

Lab 4: Parser Implementation

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A Hands-on Tutorial on P4 Programmable Data Planes

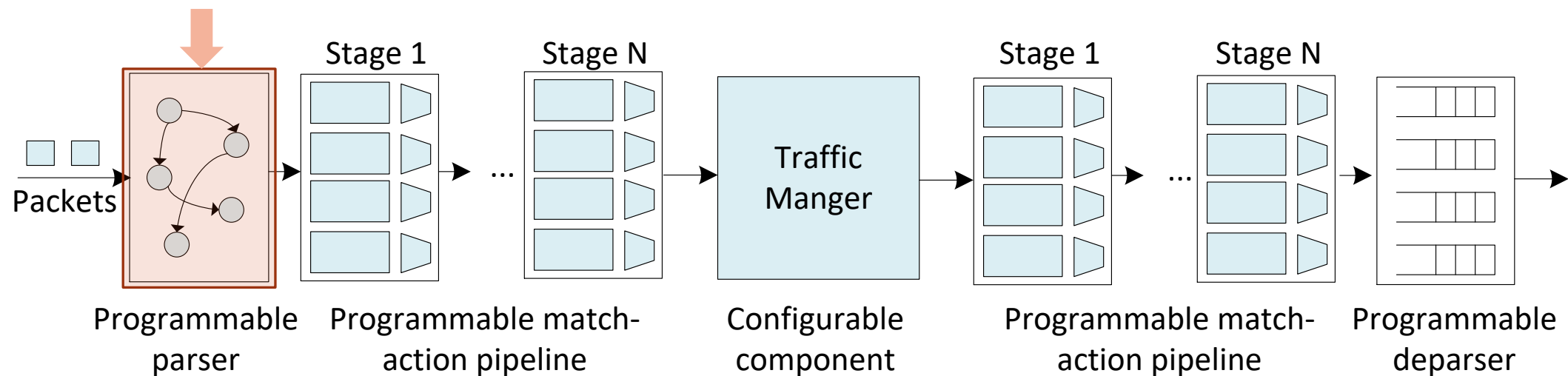
Monday March 6, 2023

Parser Implementation

Lab activities are described in Lab 4, P4 Programmable Data Plane Switches (BMv2) lab series

Programmable Parser

- The parser enables parsing arbitrary headers with a finite state machine
- The state machine defines the order of the headers within the packets
- The packet is split into the defined headers and the remaining is treated as the payload



Packet Headers

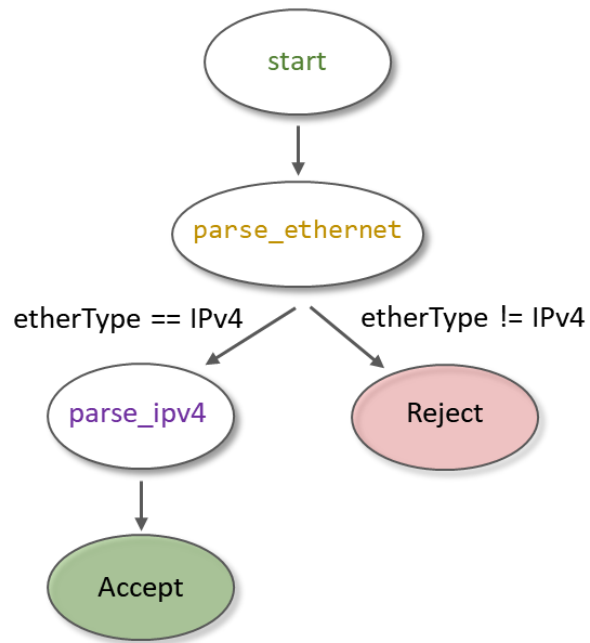
- The packet headers are specified by the programmer
- The programmer has the flexibility of defining custom/non-standardized headers
- Such capability is not available in non-programmable devices

Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Version				IHL				DSCP				ECN		Total Length																	
32	Identifier														Flags		Fragment Offset															
64	Time To Live				Protocol				Header Checksum																							
96	Source IP Address																															
128	Destination IP Address																															
160	Options (if IHL > 5)																															

```
header ipv4_t {
    bit<4> version;
    bit<4> ihl;
    bit<8> diffserv;
    bit<16> totalLen;
    bit<16> identification;
    bit<3> flags;
    bit<13> fragOffset;
    bit<8> ttl;
    bit<8> protocol;
    bit<16> hdrChecksum;
    ip4Addr_t srcAddr;
    ip4Addr_t dstAddr;
}
```

Programmable Parser

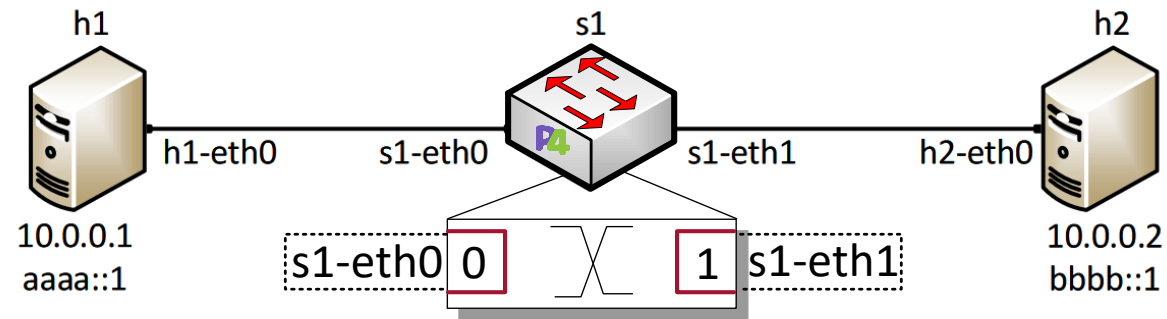
- The parser enables declaring arbitrary headers with a finite state machine
- The state machine defines the order of the headers within the packets



```
state start {
    transition parse_ethernet;
}
state parse_ethernet {
    packet.extract(hdr.ethernet);
    transition select(hdr.ethernet.etherType) {
        TYPE_IPV4: parse_ipv4;
        default: reject;
    }
}
state parse_ipv4 {
    packet.extract(hdr.ipv4);
    transition accept;
}
```

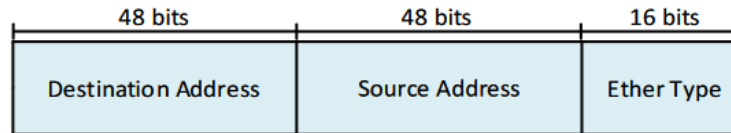
Lab Topology and Objectives

- The topology consists of two hosts: h1 and h2; one P4 switch: s1
- Defining the headers for Ethernet, IPv4 and IPv6
- Implementing the parser
- Testing and verifying the switch behavior when IPv4 and IPv6 packets are received

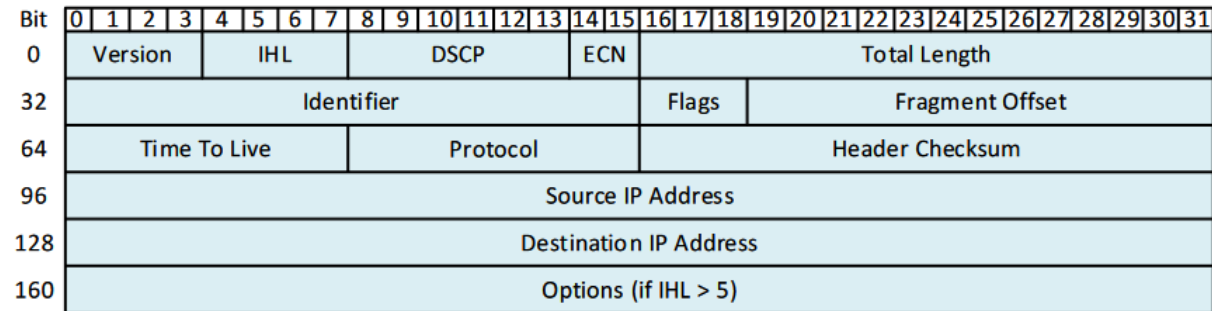


Headers Format

- Ethernet header:



- IPv4 header:



- IPv6 header:

