Finanziato dall'Unione europea NextGenerationEU

Ministero dell'Università e della Ricerca

Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

RESTART

Telecommunications of the Future

RESTART research program

Antonio Capone

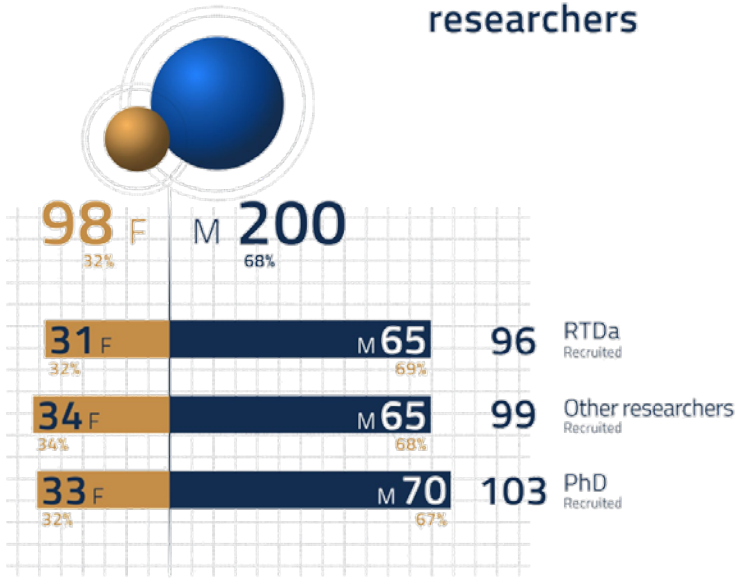
Scientific Coordinator

Milan, March 31st, 2025

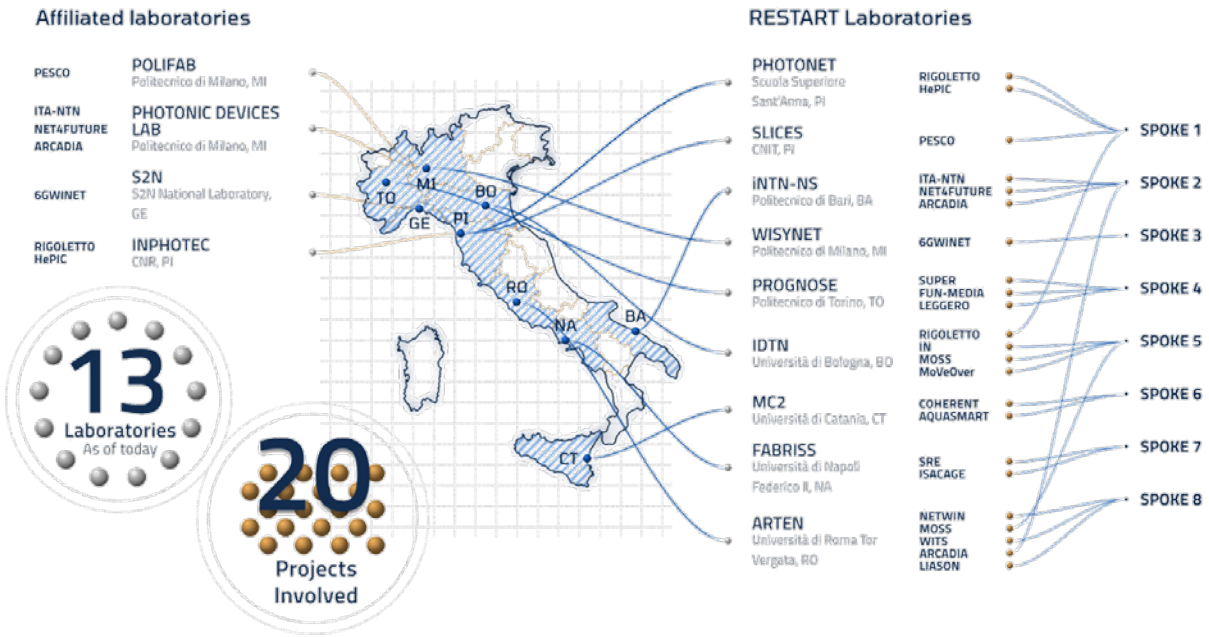
RESTART program

116 Millions Euros Grant

↙ Recruited researchers



↘ I laboratori di RESTART



Program Partners

27
Program Partners

Cascade Call Partners

89
Cascade Calls Partners

Spokes

SPOKE1
Pervasive and Photonic Network Technologies and Infrastructures
Consiglio Nazionale delle Ricerche
SPOKE2
Integration of Networks and Services
Politecnico di Bari
SPOKE3
Wireless Networks and Technologies
POLITECNICO MILANO 1863
SPOKE4
Programmable Networks for Future Services and Media
Politecnico di Torino
SPOKE5
Industrial and Digital Transition Networks
ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
SPOKE6
Innovative Architectures and Extreme Environments
Università di Catania
SPOKE7
Green and Smart Environments
Università degli Studi di Napoli Federico II
SPOKE8
Intelligent and Autonomous Systems
TOR VERGATA Università degli Studi di Roma

Missions

2
Laboratories, Proofs of Concept and Demonstrators

3
Innovation and Technology Transfer

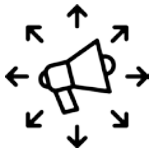
4
Support to Start-ups and Spin-offs

1
Research
Telecommunications of the Future

5
Education and Training Activities

6
PhD Programs

7
Communication, Standardization and Open Source Solutions



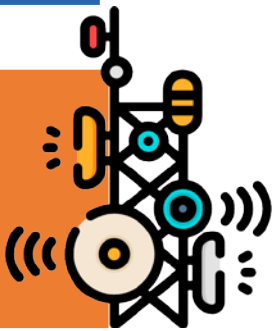
Research domains

32 Research Projects

14 Structural Projects + **18** Focused Projects

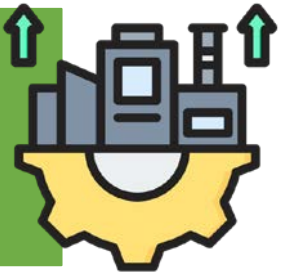
Vision of telecommunications evolution

Technologies



System approaches

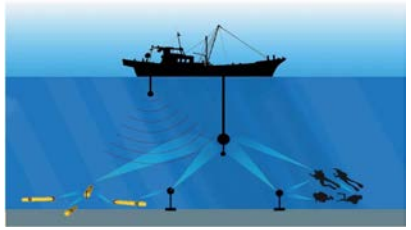
Application domains



Spoke 6: Innovative Architectures and Extreme Environments

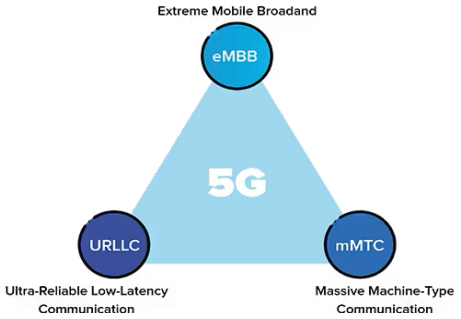
RESTART structural project S10 – SEXTET aims at exploring **new telecommunication solutions** for scenarios that, despite their huge societal and economical impact, are **not suitably supported by current mainstream telecommunication systems** due to their extremely **challenging characteristics**

Operating conditions

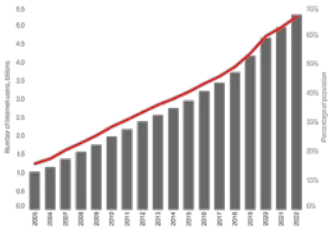


Devices

Requirements



Number of users



Disruptive events

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RESTART Grand Challenges

Create a vision of future evolution of telecommunications ecosystem

Design networks hard to die (even in extreme conditions)

Define how to transmit meanings, not information

Bend propagation to the needs of networks

Make teleportation virtually possible with digital twins

No more generations but continuous innovation in networks

Design an Internet of Emotions

Digitalize the natural resources for a sustainable world

Add connectivity to digital transformation for a sustainable industry

Integrate media and networks for an immersive new digital world

Make the network a platform for programming and running applications

Uncovering image and video deepfakes to fight against misinformation

Sensing and protecting the world with communication signals

Make artificial intelligence distributed and networked

Open up the large spaces of high frequencies to radio access

Redefine the role of hardware components in softwarized networks

Investigate the role of hyperscalers and app devolopers in network design

Connect and support everything and everyone that moves

Building the future highways for fiber communications

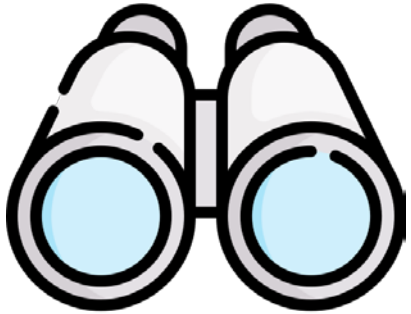
RESTART Grand Challenges

Design networks hard to die (even in extreme conditions)

Define what the aspects of networks that can give high reliability to **end to end communications**. Define the **application domains**, the associated expected network reliability and the **range of working conditions**. Identify **technology gaps** and propose novel solutions at system and component levels.

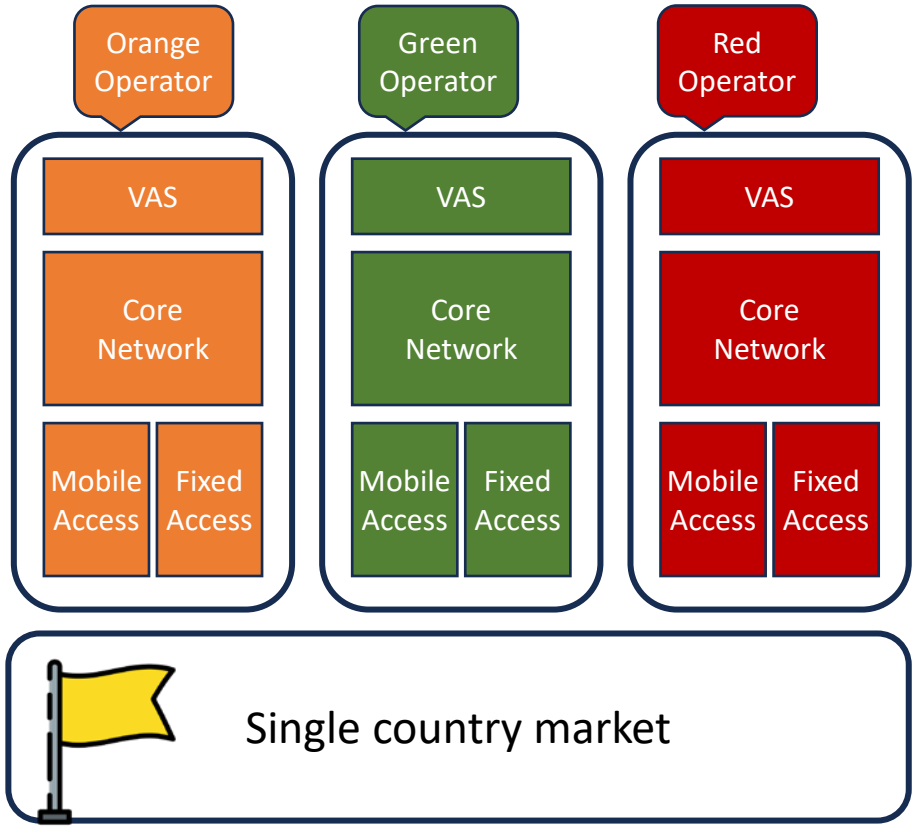
RESTART Grand Challenges

Create a vision of future evolution of telecommunications ecosystem

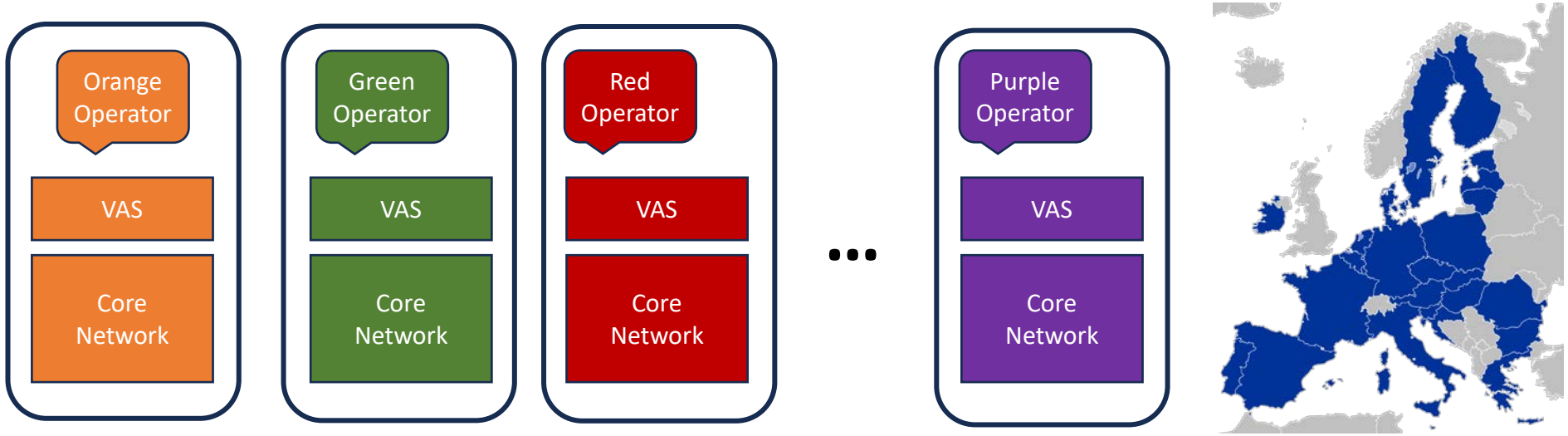


Envision the future evolution of the telecommunications ecosystem in Italy and at an international scale. This task involves a comprehensive and forward-looking analysis of various factors. Key areas of focus include: **decomposition and recomposition of the ecosystem** in terms of players and value chain, **impact of the technology** evolution to relations among players, **impact of regulatory aspects** at national and European level, and others.

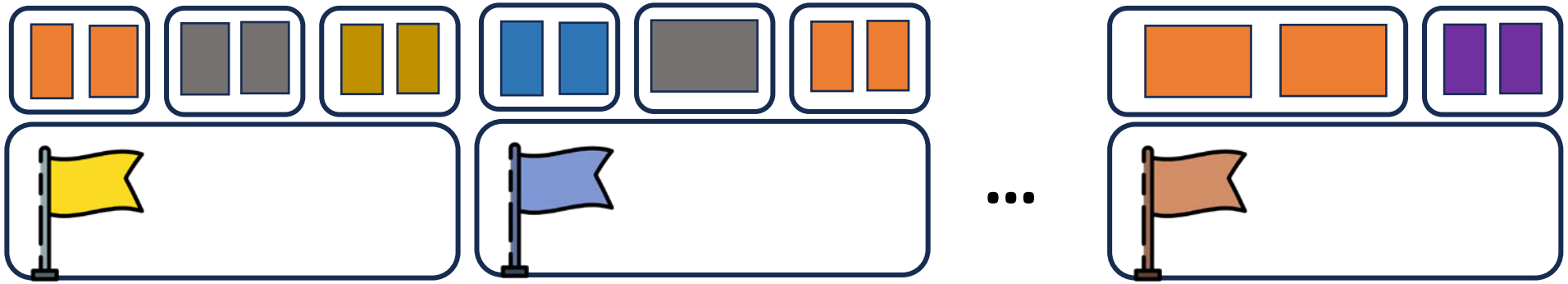
The European telecommunications market is fragmented and deeply in crisis



Towards a single European market of connectivity services?



Infrastructural service platform (digital twin and orchestration)



Barriers?

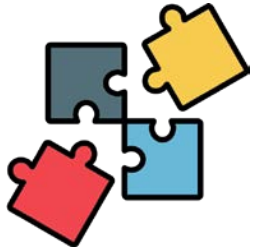
Risks?

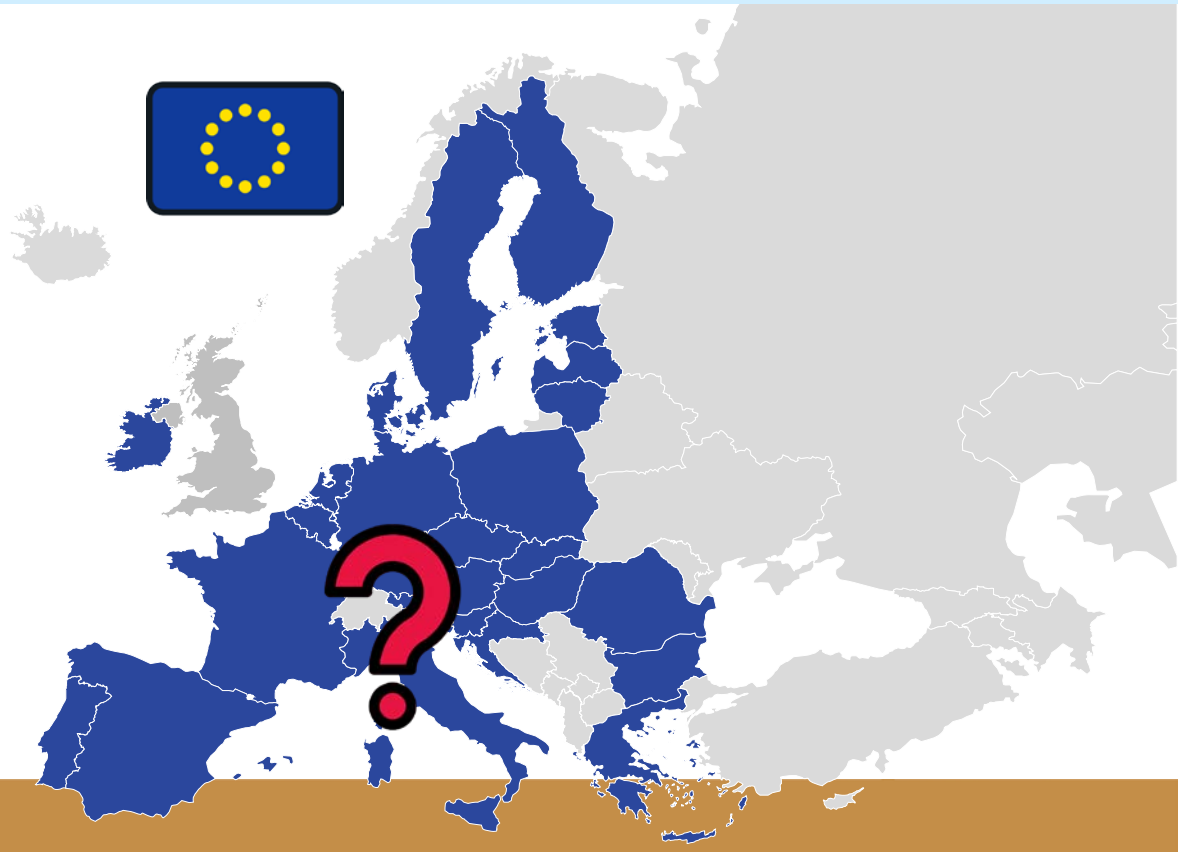
Barriers to single market

The main **barriers** to the single market are **national regulations**, such as those on **legal interception**, and the **lack of harmonized management of radio spectrum** at European level

So far, attempts to centralize the management of communication services for multiple countries have foundered due to national constraints on security and interception

The fragmentation of spectrum use policies has slowed down the development of a uniform technology ecosystem in Europe





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Technology and strategic foresight

Analysis of secondary sources **X 38**

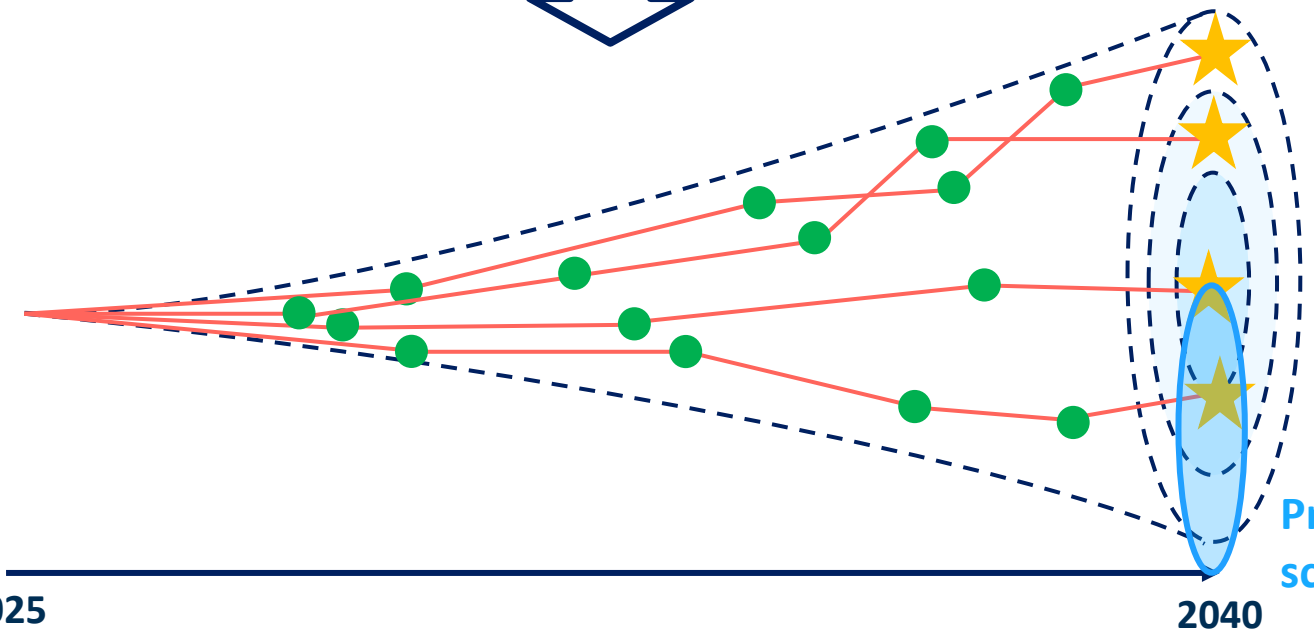
Analysis of reports and news **X 44**

Workshop of co-creation

Qualitative interviews with experts **X 40**

X 75 trend

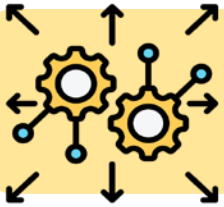
X 16 megatrend



X 4 scenarios

Fonte: Gall et al., 2022 https://doi.org/10.1016/j.futures.2022.103024

Future scenarios

Scenarios	Market structure	Technological innovations	Regulation	Ecosystem protection
	Excessive competition between actors	Innovation not driven by European actors	Fragmented regulation	Lack of a European single market
	Market consolidation through M&A	Co-management of network platforms	Creation of the European single market	Increased ecosystem competitiveness
	M&A + Network spin-offs	Creation of a European Cloud and AI consortium	Loosening regulation	Increasing European technological independence
	Network spin-offs between actors		Support to the creation of a EU consortium	Ecosystem protection support

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