NMRA Technical Note	
Layout Command Control™ (LCC) Glossary	
Apr 25, 2021	**TN-9.7.0.1**

Adopted as a NMRA Technical Note

The OpenLCB Standard document appended to this cover sheet has been formally adopted as a NMRA Standard by the NMRA Board of Directors on the date shown in the *Adopted* column in the *Version History* table below.

Version History

Date	Adopted	Summary of Changes
Feb 17, 2015		Initial version submitted for public comment
Feb 6, 2016	**Feb 20, 2016**	Minor grammatical corrections and readability improvements as well as the following specific changes: • Added Blue/Gold, CBUS, MERG sections • Added references to relevant S and TN documents
Apr 25, 2021		Changed LCC logo to include the ® symbol Changed “Layout Command Control” to have the ™ symbol Added the NMRA Legal Disclaimer fine-print Changed the OpenLCB license to “Creative Commons Attribution-ShareAlike 4.0 International”

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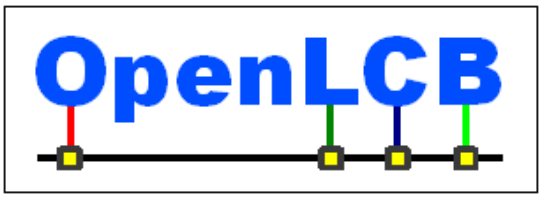

OpenLCB Technical Note	
Glossary	
Apr 25, 2021	Adopted

1 Introduction

This glossary provides working definitions and commentary on definitions for OpenLCB. It is not normative in any way.

We provide a separate section of “Key Terms” for initial reading.

2 Key Terms

Event

OpenLCB allows nodes to notify each other when specific "events" occur on the layout. These in turn can cause nodes to take particular actions. Events are not necessarily attached to a producer (“Button 2 pressed”) or attached to a consumer (“Turn off light 4”), but rather to an overall state change (“Set for nighttime operation”). This is called a “Producer/Consumer model”.

Node

A “node” is the basic unit of addressability in OpenLCB. It can be a single board, or a process in a larger computer, or any other independent actor on the OpenLCB network. Every OpenLCB interaction originates in a node. Every board that connects to OpenLCB is at least one node. For example, a simple turnout controller board is one node, while a PC with multiple programs running may contain several nodes.

Message

The basic unit of OpenLCB communication. OpenLCB nodes exchange messages to control communications and to move information. Some interactions may be just a single message (for example pressing a fascia button, which causes an event to be produced, which an output node receives and throws a turnout). Other interactions may use a request message followed by a response message. More complicated interactions may need to move dozens of messages or even more between nodes.

Protocol

An OpenLCB protocol defines how messages are exchanged to do some particular thing. OpenLCB protocols are layered, with higher-level protocols being implemented with lower-level protocols. Low level protocols are used for things like sending datagrams, exchanging events, and doing link start-up. Higher-level protocols then define how configuration information is exchanged, or a node's memory can be read, or a message can be put on a display.

3 General Glossary

Addressed

An “addressed” message is meant for only a single node. Contrast “global”.

Alias

An Alias is a unique identifier associated to a Node to be used, temporarily during a session, as its address instead of its Node ID. The Alias can always be mapped back and forth to the full number. On CAN, the Node ID Alias is a 12-bit value and thus more suited for CAN's limited packet sizes. The term Alias is often used with a modifier, as in “Source Alias”, “Destination Alias” where Source and Destination describe a Node taking part of the interaction.

Automatically Routed Event

The Event transfer protocol defines a series of messages that determine where Event messages must be routed. Automatically Routed Events are events within a particular part of the EventID space that are routed to all nodes, without using those messages. See the Event Transport protocol documentation for more information. An example Automatically Routed Event ID is that of “Emergency Off”.

Board

“Board” has no precise meaning in OpenLCB. It generally refers to a single piece of electronics. Sometimes used to refer to “the piece of electronics that implements a Node”. Note that a Board may contain one or more Nodes.

Blue/Gold

An example of a simple button-based system to allow teaching of Event IDs from one node to another.

Bridge

A bridge connects multiple segments of an OpenLCB bus together. Usually a bridge works on the data link layer of the OSI model, and therefore has knowledge only about those messages transferred, but not about the meaning of the messages as they are defined in a higher layer of the OSI model, such as at the transport layer. Similarly to a repeater, a bridge may be used to allow the connection of more nodes than is possible on one segment due to physical limitations, but this is not its main purpose. Usually a bridge does not translate between different wire protocols, and for that a gateway is used. A bridge differs from a repeater in that a bridge can forward messages to different segments based on Node ID. To do this, the bridge listens to and interprets the messages transferred in order to learn which nodes are connected to which segment. For OpenLCB the bridge may also support different node aliases on the different segments to which it is connected. It this case, it would translate the node alias before forwarding that frame to another segment.

CBUS

A universal layout control system from MERG, based on CAN using 11-bit headers at 125 kbps.

CDI

“Configuration Description Information”, the information provided by a node so that other nodes can understand what the configuration information in the first node includes, how it's organized and how to present it to a user in a Configuration Tool. See the Configuration Description Information documents.

Configuration Tool

A node on the OpenLCB network, possibly implemented as software running on a computer, with sufficient User Interface to browse other nodes on the network, retrieve and understand the information provided by the CDI, render the configuration options to the user and manipulate the configuration memory of the target node according to the choices of the user. An example is JMRI DecoderPro, see http://www.jmri.org.

Datagram
: The actual data content transported by the Datagram Protocol. This can be up to 72 bytes.

Datagram Protocol
: The datagram protocol is a way for a OpenLCB node to efficiently send a short, definite-length message to another specific node. In that, it lies in between the event exchange protocol, which efficiently sends very short event IDs to all interested nodes, and the streaming protocol, which sends long messages between specific nodes, at some cost in efficiency. Sending a datagram can take multiple messages on limited transports, such as CAN.

Datagram Protocol ID (DPID or DPI)
: The first 1-7 bytes of data transferred by a datagram is used to indicate the protocol being transported, but the encoding is extensible and the most common case use is to use a single byte.

Device
: “Device” has no precise meaning in OpenLCB. It generally refers to a single piece of equipment on a layout connected to a Node.

Destination Node ID (DID)
: The Node ID of the node to which a specific message is addressed.

Event Exchange Protocol
: This protocol uses PCER (Producer-Consumer Event Report) messages to propagate Event IDs from source nodes to multiple destination nodes. These messages are typically used to announce that something of interest has happened on the layout, and consequently a change in the layout's state, so that controlled devices can respond. The protocol also includes inquiry and response messages for examining configuration and status. See Event Transport S&TN.

Event ID (EID)
: The 64-bit unsigned number that identifies a specific event. OpenLCB event IDs must be globally unique. NB: Events are <u>not</u> associated with any particular node. It may be convenient to use, for example, Node ID as a way of numbering them uniquely, but Node IDs and Event IDs are not directly related.

Gateway
: A Gateway translates between different wire protocols (e.g. CAN and Ethernet), or even different network architectures (e.g. OpenLCB and Loconet). They repackage and convert data going from one environment to another so that each environment can understand the other's data. Since OpenLCB uses unique identifiers, and these are meant to be used unchanged on most wire protocols, this should reduce the necessity of Gateways.

Global
: A “Global” message is meant for all OpenLCB nodes that are interested in it. Contrast “Addressed”.

Installation
: An OpenLCB installation, or OpenLCB network, is the complete set of OpenLCB hardware, software, nodes, etc, that can be reached from any one of them.

Message Type Indicator (MTI)
: Every OpenLCB message contains a Message Type Indicator field that identifies the type of that particular message. Also used to refer to a particular value for that field. These are documented in the relevant Standard and Technical Note.

MERG
: Model Electronic Railway Group, http://merg.org.uk

Node ID (NID)
: Number identifying a specific node. OpenLCB Node IDs must be globally unique, so they form a one-to-one mapping to the nodes themselves. OpenLCB Node IDs are 48-bit long.

OSI model
: A conceptual model for communication networks, where the protocols are divided into layers, each layer building upon the lower layers and providing an abstraction of service for the upper layers. See http://en.wikipedia.org/wiki/OSI_model

Producer/Consumer Model
: A way of thinking about communications on a layout network. Events (unique messages on the layout network) are “produced” by some node(s), and “consumed” by other node(s). An event indicates something happened, but the corresponding message isn't necessarily a status report or a command for something to change; it's just an announcement of the event. That event can be produced by many different sources (e.g. the “use passing siding” event could be produced by a push button at either end of the siding, or on a dispatcher panel), and can be consumed by several sources (it can turn on lamps on a panel, change signal aspects, set turnouts in multiple places, set an internal software flag, etc).

Producer-Consumer Event Report (PCER)
: OpenLCB message type sent globally by producers of a particular Event to indicate that it has occurred, so that the corresponding consumers of that Event are notified. The PCER is documented in the Event Transport documents.

Repeater
: Connects two segments of the same type at the physical layer of the OSI model. It regenerates the received signals and then retransmits the regenerated (or conditioned) signals on the other segment. It has no knowledge of the information transferred. It is usually used to connect two like segments, e.g. two CAN segments, to allow more nodes to be attach to the combined segments as if they were one. They can be used to overcome physical limitations of a segment, such as maximum number of nodes, or cable length.

Router
: Routers work at the Network layer of the OSI model, meaning that they can route frames across multiple segments based on only the information contained in messages. They do not have knowledge about protocols of (higher) transport layers. Routers are usually used in complex network situations because they provide better traffic management than bridges, such as traffic filtering, and do not pass broadcast traffic. Routers can share status and routing information with one another, and can use this information to bypass slow or malfunctioning segments.

Source Node ID (SID)
: The Node ID of the node which originated a specific message.

Segment
: Subset of an overall OpenLCB installation which uses a specific wire protocol, and all nodes on it are directly talking to each other. A segment never spans over Bridges, Gateways, Repeaters or Routers, but it may have multiple cables, for example if the physical link layer allows daisy-chaining multiple nodes.

Simple Node
: A “simple node” is typically an individual board with a small processor on it which one connection to an OpenLCB network. A simple node doesn't initiate complex communications with other nodes, but may be the target of complex interactions, for example when it is being configured. This is documented in the Message Network S&TN.

Stream

Streams are a method of moving a large number of bytes, or an a-priori unknown number of bytes, from a source node to a destination node. The streaming protocol defines a way to do this in OpenLCB.

Streaming Protocol

Protocol that defines the messages and interactions to setup a stream transfer, move the data along with the necessary buffer management, and then take down the transfer at the end. Streams are efficient ways to move large amounts of data when the setup and take-down process can be considered a negligible part of the total transfer. This is documented in the Stream Transport S&TN.

Virtual Node

One of one or more nodes co-resident within a single board or computer. Often a board is a single node, but it's possible for a board or a computer to behave on the OpenLCB network as if it contained multiple nodes. Those are then referred to as virtual nodes.

Well Known Events

Certain Events are globally defined to have specific meanings. Their Event IDs are documented as part of the event protocol. These are documented in the Event Identifiers S&TN.

Wire protocol

The version of the OpenLCB common messages, interactions, etc. adapted to a particular transport mechanism. Examples are the wire protocols for CAN bus segments and TCP/IP links.

4 CAN Glossary

Alias

See the general definition. On CAN an Alias is a 12-bit mapping of the Node ID.

CAN

Controller Area Network, an ISO-standardized communication network type. The CAN Standard includes aspects of the physical- and link-layer definitions for OpenLCB.

Frame

A Frame is a packet as it is defined on the CAN bus. It consists of an 11 or 29 bit CAN header, zero through 8 bytes of data, and some additional bits and fields. An OpenLCB message may become one or more frames when transmitted over CAN. Some frames, called Control Frames, are used for link-layer control and do not correspond to any particular OpenLCB message, and are used in the management of Node ID Aliases.

OpenLCB-CAN

Short form for “OpenLCB as implemented on a CAN link”. For example, “OpenLCB-CAN message” refers to an OpenLCB message formatted for transmission over a CAN link.

Segment

See general definition. Note that nodes on a single CAN segment share CAN arbitration and a set of aliases.

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