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THE FRENCH AEROSPACE LAB

ResTSN
Resilient Time-Sensitive Networking

THALES

Embedded reconfiguration of TSN

ECRTS 2025

Industrial Challenge session

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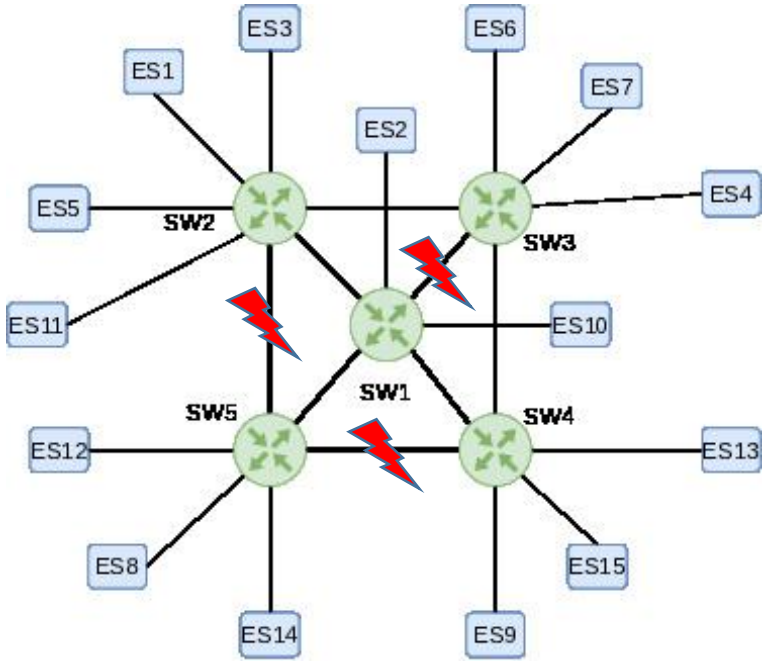
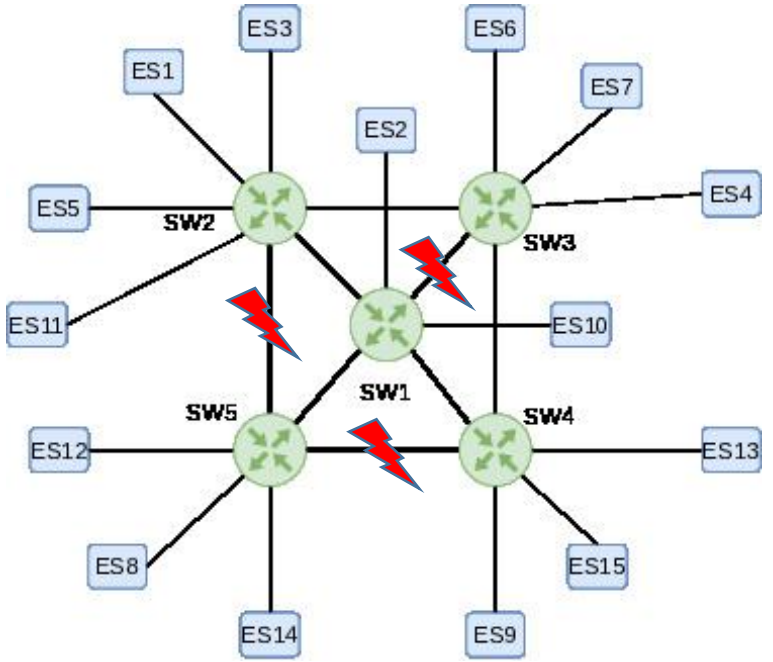
Challenge context

- TSN: Time Sensitive Networking
  - IEEE real-time Ethernet
- A TSN network
- Set of real-time data flows (*streams)*
- Initial static configuration
- Possible faults



The challenge itself

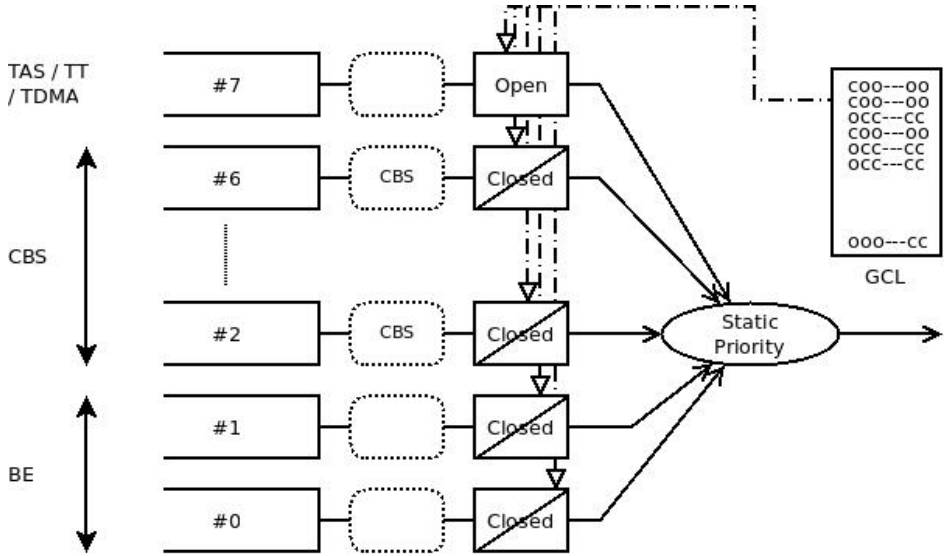
- In case of faults
  - Computing a new configuration
  - Still ensuring real-time guarantees
  - At least for most critical flows
    - Notion of flow utility/criticality
  - In short amount of time
  - Using embedded resources
  - While maintaining service



The challenge details

A subset of TSN

- One Time Aware Shaper queue (#7)
- A few Credit-Based-Shaper queues (#6-#2)
- Best-effort traffic
- 184 streams



Class	Nb streams	Period (in µs)			Size (in bits)			Dead./Per.	Jit./Per.
		Min	Av	Max	Min	Av	Max		
#2	19	400	1,558	6,400	3,656	8,280	11,920	2	2
#3	20	400	1,280	6,400	2,152	7,564	11,760	2	2
#4	29	400	897	3,200	2,192	7,970	11,920	2	2
#5	45	400	889	3,200	3,528	7,933	11,744	1	1
#6	39	200	552	1,600	2,584	7,643	11,624	1	1
#7	32	200	406	800	2,800	6,710	11,920	.5	.2

Hard points

- TAS re-configuration
  - Short configuration time (s – mn)
  - Incremental schedule (keep existing windows, as much as possible)
  - Removing less usefull flows
  - The coherence problem ….
- CBS re-configuration
  - Short configuration time
  - Impact of TAS reconfiguration