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
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

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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
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 role of 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
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
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
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
(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
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
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
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
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
Fenix Credits

- Fenix Credit = Vouchers for authorising resource consumption
- Different types of resources
  - Scalable compute resources \( (N_{\text{node}} \times \text{time}) \)
  - Interactive computing services \( (N_{\text{node}} \times \text{time}) \)
  - Active data repositories (capacity \( \times \text{time} \))
  - Archival data repositories (capacity)
  - Virtual Machines (VM flavours[cores, memory, network IPs] \( \times \text{time} \))

- 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)
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
Q&A

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Fenix Website:
https://fenix-ri.eu