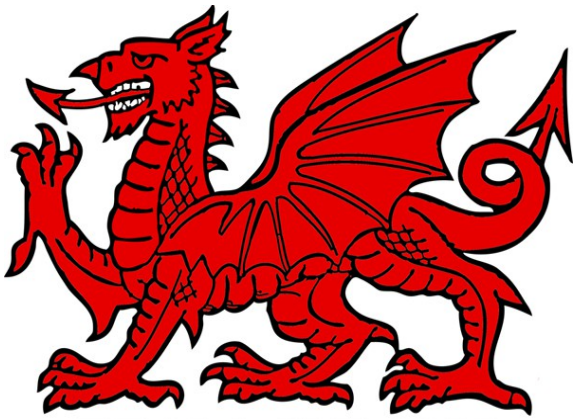
DVMRP Ask Neighbors2: an IGMP-based DDoS/leak threat



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Internet Group Multicast Protocol (IGMP)

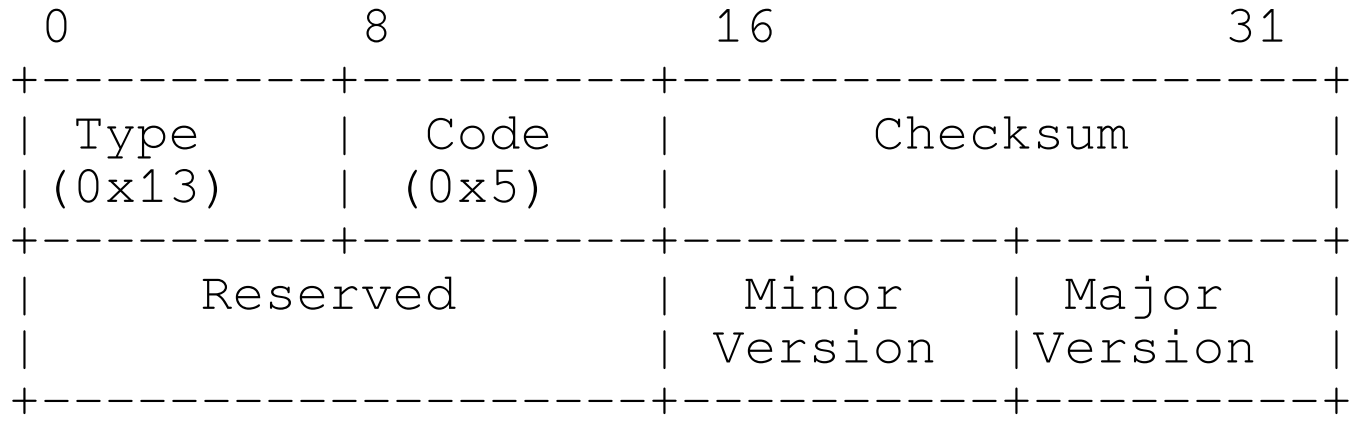
- End hosts signal interest in a group
- Routers (and often switches) maintain membership
- No real reason for IGMP to leave local subnet

Distance Vector Multicast Routing Protocol (DVMRP)

- Long obsolete IP multicast routing protocol
- Runs (ran) over IGMP
- Details relatively unimportant for our purposes
- Never got out of experimental (v1) or draft (v3)
- v3 draft added “tracing and troubleshooting” messages
  - Ask Neighbors2 – yay, a use for forwarding IGMP?
  - implemented in mrinfo (see the mrouted package)
  - widely implemented by Cisco & Juniper
  - last doc: **draft**-ietf-idmr-dvmrp-v3-11 (Aug 2000)

Ask Neighbors2

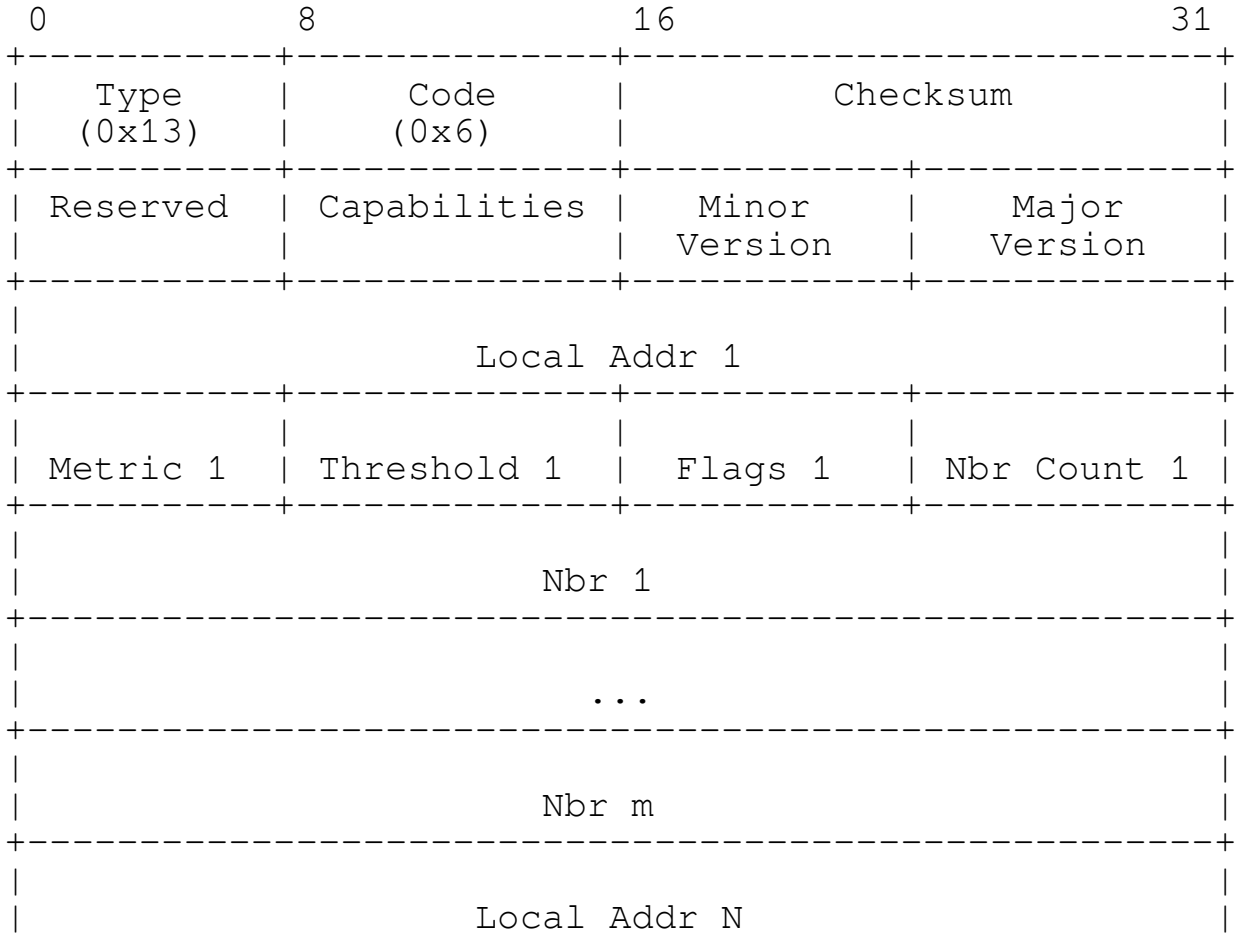
“[...] a unicast request packet directed at a DVMRP router. The destination should respond with a unicast Neighbors2 message back to the sender of the Ask Neighbors2 message”



Neighbors2 Response

- “[...] a common header at the top followed by the routers capabilities. One or more sections follow that contain an entry for each logical interface. The interface parameters are listed along with a variable list of neighbors learned on each interface.”

Neighbors2 Response



Notes on Ask Neighbors2

- Some responses can be very large (long interface list)
  - Cisco will send multiple 576 byte responses
  - Note: there is no sequence ID, can't guarantee order
  - Juniper will perform IP fragmentation
- Spec says put 0x3, 0xff in the major/minor version fields
  - Cisco fills these with their IOS major/minor version

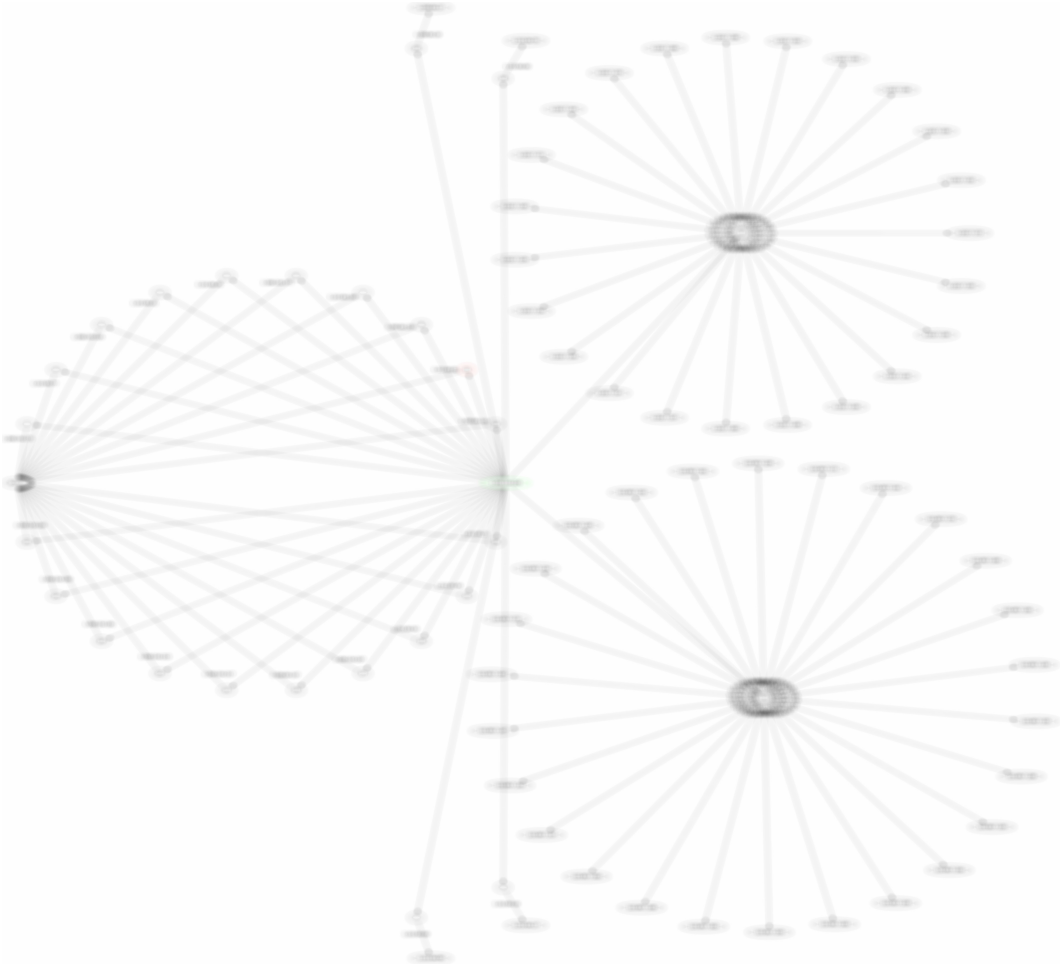
The Bad News

- DVMRP doesn't need to be activated
  - e.g Cisco “ip pim sparse mode” on any interface
  - e.g Juniper “protocols { igmp; }” globally
  - many publicly accessible routers in this state
- The response packets can be big and numerous
- The content of the responses can be interesting
  - e.g. interface list and neighbor addresses
  - e.g. IOS major/minor version (in Cisco responses)
- IGMP responses are not rate limited like ICMP

The Good News

- Relatively easy to mitigate
- Some networks/gear will not forward IGMP messages
- Vendors removing associated code in future releases
- No IGMP in IPv6, at least none of this legacy stuff there
- Doesn't appear to be “millions” of potential reflectors

Pretty Picture (well kinda)
28 bytes → 340 bytes (common)



How Much Packet Potential?

- Work in progress
- Accurate numbers require anti-aliasing analysis
- Approximately 3-5% Internet routers seem to respond
- I've not scanned all of IPv4, but from a “router set”
  - I've seen approximately 20,000 – 25,000 routers
- I've seen some routers send **thousands** of responses
  - Appears to be just a rare bug or configuration oddity
  - 2,235,623:1 packet amplification anyone?

Cisco Mitigation

- See:

  http://www.cisco.com/web/about/security/intelligence/multicast_toolkit.html#20

```
ip multicast mrinfo-filter 52
access-list 52 deny any
```

Juniper Mitigation

```
filter igmp {
    term igmp_accept {
        from {
            destination-address {
                224.0.0.0/4;
             }
             protocol igmp;
        }
        then accept;
    }
    term igmp_drop {
        from {
            protocol igmp;
        }
        then {
            discard;
        }
    }
}
```

What Else is Happening?

- Kudos to Cisco PSIRT and Juniper SIRT!
  - Ask Neighbors2 functionality being removed
  - Vendor bulletins should be published around now
  - NOTE: there is intentionally no CVE for this
- Conducting research with ICSI (Vern Paxson's group)
- Limited heads up given to nsp-security / REN-ISAC
- And not happening: ongoing data feed of AN2 routers
  - Our infrastructure will not transit IGMP probes :-/

References

- Internet Group Multicast Protocol (IGMP)

  http://tools.ietf.org/html/rfc3375

- Distance Vector Multicast Routing Protocol (DVMRP)

  https://tools.ietf.org/html/draft-ietf-idmr-dvmrp-v3-11

  https://tools.ietf.org/html/rfc1075

- This slide deck and a blog post

  https://www.cymru.com/jtk/talks/nanog62-an2.pdf

  https://www.cymru.com/jtk/blog/2014/10/06#an2