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Sensor networks: 6LoWPAN & LPWAN

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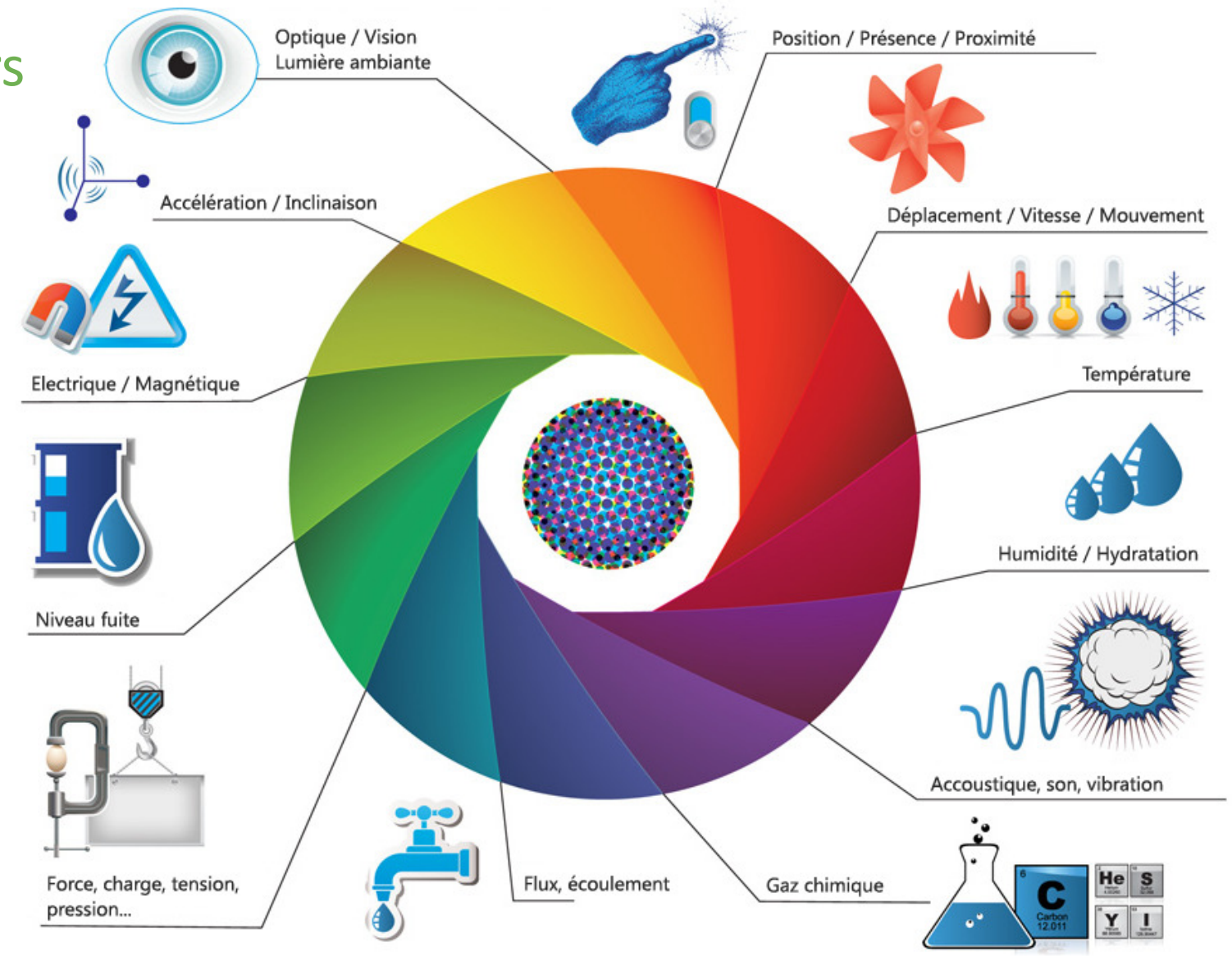
Agenda

- IoT context
- Wireless sensor networks
- 6LoWPAN
- LPWAN
- Conclusion

IoT & Sensors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Position / Présence / Proximité
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Déplacement / Vitesse / Mouvement
Electrique / Magnétique
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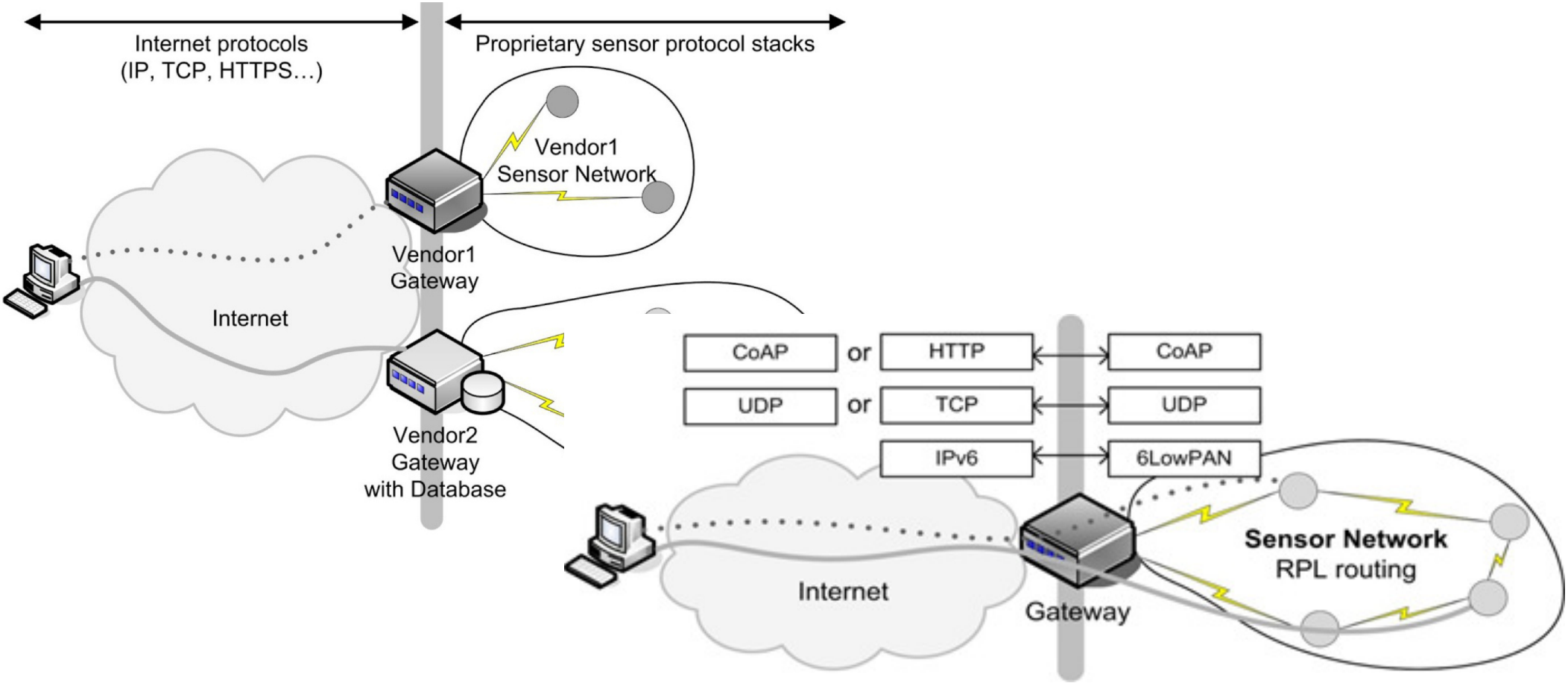
Anytime, anywhere connectivity is a priority for IoT

6LoWPAN – general characteristics

- New standard protocol dedicated for Internet of Things
  - IPv6 : each node can be directly addressed, end2end IP communication (sensor2server)
    - IPv6 header compression for efficiency, managed by a border router
  - Rely on IEEE 802.15.4 as a transmission layer (same as Zigbee, WirelessHART,..)
  - Open source implementation
- Supports mesh networks (sensors can relay communication)
  - Standard routing protocols (RPL, LoadNG) customizable for energy optimisation vs. mobility support, e.g. taking into account energy levels of sensors in case of energy harvesting
- Supported by IoT Operating Systems (**Contiki**, TinyOS, FreeRTOS)
  - Contiki modern OS for smart nodes, RAM: 2~35KB, Flash: 5~40KB, multithreading: protothread
- Powerful simulation tools (Cooja)

6LoWPAN as an extension of Internet protocols



LPWAN – General characteristics

- Low Power
  - 6LoWPAN < Bluetooth LE << LPWAN << GPRS/3G/4G
  - Simplified protocol (% 4G) -> less overhead, less CPU
- Wide Area
  - Range from few kms to a couple of dozen kms
  - Suitable to deploy at low cost a regional or national network
  - Better Indoor transmission performance than 3G/4G (to be discussed)
- Simple protocol
  - Low bandwidth (100 bps -> few dozen of kbps)
  - Use of ISM bands in Europe (868 MHz)
  - Short messages (-> 242 octets), not suitable for high volume
  - Basic addressing (p2p), no routing, session,..
  - Basic security (usually AES128)

LPWAN: the contenders

- Sigfox
  - Very limited, dedicated to data capture :
  - Uplink: 100bps, 12 bytes/msg, max 140 msg/day
  - Downlink: 8 bytes/msg, max 4 msg/day
  - Focused on low cost & scalabity
  - Proprietary, 1 license per country
- LoRa(WAN)
  - 3 classes of devices (asynchronous, synchronous, continuous)
  - (a little bit) more versatile than Sigfox
  - Standardized by LoRa Alliance, local networks and multiple licences allowed
- Narrowband IoT
  - New standard proposed by 3GPP, standardisation body of GSM, 3G, 4G
    - Only usable by existing owners of licenced bands!
  - Main advantage: 3G/4G base stations are HW compliant (only SW upgrade)
  - More complex and more expensive (energy) at node side

Conclusion

- LPWAN networks allow direct connectivity between sensors and Cloud through public networks
  - Without gateways and usage of other private/public networks
- But with limitations regarding throughput and messaging (use case)

- 6LoWPAN provide end2end IP connectivity between sensors and Cloud in a very efficient way (energy, routing, mobility)
- But requires a gateway through Internet (IPv4 or IPv6)

- CETIC investigates new solutions for Wireless sensor networks and participates in the definition of 6LoWPAN (Border router, tests)
- Related CETIC projects: MIDFLEX, Manet, SAVE, IDEES

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Questions?

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