

P4内置Hash函数

v1model.p4 中提供了以下8种哈希方法

```
enum HashAlgorithm {  
    crc32,  
    crc32_custom,  
    crc16,  
    crc16_custom,  
    random,  
    identity,  
    csum16,  
    xor16  
}
```

在 /root/P4/behavioral-model/src/bm_sim/calculations.cpp 中，实现了以上几种哈希方法

实验环境

- cpu : AMD Ryzen 7 3700X
- 内存 : 16GB 2666MHz
- 系统 : Ubuntu 22.04.3 LTS

带宽测试

- 仅使用基于端口的转发策略
- 在debug模式下，behavior-model的带宽受限基本在160Mb/s左右

```
"Node: h1"
root@kali:~/P4/MyP4Project# iperf3 -c 10.0.0.2
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 42704 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate      Retr  Cwnd
[ 7]  0.00-1.00   sec    21.0 MBytes  176 Mbits/sec    0   1.10 MBytes
[ 7]  1.00-2.00   sec    20.0 MBytes  168 Mbits/sec    0   2.01 MBytes
[ 7]  2.00-3.00   sec    20.0 MBytes  168 Mbits/sec    0   2.91 MBytes
[ 7]  3.00-4.00   sec    22.5 MBytes  189 Mbits/sec    0   3.87 MBytes
[ 7]  4.00-5.00   sec    17.5 MBytes  147 Mbits/sec    0   4.71 MBytes
[ 7]  5.00-6.00   sec    17.5 MBytes  147 Mbits/sec    0   5.59 MBytes
[ 7]  6.00-7.00   sec    17.5 MBytes  147 Mbits/sec    0   6.45 MBytes
[ 7]  7.00-8.00   sec    17.5 MBytes  147 Mbits/sec    0   7.31 MBytes
[ 7]  8.00-9.00   sec    20.0 MBytes  168 Mbits/sec    0   8.34 MBytes
[ 7]  9.00-10.00  sec    18.8 MBytes  157 Mbits/sec    0   8.40 MBytes
-----
[ ID] Interval           Transfer     Bitrate      Retr
[ 7]  0.00-10.00  sec    192 MBytes  161 Mbits/sec    0          sender
[ 7]  0.00-10.26  sec    189 MBytes  154 Mbits/sec                receiver

iperf Done.
root@kali:~/P4/MyP4Project#
```

- 重新对bmv2编译，不使用debug模式，用iperf3测量带宽，时间10s。可知虚拟网络带宽已不受限,在5.4Gb/s左右

```
-----
[ ID] Interval           Transfer     Bitrate      Retr
iperf3: interrupt - the client has terminated
root@kali:~/P4/MyP4Project/crc16Test# iperf3 -c 10.0.0.2
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 56100 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate      Retr  Cwnd
[ 7]  0.00-1.00   sec    641 MBytes  5.38 Gbits/sec  295   1.96 MBytes
[ 7]  1.00-2.00   sec    804 MBytes  6.74 Gbits/sec  305   821 KBytes
[ 7]  2.00-3.00   sec    819 MBytes  6.87 Gbits/sec  254   1.78 MBytes
[ 7]  3.00-4.00   sec    735 MBytes  6.17 Gbits/sec   25   1.68 MBytes
[ 7]  4.00-5.00   sec    571 MBytes  4.79 Gbits/sec    2   1.77 MBytes
[ 7]  5.00-6.00   sec    492 MBytes  4.13 Gbits/sec    2   1.69 MBytes
[ 7]  6.00-7.00   sec    490 MBytes  4.11 Gbits/sec    3   1.65 MBytes
[ 7]  7.00-8.00   sec    505 MBytes  4.24 Gbits/sec    3   1.52 MBytes
[ 7]  8.00-9.00   sec    635 MBytes  5.32 Gbits/sec  153   1.42 MBytes
[ 7]  9.00-10.00  sec    696 MBytes  5.84 Gbits/sec  125   1.35 MBytes
-----
[ ID] Interval           Transfer     Bitrate      Retr
[ 7]  0.00-10.00  sec    6.24 GBytes  5.36 Gbits/sec  1167          sender
[ 7]  0.00-10.04  sec    6.23 GBytes  5.33 Gbits/sec                receiver

iperf Done.
root@kali:~/P4/MyP4Project/crc16Test#
```

CRC16

带宽测试

- 测试时间：1200s
- 网络拓扑：同带宽测试
- 转发策略：基于交换机端口的转发策略

```
[ ID] Interval          Transfer    Bitrate
[  8]   0.00-1200.05 sec   739 GBytes  5.29 Gbits/sec
-----
Server listening on 5201
-----
iperf3: interrupt - the server has terminated
```

CRC32

如果对CRC32的每一个哈希值进行分配一个大小为 sizeof(int)的

带宽测试

- 测试时间：1200s
- 网络拓扑：同带宽测试
- 转发策略：基于交换机端口的转发策略

```
[ ID] Interval          Transfer    Bitrate
[  8]   0.00-1200.04 sec   711 GBytes  5.09 Gbits/sec
-----
Server listening on 5201
-----
iperf3: interrupt - the server has terminated
```

哈希速度测试

- 文件大小：4.72MB(测试中buffer无法超过10MB，暂未发现解决方案，减小文件读取带来的额外开销)
- buffer：5MB
- 对文件进行10次哈希，取平均值

v1model 内置Hash速度

Hash	Speed(MB/s)	描述
CRC16	25.39	16bit
CRC32	25.15	32bit
XOR16	786.67	16bit

IDENTITY	9731.96	64bit;最多只将前8个字节相加
CSUM16	2950	16bit