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Portability and Interoperability across a Pan-European Virtualized Cloud-Edge Continuum

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OpenNebula Systems

OpenNebula

FOSDEM'25

Agenda

What are we going to see today?

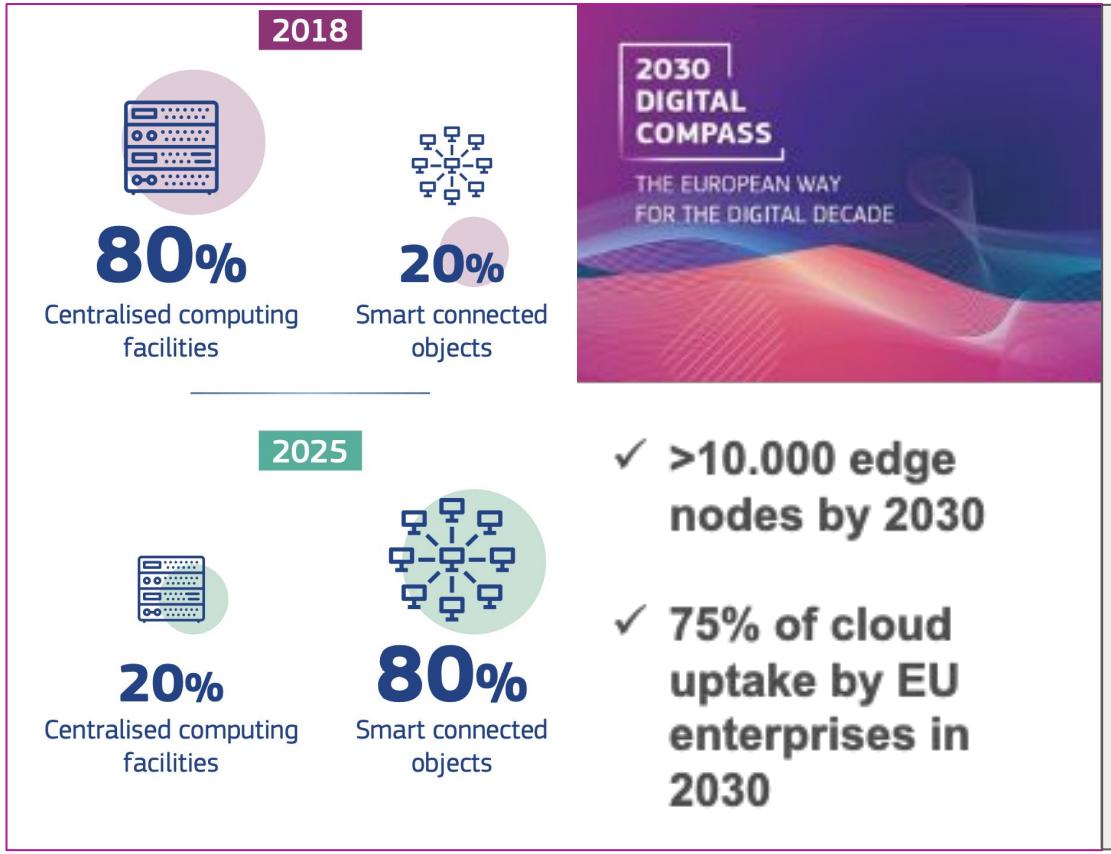
1. Edge or Edge
2. IPCEI-CIS virt8ra initiative
3. IPCEI-CIS virt8ra testbed
4. Next steps
5. Q&A

Introduction

virt8ra.cloud

Edge Computing

Opening up **new opportunities** while **disrupting current business models**



Source: EU Data Strategy

✓ **>10.000 edge nodes by 2030**

✓ **75% of cloud uptake by EU enterprises in 2030**

Source: EU Digital Compass

Europe's strengths in Industrial Internet of Things, 5G networks, and telco-cloud solutions

Source: EU Industrial Strategy

Edge Computing Observatory

What is edge?

https://digital-strategy.ec.europa.eu/en/policies/edge-observatory

Edge Computing Observatory

What is edge?

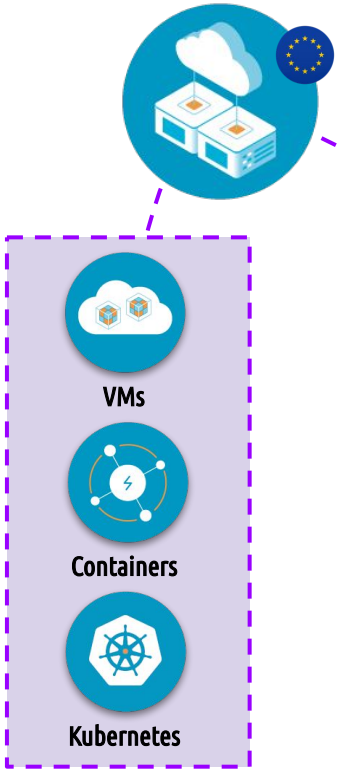
Edge nodes measured as the number of compute nodes providing **latencies below 20 milliseconds**, such as an individual server or other set of connected computing resources, operated as part of an edge computing infrastructure, typically residing within an edge data centre operating at the infrastructure edge, and therefore physically closer to its intended users than a cloud node in a centralised data centre, designed and operated:

- **in an energy-efficient manner** to minimize its carbon footprint and environmental impact, with a specific focus on reducing greenhouse gas emissions, to achieve a net-zero carbon impact
- **at the edge of a network** to provide secure access to data and services. It must provide both **physical and cyber security** to ensure uninterrupted operation and data safety.

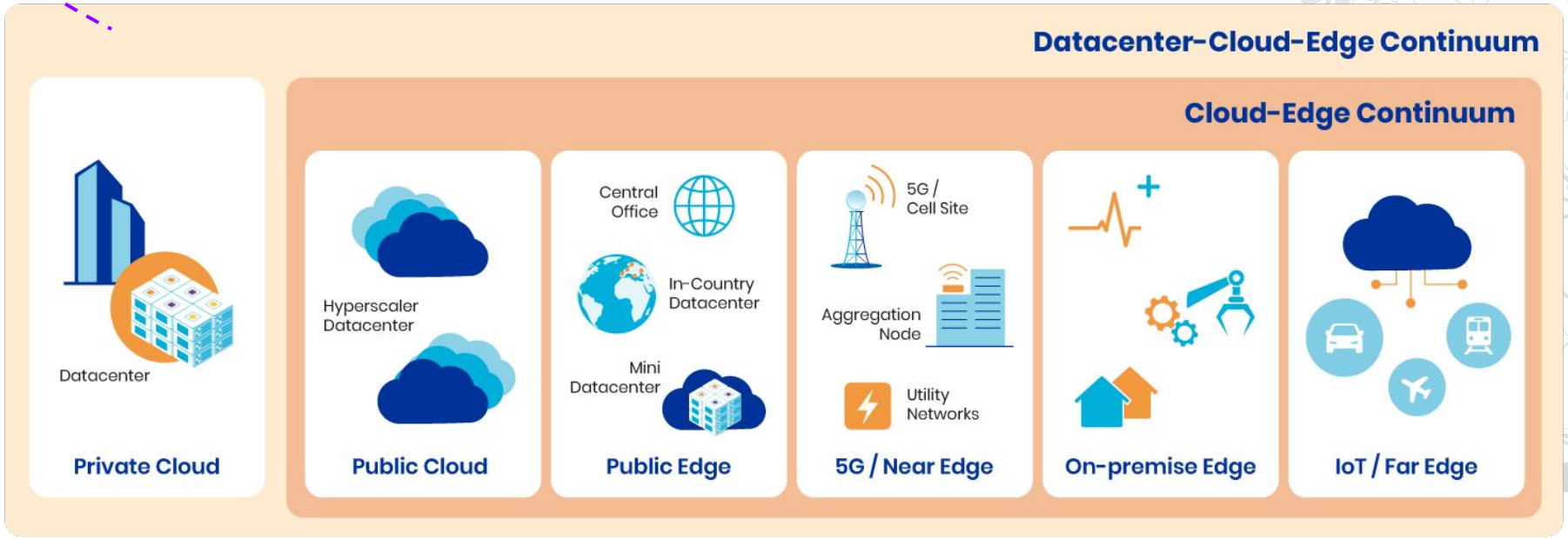
https://digital-strategy.ec.europa.eu/en/policies/edge-observatory

IPCEI Cloud – *General overview*

- ✓ *Enable Multi-Provider Cloud-Edge Continuum*
- ✓ *Strengthening of EU Digital Industry*
- ✓ *Development of European Open Source Technologies*



IPCEI-CIS.eu



IPCEI Cloud – *Technological priorities*

STATE OF THE ART

Cloud-Edge Hybrid Architectures

- Mostly based on **proprietary**, **complex** technologies, leading to **vendor lock-in**.
- **Centralized cloud structures** that assume highly **homogeneous** datacenters.

Multi-provider Interoperability and Portability

- **Low adoption of standards**, with **abstraction layers** based on containers with **reduced security** (i.e. K8s).
- Storage and network model **not well suited for the highly distributed** cloud-edge continuum.
- **Partial use of automation techniques** (e.g. IaC) for infrastructure provisioning automation.
- **Lack of specific edge node architectures** able to meet the needs of HPC and 5G/telco environments.

Multicloud Management and Orchestration

- Lack of **AI used to optimize and automate** cloud/edge infrastructure management.
- Centralized control planes that **do not allow the federation** of cloud and edge infrastructures.
- Limited support for **optimized orchestration**, **energy efficiency,** and enforcement of **security policies**.

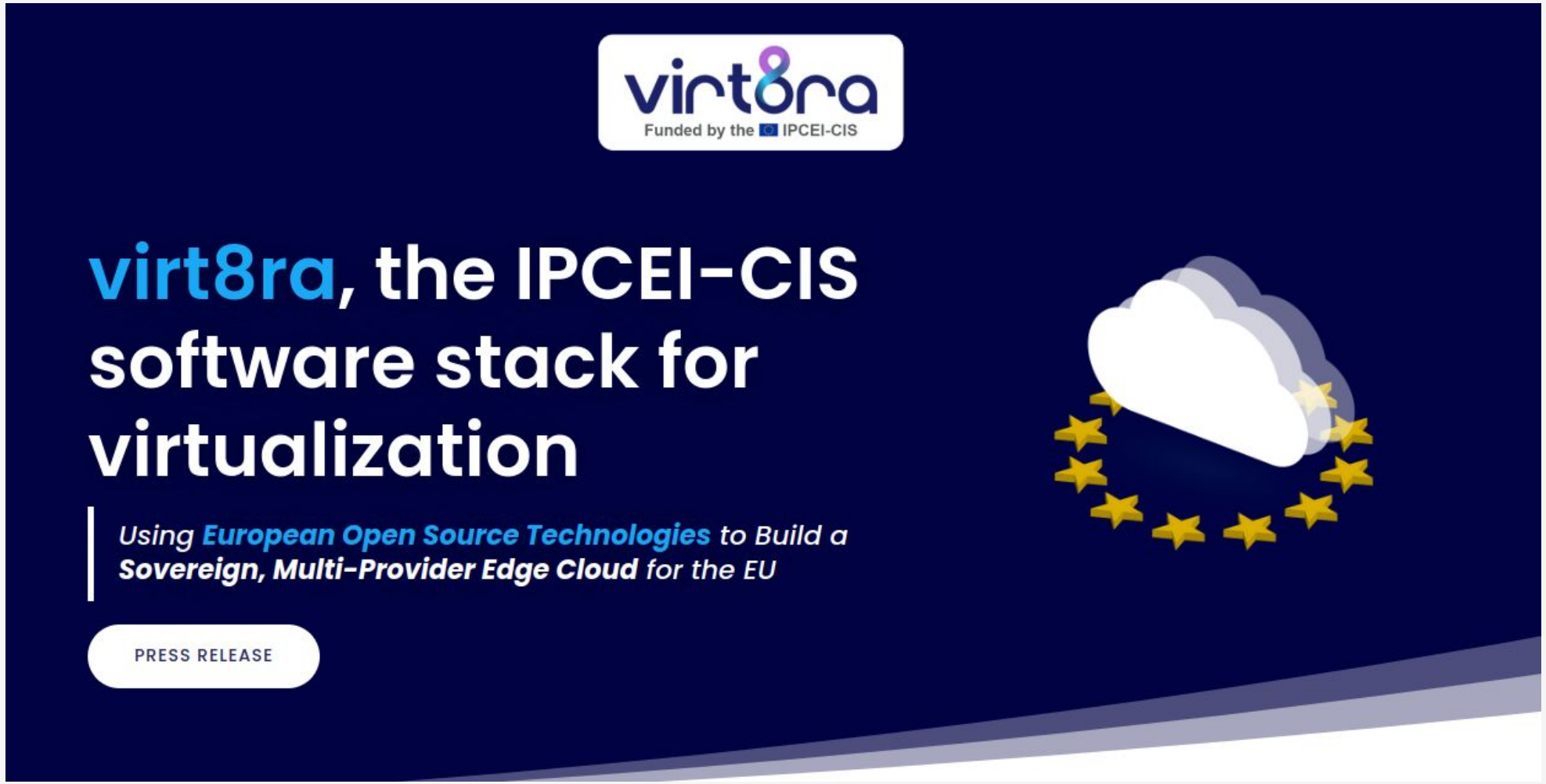
Use Cases

- Deployed as **static solutions** on a **case-by-case basis,** lacking automation, interoperability and portability.
- Creating **silos in strategic sectors** based on different technological stacks and ad hoc implementations.
- **Jeopardizes the consolidation of a cloud-edge continuum** and an associated industry ecosystem.

FUTURE CHALLENGES

- Increasing number of **edge providers** in the market.
- Emergence of **tens of thousands** of geographically distributed edge nodes.
- Need for complete **automation** of cloud edge operations.
- New **security threats** and larger impact of vulnerabilities.
- Preference for **energy-efficient** nodes.
- Tendency to platform **heterogeneity**.
- Infrastructure **dynamicity** and **volatile** devices.
- Dependency on **general-purpose**, **public** networks.
- Widely **distributed** environments.

IPCEI-CIS 8ra First Outcomes



https://opennebula.io/innovation/virt8ra/

IPCEI-CIS WS2 virt8ra Cluster Participants

virt8ra : Cloud-Edge Management and Orchestration

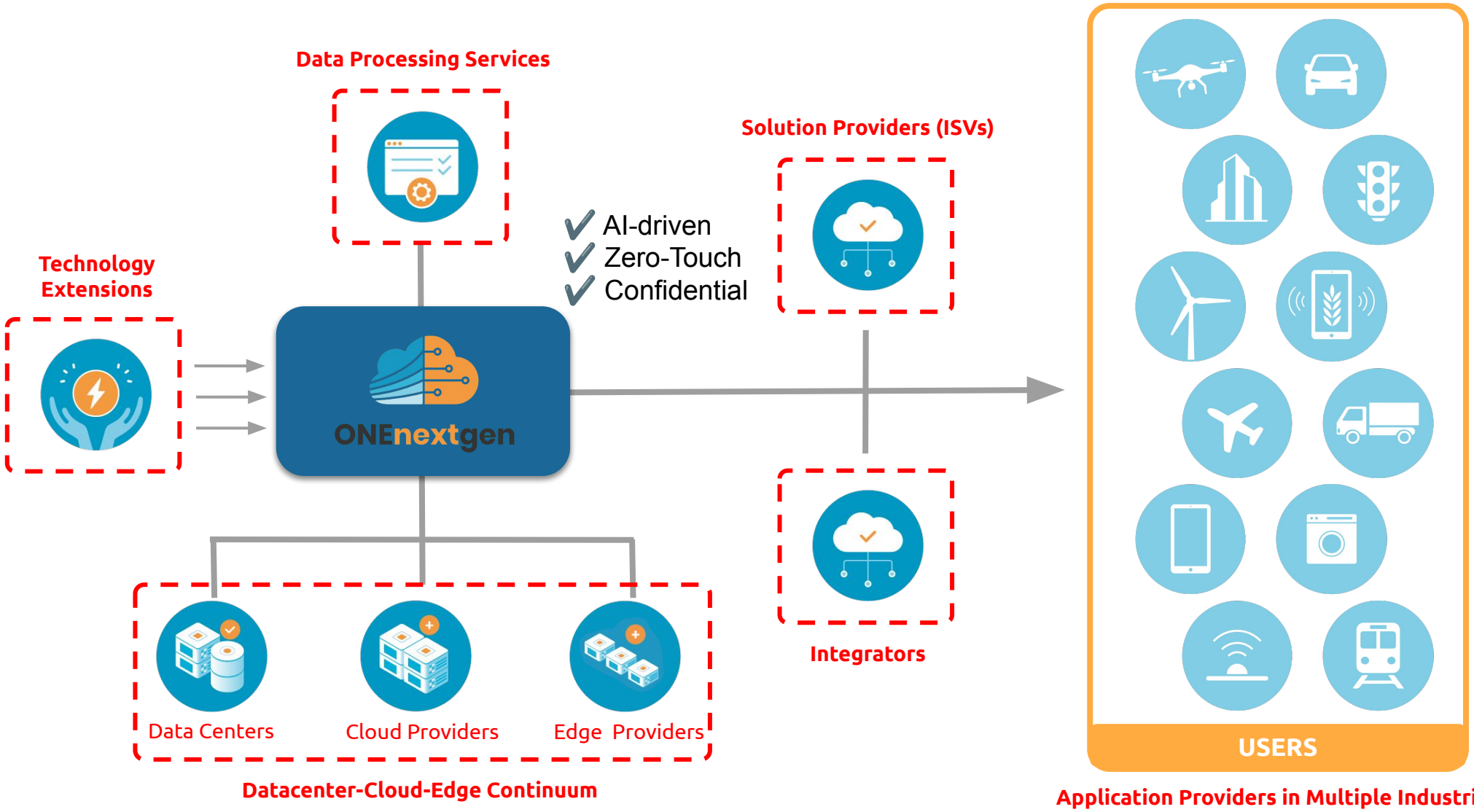
virt8ra
Funded by the IPCEI-CIS

Introduction : IPCEI-CIS virt8ra cluster

virt8ra
Funded by the IPCEI-CIS

The purpose of **virt8ra cluster** is to provide a space for the **integration of the different virtualization components** that participate in the cluster.

IPCEI Cloud – *ONEnextgen*



IPCEI-CIS 8ra Enablers

DCD > Channels > Media > Live Events > Academy > Industry Awards

HOME › NEWS › STANDARDS & REGULATIONS

EU cloud companies required to facilitate provider switching by Data Act

EU Data Act goes into force on January 11, 2024

January 09, 2024 By: Georgia Butler Have your say

The impending EU Data Act will require cloud providers in Europe to make it easier for customers to switch to competitors.

The act is currently set to go into force on January 11, 2024, and provisions of the act will begin to apply 20 months later meaning that businesses must be ready to comply by 12 September 2025.

In addition to impacting the cloud computing sector, new rules regarding GDPR, IoT data sharing, and smart contracts are included.

The Data Act will require public and private cloud computing service providers to remove "obstacles to effective switching" between their own and competing cloud services, including commercial, contractual, technical, or organizational hurdles.

This includes common deterrents such as egress fees, where cloud providers charge costs to users sending data from their cloud environments to another location.

– dimitrisvetsikas1969 / 15115 images

https://digital-strategy.ec.europa.eu/en/factpages/data-act-explained

Cloud-Edge Testbed Architecture

A Distributed Testbed Aggregating 11 Providers in 7 Member States

virtora

Funded by the IPCEI-CIS

OneKE

MINIO

Marketplace

Open Nebula

Front-End

bit internet technology

Netherlands

bit internet technology
Netherlands

aws
Frankfurt

IONOS
Germany

arsys
Germany

OKTAWAVE
Poland

GDAŃSK UNIVERSITY OF TECHNOLOGY
Poland

arsys
Spain

MONDRAGON
Spain

EQUINIX
France

kontron
Slovenia

infobip
Croatia

IPCEI-CIS virt8ra Cloud-Edge Testbed

virt8ra : Cloud-Edge Management and Orchestration

virt8ra
Funded by the IPCEI-CIS

The **virt8ra Cloud-Edge Testbed** have been developed to create a **scalable** environment for exploring cloud-edge computing scenarios.

It serves as **a development, research and validation platform** to demonstrate the application of innovative cloud-edge solutions in **real-world use cases,** providing a unified virtualization management and orchestration layer on top of bare-metal resources for the **IPCEI-CIS/8ra distributed cloud-edge continuum**.

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Nebula
Cloud-Edge Testbed Architecture
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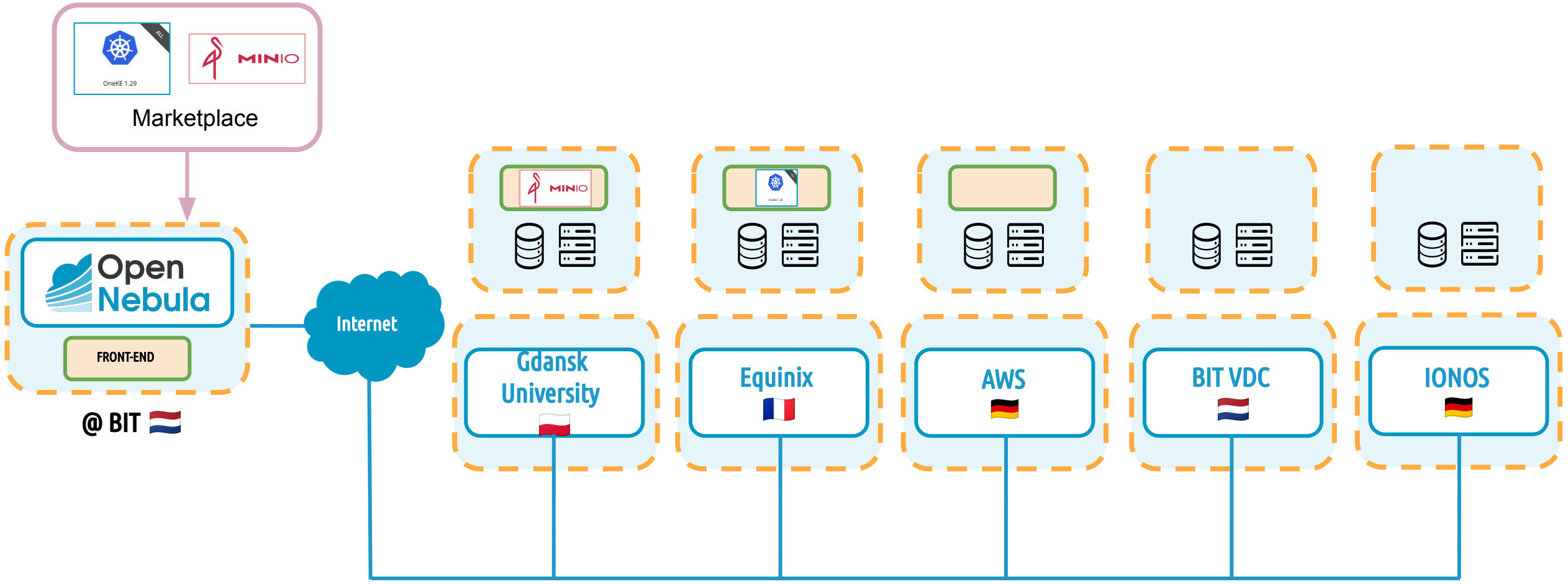
Multi-Cloud Multi-Provider Infrastructure

virt8ra testbed Arch

ONEnextgen



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Cloud-Edge Testbed Interoperability

Deploying the Same Workload in Different Locations

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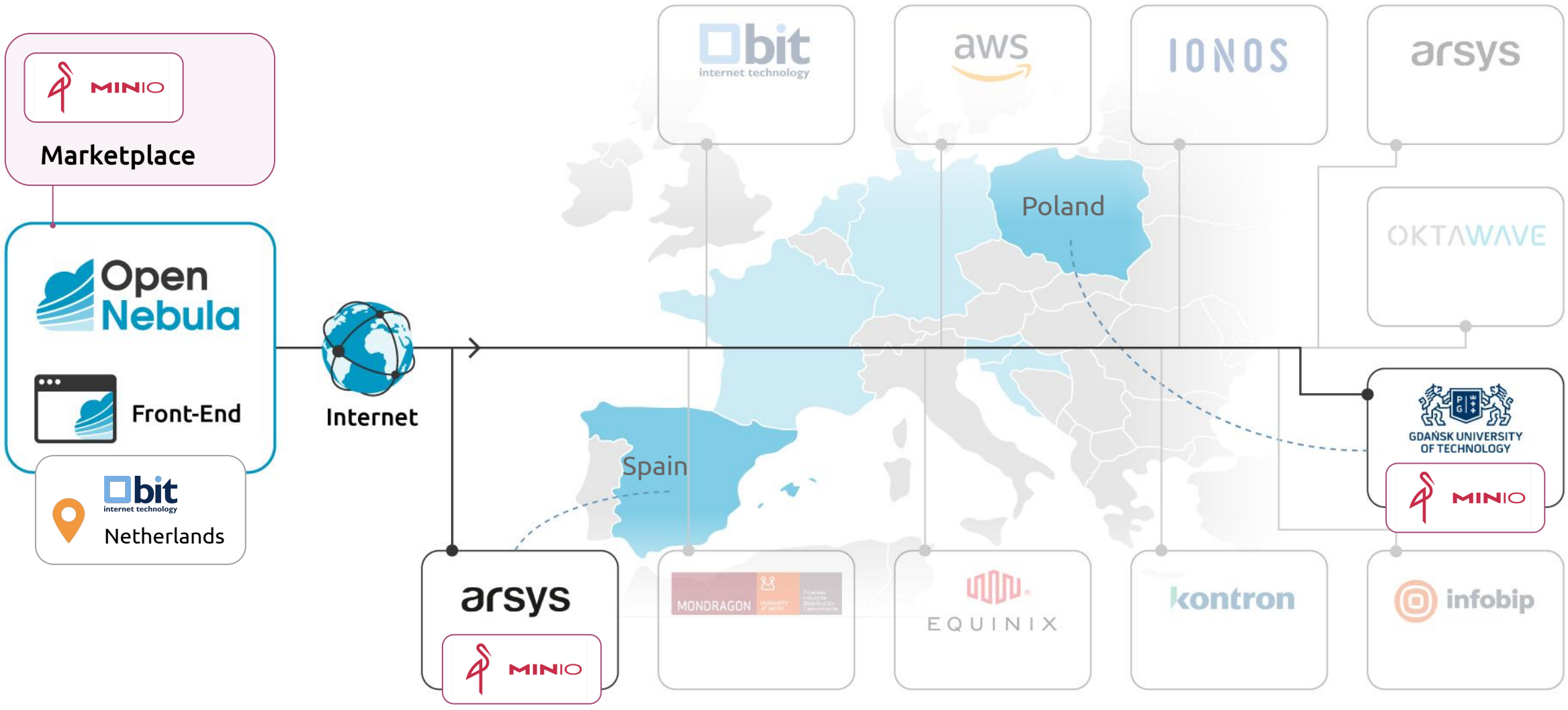

Cloud-Edge Testbed Interoperability

Deploying the Same Workload in Different Locations

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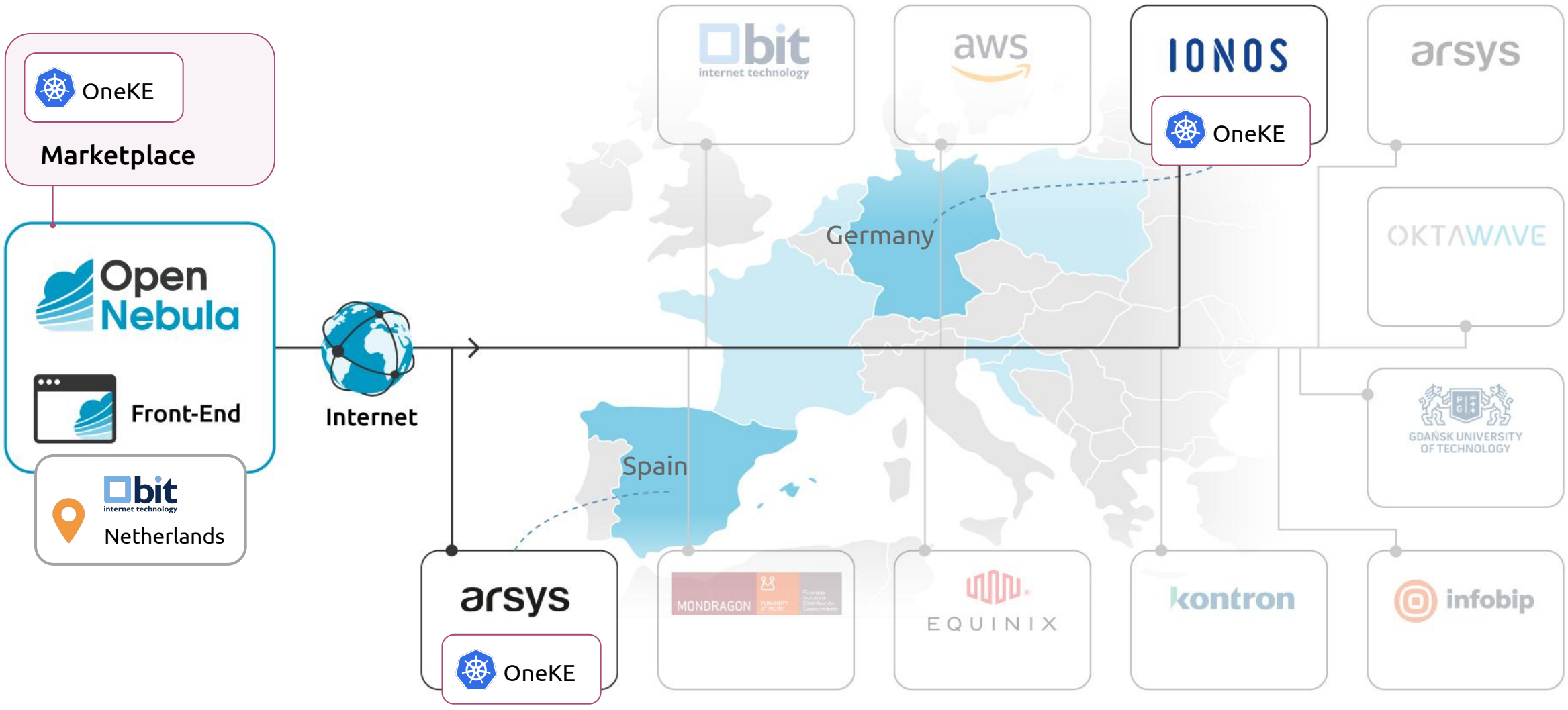

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Portability
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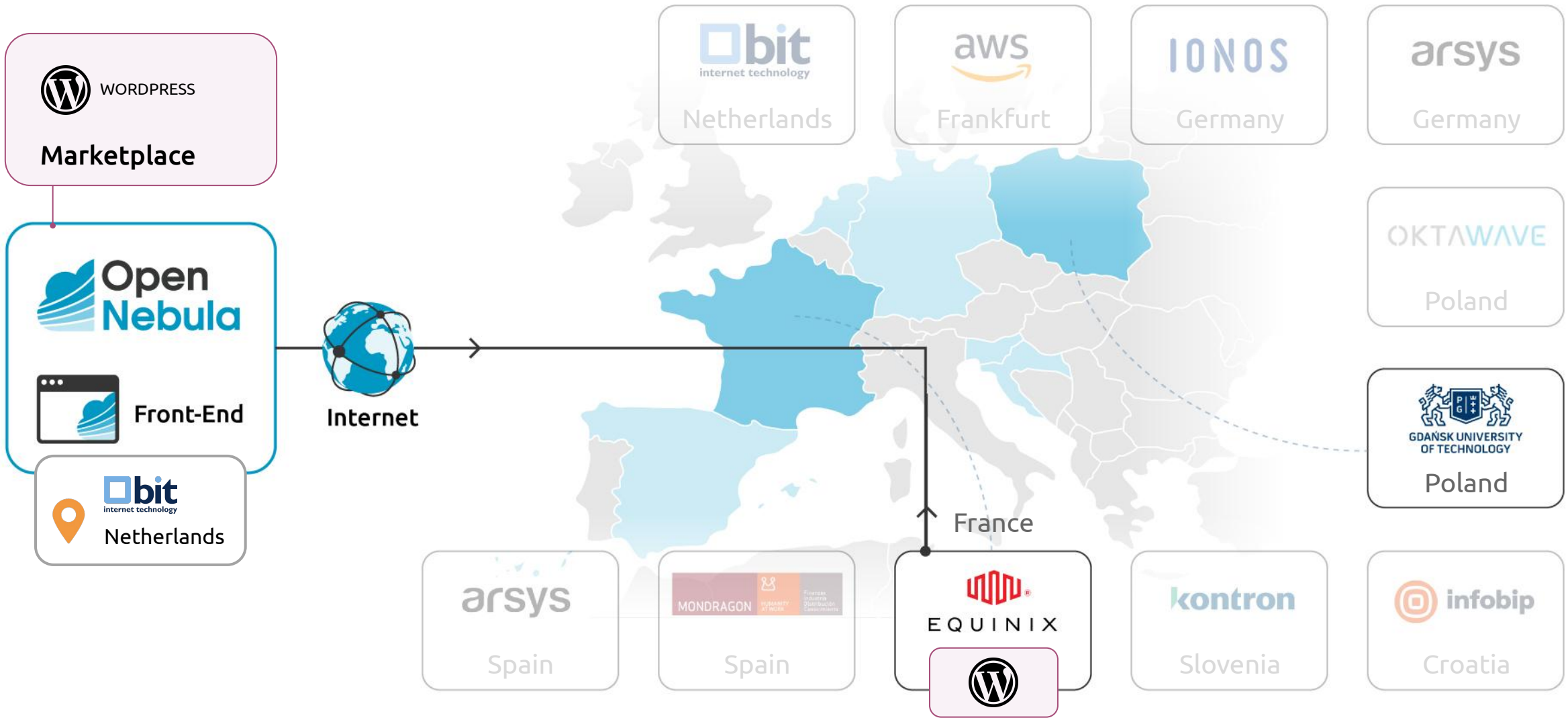
Showcasing Portability

Migrating Workloads Across Providers

ONEnextgen



Showcasing Portability

Migrating Workloads Across Providers

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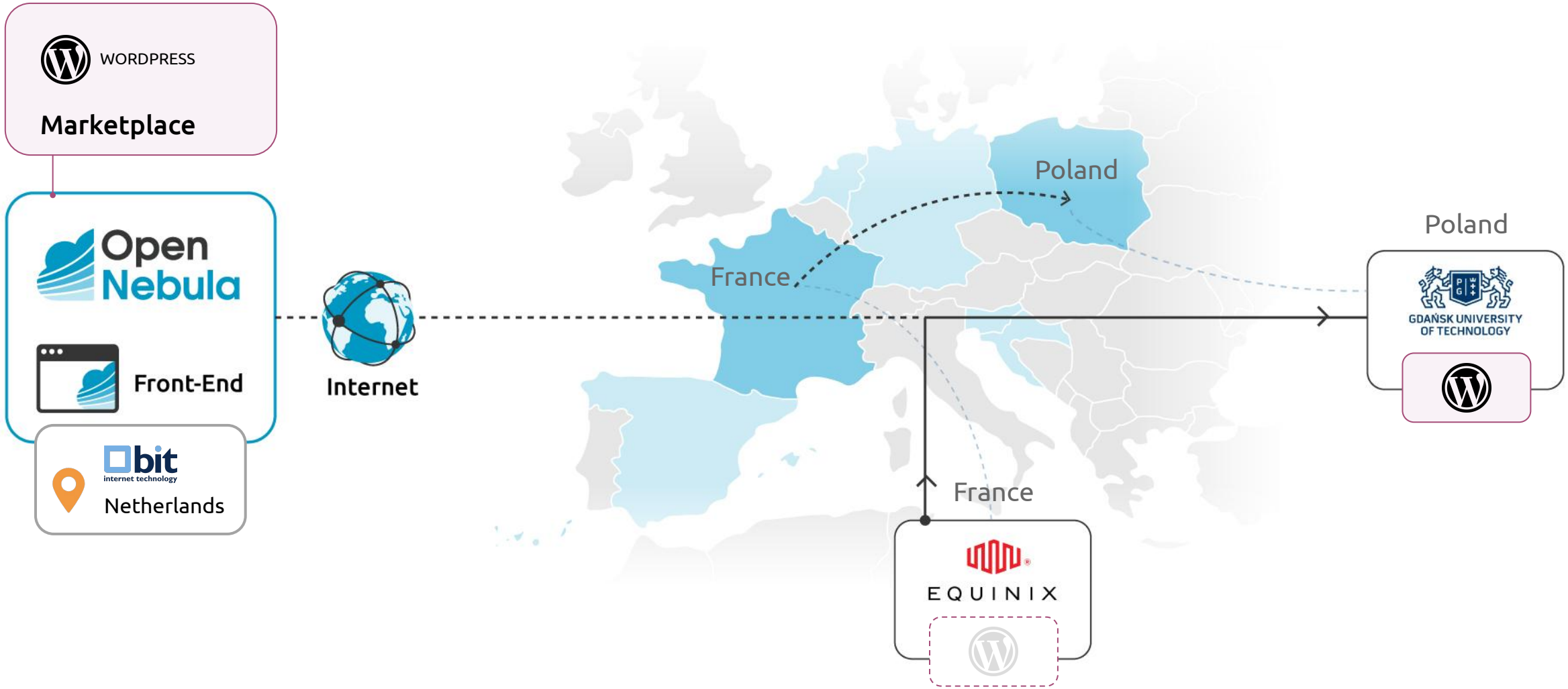

Next Steps

virt8ra.cloud

virt8ra Testbed - Scope & Aim

ONEnextgen

- **Applications**
  - Demonstrations featuring advanced cloud-edge applications.
- **Test Descriptions**
  - Performance tests to evaluate resource orchestration, scalability, and portability in multi-provider setups.
- **Benchmarking Results**
  - Metrics from the demo to highlight performance benchmarks.

Confidential

Q & A

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CAREER MENU

Open Nebula

OPEN CALL 2025

https://careers.opennebula.io/jobs/internal/30e94424-04bf-48b9-8afc-0761559acd96

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Watch the film

IPCEI-CIS

Next-Generation European Platform for the Datacenter-Cloud-Edge Continuum

Initiative supported by the Spanish *Ministerio para la Transformación Digital y de la Función Pública* through the **ONEnextgen Project: Next-Generation European Platform for the Datacenter-Cloud-Edge Continuum** (UNICO IPCEI-2023-003) and co-funded by the European Union's NextGenerationEU instrument through the Recovery and Resilience Facility (RRF).

Financiado por la Unión Europea NextGenerationEU

Plan de Recuperación, Transformación y Resiliencia

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