Bootchart 2

what you see under the hood ...
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"Stand at the crossroads and look; ask for the ancient paths, ask where the good way is, and walk in it, and you will find rest for your souls..." - Jeremiah 6:16

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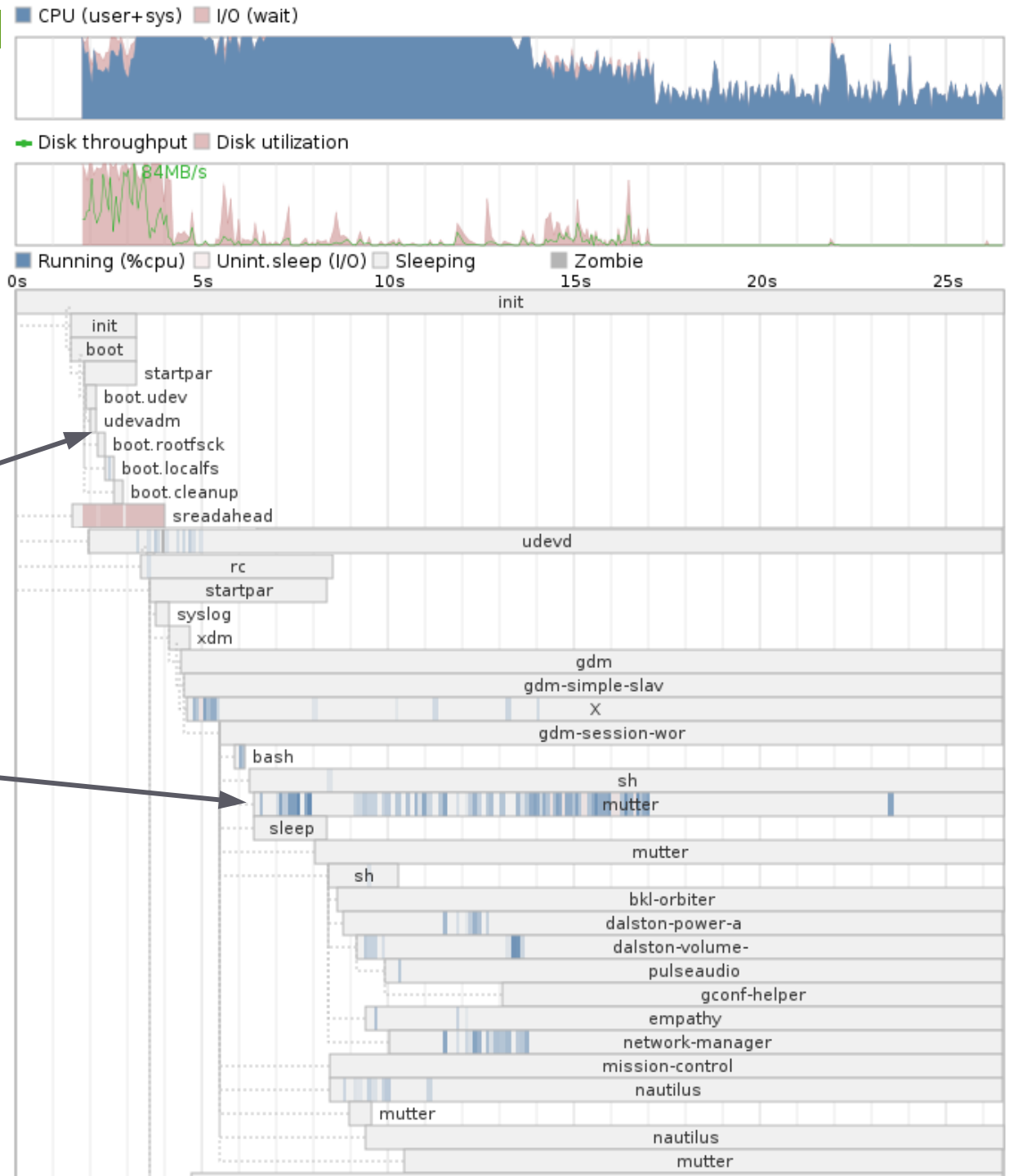
Bootchart 1

Bootchart 1 – it rocked

- http://www.bootchart.org
  - Ziga Mahkovec <ziga.mahkovec@klika.si>
  - Met Owen Taylor's challenge ...
  - showed us for the first time what was going on
- We noticed a lot was wrong in booting
  - and started to fix it.
  - boot times of 1 minute+ - common
  - years of accumulated bug fixes in booting:
    - *Yeah, that would be faster, but what about NFS root, with an NTP server, and remote syslogging !? - I need to fix that fast !*
  - the problems were **so** prevalent, this was no issue

Bootchart 1

- Poor resolution – 25 pixels per second, and lower res data collection.
- Processes appear to take no time, when we know they are busy: eg. boot.udev, udevadm
- Many processes appear to take no CPU time, even at startup when they are linking.
- Bootchart 1 - less truthful even than gdb !



Bootchart 1 – other issues ...

- Initial version rendered using **Java**
  - Not ubiquitous on Linux, requires compilation
- Enter: pybootchartgui
  - http://code.google.com/p/pybootchartgui
  - Anders Norgaard & Henning Niss' blow for freedom
  - Hackable: python / cairo rendering – to SVG, PNG
- Initial version data collection written in **shell**
  - `while true; do cat /proc/*/stat > log-file; done`
- Bootchart-collector:
  - Scott James Remnant 's contribution ...
  - re-write in C for faster collection
  - still using low-res `/proc/<task>/stat` data

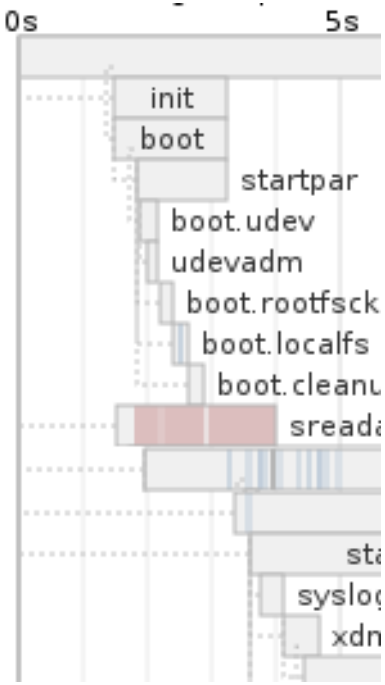
Bootchart 2

for the world of the
ten second boot

Bootchart 2 – a new approach

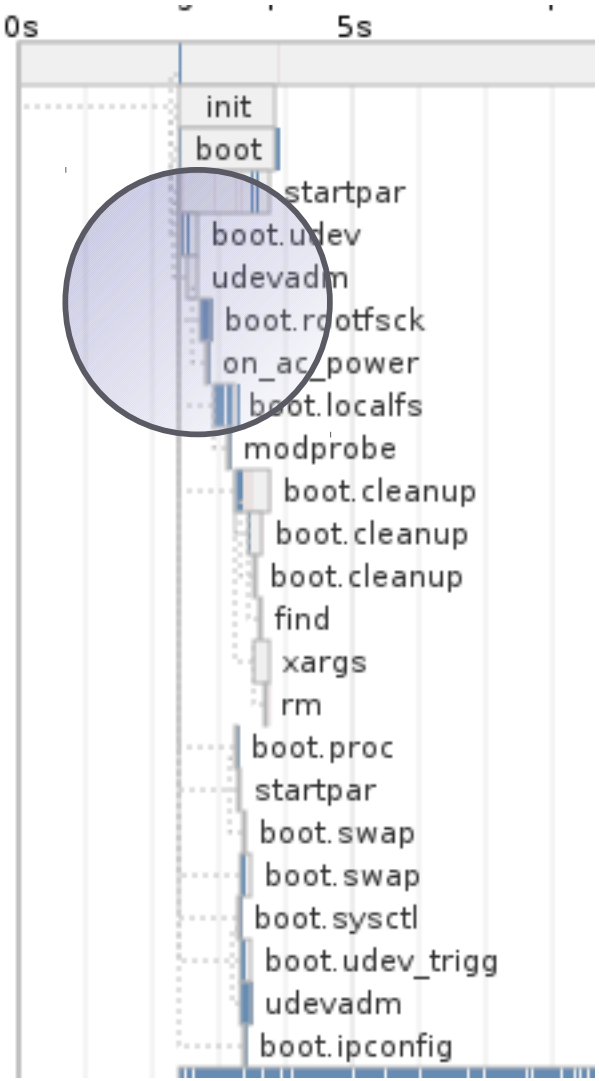
- I re-wrote bootchart-collector:
  - Use kernel's taskstats interface: **ns** accurate time accounting for processes.
  - Interface baroque, unpleasant, and inefficient
    - **But** – available in all shipping kernels (unless you turn it off -go Moblin!)
  - allows us to say: “which process used how much CPU”
  - Uses PROC_EVENTS to get real process parentage
    - remove shocking pacct nonsense
- Integrates & improves pybootchartgui
  - better coupling with the collector - key.

Old



New, and differently broken bootchart !

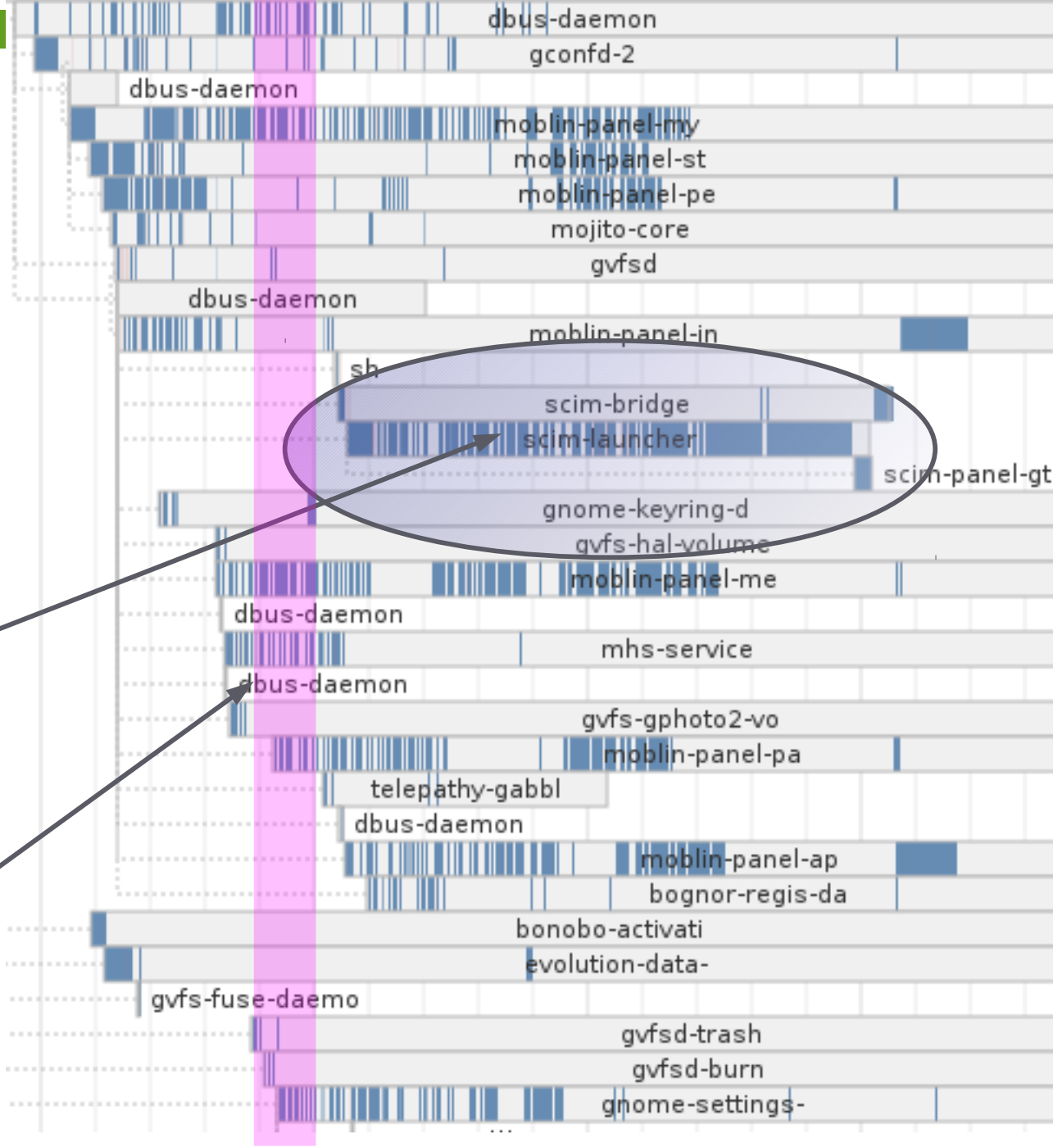
New



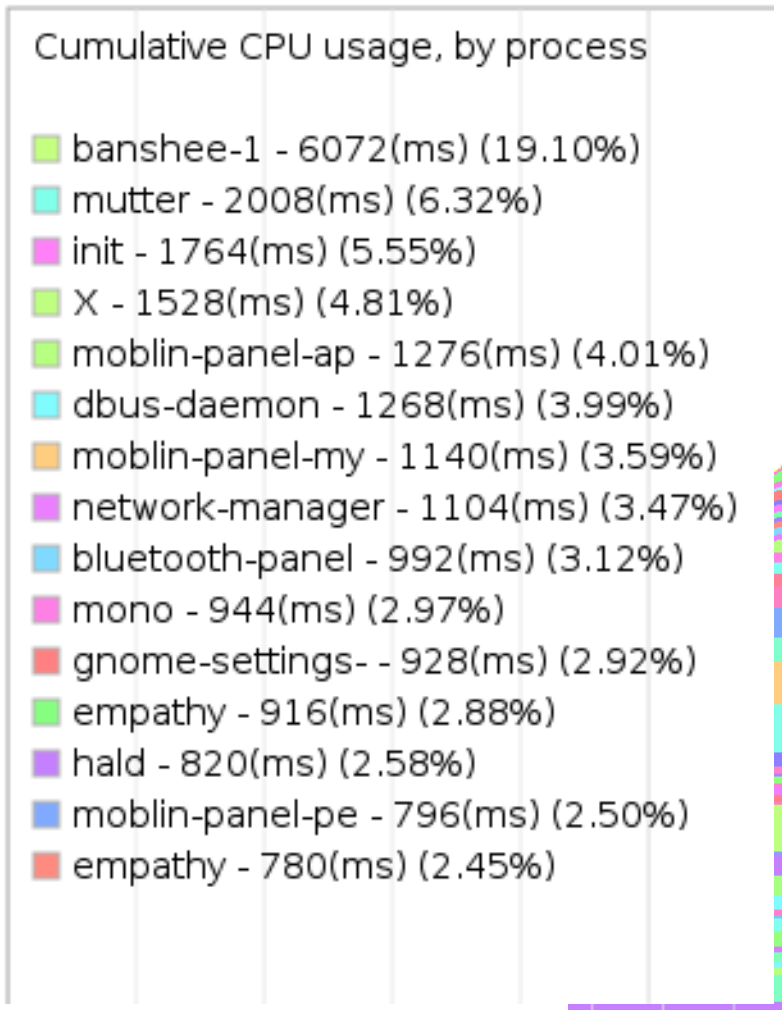
Which in bulk has lots of little lines:

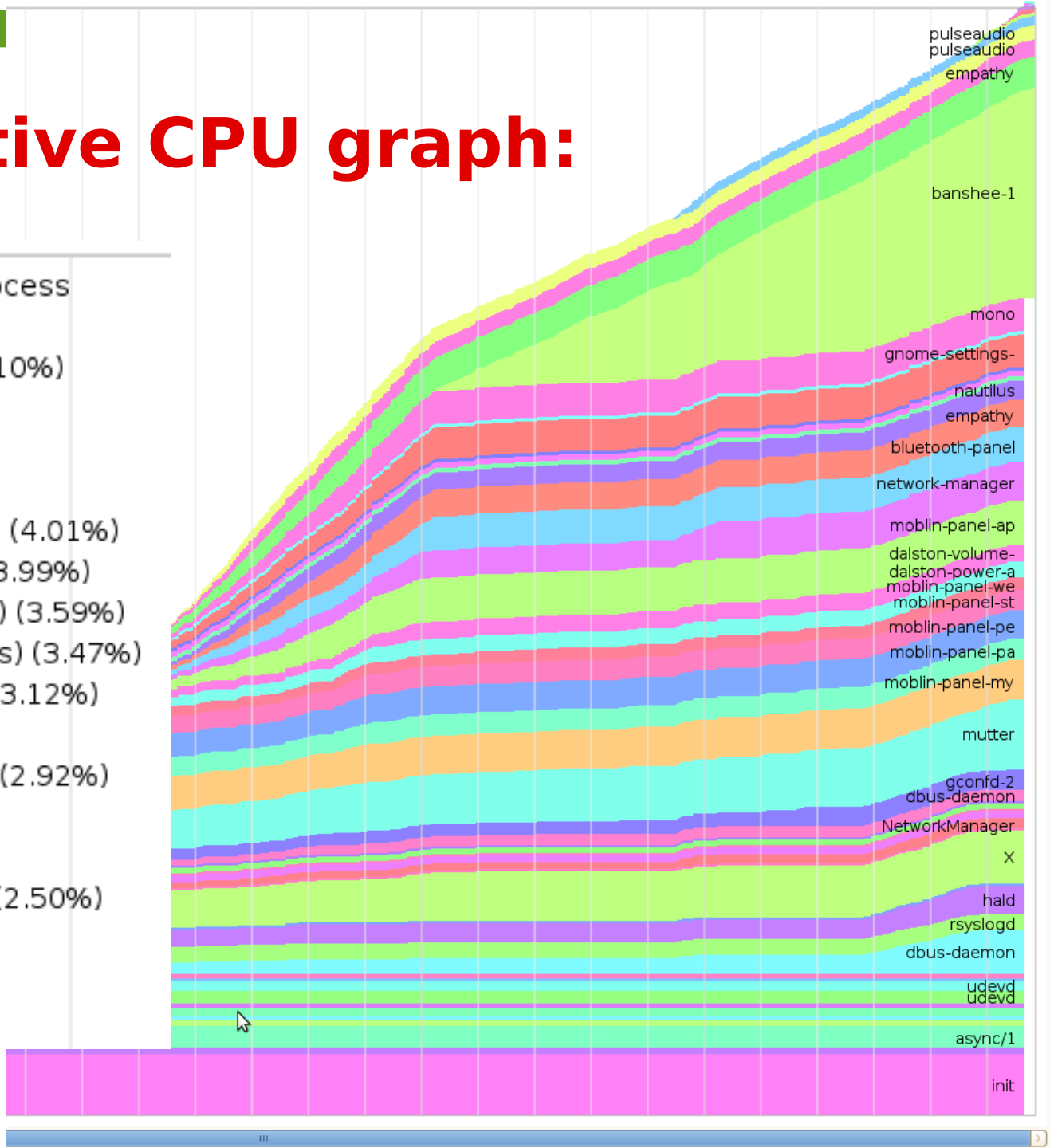
Who is a naughty process then ?

Killed feature to add alpha transparency based on %age of CPU used



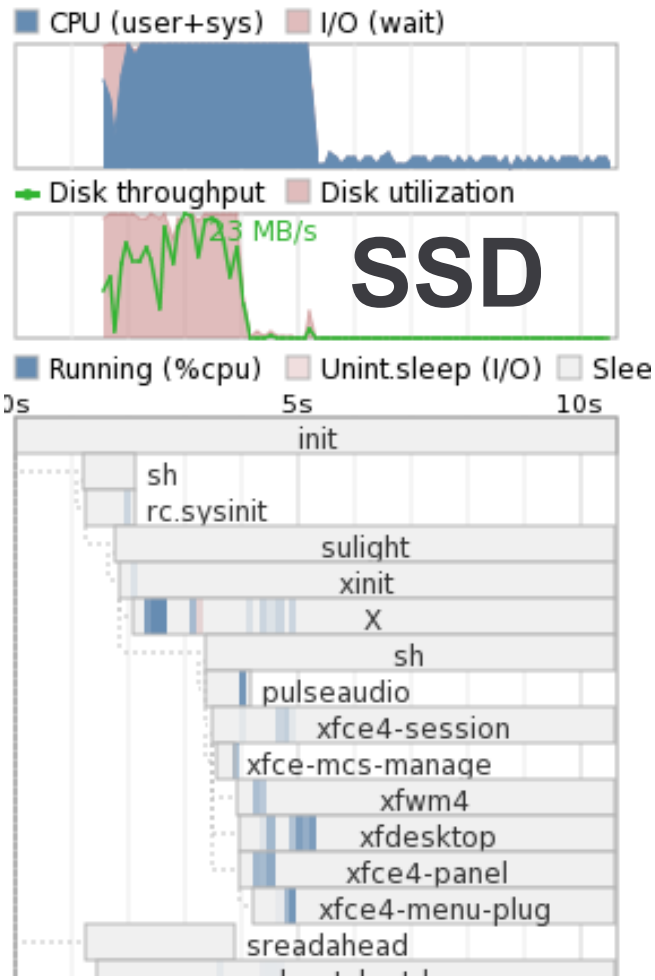
Cumulative CPU graph:



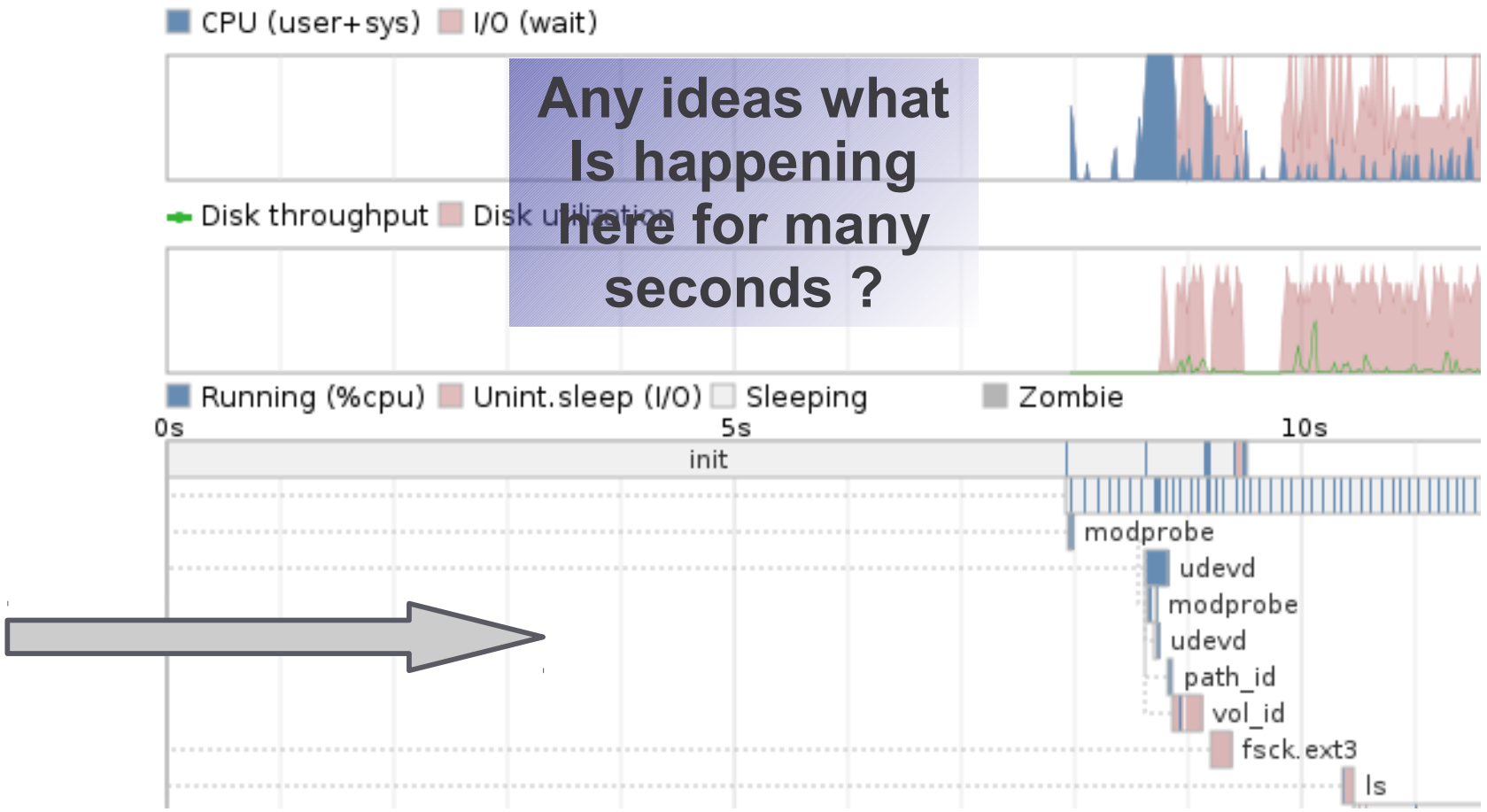


Spot the SSD ...

- Interleave 'sleep' (or CPU) and 'read'



The icing – kernel boot-charting



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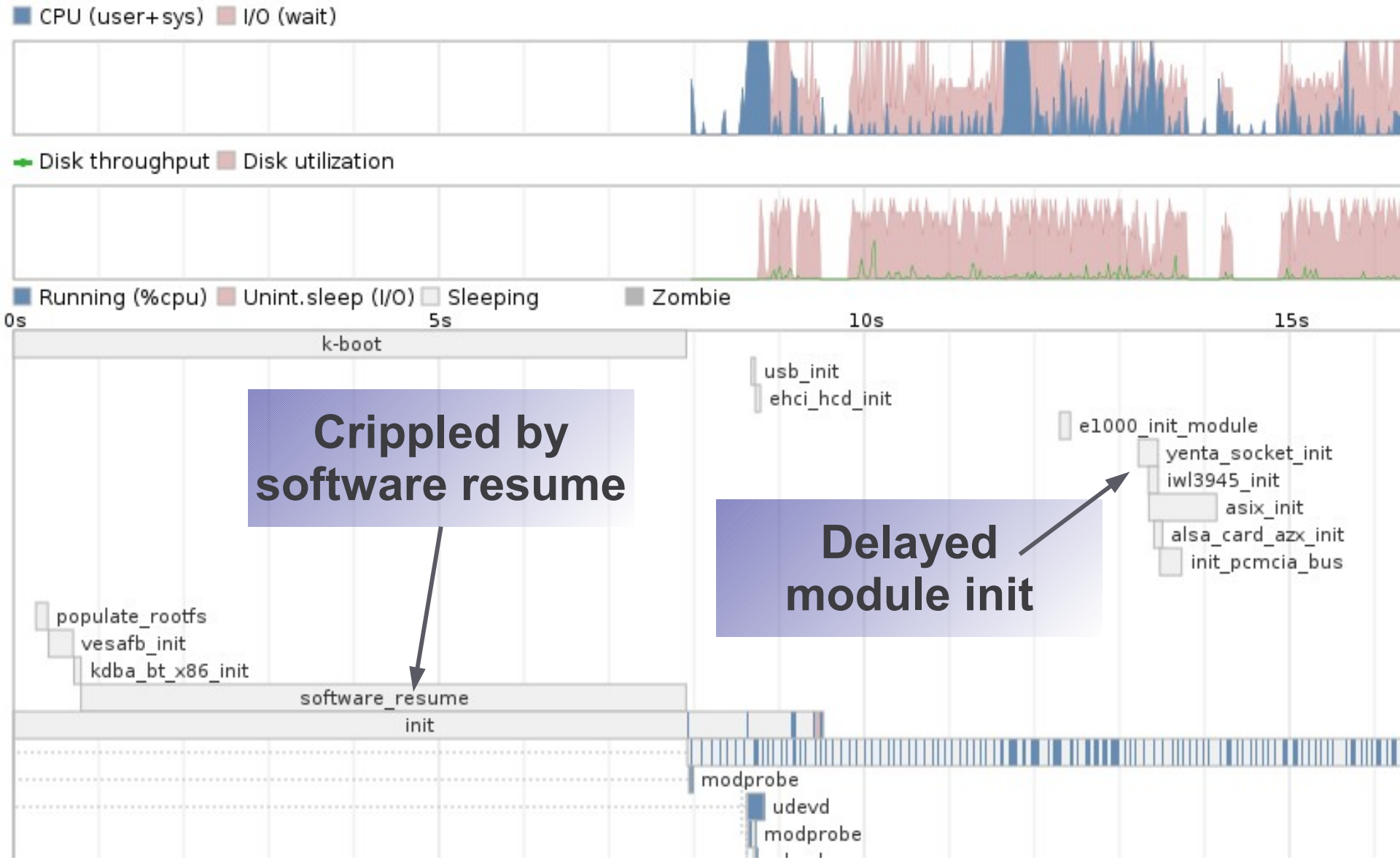
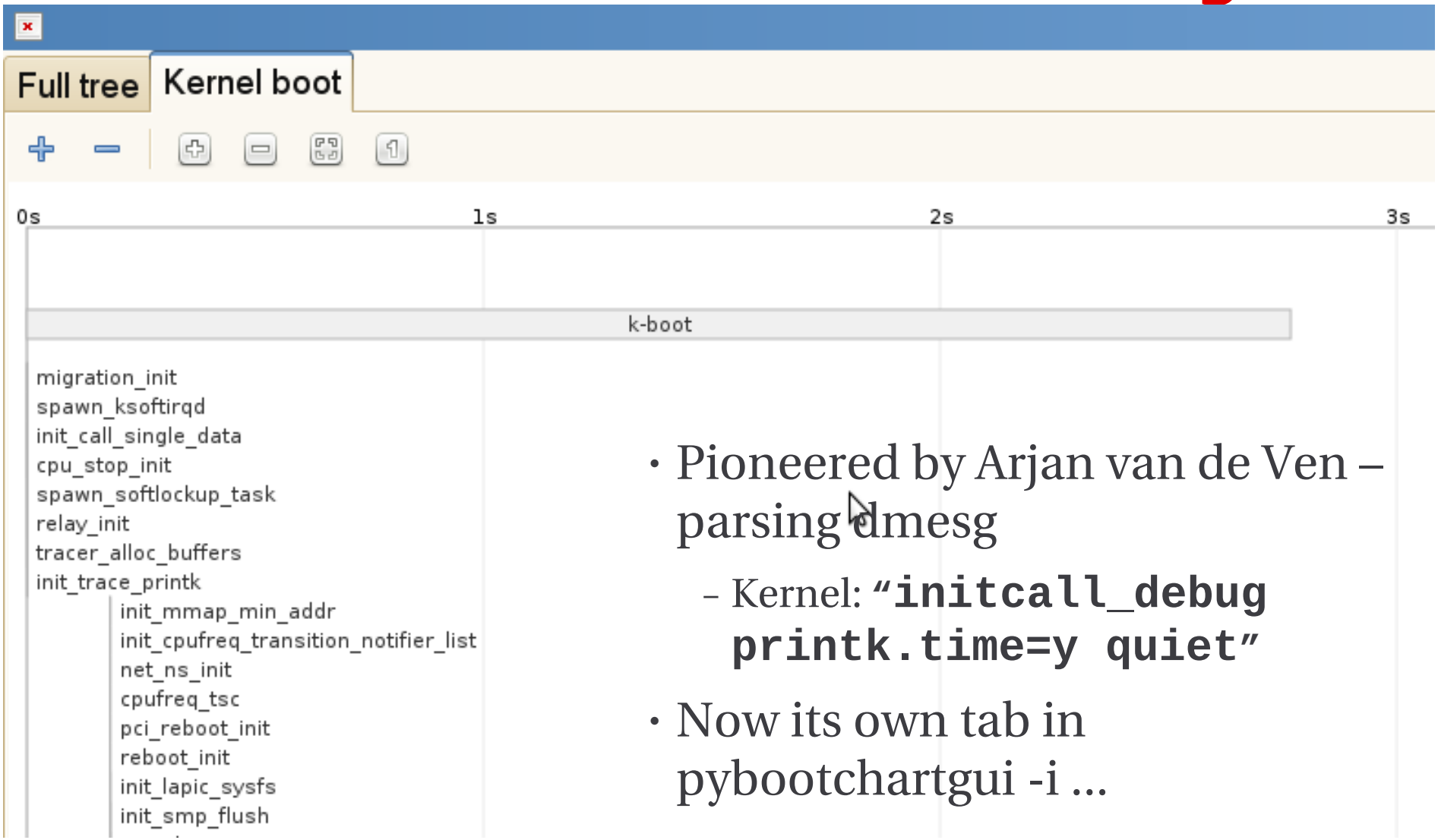


More detailed kernel charting:



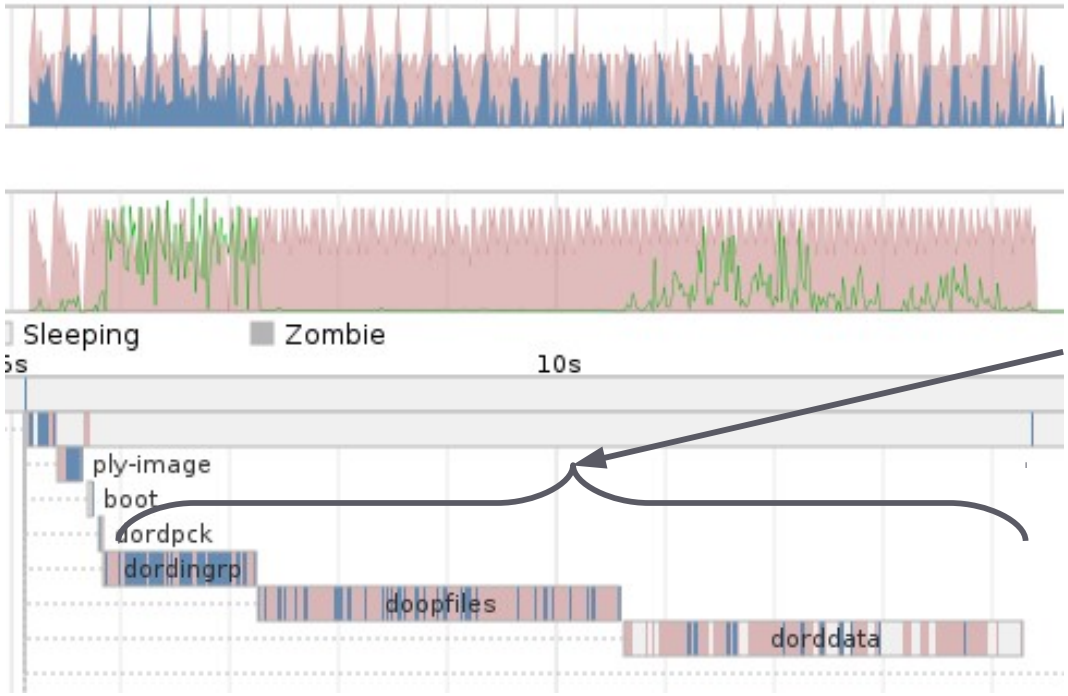
- Pioneered by Arjan van de Ven – parsing dmesg
  - Kernel: **"initcall_debug printk.time=y quiet"**
- Now its own tab in pybootchartgui -i ...

Earlier booting ...

- rdinit=bootchartd
  - Charting from the earliest initrd …
-

More tools and tricks:

- A deeper dive:
  - The process is slow but where !?
  - `prctl(PR_SET_NAME, "HelloMu", 0, 0, 0);`



ureadahead

Demo

Missed tricks / future fun

- Use: */proc/<pid>/schedstat*
  - Auke Koke's (nice) bootchart does this
- **Or** better kernel interfaces:
  - Polling /proc/<pid>is for lamers – very little changes each timeslice
  - Using taskstats – for-each-thread, for-each-cycle is even worse
  - We need to use **sched_switch** kernel tracing to reduce thrash
- More truthfulness:
  - Scale output to remove bootchart side-effects
  - Back propagate I/O delays in the rendering
- Better GUI
  - Interactive / remote rendering …
  - Graph swap / I/O delay inside process bars
  - Expand / collapse process trees interactively

Other helpful tooling ...

- In-kernel tool for better svg rendering:
  - dmesg | perl scripts/bootchart.pl > foo.svg
- Timechart – even more detailed CPU foo
  - http://blog.fenrus.org/?p=5 - Arjan's blog.
- Various magic scripts for **systemtap**
  - **http://git.fedoraproject.org/git/?p=tuned.git**
  - **http://git.fedoraproject.org/git/?p=tuned.git;a=blob_p**
    - Various scripts of goodness
    - What processes are taking what time

Conclusion / Q&A

- Bootchart2 reaches places other boot charts cannot.
  - http://github.com/mmeeks/bootchart
  - Plenty more to do there, grab me afterward
    - python hackers ? ****Package Me !****
- Getting better data is a pre-requisite for optimising
  - Never optimize without profiling
  - Never optimise without submitting a botchart2 patch :-)
- Thanks – to all the people that did it [mostly not me]
  - Particularly Riccardo Magliocchetti (co maintainer)

Oh, that my words were recorded, that they were written on a scroll, that they were inscribed with an iron tool on lead, or engraved in rock for ever! I know that my Redeemer lives, and that in the end he will stand upon the earth. And though this body has been destroyed yet in my flesh I will see God, I myself will see him, with my own eyes - I and not another. How my heart yearns within me. - Job 19: 23-27