

Work-in-Progress:  
*RWS* – A Roulette Wheel Scheduler  
for Preventing Execution Pattern Leakage

Ying Zhang, Lingxiang Wang, Wei Jiang, Zhishan Guo  
Department of Computer Science, Missouri S&T

Presenter: **Zheng Dong\***

\* Department of Computer Science, The University of Texas at Dallas



# Motivation

- Real-time system is to support various critical computations and control systems.



[/techcrunch.com/2016/07/14/autopilot-was-off-when-tesla-model-x-in-pennsylvania-crashed/](https://techcrunch.com/2016/07/14/autopilot-was-off-when-tesla-model-x-in-pennsylvania-crashed/)  
[/www.theverge.com/2018/4/5/17197742/spacex-falcon-9-rocket-launch-livestream-noaa-regulation](https://www.theverge.com/2018/4/5/17197742/spacex-falcon-9-rocket-launch-livestream-noaa-regulation)

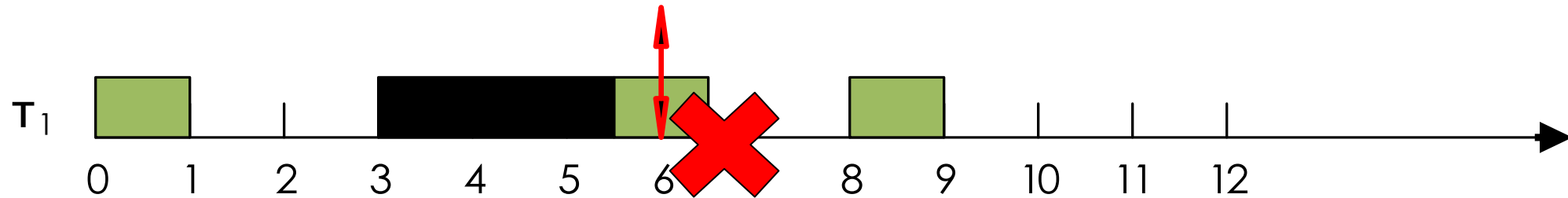


# Motivation

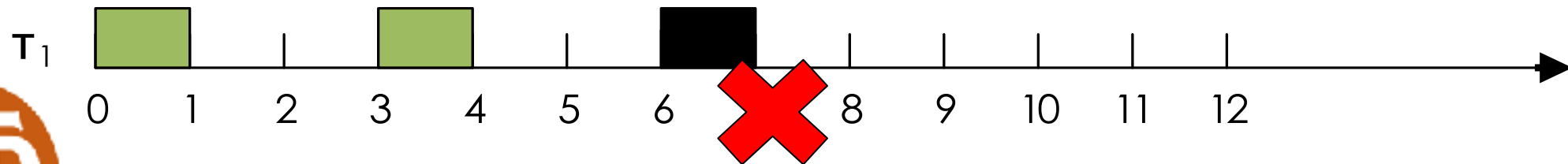
Detect the critical job and damage it.

- Cyber attacks aim at damage the reliability of the real-time system.

A task misses its deadline!



Break the logical correctness!

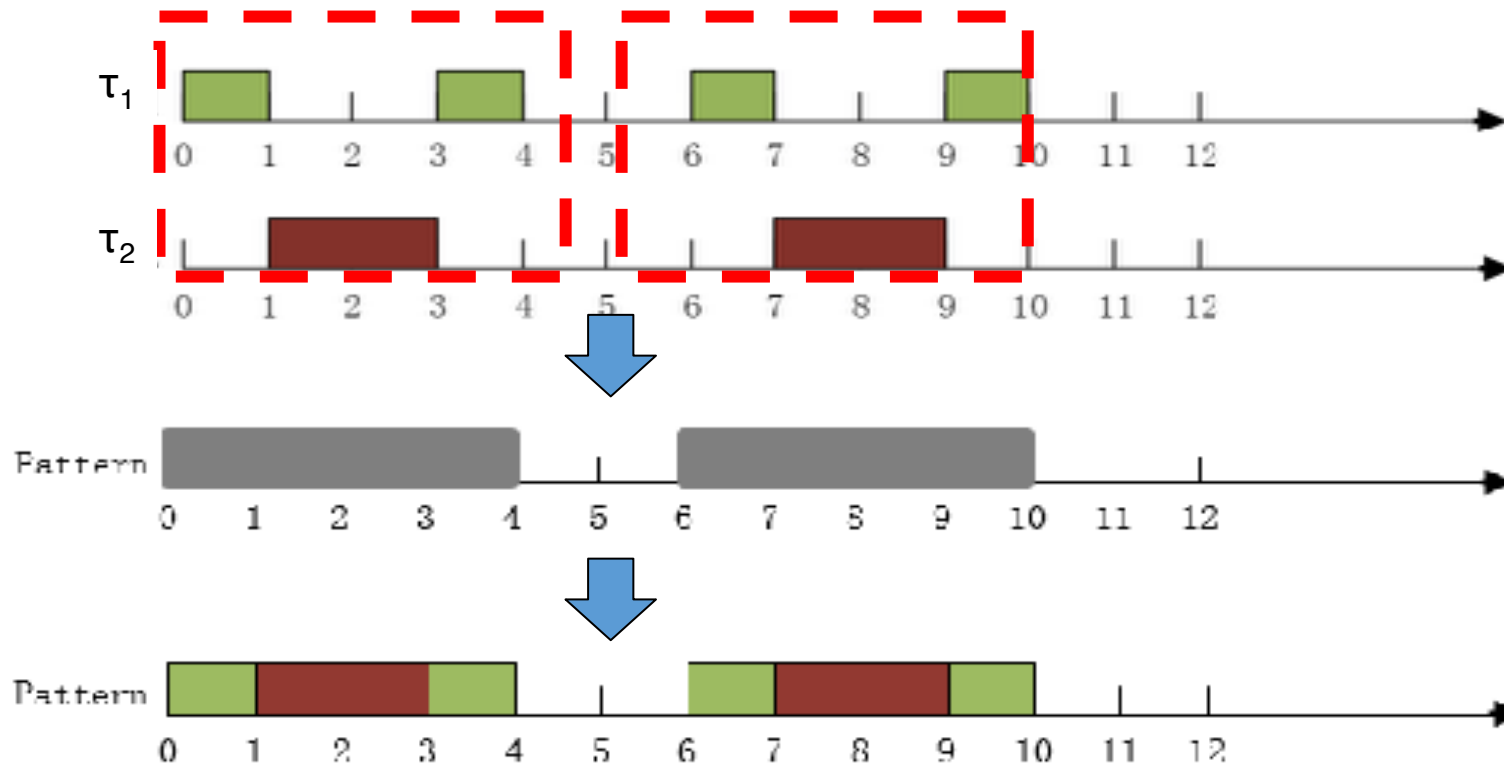


# Motivation

The critical job can be detected in a few possible execution patterns.

- Scheduling information leakage<sup>1</sup>

Same Execution Pattern!

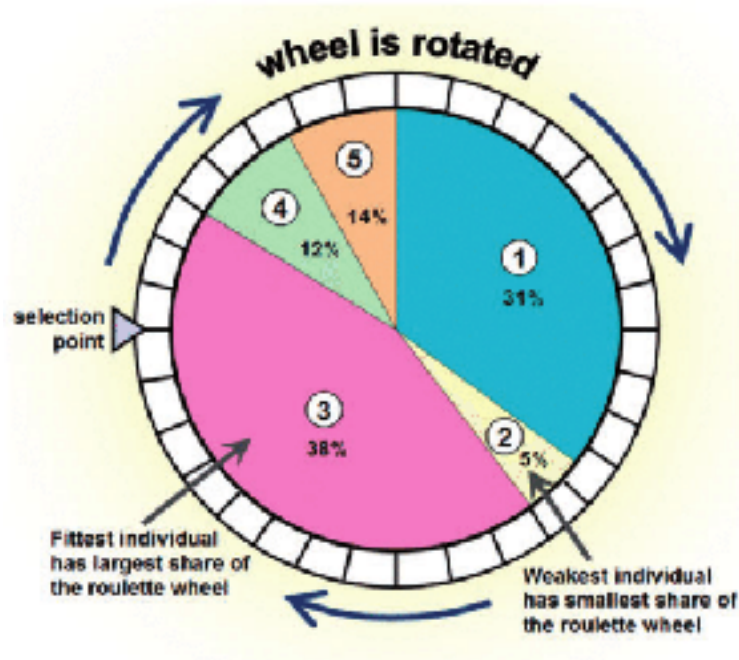


<sup>1</sup>Chen, Chien-Ying, et al. Schedule-based side-channel attack in fixed-priority real-time systems. 2015.



# Roulette Wheel Scheduler (*RWS*)

- *RWS* is a randomized scheduling algorithm based on the roulette wheel selection.
- It schedules the jobs according to the predefined possibilities.

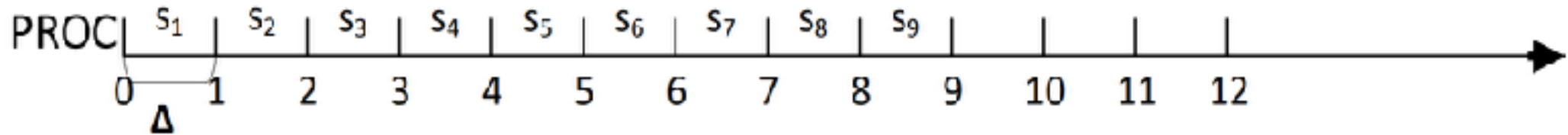


Randomize the jobs' execution patterns.



# Roulette Wheel Scheduler (*RWS*)

- Divide the timeline into mini-slots of length  $\Delta$

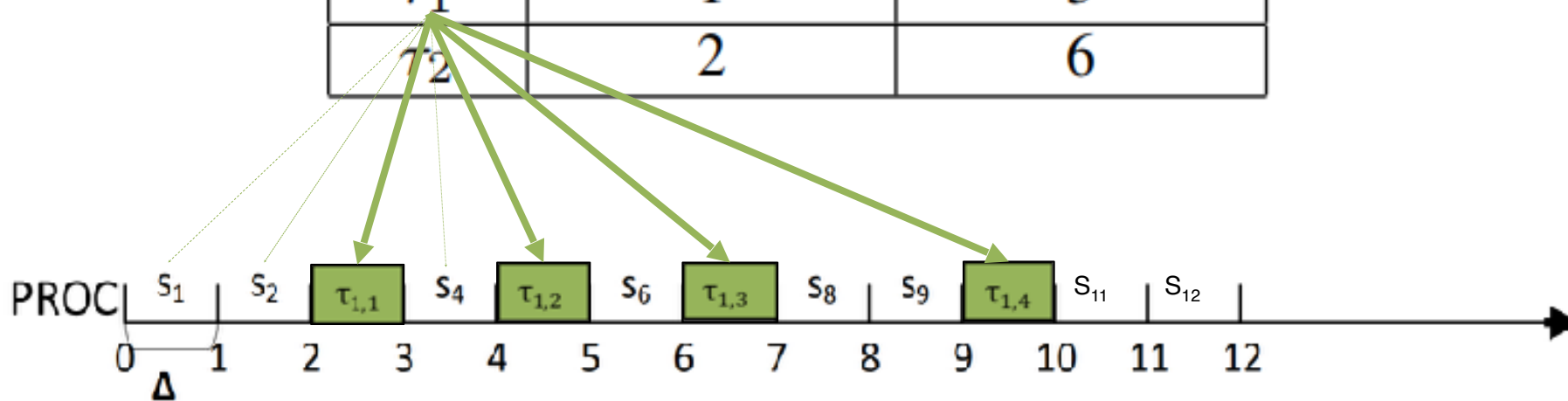


# Roulette Wheel Scheduler (*RWS*)

- Divide the timeline into mini-slots of length  $\Delta$
- Assign sufficient time slices to every job.

TABLE I: Parameters of a task set.

Task	WCET ( $e_i$ )	Period ( $\mathcal{P}_i$ )
$\tau_1$	1	3
$\tau_2$	2	6

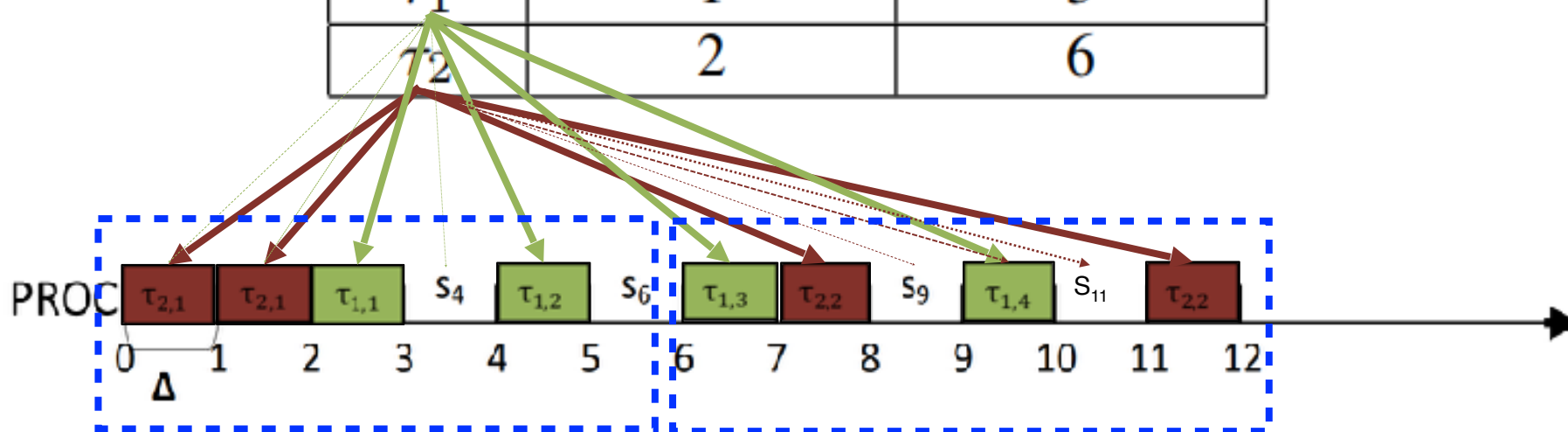


# Roulette Wheel Scheduler (*RWS*)

- Divide the timeline into mini-slots of length  $\Delta$
- Assign sufficient time slices to every job.

TABLE I: Parameters of a task set.

Task	WCET ( $e_i$ )	Period ( $\mathcal{P}_i$ )
$\tau_1$	1	3
$\tau_2$	2	6





Thanks!