

This document is under formal review of the NMRANET Working Group. It has not been approved by the WG, reviewed by the Manager, S&C Dept., nor approved by the NMRA Board of Directors.

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| NMRA TECHNICAL NOTES | |
| S-9.6/OpenLCB NMRAnet Proposal | |
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| 06/06/10 | S-9-6 |

NMRAnet Goals and Mandates

This document discusses how the OpenLCB™/S9.6 proposal for the NMRAnet™ layout control bus meets the published Goals and Mandates of the NMRA's NMRAnet effort¹. The proposal for NMRAnet S9.6 has been developed by the OpenLCB group via their web site at

5 <http://openlcb.org/> and discussion group at <http://groups.yahoo.com/group/OpenLCB>.

References here to "NMRAnet" refer to this proposal. Further details of NMRAnet are available in other Standards and Recommended Practice documents in the S9.6 group.

1. Develop standards to define a communications bus that will manage and control devices that are independent of train control on a model railroad layout.

10 S9.6/OpenLCB is designed to control devices, both real and virtual, associated with a model railroad layout, whether that is novice layout requiring only two nodes, or very large layouts, such as museums or modular layout meets that require thousands of nodes across heterogeneous networks.

2. This bus shall be capable of working independently from other train control busses.

15 S-9.6 can works independently of other train control buses.

3. This bus should be capable of bridging commands from other train control busses. The bus shall be capable of bridging commands from a DCC bus.

20 S-9.6 has working prototype hardware that bridges from other buses, including LocoNet and Ethernet. A bridge from DCC has been designed and is being implemented. The large ID size means that IDs from other networks can be included as part of their S-9.6 ID, and allows fuller integration in S-9.6 operations.

4. Developing a set of instructions for track control is outside the scope of this working group at this time. However, the bus shall have the capability of managing and controlling devices that effect train control.

25 Although train control has been discussed and is fully within the capabilities of S-9.6, specific solutions have not been developed. We are exploring more general mechanisms of train control which can use legacy equipment but not limit the development of new technologies.

¹The NMRA has specified these Goals and Mandates in a separate document.

5. The bus shall be designed so that the complexity to the user is minimized. Management and configuration of devices as well as fault finding of the system or individual devices shall require little to no technical knowledge of the bus by the user.

30 S-9.6 is specifically designed with the novice model railroader in mind. These users can connect nodes directly from the box and do not need to be aware of details (such as node IDs or event numbers), but can program even relatively complex interactions with push-button programming. No investment in separate tools is required, but separate configuration tools can ease this process when desired. Prototypes of both approaches exist.

35 Although the specific user interface (UI) remains a manufacturer choice, S-9.6 makes recommendations and prototype implementations are available. Simple networks will be easily debugged without additional equipment. Larger networks can use software support that is able to log, filter, and monitor bus traffic, and to drill down into the network to individual node level.

6. Maximum utilization of existing globally standardized communication technologies should be used to develop this bus. Multiple forms of communication transport shall co-exist. Generic implementations to enable all forms of communication shall not be required if it greatly impacts the size/cost/complexity of the solution. Defining communication technologies is beyond the scope of this WG.

45 S-9.6 uses standardized transports, including CAN and Ethernet. The protocol has been designed to meld with the different transports with transport-specific modifications. Simple nodes need to respond to a base number of messages. The more heavy lifting is confined to the bridging nodes. The protocol is designed to allow the network to scale gracefully, allowing bigger layouts to grow without excessive overhead. Allowance has been made for use of additional transports in the future.

7. The bus shall be owned by, and under the control of, the NMRA. All future changes to this bus shall be controlled by NMRA.

50 Standards and Recommended Practices that describe the NMRAnet are and will be entirely under the NMRAs control. The S9.6 developers would be happy to agree to that in whatever way is required. Actual ownership is a legal matter that we are not qualified to discuss.

8. Develop a bus that minimizes the amount of certification testing required of NMRA. Certification of this bus should not require special testing equipment beyond a computer and appropriate connections.

55 Since S-9.6 uses standard transports, testing is already defined for the transport layers and commercial tools are available as desired.

60 The protocol has the capability for self-testing of nodes and its protocols. In addition to prototypes and demonstration implementations, S-9.6 has developed more than 5,000 lines of testing code to date.

9. Develop a set of NMRA Standards and Recommended Practices that fully define the characteristics of the bus which can be used by manufacturers to develop products.

65 S-9.6 is fully committed to developing draft NMRA Standards and Recommended Practices to fully document the technical requirements of the bus. At present, we do not understand the process for converting those drafts to final, approved documents, and therefore cannot comment on that aspect.

70 We have also developed basic and higher-level documentation for both users and manufacturers to better understand the operation of the bus and intentions of the specifications. At present, the documentation set consists of more than a dozen draft specifications, plus more than twenty examples and application notes. In addition, we provide example implementations on three types of hardware to date.

10. Develop NMRA education and marketing material to inform the users on the benefit, concepts and usage of the bus.

We do not understand what this entails, and therefore cannot comment at this time.

11. Ultimately this bus shall be named the NMRANet.

75 We agree in principle to this.

12. NMRA Working Groups shall be kept informed on the development of this Working Group and be allowed to offer suggestions or comments on the Standards and Recommended Practices being developed.

80 S-9.6 has striven to provide the means and sites for this to happen. Our development documentation, prototype and example implementations, and discussion group are publicly available in real time. We have reported through the NMRA structures for NMRANet development as they have evolved. We will continue to do this.

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