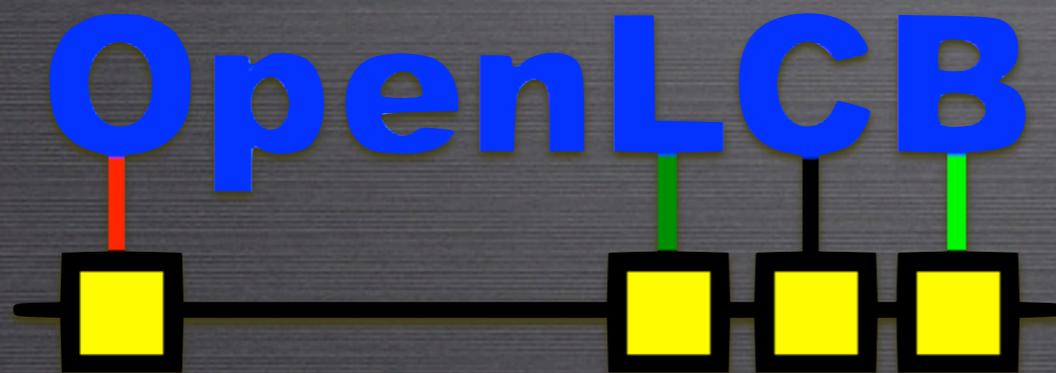


AN INTRODUCTION TO OPENLCB / NMRRANET S-9.7



GRAND RAILS 2012

rail*stars

NMRANET

- What is it?
- Why should I care?
- What can it do for me?



GRAND RAILS 2012

rail*stars

NMRRANET TECHNICAL OVERVIEW

- Capabilities & Limitations
- Producer-Consumer Model
- Peer-to-Peer Model



GRAND RAILS 2012

rail*stars

OVERVIEW

- OR -

TOO MUCH INFORMATION IN TOO LITTLE TIME



GRAND RAILS 2012

rail*stars

NMRANET AND OPENLCB

- NMRAnet is a proper subset of OpenLCB protocol suite.
- NMRAnet development is carried out by the OpenLCB working group, in conjunction with the NMRA.



GRAND RAILS 2012

rail*stars

WHAT IS IT?

- NMRAnet is a Layout Control Bus
- A common method for Layout Control Elements to talk to each other:
 - turnouts
 - signals
 - panels
 - PCs / smartphones
 - &c.



GRAND RAILS 2012

rail*stars

WHAT IS IT?

- Interoperability at every level
 - physical (RJ45 cabling)
 - data link (CAN / ethernet / ZigBee)
 - message types and format
 - application protocols



GRAND RAILS 2012

rail*stars

WHY SHOULD I CARE?

- Because contemporary layout control elements are:
 - bound very closely to DCC
 - unnecessarily difficult to configure or use
 - overkill for small layouts
 - ill-suited to modular layouts



GRAND RAILS 2012

rail*stars

BOUND TO DCC

- Current layout control boards are either DCC or LocoNet
- Accessory decoders must be used with a DCC throttle
- LocoNet is also very closely bound to DCC
 - Nevermind that it's a closed ecosystem.



GRAND RAILS 2012

rail*stars

DIFFICULT TO USE

- Have you set up a Digitrax SEC8?
 - (not to rag on Digitrax)
- DCC provides a terrible configuration interface
- Operation is limited to DCC throttles and PC software



GRAND RAILS 2012

rail*stars

NOT GREAT FOR SMALL LAYOUTS

- Most layout control elements are targeted at medium- to large-sized layouts
- Too much trouble to use on small layouts



GRAND RAILS 2012

rail*stars

NOT GREAT FOR MODULES EITHER

- Lack of unique IDs
- Can't combine different brands easily
- No standard for interconnects
 - And where there are, they aim for lowest common denominator



GRAND RAILS 2012

rail*stars

THE NEED FOR NMRRANET

- Interoperability and openness
- Not bound to any particular traction-control technology
- Handles the complexity of operation for us
- Is infinitely flexible
- Is forward-looking



GRAND RAILS 2012

rail*stars

NMRRANET HIDES COMPLEXITY

- Complexity is in the engineering, not in the user interface
- Implementation details are hidden from users
- Configuration system is designed for humans
- Designed to be robust and reliable



GRAND RAILS 2012

rail*stars

NMRANET IS FLEXIBLE

- Point-to-multi-point networking based on “producer-consumer” model
- Producers detect events on layout and produce event reports
- Consumers consume event reports to trigger some layout behavior



GRAND RAILS 2012

rail*stars

NMRANET IS FLEXIBLE

- End user gets to decide what an event *is* and what each event *means*
- User connects producers and consumers
- Connections are free-form
- Any event can trigger any behavior



GRAND RAILS 2012

rail*stars

NMRRANET IS FORWARD LOOKING

- Not tied to any particular train-control technology
 - Works with DCC, DC, Brio, whatever
- Not tied to any particular networking technology
 - Currently works with CAN, ethernet
 - Being made to work with ZigBee



GRAND RAILS 2012

rail*stars

EVERYONE STILL WITH US?



GRAND RAILS 2012

rail*stars

NMRRANET TECHNICAL OVERVIEW

- Physical capabilities and limitations
- Event transport (producer / consumer)
- Datagram / Stream transport (peer-to-peer)



GRAND RAILS 2012

rail*stars

PHYSICAL CAPABILITIES AND LIMITATIONS

- Current implementation based on CAN
- 125Kbps data rate
- Extremely efficient capacity utilization
- Designed for high reliability in electrically noisy environments
- Can provide limited power over the bus



GRAND RAILS 2012

rail*stars

PHYSICAL CAPABILITIES AND LIMITATIONS

- Linear *terminated* bus
 - short stubs permitted
- Segment length max 1000ft / 300m
 - for each node on bus subtract 20ft / 6m
 - for each stub, subtract double the stub length
- Max 48 nodes segment
- Of course, a network can comprise multiple segments!



GRAND RAILS 2012

rail*stars

NETWORK STRUCTURE

- Each node is assigned a permanent unique identifier (NodeID)
- Nodes can also be assigned a human-readable name and description
- There is no “master” node
 - No PC required!
 - All nodes are equal peers



GRAND RAILS 2012

rail*stars

PRODUCER-CONSUMER MODEL

- Each layout event is given a unique identifier (EventID)
- Event Reports contains EventID and is broadcast to entire network
- Consumers can choose to act or not without requiring explicit activation by producer



GRAND RAILS 2012

rail*stars

PRODUCER-CONSUMER MODEL

- Multiple producers can produce same event
- Multiple consumers can consume same event
- Allows true many-to-many network architecture



GRAND RAILS 2012

rail*stars

PRODUCER-CONSUMER MODEL

- Connections between producers and consumers are trained via the Learning Protocol
- Nodes are taught to produce / consume a particular Event by demonstration



GRAND RAILS 2012

rail*stars

PRODUCER-CONSUMER MODEL

- Use cases:
 - Controlling a siding from multiple panels
 - Occupancy at a single point triggering multiple signals (on layout and on panels)
 - Easy configuring of routes through a yard



GRAND RAILS 2012

rail*stars

PEER-TO-PEER COMMUNICATIONS

- Datagrams and Streams permit routing data to a particular node
- Datagrams carry 72-byte payloads
- Streams carry arbitrarily sized payloads
 - More efficient, but increased protocol complexity
- In most cases, user will not interact with these kinds of messages.



GRAND RAILS 2012

rail*stars

PEER-TO-PEER COMMUNICATIONS

- Use cases:
 - Reading and writing node configuration
 - Remote displays
 - Traction control



GRAND RAILS 2012

rail*stars

BUT, WILL IT BLEND?



GRAND RAILS 2012

rail*stars

COMMERCIAL HARDWARE

Available today



GRAND RAILS 2012

rail*stars

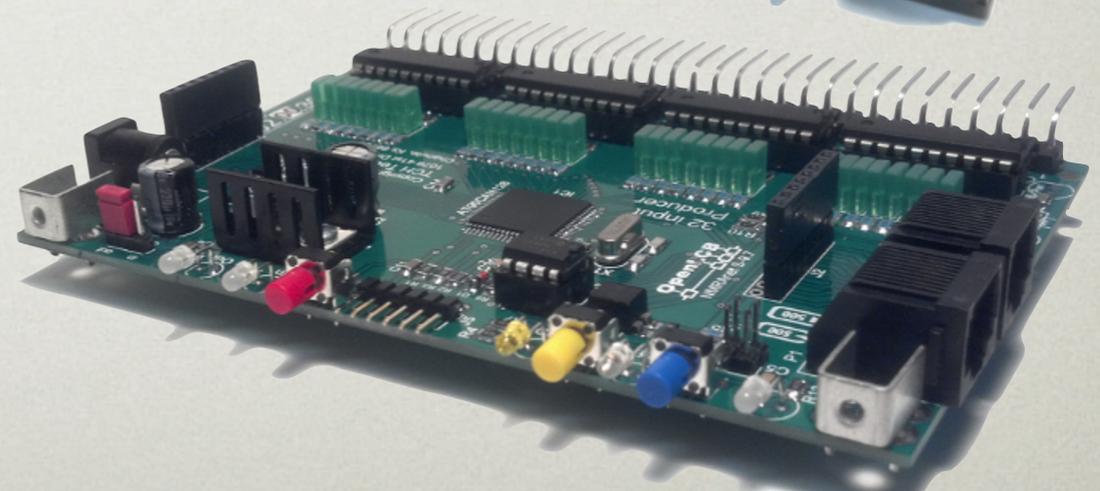
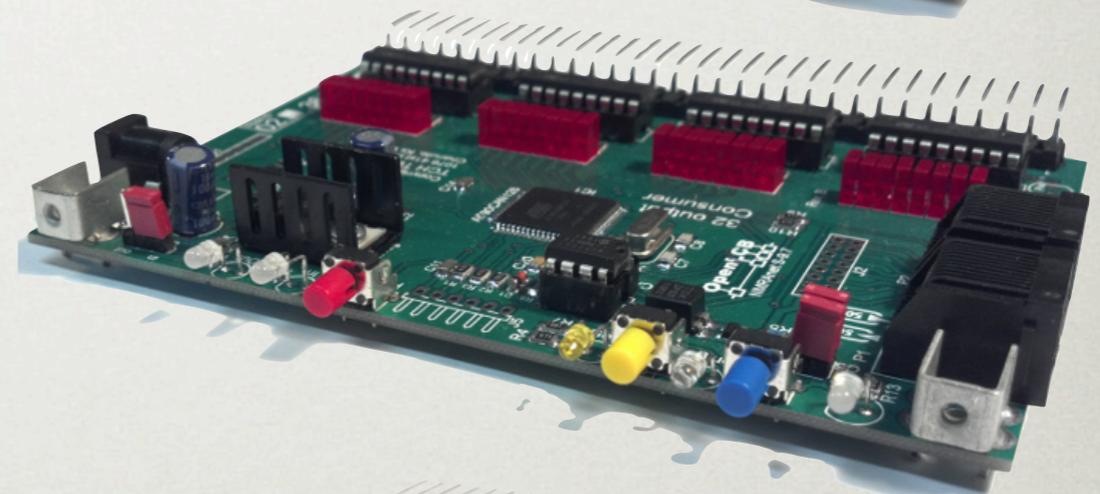
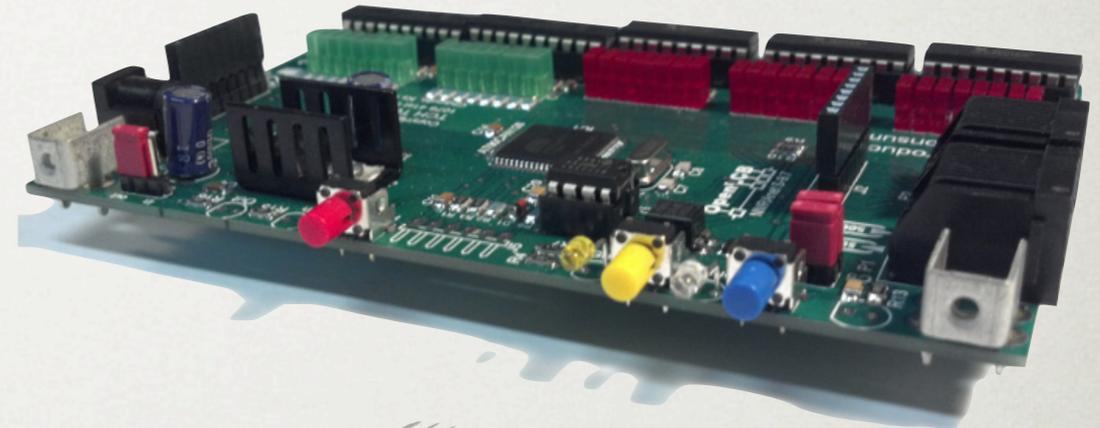
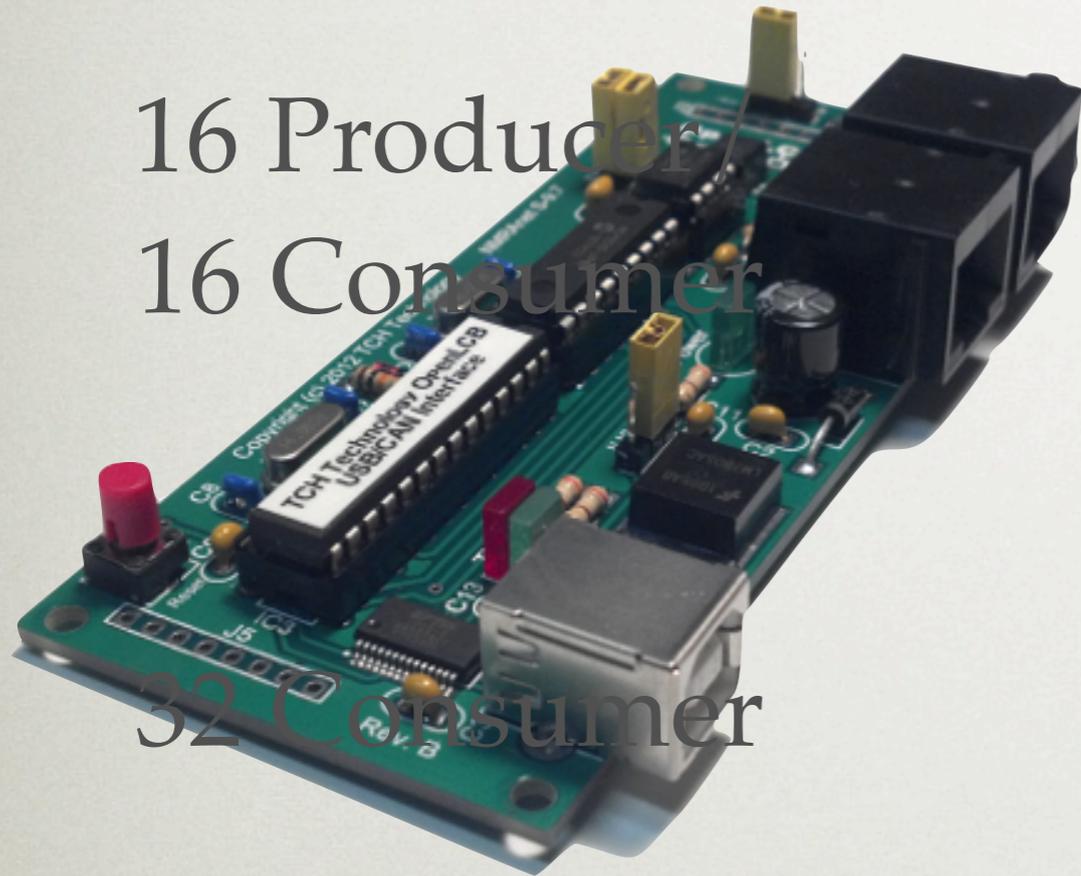
TCH TECHNOLOGY

THE OPENLCB SPECIALIST

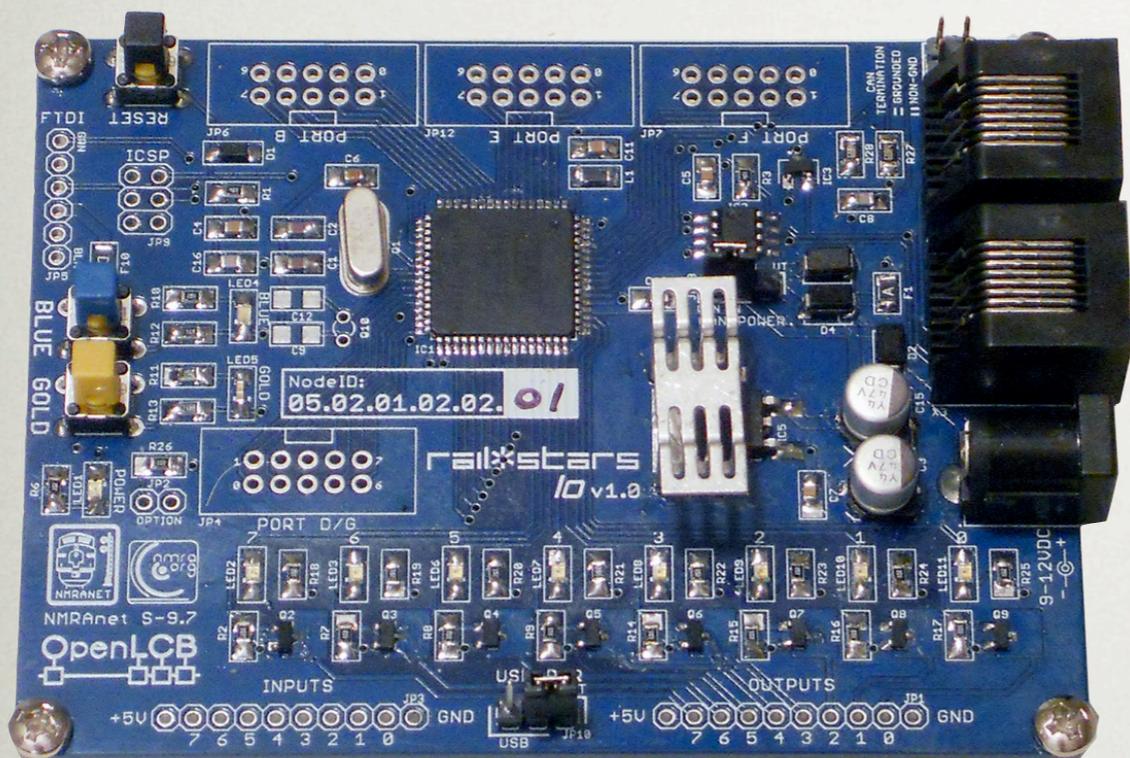
16 Producer
16 Consumer

32 Consumer

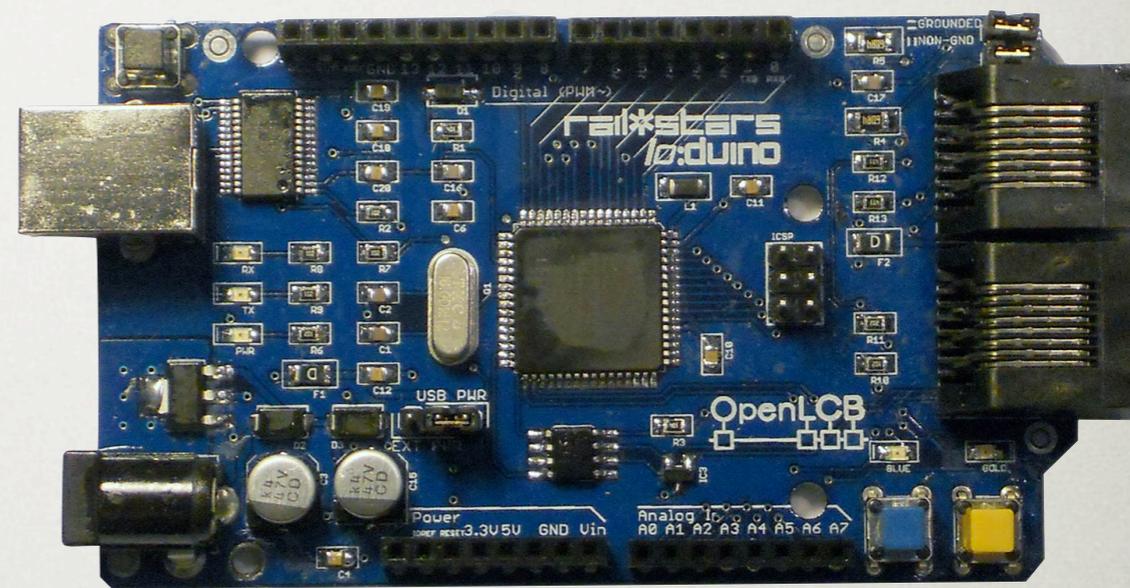
CAN/USB interface



rail*stars



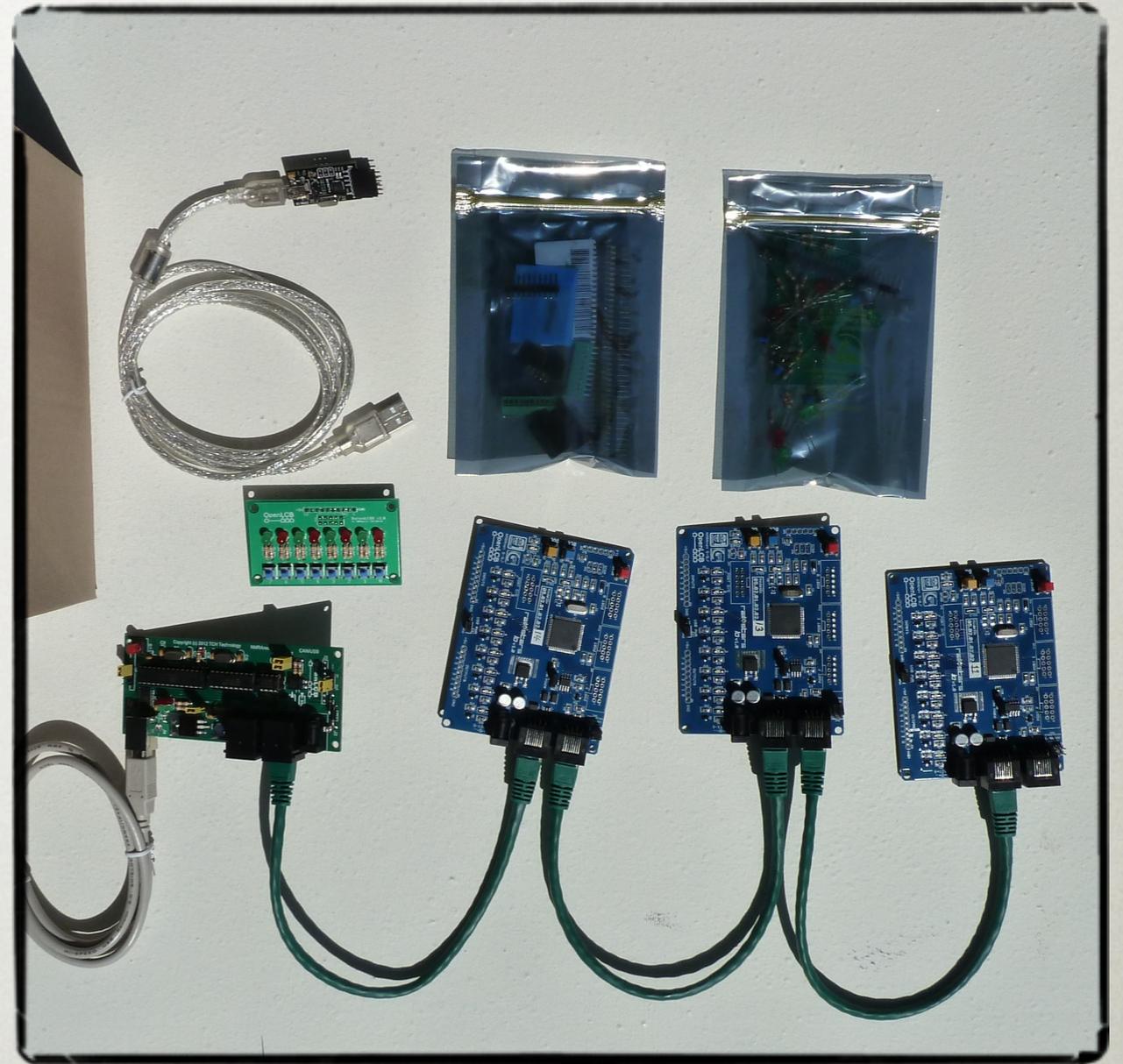
io



io:duino

NMRRANET DEV KITS

- Three Railstars *Io* nodes
- One TCH Technology CAN/USB adapter
- Assortment of connectors and accessories



LINKS!



GRAND RAILS 2012

rail*stars

LINKS

- <http://nmranet.org>
- <http://openlcb.org>
- <http://railstars.com>
- <http://tchtechnology.com>



GRAND RAILS 2012

rail*stars

DEMO!



GRAND RAILS 2012

rail*stars

QUESTIONS?



GRAND RAILS 2012

rail*stars