Zero-Configuration Multicast Address Assignment

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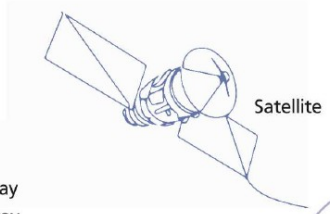
OneNet

NMEA 0183: 40 kbits/sec

NMEA 2000: 250 kbits/sec, 52 devices per network

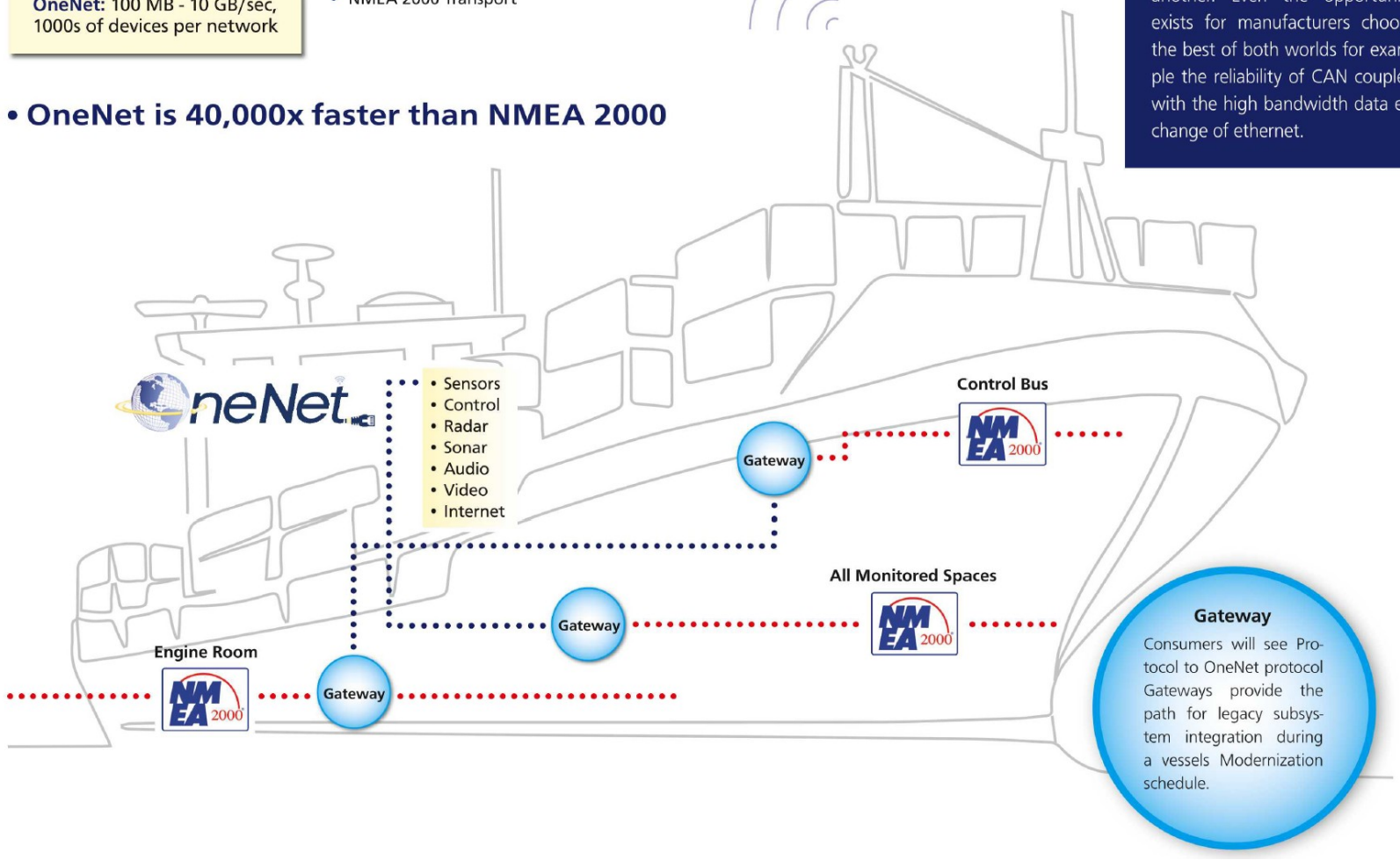
OneNet: 100 MB - 10 GB/sec, 1000s of devices per network

- Internet Gateway
- Vessel Recording
- NMEA 0183 Gateway
- NMEA 2000 Gateway
- NMEA 2000 Transport



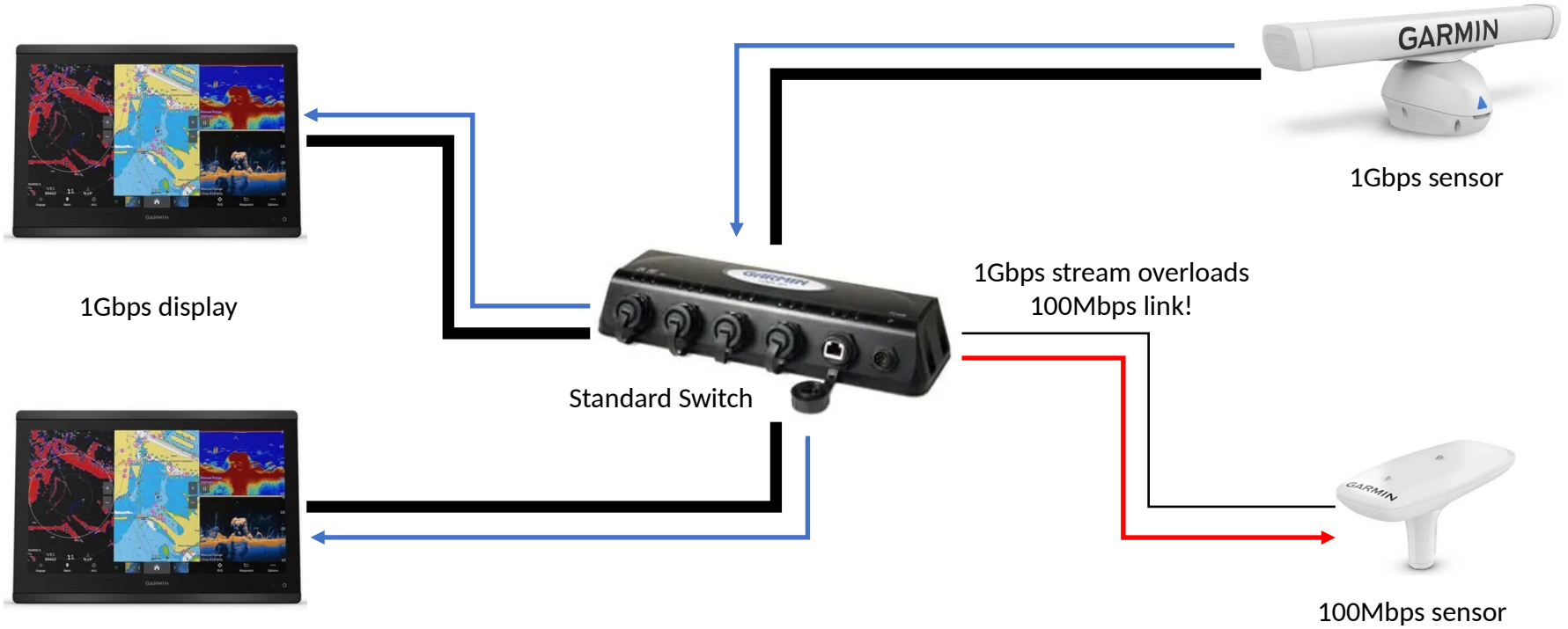
NMEA OneNet povides the means for sensing/control messages to work over secure ethernet. Manufacturers will now have the ability to choose what type of product they wish to support eliminating the tradeoffs of one protocol vs another. Even the opportunity exists for manufacturers choose the best of both worlds for example the reliability of CAN coupled with the high bandwidth data exchange of ethernet.

• • • • OneNet is 40,000x faster than NMEA 2000



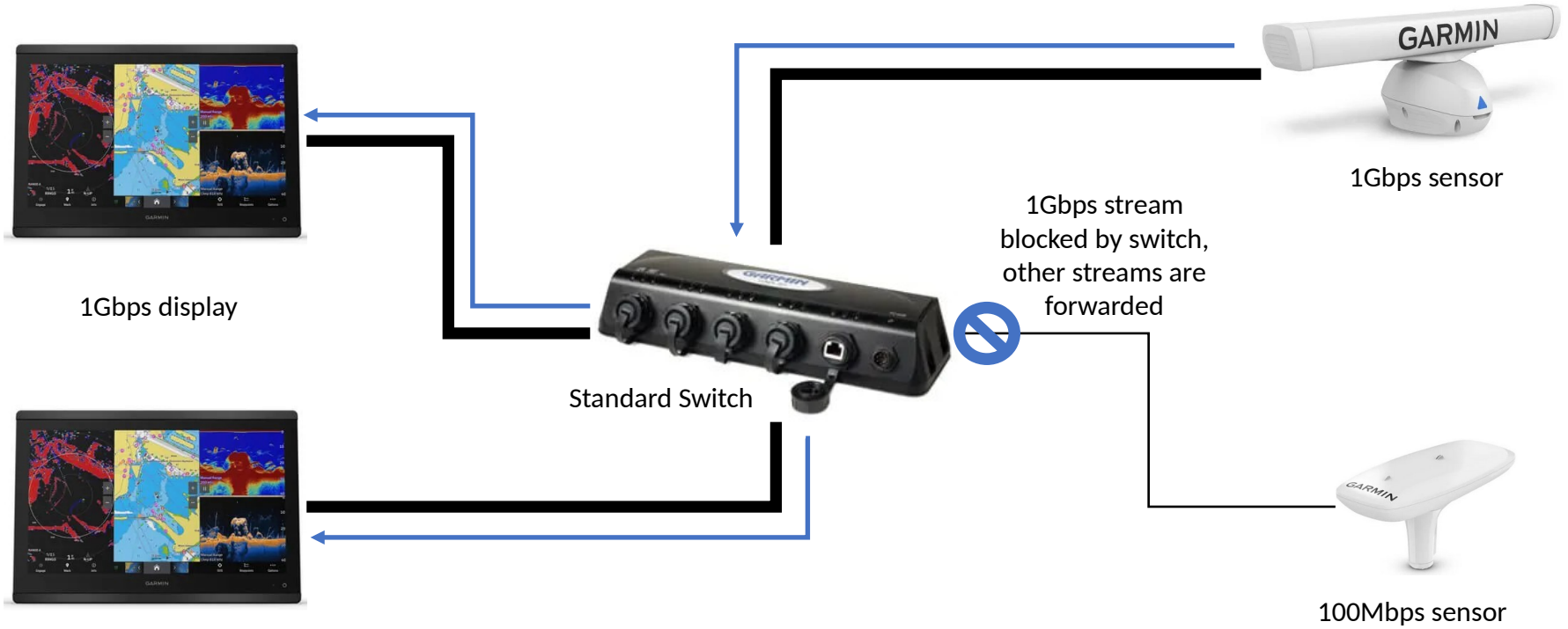
First Problem

- Coexistence of devices with varying link speeds



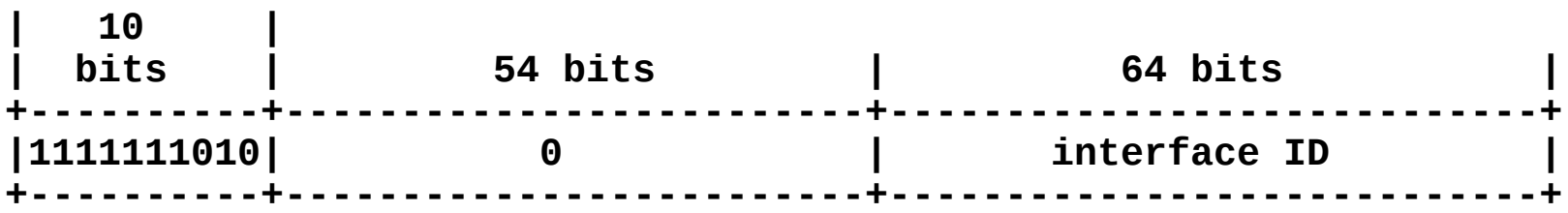
The Solution

- Each data stream assigned a different multicast address
- Devices only request streams they are interested in or can handle
- Multicast snooping forwards packets only to interested ports



Link-Local IPv6 Unicast Address

- RFC 4291



Multicast Addresses

flgs are **0RPT** where:

- 0 = reserved
- R = 0 -> does not embed Rendezvous Point address
  R = 1 -> embeds Rendezvous Point address
- P = 0 -> address not assigned based on network prefix
  P = 1 -> address is assigned based on the network prefix
- T = 0 -> permanently assigned multicast address
  T = 1 -> dynamically assigned

- RFC 1884 (RFC 4291): Multicast Address

```
|   8    |  4 |  4 |                   112 bits                    |
+--------+----+----+-----------------------------------------------+
|11111111|flgs|scop|                   group ID                    |
+--------+----+----+-----------------------------------------------+
```

- RFC 3306: Unicast-Prefix-based IPv6 Multicast Address

```
|   8    |  4 |  4 |   8    |    8   |       64       |    32    |
+--------+----+----+--------+--------+----------------+----------+
|11111111|flgs|scop|reserved|  plen  | network prefix | group ID |
+--------+----+----+--------+--------+----------------+----------+
```

- RFC 4489: Link-Scoped IPv6 Multicast Address

```
|   8    |  4 |  4 |   8    |    8   |       64       |    32    |
+--------+----+----+--------+--------+----------------+----------+
|11111111|flgs|scop|reserved|  plen  |       IID      | group ID |
+--------+----+----+--------+--------+----------------+----------+
```

flgs are 0011
(R = 0, P = 1, T = 1)

scop <= 2

reserved = 0

plen = 0xff

IID = IPv6LL IID

Allocated as per
RFC 3307

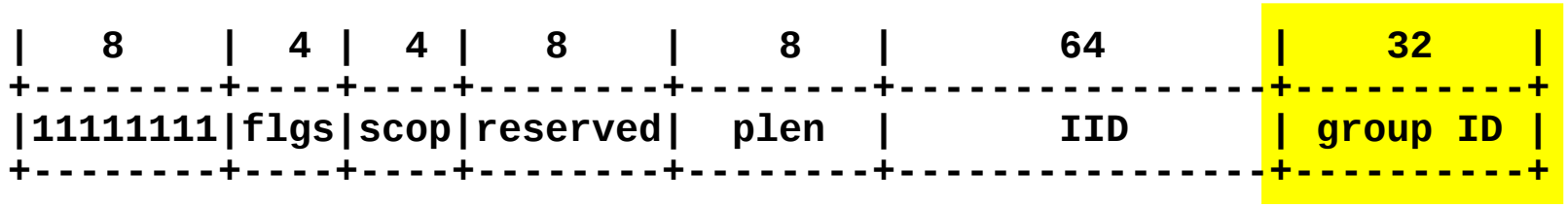
RFC 3307: IPv6 Multicast Address Guidelines

Group ID is:

- 4.1 Permanent IPv6 Multicast Addresses
  Allocated by IANA (IPv6 registry)
  T = 0, P = 0
  0x00000001 to 0x3FFFFFFF
- 4.2 Permanent IPv6 Multicast Group Identifiers
  Allocated by IANA
  0x40000000 to 0x7FFFFFFF
- 4.3 Dynamic IPv6 Multicast Addresses
  T = 1
  0x80000000 to 0xFFFFFFFF

The Problem: Transmitting on Ethernet

- RFC 2464 (Transmission of IPv6 Packets over Ethernet Networks) Section 7 specifies destination multicast MAC address mapping:
  - First two octets are 33:33
  - Last four octets are last four octets of IPv6 multicast address
- Link-Scoped IPv6 Multicast Address



Different nodes can generate different IPv6LL addresses with the same MAC address

Solutions

- Source-Specific Multicast
  - Not universally supported by switch hardware
- MADCAP (RFC 2730)
  - Uses a server to allocate addresses
  - Single point of failure
  - Could auto-negotiate MADCAP server and provide failover mechanism
    - Common format for lease database
- ZMAAP
  - Never published, draft expired in 2003
  - Addresses and ports are TBD

Proposal

- Restore ZMAAP and use existing draft as a starting point
- Specify addresses and port for MAAS coordination
- Do not assume single MAAS per host
- Require defending addresses with same destination MAC address
- Allocate Group IDs for zeroconf dynamic addresses

Thank You!