



我们专注于嵌入式

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## CS8900A 驱动程序分析

( 国嵌 )

### 1. 寄存器

·LINECTL ( 0112H )

LINECTL 决定 CS8900 的基本配置和物理接口。例如：设置初始值为 00d3H，选择物理接口为 10BASE-T，并使能设备的发送和接收控制位。

·RXCTL ( 0104H )

RXCTL 控制 CS8900 接收特定数据报。设置 RXTCL 的初始值为 0d05H，表示接收网络上的广播或者目标地址同本地物理地址相同的正确数据包。

·RXCFG ( 0102H )

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RXCFG 控制 CS8900 接收到特定数据报后会引发接收中断。RXCFG 可设置为 0103H，这样当收到一个正确的数据报后，CS8900 会产生一个接收中断。

·BUSCT (0116H)

BUSCT 可控制芯片的 I/O 接口的一些操作。设置初始值为 8017H，打开 CS8900 的中断总控制位。

·ISQ (0120H)

ISQ 是网卡芯片的中断状态寄存器，内部映射接收中断状态寄存器和发送中断状态寄存器的内容。

·PORT0 (0000H)

发送和接收数据时，CPU 通过 PORT0 传递数据。

·TXCMD (0004H)

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发送控制寄存器，如果写入数据 00C0H，那么网卡芯片在全部数据写入后开始发送数据。

·TXLENG (0006H)

发送数据长度寄存器，发送数据时，首先写入发送数据长度，然后将数据通过 PORT0 写入芯片。

以上为几个最主要的工作寄存器（为 16 位）。

系统工作时，应首先对网卡芯片进行初始化，即写寄存器 LINECTL、RXCTL、RCCFG、BUSCT。

发数据时，写控制寄存器 TXCMD，并将发送数据长度写入 TXLENG，然后将数据依次写入 PORT0 口，网卡芯片将数据组织为链路层类型并添加填充位和 CRC 校验送到网络。

## 2. 程序框架

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## 2.1 模块注册

```
static int __init init_cs8900a_s3c2410(void)
```

```
{
```

```
    struct net_local *lp;
```

```
    int ret = 0;
```

```
    dev_cs89x0.irq = irq;
```

```
    dev_cs89x0.base_addr = io;
```

```
    dev_cs89x0.init = cs89x0_probe;
```

```
    request_region(dev_cs89x0.base_addr,  
NETCARD_IO_EXTENT, "cs8900a");
```

```
    if (register_netdev(&dev_cs89x0) != 0)
```

```
}
```

## 2.2 设备检测

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```
static int __init cs89x0_probe1(struct net_device *dev, int ioaddr)
{

    /* get the chip type */

    rev_type = readreg(dev, PRODUCT_ID_ADD);

    lp->chip_type = rev_type &~ REVISION_BITS;

    lp->chip_revision = ((rev_type & REVISION_BITS) >> 8) + 'A';


    if (lp->chip_type != CS8900)
    {

        printk(__FILE__ ": wrong device driver!\n");

        ret = -ENODEV;

        goto after_kmalloc;

    }


    dev->dev_addr[0] = 0x00;

    dev->dev_addr[1] = 0x00;

    dev->dev_addr[2] = 0xc0;
```

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```
dev->dev_addr[3] = 0xff;

dev->dev_addr[4] = 0xee;

dev->dev_addr[5] = 0x08;

set_mac_address(dev, dev->dev_addr);


dev->irq = IRQ_LAN;

printk(", IRQ %d", dev->irq);


dev->open      = net_open;

dev->stop      = net_close;

dev->tx_timeout  = net_timeout;

dev->watchdog_timeo = 3 * HZ;

dev->hard_start_xmit = net_send_packet;

dev->get_stats   = net_get_stats;

dev->set_multicast_list = set_multicast_list;

dev->set_mac_address  = set_mac_address;


/* Fill in the fields of the device structure with ethernet values. */

ether_setup(dev);

}
```

---

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## 2.3 数据发送

```
static int net_send_packet(struct sk_buff *skb, struct net_device *dev)
{

    netif_stop_queue(dev);

    /* initiate a transmit sequence */

    writeword(dev, TX_CMD_PORT, lp->send_cmd);

    writeword(dev, TX_LEN_PORT, skb->len);

    /* Test to see if the chip has allocated memory for the packet */

    if ((readreg(dev, PP_BusST) & READY_FOR_TX_NOW) == 0)
    {

        spin_unlock_irq(&lp->lock);

        DPRINTK(1, "cs89x0: Tx buffer not free!\n");

        return 1;

    }

    /* Write the contents of the packet */
```

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```
writeblock(dev, skb->data, skb->len);
```

```
return 0;
```

```
}
```

## 2.4 中断

```
static void net_interrupt(int irq, void *dev_id, struct pt_regs *regs)
```

```
{
```

```
    while ((status = readword(dev, ISQ_PORT)))
```

```
{
```

```
    switch(status & ISQ_EVENT_MASK) {
```

```
        case ISQ_RECEIVER_EVENT:
```

```
            /* Got a packet(s). */
```

```
            net_rx(dev);
```

```
            break;
```

---

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```
case ISQ_TRANSMITTER_EVENT:
```

```
lp->stats.tx_packets++;
```

```
netif_wake_queue(dev); /* Inform upper layers. */
```

```
break;
```

```
}
```

## 2.5 接收

```
static void net_rx(struct net_device *dev) {
```

```
    status = inw(ioaddr + RX_FRAME_PORT);
```

```
    if ((status & RX_OK) == 0) {
```

```
        count_rx_errors(status, lp);
```

```
        return;
```

```
    }
```

```
    length = inw(ioaddr + RX_FRAME_PORT);
```

```
    /* Malloc up new buffer. */
```

```
    skb = dev_alloc_skb(length + 2);
```

---

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---

```
if (skb == NULL) {  
  
    lp->stats.rx_dropped++;  
  
    return;  
  
}  
  
    skb_reserve(skb, 2);  
  
/*  mac 头是 14 个字节，一开始保留两个字节，正是为了保证 ip 头  
   的开始是四字节对齐的。*/  
  
    skb->len = length;  
  
    skb->dev = dev;  
  
    readblock(dev, skb->data, skb->len);  
  
  
    skb->protocol=eth_type_trans(skb,dev);  
  
    netif_rx(skb);  
  
}
```

---

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## DM9000 驱动程序分析

### 1. 模块注册

```
static int __init dm9000_init(void)
{
    printk(KERN_INFO "%s Ethernet Driver, V%s\n",
        CARDNAME, DRV_VERSION);

    return platform_driver_register(&dm9000_driver);
}

static struct platform_driver dm9000_driver = {
    .driver = {
        .name      = "dm9000",
        .owner     = THIS_MODULE,
    },
    .probe      = dm9000_probe,
    .remove     = __devexit_p(dm9000_drv_remove),
    .suspend    = dm9000_drv_suspend,
```

---

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```
.resume = dm9000_drv_resume,  
};
```

## 2. 驱动初始化

```
static int __devinit  
dm9000_probe(struct platform_device *pdev)  
{  
    struct dm9000_plat_data *pdata = pdev->dev.platform_data;  
    struct board_info *db; /* Point a board information structure */  
    struct net_device *ndev;  
    const unsigned char *mac_src;  
    int ret = 0;  
    int iosize;  
    int i;  
    u32 id_val;  
  
    /* Init network device */  
  
    ndev = alloc_etherdev(sizeof(struct board_info));
```

---

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```
if (!ndev) {  
    dev_err(&pdev->dev, "could not allocate device.\n");  
    return -ENOMEM;  
}  
  
SET_NETDEV_DEV(ndev, &pdev->dev);  
  
dev_dbg(&pdev->dev, "dm9000_probe()\n");  
  
/* setup board info structure */  
db = netdev_priv(ndev);  
memset(db, 0, sizeof(*db));  
  
db->dev = &pdev->dev;  
db->ndev = ndev;  
  
spin_lock_init(&db->lock);  
mutex_init(&db->addr_lock);  
  
INIT_DELAYED_WORK(&db->phy_poll, dm9000_poll_work);
```

---

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---

```
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);
```

```
if (db->addr_res == NULL || db->data_res == NULL ||  
    db->irq_res == NULL) {  
    dev_err(db->dev, "insufficient resources\n");  
    ret = -ENOENT;  
    goto out;  
}
```

```
iosize = res_size(db->addr_res);
```

```
db->addr_req  = request_mem_region(db->addr_res->start,  
iosize,  
    pdev->name);
```

---

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```
if (db->addr_req == NULL) {  
    dev_err(db->dev, "cannot claim address reg area\n");  
    ret = -EIO;  
    goto out;  
}
```

```
db->io_addr = ioremap(db->addr_res->start, iosize);
```

```
if (db->io_addr == NULL) {  
    dev_err(db->dev, "failed to ioremap address reg\n");  
    ret = -EINVAL;  
    goto out;  
}
```

```
iosize = res_size(db->data_res);
```

```
db->data_req = request_mem_region(db->data_res->start, iosize,  
    pdev->name);
```

```
if (db->data_req == NULL) {  
    dev_err(db->dev, "cannot claim data reg area\n");
```



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```
ret = -EIO;

goto out;

}

db->io_data = ioremap(db->data_res->start, iosize);

if (db->io_data == NULL) {

    dev_err(db->dev, "failed to ioremap data reg\n");

    ret = -EINVAL;

    goto out;

}

/* fill in parameters for net-dev structure */

ndev->base_addr = (unsigned long)db->io_addr;

ndev->irq = db->irq_res->start;

/* ensure at least we have a default set of IO routines */

dm9000_set_io(db, iosize);

/* check to see if anything is being over-ridden */
```

---

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```
if (pdata != NULL) {  
  
    /* check to see if the driver wants to over-ride the  
  
    * default IO width */  
  
    if (pdata->flags & DM9000_PLATF_8BITONLY)  
  
        dm9000_set_io(db, 1);  
  
    if (pdata->flags & DM9000_PLATF_16BITONLY)  
  
        dm9000_set_io(db, 2);  
  
    if (pdata->flags & DM9000_PLATF_32BITONLY)  
  
        dm9000_set_io(db, 4);  
  
    /* check to see if there are any IO routine  
  
    * over-rides */  
  
    if (pdata->inblk != NULL)  
  
        db->inblk = pdata->inblk;  
  
    if (pdata->outblk != NULL)
```

---

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```
db->outblk = pdata->outblk;

if (pdata->dumpblk != NULL)

    db->dumpblk = pdata->dumpblk;

db->flags = pdata->flags;
}

#ifdef CONFIG_DM9000_FORCE_SIMPLE_PHY_POLL

    db->flags |= DM9000_PLATF_SIMPLE_PHY;

#endif

dm9000_reset(db);

/* try multiple times, DM9000 sometimes gets the read wrong */
for (i = 0; i < 8; i++) {

    id_val  = ior(db, DM9000_VIDL);

    id_val |= (u32)ior(db, DM9000_VIDH) << 8;

    id_val |= (u32)ior(db, DM9000_PIDL) << 16;

    id_val |= (u32)ior(db, DM9000_PIDH) << 24;
```

---

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```
if (id_val == DM9000_ID)

    break;

dev_err(db->dev, "read wrong id 0x%08x\n", id_val);
}

if (id_val != DM9000_ID) {

    dev_err(db->dev, "wrong id: 0x%08x\n", id_val);

    ret = -ENODEV;

    goto out;
}

/* Identify what type of DM9000 we are working on */

id_val = ior(db, DM9000_CHIPR);

dev_dbg(db->dev, "dm9000 revision 0x%02x\n", id_val);

switch (id_val) {

case CHIPR_DM9000A:

    db->type = TYPE_DM9000A;
```

---

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---

```
break;

case CHIPR_DM9000B:

    db->type = TYPE_DM9000B;

    break;

default:

    dev_dbg(db->dev, "ID %02x => defaulting to DM9000E\n",
id_val);

    db->type = TYPE_DM9000E;

}

/* from this point we assume that we have found a DM9000 */

/* driver system function */

ether_setup(ndev);

ndev->open          = &dm9000_open;

ndev->hard_start_xmit    = &dm9000_start_xmit;

ndev->tx_timeout      = &dm9000_timeout;

ndev->watchdog_timeo = msecs_to_jiffies(watchdog);

ndev->stop           = &dm9000_stop;
```

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```
ndev->set_multicast_list = &dm9000_hash_table;
```

```
ndev->ethtool_ops      = &dm9000_ethtool_ops;
```

```
ndev->do_ioctl         = &dm9000_ioctl;
```

```
#ifdef CONFIG_NET_POLL_CONTROLLER
```

```
    ndev->poll_controller = &dm9000_poll_controller;
```

```
#endif
```

```
db->msg_enable          = NETIF_MSG_LINK;
```

```
db->mii.phy_id_mask     = 0x1f;
```

```
db->mii.reg_num_mask = 0x1f;
```

```
db->mii.force_media    = 0;
```

```
db->mii.full_duplex    = 0;
```

```
db->mii.dev            = ndev;
```

```
db->mii.mdio_read      = dm9000_phy_read;
```

```
db->mii.mdio_write     = dm9000_phy_write;
```

```
mac_src = "eeprom";
```

```
/* try reading the node address from the attached EEPROM */
```

---

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```
for (i = 0; i < 6; i += 2)

    dm9000_read_eeprom(db, i / 2, ndev->dev_addr+i);

if (!is_valid_ether_addr(ndev->dev_addr) && pdata != NULL) {

    mac_src = "platform data";

    memcpy(ndev->dev_addr, pdata->dev_addr, 6);

}

if (!is_valid_ether_addr(ndev->dev_addr)) {

    /* try reading from mac */

    mac_src = "chip";

    for (i = 0; i < 6; i++)

        ndev->dev_addr[i] = ior(db, i+DM9000_PAR);

}

if (!is_valid_ether_addr(ndev->dev_addr))

    dev_warn(db->dev, "%s: Invalid ethernet MAC address.

Please "

        "set using ifconfig\n", ndev->name);
```

---

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---

```
platform_set_drvdata(pdev, ndev);
```

```
ret = register_netdev(ndev);
```

```
if (ret == 0)
```

```
    printk(KERN_INFO "%s: dm9000%c at %p,%p IRQ %d
```

```
    MAC: %pM (%s)\n",
```

```
        ndev->name, dm9000_type_to_char(db->type),
```

```
        db->io_addr, db->io_data, ndev->irq,
```

```
        ndev->dev_addr, mac_src);
```

```
    return 0;
```

```
out:
```

```
    dev_err(db->dev, "not found (%d).\n", ret);
```

```
    dm9000_release_board(pdev, db);
```

```
    free_netdev(ndev);
```

```
    return ret;
```

---

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---

}

### 3. 打开网卡

```
static int dm9000_open(struct net_device *dev)
{
    board_info_t *db = netdev_priv(dev);

    unsigned long irqflags = db->irq_res->flags &
    IRQF_TRIGGER_MASK;

    if (netif_msg_ifup(db))
        dev_dbg(db->dev, "enabling %s\n", dev->name);

    /* If there is no IRQ type specified, default to something that
     * may work, and tell the user that this is a problem */

    if (irqflags == IRQF_TRIGGER_NONE)
        dev_warn(db->dev, "WARNING: no IRQ resource flags
set.\n");
```

---

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---

```
irqflags |= IRQF_SHARED;

if (request_irq(dev->irq, &dm9000_interrupt, irqflags,
dev->name, dev))

    return -EAGAIN;

/* Initialize DM9000 board */

dm9000_reset(db);

dm9000_init_dm9000(dev);

/* Init driver variable */

db->dbug_cnt = 0;

mii_check_media(&db->mii, netif_msg_link(db), 1);

netif_start_queue(dev);

dm9000_schedule_poll(db);

return 0;
```

---

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---

}

#### 4. 数据发送

```
static int dm9000_start_xmit(struct sk_buff *skb, struct net_device
*dev)
{
    unsigned long flags;

    board_info_t *db = netdev_priv(dev);

    dm9000_dbg(db, 3, "%s:\n", __func__);

    if (db->tx_pkt_cnt > 1)
        return 1;

    spin_lock_irqsave(&db->lock, flags);

    /* Move data to DM9000 TX RAM */

    writew(DM9000_MWCMD, db->io_addr);
```

---

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---

```
(db->outblk)(db->io_data, skb->data, skb->len);

dev->stats.tx_bytes += skb->len;

db->tx_pkt_cnt++;

/* TX control: First packet immediately send, second packet queue */
if (db->tx_pkt_cnt == 1) {

    /* Set TX length to DM9000 */

    iow(db, DM9000_TXPLL, skb->len);

    iow(db, DM9000_TXPLH, skb->len >> 8);

    /* Issue TX polling command */

    iow(db, DM9000_TCR, TCR_TXREQ); /* Cleared after TX
complete */

    dev->trans_start = jiffies; /* save the time stamp */

} else {

    /* Second packet */

    db->queue_pkt_len = skb->len;

    netif_stop_queue(dev);
```

---

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---

```
}

spin_unlock_irqrestore(&db->lock, flags);

/* free this SKB */
dev_kfree_skb(skb);

return 0;
}
```

## 5. 数据接收

```
static irqreturn_t dm9000_interrupt(int irq, void *dev_id)
{
    struct net_device *dev = dev_id;

    board_info_t *db = netdev_priv(dev);

    int int_status;

    unsigned long flags;

    u8 reg_save;
```

---

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---

```
dm9000_dbg(db, 3, "entering %s\n", __func__);
```

```
/* A real interrupt coming */
```

```
/* holders of db->lock must always block IRQs */
```

```
spin_lock_irqsave(&db->lock, flags);
```

```
/* Save previous register address */
```

```
reg_save = readb(db->io_addr);
```

```
/* Disable all interrupts */
```

```
iow(db, DM9000_IMR, IMR_PAR);
```

```
/* Got DM9000 interrupt status */
```

```
int_status = ior(db, DM9000_ISR); /* Got ISR */
```

```
iow(db, DM9000_ISR, int_status); /* Clear ISR status */
```

```
if (netif_msg_intr(db))
```

```
    dev_dbg(db->dev, "interrupt status %02x\n", int_status);
```

---

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---

```
/* Received the coming packet */
```

```
if (int_status & ISR_PRS)
```

```
    dm9000_rx(dev);
```

```
/* Trnasmit Interrupt check */
```

```
if (int_status & ISR_PTS)
```

```
    dm9000_tx_done(dev, db);
```

```
if (db->type != TYPE_DM9000E) {
```

```
    if (int_status & ISR_LNKCHNG) {
```

```
        /* fire a link-change request */
```

```
        schedule_delayed_work(&db->phy_poll, 1);
```

```
    }
```

```
}
```

```
/* Re-enable interrupt mask */
```

```
iow(db, DM9000_IMR, db->imr_all);
```

```
/* Restore previous register address */
```

---

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# 我们专注于嵌入式

---

```
writeb(reg_save, db->io_addr);

spin_unlock_irqrestore(&db->lock, flags);

return IRQ_HANDLED;
}
```

```
static void
dm9000_rx(struct net_device *dev)
{
    board_info_t *db = netdev_priv(dev);

    struct dm9000_rxhdr rxhdr;

    struct sk_buff *skb;

    u8 rxbyte, *rdptr;

    bool GoodPacket;

    int RxLen;

    /* Check packet ready or not */

    do {
```

---

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---

```
ior(db, DM9000_MRCMDX); /* Dummy read */

/* Get most updated data */

rxbyte = readb(db->io_data);

/* Status check: this byte must be 0 or 1 */

if (rxbyte > DM9000_PKT_RDY) {

    dev_warn(db->dev, "status check fail: %d\n", rxbyte);

    iow(db, DM9000_RCR, 0x00); /* Stop Device */

    iow(db, DM9000_ISR, IMR_PAR);/* Stop INT request */

    return;

}

if (rxbyte != DM9000_PKT_RDY)

    return;

/* A packet ready now  & Get status/length */

GoodPacket = true;

writeb(DM9000_MRCMD, db->io_addr);
```

---

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---

```
(db->inblk)(db->io_data, &rxhdr, sizeof(rxhdr));
```

```
RxLen = le16_to_cpu(rxhdr.RxLen);
```

```
if (netif_msg_rx_status(db))
```

```
    dev_dbg(db->dev, "RX: status %02x, length %04x\n",
```

```
        rxhdr.RxStatus, RxLen);
```

```
/* Packet Status check */
```

```
if (RxLen < 0x40) {
```

```
    GoodPacket = false;
```

```
    if (netif_msg_rx_err(db))
```

```
        dev_dbg(db->dev, "RX: Bad Packet (runt)\n");
```

```
}
```

```
if (RxLen > DM9000_PKT_MAX) {
```

```
    dev_dbg(db->dev, "RST: RX Len:%x\n", RxLen);
```

```
}
```

```
/* rxhdr.RxStatus is identical to RSR register. */
```

---

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---

```
if (rxhdr.RxStatus & (RSR_FOE | RSR_CE | RSR_AE |  
  
    RSR_PLE | RSR_RWTO |  
  
    RSR_LCS | RSR_RF)) {  
  
    GoodPacket = false;  
  
    if (rxhdr.RxStatus & RSR_FOE) {  
  
        if (netif_msg_rx_err(db))  
  
            dev_dbg(db->dev, "fifo error\n");  
  
        dev->stats.rx_fifo_errors++;  
  
    }  
  
    if (rxhdr.RxStatus & RSR_CE) {  
  
        if (netif_msg_rx_err(db))  
  
            dev_dbg(db->dev, "crc error\n");  
  
        dev->stats.rx_crc_errors++;  
  
    }  
  
    if (rxhdr.RxStatus & RSR_RF) {  
  
        if (netif_msg_rx_err(db))  
  
            dev_dbg(db->dev, "length error\n");  
  
        dev->stats.rx_length_errors++;  
  
    }  
  
}
```

---

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---

```
/* Move data from DM9000 */

if (GoodPacket

    && ((skb = dev_alloc_skb(RxLen + 4)) != NULL)) {

    skb_reserve(skb, 2);

    rdptr = (u8 *) skb_put(skb, RxLen - 4);

    /* Read received packet from RX SRAM */

    (db->inblk)(db->io_data, rdptr, RxLen);

    dev->stats.rx_bytes += RxLen;

    /* Pass to upper layer */

    skb->protocol = eth_type_trans(skb, dev);

    netif_rx(skb);

    dev->stats.rx_packets++;

} else {

    /* need to dump the packet's data */
```



# 我们专注于嵌入式

---

```
(db->dumpblk)(db->io_data, RxLen);  
  
}  
  
} while (rxbyte == DM9000_PKT_RDY);  
  
}
```

---

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