Live Process Migration

Techniques for VM migration

There are basically two main approaches for Live VM Migration:-

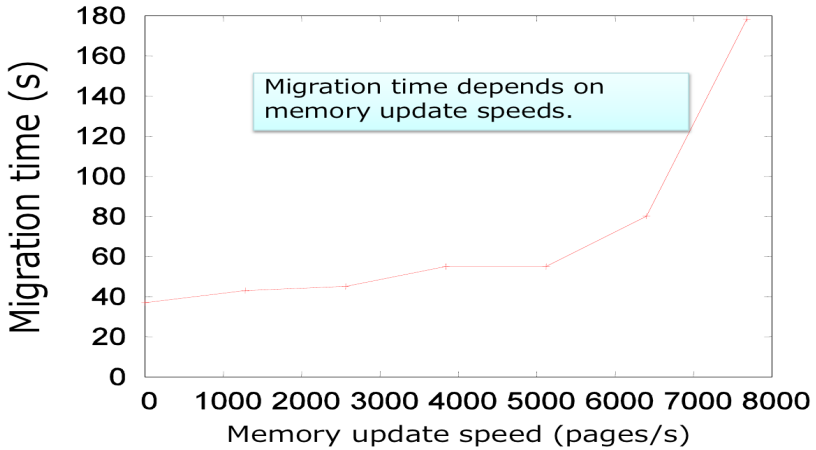
1. Pre-Copy
2. Post-Copy

Pre- Copy Live Migration

- Copy all memory pages to the destination.
- Copy memory pages dirtied during the previous copy again.
- Repeat the above step until the rest of memory pages are enough small (dirtying speed < link speed).
- Stop VM
- Copy the remaining pages and process state to destination.
- Resume VM at destination.

Characteristics of Pre-Copy

- Total migration time and downtime depend on memory dirtying speed.
- Especially the number of dirty pages doesn't converge when dirtying speed > link speed.
- The same page can be copied multiple times



Post-Copy Live Migration

- Stop VM on source.
- Copy VM state and resume the process on target.
- Copy pages on demand/background.

Post-Copy Characteristics

- A single page is copied only once.
- If there is a network failure or source or destination failure, the VM is lost.

Pre-copy v/s Post-copy

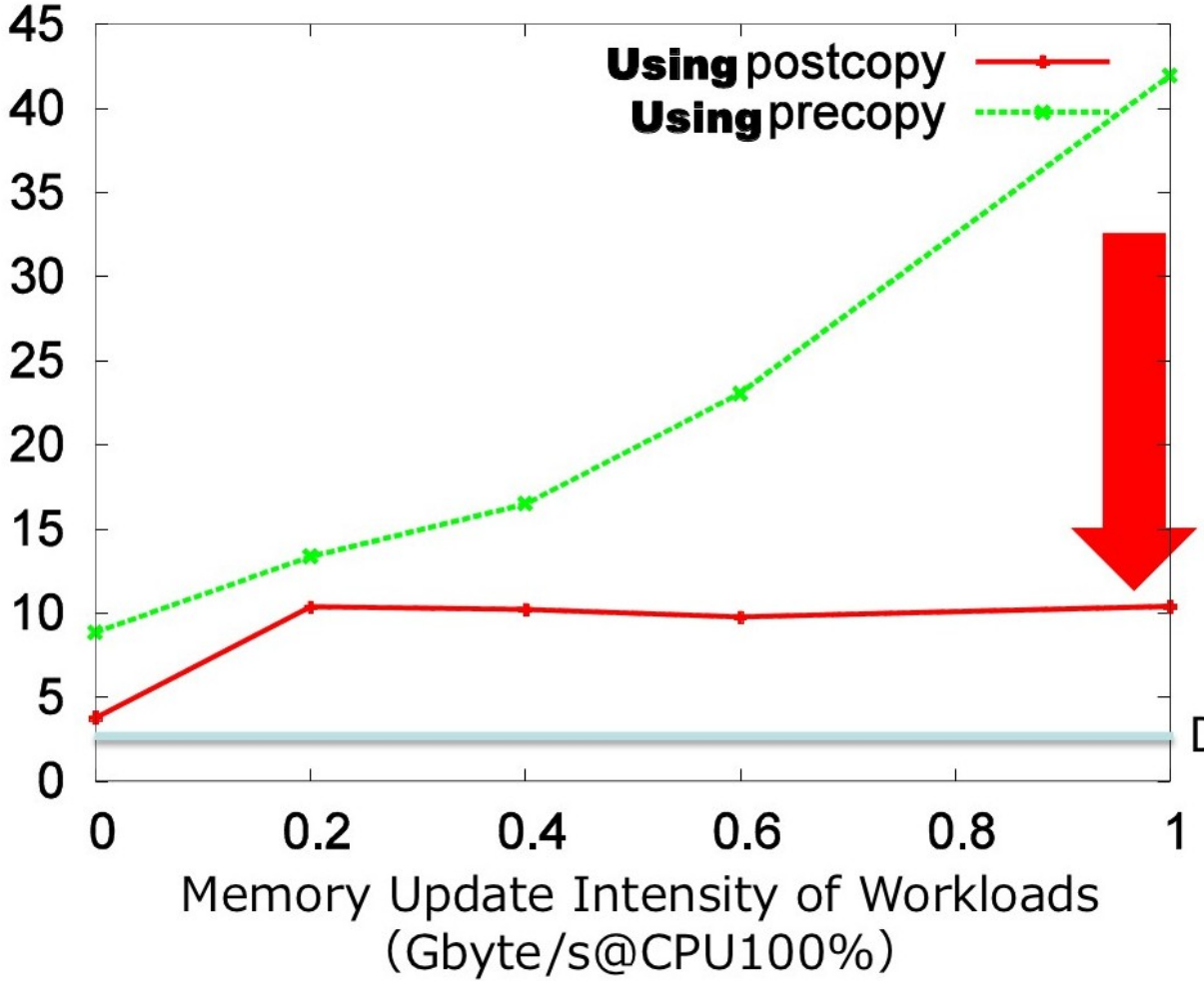
Pre-Copy

- Total Migration time = (RAM size/link speed) +overhead + non-deterministic(depending on dirtying pattern).
- Worst downtime = (VM state time) + (RAM size/link speed).
- It can cope with network or system failure.

Post-Copy

- Total Migration Time = (RAM size/link speed) + overhead.
- Worst Downtime = VM state time
- In case of network or system failure, process cannot be recovered.

Performance Degradation (%)



The consolidation system using precopy cannot quickly migrate VMs, resulting serious performance loss on sudden load changes.

Postcopy contributes alleviating performance loss.

Detection overhead

Yabusame

- Yabusame is yet another live migration mechanism which implements the post-copy method.
- The key of Yabusame is an on-demand memory transfer mechanism, which traps the first access to a memory page at the destination and copies its content from a source host.

Optimization

- There are a lot of methods which are used to optimize the pre-copy and post copy methods.
- LRU page reordering is used to reduce the number of pages transferred during pre-copy.
- Asynchronous page fault is used to optimize the post-copy mechanism.
- In APF, there are multiple threads. The thread which calls the page fault is blocked and some other is resumed.