CSR

An Introduction to CSRmesh™

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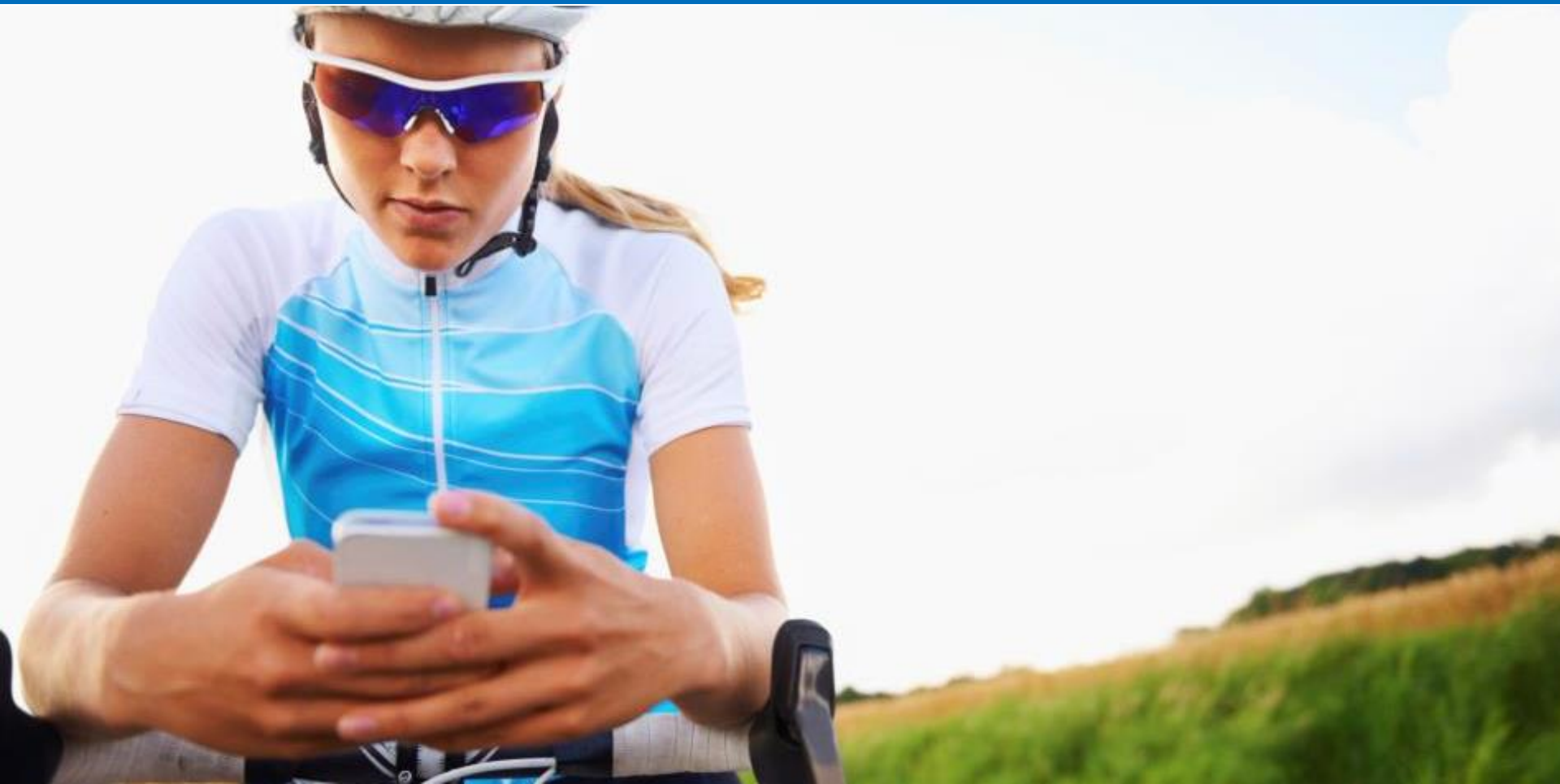
Push every boundary.™

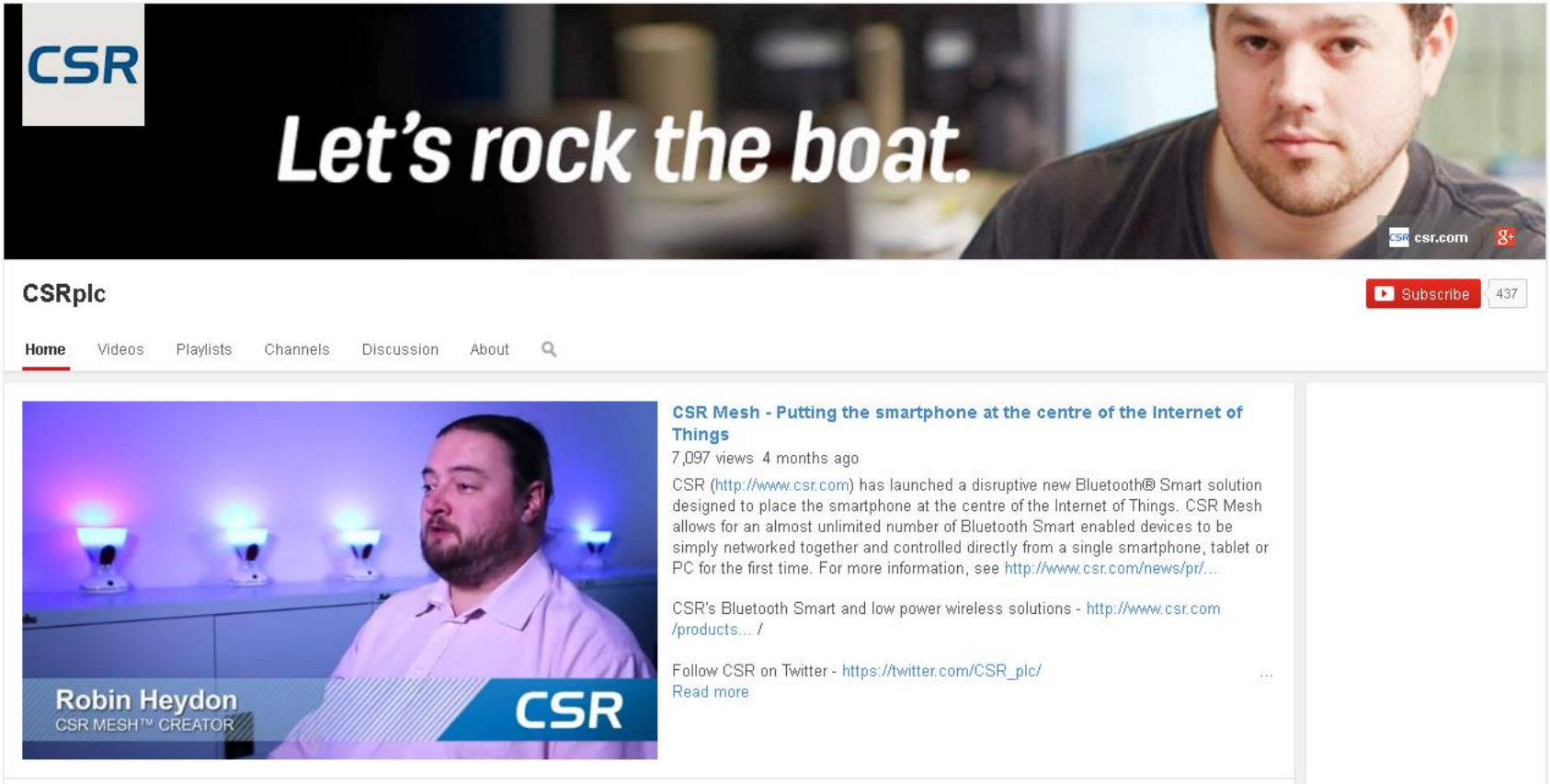


This Session

CSRmesh™

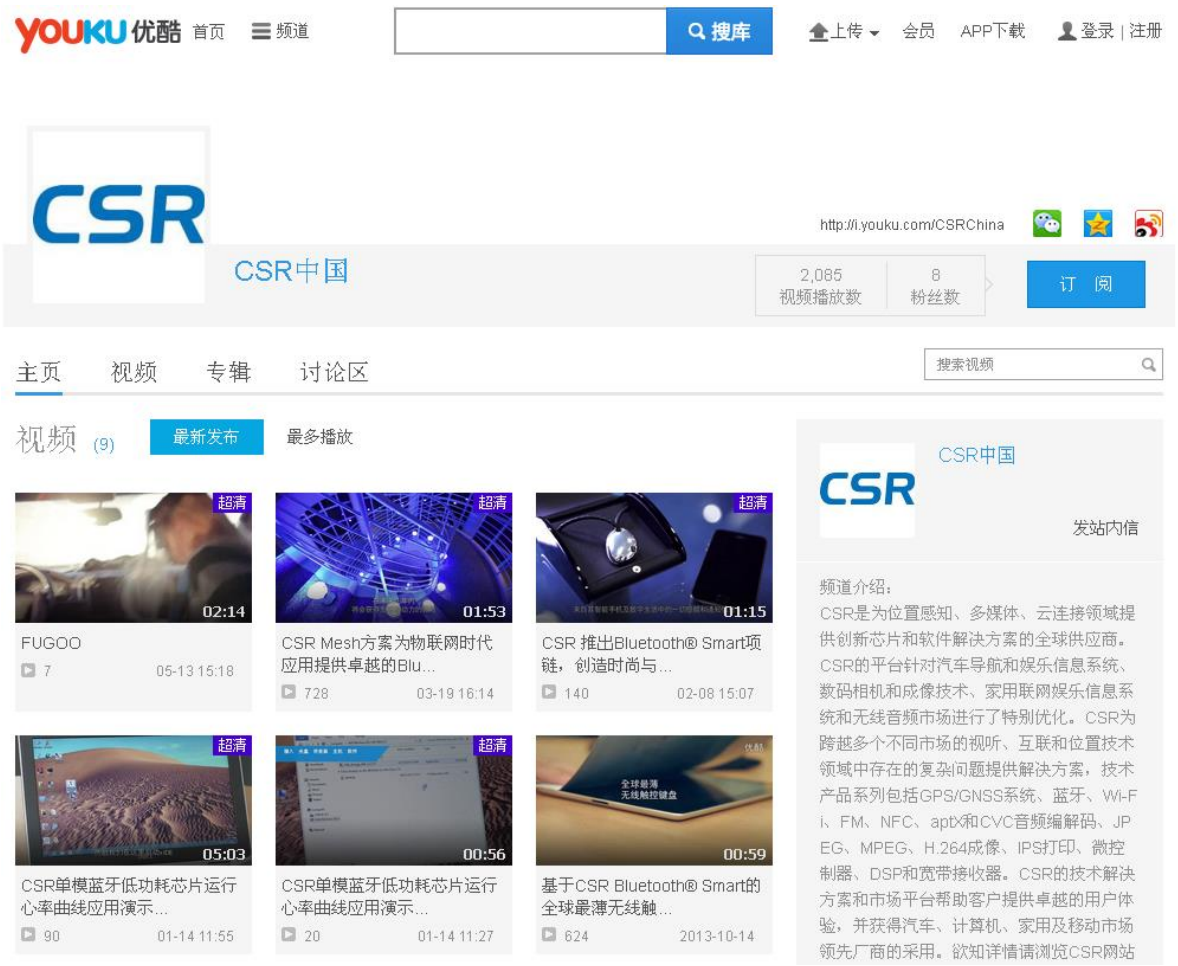
- Overview
- Development resources

CSRmesh™ - Get ready to be inspired…



http://www.youtube.com/user/CSRplc

CSRmesh™ - Get ready to be inspired…



http://i.youku.com/CSRChina

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CSRmesh™ overview

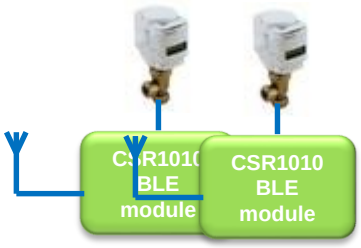
CSRmesh™ Overview

- CSRmesh™ creates a mesh network from existing CSR Bluetooth Smart & Smart Ready devices
- CSRmesh™ enables you to increase the scale of what you can control via your mobile device
- This presentation is an overview of the CSRmesh™ capabilities that are enabling innovative products for The Internet of Things.

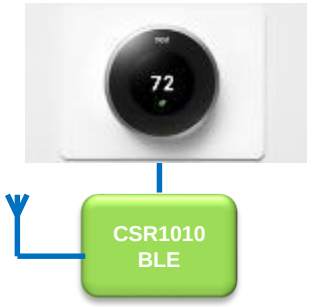
CSRmesh network

Lighting

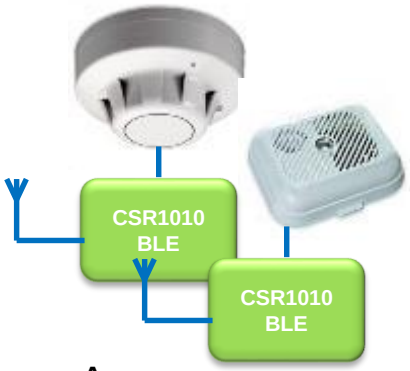
Heating



Thermostats

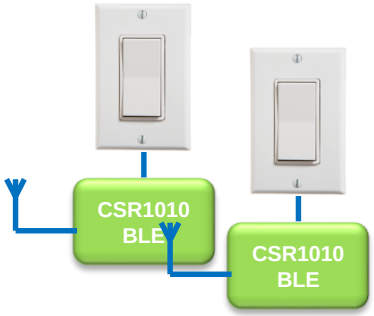


Sensors



Access

Switches



Allows you to control anything from anywhere in the world

Android

OR

iPhone

OR

PC

CSRmesh Use Cases

- CSR's creation of the Mesh protocol to run on its existing Bluetooth Smart silicon, is expected to have a major impact on the lighting and home automation market from 2014
- With this protocol the user is now able to configure, control and monitor the status of just about anything from a smartphone or Win8 PC
- The list of use-cases extends well beyond just home automation

Is this the right solution for YOU?

- Using or looking into Zigbee or Z-wave?
- Current solution too complex to setup?
- Need capability to use a smartphone without having to use an access point or router?
- Need whole-home or building coverage beyond radio range of normal WiFi or Bluetooth?
- Do you want something simpler?
- Current solution too expensive?

CSRmesh features

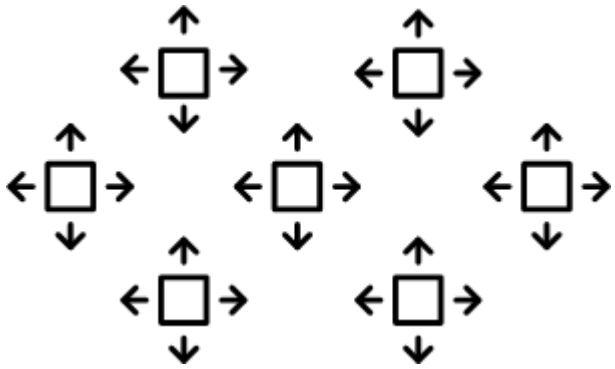
- Extends range of Bluetooth Smart by repeating messages
  - No setup required, no hub or access point required for local network
  - Minimal propagation delay ~15ms node to node
- Messages can be sent to an individual node or to a group
  - Flood mesh – no routing tables
  - No single point of failure
- Simple provisioning
  - Smartphone application and QR codes
- The network is secure
  - Messages are encrypted to prevent eavesdropping
  - Optional authentication to prevent man-in-the-middle attacks

CSRmesh features

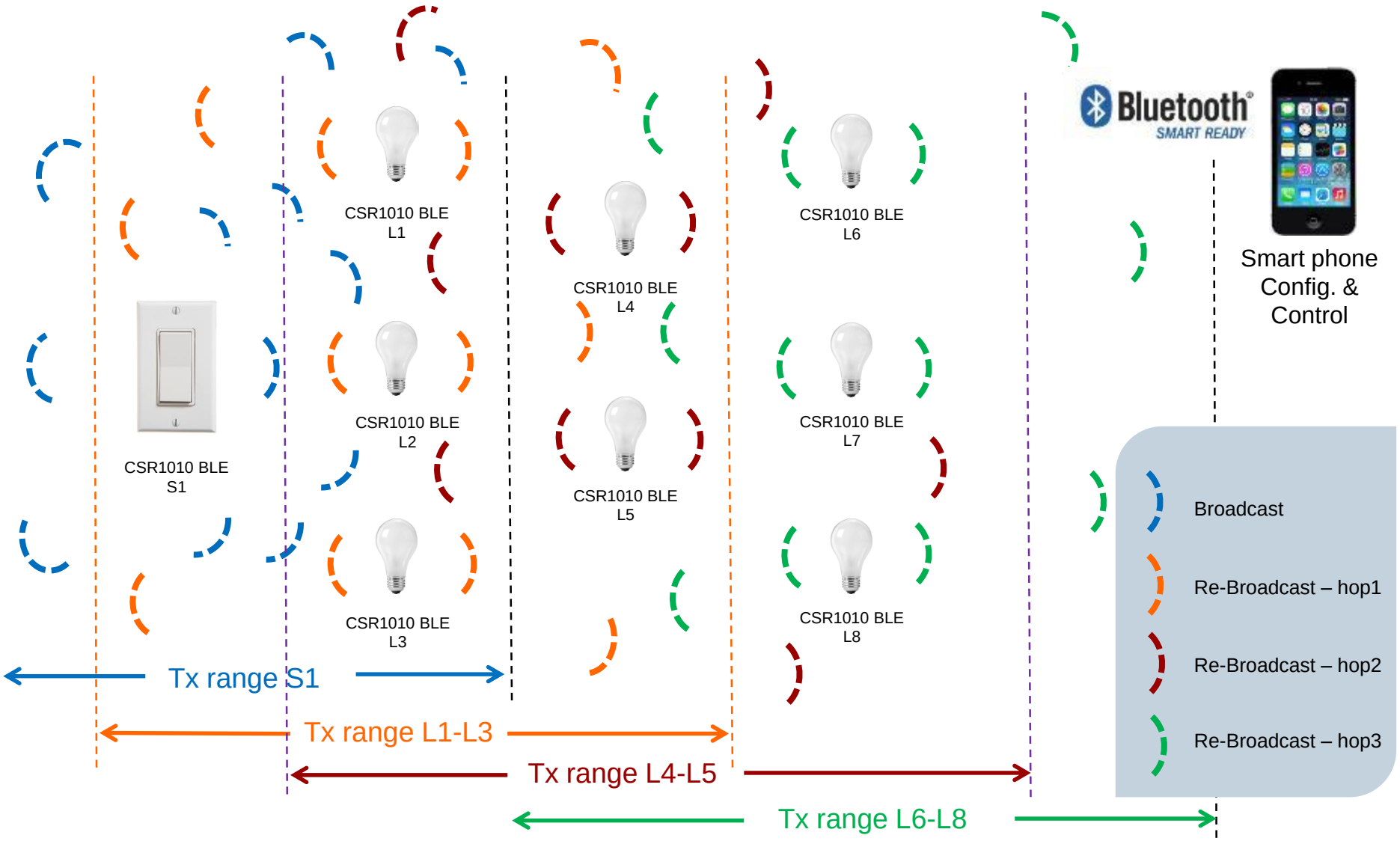
- The network is robust
  - Messages are sent on 3 separate channels
  - Channels co-exist very well with WiFi
  - Uses proven CSR silicon – CSR101x, CSR8811, CSR8670 etc.

- Communicates directly with the phone
  - Unlike ZigBee, Z-wave or any other proprietary protocol
  - Simple bridging to Bluetooth Smart Ready devices – no additional components

- Low power consumption
  - 20x times less than WiFi



CSRmesh



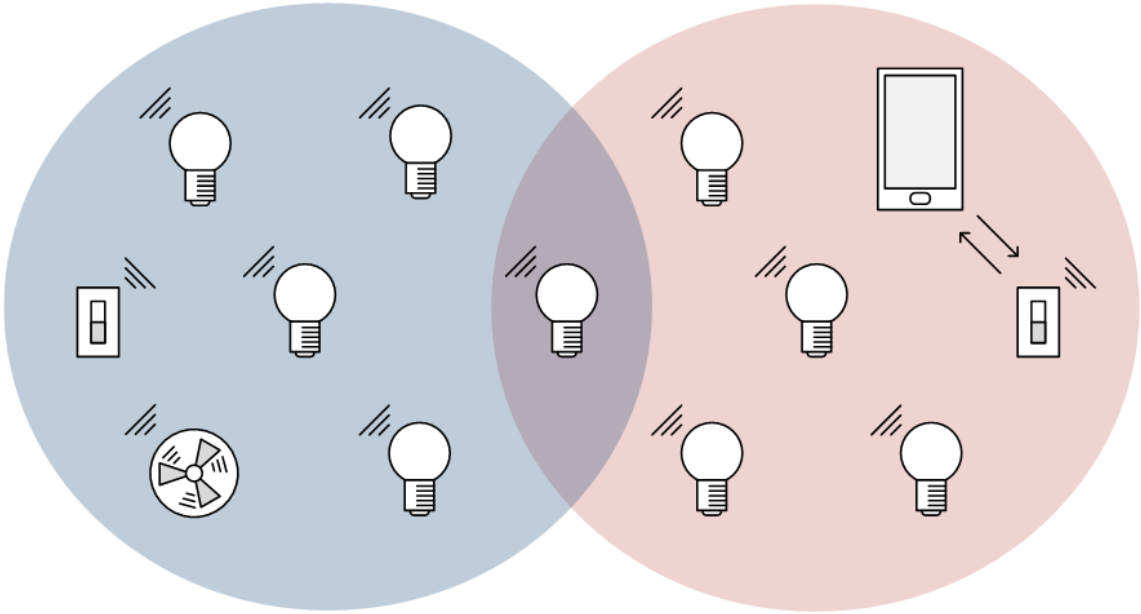
CSRmesh networks

- Devices are organised into secure networks
  - Up to 65535 devices per network
- Networks are secured using a network key
  - Can be pre-generated or derived from a pass phrase

    “39MargettStreet” => 0x56e62270cacd25283c01f2eee3d7e92b
- All devices within network are trusted devices
  - Can send messages to any other group of devices

CSRmesh networks

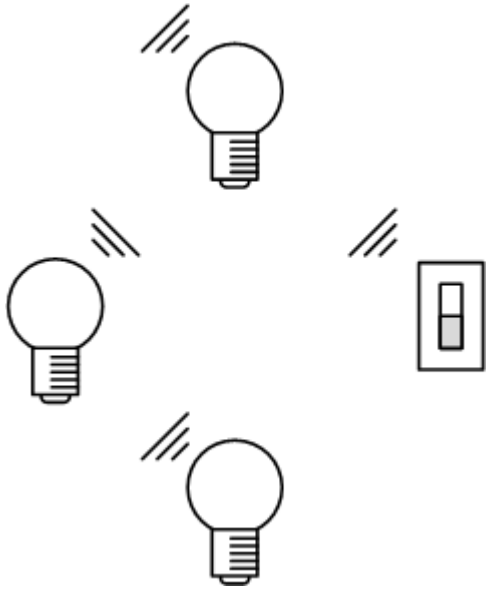
- Devices can be in "multiple networks"
  - e.g. Hotel Room Lock (guest, maintenance, maid service)
  - e.g. Hotel Room Lighting (guest, physical switches)
  - Knowledge of one network key does not enable access to other network keys or their functionality



Messages and groups

- Devices configured to process messages sent
  - directly to their DeviceID
  - to the Broadcast GroupID 0x0000
  - to the GroupIDs that they have been configured to use

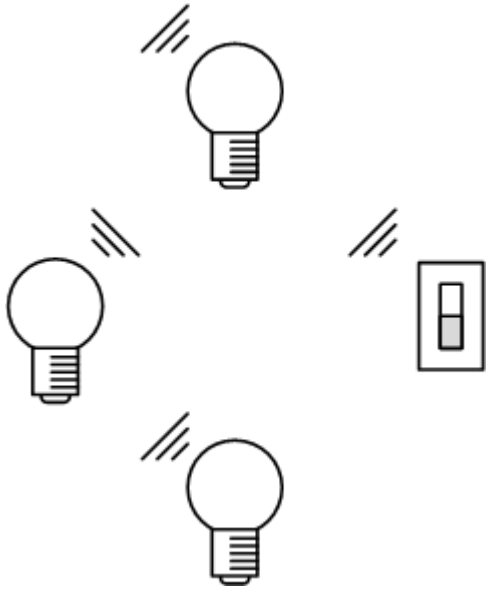
- GroupIDs can therefore be considered to give semantics
  - “LivingRoom” Light 100%



Messages and groups

- Messages from single devices
  - Each device within the network is configured with a unique 16-bit DeviceID
  - Devices can be organised into groups

- Messages are sent to “destinations”
  - Either a DeviceID or a GroupID



CSRmesh Provisioning

- Devices are identified using a 128-bit UUID
  - no MAC Address from IEEE is required
  - self-management of allocated random UUIDs possible
    - 5,316,911,983,139,663,491,615,228,241,121,378,304 devices

- Devices publish a 64-bit Authorisation Code
  - either as a QR-Code – linking to your app
  - or as a ShortText code
    - NDhd-pbbD-Hb9D-9frR-b68T

- Use an app to provision service
  - can use cloud services to store information

Step 1a – Installation

Device has a “Barcode”

Scan barcode using App

App securely distributes a network key to device

App knows about switch

Switch is now part of Network

Step 1b – Installation

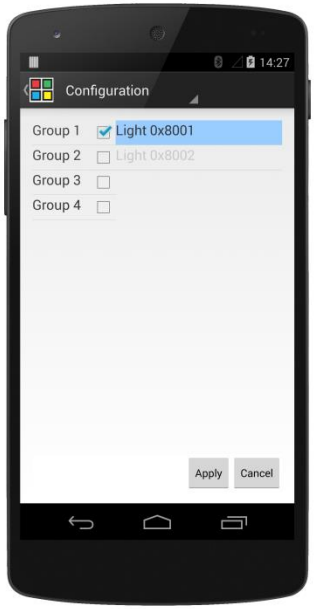
Device has a “Barcode”

Scan barcode using App

App securely distributes a network key to device

App knows about light. Switch and light are now part of Network

Step 2: Configuration



User connects switch with light in App

App programs Light to be in Group 1

App programs Switch to be in Group 1

Any number of lights or switches can be in a single group

Step 3: Use

User presses switch to turn light on

Group1: PowerOn

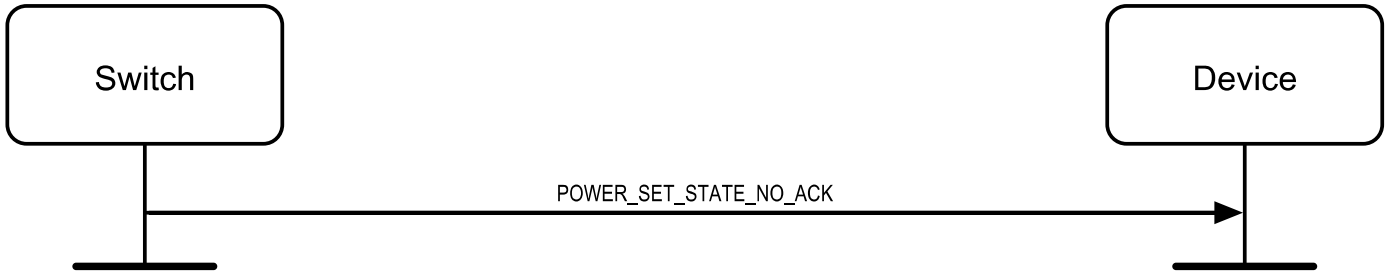
User presses switch to turns light off

Group1: PowerOff

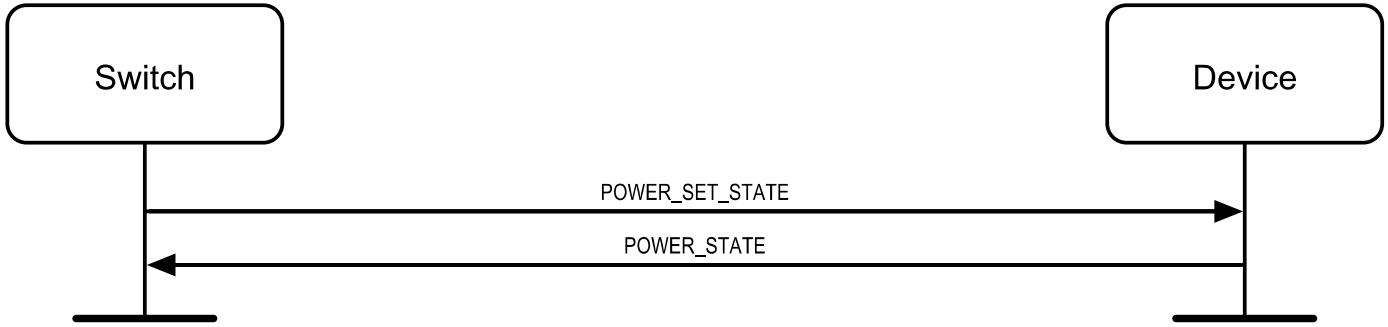
Messages are secure and quickly & reliably delivered, even in a very large building

Reliable and unreliable transactions

- Unreliable transactions

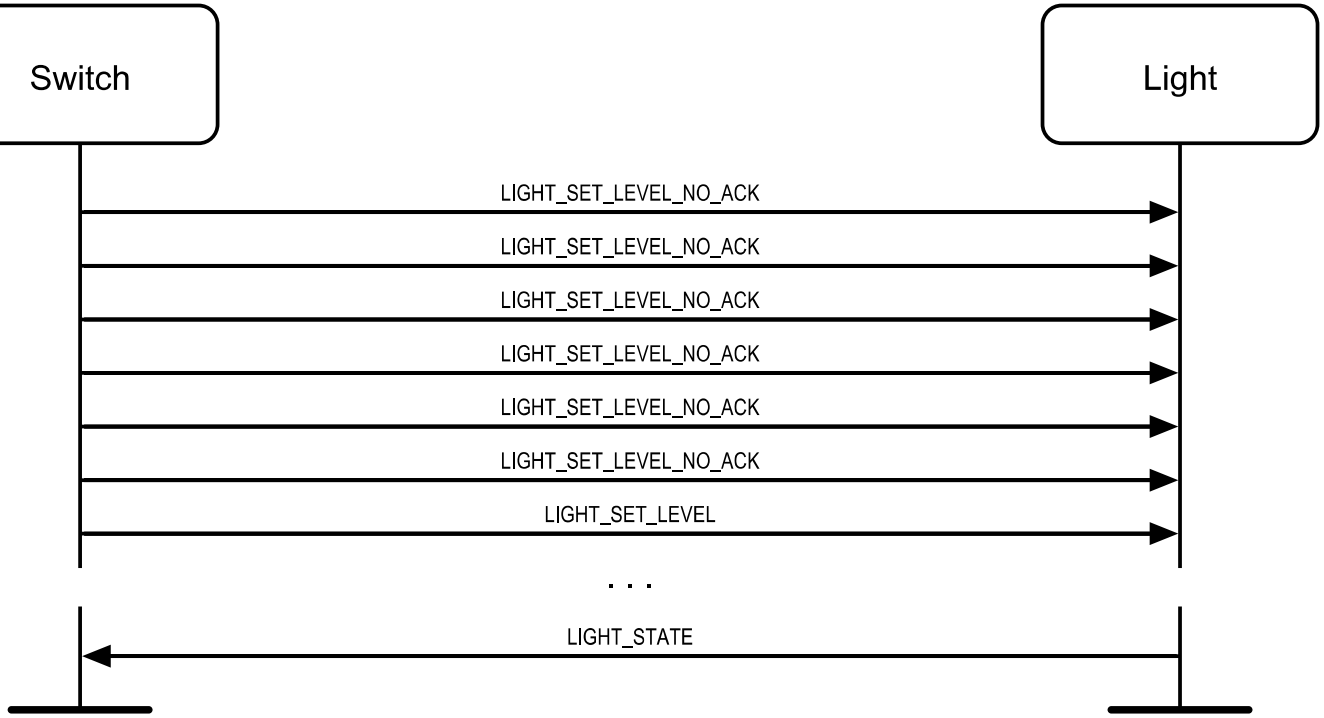


- Reliable transactions



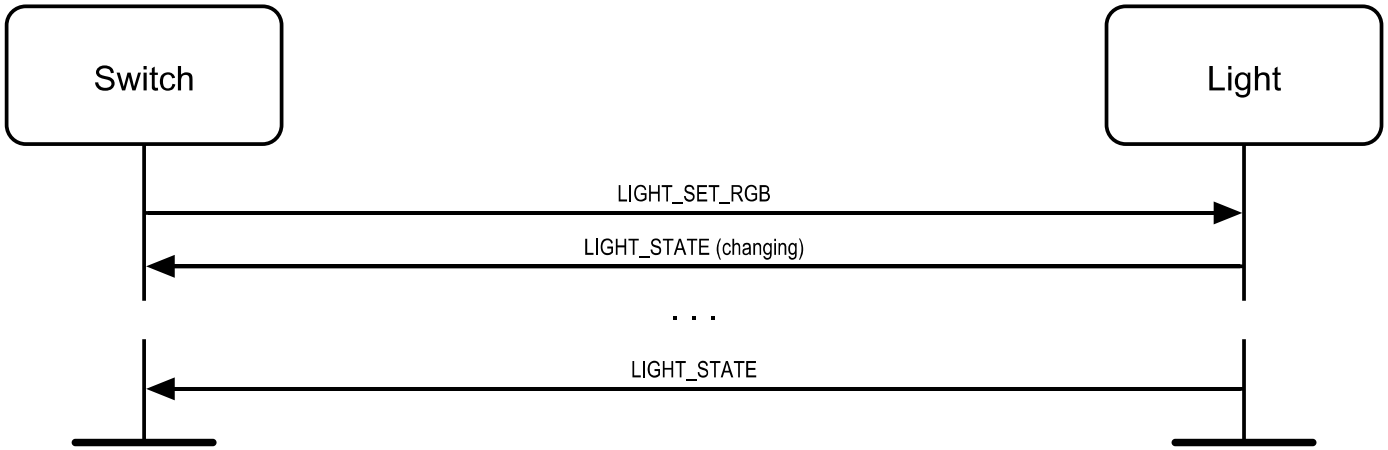
Example dimmer switch

- While rotating dimmer switch
  - only send LIGHT_SET_LEVEL_NO_ACK message
- When dimmer switch stops moving
  - send LIGHT_SET_LEVEL message



Example RGB light

- RGB lights can be changed “over time”
  - send LIGHT_SET_RGB with color and “duration”
  - LIGHT_STATE is sent to acknowledge this command
  - then LIGHT_STATE is sent once at commanded color

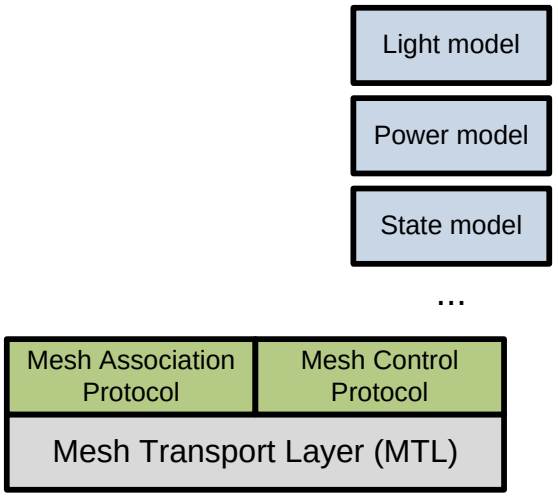


Network security

- Secure device association to the network and distribution of the network key
  - Diffie-Hellman-Merkle key exchange to prevent eavesdroppers
  - Authorisation codes are used to prevent man-in-the-middle attack
- Message encryption and authentication
  - Prevents against eavesdropping, replay and man-in-the-middle attacks
  - All messages also have Message Authentication Code

Technical design

- Mesh Transport Layer
  - Authenticates messages against known Network Keys
  - Enables relaying of messages through mesh network
- Mesh Association Protocol
  - Network management
- Mesh Control Protocol
  - Simple opcode / parameters
  - Opcodes grouped by models
  - Exposes set of models supported



Models

- Config Server model
  - Device discovery within the model, ID assignments, models implemented etc.
- Group model
  - Controls grouping of the devices by physical location or semantic meaning (“Kitchen”, “Living Room”, “Security control” etc.)
- Power model
  - Power state of the device – on, off, standby
- Switch model
  - Controls individual switches and changes state of the other devices or groups
- Light model
  - Controls brightness and colour of the light

Models

- Firmware model
  - Requests and controls the firmware update procedure
- Ping model
  - Pings specific device or group of devices in the network and allows estimation of the network physical topology
- Relay model
  - Remotely controls relay capabilities of the device (and bridging to the other technologies)
- Data model
  - Allows streaming of the data in custom format
- Battery model, Sensor model, Event model, Volume model, WallClock model etc.

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CSRmesh development resources

Resources

- CSRsupport*
  - *Access to CSRmesh™ on CSR Support granted to a verified account with product registration
  - Will be open to everyone who already have CSR µEnergy access
  - CSRmesh library
  - Application examples
    - On-chip, iOS and Android versions are available
  - Documentation
- Specification will be open publicly
  - Additional help through forum and wiki

CSRmesh™ development board

- New demo vehicle for CSRmesh™ applications
  - RGB LED
  - 2 push buttons (dimmer or volume control)
  - Slide on-off switch
  - External I²C temperature sensor

Part number: DB-CSR1010-10185-1A

CSRmesh™ development kit

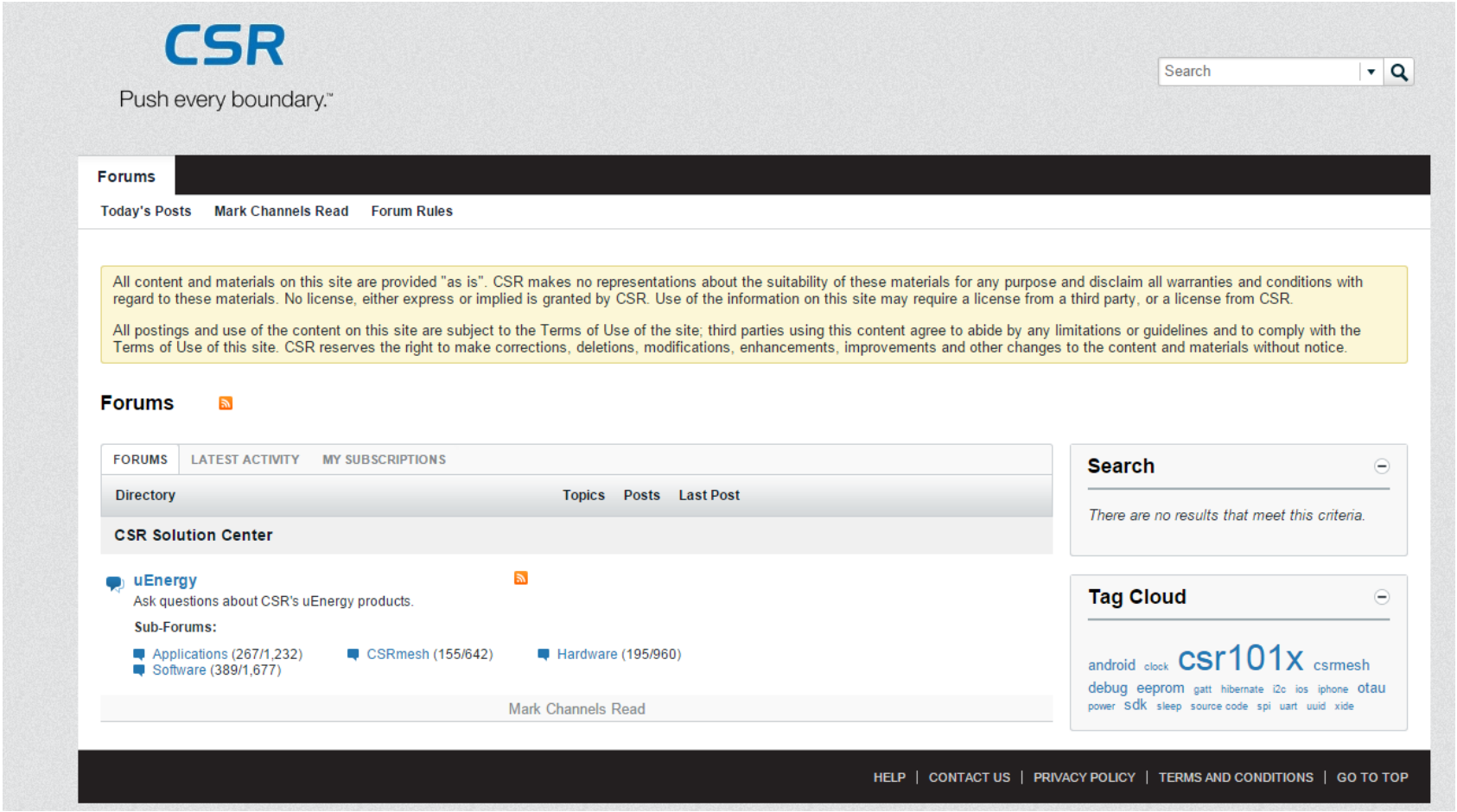
- Comprises:
  - 3 CSRmesh™ development boards
  - Programmer and cables
  - Quick start guide

Part number: DK-CSR1010-10184-1A

CSRmesh™ Milestones

- CSRmesh 1.2
  - Targeted for consumer lighting, available now
  - Light capabilities: on/off, dim, RGB, grouping, association/deassociation, over-the-air update, reading configuration, production tool
- CSRmesh 1.3
  - Adds home automation support, COMING SOON
  - HVAC, appliance, sensor model, actuator model, diagnostics tool
- CSRmesh 2.0
  - CSRmesh gateway support for remote monitoring, control and configuration, AVAILABLE THIS YEAR
  - Cloud and data services, multiple controllers

Developer support: forum



http://forum.csr.com/

Developer support: wiki

CSRmesh

Contents [hide]

CSRmesh

Low power wireless technology for the Internet of Things (IoT)

CSRmesh enables Bluetooth® low energy devices not only to receive and act upon messages, but also to repeat those messages to surrounding devices thus extending the range of Bluetooth Smart and turning it into a mesh network for the Internet of Things.

Features

- **Freedom of Control** - CSRmesh works directly with your existing devices. You can collect data and control devices with existing tablets and smartphones. There is no need for a special hub to connect your devices. You can configure and control devices with existing tablets and smartphones.
- **Simple Setup** - CSRmesh is simple and easy to setup. Just switch on the device. Discovery and control is then handled by the app on your smart device.
- **Safe and Secure** - CSRmesh uses high-level banking-like encryption to ensure safe and secure transmission of messages throughout your network. There is an additional authentication mode for enhanced security. Simplicity is maintained with a network passcode that is provided to authorised users and devices to enable them to participate in the mesh.
- **Applications** - CSRmesh has been initially developed to support wireless lighting control, but the protocol supports models for additional applications. Full home automation models enabling Heating, ventilation and Air Conditioning (HVAC), as well as security and sensing will be rolled out in the future.
- **Technology** - CSRmesh is a protocol layer that runs on top of the Bluetooth 4.0 standard. It is supported on single mode Bluetooth Smart devices as well as dual-mode Bluetooth Smart Ready devices. By using the existing Bluetooth standard it enables consumer products such as smartphones, tablets, TVs and set-top boxes to interact directly with devices within the CSRmesh network. CSR is actively working to standardise the technology and enable wide participation from many manufacturers.
- **Resources** - The CSRmesh development kit provides three development boards, a programmer and access to a full SDK to enable you to develop wireless switches and lights and evaluate the CSRmesh technology. Additional CSRmesh development boards can be purchased to expand your network

http://wiki.csr.com/wiki/CSRmesh

Developer support: webinars

Bluetooth® Smart Webinars

Click on the links below to watch our webinars again.

- *NEW!* CSR and ARM® mbed Webinar
- CSRmesh™ Digging Deeper
- Customising SDK Applications with CSR
- Getting started with Bluetooth® Smart
- Introduction to CSRmesh™

Please Note: If you do not already have codec installed please following the instructions provided by GoToWebinar

http://www.csr.com/bluetooth-smart-webinars

CSRmesh™ Development Kit: Video walk-through

https://youtu.be/hRJ3RQvsgn8

CSRmesh™ Development Kit: Video walk-through

http://v.youku.com/v_show/id_XNzgwMTkwMjI4.html

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