Introduction to Fenix and ICEI

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Fenix Goals

- Establish HPC and data **infrastructure services** for multiple research communities
  - Encourage communities to build community specific platforms
  - Delegate resource allocation to communities
- Develop and deploy services that facilitate **federation**
  - Based on European and national resources
- **Science community driven approach**
  - Infrastructure realisation and enhancements based on co-design approach
  - Science communities providing resources to realise infrastructure → HBP SGA Interactive Computing E-Infrastructure
  - Resource allocation managed by community

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Fenix Governance Structure

- Fenix is a Consortium
  - Establishing an **MoU** between the participating HPC sites
    - Comprised of large HPC sites within Europe
    - Currently, BSC, CEA, CINECA, CSCS, JSC
    - The intention is to keep the number of participating sites below 10
  - EPFL included for the ICEI part only
    - Fenix has close ties to the HBP via ICEI (next slide)

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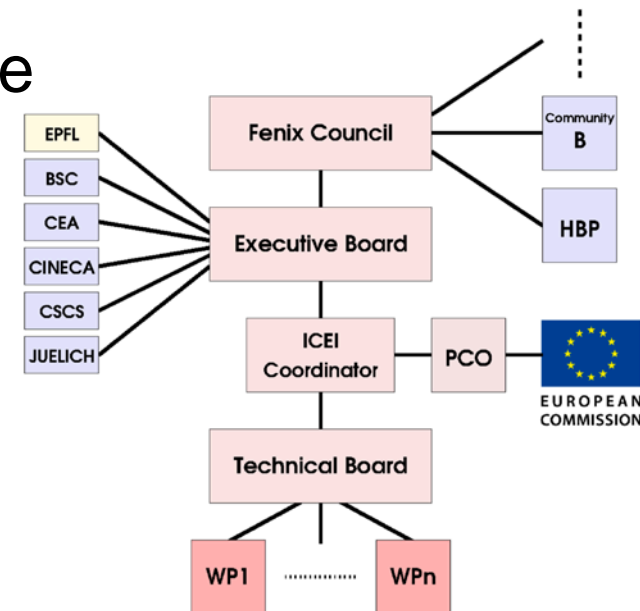
ICEI as the First Instantiation of Fenix

- The Human Brain Project (HBP) presented a unique opportunity
    - Funding available from the EC for a federated data and compute infrastructure
    - Name: **Interactive Computing e-Infrastructure** (ICEI)
    - Nice fit with the concept for Fenix which had grown out of the Federated Data Pilot Project (FeDaPP) run in 2016 at the start of HBP SGA1
- ICEI is the first Instantiation of the Fenix Infrastructure
    - Funds the development of many of the federated services in Fenix
   - HBP-centric but Fenix has the goal to be more general

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ICEI Summary

- ICEI is an SGA under the HBP FPA-CA
    - EPFL is the coordinator of HBP and hence plays a role in ICEI coordination
- ICEI to provide infrastructure services to HBP
    - HBP SP7 (High-performance Analytics and Computing Platform) is in the roleof developer/provider of platform services
    - Strong links between ICEI and SP7 DoA
- Timeline overview
    - Evaluation of proposal finalised by the EC in 4Q2017
    - Project duration of **63 months** (1.1.2018 – 31.3.2023)
    - First resources available at CSCS as of April 2018
    - First **co-design workshop** took place on 9.2.2018
    - **Public Information event** held 15 March 2018
    - **RFI meetings** held with vendors 26-27 May 2018

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Fenix Architectural Concept (1/2)

- Service-oriented provisioning of resources
  - Focus on infrastructure services suitable for different science communities

- Support for community specific platforms
  - Encourage and facilitate community efforts

- Federation of infrastructure services
  - Enhance availability of infrastructure services
  - Broaden variety of available services
  - Optimise for data locality

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Architectural Concept (2/2)
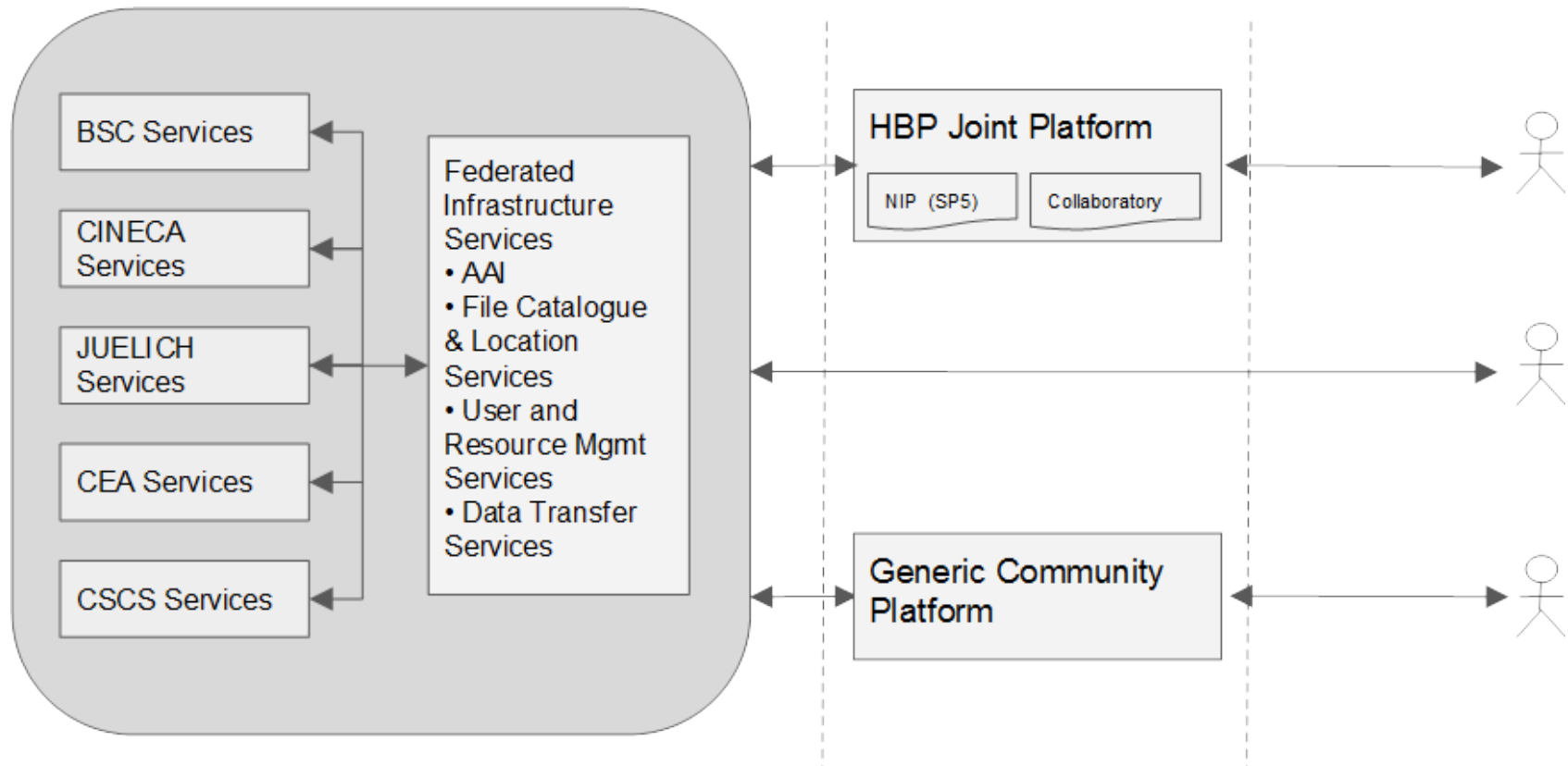
ICEI infrastructure services   **SP7 platform services**

Overview over Planned Fenix Services

- **Computing services**
  - Interactive Computing Services
  - (Elastic) Scalable Computing Services
  - VM Services
- **Data services**
  - Active Data Repositories + (federated) Archival Data Repositories
  - Data Mover Services, Data Location and Transport Services
- **Other**
  - Authentication and Authorisation Services
  - User and Resource Management Services (FURMS)
  - Monitoring Services
  - Internal/external interconnect

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Interactive Computing Services

- Interactivity
  - Interactive processing of data
  - Capability of a system to support distributed computing workloads while permitting
    - Monitoring of applications
    - On-the-fly interruption/steering by the user

- Architectural requirements
  - Interactive access
  - Tight integration with scalable compute resources
  - Fast access to storage resources

- Support for interactive user frameworks
  - Jupyter notebook, R, Matlab/Octave

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(Elastic) Scalable Computing Services

- Different options for service provisioning
    - Access to highly scalable compute resources with possible longer wait times
    - Elastic access to a limited amount of compute resources
- Possible realisation of elastic provisioning
    - Free resources by means of checkpoint/resume mechanisms
    - Reserve (small) amount of nodes
- Considered use case
    - Coupling of neuro-robotics experiments to brain simulations
- Open co-design questions
    - Upper limit for acceptable response times
    - Scaling range

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Virtual Machine Services

- ■ Use case

  - ■ Deployment of **community platform services** running 24/7

  - ■ Examples: HBP *Collaboratory*, database servers, visualisation services

- ■ Requirements

  - ■ Allow communities to flexibly create and manage VM services similar to a cloud environment

  - ■ Provide stable infrastructure services

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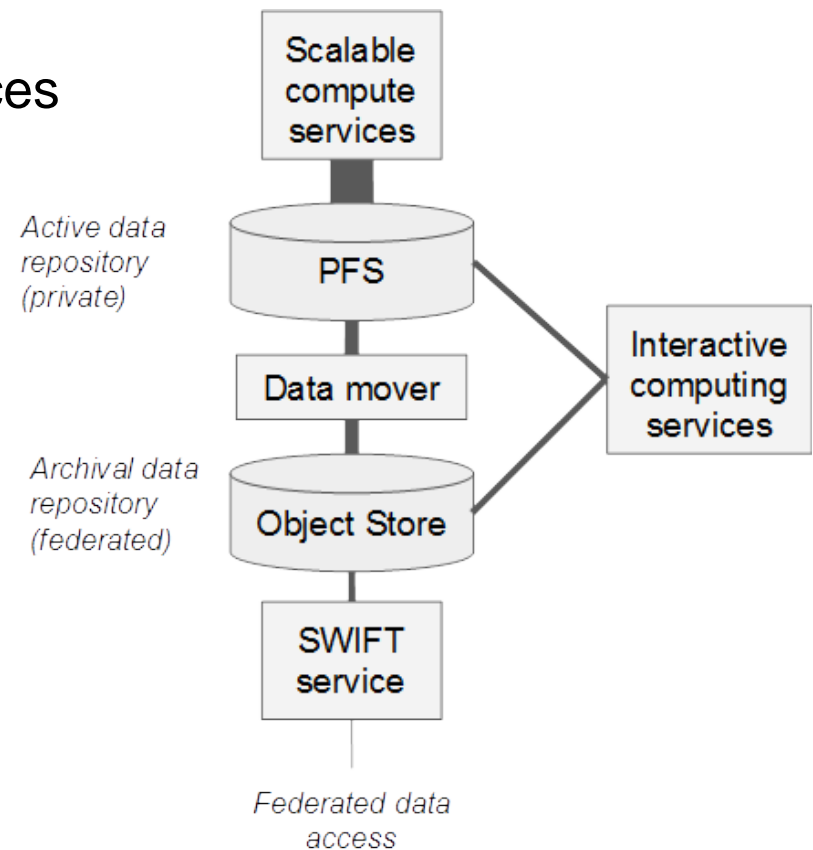# Architectural Concepts: Data Store Types

- ## Archival Data Repository
  - Data store optimised for **capacity, reliability and availability**
  - Used for storing large data products permanently that cannot be easily regenerated

- ## Active Data Repository
  - Data repository localized close to computational or visualization resources **optimised for performance**
  - Used for storing temporary slave replica of large data objects

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Storage Architecture

- Concept
    - **Federated archival-class data repositories** with Cloud interfaces
    - **Non-federated active data repositories** with POSIX interface accessible from HPC nodes
- Envisaged implementation
    - Mandate same technology at all sites
    - Current prime candidate: **OpenStack SWIFT**

Scalable compute services

Active data repository (private)

PFS

Data mover

Archival data repository (federated)

Object Store

Interactive computing services

SWIFT service

Federated data access

Resource Allocation Model

- **Actors**
    - Fenix Resource Providers
    - Fenix Communities
    - Fenix Users

- **Role of Fenix Resource Providers**
    - Provide fixed amount of resources for given period to Fenix Communities
    - Define rules for resource allocation (e.g., peer-review process)

- **Fenix Users**
    - Submit proposal for resources to relevant Fenix Community

- **Fenix Community**
    - Review proposal and award available resources to Fenix Users

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Fenix Credits

- Fenix Credit =

    Vouchers for authorising resource consumption

- Different types of resources

    - Scalable compute resources (N_{node} **×** time)

    - Interactive computing services (N_{node} **×** time)

    - Active data repositories (capacity **×** time)

    - Archival data repositories (capacity)

    - Virtual Machines (VM flavours[cores, memory, network IPs] x time)

- Credit attributes

    - Value and type of resource

    - Fenix Resource Provider

    - Validity period

Note
Fenix Credits will only allow to use the ICEI infrastructure. Other access mechanisms apply for other resources (e.g. PRACE)

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User Management

- **Model**
    - Scientist identifies itself through virtual identity issued by accepted Identity Provider
    - Scientist registers with Fenix Community to become a Fenix User
- **Workflow**
    - Scientist obtains virtual identity
    - Scientist applies for membership in a Fenix Community and accepts Fenix Community Usage Agreement
    - Fenix Community decides on application

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Q&A

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Fenix Website:

https://fenix-ri.eu

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