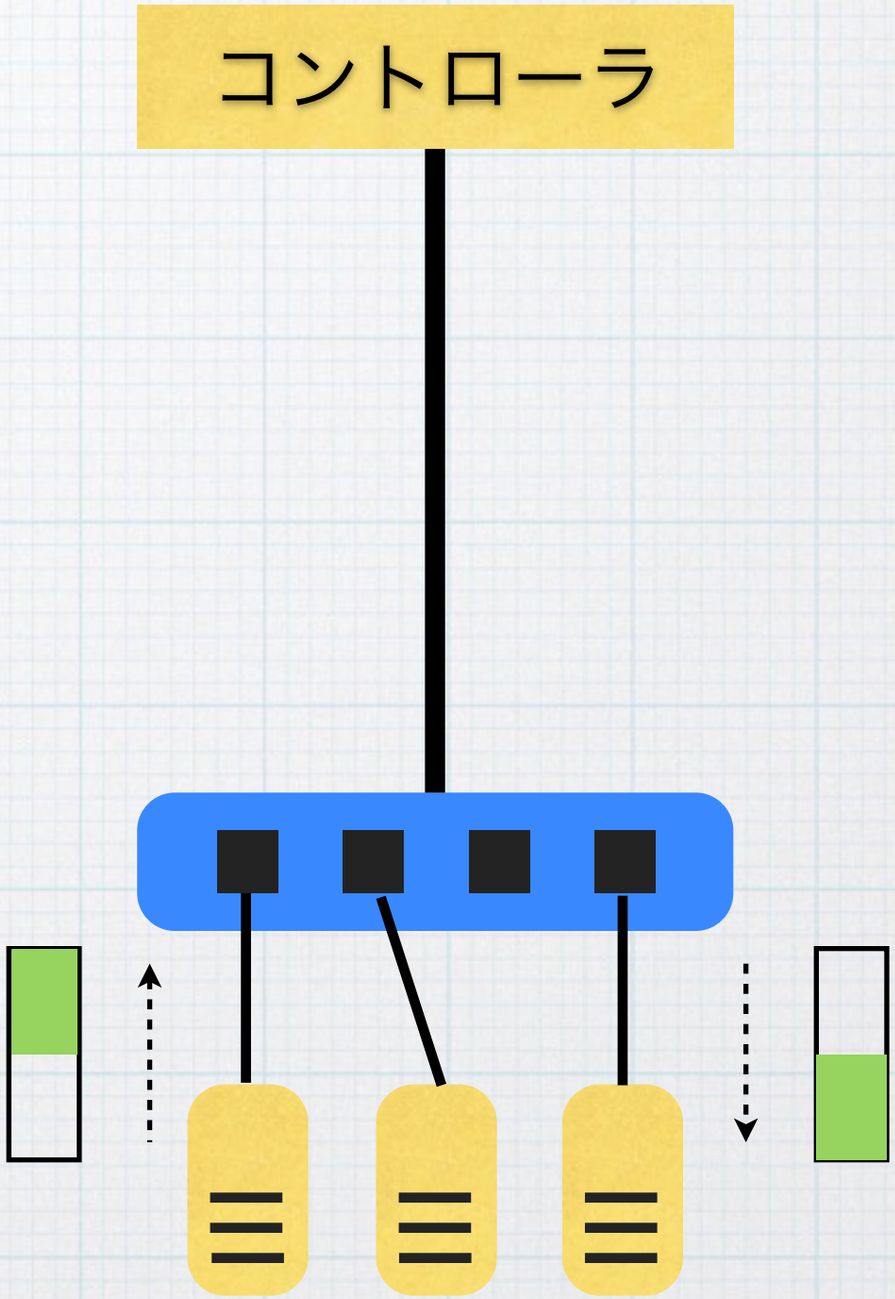
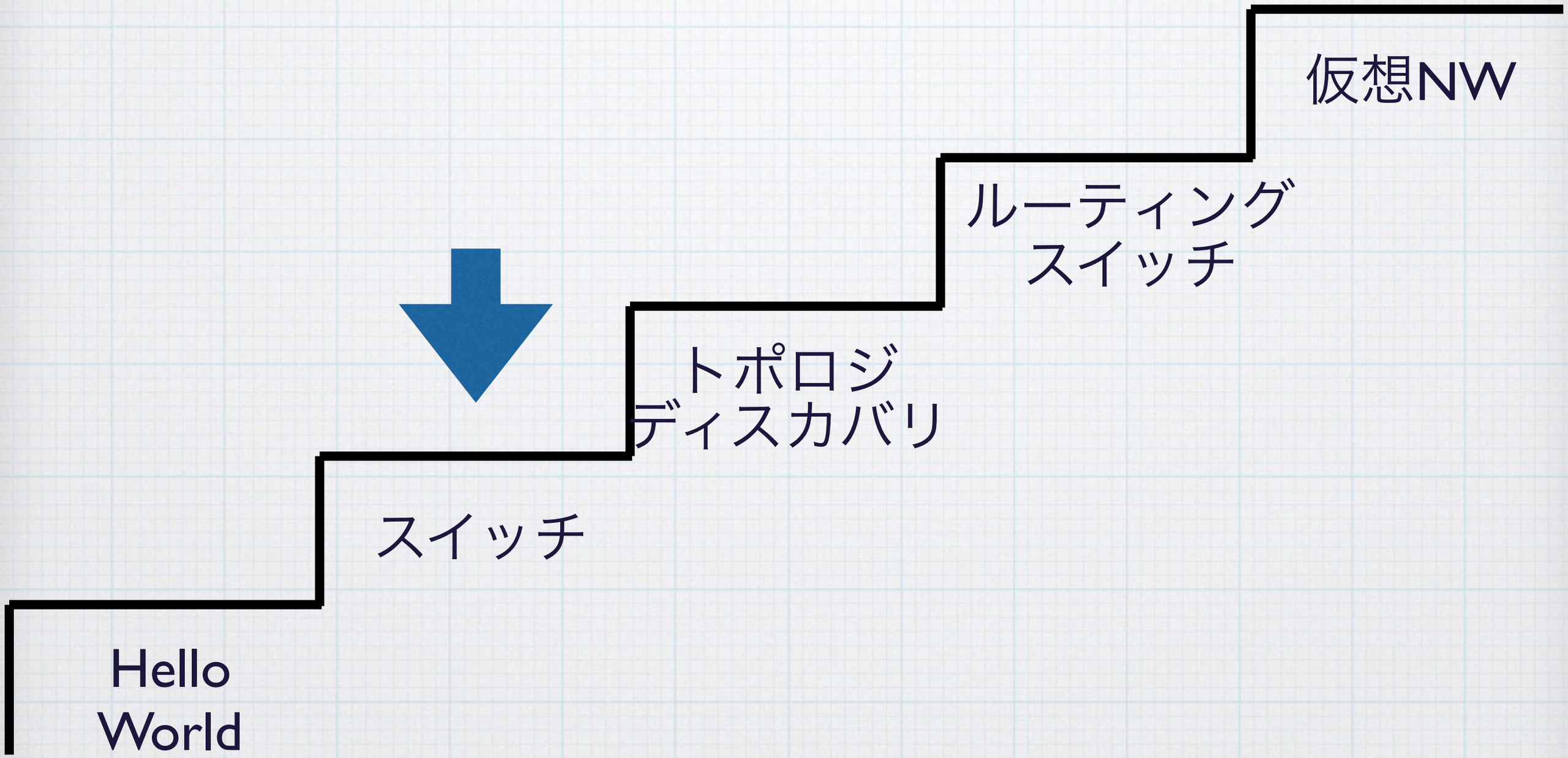
スイッチを作ろう

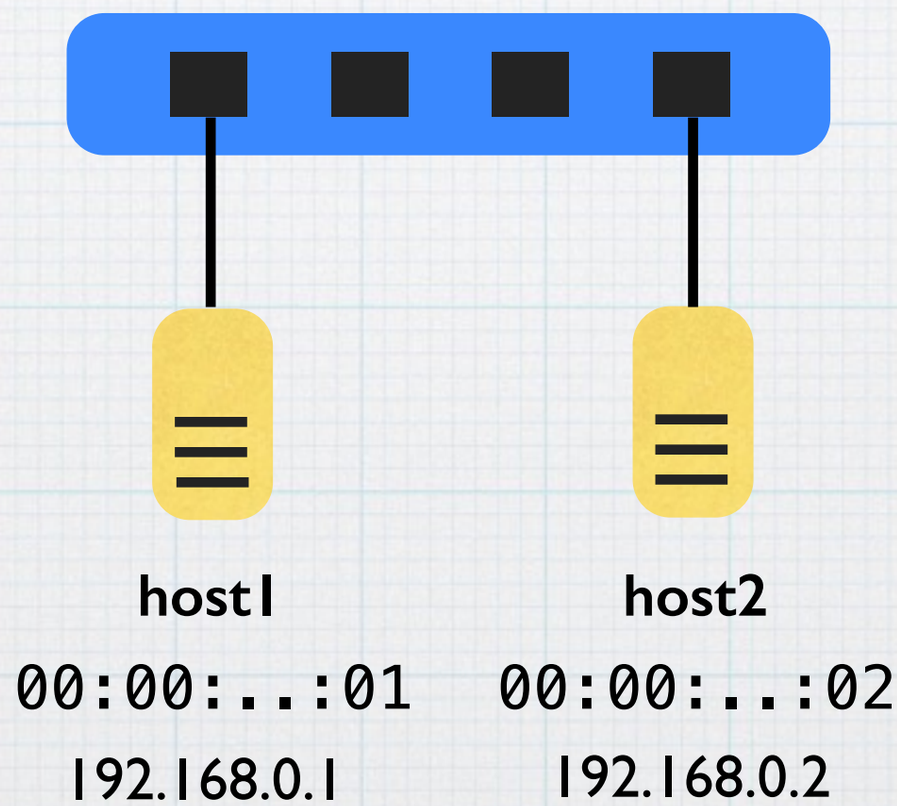



仮想NW
ルーティング
スイッチ
トポロジ
ディスカバリ
スイッチ
Hello
World

普通のスイッチの仕組み

Forwarding DB

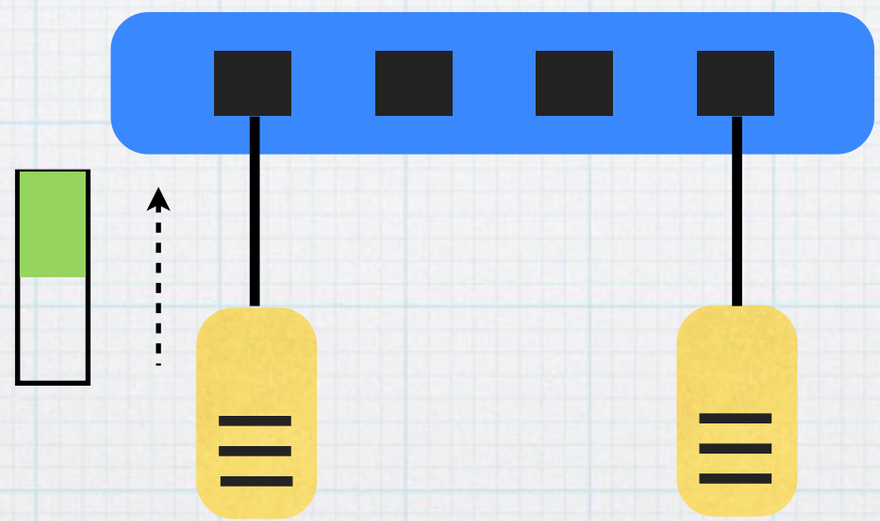
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4



Forwarding DB

00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4

宛先 = host2

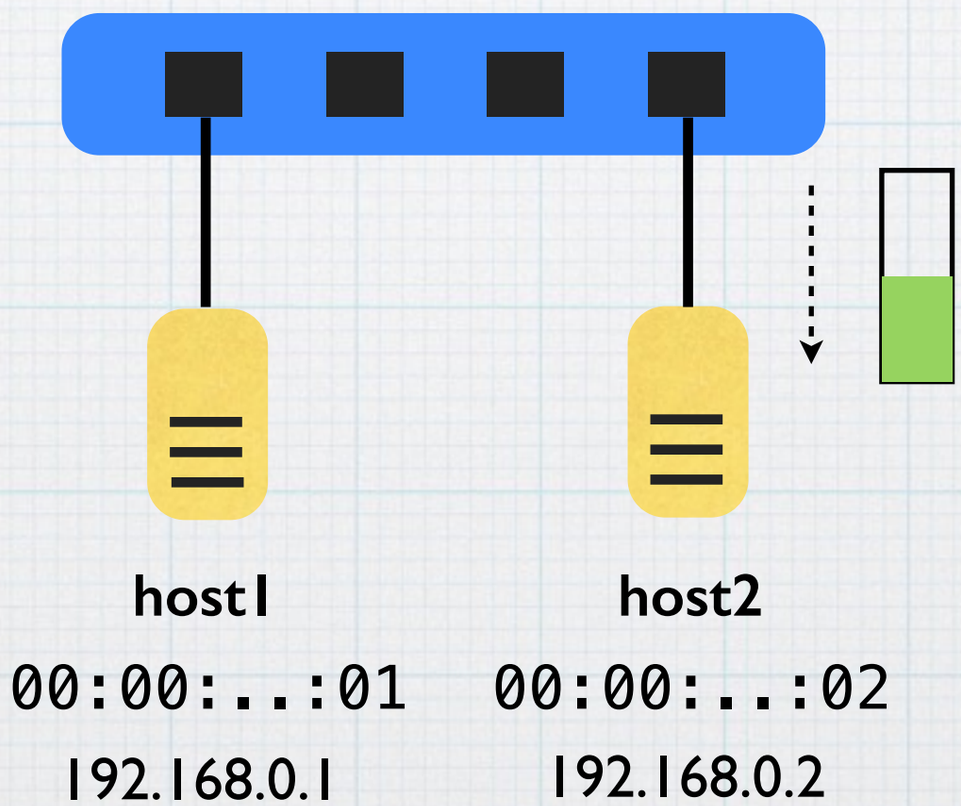


host1
00:00:..:01
192.168.0.1

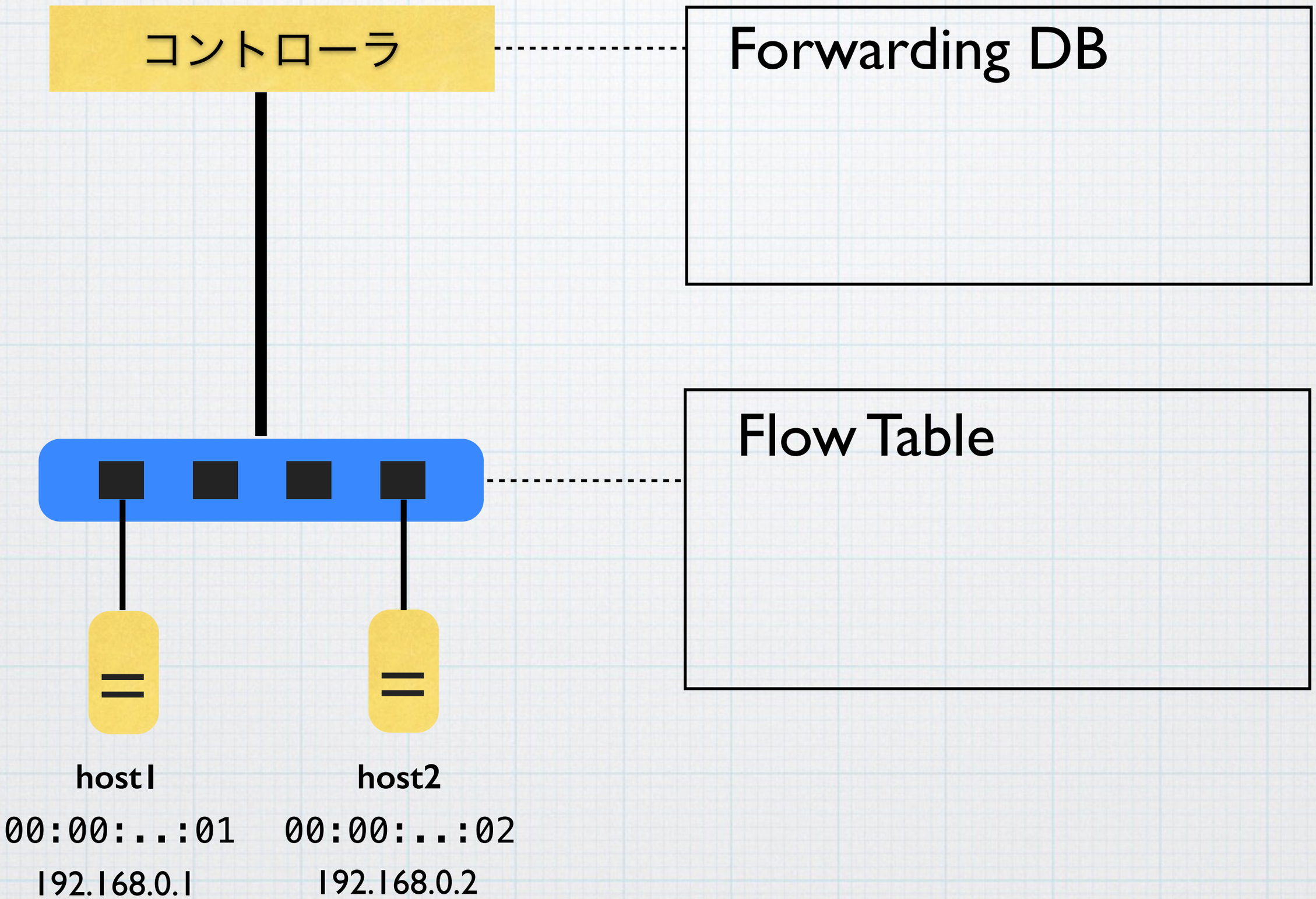
host2
00:00:..:02
192.168.0.2

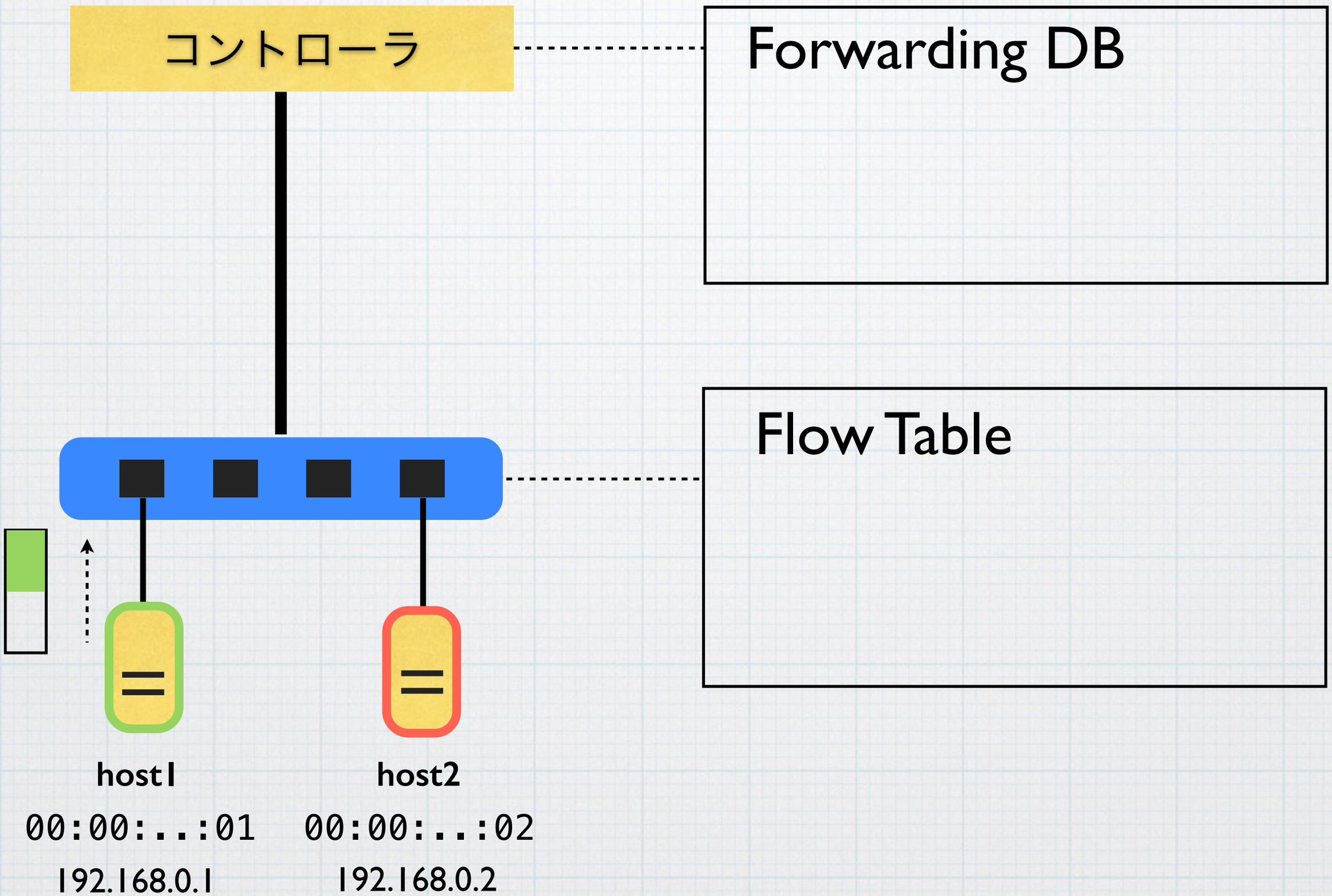
Forwarding DB

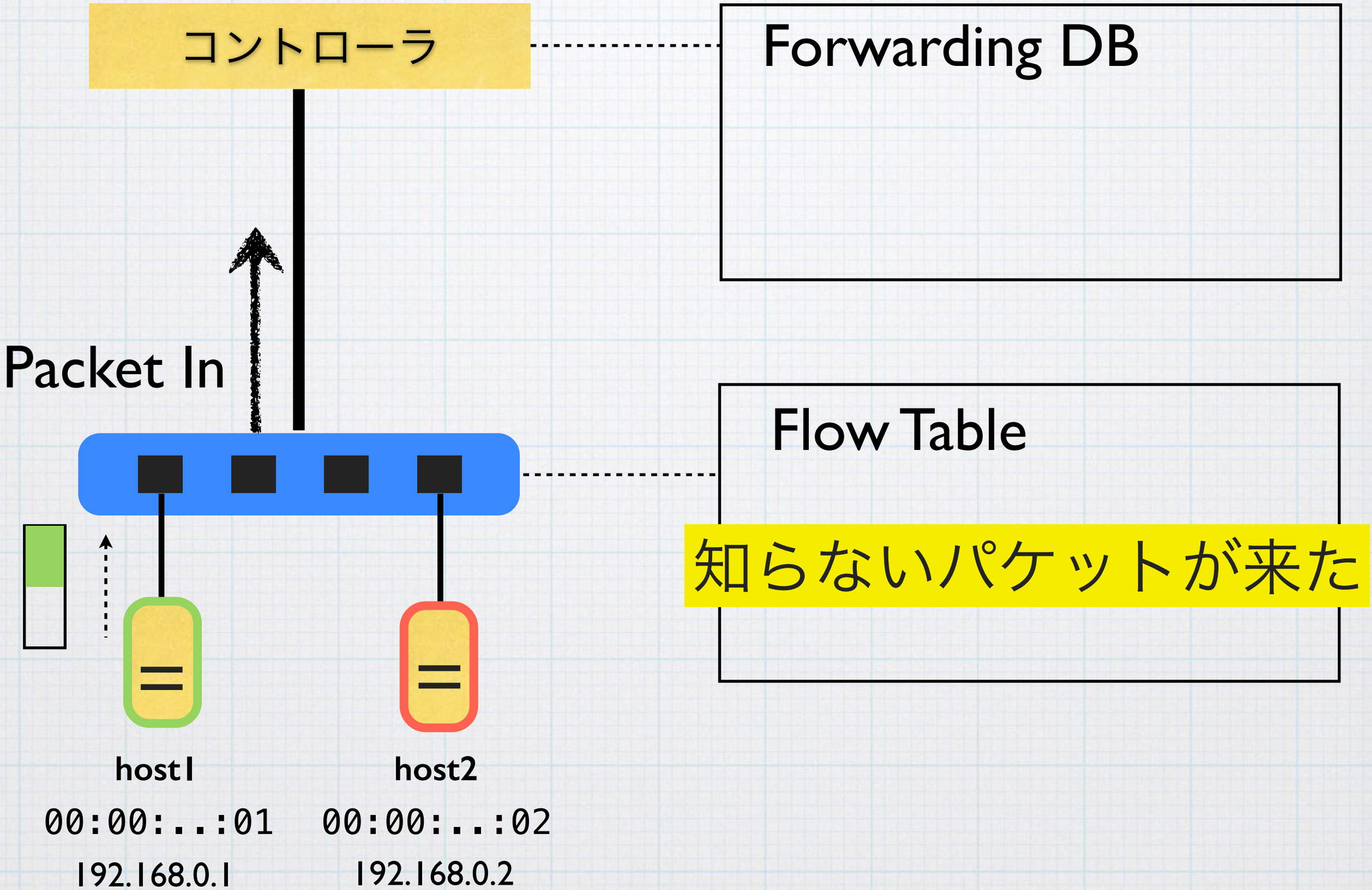
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4

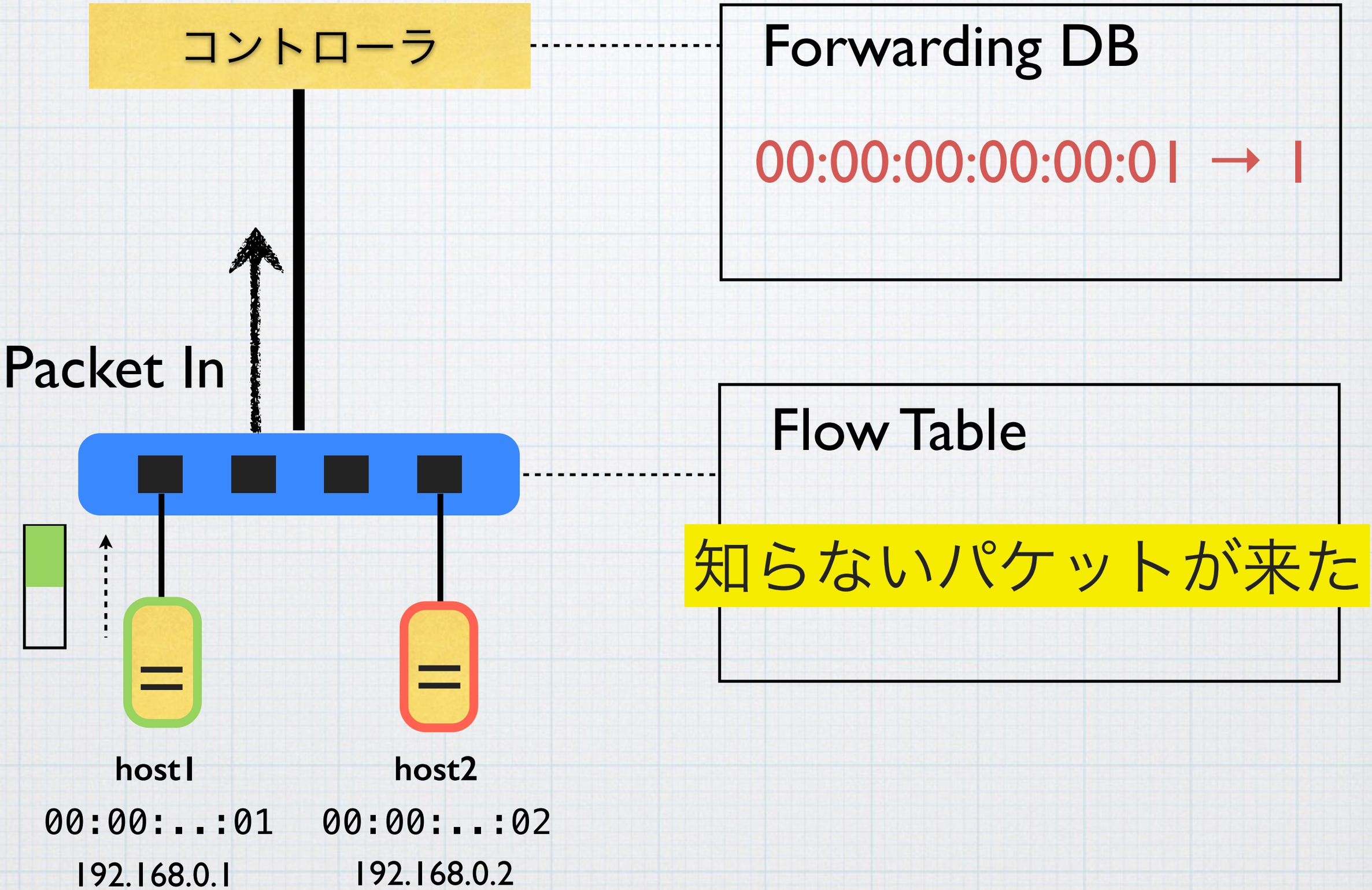


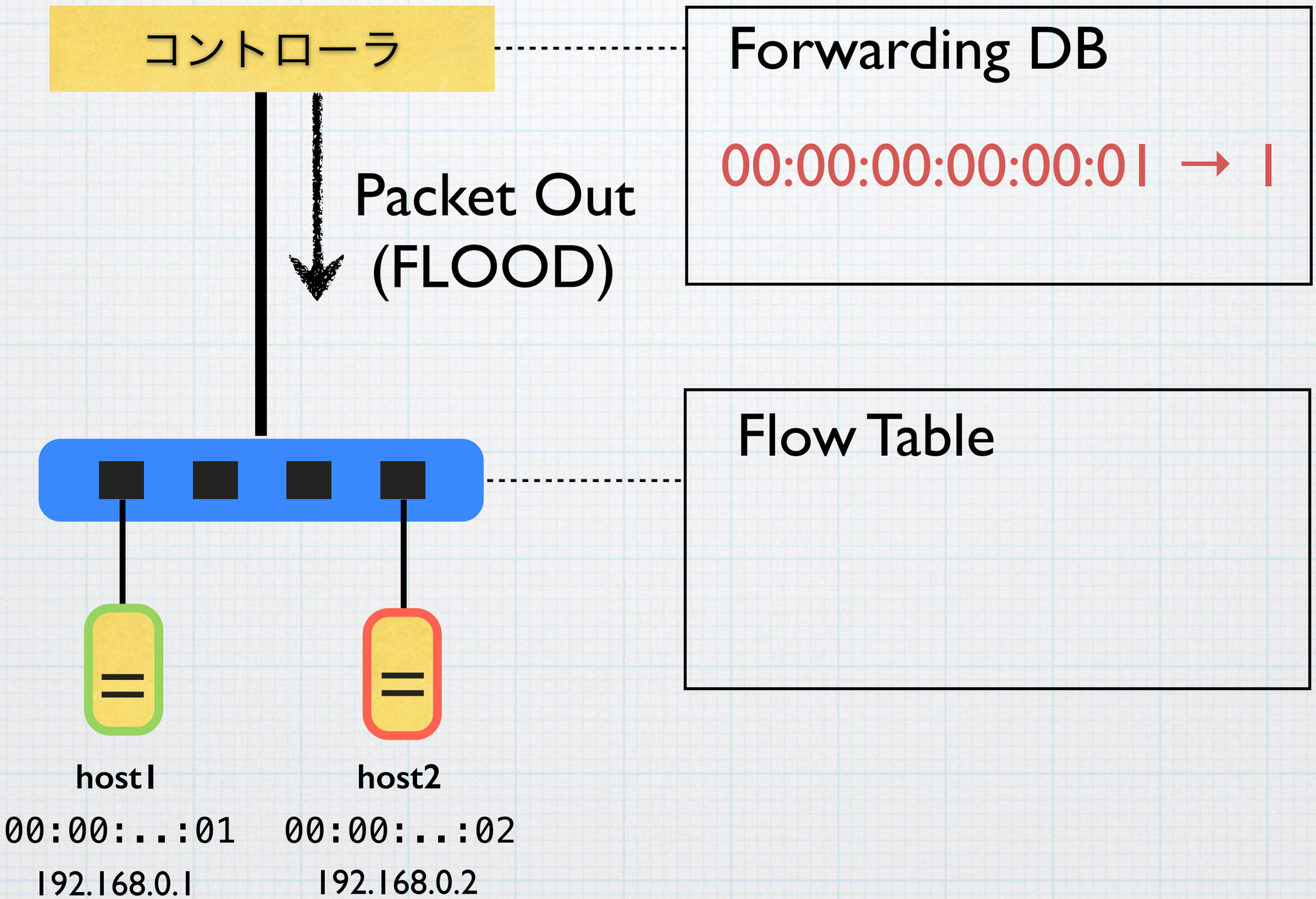
OpenFlowによる
スイッチの仕組み

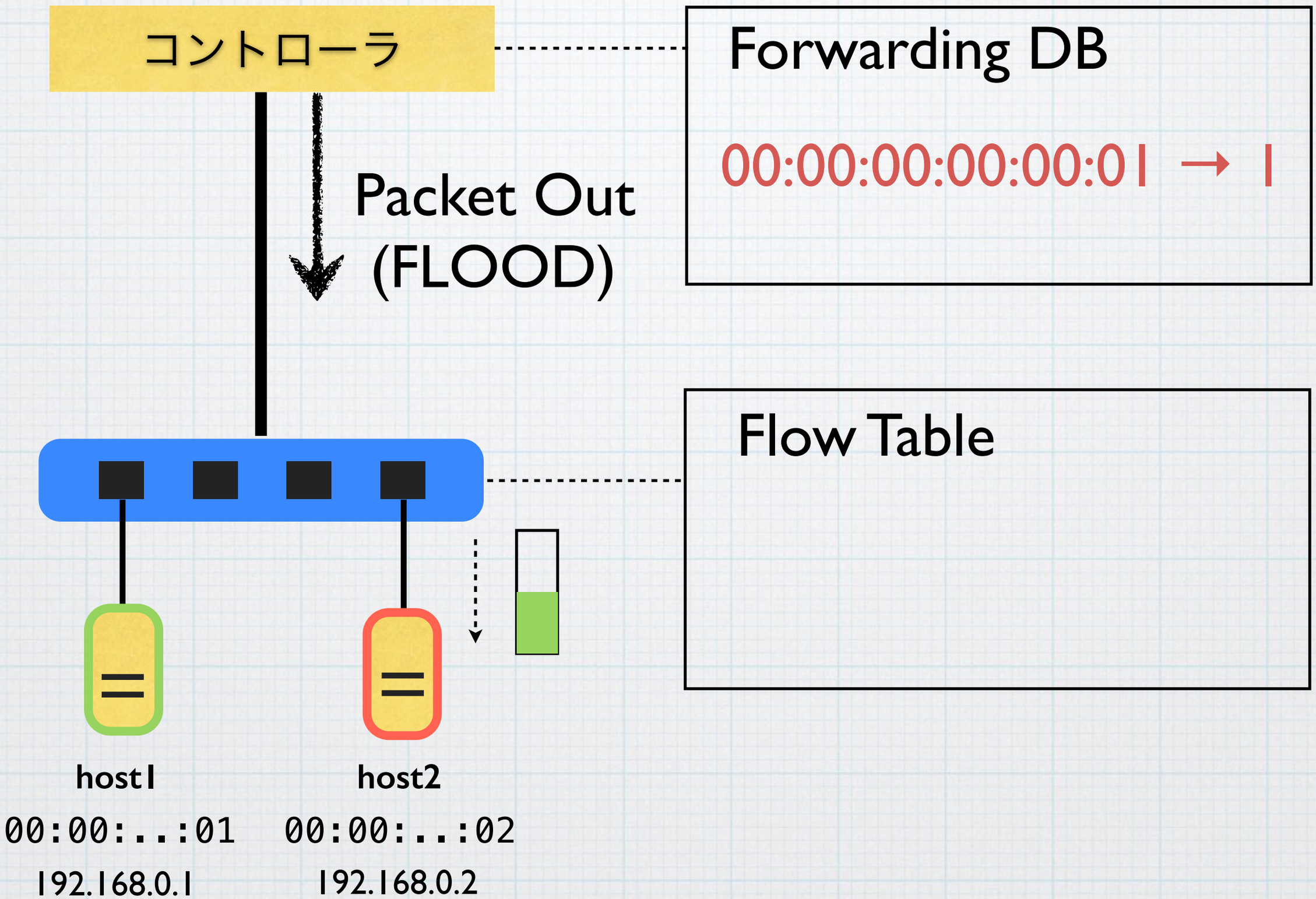

コントローラ
Forwarding DB
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

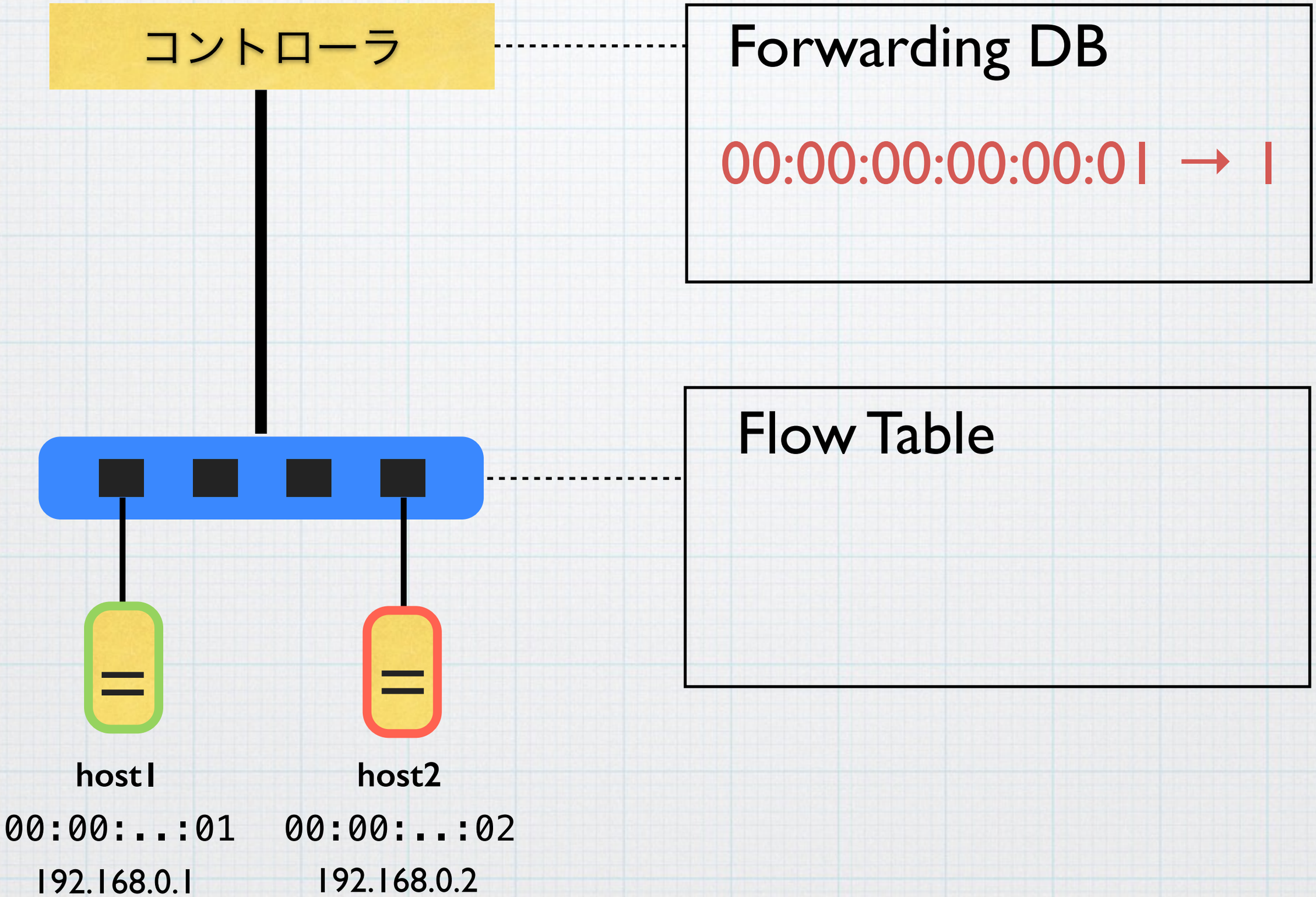

コントローラ
Forwarding DB
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

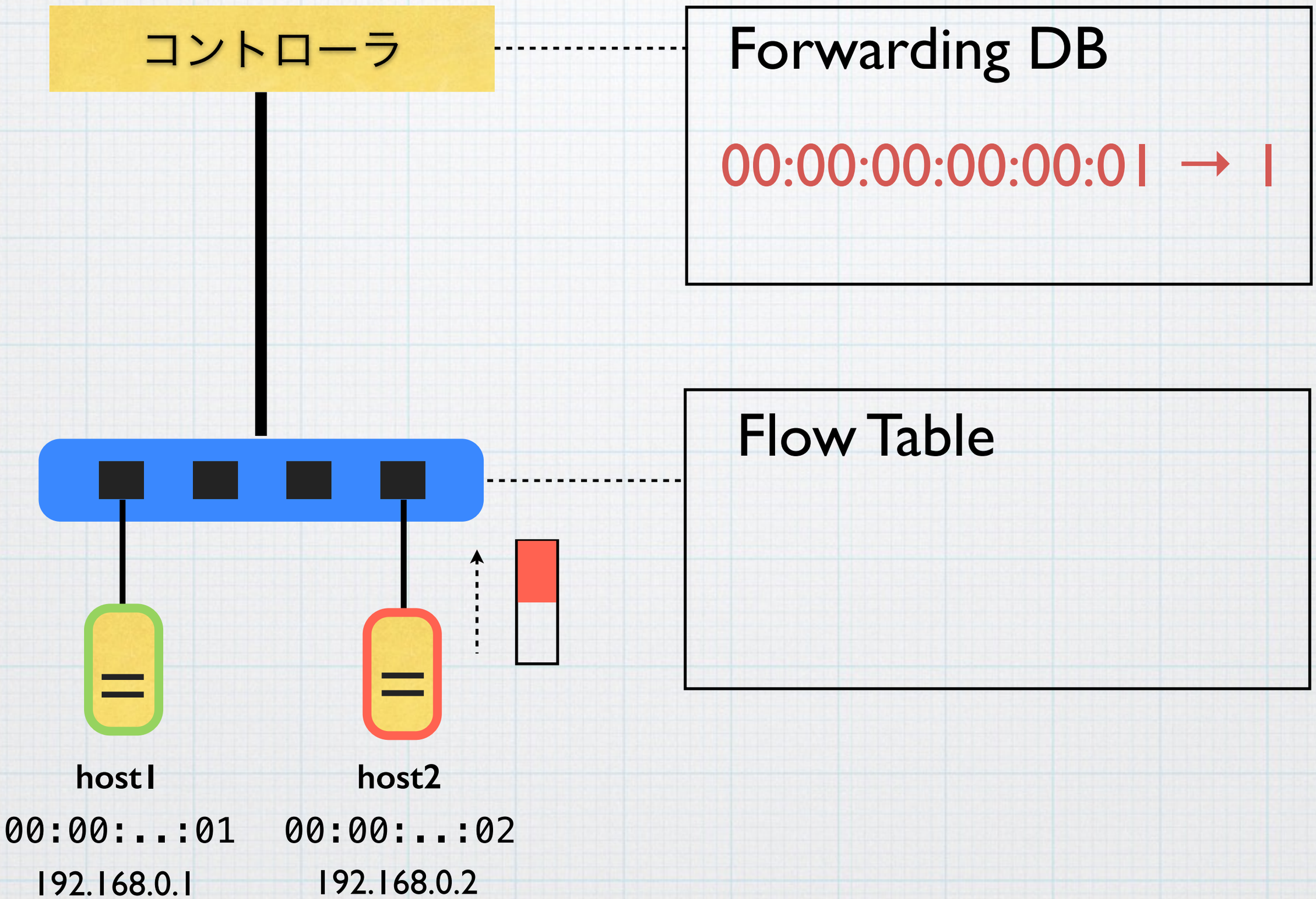

コントローラ
Forwarding DB
Packet In
Flow Table
知らないパケットが来た
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

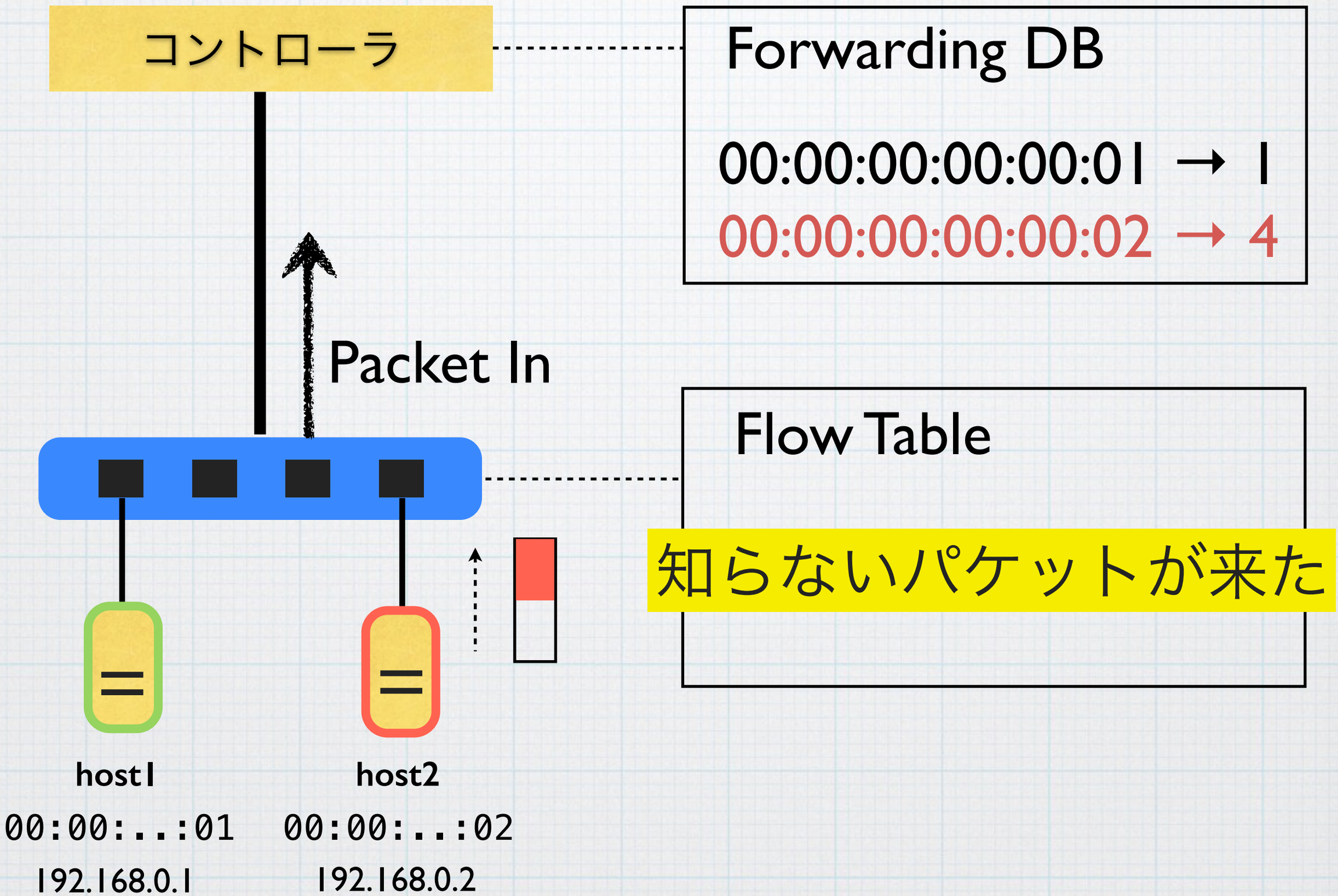

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
Packet In
Flow Table
知らないパケットが来た
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

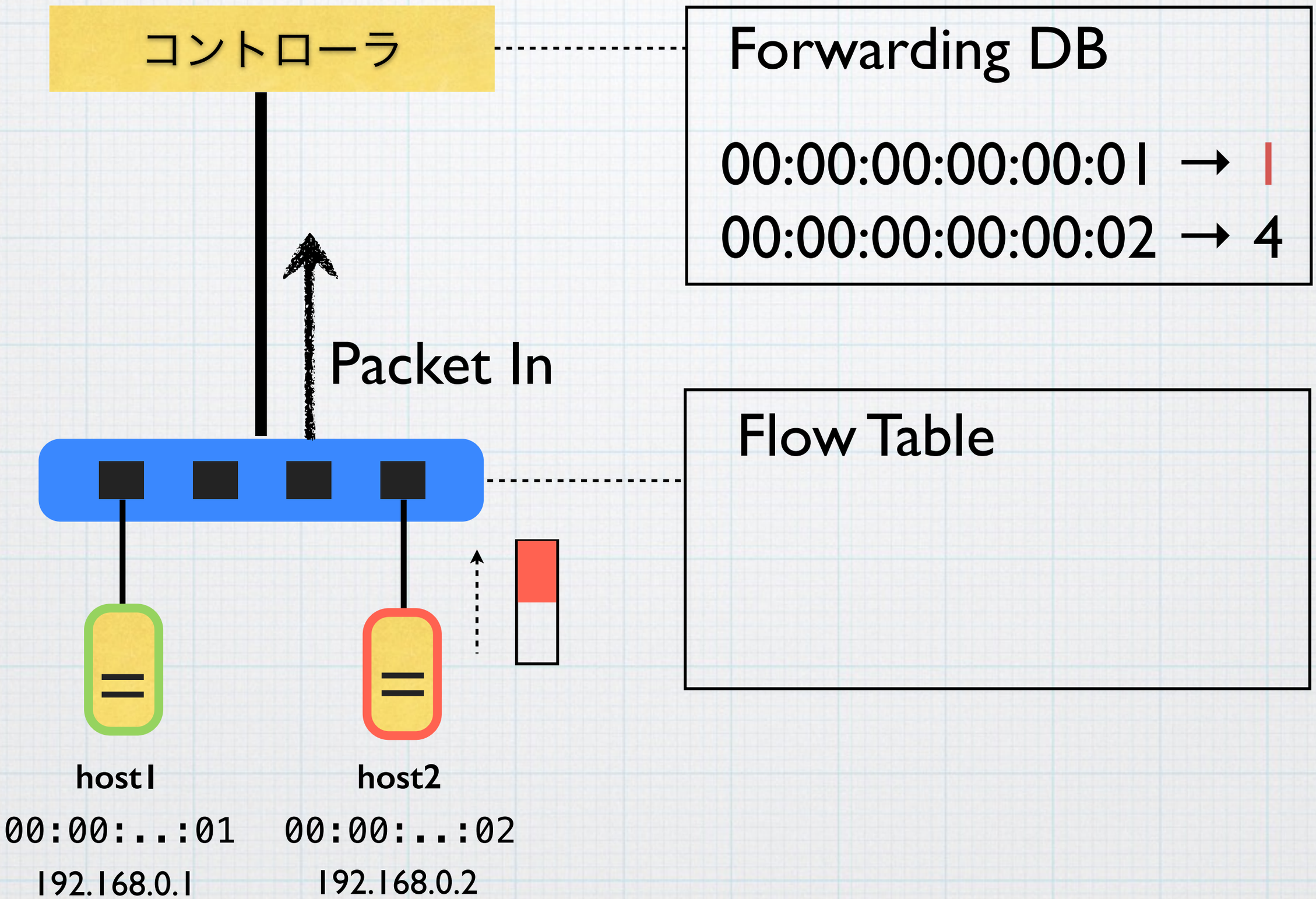

コントローラ
Packet Out
(FLOOD)
Forwarding DB
00:00:00:00:00:01 → 1
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

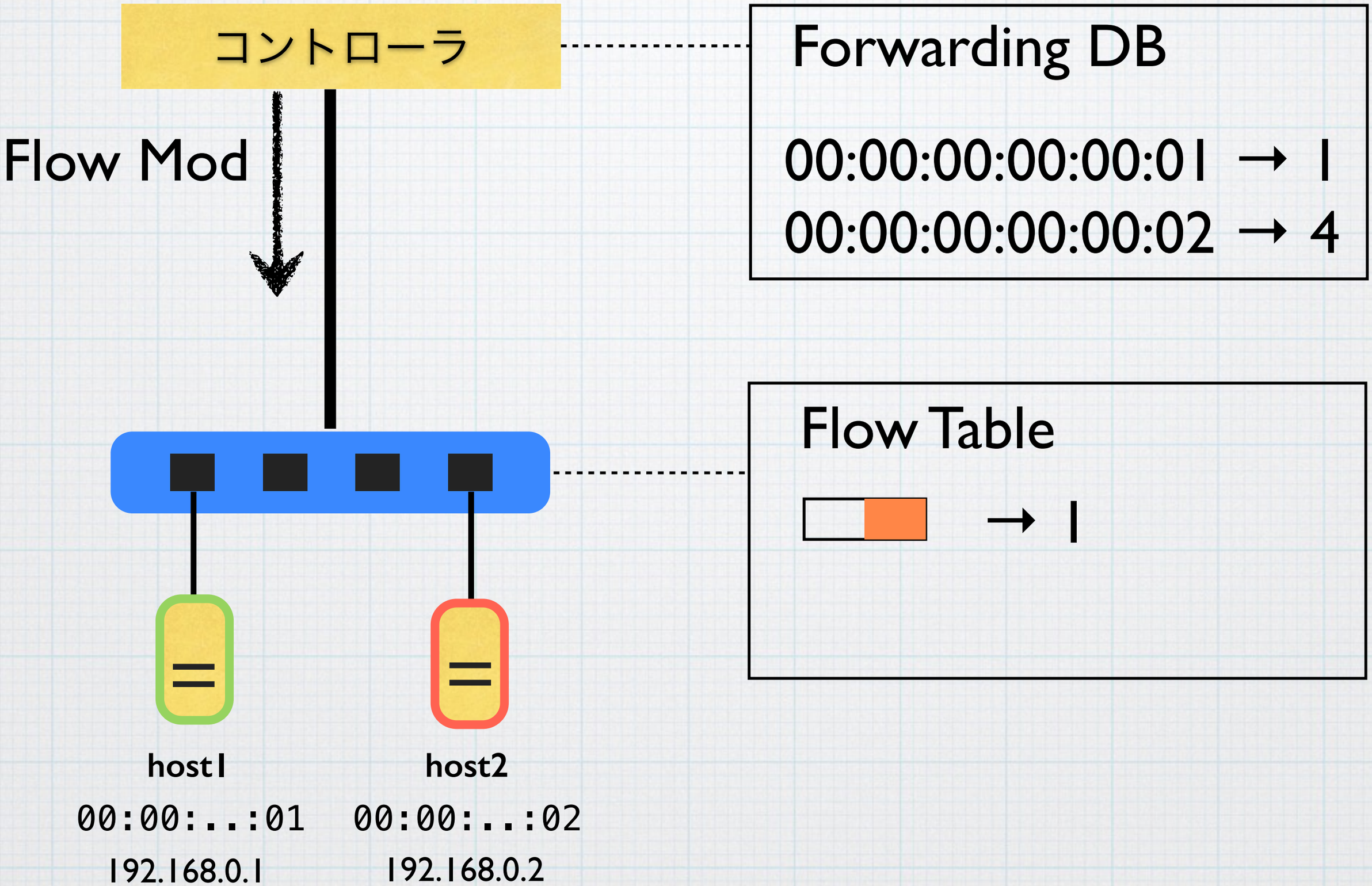

コントローラ
Packet Out
(FLOOD)
Forwarding DB
00:00:00:00:00:01 → 1
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

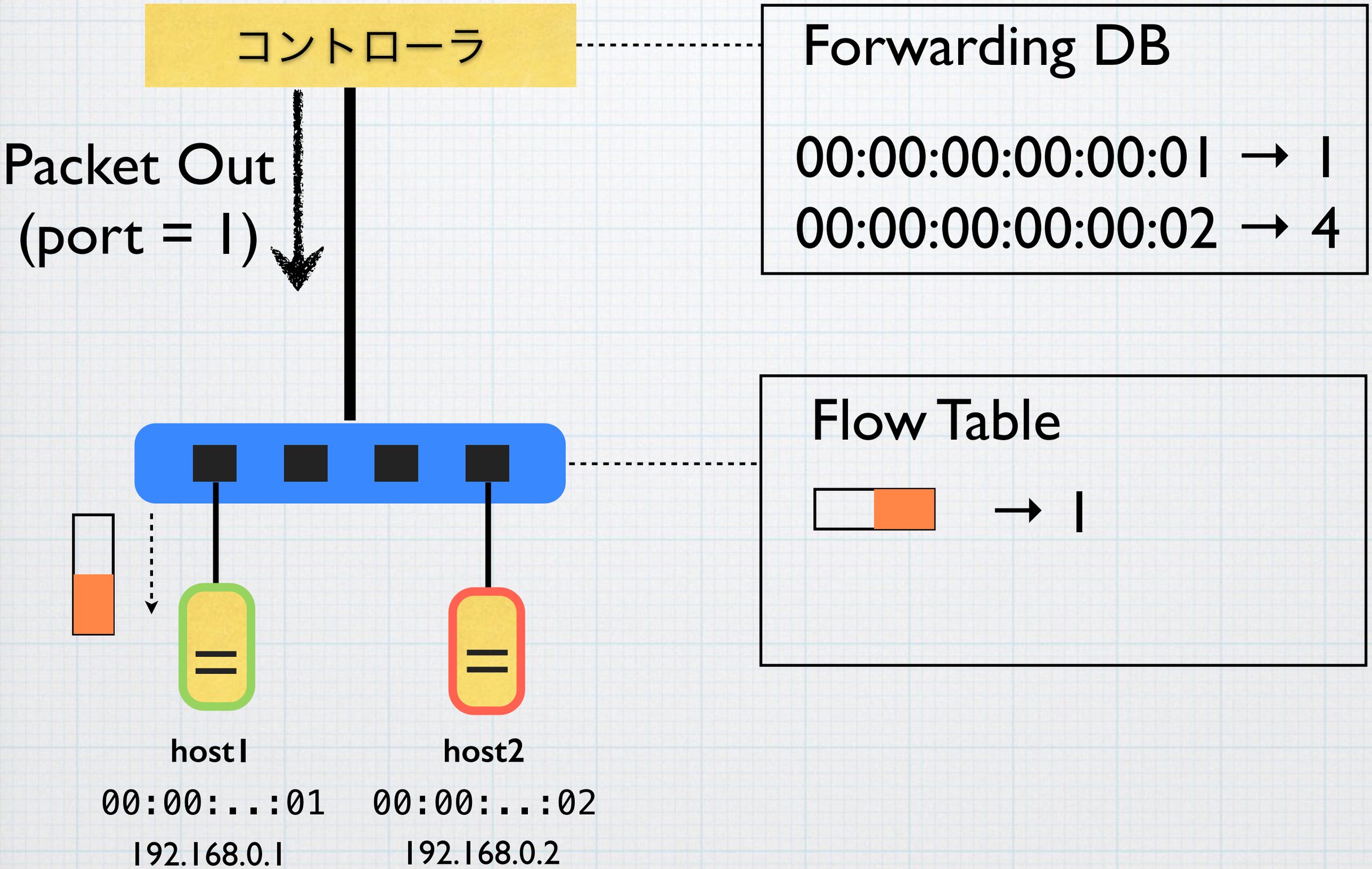

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

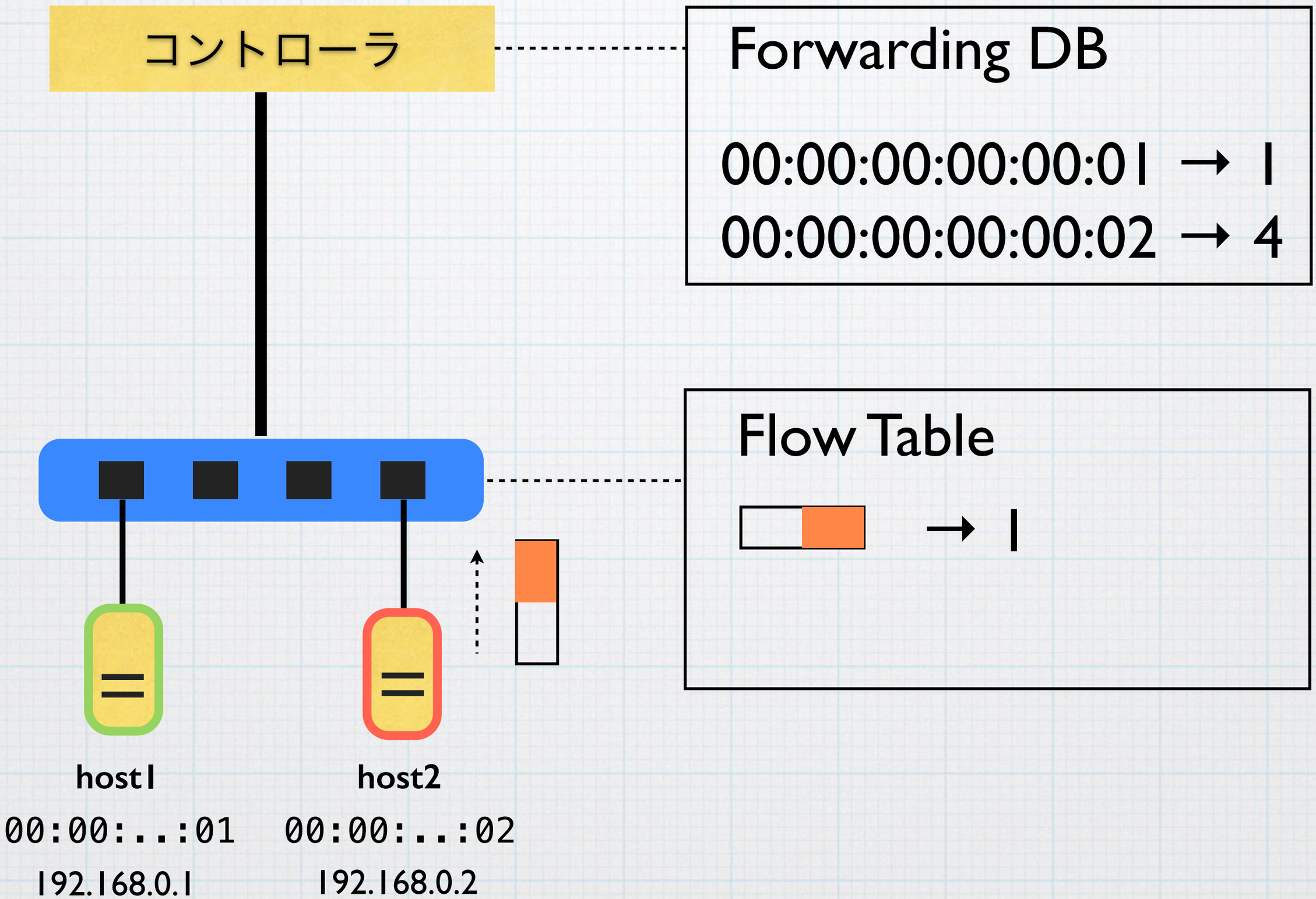

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

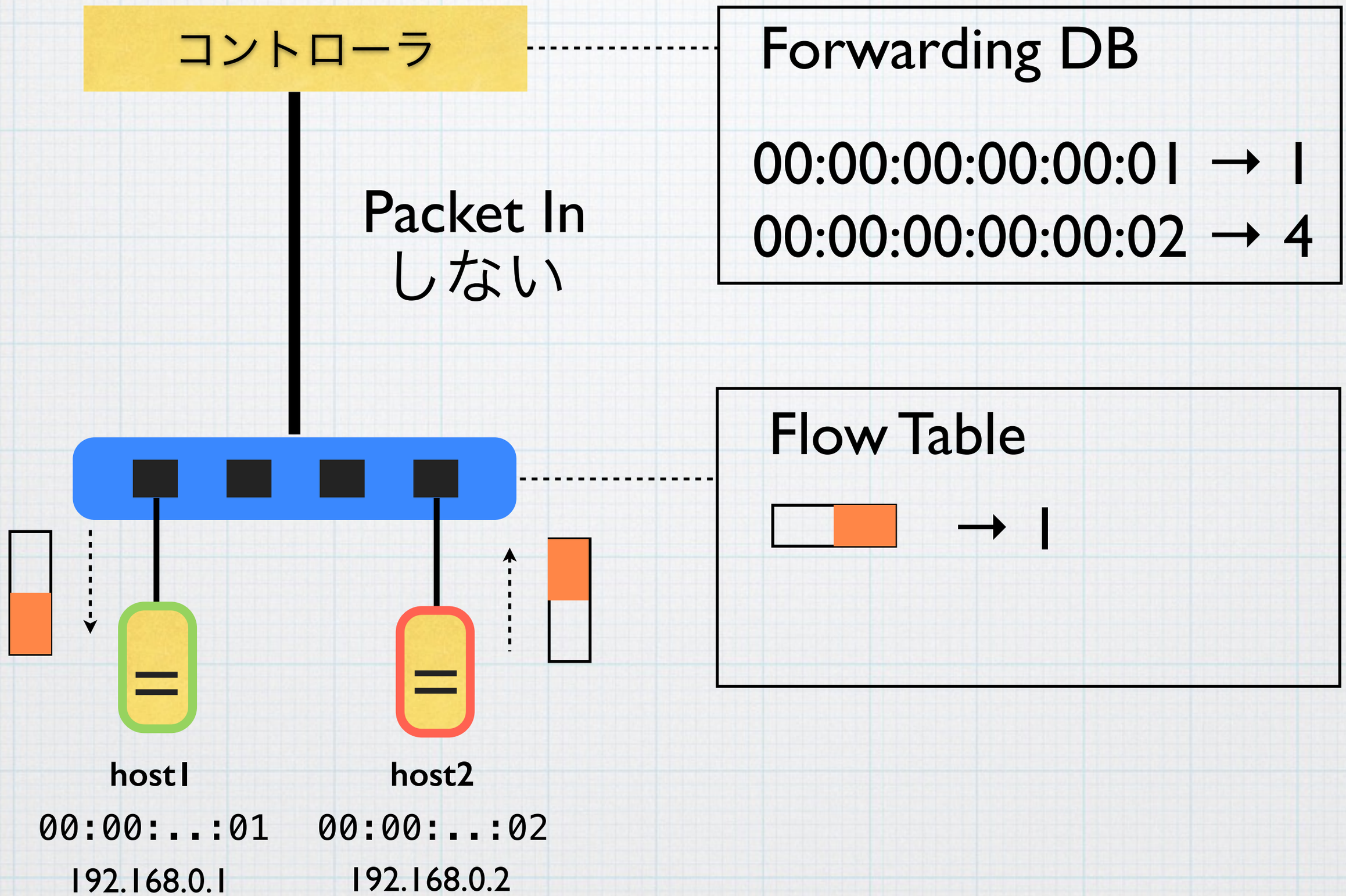

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Packet In
Flow Table
知らないパケットが来た
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

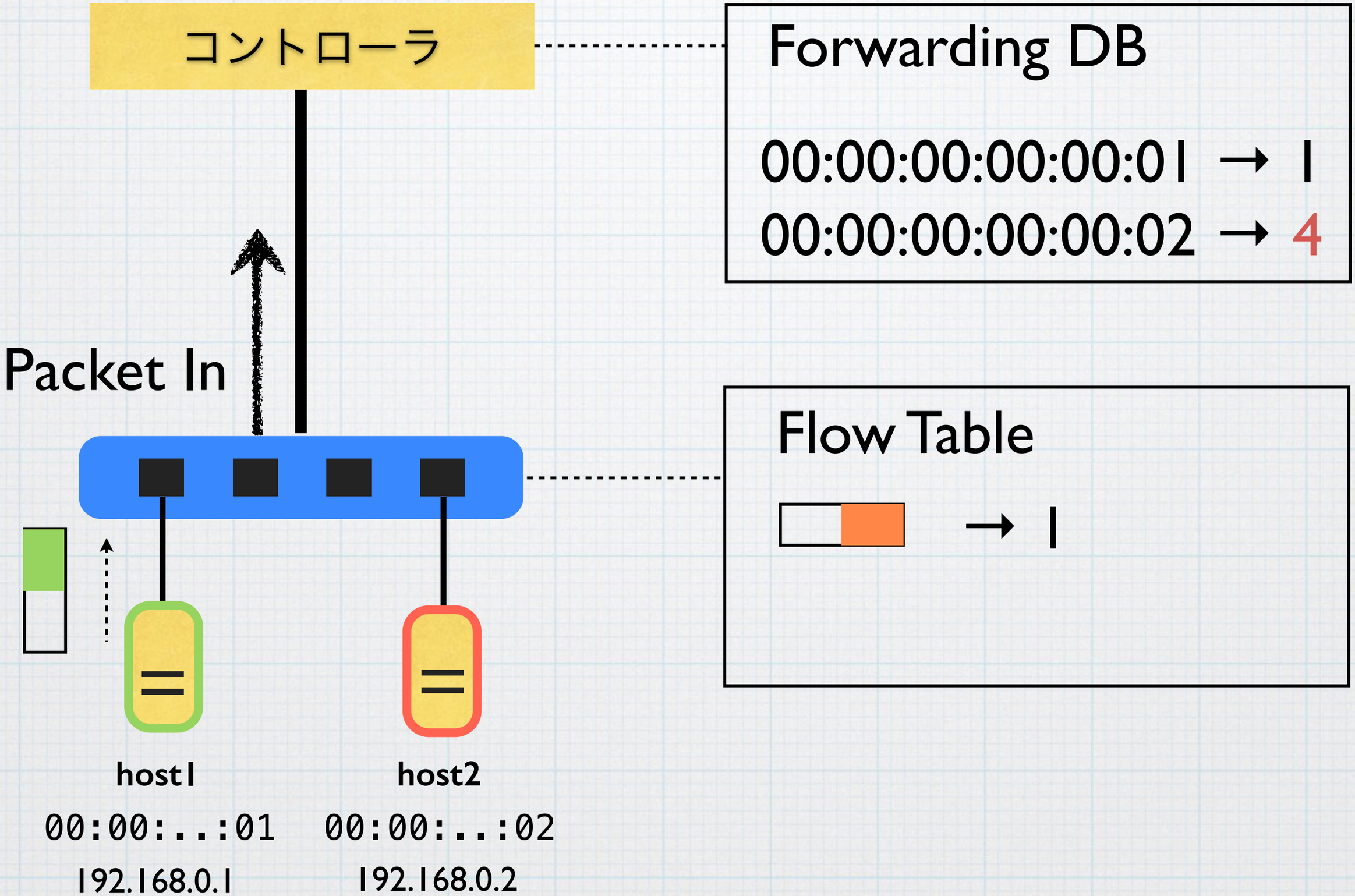

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Packet In
Flow Table
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

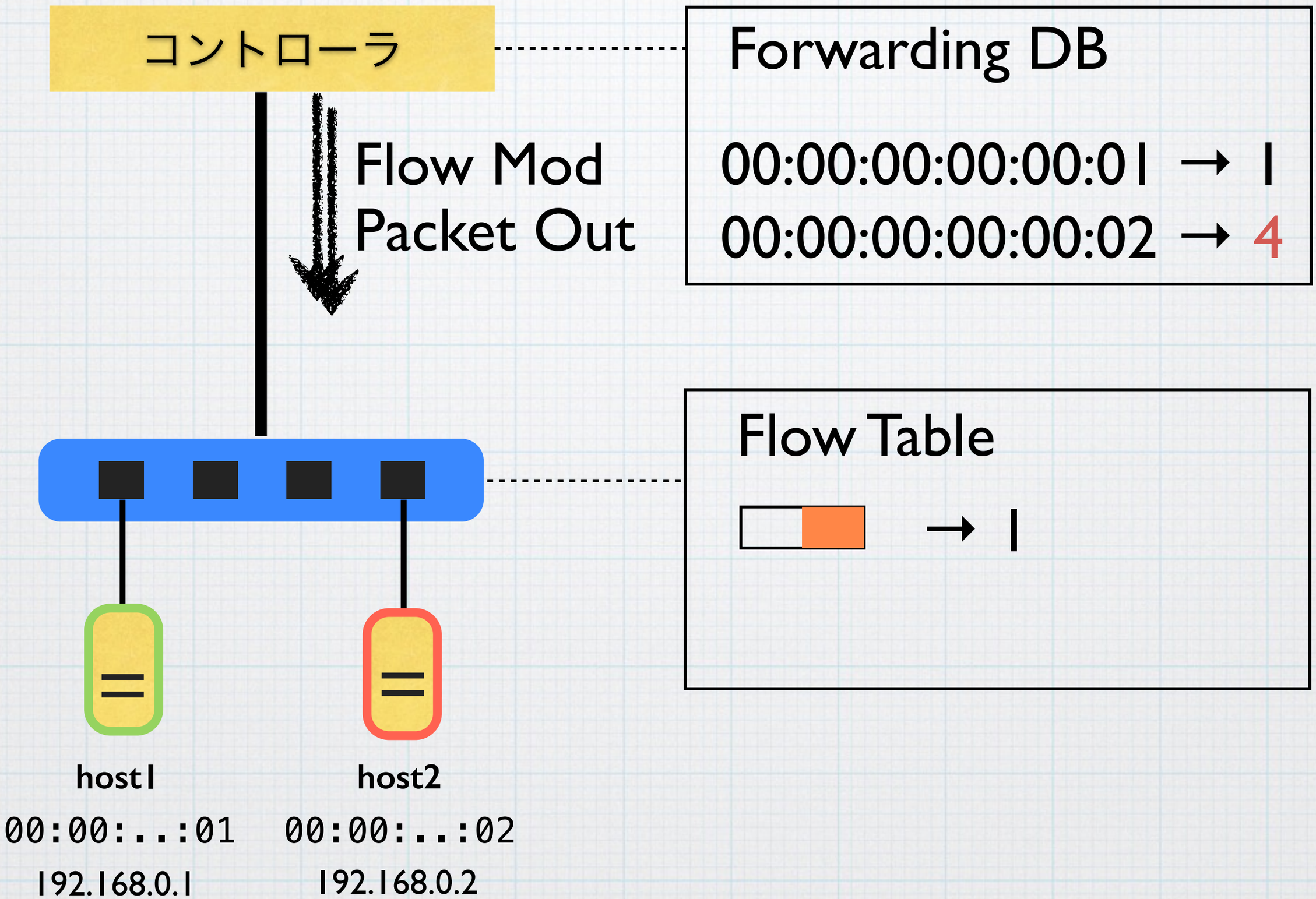

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Flow Mod
Flow Table
→ 1
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

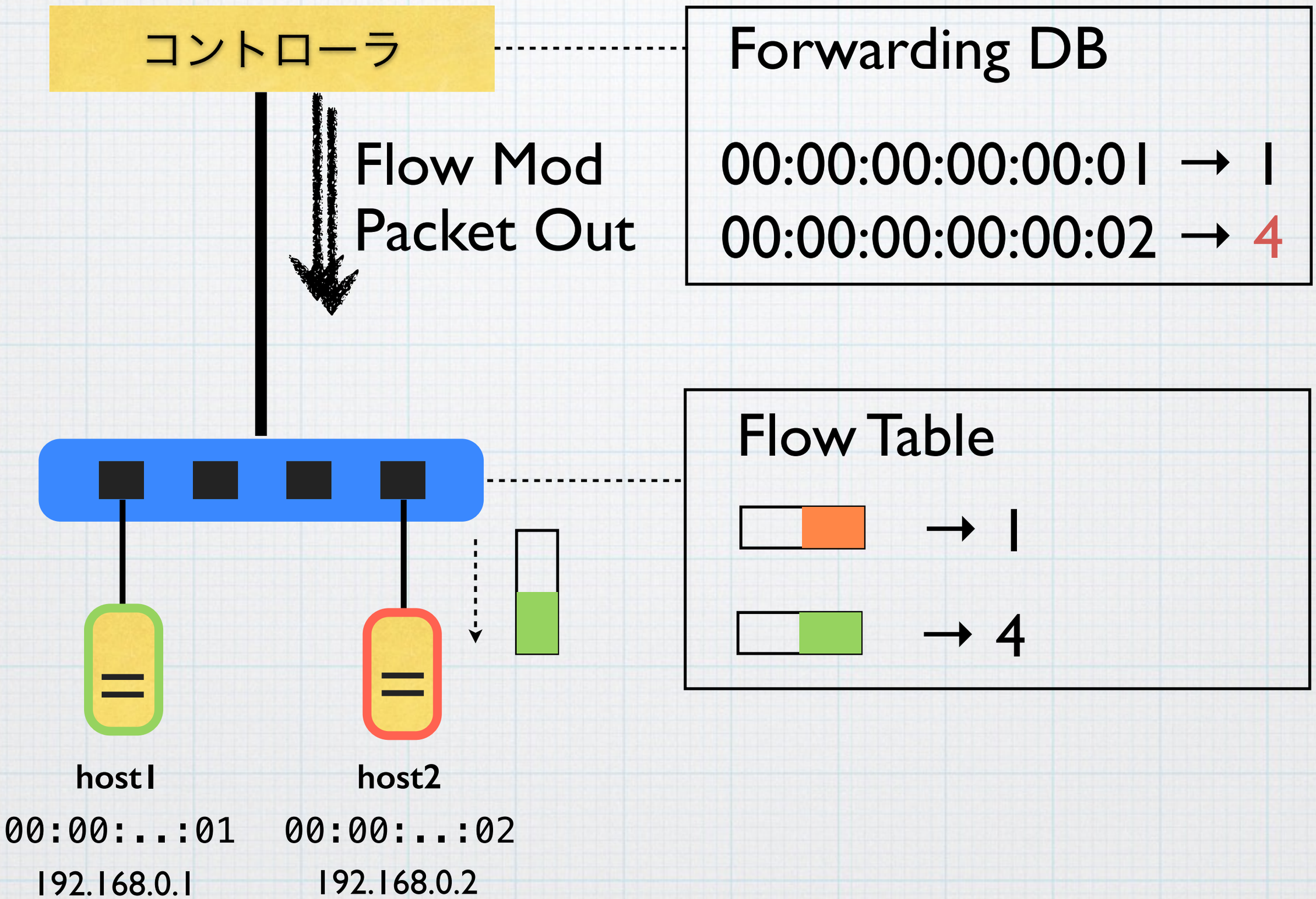

コントローラ
Packet Out
(port = 1)
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Flow Table
→ 1
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

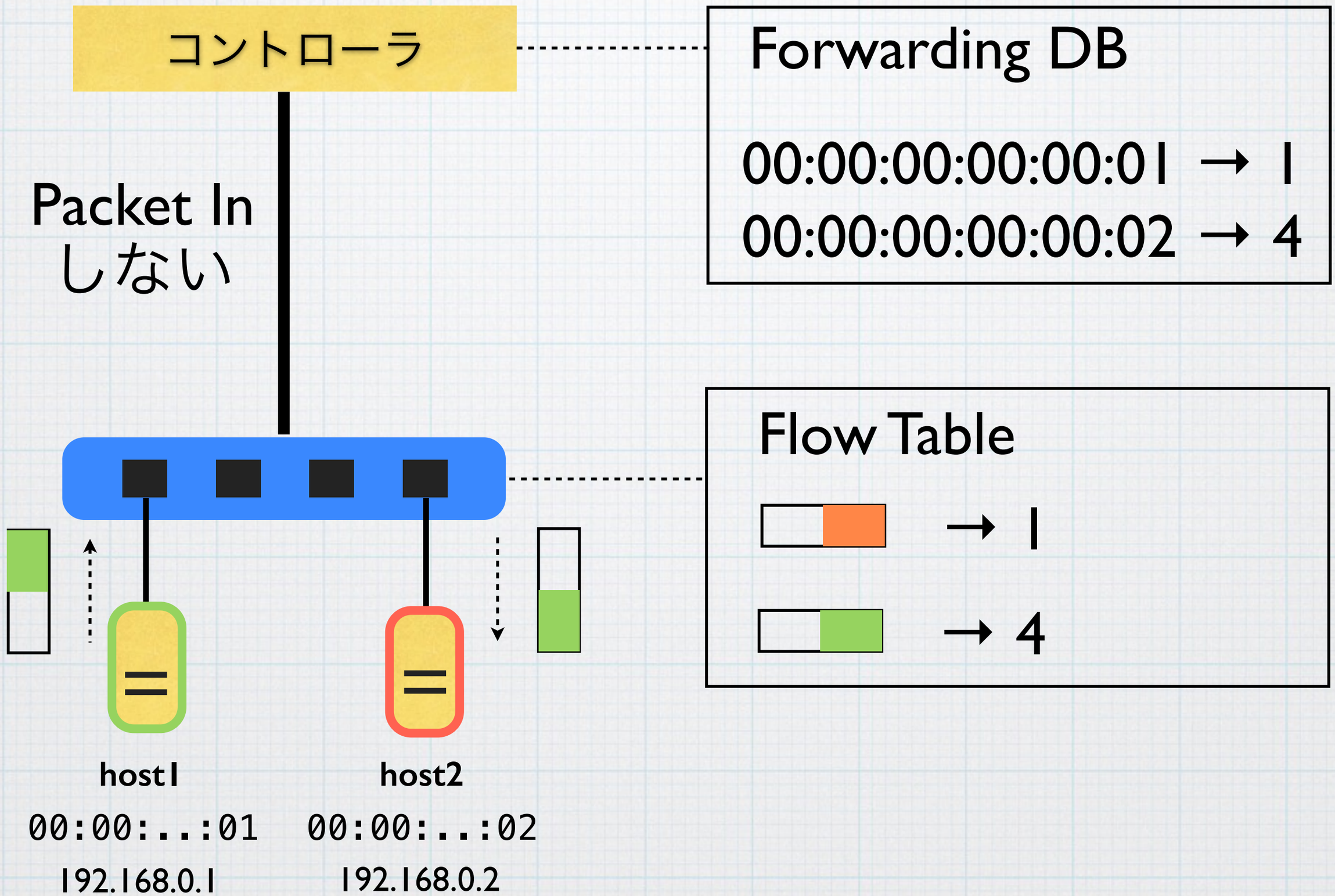

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Flow Table
→ 1
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2

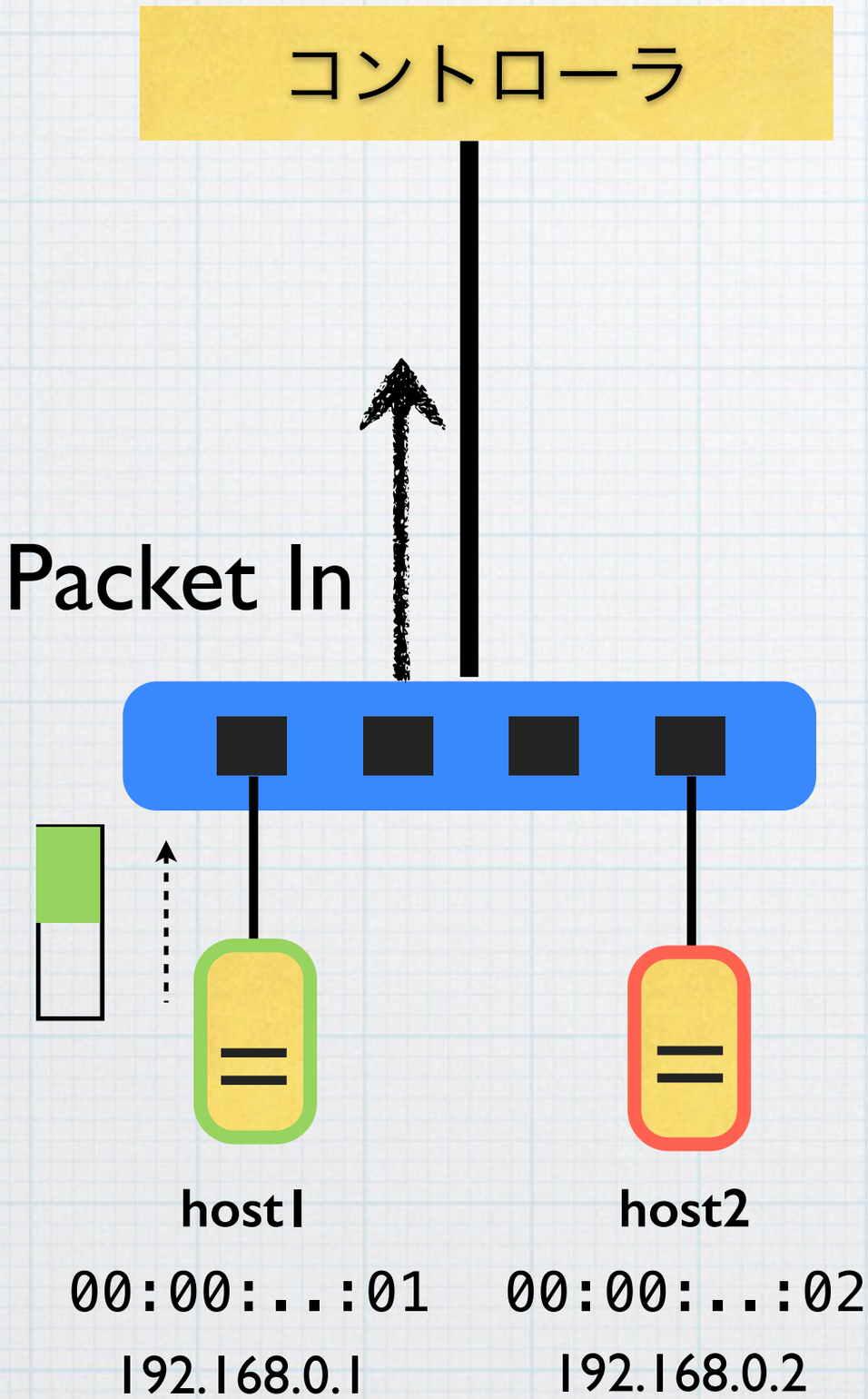

コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Packet In
しない
Flow Table
→ 1
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2


コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Packet In
Flow Table
→ 1
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2


コントローラ
Flow Mod
Packet Out
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Flow Table
→ 1
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2


コントローラ
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Flow Mod
Packet Out
Flow Table
→ 1
→ 4
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2


コントローラ
Packet In
しない
Forwarding DB
00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4
Flow Table
→ 1
→ 4
host1
00:00:..:01
192.168.0.1
host2
00:00:..:02
192.168.0.2



課題

Packet In を

起こしてみよう

```
$ trema send_packets \
  --source host1 --dest host2
```

・テストパケットの送信
・host1 から host2 へ送る

```
$ trema show_stats host2
```

・host2の受信パケットの統計
・ちゃんと届くか？ 確認

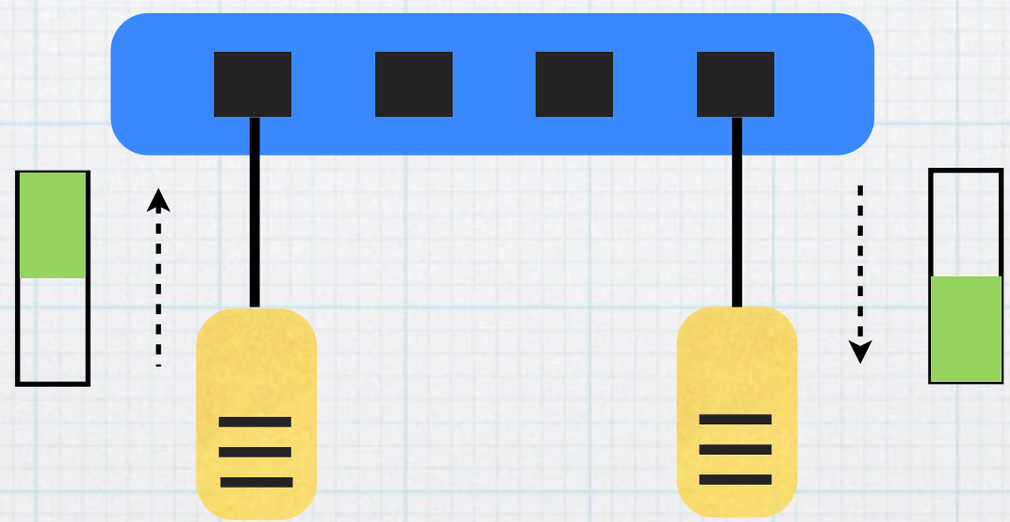
宛先ホストだけに
パケットを届けるには?

ハッシュテーブル

Forwarding DB

00:00:00:00:00:01 → 1
00:00:00:00:00:02 → 4

宛先 = host2



host1
00:00:..:01
192.168.0.1

host2
00:00:..:02
192.168.0.2

```
# MAC アドレス→ポート番号の学習
@fdb[message.macsa] = message.in_port

# MAC アドレスから転送先のポート番号を引く
port_no = @fdb[message.macda]
```

- 学習: hash[キー] = 値
- ルックアップ: hash[キー]

疑似コード

```
def packet_in(dpid, message)
  「MAC → ポート番号」を学習

  port ← message の macda からポート番号を検索

  if port がみつかった
    フロー (message → port) をスイッチに書き込む

    message を port に出力

  else
    message を FLOOD

  end
end
```

```
$ trema dump_flows 0xabc
```

・フローのダンプ
・0xabcのフローテーブルを表示

まとめ

- OpenFlow スイッチの仕組み
  Packet In/Packet Out/Flow Mod
- テストパケットの送りかた
- フローテーブルのダンプ