

SLICES

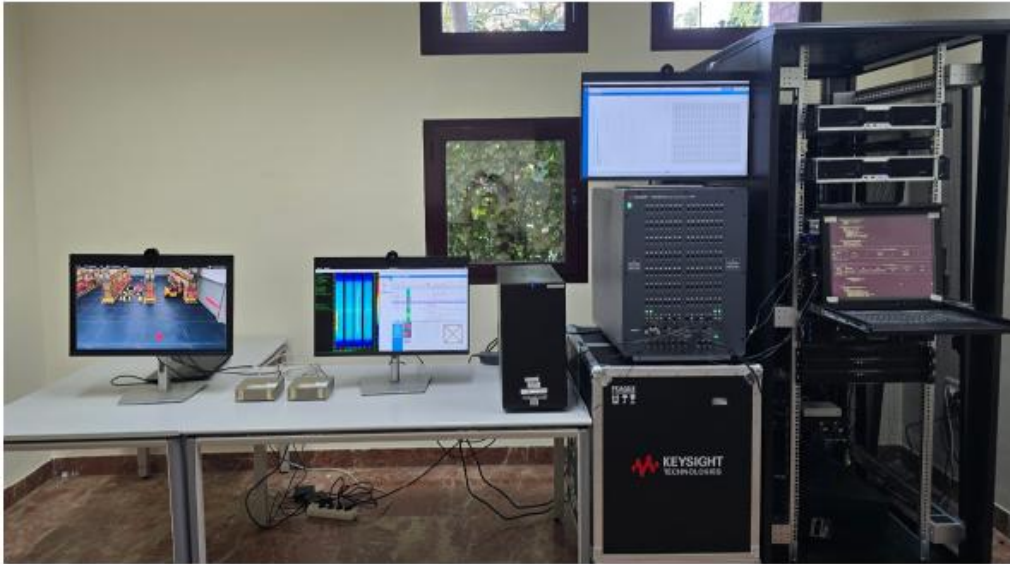
Research Infrastructure

Goals and architecture

09/06/2026

Brecht Vermeulen (imec)





Testbed for software defined radio and channel emulation -
Credit: Pablo Picazo, UC3M.



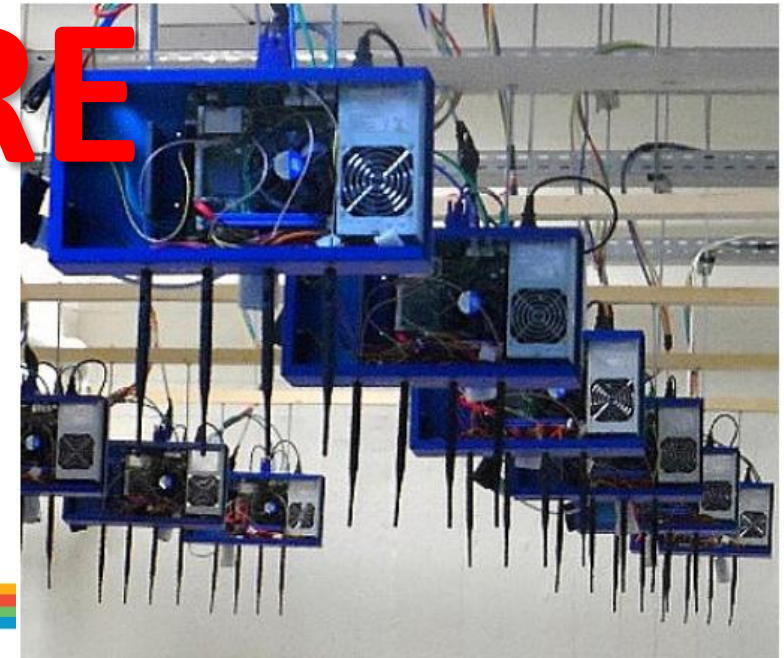
IoT sensors at the French Node - Credit: Inria Photo G. Scagnelli.



Belgian node distributed cloud infrastructure - Credit: IMEC/
Ghent University Photo: B. Vermeulen.

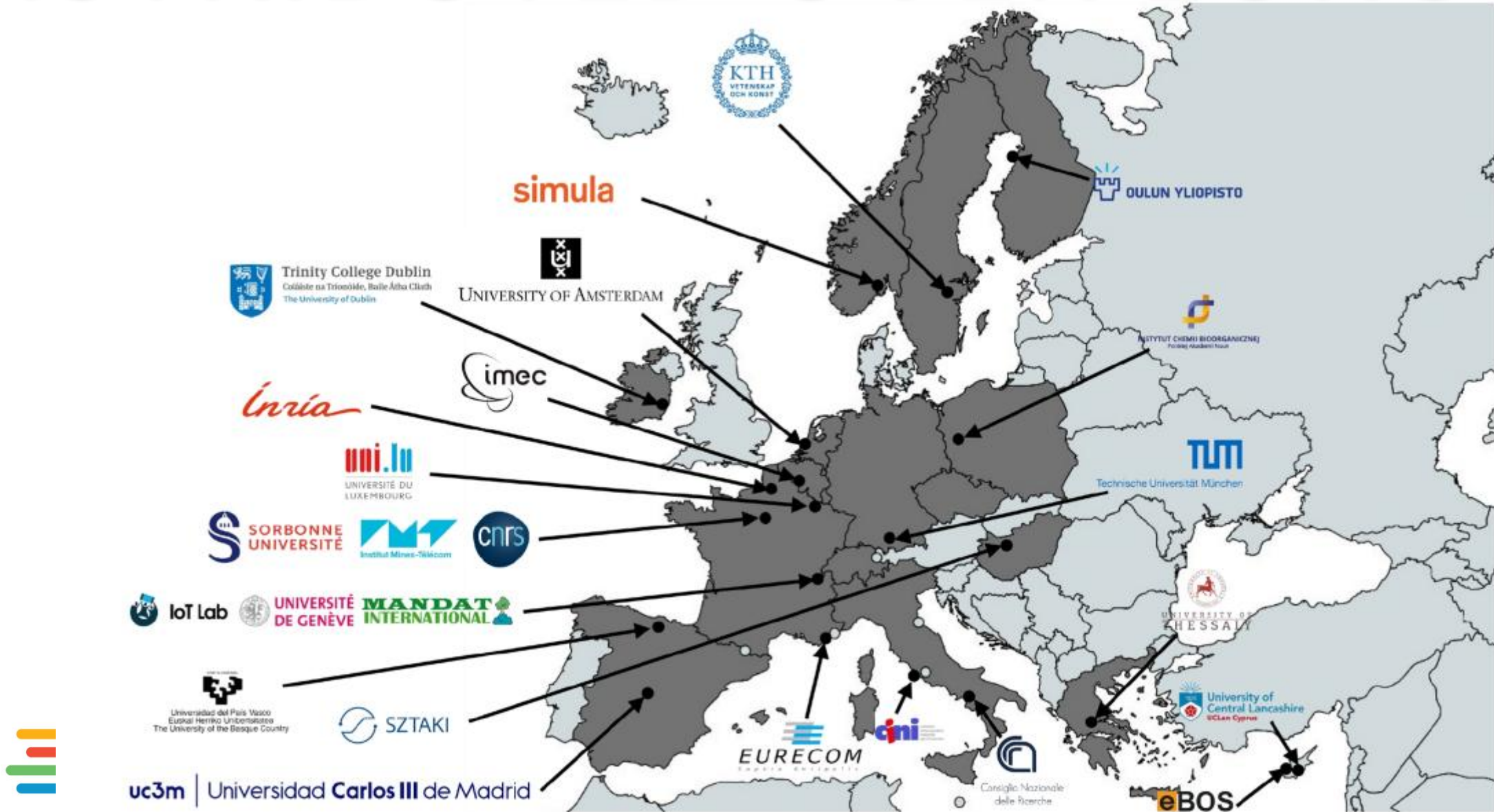
REAL

HARDWARE



Nodes for wireless network experimentation at the Greek node -
Credit: NITLAB, University of Thessaly.

DISTRIBUTED OVER EUROPE



Geographically distributed SLICES nodes interconnected across Europe - Credit: Inria.

Scientific Large Scale Infrastructure for Computing/Communication Experimental Studies

- 5G/6G wireless
- Internet of Things (IoT)
- Edge
- Cloud
- HPC
- AI infrastructure
- programmable elements across the digital continuum
- to produce trustworthy, repeatable, and accessible results.

SLICES is not...

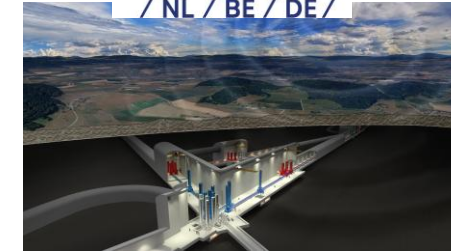
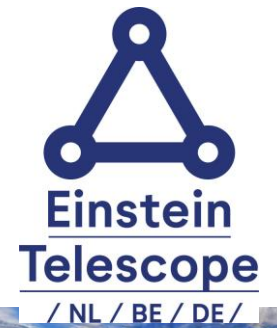
- A 5G network
- A cloud
- A HPC
- An AI factory
- ...

But...

- SLICES supports experimenting on all those technologies
- So you can build:
 - A 5G network
 - A cloud
 - A HPC
 - An AI factory
 - ...

ESFRI ROADMAP 2021: Slices

**European Strategy Forum on
Research Infrastructures**



Scientific

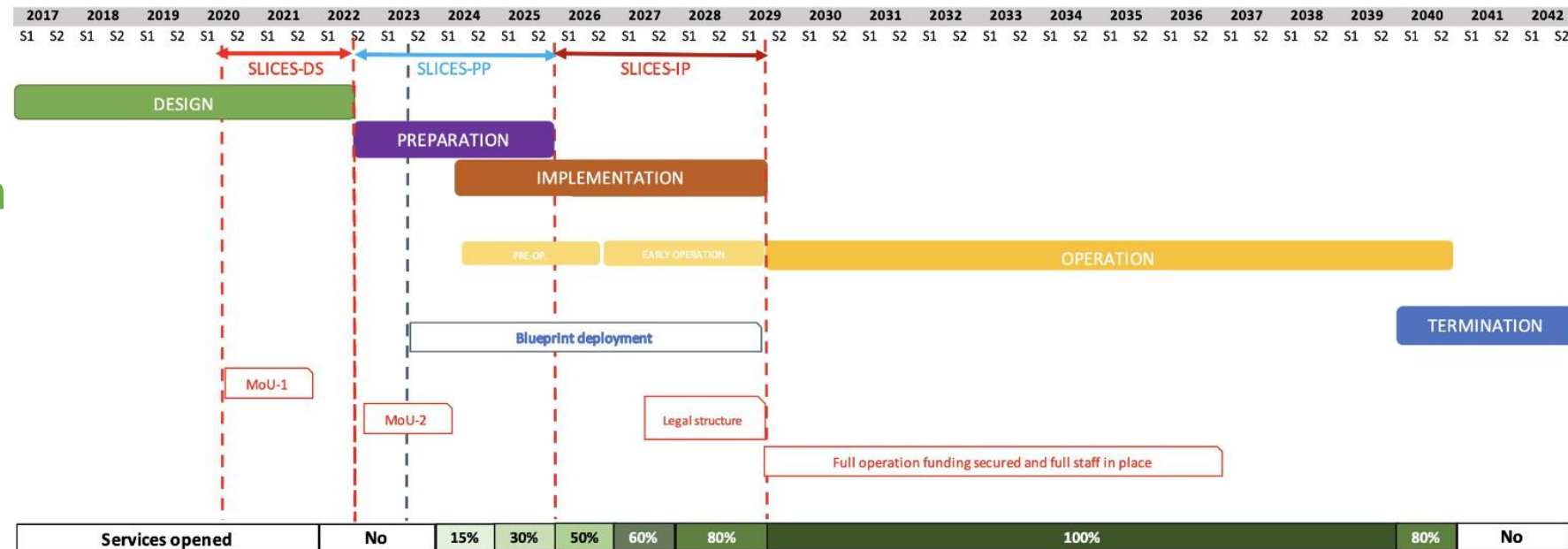
Largescale

Infrastructure for

Computing/Communication

Experimental

Studies



OpenStack began in 2010 as a joint project of Rackspace and NASA
Kubernetes initial release: September 2014
Several bare metal testbeds were started in 2006....
-> testbed can be used to develop/research that kind of frameworks

Long term

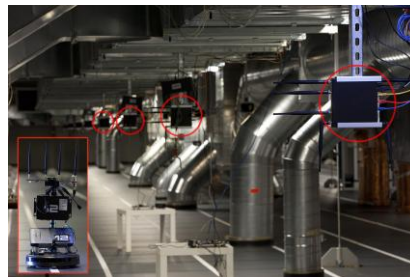
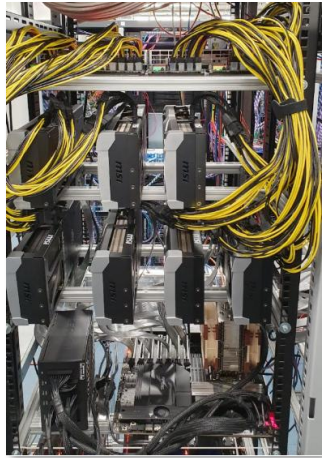
1998: XML, XML-RPC, Google search
1999: VMware workstation, Bluetooth 1.0, TLS 1.0
2000: **Emulab/Instageni/Cloudlab (US)**, REST, VMware ESX
2001: Linux vserver, 3G, SOAP, WSDL
2002: **PlanetLab (US)**, IEEE 802.15.4, WebRTC
2003: XEN, **Orbit (US)**
2004: EGEE, USRP1
2005: OpenVZ, **Grid'5000 (EU-FR)**, Git
2006: AWS, KVM, **Virtual Wall (EU-BE)**, Json, **Orca/exogeni (US)**, OAuth, Ceph, Proxmox VE, Nvidia CUDA, Facebook public
2007: **Geni (US)**, Virtualbox, **Nitos (EU-GR)**
2008: OpenNebula, LXC, Apache Hadoop 1.0, Android, **PlanetLab Europe (EU)**, TLS 1.2
2009: 4G, Open vSwitch, OpenFlow 1.0 (SDN), Chromium OS, GitLab
2010: OpenStack, Azure, EGI, JWT, OAuth, Apache Cassandra
2011: OpenShift, edugain, **Ofelia (EU)**, OpenAirInterface
2012: Google compute engine, MAAS, Ansible, **Fed4FIRE (EU)**, ONOS, Raspberry Pi 1, AlexNet neural network
2013: Docker, Kafka, P4, Zenodo, gQUIC (google)
2014: Kubernetes, Openstack ironic, Terraform, OpenID connect, NFV, **FIT IoT-LAB**, HTML5 standard
2015: Containerd, Openmano, **Chameleon cloud (US)**, Let's encrypt, HTTP/2
2016: Rancher
2018: OpenAI GPT-1, TLS 1.3
2019: 5G, **Fabric testbed (US)**, ArgoCD
2020: Confidential computing, Federated AI
2021: QUIC (IETF)
2022: ChatGPT, HTTP/3



imec cleanrooms

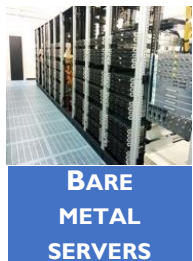


Chip lab of the world
(not a chip factory)

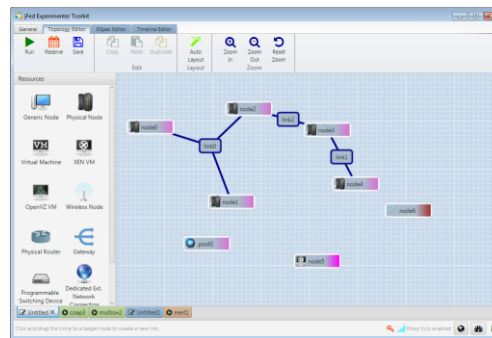


**Lab for the software and
networking stack of
clouds, AI infrastructure,
data science, future
connectivity, ...**

SLICES research infrastructure



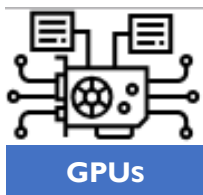
BARE
METAL
SERVERS



Configure experiment



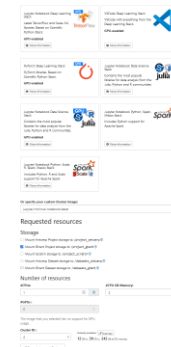
Networking, distributed services,
cloud, scaling, ... research



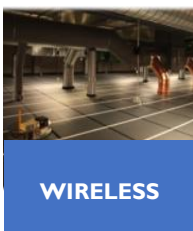
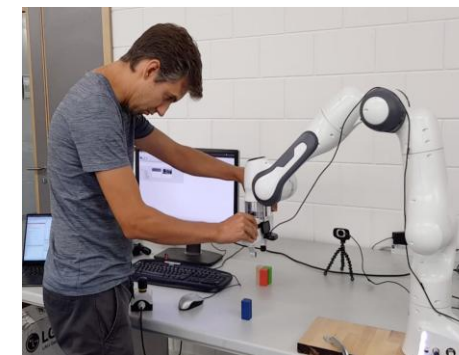
GPUs



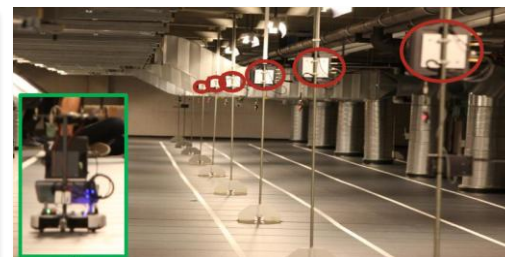
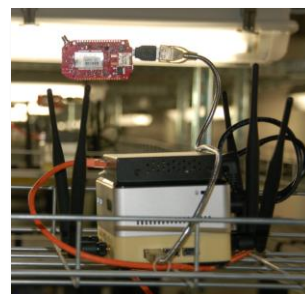
Command line job submission
or jupyter notebook



AI research



WIRELESS



Advanced wireless and
IoT experiments

How is SLICES-RI organized ?
in services...

ADVANCED SERVICES

Experiment as a Service

(with a couple of parameters you can automatically (re)run experiments)

e.g. reproducibility service, notebook services, ...

Complete Experiment services

(services which are complete to execute directly an experiment, just describe and start)

e.g. 5G deployment, AI infrastructure service, ...

BASIC SERVICES

Experiment building block services

(not bare infrastructure, but a service which uses some basic infrastructure but is not complete enough for an experiment)

e.g. storage, connectivity, Kubernetes cluster on demand, artefacts deposit service, metadata registry,

Basic infrastructure services

(bare metal or virtualized infrastructure)

e.g. bare metal machine, VM, programmable IoT device, user-defined radio, ...

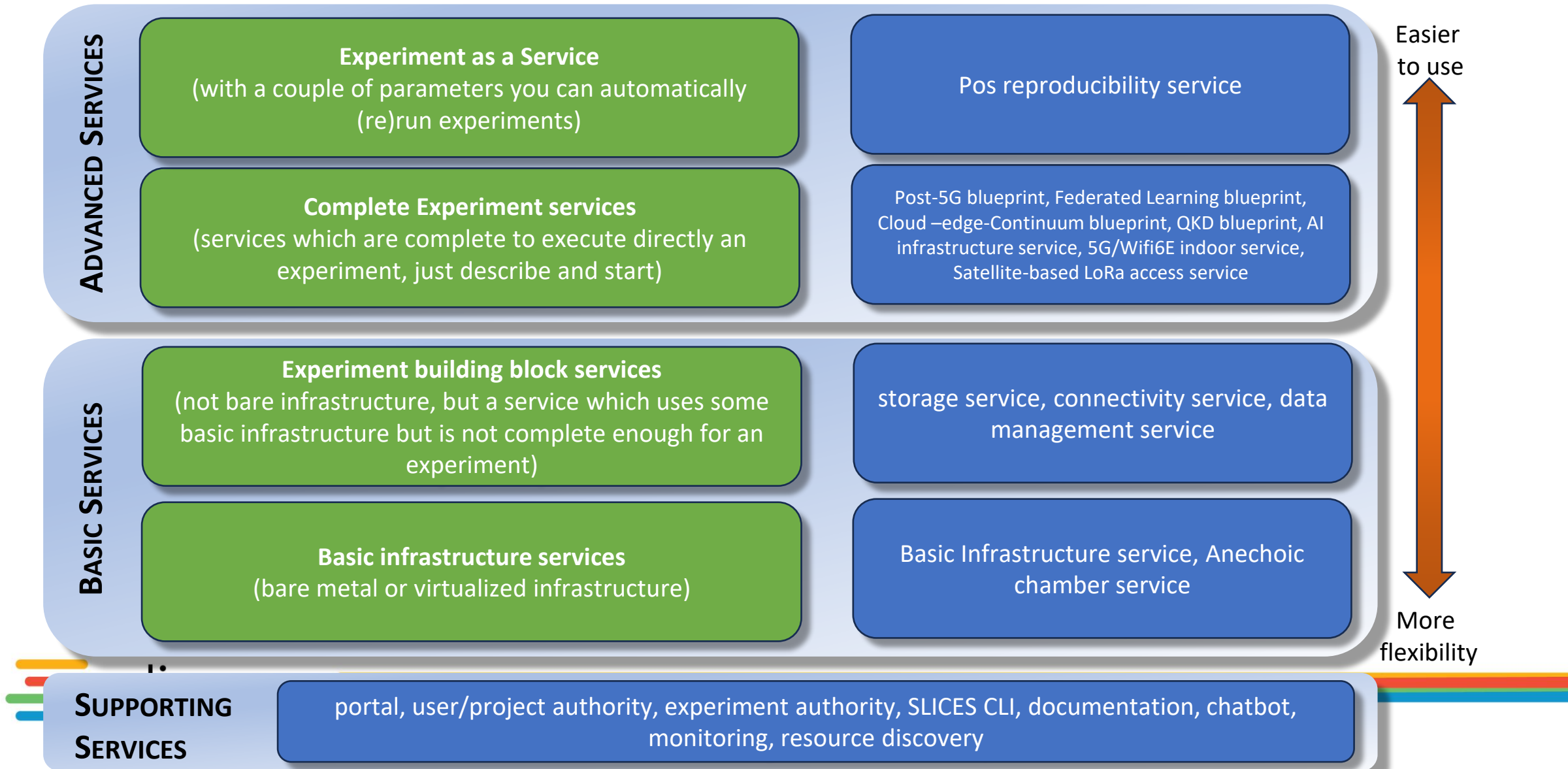
SUPPORTING SERVICES

e.g. portal, user/project authority, experiment authority, experimenter tools, documentation, chatbot, ...

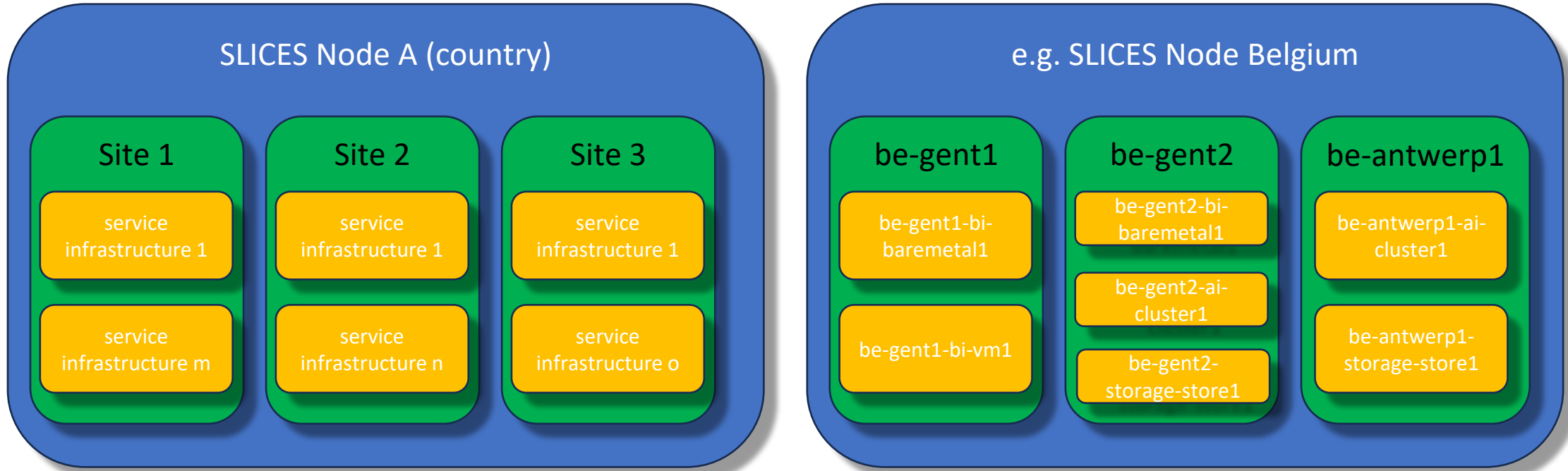
Easier to use

More flexibility

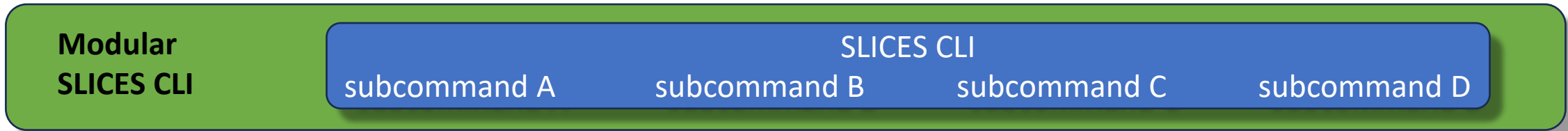
Concrete SLICES-RI services today



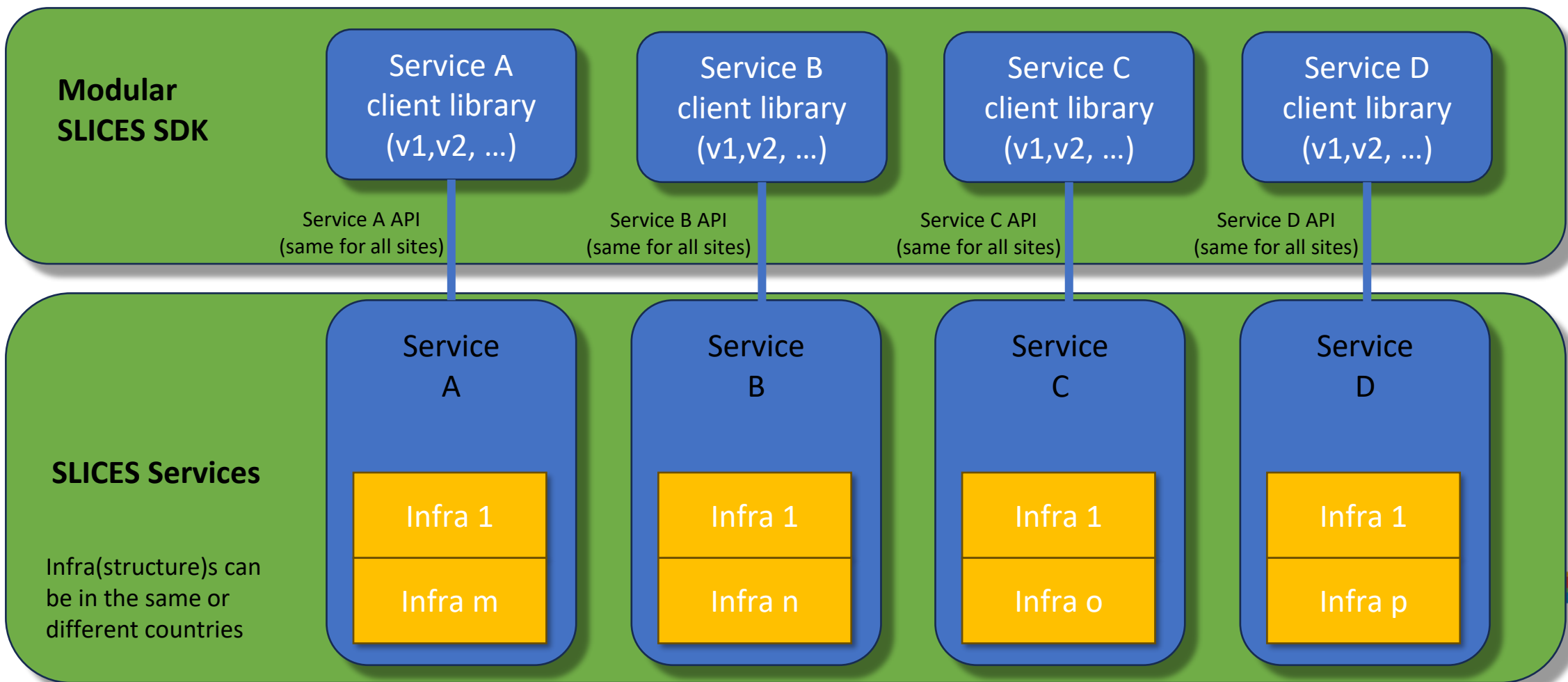
Services can be distributed



Other user tools using SDK
(more variation, 3rd party, ...) website, apps, ...

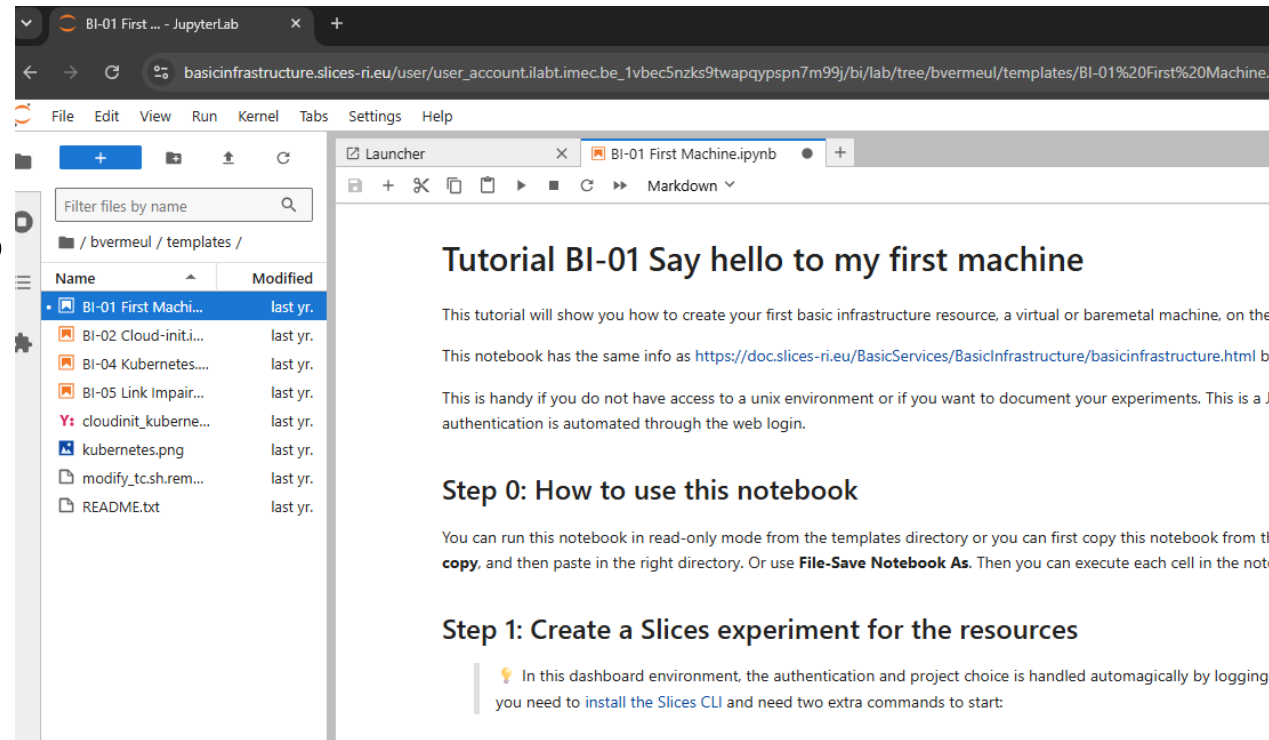


Similar experiment life cycle and look&feel of CLI and client libraries. 1 CLI with subcommands



Modular CLI and service user interfaces

```
> slices --version
Slices CLI v2026.1.2
  Slices CLI core v1.2.4
  Slices CLI bi v2.2.0
  Slices CLI ai v1.1.0
  Slices CLI helloworld v1.0.4
  Slices clientlib ai v1.0.0
  Slices clientlib core v5.5.1
  Slices clientlib bi v6.1.1
```



The screenshot shows a JupyterLab environment. On the left is a file browser for the directory `/bvermeul/templates/`. It contains a table of files:

Name	Modified
BI-01 First Machi...	last yr.
BI-02 Cloud-init...	last yr.
BI-04 Kubernetes....	last yr.
BI-05 Link Impair...	last yr.
cloudinit_kuberne...	last yr.
kubernetes.png	last yr.
modify_tc.sh.rem...	last yr.
README.txt	last yr.

On the right is a Jupyter Notebook titled "Tutorial BI-01 Say hello to my first machine". The notebook content includes:

Tutorial BI-01 Say hello to my first machine

This tutorial will show you how to create your first basic infrastructure resource, a virtual or baremetal machine, on the

This notebook has the same info as <https://doc.slices-ri.eu/BasicServices/BasicInfrastructure/basicinfrastructure.html> b

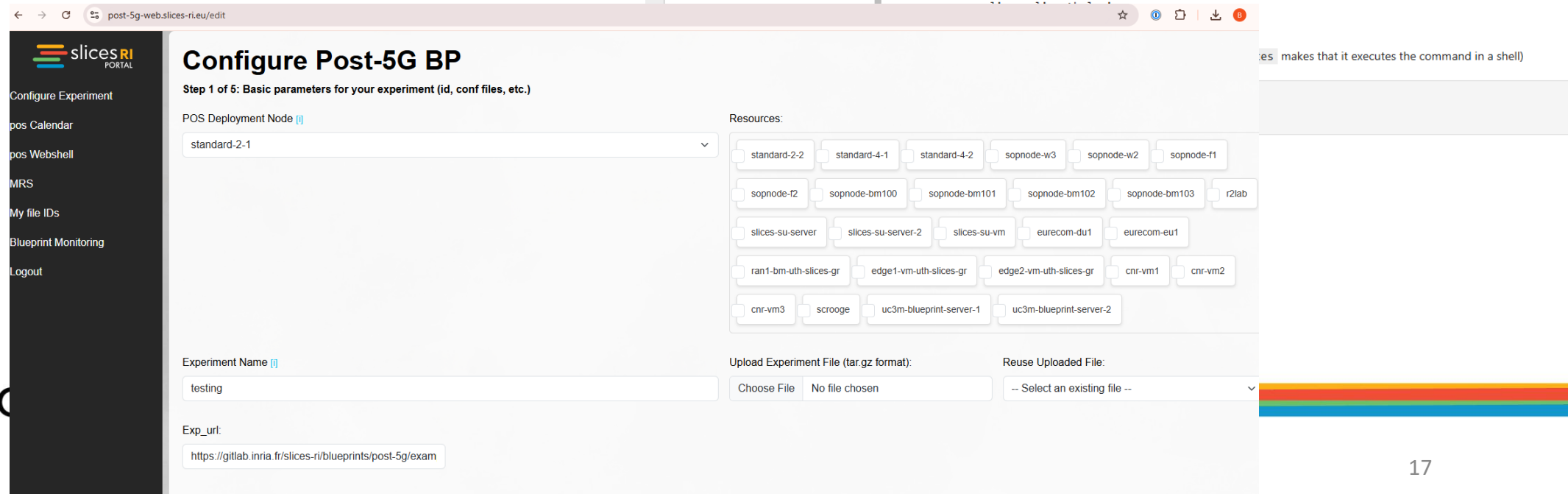
This is handy if you do not have access to a unix environment or if you want to document your experiments. This is a J authentication is automated through the web login.

Step 0: How to use this notebook

You can run this notebook in read-only mode from the templates directory or you can first copy this notebook from the **copy**, and then paste in the right directory. Or use **File-Save Notebook As**. Then you can execute each cell in the notebook

Step 1: Create a Slices experiment for the resources

In this dashboard environment, the authentication and project choice is handled automatically by logging in you need to [install the Slices CLI](#) and need two extra commands to start:



The screenshot shows the "Configure Post-5G BP" page in the Slices RI Portal. The page is titled "Step 1 of 5: Basic parameters for your experiment (id, conf files, etc.)".

On the left is a sidebar with the Slices RI logo and navigation links: Configure Experiment, pos Calendar, pos Webshell, MRS, My file IDs, Blueprint Monitoring, and Logout.

The main content area includes:

- POS Deployment Node**: A dropdown menu currently showing "standard-2-1".
- Resources**: A grid of resource selection buttons including standard-2-2, standard-4-1, standard-4-2, sopnode-w3, sopnode-w2, sopnode-f1, sopnode-f2, sopnode-bm100, sopnode-bm101, sopnode-bm102, sopnode-bm103, r2lab, slices-su-server, slices-su-server-2, slices-su-vm, eurecom-du1, eurecom-eu1, ran1-bm-uth-slices-gr, edge1-vm-uth-slices-gr, edge2-vm-uth-slices-gr, cnr-vm1, cnr-vm2, cnr-vm3, scrooge, uc3m-blueprint-server-1, and uc3m-blueprint-server-2.
- Experiment Name**: A text input field containing "testing".
- Exp_url**: A text input field containing "https://gitlab.inria.fr/slices-ri/blueprints/post-5g/exam".
- Upload Experiment File (tar.gz format)**: A "Choose File" button and a "No file chosen" status.
- Reuse Uploaded File**: A dropdown menu showing "-- Select an existing file --".

At the bottom right, there is a rainbow-colored decorative bar.

https://doc.slices-ri.eu



Slices-RI
Documentation

🔍 Search

[Slices Website](#) ↗

[Slices User Portal](#) ↗

GETTING STARTED

[Request a Slices account](#)

[Slices CLI \(Command Line Interface\)](#)

[User support](#)

BLUEPRINT SERVICES

[Post-5G Blueprint](#) ▼

[Federated Learning Blueprint](#)

[Quantum Key Distribution Blueprint](#)

BASIC SERVICES

[Basic infrastructure service](#) ▼

[AI Infrastructure service](#) ▼

[S3 object storage](#)

[MRS \(Metadata Registry System\)](#)

Welcome to the Slices-RI documentation



What is Slices-RI?

Slices is a flexible platform designed to support large-scale, experimental research focused on networking protocols, radio technologies, services, data collection, parallel and distributed computing and in particular cloud and edge-based computing architectures and services.

To learn more about the Slices project, please visit the [general Slices Research Infrastructure homepage](#).

Getting Started

GETTING STARTED

- [Request a Slices account](#)
- [Slices CLI \(Command Line Interface\)](#)
- [User support](#)

Blueprint services

These services aim at more complex experiments, combining a lot of functionality and infrastructure.

BLUEPRINT SERVICES

- [Post-5G Blueprint](#)
- [Federated Learning Blueprint](#)
- [Quantum Key Distribution Blueprint](#)

Basic services

These services aim at using a combination of basic building blocks to build your own complex experiment or service.

BASIC SERVICES

- [Basic infrastructure service](#)
- [AI Infrastructure service](#)
- [S3 object storage](#)
- [MRS \(Metadata Registry System\)](#)



<https://portal.slices-ri.eu>

Organised in projects
with project lead/admin
and members

Project has expiration time

Project is approved by SLICES
Members are approved by
project lead/admin

e.g. share experiments/data
in a project

Project *summerschool2026*

Slices ID: proj_account.ilabt.imec.be_0e0b3rq16q95saqqq2dpeqsq0h

Description: Slices summer school project for all tutorials

Lead: Brecht Vermeulen (bvermeul)

Created: 2026-05-19 08:50 CEST

Expiration: 2026-07-10

S3 storage bucket name: `ilabt.imec.be-project-summerschool2026` ([How do I use this?](#))

portal.slices-ri.eu/projects/

Incognito (2)

Projects Documentation Logout

Request to join a project Request a new project

Overview Projects Services External Applications Documentation

justtesting DENIED

testing2 DENIED

bvermeu2 Role: Lead Members: 1

testwimthijs Role: Lead Members: 4 (+ 1 pending) EXPIRED

rsporto Role: Lead Members: 19 (+ 2 pending) EXPIRED

icn2020 Role: Member Members: 4 EXPIRED

tutorial1 Role: Lead Members: 28

eucnc Role: Lead Members: 2 EXPIRED

summerschool2026 Role: Admin Members: 25 EXPIRED

ilabt-dev Role: Viewer Members: 7

slicesbv2 Role: Lead Members: 1

slices-bv3 Role: Lead Members: 2

summerschool2026 Role: Member Members: 10

<https://portal.slices-ri.eu/invite/summerschool2026>

Example service: S3 storage in Belgium

<https://s3.slices-be.eu>



Use SLICES-RI account - iam

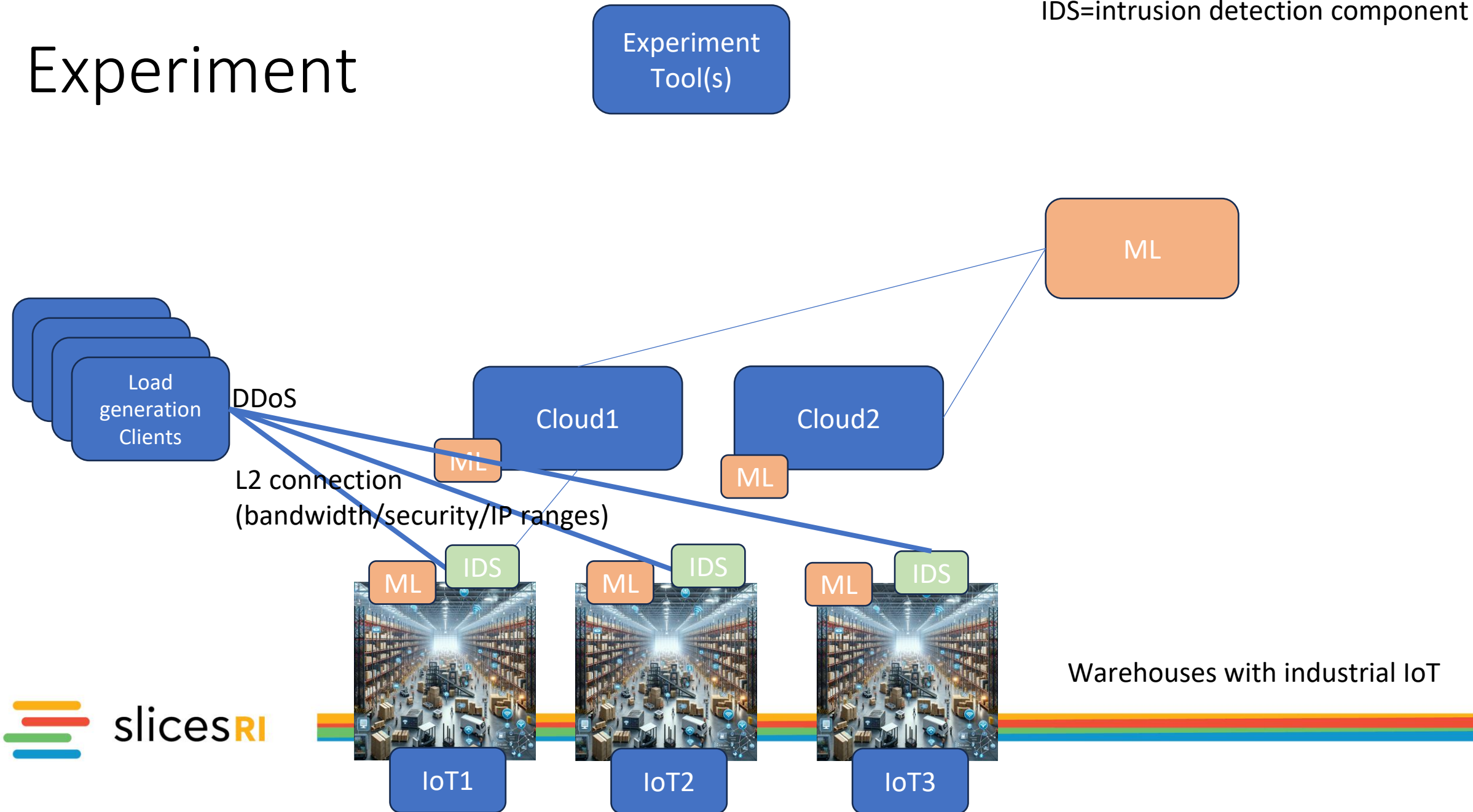
A screenshot of the MINIO Object Store web interface. The browser address bar shows the URL "s3-gent.slices-be.eu/minio/ui/browser/ilabt.imec.be-project-summerschool2026". The interface has a dark blue sidebar on the left with the MINIO logo and navigation links: "Object Browser" (selected), "Access Keys", "Documentation", "Administrator", and "Buckets". The main content area shows the "Object Browser" for the bucket "ilabt.imec.be-project-summerschool2026". It includes a search bar, a "Created on" timestamp, "Access: PRIVATE", and buttons for "Rewind", "Refresh", and "Upload". Below this is a table of objects in the bucket.

☐	Name	Last Modified	Size
☐	SLICES-ES Summer School logistics.pdf	Today, 23:45	542.7 KiB

Advanced: combining services

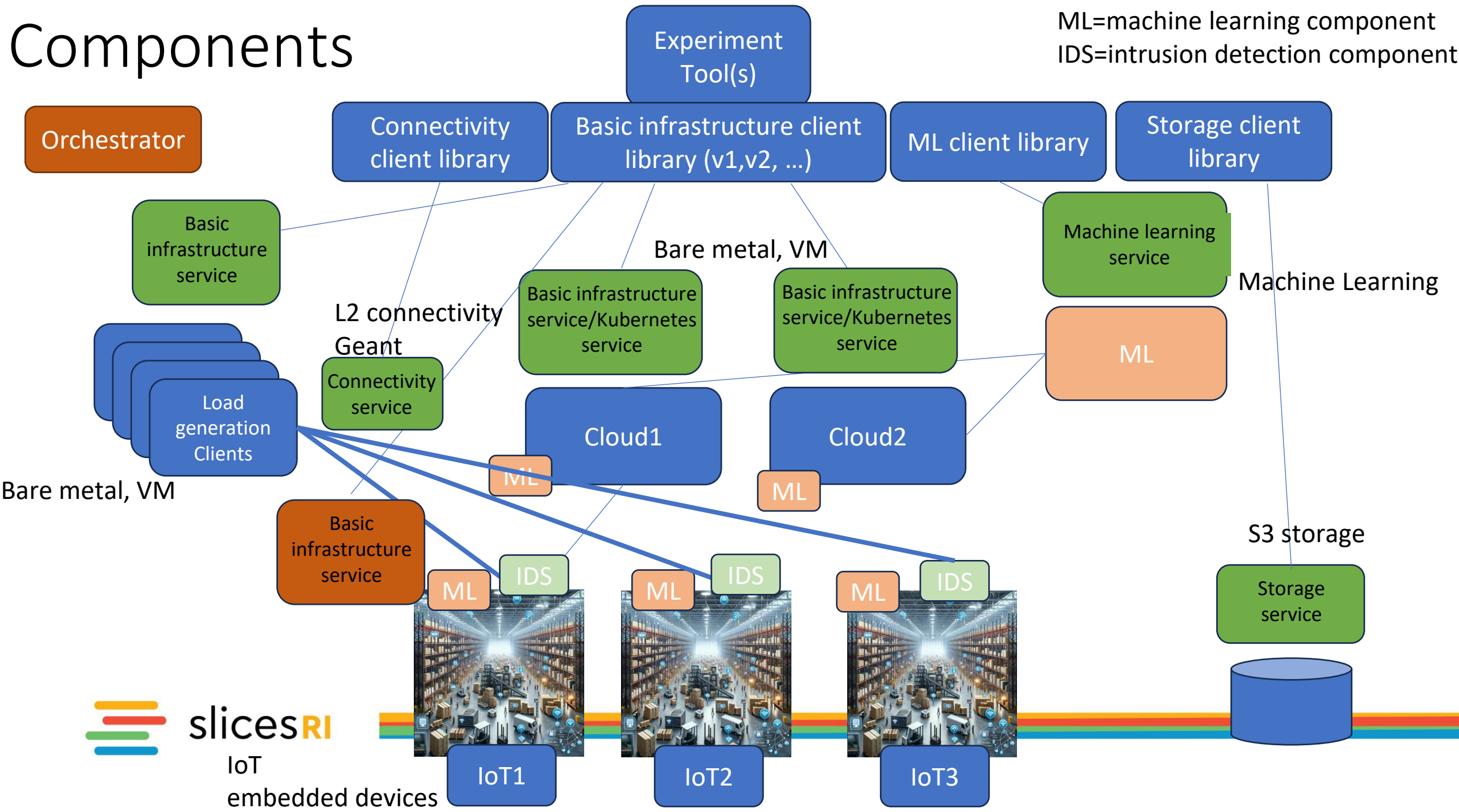
Experiment

ML=machine learning component
IDS=intrusion detection component

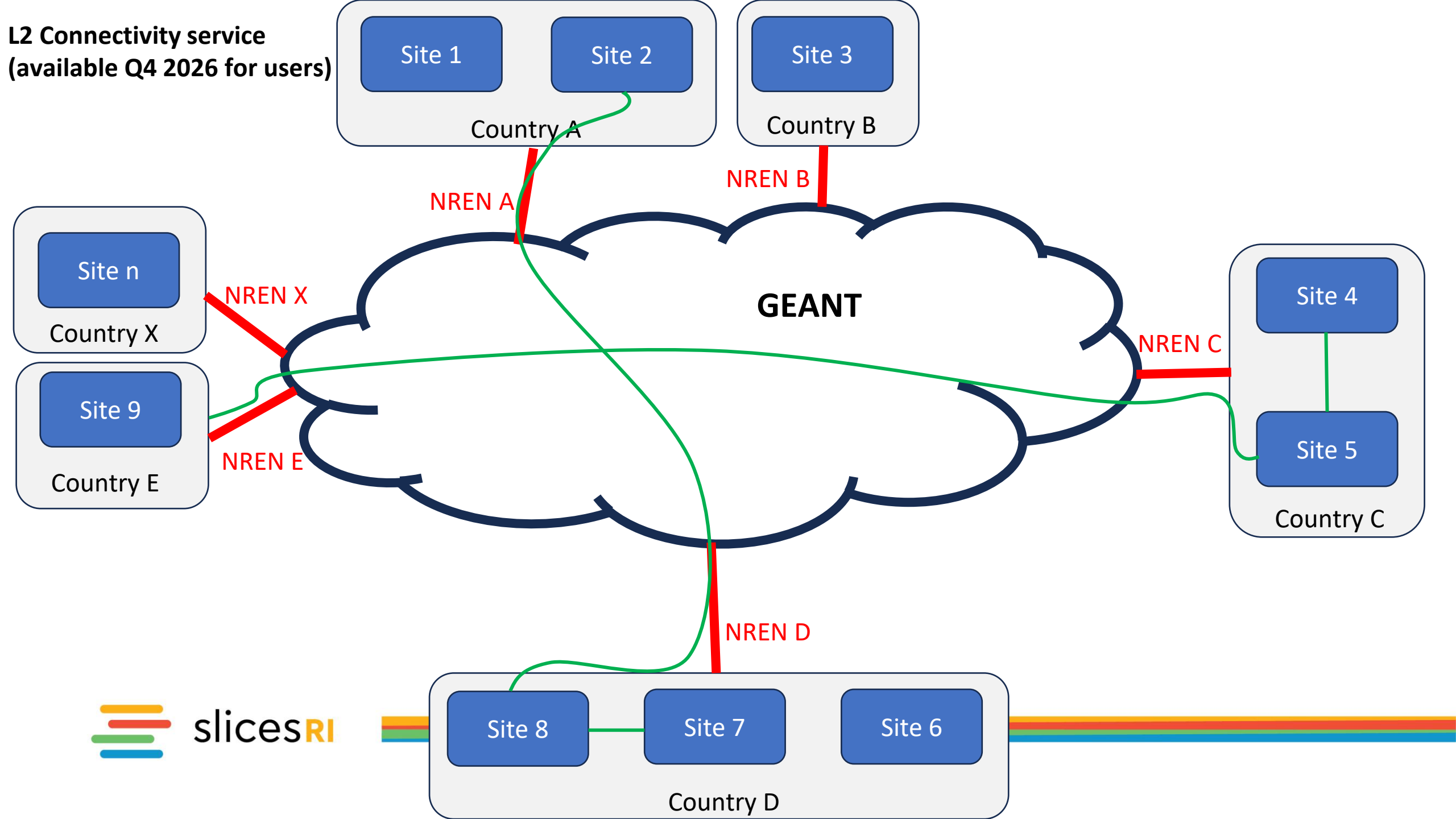


Components

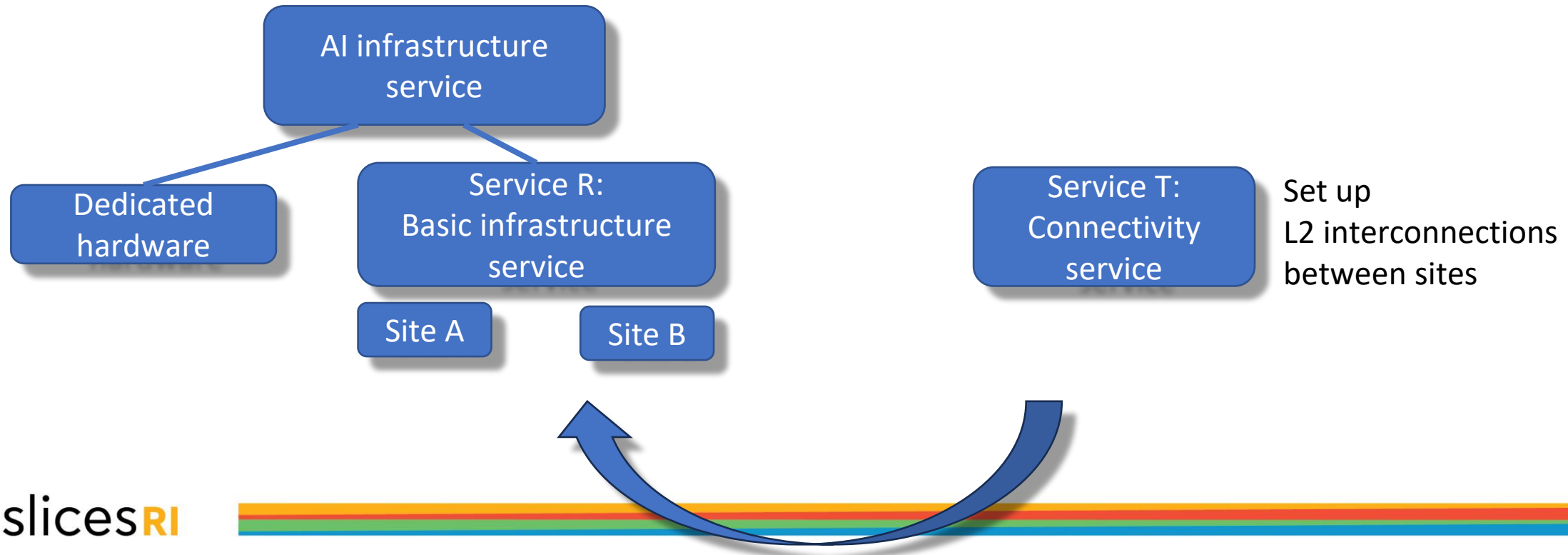
ML=machine learning component
IDS=intrusion detection component



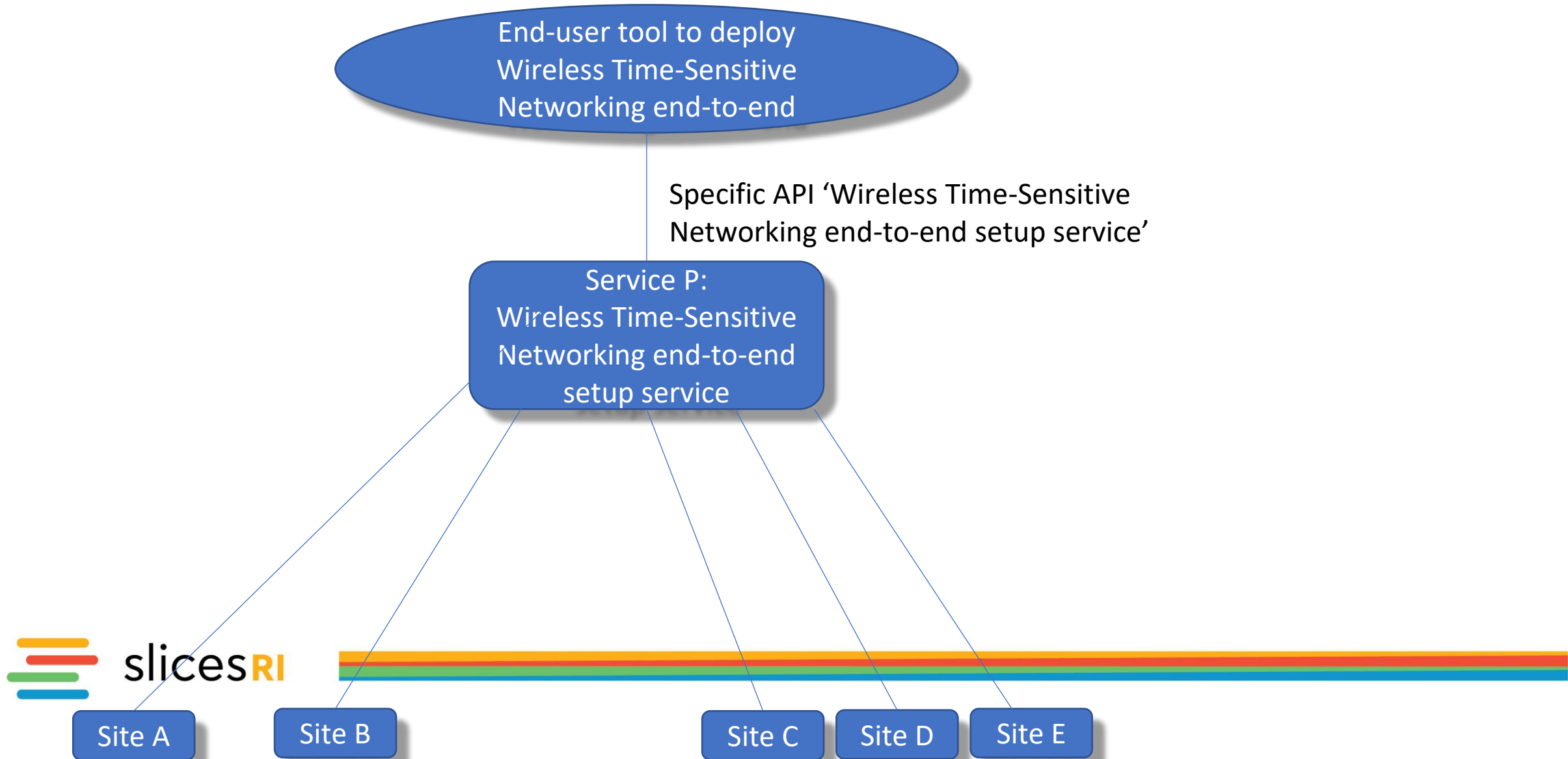
**L2 Connectivity service
(available Q4 2026 for users)**



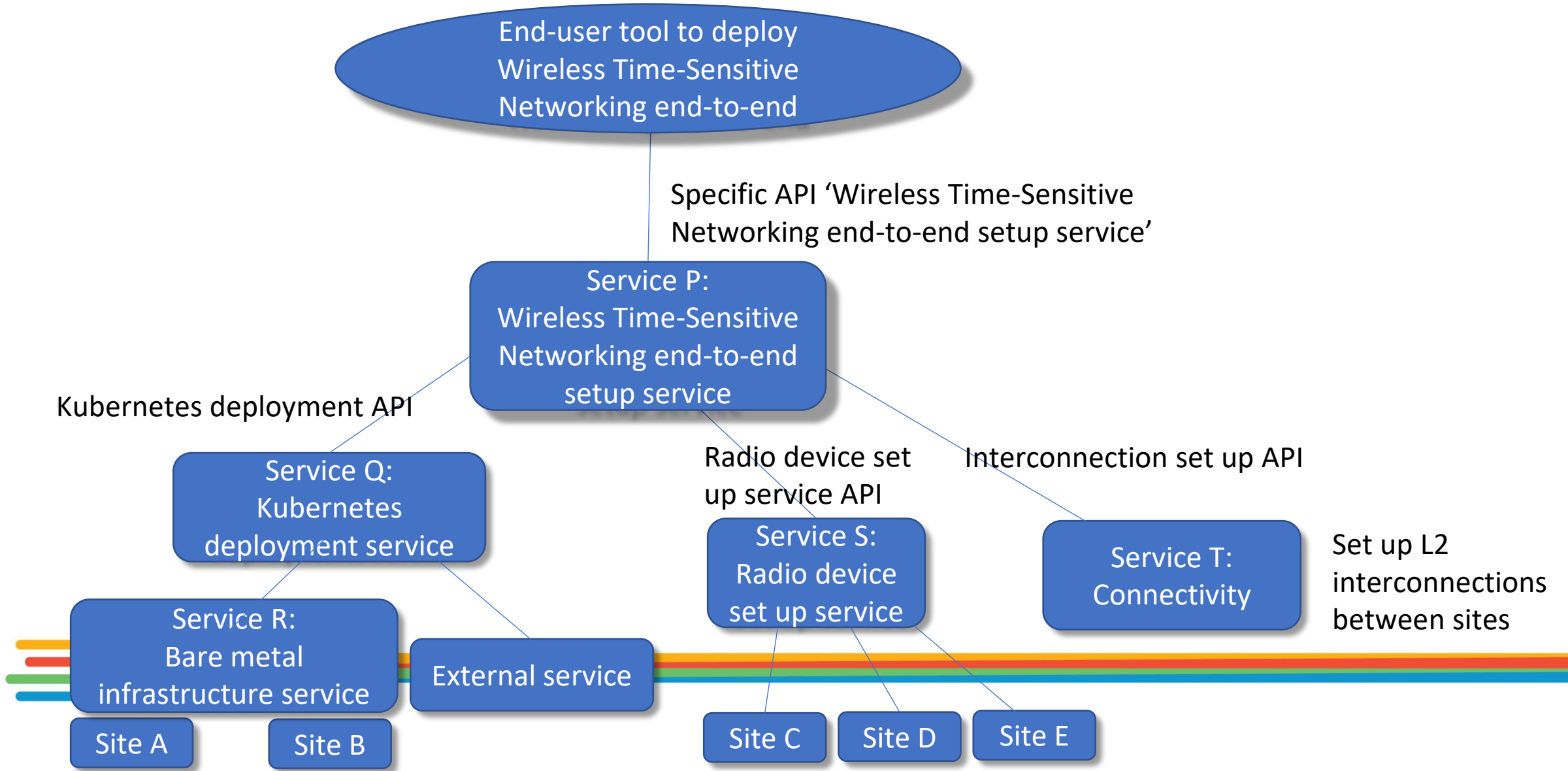
Service composition: 2 flavours of advanced services (flexibility vs. easy to use)



Example of monolithic service implementation for deployment of distributed time-sensitive Networking setup



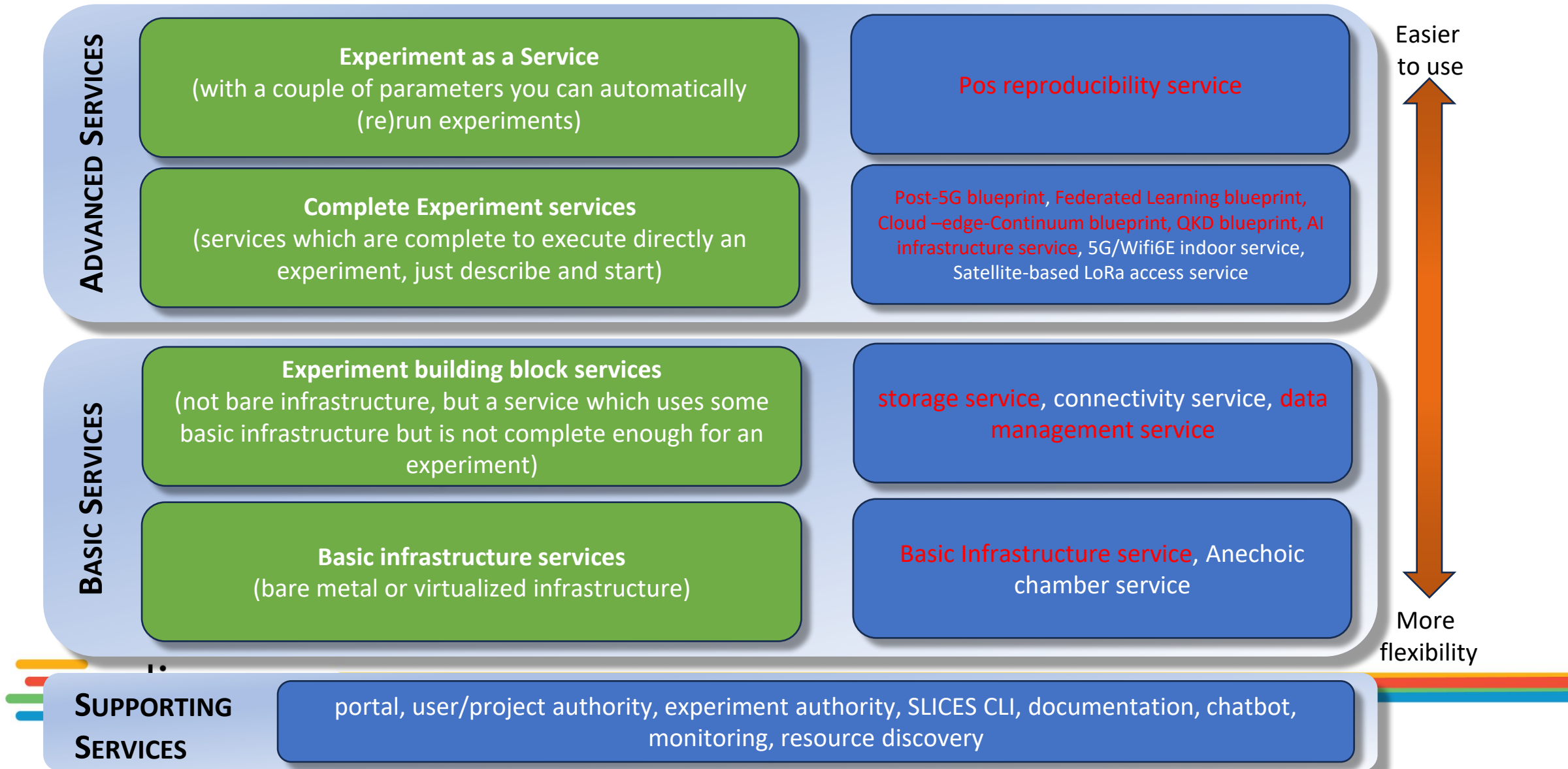
Example of service composed of services for deployment of Time-Sensitive end-to-end setup



What is coming next ?

- Full operations and services: 2029
- Q4 2026: Next big release (more services/sites/resources, this summerschool is a start)
 - Planned features: quota restrictions on services, reservation of resources in the future, L2 connectivity over Geant

Summerschool 2026



Welcome to SLICES-RI: Scientific Large Scale Infrastructure for Computing/Communication Experimental Studies