67th AMEU Convention

SUSTAINABLE CUSTOMER CENTRIC ELECTRICITY UTILITIES IN THE 4TH AND 5TH INDUSTRIAL REVOLUTION

From ballast to brains

The LED driver as key component for realizing smart street lighting

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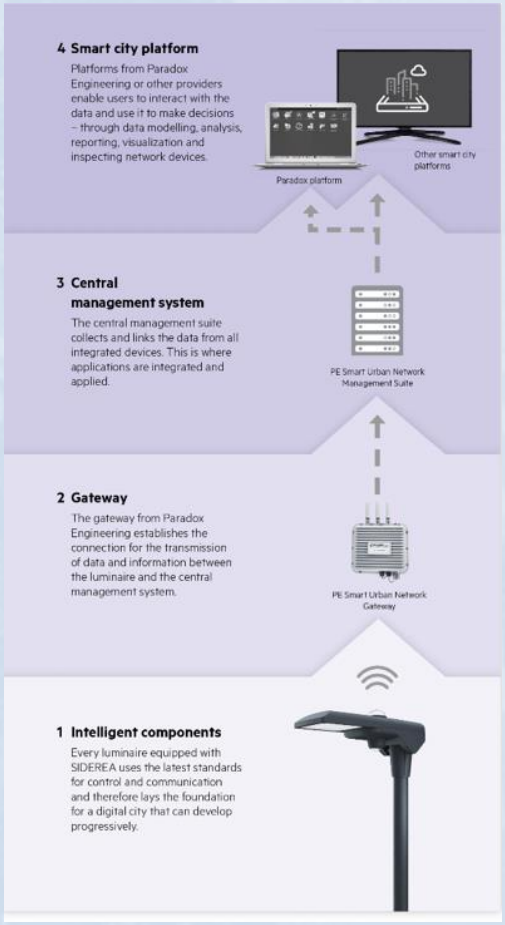
Smart lighting as backbone for smart cities

Smart street lighting is considered an **‘anchor application’** for a smart city

‘*Smart street lighting is being recognized by many city leaders as a first step toward the development of a smart city. In addition to increasing the energy efficiency of the city and reducing energy costs, intelligent lighting can also provide a backbone for a range of other city applications, including public safety, traffic management, smart parking, environmental monitoring, and extended WiFi cellular communications’ **

*based on a report by Navigant Research

Architecture of a smart city system



Smart city and smart street lighting discussions almost exclusively focus on the higher levels of the architecture.

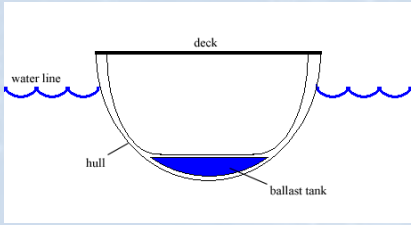
This presentation focusses on recent developments on the lowest level (intelligent components) which will greatly facilitate the Implementation of smart street lighting and address several of the challenges.

Set-up of a street light

- For a very long period a street light consisted of 2 parts :
  - Light source
  - Luminaire or fixture

- With the introduction of ‘High Intensity Discharge lamps’ in street lighting a new component appeared :
  the control gear or *ballast*, a device needed to properly operate the lamp

- The ballast has the same reputation as ballast of a ship :
  it is needed but better to get rid it off



Ballasts for street lighting

- The common technology used in ballasts for street lighting is the electro-magnetic technology, consisting of a copper coil and iron laminates.

- An electro-magnetic ballast is heavy and bulky but as it has just a few components it is robust and reliable.

- Over the years the electro-magnetic ballast has not evolved much for the outside world

Introduction of electronic ballasts

- In the 1990's the electronic technology was introduced for ballasts for street lighting, consisting of electronic components mounted on a Printed Circuit Board with a housing around it.

- The electronic technology offered several advantages (depending on lamp type) :
  - Better handling of voltage fluctuations
  - Increased lifetime of the lamps
  - Energy-savings

- It also brought disadvantages :
  - Sensitive to heat
  - Sensitive to voltage peaks / transients
  - Higher level of failures and shorter lifetime compared to electro-magnetics

Developments of electronic technology

- In contrast to electro-magnetic technology electronic technology evolves constantly

- Development directions of electronic ballasts :
  - Miniaturization
  - Reduced costs
  - Increased functionality / reliability
  - Increased intelligence

- Intelligence can be built into electronic technology via adding IC's to the electronics including embedded software

LED technology



- To operate LED’s correctly also an additional component is needed, this is not called a ‘ballast’ but a ‘driver’ and is based on the electronic technology

- Advances in electronics combined with the fact that LED’s are electronic devices have allowed LED driver suppliers to add more and more intelligence to their products.

- Examples of features :
  - Constant Light Output
  - Step dim profile
  - ‘Soft start’
  - Temperature management of both driver and LED’s

The relevance of temperature management

- ‘Day burners’ are common in major South-African cities

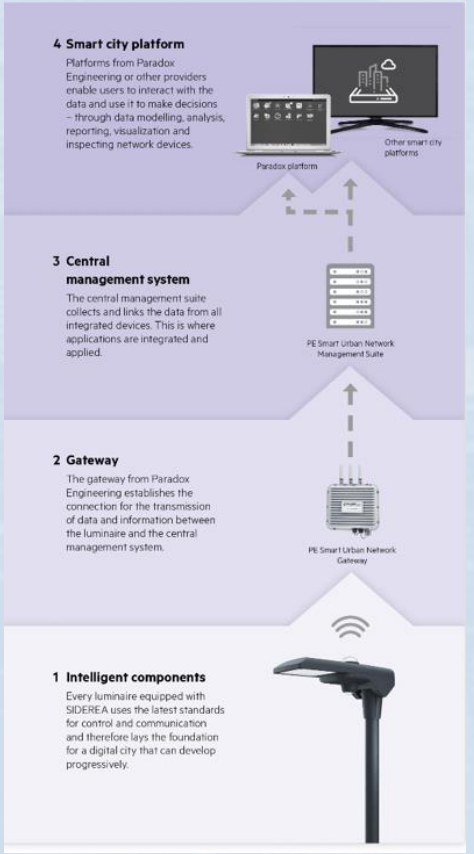
- With the change-over to LED technology day burners become a bigger problem as both LED’s and the drivers are sensitive to heat. Shortening of lifetime and early failures are risks.

- Temperature management offered by full feature LED outdoor drivers reduces the risks created by day burners by lowering the temperature of LED’s and drivers via reducing the operating current (=dimming)

The next step : LED drivers as key component of smart lighting

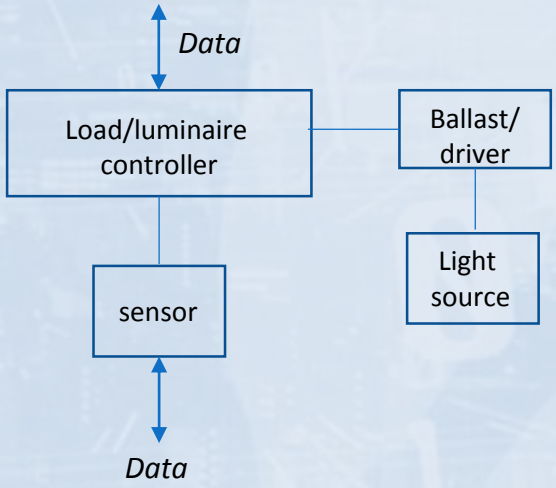
Challenges for implementing smart street lighting :
Functionality of a smart street lighting system : basic versus full
Choice of a system and communication protocol
Interoperability and scalability
Budgetary issues

latest LED driver developments and standardization make these challenges more manageable



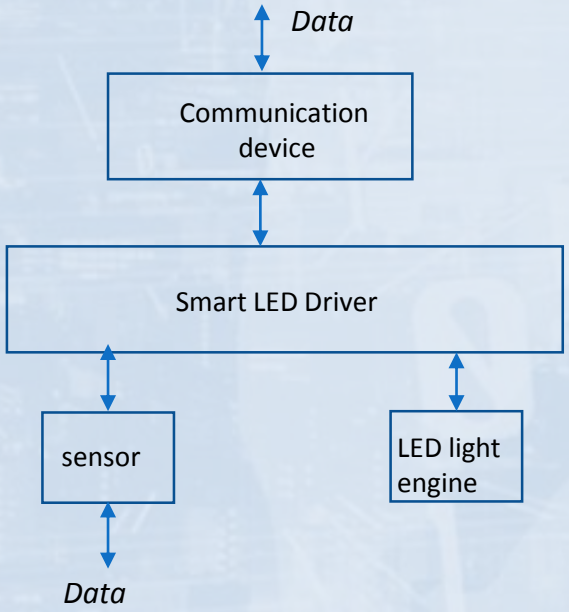
Traditional set-up of a smart street light

- Traditionally the set-up of a smart street light looked like this :



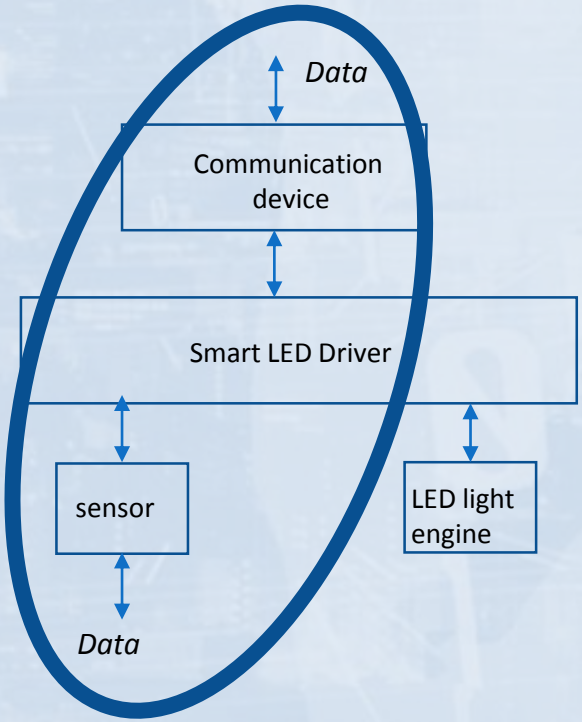
- The load/luminaire controller played a big role, it was the 'intelligent' device, the ballast/driver was a simple device. No standardization was in place for the load/luminaire controller, it was manufacturer specific.

State of the art set-up of a smart street light



Communication flows through the driver. The driver has become the ‘intelligent device’

A further step : standardization of the smart LED driver, sensors and communication devices

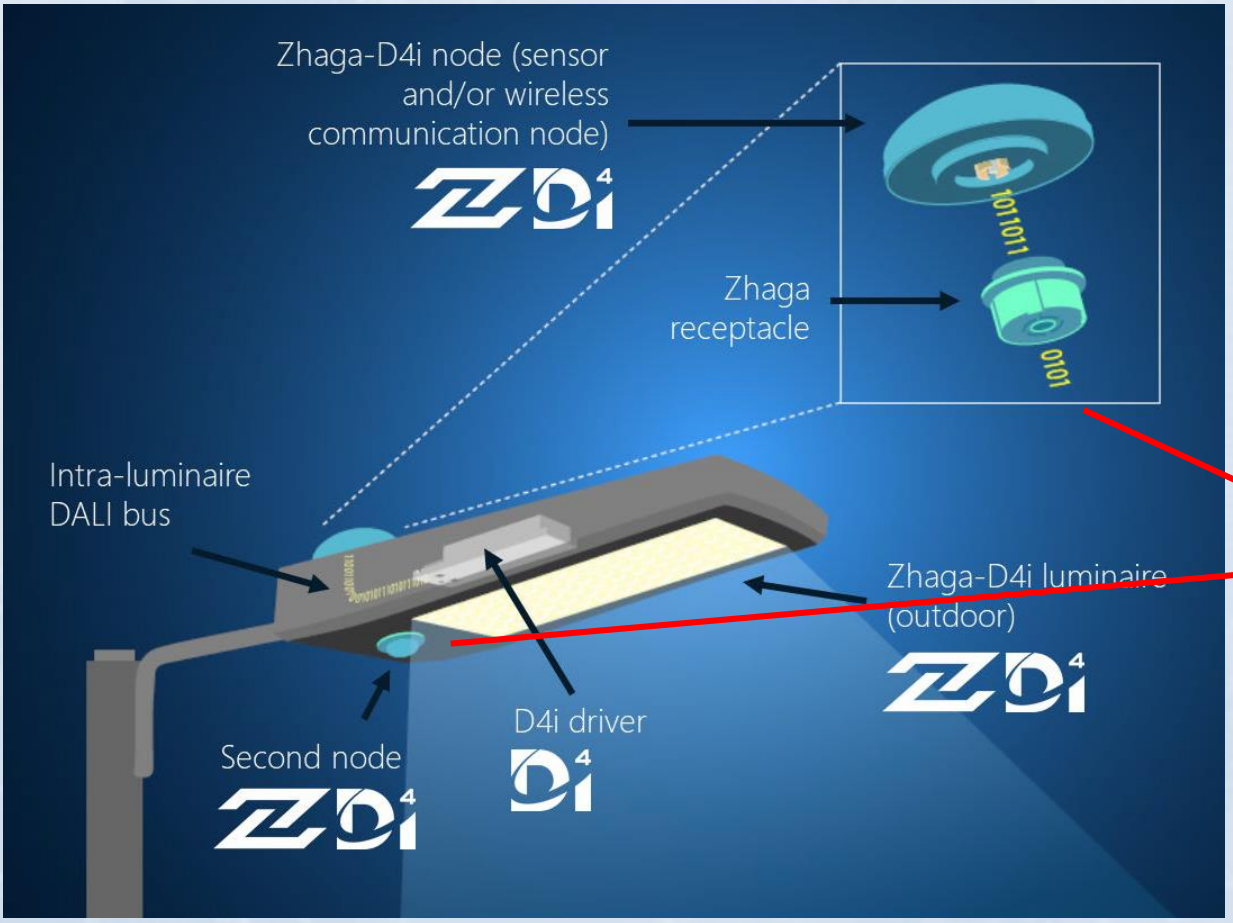


- To accelerate the use of this new set-up a standard has been defined specifying how the smart LED driver, sensors and communication devices interact. This standard is called **'D4i'** (DALI for IoT)

- Sensors and communication devices are standardized according Zhaga book 18

- *Zhaga-D4i is defining the 'USB' equivalent for smart street lighting*

Zhaga –D4i street light



Zhaga-D4i standard covers :

- Mechanical connection
- Data communication
- Data reporting
- Power requirements

Communication devices and sensors are mounted externally, allowing to use them across several Zhaga-D4i compliant street lights

How does Zhaga-D4i address the challenges for implementing smart street lighting ?

Challenges for implementing smart street lighting :	How addressed by Zhaga-D4i :
Functionality of a smart street lighting system : basic versus full	Specifying D4i street lights for replacements of traditional street lights to LED's allows for a phased approach
Choice of a system and communication protocol	buys the end-user time to decide on the right functionality versus costs and the right communication protocol
Interoperability and scalability	phased approach also addresses scalability and budgets
Budgetary issues	

What does the Zhaga-D4i standard bring to end-users ?

- Installing LED street lights incl D4i driver and ‘sockets’ for Zhaga sensor and communication module allows end-users a phased implementation of smart street lighting. Allowing time to decide on the right smart lighting system (functionality and communication protocol).

- With Zhaga-D4i being an ‘open’ standard (not manufacturer specific) different types of street lights, from different suppliers can be connected to a smart street lighting system, as long as these street lights are Zhaga-D4i compliant

- Once decided for a system, existing street lights with D4i driver can be equipped with the right sensors/communication modules and be connected to the smart lighting system

Going forward :
Any end-user considering implementing smart street lighting sometime in the future should start specifying a D4i compliant street light now (D4i driver inside plus Zhaga book 18 socket)

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Thank you

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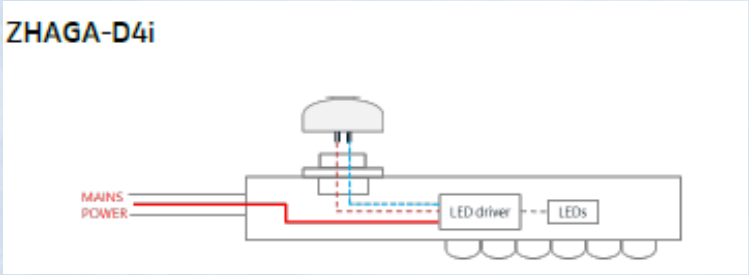
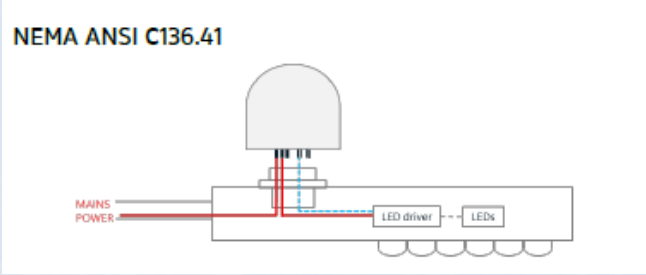
Comparison Zhaga-D4i versus NEMA





Zhaga-D4i	NEMA
Europe origin	USA origin
4-pin, small	7-pin, large
Top & Bottom mounting option	Top option only
Powered by driver (low-voltage),	Mains powered (Module needs surge protection)
Certification of Zhaga-D4i luminaires and components in place (DiiA) https://www.zhagastandard.org/products.html	No certification of luminaires
Empty socket easy to fill (mechanical only)	More complex to fill empty socket (mechanical and electrical)
Intelligence in the (D4i) driver (DALI extension)	Intelligence in the module (DALI/1-10V driver needed)