IQRF Tech s.r.o.
... we are the IQRF®

IQRF Tech s.r.o.
... we are the IQRF®
120 years ago
The first wireless transmission is realized.
2017
IQRF Tech technological spin-off is found with the mission to
deliver #1 wireless mesh technology for IoT.
IQRF® solves global market demand
and simply connects devices to IoT through wireless mesh networks.

2004 – 2017 ⇨ IQRF® ecosystem

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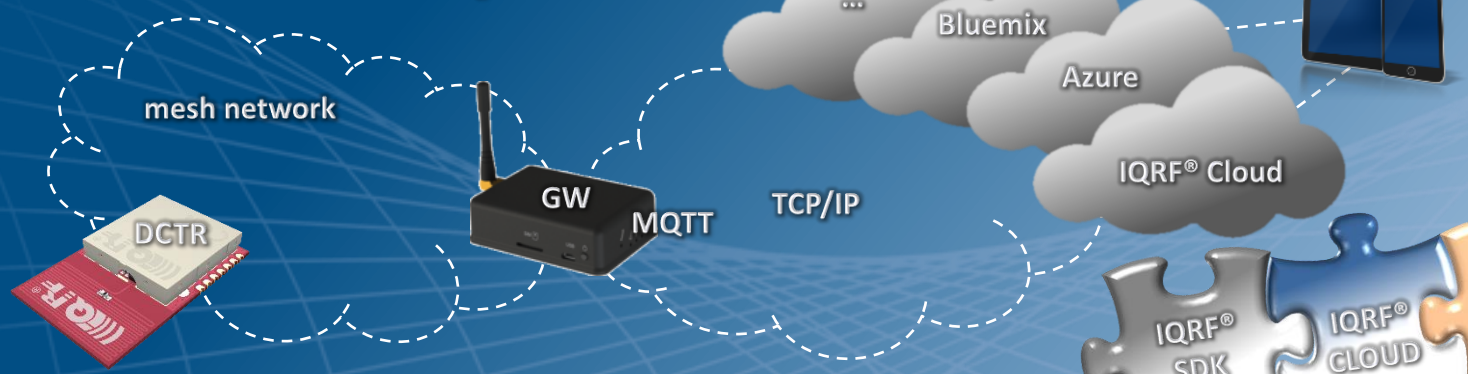
... we are the IQRF®

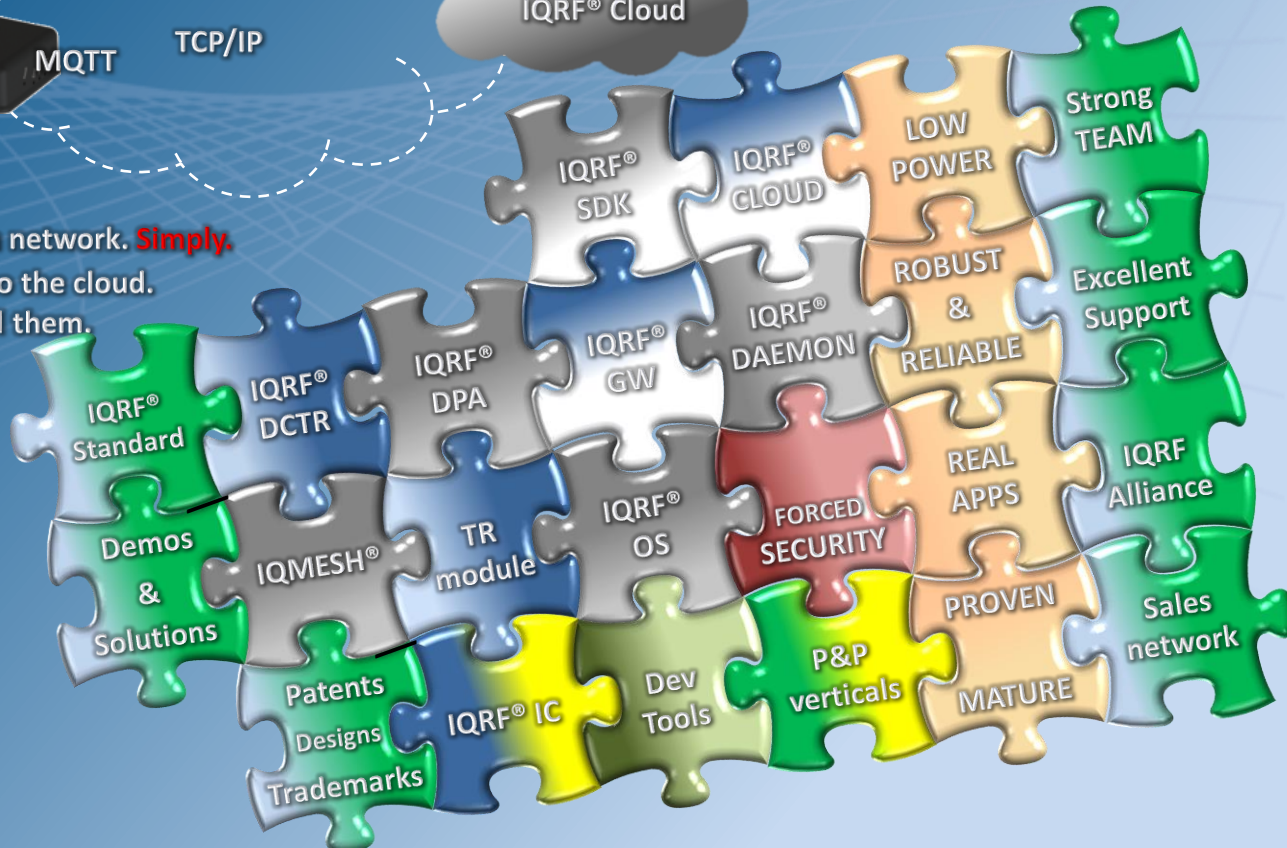


We taught things to communicate in a mesh network. Simply.
We made them accessible. And connected to the cloud.
We enabled others to use them. And control them.

We have built up huge ecosystem, with unique features, great specs & huge IP.

IQRF® is an excellent horizontal platform.

Further we should accelerate verticals and increase economic attractiveness.



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Comparisons and positioning

IQRF Tech s.r.o.
... we are the IQRF®

Opportunity

Market fragmentation
No global standard

RANGE SPEED MEDICAL POWER EFFICIENCY APPLICATION INDUSTRIAL SECURITY CHANNELS STORAGE SECURITY COMMERCIAL SENSORING GEO DATA INDOOR DEEPER INDOOR INFRASTRUCTURE PROCESSING OUTDOOR ENVIRONMENT OBSTACLES CONNECTIVITY FEES INTERFERENCES ATTENUATION

Bluetooth Z-wave Wi-Fi WPANs Zigbee ANT WLANs WNANs EnOcean Wireless M-Bus

5G 4G 3G CELLULARs 2G NB-IoT

LoRaWAN Ingenu Nwave LPWANs Weightless Sigfox

IQRF

Developer can design the whole system

IQRF

Security, reliability, up to 240 hops

Routing infrastructure – rented or bought

IQRF ONLINE

Security, reliability, up to 16 hops,
low power, cloud processing, design simplicity

IQRF ZONE

local autonomy

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Comparisons: positioning

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ANT
Wi-Fi
Bluetooth
Zigbee
Z-wave
EnOcean
WPAN

Wi-Fi
Wireless M-Bus
WLAN

Wi-SUN
Zigbee-NAN
WNAN

5G
4G
3G
2G
WWAN
LoRaWAN
Nwave
Sigfox
NB-IoT
Weightless

Short range (10 - 100 m)

Short/Medium range (100 - 1000 m)

Medium range (1 – 10 km)

Long range (10 - 100 km)

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Delivered unique value

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... we are the IQRF®

IQRF® is a mature wireless technology, which can be easily integrated into any electronic product by ready-to-use transceiver modules, dramatically shortening time-to-market.

Devices talking by the same language, IQRF® DPA commands, are fully interoperable.

IQRF® is complementary to standards (cellular, WiFi, Ethernet), deploying existing communication infrastructures, while enabling local autonomy & control in wireless mesh networks. IQRF® is nowadays horizontal wireless platform and growing ecosystem providing strong basis for variety of vertical solutions and applications.

IQMESH® FRC®
DCTR® HWP DPA

SECURE
SECURE
SECURE

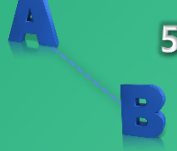
Based on standards
+ security extensions

reasonable speed
& bidirectional

control + centralized maintenance
OTA management + reliability

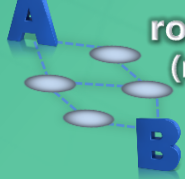
low power

4.55 nAh/B
<< LPWAN



500+ m

reasonable coverage
outdoor + indoor



routing
(mesh)

reliability + robustness
+ deeper indoor

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The IQRF® technical background

by Dr. Vladimír Šulc

... to be #1 wireless mesh technology for IoT

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A mature technology connecting devices to IoT via wireless mesh networks

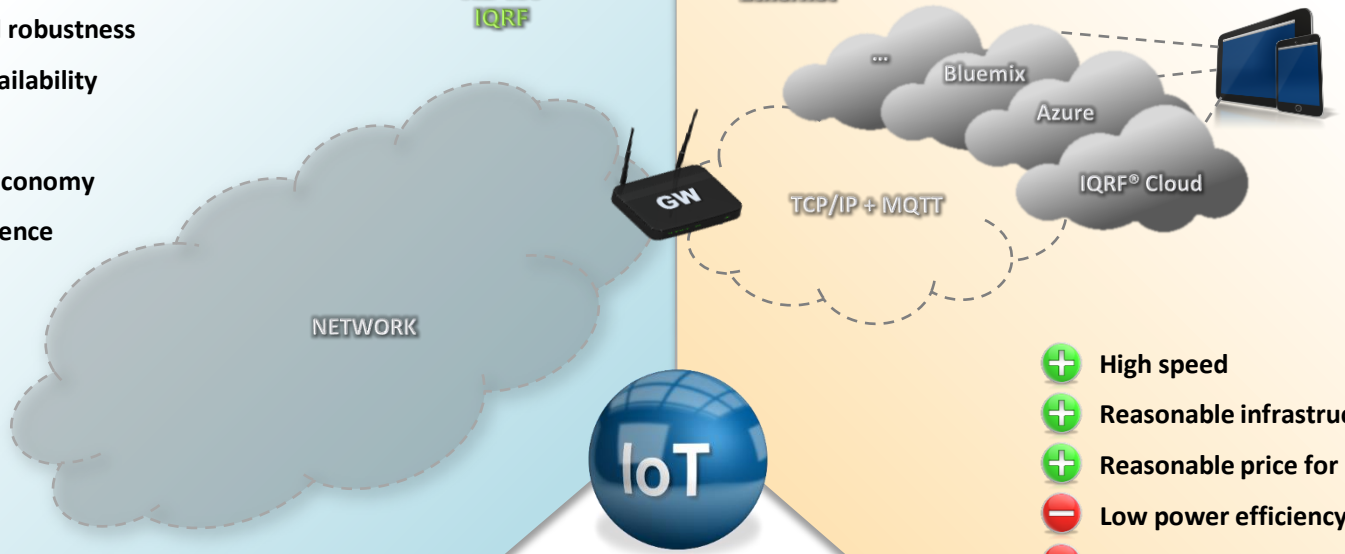
- Power efficiency
- Complexity
- Local autonomy and control
- Reliability and robustness
- Maturity & availability
- Security
- Connectivity economy
- NANs convenience

Low Power Wireless

LPWANs
Zigbee
Z-wave
NB-IoT
IQRF

High Speed

CELLULARs
Wi-Fi
DSLx
Ethernet



- High speed
- Reasonable infrastructure density
- Reasonable price for high volume data
- Low power efficiency / DEVICE-message
- Establishing connection time
- Complex protocols

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A mature technology connecting devices to IoT via wireless mesh networks

	Sigfox	LoRaWAN	Zigbee	NB-IoT	IQRF
Power efficiency					
Low complexity (device)					
Local autonomy and control					
Maturity & availability					
Security					
Connectivity economy					
NANs convenience					

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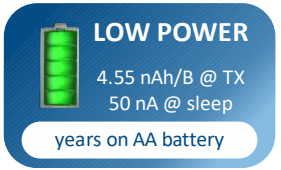
Low Power

Supply current	
Deep sleep mode (OS v4.00 or higher only)	56 nA (all peripherals disabled [4], RF IC in Standby mode)
Sleep mode	610 nA (all peripherals disabled [4], RF IC in Sleep mode)
Run mode	
RF sleep	1.6 mA
RF ready	3.0 mA
RX mode	
STD	11.8 mA
LP [5]	250 µA
XLP [5]	16.3 µA
TX mode	8.3 mA – 21.5 mA (according to RF output power)



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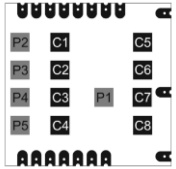
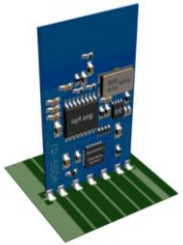
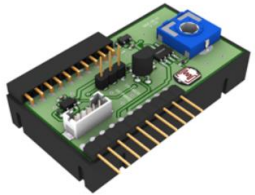
Low complexity and rapid development

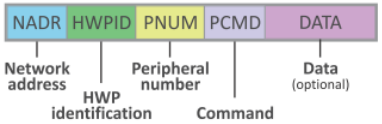
- Small PIC micro delivers complete functionality
- Transceivers can be easily integrated into HW (SIM/soldering)
- Universal development tools for solderless prototyping

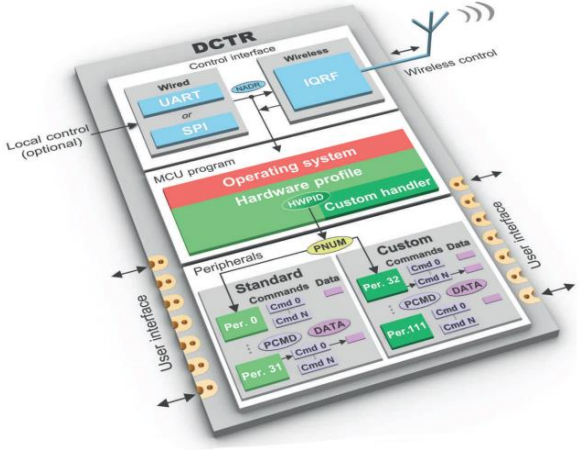






- IQRF® OS … basic SW layer with basic services inside
- IQRF® DCTR … development without programming
- IQRF® DPA protocol … ability to listen
- IQRF® DPA Commands … standardized language





- IQRF® Daemon open source

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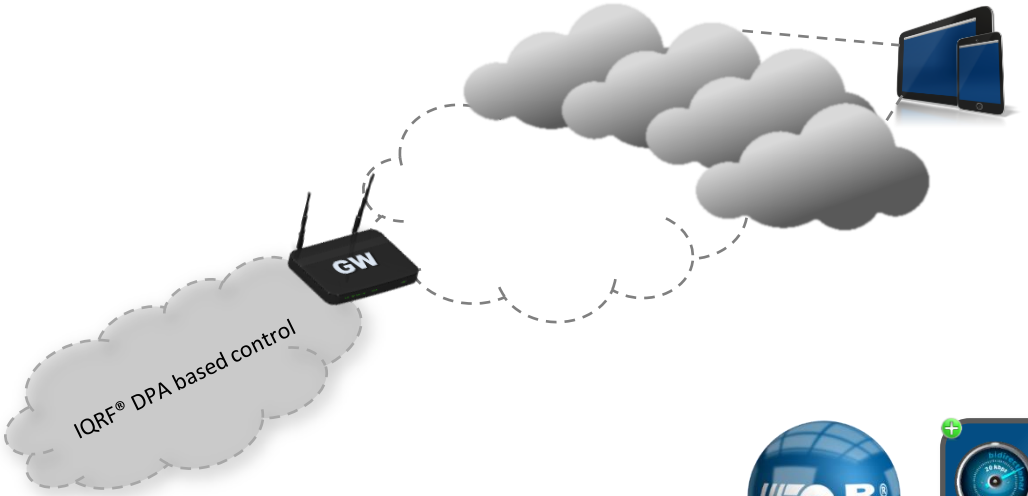
Local autonomy and control



Local autonomy & control motivanion and preconditions

- Independency on-line services availability
- Bidirectional link between control unit and devices
- Reliable delivery of control commands
- Controlled devices confirmations and responsiveness

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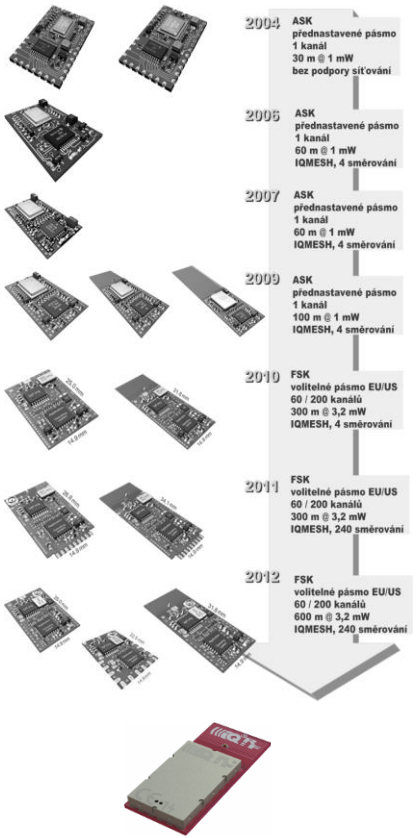
A mature technology connecting devices to IoT via wireless mesh networks

Maturity and availability

250+ kpcs IQRF® based devices in the field
Hundreds of projects

2004 - 2017

- Unique transceiver architecture with built in operating system — patented
- Robust routing algorithm for really working wireless mesh networks — patented
- IQRF® IDE with real time debugging and network maintenance tools
- IQRF® Data Controlled Transceivers for programming free integration — patented
- Simultaneous work in two networks enables networks chaining — patented
- Advanced Network Management Tools – remote bonding, back up, replacement
- RFPGM® + IQRF® OTA - robust RF programming in application
- FRC® - the fastest network management and data aggregation — patented



Why to wait for tomorrow's promises? It should be available today.

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Security

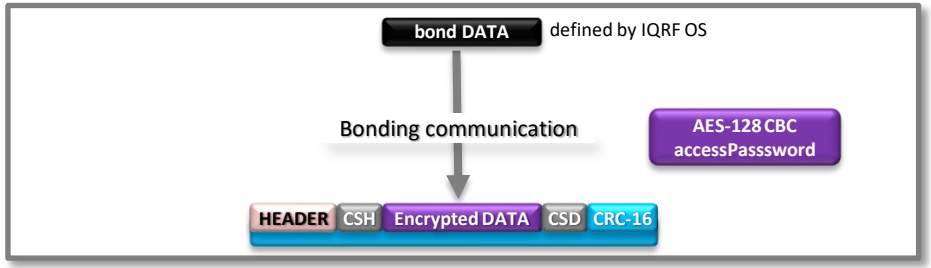
- Multi-layer **forced** security based on standards
- Complexity, adequacy, understandability, simplicity
- No golden keys, no fixed keys, trusted keys management
- System security isolation
- Secure IQRF® OTA updates for future fixes

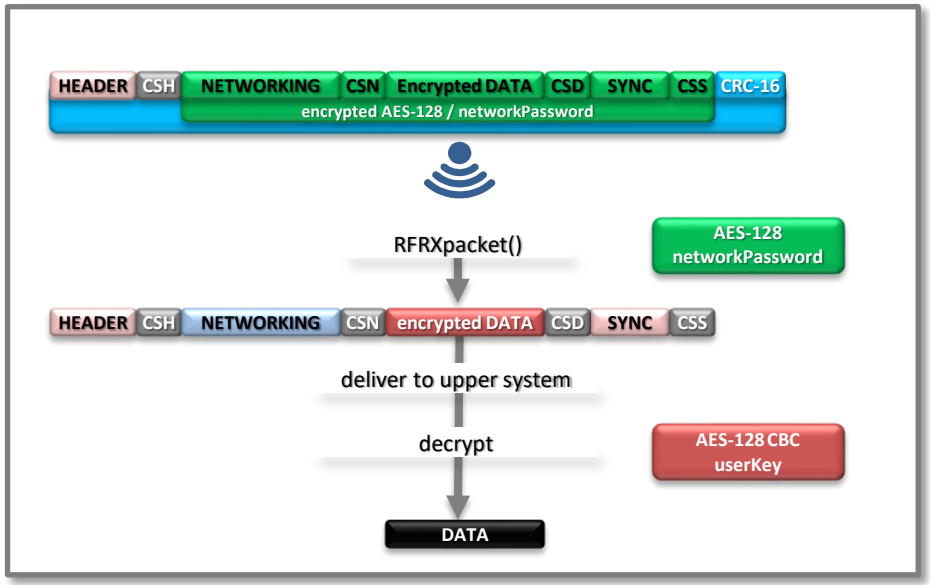
encryptBufferRF(x)

decryptBufferRF(x)

setUserKey()

setAccessPassword()





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A mature technology connecting devices to IoT via wireless mesh networks

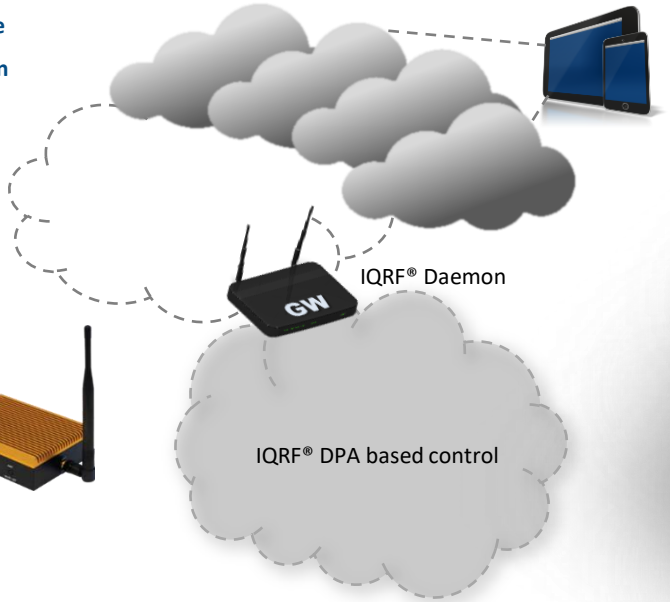
Connectivity economy

- Supporting both business models
- Reasonable price of HW per device
- Low cost GW, open source daemon
- Easy integration
- IQRF® DPA shorten development
- Interoperability
- IQRF® OTA remote maintenance
- Ownership: low cost

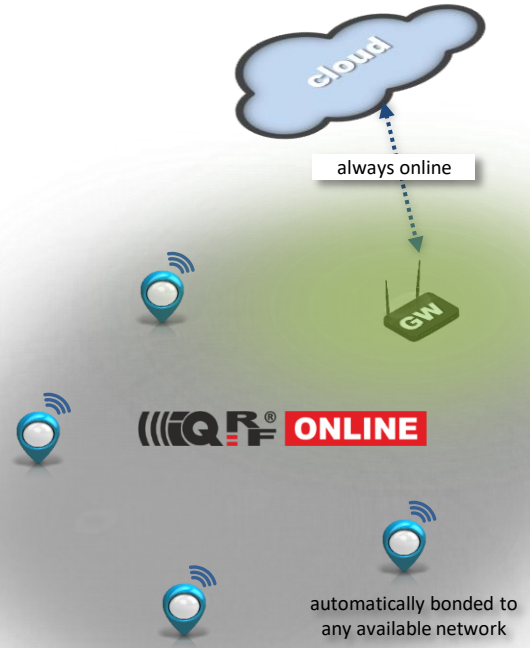
IQRF® Daemon

IQRF® DPA based control

(1) Infrastructure ownership



(2) Infrastructure renting



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A mature technology connecting devices to IoT via wireless mesh networks

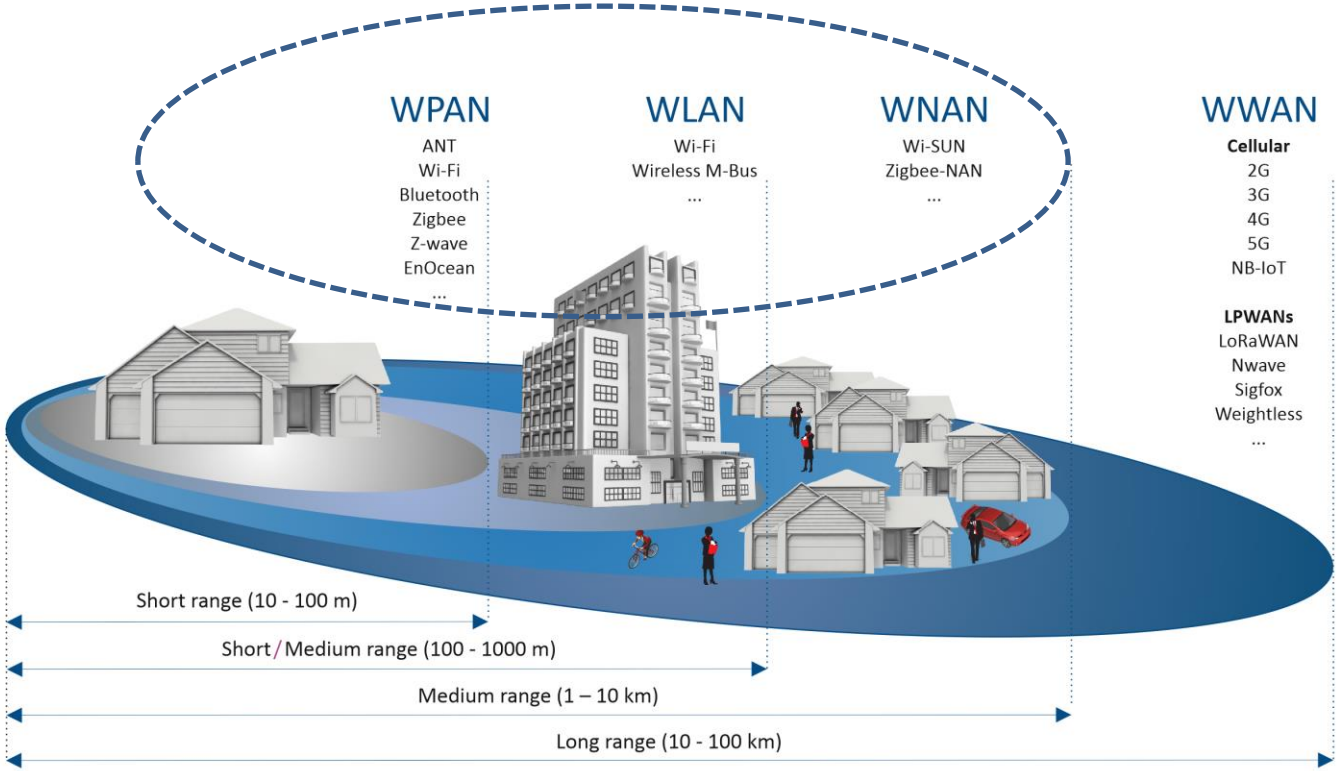
NANs convenience

RANGE
500+ m
8 mW
Reasonable coverage

+

ROUTING
IQMESH®
up to 240 hops
Robustness + reliability

10+ km range



Proven by 100k+ devices running in street lighting projects. For years.

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A mature technology connecting devices to IoT via wireless mesh networks

	Sigfox	LoRaWAN	Zigbee	NB-IoT	IQRF
Power efficiency					+
Low complexity (device)					+
Local autonomy and control					+
Maturity & availability					+
Security					+
Connectivity economy					+
NANs convenience					+

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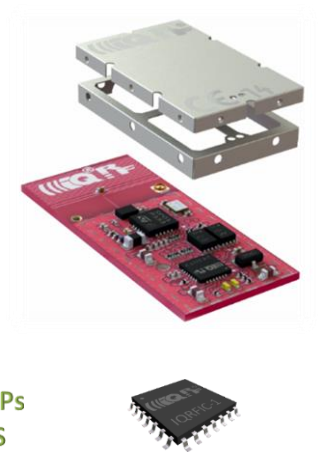
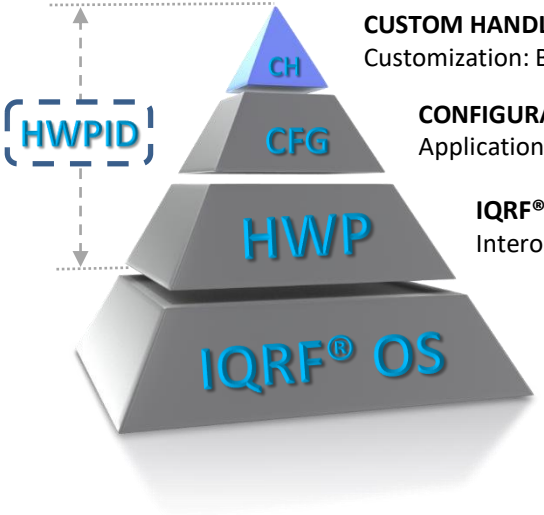
HW & SW architecture

Data Controlled Transceiver Module



IQRF® Core SW



CUSTOM HANDLER
Customization: Behavior, Additional functionality

CONFIGURATION
Application Specific Configuration

IQRF® HWP (DPA based)
Interoperability, Optimizing, Maintenance

IQRF® OS
PHY, Networking, Security, App mgmt.

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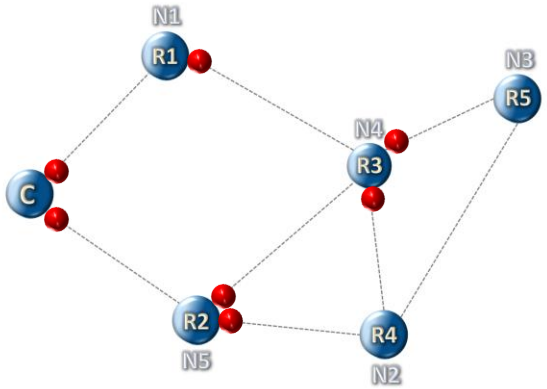
Why IQMESH® is the best choice for reliability & robustness

It's reliable due to the patented routing



Example: C sends message to N2

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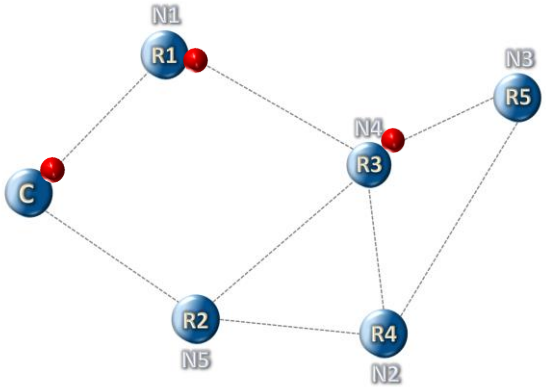
Why IQMESH® is the best choice for reliability & robustness

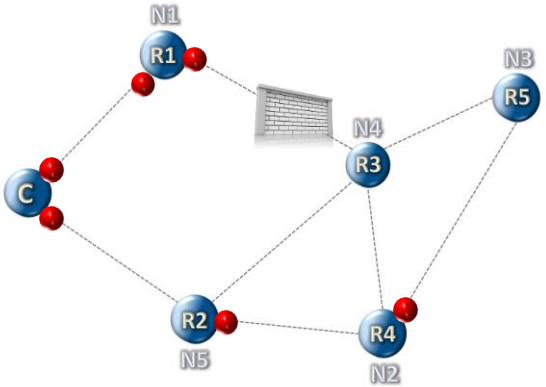
It outperforms Ad-Hoc routing in real applications

Example: C sends message to N3

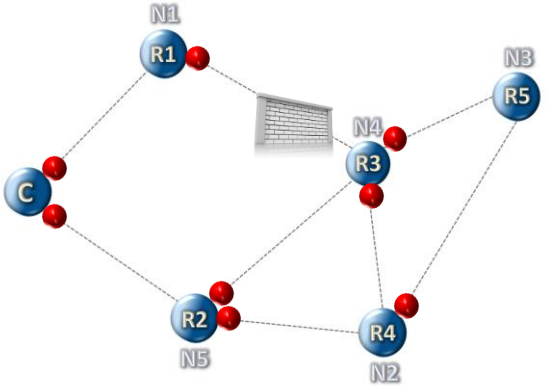
Ad-hoc routing



Ad-hoc routing



IQMESH®



In reality, acknowledgements should be made during ad-hoc routing. It dramatically decreases performance.

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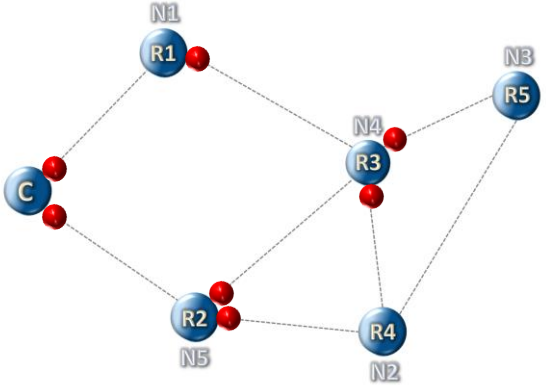
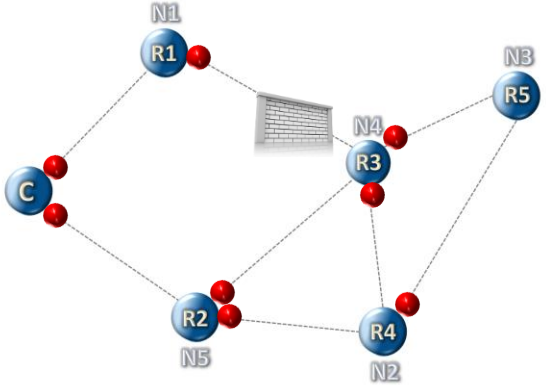
Why IQMESH® is the best choice for reliability & robustness

- It's unique and patented (EU/USA)
- Redundancy dramatically increases robustness
- It's simple to use it
- It's collision free, based on oriented flooding in dedicated time slots
- It's deterministic, packet always reaches destination in less than N_{VRN} time slots
- No partial acknowledgments are needed
- It's proven in real applications





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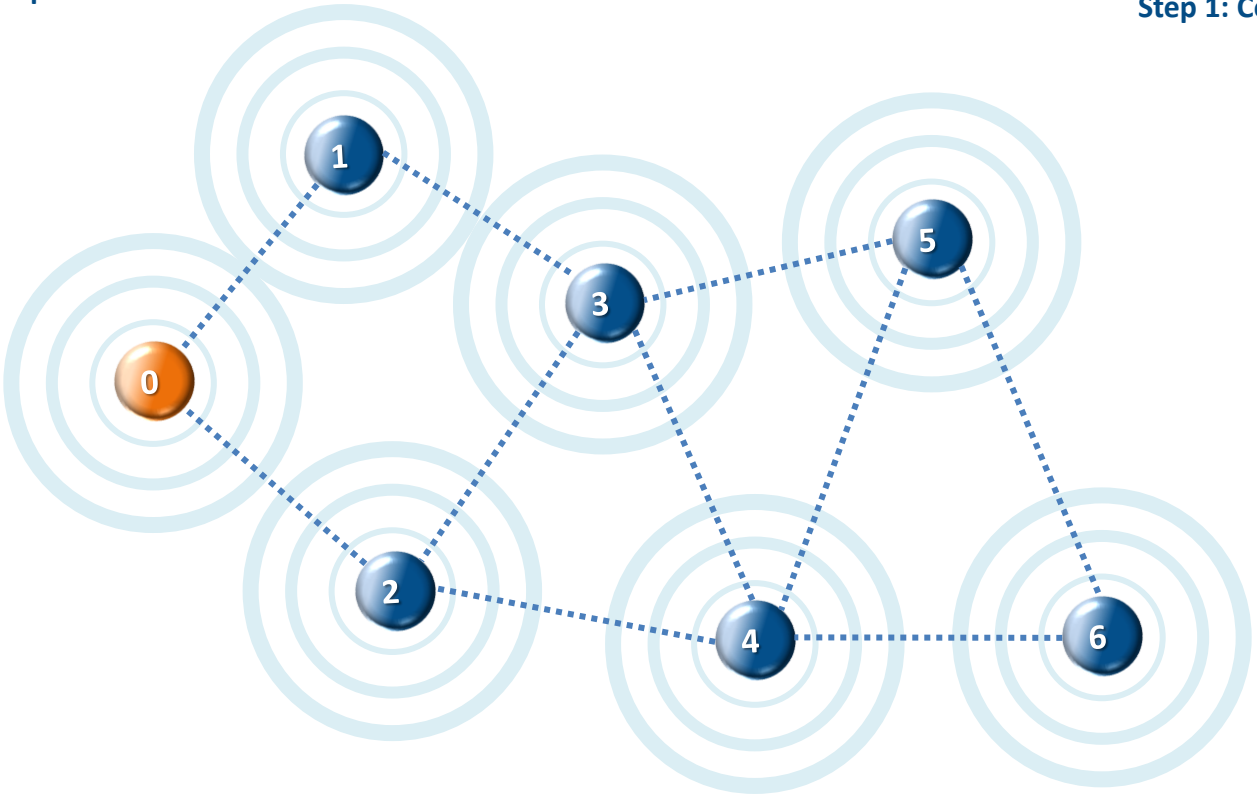
FRC® - Fast Response commands

Step 1: Command distribution



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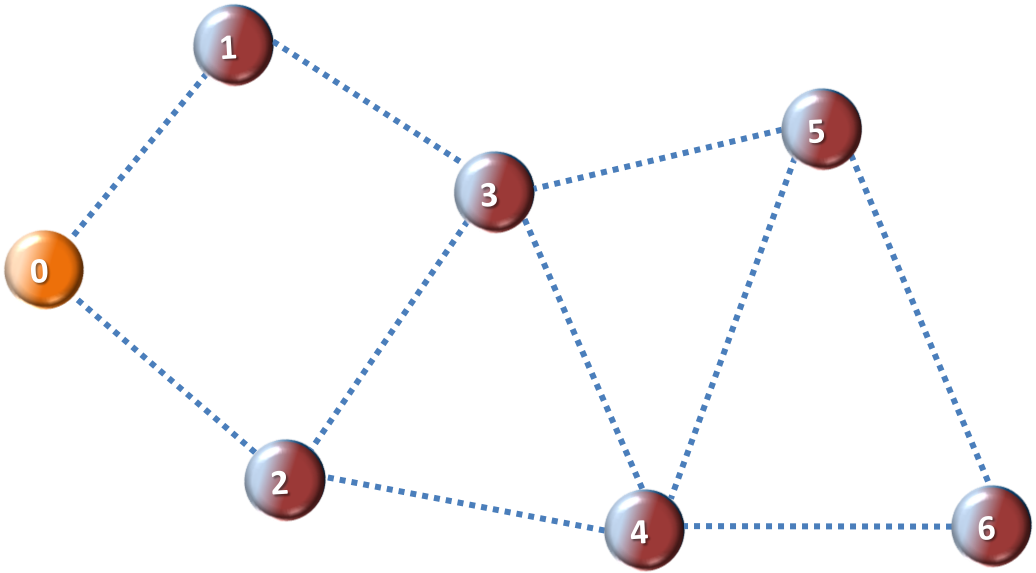
FRC® - Fast Response commands

Step 2: Synchronized activity start



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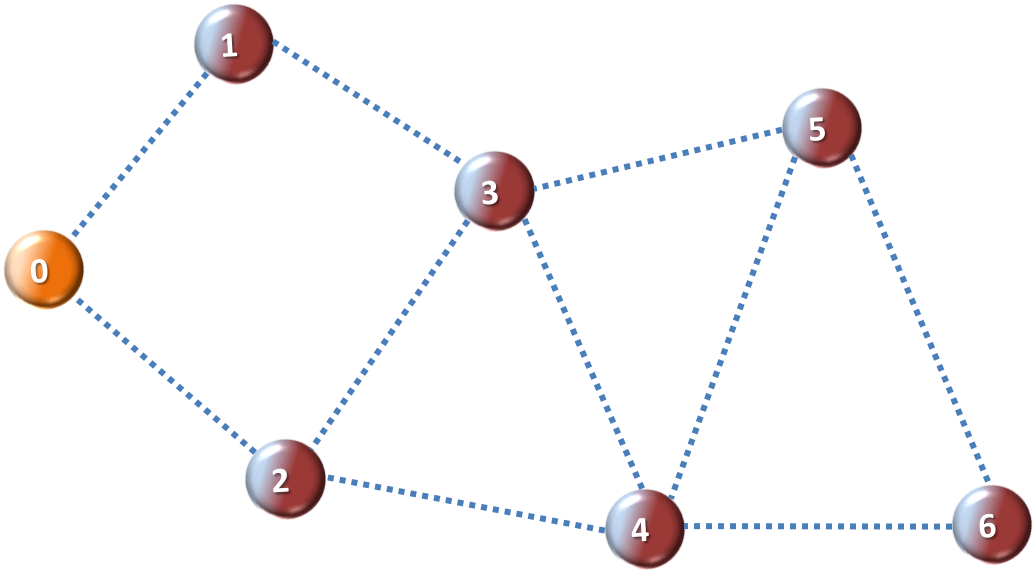
FRC® - Fast Response commands

Step 3: Synchronized command execution



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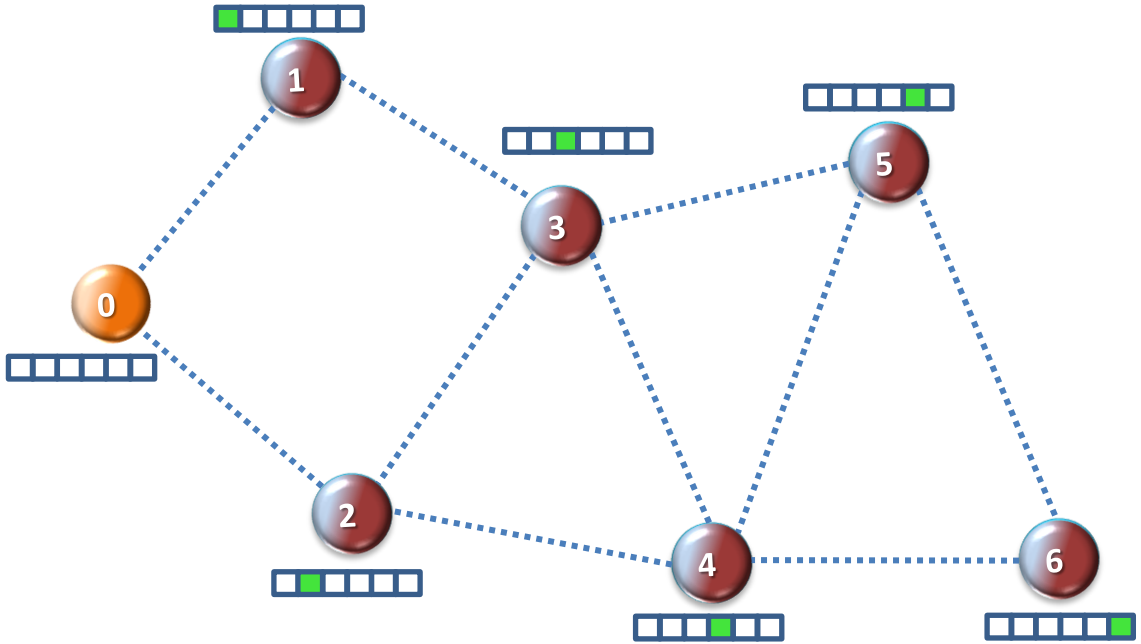
FRC® - Fast Response commands

Step 4: Own data preparation



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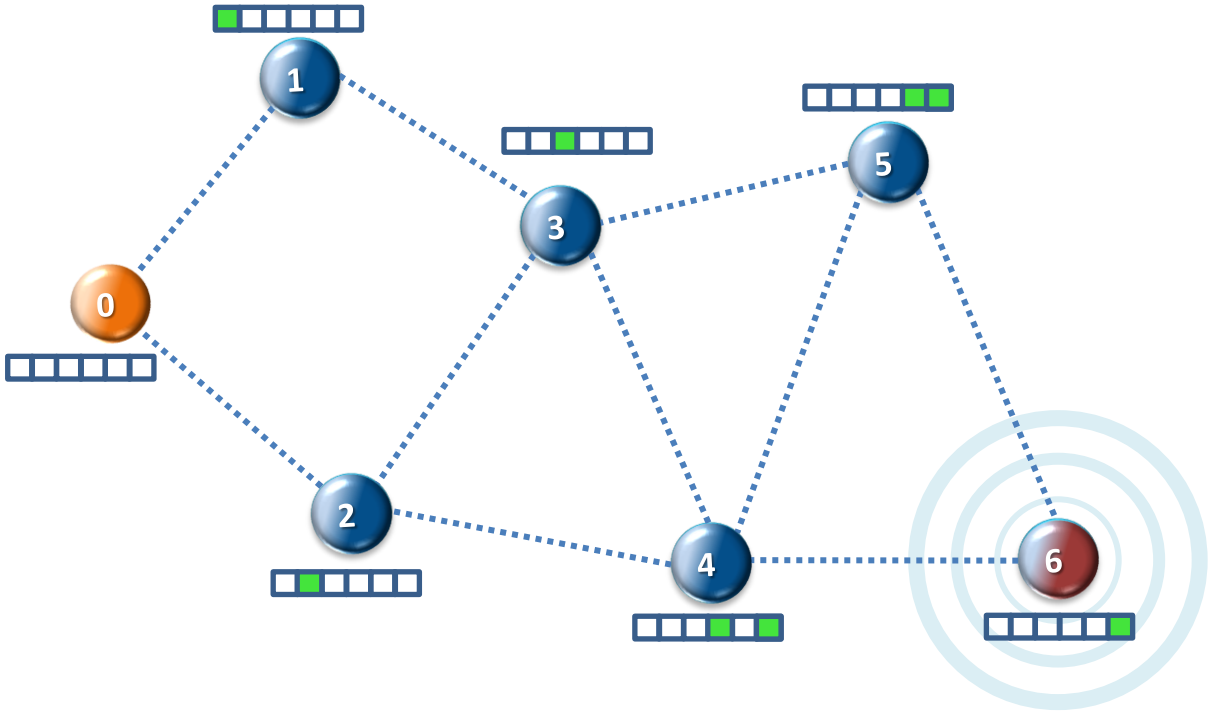
FRC® - Fast Response commands

Step 5: Data aggregation



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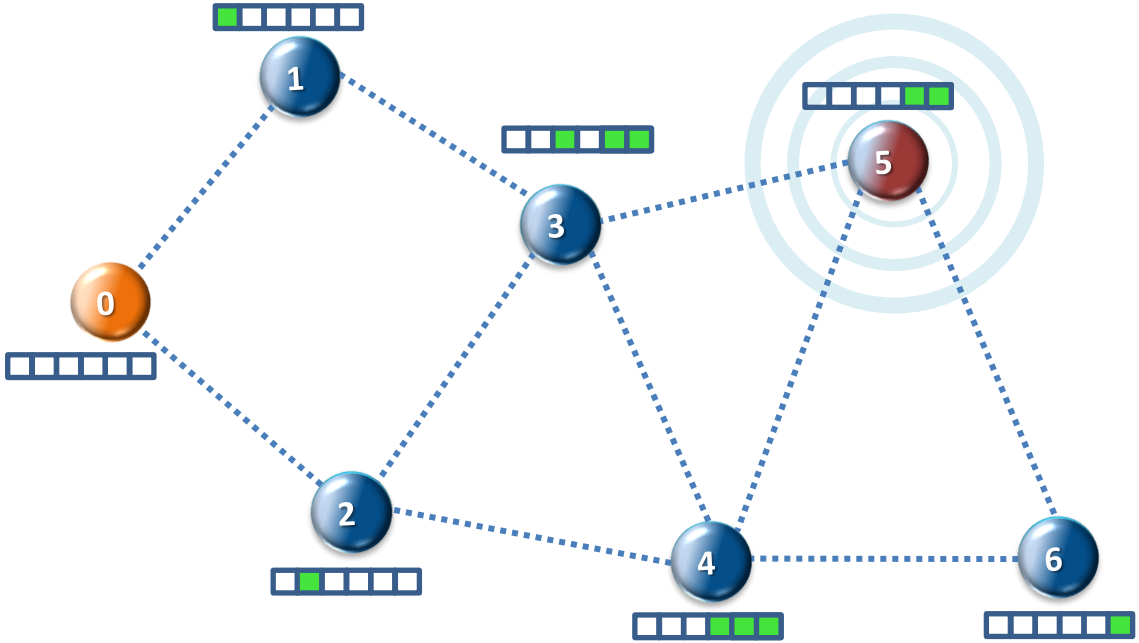
FRC® - Fast Response commands

Step 5: Data aggregation



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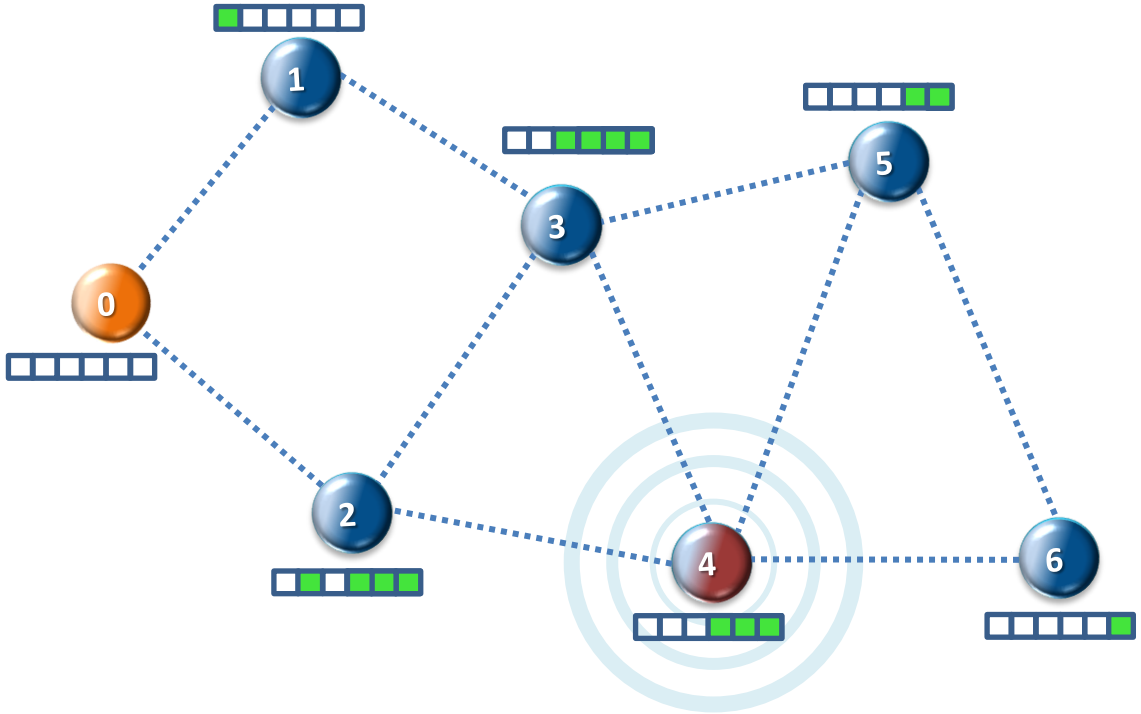
FRC® - Fast Response commands

Step 5: Data aggregation



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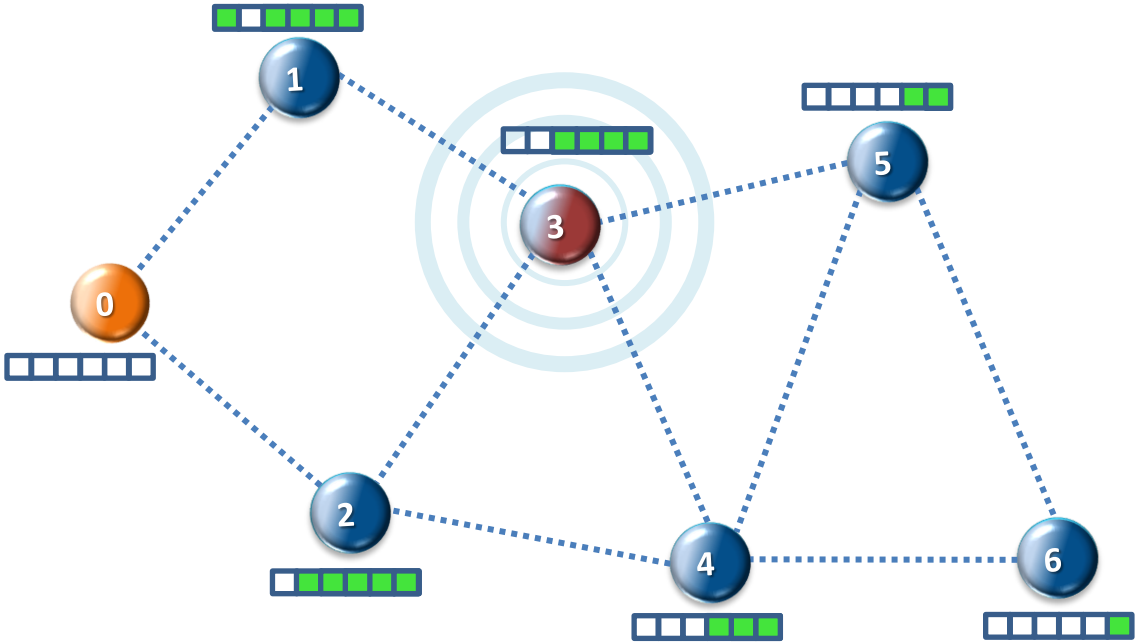
FRC® - Fast Response commands

Step 5: Data aggregation



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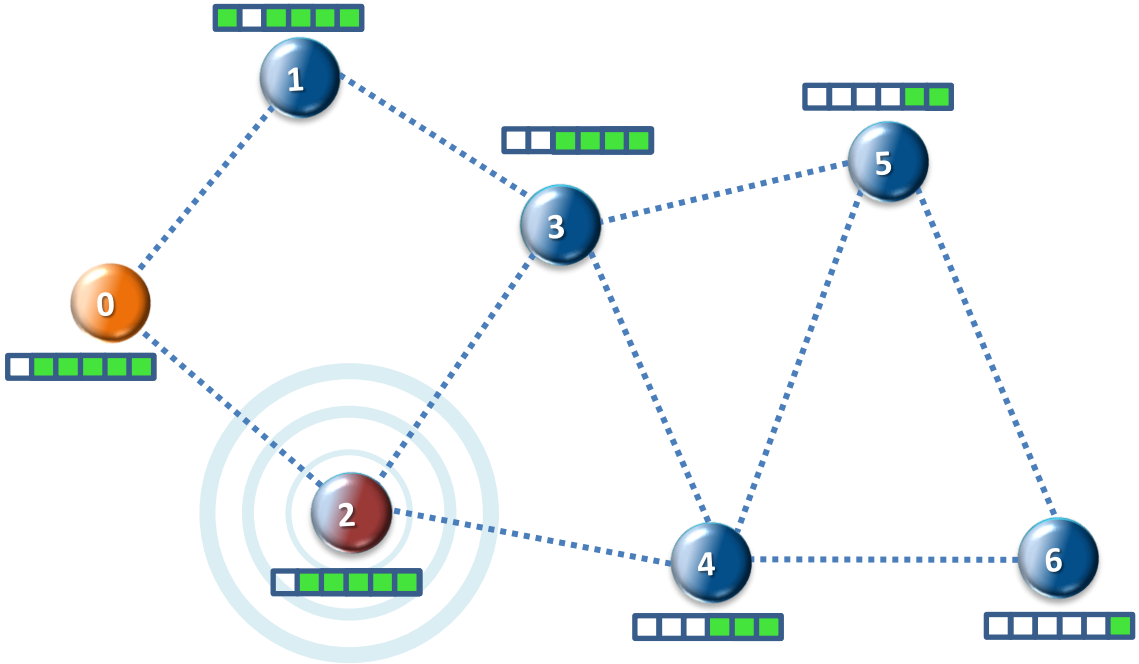
FRC® - Fast Response commands

Step 5: Data aggregation



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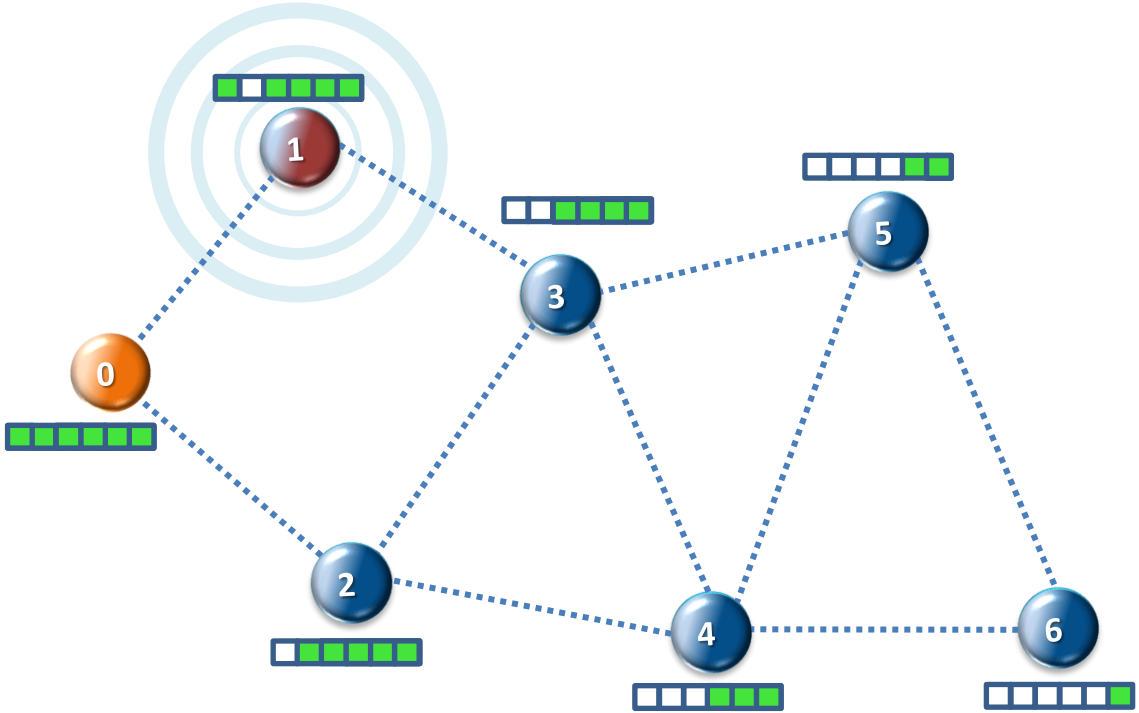
FRC® - Fast Response commands

Step 5: Data aggregation



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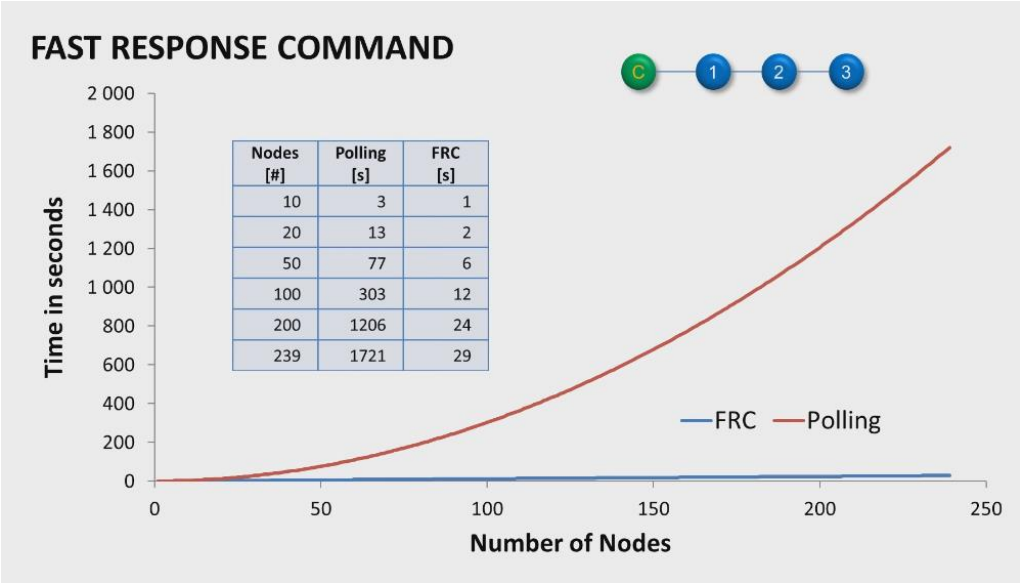
FRC® - Fast Response commands

- It's unique and patented (EU, USA, CN, JP)
- It deploys IQMESH® configuration
- Further dramatically increases robustness
- It linearizes exponential time for dummy polling
- 2 N time slots only
- It's a great tool for network maintenance



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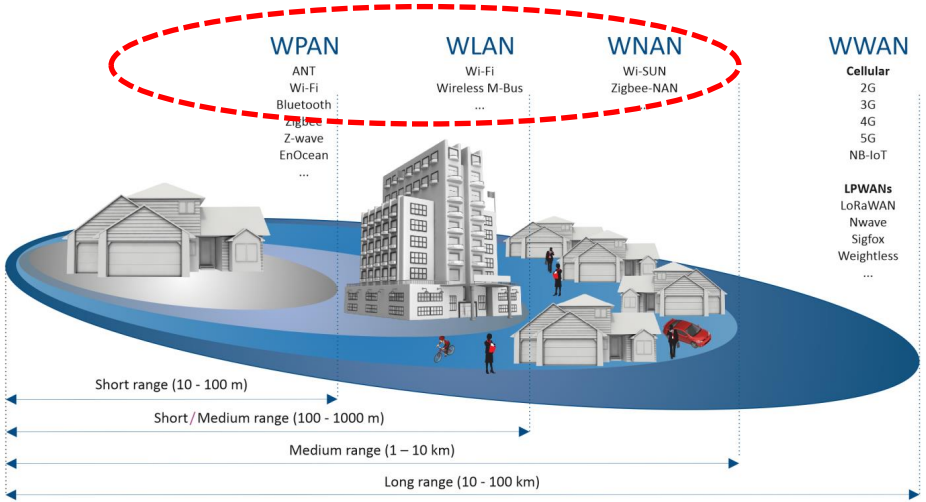
A mature technology connecting devices to IoT via wireless mesh networks

- IQMESH® … the best choice for reliability and robustness
- FRC® - Fast Response commands … a must for any control
- IQMESH® / Gateway / Cloud architecture
- The best solution for chain mesh topology (street)
- ISM band, 500+ m / hop, 10+ km coverage

Excellent fit to SMART CITY applications

Proven: Street lighting, Parking systems, Environment monitoring



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And IQRF® future?

... to be #1 wireless mesh technology for IoT

A mature technology connecting devices to IoT via wireless mesh networks

… to be #1 wireless mesh technology for IoT

2018

SW

New bonding
Virtual devices
IQRF® zones
PHY

IQRF® Daemon

HW

The IQRF® infrastructure

2019

STANDARDIZATION

Opening the IQRF®
Flooding routing
IQRF FRC®
IQRF® DPA

2021

The IQRF®

RFICs neutrality
GW independence
Cloud neutrality

Simple
Secure
Interoperable
Standardized

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... we are the IQRF®

Smarter wireless. Simply.

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