IES Educational Webinar Series

See Your Lighting System in a New Light with D4i

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Answers are provider by the presenters in collaboration with the DALI Alliance (DiiA).

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Is D4i proprietary technology?

No, D4i is an open, global standard that has been created by the DALI Alliance (DiiA). The D4i specifications build on the international IEC 62386 standard, and D4i certification is part of the DALI-2 certification program run by DiiA. D4i is also adopted by ANSI C137.

Does D4i specify any cloud connection?

D4i does not specify a cloud connection. If there is a cloud connection, this will be defined by the Networked Lighting Control system, comprising a gateway and application controllers. Some deployments will not have a cloud connection.

Which protocol is D4i using? MQTT, HTTP, WebSocket?

D4i uses the DALI-2 protocol, which is the leading standardized digital protocol for communication between lighting-control devices. A D4i luminaire uses DALI-2 inside the luminaire, and then will typically have a gateway to translate to a separate, wireless network protocol (this is outside of the DALI-2/D4i specifications).

What happens when the driver dies? Does the information go away?

Great question. The LED driver will contain a lot of the information in the flash memory on the driver. The LED driver OEM can usually retrieve the data by replacing some of the failed components. In the future, the Networked Lighting Control systems will store the D4i data on the gateway or in the cloud.

What's a 'bus'? Is it an acronym or just a word to describe a process?

Bus stands for data bus. The DALI-2 bus is a wire connection that transfers data between components using a dedicated pair of wires. In this case a DALI-2 bus allows the LED driver, application controller, motion sensors, and photocells to communicate with each other in a defined way.

The complication with future-proofing is that in 10 years the protocols are likely to have changed, so adding compatible components could be tricky. How do we know D4i will be an enduring system?

Yes, your comment is of course very valid. D4i is part of DALI-2, which is the latest version of the DALI protocol, which in turn has been used in products for well over 20 years. DALI-2 was developed by industry consensus to provide a feature-rich digital control language which is focused on lighting. The DALI Alliance has created the DALI-2 certification program, which includes D4i, to create confidence in interoperability, while ensuring backwards compatibility. The specifications are maintained and updated as necessary, and new features are added to ensure continued relevance in the market. New specifications in progress will ensure enhanced connectivity for DALI-2/D4i using wireless and IP-based networks. The active participation in DiiA of major lighting companies will ensure the long-term viability of DALI-2 and D4i.

How is CCT, CRI and light distribution "stored" in the LED driver? Wouldn't these characteristics be dependent on the LEDs used and the optics used?

Yes, correct. Luminaire-related D4i data, including the attributes mentioned, is programmed into the D4i driver in the factory by the luminaire OEM. When the luminaire is commissioned, the data can be made available to a network, in a standard format, allowing the operator to easily manage inventory.

What cyber protection is being provided or considered for the wireless signal?

There are multiple wireless technologies being deployed in Networked Lighting Control (NLC) systems. Each of these technologies has a level of encryption, typically this is AES128. DLC has set a requirement for cybersecurity for NLC systems. This requirement goes into effect in 2021. A good approach is to specify a DLC Version 5.0 system for cybersecurity.

Is there a strong emphasis on outdoor vs. indoor for D4i?

The D4i specifications don't distinguish between indoor and outdoor. The early interest in D4i has been in outdoor, due to the availability of the Zhaga Book 18 socket but also driven by the influence of end users such as utilities. Indoor applications will emerge now that the Zhaga Book 20 specification has been published, and interest will be accelerated by the PNNL IoT-Upgradeable challenge (https://bit.ly/3kVT3Od).

Is there discussion about incorporating the controller in the driver? A separate controller means added cost to every luminaire.

Great vision. Many of the lighting controllers that are in today's Networked Lighting Control Systems include circuits for power supplies, dimming circuits, surge, high voltage isolation, and relays to cut off the power. The next generation lighting controllers are likely to move more functionality into the LED driver. The next step could be to fold the wireless application controller into the DALI-2 LED driver. There are discussions happening today, but there are some hurdles to overcome to make this a reality.

Which driver manufacturers are making D4i products?

Please consult the DiiA Product Database (www.dali2.org/products). In Product Search, check the "Control gear" button, then select "D4i".

Does testing have to be conducted through an independent accredited lab? What is the process to get products listed on the DiiA product database?

Testing can be carried out by either a DiiA member company, or by an accredited test house (see www.dali2.org/testing). In either case, test results must be submitted to the DiiA for independent verification of the results, and if successful this allows listing in the database and Trademark use.

How will this integrate with HVAC systems?

Such integration is outside the scope of D4i. However, most Networked Lighting Control systems have a BACnet gateway that will easily allow integration into a HVAC system. BACnet is a communication protocol for Building Automation and Control (BAC) networks that leverage the ASHRAE, ANSI, and ISO 16484-5 standard protocol.

What's required to get a luminaire "D4i" certified if it uses a D4i-certified driver and Zhaga sockets?

In this case we have a joint certification program with Zhaga, called Zhaga-D4i. Luminaires using D4i certified components and Zhaga connectors (currently Book 18 or Book 20) can gain Zhaga-D4i certification by submission to an accredited Zhaga test-house.

So, do D4i certified LED drivers have higher power capacity than normal to run the sensors and Wi-Fi modules?

D4i requires an integrated bus power supply in the driver, this provides power for DALI communications and can also provide power to certain DALI devices such as sensors. (Obviously the driver also provides power to the LEDs!) For wireless communication modules with higher power requirements, an auxiliary 24V supply (AUX) will be required. This can be integrated into the driver, or can be a separate component. An AUX supply is mandatory for Zhaga-D4i luminaires.

Are there any other competing standards being developed?

Other standards exist, but DALI is highly successful already, having arguably the largest installed base globally of any digital wired standard for lighting controls. We don't believe there is anything close to rival the capabilities of control, bi-directional communication and standardised data that D4i offers. DiiA also works closely with various partners to ensure that capabilities beyond D4i are served, for example including wireless connectivity.

Do you need an application controller in order to communicate with the driver?

Yes, an application controller is required to communicate with the D4i LED driver. An application controller can be as simple as a motion sensor, or it can be a Networked Lighting Controller (NLC) that allows lights to be controlled via schedules, motion, or daylight harvesting. To take maximum advantage of the diagnostic data in the D4i LED driver, a cloud-based NLC system is required.

How long before D4i becomes a standard technology?

D4i is already standardized via the DiiA specifications, which have also been adopted by ANSI and major lighting companies, and this expected to result in further penetration in the North America market.

How do you plan to keep this as a true standard and how does that strategy differ from the original DALI protocol that many manufacturers used as a baseline to develop their proprietary communication protocol?

A key difference with DALI-2 (including D4i) is the certification program that drives interoperability. The underlying specifications are much more detailed and require extensive testing to confirm compliance. DALI-2 also includes all relevant product types, and new features continue to be added. We expect (and are seeing) that manufacturers prefer to work with a fit-for-purpose standard (DALI-2) rather than taking the proprietary route.

How do you ensure the D4i logo is not being misused?

DiiA takes Trademark use very seriously. We have clearly-defined Trademark use guidelines for members, and work very closely with our trademark attorneys where necessary to take action whenever we become aware of an issue. The key rule is that the D4i logo can only be used by members and only on certified devices, which are all listed on our website.

This presentation seems to have used DALI-2 and D4i interchangeably. What is the D4i part of this system that is beyond the scope of DALI-2?

D4i is part of DALI-2 and is focused on intelligent, IoT-ready luminaires. D4i gathers together a specific set of features (all of which are optional in other DALI-2 devices). The purpose is to enable sensors and other control devices to be attached to luminaires, by taking care of power-supply requirements, while also providing luminaire, energy and diagnostics data.

In the 1980s, concurrent with the emergence of the research driven TCP/IP protocols was the parallel, organizationally driven OSI/ISO model and implementation models for communication systems TCP took off, OSI died. Why is D4i TCP/IP for the lighting industry?

The OEM suppliers in the lighting industry are behind the standardization of D4i. The majority of the LED driver companies, the Networked Lighting Control companies, and the Luminaire OEMs are part of the DiiA organization establishing the standards. The DiiA is working closely with ANSI C136 and C137 to create a robust and lasting standard. The momentum for innovation is gearing up with standardized diagnostic and asset data. Some sensor OEMs are creating motion and photocell compatible sensors.

Is each manufacturer providing its own software to monitor and create reports on the D4i data?

Yes, most luminaire OEMs have a control solution that will monitor and create reports on the D4i data. Some OEMs offer the same solution with their own branding. Controls companies work closely with the luminaire companies to integrate solutions for different applications. D4i provides a platform for a standardized solution.

Are events time-stamped?

Time-stamped events depend on the luminaire OEMs' solution. Some solutions time-stamp events such as motion, schedules, dimming events, and alerts. All DLC-listed Networked Lighting Control systems provide time-stamped power monitoring data. This time stamp is a requirement of ANSI C137 and ASHRAE 90.1 2019.

Are "complimentary specifications: Book 18 and Book 20 specifications from Zhaga" included in the capabilities of all D4i certified LED luminaires?

D4i luminaires do not have to use Zhaga sockets, they can use other sockets (e.g. C136.41) or directly-attached sensors or communication nodes. Conversely, Zhaga Books 18 and 20 both require the use of D4i to enable interoperable, plug-and-play operation of the Zhaga socket.

Will there be options to retrofit current luminaires?

Retrofitting current luminaires will require a DALI-2 LED driver and an application controller that supports DALI-2. Check with the luminaire OEM on warranty and if they offer a retrofit kit.

You mentioned parking lots, but is this kind of system feasible in a municipal application with a higher quantity of roadway and pedestrian lights spread over a much larger area?

Yes, this application is perfect for higher quality roadway and pedestrian lights spread over a much larger area. The utilities and cites are the ones pushing for the standardization of asset and diagnostic data. This is illustrated by the adoption of D4i by the ANSI C136 and ANSI C137 committees. The D4i luminaires provide much more value and save money over the long term for these applications.

Isn't all this available with standard DALI systems now?

All the individual parts of D4i, such as the luminaire, energy and diagnostics data specifications, are optional features of DALI-2 products. But D4i has a specific, compulsory set of features, and this makes D4i devices easier to specify and implement.

How many systems are actively able to access the D4i data?

Today there over a dozen systems that are using a limited set of the D4i data. Most of them are using the power monitoring part and some basic identification information from the LED driver. By the end of 2021 many systems will take advantage of the diagnostic data. Another DALI-2 application that is going to explode on the market in 2021 is white color tuning for the low-wattage office space.

Do sensors need to be D4i approved/labelled?

All D4i components including sensors must be certified and listed in the DiiA database in order to carry the D4i trademarks.

What does a D4i operator's display look like?

The D4i dashboards will be customized by the Networked Lighting Control system. Each OEM has developed the graphs and dashboards to suit their customer base. If you have specific requirements, reach out to the companies that are developing D4i luminaires and control systems.

Anyone have high percentages of their product D4i ready?

If you mean manufacturers, many of our members already have D4i products, as listed in our Product Database (www.dali2.org/products).

I'm confused as to what I would specify... Do I ask for a D4i driver or do I ask for a DALI-2 driver that meets D4i standards?

You can simply specify D4i drivers. All D4i drivers are also DALI-2 certified. The luminaire OEMs will be able to provide a luminaire that is D4i certified with the correct D4i components.

Can D4i data tie into a BACnet system?

The D4i data will tie into the BACnet system via the Networked Lighting Control system, using a BACnet gateway. The luminaire OEMs will have control systems that tie the D4i data into BACnet. The basic D4i data (power monitoring and some asset information) is available today, and data and predictive maintenance will become available in BACnet soon.

Does it ONLY work with a Zhaga socketed fixture, or will traditional DALI 2-wire systems allow systems to access the same D4i data?

D4i data is not restricted to fixtures with Zhaga sockets. Traditional DALI-2 systems can access D4i data if the DALI-2 driver incorporates the relevant specifications.

In order to use the D4i drivers, do we have buy a DALI-2 system? Is it costly?

Request a D4i luminaire from your luminaire OEM. The LED drivers cost a bit more, but the lower application controller cost will offset the cost of the LED driver. The D4i system is in line with the cost of any Networked Lighting Control system. The payback benefits go far beyond just energy savings.

To take this option to the next level, I suppose there must be a contract with a company that supports us with this monitoring? How many companies can provide this service of reporting, monitoring, everything that refers to control?

The DLC QPL provides a list of companies that can provide Networked Lighting Controls. The level of reporting ranges from very basic with no annual fees to elaborate monitoring with alarms and the ability to download reports that require a monthly or annual fee. The controls companies will have different levels of reporting to choose from.

Which lighting companies are leading the charge with D4i?

Many DiiA members are involved in the development of D4i (see www.dali2.org/membership/member-companies.html), and D4i devices can be located in our Product Database (www.dali2.org/products).

How granular can the data get (e.g. which lamp in the luminaire is non-functional)?

Today the data will provide power monitoring where a comparison can be made between actual power data and the wattage of the luminaire. Next year some controls will provide information on each driver to give a more granular diagnostic on the health of the luminaire.

Any idea at this point of cost adder?

The cost adder for Networked Lighting Controls should be less than 15%, but is greatly dependent on the luminaire cost and other factors. But the cost is far outweighed by benefits arising from new functionality related, for example, to asset management, maintenance, and install and commissioning costs

How long do you think this will take to gain some real momentum?

The momentum started in 2019. This year the number of available DALI-2 LED drivers has tripled. Every major OEM has a SKU for DALI-2 LED drivers. Make sure you request your luminaire to be DALI-2 and D4i compatible.

I know a lot of what we typically are dealing with is commercial products, but will we see a similar push in residential type products?

We expect that the technology will filter through as industry adoption increases, but right now the ROI really is in the commercial/industrial arena.

Who are the controls manufacturers currently that have the systems for D4i?
Please refer to the DiiA member list (www.dali2.org/membership/member-companies.html), and our Product Database (www.dali2.org/products).

What utilities are encouraging the use of this technology?

Most utilities offer rebates based on energy savings and the use of Networked Lighting Controls (NLCs). DLC has a QPL of NLC products that will qualify for utility rebates. Georgia Power and the Southern Company are the leaders in DALI-2 luminaires.

What of the C136.41 receptacle? Will it be replaced by the Zhaga 18 socket?

Today the C136.41 receptacle is offered by all luminaire OEMs and is a requirement for many city and roadway lights. The Zhaga Book 18 socket will gain momentum as more products are introduced using the footprint. Customer request will prompt the luminaire OEMs to offer it. They have all of the needed components —LED drivers , application controllers, sensors and the Zhaga sockets—to move forward.

Do you conduct any confirmation of fixture compliance after certification? Do you test luminaires to confirm they still meet the D4I standard in production vs. during development?

All luminaire components must maintain D4i certification, at all times, in order for the luminaire to use the D4i Trademarks.

Could this interface be used with DMX controlled fixtures?

The D4i standard is not compatible with DMX controlled luminaires. DMX is very limited in its capabilities for general lighting compared to D4i.