



Interconnection of IoT communication elements and 5G networks — a summary for experts across the EU

#### AT A GLANCE

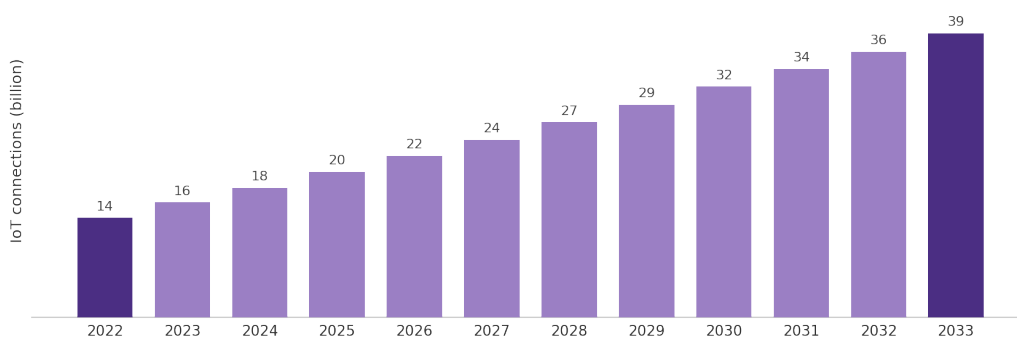
Study 09 maps how the Internet of Things and 5G come together — from device, network and edge architecture to real-world use cases across industry, healthcare, mobility, energy, agriculture and smart cities. It explains the new 5G-for-IoT technologies (RedCap and Passive IoT), gives a systematic method for matching each use case to the right technology, and sets out the trends shaping the future of IoT.

## What the study covers

The study is a comprehensive overview of the Internet of Things: how IoT systems work, their layers and components, where they are applied, the challenges they face, and where they are heading. Because 5G has a decisive impact on IoT — shaping the network, device (perception) and edge layers as well as system security and economics — considerable space is devoted to IoT communication technologies, both short- and long-range, with their strengths and weaknesses.

## Why it matters

IoT is a foundational technology for digitalising companies, raising production efficiency, improving healthcare, streamlining transport and city life, and increasing agricultural yields. Its importance is reflected in the market: the number of IoT connections is forecast to climb from roughly 15 billion today to around 40 billion by 2033, while the global enterprise-IoT market — about USD 300 billion — is expected to more than double by 2030.



Forecast IoT connections worldwide, 2022–2033 (billions). Source: Transforma Insights, as cited in the study.

## 5G technologies for IoT

### NB-IoT & Cat-M

Derived from the 4G ecosystem and further developed within 5G — the established backbone for low-power, wide-area IoT.

### Today's 5G

Powerful for business-critical use but relatively costly — especially end devices — and not optimised for energy consumption.

### RedCap (NR-Light)

Standardised specifically for IoT to serve mid-range needs at lower cost and complexity than full 5G.

### Passive IoT

An emerging 5G variant carrying high expectations for ultra-low-cost, battery-free connectivity at massive scale.

## Three types of IoT systems

From the perspective of use, the study divides IoT into three families that differ in their requirements. It then offers a systematic way to choose the right technology: each use case is placed in a category, and a built-in requirements form lets readers match needs — data rate, latency, communication direction, mobility and perimeter — against technology parameters to shortlist suitable options.

### Critical IoT

High performance and security, higher data rates and very high transmission reliability.


### Mid-range IoT


Balanced requirements that sit between critical and massive IoT — the sweet spot for RedCap.


### Massive IoT


Low power consumption, low device cost and relatively modest transmission speeds at huge scale.


## Use cases across the economy


 **Industry & manufacturing** — predictive maintenance, smart production and energy management.


 **Healthcare** — remote monitoring and better availability of care.


 **Energy & utilities** — smart metering, grid monitoring and efficiency.

 **Agriculture & food** — precision farming and yield optimisation.

 **Automotive** — connected vehicles and data-driven mobility services.

 **Finance & insurance** — telemetry-based products and risk insight.

 **Municipalities & smart cities** — lighting, parking and public-service sensing.

 **Transport & logistics** — asset tracking and supply-chain visibility.

## Where IoT is heading

Cybersecurity, still-limited interoperability and a fragmented landscape of protocols and technologies remain the main hurdles — making stronger security and further standardisation the decisive directions for the future. Alongside them, the study highlights three pivotal trends:

- **New 5G-ecosystem technologies** — especially RedCap and Passive IoT, overcoming today's limits both technically and commercially and enabling new business models with far wider deployment.
- **AI / ML for advanced analytics** — adding substantial value through predictive maintenance, anomaly detection and broad automation.
- **Cloud IoT (PayGo)** — sophisticated yet affordable cloud products that deploy in a few clicks and put AI/ML analytics within reach of organisations of any size.

### KEY TAKEAWAY

**5G-era IoT — powered by RedCap, Passive IoT, AI/ML and cloud delivery — can make connected systems cheaper, smarter and far more scalable, unlocking value across every sector of the European economy.**