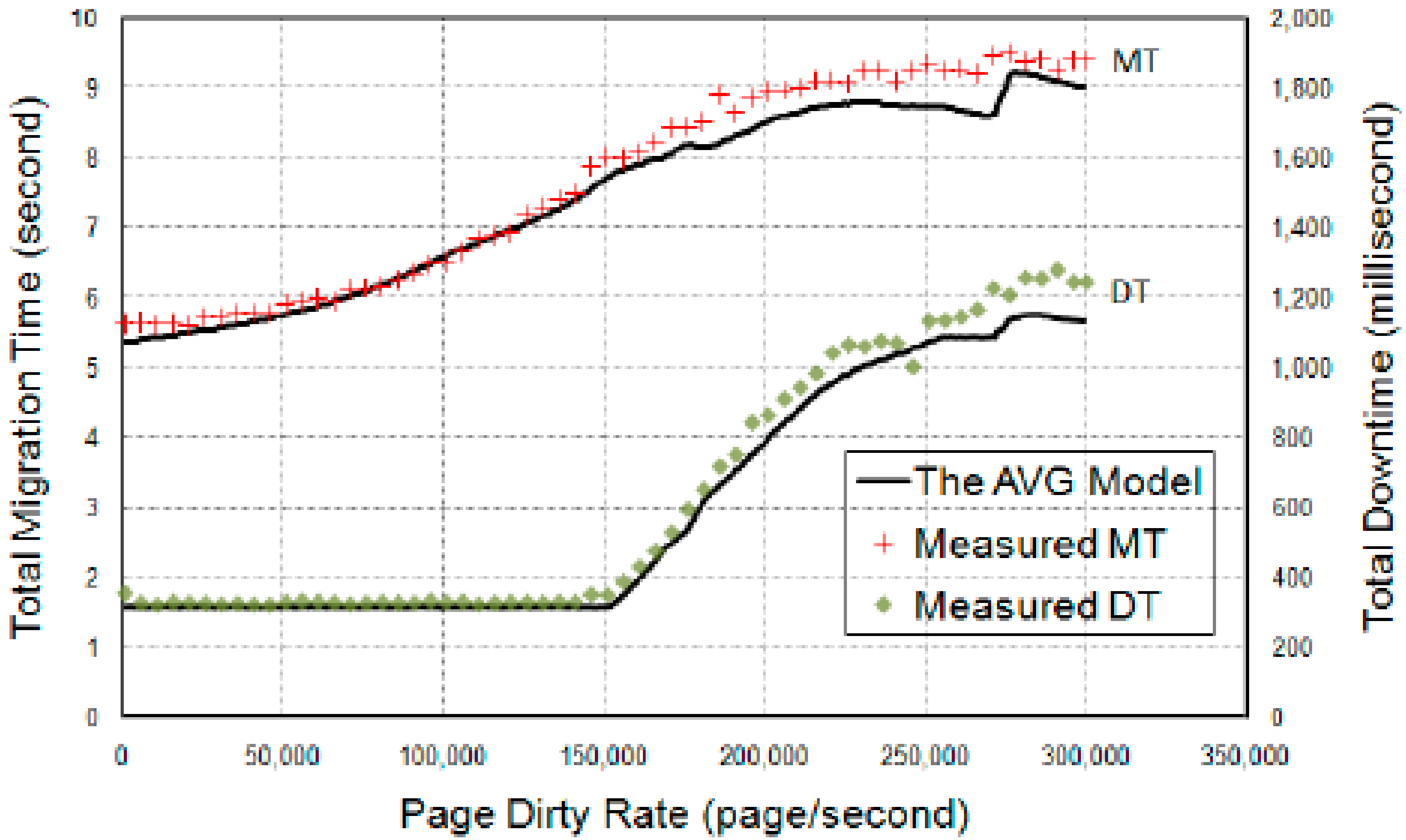
Downtime | Migration time

1 Gbps

10 Gbps



AVG model suitable for guests with a constant page dirty rate



HIST model for guests with cyclic behaviour

1) Keep a recorded history of page dirtying
2) Simulate the Xen migration process

Migration time | Down time

	MT_A	MT_P	Err	DT_A	DT_P	Err
CPU	5.8 s	5.7 s	2.4%	317.3 ms	314.1 ms	2.4%
WEB	7.5 s	7.4 s	2.0%	449.5 ms	420.4 ms	6.4%
SFS	14.8 s	14.9 s	1.5%	217.6 ms	217.7 ms	0.1%
MR	14.9 s	15.13 s	1.4%	348.9 ms	348.1 ms	0.2%

Future work

How can we change the stopping condition heuristics to provide some guarantees about migration time?

We've so far only considered migration of RAM. What happens when we need to move storage too?

What is the most effective means for migrating a set of VMs simultaneously?

Conclusion

It is important to know the expected interruption due to migration in advance

Its possible to predict migration times and service interruption

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http://www.cl.cam.ac.uk/research/dtg/planet