

Linux Kernel Drivers for I2C-manageable High Precision Power Source

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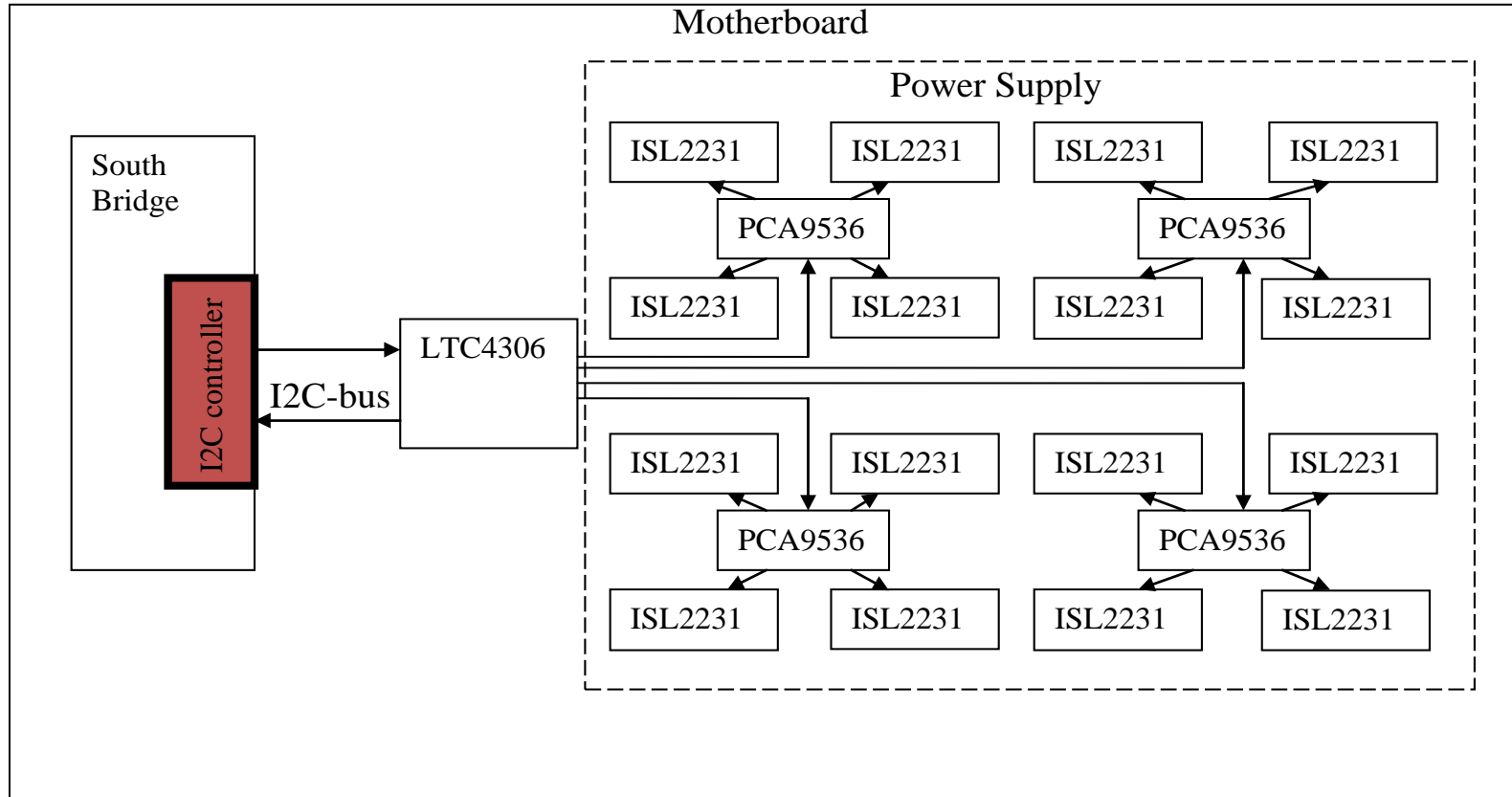
ZAO “MCST”

Research and Development area:

- High performance microprocessor architecture and microarchitecture
(SRARC v9, Elbrus)
- Computer Systems of Different Classes
(Embedded, Notebook, Desktop, Servers, Clusters)
- Interface Controllers
- Optimizing compilers (C, C++, Fortran)
- Binary Compilers (x86 → SPARC, x86 → Elbrus)
- Linux-based Operating Systems (hard real-time, protected versions)

Project subject and environment

Motherboard Power Supply System (MPSS)



- PCA9536 – power source
- ISL22317 - digital control potentiometer (Intersil)
- LTC4306 – 4-channel 2-wire multiplexer/switch
- I2C – multifunctional MPSS controller

Project Requirements

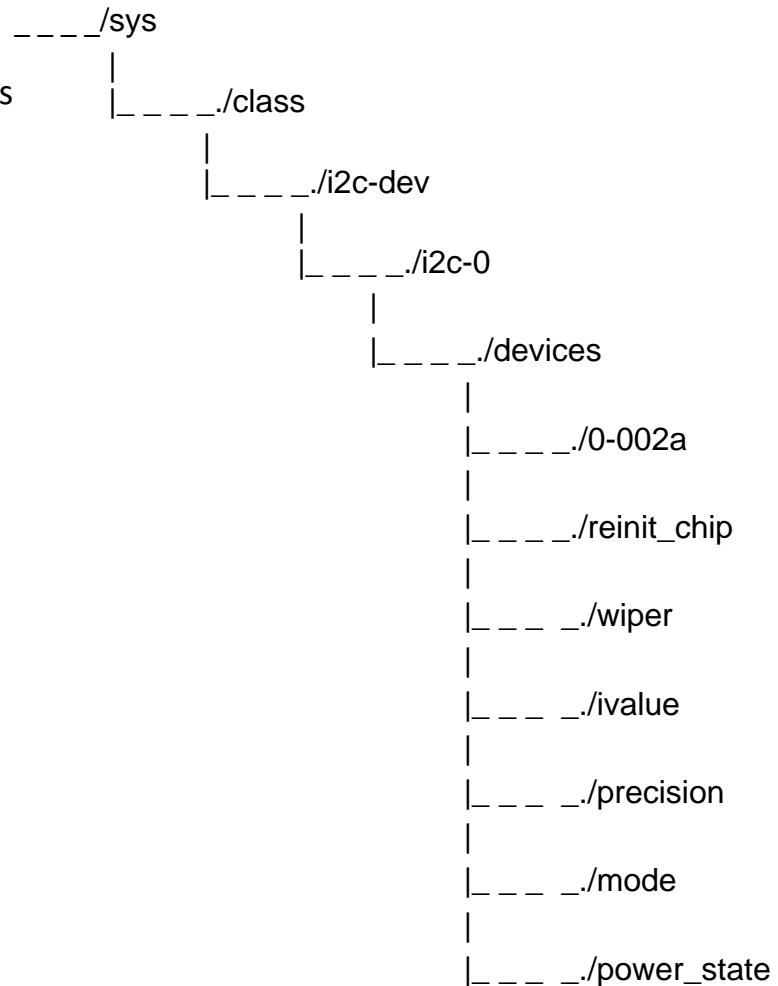
- ISL22317 interface file structure
- Linux Kernel Configs
- Power source management from userspace
- Output voltage control
- Architecture-independent solution

ISL22317 chip realizes the following functionalities:

- 1) supply voltage management in the range of [0; Vcc] by setting the position of wiper (from 0 till 127 in conditional values);
- 2) storing the default wiper position in EEPROM;
- 3) ability to manage precision regimes ;
- 4) support of low power consumption state of chip and ability to move chip from active to low power state and back;
- 5) support of two modes of chip: potentiometer and resistor, and ability to switch between them.

File structure for ISL22317 interface

- Writing "1" value to reinit_chip file causes reinitialization of i2c_client structure that describes ISL22317.
- File wiper contains current decimal value of wiper position in conditional values (from 0 till 127).
- File ivalue contains the initial value of wiper position that is to be set by default on power on.
- File precision having only two valid contents: 1 or 0, allows to manage precision regimes of ISL22317.
- File mode is used for switching ISL22317 chip from "potentiometer" mode (corresponds value "1") to "resistor" mode (corresponds value "0").
- File power_state is used for moving chip from active state (value "0") to low power consumption state (value "0") and back.



Linux kernel configs

- I2C (CONFIG_I2C)
- IntelPIIX4 (CONFIG_I2C_PIIX4)
- ISL22317 (CONFIG_ISL22317)
- PCA9536 (CONFIG_GPIO_PCA953X)
- I2C-DEV (CONFIG_I2C_CHARDEV)
- SYSFS (CONFIG_SYSFS)

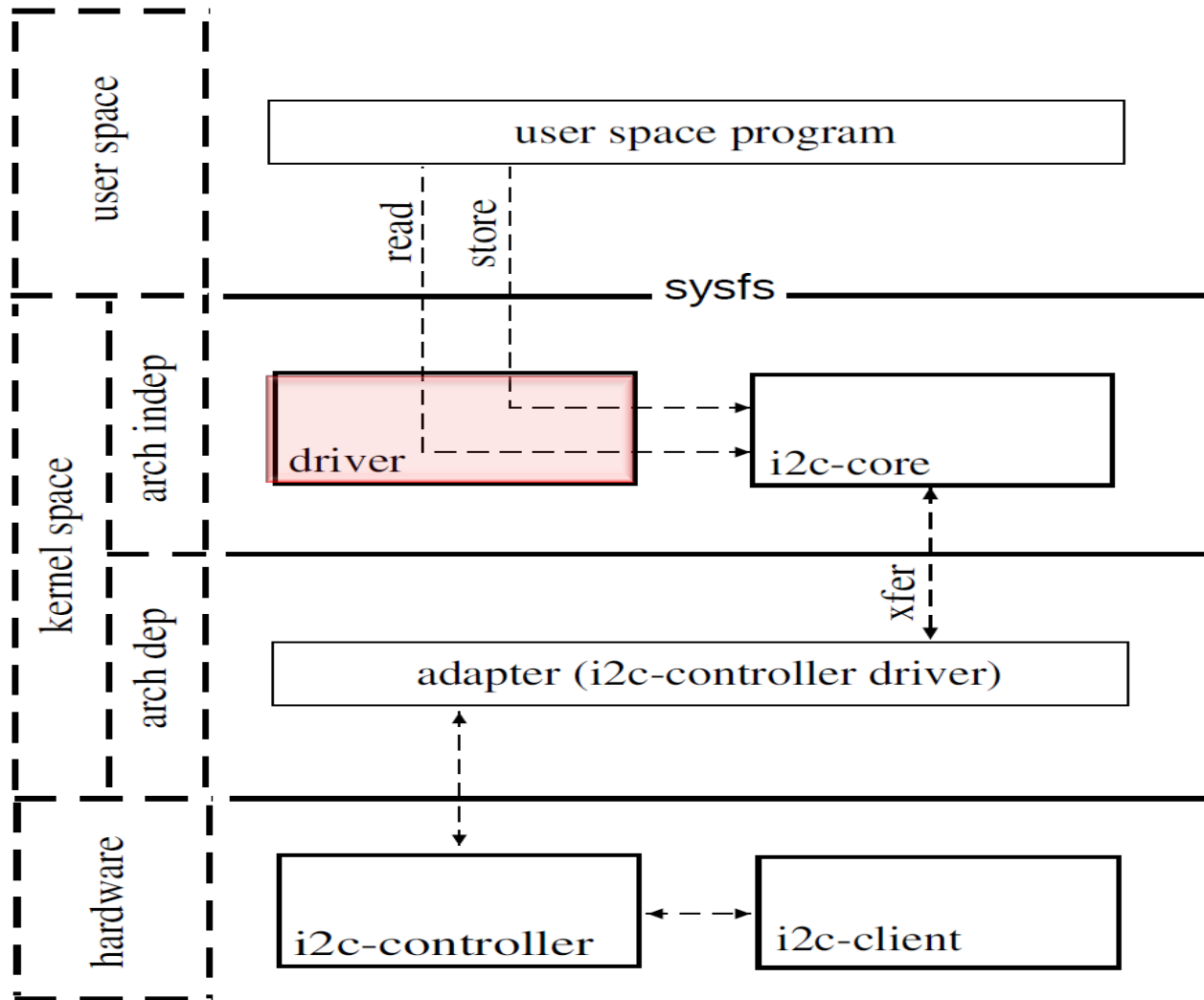
POWER SOURCE MANAGEMENT FROM USERSPACE

Action	Corresponding shell commands
Load necessary modules:	<pre>\$ modprobe i2c-dev \$ modprobe pca953x \$ modprobe isl22317</pre>
Export gpio pins and set their directions to "output":	<pre>\$ cd /sys/class/i2c-dev/i2c-0/devices \$ echo "0" > ./0-0041/export \$ echo "1" > ./0-0041/export \$ echo "2" > ./0-0041/export \$ echo "3" > ./0-0041/export \$ echo "out" > ./0-0041/gpio0/direction \$ echo "out" > ./0-0041/gpio1/direction \$ echo "out" > ./0-0041/gpio2/direction \$ echo "out" > ./0-0041/gpio3/direction</pre>
Select and reinitialize potentiometer:	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ echo "1" > ./devices/0-0041/gpio0/value \$ echo "0" > ./devices/0-0041/gpio1/value \$ echo "0" > ./devices/0-0041/gpio2/value \$ echo "0" > ./devices/0-0041/gpio3/value \$ echo "1" > ./devices/0-002a/reinit_chip</pre>
Set the value of wiper position X : (X belongs to the range [0,127])	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ echo X > ./devices/0-002a/wiper</pre>

output voltage control over sysfs interface

Action	Corresponding shell commands
Read the initial value of wiper position from EEPROM:	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ cat ./devices/0-002a/ivalue</pre>
Write the initial value X of wiper position to EEPROM:	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ echo x > ./devices/0-002a/ivalue</pre>
Read current wiper position:	<pre>\$ cd /sys/class/i2c-dev \$ cat ./i2c-0/devices/0-002a/wiper</pre>
Switch to "precision" regime and back:	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ echo 1 > ./devices/0-002a/precision \$ echo 0 > ./devices/0-002a/precision</pre>
Switch to "resistor" mode and back to "potentiometer" mode:	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ echo 0 > ./devices/0-002a/mode \$ echo 1 > ./devices/0-002a/mode</pre>
Switch from "active" state to "low power" state and back:	<pre>\$ cd /sys/class/i2c-dev/i2c-0 \$ echo 1 > ./devices/0-002a/power_state \$ echo 0 > ./devices/0-002a/power_state</pre>

Architecture-independent solution



Embeded systems or peripheral devices

**THANK YOU
FOR YOUR ATTENTION**