DALI-2:
The global standard for smart, digital lighting control in the IoT era
物聯網時代智慧，數位，照明控制的全球標準

Scott Wade, DiiA Technical & Certification Manager – DiiA

29th October 2019, **Hong Kong International Lighting Fair**

Digital Illumination Interface Alliance

DALI

# DALI-2: The global standard for smart, digital lighting control

Digital Addressable Lighting Interface

- **World-wide standard** for lighting control communications

- Technically managed in the open standard **IEC 62386**

- Driven by Digital Illumination Interface Alliance (DiiA)

- Ensures **interoperability** through **testing, certification** and **registration** with **trademark** use

- **Control, configuration & querying** of devices over a 2-wire bus

- **Individual, group & broadcast addressing** to any DALI device

- DALI, DALI-2 and D4i trademarks owned by Digital Illumination Interface Alliance

Membership (October 2019)

- **190+ members** world-wide

- Membership allows DALI trademark use:
  - **600+ DALI-2** certified products
  - **1000+ DALI version-1** registered products

- **Membership types:**
  - **Regular**
  - **Associate**
  - **Community registration** – for luminaire makers

Membership benefits

Digital Illumination Interface Alliance
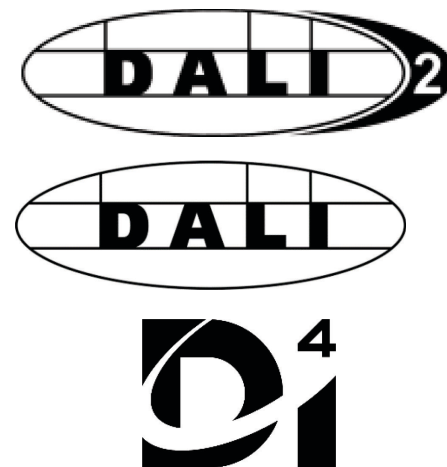
	ASSOCIATE MEMBER	REGULAR MEMBER	COMMUNITY (note 2)
Access to DiiA test sequences	X	X	
Certification of DALI-2 products, use of DALI-2 logo on certified products	X	X	
Use of logos (DALI-2, DALI version-1) on luminaires containing DALI devices from DiiA members	X	X	X
Use of DALI version-1 logo on products other than luminaires	X	X	
Use of DiiA logo and DALI version-1 logo for marketing materials	X	X	X
Access to members-only website	X	X	
Participation in General Assembly meetings	X	X	
Receive membership communication	X	X	X
Access to draft deliverables (test sequences, specifications)		X	
Approval of final deliverables		X	
Participation and voting in working groups. Contribute to DiiA roadmap and development of test specifications.		X	
Participation in interoperability events (Plugfests)		X	
Eligible for Board of Directors membership		X	

Membership benefits:

www.dali2.org/membership/benefits.html

Member companies

For the latest list of members:
www.dali2.org

First DiiA Members' Plugfest Vienna 4-5 September

- 18 companies attended, bringing an estimated 70-100 products
- Control gear, control devices and bus power supplies
- 1 to 1 testing, as well as larger system testing
- Excellent cooperation between members to develop DALI.
- All gained confidence in their products, with many finding minor issues or areas for improvement.

Digital Illumination Interface Alliance

DiiA events in 2020 – under consideration

DiiA is considering events in the Asia-Pacific region in 2020

- **Please let us know** if your company is interested in participating in DiiA events in 2020
- Several possibilities are:
  - **Plugfest** (product testing event)
  - **Technical training** (DALI-2 and D4i specifications)
  - **DALI Summit** + Seminars
- **Which location(s) are preferred?** For example:
  - Hong Kong
  - Shenzhen
  - Shanghai
  - Beijing
  - Taipei
  - Tokyo

Digital Illumination Interface Alliance

Key facts – devices

Currently, the standard describes **three basic types** of devices:

- **Control gear**
  - Normally directly connected to the lamp (example: LED drivers)

- **Control devices**
  - Application controllers: Make decisions and control the lights
  - Input devices: Provide information to the system (example: occupancy sensor)

- **Bus power supplies**
  - Provide typically 16 V, up to 250 mA to power the bus.

Key facts – technical limits

- **Maximum 64+64 addresses per DALI subnet**
  - 64 drivers (control gear)
  - 64 control devices

- **Maximum 300 m cabling (between furthest-apart devices)**

- **250 mA max. bus power supply**

Digital Illumination
Interface Alliance

Key facts – digital benefits

- **Digital benefits**
  - Robust communication
  - Addressing: individual (64+64), groups (16/32) and broadcast (all)
  - Flexible: Changes can be made via software
  - Flexible: Simple operation "out-of-box"
  - Two-way communication (feedback)
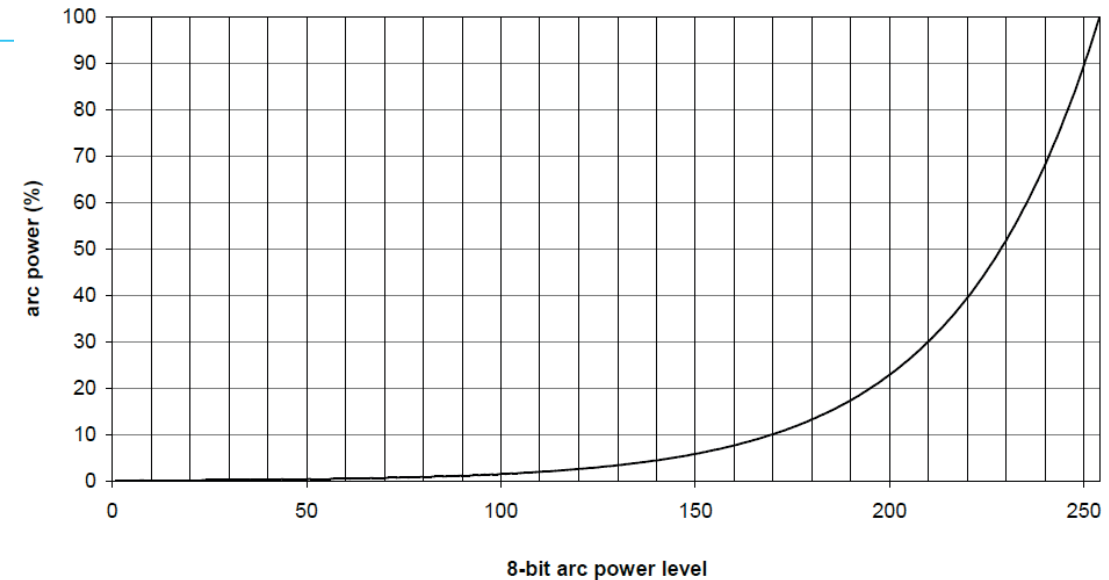
- **Cabling benefits**
  - Standard 2-core cable (1.5mm²)
  - Polarity-free & free wiring topology
  - DALI power and data on same pair of wires

DALI benefits – light output

- **"If you ask for 50%, you get 50%"**
  - The dimming curve is standardised and tested
  - This means that devices follow the same dimming curve, maintaining light output consistency

DALI benefits – colour control

- Allows **simple control** of colour:
  - **RGBWAF** for individual control of each colour channel
  - **Tc**/tuneable white for colour temperature control

- Allows **precise and repeatable selection of colour**:
  - **xy**

- Allows smooth fading between colours

- For best results, **xy** and **Tc** colour types allow **calibration**

Digital Illumination
Interface Alliance
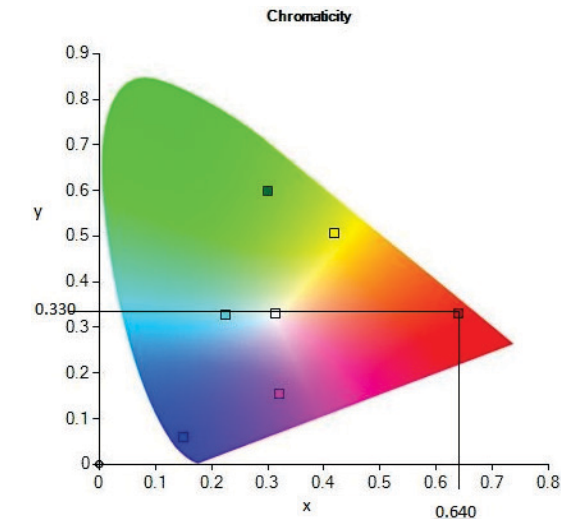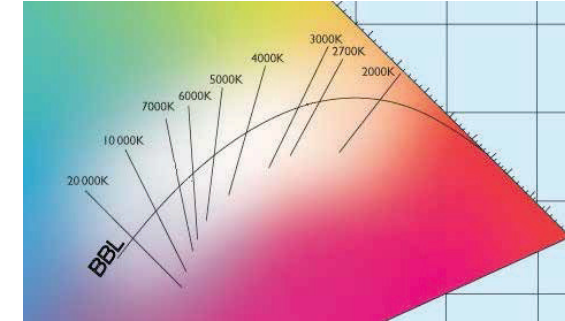
DALI benefits – emergency lighting

- **Automated self-testing:**
  - In many countries, there is a **legal requirement** for periodic testing of emergency lighting
  - DALI allows this to be automated:
    - **Function test**: quick test of the battery, charging circuit, driver/relay and lamp
    - **Duration test**: checks operation for the rated duration (for example: 1 h, 3h...)

- **Feedback:**
  - Test results and information on failures
  - Other information, including battery charge level, lamp operating hours and more.

DALI benefits – Data/diagnostics for IoT

Recent new specifications from DiiA:

- 5 new specifications for control gear and a 24V power supply (parts 150, 250-253)
  - Provide: **luminaire data**, **power/energy measurement**, **diagnostics** information
- New Trademark to indicate suitability for **intra-luminaire** and small systems up to **4 luminaires**
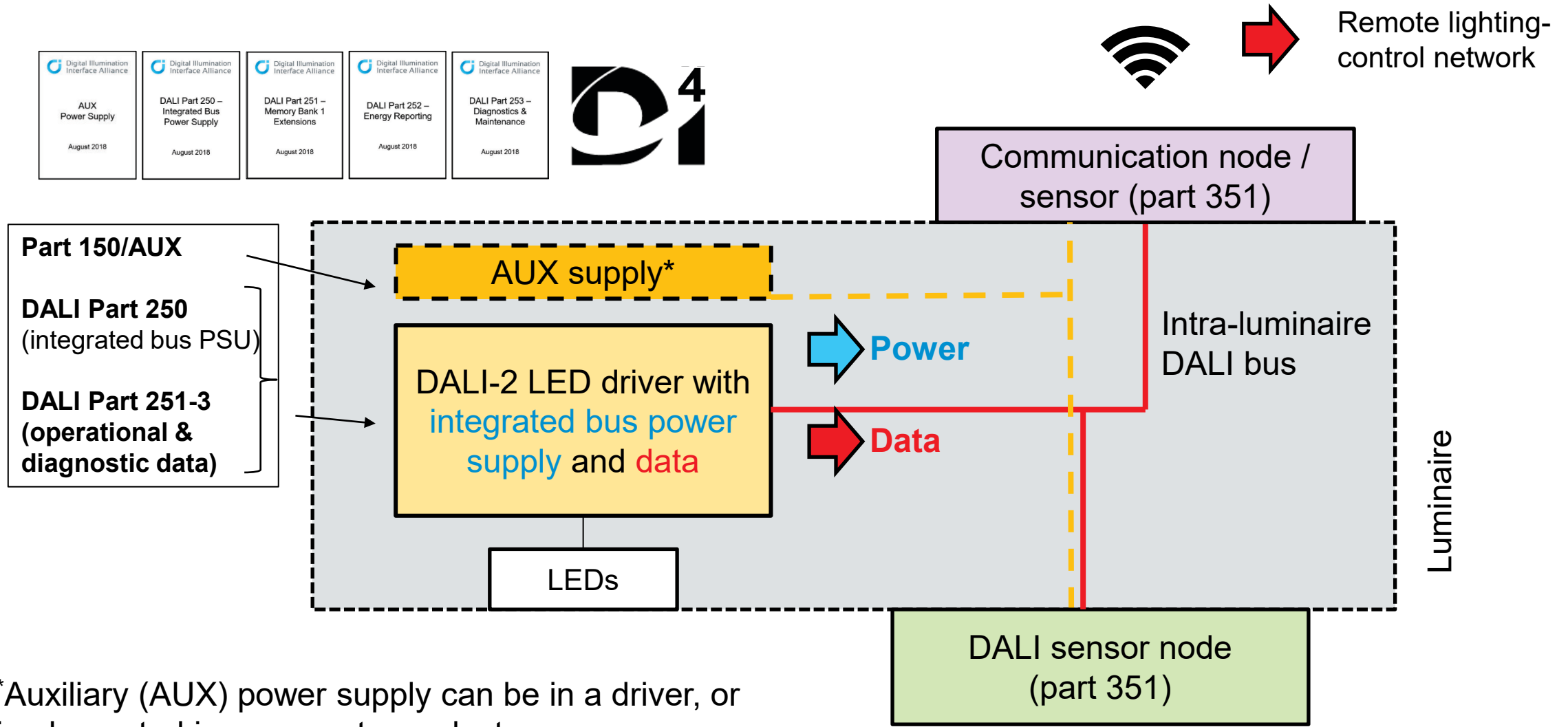
Coming soon:

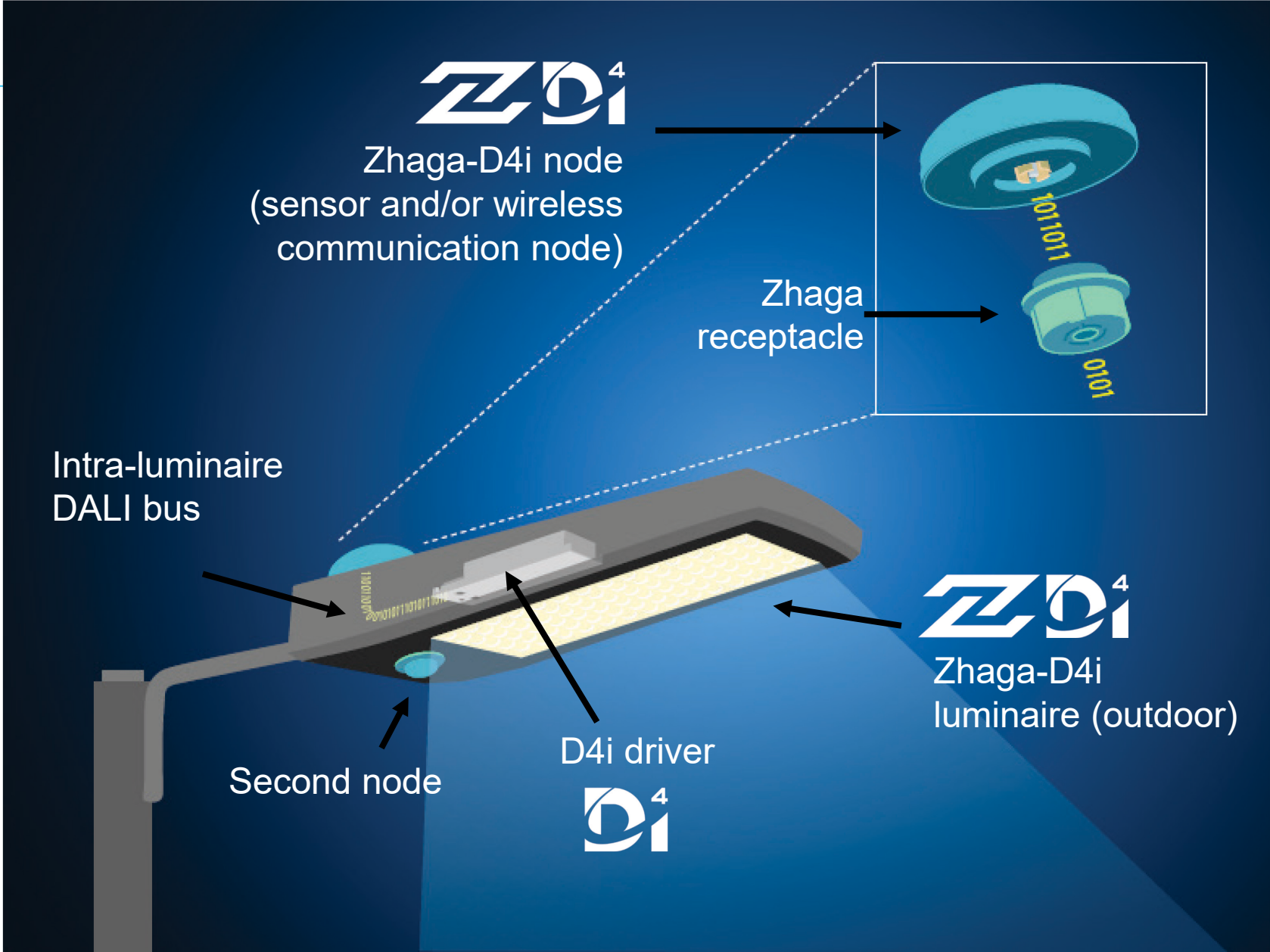- New specification for **luminaire-mounted control devices** (part 351)
- **Certification**

Digital Illumination Interface Alliance

D4i specifications for intra-luminaire DALI (outdoor luminaires)

Remote lighting-control network

Communication node / sensor (part 351)

Intra-luminaire DALI bus

Part 150/AUX

DALI Part 250 (integrated bus PSU)

DALI Part 251-3 (operational & diagnostic data)

AUX supply*

DALI-2 LED driver with integrated bus power supply and data

Power

Data

LEDs

Luminaire

DALI sensor node (part 351)

*Auxiliary (AUX) power supply can be in a driver, or implemented in a separate product.

AUX Power Supply — August 2018

DALI Part 250 – Integrated Bus Power Supply — August 2018

DALI Part 251 – Memory Bank 1 Extensions — August 2018

DALI Part 252 – Energy Reporting — August 2018

DALI Part 253 – Diagnostics & Maintenance — August 2018

Digital Illumination Interface Alliance

Zhaga – D4i

Zhaga-D4i node
(sensor and/or wireless
communication node)

Zhaga
receptacle

Intra-luminaire
DALI bus

Zhaga-D4i
luminaire (outdoor)

D4i driver

Second node

Digital Illumination
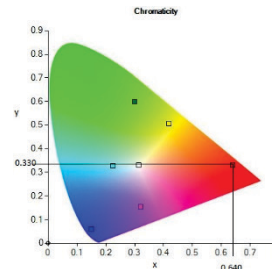Interface Alliance

Specifications and tests – Recent or in progress

- **Input devices (301-304)**
  - Tests released and certification started (**May 2019**)

- **D4i and parts: 150, 250-253, 351:**
  - D4i certification: starting soon
  - Updates to parts 150, 250-253
  - New specification, part 351: Luminaire mounted control devices

- **DALI-2 tests for the following are in progress:**
  - 209 – Colour control
  - 208 – Switching control gear
  - 205 – Dimmer
  - 202 – Self-contained emergency lighting

Specifications and tests – Work in progress (2)

- **Other specifications in progress:**
  - 306 – Generic sensor
  - 305 – Colour sensor (IEC)
  - DALI-wireless

- **Future work:**
  - Tests for 105 – Firmware update
  - Tests for 220 – Central emergency

DALI wireless

- **DiiA recently announced that two routes are being investigated:**
  1. DALI wireless **gateway**
  2. DALI wireless using **IEC 62386-104**

- The DiiA Technical & Certification Work Group is now working on both options

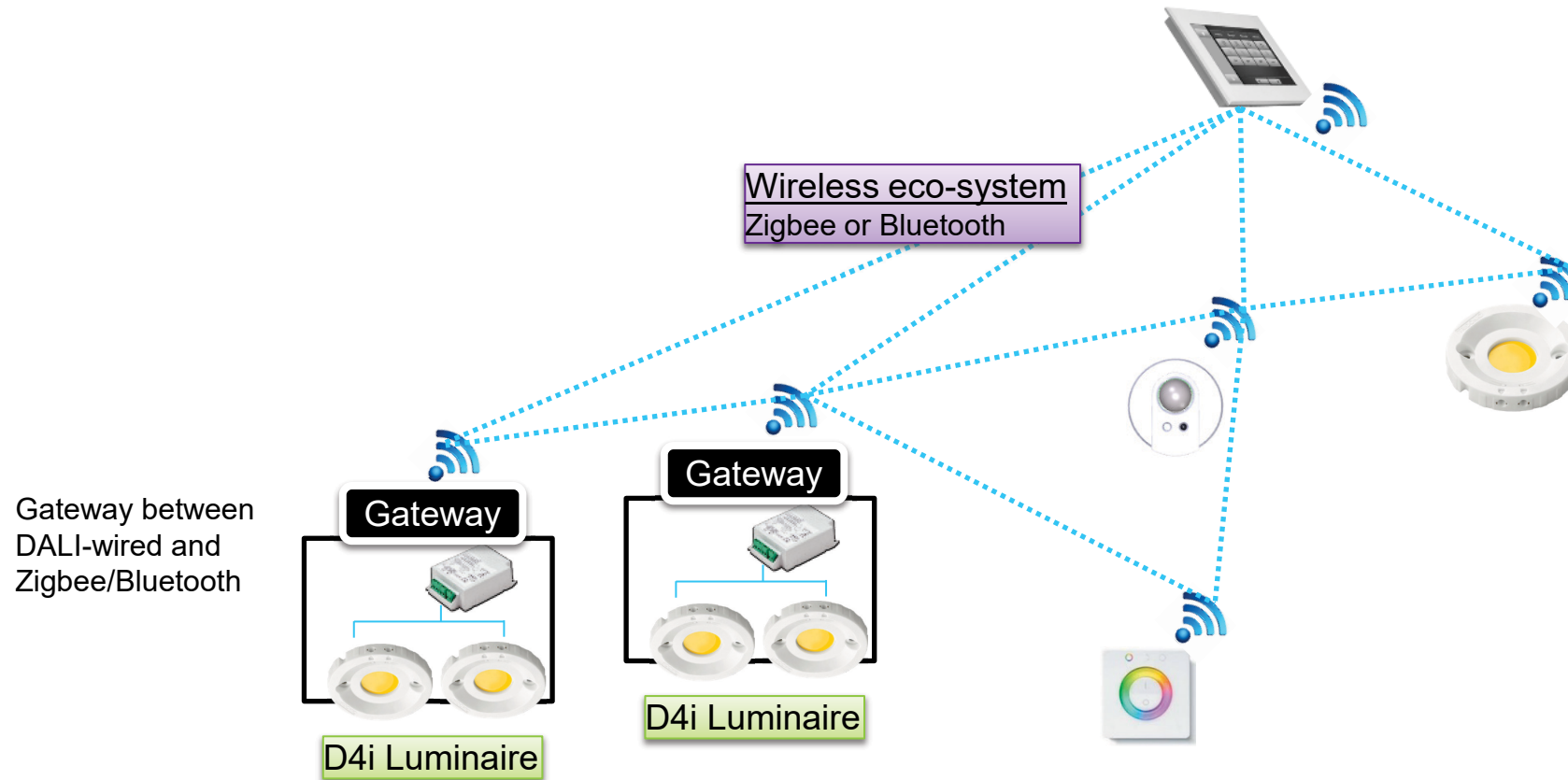Digital Illumination
Interface Alliance

DALI wireless – Gateway

- DALI wireless **gateway**:

  - Interface between a DALI-wired system and a wireless system such as Zigbee or Bluetooth™

  - The wireless system used initially will be announced later.

  - A specification will describe which commands and data will be supported across the interface.

  - Tests will be developed to allow certification.

- The next page shows an **example** of the **system architecture**

  - Including 2 gateways

  - D4i luminaires are single luminaires containing DALI-wired control gear and possibly a sensor

Digital Illumination Interface Alliance

DALI wireless – Gateway: example architecture

Wireless eco-system
Zigbee or Bluetooth

Gateway

Gateway

Gateway between DALI-wired and Zigbee/Bluetooth

D4i Luminaire

D4i Luminaire

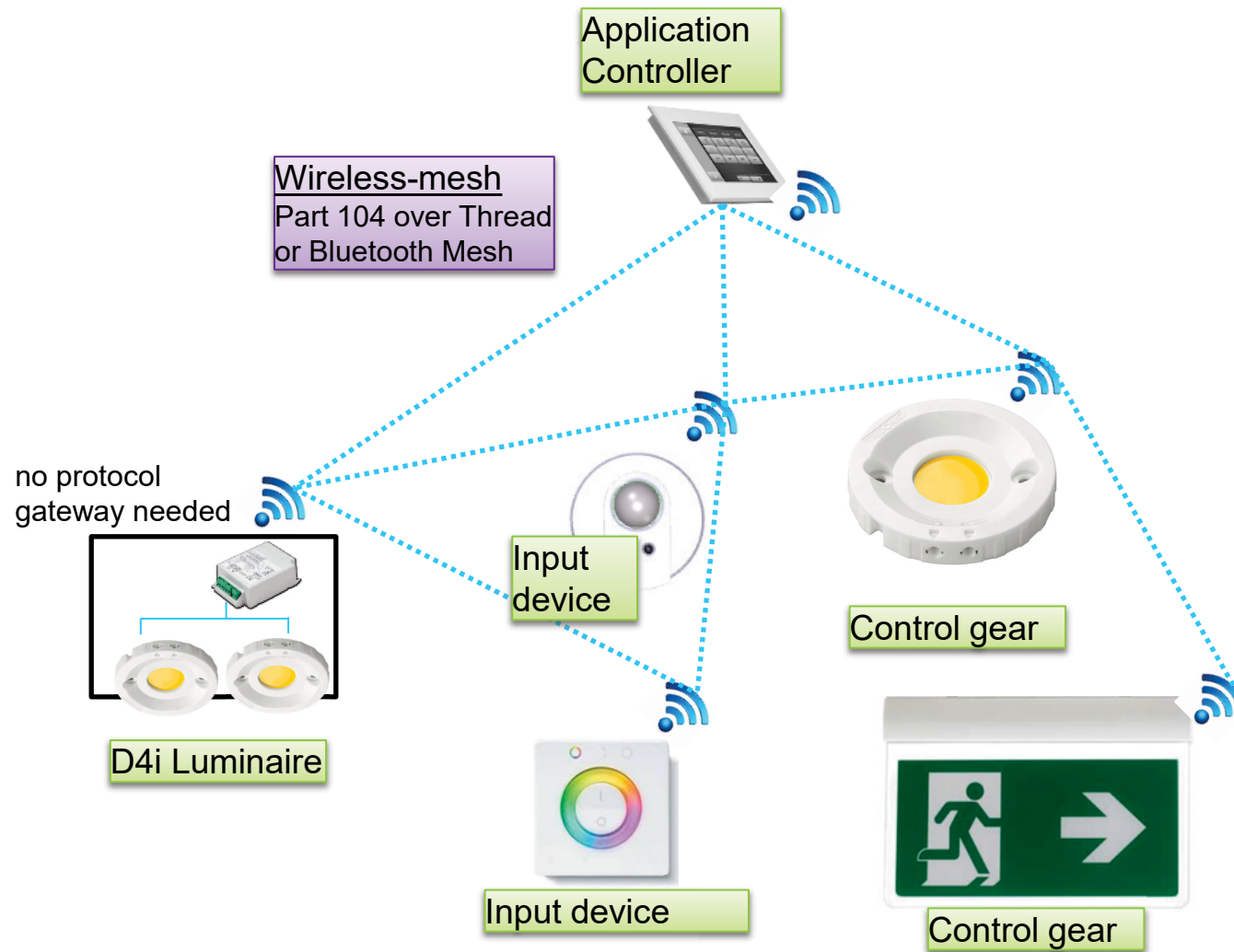Digital Illumination Interface Alliance

DALI wireless – 104 solution

- **DALI wireless using IEC 62386-104**

  - Part 104 was published in May 2019

  - Support for 2 underlying wireless protocols is specified: Bluetooth™ mesh and UDP

  - The T&C Work Group will determine any additional requirements that are necessary.

  - Tests will be developed to allow **certification**.

- The next page shows an **example** of the **system architecture**

  - Products in the wireless mesh are DALI-wireless using part 104

  - A device with both DALI-wired and DALI-wireless connections can be used to connect a D4i luminaire

  - D4i luminaires are single luminaires containing DALI-wired control gear and possibly a sensor

Digital Illumination Interface Alliance

DALI wireless – 104 solution: example architecture

Application Controller

Wireless-mesh
Part 104 over Thread or Bluetooth Mesh

no protocol gateway needed

D4i Luminaire

Input device

Control gear

Input device

Control gear

Digital Illumination Interface Alliance

Further information – DiiA website:

- ***DALI Quick Start Guide:***

  http://www.dali2.org/downloads/

- **Product database:**

  http://www.dali2.org/products

- **Membership benefits:**

  http://www.dali2.org/membership/benefits.html

- **D4i**:   https://www.dali2.org/d4i/

- **Contact us:**

  info@digitalilluminationinterface.org

Digital Illumination
Interface Alliance

www.dali2.org