VISION 2020「From Domestic No.1 to Global Top 10」

SiW Touch Driver
v 2.07

2016.05.17

R&D / Touch Team

Silicon Works

History

Version	Date	Description
1.0	2016.03.15	1st release
2.0	2016.04.15	Rebuild Driver Framework for HAL layer
2.07	2016.05.17	Add PRD, Watch

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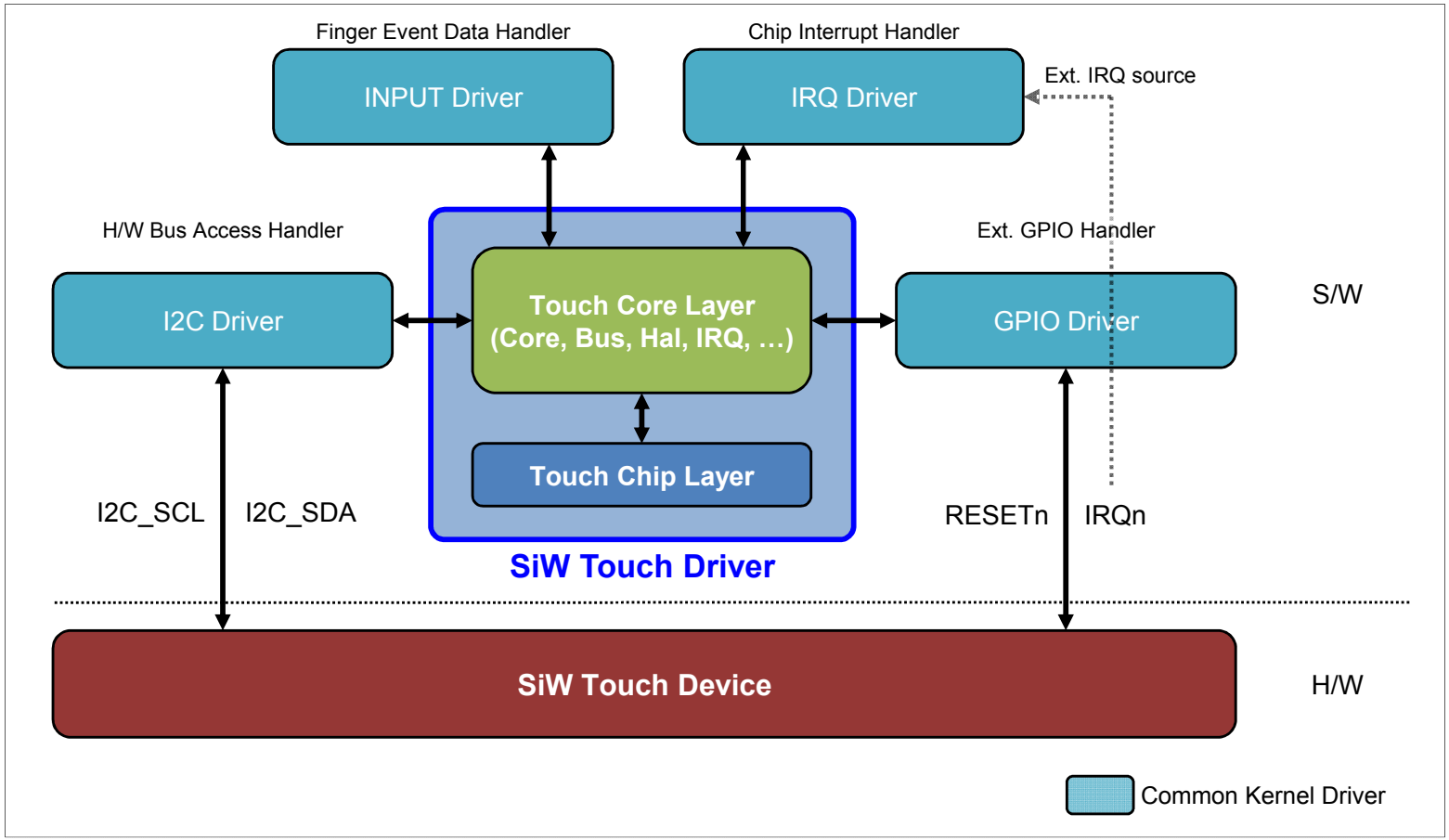
1.1 Architecture

(1) Overview



[Fig. 1-1] Driver Relationship

1. Driver Operation

1.1 Driver Architecture

(2) SiW Touch Driver Files

Layer	Name	Description
Touch Core Layer	siw_touch.c	Touch Core main control
	siw_touch_bus.c	Touch Bus I/F main
	siw_touch_bus_i2c.c	Touch Bus I/F - I2C type
	siw_touch_bus_spi.c	Touch Bus I/F - SPI type
	siw_touch_bus_event.c	Touch Input & Event control
	siw_touch_gpio.c	Touch GPIO control
	siw_touch_irq.c	Touch Interrupt control
	siw_touch_notify.c	Touch Notifier Chain
	siw_touch_of.c	Touch Device Tree analysis
	siw_touch_sysfs.c	Touch Sysfs control
	siw_touch_sys.c	Helper for Touch & System Inter-connection
	siw_touch_hal.c	Touch HAL
	siw_touch_hal_abt.c	Touch HAL for ABT
	siw_touch_hal_prd.c	Touch HAL for PRD
	siw_touch_hal_sysfs.c	Touch HAL for Sysfs
	siw_touch_hal_watch.c	Touch HAL for WATCH
Touch Chip Layer	touch_lg4894.c	Initial driver for LG4894
	touch_lg4895.c	Initial driver for LG4895
	touch_lg4946.c	Initial driver for LG4946
	touch_sw1828.c	Initial driver for SW1828
Build Files	Kconfig / Makefile	

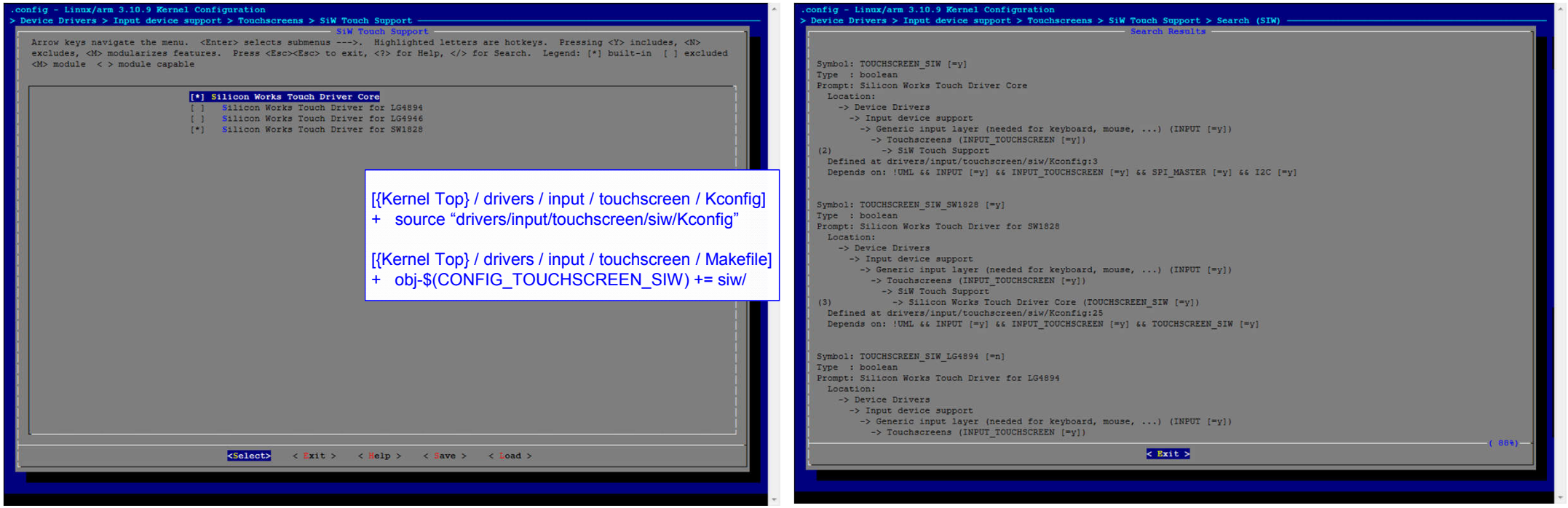
[Table. 1-1] Driver File List

* HAL : Hardware Abstraction Layer

1. Driver Operation

1.1 Driver Architecture

(2) SiW Touch Driver Files - Kconfig



[Fig. 1-2] Kconfig (example)

1. Driver Operation

1.1 Driver Architecture

(2) SiW Touch Driver Files - Test Environment

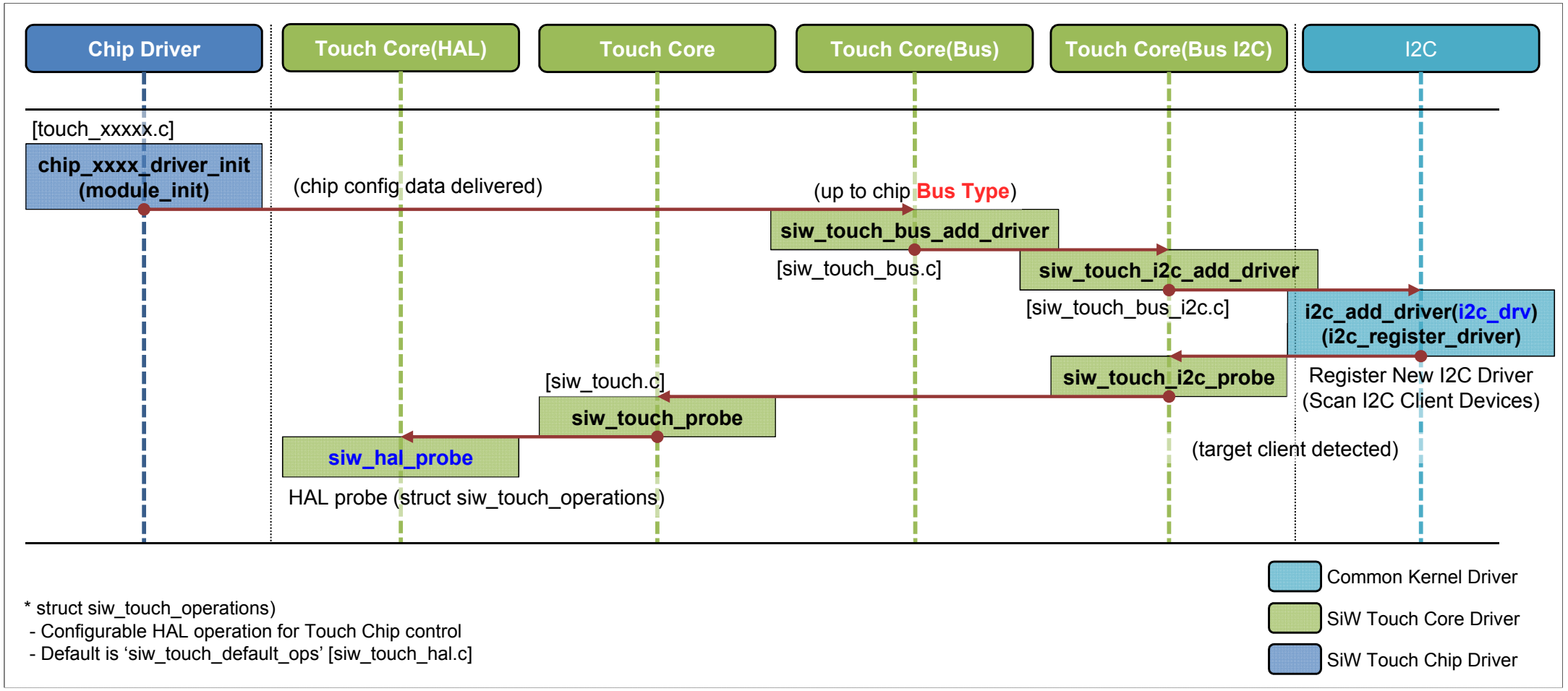
Test Environment		
H/W		Odroid-XU4(Exynos5422)
S/W	Platform Version	Android 4.4.4
		Kernel 3.10.9
	Driver Folder	{Kernel Top} / drivers / input / touchscreen / siw
		{Kernel Top} / include / linux / input : siw_touch_notify.h

[Table. 1-2] Test Environment

1. Driver Operation

1.2 Initialization Flow

(1) Probe Sequence - I2C (LG4894, SW1828)

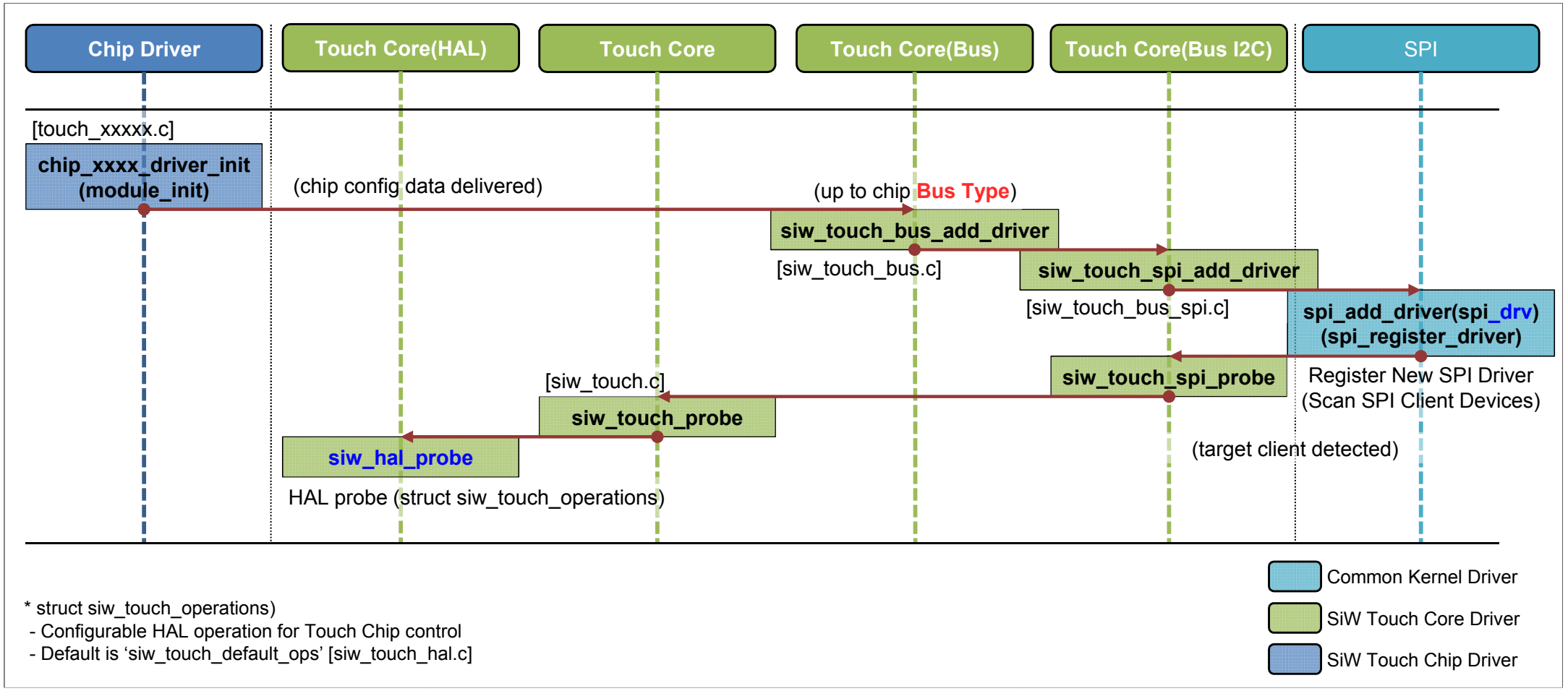


[Fig. 1-3] Initial Probe Sequence (I2C)

1. Driver Operation

1.2 Initialization Flow

(1) Probe Sequence - SPI (LG4895, LG4946)

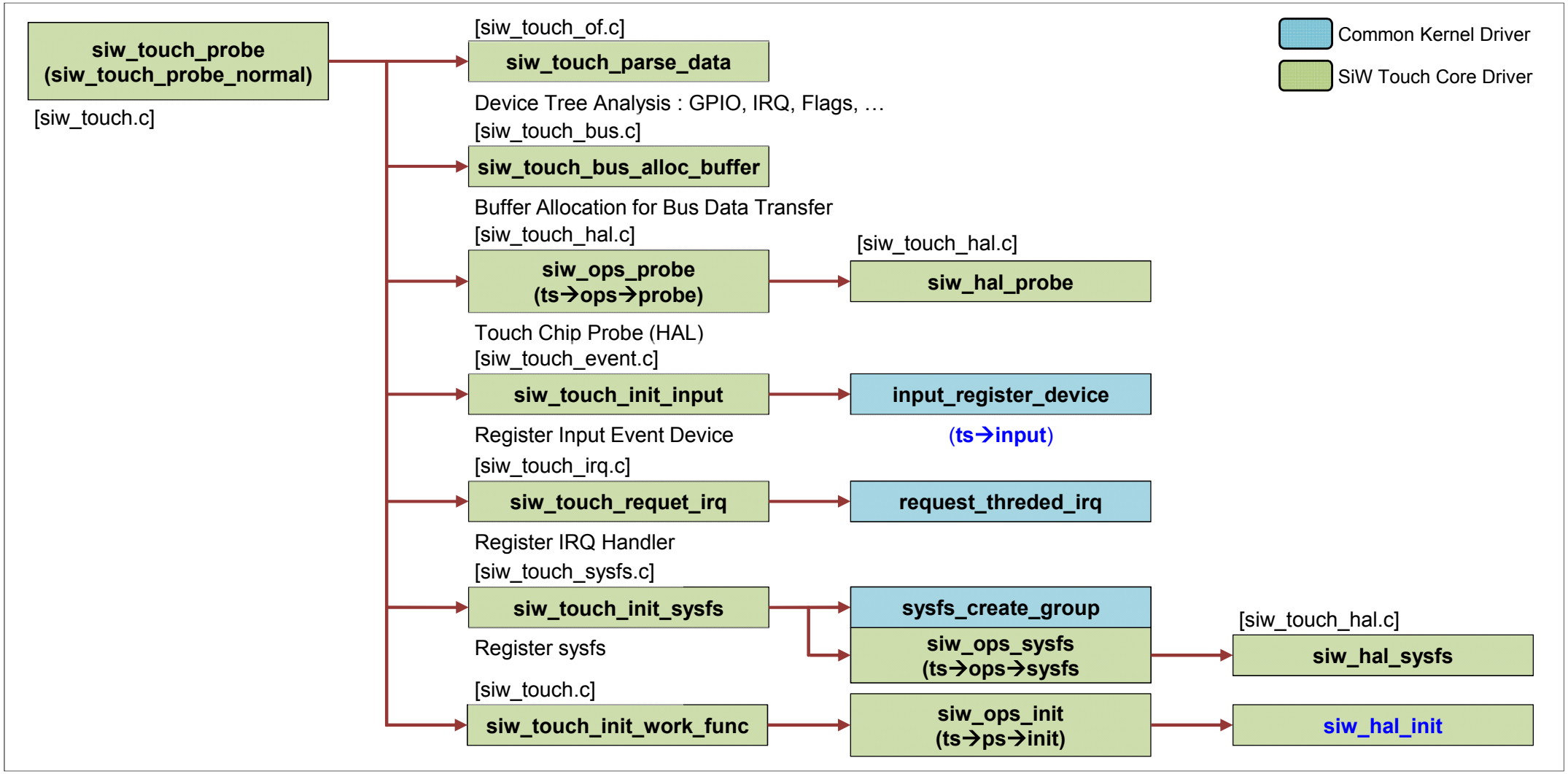


[Fig. 1-4] Initial Probe Sequence (SPI)

1. Driver Operation

1.2 Initialization Flow

(3) siw_touch_probe

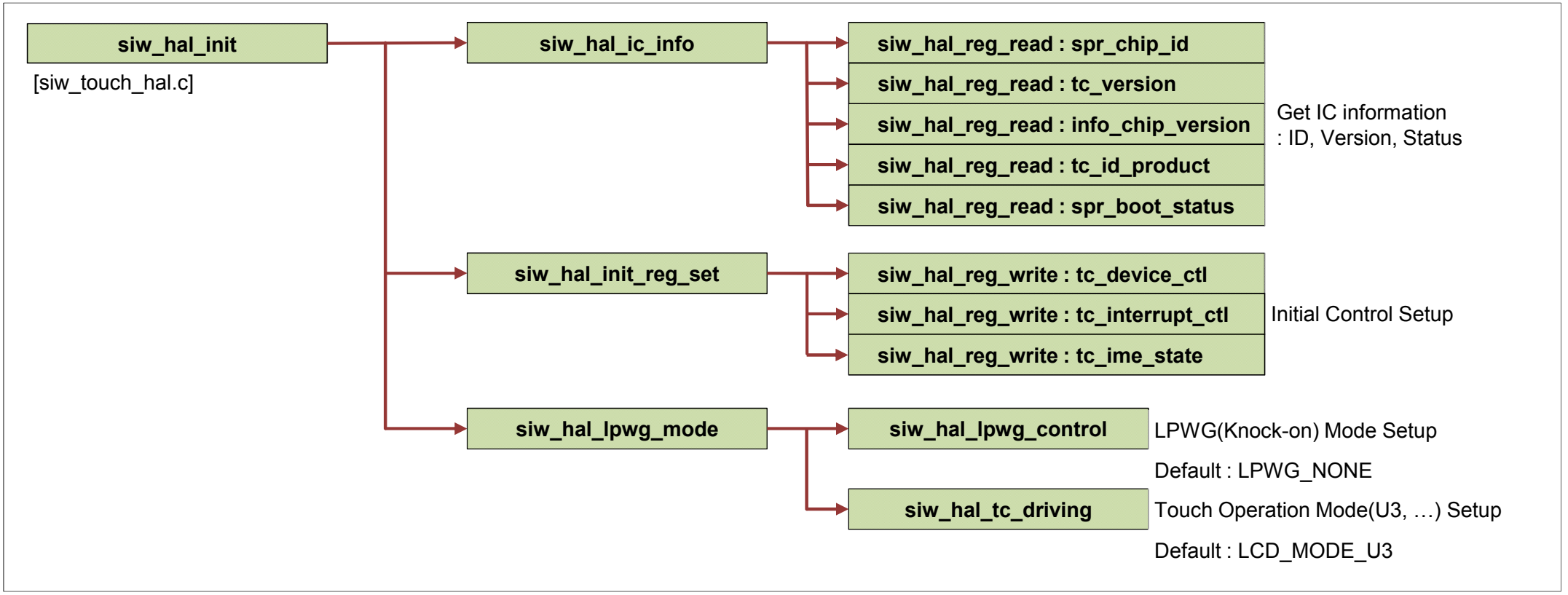


[Fig. 1-5] Inside operation of siw_touch_probe

1. Driver Operation

1.2 Initialization Flow

(4) siw_hal_init

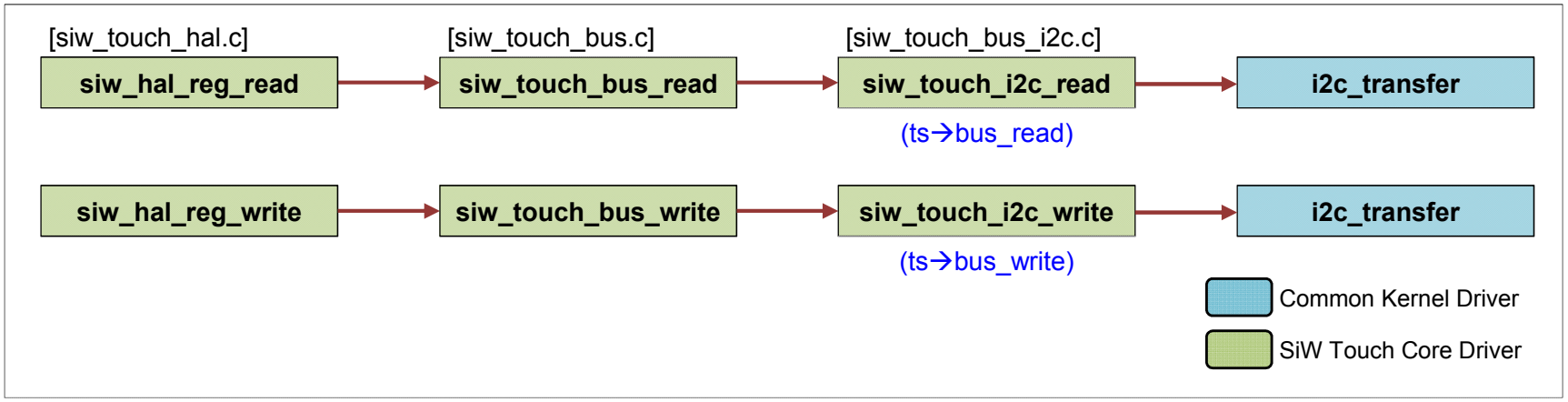


[Fig. 1-6] Inside operation of siw_hal_init

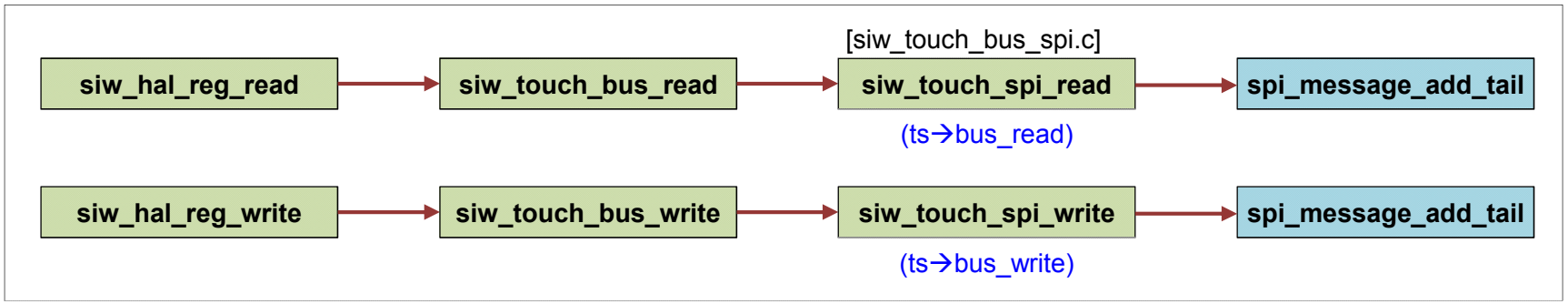
1. Driver Operation

1.3 Operation

(1) Bus Access



[Fig. 1-7] Bus Access Flow for I2C type

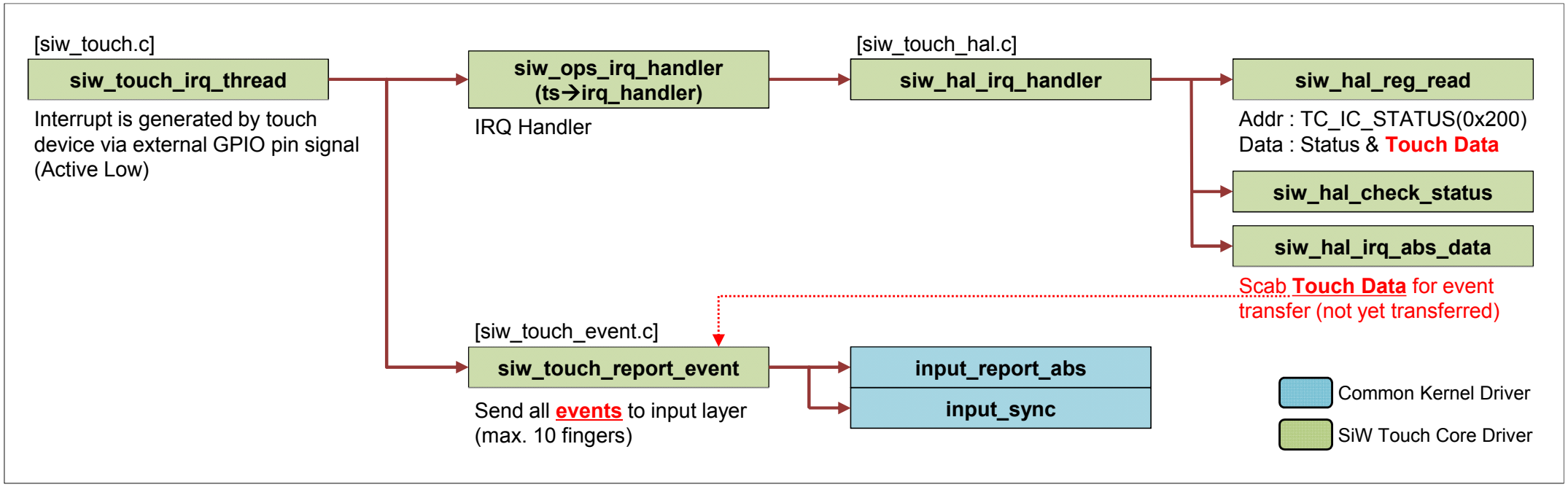


[Fig. 1-8] Bus Access Flow for SPI type

1. Driver Operation

1.3 Operation

(2) IRQ Handler (when touch event detected)



[Fig. 1-9] Interrupt Handling

- An appropriate external interrupt connection shall be guaranteed for the accuracy of this IRQ operation

1. Driver Operation

1.4 Kernel Log (example)

(1) Probe message

```
[ 4182.573535] SW1828 driver init
[ 4182.575821] siw_touch 5-0028: dev bus probe : 12c70000.i2c/i2c-5/5-0028
[ 4182.581784] siw_touch 5-0028: SiW Touch Probe
[ 4182.586090] siw_touch 5-0028: SW1828 quirks = 0x10030300
[ 4182.592590] siw_touch 5-0028: SW1828 ops is NULL : default ops selected
[ 4182.598057] siw_touch 5-0028: of gpio  : reset-gpio(0x1), 23
[ 4182.603801] siw_touch 5-0028: of gpio  : irq-gpio, 22
[ 4182.610170] siw_touch 5-0028: flags(of) = 0x00000100
[ 4182.613937] siw_touch 5-0028: caps max_x           = 800
[ 4182.619160] siw_touch 5-0028: caps max_y           = 480
[ 4182.625592] input: siw_touch_input as /devices/virtual/input/input13
[ 4182.631348] input input13: input device[i2c-5/5-0028 - siw_touch_input] registered (800, 480, 255, 15, 15, 1, 10)
[ 4182.641311] siw_touch 5-0028: threaded irq request done(530, siw_touch, 0x2002)
[ 4182.649485] siw_touch 5-0028: hw_reset_delay : 210 ms
[ 4182.863458] siw_touch 5-0028: fb_notif change
[ 4182.869007] siw_touch 5-0028: [T] chip id    : 1828
[ 4182.872426] siw_touch 5-0028: [T] version    : v0.00 (0x00000000, 0xFF)
[ 4182.879125] siw_touch 5-0028: [T] product id : L0L53P1
[ 4182.884244] siw_touch 5-0028: [T] flash boot : idle(done), crc : ok (0x00000044)
[ 4182.894245] siw_touch 5-0028: current driving mode is U3
[ 4182.898659] siw_touch 5-0028: DDI Display Mode = 0x00000003
[ 4182.928510] siw_touch 5-0028: SW1828 init done
[ 4182.972872] siw_touch 5-0028: mon thread[siw_touch-0, 5] begin
```

- 5-0028 : I2C adaptor(0x12C70000) is registered as I2C-5 and the slave address of the client(SW1828) is 0x28.

1. Driver Operation

1.4 Kernel Log (example)

(2) System Information

```
root@odroidxu3:/sys/bus/i2c/devices/5-0028 # ll
lrwxrwxrwx root     root              2016-04-12 08:48 driver -> ../../../../bus/i2c/drivers/siw_touch
-r--r--r-- root     root         4096 2016-04-12 08:40 modalias          // = i2c:sw1828
-r--r--r-- root     root         4096 2016-04-12 08:40 name              // = sw1828
drwxr-xr-x root     root              2016-04-12 08:40 power
lrwxrwxrwx root     root              2016-04-12 08:40 subsystem -> ../../../../bus/i2c
-rw-r--r-- root     root         4096 2016-04-12 08:40 uevent

root@odroidxu3:/sys/device/virtual/input # ll
drwxr-xr-x root     root              2016-04-12 08:40 input2
drwxr-xr-x root     root              2016-04-12 08:41 input4
drwxr-xr-x root     root              2016-04-12 08:40 mice
drwxr-xr-x root     root              2016-04-12 08:47 siw_touch_input


root@odroidxu3:/proc/bus/input # cat devices
…
I: Bus=0018 Vendor=abcd Product=9876 Version=1234
N: Name="siw_touch_input"
P: Phys=i2c-5/5-0028 - siw_touch_input
S: Sysfs=/devices/virtual/input/input4
U: Uniq=
H: Handlers=event4
B: PROP=2
B: EV=9
B: ABS=67c8000 0
```

2. Device Tree (example for I2C)

- Definition of I2C client device for SW1828 (refer to DTS example files for more information)

```
&i2c_1 {                                    // indicates parent device : I2C_1 adapter block
   sw1828@28 {                              // define new client device(sw1828) and slave addr. is 0x28
      status = "okay";
      compatible = "siw,sw1828";            // compatible name (see touch_xxxxxx.c)
      reg = <0x28>;                         // slave addr. : 0x28
      interrupt-parent = <&gpx1>;           // interrupt source : GPIO group gpx1
      interrupts = <6 0x02>;                // index 6(0~7) in gpx1 external interrupts
      irqflags = <0x2002>;                  // IRQF_ONESHOT(0x2000) | IRQF_TRIGGER_FALLING(0x2)
      chip_flags = <0>;
      reset-gpio = <&gpx1 7 GPIO_ACTIVE_LOW>;          // index 7 in gpx1
      irq-gpio = <&gpx1 6 GPIO_ACTIVE_LOW>;            // index 6 in gpx1

      /* Caps */
      max_x = <800>;
      max_y = <480>;
      max_pressure = <0xff>;
      max_width = <15>;
      max_orientation = <1>;
      max_id = <10>;
      /* role */
      hw_reset_delay = <210>;
      sw_reset_delay = <90>;
      use_lpwg = <0>;
      use_lpwg_test = <0>;
      /* firmware */
      use_firmware = <1>;          // enable firmware control
      use_fw_upgrade = <1>;        // auto-update during driver initialization
      fw_image = "siw/sw1828/LA080WV9_9_02_00_3V.img";      // in android -> /lib/firmware/siw/..
      //absoulte path
      prd_in_file = "/sdcard/siw/sw1828_test_spec_V0.1.txt";
      prd_in_file_m = "/sdcard/siw/sw1828_test_spec_mfts_V0.1.txt";
      prd_out_file = "/sdcard/siw/touch_self_test.txt";
   };
};
```

(mandatory)

[gpx1 definition in exynos5422 pinctrl device tree]

```
...
   pinctrl@13400000 {
   …
      gpx1: gpx1 {
         …
                  interrupt-controller;
                  interrupt-parent = <&combiner>;
                  #interrupt-cells = <2>;
                  interrupts = <28 0>, <28 1>, <29 0>, <29 1>,
                               <30 0>, <30 1>, <31 0>, <31 1>;
      };
      …
   };
…
```

- This example has been established based on odroidx-xu4(exynos5422) platform
- The detail configuration shall be modified up to main chipset.

2. Device Tree (example for SPI)

- Definition of SPI client device for LG4895 (refer to DTS example files for more information) (1/2)

```
&spi_1 {                                    // indicates parent device : SPI_1 block
    status = “okay”;
    samsung,spi-src-clk = <0>;
    num-cs = <1>;

    lg4895@0 {                              // define new spi device(lg4895)
        status = "okay";
        compatible = "siw,lg4895";          // compatible name (see touch_xxxxxx.c)
        reg = <0>;
        interrupt-parent = <&gpx1>;         // interrupt source : GPIO group gpx1
        interrupts = <6 0x02>;              // index 6(0~7) in gpx1 external interrupts
        irqflags = <0x2002>;                // IRQF_ONESHOT(0x2000) | IRQF_TRIGGER_FALLING(0x2)
        chip_flags = <0>;
        reset-gpio = <&gpx1 7 GPIO_ACTIVE_LOW>;          // index 7 in gpx1
        irq-gpio = <&gpx1 6 GPIO_ACTIVE_LOW>;            // index 6 in gpx1
```

(mandatory)

```
        /* Caps */
        max_x = <800>;
        max_y = <480>;
        max_pressure = <0xff>;
        max_width = <15>;
        max_orientation = <1>;
        max_id = <10>;
        /* role */
        hw_reset_delay = <210>;
        sw_reset_delay = <90>;
        use_lpwg = <0>;
        use_lpwg_test = <0>;
        /* firmware */
        use_firmware = <1>;         // enable firmware control
        use_fw_upgrade = <1>;       // auto-update during driver initialization
        fw_image = "siw/lg4895/L0W49P1_1_13.img.img";          // in android -> /lib/firmware/siw/..
        …
```

- This example has been established based on odroidx-xu4(exynos5422) platform
- The detail configuration shall be modified up to main chipset.

2. Device Tree (example for SPI)

- Definition of SPI client device for LG4895 (refer to DTS example files for more information) (2/2)

```
&spi_1 {
    …
    lg4895@0 {
        …
        (after /* firmware */)

        //absoulte path
        prd_in_file = "/sdcard/siw/lg4895_test_spec_V0.1.txt";
        prd_in_file_m = "/sdcard/siw/lg4895_test_spec_mfts_V0.1.txt";
        prd_out_file = "/sdcard/siw/touch_self_test.txt";

        controller-data {
            cs-gpio = <&gpa2 5 GPIO_ACTIVE_LOW>;
            samsung,spi-feedback-delay = <0>;
            samsung,spi-chip-select-mode = <0>;      //MANUAL_CS_MODE = 0, AUTO_CS_MODE = 1,
        };
};
```

- This example has been established based on odroidx-xu4(exynos5422) platform
- The detail configuration shall be modified up to main chipset.