BIOBANKING FOR A HEALTHIER WORLD

EUROPE BIOBANK WEEK CONGRESS 19-22 MAY 2026

BBMRI.at Biobanking and BioMolecular resources Research Infrastructure Austria

THE ARCHITECTURE OF THE BBMRI.AT NATIONAL NODE BIOBANK DATA COMMUNICATION PLATFORM

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NN BIOBANK DATA COMMUNICATION PLATFORM: PROBLEM STATEMENT AND PROJECT GOAL

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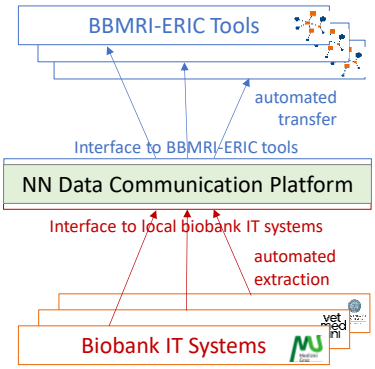
- **Dissemination Problem:** Austrian biobanks face challenges in disseminating information about their sample collections.
- **Existing Infrastructure to address dissemination problem:** BBMRI-ERIC supports dissemination through tools such as the BBMRI-ERIC Directory.
- **Communication Problem:** Communicating with ERIC tools still involves manual effort and technical knowledge.
- **Project Goal:** Enable automated extraction and transfer of biobank data from local biobank IT systems to BBMRI-ERIC tools by means of **National Node Biobank Data Communication Platform**
- **Work Performed:**
  - Analyzed **IT landscape at Austrian biobanks** to derive requirements for interfaces to local systems
  - Analyzed **BBMRI-ERIC tools requirements** for interfaces supporting automated transfer
  - Established **a technical specification for a BBMRI.at Data Communication Platform**, including its **architecture**



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ANALYSIS OF THE IT LANDSCAPE OF AUSTRIAN BIOBANKS

- **What was done:** Qualitative data collection with structured comparative analysis. A questionnaire distributed to partner biobanks, interviews and workshops with biobank representatives.
- **Data collection scope:** Software systems, underlying data models and their implementation, data input and output interfaces, workflows supporting routine operations and research activities.
- **Consolidation and analysis:** Site-specific summaries and comparative analysis, identification of technology gaps
- **Validation:** Follow-up consultations, resulting in harmonized transcripts, verified process descriptions, agreed conceptual models for each biobank.

- **What is important for the establishing of NN Biobank Data Communication Platform**
  - **Heterogeneity among Austrian biobanks:** differences in maturity and design of local IT infrastructures.
  - **Shared goals among biobanks:** standardized data structures, controlled data exchange with clinical and research systems (**data control must remain 100% on the biobank side**)
  - **Common issues:** continued reliance on manual or semi-automated data flows, limited alignment with standards.

Amended communication platform goals: to integrate heterogeneous site infrastructures into a shared framework for metadata publication and interoperable data exchange.

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REQUIREMENTS ANALYSIS OF AUTOMATED DATA EXCHANGE WITH BBMRI-ERIC TOOLS

- **What was done:** Collected testable requirements (with acceptance/fit criteria) on automated data exchange with BBMRI-ERIC tools
  - Based on BBMRI-ERIC documentation and CS/IT-FS TF meetings participation
  - Covering AAI (LifeScience/BBMRI AAI) as a crosscutting prerequisite
  - Covering the tool-specific machine interfaces for the BBMRI-ERIC Directory, Negotiator, and the Federated Platform
  - Serve as a foundation for the technical specification (interfaces to BBMRI-ERIC infrastructure)
- **What is important for the establishing of NN Biobank Data Communication Platform**
  - Only **BBMRI-ERIC Directory acquires data** from the National Node, **Negotiator may only provide data to the Node**, whereas FP relies on its own component (**bridgehead**) installed locally at biobank sites to provide data, but the configuration information for bridgehead deployments may be managed centrally
  - Within these limits, the automated data exchange with BBMRI-ERIC tools **can be implemented** based on the available interfaces
  - Implementing this exchange separately for every biobank may lead to duplicating the effort, again, emphasizing the need for a National Node-level communication platform
  - a **commitment of the local biobanks** (i.e. the assignment of local resources) is necessary

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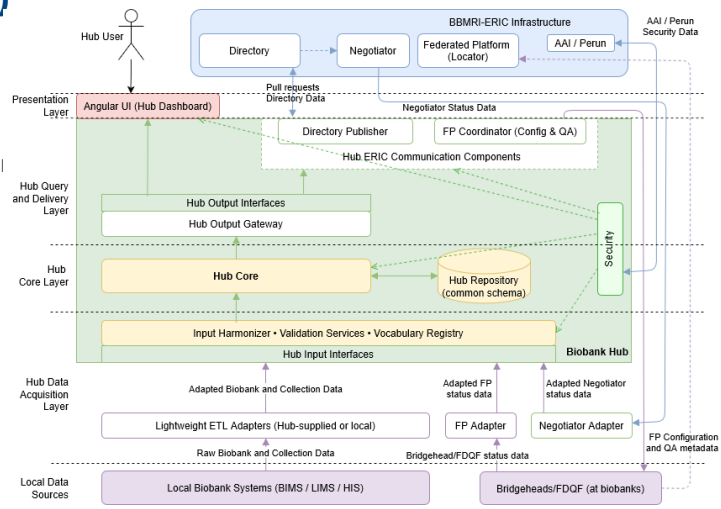
BBMRI.AT BIOBANK DATA COMMUNICATION PLATFORM (BIOBANK HUB)

- **What was done:** System design for the BBMRI.at National Node Biobank Data Communication Platform (**BBMRI.AT Biobank Hub**)
  - Defines **layered architecture** for automated data exchange between BBMRI.AT biobanks and BBMRI ERIC tools
  - Specifies the software solution to run on top of established Oracle ORDS infrastructure at MUI
  - Makes use of BBMRI-ERIC security infrastructure
- **Biobank Hub software is responsible for:**
  - automated acquisition and harmonization of data from BBMRI.AT biobanks' IT systems
  - maintaining an authoritative data model aligned with MIABIS
  - validated preparation and delivery of BBMRI-ERIC Directory metadata
  - coordination for Federated Platform (Locator) configurations, providing FP and Negotiator status information through the Dashboard



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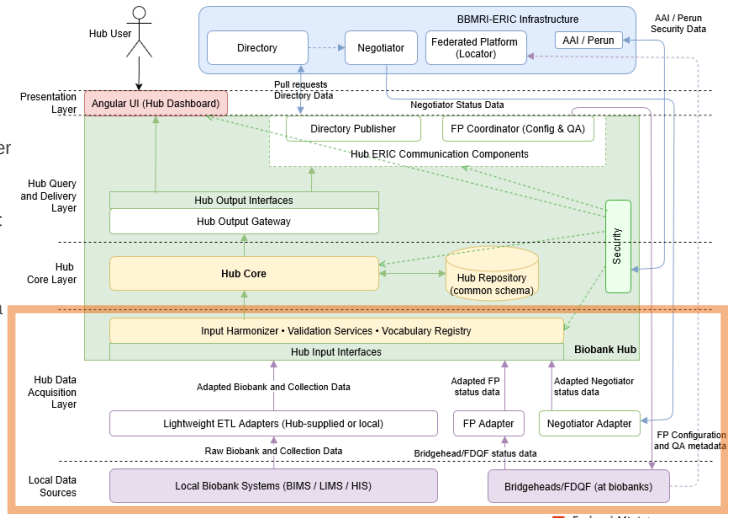
ACQUIRING DATA FROM LOCAL BIOBANK IT SYSTEMS

- **Local Data Sources**
  - Local biobank IT systems (LIMS, BIMS, HIS, or legacy databases).
  - provide the source data to the data acquisition layer
- **Local and external adapters**
  - The data from local systems comes to **lightweight ETL adapters** for harmonization and delivery.
  - They run at biobank sites; may be provided locally
  - **FP Adapter** also runs locally, acquiring status data from bridgehead / FDQF, to return it to the Hub.
  - **Negotiator Adapter** acquires status data from Negotiator
- **Harmonizing data**
  - Hub receives data from adapters through **Hub Input Interfaces**.
  - **Input Harmonizer** ensures incoming data consistency and provides harmonized data to the Hub Core.



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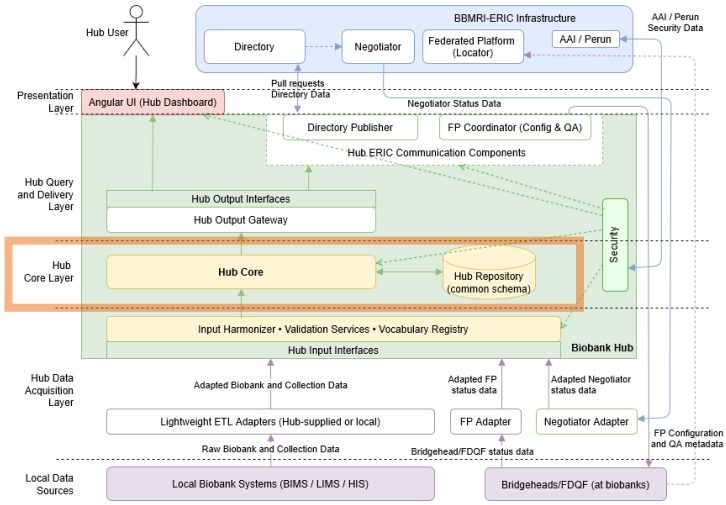
CORE FUNCTIONALITY

- **Hub Core Layer**
  - maintains the common repository (**Hub repository**) of validated, version-controlled metadata and controlled vocabularies.
  - enforces schema integrity and vocabulary consistency, providing the single authoritative source of truth for all Hub operations.
  - all acquisition and delivery components interact with it through standardized internal interfaces
- Hub repository has a **common database schema** aligned with MIABIS



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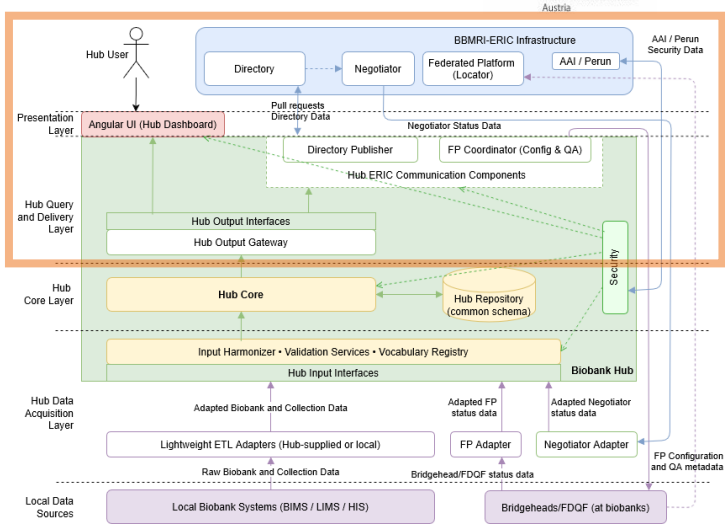
COMMUNICATING WITH BBMRI-ERIC TOOLS

- **Hub Query and Delivery Layer**
  - Outbound access to validated data and its transformation for external systems.
  - **Hub Output Gateway:** exposes read-only, versioned data via the **Hub Output Interfaces** to Directory Publisher and FP Coordinator and to the presentation layer
  - **Directory Publisher and FP Coordinator:** responsible for communication with the specific BBMRI-ERIC tools, providing data to them
- **Presentation Layer**
  - **Hub Dashboard**: read-only visibility of Hub's operations and their results together with current FP/Negotiator status information.
  - Authentication via the AAI / Perun framework.



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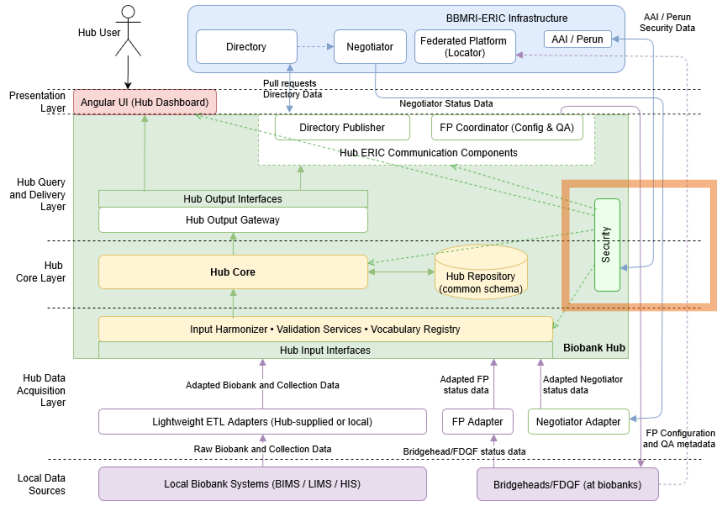
SECURITY

- **To support security, the Biobank Hub**
  - implements **crosscutting Security Service** integrated with the BBMRI-ERIC AAI / Perun infrastructure
  - does not host its own identity provider but relies on AAI / Perun for federated authentication
  - accepts federated logins for Data Acquisition and Presentation layers and the ERIC Communication Components
  - maps these logins into local roles



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OUTLOOK

- **Biobank Hub Pilot Operative implementation**
  - **ongoing, planned to be complete until October 2026**
  - Limited to MUI
  - Core Hub development in cooperation with the local MUI Health Data Research Hub team
  - Providing data to BBMRI-ERIC Directory via Directory Publisher.
  - Presenting status information of Negotiator and FP
  - Pilot setup at MUI (acquiring data from Biobank Innsbruck CentraXX system)
  - End-to-end validation for the corresponding BBMRI-ERIC tools (Directory, Negotiator, FP).
- **National rollout preparation**
  - **planned for October-November 2026**
  - preparing the foundations for national rollout and stabilization

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THANK YOU!

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