Qualcomm

Linux Plumbers Conference 2025

Status of DTS Validation in Linux Kernel

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Introduction

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- I work for Qualcomm
- I am a co-maintainer (with Rob Herring and Conor Dooley) of Devicetree bindings in the Linux kernel
  - I co-maintain also the soc subsystem (arm-soc)
  - … and a few Linux kernel subsystems and drivers
- I contributed a lot to the Linux kernel, although now I mostly read the code
  - git shortlog -s -n --no-merges | head -n 5

Agenda

- Status of the validation per architectures
- Status of the validation per SoC Platforms

Disclaimer

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- However in a few slides I use adjectives like “incomplete” or “active” describing my opinion about given architecture or platform
- These opinions are my own and do not reflect the views of my employer

Status of Architectures

Kernel Versions

- All further slides show results as of Linux kernel:
  - Future v6.19 (next-20251125) - not for all slides
    - Validated with dtschema v2025.08
  - Latest v6.18, released few days ago
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  - v6.13, released January 2025
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- Trying to show change happening during last year
- Comparing with earlier Linux kernel releases is tricky, because dtschema is stricter now
  - Therefore trying to use dtschema package from that era

Architectures Tested Here

- ARM
  - `ls arch/arm/boot/dts`
  - Everything which could build, so includes ARMv7, ARMv6 and ancient ARMv4T (ARM9 like TI Nspire calculator)
- ARM64
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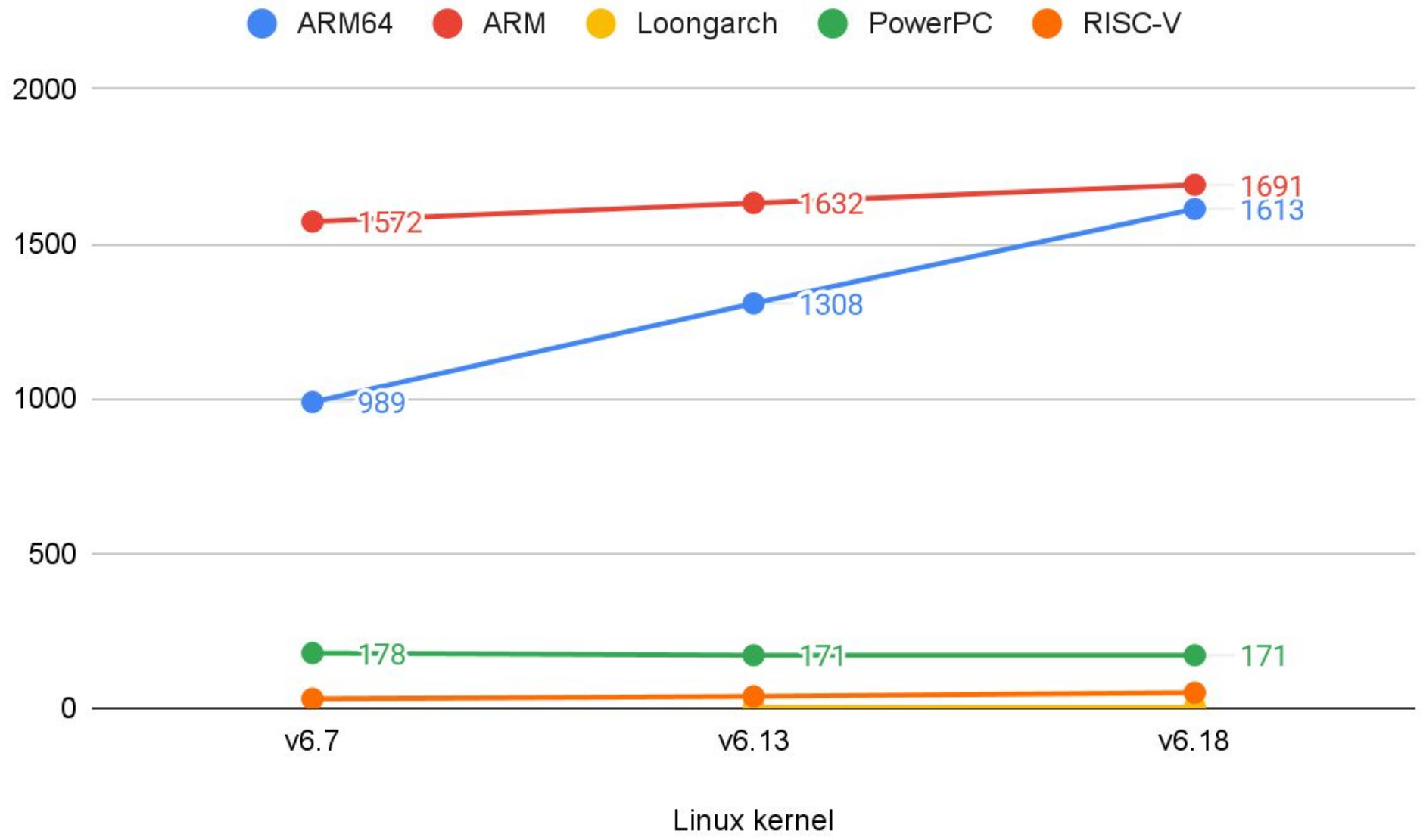
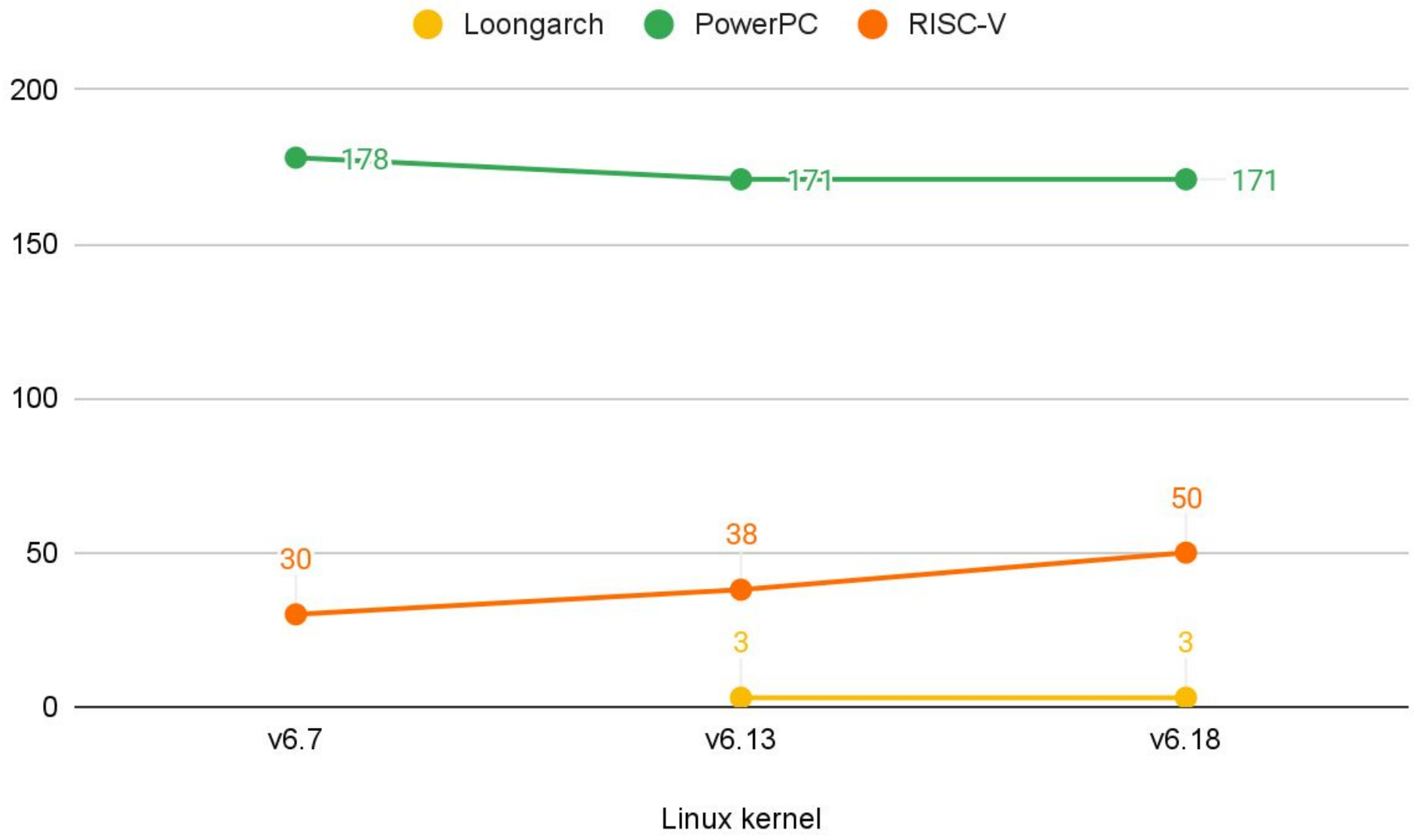
- PowerPC
- Not included in my talk
  - MIPS - allyesconfig builds only part of it (being fixed by Rob)
  - Pity if some architectures wanted to be on this list, but `git log` does not lie

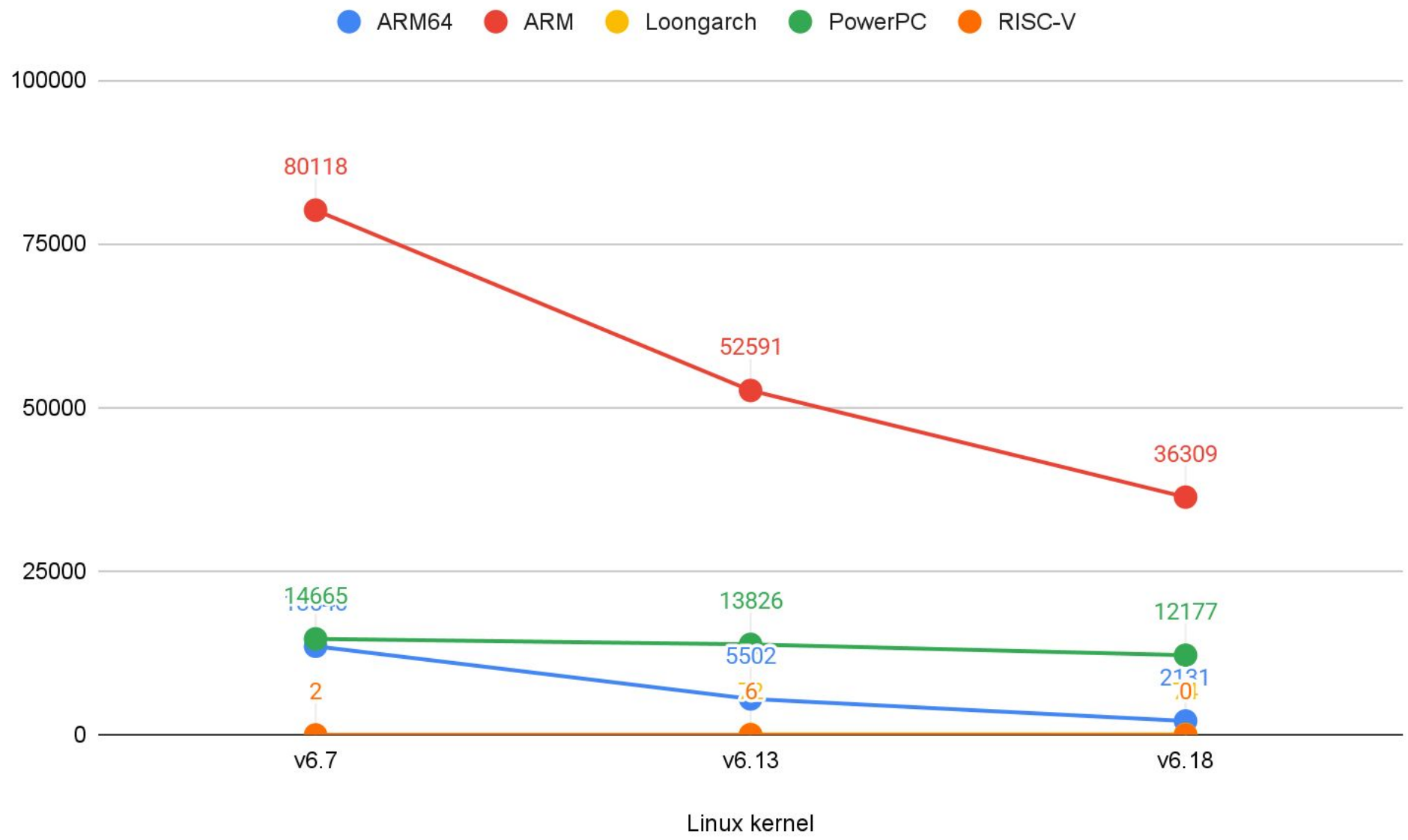
Targets per Architecture



Targets per Architecture (Loongarch, PowerPC and RISC-V)



Total DTBs Check Warnings (Lower Better)



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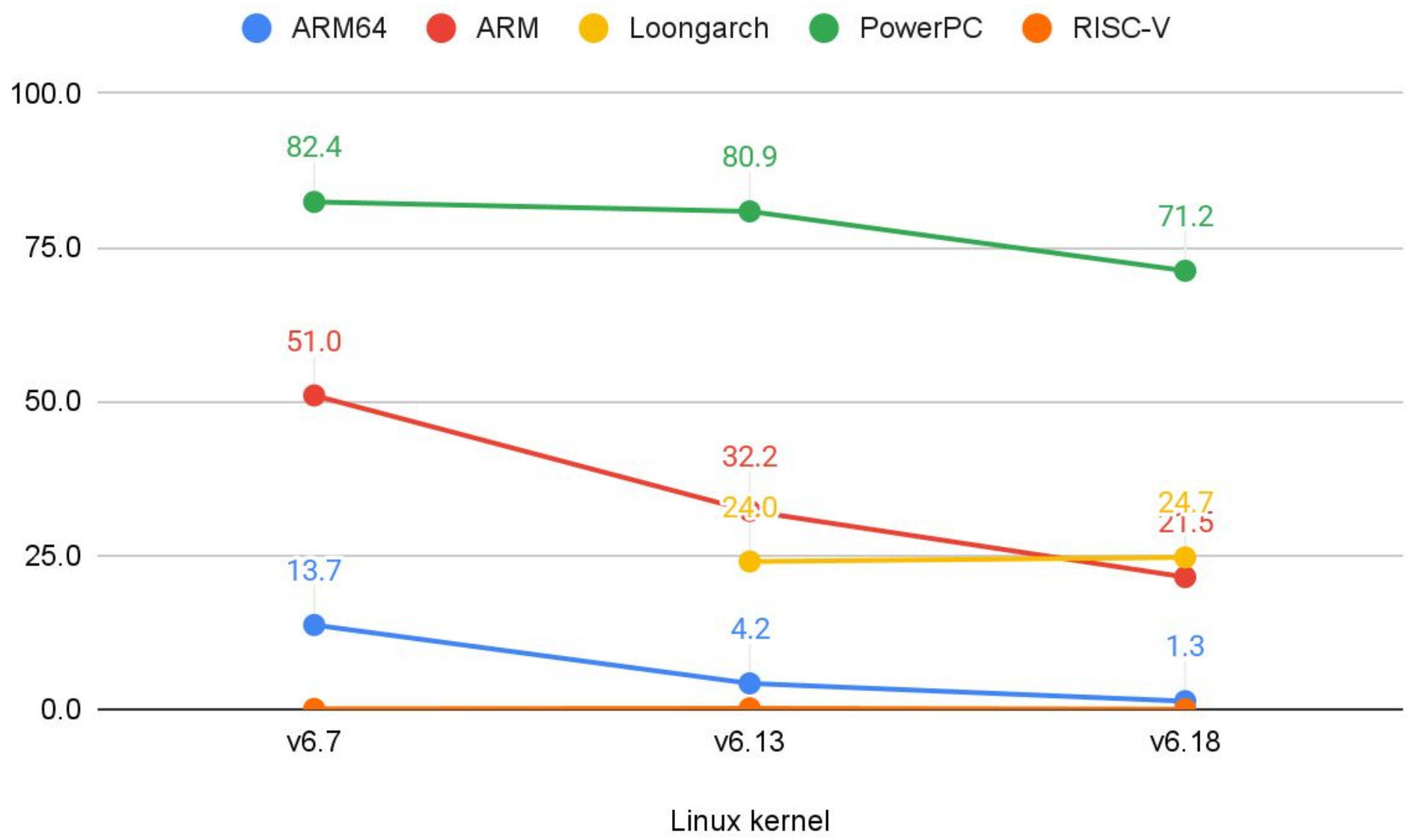

DTBs Check Warnings / Target (Lower Better)

Linux kernel	ARM64	ARM	Loongarch	PowerPC	RISC-V
v6.7	13.7	51.0	N/A	82.4	0.1
v6.13	4.2	32.2	24.0	80.9	0.2
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- RISC-V has fifty DTB target and no warnings
  - RISC-V was actually warnings free for two or more years, with minor occasional bumps in the warnings

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- ARM and ARM64 has comparable size (number of targets) but different number of warnings
- Conclusion: the size of your ecosystem does not guarantee your DTS will be correct
  - Thank you, Captain Obvious!

Status of (SoCs) Platforms

SoC Platforms - PowerPC

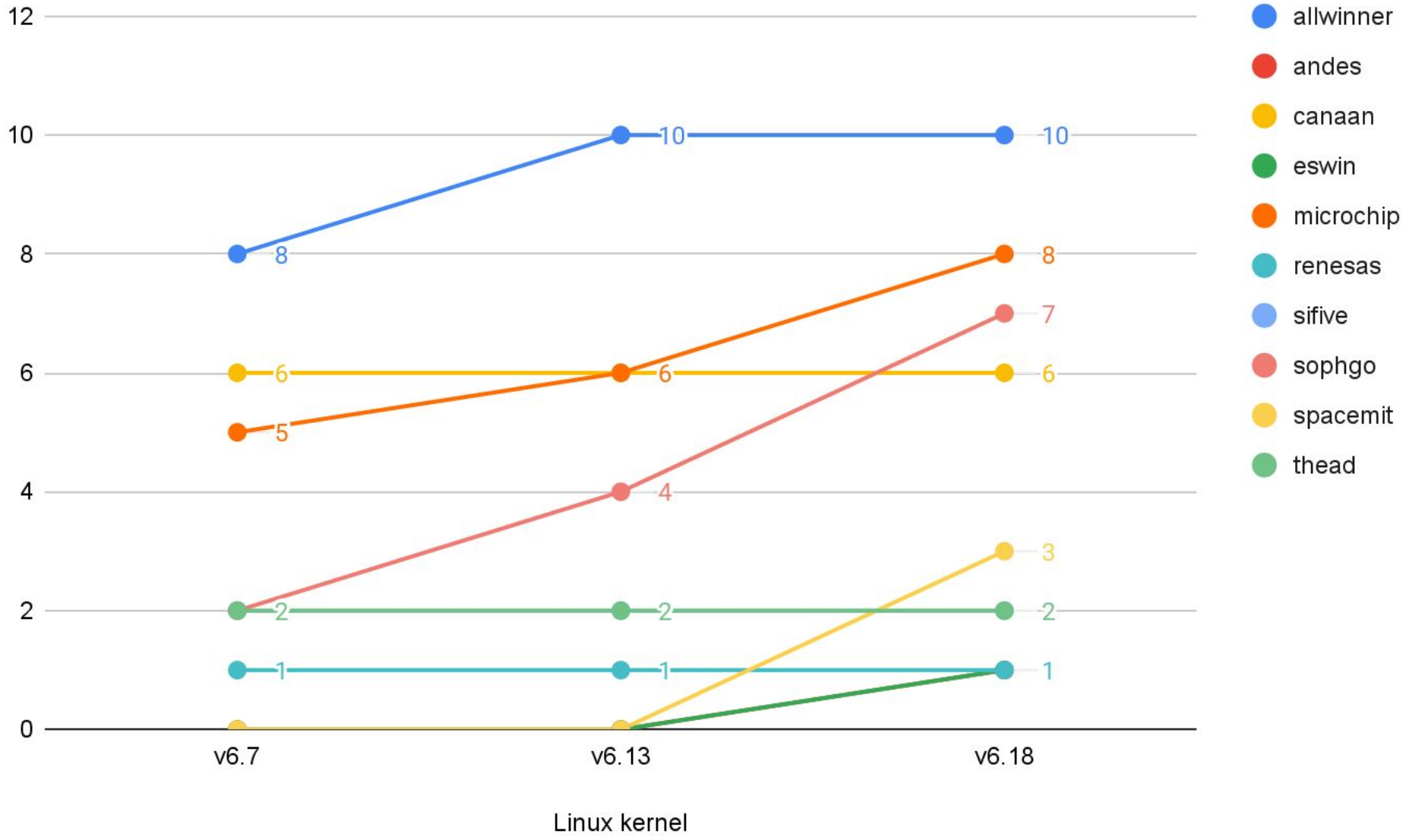
- PowerPC has no per-vendor split, thus not investigating individual platforms

Status of RISC-V Platforms

SoC Platforms - RISC-V

- RISC-V has 100% DTBs check compliance so no need to compare SoCs
- I can show number of targets...

Number of Targets - RISC-V

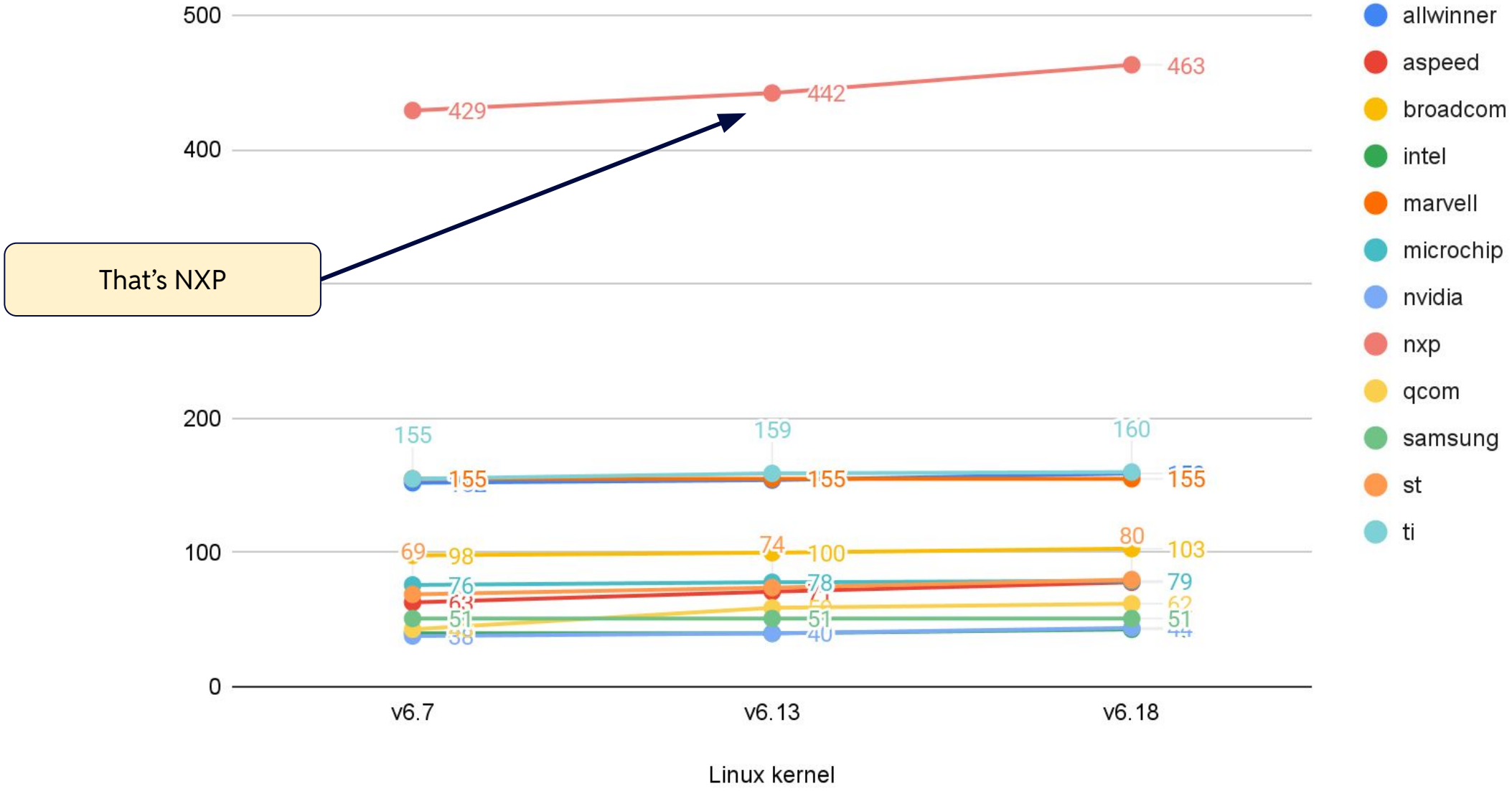


Status of ARM (32-bit) Platforms

SoC Platforms - ARM

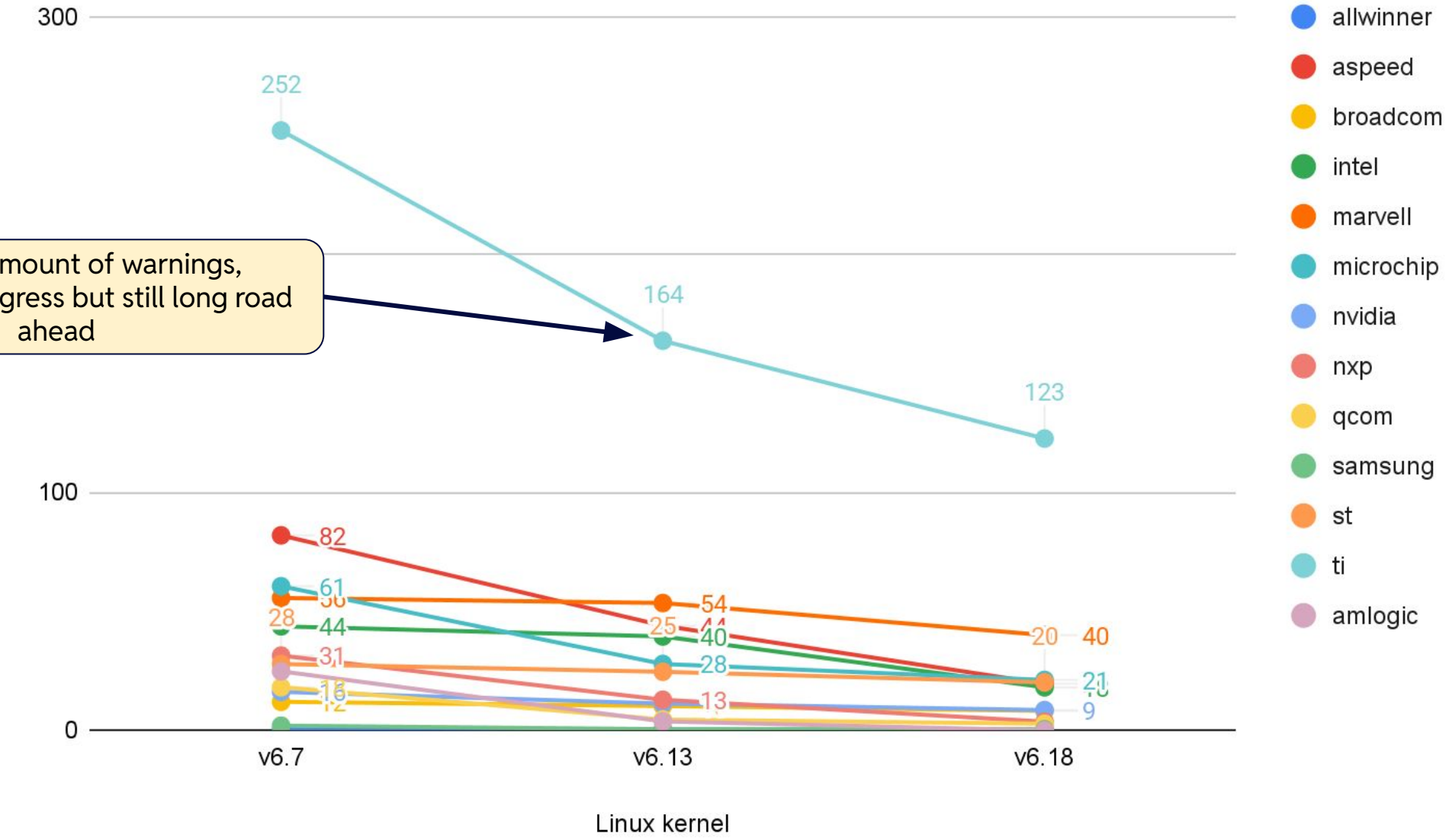
- There is 40 subdirectories in arch/arm/boot/dts - ~40 SoC vendors
- Many not being actively developed
- Following slides show subset of architectures, e.g. most active in Linux kernel

Number of Targets - ARM (Excerpt)

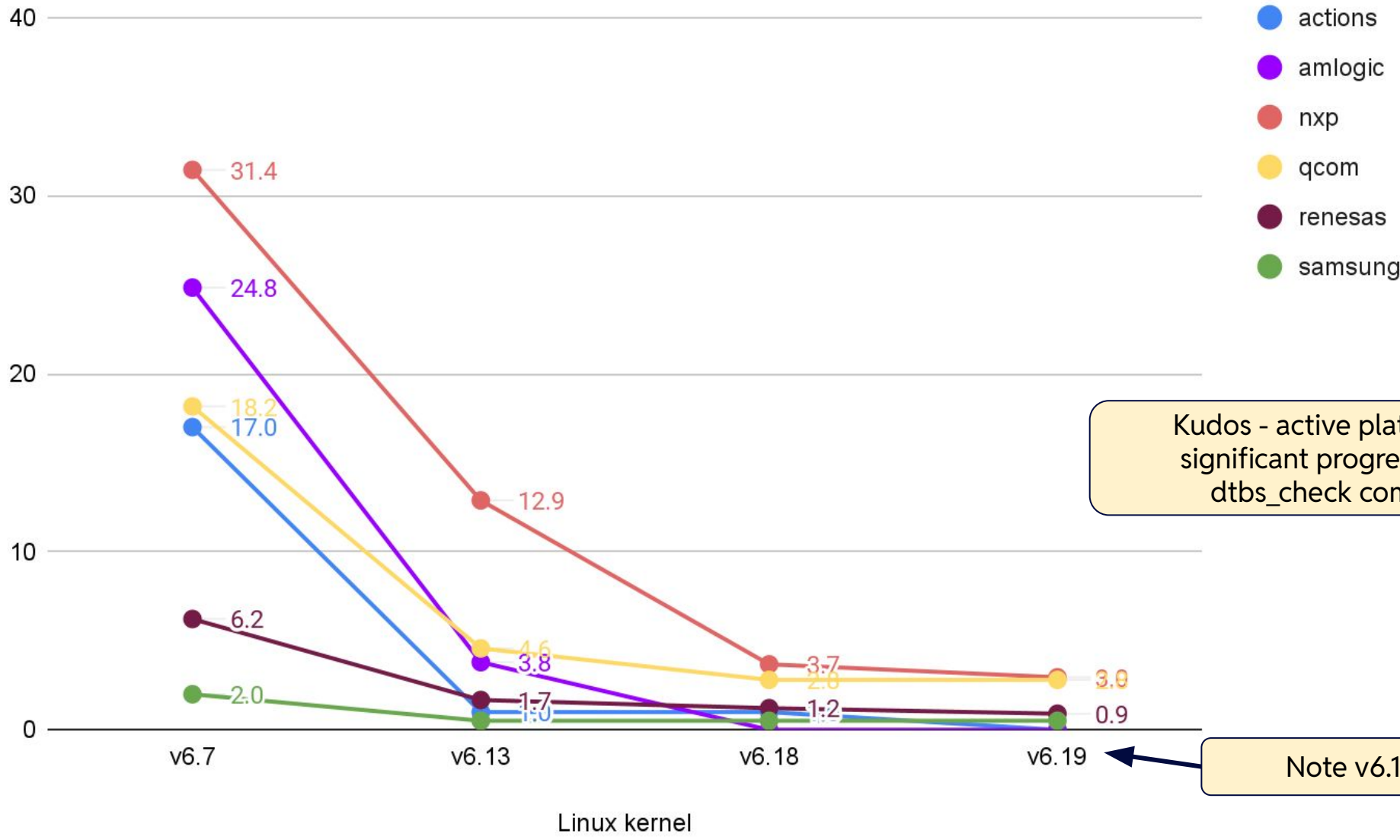


DTBs Check Warnings / Target (Lower Better) - ARM (Excerpt)

TI: Huge amount of warnings, significant progress but still long road ahead



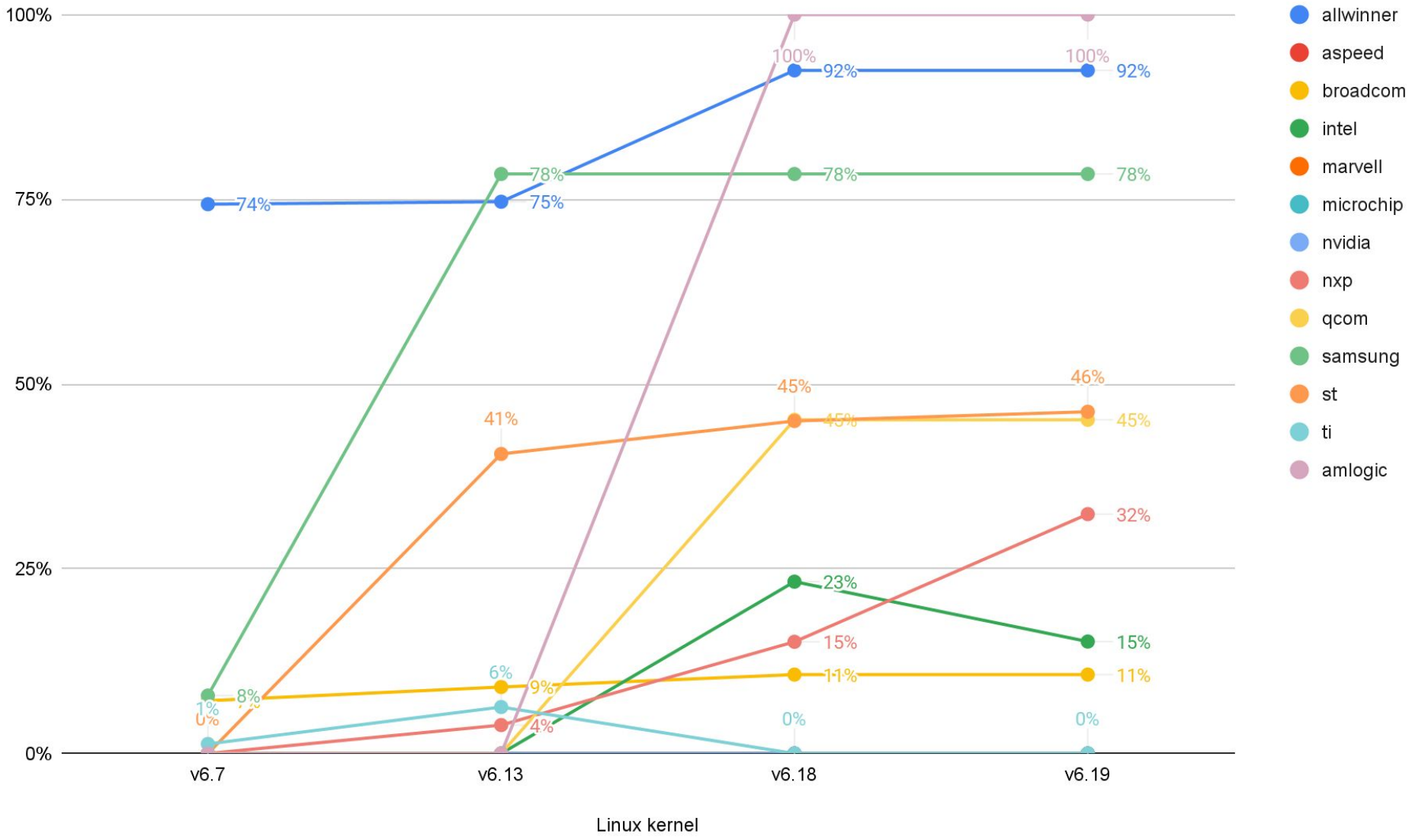
DTBs Check Warnings / Target (Lower Better) - ARM Kudos



Kudos - active platforms with significant progress towards dtbs_check compliance

Note v6.19 appearing

Percentage of Warning-free Targets (Higher Better) - ARM (Excerpt)



Warning-free Platforms (Higher Better) - ARM, v6.19 (next)

SoC Platform	Percentage of Warning-free Targets	No. Targets
Actions	100%	5
Airoha	100%	1
Amlogic	100%	6
HPE	100%	1
Allwinner	92.5%	159

Platforms with Only Warnings - ARM, v6.19 (next)

SoC Platform	Percentage of Warning-free Targets	No. Targets
alphascale	0%	1
amazon	0%	1
arm	0%	24
aspeed	0%	80
axis	0%	1
calxeda	0%	2
cnxt	0%	1
gemini	0%	10
marvell	0%	155
microchip	0%	79
moxa	0%	1
nspire	0%	3

SoC Platform	Percentage of Warning-free Targets	No. Targets
nuvoton	0%	6
nvidia	0%	45
realtek	0%	2
sigmastar	0%	8
sunplus	0%	1
synaptics	0%	4
ti	0%	161
unisoc	0%	2
vt8500	0%	6
xen	0%	1
xilinx	0%	15

Commentary

- Fixing some DTBs check warnings might require testing and many ARM platforms are now legacy
  - Some are still actively developed, like Aspeed, but not much happening in fixing warnings
- Effort is mostly moved to ARM64

Status of ARM64 Platforms

SoC Platforms - ARM64

- There is 40 subdirectories in arch/arm64/boot/dts - ~40 SoC vendors
  - Tesla and Exynos are both Samsung
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  - Tesla and Exynos are both Samsung
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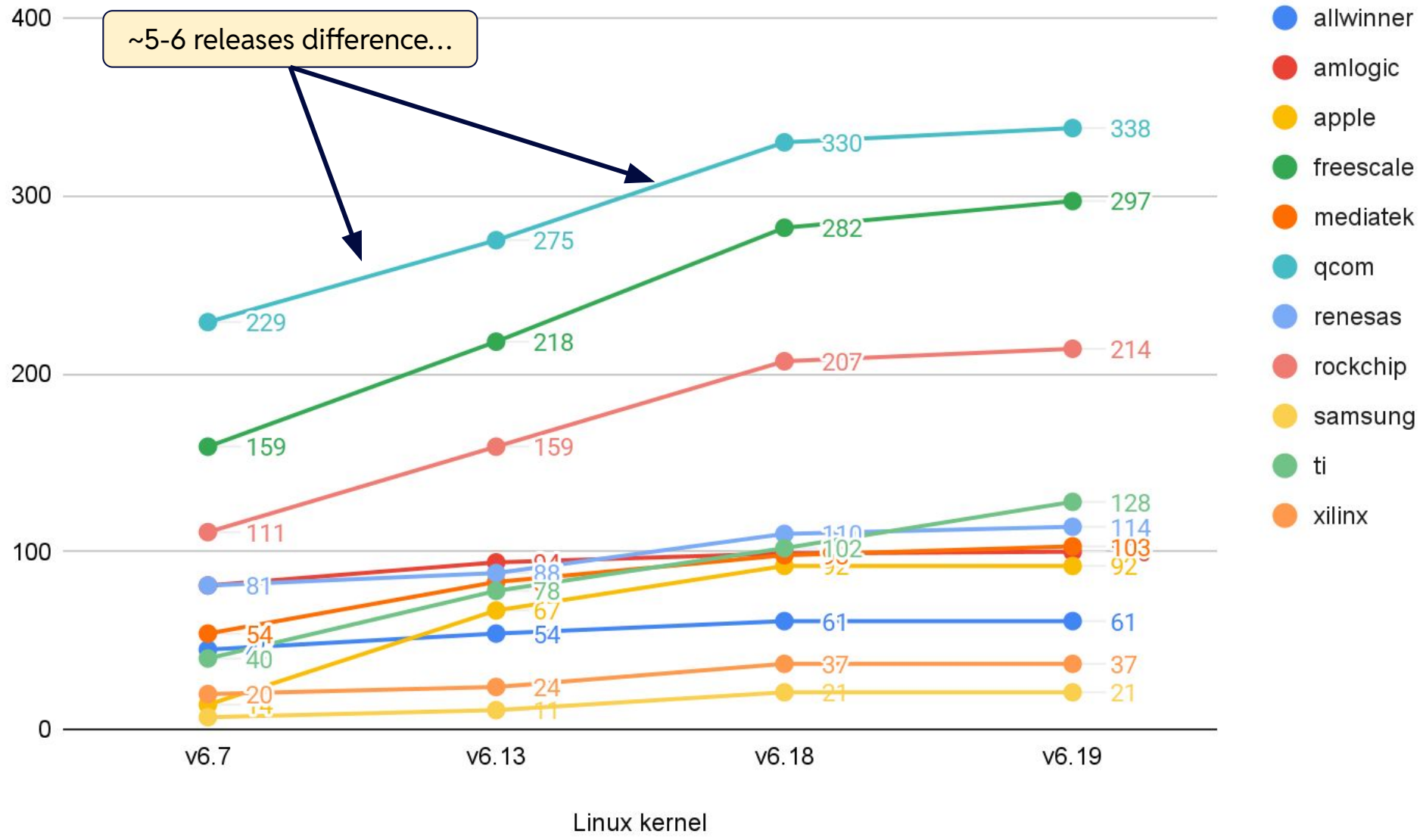
- Some not being actively developed, at least in DTS
  - They still could be well supported ACPI platform...
- Following slides show subset of architectures, e.g. most active in Linux kernel

Number of Targets - ARM64 (Most Active)



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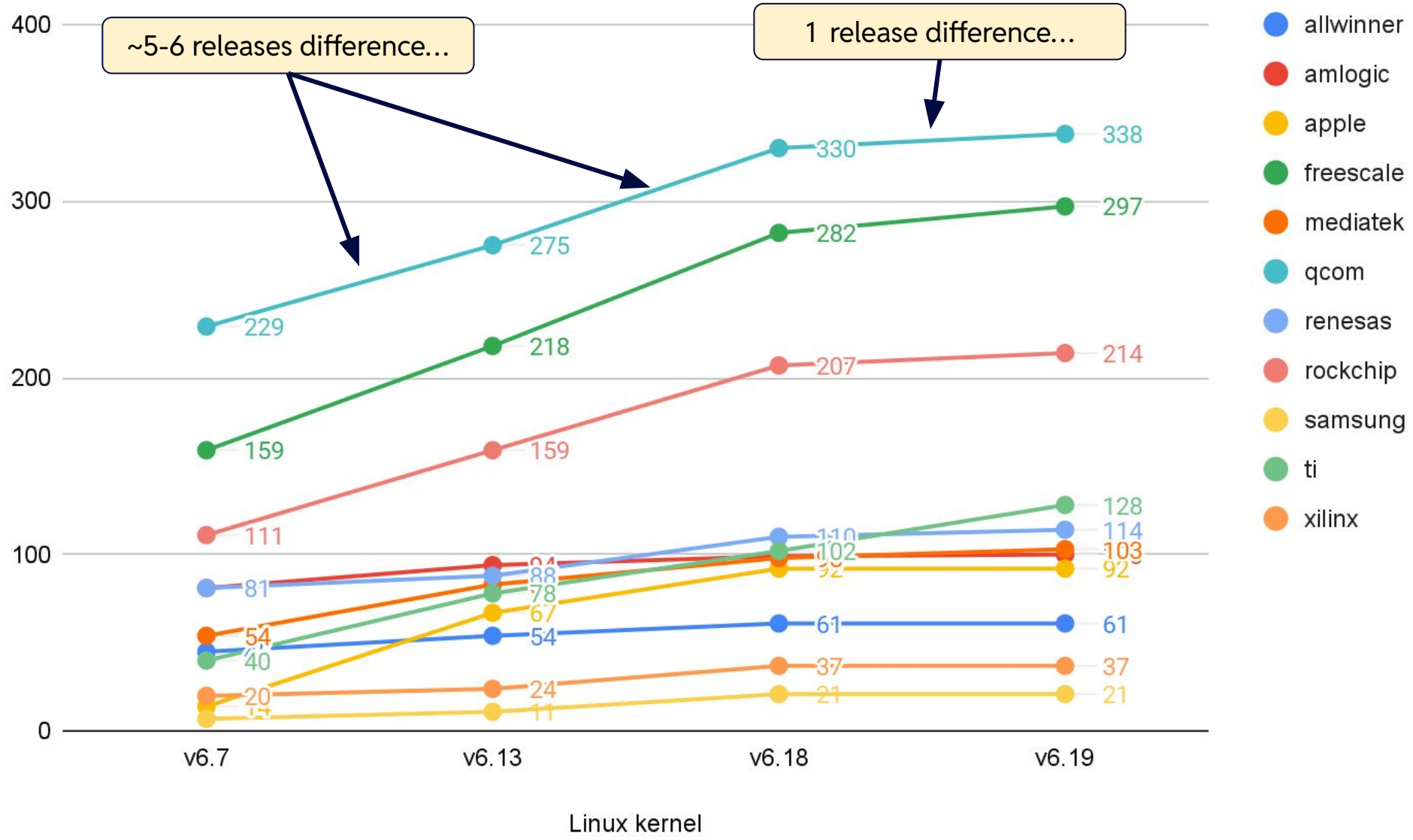

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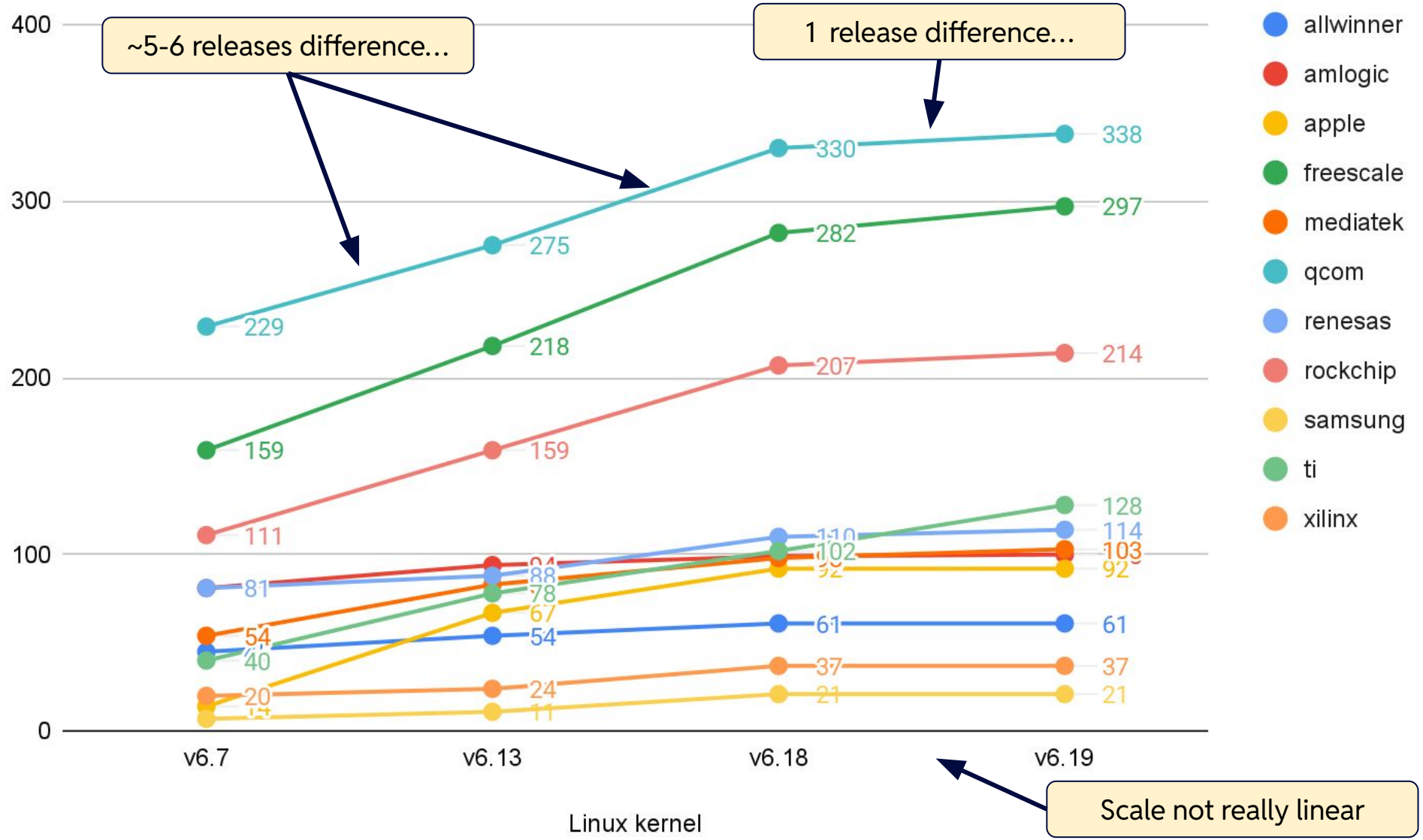

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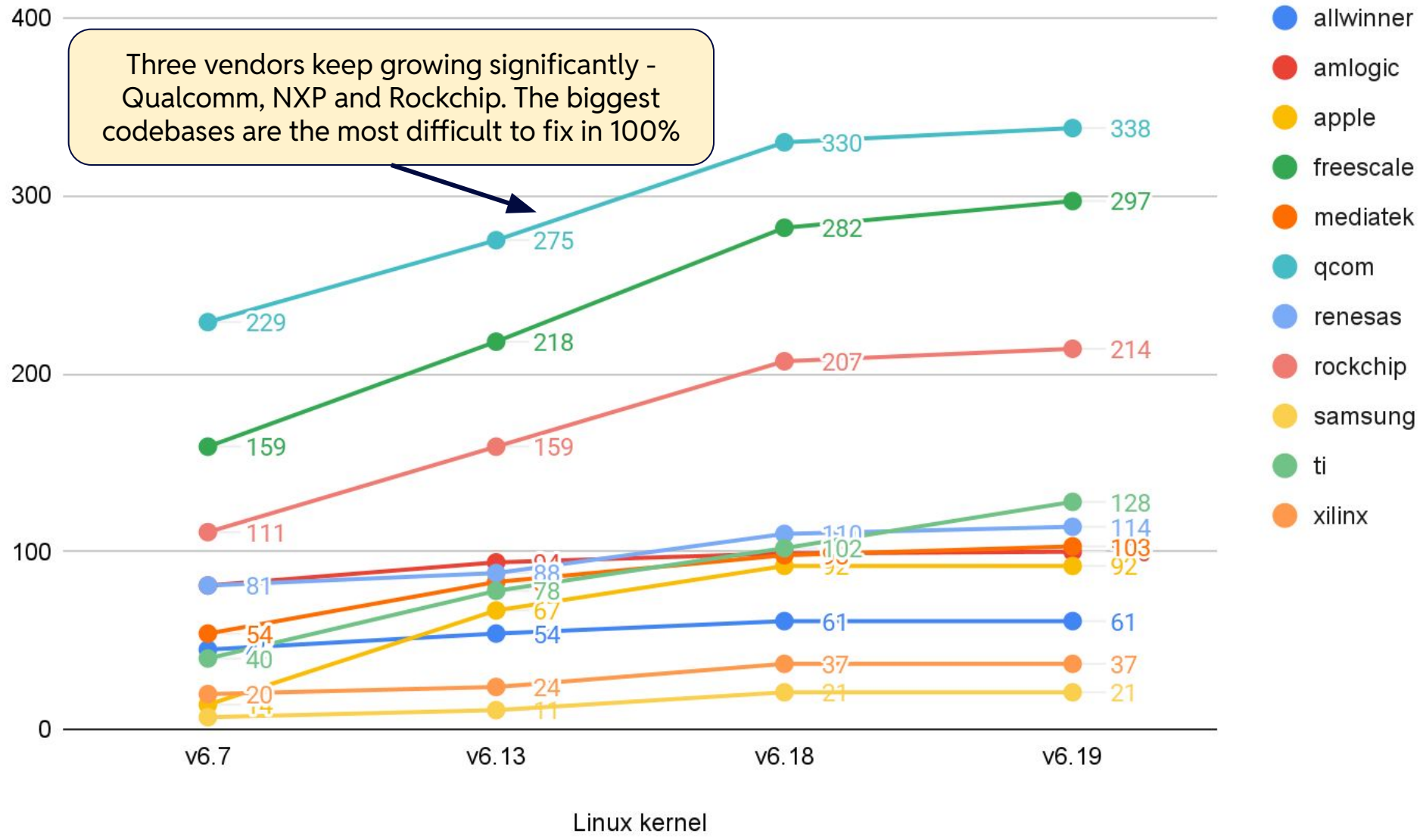
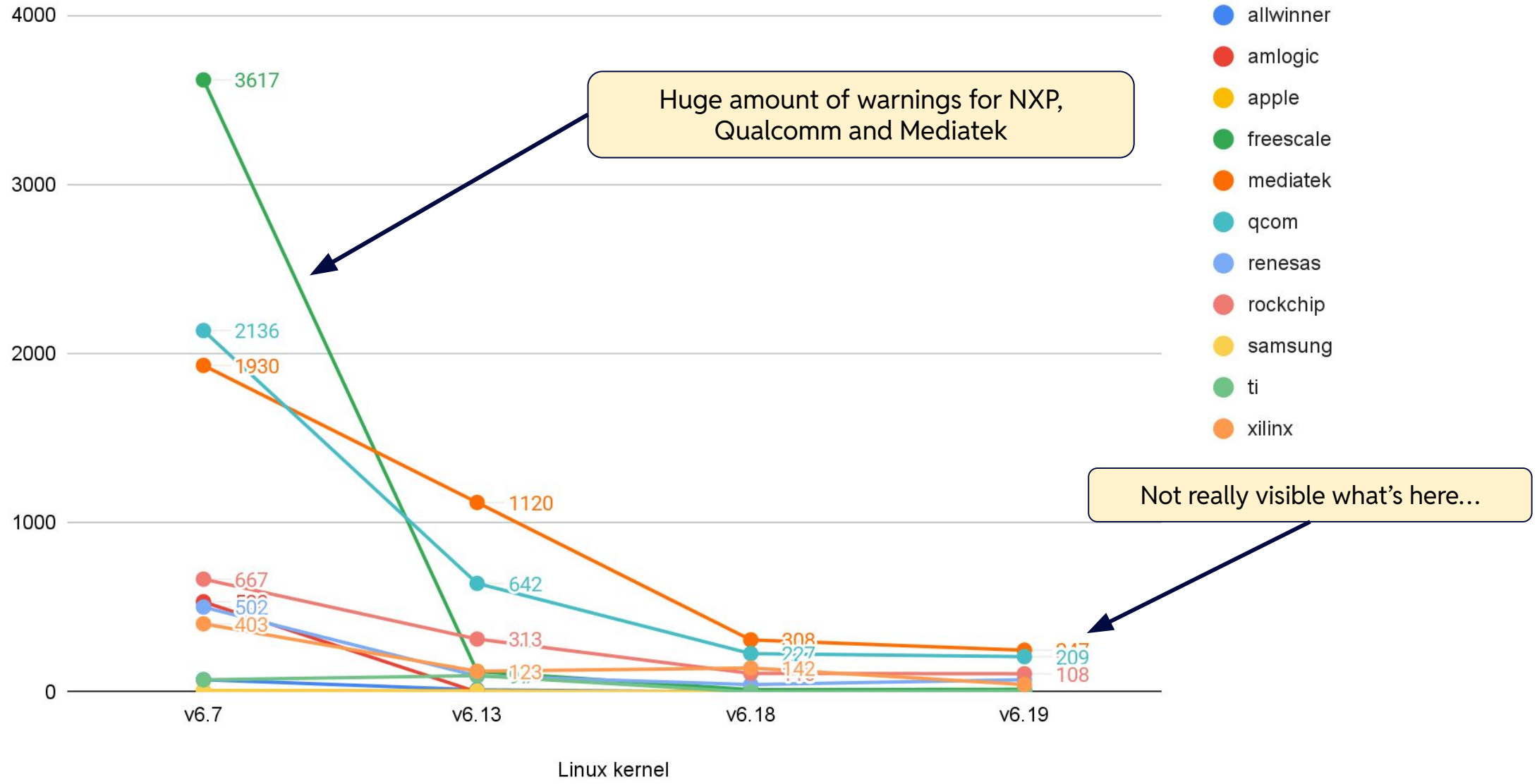
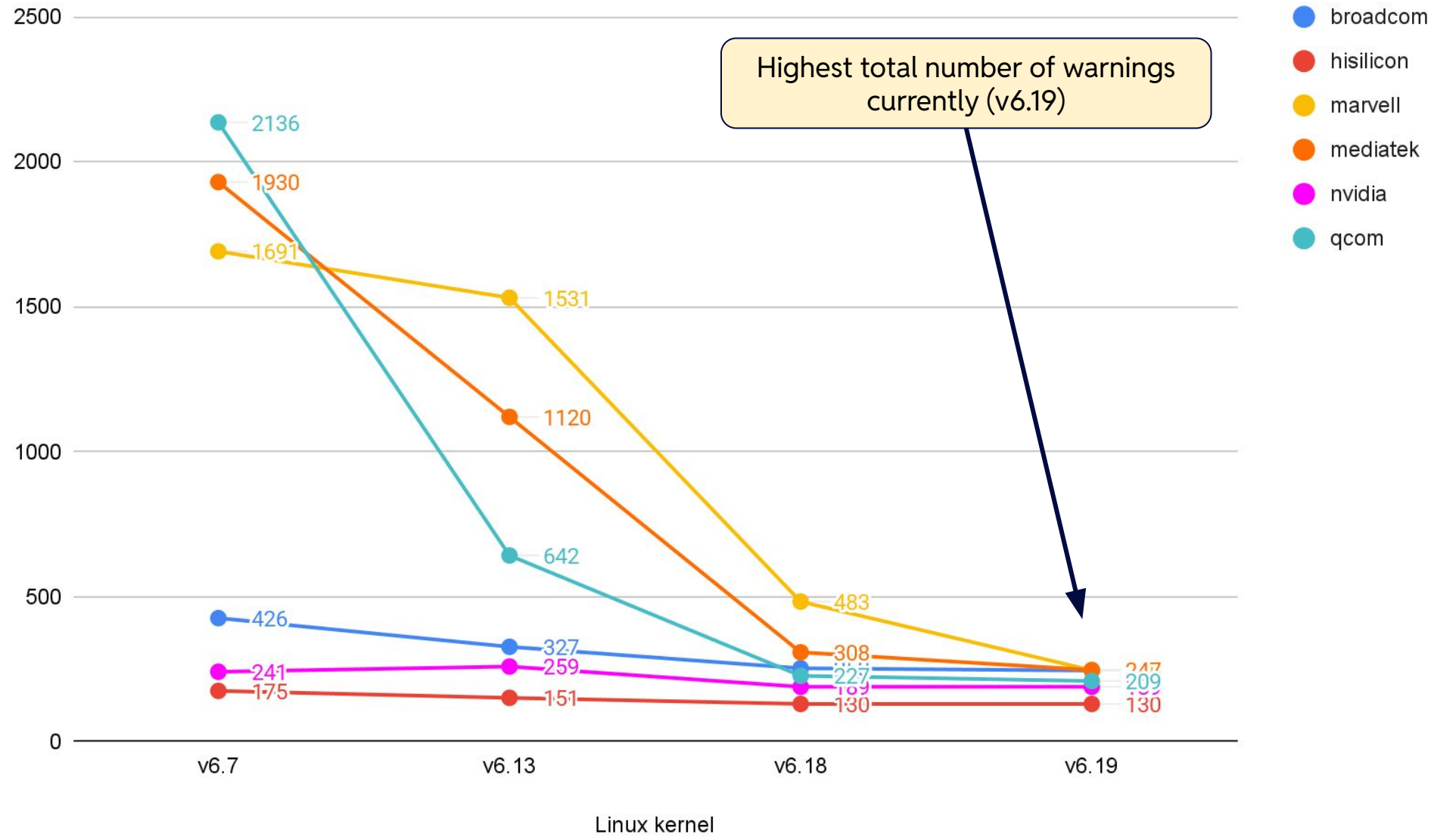


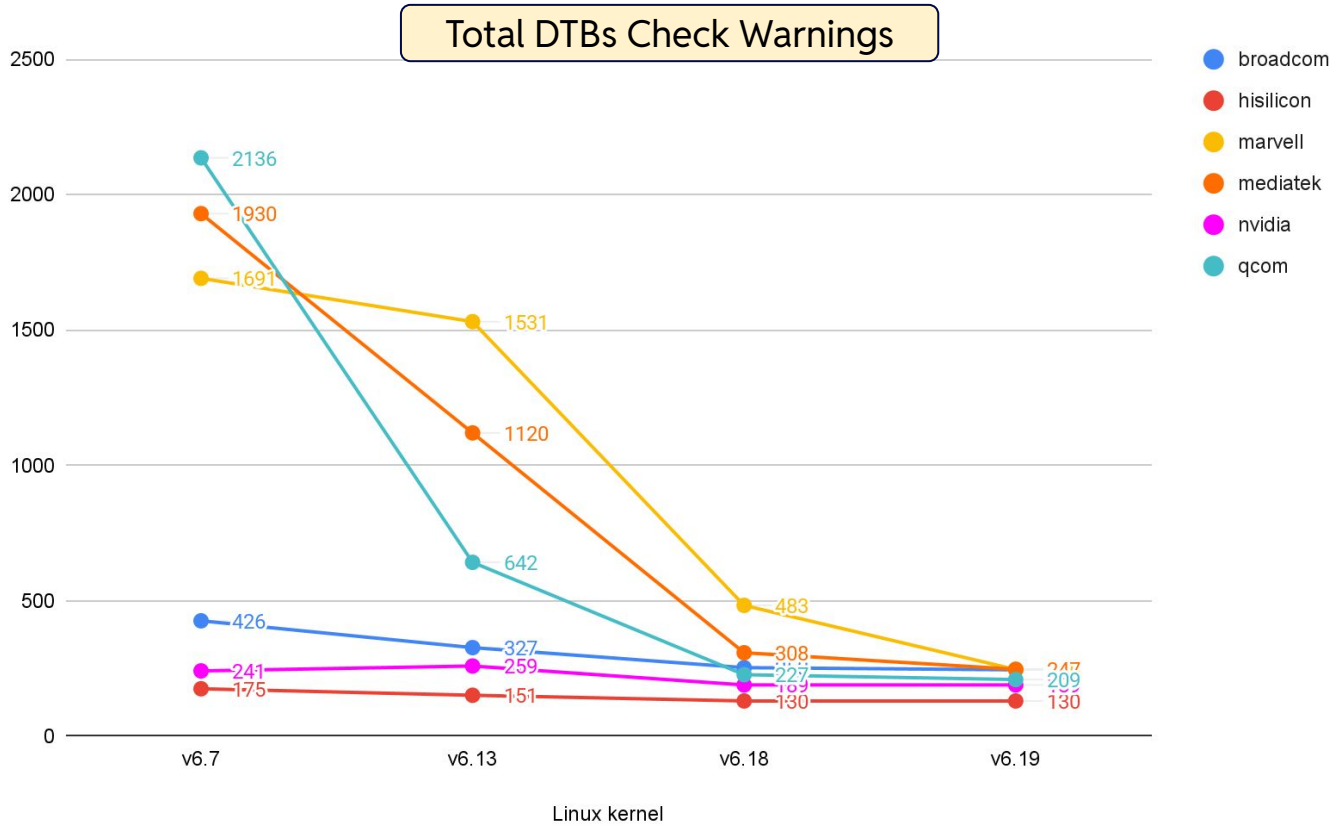
Total DTBs Check Warnings (Lower Better) - ARM64 (Most Active)



Total DTBs Check Warnings (Lower Better) - Highest To. Numbers



Total and DTBs Check Warnings / Target (Lower Better)



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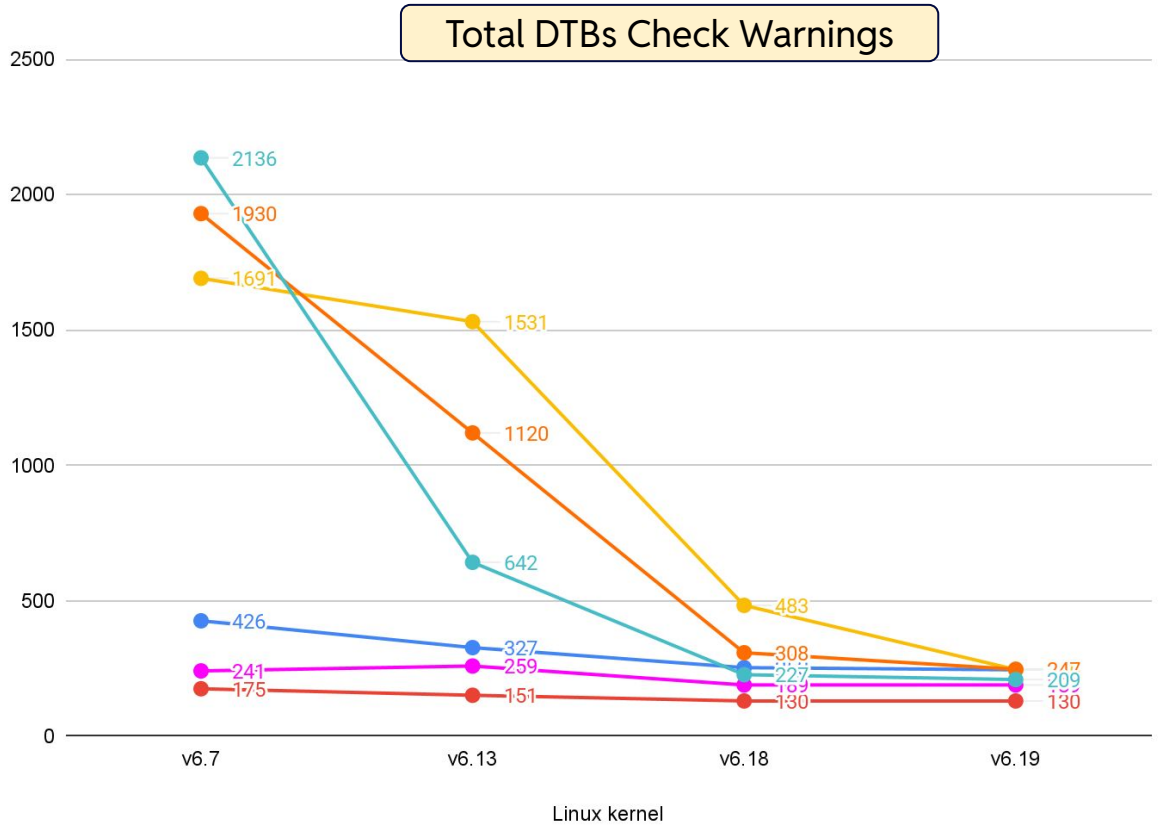

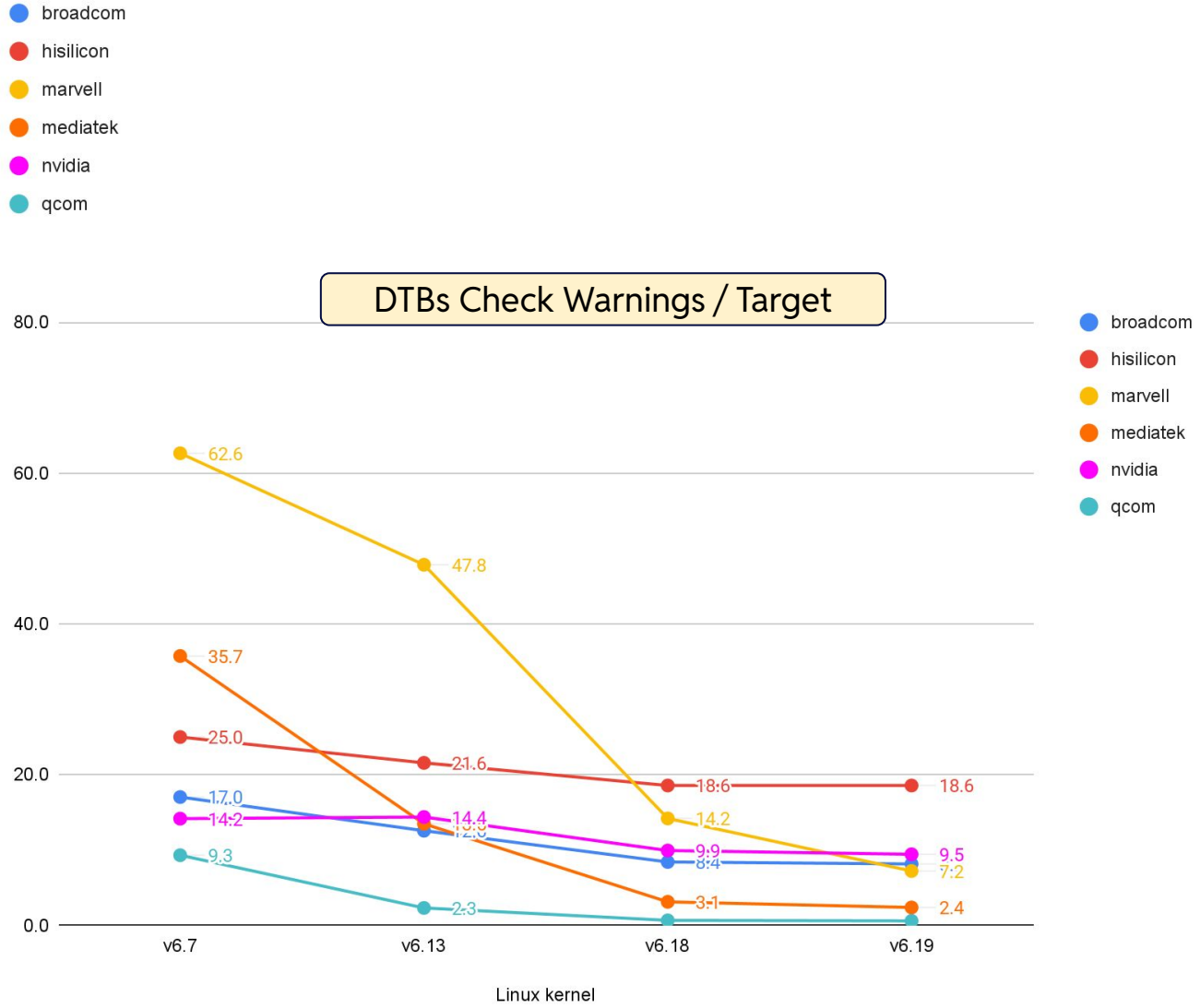

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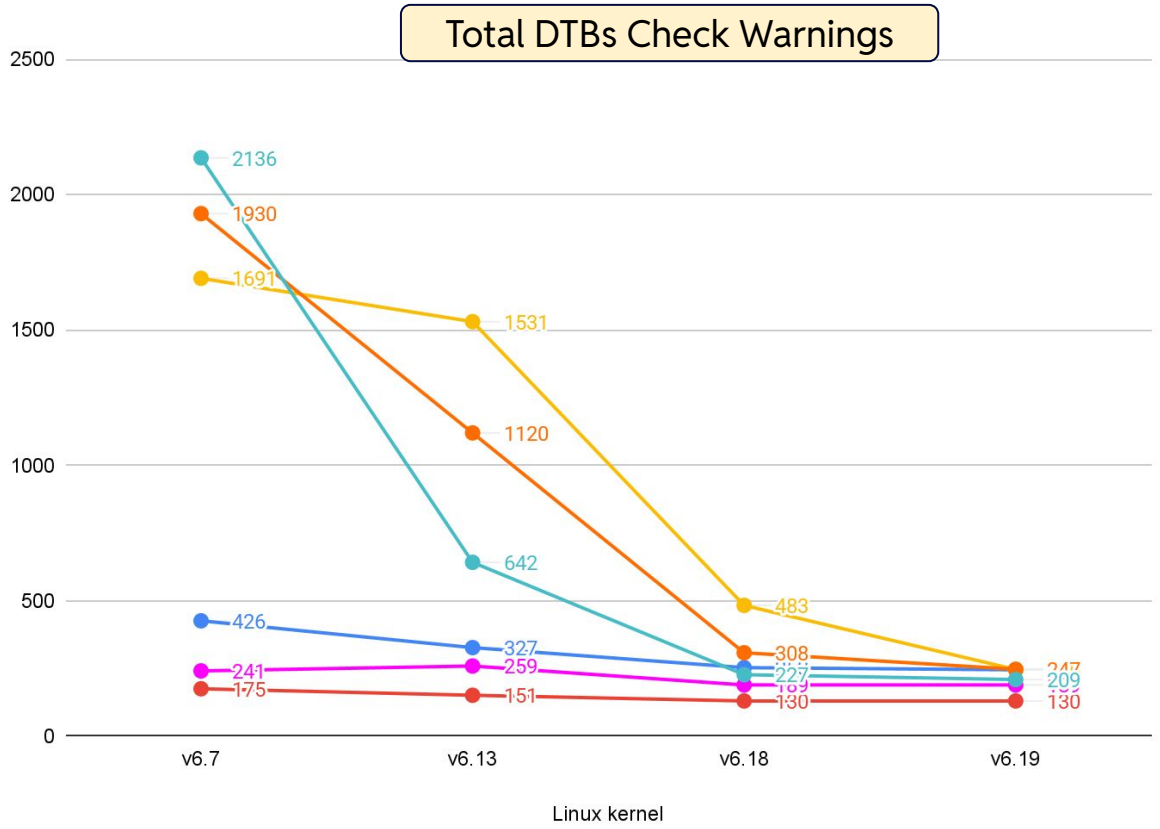
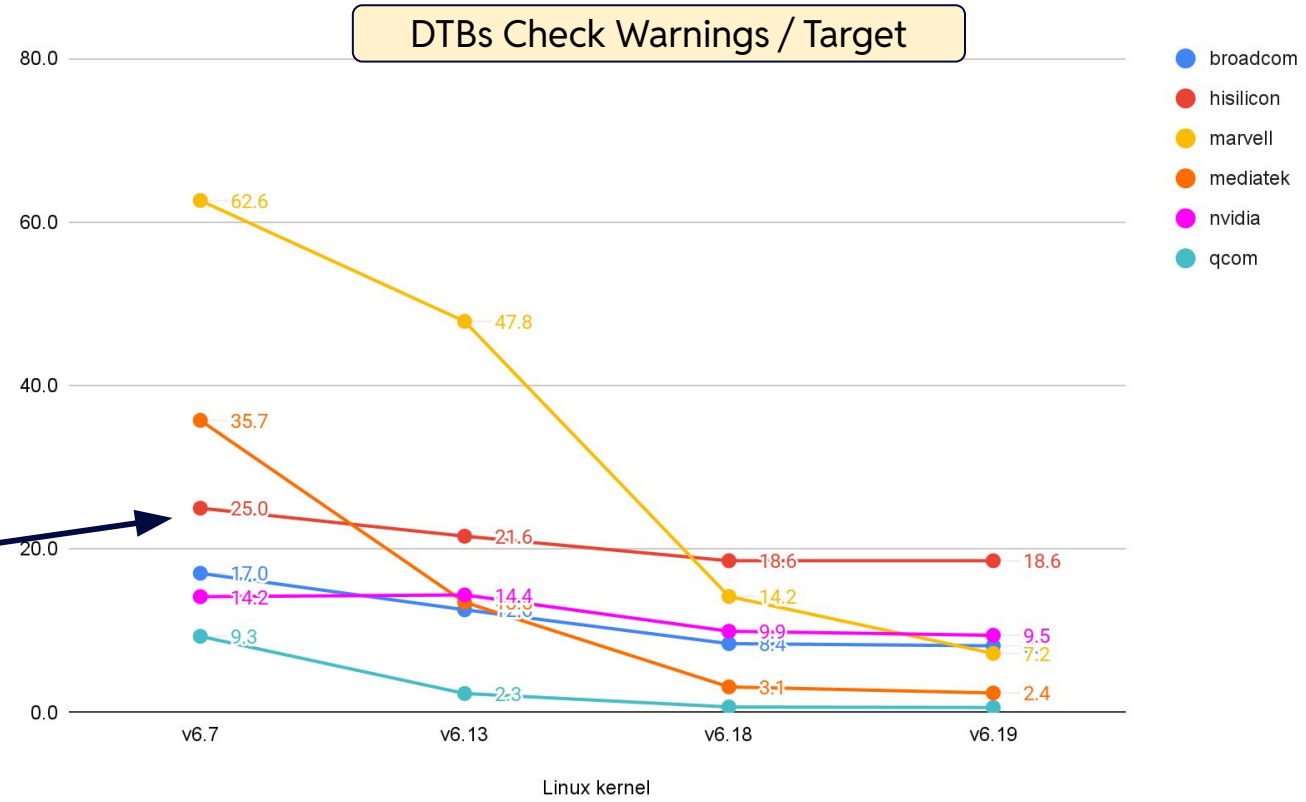


HiSilicon is not an active platform, nothing changing. Nvidia and Broadcom are moderately active, but not improving



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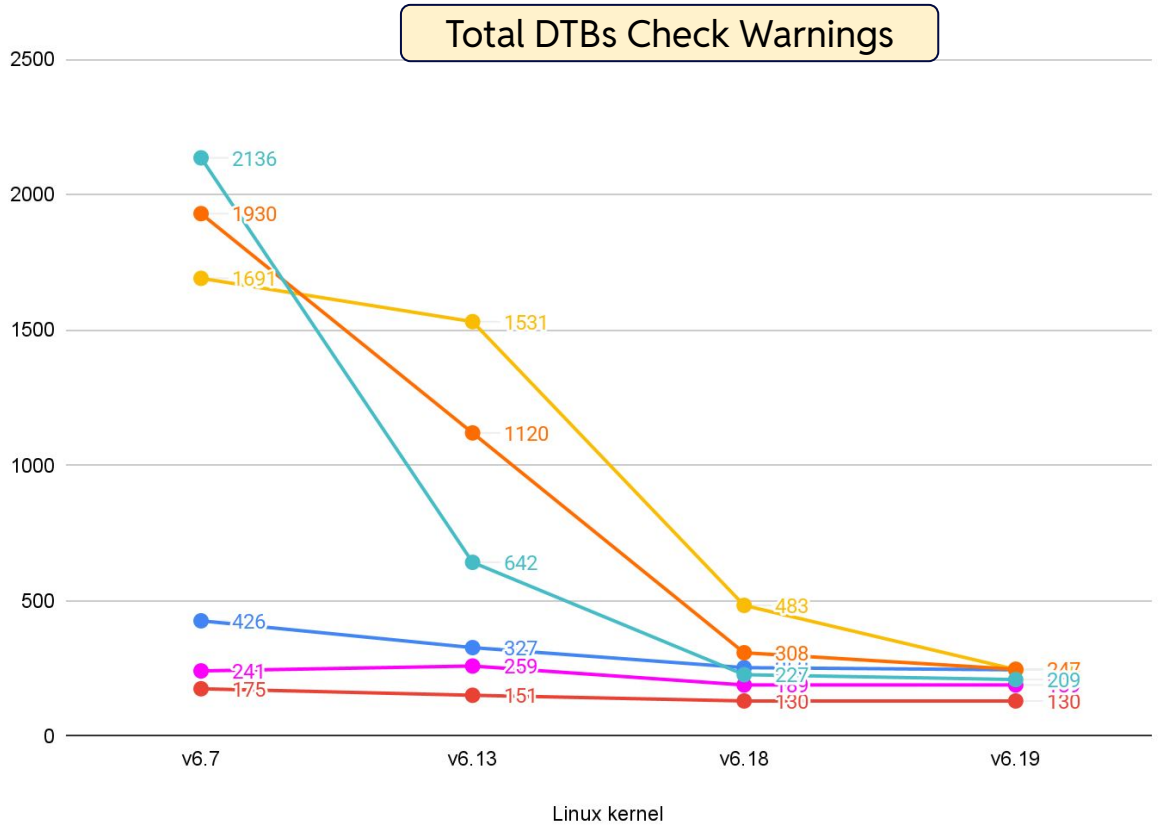

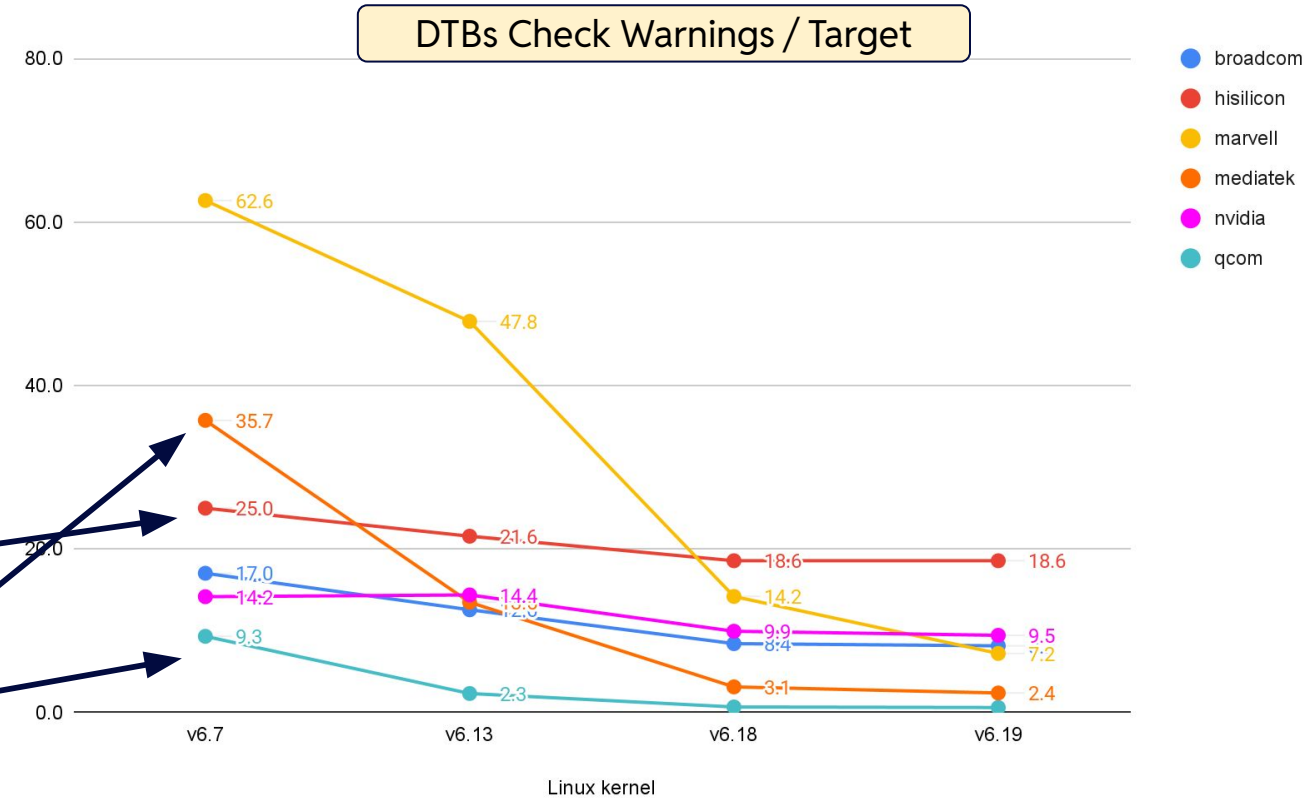

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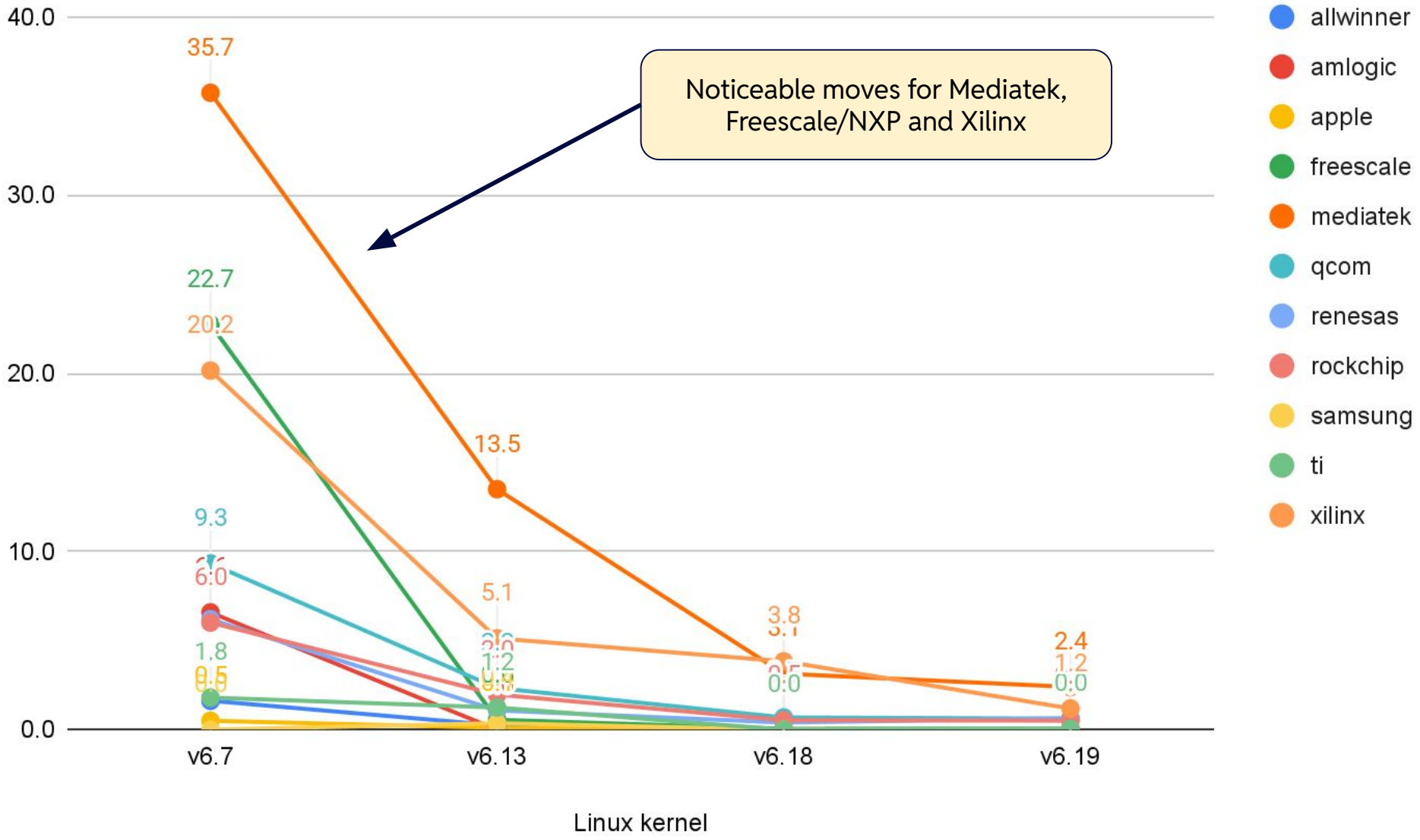
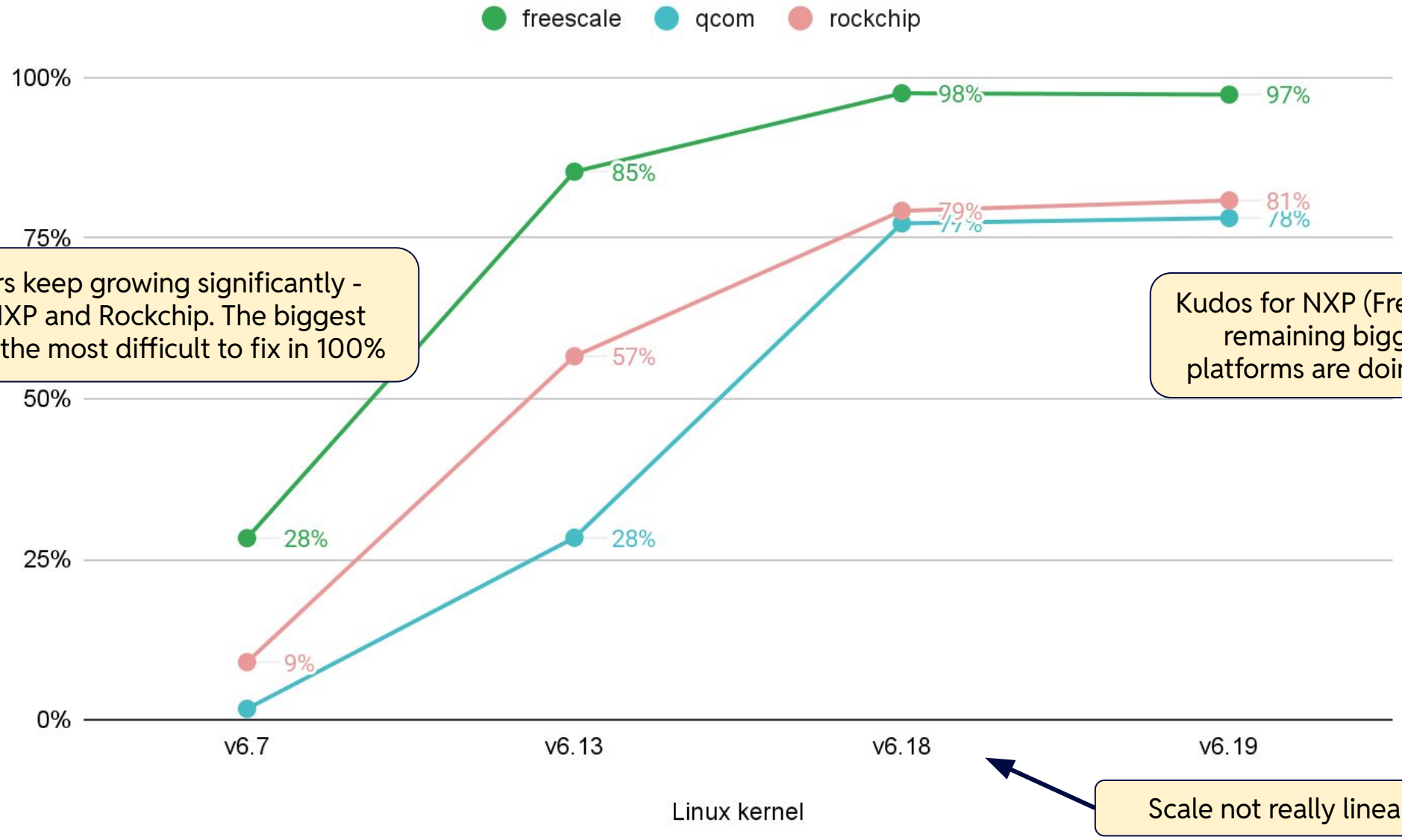
Qualcomm and MediaTek, very high in total numbers, are doing actually well

DTBs Check Warnings / Target (Lower Better) - ARM64 (Most Activ



Percentage of Warning-free Targets (Higher Better) - ARM64

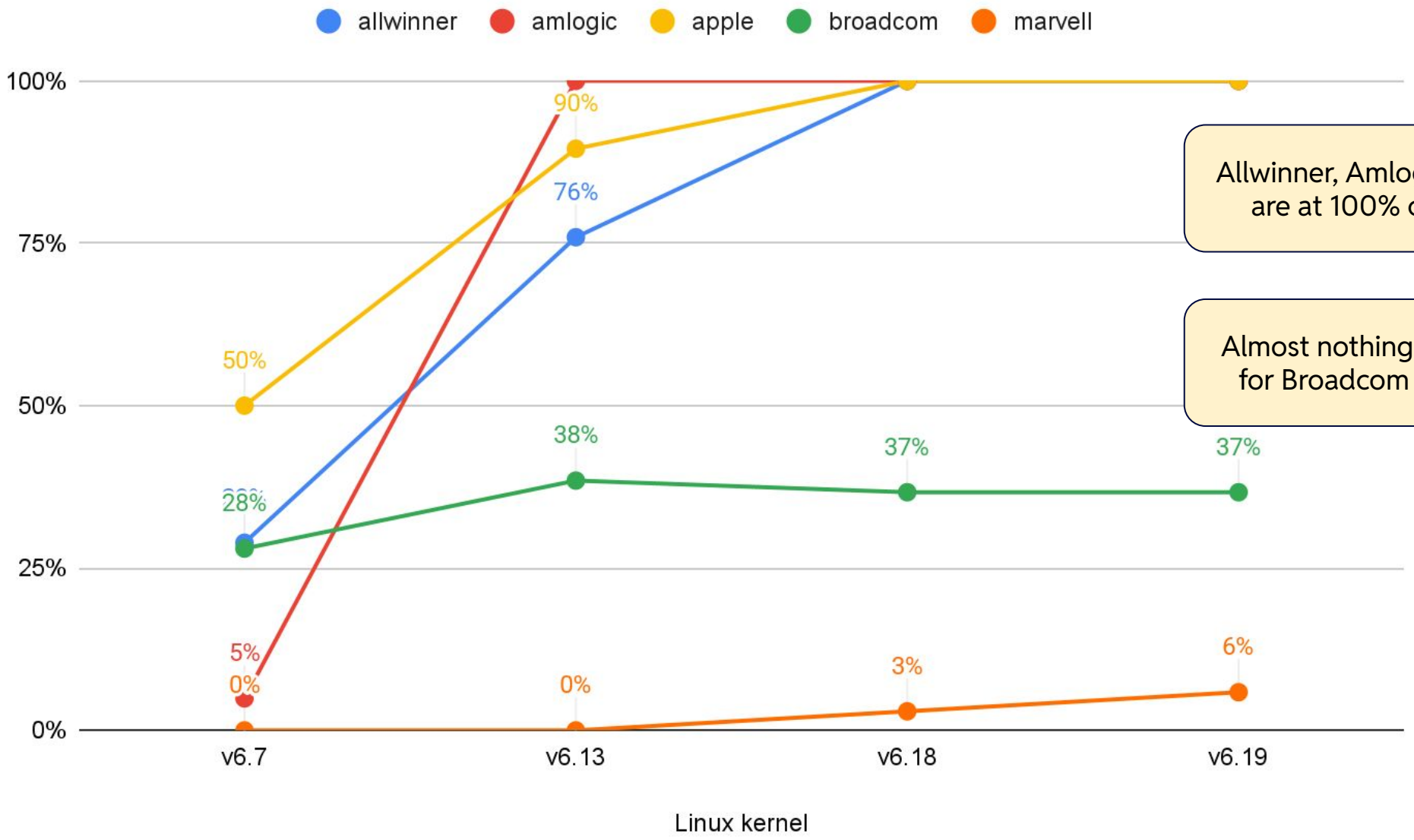


Three vendors keep growing significantly - Qualcomm, NXP and Rockchip. The biggest codebases are the most difficult to fix in 100%

Kudos for NXP (Freescale). Two remaining biggest SoC platforms are doing well too.

Scale not really linear

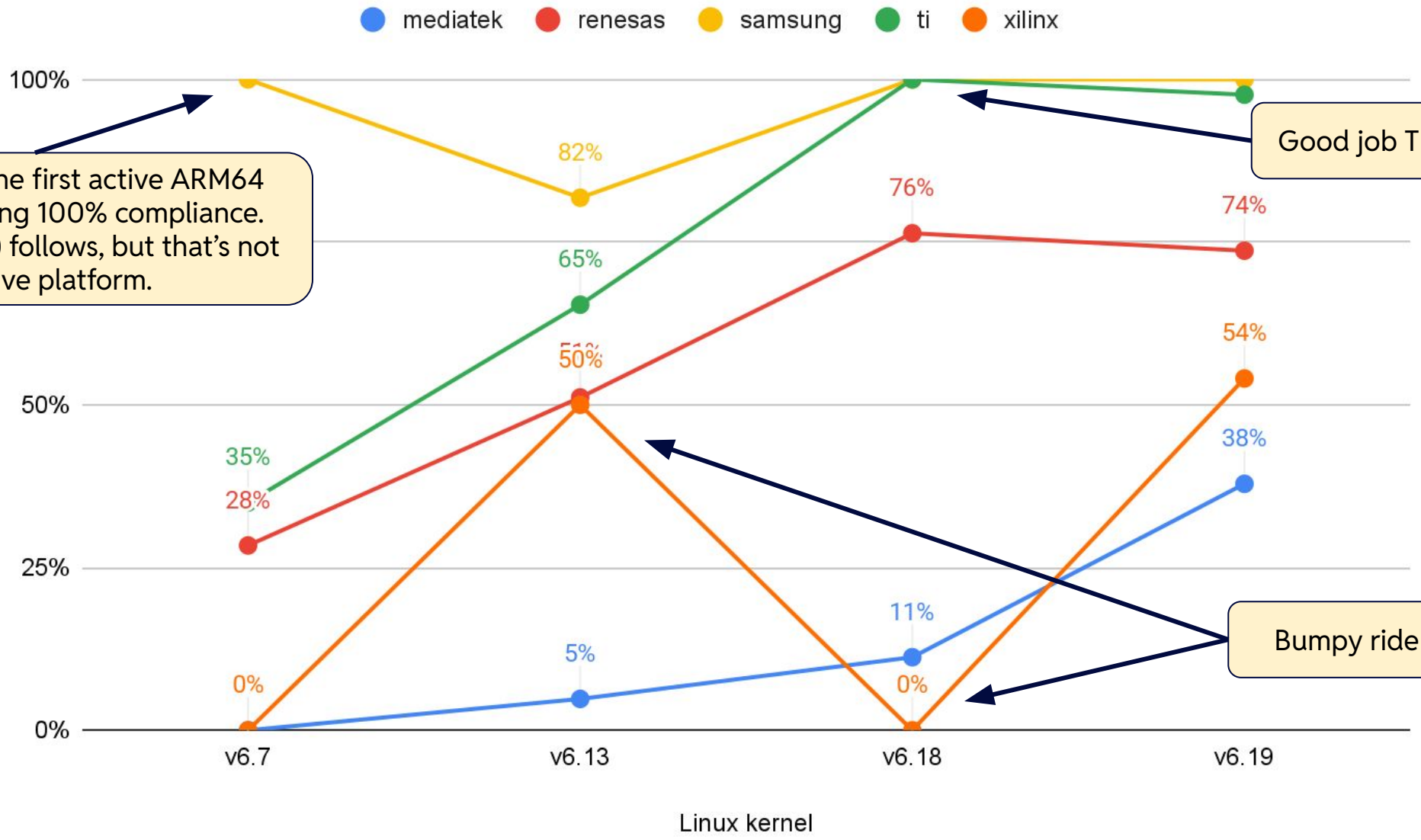
Percentage of Warning-free Targets (Higher Better) - ARM64



Allwinner, Amlogic and Apple are at 100% compliance

Almost nothing is happening for Broadcom and Marvell

Percentage of Warning-free Targets (Higher Better) - ARM64



Samsung was the first active ARM64 platform reaching 100% compliance. ST (with 1 target) follows, but that's not an active platform.

Good job TI getting to 100%!

Bumpy ride of AMD/Xilinx

Warning-free Platforms (Higher Better) - ARM64, v6.19 (next)

SoC Platform	Percentage of Warning-free Targets	No. Targets	LoC
actions	100%	2	1007
airoha	100%	1	509
allwinner	100%	61	19096
altera	100%	3	1158
amazon	100%	2	725
amlogic	100%	100	37138
apple	100%	92	26375
axiado	100%	1	604
blaize	100%	1	361

SoC Platform	Percentage of Warning-free Targets	No. Targets	LoC
bst	100%	1	123
cix	100%	1	1080
intel	100%	9	2718
samsung	100%	21	36021
sophgo	100%	1	204
synaptics	100%	2	378
ti	97.6%	128	69486
freescale	97.3%	297	155467

Platforms with Only Warnings - ARM64, v6.19 (next)

SoC Platform	Percentage of Warning-free Targets	No. Targets	LoC
apm	0%	2	2094
bitmain	0%	1	413
cavium	0%	2	660
hisilicon	0%	7	12743
lg	0%	2	478
microchip	0%	5	2403
nvidia	0%	20	45495
realtek	0%	9	1203
socionext	0%	8	3580
toshiba	0%	2	788

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    - Thank you contributors for keeping it at 100% :)
- Kudos to several active platforms reaching 100%
  - Allwinner
  - Amlogic (early, v6.12!)
  - Apple
  - Intel/Altera (at v6.19)
  - NXP/Freescale
  - Texas Instruments

Thank you

Krzysztof Kozlowski
krzk@kernel.org, @krzk@social.kernel.org

Thank you