Lottery Scheduling: Flexible Proportional-Share Resource Management – Critique

- Vidit Jan (862394973)

Summary:

The paper presents a novel approach for process scheduling in operating systems. The central idea is that resource rights are represented by lottery tickets. When a process is scheduled, the client holding the winning ticket gets to use that resource for a time period. Probability of selection is proportional to the share of tickets held by the process. This allows for dynamically adjusting resource allocation to achieve a desired outcome.

The idea is a probabilistic approach to resource allocation instead of the conventional priority-based scheduling. This offers interesting benefits. Assuming uniform distribution, law of large numbers would guarantee convergence on expected ratios. Features such as ticket transfers, currencies and compensation tickets offer additional benefits. Ticket transfer helps avoid the problem of priority inversion. Ticket currencies helps establish logical trust boundaries, where a unique currency backs lottery tickets within a trust boundary. Compensation tickets can be issued when a resource uses less resources than allocated to it.

Also, this policy can co-exist with the standard fixed priority policies by the mark kernel interface implementation.

Strengths:

- The scheduling overhead of the proposed policy is very low, with lg n time complexity
- It allows for flexibility since due to the dynamic lottery tickets allocation
- Straightforward implementation ensuring it can be integrated into existing systems
- No resource starvation

Weaknesses:

- Non deterministic runtimes which is critical for real-time systems
- The paper does not provide performance comparison against other scheduling policies
- Lottery ticket allocation can get complex and might start incurring overheads
- Although the implementation can co-exist with fixed priority policies to ensure priority execution of certain processes, this might introduce significant overhead.

Other Comments and discussion:

The approach seems novel in the sense it relies on probabilistic determinism and the concepts of market economics. I think we need to add more features to ensure certain processes can be guaranteed deterministic runtimes, since all systems have processes with hard (or soft) deadlines. Also, I think comparisons with other popular scheduling policies would have really helped.

Overall, I think this is a great approach and very innovative. Further work is needed for a more comprehensive understanding of the strengths and weaknesses.