

How D4i and DALI-2 can help you win the L-Prize

Scott Wade, DALI Alliance

19th August 2021



Agenda

How D4i and DALI-2 can help you win the L-Prize

- Introduction: DALI, DALI-2, D4i and the DALI Alliance
- DALI parts helping L Prize criteria
- What is D4i?
- Testing & Certification



Scott Wade,
Technical &
Certification Manager,
DALI Alliance

DALI – The basics




Digital **A**dressable **L**ighting **I**nterface

- DALI® is the industry-standard protocol (language) for bi-directional, digital communication between lighting-control devices.
 - Dedicated to lighting, with a rich feature set
- DALI is technically managed in the open, global standard IEC 62386.
- DALI-2™ is the latest version of the DALI protocol.
- DALI-2 and D4i certification is driven by DiiA, the global DALI alliance.
 - Ensures interoperability through testing and certification with trademark use
- DALI, DALI-2 and D4i trademarks are controlled by DiiA.



The DALI Alliance

- The DALI Alliance (DiiA) 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.
 - Industry leaders in lighting and control
- Membership allows certification or registration of products:
 - Over **1,870 DALI-2 certified products (including D4i)**
 - Over 1,460 DALI version-1 registered products
- Membership allows DALI, DALI-2 and D4i **trademark use.**



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](#)*

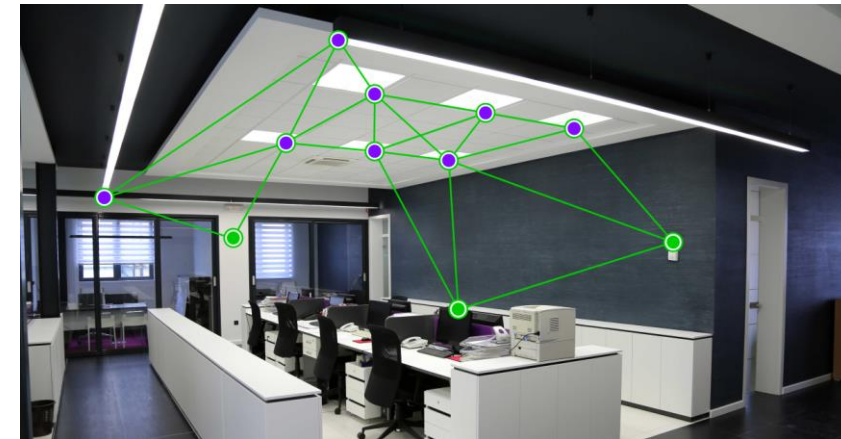


Mapping D4i and DALI-2 to L-Prize criteria

The U.S. Department of Energy lists several areas that winning systems must meet.

D4i and DALI-2 help meet the criteria:

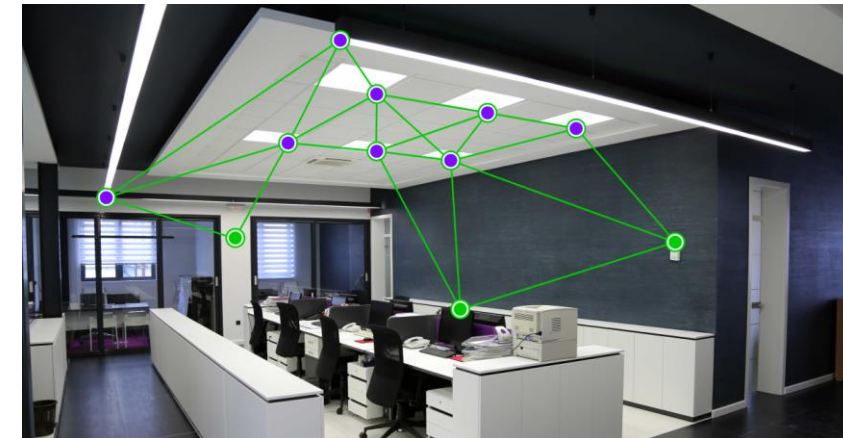
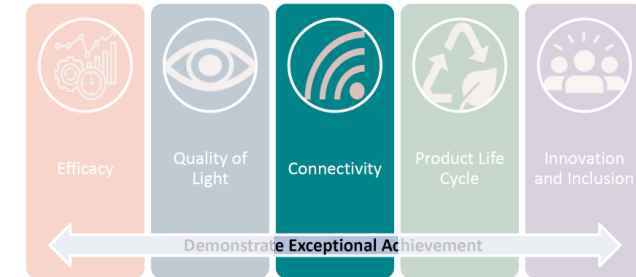
- **Efficacy (up to 10 points)**
 - **Wide dimming range + individual addressability:** get just the right amount of light in just the right places.
- **Quality of Light (up to 8 points)**
 - **Light output:** Part of the DALI specifications and tests, for all D4i and DALI-2 LED drivers.
 - **Colour:** DALI part 209 – from simple tunable white to full xy-chromaticity.
 - **Dimming range:** The DALI standard allows for dimming down to 0.1%. Check with the driver manufacturer.



Mapping D4i and DALI-2 to L-Prize criteria

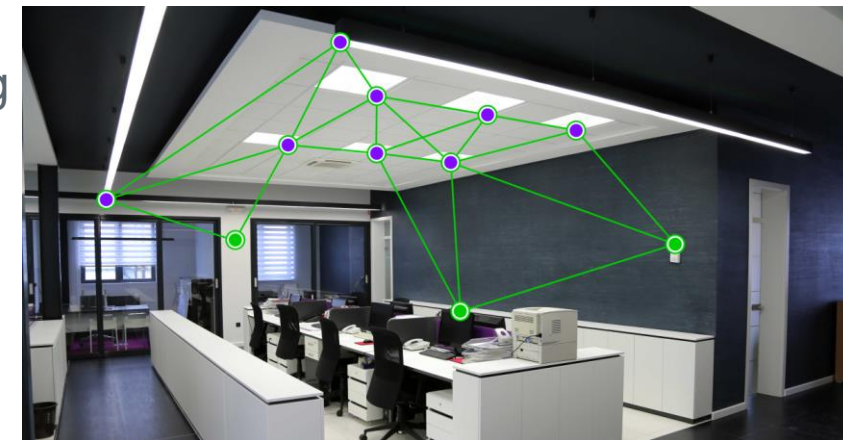
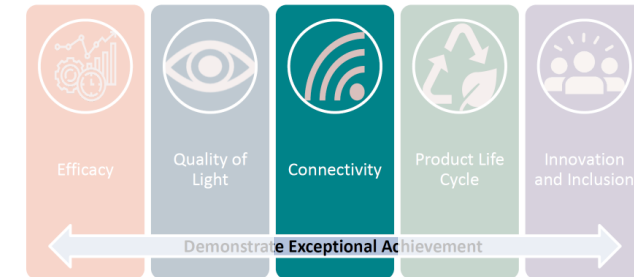
- **Connectivity (up to 11 points)**

- **Technical interoperability:** D4i and DALI-2 use international industry standards, with testing and certification, ensuring a high level of interoperability.
- **Application interoperability:** Standardised data available from D4i LED drivers.
- **Addressability:** D4i and DALI-2 drivers are individually addressable.
- **Energy reporting:** D4i drivers provide energy and power data.
- **Lighting control strategies:** All are supported.
- **System resilience:** Operation through power cycles, short power interruptions and bus failure is defined, configurable, and tested.



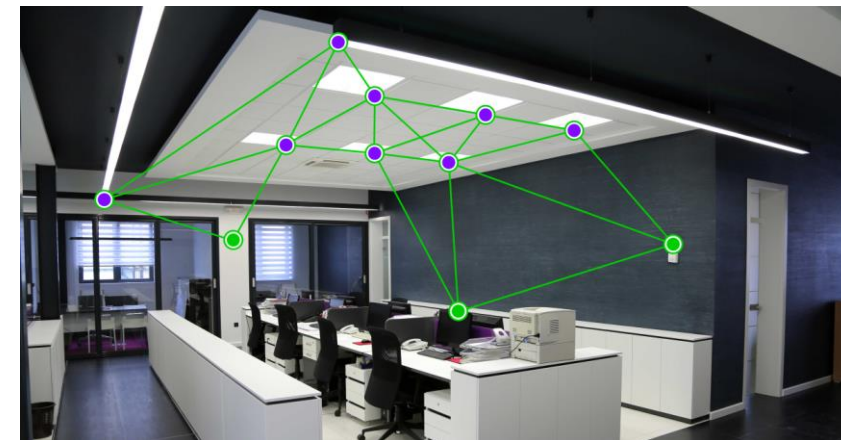
Mapping D4i and DALI-2 to L-Prize criteria

- **Connectivity (up to 11 points) - continued**
 - **Fault detection and diagnostics (FDD):** DALI-2 includes fundamental information, with D4i adding more.
 - **Luminaire level lighting control (LLLC):** D4i or DALI-2 sensors can be attached to individual luminaires. Addressability allows control of a single luminaire, a group of luminaires or all luminaires.
 - **Grid services capable:** Check with your supplier for suitable D4i or DALI-2 control devices that provide demand-response functionality.
 - **Sensor ready and upgradeable:** D4i luminaires are ready for sensors or communication devices to be plugged-in or upgraded.
 - **Ease of installation and configuration:** Simple 2-wire bus providing communications and power, that simply connects to all devices in parallel, using a daisy chain and/or star connections.



Mapping D4i and DALI-2 to L-Prize criteria

- **Product Life Cycle (up to 7 points)**
 - **Replaceable components:** Interoperability of drivers and control devices enables replacement by using appropriately specified components.
- **Innovation and Inclusion**
 - Initial cost minimised by allowing sensors/communication devices to be plugged-in later, if required.
 - Future: DALI-2 and D4i are still evolving, with new standards and certification being added. For example, centralized emergency lighting to complement the existing standardisation of DALI self-contained emergency lighting.



What is D4i?

D4i is an extension to DALI-2:

- Control gear (drivers) require a minimum set of functionality for D4i
- Control devices require functionality to aid “plug & play”
- Luminaires require up to four D4i drivers.
 - Especially for intra-luminaire use: DALI is inside the luminaire
- 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

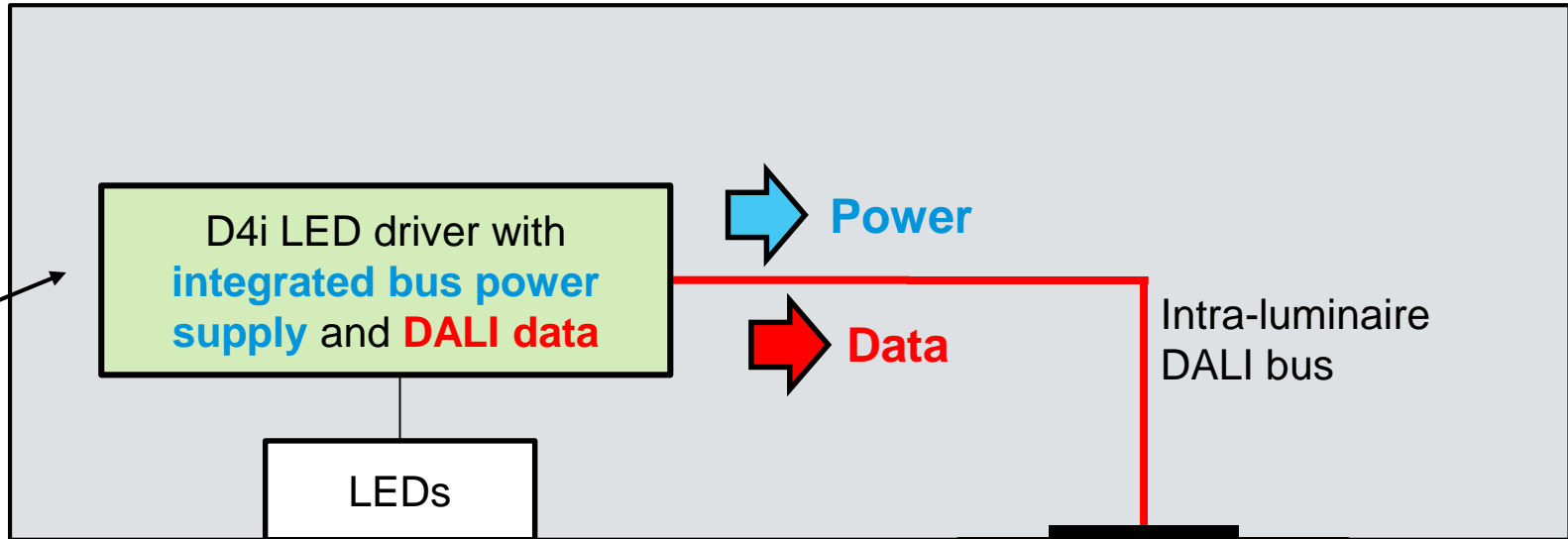


D4i example luminaire



DALI Part 250
(integrated bus power)

DALI Parts 251-3
(data for enhanced asset tracking & performance monitoring)



DALI Part 351
(luminaire-mounted control devices)

Data specifications



- Data for enhanced asset management & performance monitoring
- Data storage in DALI memory banks, with standardized format & locations



Luminaire Data

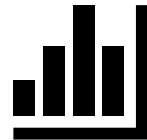


DALI Part 251 – Luminaire Data

- Information about the luminaire (e.g. GTIN, light output, CCT & CRI, light distribution etc) can be stored in the LED driver
- Enables asset management



Energy Data



DALI Part 252 – Energy Reporting

- Provides real-time power & energy usage for LED drivers



Diagnostics Data

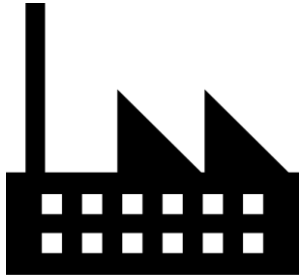


DALI Part 253 – Diagnostics & Maintenance

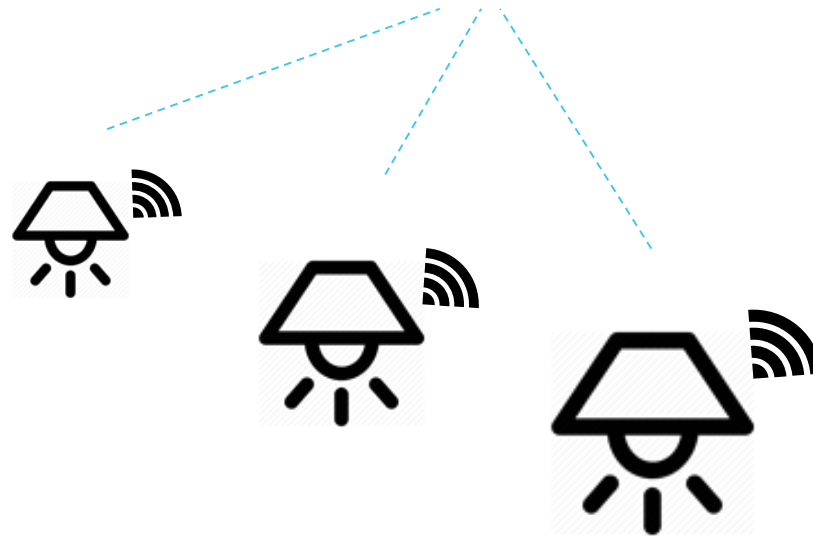
- Operating data for control gear and lamps, including failure conditions, run-time data
- Enables predictive maintenance

- **These specifications are available from DiiA, and are also included in ANSI C137.4.**

Using DALI data: Example

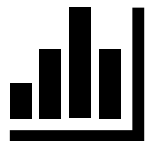


In the factory:
Luminaire data is programmed into drivers.



During operation:
Performance monitoring

- Energy usage data can be used e.g. for billing



In the field:

Automated commissioning

- When installed, luminaires can automatically transfer data to a remote network
- Reduces human error, saves installation time and cost
- Operator has a full map of asset information

During operation:

Predictive maintenance

- Diagnostics data allows network operator to anticipate need for maintenance
- Repair team has knowledge of location and type of fixture



Testing & certification



DALI-2 and D4i products are tested and certified:

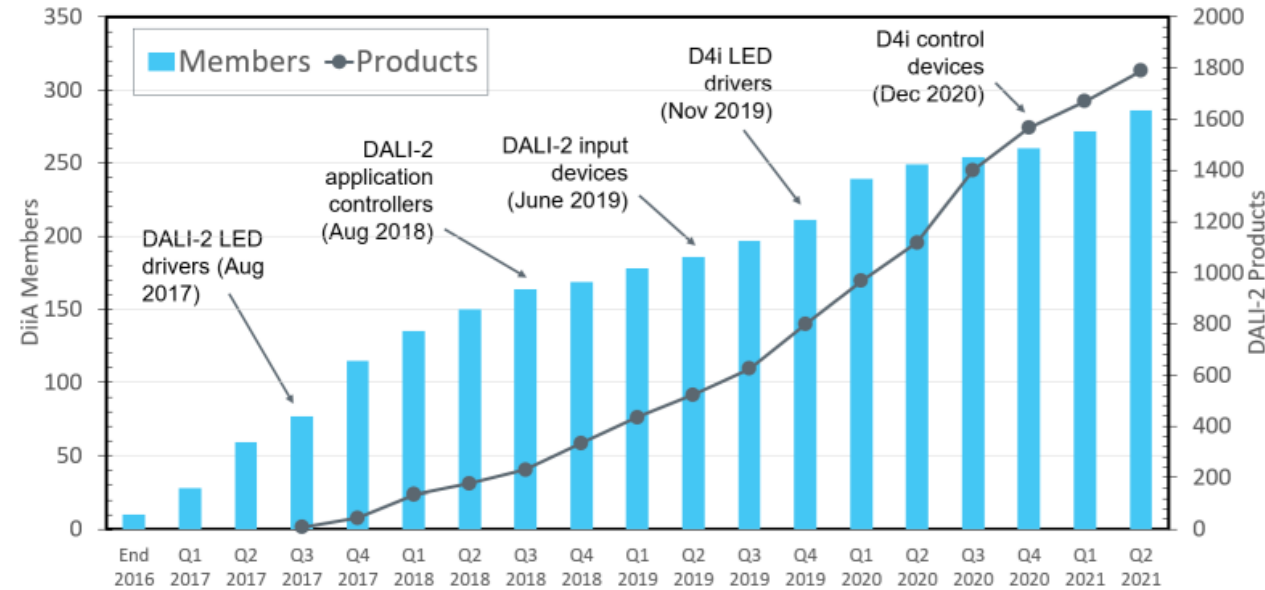
- **Testing**
 - Compliance testing may be carried out by the DALI Alliance member, or at an accredited test-house.
- **Test-houses**
 - Accredited test-houses are listed on the DALI Alliance website:
 - www.dali2.org/testing/test-houses.html



- **Certification**
 - Product information and test results are submitted to the DALI Alliance for verification, before D4i or DALI-2 certification is granted.
 - Once certification is granted, products are publicly listed on the website.

Product database

- All D4i and DALI-2 certified products are listed and searchable on the DALI Alliance website:
 - www.dali-alliance.org/products
- The product information shows if D4i certification was achieved in addition to DALI-2, and shows the specific parts of the standard that are implemented, such as luminaire data, power/energy and diagnostics data.



D4i and Zhaga–D4i certification

DALI Alliance members

Zhaga members

LED driver

D4i
certification
→

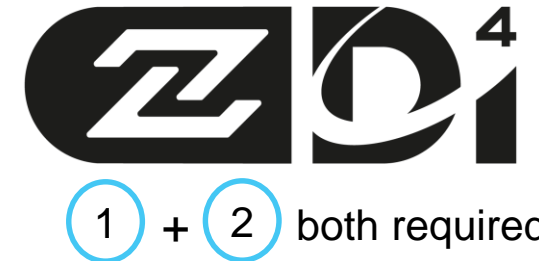


Control device

1
D4i
certification
→



2
Zhaga
certification
→



Luminaire

*Use of D4i
components*



Zhaga
certification
→



Connector

Zhaga
certification
→

