Linux总线、设备、驱动模型

讲解时间：2017年7月5日晚8时

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观看录播：

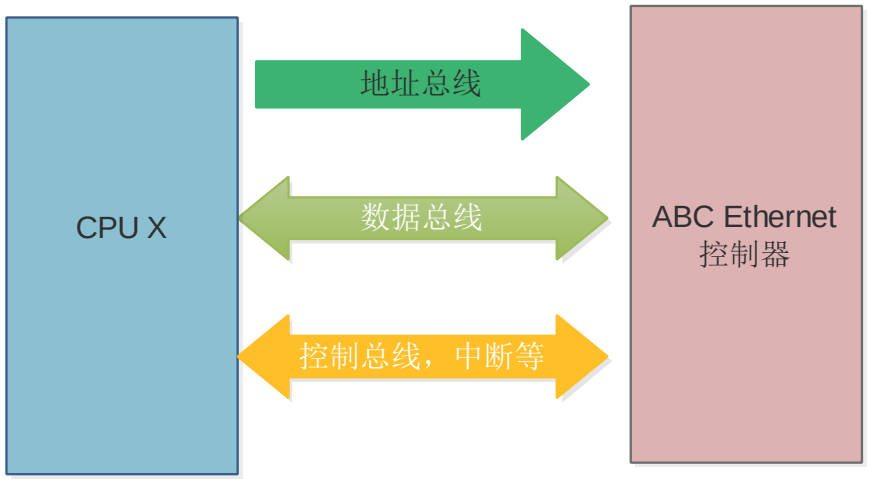
http://edu.csdn.net/course/detail/5329

麦当劳喜欢您来，喜欢您再来

扫描关注

Linuxer

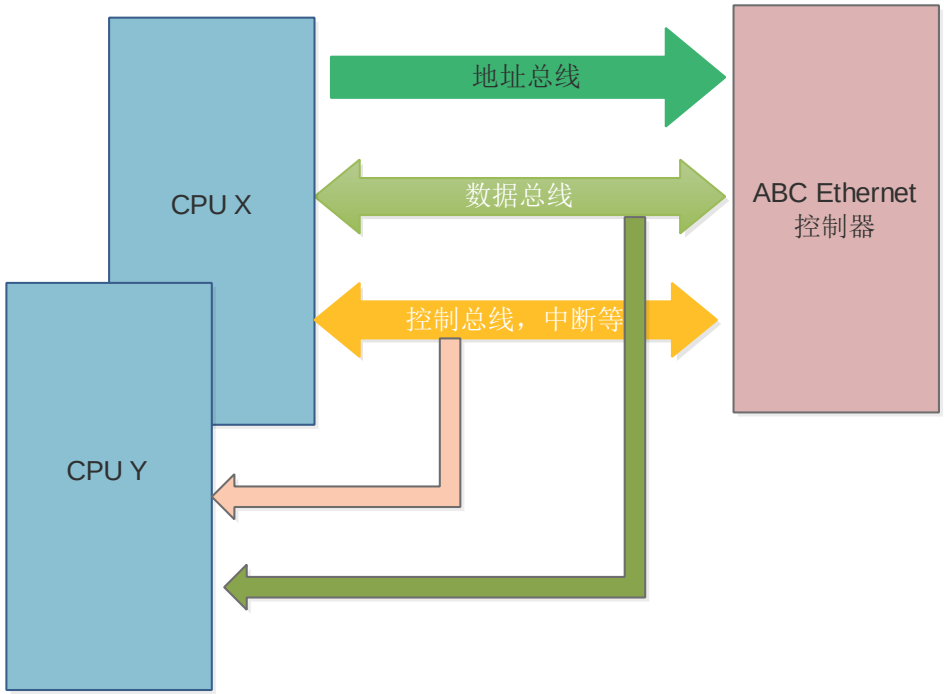
一个想象的Ethernet控制器/一块板




```
#define ABC_BASE 0x100000
#define ABC_IRQ 10

int abc_send(...)
{
        writel(ABC_BASE + REG_X, 1);
        writel(ABC_BASE + REG_Y, 0x3);
        ...
}

int abc_init(...)
{
        request_irq(ABC_IRQ,...);
}
```

一个想象的Ethernet控制器/N块板

可以这样写代码吗？

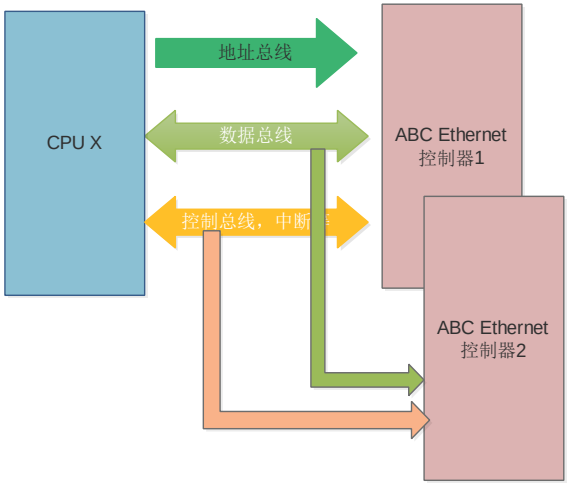



```
#ifdef BOARD_A
#define ABC_BASE 0x100000
#define ABC_IRQ 10

#elif defined(BOARD_B)
#define ABC_BASE 0x110000
#define ABC_IRQ 20

#elif defined(BOARD_C)
#define ABC_BASE 0x120000
#define ABC_IRQ 10
...
#endif
```

一个想象的Ethernet控制器/1板N卡

可以这样写代码吗？

```
#ifdef BOARD_A
#define ABC1_BASE 0x100000
#define ABC1_IRQ 10
#define ABC2_BASE 0x101000
#define ABC2_IRQ 11

#elif defined(BOARD_B)
#define ABC1_BASE 0x110000
#define ABC1_IRQ 20
...
#endif
```

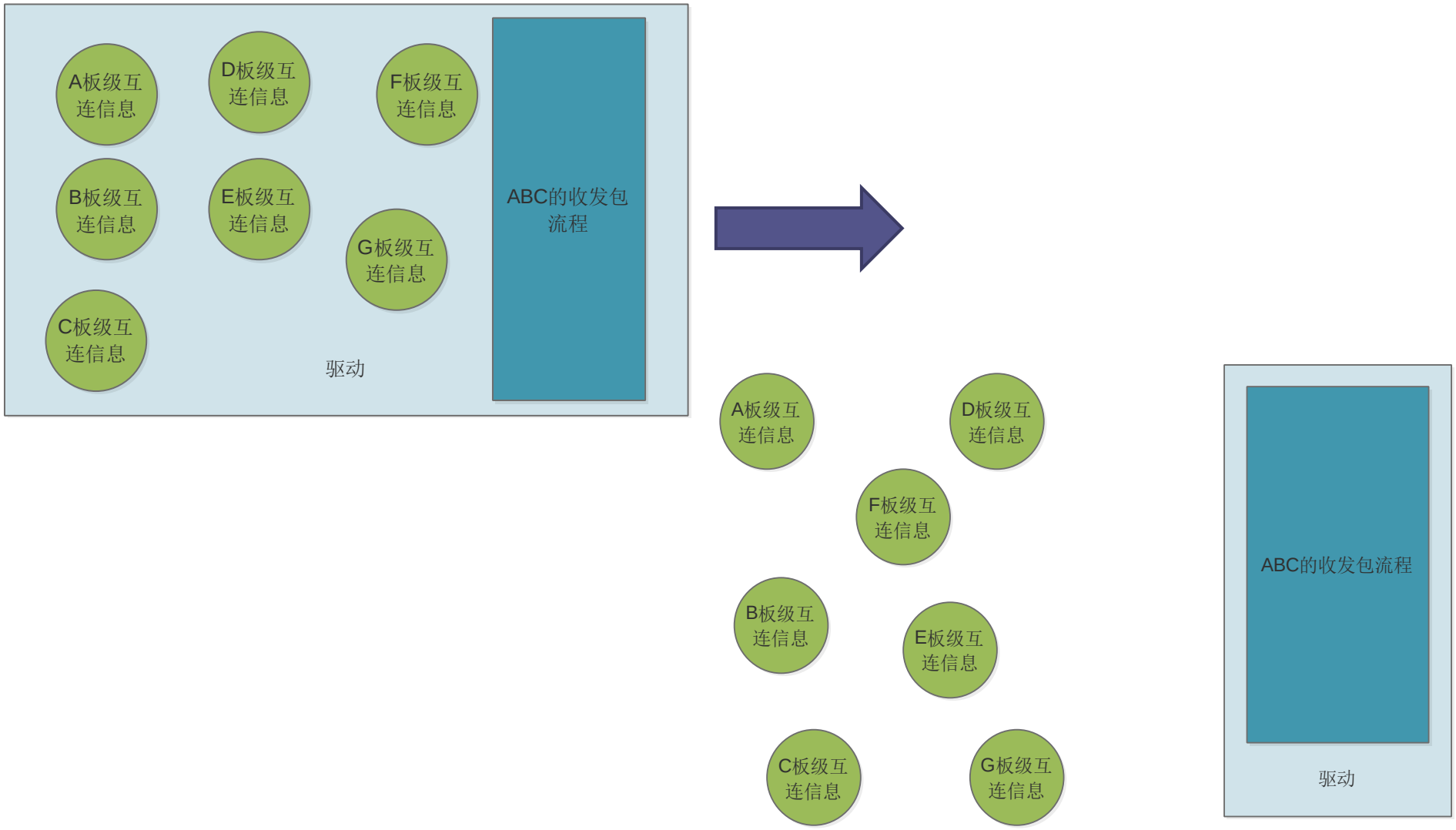



```
int abc1_send(...)
{
        writel(ABC1_BASE + REG_X, 1);
        writel(ABC1_BASE + REG_Y, 0x3);
        ...
}

int abc1_init(...)
{
        request_irq(ABC1_IRQ,...);
}

int abc2_send(...)
{
        writel(ABC2_BASE + REG_X, 1);
        writel(ABC2_BASE + REG_Y, 0x3);
        ...
}

int abc2_init(...)
{
        request_irq(ABC2_IRQ,...);
}
...
```

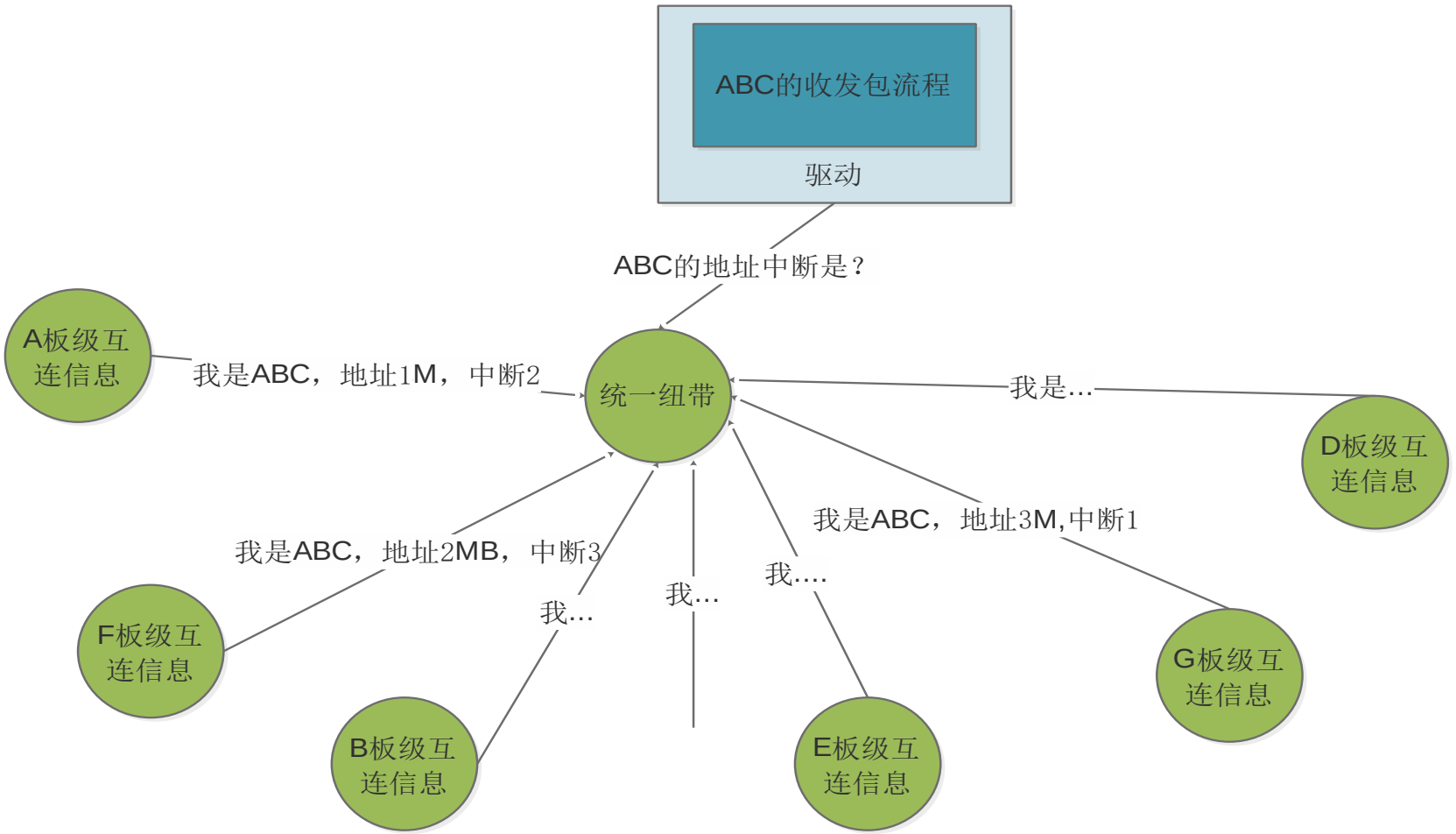
还是这样？

```
int abc_send(int id, ...)
{
   if (id == 0) {
                writel(ABC1_BASE + REG_X, 1);
                writel(ABC1_BASE + REG_Y, 0x3);
    } else if (id == 1) {
                writel(ABC2_BASE + REG_X, 1);
                writel(ABC2_BASE + REG_Y, 0x3);
   }
   ...
}
```

去耦合


A板级互连信息
D板级互连信息
F板级互连信息
B板级互连信息
E板级互连信息
G板级互连信息
C板级互连信息
驱动
ABC的收发包流程
A板级互连信息
D板级互连信息
F板级互连信息
B板级互连信息
E板级互连信息
C板级互连信息
G板级互连信息
ABC的收发包流程
驱动

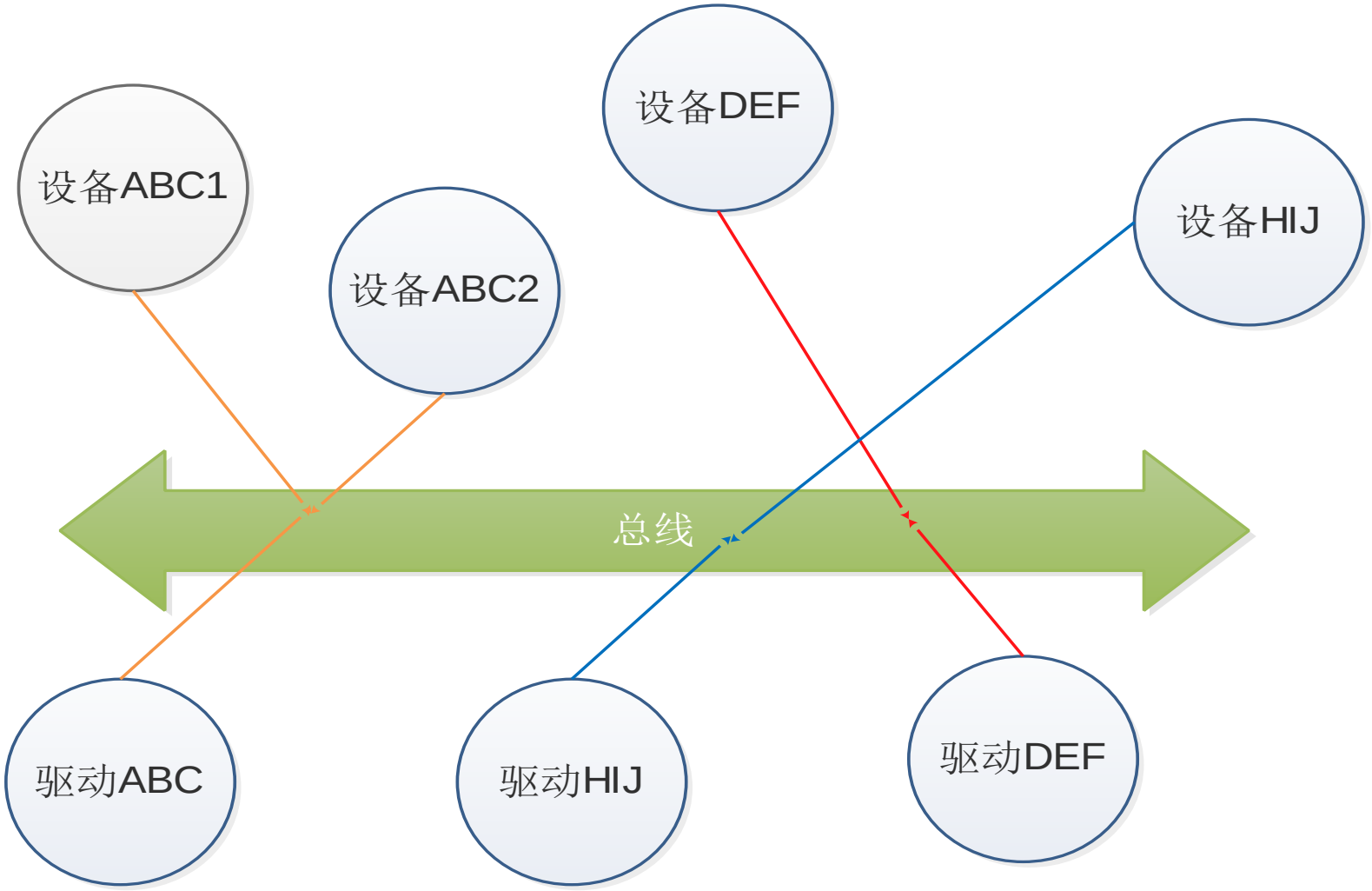
统一纽带


ABC的收发包流程
驱动
ABC的地址中断是？
A板级互连信息
我是ABC，地址1M，中断2
统一纽带
我是…
D板级互连信息
我是ABC，地址3M,中断1
我是ABC，地址2MB，中断3
我…
我…
我….
F板级互连信息
G板级互连信息
B板级互连信息
E板级互连信息

总线、设备、驱动

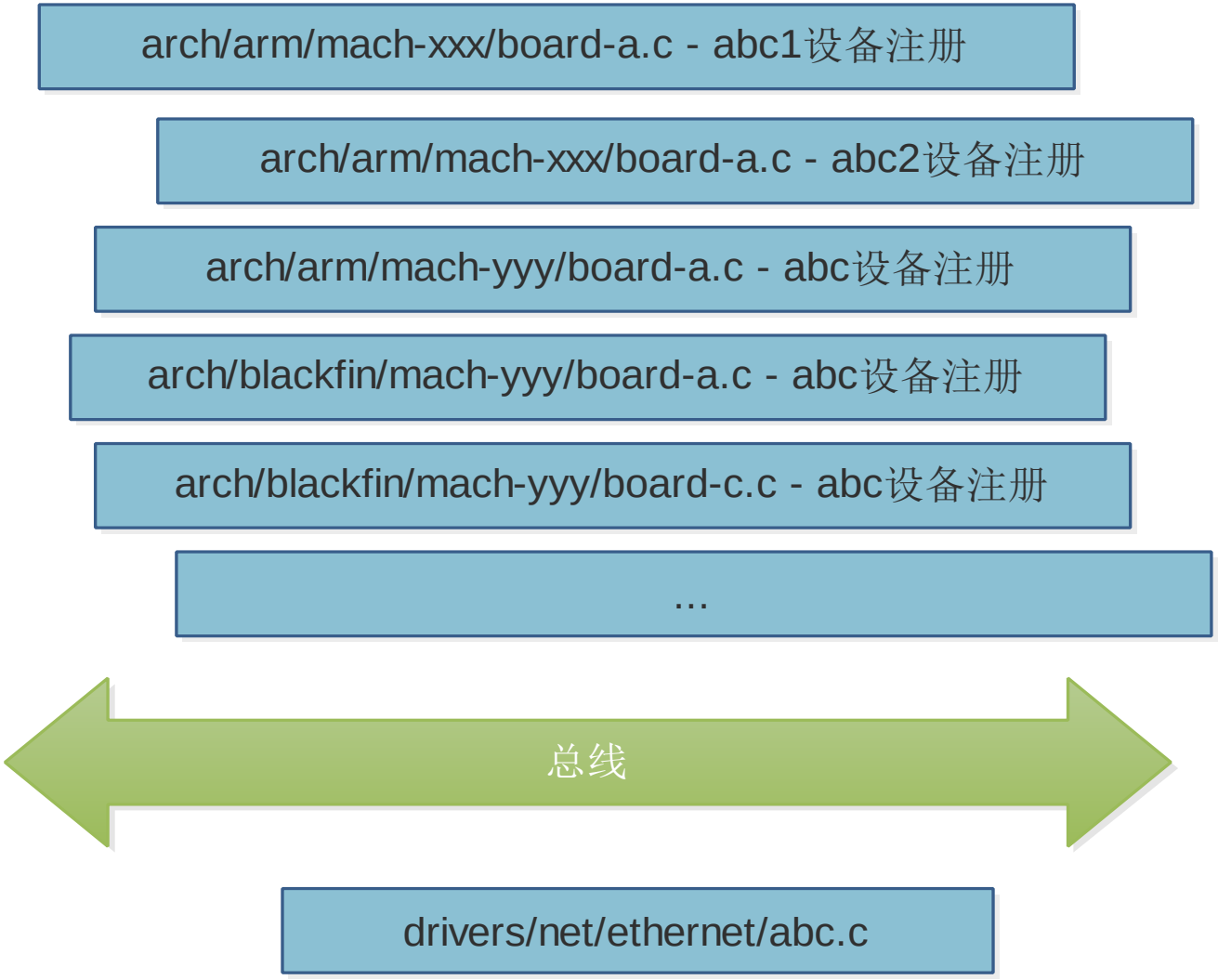
实体	功能	代码
设备	描述基地址、中断号、时钟、DMA、复位等信息	arch/arm arch/blackfin arch/xxx 等目录
驱动	完成外设的功能，如网卡收发包，声卡录放，SD卡读写...	drivers/net sound drivers/mmc 等目录
总线	完成设备和驱动的关联	drivers/base/platform.c drivers/pci/pci-driver.c ...

匹配



驱动、设备注册demo：globalfifo

设备是设备，驱动是驱动


arch/arm/mach-xxx/board-a.c - abc1设备注册
arch/arm/mach-xxx/board-a.c - abc2设备注册
arch/arm/mach-yyy/board-a.c - abc设备注册
arch/blackfin/mach-yyy/board-a.c - abc设备注册
arch/blackfin/mach-yyy/board-c.c - abc设备注册
...
总线
drivers/net/ethernet/abc.c

设备端代码: arch/xxx/

```
static struct resource dm9000_resource1[] = {
        {
                .start = 0x20100000,
                .end   = 0x20100000 + 1,
                .flags = IORESOURCE_MEM
        ...
                .start = IRQ_PF15,
                .end   = IRQ_PF15,
                .flags = IORESOURCE_IRQ | IORESOURCE_IRQ_HIGHEDGE
        }
};

static struct platform_device dm9000_device1 = {
        .name           = "dm9000",
        .id             = 0,
        .num_resources  = ARRAY_SIZE(dm9000_resource1),
        .resource       = dm9000_resource1,
};

static struct platform_device *ip0x_devices[] __initdata = {
        &dm9000_device1,
        &dm9000_device2,
};

static int __init ip0x_init(void)
{
        platform_add_devices(ip0x_devices, ARRAY_SIZE(ip0x_devices));
}
```

驱动端代码：drivers/xxx/

```
static int dm9000_probe(struct platform_device *pdev)
{
        ...
        db->addr_res = platform_get_resource(pdev, IORESOURCE_MEM, 0);
        db->data_res = platform_get_resource(pdev, IORESOURCE_MEM, 1);
        db->irq_res  = platform_get_resource(pdev, IORESOURCE_IRQ, 0);
        ...
}

static struct platform_driver dm9000_driver = {
        .driver = {
                .name    = "dm9000",
                .pm      = &dm9000_drv_pm_ops,
                .of_match_table = of_match_ptr(dm9000_of_matches),
        },
        .probe   = dm9000_probe,
        .remove  = dm9000_drv_remove,
};
```

总线match函数

```
static int platform_match(struct device *dev, struct device_driver *drv)
{
	struct platform_device *pdev = to_platform_device(dev);
	struct platform_driver *pdrv = to_platform_driver(drv);

	/* When driver_override is set, only bind to the matching driver */
	if (pdev->driver_override)
		return !strcmp(pdev->driver_override, drv->name);

	/* Attempt an OF style match first */
	if (of_driver_match_device(dev, drv))
		return 1;

	/* Then try ACPI style match */
	if (acpi_driver_match_device(dev, drv))
		return 1;

	/* Then try to match against the id table */
	if (pdrv->id_table)
		return platform_match_id(pdrv->id_table, pdev) != NULL;

	/* fall-back to driver name match */
	return (strcmp(pdev->name, drv->name) == 0);
}
```

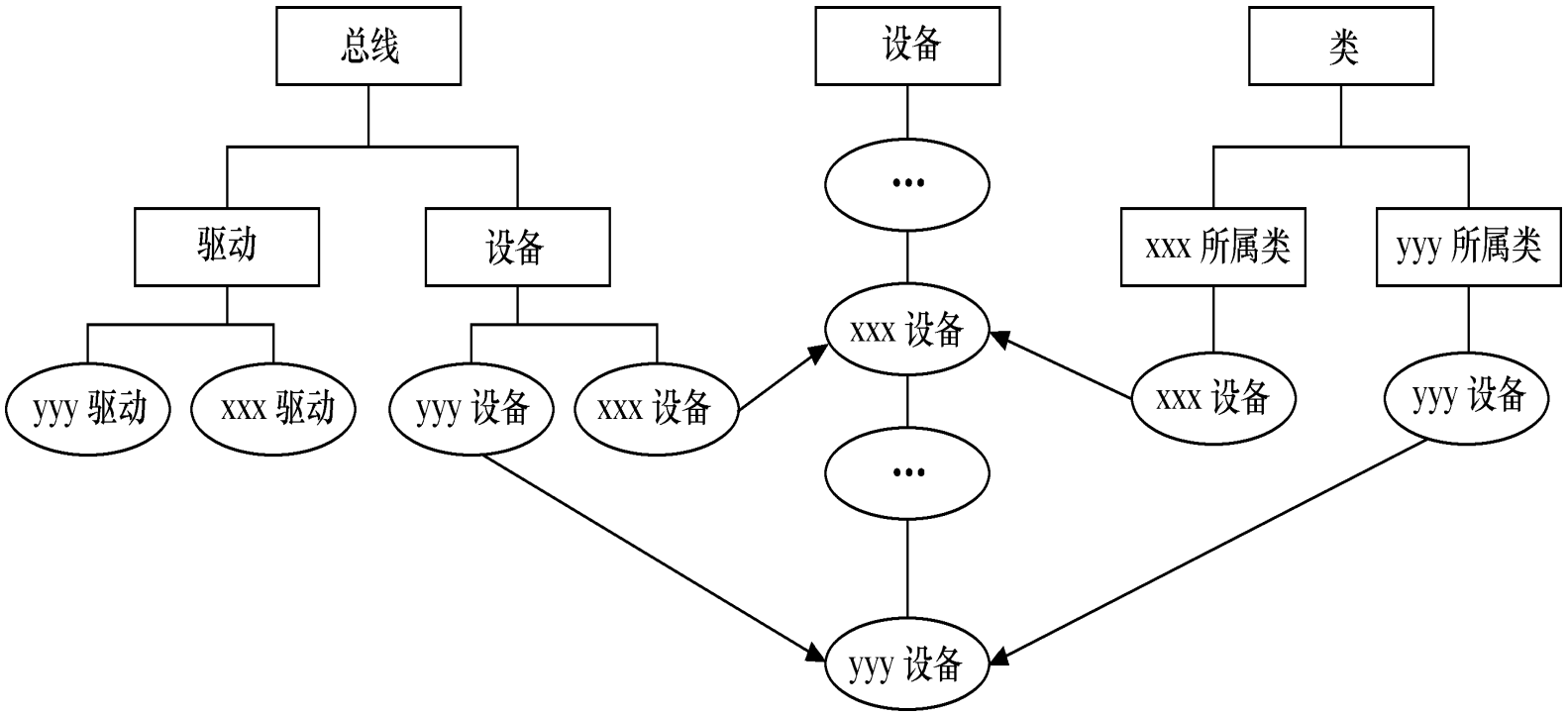
1个驱动多个设备

Linux习惯使用alloc
Linux习惯使用私有数据

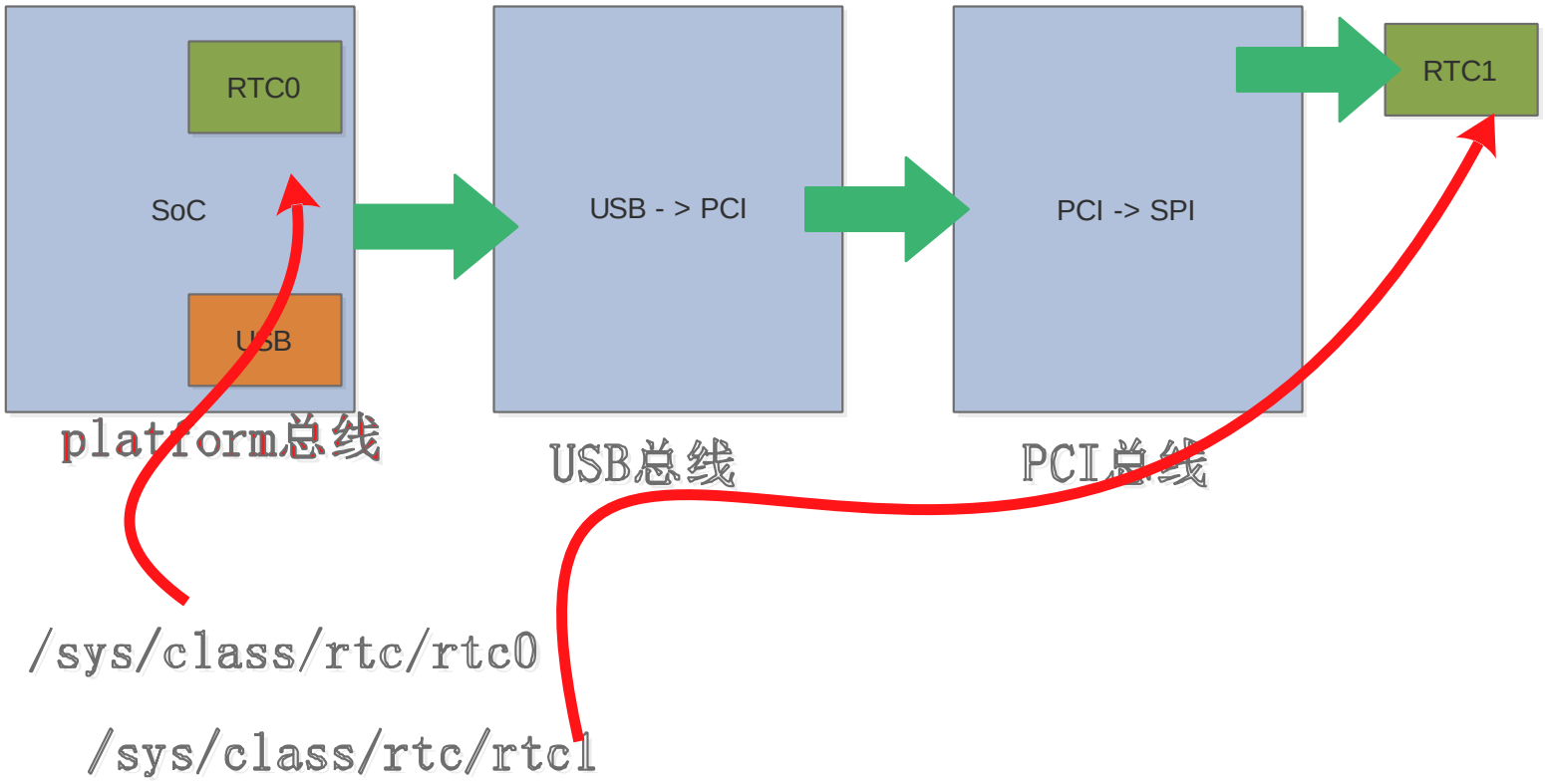
```
static int dm9000_probe(struct platform_device *pdev)
{
        struct board_info *db;        /* Point a board information structure */
        ...
        ndev = alloc_etherdev(sizeof(struct board_info));
        if (!ndev)
                return -ENOMEM;
        ...
        /* setup board info structure */
        db = netdev_priv(ndev);
        ...
        db->addr_res = platform_get_resource(pdev, IORESOURCE_MEM, 0);
        db->data_res = platform_get_resource(pdev, IORESOURCE_MEM, 1);
        db->irq_res  = platform_get_resource(pdev, IORESOURCE_IRQ, 0);
        ...
        ret = register_netdev(ndev);
        ...
        return ret;
}

static int dm9000_start_xmit(struct sk_buff *skb, struct net_device *dev)
{
        struct board_info *db = netdev_priv(dev);
        ...
        return NETDEV_TX_OK;
}
```

/sys

- /sys/bus
- /sys/devices
- /sys/class



class的视角


RTC0
SoC
USB
USB - > PCI
PCI -> SPI
RTC1
platform总线
USB总线
PCI总线
/sys/class/rtc/rtc0
/sys/class/rtc/rtc1

一个LED在/sys/devices和/sys/class

/sys/class/leds/v2m:green:user1 简洁直观的路径

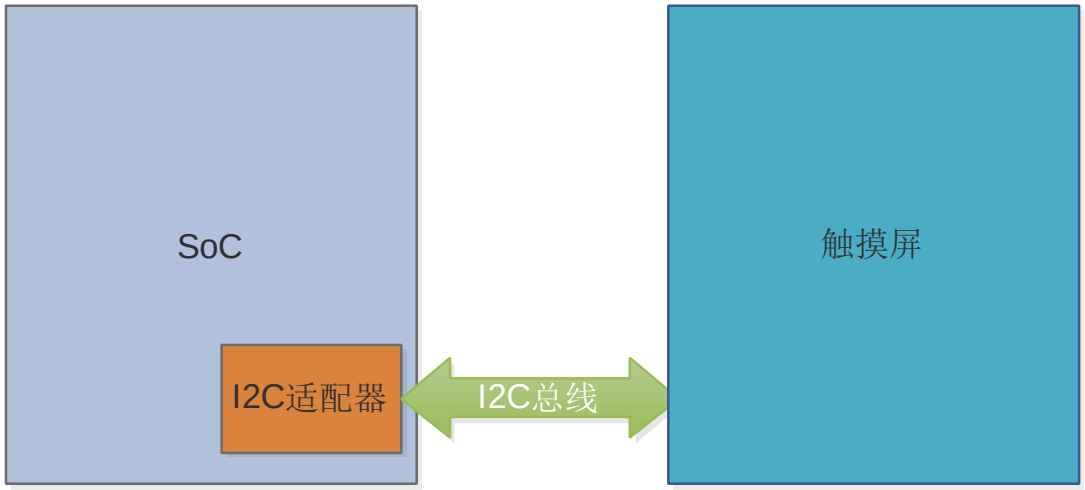
/sys/devices/platform/smb/smb:motherboard/smb:motherboard:leds/leds/vm:green:user1
等级化的硬件互连

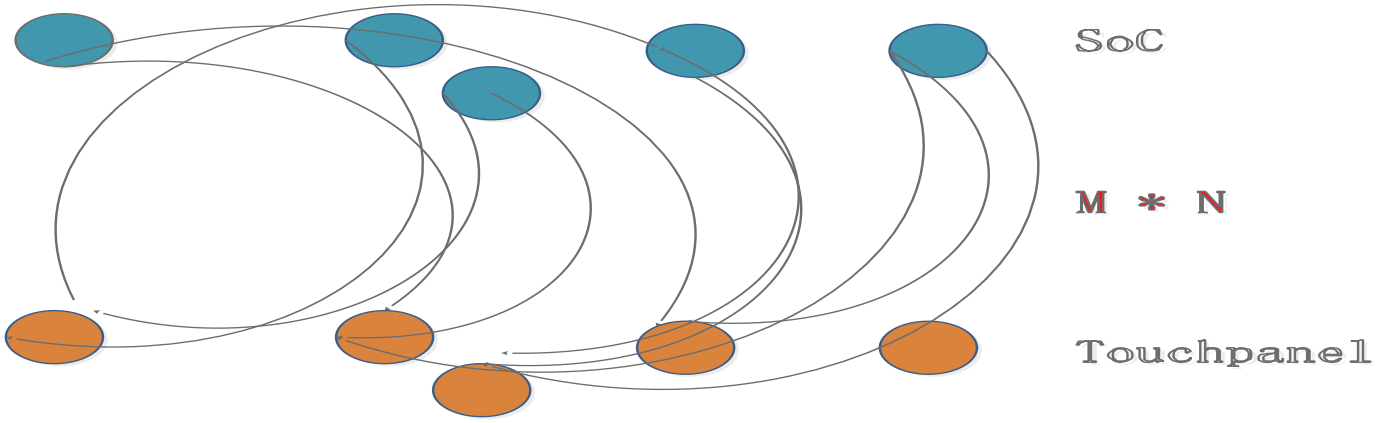
总线级联 - 单片机编码思维

可以这样写代码吗？

cpu_x_i2c_reg...
cpu_x_i2c_reg...
tp_y_reg...
tp_y_reg...
cpu_x_i2c_reg...
cpu_x_i2c_reg...
tp_y_reg...
tp_y_reg...

这是M*N强耦合



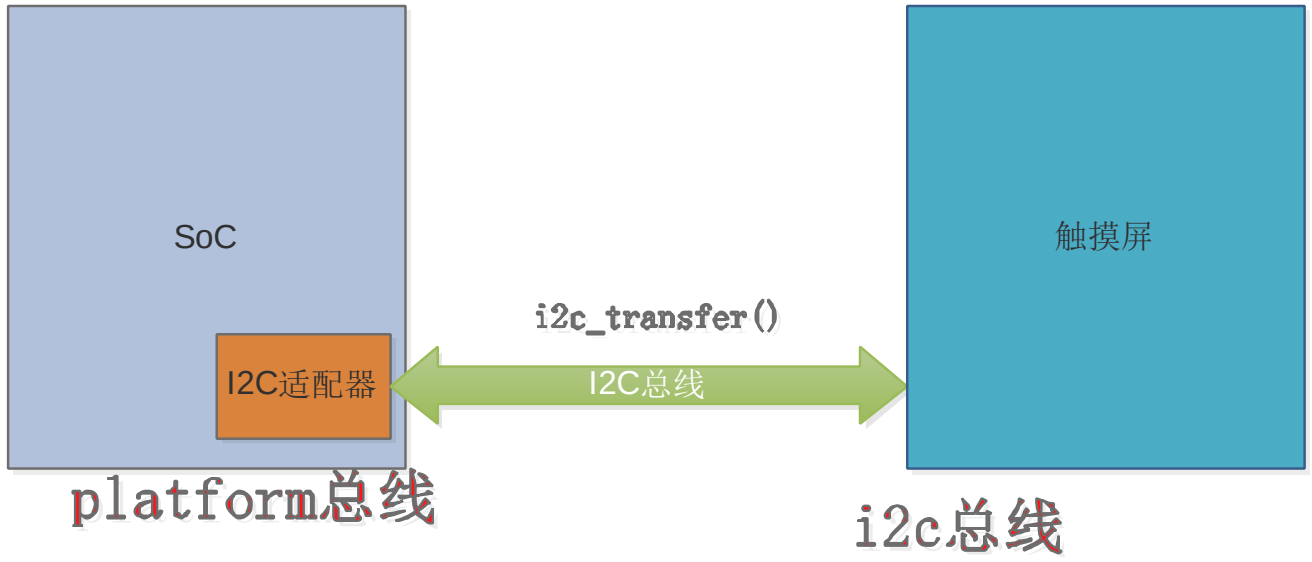


总线级联 - 适配器单独驱动

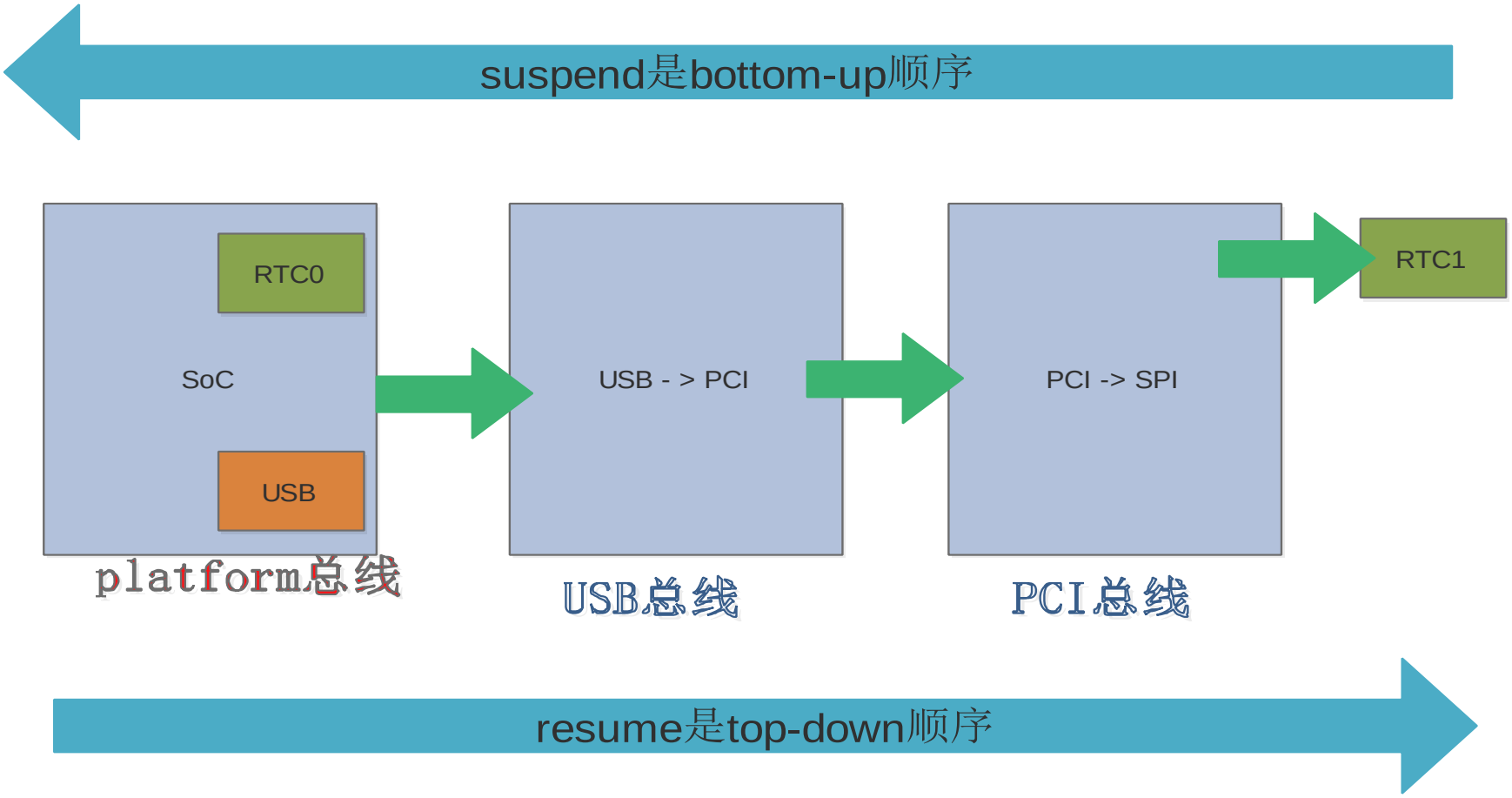
每一级透过自己挂的总线枚举进来；
尽管它自己可能是总线适配器

可以这样写代码吗？

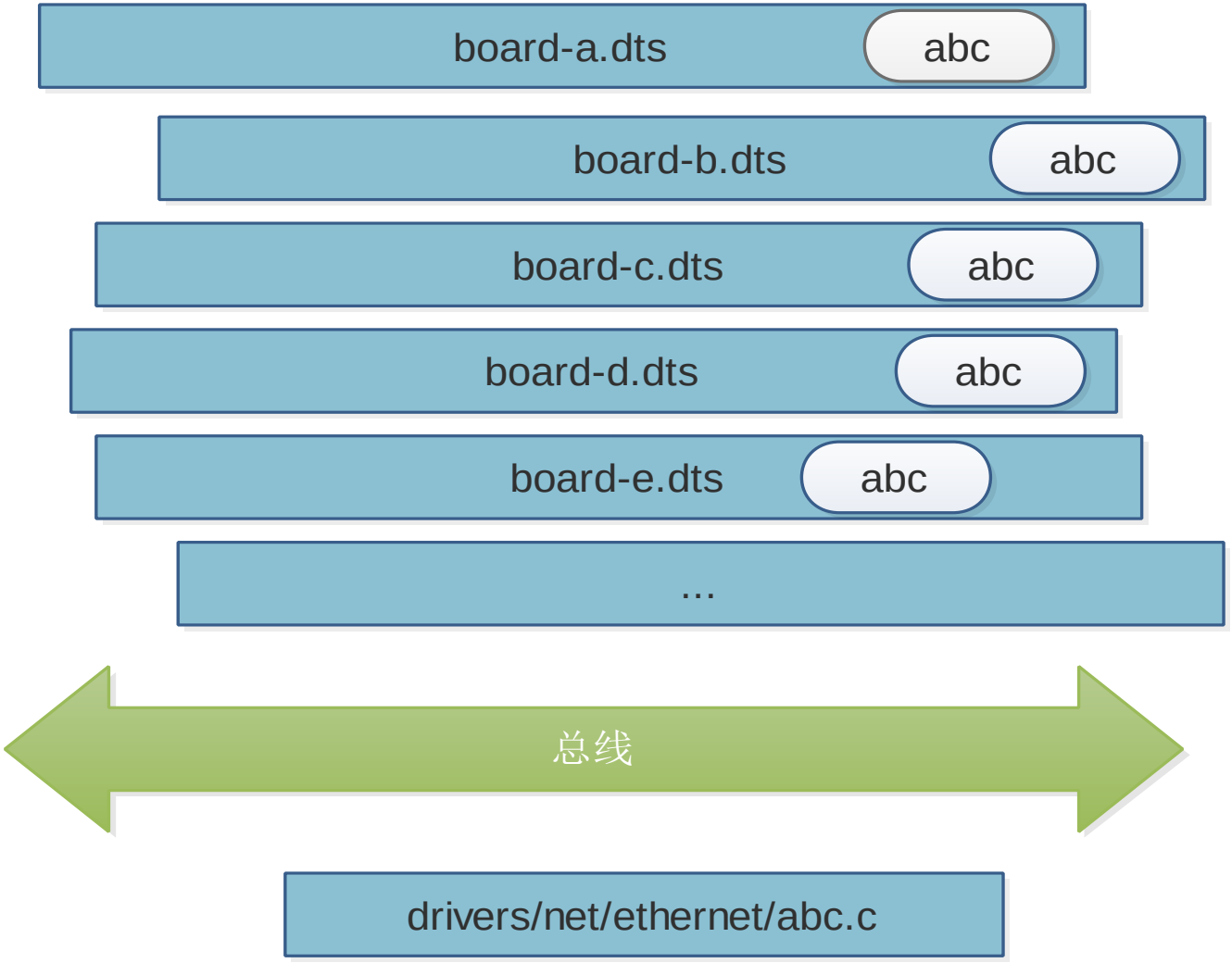
```
cpu_x_i2c_reg...
cpu_x_i2c_reg...
tp_y_reg...
tp_y_reg...
cpu_x_i2c_reg...
cpu_x_i2c_reg...
tp_y_reg...
tp_y_reg...
```



总线级联与电源管理


suspend是bottom-up顺序
RTC0
SoC
USB
USB - > PCI
PCI -> SPI
RTC1
platform总线
USB总线
PCI总线
resume是top-down顺序

设备在脚本，驱动在C里


board-a.dts
abc
board-b.dts
abc
board-c.dts
abc
board-d.dts
abc
board-e.dts
abc
...
总线
drivers/net/ethernet/abc.c

DTS

开机过程中执行的类似语句会帮忙从dts节点生成platform_device：
of_platform_populate(NULL, of_default_bus_match_table, NULL, NULL);

```
eth: eth@4,c00000 {
        compatible = "davicom,dm9000";
        reg = <
            4 0x00c00000 0x2
            4 0x00c00002 0x2
        >;
        interrupt-parent = <&gpio2>;
        interrupts = <14 IRQ_TYPE_LEVEL_LOW>;
        ...
    };
```

dts和driver的匹配

```
eth: eth@4,c00000 {
        compatible = "davicom,dm9000";
        …
    };
```

```
#ifdef CONFIG_OF
static const struct of_device_id dm9000_of_matches[] = {
    { .compatible = "davicom,dm9000", },
    { /* sentinel */ }
};
MODULE_DEVICE_TABLE(of, dm9000_of_matches);
#endif

static struct platform_driver dm9000_driver = {
    .driver = {
        .name    = "dm9000",
        .pm      = &dm9000_drv_pm_ops,
        .of_match_table = of_match_ptr(dm9000_of_matches),
    },
    .probe   = dm9000_probe,
    .remove  = dm9000_drv_remove,
};
```

Of populate 展开device

of_platform_populate函数会最终生成和展开platform_device

```
struct platform_device *of_device_alloc(struct device_node *np,
                                        const char *bus_id,
                                        struct device *parent)
{
        struct platform_device *dev;
        int rc, i, num_reg = 0, num_irq;
        struct resource *res, temp_res;

        dev = platform_device_alloc("", -1);
        if (!dev)
                return NULL;

        /* count the io and irq resources */
        while (of_address_to_resource(np, num_reg, &temp_res) == 0)
                num_reg++;
        num_irq = of_irq_count(np);

        /* Populate the resource table */
        if (num_irq || num_reg) {
                res = kzalloc(sizeof(*res) * (num_irq + num_reg), GFP_KERNEL);
                ...
                dev->num_resources = num_reg + num_irq;
                dev->resource = res;
                for (i = 0; i < num_reg; i++, res++) {
                        rc = of_address_to_resource(np, i, res);
                        WARN_ON(rc);
                }
                if (of_irq_to_resource_table(np, res, num_irq) != num_irq)
                        ...
        }
        ...
}
```

设备驱动模型连本质都没有变!

- 2017.8.14

CSDN 《深入理解Linux的设备树》直播

讲解时间：2017年8月14日晚8时

报名直播或者录播：
http://edu.csdn.net/huiyiCourse/detail/465

也可扫描二维码报名

谢谢！