IPv6 Associated Protocols

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IPv6DISSemination and Exploitation

New Protocols

- Neighbor Discovery (ND) (RFC 2461 DS)

- Auto-configuration :

  - Stateless Address Auto-configuration (RFC 2462 DS)

  - DHCPv6: Dynamic Host Configuration Protocol for IPv6 (RFC 3315 PS)

- Path MTU discovery (pMTU) (RFC 1981 PS)

New Protocols (2)

- **MLD (Multicast Listener Discovery) (RFC 2710)**

  - Multicast group management over an IPv6 link

  - Based on IGMPv2

  - MLDv2 (equivalent to IGMPv3 in IPv4)

- **ICMPv6 (RFC 2463 DS) "Super" Protocol that :**

  - Covers ICMP (v4) features (Error control, Administration,…)

  - Transports ND messages

  - Transports MLD messages (Queries, Reports, …)

Neighbor Discovery

- IPv6 nodes which share the same physical medium (link) use Neighbor Discovery (NDP) to:
    - discover their mutual presence
    - determine link-layer addresses of their neighbors
    - find routers
    - maintain neighbors' reachability information (NUD)
    - ND uses multicast for certain services.

IPv6DISSemination and Exploitation

Neighbor Discovery (2): Comparison with IPv4

- It is the synthesis of:
  - ARP
  - Router Discovery
  - ICMP redirect
  - ...

Neighbor Discovery (3)

- Protocol features:
  - Router discovery
  - Prefix(es) discovery
  - Parameters discovery (link MTU, Max Hop Limit, ...)
  - Address auto-configuration
  - Address resolution
  - Next Hop determination
  - Neighbor Unreachability Detection
  - Duplicate Address Detection
  - Redirect

Neighbor Discovery (4)

- ND specifies 5 types of ICMPv6 packets :

  – Router Advertisement (RA) :

  - periodic advertisement (of the availability of a router) which contains:
    – list of prefixes used on the link (autoconf)
    – a possible value for Max Hop Limit (TTL of IPv4)
    – value of MTU

  – Router Solicitation (RS) :

  - the host needs RA immediately (at boot time)

Neighbor Discovery (5)

- Neighbor Solicitation (NS):
  - to determine the link-layer of a neighbor
  - or to check its impeachability
  - also used to detect duplicate addresses (DAD)
- Neighbor Advertisement (NA):
  - answer to a NS packet
  - to advertise the change of physical address
- Redirect :
  - Used by a router to inform a host of a better route to a given destination

Path MTU discovery (RFC 1981)

- Derived from RFC 1191, (IPv4 version of the protocol)

- **Path** : set of links followed by an IPv6 packet between source and destination

- **link MTU** : maximum packet length (bytes) that can be transmitted on a given link without fragmentation

- **Path MTU** (or pMTU) = min { link MTUs } for a given path

- **Path MTU Discovery** = automatic pMTU discovery for a given path

Path MTU discovery (2)

- Protocol operation
  - makes assumption that pMTU = link MTU to reach a neighbor (first hop)
  - if there is an intermediate router such that link MTU < pMTU ➔ it sends an ICMPv6 message: "Packet size Too Large"
  - source reduces pMTU by using information found in the ICMPv6 message

  => Intermediate network element aren't allowed to perform packet fragmentation