DALI connectivity webinar
Wednesday 7th July, 2021
Welcome to the DALI Connectivity Webinar

- Presentations will last for 40-45 minutes
- Followed by a Q&A session
- Please type questions into the “Q&A” box on your screen
- Presentation materials and a webinar recording will be available after the event:
  - www.dali-alliance.org/events
- We will also provide written answers to all questions
Agenda & Speakers

Part 1:
• Introduction: DALI, DALI-2, D4i and the DALI Alliance
• Key features

Part 2:
• DALI and Connectivity: Choice and flexibility with DALI+ and Wireless Gateways

Q&A:
• Type your questions into the “Q&A” box

Paul Droshin, General Manager, DALI Alliance
Scott Wade, Technical & Certification Manager, DALI Alliance
Introducing the DALI Alliance

Paul Drosihn, General Manager

DALI Alliance connectivity webinar
7th July 2021
Contents – Part 1 Introduction

• Introducing DALI, DALI-2 & the DALI Alliance
  – Introducing DALI
  – The DALI Alliance organization
  – DALI in the market
  – DALI trademarks and logos

• D4i and Zhaga-D4i

• Overview: What can DALI do?

• DALI for connectivity and IoT

Our new identity explains that we are the global industry organization for DALI.
We are also known as the Digital Illumination Interface Alliance (DiiA).
DALI-2: Smart, digital lighting control

- DALI® is an established protocol (language) for bi-directional, digital communication between lighting-control devices.
  - Technically managed in the open, global standard IEC 62386
  - Rich feature set, dedicated to lighting

- DALI-2™ is the certification program based on the latest version of the DALI protocol.

- DALI-2 is driven by the DALI Alliance (DiiA)
  - Ensures interoperability through testing and certification with trademark use

- DALI, DALI-2, D4i and DALI+ trademarks owned by the DALI Alliance
The DALI Alliance

- The DALI Alliance is an open, global consortium of lighting companies that aims to grow the market for lighting-control solutions based on DALI.

- Also known as Digital Illumination Interface Alliance

- More than 290 members worldwide, growing fast
  - Industry leaders in lighting and control
  - See www.dali-alliance.org/membership/member-companies.html

- Membership allows certification or registration of products:
  - Over 1,800 DALI-2 certified products
  - Over 1,400 DALI version-1 registered products

- Membership allows trademark use
Members and DALI-2 certified products

- DALI-2 LED drivers (Aug 2017)
- DALI-2 application controllers (June 2019)
- DALI-2 input devices (Nov 2019)
- D4i LED drivers (Dec 2020)
- D4i control devices (Dec 2020)
DALI market

- Very large installed base of projects, spanning three decades
  - See www.dali-alliance.org/awards
  - Also www.dali-alliance.org/projects

- Used in major infrastructure projects
  - e.g. Crossrail in London, MTA New York City Transit, Manchester Airport and Beijing Airport

- DALI is “the largest wired digital open protocol in the world for lighting.”
  - Pål Karlsen, research analyst, Omdia, LED Professional May/June 2020 issue, Link

- “Open protocols will be the growth winners over the next few years in smart lighting and connected controls.”
  - Ibid

- “DALI is the largest segment for smart lighting, with 15% CAGR expected over the next 5 years”
  - Global Smart Lighting Market research report, Link
D4i overview

- D4i is an extension of DALI-2 certification
- D4i components have a compulsory set of features
  - Based on power-supply and data specifications from DiiA
- All D4i LED drivers provide luminaire, energy & diagnostics data
- D4i enables DALI inside intelligent, IoT-ready luminaires
  - Other D4i implementations are also permitted
- D4i simplifies addition of sensors and communication devices to luminaires
- D4i enables plug-and-play interoperability when combined with a connector system
  - e.g. Zhaga Book 18 & 20 or NEMA/ANSI C136.41
Zhaga-D4i certification

A joint certification program based on complementary specifications

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**Specifications from DiiA enabling D4i certification**

**Book 18 & Book 20 specifications from Zhaga**

**DALI Part 250**: Integrated bus power supply  
**DALI Part 251**: Luminaire data  
**DALI Part 252**: Energy data  
**DALI Part 253**: Diagnostics data  
**DALI Part 351**: Luminaire-mounted control devices  
**DALI Part 150**: AUX power supply

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**Book 18 for outdoor:**  
**Book 20 for indoor:**
- Mechanical interfaces
- Electrical pin assignment (Book 18)
- Electrical connectors (Book 20)
- References to D4i specs for power & control, and luminaire tests

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What can DALI do?

Digital control of light quality with intelligent feedback

- **Interoperability**, backed by rigorous testing and certification, with trademarks
- Precise, repeatable **light-output control** and standardized dimming curve
- **Occupancy and light-level sensing**
  - DALI-2 sensors and other input devices provide information to the system
- **Luminaire, energy & diagnostics data**
  - Data for enhanced asset management & performance monitoring
- **Emergency lighting**, automated tests
- **Colour control** for human-centric-lighting, enhanced comfort and well-being
- DALI is already positioned to participate in the **Internet of Things**
- New specifications to enable DALI connectivity via **wireless networks and IP-based networks**
**DALI in an IoT world**

How does DALI fit with this simple IoT definition?

- **IoT:** A system of devices with *unique identifiers* and ability to *transfer data* over a network

DALI devices are individually addressable

Data exchange is inherent in DALI, due to bi-directional communication

Multiple current & emerging options, including wireless

**DALI is already positioned to participate in the Internet of Things**
DALI in an IoT world – Connectivity

Current DALI capabilities:

• Multiple DALI subnets can be networked together, for building-wide control
  – A single application controller can control multiple DALI subnets
  – Several application controllers can be connected together via a backbone e.g. Ethernet-based

• DALI systems can connect with other networks via non-standardized gateways
  – e.g. Gateways connecting with building-management systems (BMS)

• D4i facilitates addition of wireless nodes (network lighting controllers) to luminaires
  – Standalone luminaires can participate in remote lighting-control networks

Emerging DALI capabilities:

- DALI connectivity via wireless networks
- DALI connectivity via IP-based networks
Agenda & Speakers

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Scott Wade,
Technical & Certification Manager, DALI Alliance

Paul Drosihn,
General Manager, DALI Alliance
DALI and Connectivity – Choice and flexibility with DALI+ and Wireless Gateways

Scott Wade, DALI Alliance

7th July 2021
Agenda

• DALI connectivity – Two new solutions

• DALI gateways
  – Architecture
  – Supported ecosystems

• DALI+
  – Architecture
  – Supported wireless carrier
  – New trademark

• Developing, testing and certifying products

• Finding products in the product database
DALI connectivity – Two new solutions

• Two very different solutions allowing wireless connectivity have been developed by the DALI Alliance with our members.
  – These provide two different “ways of working” – explained later.
  – These solutions were developed in line with the requests from our members.
  – They cover the various lighting applications, considered by our members to be the priority for enabling standardised wireless connectivity.

• The next slide will show the two solutions in examples:
  – **DALI gateways** (left side)
    ▪ Allow existing DALI wired products to be used in a non-DALI wireless ecosystem.

  – **DALI+** (right side)
    ▪ Devices communicate using existing DALI commands, carried over a wireless medium.
Wireless solutions for DALI

DALI Gateways

- Gateway
- zigbee
- Bluetooth

DALI+

DALI+ with

devices

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DALI Gateways

- Gateways translate between DALI and a wireless protocol
- Initial support is for Bluetooth mesh lighting and Zigbee lighting
Gateway implementation: DALI-2 subnets

Wireless mesh network

DALI-2 wired subnet

DALI application controller

DALI bus

Sensor

Luminaire
Gateway implementation: D4i luminaires

This implementation also works for DALI-2 luminaires
Wireless Gateways – Overview

- Allow existing wireless ecosystems to **control** and **query** DALI control gear:
  - Wireless devices communicate using their existing protocol, and can talk with the gateway.
  - The gateway provides a wired DALI connection, supporting at least 4 DALI control gear in the same luminaire or system (broadcast control).
  - Wireless devices can control light output and fading of the DALI devices.
  - Wireless devices can read lamp failure information, and data from parts 251-253, from the DALI devices.

- Two wireless ecosystems will be supported initially:
  - **Bluetooth Mesh lighting model**
    - New control device feature: DiiA Specification, **part 341** (feature type 41)
  - **Zigbee**
    - New control device feature: DiiA Specification, **part 342** (feature type 42)
Wireless Gateways – Features

• **Lighting control**
  – Broadcast control of light output from the connected control gear.
  – The capability and limits of the ecosystem levels and fade times, apply.

• **Data**
  – Gateways provide the ecosystem devices with access to much of the data from:
    ▪ parts 251 (luminaire data), 252 (energy/power), 253 (diagnostics), and
    ▪ common control gear information: control gear missing/failure, lamp failure, light source type.
  – Data is aggregated from the connected control gear, and presented to the ecosystem as a single set of data.

• **Security**
  – Gateways are subject to the requirements of the ecosystem. This means that the security features of the wireless ecosystem apply.
Wireless Gateways – Features

• **System limits**
  – Gateway will support collection of data from 4 control gear, but manufacturers can design their gateways to optionally support more control gear.
  – In the first version, level commands are broadcast to all control gear.
  – The usual rules apply for bus power. It is likely that many gateways will have a DALI bus power supply integrated, avoiding the need for an external bus power supply.

• **Future additions under consideration**
  – Individual addressing and control of connected control gear.
  – Support for input devices (using event messages and polling).
  – Specific features of control gear device types, such as those described in parts 202, 207 and 209 (device types 1, 6 and 8).
  – Support for other wireless ecosystems may be considered.

• **Tests** are under development!
  – Gateways implement at least IEC 62386 parts 101 and 103, and either DiiA Specification part 341 or 342.
• **DALI+ system**
  - The entire DALI+ system communicates using the existing DALI language.
  - Commands are efficiently packaged into frames.

• **Wireless carrier**
  - Frames are transported using a carrier – **Thread** is supported initially.

• **DALI+ devices**
  - All DALI control gear and control devices from IEC 62386 can be implemented in DALI+. Examples include LED drivers, colour controllable drivers, emergency drivers, application controllers, buttons, and sensors.

• **Support for wired DALI**
  - A DALI+ **bridge** allows application controllers in the DALI+ system to control, configure and query devices in a DALI wired system.
• **Connection to other systems**
  
  – Just as with a DALI wired system, DALI+ systems may be connected to other systems.
  
  – For example: connection to a BMS through a BACnet interface.
  
  – Additionally, a backbone may be used to connect multiple DALI+ systems together. An example is using Ethernet.
• **Support for multiple subnets**
  - Just as with DALI wired systems, DALI+ application controllers may support multiple subnets
  - These can be any combination of DALI+ and wired DALI subnets.
  - The example shows an application controller with 3 subnets: 2 are wired DALI and 1 is DALI+.
• **DALI+ bridges**
  - These allow one or more wired DALI subnets to be controlled or accessed from a DALI+ system.
  - Application controllers in the DALI+ network can control, configure and query DALI wired devices.
  - All types of DALI wired control gear and control devices are supported.
  - Example: a luminaire containing a DALI+ bridge, and DALI wired devices – LED drivers and a sensor – can be controlled from the DALI+ system, and events from the sensor are transported across to the DALI+ system allowing application controllers to trigger lighting changes.
• **DALI+ with Thread**
  - Thread is the first wireless carrier that will be used for DALI+ devices.
  - Thread is a wireless protocol, transporting IPv6 packets using the low-power wireless technology, 6LoWPAN.
  - Other Thread devices may be used in the same Thread network as the DALI+ devices.
  - Thread **border routers** allow connection through other IP-based physical layers, for example Ethernet or Wi-Fi.
  - This allows for highly scalable systems.
• Devices communicate using **existing DALI commands**, arranged into frames that are carried over a wireless medium.
  – There is **no wired DALI bus** (except for bridges).

• Each device implements IEC 62386-104, with the DiiA additions and changes.
  – Commands and features in the current and future IEC 62386 parts are used.
  – For example, a DALI+ colour controllable LED driver will implement parts 101, 102, 104, 207, 209 and the additions and clarifications from DiiA.

• **Bridges** allow access to DALI wired luminaires or subnets, from the DALI+ subnet.

• **Thread** will be the first wireless carrier that is supported in our testing and certification.
  – Thread border routers allow DALI+ communications through other IP-capable media, such as Ethernet and Wi-Fi.
  – In the future, DALI+ is likely to be extended to include other carriers such as Bluetooth Mesh, Ethernet and Wi-Fi.

• **Security** is provided by the authentication and encryption methods that are already part of Thread, with CoAPs providing further application level security and reliability.
System example

Wireless interface and application controller

Wireless Switches

Wireless Sensors

Wireless Bridges

Luminaire

TCP/IP & other Application Controllers

Image courtesy of: zencontrol

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Developing, testing and certifying products

- Use the **IEC 62386 & DiiA standards**:  
  - [https://www.dali-alliance.org/dali/standards.html](https://www.dali-alliance.org/dali/standards.html)

- In addition, check the DiiA’s **Clarifications** document:  
  - [https://www.dali-alliance.org/members/documents/](https://www.dali-alliance.org/members/documents/)  
  - Describes many clarifications, changes and additions to the IEC 62386 parts. These changes are fed back into IEC to make updates to the standard.

- For DALI **gateways**:  
  - Bluetooth mesh: DiiA Specification – Part 341 Bluetooth mesh Gateway  
  - Zigbee: DiiA Specification – Part 342 Zigbee gateway

- For **DALI+** products: DiiA Specification – Part 104 Changes and Additions

- Develop your product to meet these specifications, not simply to pass the tests!
Developing, testing and certifying products

• **Test** with the latest version of test sequences:
  – [https://www.dali-alliance.org/members/test-sequences/](https://www.dali-alliance.org/members/test-sequences/)
  – There are several “**known issues**”. Check on the above web-page.

• The next release is expected to be made in August, and will include:
  – Part 202 – Control gear – Self-contained emergency lighting
  – Part 206 – Control gear – Converter to d.c. voltage
  – Part 209 – Control gear – Colour: the additional colour types RGBWAF and xy

• Test sequences for DALI+ and gateways are now in development, but are not expected to be ready until 2022.
Testing, certification and Trademark use on wireless devices

- As soon as test sequences are released, **certification** for these devices will start.

- **Gateway devices** will be included in DALI-2 and D4i testing and certification.

- **DALI+** devices will use the new trademark:  
  - This will be used in conjunction with the Trademark relating to the carrier, for example Thread.

- Reminder: Only products that are listed as certified in the product database, can use the appropriate Trademarks, which include DALI, DALI-2, D4i and DALI+.
Finding certified products

• Once a product is certified, it is visible to the public in the **product database**:  
  – [https://www.dali-alliance.org/products](https://www.dali-alliance.org/products)

• Use the search-filter to select specific properties

• The example shows the following selected:  
  – Control gear
    ▪ Colour control (part 209, DT8)
      ▫ Colour type Tc

• With these “filters” selected, only products that meet all properties are shown in the results.

• Searching for DALI gateways and DALI+ will be included once certification starts.
Summary

- New connectivity solutions:
  - DALI gateways
  - DALI+

- Coming soon:
  - Technical Guides for Gateways and DALI+
  - DALI Lighting Awards 2021-22

- Enquiries:
  [www.DALI-Alliance.org/contact](http://www.DALI-Alliance.org/contact)

- Q&A