Dsr.c
Ack 发送、选项添加、选项接收
Ack-request 创建、添加、发送、接收
Dsr-dev.c

sk_buff（socket buffer）结构是 linux 网络代码中重要的数据结构，它管理和控制接收或发送数据包的信息。

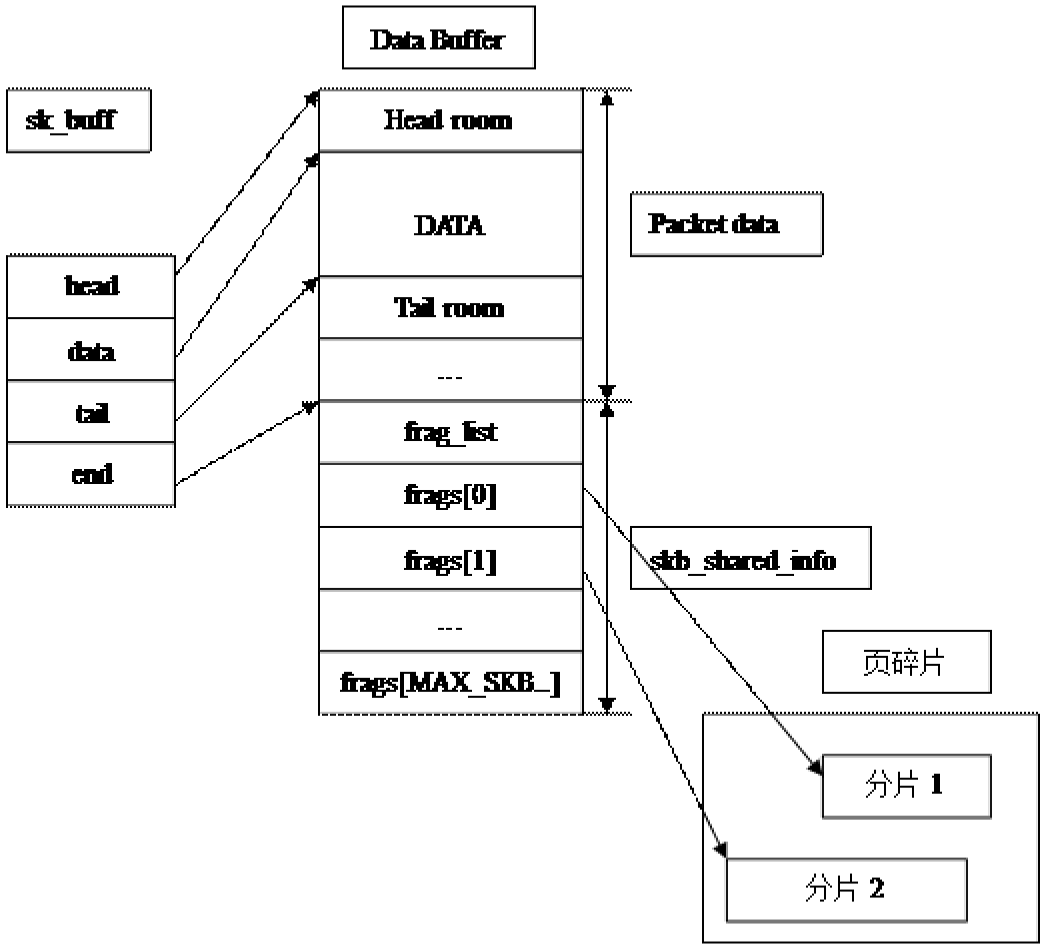
sk_buff 组成

Packet data：通过网卡收发的报文，包括链路层、网络层、传输层的协议头和携带的应用数据，包括 head room,data,tail room 三部分。

skb_shared_info 作为 packet data 的补充，用于存储 ip 分片，其中 sk_buff *frag_list 是一系列子 skbuff 链表，而 frag[]是由一组单独的 page 组成的数据缓冲区。

Data buffer：用于存储 packet data 的缓冲区，分为以上两部分。

Sk_buff：缓冲区控制结构 sk_buff。



```c
struct sk_buff *dsr_skb_create(struct dsr_pkt *dp, struct net_device *dev)
{
    struct sk_buff *skb;
    char *buf;
    int ip_len;
    int tot_len;
    int dsr_opts_len = dsr_pkt_opts_len(dp);

    ip_len = dp->nh.iph->ihl << 2;

    tot_len = ip_len + dsr_opts_len + dp->payload_len;

    DEBUG("ip_len=%d dsr_opts_len=%d payload_len=%d tot_len=%d\n",
          ip_len, dsr_opts_len, dp->payload_len, tot_len);
#ifdef KERNEL26
    skb = alloc_skb(tot_len + LL_RESERVED_SPACE(dev), GFP_ATOMIC);
#else
    skb = alloc_skb(dev->hard_header_len + 15 + tot_len, GFP_ATOMIC);
#endif
    if (!skb) {
        DEBUG("alloc_skb failed\n");
        return NULL;
    }

    /* We align to 16 bytes, for ethernet: 2 bytes + 14 bytes header */
#ifdef KERNEL26
    skb_reserve(skb, LL_RESERVED_SPACE(dev));
#else
    skb_reserve(skb, (dev->hard_header_len + 15) & ~15);
#endif
    skb->mac.raw = skb->data - 14;
    skb->nh.raw = skb->data;
    skb->dev = dev;
    skb->protocol = htons(ETH_P_IP);

    /* Copy in all the headers in the right order */
    buf = skb_put(skb, tot_len);

    memcpy(buf, dp->nh.raw, ip_len);

    /* For some reason the checksum has to be recalculated here, at least
     * when there is a record route IP option */
    ip_send_check((struct iphdr *)buf);

    buf += ip_len;

    /* Add DSR header if it exists */
    if (dsr_opts_len) {
        memcpy(buf, dp->dh.raw, dsr_opts_len);
        buf += dsr_opts_len;
    }

    /* Add payload */
    if (dp->payload_len && dp->payload)
        memcpy(buf, dp->payload, dp->payload_len);

    return skb;
} « end dsr_skb_create »
```

添加 packet 内容到 socket_buffer

Dsr_hardware_header_create

*int dsr_hw_header_create(struct dsr_pkt *dp, struct sk_buff *skb)*

{

```
	struct sockaddr broadcast =
		{ AF_UNSPEC, {0xff, 0xff, 0xff, 0xff, 0xff, 0xff} };
	struct neighbor_info neigh_info;

	if (dp->dst.s_addr == DSR_BROADCAST)			packet 的目的地址为广播
		memcpy(neigh_info.hw_addr.sa_data, broadcast.sa_data, ETH_ALEN);
	else {
		/* Get hardware destination address */
		if (neigh_tbl_query(dp->nxt_hop, &neigh_info) < 0) {
			DEBUG
				("Could not get hardware address for next hop %s\n",
				 print_ip(dp->nxt_hop));
			return -1;
		}
	}

	if (skb->dev->hard_header) {
		skb->dev->hard_header(skb, skb->dev, ETH_P_IP,
				      neigh_info.hw_addr.sa_data, 0, skb->len);
	} else {
		DEBUG("Missing hard_header\n");
		return -1;
	}
	return 0;
}
```

网络设备地址事件处理

```
static int dsr_dev_inetaddr_event(struct notifier_block *this,
				  unsigned long event, void *ptr)
{
	struct in_ifaddr *ifa = (struct in_ifaddr *)ptr;
	struct in_device *indev;

	if (!ifa)
		return NOTIFY_DONE;

	indev = ifa->ifa_dev;

	if (!indev)
		return NOTIFY_DONE;

	switch (event) {
	case NETDEV_UP:
		DEBUG("inetdev UP\n");
```

```
		if (indev->dev == dsr_dev) {
			struct dsr_node *dnode;
			struct in_addr addr, bc;

			dnode = (struct dsr_node *)indev->dev->priv;

			dsr_node_lock(dnode);
			dnode->ifaddr.s_addr = ifa->ifa_address;
			dnode->bcaddr.s_addr = ifa->ifa_broadcast;

			dnode->slave_indev = in_dev_get(dnode->slave_dev);

					/* Disable rp_filter and enable forwarding */
					if (dnode->slave_indev) {
						rp_filter = dnode->slave_indev->cnf.rp_filter;
						forwarding   =   dnode->slave_indev->cnf.forwarding;
dnode->slave_indev->cnf.rp_filter = 0;
						dnode->slave_indev->cnf.forwarding = 1;
					}
			dsr_node_unlock(dnode);

			addr.s_addr = ifa->ifa_address;
			bc.s_addr = ifa->ifa_broadcast;

			DEBUG("New ip=%s broadcast=%s\n",
			      print_ip(addr), print_ip(bc));
		}
		break;
	default:
		break;
	};
	return NOTIFY_DONE;
}
```

Dsr-device-netdevice-event 处理

Dsr-device-netdevice 启动、状态改变、关闭

```
static int dsr_dev_netdev_event(struct notifier_block *this,
				unsigned long event, void *ptr)
{
	struct net_device *dev = (struct net_device *)ptr;
	struct dsr_node *dnode = (struct dsr_node *)dsr_dev->priv;
	int slave_change = 0;
```

```
if (!dev)
        return NOTIFY_DONE;

switch (event) {
case NETDEV_REGISTER:
        DEBUG("Netdev register %s\n", dev->name);
        if (dnode->slave_dev == NULL &&
                strcmp(dev->name, dnode->slave_ifname) == 0) {     当前无且 name 相同

                DEBUG("Slave dev %s up\n", dev->name);

                dsr_node_lock(dnode);
                dnode->slave_dev = dev;
                dev_hold(dev);
                dsr_node_unlock(dnode);

                /* Reduce the MTU to allow DSR options of 100
                 * bytes. If larger, drop or implement
                 * fragmentation... ;-) Alternatively find a
                 * way to dynamically reduce the data size of
                 * packets depending on the size of the DSR
                 * header. */
                dsr_dev->mtu = dev->mtu - DSR_OPTS_MAX_SIZE;

                DEBUG("Registering packet type\n");
                dsr_packet_type.func = dsr_dev_llrecv;
                dsr_packet_type.dev = dev;
                dev_add_pack(&dsr_packet_type);

                slave_change = 1;
        }

        if (slave_change)
                DEBUG("New DSR slave interface %s\n", dev->name);
        break;
case NETDEV_CHANGE:
        DEBUG("Netdev change\n");
        break;
case NETDEV_UP:
        DEBUG("Netdev up %s\n", dev->name);
        if (ConfVal(PromiscOperation) &&
                dev == dsr_dev && dnode->slave_dev)
                dev_set_promiscuity(dnode->slave_dev, +1);
```

```
		break;
	case NETDEV_UNREGISTER:
		DEBUG("Netdev unregister %s\n", dev->name);

		dsr_node_lock(dnode);
		if (dev == dnode->slave_dev) {
			dev_remove_pack(&dsr_packet_type);
			dsr_packet_type.func = NULL;
			slave_change = 1;
			dev_put(dev);
			dnode->slave_dev = NULL;
		}
		dsr_node_unlock(dnode);

		if (slave_change)
			DEBUG("DSR slave interface %s unregisterd\n",
			      dev->name);
		break;
	case NETDEV_DOWN:
		DEBUG("Netdev down %s\n", dev->name);
		if (dev == dsr_dev) {
			if (dnode->slave_dev && ConfVal(PromiscOperation))
				dev_set_promiscuity(dnode->slave_dev, -1);

			dsr_node_lock(dnode);
					if (dnode->slave_indev) {
						dnode->slave_indev->cnf.rp_filter = rp_filter;
						dnode->slave_indev->cnf.forwarding = forwarding;
in_dev_put(dnode->slave_indev);
						dnode->slave_indev = NULL;
					}
					dsr_node_unlock(dnode);
		} else if (dev == dnode->slave_dev && dnode->slave_indev) {
			dsr_node_lock(dnode);
			dnode->slave_indev->cnf.rp_filter = rp_filter;
			dnode->slave_indev->cnf.forwarding            =            forwarding;
in_dev_put(dnode->slave_indev);
			dnode->slave_indev = NULL;
					dsr_node_unlock(dnode);
		}
		break;
	default:
		break;
	};
```

return NOTIFY_DONE;

}

Dsr_dev_start_xmit 发射 dev 开始

Dsr_dev_get_stats 获取状态

Dsr_dev_set_address 设置 dev 的地址

Dsr_dev_accept_fastpath　允许 dev fastpath 可以依据已有状态直接转发的路径　slowpath 需要寻找路由、解析 MAC

以及 open、stop、uninit device

Dsr-io.c

Dsr 接收、开始发送

```c
int NSCLASS dsr_recv(struct dsr_pkt *dp)
{
    int i = 0, action;
    int mask = DSR_PKT_NONE;

    /* Process DSR Options */
    action = dsr_opt_recv(dp);

    /* Add mac address of previous hop to the neighbor table */

    if (dp->flags & PKT_PROMISC_RECV) {
        dsr_pkt_free(dp);
        return 0;
    }
    for (i = 0; i < DSR_PKT_ACTION_LAST; i++) {

        switch (action & mask) {
        case DSR_PKT_NONE:
            break;
        case DSR_PKT_DROP:
        case DSR_PKT_ERROR:
            DEBUG("DSR_PKT_DROP or DSR_PKT_ERROR\n");
            dsr_pkt_free(dp);
            return 0;
        case DSR_PKT_SEND_ACK:
            /* Moved to dsr-ack.c */
            break;
        case DSR_PKT_SRT_REMOVE:
            //DEBUG("Remove source route\n");
            // Hmm, we remove the DSR options when we deliver a
            //packet
            //dsr_opt_remove(dp);
            break;
        case DSR_PKT_FORWARD:

#ifdef NS2
            if (dp->nh.iph->ttl() < 1)
#else
            if (dp->nh.iph->ttl < 1)
#endif
```

Action 为收到的 dsr 报文的选项

添加 MAC 地址到前一跳到相邻节点表中
如果 dp 不为零 收到 则返回
I=0; i<12;switch (action&mask mask=1) 处理报文

```
case DSR_PKT_FORWARD:
#ifdef NS2
        if (dp->nh.iph->ttl() < 1)
#else
        if (dp->nh.iph->ttl < 1)
#endif
        {
            DEBUG("ttl=0, dropping!\n");
            dsr_pkt_free(dp);
            return 0;
        } else {
            DEBUG("Forwarding %s %s nh %s\n",
                  print_ip(dp->src),
                  print_ip(dp->dst), print_ip(dp->nxt_hop));
            XMIT(dp);
            return 0;
        }
        break;
```

主要 case DSR_PKT_FORWARD 2^7
若 ttl<1 则丢弃
否则转发

```
case DSR_PKT_FORWARD_RREQ:
    XMIT(dp);
    return 0;
case DSR_PKT_SEND_RREP:
    /* In dsr-rrep.c */
    break;
case DSR_PKT_SEND_ICMP:
    DEBUG("Send ICMP\n");
    break;
case DSR_PKT_SEND_BUFFERED:
    if (dp->rrep_opt) {
        struct in_addr rrep_srt_dst;
        int i;

        for (i = 0; i < dp->num_rrep_opts; i++) {
            rrep_srt_dst.s_addr = dp->rrep_opt[i]->addrs[DSR_RREP_ADDRS_LEN(dp->rrep_opt[i]) / sizeof(struct in_addr)];

            send_buf_set_verdict(SEND_BUF_SEND, rrep_srt_dst);
        }
    }
        break;
case DSR_PKT_DELIVER:
    DEBUG("Deliver to DSR device\n");
    DELIVER(dp);
    return 0;
case 0:
    break;
default:
    DEBUG("Unknown pkt action\n");
```

DSR-FORWARD-RREQ 转发
DSR-SEND-RREP 路由应答
DSR_PKT_SEND_BUFFERED
发送 buffer 详细在 send-buf.c
DSR-PKT-DELIVER deliver 到 DSR device 函数在 dsr-dev.h

Dsr_start_xmit

```
void NSCLASS dsr_start_xmit(struct dsr_pkt *dp)
{
	int res;

	if (!dp) {
		DEBUG("Could not allocate DSR packet\n");
		return;
	}

	dp->srt = dsr_rtc_find(dp->src, dp->dst);

	if (dp->srt) {

		if (dsr_srt_add(dp) < 0) {
			DEBUG("Could not add source route\n");
			goto ↓out;
		}
		/* Send packet */

		XMIT(dp);

		return;

	} else {
#ifdef NS2
		res = send_buf_enqueue_packet(dp, &DSRUU::ns_xmit);
#else
		res = send_buf_enqueue_packet(dp, &dsr_dev_xmit);
#endif
```

无 packet DEBUG

dp->srt = dsr_rtc_find(dp->src, dp->dst); 寻找源路由

判断能否添加源路由

发送 dp

发送 buffer 入列的 packet

Res<0 buffer full

Res <0 无 route request table entry　RREQ transmission failed

```
		if (res < 0) {
			DEBUG("Queueing failed!\n");
			goto ↓out;
		}
		res = dsr_rreq_route_discovery(dp->dst);

		if (res < 0)
			DEBUG("RREQ Transmission failed...");

		return;
	}
      out:
	dsr_pkt_free(dp);
} « end dsr_start_xmit »
```

Dsr-opt.c

```c
struct dsr_opt_hdr *dsr_opt_hdr_add(char *buf, unsigned int len,
                                    unsigned int protocol)
{
    struct dsr_opt_hdr *opt_hdr;

    if (len < DSR_OPT_HDR_LEN)
        return NULL;

    opt_hdr = (struct dsr_opt_hdr *)buf;

    opt_hdr->nh = protocol;
    opt_hdr->f = 0;
    opt_hdr->res = 0;
    opt_hdr->p_len = htons(len - DSR_OPT_HDR_LEN);

    return opt_hdr;
}
```

添加 dsr-header option

```c
struct iphdr *dsr_build_ip(struct dsr_pkt *dp, struct in_addr src,
               struct in_addr dst, int ip_len, int tot_len,
               int protocol, int ttl)
{
    struct iphdr *iph;

    dp->nh.iph = iph = (struct iphdr *)dp->ip_data;

    if (dp->skb && dp->skb->nh.raw) {
        memcpy(dp->ip_data, dp->skb->nh.raw, ip_len);
    } else {
        iph->version = IPVERSION;
        iph->ihl = 5;
        iph->tos = 0;
        iph->id = 0;
        iph->frag_off = 0;
        iph->ttl = (ttl ? ttl : IPDEFTTL);
        iph->saddr = src.s_addr;
        iph->daddr = dst.s_addr;
    }

    iph->tot_len = htons(tot_len);
    iph->protocol = protocol;

    ip_send_check(iph);

    return iph;
} « end dsr_build_ip »
```

构造 IP 报文

```c
struct dsr_opt *dsr_opt_find_opt(struct dsr_pkt *dp, int type)
{
    int dsr_len, l;
    struct dsr_opt *dopt;

    dsr_len = dsr_pkt_opts_len(dp);

    l = DSR_OPT_HDR_LEN;
    dopt = DSR_GET_OPT(dp->dh.opth);

    while (l < dsr_len && (dsr_len - l) > 2) {
        if (type == dopt->type)
            return dopt;

        l += dopt->length + 2;
        dopt = DSR_GET_NEXT_OPT(dopt);
    }
    return NULL;
}
```

发现选项 -2 大概因为选项一个字段为 kind 一个字段为 length

```c
int NSCLASS dsr_opt_remove(struct dsr_pkt *dp)
{
    int len, ip_len, prot, ttl;

    if (!dp || !dp->dh.raw)
        return -1;

    prot = dp->dh.opth->nh;
#ifdef NS2
    ip_len = 20;
    ttl = dp->nh.iph->ttl();
#else
    ip_len = (dp->nh.iph->ihl << 2);
    ttl = dp->nh.iph->ttl;
#endif
    dsr_build_ip(dp, dp->src, dp->dst, ip_len,
             ip_len + dp->payload_len, prot, ttl);

    len = dsr_pkt_free_opts(dp);

    /* Return bytes removed */
    return len;
} « end dsr_opt_remove »
```

移除选项 --通过截断 IP 前 20 字节

Dsr-opt-parse 解析 dsr 的 opt 服务器接收 SYN 包时

```
        case DSR_OPT_RREQ:
            if (dp->num_rreq_opts == 0)
                dp->rreq_opt = (struct dsr_rreq_opt *)dopt;
#ifndef NS2
            else
                DEBUG("ERROR: More than one RREQ option!!\n");
#endif
            break;
        case DSR_OPT_RREP:
            if (dp->num_rrep_opts < MAX_RREP_OPTS)
                dp->rrep_opt[dp->num_rrep_opts++] = (struct dsr_rrep_opt *)
#ifndef NS2
            else
                DEBUG("Maximum RREP opts in one packet reached\n");
#endif
            break;
        case DSR_OPT_RERR:
            if (dp->num_rerr_opts < MAX_RERR_OPTS)
                dp->rerr_opt[dp->num_rerr_opts++] = (struct dsr_rerr_opt *)
#ifndef NS2
            else
                DEBUG("Maximum RERR opts in one packet reached\n");
#endif
```

不确定 in one packet reached 是指在这之前已经到达还是这个 packet 包含

Dsr-opt-recv

```
int NSCLASS dsr_opt_recv(struct dsr_pkt *dp)
{
    int dsr_len, l;
    int action = 0;
    struct dsr_opt *dopt;
    struct in_addr myaddr;

    if (!dp)
        return DSR_PKT_ERROR;

    myaddr = my_addr();

    /* Packet for us ? */
#ifdef NS2
    //DEBUG("Next header=%s\n", packet_info.name((packet_t)dp->dh.opth->nh));

    if (dp->dst.s_addr == myaddr.s_addr &&
        (DATA_PACKET(dp->dh.opth->nh) || dp->dh.opth->nh == PT_PING))
        action |= DSR_PKT_DELIVER;
#else
    if (dp->dst.s_addr == myaddr.s_addr && dp->payload_len != 0)
        action |= DSR_PKT_DELIVER;
#endif
    dsr_len = dsr_pkt_opts_len(dp);

    l = DSR_OPT_HDR_LEN;
    dopt = DSR_GET_OPT(dp->dh.opth);
```

Myaddr 由 my_addr()获取 dsr_node 的 ifaddr 即 ipaddr

如果 datapacket 的目的地址与 destnode 的 addr 相同且 datapacket 的 header 满足要求(DATA_PACKET()与 PT_PING 均没找到)

或 datapacket 的目的地址与 destnode 的 addr 相同且 dp 的负载 len 不为 0

Action 为 DSR_PKT_DELIVER

```c
while (l < dsr_len && (dsr_len - l) > 2) {
    //DEBUG("dsr_len=%d l=%d\n", dsr_len, l);
    switch (dopt->type) {
    case DSR_OPT_PADN:
        break;
    case DSR_OPT_RREQ:
        if (dp->flags & PKT_PROMISC_RECV)
            break;

        action |= dsr_rreq_opt_recv(dp, (struct dsr_rreq_opt *)dopt);
        break;
    case DSR_OPT_RREP:
        if (dp->flags & PKT_PROMISC_RECV)
            break;

        action |= dsr_rrep_opt_recv(dp, (struct dsr_rrep_opt *)dopt);
        break;
    case DSR_OPT_RERR:
        if (dp->flags & PKT_PROMISC_RECV)
            break;
        if (dp->num_rerr_opts < MAX_RERR_OPTS) {
            action |=
                dsr_rerr_opt_recv(dp, (struct dsr_rerr_opt *)dopt);
        }

        break;
    case DSR_OPT_PREV_HOP:
        break;
    case DSR_OPT_ACK:
        if (dp->flags & PKT_PROMISC_RECV)
            break;
```

判断 action

```
            if (dp->flags & PKT_PROMISC_RECV)
                break;

            if (dp->num_ack_opts < MAX_ACK_OPTS) {
                dp->ack_opt[dp->num_ack_opts++] =
                    (struct dsr_ack_opt *)dopt;
                action |=
                    dsr_ack_opt_recv((struct dsr_ack_opt *)
                             dopt);
            }
            break;
        case DSR_OPT_SRT:
            action |= dsr_srt_opt_recv(dp, (struct dsr_srt_opt *)dopt);
            break;
        case DSR_OPT_TIMEOUT:
            break;
        case DSR_OPT_FLOWID:
            break;
        case DSR_OPT_ACK_REQ:
            action |=
                dsr_ack_req_opt_recv(dp, (struct dsr_ack_req_opt *)
                             dopt);
            break;
        case DSR_OPT_PAD1:
            l++;
            dopt++;
            continue;
        default:
            DEBUG("Unknown DSR option type=%d\n", dopt->type);
        } « end switch dopt->type »
        l += dopt->length + 2;
        dopt = DSR_GET_NEXT_OPT(dopt);
    } « end while l<dsr_len&&(dsr_len-l... »
    return action;
} « end dsr_opt_recv »
```

中间的 while 循环应该是用来读取包内的下一个 opt 结束时减去一个 opt 的大小，进入下一个解析

Dsr-pkt.c

Dsr_pkt_alloc_opts 和 dsr_pkt_alloc_opts_expand

添加选项和扩展选项（增加选项）

Dsr_pkt_free_opts

释放/删除选项

Dsr_pkt_alloc （重载）

创建 pkt 填充字段

Dsr_pkt_free

释放 pkt

Dsr-rerr.c

Dsr_rerr_opt_add

填充字段

判断错误类型 不可达、流状态不支持？（猜测不能在链路中传递）选项不支持

Dsr_rerr_send

*int NSCLASS dsr_rerr_send(struct dsr_pkt *dp_trigg, struct in_addr unr_addr)*

```
{
	struct dsr_pkt *dp;
	struct dsr_rerr_opt *rerr_opt;
	struct in_addr dst, err_src, err_dst, myaddr;
	char *buf;
	int n, len, i;

	myaddr = my_addr();

	if (!dp_trigg || dp_trigg->src.s_addr == myaddr.s_addr)		不存在包或包的源地址为
当前地址/为当前地址发出的包	（not sure）
		return -1;

    if (!dp_trigg->srt_opt) {				没有源路由选项 因为源路由选项不为空？
		DEBUG("Could not find source route option\n");
		return -1;
	}

	if (dp_trigg->srt_opt->salv == 0)			重新发送次数为 0
		dst = dp_trigg->src;				目的地址为 dp 的源地址
	else
		dst.s_addr = dp_trigg->srt_opt->addrs[1];	发送次数不为 1 dst 的地址为 dp_源
路由的第二跳地址	（不确定 addr 数组的规则）

	dp = dsr_pkt_alloc(NULL);				新分配 pkt

	if (!dp) {
		DEBUG("Could not allocate DSR packet\n");
		return -1;
	}

	dp->srt = dsr_rtc_find(myaddr, dst);			pkt 的源路由赋值为 routecache？find

	if (!dp->srt) {
		DEBUG("No source route to %s\n", print_ip(dst));
		return -1;
	}

	len = DSR_OPT_HDR_LEN + DSR_SRT_OPT_LEN(dp->srt) +		选项头+源路由选项
		(DSR_RERR_HDR_LEN + 4) +				+RERR 头+4(自定义 DSR 首部长度)
		DSR_ACK_HDR_LEN * dp_trigg->num_ack_opts;	+ACK 头

	/* Also count in RERR opts in trigger packet */		触发包？
	for (i = 0; i < dp_trigg->num_rerr_opts; i++) {
```

```
        if (dp_trigg->rerr_opt[i]->salv > ConfVal(MAX_SALVAGE_COUNT))   发送次数>最大次数
            break;

        len += (dp_trigg->rerr_opt[i]->length + 2);          下一个 option
}

DEBUG("opt_len=%d SR: %s\n", len, print_srt(dp->srt));
n = dp->srt->laddrs / sizeof(struct in_addr);                有多少个节点
dp->src = myaddr;
dp->dst = dst;
dp->nxt_hop = dsr_srt_next_hop(dp->srt, n);                 下一跳赋值

dp->nh.iph = dsr_build_ip(dp, dp->src, dp->dst, IP_HDR_LEN,          构造 ipheader
                    IP_HDR_LEN + len, IPPROTO_DSR, IPDEFTTL);

if (!dp->nh.iph) {
        DEBUG("Could not create IP header\n");
        goto out_err;
}

buf = dsr_pkt_alloc_opts(dp, len);              分配 pkt option

if (!buf)
        goto out_err;

dp->dh.opth = dsr_opt_hdr_add(buf, len, DSR_NO_NEXT_HDR_TYPE);  构造/添加 optionheader

if (!dp->dh.opth) {
        DEBUG("Could not create DSR options header\n");
        goto out_err;
}

buf += DSR_OPT_HDR_LEN;                               opt-header 放到 buf?
len -= DSR_OPT_HDR_LEN;

dp->srt_opt = dsr_srt_opt_add(buf, len, 0, 0, dp->srt);  添加源路由选项

if (!dp->srt_opt) {
        DEBUG("Could not create Source Route option header\n");
        goto out_err;
}

buf += DSR_SRT_OPT_LEN(dp->srt);
len -= DSR_SRT_OPT_LEN(dp->srt);
```

```
rerr_opt = dsr_rerr_opt_add(buf, len, NODE_UNREACHABLE, dp->src,       rerr 添加 buf
                            dp->dst, unr_addr,
                            dp_trigg->srt_opt->salv);

if (!rerr_opt)
        goto out_err;

buf += (rerr_opt->length + 2);                              下个选项 大概
len -= (rerr_opt->length + 2);

/* Add old RERR options */                               添加旧选项
for (i = 0; i < dp_trigg->num_rerr_opts; i++) {

        if (dp_trigg->rerr_opt[i]->salv > ConfVal(MAX_SALVAGE_COUNT))    重发次数大于
最大次数
                break;

        memcpy(buf, dp_trigg->rerr_opt[i],
                dp_trigg->rerr_opt[i]->length + 2);                  copy    opt

        len -= (dp_trigg->rerr_opt[i]->length + 2);
        buf += (dp_trigg->rerr_opt[i]->length + 2);
}

/* TODO: Must preserve order of RERR and ACK options from triggering
 * packet */

/* Add old ACK options */                                       添加旧 ACK 选项
for (i = 0; i < dp_trigg->num_ack_opts; i++) {
        memcpy(buf, dp_trigg->ack_opt[i],
                dp_trigg->ack_opt[i]->length + 2);

        len -= (dp_trigg->ack_opt[i]->length + 2);
        buf += (dp_trigg->ack_opt[i]->length + 2);
}

err_src.s_addr = rerr_opt->err_src;                    err 的源地址
err_dst.s_addr = rerr_opt->err_dst;                    err 的目的地址

DEBUG("Send RERR err_src %s err_dst %s unr_dst %s\n",
          print_ip(err_src),
          print_ip(err_dst),
          print_ip(*((struct in_addr *)rerr_opt->info)));
```

XMIT(dp);　　　　　　　　发送 dp

return 0;

out_err:

dsr_pkt_free(dp);　　　　　释放 dp

return -1;

}

Dsr_rerr_opt_recv

```c
int NSCLASS dsr_rerr_opt_recv(struct dsr_pkt *dp, struct dsr_rerr_opt *rerr_opt)
{
    struct in_addr err_src, err_dst, unr_addr;

    if (!rerr_opt)
        return -1;

    dp->rerr_opt[dp->num_rerr_opts++] = rerr_opt;

    switch (rerr_opt->err_type) {
    case NODE_UNREACHABLE:
        err_src.s_addr = rerr_opt->err_src;
        err_dst.s_addr = rerr_opt->err_dst;

        memcpy(&unr_addr, rerr_opt->info, sizeof(struct in_addr));

        DEBUG("NODE_UNREACHABLE err_src=%s err_dst=%s unr=%s\n",
              print_ip(err_src), print_ip(err_dst), print_ip(unr_addr));

        /* For now we drop all unacked packets... should probably
         * salvage */
        maint_buf_del_all(err_dst);

        /* Remove broken link from cache */
        lc_link_del(err_src, unr_addr);

        /* TODO: Check options following the RERR option */
/*      dsr_rtc_del(my_addr(), err_dst); */
        break;
    case FLOW_STATE_NOT_SUPPORTED:
        DEBUG("FLOW_STATE_NOT_SUPPORTED\n");
        break;
    case OPTION_NOT_SUPPORTED:
        DEBUG("OPTION_NOT_SUPPORTED\n");
        break;
    } « end switch rerr_opt->err_type »

    return 0;
} « end dsr_rerr_opt_recv »
```

判断存在
向 rerr_opt 数组添加
判断错误类型
case 不可达 DEBUG 源地址，目的地址
丢弃无 ack 和发送次数超过最多次数的包
将不可达的源地址和目的地址对应路径删除

Case 其他报错

Dsr-rrep.c

两个 struct grat_rrep_entry、grat_rrep_query （grant route response xx？）

Crit_query 判断上述两个结构的 src.addr 以及上一跳是否一致（Criteria Query)条件查询

Crit_time 判断时间

grat_rrep_tbl_timeout 超时

grat_rrep_tbl_add 判断是否在 table 中(读锁) 设定计时器 添加到表头

tbl find、print

grat_rrep_tbl_proc_info 返回数据包长度

```
static inline int
dsr_rrep_add_srt(struct dsr_rrep_opt *rrep_opt, struct dsr_srt *srt)
{
    int n;

    if (!rrep_opt | !srt)
        return -1;

    n = srt->laddrs / sizeof(struct in_addr);

    memcpy(rrep_opt->addrs, srt->addrs, srt->laddrs);
    rrep_opt->addrs[n] = srt->dst.s_addr;

    return 0;
}

static struct dsr_rrep_opt *dsr_rrep_opt_add(char *buf, int len,
                        struct dsr_srt *srt)
{
    struct dsr_rrep_opt *rrep_opt;

    if (!buf || !srt || (unsigned int)len < DSR_RREP_OPT_LEN(srt))
        return NULL;

    rrep_opt = (struct dsr_rrep_opt *)buf;

    rrep_opt->type = DSR_OPT_RREP;
    rrep_opt->length = srt->laddrs + sizeof(struct in_addr) + 1;
    rrep_opt->l = 0;
    rrep_opt->res = 0;

    /* Add source route to RREP */
    dsr_rrep_add_srt(rrep_opt, srt);

    return rrep_opt;
} « end dsr_rrep_opt_add »
```

Dsr_rrep_add_srt 添加源路由到 RREP

dsr_rrep_send 发送 rrep

```
int NSCLASS dsr_rrep_send(struct dsr_srt *srt, struct dsr_srt *srt_to_me)
{
    struct dsr_pkt *dp = NULL;
    char *buf;
    int len, ttl, n;

    if (!srt || !srt_to_me)
        return -1;
```

```
dp = dsr_pkt_alloc(NULL);

if (!dp) {
	DEBUG("Could not allocate DSR packet\n");
	return -1;
}                                                        判断错误

dp->src = my_addr();
dp->dst = srt->dst;

if (srt->laddrs == 0)                                    源路由为空
	dp->nxt_hop = dp->dst;                  packet 的下一跳为目的地址
else
	dp->nxt_hop = srt->addrs[0];            packet 的下一跳为源路由第一跳

len = DSR_OPT_HDR_LEN + DSR_SRT_OPT_LEN(srt) +
	DSR_RREP_OPT_LEN(srt_to_me)/*    + DSR_OPT_PAD1_LEN */;
                                        Len 为 dsr 选项首部+源路由选项
                                        +RREP 选项 /* + PAD 选项*/
n = srt->laddrs / sizeof(struct in_addr);              跳数

DEBUG("srt: %s\n", print_srt(srt));
DEBUG("srt_to_me: %s\n", print_srt(srt_to_me));
DEBUG("next_hop=%s\n", print_ip(dp->nxt_hop));
DEBUG
	("IP_HDR_LEN=%d DSR_OPT_HDR_LEN=%d DSR_SRT_OPT_LEN=%d
DSR_RREP_OPT_LEN=%d DSR_OPT_PAD1_LEN=%d RREP len=%d\n",
	 IP_HDR_LEN, DSR_OPT_HDR_LEN, DSR_SRT_OPT_LEN(srt),
	 DSR_RREP_OPT_LEN(srt_to_me), DSR_OPT_PAD1_LEN, len);

ttl = n + 1;                                 跳数+1   ttl 为 1 丢弃

DEBUG("TTL=%d, n=%d\n", ttl, n);

buf = dsr_pkt_alloc_opts(dp, len);           分配 buf

if (!buf)
	goto out_err;

dp->nh.iph = dsr_build_ip(dp, dp->src, dp->dst, IP_HDR_LEN,
			  IP_HDR_LEN + len, IPPROTO_DSR, ttl);          构造 IP header

if (!dp->nh.iph) {
	DEBUG("Could not create IP header\n");
```

```
		goto out_err;
	}

	dp->dh.opth = dsr_opt_hdr_add(buf, len, DSR_NO_NEXT_HDR_TYPE);    构造选项首部

	if (!dp->dh.opth) {
		DEBUG("Could not create DSR options header\n");
		goto out_err;
	}

	buf += DSR_OPT_HDR_LEN;                        加选项首部到 buf
	len -= DSR_OPT_HDR_LEN;

	/* Add the source route option to the packet */
	dp->srt_opt = dsr_srt_opt_add(buf, len, 0, dp->salvage, srt);       源路由选项加到 packet

	if (!dp->srt_opt) {
		DEBUG("Could not create Source Route option header\n");
		goto out_err;
	}

	buf += DSR_SRT_OPT_LEN(srt);
	len -= DSR_SRT_OPT_LEN(srt);

	dp->rrep_opt[dp->num_rrep_opts++] =
		dsr_rrep_opt_add(buf, len, srt_to_me);             把源路由选项添加到 rrep 选项数组

	if (!dp->rrep_opt[dp->num_rrep_opts - 1]) {
		DEBUG("Could not create RREP option header\n");
		goto out_err;
	}

	/* TODO: Should we PAD? The rrep struct is padded and aligned
	 * automatically by the compiler... How to fix this? */

/*	buf += DSR_RREP_OPT_LEN(srt_to_me); */
/*	len -= DSR_RREP_OPT_LEN(srt_to_me); */

/*	pad1_opt = (struct dsr_pad1_opt *)buf; */
/*	pad1_opt->type = DSR_OPT_PAD1; */

	/* if (ConfVal(UseNetworkLayerAck)) */
/*		dp->flags |= PKT_REQUEST_ACK; */
```

```
	dp->flags |= PKT_XMIT_JITTER;			与 0x08 即 1000 做或运算

	XMIT(dp);					发送 packet

	return 0;
      out_err:
	if (dp)
		dsr_pkt_free(dp);

	return -1;
}
```

Dsr_路由回答选项 接收

```
int NSCLASS dsr_rrep_opt_recv(struct dsr_pkt *dp, struct dsr_rrep_opt *rrep_opt)
{
	struct in_addr myaddr, srt_dst;
	struct dsr_srt *rrep_opt_srt;

	if (!dp || !rrep_opt || dp->flags & PKT_PROMISC_RECV)
		return DSR_PKT_ERROR;

	if (dp->num_rrep_opts < MAX_RREP_OPTS)
		dp->rrep_opt[dp->num_rrep_opts++] = rrep_opt;
	else
		return DSR_PKT_ERROR;
									错误判断
	myaddr = my_addr();

	srt_dst.s_addr = rrep_opt->addrs[DSR_RREP_ADDRS_LEN(rrep_opt) / sizeof(struct
in_addr)];				源路由目的地址赋为路由回答报文选项最后一个的地址

	rrep_opt_srt = dsr_srt_new(dp->dst, srt_dst,
				   DSR_RREP_ADDRS_LEN(rrep_opt),
				   (char *)rrep_opt->addrs);		构造 rrep 选项

	if (!rrep_opt_srt)
		return DSR_PKT_ERROR;

	dsr_rtc_add(rrep_opt_srt, ConfValToUsecs(RouteCacheTimeout), 0);	源路由添加构造
的 rrep 选项源路由

	/* Remove pending RREQs */
	rreq_tbl_route_discovery_cancel(rrep_opt_srt->dst);		移除等待的 RREQs
```

FREE(rrep_opt_srt);

if (dp->dst.s_addr == myaddr.s_addr) {　　目的地址为为当前节点的地址
/*RREP for this node */

DEBUG("RREP for me!\n");

return DSR_PKT_SEND_BUFFERED;
}

DEBUG("I am not RREP destination\n");

/* Forward */
return DSR_PKT_FORWARD;
}
返回值为一系列状态

grat_rrep_tbl_init、grat_rrep_tbl_cleanup　　rrep 表初始化和清空

dsr-rreq.c

struct　rreq_tbl_entry、id_entry、rreq_tbl_query 用于 rreq 验证

```
struct rreq_tbl_entry {
    list_t l;
    int state;
    struct in_addr node_addr;
    int ttl;
    DSRUUTimer *timer;
    struct timeval tx_time;
    struct timeval last_used;
    usecs_t timeout;
    unsigned int num_rexmts;
    struct tbl rreq_id_tbl;
};

struct id_entry {
    list_t l;
    struct in_addr trg_addr;
    unsigned short id;
};
struct rreq_tbl_query {
    struct in_addr *initiator;
    struct in_addr *target;
    unsigned int *id;
};
```

```c
static inline int crit_addr(void *pos, void *data)
{
    struct rreq_tbl_entry *e = (struct rreq_tbl_entry *)pos;
    struct in_addr *a = (struct in_addr *)data;

    if (e->node_addr.s_addr == a->s_addr)
        return 1;
    return 0;
}

static inline int crit_duplicate(void *pos, void *data)
{
    struct rreq_tbl_entry *e = (struct rreq_tbl_entry *)pos;
    struct rreq_tbl_query *q = (struct rreq_tbl_query *)data;

    if (e->node_addr.s_addr == q->initiator->s_addr) {
        list_t *p;

        list_for_each(p, &e->rreq_id_tbl.head) {
            struct id_entry *id_e = (struct id_entry *)p;

            if (id_e->trg_addr.s_addr == q->target->s_addr &&
                id_e->id == *(q->id))
                return 1;
        }
    }
    return 0;
}
```

crit_addr 判断 rreq address 是否一致

crit_duplicate 赋 data 值给 id_e

rreq_tbl_set_max_len 设置 rreq 表最大长度

rreq_tbl_print 打印 rreq 表

rreq_tbl_timeout rreq 超时处理

```c
void NSCLASS rreq_tbl_timeout(unsigned long data)
{
    struct rreq_tbl_entry *e = (struct rreq_tbl_entry *)data;
    struct timeval expires;

    if (!e)
        return;

    tbl_detach(&rreq_tbl, &e->l);

    DEBUG("RREQ Timeout dst=%s timeout=%lu rexmts=%d \n",
          print_ip(e->node_addr), e->timeout, e->num_rexmts);

    if (e->num_rexmts >= ConfVal(MaxRequestRexmt)) {
        DEBUG("MAX RREQs reached for %s\n", print_ip(e->node_addr));

        e->state = STATE_IDLE;

/*      DSR_WRITE_UNLOCK(&rreq_tbl); */
        tbl_add_tail(&rreq_tbl, &e->l);
        return;
    }

    e->num_rexmts++;

    /* if (e->ttl == 1) */
/*      e->timeout = ConfValToUsecs(RequestPeriod);  */
/*  else */
    e->timeout *= 2;    /* Double timeout */

    e->ttl *= 2;        /* Double TTL */

    if (e->ttl > MAXTTL)
        e->ttl = MAXTTL;

    if (e->timeout > ConfValToUsecs(MaxRequestPeriod))
        e->timeout = ConfValToUsecs(MaxRequestPeriod);

    gettime(&e->last_used);

    dsr_rreq_send(e->node_addr, e->ttl);
```

报错目的地址 超时时间 计时器重传次数（没有查到）

重传>=最大请求重传时间？次数

将状态设为闲置

将其加到表尾

加倍超时、加倍 ttl　若超过最大设置为最大

再次发送 rreq

到期时间设置为 e->上一个时间

将这个数据包放在表尾

设置 table 的定时器

```c
expires = e->last_used;
timeval_add_usecs(&expires, e->timeout);

/* Put at end of list */
tbl_add_tail(&rreq_tbl, &e->l);

set_timer(e->timer, &expires);
```

__rreq_tbl_entry_creat、__rreq_tbl_add、rreq_tbl_add_id　　rreq 表 建表、添加 rreq、添加 id

rreq_tbl_route_discovery_cancel rreq 路由发现取消

```
int NSCLASS rreq_tbl_route_discovery_cancel(struct in_addr dst)
{
    struct rreq_tbl_entry *e;

    e = (struct rreq_tbl_entry *)tbl_find_detach(&rreq_tbl, &dst,
                                                 crit_addr);

    if (!e) {
        DEBUG("%s not in RREQ table\n", print_ip(dst));
        return -1;
    }

    if (e->state == STATE_IN_ROUTE_DISC)
        del_timer_sync(e->timer);

    e->state = STATE_IDLE;
    gettime(&e->last_used);

    tbl_add_tail(&rreq_tbl, &e->l);

    return 1;
} « end rreq_tbl_route_discovery_cancel »
```

不在 RREQ 表报错
状态为在路由（表）disc 中　（not idle）
删除计时器 并设置状态为闲置
添加到尾部

dsr_rreq_route_discovery 路由发现

```
int NSCLASS dsr_rreq_route_discovery(struct in_addr target)
{
        struct rreq_tbl_entry *e;
        int ttl, res = 0;
        struct timeval expires;

#define   TTL_START 1

        DSR_WRITE_LOCK(&rreq_tbl.lock);                                写锁

        e = (struct rreq_tbl_entry *)__tbl_find(&rreq_tbl, &target, crit_addr);     在路由表中寻找 e

        if (!e)
                e = __rreq_tbl_add(target);                  e 不在表中，添加到 rreq 表
        else {
                /* Put it last in the table */               e 在表中
                __tbl_detach(&rreq_tbl, &e->l);              e 连接断开
                __tbl_add_tail(&rreq_tbl, &e->l);            把 e 放在最后
```

```
	}

	if (!e) {
		res = -ENOMEM;
		goto out;
	}

	if (e->state == STATE_IN_ROUTE_DISC) {                  e 的状态是在路由 DISC
		DEBUG("Route discovery for %s already in progress\n",
		      print_ip(target));
		goto out;
	}
	DEBUG("Route discovery for %s\n", print_ip(target));

	gettime(&e->last_used);
	e->ttl = ttl = TTL_START;                               设置 ttl 为 1
	/* The draft does not actually specify how these Request Timeout values
	 * should be used... ??? I am just guessing here. */

	if (e->ttl == 1)                                        设置超时
		e->timeout = ConfValToUsecs(NonpropRequestTimeout);
	else
		e->timeout = ConfValToUsecs(RequestPeriod);

	e->state = STATE_IN_ROUTE_DISC;
	e->num_rexmts = 0;                                      计时器发送次数

	expires = e->last_used;
	timeval_add_usecs(&expires, e->timeout);

	set_timer(e->timer, &expires);

	DSR_WRITE_UNLOCK(&rreq_tbl.lock);                       解锁

	dsr_rreq_send(target, ttl);                             发送

	return 1;
      out:
	DSR_WRITE_UNLOCK(&rreq_tbl.lock);

	return res;
}
```

dsr_rreq_duplicate 复制 rreq

dsr_rreq_opt_add 添加 rreq 选项

rreq 发送

```
int NSCLASS dsr_rreq_send(struct in_addr target, int ttl)
{
	struct dsr_pkt *dp;
	char *buf;
	int len = DSR_OPT_HDR_LEN + DSR_RREQ_HDR_LEN;          分配长度

	dp = dsr_pkt_alloc(NULL);                             分配 packet

	if (!dp) {
		DEBUG("Could not allocate DSR packet\n");
		return -1;
	}
	dp->dst.s_addr = DSR_BROADCAST;
	dp->nxt_hop.s_addr = DSR_BROADCAST;
	dp->src = my_addr();                                赋源地址、设置广播

	buf = dsr_pkt_alloc_opts(dp, len);


	if (!buf)
		goto out_err;

	dp->nh.iph =
		dsr_build_ip(dp, dp->src, dp->dst, IP_HDR_LEN, IP_HDR_LEN + len,
			IPPROTO_DSR, ttl);                          构造 IP

	if (!dp->nh.iph)
		goto out_err;

	dp->dh.opth = dsr_opt_hdr_add(buf, len, DSR_NO_NEXT_HDR_TYPE);     构造选项头

	if (!dp->dh.opth) {
		DEBUG("Could not create DSR opt header\n");
		goto out_err;
	}

	buf += DSR_OPT_HDR_LEN;
	len -= DSR_OPT_HDR_LEN;                             去选项头

	dp->rreq_opt = dsr_rreq_opt_add(buf, len, target, ++rreq_seqno);     添加选项头
```

```
        if (!dp->rreq_opt) {
                DEBUG("Could not create RREQ opt\n");
                goto out_err;
        }
#ifdef NS2
        DEBUG("Sending RREQ src=%s dst=%s target=%s ttl=%d iph->saddr()=%d\n",
              print_ip(dp->src), print_ip(dp->dst), print_ip(target), ttl,
              dp->nh.iph->saddr());
#endif

        dp->flags |= PKT_XMIT_JITTER;                与 0X08 进行或运算

        XMIT(dp);                                    发送 packet

        return 0;

    out_err:
        dsr_pkt_free(dp);

        return -1;
}
```

接收 RREQ

Dsr_rreq_opt_recv

```
    struct in_addr myaddr;
    struct in_addr trg;
    struct dsr_srt *srt_rev, *srt_rc;
    int action = DSR_PKT_NONE;
    int i, n;

    if (!dp || !rreq_opt || dp->flags & PKT_PROMISC_RECV)
        return DSR_PKT_DROP;

    dp->num_rreq_opts++;

    if (dp->num_rreq_opts > 1) {
        DEBUG("More than one RREQ opt!!! - Ignoring\n");
        return DSR_PKT_ERROR;
    }
```

丢弃 packet 和 packet 选项过多出错

```
dp->rreq_opt = rreq_opt;

        myaddr = my_addr();

        trg.s_addr = rreq_opt->target;               赋值
```

```
    if (dsr_rreq_duplicate(dp->src, trg, ntohs(rreq_opt->id))) {            判断该请求是否
已在缓存中
        DEBUG("Duplicate RREQ from %s\n", print_ip(dp->src));
        return DSR_PKT_DROP;
    }                                                                        存在就丢弃

    rreq_tbl_add_id(dp->src, trg, ntohs(rreq_opt->id));        不存在，添加到 rreq 表

    dp->srt = dsr_srt_new(dp->src, myaddr, DSR_RREQ_ADDRS_LEN(rreq_opt),
                          (char *)rreq_opt->addrs);                  新建源路由

    if (!dp->srt) {
        DEBUG("Could not extract source route\n");           无法导入
        return DSR_PKT_ERROR;
    }
    DEBUG("RREQ target=%s src=%s dst=%s laddrs=%d\n",
          print_ip(trg), print_ip(dp->src),
          print_ip(dp->dst), DSR_RREQ_ADDRS_LEN(rreq_opt));

    /* Add reversed source route */
    srt_rev = dsr_srt_new_rev(dp->srt);                     源路由反转  以便发送路由回复

    if (!srt_rev) {
        DEBUG("Could not reverse source route\n");
        return DSR_PKT_ERROR;
    }
    DEBUG("srt: %s\n", print_srt(dp->srt));
    DEBUG("srt_rev: %s\n", print_srt(srt_rev));

    dsr_rtc_add(srt_rev, ConfValToUsecs(RouteCacheTimeout), 0);      添加缓存表

    /* Set previous hop */                                   设置反向路由的前一跳
    if (srt_rev->laddrs > 0)
        dp->prv_hop = srt_rev->addrs[0];
    else
        dp->prv_hop = srt_rev->dst;

    neigh_tbl_add(dp->prv_hop, dp->mac.ethh);                邻居节点表添加信息

    /* Send buffered packets */
    send_buf_set_verdict(SEND_BUF_SEND, srt_rev->dst);        发送缓存区的包

    if (rreq_opt->target == myaddr.s_addr) {       路由请求选项的目的地址为当前地址
```

```
		DEBUG("RREQ OPT for me - Send RREP\n");

		/* According to the draft, the dest addr in the IP header must
		 * be updated with the target address */			更新 ip 头的目的地址
#ifdef NS2
		dp->nh.iph->daddr() = (nsaddr_t) rreq_opt->target;
#else
		dp->nh.iph->daddr = rreq_opt->target;
#endif
		dsr_rrep_send(srt_rev, dp->srt);				发送路由回复

		action = DSR_PKT_NONE;
		goto out;
	}									endOfIf

	n = DSR_RREQ_ADDRS_LEN(rreq_opt) / sizeof(struct in_addr);

	if (dp->srt->src.s_addr == myaddr.s_addr)		若源地址为当前地址  丢弃
		return DSR_PKT_DROP;

	for (i = 0; i < n; i++)					源路由中包含当前地址  丢弃
		if (dp->srt->addrs[i].s_addr == myaddr.s_addr) {
			action = DSR_PKT_DROP;
			goto out;
		}

	/* TODO: Check Blacklist */				检测列表是否存在
	srt_rc = lc_srt_find(myaddr, trg);

	if (srt_rc) {			若存在  连接 packet 的源路由和路由缓存后 free 路由缓存
		struct dsr_srt *srt_cat;
		/* Send cached route reply */

		DEBUG("Send cached RREP\n");

		srt_cat = dsr_srt_concatenate(dp->srt, srt_rc);

		FREE(srt_rc);

		if (!srt_cat) {
			DEBUG("Could not concatenate\n");
			goto rreq_forward;
		}
```

```
		DEBUG("srt_cat: %s\n", print_srt(srt_cat));

		if (dsr_srt_check_duplicate(srt_cat) > 0) {    存在重复的源路由  free 拼接的源路由
			DEBUG("Duplicate address in source route!!!\n");
			FREE(srt_cat);
			goto rreq_forward;
		}
#ifdef NS2
		dp->nh.iph->daddr() = (nsaddr_t) rreq_opt->target;
#else
		dp->nh.iph->daddr = rreq_opt->target;
#endif
		DEBUG("Sending cached RREP to %s\n", print_ip(dp->src));
		dsr_rrep_send(srt_rev, srt_cat);                        发送缓存的路由回复

		action = DSR_PKT_NONE;

		FREE(srt_cat);
	} else {

	rreq_forward:
		dsr_pkt_alloc_opts_expand(dp, sizeof(struct in_addr));

		if (!DSR_LAST_OPT(dp, rreq_opt)) {
			char *to, *from;
			to = (char *)rreq_opt + rreq_opt->length + 2 +
				sizeof(struct in_addr);
			from = (char *)rreq_opt + rreq_opt->length + 2;

			memmove(to, from, sizeof(struct in_addr));
		}
		rreq_opt->addrs[n] = myaddr.s_addr;
		rreq_opt->length += sizeof(struct in_addr);

		dp->dh.opth->p_len = htons(ntohs(dp->dh.opth->p_len) +
					   sizeof(struct in_addr));
#ifdef __KERNEL__
		dsr_build_ip(dp, dp->src, dp->dst, IP_HDR_LEN,
			     ntohs(dp->nh.iph->tot_len) +
			     sizeof(struct in_addr), IPPROTO_DSR,
			     dp->nh.iph->ttl);
#endif
		/* Forward RREQ */
		action = DSR_PKT_FORWARD_RREQ;
```

}
out:
FREE(srt_rev);
return action;

rreq_tbl_proc_info 返回 RREQ table 的长度

rreq_tbl_init RREQ 表初始化

rreq_tbl_cleanup RREQ 表清空

dsr-rtc-simple.c

```
struct rtc_entry {
	list_t l;
	unsigned long expires;
	unsigned short flags;
	struct dsr_srt srt;
};用于维护路由缓存
```

__dsr_rtc_set_next_timeout 设置下一个超时

Dsr_rtc_timeout 判断超时

```
static void dsr_rtc_timeout(unsigned long data)
{
    list_t *pos, *tmp;
    int time = TimeNow;

    DSR_WRITE_LOCK(&rtc_lock);

    DEBUG("srt timeout\n");

    list_for_each_safe(pos, tmp, &rtc_head) {
        struct rtc_entry *e = (struct rtc_entry *)pos;

        if (e->expires > time)
            break;

        list_del(&e->l);
        FREE(e);
        rtc_len--;
    }
    __dsr_rtc_set_next_timeout();
    DSR_WRITE_UNLOCK(&rtc_lock);
} « end dsr_rtc_timeout »
#endif              /* RTC_TIMER */
```

_dsr_rtc_flush 刷新/清空路由缓存

__dsr_rtc_add 添加到路由缓存

```c
static inline int __dsr_rtc_add(struct rtc_entry *e)
{

    if (rtc_len >= RTC_MAX_LEN) {
        printk(KERN_WARNING "dsr_rtc: Max list len reached\n");
        return -ENOSPC;
    }

    if (list_empty(&rtc_head)) {
        list_add(&e->l, &rtc_head);
    } else {
        list_t *pos;

        list_for_each(pos, &rtc_head) {
            struct rtc_entry *curr = (struct rtc_entry *)pos;

            if (curr->expires > e->expires)
                break;
        }
        list_add(&e->l, pos->prev);
    }
    return 1;
} « end __dsr_rtc_add »
```

若长度达到缓存表最大长度 return

表为空添加到表头，不为空添加到表尾

__dsr_rtc_del 删除路由表缓存的表项

dsr_rtc_update 更新路由缓存表项

dsr_rtc_print 列表 dsr_rtc_proc_info 获取表长度

dsr-srt.c

dsr_srt_next_hop、dsr_srt_prev_hop 获取上一跳、下一跳 为边界的话为目的地址/源地址

dsr_srt_find_addr 查找当前项

dsr_srt_new 构造源路由

dsr_srt_new_rev 构造反向路由

```
struct dsr_srt *dsr_srt_new_split(struct dsr_srt *srt, struct in_addr addr)
{
    struct dsr_srt *srt_split;
    int i, n;

    if (!srt)
        return NULL;

    n = srt->laddrs / sizeof(struct in_addr);

    if (n == 0)
        return NULL;

    for (i = 0; i < n; i++) {
        if (addr.s_addr == srt->addrs[i].s_addr)
            goto ↓split;
    }
    /* Nothing to split */
    return NULL;
      split:
    srt_split = (struct dsr_srt *)MALLOC(sizeof(struct dsr_srt) +
                     (i * sizeof(struct in_addr)),
                     GFP_ATOMIC);

    if (!srt_split)
        return NULL;

    srt_split->src.s_addr = srt->src.s_addr;
    srt_split->dst.s_addr = srt->addrs[i].s_addr;
    srt_split->laddrs = sizeof(struct in_addr) * i;

    memcpy(srt_split->addrs, srt->addrs, sizeof(struct in_addr) * i);

    return srt_split;
} « end dsr_srt_new_split »
```

若第 i 个源地址与 addr 的源地址相同，则截断 i 之后的

dsr_srt_new_split_rev　split 逆序

dsr_srt_shortcut

```
struct dsr_srt *dsr_srt_shortcut(struct dsr_srt *srt, struct in_addr a1,
                 struct in_addr a2)
{
    struct dsr_srt *srt_cut;
    int i, j, n, n_cut, a1_num, a2_num;

    if (!srt)
        return NULL;

    a1_num = a2_num = -1;

    n = srt->laddrs / sizeof(struct in_addr);            记录总节点数

    if (srt->src.s_addr == a1.s_addr)                    a1 为源节点
        a1_num = 0;

    /* Find out how between which node indexes to shortcut */ 记录 a1、a2 下标
    for (i = 0; i < n; i++) {
        if (srt->addrs[i].s_addr == a1.s_addr)
```

```
			a1_num = i + 1;
		if (srt->addrs[i].s_addr == a2.s_addr)
			a2_num = i + 1;
	}

	if (srt->dst.s_addr == a2.s_addr)			a2 为目的节点
		a2_num = i + 1;

	n_cut = n - (a2_num - a1_num - 1);			a1，a2 区间外有多少节点

	srt_cut = (struct dsr_srt *)MALLOC(sizeof(struct dsr_srt) +
					(n_cut*sizeof(struct in_addr)),
					GFP_ATOMIC);

	if (!srt_cut)
		return NULL;

	srt_cut->src = srt->src;				构造削短后的路径
	srt_cut->dst = srt->dst;
	srt_cut->laddrs = n_cut * sizeof(struct in_addr);

	if (srt_cut->laddrs == 0)
		return srt_cut;

	j = 0;

	for (i = 0; i < n; i++) {
		if (i + 1 > a1_num && i + 1 < a2_num)
			continue;
		srt_cut->addrs[j++] = srt->addrs[i];
	}

	return srt_cut;
}
```

dsr_srt_concatenate　连接两个 srt 假设 srt1 的尾是 srt2 的头
dsr_srt_check_duplicate　检测是否有重复
dsr_srt_opt_add　添加源路由选项
dsr_srt_add　添加 packet 到源路由选项头

dsr_srt_opt_recv

```
int NSCLASS dsr_srt_opt_recv(struct dsr_pkt *dp, struct dsr_srt_opt *srt_opt)
{
```

```c
    struct in_addr next_hop_intended;
    struct in_addr myaddr = my_addr();
    int n;

    if (!dp || !srt_opt)
        return DSR_PKT_ERROR;
                                                  dp 赋值
    dp->srt_opt = srt_opt;

    /* We should add this source route info to the cache... */
    dp->srt = dsr_srt_new(dp->src, dp->dst, srt_opt->length,
                  (char *)srt_opt->addrs);

    if (!dp->srt) {
        DEBUG("Create source route failed\n");
        return DSR_PKT_ERROR;
    }
    n = dp->srt->laddrs / sizeof(struct in_addr);

    DEBUG("SR: %s sleft=%d\n", print_srt(dp->srt), srt_opt->sleft);

    /* Copy salvage field */
    dp->salvage = dp->srt_opt->salv;

    next_hop_intended = dsr_srt_next_hop(dp->srt, srt_opt->sleft);
    dp->prv_hop = dsr_srt_prev_hop(dp->srt, srt_opt->sleft - 1);
    dp->nxt_hop = dsr_srt_next_hop(dp->srt, srt_opt->sleft - 1);

    DEBUG("next_hop=%s prev_hop=%s next_hop_intended=%s\n",
          print_ip(dp->nxt_hop),
          print_ip(dp->prv_hop), print_ip(next_hop_intended));

    neigh_tbl_add(dp->prv_hop, dp->mac.ethh);

    lc_link_add(my_addr(), dp->prv_hop,
            ConfValToUsecs(RouteCacheTimeout), 0, 1);

    dsr_rtc_add(dp->srt, ConfValToUsecs(RouteCacheTimeout), 0);

    /* Automatic route shortening - Check if this node is the
     * intended next hop. If not, is it part of the remaining
     * source route? */
```

对路由缩减的条件进行判断：如果下一跳的地址不是当前地址，且源路由中存在当前地址且其不在缩减列表中，

```
             则可以进行路由缩减。

    if (next_hop_intended.s_addr != myaddr.s_addr &&
        dsr_srt_find_addr(dp->srt, myaddr, srt_opt->sleft) &&
        !grat_rrep_tbl_find(dp->src, dp->prv_hop)) {
        struct dsr_srt *srt, *srt_cut;

        /* Send Grat RREP */
        DEBUG("Send Gratuitous RREP to %s\n", print_ip(dp->src));

        srt_cut = dsr_srt_shortcut(dp->srt, dp->prv_hop, myaddr);

        if (!srt_cut)
            return DSR_PKT_DROP;

        DEBUG("shortcut: %s\n", print_srt(srt_cut));

        /* srt = dsr_rtc_find(myaddr, dp->src); */
        if (srt_cut->laddrs / sizeof(struct in_addr) == 0)
            srt = dsr_srt_new_rev(srt_cut);
        else
            srt = dsr_srt_new_split_rev(srt_cut, myaddr);

        if (!srt) {
            DEBUG("No route to %s\n", print_ip(dp->src));
            FREE(srt_cut);
            return DSR_PKT_DROP;
        }
        DEBUG("my srt: %s\n", print_srt(srt));

                    在路由缩减列表中添加本次路由，并且发送一个路由回复用于通知新的路由
变更。

        grat_rrep_tbl_add(dp->src, dp->prv_hop);

        dsr_rrep_send(srt, srt_cut);

        FREE(srt_cut);
        FREE(srt);
    }

    if (dp->flags & PKT_PROMISC_RECV)
        return DSR_PKT_DROP;

```

```
    if (srt_opt->sleft == 0)
        return DSR_PKT_SRT_REMOVE;

    if (srt_opt->sleft > n) {
        // Send ICMP parameter error
        return DSR_PKT_SEND_ICMP;
    }

    srt_opt->sleft--;

    /* TODO: check for multicast address in next hop or dst */
    /* TODO: check MTU and compare to pkt size */

        如果不能进行路由缩减，则转发数据包。
    return DSR_PKT_FORWARD;
}
```

Endian.c

It solves the problem of non-existent <endian.h> on some systems by generating it.

Link-cache.c　　维护缓存表相关的增删改查

Maint-buf.c

```
struct maint_entry {
    list_t l;
    struct in_addr nxt_hop;
    unsigned int rexmt;
    unsigned short id;
    struct timeval tx_time, expires;
    usecs_t rto;
    int ack_req_sent;
    struct dsr_pkt *dp;
};

struct maint_buf_query {
    struct in_addr *nxt_hop;
    unsigned short *id;
    usecs_t rtt;
};
```

All for buffered packets

crit_addr_id_del　　从缓冲根据下一跳和 id 删除 packet

crit_addr_del　　根据下一跳删除缓冲区的 packet

crit_addr　　判断下一跳地址

crit_expires　　判断是否超时
crit_ack_req_sent 判断是否发送
end for buffered packets
maint_buf_set_max_len 设置最大长度
maint_entry_create　　构造 maint_entry
maint_buf_salvage　　不知道在干什么
maint_buf_timeout　　缓冲区超时
重传次数大于最大重传次数 丢弃
设置新传送时间，发送新的 ACK REQ，再次添加到维护缓冲区
maint_buf_set_timeout 设置超时时间
maint_buf_add　　判断是否有邻居节点　检查是否添加 ACK REQ
maint_buf_del_all、maint_buf_del_all_id、maint_buf_del_addr 删除相关
maint_buf_print 打印缓冲区
maint_buf_get_info 获取长度
maint_buf_init　　初始化缓冲区
maint_buf_cleanup　　清空缓冲区

neigh.c

```
struct neighbor {
    list_t l;
    struct in_addr addr;
    struct sockaddr hw_addr;
    unsigned short id;
    struct timeval last_ack_req;
    usecs_t t_srtt, rto, t_rxtcur, t_rttmin, t_rttvar, jitter;  /* RTT in usec */
};

struct neighbor_query {
    struct in_addr *addr;
    struct neighbor_info *info;
};
```

crit_addr 设置队列
crit_addr_id_inc　　判断 addr 是否相同，相同则 id+1
set_ack_req_time　设置 ack-请求时间
rto_calc　　　　　计算 trip timeout
neigh_tbl_create 、neigh_tbl_add、neigh_tbl_del　　建表、增删
neigh_tbl_set_ack_req_time、neigh_tbl_set_rto 设置 ack 请求时间、设置 trip timeout（单次超时）
neigh_tbl_query 添加到邻居表中、neigh_tbl_id_inc 调用 crit_addr_id_inc、neigh_tbl_print 打印、neigh_tbl_proc_info 获取长度
neigh_tbl_init、neigh_tbl_cleanup　　初始化邻居表、清空邻居表

send-buf.c

```c
struct send_buf_entry {
    list_t l;
    struct dsr_pkt *dp;
    struct timeval qtime;
    xmit_fct_t okfn;
};
```

用于维护 buf

crit_addr 判断 addr 是否相同

crit_garbage 判断是否超时

send_buf_set_max_len 设置发送 buf 最大长度

send_buf_timeout 设置 buf 超时

send_buf_entry_create 构造 packet

send_buf_enqueue_packet 判断 buffer 是否满，排在队尾，若 buffer 满则移除第一个

send_buf_set_verdict 根据状态确定发送 buffer 内的还是丢弃 buffer 内的数据

send_buf_flush 刷新发送缓冲区、send_buf_print 打印发送缓冲区 、send_buf_get_info 获取缓冲区长度、send_buf_init 初始化缓冲区、 send_buf_cleanup 清空缓冲区