Capgemini

Pioneering in 5G for every industry

5GLab

Intelligent Industry.
Powered by data.

As the industrial world becomes more and more data-driven, companies face important decisions regarding whether the acceleration of connectivity and Cloud computing, can best address and future-proof their fast-changing needs.

Technologies considered “emerging,” (e.g. IoT, AR/VR, AI, 3D Immersion) are now arriving at a maturity state after years of development and are about to be significantly exploited by the rise of 5G and Edge computing.

Introduction

Companies need to engage these disruptive transformation paths through deep reflection on use case innovation, technology landscapes, and business value generated. To support organizations in their 5G journey and win the innovation game, we at Capgemini help them strategize, build and monetize what 5G can bring next to their business.

We harness this unique potential within our global network of ***5G Labs***, where we tailor solutions to help our clients achieve their future business ambitions in a sustainable manner through 5G connectivity and its related technologies. By leveraging our facilities together, we address the whole value chain in the Intelligent Industry with attention to both network technology innovation and industry-focused transformative solutions.
We enable Network Equipment Providers (NEPs), Communication Services Providers (CSPs) as well as, Enterprises and Industrial players to accelerate their deployment of next-generation services and solutions.

	5G Network-focus Labs	5G Industry-focus Labs
Team size	+20 people	+30 people
People & skills	Architects (Telecom, Cloud, Application), Radio / Core Engineers, Software Developers, Support Engineers, SI Experts, Security Engineers, Data Privacy Experts, Project Managers	Business Consultants, Architects (Enterprise, Telecom, Cloud, Application), Software Developers, Hardware Programmers, Data Scientists, SI Experts, Industry SMEs
Sector focus	Network Equipment Providers, Communication Services Providers	Industry verticals
Capabilities	Network-technology, platforms, and integration services driven	Use case driven and ecosystem orchestration
Services	Interoperability & Integration Testing & certification Lab hosting services	Ideation and Journey framing PoC/MVP development Capabilities building

Welcome to the 5G Industry-focus Labs: our Lighthouse for Industries

What are 5G Industry-focus Labs?

Capgemini's 5G Labs is the name of our innovation program for 5G. 5G Industry-focus Labs are Centers of Excellence dedicated to new technology solutions developed for Intelligent Industry and Smart Cities. They enable to achieve this vision by delivering three primary objectives:

1 - Accelerate the deployment of 5G through transformative use cases. Clients only have to focus on the application layer to develop their use cases, leveraging the pre-assembled technical platform of our Labs as well as our multidisciplinary team and experts with direct interaction with Capgemini's global network of innovation capabilities (Applied Innovation Exchange –AIE).

2 - Build new strategic partnerships to foster innovation. The Labs rely on a constantly evolving ecosystem of partners (both telecom and technology-driven) that help build end-to-end solutions for industries.

3 - Standardize the usage of 5G technologies to encourage sustainable innovation for industries. Continuous development of enriched assets, use cases, and credentials with best-of-breed solutions that exceeds market expectations.

Our facilities in Paris

Our facilities in Mumbai

Our services and value proposition

Through the delivery of four key service offerings, the Labs support industries' end-to-end transformation regardless of their 5G maturity: from strategy & planning, to use case design & development, to ecosystem orchestration and integration.

1 5G & EDGE IDEATION CATALYST PROGRAM

PURPOSE

Get insights on how 5G can help transform a business

ACTIVITIES

- 5G awareness days
- 5G use cases ideation and framing

2 5G & EDGE USE CASE ACCELERATION PLATFORM

PURPOSE

Implement business use cases on a pre-packaged platform

ACTIVITIES

- Use case E2E solutionning
- POC/MVP build
- Industrialization & E2E deployment strategy
- Devices adaptation to 5G
- Certification, testing & proofing

Coming Soon

3 5G & EDGE FAB LAB

PURPOSE

Setup capabilities to operate a «client-exclusive» 5G Lab

ACTIVITIES

- Setup of an on-premise 5G use cases Lab
- Assistance or Operation and transition of the on-premise 5G Fab Lab

Our industry prioritization under four categories

The lines between the sectors are blurring. Products and services become applicable across industries resulting from their increasing dependence on technology, and 5G is no exception to this. Thus, we have classified industries under four main categories to enhances the relevance of the Labs' use cases in this multisectoral paradigm:

Smart Factory

Description: any executed production activity in factories and warehouses.

Use case examples:
- Remote control of critical production assets
- Remote assistance

Manufacturing

Automotive

Smart Utilities

Description: any process supporting logistics and operations.

Use case examples:
- Remote critical process control
- Hyperconnected digital twin

Energy & utilities

Life sciences

Building & construction

Smart City

Description: any service provided to large population samples or enterprise buildings.

Use case examples:
- Public transport infotainment
- Crowd management
- Remote and connected medical services (augmented teleconsultation, connected Ambulance…)

Public sectors

Education

Transportation

Entertainment

Healthcare

Smart Retail

Description: any activity that reinforces the customization of end-consumer services.

Use case examples:
- Immersive shopping experience
- Purchase automation via smart carts

Consumer goods

Retail

Luxury goods

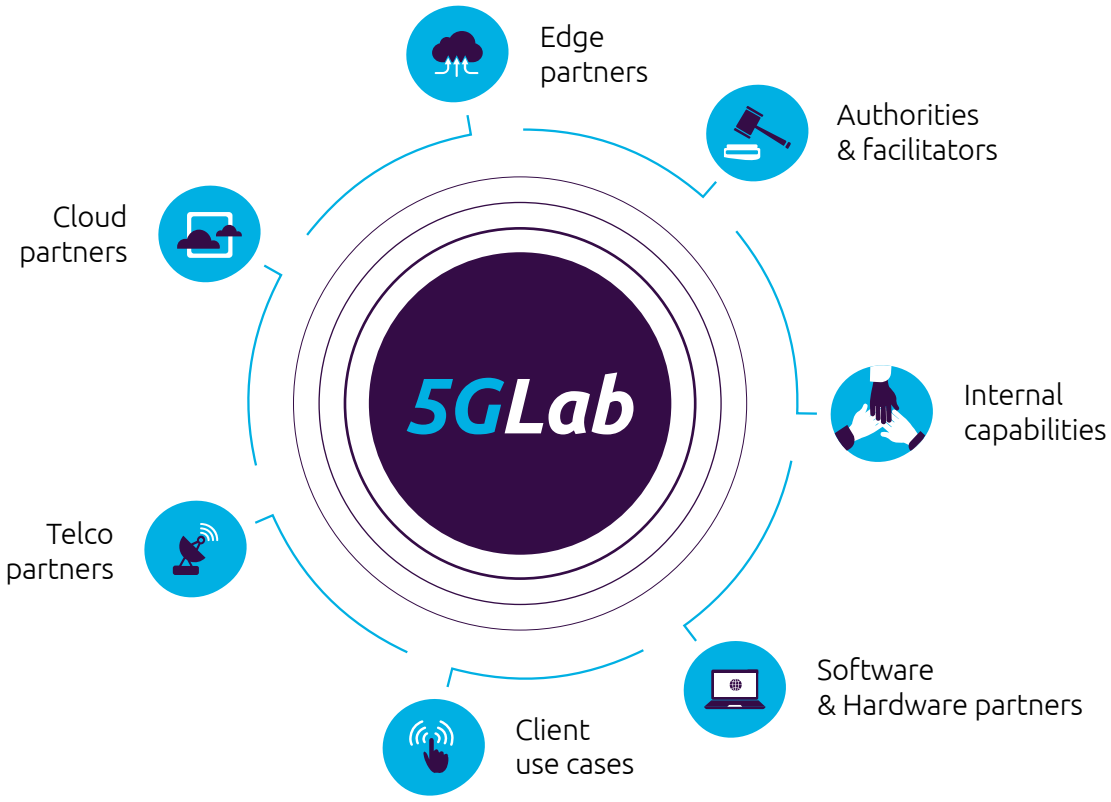
Our capabilities leveraging a best-in-class partners' ecosystem

5G Labs: partner ecosystem

For companies to understand how to benefit from 5G is complex since ***5G networks for Industries are at the same time different and complementary from the Public ones***. This is due to three main reasons:

> The industrial requirements of QoS, reliability, security and mission-criticality: 5G enable not only Enhanced Mobile Broadband (for Ultra High Definition, Video, AR/VR) but also Ultra-reliable low latency (for Critical connectivity missions, Industrial robotics, Manufacturing…) and Massive IoT support (sensors...);
>
> The recentness of mobile connectivity getting introduced in the industries and its amalgamation with wired connectivity;
>
> The seamless integrations required between enterprise systems, network, infrastructure, platforms and applications, and device layers.

Consequently, Capgemini's 5G Labs rely on an innovation ecosystem of partners to exploit a stable and scalable infrastructure that can integrate the latest technologies. Overall, this provides our Labs with a flourishing agile and collaborative environment leveraging the best-of-breed network, Cloud, Edge computing, hardware & software solutions and devices. The 5G Labs' ecosystem is composed of seven internal and external partners with de-limited scopes:



Our combined architecture and setup in Paris and Mumbai's 5G Labs

Our infrastructure built on three technical pillars is at our clients' disposal to enable them to achieve their business ambition leveraging 5G.

Technical pillars and components

A reliable telecom environment

5G private campus from two NEPs

5G dedicated network from one CSP

A balanced, agile, and decoupled application environment

Multi-access Edge Computing

Latest generation edge servers

Distributed cloud environments

Fully virtualized technology stack for rapid deployment

Cutting-edge devices powered by 5G-enabled modules

5G communication modules, AR/VR headsets, robots, tablets, etc.

Devices

Radio access

5G Radio Dot - 3,5GHz

5G RAN - 2,6GHz

WIFI - 2,4GHz - 5GHz

Client layer

Applications & Use cases

Media Server | AR/VR Server | AI Module | App Server | MCX Server | ...

5G & Edge Backbone

Telco Services & Platforms

ALTRAN Part of Capgemini

5G Core

Edge Computing Services

ALTRAN Part of Capgemini

MEC

Edge Cloud Services

Distributed Cloud infrastructure

Virtualization Layer

Hardware, CPU, NEM, Network

Internal network — **Internet** — **Public cloud**

- Applications & Use cases
- Services
- Virtualized Infrastructure

How we bring our use cases to life

The 5G Labs' areas of investments

From our complementary expertise and know-how between Capgemini and Altran, we had already converged to develop more than 25 use cases by the end of 2020. These have either already been deployed for our clients or are ready to be leveraged and tailored. While designing and developing the use cases we have kept them modular and functional so that they can be leveraged and tailored for client specific needs. This has been done by identifying the key functionalities that are being used in the use cases and developing client/server-side assets and microservices for the same.

We will continue to intensify our technical and technological competencies through R&D investments in *5G network features, Edge computing, Distributed Cloud, Hardware & software integration, IoT/IIoT, AR/VR, Advanced analytics, and Computer vision.*

Mastering these technical domains is key to making the most of the 5G connectivity by generating business value to organizations through the development of the groundbreaking use cases, such as:

- Real-time analytics leveraging Edge computing;
- Video surveillance of remote production lines;
- Remote control of distributed production line;
- AI enabled and remote-controlled motion (e.g., collaborative robots, self-driven cars, drones);
- Real-time service and breakdown alerts;
- Remote operations/maintenance/training solutions through AR/VR;
- Predictive/preventive maintenance.

5G uses cases examples developed across all our Labs

Autonomous Intelligent Vehicle (AIV)

Autonomous Intralogistics Operations bring significant efficiency, flexibility, and enhanced performance at the factory. Autonomous Intralogistics can be addressed with an Autonomous Intelligent Vehicle (AIV) with the help of 5G. The Capgemini 5G team has built a showcase video wherein an AIV forklift solution has been developed for a smart warehouse setup.

Learn more

Real-time Medical Tele-transmission

At Capgemini, we've developed a real-time Tele-ultrasound solution enabled by 5G to realize the vision of an effective point-of-care system. When integrated with Artificial Intelligence, Augmented Reality, and Virtual Reality, 5G can revolutionize the way healthcare is delivered.

Learn more

Smart Connected Mining

In this demo, Capgemini's "Mines with an Edge" solution enabled by 5G, we showcase an autonomous haul truck fitted with on-board sensors that keep communicating with other equipment over 5G, while effortlessly bypassing obstacles between loading and dumping points.

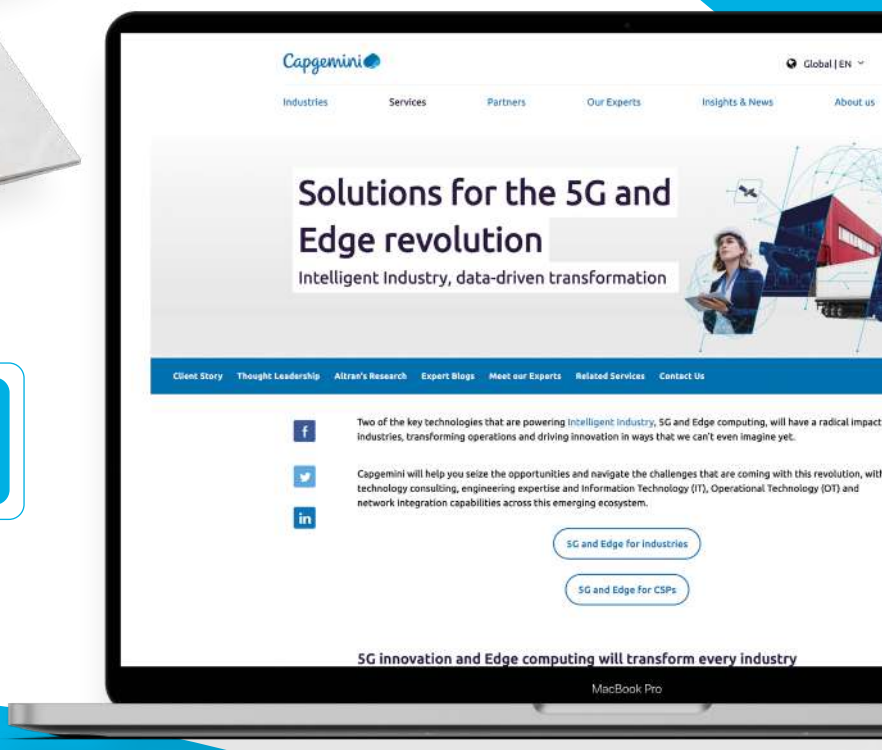
Learn more

Livestreaming

By leveraging 5G, livestreaming will bring an immersive experience through high quality, high reliability and low latency image streaming.

Learn more

More than 25 use cases available in our Labs



Example of the Autonomous Intelligent Vehicle (AIV) for intralogistics setup

Within the Capgemini 5G Labs, we've implemented Autonomous Intelligent Vehicle (AIV) from the re-engineering of a forklift (that is an Autonomous Guided Vehicle - AGV) by adding onboard sensors, cameras, and other electronics. This AIV performs:

- Autonomous navigation with real-time tracking through hand-held device;
- Dynamic positioning and orientation for high-precision automated pick-up and drop-off operations;
- En-route obstacle detection and auto reroute;
- Remote control in some exceptions.

The design and development of this use case required our teams in Paris and Mumbai to go through three critical technology development stages coordinated by the Paris and Mumbai teams.

> **Phase 1:** AIV engineering and development of autonomous navigation module.
>
> **Phase 2:** Carrier positioning and pickup/drop module though onboarded sensors, cameras and optimized AI/ML models.
>
> **Phase 3:** Precision orientation with machine vision with trained AI/ML models and 4G/5G based communication.

5G enablement and benefits. 5G network makes it possible to collate real-time feeds from live sensors and cameras embedded in the AIV for complex, real-time computations in support of fully autonomous intralogistics operations. These advanced features supplied by 5G network enable to build the following technical solutions.

At the edge with the development of…

- AI-based model for position detection and dynamic orientation detection
- Route management for low-latency processing
- Task level controls for remote operation monitoring

In the cloud leveraging…

- Flexible data storage and historical data aggregation
- AI/ML models training for specific feature development
- Fleet management through a network of interconnected AIVs

High reliability / robustness

Business/operational benefits : guaranteed QoS from greater pick-up and drop precision.
AIV performance : pickup/drop accuracy range of 10mm.

Low latency / high bandwidth

Business/operational benefits : larger amount of data is now exploitable at the edge (sensor and video feeds) with low latency to be processed with AI/ML.
AIV performance : Vehicle reaction time in milliseconds.

Greater density / coverage

Business/operational benefits : broader area coverage makes 5G a viable solution for warehouse/logistics spaces to replace wired setup, connecting a lot more devices within the same environment.
AIV performance : connection of 1k to 1M devices/km².

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About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future.
It is a responsible and diverse organization of 270,000 team members in nearly 50 countries. With its strong 50 year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fuelled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms.
The Group reported in 2020 global revenues of €16 billion.

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