

# A Comprehensive Review of Speculation for Hadoop Ecosystem

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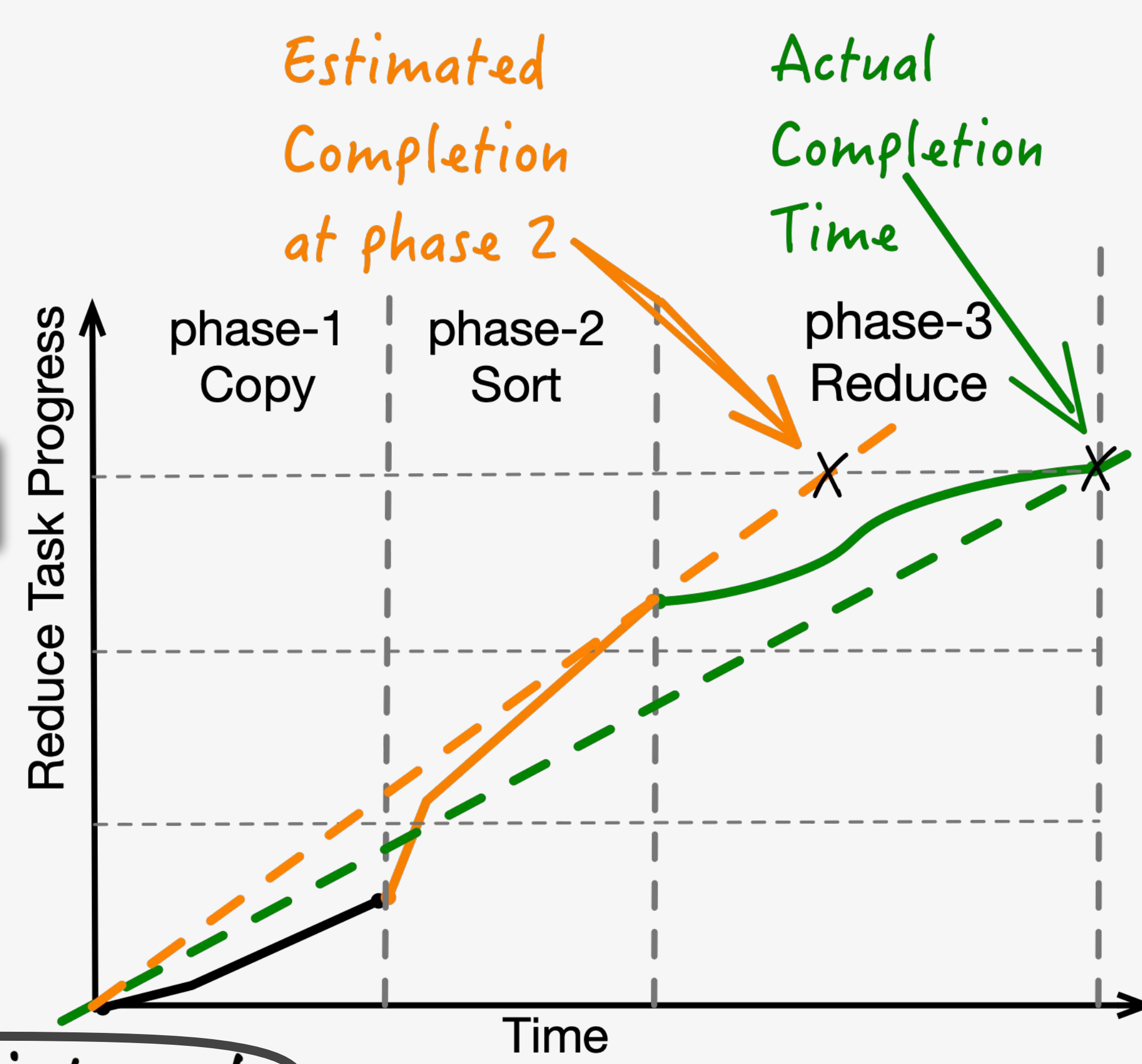
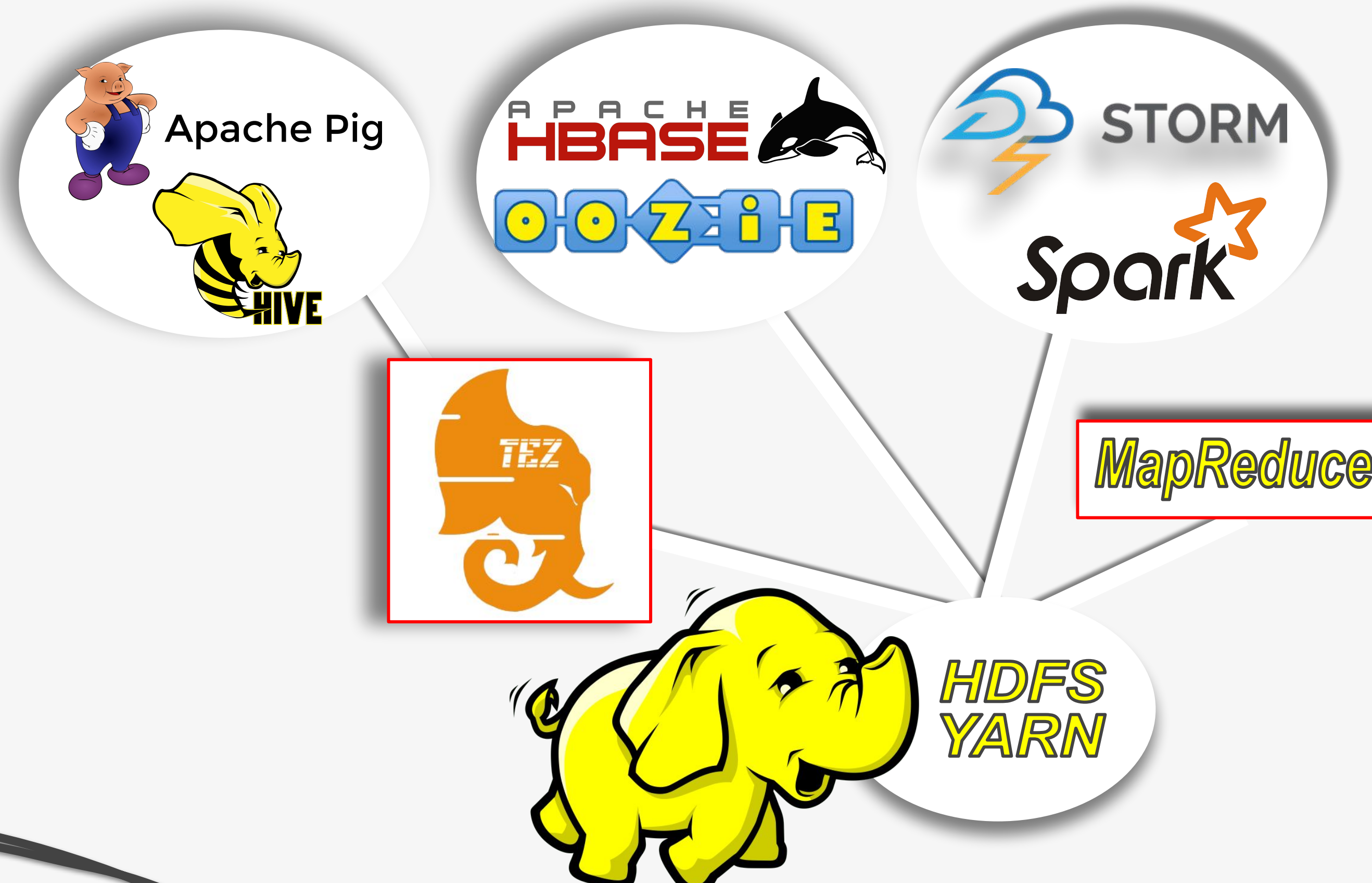


## Story

**What:** to Improve detection and correction of straggler tasks.

**Why:** to Improve operability by enhancing the self-healing paradigm of jobs and providing better guarantees for customer SLAs.

**How:** to deploy an adaptive task runtime estimator that better fits non-linear progress workloads present in the Hadoop ecosystem.



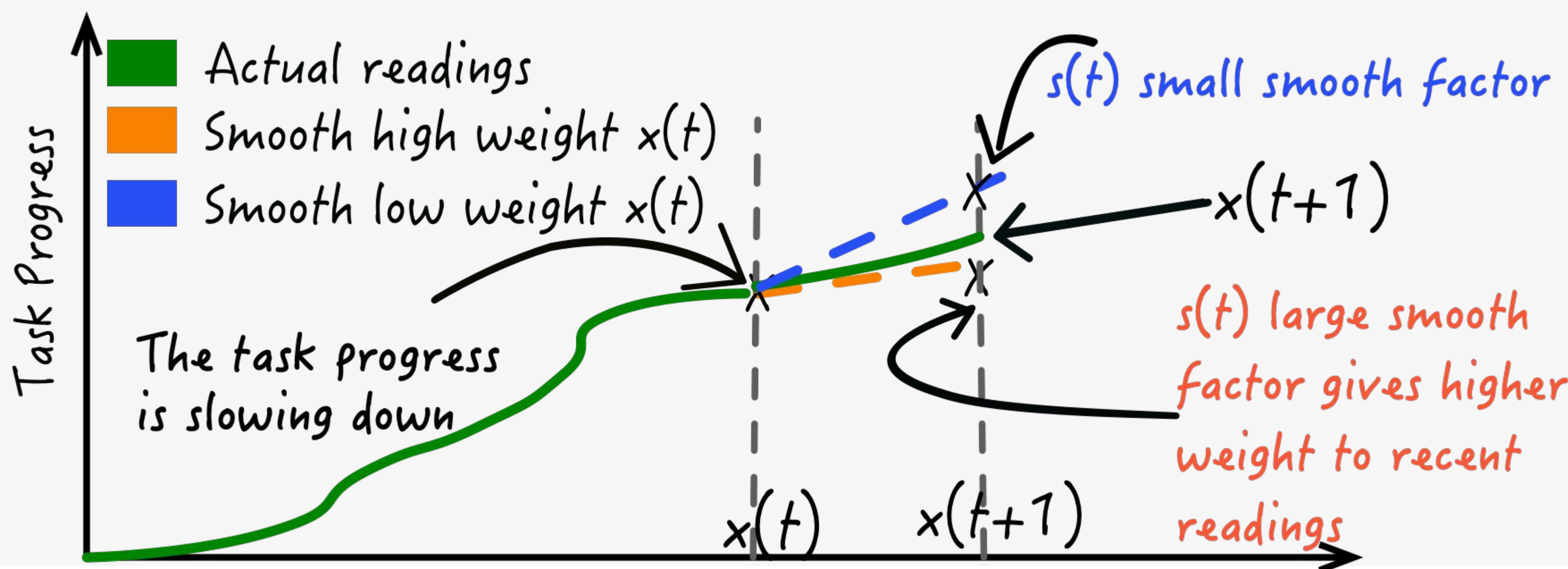
linear regression only works fine for homogeneous systems that produce regular data in periodic intervals and does not exhibit stragglers or skewed data

average does not count for confidence interval

Speculation Workflow	1-Dispatch	2-Update Stats	3-Estimate End Time	4-Detect Stagglers	5-Speculate Slowest
	After all map tasks have been dispatched for execution, the scheduler will pick the next speculative task if any. <i>Change</i>	Each task sends periodically a progress score between 0 and 1. In addition, the estimator keeps track of the execution time of the finished tasks <i>Change</i>	Based on the progress of each task the estimator will calculate the expected completion time assuming: tasks have constant progress, and all tasks need same amount of time.	The speculator looks at tasks that run for more than a minute and their estimated finishing time exceeds the average of their category (map or reduce)	The task with farthest estimated finish time into the future is labeled straggler and a new task is speculated. <i>Change</i>

## Adaptive Estimator: Exponential Smooth

The smoothed statistic  $S(t)$  is the weighted average of the previous smoothed statistic  $S(t-1)$  and the current reading  $X(t)$ . It requires no minimum number of observations to generate a forecast.



## Summary

With Our new estimator, the number of speculative jobs dropped to 50% saving more resources. Percentage of speculative tasks per job has dropped significantly (more than 85% of jobs launched at most 5% speculative tasks).

