EECS 489 PA1

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Code base

- How many of you still cannot get the program running?
  - Download the new code
- Functions already implemented in .o
  - But you need to implement them again
  - Check with it as the specification
- Incrementally implement your code and replace old .o with yours.

Task 1

- vip_input()
  - Get VIP header, integrity check, receive or forward
- vip_output()
  - Find next hop to send packet, error?
- vip_forw()
  - Route the packets to the next vrouter
- vip_drop()
  - Discard packets and generate error code when appropriate

Task 1 - Common questions

- Byte order
  - ntohs() vs. htons()
- When to convert from char* to int and vice versa
- Hop count
- vif_pullup() vs. vif_pullupn()
- How to clear interface?
- packets_buf full error

Byte order

- ntohs() vs. htons()
  - ntohs(): Network byte order to host
  - htons(): Host to network
- Example:
  - 0x12345678 vs. 0x78563412

When to convert from char* to int and vice versa

```
char* a = “123”;
int b = atoi(a);
```

- No need to do it when you pull up the header.

1.
```
char* buf = malloc(sizeof(vip_t));
vif_pullupn(vif, buf, sizeof(vip_t));
vip_t* vip = (vip_t*) buf;
```
2.
```
vif_pullupn(vif, (char *) &vip, sizeof(vip_t));
```

- You can check on you own by trying to print out the content

```
struct _vip_hdr {
  u_short vip_ver;      /* version number */
  u_short vip_hop;      /* hop limit */
  u_short vip_len;      /* packet size, excluding header */
  u_short vip_prot;     /* protocol number */
  vin_addr_t vip_src;   /* source vin address, see vnet.h */
  vin_addr_t vip_dst;   /* destination vin address */
};
typedef struct _vip_hdr vip_t;
```

Hop count

- Decrement the hop count field in VIP header by 1 whenever the packet go through a vrouter
- In vip_forw()
- Not related to link cost at this point

vif_pullup() vs. vif_pullupn()

- Better guarantee by vif_pullupn()
- Should use vif_pullupn() in most cases
  - Except for clearing interface

packets_buf full error

- Reliable VTP Packets unACKed.

How to clear interface?

- Look at the comments at the end of vip_input ()
- Use vip_pullup()

Task 2 - VCMP error messages

- When to generate VCMP messages
  - Hop count exceeded
  - Host unreachable (no route to the host)
  - Link down (route found but error in transmission)
  - Unknown protocol (in VIP header)
- For all other errors, you are not required, but encouraged to think about when it is necessary to generate error message
- Never generate error message for VCMP packet

Task 2 - VCMP error messages

- Don’t forget to wrap the original VIP header in the error message

Task 3 – end-to-end retransmission

- Simulate TCP's basic functionality
- TCP has:
  - Retransmission
  - In-order delivery
  - congestion control
- We only need to implement retransmission
- End-to-end vs. Hop-by-hop retransmission

Task 3 - end-to-end retransmission

- Concepts
  - Reliable VTP packet vs. Unreliable VTP packet
  - ACK packet
  - Retransmission window
  - Timeout
- Retransmit ACK?
- Piggyback ACK

Q&A

- Thanks!