APEIRO REFERENCE ARCHITECTURE

STRENGTHENING DIGITAL SOVEREIGNTY FOR EUROPE

Peter Giese, Director of SAP Open Source Program Office

Vasu Chandrasekhara, Chief Product Owner of the Apeiro Project at SAP

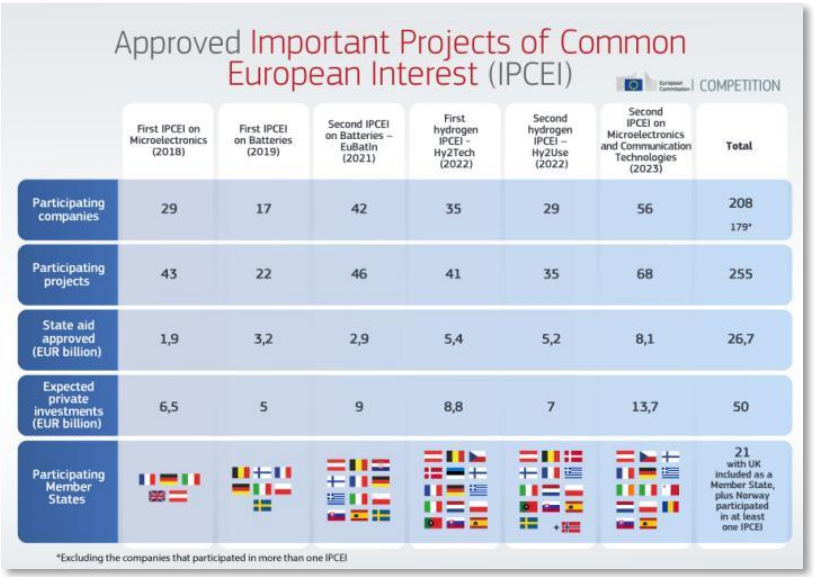
Public

May 8h, 2025 | 3:00 pm CEST

Important Project of Common European Interest

Important Project of Common European Interest (IPCEI)

Special EU framework that allows member states to provide **coordinated state aid** for large-scale, cross-border **industrial projects** that are **strategically important** to Europe - in areas where the market alone wouldn't invest at the needed scale or speed.



Approved Important Projects of Common European Interest (IPCEI)

COMPETITION

	First IPCEI on Microelectronics (2018)	First IPCEI on Batteries (2019)	Second IPCEI on Batteries – EuBatIn (2021)	First hydrogen IPCEI – Hy2Tech (2022)	Second hydrogen IPCEI – Hy2Use (2022)	Second IPCEI on Microelectronics and Communication Technologies (2023)	Total
Participating companies	29	17	42	35	29	56	208 179*
Participating projects	43	22	46	41	35	68	255
State aid approved (EUR billion)	1,9	3,2	2,9	5,4	5,2	8,1	26,7
Expected private investments (EUR billion)	6,5	5	9	8,8	7	13,7	50
Participating Member States							21 with UK included as a Member State, plus Norway participated in at least one IPCEI

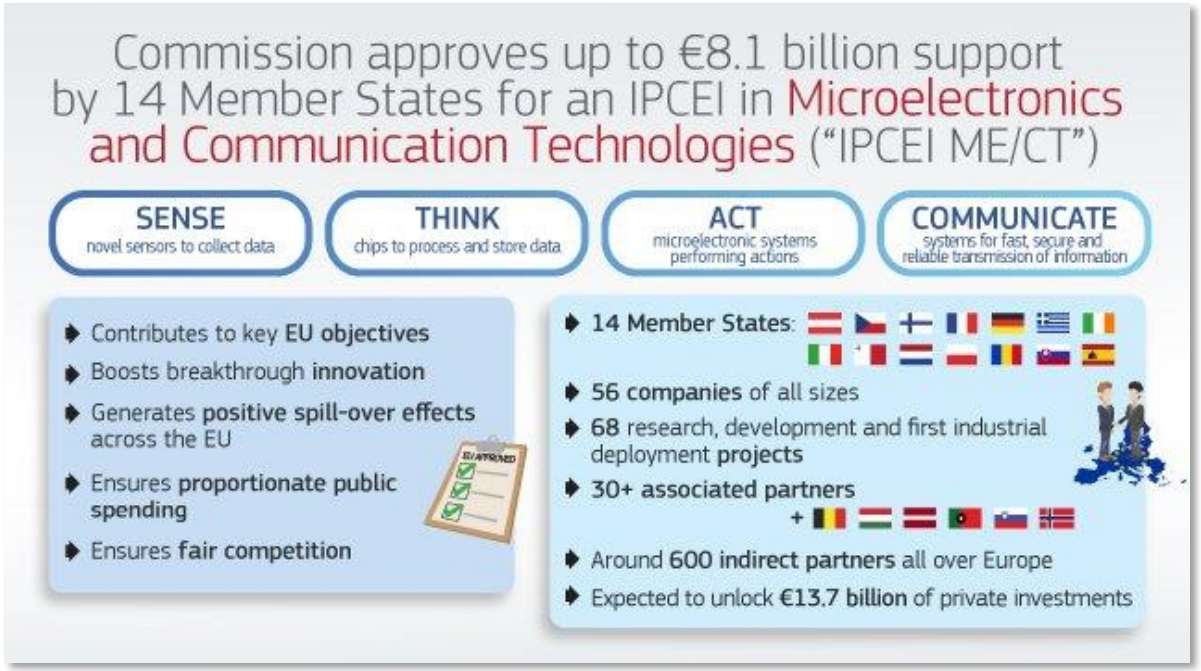
*Excluding the companies that participated in more than one IPCEI

Public funding under constraints

- Ambitious R&D&I exceeding current state-of-the-art
- No market distortion
- Co-financing by beneficiaries
- Spill-over effect to the whole EU

Strategic Importance

- Projects must address key EU priorities like
  - green transition
  - technological leadership
  - or digital sovereignty



Commission approves up to €8.1 billion support by 14 Member States for an IPCEI in Microelectronics and Communication Technologies ("IPCEI ME/CT")

SENSE
novel sensors to collect data

THINK
chips to process and store data

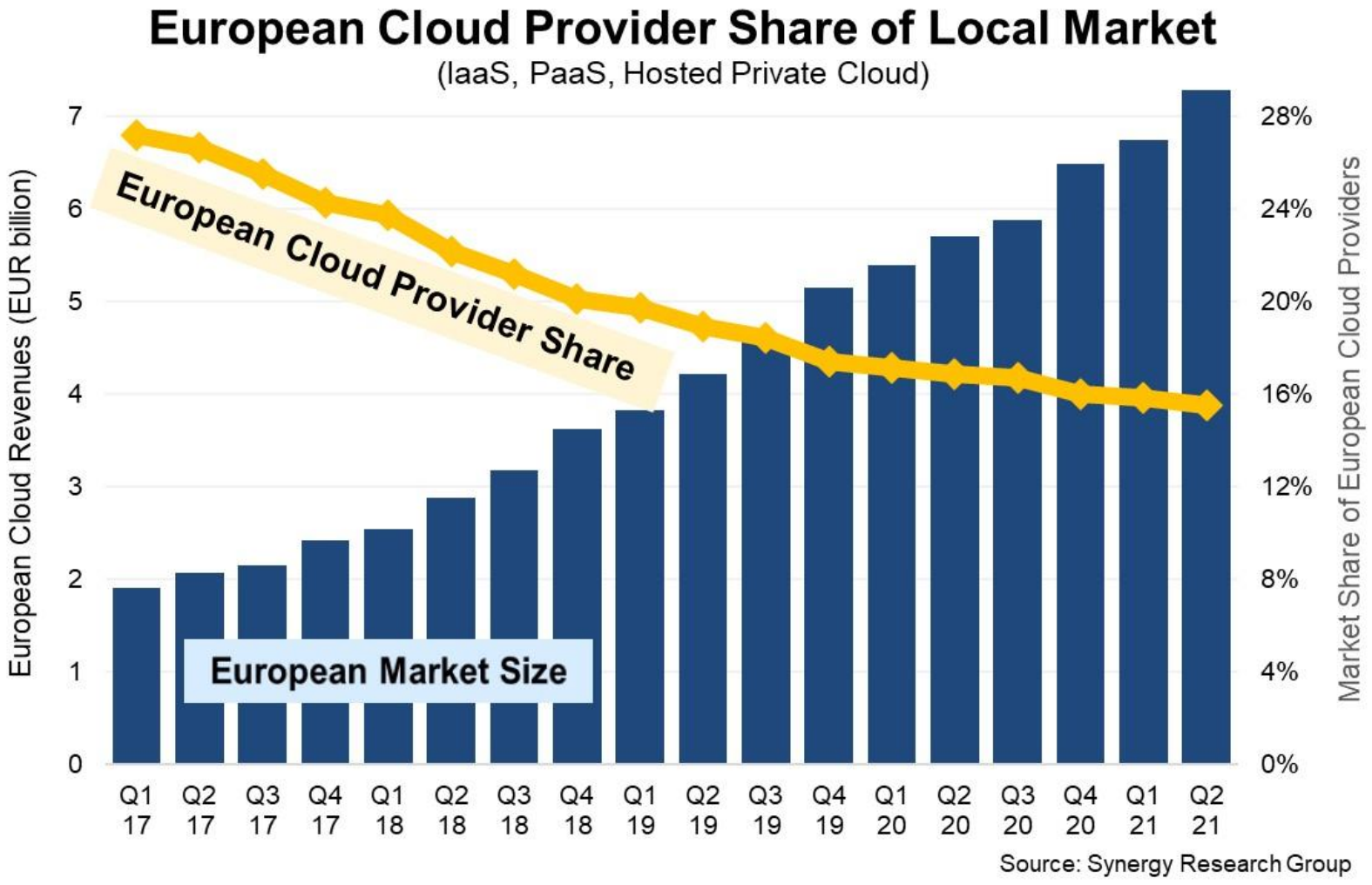
ACT
microelectronic systems performing actions

COMMUNICATE
systems for fast, secure and reliable transmission of information

- Contributes to key **EU objectives**
- Boosts breakthrough **innovation**
- Generates **positive spill-over effects** across the EU
- Ensures **proportionate public spending**
- Ensures **fair competition**

- 14 Member States:
- **56 companies** of all sizes
- **68** research, development and first industrial deployment **projects**
- **30+ associated partners**
- Around **600 indirect partners** all over Europe
- Expected to unlock **€13.7 billion** of private investments

Digital Sovereignty – The European Cloud Market



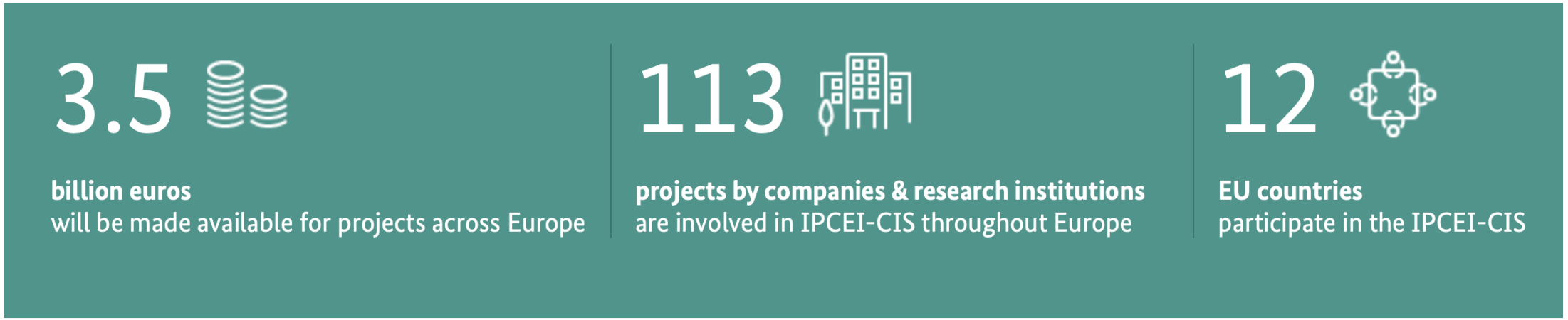
[1]Source: https://www.srgresearch.com/articles/european-cloud-providers-double-in-size-but-lose-market-share

IPCEI – Next Generation Cloud Infrastructure & Services (CIS)

Create a

'Multi-Provider Cloud-Edge Continuum'

without being tied to a single provider.



Commission approves up to €1.2 billion support by 7 Member States for an IPCEI on Next Generation Cloud Infrastructure and Services (IPCEI CIS)

Workstream 1 Cloud-Edge Continuum Infrastructure	Workstream 2 Cloud-Edge Capabilities	Workstream 3 Advanced smart data processing tools and services	Workstream 4 Advanced Applications
Deutsche Telekom	Atos	4iG	Siemens
Telefónica España	Orange	E-Group ICT Software	Fincantieri
	SAP	Tiscali Italia	Engineering Ingegneria Informatica
	Reply	CloudFerro	
	TIM		
	Oktawave		
	Atende Industries		
	OpenNebula Systems		
	Arsys Internet		
	Leaseweb Global		

Competition

Wider IPCEI CIS Ecosystem

Direct Participants

4iG · Arsys Internet · Atende Industries · Atos · CloudFerro · Deutsche Telekom · E-Group ICT Software · Engineering Ingegneria Informatica · Fincantieri · Leaseweb Global · Oktawave · OpenNebula Systems · Orange · Reply · SAP · Siemens · Telefónica España · TIM · Tiscali

Indirect Partners

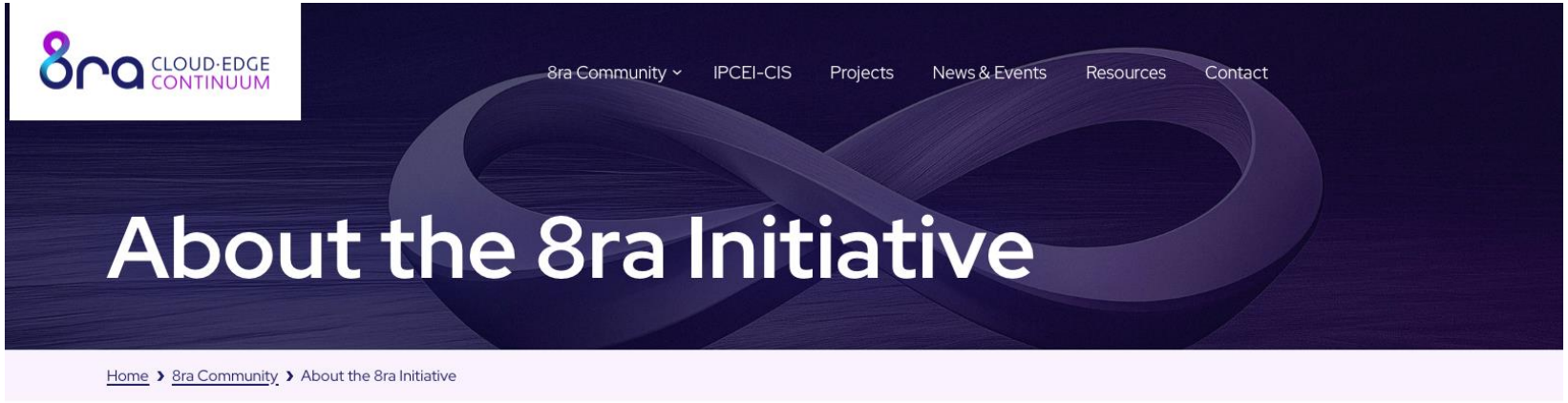
ADVA Optical Networking · Aecorsis · Airbus Operations · Amadeus · Amiral Technologies · Amsterdam Internet Exchange · Armadillo · Aspired · Bass · BetterBe · BIT · Capital Energy Service · CGI France · CNRS IRISA · CNRS LAAS · CNRS UGA ERODS · CNRS UT 3 IRIT SEPIA · DataVaccinator · DATI Group · DB Netz · DE-CIX Management · Deerns Nederland · Diehl Aerospace · e-BO Enterprises · elevait · ENEA · Engie Laborelec · Ericsson · Eurofiber Nederland · Excellium Services · Fachhochschule Dortmund · Fondazione Bruno Kessler · Gdańsk University of Tech · Gigas Hosting · H1 Systems · Hashnet · i3d.net · Igea · Indra Soluciones Tecnológicas de la Información · Infobip · Info Support · Infrachain · INRIA LILLE - Nord Europe · INRIA Nancy- GRAND EST · Institut Imagine · Internet Institute · Ionos · Iskra · itrust consulting · Kontron · Lacroix Electronics Cesson · Lacroix Sofrel · Limebird · Lindner · Luxembourg House of Cybersecurity · Mondragon Corporación · Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek (TNO) · N+P Informationssysteme · Ningaloo · No Blue Screen System · Operator Chmury Krajowej · Phoenix Systems · Pro-bit · Provenrun · Proximus · Recog. AI · Result · RHEA Group · Rheinmetall Technology Center · Robert Bosch · RYAX Technologies · Secunet Security Networks · Stichting Nationale Beheersorganisatie Internet Providers · SYSGO · Telemach · ThreeFold Tech · Tilde · United Biometrics · Universite Bretagne Sud · Universite Caen Basse Normandie · Universite de Lille · Universite de Versailles Saind-Quentin-en-Yvelines · Universiteit Twente · Universiteit van Amsterdam · University of Latvia (IMCS) · Ventspils High Ventspils Technology Park · WestfalenWIND IT · Zejn

IPCEI-CIS and 8ra Initiative

https://8ra.com

Funded by the European Union
NextGenerationEU

Supported by:
Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag



The 8ra Initiative is a strategic European endeavour dedicated to establishing a resilient, open and future-proof digital infrastructure. At its core is the Important Project of Common European Interest on Next Generation Cloud Infrastructure and Services (→ IPCEI-CIS), bringing together 12 EU member states and about 120 industrial and research partners to drive Europe's digital sovereignty.

Our mission

The 8ra Initiative lays the foundation for a decentralised, interoperable, and secure Multi-Provider Cloud-Edge Continuum (MPCEC), ensuring seamless IT services across providers and national borders. By fostering open source collaboration, interoperability, and technological independence, we enable European enterprises – especially SMEs – to scale, innovate, and remain competitive in the global digital economy.

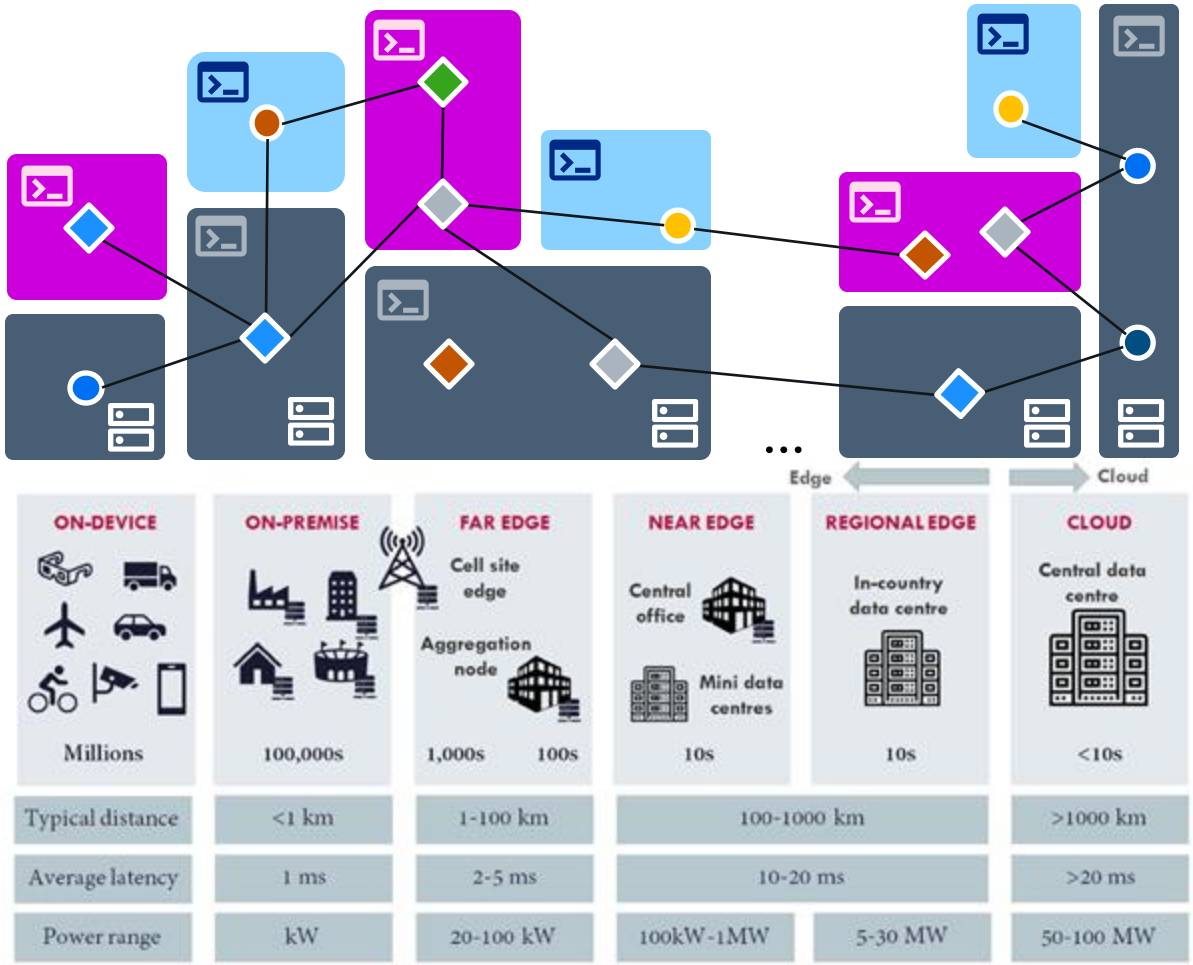
Multi-Provider Cloud-Edge Continuum

Funded by the European Union
NextGenerationEU

Supported by:
Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag

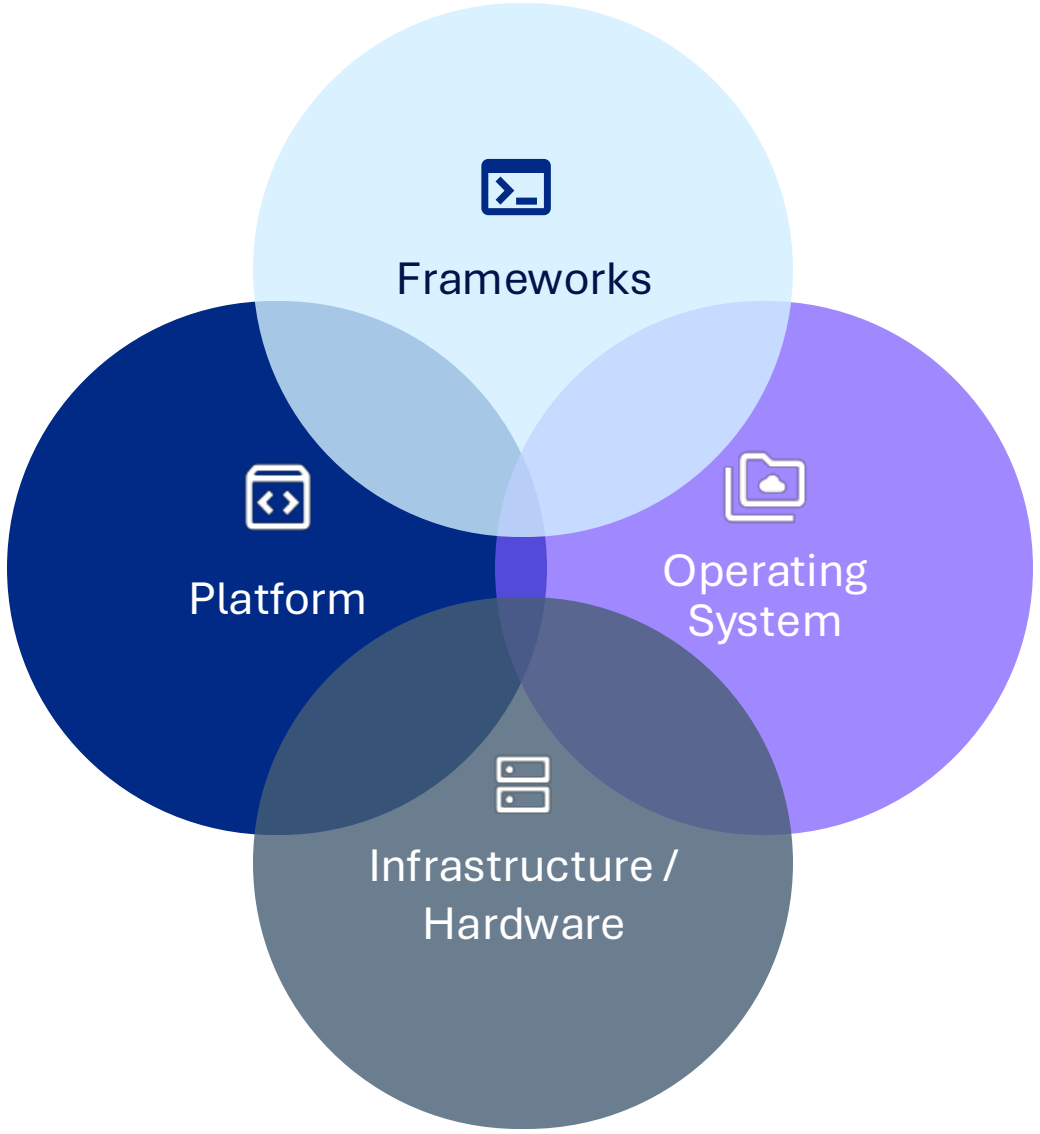
Ecosystem: **Software Providers**

Ecosystem: **Infrastructure Providers**



8ra CLOUD·EDGE CONTINUUM

SAP’s IPCEI-CIS Project Proposal



SAP aims to develop a reference for an open, flexible, powerful, secure, and compliant next generation cloud-edge continuum. The reference will be made available as a straightaway usable construction kit that provides blueprints and re-usable components for central building blocks.

Build with Cloud Native. No Need to Re-invent the Wheel ...

The de-facto grass-roots cloud native open standard with attached ecosystem

Future Proof

Distributed Systems

Beyond Containers

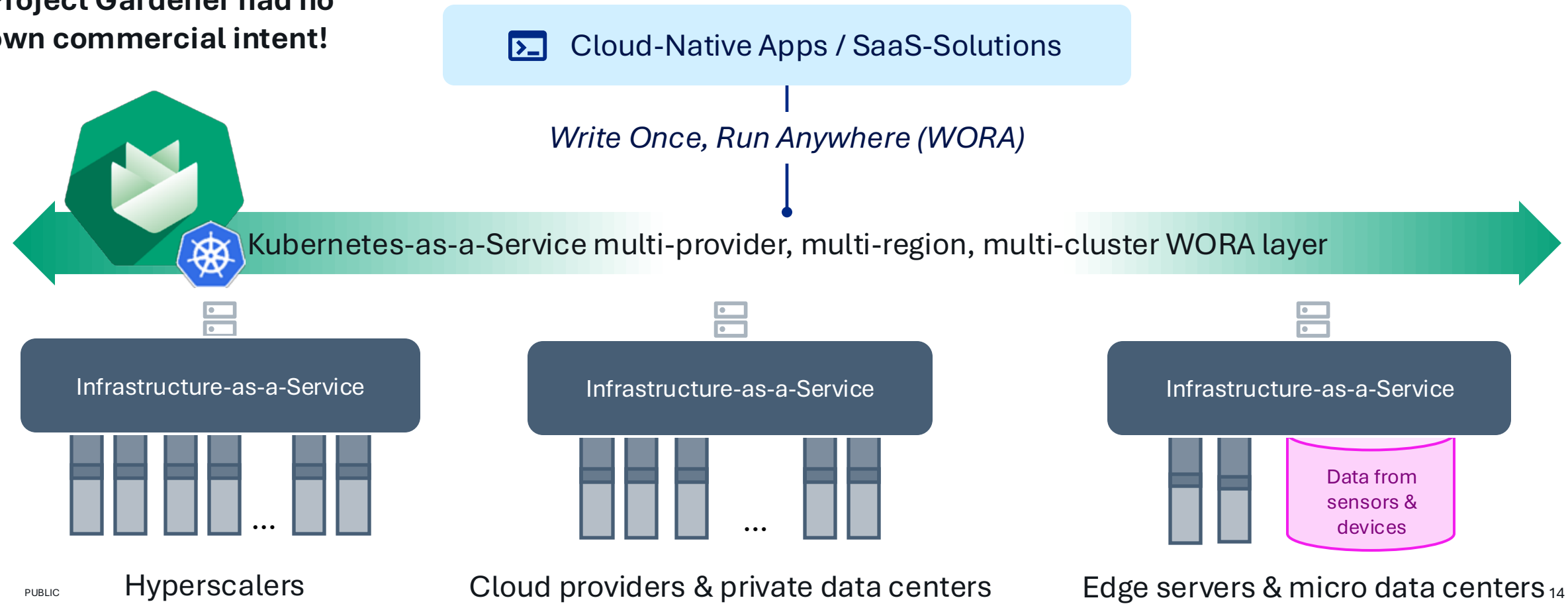
API Machinery

“API for all of the Ecosystem”

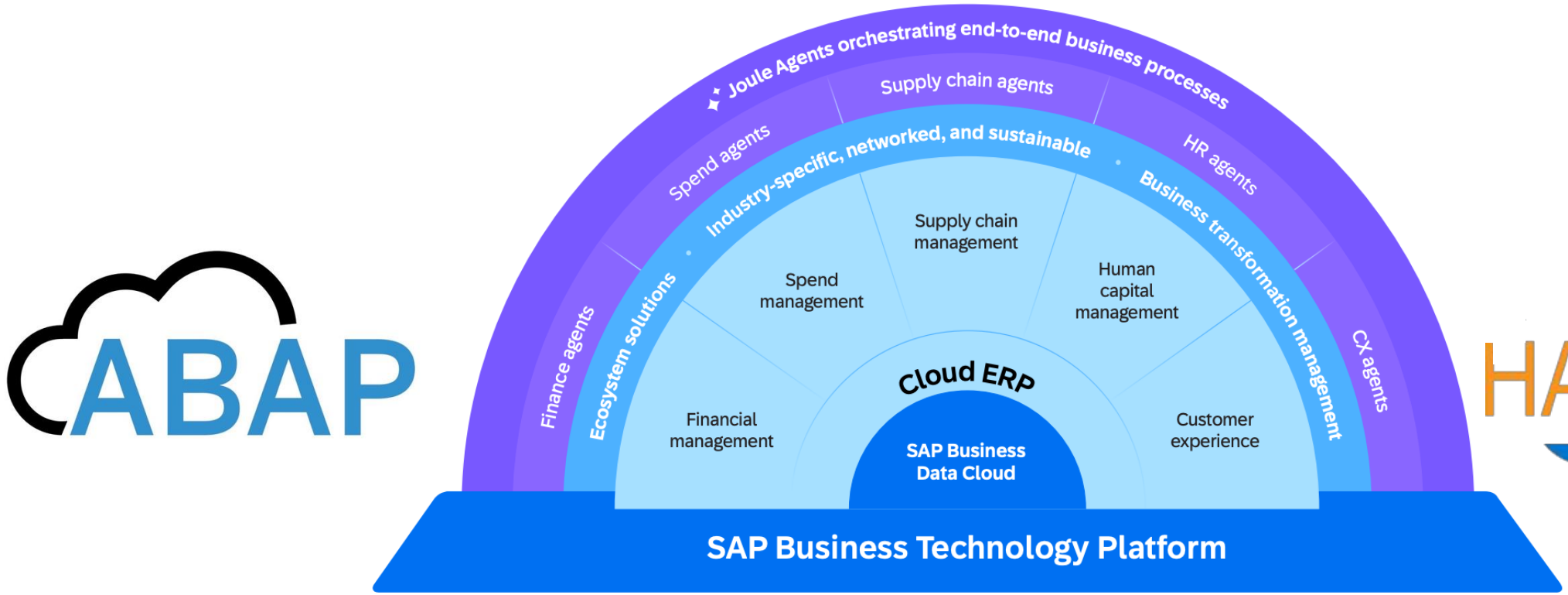
... Initiate Co-Innovation (with a Leap of Faith)

It started with Kubernetes-as-a-Service built for use at SAP
Initiated as outbound OSS Project as Leap of Faith

Project Gardener had no own commercial intent!



Enterprise hardened in the internal backbone of SAP's BTP



ABAP

HANA

Write Once, Run Anywhere (WORA)

Kubernetes-as-a-Service multi-provider, multi-region, multi-cluster WORA layer

Collaboration with STACKIT

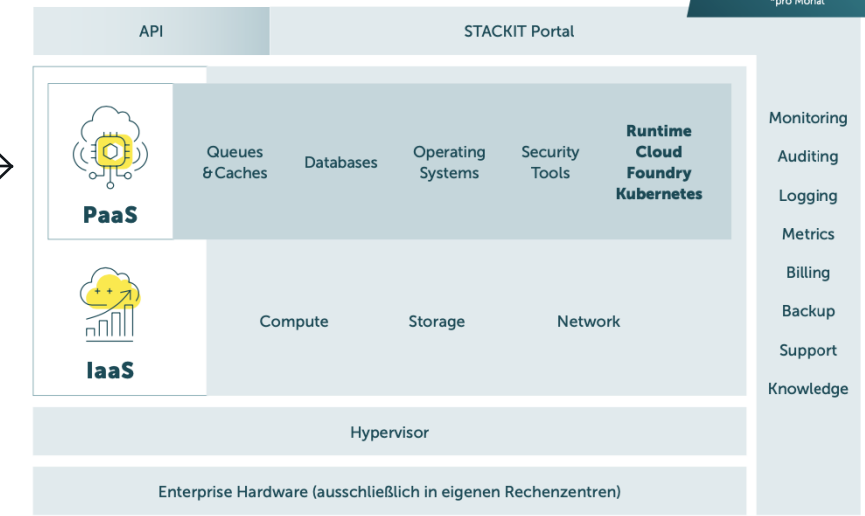
PROFESSIONAL SERVICE & SUPPORT

Unser Support-Team steht Ihnen zu Beginn unserer Go-Live-Phase im Rahmen eines kostenlosen Serviceplans zur Verfügung und reagiert in einem zugesicherten Zeitfenster auf Ihre Anfragen.

Der Professional Service – ein engagiertes Team aus Cloud-Experten – unterstützt und berät Sie jederzeit zu allen Fragen rund um Migration, Zielarchitektur und Cloud Assessment und vieles mehr.

UNSER ANGEBOT

GENERELLE VERFÜGBARKEIT
99,9 %*
*pro Monat



Collaboration with DTAG

Open Sovereign Cloud with confidential computing

Digital sovereignty in data, operations, and technology for a secure and private innovation

Contact

Experience the future of open-source cloud with T-Systems Open Sovereign Cloud

Our Open Sovereign Cloud (OSC) with its cloud stack based entirely on open source technology empowers our customers with full digital sovereignty. It offers freedom from license costs and non-EU software vendors. Geo-redundant data centers in Germany and confidential computing keep your data secure. Compliance meets top standards, including ISO 27001 and BSI C5.

Adoption in the EU

cleura | The European cloud | Support | All of Cleura | Get Started

Cleura / Services / Cloud Features / Containers

Cloud Features | Explore

Lightweight, fast and efficient containers

Container workloads have increased in popularity over several years, and for a good reason. Running your workloads in a lightweight and containerized environment increases isolation and makes operating the underlying layer of virtual servers, storage, and networks easier.

FUGA cloud solutions | Platform | Services | Pricing | Blog | Company | Partners | Contact | Docs | Console login

Enterprise Managed Kubernetes

EMK

Kubernetes as a Service
Available in AMS and FRA regions, and soon in the rest of the EU.

- OpenStack Magnum
- Gardener

Adoption in the EU

plusserver

Consulting: +49 2203 1045 3500 | Support: +49 2203 1045 3600

Downloads Company Career Login EN

Why plusserver | Cloud Services | Managed Hosting | Security | Partner

Consulting | Support

Overview | Features | References | Prices & more | FAQ

30 days trial

Features

Documentation

Self-service

Do a lot of things yourself: Provisioning, up/down scaling, user management, upgrades, OS lifecycle, ...

Multi-region

You can choose from one of four regions in Germany when you set up your Kubernetes cluster.

Autoscaling

Nodes can be automatically scaled whe compute resources become insufficient.

Hibernation

By switching off pods and nodes on a timed basis, for example overnight, you can save money.

ReadWriteMany (RWX)

The PSKE supports RWX volumes, which can be used by multiple pods as persistent volumes (separate NFS product required).

Security by design

The PSKE can be audited and provides regular patching of K8s and OS, encryption of persistent data (encryption at rest), etc.

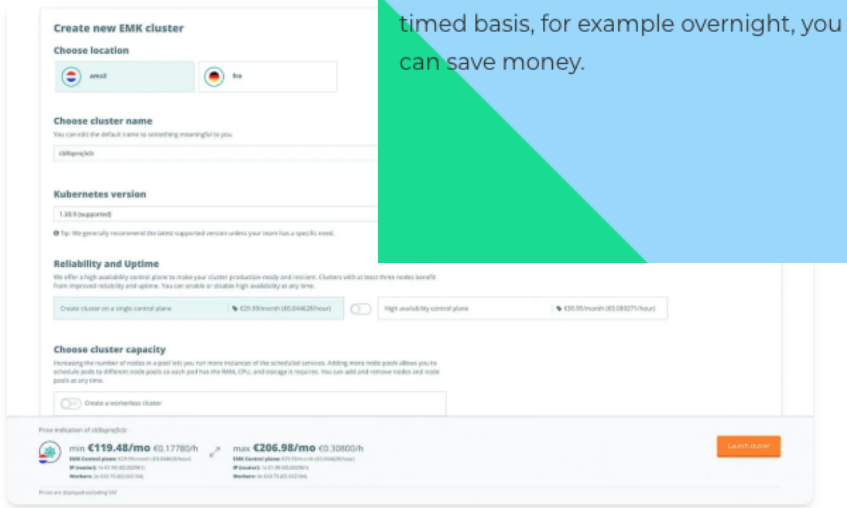
CYSO

Services | Platform | Resources | Pricing | Solutions | Abou

Managed Kubernetes

Simplify container management with our secure, scalable, and high-availability Enterprise Managed Kubernetes solution.

Plan a discovery call | Deploy a cluster



certified kubernetes

CLOUD NATIVE COMPUTING FOUNDATION SILVER MEMBER

EU GDPR COMPLIANT

Innovation down to Bare Metal

metalstack cloud

The sovereign alternative to proprietary clouds

Your infrastructure. Your advantage.

With metalstack.cloud on premises, your data center becomes a powerful private cloud. Our fully open-source all-in-one stack offers you maximum transparency and freedom - without vendor lock-in. Thanks to elastic hardware and a fully automated basis, you can operate Kubernetes clusters directly on bare metal, scalably and efficiently.

cloud services MADE IN GERMANY

Included

Preconfigured rack
For installation on your premises as a test installation

Hardware
8 Server Nodes, 2 Leaf Switches, Management Switch, Edge Router

Configuration and maintenance
Bare-Metal-as-a-Service-API for the resources. Kubernetes-as-a-Service-API with an integration between the bare metal layer and Gardener

Networking
Two times 1G for the servers, edge ready

Optional
Training concept for knowledge transfer

Adoption in the Software Ecosystem

codesphere

Managed Kubernetes

- Node health checks, provisioning, etc..
- Automated K8s Updates
- Very cheap Controlplane (save around 2k per month for 3 Clusters)
- Autoscaling

Support of several Cloudproviders (Equinix, Openstack, Google)

- Support for managed Kubernetes of Equinix
- Homogeneous cluster across all our providers

Fast support of new Kubernetes versions

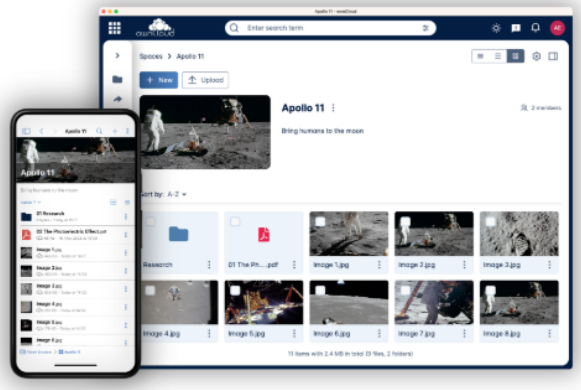
OIDC Support (Gardener and the clusters)

→ Even we as a small Team can operate multiple up-to-date clusters.

Adoption in the SaaS Ecosystem

"We use the plusserver Kubernetes engine for our cloud-native application 'ownCloud Infinite Scale'. The PSKE provides us with sufficient performance and the spontaneous scalability in Kubernetes that we need. Infinite Scale is by nature a storage-intensive solution. Again, this requirement was met with flexibility."

Klaas Freitag
CTO owncloud



Cloud Native Architecture

ownCloud Infinite Scale empowers organizations to build and scale applications in dynamic environments, including public, private, and hybrid clouds. With support for containers, microservices, and declarative APIs, it enables seamless integration and efficient resource management.

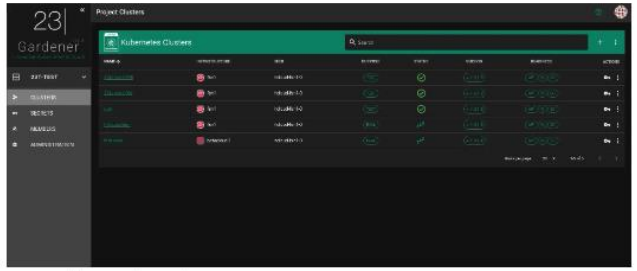
23KE

Enterprise-class Kubernetes Engine

23KE is an enterprise-class Kubernetes engine for industrial use cases as well as cloud service providers. Its strength is its focus on Kubernetes itself. It focuses on scalability, reliability, and self-healing of Kubernetes clusters. No bloatware with tons of features on top that only a few or no one needs and only exist for themselves. This enables 23KE to achieve a high production grade.

Based on the open source project Gardener it offers Kubernetes Clusters as a Service at scale. With a lot out-of-the-box functionalities for the daily operations routine of the Kubernetes clusters.

Contact us via email to get further information about 23KE.



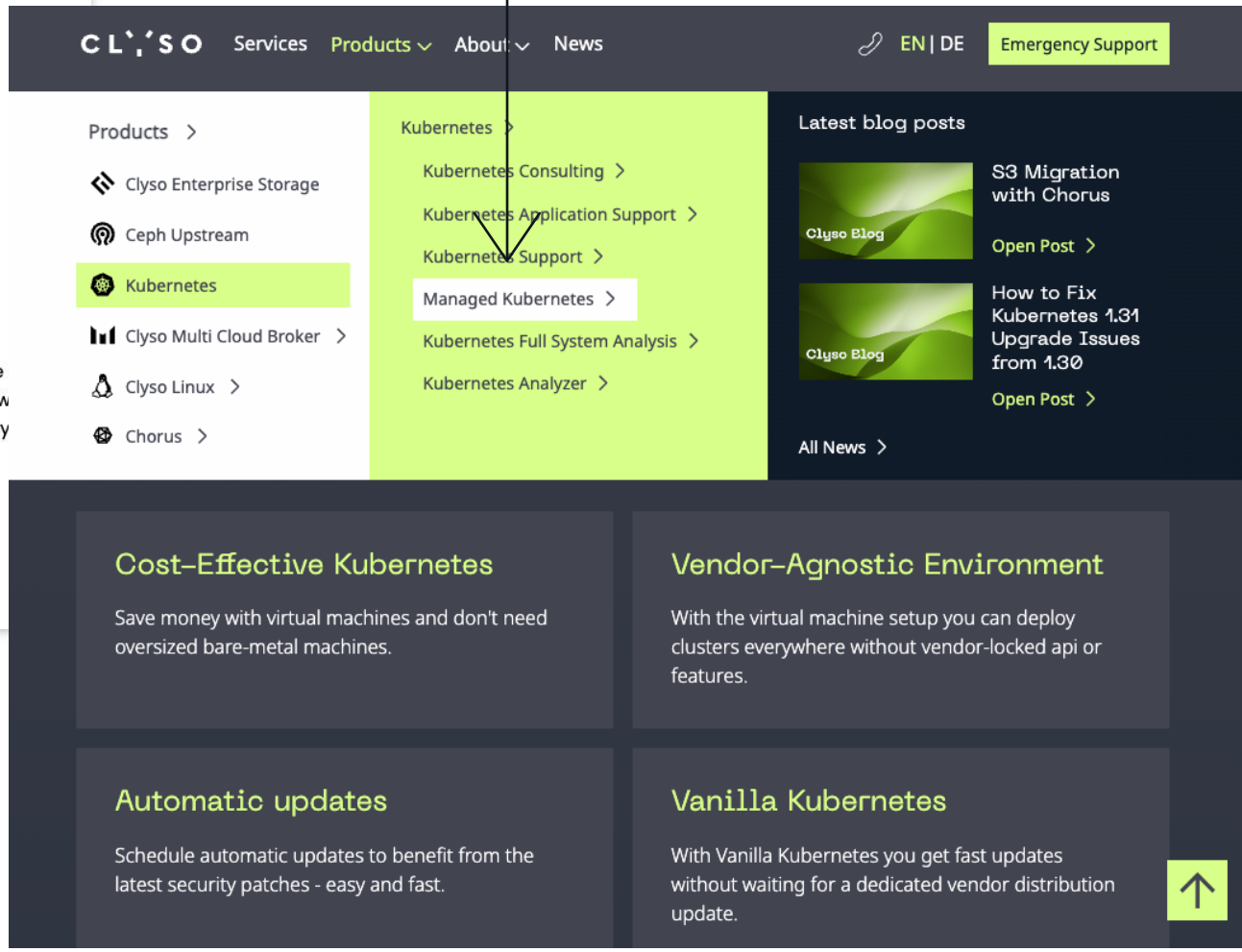
Source: https://github.com/gardener/dashboard

Digital sovereignty layer model

Source: https://www.acatech.de/allgemein/digitale-souveraenitaet-acatech-impuls-entwirft-schichtenmodell-als-handlungsrahmen-fuer-die-eu/

In the document Digitale Souveränität – Status quo und Handlungsfelder by the Deutschen Akademie der Technikwissenschaften (acatech) the Gardener project, the of 23KE, is listed as a key building block in Gaia-X for the new Infrastructure as a Service layer in the digital sovereignty lay model.

Gardener Support Ecosystem



DBaaS at Scale

Blogs / 2020 / PingCAP's TiDB Cloud

PingCAP's Experience in Implementing Their Managed TiDB Service with Gardener

Wednesday, May 27, 2020

7 minute read

Gardener is showing successful collaboration with its growing community of contributors and adopters. With this come some success stories, including PingCAP using Gardener to implement its managed service.

About PingCAP and Its TiDB Cloud

PingCAP started in 2015, when three seasoned infrastructure engineers working at leading Internet companies got sick and tired of the way databases were managed, scaled and maintained. Seeing no good solution on the market, they decided to build their own - the open-source way. With the help of a first-class team and hundreds of contributors from around the globe, PingCAP is building a distributed NewSQL, hybrid transactional and analytical processing (HTAP) database.

Its flagship project, TiDB, is a cloud-native distributed SQL database with MySQL compatibility, and one of the most popular open-source database projects - with 23.5K+ stars and 400+ contributors. Its sister
Native Interactive Landscape project.

PingCAP envisioned their managed TiDB service, known as TiDB C
to be compatible with different cloud providers. As a result
loud service offering.

TiDB Cloud
Fully Managed TiDB as a Service

PingCAP Home TiDB Cloud TiDB Playground Forum Contact Us

- Docs Home
- About TiDB Cloud
  - Why TiDB Cloud
  - Architecture
  - High Availability
  - MySQL Compatibility
  - Roadmap
- Get Started
- Develop Applications
- Manage Cluster
- Migrate or Import Data
- Explore Data
- Data Service (Beta)
- Stream Data
- Security
- Billing
- API
- Integrations
- Reference
- FAQs
- Release Notes
- Maintenance Notification

TiDB Cloud is a fully-managed Database-as-a-Service (DBaaS)
Processing (HTAP) database, to your cloud. TiDB Cloud offers a
applications, not the complexities of the databases. You can cre
Google Cloud and Amazon Web Services (AWS).

... and many more

Let’s replicate this co-innovation model across the stack

Shared, Open, and Immediate Usefulness via Co-Innovation

Apeiro is Open and carved out from and is intended for Production!

Cloud Native Technology Platform

Cloud-Edge Continuum Use Cases

IPCEI-CIS Participants & EU Industry

- agile
- not purely academic
- pragmatic research & development
- collaborative and open-source
- using de-facto cloud-native standards

Reference needs brownfield **entry points** & **neutral governance** to enable EU-wide adoption

Multi-Provider Cloud-Edge Continuum

Funded by the European Union
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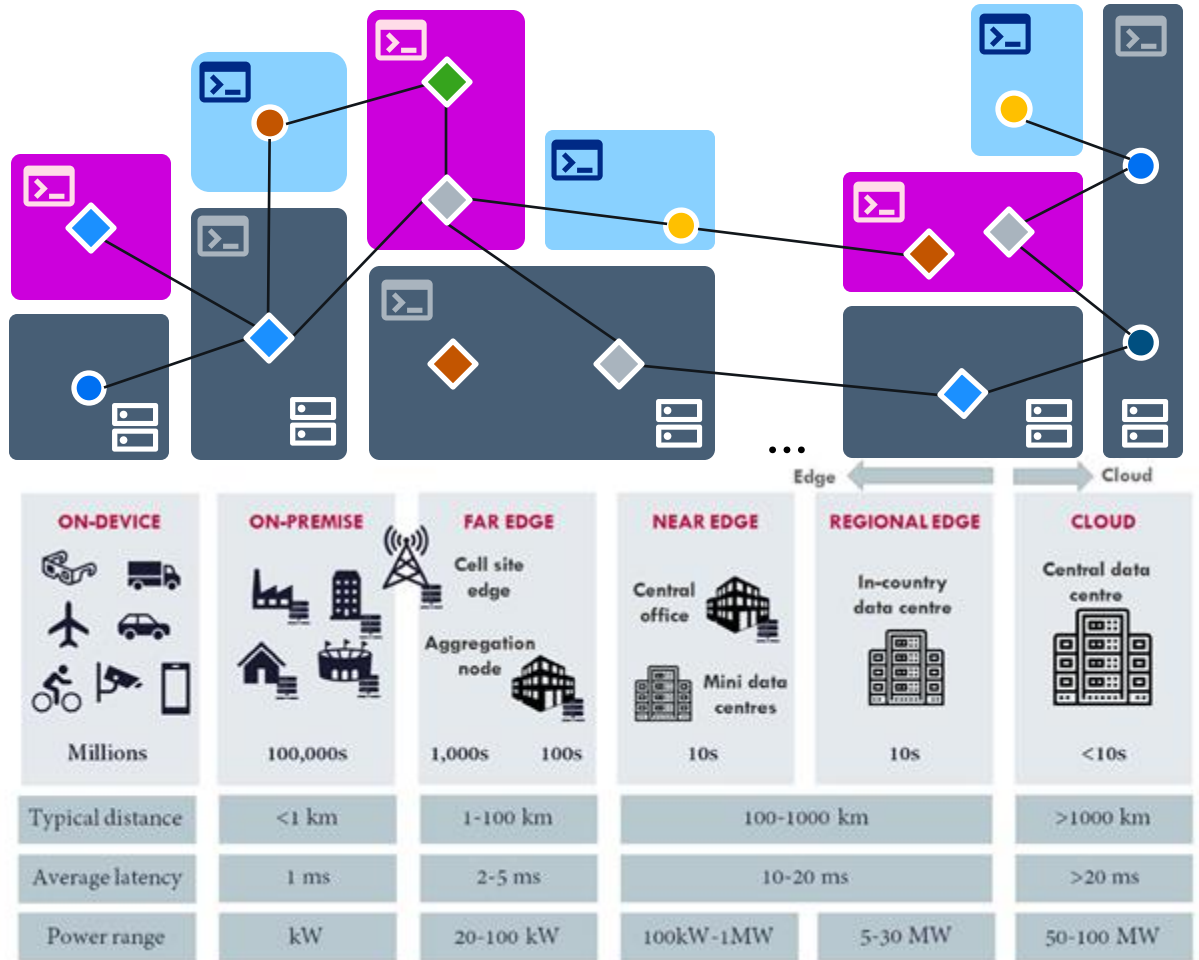
Ecosystem: **Software Providers**

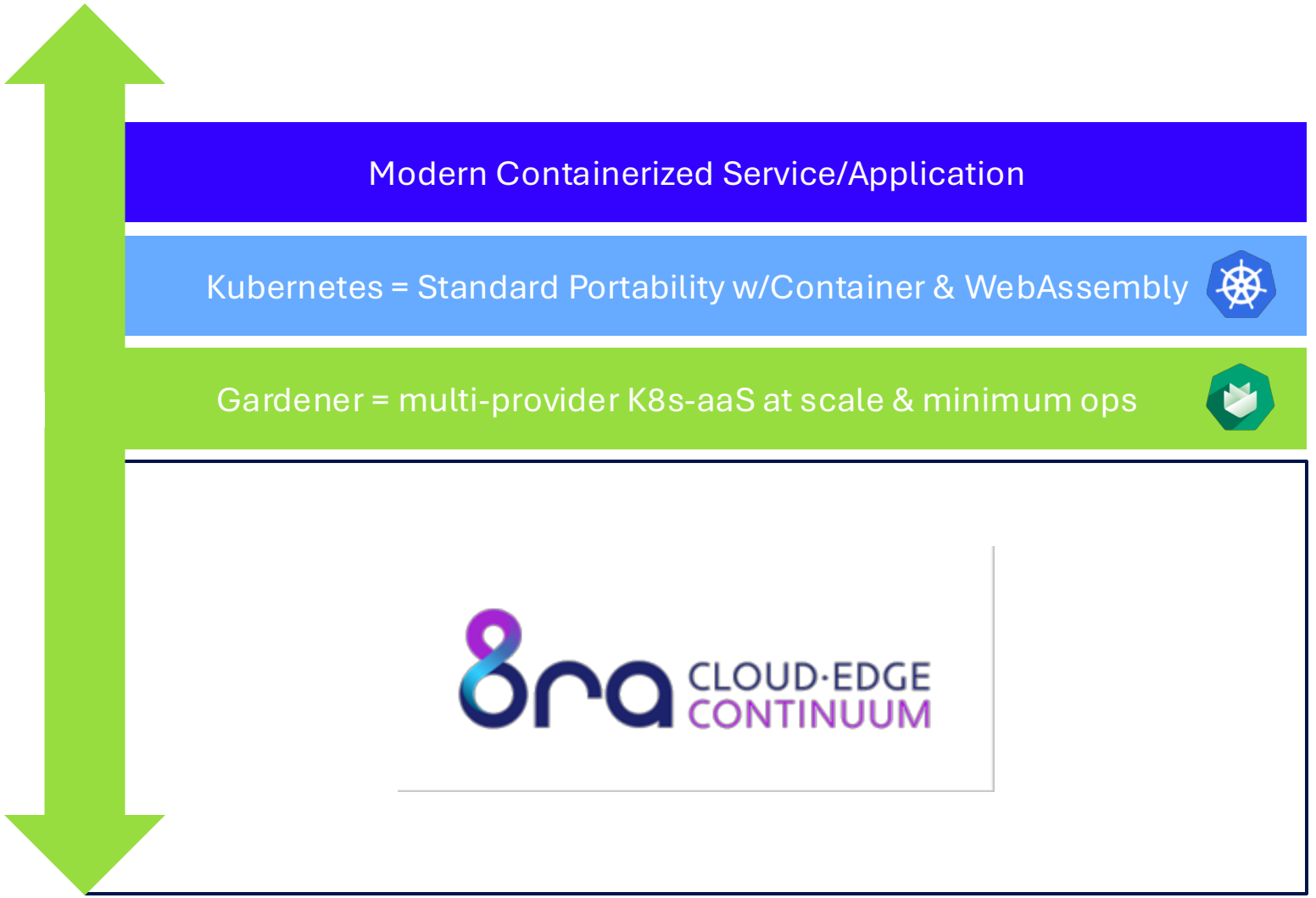
Ecosystem: **Infrastructure Providers**



8ra CLOUD·EDGE CONTINUUM

Entry point 1: Kubernetes-aaS

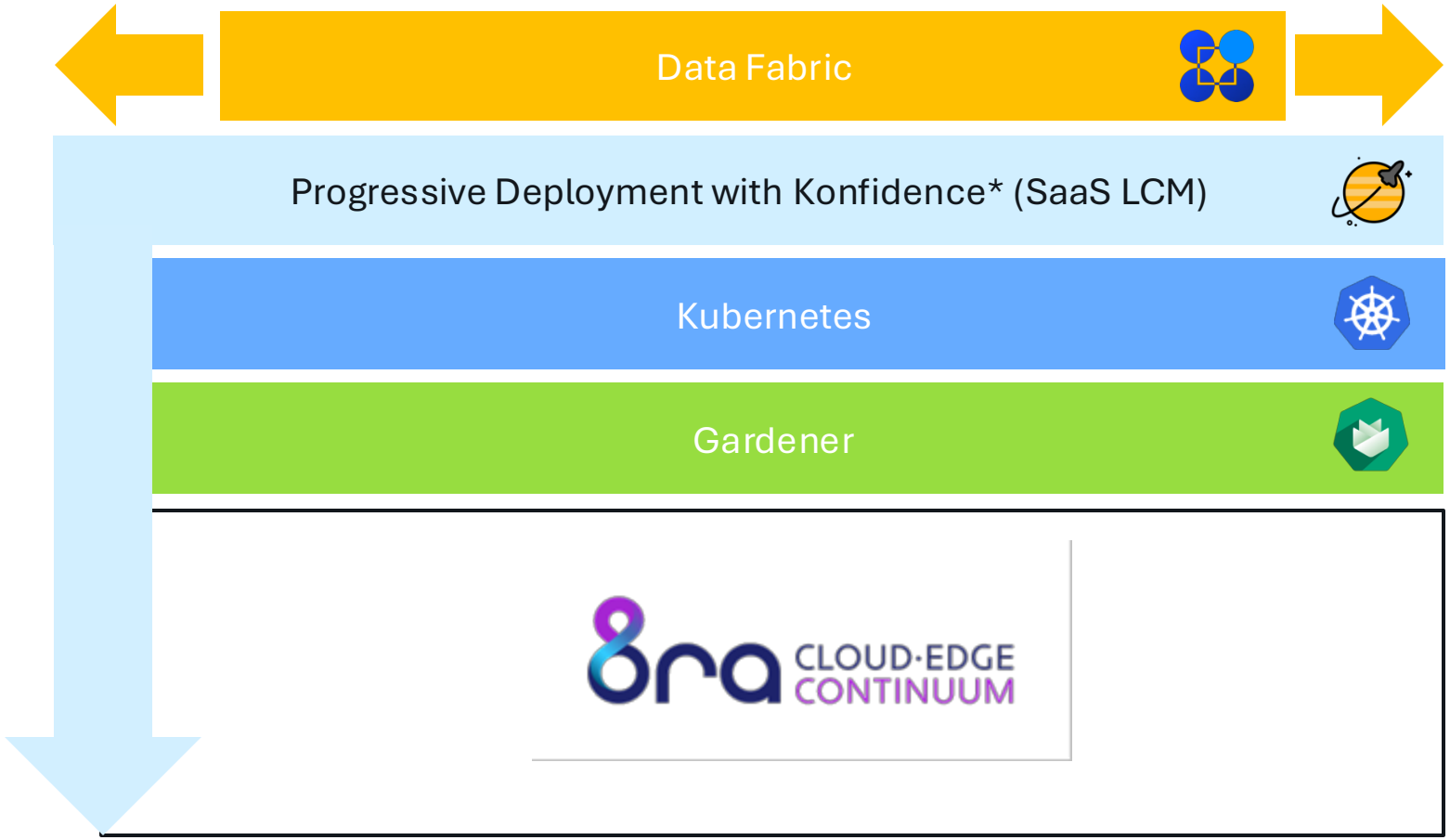
- Multi-Cloud Approach
  - Portability
  - De-facto standard
  - Cloud-native
- Resilience in SW not HW
- Atomic Primitive
  - VM ➔ Kubernetes
- New Investments to enable MPCEC
  - Easier Adoption
    - Day 0 – 1 – 2
  - Autonomous Cluster
  - Edge Cluster



Multi Provider Cloud-Edge Continuum

Entry point 2: SaaS

- SaaS LCM
  - Version Vectors
  - Ring Deployments
  - Feature Flagging
  - Engineering culture
- Investments for Edge
  - E.g. w/ WASM
- Data Fabric for Business Data
  - Meta Data Exchange
  - Data Products

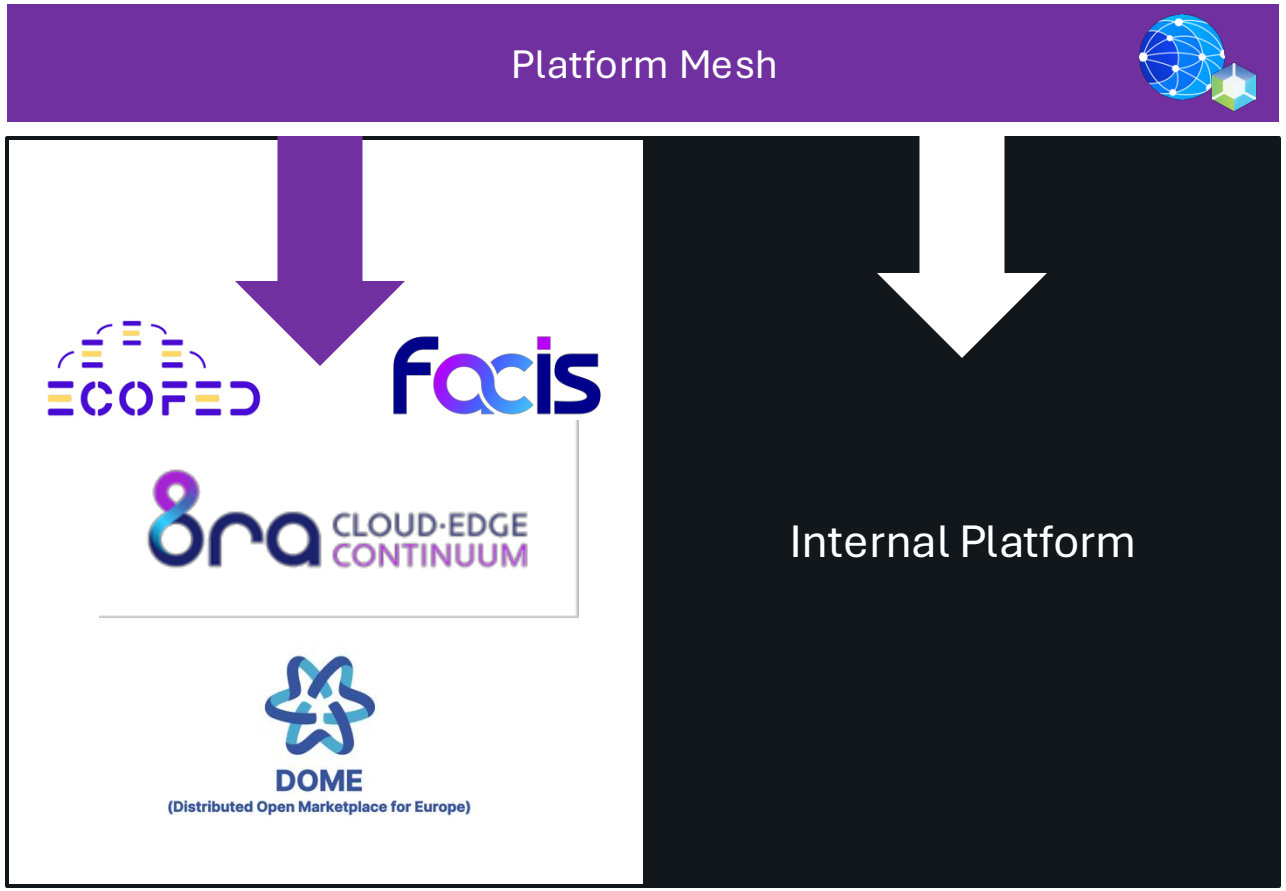


Multi Provider Cloud-Edge Continuum

Entry point 3: Order Interoperability between Providers

- Resource Order Interoperability
- Re-use accepted standards of cloud-native API
- Order Infrastructure as Data/Config

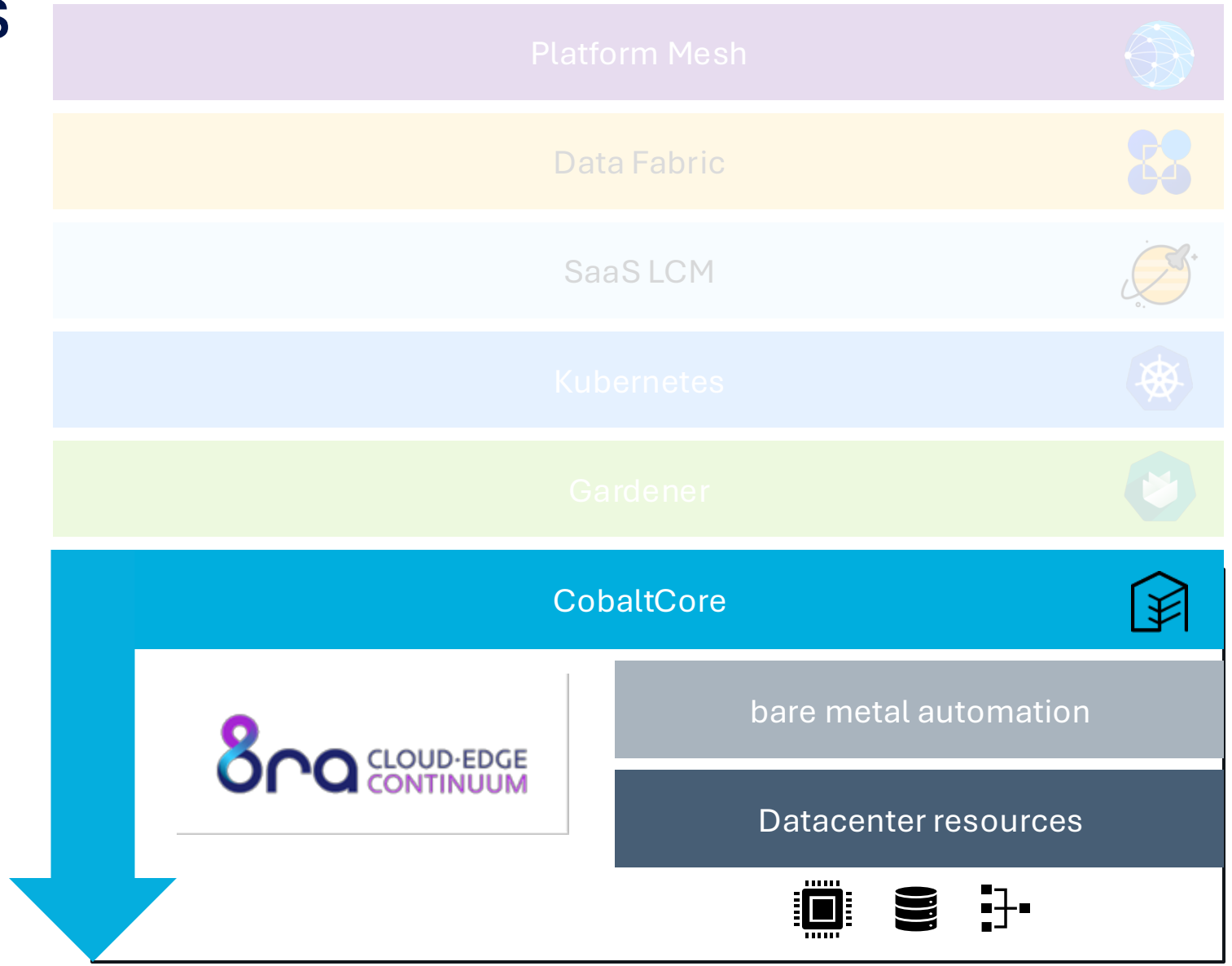
- Enables Buy vs. Build
- P2P Contracts = Consortias
- (Optional) Marketplaces



Multi Provider Cloud-Edge Continuum

Entry point 4: Classic IaaS

- OpenStack variant (maybe SCS conform)
  - Heritage Workloads
- Standard HW Blueprints
- Bare metal Automation
  - Easy Setup
  - Reproducibility
- Operational Excellence

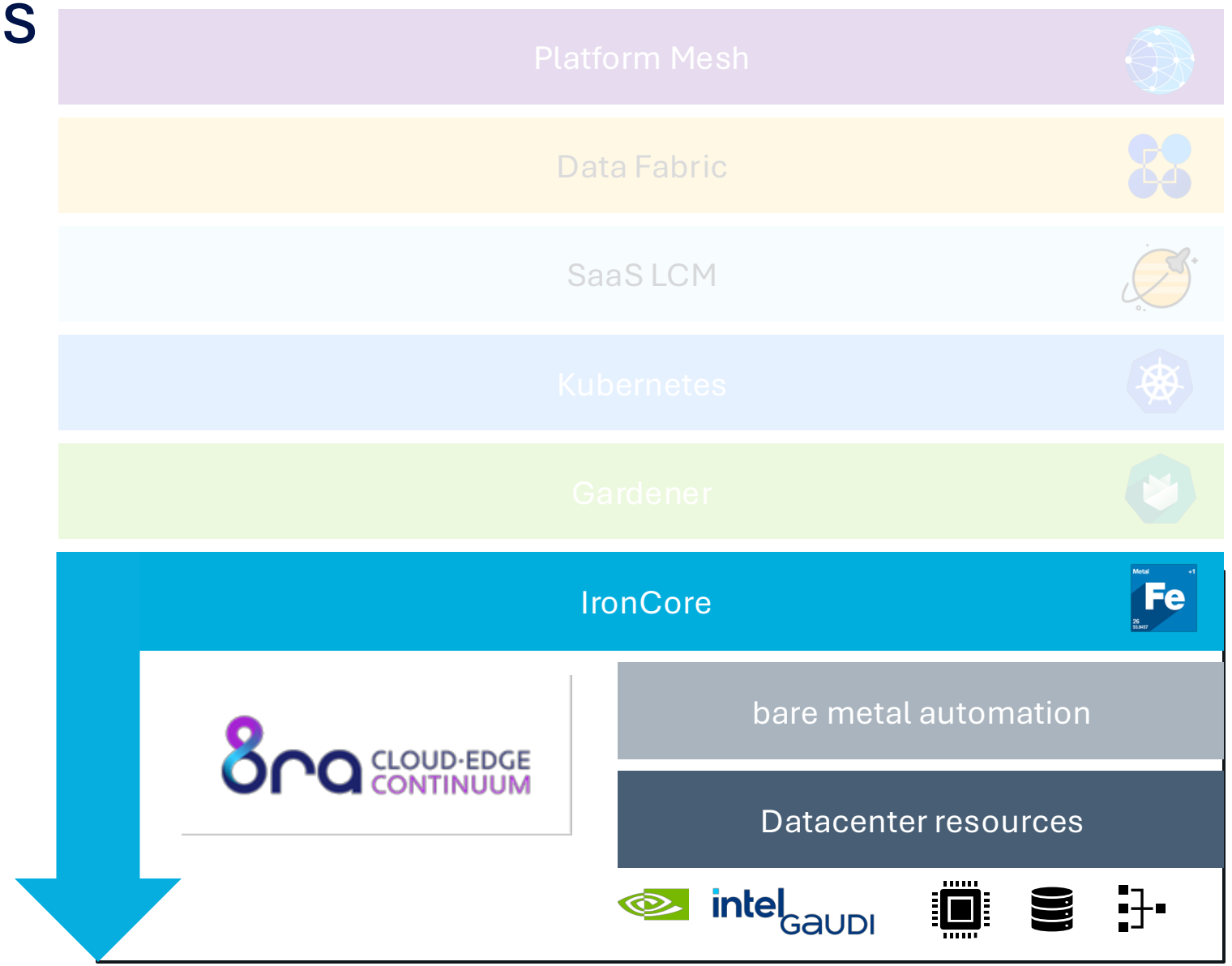


Multi Provider Cloud-Edge Continuum

Entry point 5: Nextgen IaaS

- Leapfrog cloud-native IaaS
- Massive Simplification and Automation
- “Micro is the new Mega”

- Cloud-native APIs down to the Hardware
- Kubernetes powered GPU support



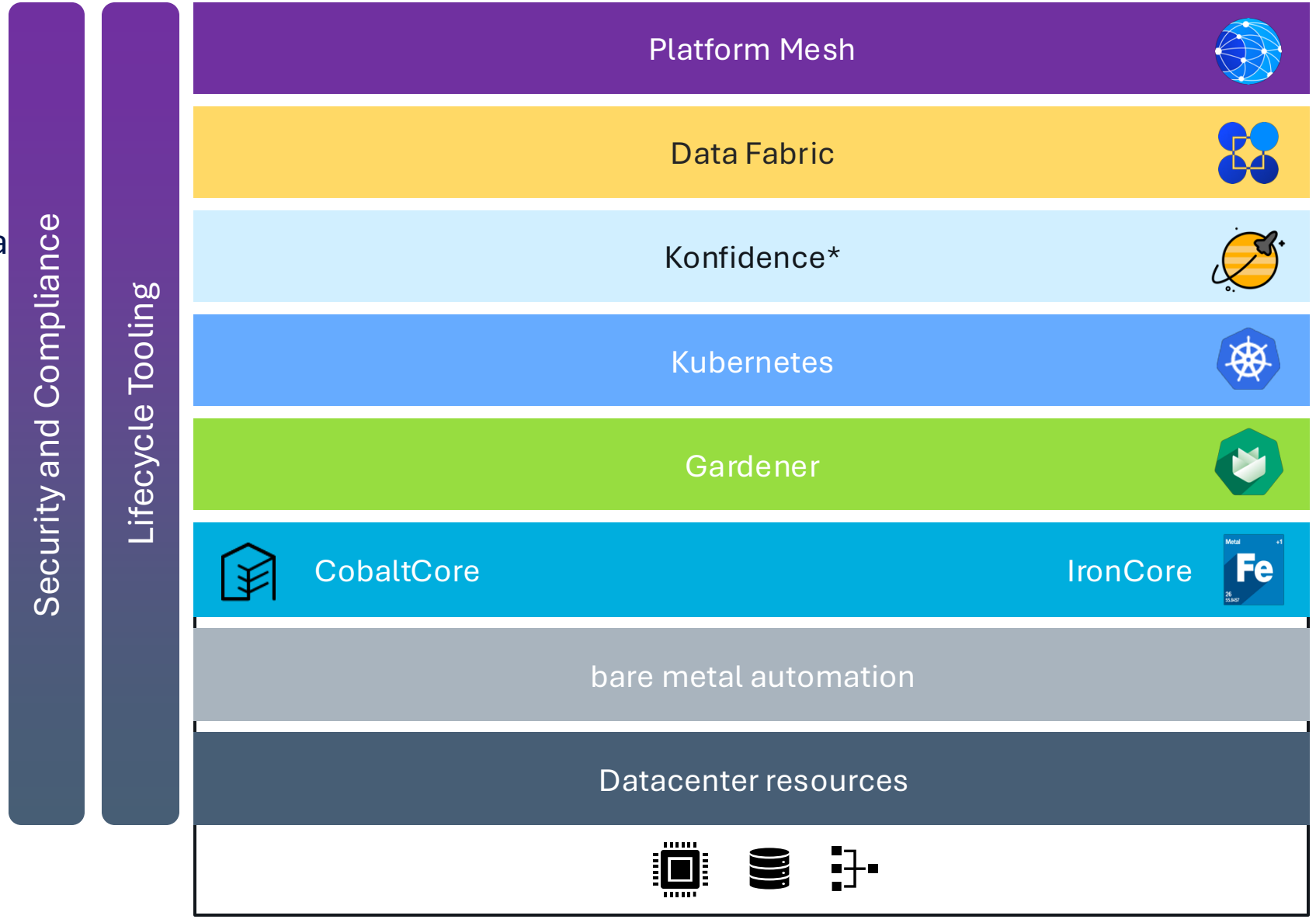
Multi Provider Cloud-Edge Continuum

Projects

- **Cloud Native all the way**
- Declarative API
- Unified abstraction layer via a homogeneous API model
- Extensibility
- One cloud native skillset
- Same operations tooling (kubectl, helm, kustomize)
- DevOps efficiency + “GitOps ready”

open, sovereign

reference architecture



Open needs Vendor Neutral Governance

Apeiro Projects already contributed to NeoNephos.org

Gardener is a proven, scalable system that simplifies Kubernetes cluster management across multiple infrastructures, allowing developers to focus less on cluster operations.

Garden Linux is a Debian GNU/Linux derivate that aims to provide small, auditable Linux images for most cloud providers (e.g. AWS, Azure, GCP etc.) and bare-metal machines.

Open Component Model (OCM) provides a standard for describing delivery artifacts that can be accessed from many types of component repositories.

Open Micro Frontend Platform enables the dynamic integration of services into a unified common interface experience via micro services.

Platform Mesh establishes interoperability between multiple providers by building upon the Kubernetes API and resource model. Developers and admins can discover, access, and order services from various sources through kubectl.

CobaltCore is a reimagined and opinionated OpenStack distribution fully utilizing IronCore. It ensures backward compatibility for heritage workloads.

IronCore integrates Kubernetes-based control planes for compute, storage and network with an OpenStack IaaS layers. Optimised for both virtualised and cloud-native workloads including a container registry, smart workload scheduling and an end user portal.

Greenhouse is a cloud operations platform designed to streamline and simplify the management of a large-scale, distributed infrastructure.

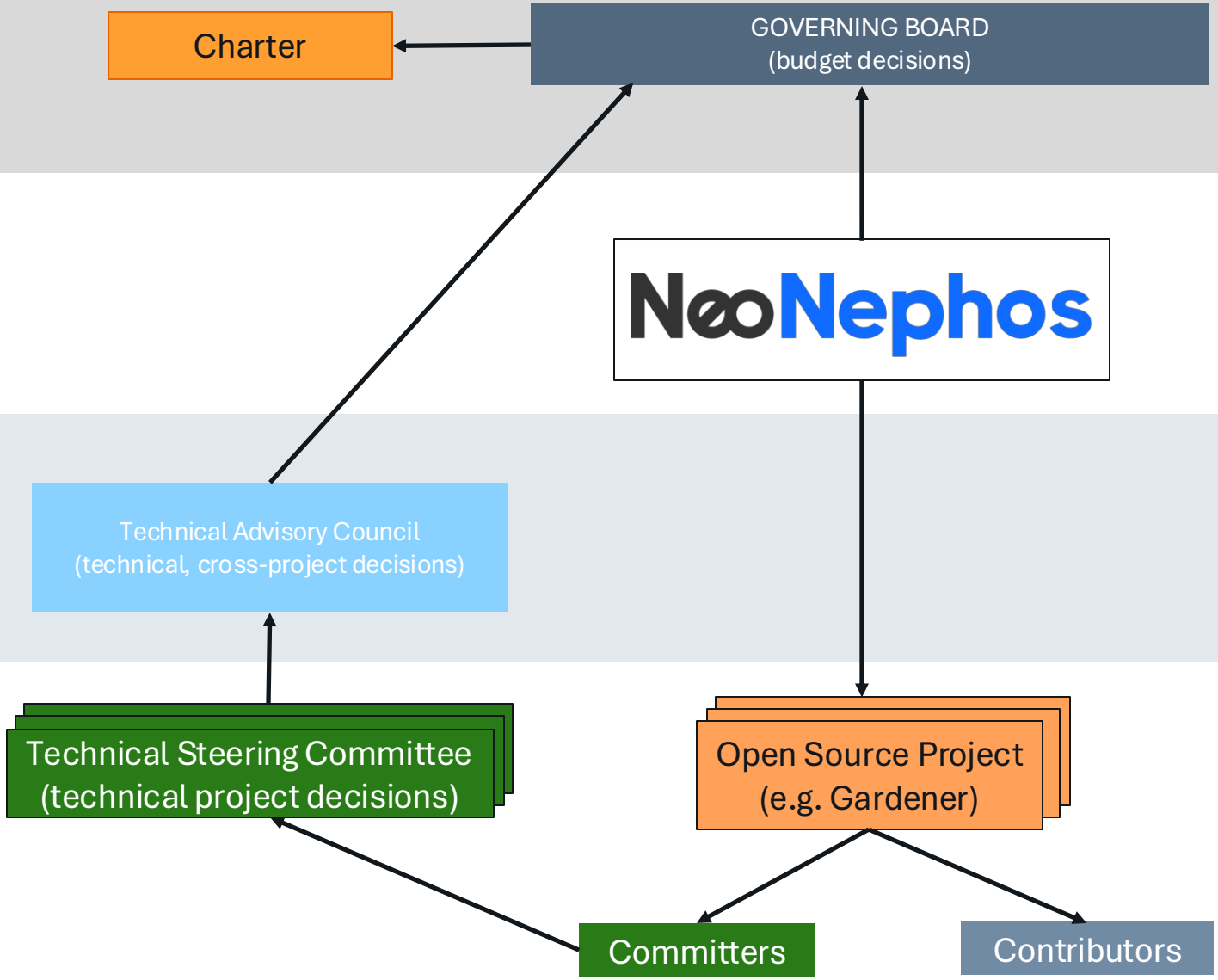
Open Resource Discovery (ORD) is a protocol that allows applications and services to self-describe their exposed resources and capabilities.

Open Managed Control Plane (OpenMCP) enables extensible Infrastructure- and Configuration-as-Data capabilities as a Service.

Launch of NeoNephos Foundation @ KubeCon

London, April 2, 2025

NeoNephos Governance Structure



Role	Who They Are	Write Access	Typical Responsibilities
Contributor	Anyone submitting code, docs, or feedback to the project	❌ No	File issues, propose features, submit pull requests
Committer	Trusted maintainer with technical stewardship role	✅ Yes	Review & merge PRs, maintain code, guide development

ApeiroRA | SAP

NeoNephos

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Demo

Platform Mesh

IronCore

NeoNephos

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Q&A

Thank you.

More Information (public)

[NeoNephos Foundation]

[Apeiro Reference Architecture]

SAP Open Source Community community.sap.com/topics/open-source

SAP Open Source Landing page opensource.sap.com

Podcast “The Open Source Way”: podcast.opensap.info/open-source-way

Webinars featuring open source topics: go4.events.sap.com/ospo-webinar-series/en_us/home.html

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