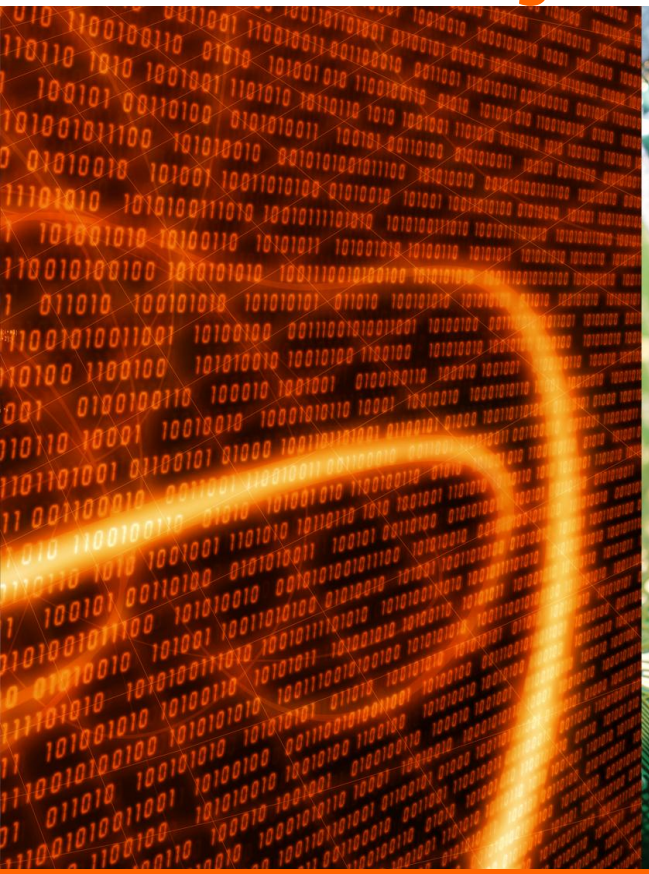
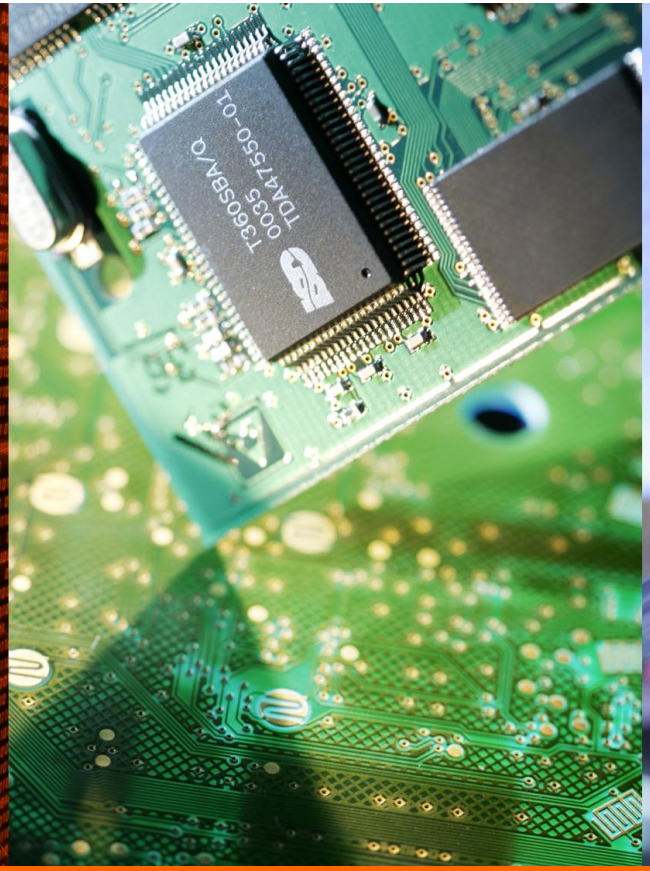
arendi

# DECT versus ZigBee, Bluetooth LE und Co.





r&d

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3) DECT and DECT ULE Technology
4) DECT ULE compared to the others
5) Use Cases for DECT ULE
6) Standardization
7) Chipset suppliers
8) Conclusion

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# Arendi and DECT – Who is Arendi?

**Embedded Engineering Design House**

- Providing software and hardware engineering service
- Providing project management service for industrial product development

- Providing product development, specialized on mid to high volume quality products with production China

arendi

arendi Products

# Arendi and DECT – Arendi Experience

"**More than12 years of experience** in developing telecom products for major European Operators"

T-Home

orange™

BT

swisscom

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# DECT in Home Automation?

## Status Quo in Home Automation

- Shake-out of protocols has yet to start in Home Automation technologies including: Z-Wave, ZigBee / 802.15.4, Wavenis, Power line, Insteon, X10, M-bus, Lonworks and HomePlug.

## Requirement for Home Automation

- A wireless network technology has to balance requirements such as range, power consumption, reliability, bandwidth and cost. All of the current protocols have strengths and weaknesses.

## DECT has been overlooked

- DECT is a technology that, according to a recent MZA report2, is already installed in 245 million households worldwide and features in around 80 million new systems for the home sold annually.

# DECT in Home Automation?

**Yet another wireless technology for home automation needed**

**?**

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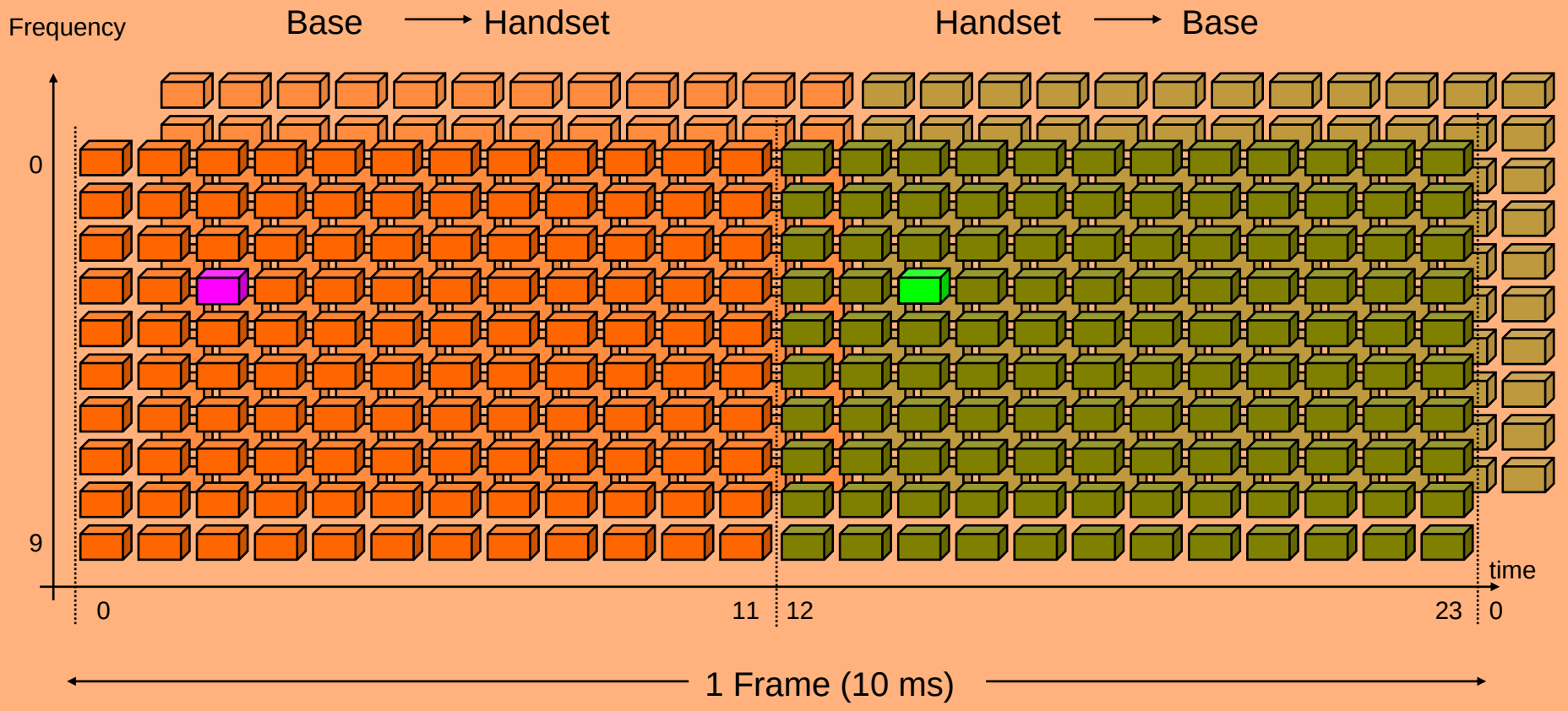
# DECT Technology - Summary

| | |
|---|---|
| Frequency | 1880 - 1900 MHz |
| Channels | 120 Duplex Channels |
| Multiplexing | Time multiplexing (TDMA), Frame length 10 ms, 24 timeslots, 10 frequencies |
| Chanel frame | 1.728 MHz |
| Bitrate | 1.152 Mbit/s |
| Modulation | GFSK (BT=0.5) |
| Speech Coding | 32 kbit/s ADPCM, 64kbit/s G.722 |
| RF power | 10 mW average; 250 mW max power |
| Range | 50 - 300 m |

# DECT Technology – Slot Format and Frequencies



# DECT Technology – Sample Chip Architecture

Ultra low power mode 32kHz time based and low power CR16 mode

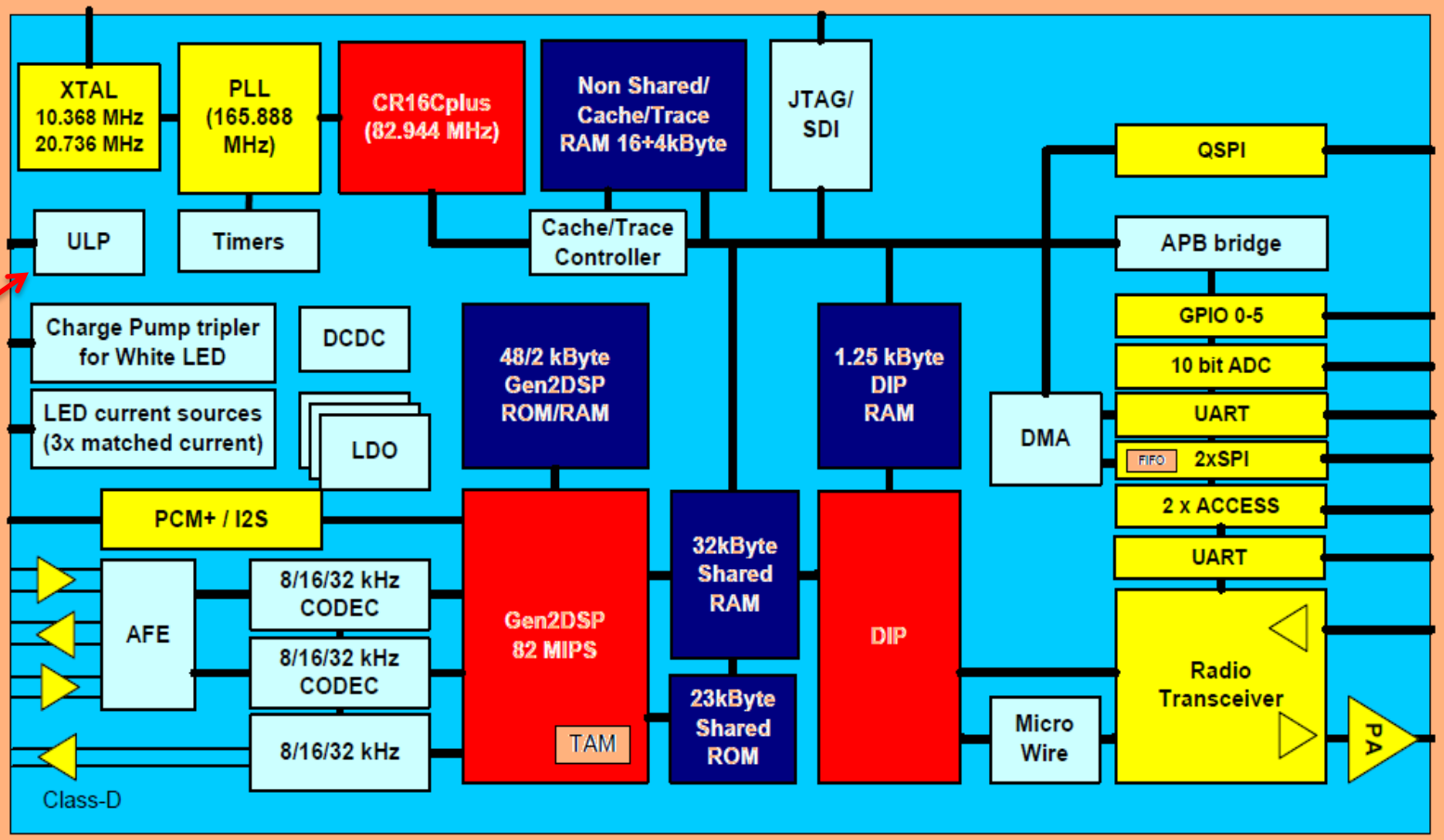
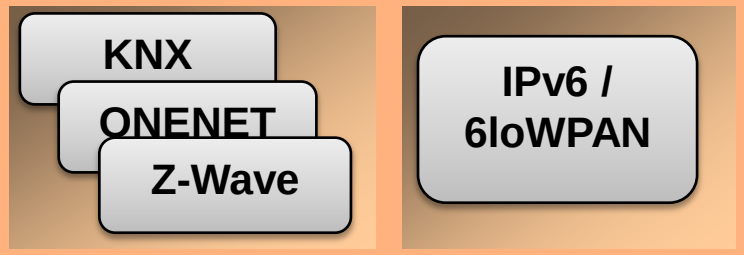



Figure 2 Blockdiagrams SC14442A

# DECT ULE Technology – Specification/Requirements

- Packet size scalable from ~32byte up to 256byte
- 32byte – 256byte ULE data messages
  - Packet fragmentation handled in ULE protocol
  - Authentication done only once per ULE datagram
  - Authentication required also for alive messages
- Latency
  - Node to base - Data Message of 64byte ULE datagram send in <100ms
  - Base to node - <100ms (line powered)
- Number of Nodes > 400
- Security - Packet authentication and Encryption
- Paging – 256 nodes directly addressable

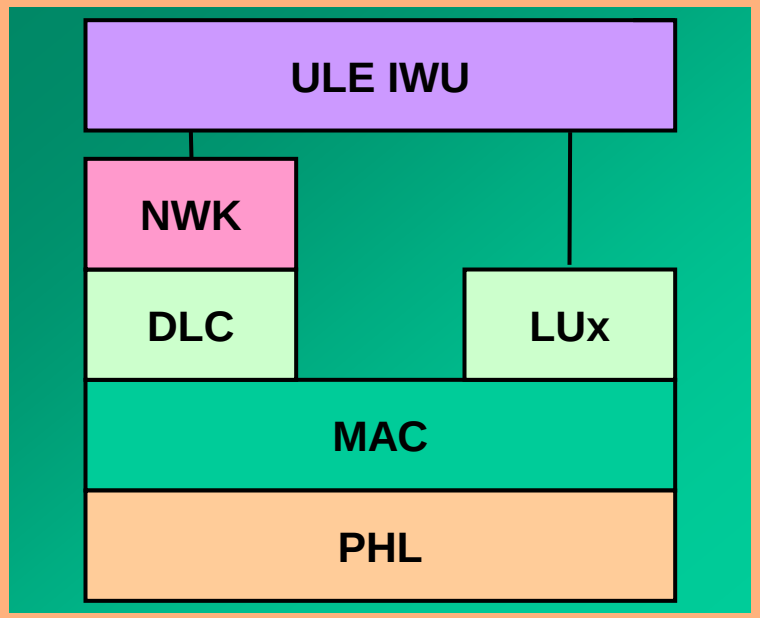
# DECT ULE Technology – Base Architecture




- Application Layers:
  - provide common device descriptors
  - Many available existing standards/frameworks
  - IP v6 to support the internet of things


- Unified interface (USB/UART/SW)

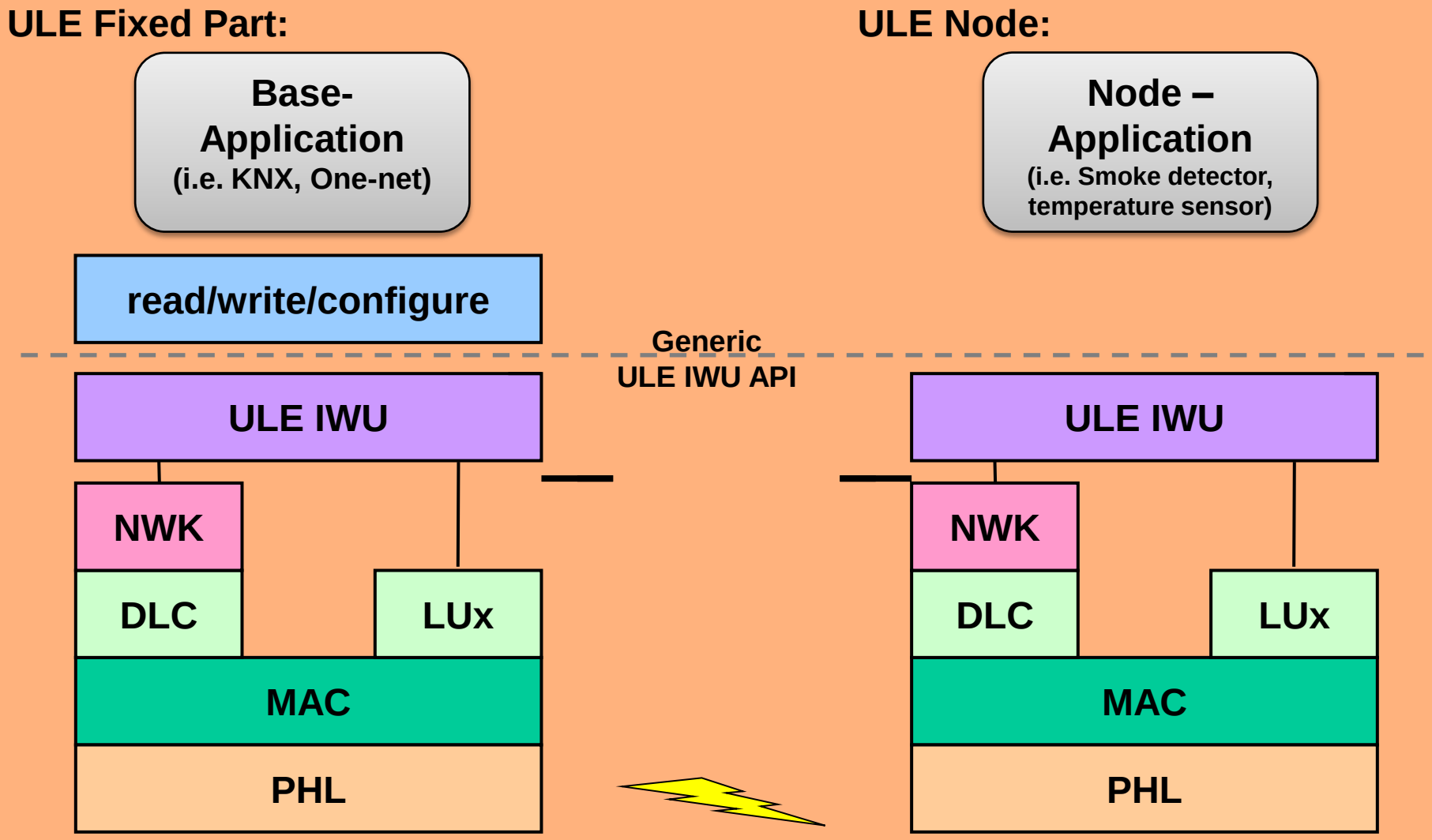
Not yet defined




- ULE Interworking Unit Payload Format defintion
- ULE Packet Service Communication Protocol

To be standardized at ETSI

# DECT ULE Technology - Peer to peer architecture



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# Power consumption

- Technologies like ZigBee / 802.15.4 are often promoted as having much lower power then other networking technologies but autonomy is mainly defined by latency requirements and **sleep / wake ratio**
- With DECT ULE, a typical sensor application with a 20-second sleep time draws an average of 20 µA, so will run for **10 years** on a single **AAA battery**
- For sensors that transmit every 20 seconds the lifetime is still 5 years.

# Interference and link reliability

- Interference between radio signals reduces the probability of information reaching its desired destination
- Many popular networking technologies operate since a while in the popular 2.4 GHz  Industry Science Medicine (ISM) band which is very crowded (WiFi, BlueTooth)
- Newcomers like ZigBee or any other 802.15.4 technology have to cope with this interference challenge
- DECT operates in the 1.9 GHz band. This band is **licensed in over 100 countries** worldwide, reducing interference issues
- DECT's unique **Dynamic Channel Selection / Allocation** (DCS / DCA) ensures always that the best radio channel can be used
- The DECT can  be uses **royalty free** and guaranties coexistence with other network technologies with a high link quality

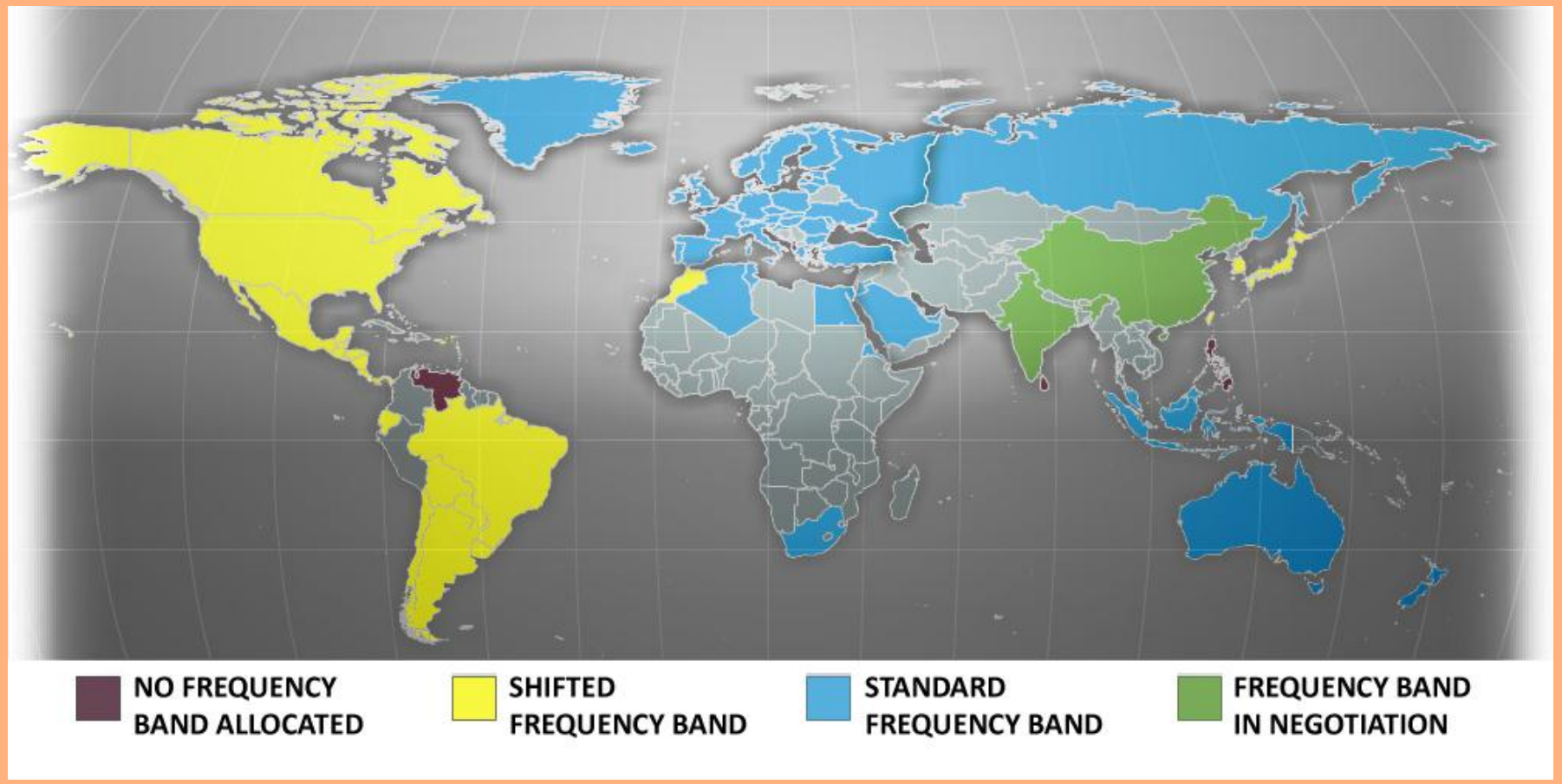
# Link budget for DECT

| Technology | Data rate | Frequency | Sensitivity | Transmitter power | Link budget |
|---|---|---|---|---|---|
| Wavenis | 19 kb/s | 900 MHz | *-107 dBm* | 14 dBm | 121 dB |
| Zigbee | 250 kb/s | 2400 MHz | -98 dBm | 8 dBm | 106 dB |
| Bluetooth | 1 Mb/s | 2400 MHz | -85 dBm | 7 dBm | 92 dB |
| Z-Wave | 40 kb/s | 900 MHz | -101 dBm | up to 0 dBm | 101 dB |
| DECT | 1 Mb/s | 1900 MHz | -98 dBm | 25 dBm | 123 dB |

- DECT Link budget **fits perfectly for typical homes**
- Due to long range, no routers required to address nodes within a home
- Perfect compromise between data rate, transmission frequency, transmitter power

* Source Table: Dialog Semiconductors

# DECT World Map




* Source: DECT Forum

# Network integration

- DECT is based on a **point-to-multipoint architecture** in which nodes communicate via a central WAN / IAD
- DECT ULE is fully backward compatible to standard DECT Fixparts
- DECT is already common **in home gateways and IADs**, and is routinely used with the SIP to deliver high-quality, reliable VoIP connections

# Cost

- ZigBee, Bluetooth and DECT all have similar hardware and software requirements.
- An average ZigBee software stack is around 100 Kbytes while DECT stacks range from 60-80 Kbytes depending on functionality
- Today's single-chip DECT SoCs are **priced well below** the ZigBee SoCs $2-3 range
- About **300 million DECT chips sold each year** guaranteeing low component pricing and high availability
- Overall system costs for the consumer can be reduced even further by sharing the DECT functionality included in existing IADs

# Voice

- DECT was originally designed for **voice cordless telephony** so high quality voice can be offered
- In parallel low to mid data rate application have been added over time
- **Voice** can be seen as an **add on possibility** in data based wireless networks

# Comparison of wireless network protocols

| Technology | Frequency | Range (min-max) | HACCS Pros (+)<br>HACCS Cons (-) | Remarks |
|---|---|---|---|---|
| DECT ULE<br>2009 | 1.9 GHz<br>(Licensed, royalty-free) | 100-300 m | + Very good range,<br>+ No interference<br>+ High data rate: 1 Mb/s<br>+ Simple network configuration<br>+ Lowest BoM<br>+ Voice enabled<br>+ Up to 10 year battery life<br>+ Compatible with DECT phones and IADs<br>- Not yet mainstream in HACCS | Target market:<br>cordless communication and home automation, control, care and security |
| Wavenis<br>2001<br>*Coronis* | 900 MHz<br>(Unlicensed) | 30-100 m | + Good range<br>- Low data rate: 19.2 kb/s<br>- Proprietary PHY<br>- Interference issues | Target markets:<br>metering and M2M |
| Z-Wave<br>2003<br>*Zensys Inc.* | sub-1 GHz<br>(Licensed) | 30-65 m | + Low interference<br>+ Medium data rate: 40 kb/s<br>- Medium range<br>- Interoperability<br>- Proprietary PHY | Target market:<br>home automation<br>Products already on the market |

* Numbers in table based on SiTel Semiconductors estimation

# Comparison of wireless network protocols

| Technology | Frequency | Range (min-max) | HACCS Pros (+)<br>HACCS Cons (-) | Remarks |
|---|---|---|---|---|
| Zigbee / 802.15.4 2001 | 2.4 GHz (Unlicensed) | 70 m | + Low power<br>+ 2-way interoperable<br>+ Medium data rate: 250 kb/s<br>+ Application Profiles<br>+ Meshed topology possible<br>- Interference issues<br>- Complex network options<br>- Certification body | Target markets: Broad range of low power networks |
| RF4CE 2008 | 2.4 GHz (Unlicensed) | 70 m | + Backed by CE market leaders<br>+ Point-to-point protocol<br>- Interference issues<br>- Still in development | Target market: Home entertainment Built upon IEEE 802.15.4 PHY |
| Bluetooth Low Energy 2009 | 2.4 GHz (Unlicensed) | 10 m | + Advanced 2-way communication<br>+ High data rate: 1 Mb/s<br>+ Compatible with legacy Bluetooth systems<br>+ Application Profiles<br>- Short range<br>- Ad hoc network<br>- Interference issues | Target market: cellphone-related ad hoc accessories |

* Numbers in table based on SiTel Semiconductors estimation

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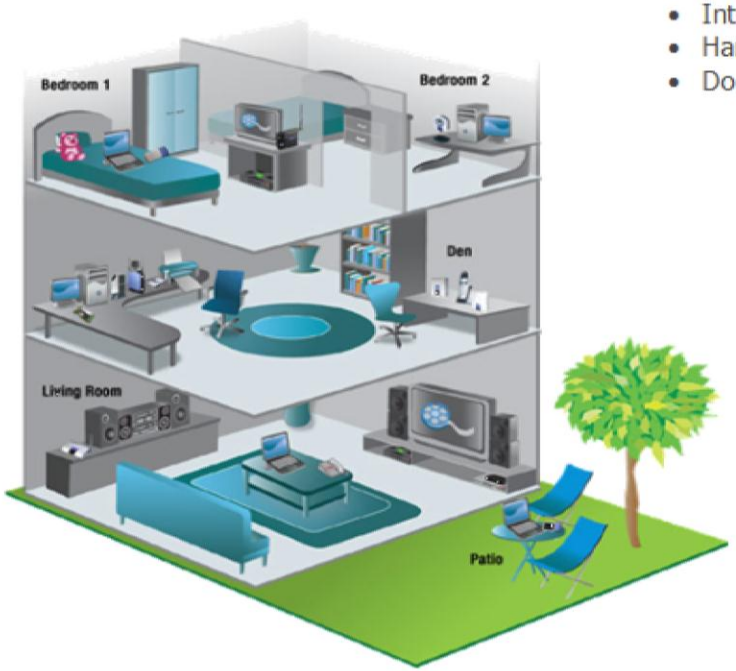
# Use cases – The Connected Home Vision

## Office
*(think, work, communicate)*
- Hands-free voice
- Conferencing
- Messaging services
- Hands-free voice
- Internet radio
- Internal communication
- Device Management
- Media Server

## Entrance Door
*(security, friendly, welcome)*
- Surveillance
- Internal communication
- Hands-free voice
- Door bell




## Kitchen
*(relax, cook, communicate)*
- Hands-free voice
- Internet radio
- Internal communication
- Messaging
- Gadgets

## Living Room
*(relax, communicate)*
- Hands-free voice
- Streaming media
- Internal communication
- Conferencing
- Messaging services
- Remote control

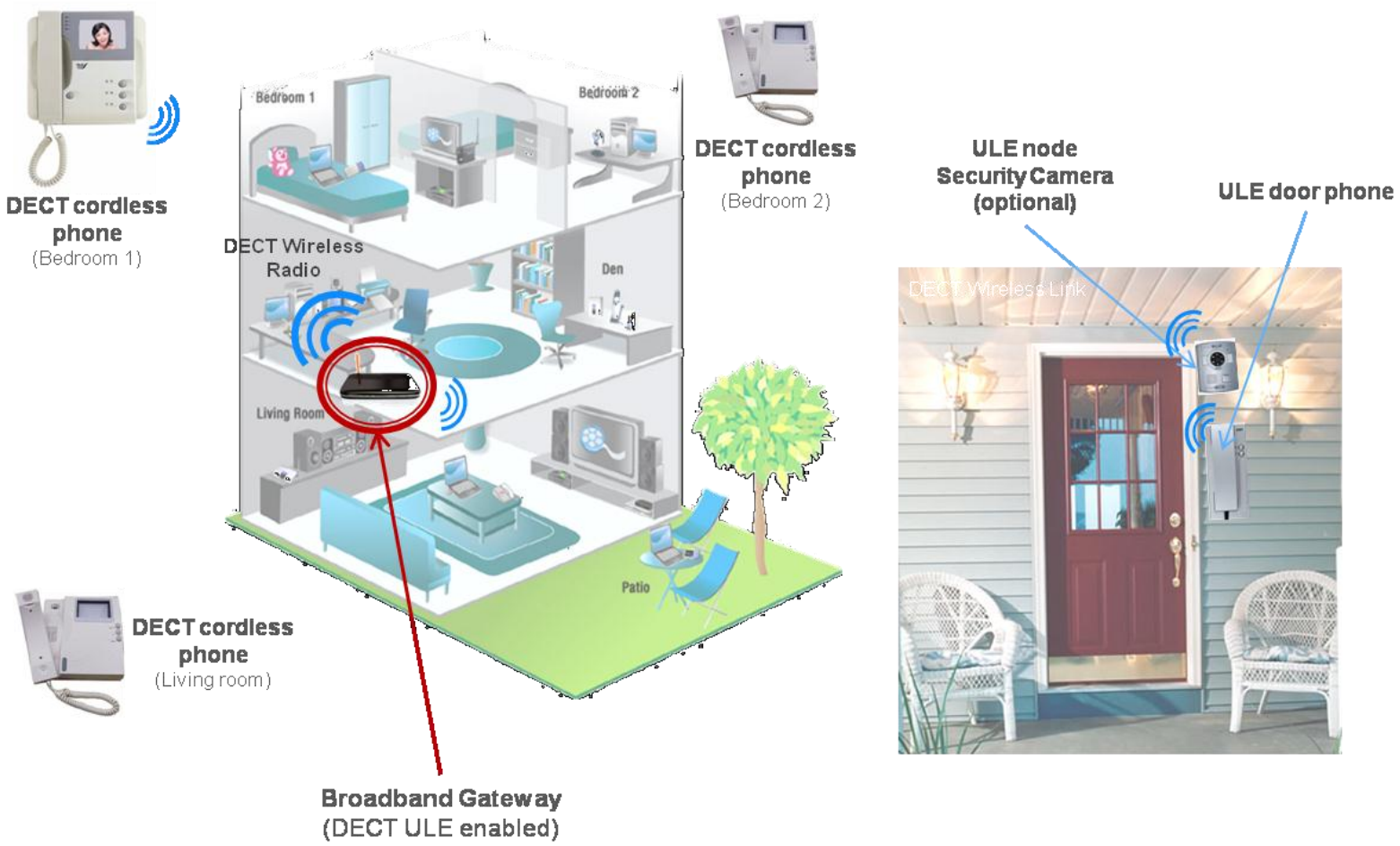
## Patio and Garden
*(relax, come together)*
- Handset
- Messaging services
- Internal communication
- Internet radio
- Remote control

* Source: DECT Forum

# Use cases – DT Home Gateway Approach (IAD)

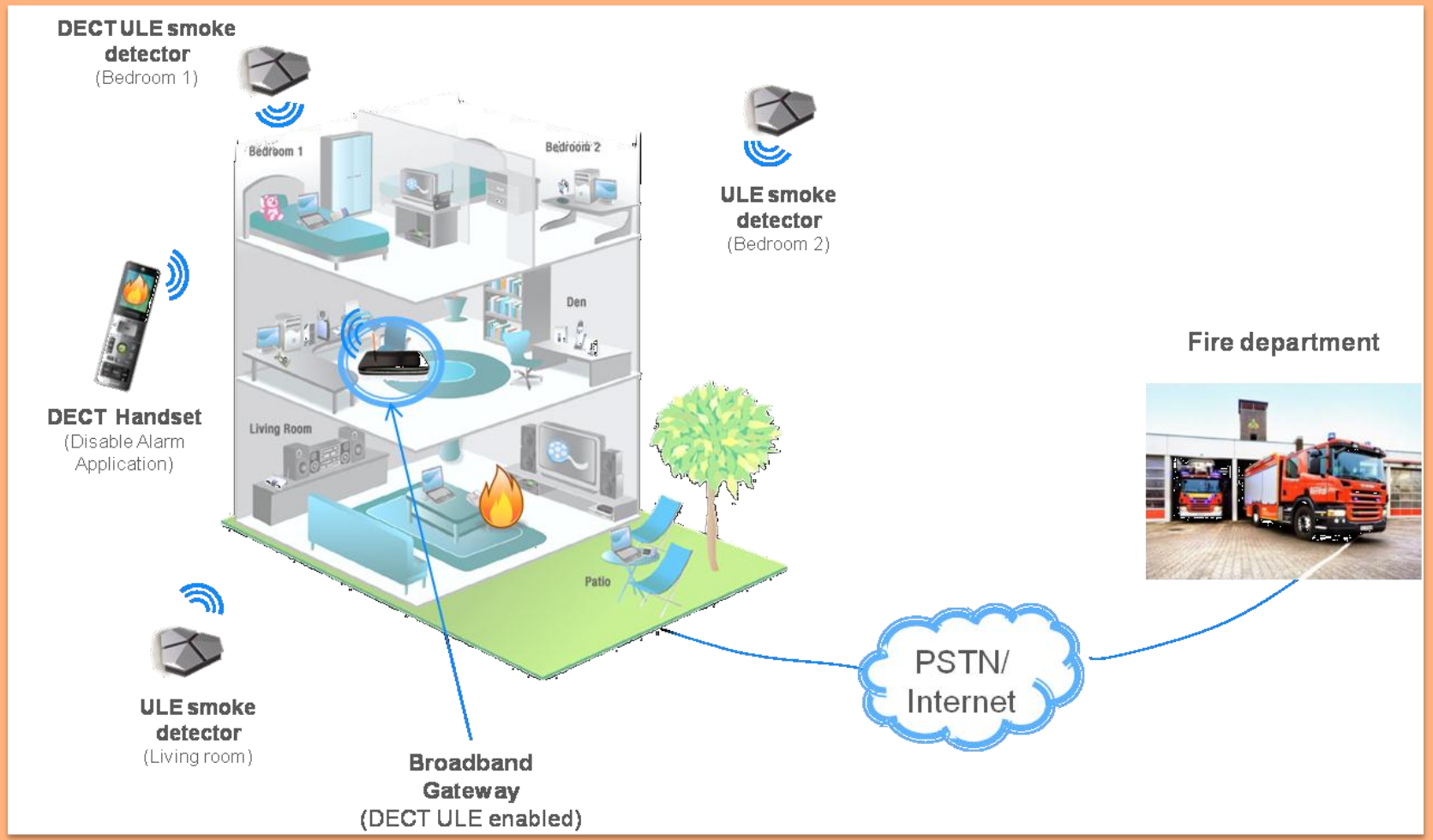
- **Deutsche Telekom AG** is implementing currently their all **IP strategy**
- They are exchanging the normal PSTN and/or ISDN access with a new home gateway which is called **IAD** (Integrated Access Device)
- **Every IAD includes** DSL for Internet Access, internal LAN and WLAN with routing functionality, include VoIP for performing phone fix net phone calls and **DECT** based on CAT-iq technology for in-house voice communication
- **130'000** units are currently exchanged **each month**

# Use case – door phone and security camera




* Source: DECT Forum

# Use cases – fire alarm




* Source: DECT Forum

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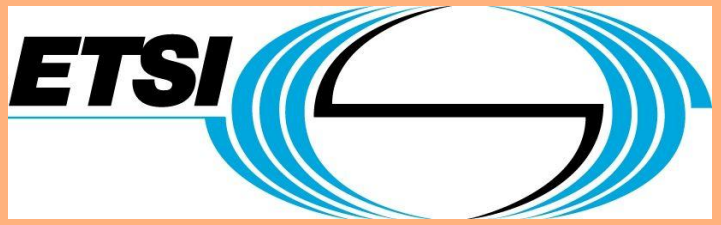
# DECT ULE Standardization Authorothies

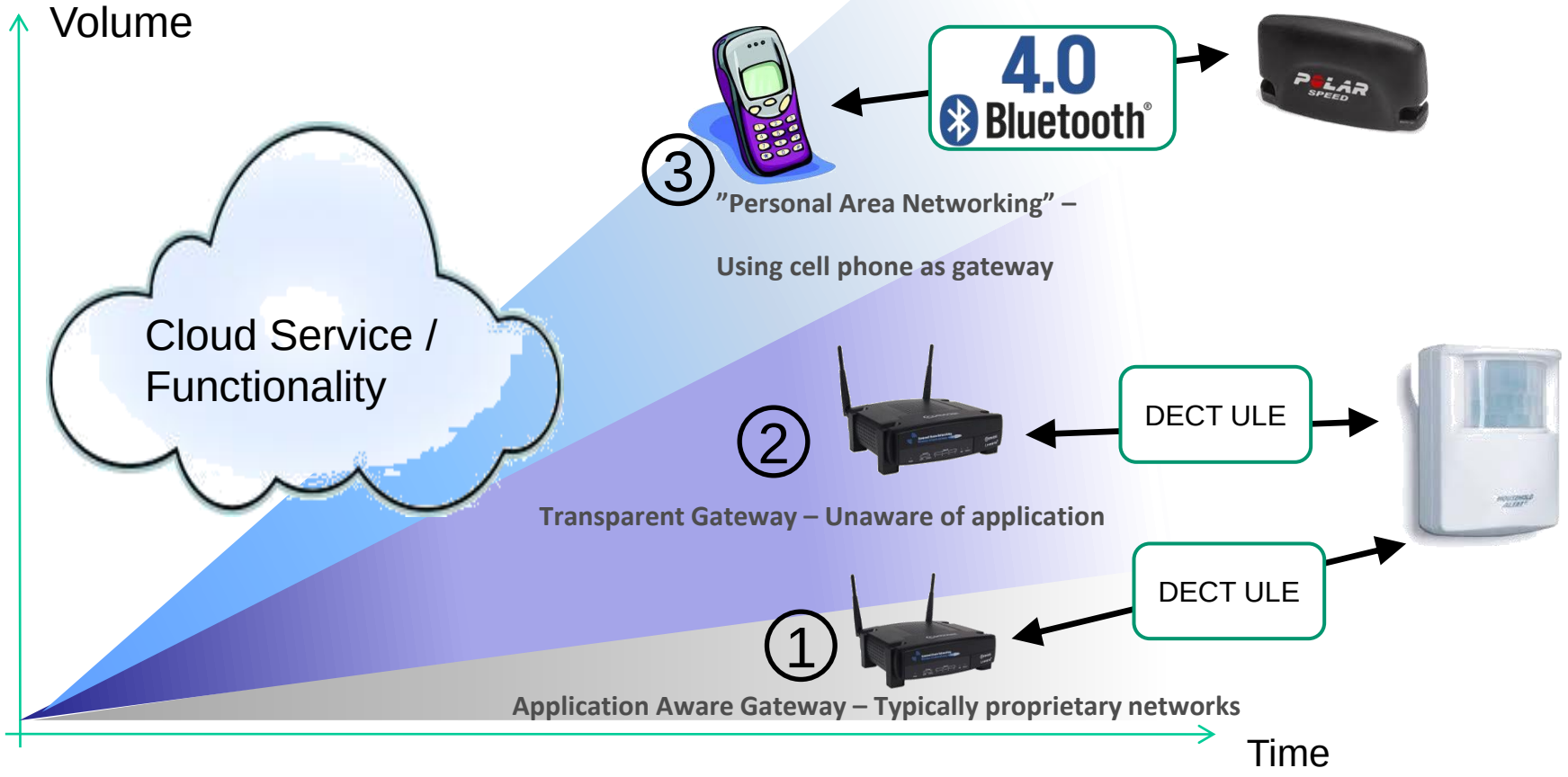
- DECT Forum (http://www.dect.org/)
  CAT-iq and ULE working group



- ETSI (http://www.etsi.org)
  DECT and DECT NG working  group

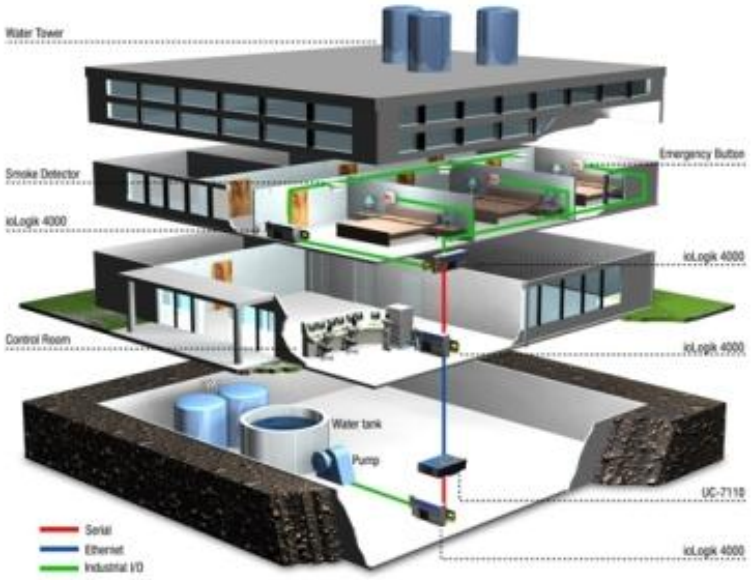


# DECT ULE Scenario - Home Network (local applications)

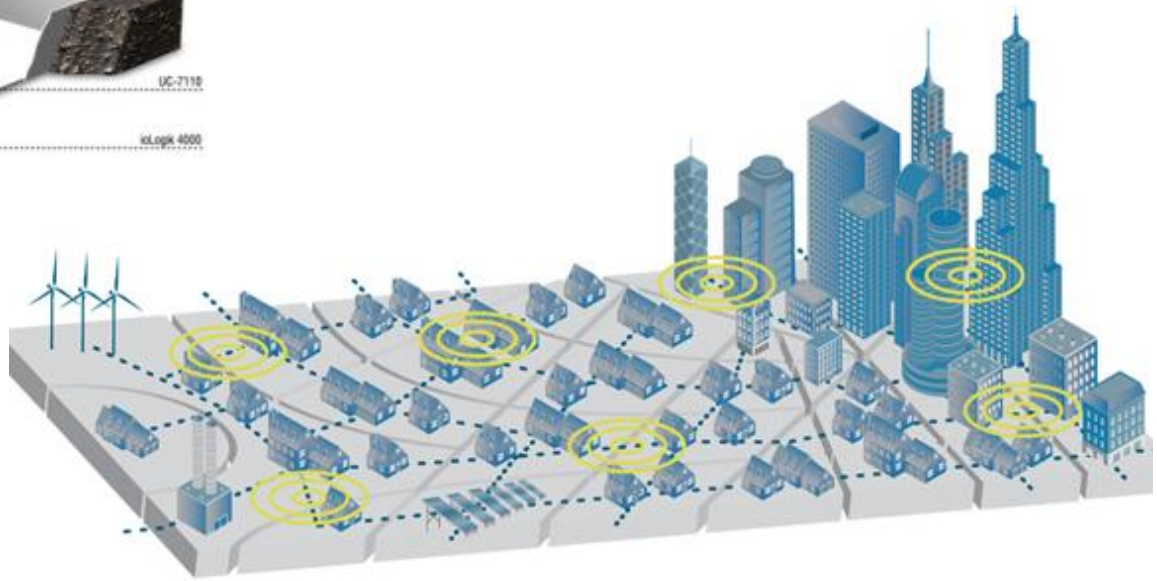



* Source: DECT Forum

# DECT ULE Scenario - Building & Wireless Local Loop




- DECT ULE will add sensors and actuators in a multi-cell network architecture for buildings, cities and rural areas



* Source: DECT Forum

# DECT ULE Standardization Roadmap

- **DECT ULE V1.0** – Single cell & local gateway applications
  - Target markets: Home Control, Security, Healthcare
  - Target specification date: 21 SEP 2011 (CAT-iq dev. Conf + BBWF11)
  - Target certification date: 21 SEP 2011 (CAT-iq dev. Conf + BBWF11)
- **DECT ULE V2.0** – Single cell, Ipv6 & on-line applications
  - Target markets: Home Control, Security, Healthcare
  - Target specification/certification date: APR 2012
- **DECT ULE V3.0** – Multi cell, Ipv6 & on-line applications
  - Target markets: Smart Energy, Tracking devices, Enterprise Healthcare
  - Target specification/certification: SEP 2012 (Ready for smart metering roll-outs in multiple countries in Europe)

# DECT ULE V1.0 - *Single cell & local gateway applications*

- Basically a MAC/PHY specification to support Home Control Scenario 1
- Provide a ULE packet data service to support various applications
- Single cell star topology specified
- Use CCM for encryption and packet authentication
- Sensor and actuator behaviour supported
- No **high layer profiles will be defined** by DF/ETSI but liaisons are on-going with Z-wave alliance, ZigBee alliance and ESMIG to leverage on the ECO systems and profile specifications already available for other MAC/PHY's.

# DECT ULE V2.0 - *Single cell , CAT-iq & on-line applications*

- Specification to support Home Automation Scenario 2
- IPv6 over DECT ULE is supported
- Possible target is **6LoWPAN integration** with DECT ULE
- Integration with **CAT-iq**
- **Interface** to existing application profile like e.g. **ZigBee Smart Energy Profile**

# DECT ULE V3.0 - M*ulti cell, Ipv6 & on-line applications*

- This is the real M2M version of DECT ULE
- Wireless Local Loop type of system with Ipv6 supported all the way to the end node
- **Multi cell** systems supported with **repeater functionality**
- Self organizing and self healing network for easy deployment

# Certification & Specification plan for ULE V1

| Target Time | Topic | Target |
|---|---|---|
| Begin APR 2011 | Draft proposal ready for ETSI | Resp: Jens/Jochen |
| 17-18 MAY 2011 | ETSI: Stable concept proposal<br>DF presence at ETSI meeting | To achieve common understanding with ETSI on schedules and priorities |
| Mid JUN 2011 | 1st Interoperability session<br>Next ULE WG F2F meeting @ RTX in DK | Basic interoperability between all interop participants (tech details TBD by Jochen/Steven/Peter) |
| End AUG 2011 | 2nd Interoperability session<br>ULE WG F2F meeting @ TBD<br>ETSI: Early Draft ready | Implementation of draft spec on 3 Golden Devices for interop<br>Application types for demo:<br>-Smoke detector<br>-Power plug + switch<br>-Temperature sensor<br>-Google power meter |
| 19 SEP 2011 | Prepare 1st demo<br>ULE WG F2F meeting | Target: De-bug and prepare for the 1st official demo |
| 20-21 SEP 2011 | 1st official Demo @ CAT-iq dev conf<br>ETSI: Final specification of V1.0 ready | Target: De-bug the last issues before the final market launch |
| 27-29 SEP 2011 | 2nd official Demo @ BBWF11 with DF Exhibition area<br>Golden devices ready<br>Certification program kick-off | Target: To enter the market with DECT ULE specs and certification |

* Source: DECT Forum

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# DECT and DECT ULE Chipset Suppliers

- **Dialog Semiconductors** (former SiTel and National)
  http://www.dialog-semiconductor.com

- **Lantiq** (former Infineon and Siemens)
  http://www.lantiq.com

- **DSPG** (former NXP, Philips)
  http://www.dspg.com

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# DECT in Home Automation?

**Yet another wireless technology for home automation needed**

**?**

# DECT USPs

- **Established technology:** DECT was launched in 1987 and specified by ETSI in 1993. It is today a proven and matured technology established worldwide (see EN300 175 1-54)
- **Open Standard & Multiple Suppliers:** These factors ensure a healthy competitive market and low price chipsets from semiconductor vendors (see EN300 175 1-54)
- **Interference Free & License Free:** DECT operates in a dedicated frequency band (no
- **Security and Authentication:** DECT has excellent security and authentication features
- **Range and building penetration:** DECT achieves a very long range (100-300 meters)
- **Voice & Media:** Support for voice profiles with high QoS and wideband voice (CAT-iq)
- **Ease of Installation/Commissioning:** Uses one-hop star network topology

# DECT ULE USPs

- **Installed base & low-cost due to mass market:** DECT has already been sold in millions of devices and the ULE devices are using exactly the same core technology
- **Low energy consumption:** Standby current in the range of microamperes which effectively means years of battery lifetime on standard batteries (see Appendix A – battery life profile)
- **Low latency:** ULE offer low latency for sensor applications that need fast feedback
- **Superior range:** The DECT maximum transmitted power is maintained to achieve the range performance needed for applications like Wireless Local Loop setup.
- **Backwards compatibility:** Interoperability with legacy DECT products allows the possibilities for combining sensor networks (M2M) with DECT voice & media applications, and exploiting the access to outside world (Internet, VoIP).

# DECT in Home Automation?

Yet another wireless technology for home automation needed

?

**The possibilities and the potential of DECT ULE say**

**YES**

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# Thanks for your attention