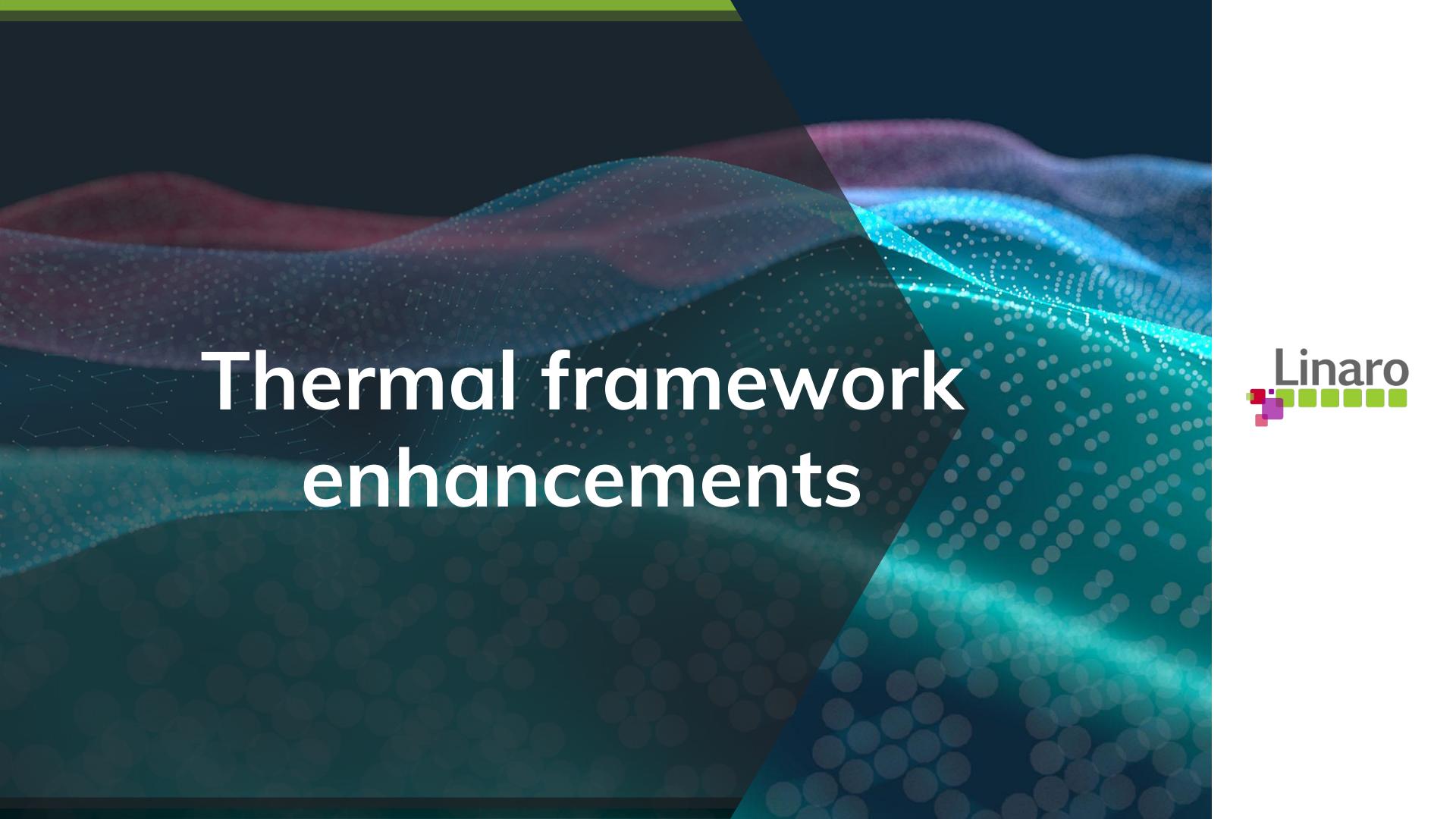


Linux Plumbers Conference 2023 Thermal MC

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The background of the slide features a dark blue and black abstract design. It consists of several wavy, translucent bands in shades of red, purple, blue, and teal. These bands are composed of numerous small, glowing white dots that form a dotted pattern. In the lower half of the slide, there is a large, semi-transparent dark blue triangle that overlaps the wavy bands. Inside this triangle, the title text is centered.

Thermal framework enhancements



Thermal enhancements

- User space dedicated trip points
- Debugfs for the thermal framework
- Improving the step wise governor

New trip point type

Dedicated user space trip point

Userspace dedicated trip points

- Most of the drivers have interrupt detection based notifications
- Userspace wants to be notified when a temperature threshold is crossed
- Writable trip points option
 - Passive, active, hot and critical temperature are writable
- Thermal framework is about protecting the silicon, letting userspace playing with the trip points is bad

Userspace dedicated trip points

Proposal : Create a <user> trip point type

- The thermal framework can clearly identify it and ignore any action except sending notification to userspace
- Takes benefit of interrupt based synchronous trip violation detection
- Writable trip point Kconfig option can be disabled
- <user> trip points stay writable
- Shall we create multiple <user> trip points?

Thermal debugfs

Debugfs for the thermal framework

- Very few information to investigate the thermal framework behavior
- Bogus cooling device stats
- We need to know how efficient are the mitigations
 - Depends on ambient temperature
 - Initial temperature
 - Heat capacity headroom
 - Temperature change speed
- Too many overshots = bad for the hardware
- Too many undershots = bad for the performances

Debugfs for the thermal framework

- Directory structure close to sysfs but simplified

```
thermal/
|-- cooling_devices
|   |-- 0
|   |   |-- reset
|   |   |-- time_in_state_ms
|   |   |-- total_trans
|   |   `-- trans_table
`-- thermal_zones
    |-- 0
    |   '-- mitigations
    '-- 1
        '-- mitigations
```

Mitigation episodes

,-Mitigation at 349988258us, duration=130136ms

trip	type	temp(°mC)	hyst(°mC)	duration	avg(°mC)	min(°mC)	max(°mC)
0	passive	65000	2000	130136	68227	62500	75625
1	passive	75000	2000	104209	74857	71666	77500

,-Mitigation at 272451637us, duration=75000ms

trip	type	temp(°mC)	hyst(°mC)	duration	avg(°mC)	min(°mC)	max(°mC)
0	passive	65000	2000	75000	68561	62500	75000
1	passive	75000	2000	60714	74820	70555	77500

,-Mitigation at 238184119us, duration=27316ms

trip	type	temp(°mC)	hyst(°mC)	duration	avg(°mC)	min(°mC)	max(°mC)
0	passive	65000	2000	27316	73377	62500	75000
1	passive	75000	2000	19468	75284	69444	77500

,-Mitigation at 39863713us, duration=136196ms

trip	type	temp(°mC)	hyst(°mC)	duration	avg(°mC)	min(°mC)	max(°mC)
0	passive	65000	2000	136196	73922	62500	75000
1	passive	75000	2000	91721	74386	69444	78125

Debugfs for the thermal framework

- More information planned

-Mitigation at **349988258**us, duration=130136ms

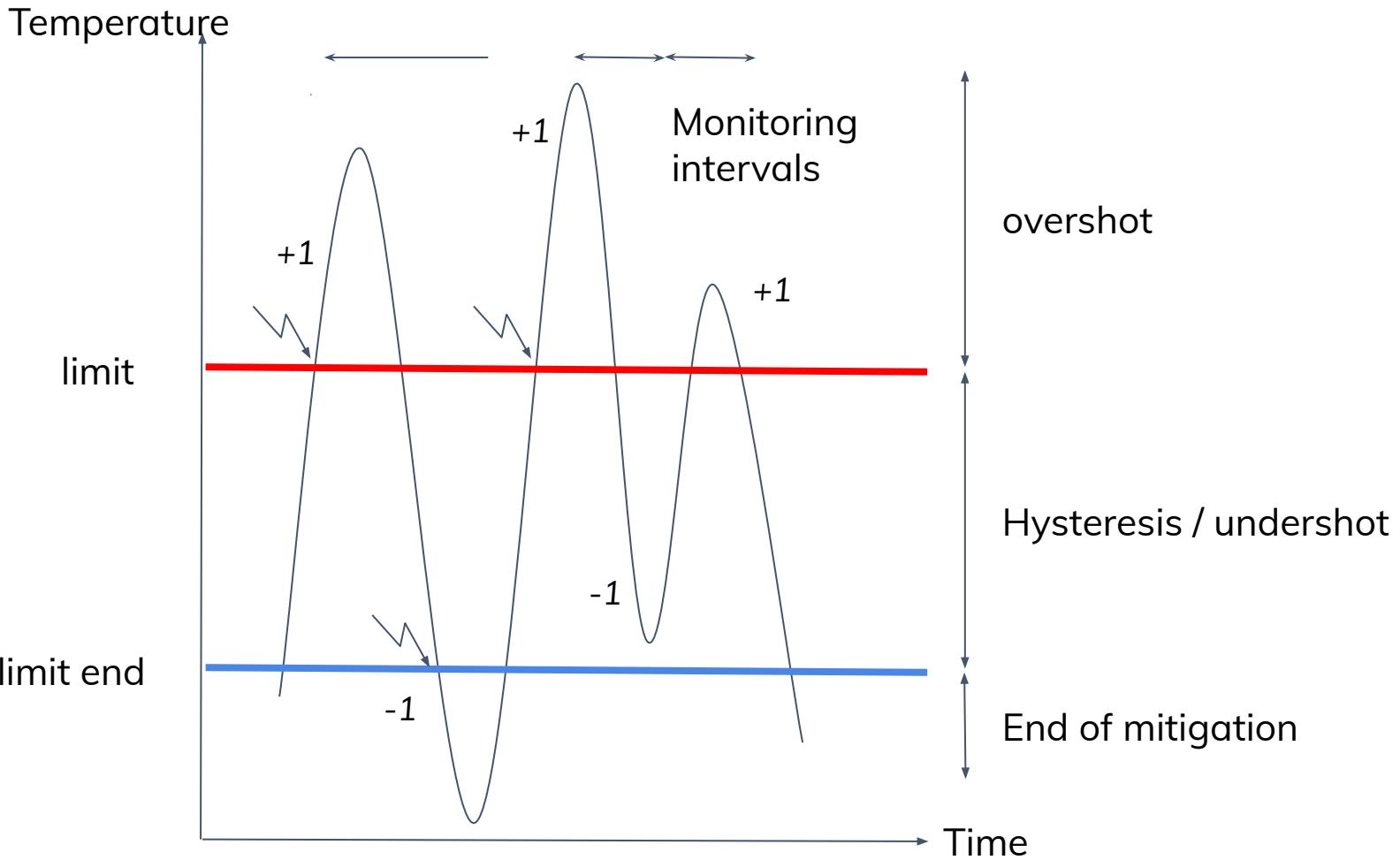
trip	type	temp(°mC)	hyst(°mC)	duration	avg(°mC)	min(°mC)	max(°mC)
0	passive	65000	2000	130136	68227	62500	75625
1	passive	75000	2000	104209	74857	71666	77500

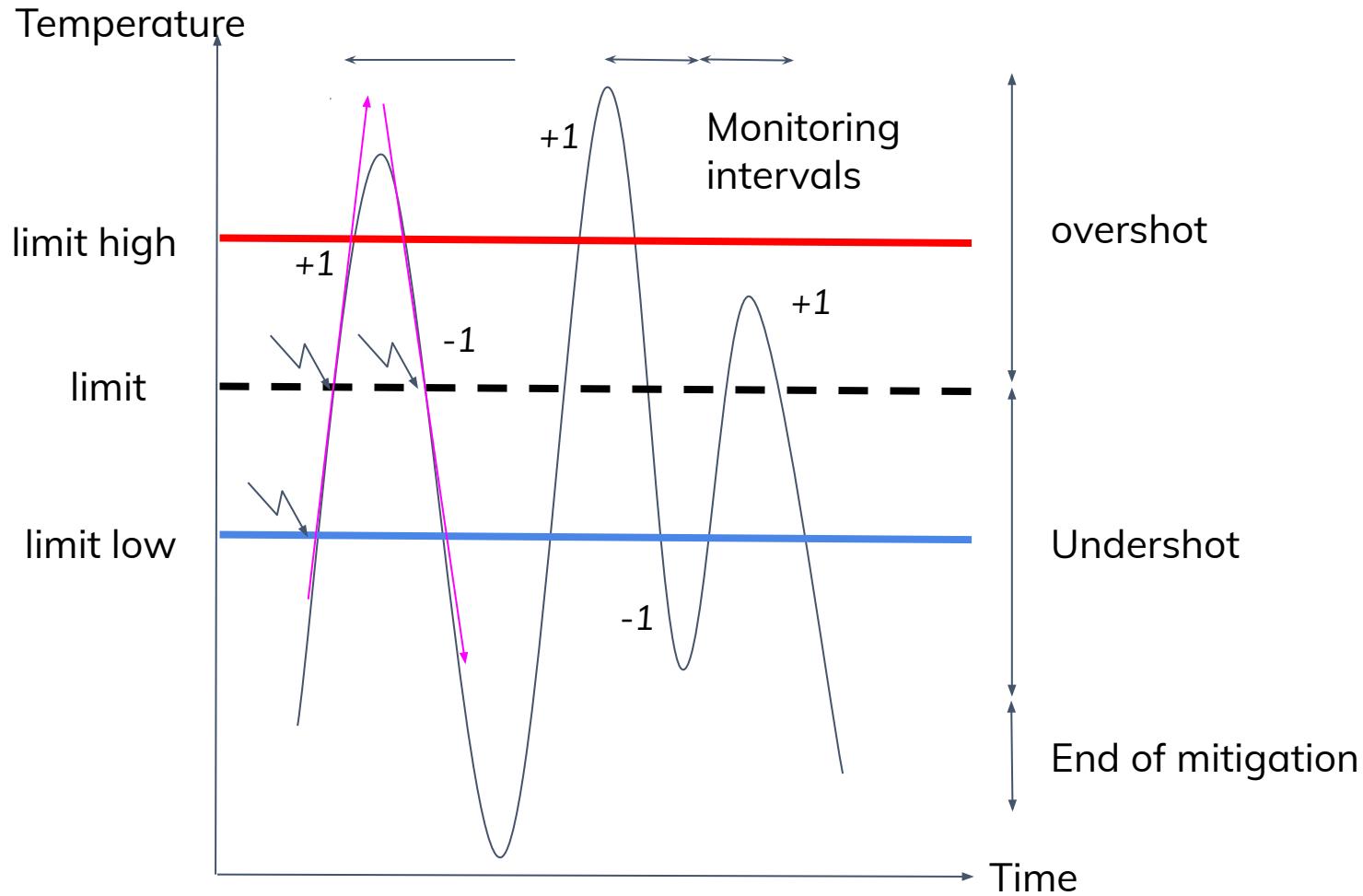
```
thermal/
|-- [ ... ]
`-- thermal_zones
  `-- 0
    `-- mitigations
      `-- 349988258
        |-- speed
        |-- [ ... ]
        `-- stddev
```

Improving the stepwise governor

Stepwise governor improvement

- Problem: stepwise governor does not react fast enough
- Consequences: overshoots and undershoots
- Current solution: Increase sampling
- Proposal:
 - Temperature speed computation
 - Temperature forecast
 - Next trip point crossed anticipated by a timer
 - We keep monitoring anyway





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Thank you

