

# RV and Real-Time Properties

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# Hybrid/Timed Automata

## Intro

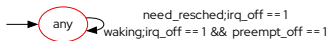


Figure: Operations with preemption and IRQ disabled

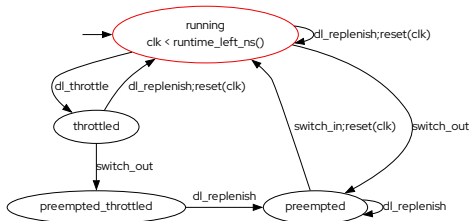


Figure: DL tasks throttled after runtime

Deterministic Automata (already available)

- ▶ Spot inconsistent events
- ▶ May find bugs hard to catch

Hybrid Automata (new)<sup>1</sup>

- ▶ Constraints on transitions and states
- ▶ Also real-time (ns/jiffy)
- ▶ Used on deadline scheduler models

<sup>1</sup> <https://lore.kernel.org/lkml/20251205131621.135513-1-gmonaco@redhat.com>



# Multiple Deadline Servers

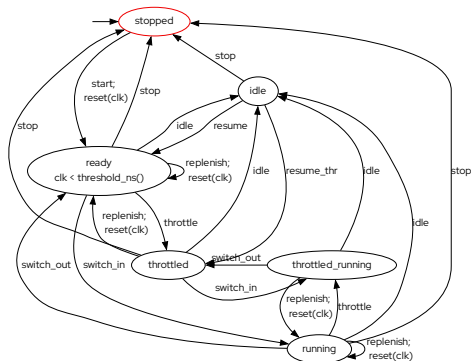


Figure: Fair task run independently or boosted

	type	cpu	dl_se
replenish		✓	✓
start/stop		✓	✓
boost	✓	✓	✓
idle	–	✓	
resume	–	✓	

Table: Info available on events

- ▶ Now 1 server per CPU (fair)
- ▶ Must know type for SCX server <sup>2</sup>
- ▶ Hierarchical RT servers ? <sup>3</sup>

<sup>2</sup> <https://lore.kernel.org/lkml/20251029191111.167537-1-arighi@nvidia.com>

<sup>3</sup> <https://lore.kernel.org/lkml/20251201124205.11169-1-yurand2000@gmail.com>



# Hybrid/Timed Automata

What else?

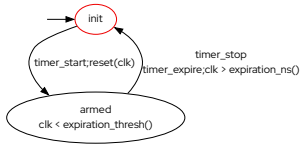


Figure: Timer

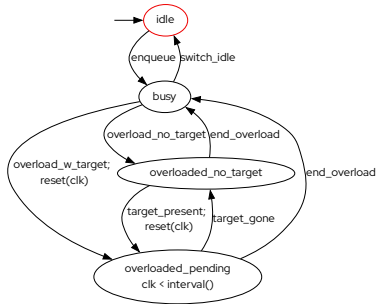


Figure: Load Balancer

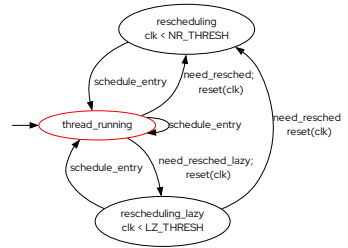


Figure: Need Resched

