

Strong Technologies for Smart Cities

With customised solutions and open protocol technology, iciti's product portfolio uses the existing infrastructure to implement intelligent communication and control solutions.

iciti.



Efficient tech for intelligent cities
Effiziente Technik für intelligente Städte

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Street lighting as the starting point for networking

Street lighting opens up new avenues for modern urban planning.

The existing infrastructure can beneficially be used on the journey to becoming a smart city.



The digital transformation of many cities includes topics such as climate and environmental protection via sensor technology, information and safety functions via voice and image, parking space management, waste management, noise detection and mapping, e-charger management and of course intelligent adaptive lighting.

iciti offers the appropriate technology platform as a basis for implementing these applications.

The new data concentrator iDC-IOT is a technology solution, both for powerline and RF mesh communication and furthermore for the integration of LoRaWAN sensors. It can be used for the implementation of all control applications in the urban environment.

The connection of the iDC-IOT to the computer - located at the customer's premises - can be established via Ethernet, WLAN, 4G/5G router or optical fibre.

Communication at the field level is established via the corresponding network interface using USB or Ethernet.

All possible communication technologies

- Narrowband powerline,
- Broadband powerline (HD-PLC),
- RF-Mesh and
- LTE-NB and
- LoRaWAN via gateway

can be operated simultaneously with the iDC-IOT.

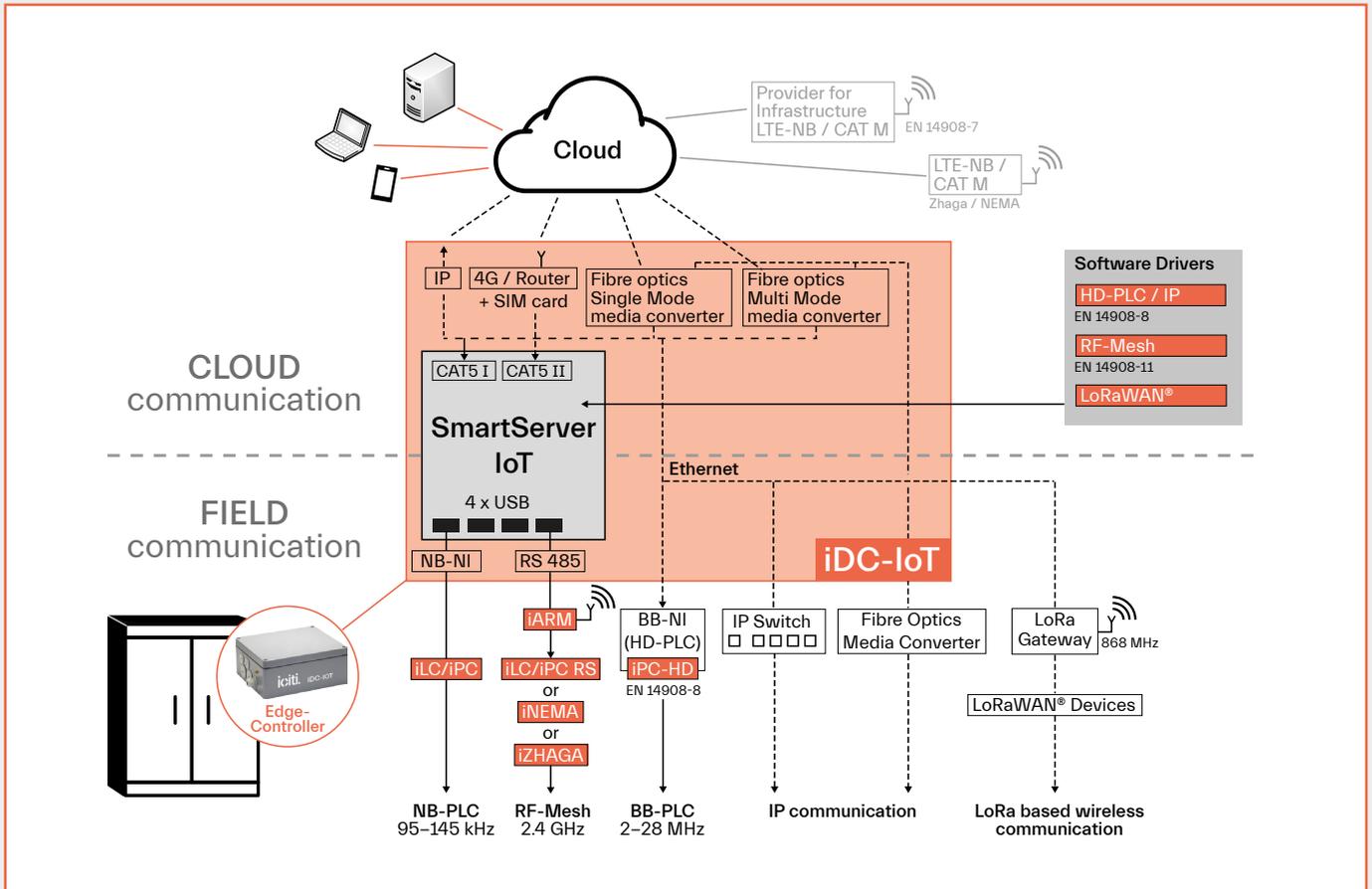
The connection of actuators and sensors as well as devices for multimedia applications, e.g. cameras, emergency call stations, enable the implementation of many applications based on the existing street lighting. The integration of LoRaWAN via a gateway is also possible.

The iCIS intelligent City Information System management software for controlling and displaying the lighting is available under a permanent licence or a leasing model.





All communication technologies can be operated **simultaneously** on the iDC-IOT.



The data concentrator is the intelligent interface between the luminaire controllers in the field and the control technology. With the integrated SmartServer IoT, the iDC-IOT is perfectly suited for the management of all Smart City applications, such as lighting, parking and waste management.

Edge-Controller iDC-IOT as a multifunctional node

The latest generation iDC-IOT data concentrator, as the central data transmission technology platform, offers various data transmission connection options.

With tailored solutions using open protocol technology, the product portfolio utilizes the existing street lighting infrastructure to implement intelligent communication and control solutions.

The great advantage is that all data is transmitted to the cloud and subsequent control system in a standardized format. In the event of a fault, and even without a cloud connection, this data is directly available to the other bus systems for further processing without latency (data transmission to the cloud and back to the field).

All communication technologies can be operated simultaneously.

The protocol and transmission media are standardised in accordance with EN 14908-X. iciti is the suitable technology platform for the implementation of all control applications in the urban environment.



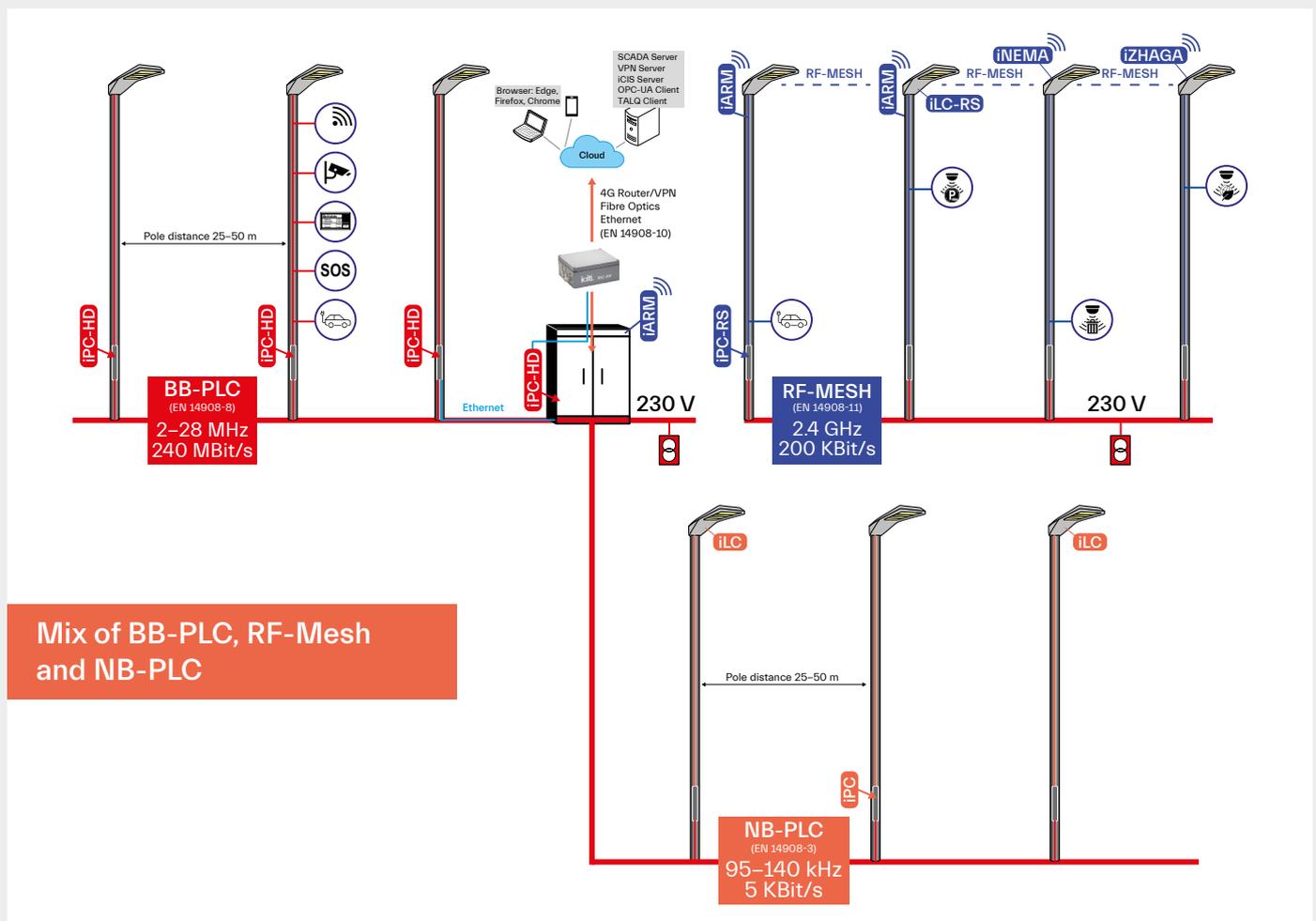
Different communication technologies can be operated either individually or as a mix on the data concentrator.

The technology used is fully interoperable at protocol and communication level through standardised protocol and transmission media in accordance with EN 14908-X.

The system is therefore independent of component manufacturer and can be supplemented with further applications at any time. A LoRa gateway can be connected to the iDC-IOT. As LoRa does not usually use a standardised data format the iDC-IOT uses software to convert the LoRa data format. This data can then be used in standardised transmission channels in accordance with EN 14908-X in both the field and the cloud.

Further advantages of the iDC-IOT

- The iDC-IOT can be integrated into existing infrastructure.
- All communication technologies (NB-PLC, BB-PLC, RF-Mesh, WLAN, LTE, LoRaWAN) can be operated simultaneously.
- Support of transmission media to the cloud, such as Ethernet, fibre, 4G/5G, VPN.
- Support of the standardised communication interfaces MQTT/REST, TALQ, OPC-UA. The XML/SOAP interface of the previous SmartServer 2.2 PL is also supported by the iCIS software. Thus, existing applications (legacy installations) can be integrated and expanded with the new iDC-IOT in a future-proof manner.



Mix of BB-PLC, RF-Mesh and NB-PLC



- The data points are read, written or programmed for typical applications such as data loggers, or schedulers using MQTT/REST with JSON, which is included in ANSI/CTA 709.10 or EN 14908–10 (in preparation) standards.
- Software interface to the cloud based on standard ANSI/CTA 709.10 or EN 14908–10 (in preparation), which is supported by the iCIS (intelligent City Information System) software.
- iCIS software licence available for purchase or as a "Software as a Service" package.

The functions of the iDC-IOT go far beyond the usual lighting management applications. Its unique selling points and interoperability are exceptional giving independent entry into many smart city applications for the municipality.

Software iCT-IOT – intelligent configuration software

The configuration software for commissioning the iDC-IOT data concentrators and the associated luminaire controllers iLC, iPC and iPC-HD.

- The iCT software is used for convenient and quick installation of all controllers in a network segment.
- Unique identification of each controller with barcode (reader optional)
- The controllers are programmed according to the OLC-LonMark® profile
- Operating system: Windows 10, 64 Bit
- Intuitive software interface
- Software is available free of charge

Functions of iCIS



Software iCIS – intelligent City Information System

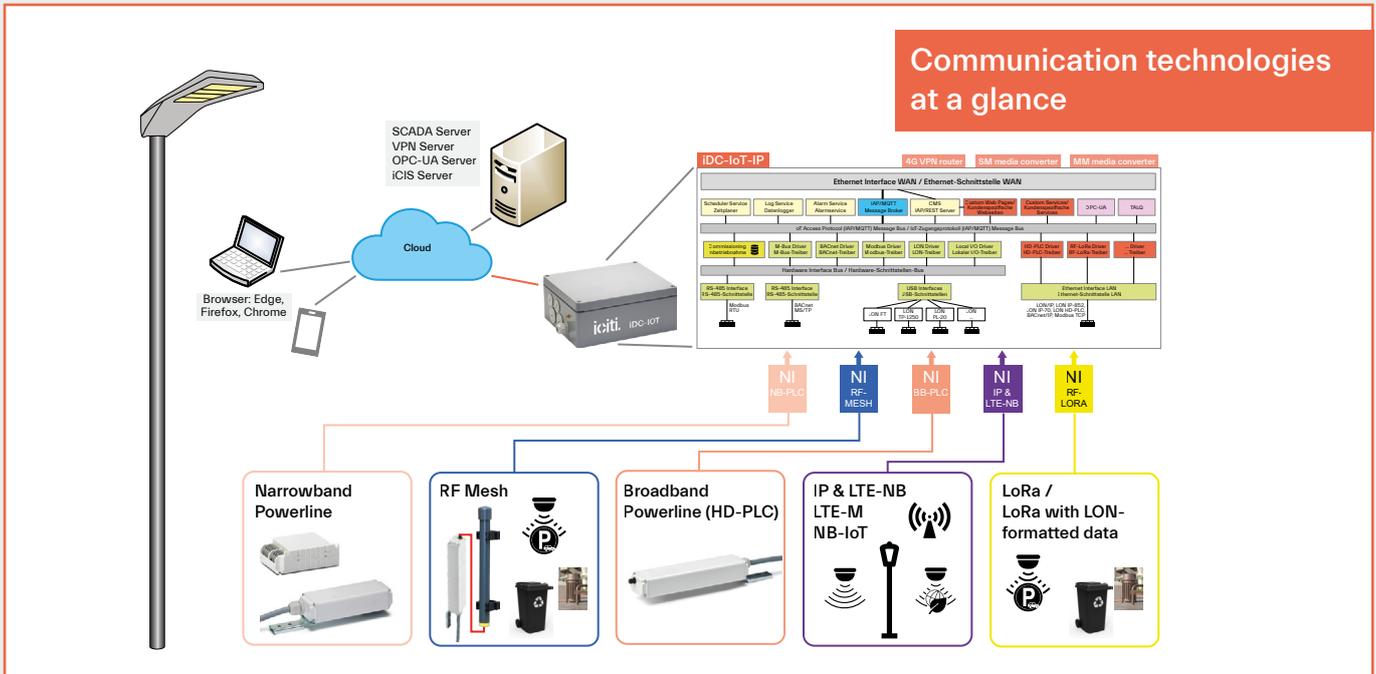
As an intelligent city information system, the iCIS takes over basic functions of standardised communication on the basis of ANSI/CTA 709.10 resp. EN 14908–10 (in preparation) for:

- Control (on/off, dimming)
- Group creation
- Support of the LON profiles for different transmission channels
- Graphical processing of measurement data
- Geographical map view
- Scheduled switching
- Data and error analysis
- Filter & updates
- iCIS can be purchased as a permanent licence with a leasing model.
- The software is multi-client capable.

The intuitive user interface (tree structure) simplifies operation even for occasional users. Setting up user roles, backup and restore functions are user-friendly. In the future, current settings such as target/actual settings, status/ error as well as current settings of the analysis values will be displayed via a dashboard so that customers can assess and monitor the installation. The software languages are German and English, and further customer-specific languages can be implemented on request. iCIS is browser-based and can be operated with Microsoft.

The application (data acquisition and control or multimedia) determines which communication technology is used. You can mix the use of the different technologies.

The advantage of the iciti platform is that with the use of the iDC-IOT, all future areas of digital transformation can already be implemented today.



Overview of the different technologies standardised according to EN 14908 and their fields of application

Narrowband powerline

- Data transmission via power supply networks in the frequency range 95–135 kHz (CENELEC 50065–1).
- For diagnosis, monitoring and control of light so that e-charging stations can also be operated.
- Replacement for audio frequency/long wave remote control.

Broadband powerline (HD-PLC)

- Data transmission via power supply networks in the frequency range of 2–28 MHz, gross < 240 MBit/s, repeating, operation up to 1000 light points/controller.
- For the transmission of multimedia such as voice, image, TV/HD-TV, emergency call, for the operation of WiFi hotspots and e-charging stations.
- Replacement for audio frequency/long wave remote control.

IP & LTE (LTE-M, NB-IoT)

- Data transmission via LTE narrowband, IoT services for the control and monitoring of IP devices in accordance with EN 14908–7 (under development).

RF Mesh

- Radio frequency data transmission via a new type of mesh system based on street lights, multi-channel operation in the 2.4 GHz frequency range, 100 KBit/s net, up to 100 repeaters/distance 100 m, 1000–3000 light points/controller.
- For motion/environmental sensing, traffic/parking/waste management, supports battery-powered devices.
- Replacement for audio frequency/long wave remote control.

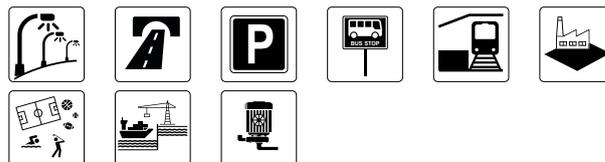
LoRa

- Long-range data transmission by radio.
- Connection of the LoRa gateway to the iDC-IOT server so that the data can be used directly in the field and in the cloud in a coordinated way.

Which technology is used for which smart city applications?



Typical fields of application



There are multiple requirements for smart city applications.

Typical fields of application

- Street, tunnel and near-building lighting
- Parking spaces, bus and train stations
- Railway and shunting facilities
- Company premises, warehouses
- Sports facilities, green spaces, parks
- Harbour and floodgate facilities
- Pump stations

Application examples for broadband powerline (HD-PLC):

- On/Off, Dimming, RGBW and Tunable White control, Diagnostics
- Multimedia, camera, emergency call, announcement, digital information boards
- Charging station for e-bikes and e-cars
- Sensor technology for motion-controlled light and traffic-dependent control

The addition of sensors optimises Smart City application solutions

Integration of on-site sensors* for

- Nitrogen oxides, carbon monoxide, carbon dioxide, fine dust, noise
 - Temperature, humidity, air pressure
 - Air flow, wind speed, UV radiation
 - Soil moisture (wet, ice, dry)
 - Water level indicator (precipitation, high water)
 - Parking management, waste management
 - Urban development, tourism analysis and city marketing
 - Smart Meter
 - IO link
- is possible.

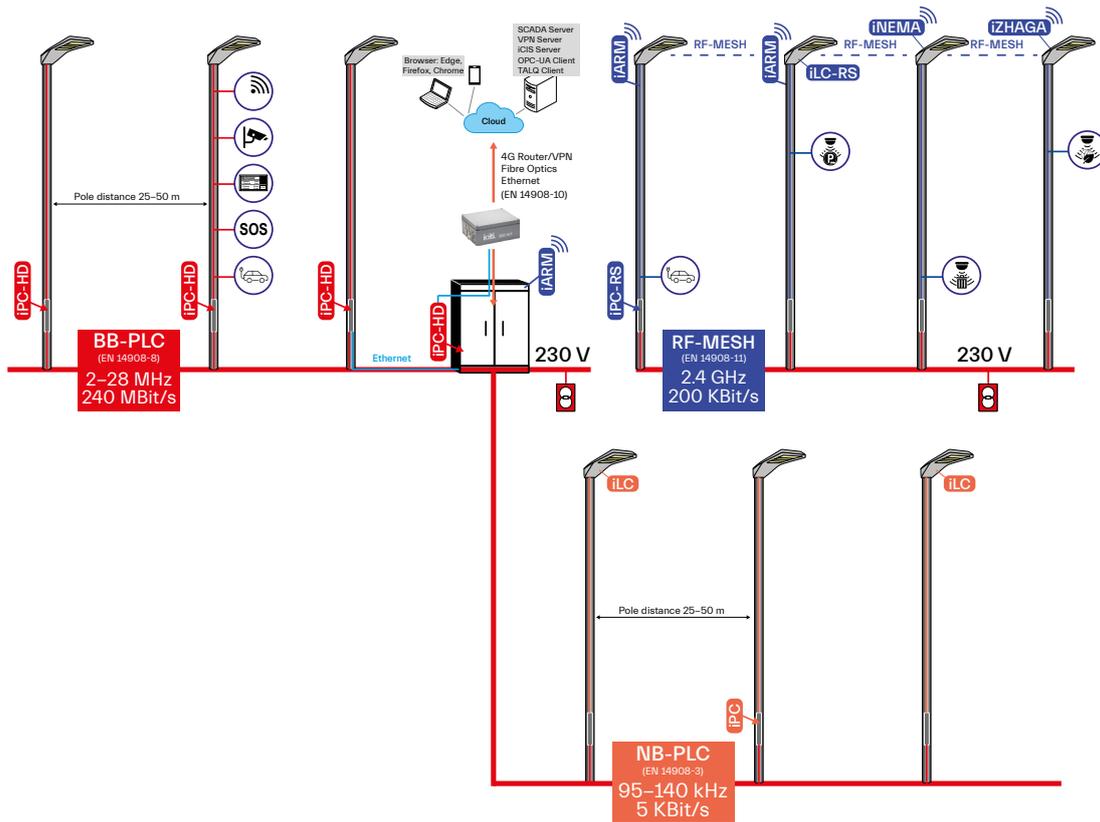
* (in future with standardised data formats and commissioning tools based on 2.4 GHz according to EN 14908-11)

Application area	System overview	Functions				
		On / Off Dimming Diagnosis	Sensors Waste Car park Environment	Multimedia Camera Emergency call / Announcement Digital information boards	Charging station for e-bikes, e-cars	Sensor technology motion-controlled light traffic-dependent control
NB-PLC Approx. 200 controllers per iDC		✓			✓	✓
RF-Mesh Approx. 1000 controllers per iDC Zhaga & Nema also possible		✓	✓		✓	✓
BB-PLC Approx. 200-300 controllers per iDC		✓		✓	✓	✓
IP / LTE-M / LTE-NB (Soft SIM card)		✓	✓		✓	
Mix of BB-PLC, RF-Mesh and NB-PLC		✓	✓	✓	✓	✓

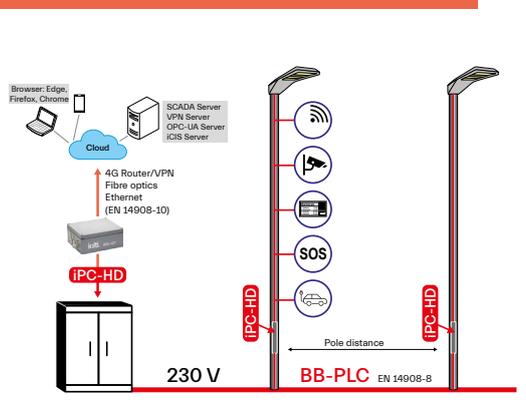
With iciti, you can easily combine the different communication technologies that exist due to the various requirements of smart city applications.



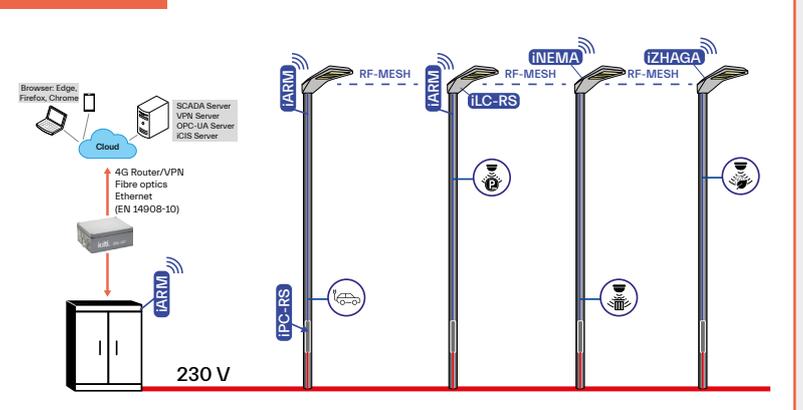
Mix of narrowband, broadband powerline and RF mesh



Broadband powerline (HD-PLC)



RF Mesh



Mesh communication is not linear, but random, with the aim of maintaining communication on alternative routes.

Presently available RF technology for street lighting:

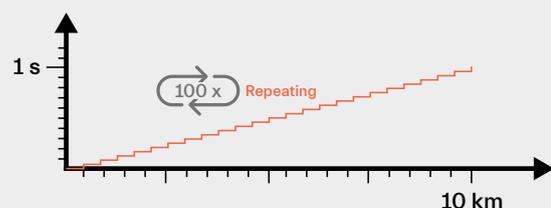
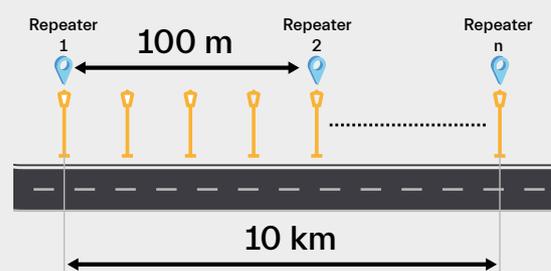
- Sender sends a message to a receiver.
- This recipient becomes the sender and sends the message on to the next recipient (repeating).
- No new message can be sent during the entire transmission until the receipt of the transmission is confirmed.
- Thus a serial processing of the data takes place.
- With each repeating, the bandwidth from transmitter/receiver to transmitter/receiver is halved and the latency increases.

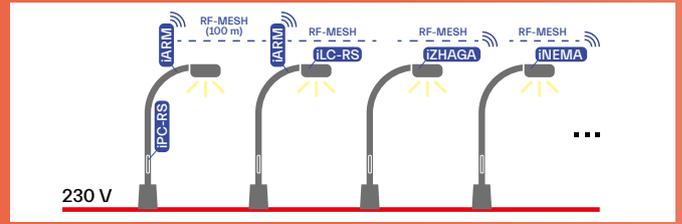
How the iciti RF mesh system works

- Multi-channel transmission, communication (sending and receiving data) takes place in different channels of the 2.4 GHz band.
- Establishment of communication areas for structured and targeted data exchange between participants
- Transmission and receiving occurs in one channel for each communication area.
- Routing only takes place if the message has to be sent outside communication area 1 to other recipients (e.g. communication area 2). This routing process (forwarding the data) does not block communication area 1.
- Low latencies due to multi-channel full duplex.
- Reception on one channel while another packet is already being forwarded on another channel.
- The **data rate of 100 KBit/s** remains the same, in contrast to the halving of the data rate in conventional systems.
- **Routing** the message with change of channel can be done **100 times**.
- Typical data transmission distance between transmitter and receiver is 100 m.
- By repeating 100 times, a **total distance** of up to **10 km** can be achieved.
- The time delay (**latency**) until the command is executed over the entire distance of 10 km is only **1 second**.

iciti RF-Mesh at a glance

- 1000 devices can communicate with each other on an IDC-IOT
- Communication distance up to 10 km
- Event-driven communication for the best possible use of the communication channel
- Standardisation of data transmission and protocol based on the EN 14908 standard
- Second source = future-proof
- Tender neutrality
- Licence-based software
- Interfaces to other software dashboards possible, as standards-based
- Data stored at the client's premises
- Use of the data takes place remotely in the field
- Communication service: Peer-to-peer, Groupcast, Broadcast
- No recurring costs as with cellular networks





Control of light points via light management system with RF-Mesh



Brief description

- Light points are connected via a communication network
- Data for lighting control or from sensors are transmitted



Benefit

- Energy saving
- Energy consumption display (target/actual values)
- Less light pollution
- Flexible adjustment of lighting parameters/levels for events or emergencies
- Increased security
- Error and failure messages in real time
- Optimisation of repair and maintenance
- Using data from street lighting and sensors in iCIS or other management software
- Display of sensor data (curves, limit values)
- Continuous power at the pole (→ prerequisite for offering value-added services)



Functionality

- Central programming of the lighting parameters
- Creation of dimming profiles
- Real-time dimming
- Twilight control
- Creation of luminaire groups
- Integration of sensor technology
- Lighting can be switched / dimmed as needed by means of sensors
- Measurement of energy consumption
- Display of energy consumption, operating hours, luminaire status
- Central bidirectional control of individual or multiple light points via light management system
- Integration into existing management software



Fields of application

- Whole city
- Street, tunnel and near-building lighting
- Green spaces, parks and public places
- Car parks and bus stops
- Bus and railway shunting yards
- Company premises
- Sports facilities



Products

- iDC-IOT-R4G-RFM + iARM (radio module)
- iCIS licences / iCT
- iARM (Refurbishment, luminaire without socket) + iLC-RS or iPC-RS
 - or iZHAGA (for new installations or refurbishments, provided luminaire with Zhaga base already exists)
 - or iNEMA (for new installations or refurbishments, provided luminaire with Nema base already exists)
- Sensors & actuators (provided by customer)



Technology

- RF mesh



Commissioning

- Training on a job
- Support



Future-proof Standard

With LON and LON over HD-PLC (ISO/IEC 14908 or ANSI/CTA 709 series), iciti uses a common standard for outdoor lighting. In acknowledgement of the long innovation cycles for street lighting infrastructure customers should not be dependent on a single source or tied to a manufacturer-specific solution.

EN 14908; ISO/IEC 14908 (ANSI/CTA 709)

Company-neutral data communication for industrial and building automation and the networked City - Building Network Protocol

- Part 1: Data protocol layer model
- Part 2: Communication via twisted pair cables
- Part 3: Communication via the power supply lines (Narrow Band Powerline) [CENELEC 50065-1] 5 KBit/s
- Part 4: Communication via tunnelling over Internet Protocol (IP) [formerly ANSI/CEA 852]
- Part 5: Implementation
- Part 6: Application elements (description of the standard network (e.g. V, A, T, E ...) and configuration variables as well as functional blocks)
- Part 7: Generic communication via Internet protocols with IPv4 and IPv6, native IP addressing of components
- Part 8: Communication via the power supply lines (Broad Band Powerline) [IEEE 1901] 240 MBit/s
- Part 9: Wireless communication in ISM bands
- Part 10: Web services for SCADA, cloud and peer to peer applications

Conformity

Of course, all iciti products meet the applicable requirements according to international standards.

The HD-PLC standard according to IEEE1901 and ITU.T G9905 ensures cooperativity between other users in the frequency range of 2–28 MHz. Other users such as radio services enjoy priority. The frequencies used by these users are automatically detected by the HD-PLC controller. The HD-PLC controller then masks the use of these frequencies for HD-PLC transmission.

Currently existing requirements for signal field strength, such as those set by Swiss OFCOM, are met by the iPC-HD controller. These requirements are derived from the EN 50561-1 standard, to which the HD-PLC controllers comply.

RF-Mesh communicates with the protocol defined in EN 14908-1 and can thus exchange data with NB-PLC and HD-PLC without conversion. Interoperability with other communication channels is thus ensured.

Through continuous participation in international standardisation bodies, LonMark International and the HD-PLC Alliance, we ensure long-term conformity with all standards relevant to our products.

PRODUCTS

intelligent Luminaire Controllers **iLC** and **iPC** – for Narrowband Powerline Communication



OLC-LonMark® profile

- For assembly into luminaires (IP20) or poles (IP65)
- Power consumption: 1 to 3 W
- 10 dimming levels with individual dimming sequences in stand-alone mode, incl. time-delayed on/off switching
- Luminaires can be switched off when connected to a powered lighting cable
- Adjustable control input to suit various tasks
- Connection of various sensors such as motion sensors, key switches and light sensors
- Compensation of reduction in luminous flux with freely definable values for lamp service life as well as start and end levels
- Optionally with audio frequency remote control receiver for migration of existing systems

intelligent Luminaire Controllers **iPC-HD** – for Broadband Powerline Communication (HD-PLC)



OLC-LonMark® profile

- High-definition powerline communication: 2-28 MHz with up to 240 MBit/s (gross) incl. 2.5 MBit/s independent LON channel
- Power consumption: ~3 W
- Ethernet transmission via HD-PLC communication
- Up to 10 self-organised repeaters to overcome large communication distances
- Connection of various sensors such as motion sensors, key switches and light sensors
- High precision measurement of voltage, current, power factor, output, energy, temperature, lighting hours with very high accuracy

intelligent Data Concentrator (Edge-Controller) **iDC-IOT**



- Transmission options: 4G router, fibre optics, IP/Ethernet cable
- Connection of the field level via widespread mobile networks of different providers
- For integration into a mobile network, an additional SIM data card is required (not included in the scope of delivery), depending on the application and network size with a data volume of 30 to approx. 300 MB
- In parallel or alternatively, the iDC-IOT can also be integrated into an IP network via a Ethernet cable

Software **iCIS** and **iCT**



- Standardised light management iCIS
 - Control (on/off, dimming), creation of luminaire groups
 - Support of different LON profiles
 - Graphical processing of measurement data
 - Scheduled switching
 - Data and error analysis
 - Filter option & updates
- iCT – intelligent Commissioning Tool

Sensors and Infrastructure Accessories



- iLUX – intelligent sensor
- iCCU – intelligent coupling unit
- iPL-NI – intelligent powerline network interface
- iPL-F – intelligent powerline filter

RF Mesh Products

- iARM – Radio module with antenna for luminaire controller RS
- Luminaire controller for operation with the iARM
 - iLC-RS for assembly in luminaire (IP20)
 - iPC-RS for pole assembly (IP65)
- Luminaire controller with integrated radio module
 - iZHAGA with Zhaga socket
 - iNEMA with Nema socket
- iARM-NI – Network interface for iDC-IOT
- iGATE – Power supply and management for external sensors
- iROUTER – Connection between different communication channels
- Software drivers
 - RF Mesh
 - LoRaWAN

coming soon