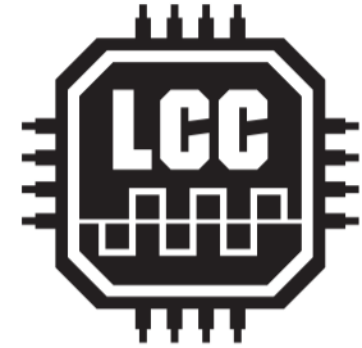


OpenLCB



**PORTLAND
DAYLIGHT
EXPRESS**

NMRA NATIONAL CONVENTION



LCC / OpenLCB

Overview and Current Status

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Outline

What is OpenLCB and LCC

Basic Concepts

Status, adoption and current scope

Product availability

Expected Future Features

Under the hood: how does it work?

What is OpenLCB?

OpenLCB = Open Layout Control Bus

A common method for Layout Elements to talk to each other:

- Turnouts
- Signals
- Detectors
- Lights
- Panels
- PCs / Smart Phones
- Boosters
- Command Stations
- Throttles
- Power Managers
- Trains
- etc...

Relation of OpenLCB vs LCC

OpenLCB

- a development community
- a set of standards they produce

LCC

- the set of OpenLCB standards which are adopted as the NMRA standard

What is OpenLCB *NOT*?

LCC does NOT replace DCC.

On the track – DCC

Beside the track – LCC

OpenLCB is not dependent on DCC

could run DC or Märklin layouts

not locked to the DCC manufacturer

OpenLCB is not proprietary

no patents or royalties

Why open standards?

- Available royalty-free to all manufacturers
- Hardware from different manufacturers will work together – mix and match as desired
- Not locked in to one supplier
- Open path to innovative products, tailored to your needs

Legacy – a lesson from DCC

Before DCC

dozens of incompatible systems

20 years later

almost every manufacturer is

DCC compliant

60+ companies to choose from

Relation to existing hardware

Q: I have a lot of LocoNet / XpressNet / CMRI / NCE / etc products. How do I get onto LCC?

A1: Ask your manufacturer.

A2: Gateway nodes could bridge to legacy bus.

Adoption status

- OpenLCB
 - First documents adopted in 2012
 - Useful set completed & adopted in Feb 2015
 - Working on next set with minor fixes based on comments
- LCC
 - NMRA board voted to adopt the OpenLCB set from Feb 2015
 - Currently in public comment period
 - Final adoption expected in October

Adoption process

- OpenLCB
 - Public working group discusses ideas and writes specs (standard and technical note)
 - Prototypes are built
 - Vetted specs are adopted
- LCC
 - OpenLCB group forwards documents to NMRA
 - They choose which ones to adopt
 - Those are adopted verbatim

Why is OpenLCB better?

- **Current technology**
 - 10x faster
 - Robust, noise-immune, very simple wiring
- **Plug and play installation**
 - Intuitive configuration interface
 - Self-describing nodes
 - No address conflicts, no DIP switches
- **Future-proof**
 - Use CAN, Ethernet, Wi-Fi, Internet, etc
 - Lots of address space
- **Scales well**
 - From two boards to thousands of modules

Product availability

Ask your favorite supplier at the train show!

When will they have LCC-compatible products?

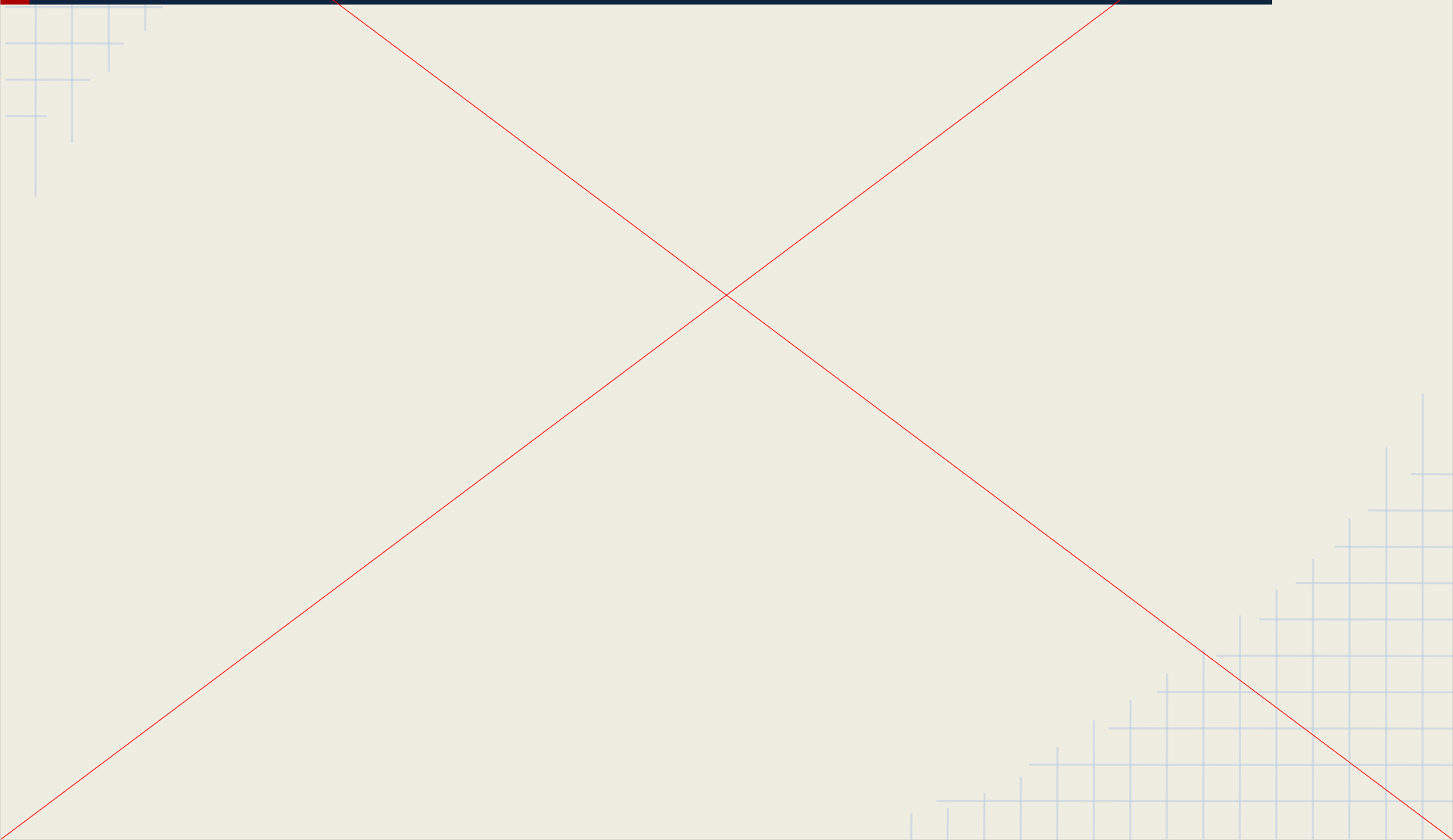
Two manufacturers in active development

- RR-CirKits
 - Full IO board selection
- Train Control Systems (TCS)

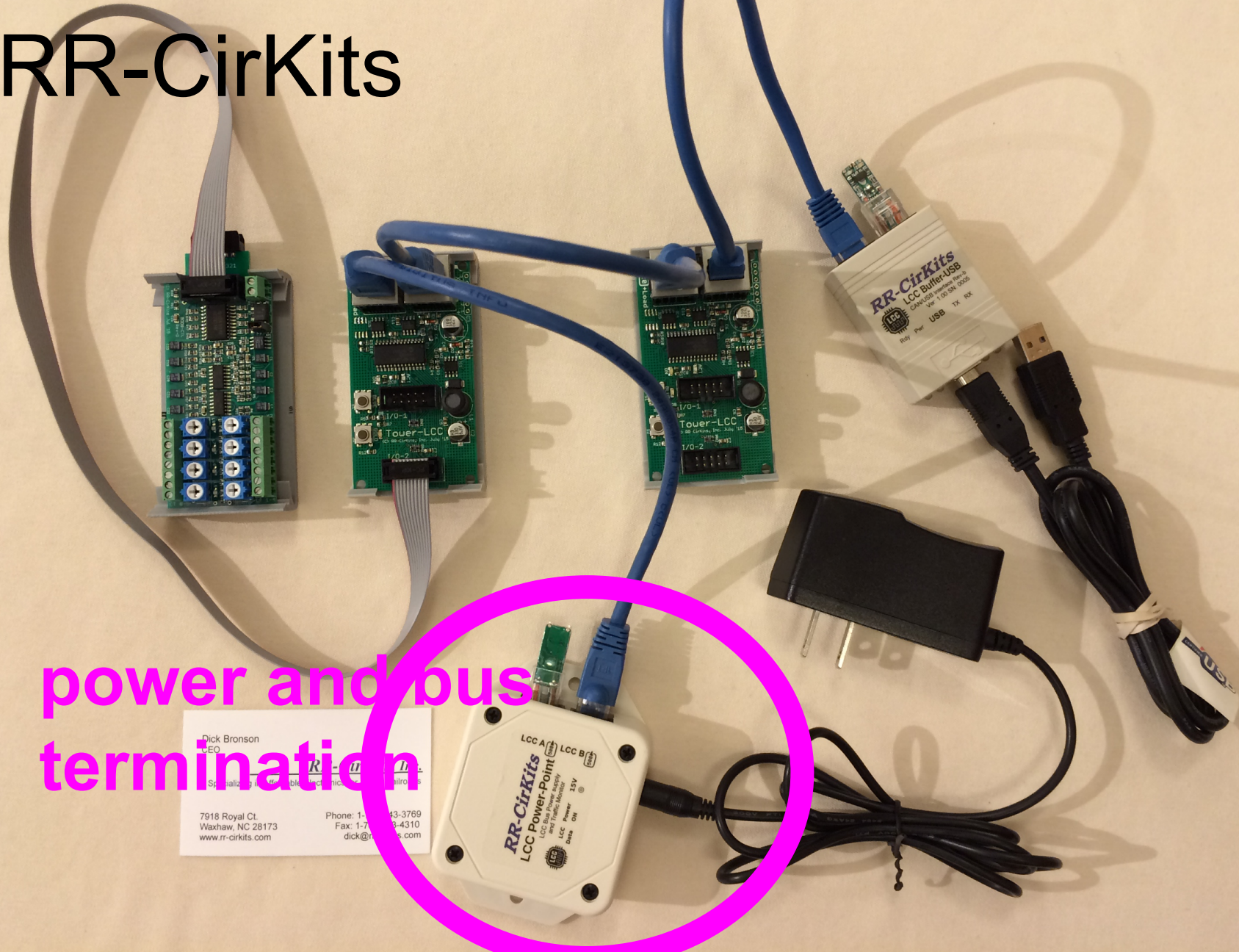
Hobbyist / development tools

- Clinic on Thu about DIY build-a-node
 - Targeted to manufacturers, engineers, hobbyist programmers & makers (~~Arduino users)

RR-CirKits



RR-CirKits



power and bus
termination

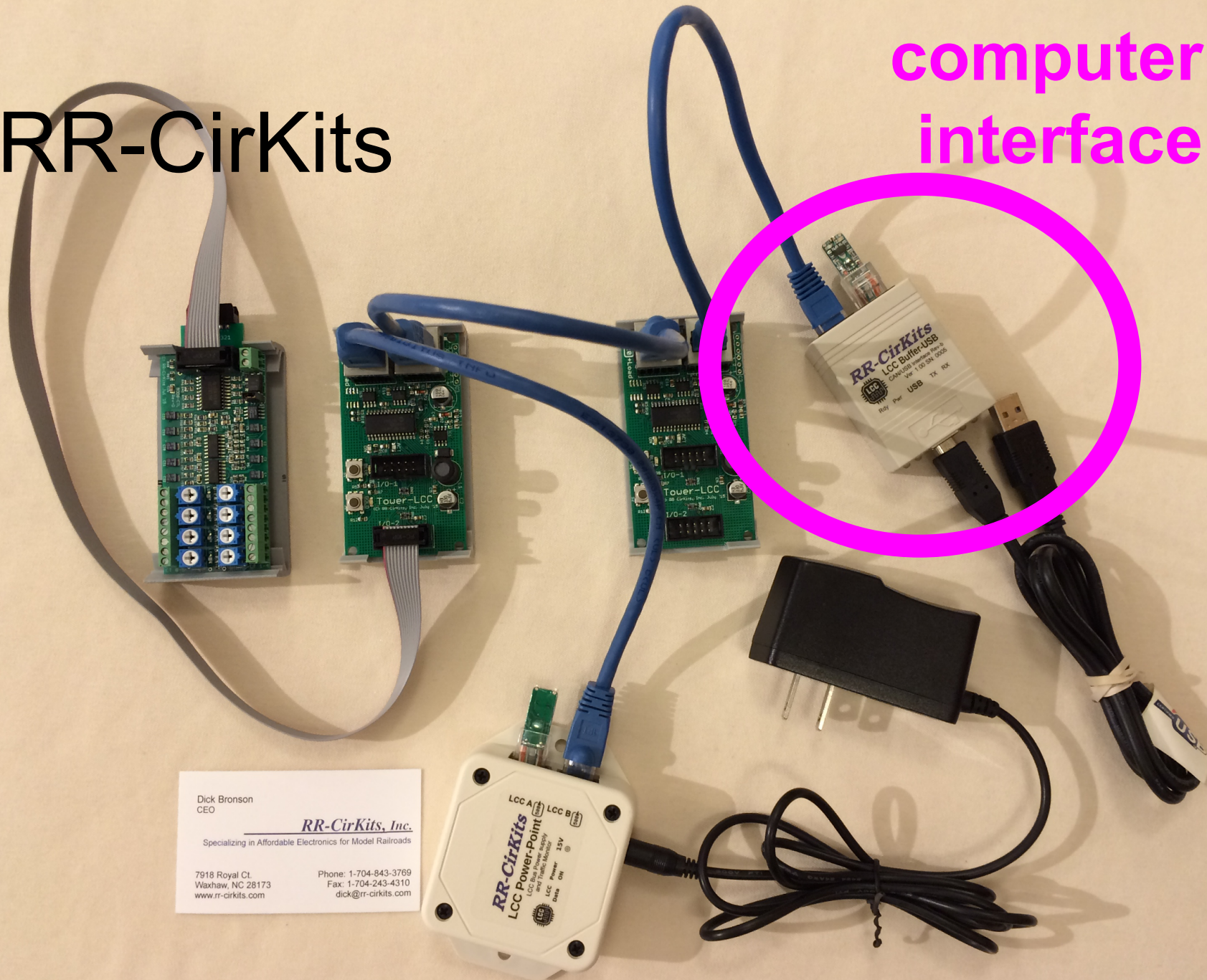
Dick Bronson
CEO
Specializing in fiber optic and network control

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RR-CirKits

computer
interface



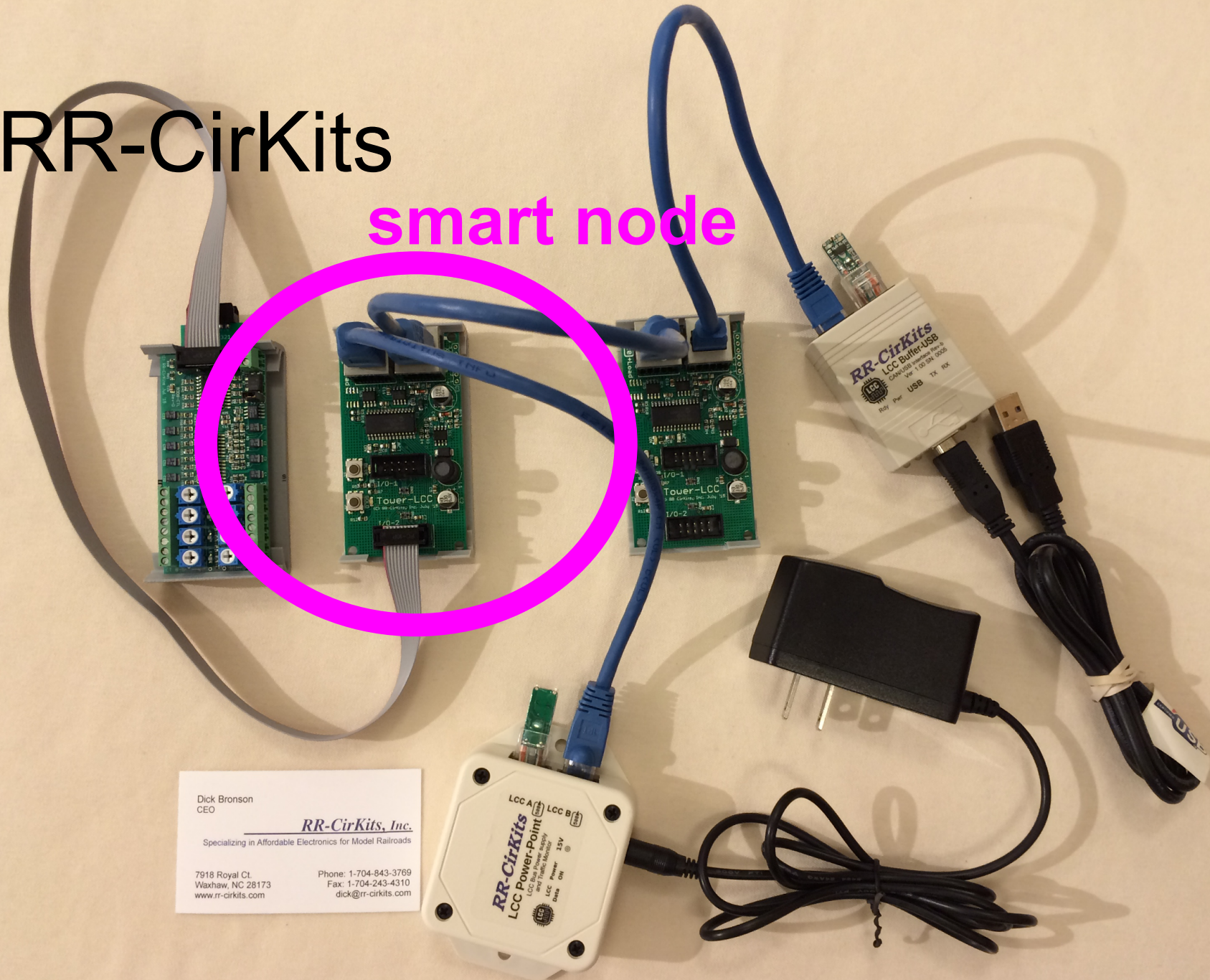
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RR-CirKits

smart node



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RR-CirKits

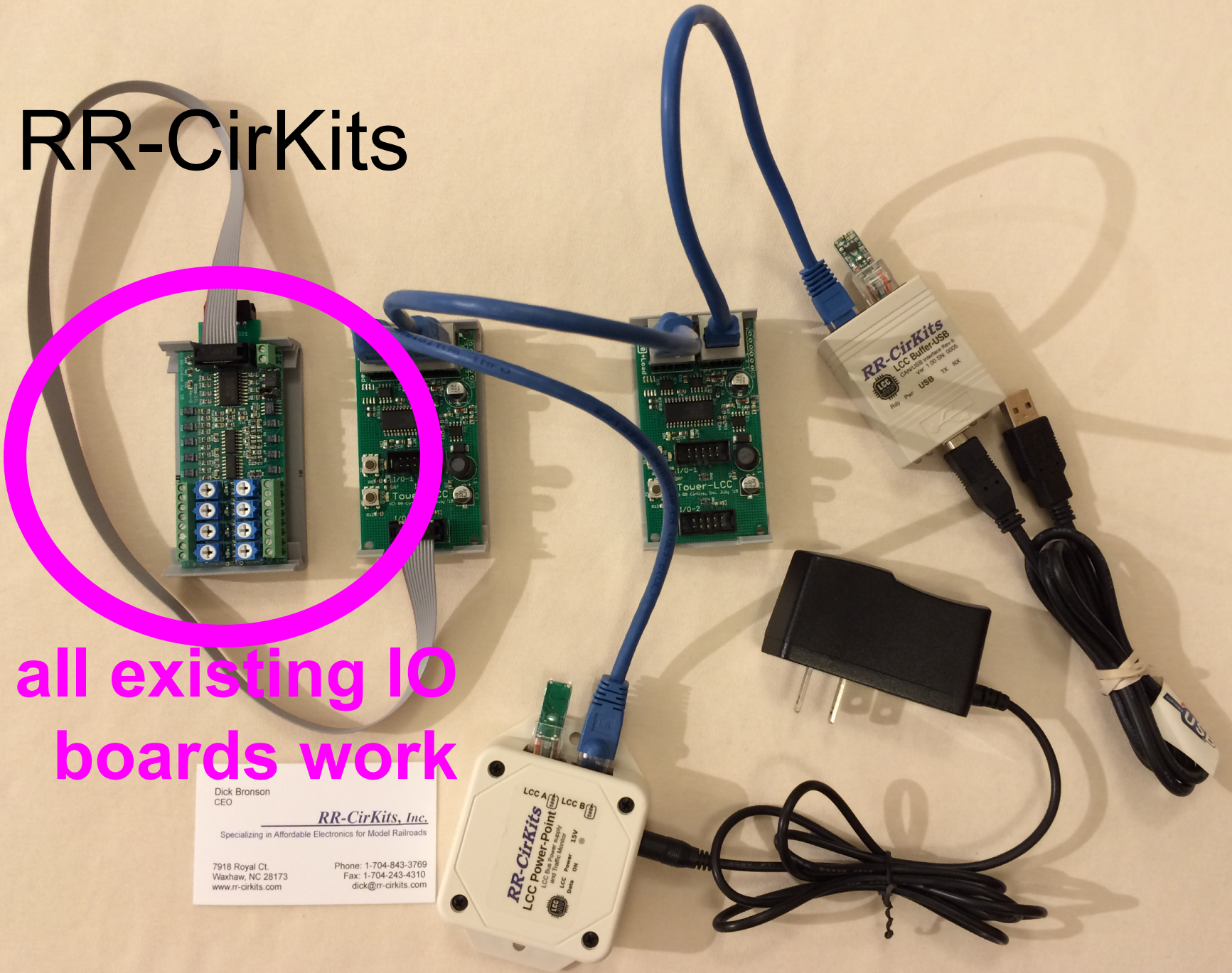
all existing IO
boards work

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Current use-cases

- Physical and network layers, plugs & cabling
- The standards cover basic layout control
 - Turnouts, signals, block detection
 - Panels, buttons, lights, etc.
 - Signaling and control point logic (cue node)
- Configuration and network management
 - Discovery: what nodes are there?
 - Configuration of nodes
- Computer interface (optional)
 - JMRI support

Work in progress

- Firmware upgrade
- Time, Fast clock, and diurnal cycles
- Simpler protocol over TCP
- Search protocol
- Throttles on OpenLCB
 - Including connection to existing command stations
 - Or a native OpenLCB command station
 - Or native OpenLCB (wireless) trains

Proof of concepts

Prototypes

- Gateways to Ethernet, WiFi, Internet
- DCC command station with LCC throttle
 - Gateways to legacy throttles
 - use Digitrax, NCC, Lenz throttles on the same layout with LCC!
 - OpenLCB throttle with touch screen
 - Android application

Future concepts & ideas

- These are all possible within the existing standards, but a manufacturer needs to develop and market the product
- Gateways to legacy buses
 - Connect your existing bus to LCC
 - Make your boards appear on the LCC bus
 - LocoNet, XpressNet, NCE
 - C/MRI
- Applications for tablets and smartphones
 - Panels, accessory control, throttle

Credits

- Prime Contributors: Bob Jacobsen, Alex Shepherd, David Harris, Stuart Baker, Balazs Racz, Jim Kueneman, Don Goodman-Wilson, John Plocher
- Developer Group
 - 10 to 15 actively working on code at any time
 - 25 to 50 regular contributors and supporters
 - Many of the same people as supporting JMRI
- User Group
 - Started November 2009
 - Aug 2015 we have 211 addresses
- NMRA liaison: Stephen Priest

Under the Hood

Nodes communicate with each other by:

- **Events**
 - Globally unique 'something happened' notice
 - These are 'broadcast' to all nodes
- **Datagrams**
 - Short blocks of specific data
- **Streams**
 - Data connections for things like voice or video

Basic Concepts -- Nodes

- Nodes retain their own settings
- Nodes describe their own settings and users can enter their own descriptions
- A node may be as small as a decoder
- A whole computer could also be a node
- All nodes have a unique id
 - just like Ethernet devices
 - huge address space, never conflict

Basic Concepts -- Network

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

- Discovery protocol
 - allows network browsers
 - configuration tools

Basic Concepts -- P/C

- Event Reports contains Event ID and is broadcast to entire network
- Consumers can choose to act or not without requiring explicit activation by producer
- Multiple producers can produce same event
- Multiple consumers can consume same event
- Allows true many-to-many network architecture
- Event ID's can be moved from node to node

Wiring

CAN-bus

- Simple Cat5 wiring (like Ethernet)
- up to 1000ft (300m) cable length
- noise immune and error correcting
- powers small nodes through the bus

Gateways

- Connect multiple bus segments together
- Optional backbone via Ethernet or WiFi
- or interface to legacy system

User Group

Yahoo Users Group

- openlcb@yahoogroups.com
- LayoutCommandControl@yahoogroups.com

Useful Links

- <http://openlcb.org>
- <http://openlcb.com>
- <http://nmra.org>, choose S&RP scroll to 9.7

