

# Modeling of OSPFv3 Link-State Routing Protocol

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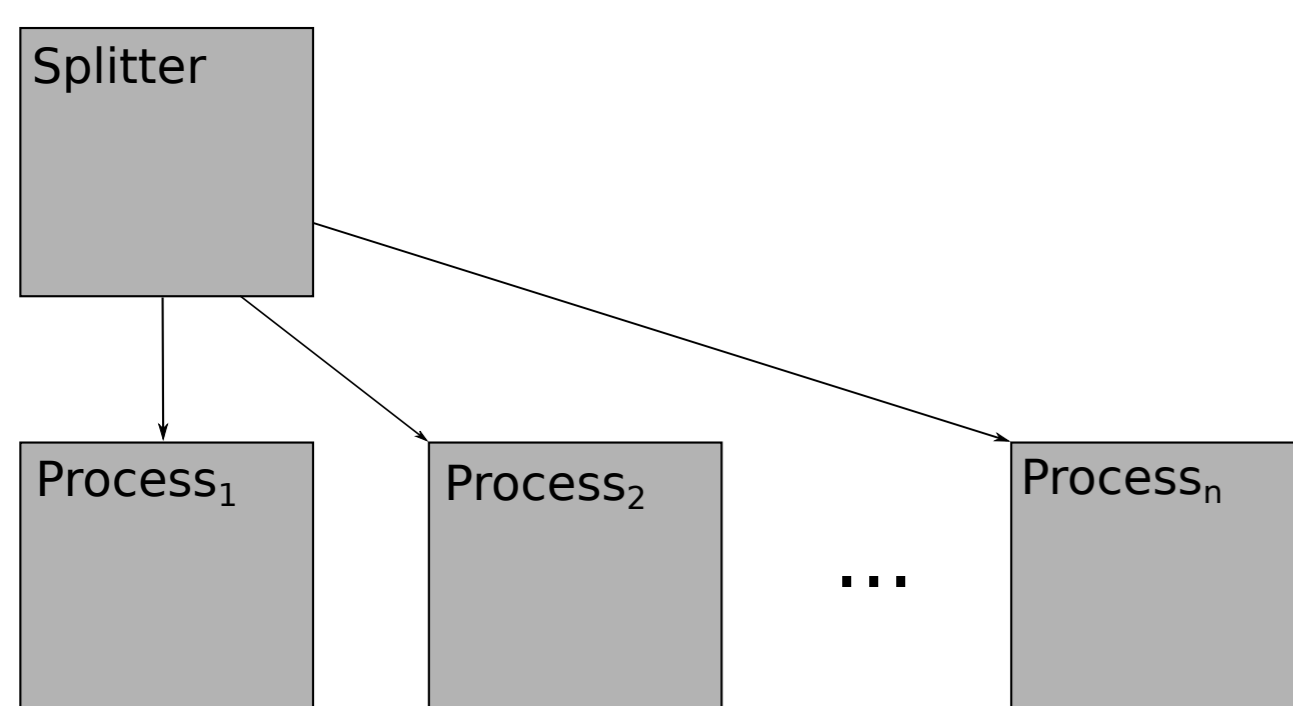
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## About

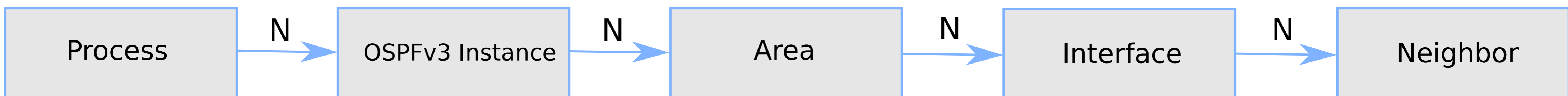
This paper deals with a simulation of routing protocols. Specifically with the OSPFv3 link-state routing protocol. OSPFv3 is a modern multi-address family protocol which means it supports both IPv4 and IPv6 routing. The resulting model may be used to demonstrate routing mechanisms in real networks. It is implemented in OMNeT++ Discrete Event Simulator and will become a part of INET framework. A contribution of this work is that a working model of OSPFv3 has not been yet implemented in any other simulators that are similar to OMNeT++.

## OSPFv3Routing



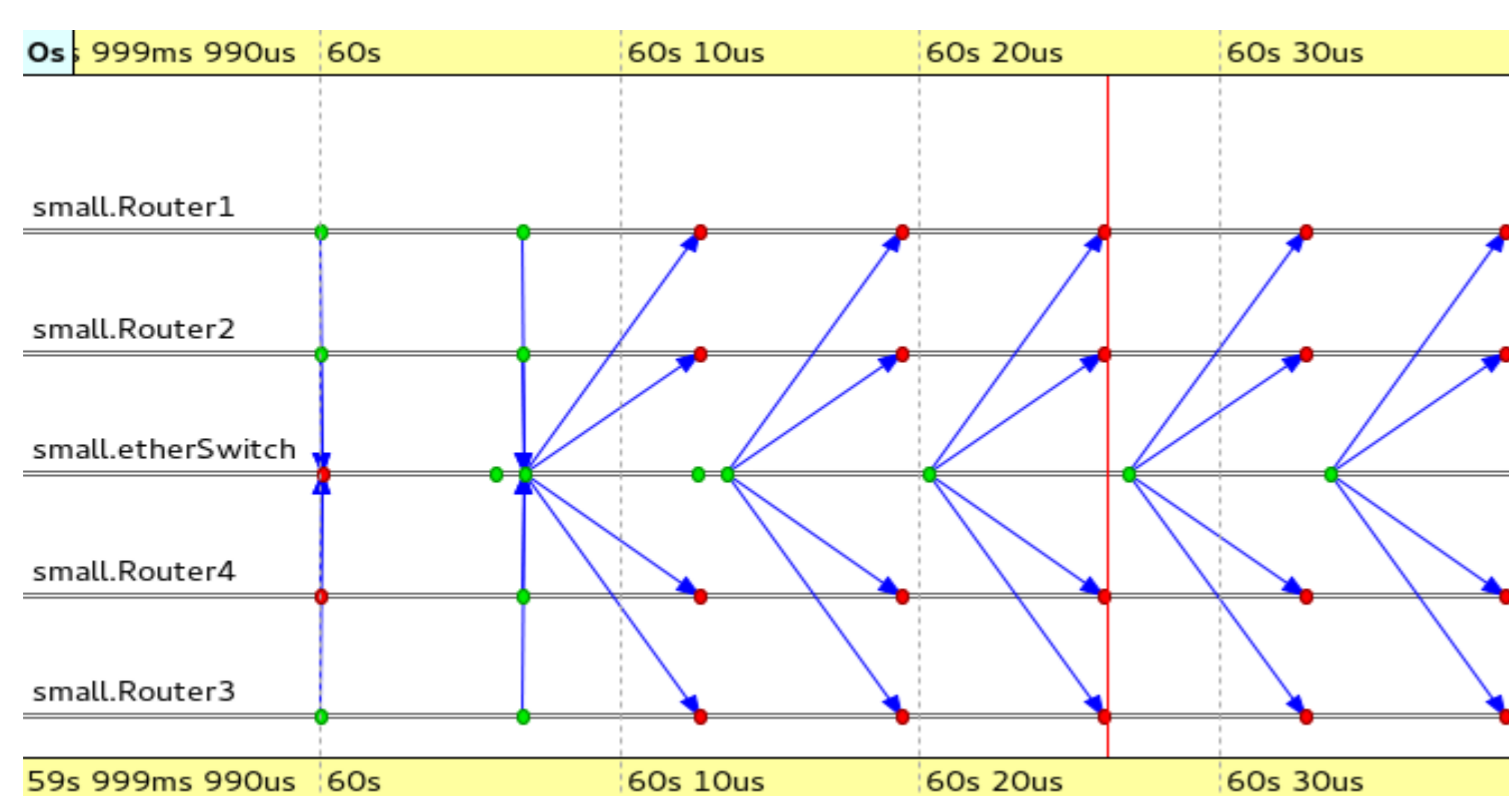
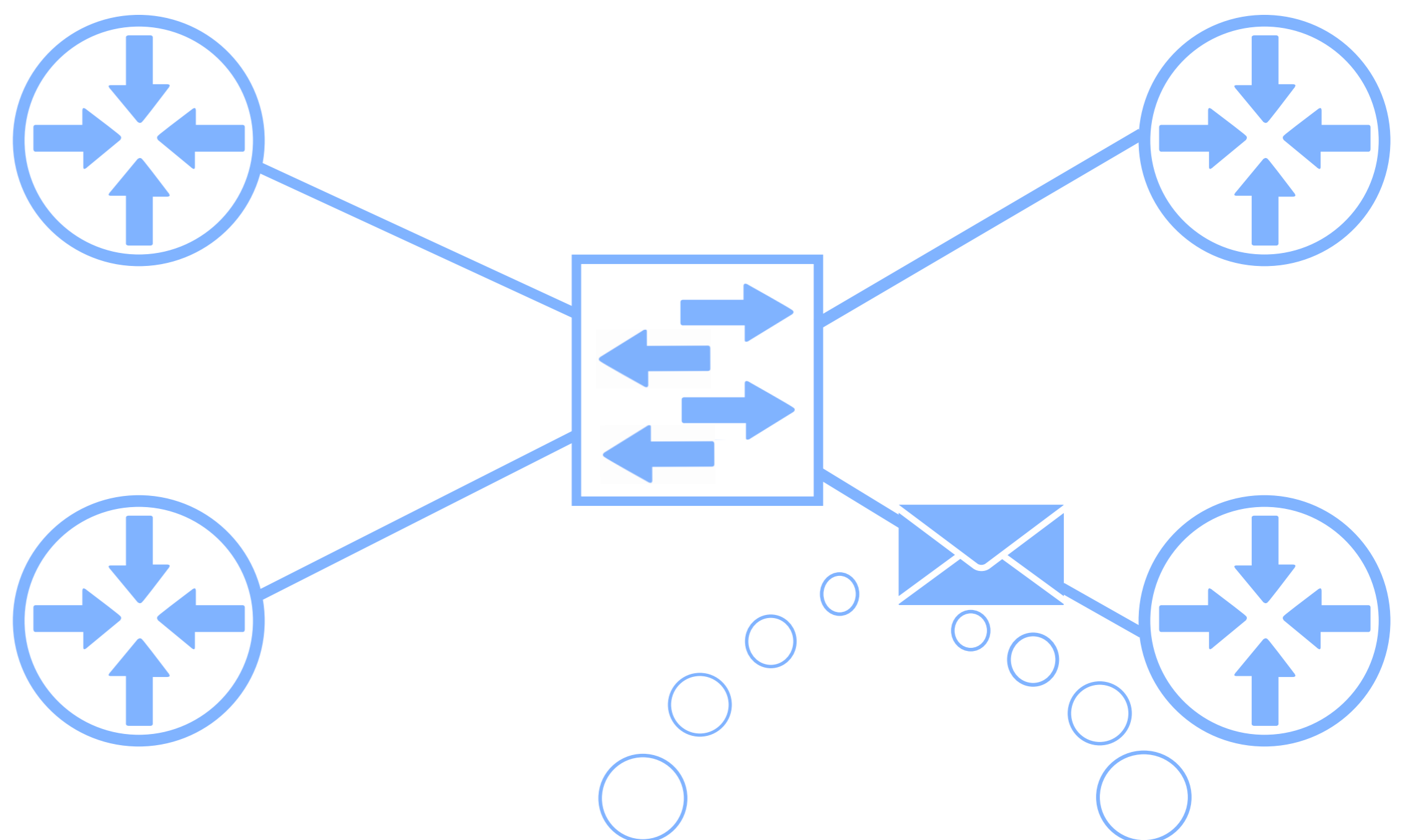
## Implementation

The splitter and process are simple modules created in NED. Internal logic of process is implemented in C++. The splitter dynamically creates processes and during the simulation handles messages. Each process has its own data structures representing OSPF instances, areas, interfaces and neighbors.



## Testing

Comparing a real network with a discrete simulation can be a little bit tricky. There are however a few options. We are able to compare order of packets received on a device or data structures and packet contents. To be able to accomplish this a simulation in GNS3 is created and Wireshark is used to capture part of communication between devices. Results may be compared with OMNeT++ output.



OMNeT++

Time	Source	Destination	Protocol	Packet Type
35 2.650152	fe80::c801:11ff:fe24:0	ff02::5	OSPF	90 Hello Packet
38 2.776159	fe80::c803:3ff:fed4:0	ff02::5	OSPF	90 Hello Packet
48 3.107178	fe80::c801:11ff:fe24:0	fe80::c803:3ff:fed4:0	OSPF	94 Hello Packet
52 3.172181	fe80::c803:3ff:fed4:0	fe80::c801:11ff:fe24:0	OSPF	94 Hello Packet
57 3.564204	fe80::c802:2ff:fe04:0	ff02::5	OSPF	90 Hello Packet
68 4.061232	fe80::c801:11ff:fe24:0	fe80::c802:2ff:fe04:0	OSPF	98 Hello Packet
69 4.126236	fe80::c802:2ff:fe04:0	fe80::c801:11ff:fe24:0	OSPF	94 Hello Packet
72 4.257243	fe80::c804:12ff:fe24:0	ff02::5	OSPF	90 Hello Packet

Wireshark and GNS3

```

(inet::OSPFv3DatabaseDescription) simulation.scheduled
Fields Contents (1)
- (inet::OSPFv3DatabaseDescription) (cObject)
  - ctrlInfo = (inet::IPv6CtrlInfo) (cObject)
  - encapsulatedPacket = NULL (cPacket)
  - version = 3 [...] (uint8_t)
  - type = 2 [...] (uint8_t)
  - packetLength = 28 [...] (uint16_t)
  - routerID = 1.1.1.1 (IPv4Address)
  - areaID = 0.0.0.0 (IPv4Address)
  - checksum = 0 [...] (uint16_t)
  - instanceID = 0 [...] (uint8_t)
  - options (OSPFv3Options)
    - reservedOne = false [...] (bool)
    - reservedTwo = false [...] (bool)
    - dcBit = false [...] (bool)
    - rBit = true [...] (bool)
    - nBit = false [...] (bool)
    - xBit = false [...] (bool)
    - eBit = true [...] (bool)
    - v6Bit = false [...] (bool)
  - interfaceMTU = 1500 [...] (uint16_t)
  - ddOptions (OSPFv3DDOptions)
    - iBit = true [...] (bool)
    - mBit = true [...] (bool)
    - msBit = true [...] (bool)
  - sequenceNumber = 3 [...] (uint32_t)
  - lsaHeaders[0] (OSPFv3LSAHeader)
  - base
  - message
  - packet
  - sending
  
```

OMNeT++

```

Open Shortest Path First
  OSPF Header
    Version: 3
    Message Type: DB Description (2)
    Packet Length: 28
    Source OSPF Router: 1.1.1.1
    Area ID: 0.0.0.0 (Backbone)
    Checksum: 0xaab4 [correct]
    Instance ID: IPv4 unicast AF (64)
    Reserved: 00
  OSPF DB Description
    Reserved: 00
  Options: 0x00112 (AF, R, E)
    ... .. = AT: Not set
    ... .. = L: Not set
    ... .. = I: Init: Set
    ... .. = M: Master: Set
    ... .. = (HS) Master: Yes
  Interface MTU: 1500
  Reserved: 00
  DB Description: 0x07 ((I) Init, (M) More, (HS) Master)
    ... .. = (R) OOBResync: Not set
    ... .. = (I) Init: Set
    ... .. = (M) More: Set
    ... .. = (HS) Master: Yes
  DD Sequence: 125260537
  
```

Wireshark and GNS3

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