BMv2 PNA Support

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Abstract:

- Need for a P4 simulator that supports PNA for NIC side use cases.
- BMv2 supports v1model and Portable Switch Architecture (PSA) but lacks PNA support.

Objective:

- Integration of a minimal core subset of Portable NIC Architecture (PNA) into BMv2 and P4C.

Goals:

- Create a new BMv2 target supporting the core PNA subset
- Develop a P4C backend for BMv2’s PNA NIC target
- Design test cases to ensure the functionality of the PNA NIC target

Implementation - BMv2 PNA NIC Target

- Basic PNA NIC target with externs (Meter, Counter, Register).
- Test case to validate loading of P4C generated PNA JSON files.

Binary:

- pna_nic

Implementation - P4C Backend

- New P4C backend created for PNA NIC target.
- Common codebase (`portable_common`) shared between PSA and PNA components.
- Merged `ProgramStructure` and `CodeGenerator` classes.
- PNA specification file included

Binary:

- p4c-bm2-pna

Demo

- Compile `pna-demo-L2-one-table.p4` using `p4c-bm2-pna` binary
  - `p4c-bm2-pna pna-demo-L2-one-table.p4 -o pna-demo-L2-one-table.p4`
- Start the `pna_nic` target

Demo …Continued

- Start `pna_nic_CLI` and populate the `L2_fwd` target
  - `table_add L2_fwd L2_send_to_port ba:dd:b1:f5:03:3c => 0`
  - `table_add L2_fwd L2_send_to_port be:05:e2:d2:4a:bc => 1`
  - `table_add L2_fwd L2_send_to_port 52:04:da:9b:15:59 => 2`

Demo …Continued

```
rupesh_chiluka:$ pna_nic_CLI
Obtaining JSON from switch...
Done
Control utility for runtime P4 table manipulation
RuntimeCmd: table_add L2_fwd L2_send_to_port ba:dd:b1:f5:03:3c => 0
Adding entry to exact match table L2_fwd
match key:           EXACT-ba:dd:b1:f5:03:3c
action:              L2_send_to_port
runtime data:        00:00:00:00
Entry has been added with handle 0
RuntimeCmd: table_add L2_fwd L2_send_to_port be:05:e2:d2:4a:bc => 1
Adding entry to exact match table L2_fwd
match key:           EXACT-be:05:e2:d2:4a:bc
action:              L2_send_to_port
runtime data:        00:00:00:01
Entry has been added with handle 1
RuntimeCmd: table_add L2_fwd L2_send_to_port 52:04:da:9b:15:59 => 2
Adding entry to exact match table L2_fwd
match key:           EXACT-52:04:da:9b:15:59
action:              L2_send_to_port
runtime data:        00:00:00:02
Entry has been added with handle 2
```

Demo …Continued

- Send the packets from one interface and listen on another interface

```
>>> p = Ether(dst="be:05:e2:d2:4a:bc")/IP(dst="11.11.1.1")/UDP()
>>> sendp(p, iface="veth0")
```

```
rupesh_chiluka:t1$ sudo tcpdump -n -i veth3
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on veth3, link-type EN10MB (Ethernet), snapshot length 262144 bytes
10:15:24.636876 IP 192.168.1.118.53 > 11.11.1.1.53: domain [length 0 < 12] (invalid)
```

Future Work

Standard PNA Features (Yet to be Implemented)

- Recirculation
- Dropping
- Differentiate between Host and Network Interfaces

Future Work

Experimental PNA Features (Yet to be Implemented)

- IPSec Encrypt/Decrypt
- Large Receive Offload (LRO)
- Receive Side Scaling (RSS)
- TCP Segmentation Offloading (TSO)

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BMv2 Repo PNA Issue Link:
https://github.com/p4lang/behavioral-model/issues/1245

P4C Repo PNA Issue Link:

https://github.com/p4lang/p4c/issues/4717

Collaboration is appreciated

Thank You!