

Power Saving Linux / Windows



Undervolting

Udev

Power limiting

Sysctl

Motivation Undervolting

$$P = C \cdot f \cdot V_{DD}^2$$

P := Power usage of a CPU

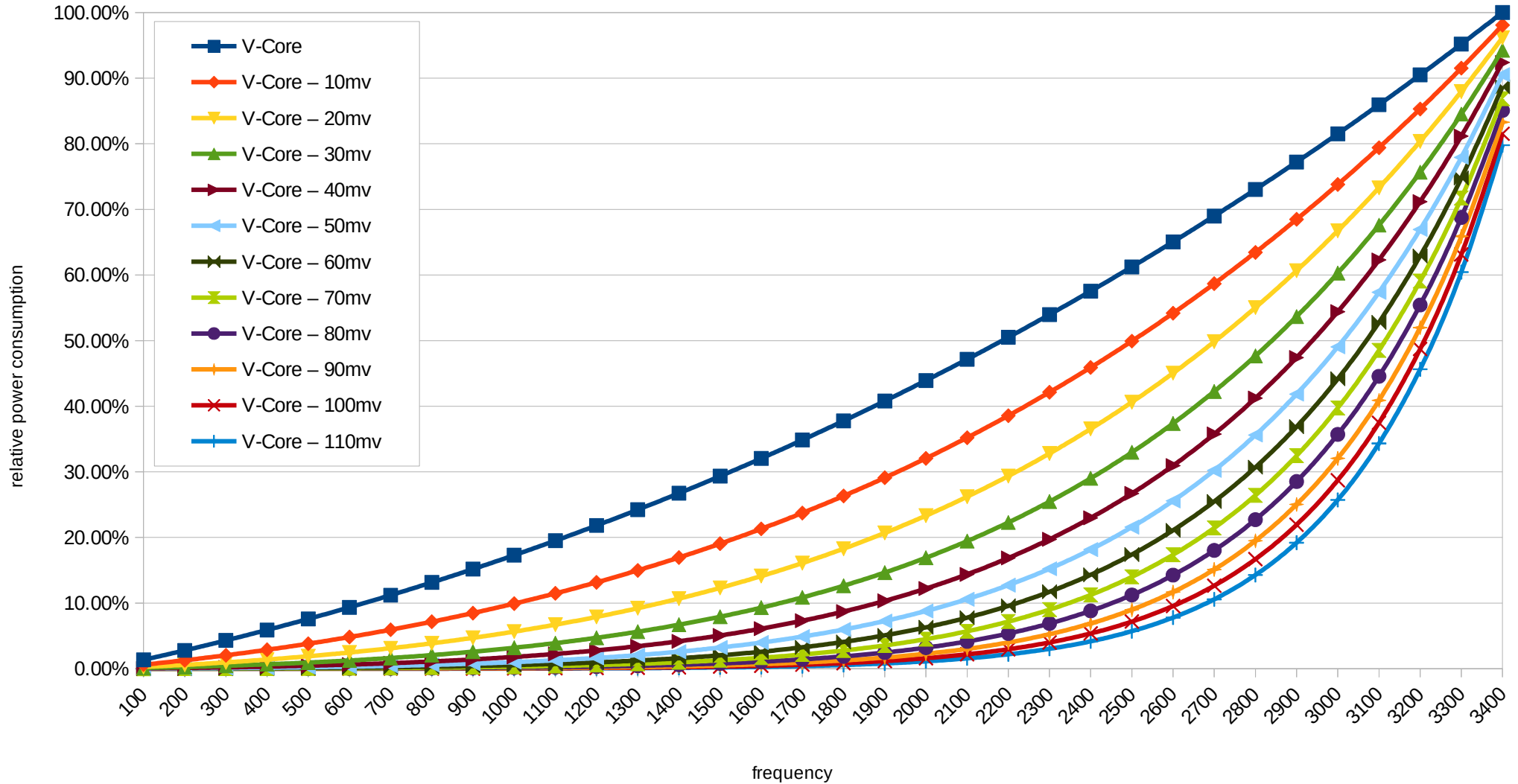
C := capacitance of all logical Gates of the CPU

f := clock frequency of the CPU

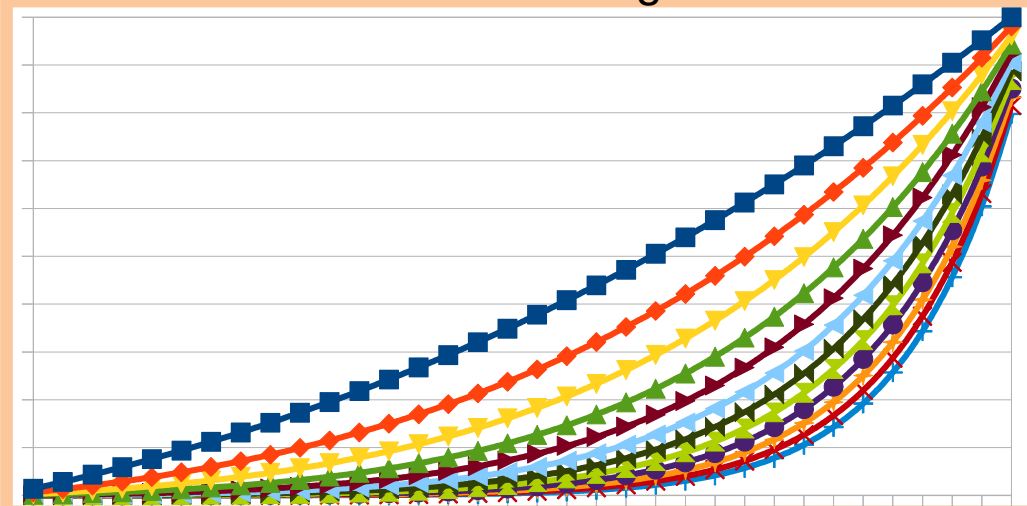
V_{DD} := *CPU Core Voltage*

Johan Pouwelse, Koen Langendoen, and Henk Sips. Dynamic voltage scaling on a low-power microprocessor. In Proceedings of the 7th annual international conference on Mobile computing and networking, pages 251–259. ACM, 2001.

Power consumption undervolting



Undervolting



Udev

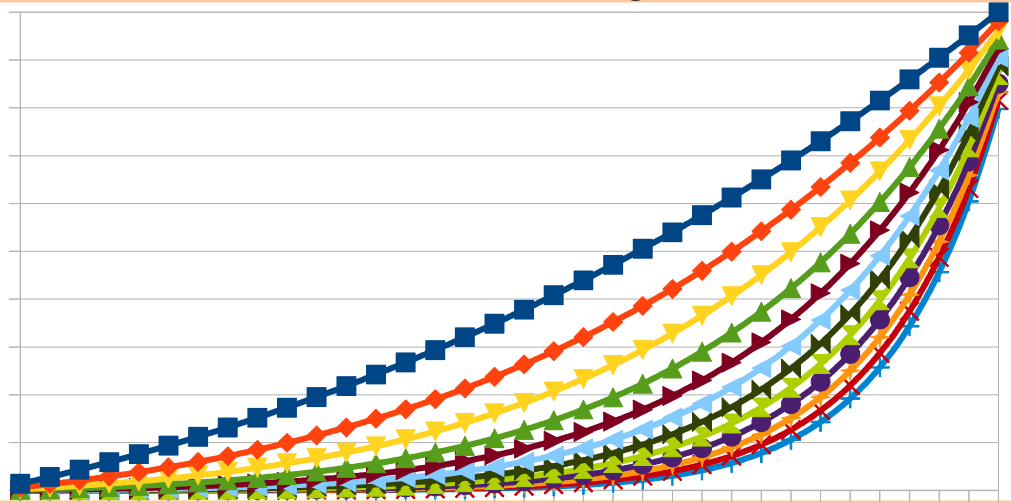
Power limiting

Sysctl

Udev Power savings

```
ACTION=="add", SUBSYSTEM=="pci", ATTR{power/control}="auto"  
ACTION=="add", SUBSYSTEM=="net",  
    KERNEL=="wlan*", RUN+="/usr/bin/iw dev %k set power_save on"  
ACTION=="add", SUBSYSTEM=="net",  
    NAME=="enp*", RUN+="/usr/bin/ethtool -s $name wol d"
```

Undervolting



Udev

```
ACTION=="add", SUBSYSTEM=="pci", ATTR{power/control}="auto"  
ACTION=="add", SUBSYSTEM=="net",  
    KERNEL=="wlan*", RUN+="/usr/bin/iw dev %k set power_save  
on"  
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```

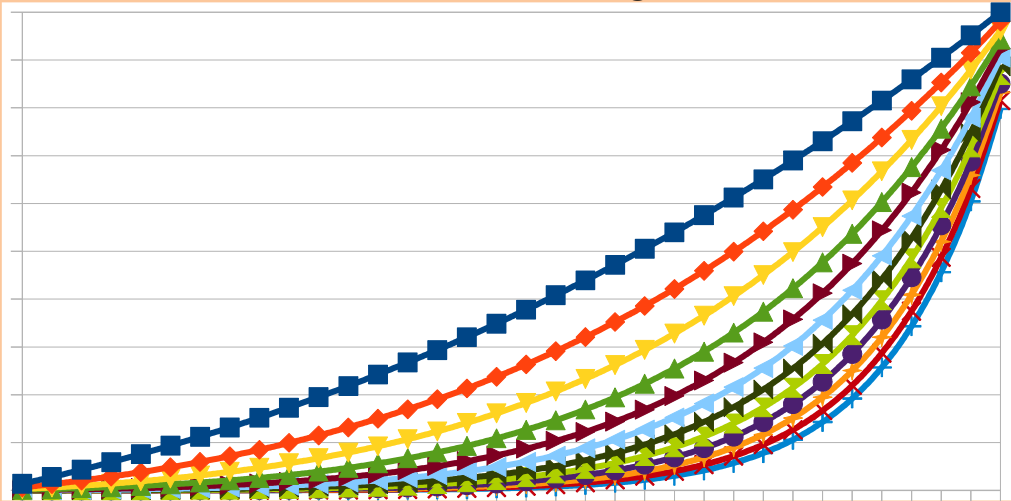
Power limiting

Sysctl

Power limiting rapl

```
#!/bin/bash  
PWD=$(pwd)  
cd "/sys/devices/virtual/powercap/intel-rapl/intel-rapl:0"  
UW=$(( $1 * 1000000 ))  
echo $UW | sudo tee constraint_*_power_limit_uw  
  
cd $PWD
```


Undervolting



Udev

```
ACTION=="add", SUBSYSTEM=="pci", ATTR{power/control}="auto"  
ACTION=="add", SUBSYSTEM=="net",  
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```

Power limiting

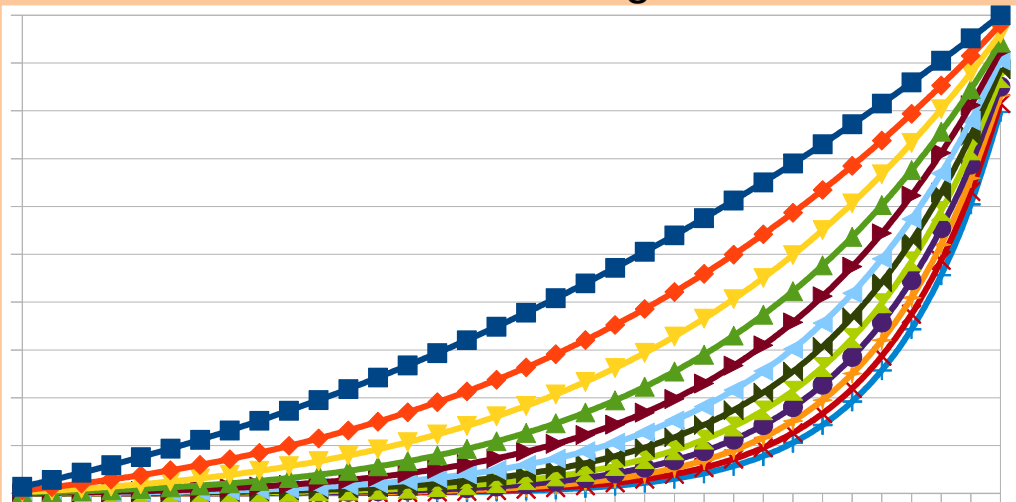
```
#!/bin/bash  
PWD=$(pwd)  
cd "/sys/devices/virtual/powercap/intel-rapl/intel-rapl:0"  
UW=$((1*1000000))  
echo $UW | sudo tee constraint_*_power_limit_uw  
  
cd $PWD
```

Sysctl

Sysctl tuning

```
michael@frittenbude:~ % cat /etc/sysctl.d/watchdog.conf  
kernel.nmi_watchdog = 0  
michael@frittenbude:~ % cat /etc/sysctl.d/dirty.conf  
vm.dirty_writeback_centisecs = 6000
```

Undervolting



Udev

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Power limiting

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Sysctl

```
kernel.nmi_watchdog = 0  
vm.dirty_writeback_centisecs = 6000
```

More things to do

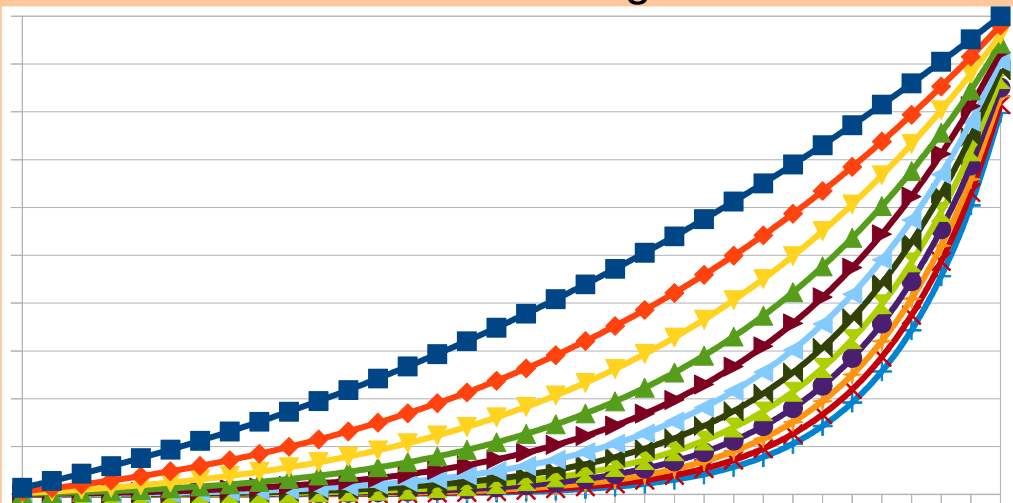
- Kernel boot parameters
 - PCI ASPM
 - Intel dri “experimental” options
- Self compile Kernel
 - Dynticks
 - 100Hz Ticks kernel
 - More experimental power saving stuff
 - Compiler optimizations for your CPU (lower load)
- Compile everything by yourself
 - Compiler optimizations for your CPU (lower load)

More things to do cont.

- Turn things in BIOS/UEFI off
 - Webcam
 - Cardreader
 - Bluetooth
 - WWAN etc

Did if forgot something ?

Undervolting



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Sysctl

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