Routing – Introduction

• In small layouts, sending every message to every node is not a problem since the message-traffic volume is not enough to saturate the network.

• In larger layouts with multiple network-segments traffic volume may enough to overwhelm slower or bandwidth limited segments.
The term **routing** refers to the technique of not distributing every message to every network-segment and every node, but rather filtering that traffic so that only that required by a segment is forwarded to it.

Routing is a responsibility of Routers – special nodes that connect more than one network-segment together.
A Router connects multiple network-segments, here we label them 1 … N:
OpenLCB/LCC routing use several filtering techniques on:

- Addressed messages
- special cases of Global messages:
  - Event messages
  - Simple Protocol messages
Addressed Messages

- Addressed messages, by definition, are only directed to one node, and one network-segment.

- A router follows all message traffic, and using that information, it builds a routing-table to determine which of its connected segments it should forward each specific addressed message using the destination Node ID.
Addressed Messages

Here is a made-up example of such a routing-table. The destination Node ID is matched to the table entry, and the message is forwarded to the appropriate connected network-segment.

<table>
<thead>
<tr>
<th>Destination NodeID</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.00.00.23.44.12</td>
<td>1</td>
</tr>
<tr>
<td>01.00.00.23.E3.22</td>
<td>1</td>
</tr>
<tr>
<td>01.00.00.35.02.01</td>
<td>2</td>
</tr>
<tr>
<td>01.00.00.8F.E3.E2</td>
<td>3</td>
</tr>
<tr>
<td>01.00.01.00.1A.77</td>
<td>4</td>
</tr>
<tr>
<td>01.00.04.1A.34.5E</td>
<td>N</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>
By definition, global messages must be distributed to every node and network-segment.

However, there are exceptions to this, namely:
- Event-messages;
- Simple protocol segments.
While Event messages are normally considered to be global, they really only need to be sent to network-segments that have nodes that consume them, or rather have an interest in them.

Routers can use interest-based routing to send Event messages to only those few segments with interested nodes.
Routers need to know which nodes are interested in each Event.

On start-up each node publishes a set of their Consumer- and Producer-Events with *ConsumerIdentified* and *ProducerIdentified* messages.

A Router then uses the contained information to build a routing table.
A routing table may look something like this. The x’s indicate to which network-segment a specific Event-message should be forwarded.

<table>
<thead>
<tr>
<th>Eventid</th>
<th>Net1</th>
<th>Net2</th>
<th>Net3</th>
<th>...</th>
<th>NetN</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.00.00.02.3E.34.00.01</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.00.00.02.3E.34.00.02</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>01.00.0E.01.45.01.02.88</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.00.10.22.A2.00.00.25</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>01.00.10.22.A2.00.00.26</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01.00.23.23.9B.00.00.77</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Event 01.00.10.22.A2.00.00.25 would be matched in the table and forwarded to segments 2, 3, and N, but not to 1.
Simple Protocol

- Some nodes are less capable, and only need to respond to an essential subset of messages. They are often considered to be leaf-nodes or ‘Simple’ nodes.

- They self-identify at start-up by announcing that they implement the Simple Protocol.
Simple Protocol - routing

• If a Router determines that a network-segment only contains Simple Nodes, it can then limit the message traffic to that segment by using the Simple Protocol.

• The Simple Protocol messages include:
  – Addressed messages to them
  – Verify Node ID Number
  – Verified Node ID Number
  – Identify Consumer and Producer
  – Identify Event Global
  – Learn Event
  – PC Event Report
Routing reduces network-segment traffic by allowing segments to only carry needed messages. These include Addressed, Global, and interest-based Event messages.

A message is forwarded to segments 2 and N, but not 3.