
Subject: Supporting overcommit with the memory controller
Posted by [Paul Menage](#) on Thu, 06 Mar 2008 00:17:13 GMT
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We want to be able to use the memory controller in the following way, and I'd like to know how practical this is currently, and will be in the future.

Users are poor at determining how much memory their jobs will actually use (partly due to poor estimation, partly due to high variance of memory usage on some jobs). So, we want to overcommit machines, i.e. we want the total limits granted to all cgroups add up to more than the total size of the machine.

Our central scheduler will try to ensure that the jobs that are packed on to the same machine are unlikely to all hit their peak usage at once, so the machine as a whole is unlikely to actually run out of memory. But sometimes it will be over-optimistic, and the machine will run out of memory. We will try to ensure that there's a mixture of high and low priority jobs on a machine, so that when the machine runs out of memory the OOM killer can nuke the low-priority jobs and we can reschedule them elsewhere.

The tricky bit is that we don't want this OOM process to impact the high-priority jobs on the machine. I.e. even while the low-priority job is OOM-killing itself, the high priority job shouldn't have any difficulty in doing regular memory allocations. And if the high-priority job gets a spike in its memory usage, we want the low-priority jobs to get killed quickly and cleanly to free up memory for the high-priority job, without stalling the high-priority job.

So for each job we need a (per-job configurable) amount of memory that's essentially reserved for that job. That way the high-priority job can carry on allocating from its reserved pool even while the low-priority job is OOMing; the low-priority job can't touch the reserved pool of the high-priority job.

But to make this more interesting, there are plenty of jobs that will happily fill as much pagecache as they have available. Even a job that's just writing out logs will continually expand its pagecache usage without anything to stop it, and so just keeping the reserved pool at a fixed amount of free memory will result in the job expanding even if it doesn't need to. Therefore we want to be able to include in the "reserved" pool, memory that's allocated by the job, but which can be freed without causing performance penalties for the job. (e.g. log files, or pages from a large on-disk data file with little access locality of reference) So suppose we'd decided to keep a reserve of 200M for a particular job - if it had 200M of stale log file pages in

the pagecache then we could treat those as the 200M reserve, and not have to keep on expanding the reserve pool.

We've been approximating this reasonably well with a combination of cpusets, fake numa, and some hacks to determine how many pages in each node haven't been touched recently (this is a bit different from the active/inactive distinction). By assigning physical chunks of memory (fake numa nodes) to different jobs, we get the pre-reservation that we need. But using fake numa is a little inflexible, so it would be nice to be able to use a page-based memory controller.

Is this something that would be possible to set up with the current memory controller? My impression is that this isn't quite possible yet, but maybe I've not just thought hard enough. I suspect that we'd need at least the addition of page refault data, and the ability to pre-reserve pages for a group.

Paul

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