Brain-CODE

Ontario Brain Institute's Integration Platform

April 15th, 2014

Ontario

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Ontario Brain Institute (OBI) Values

- Patient-centred – attack salient disorders
- Maximize neuroscience excellence across Ontario through integration and collaboration
- Standardize all assessments and diagnoses
- Build on past investments
- A partnership approach: government, researchers, clinicians, patients/advocacy groups & industry

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Productivity in Neuroscience

The data integration imperative

"Recognizing that neuroscience is not, of course, really a single field is important. Rather, it is a multidisciplinary enterprise including diverse fields of biology, psychology, neurology, chemistry, mathematics, physics, engineering, computer science and more. If scientists within neuroscience and related disciplines could unite around a small set of goals, the opportunity for advancing our understanding of brain and mental function would be huge."

-- US National Academy of Sciences, 2008

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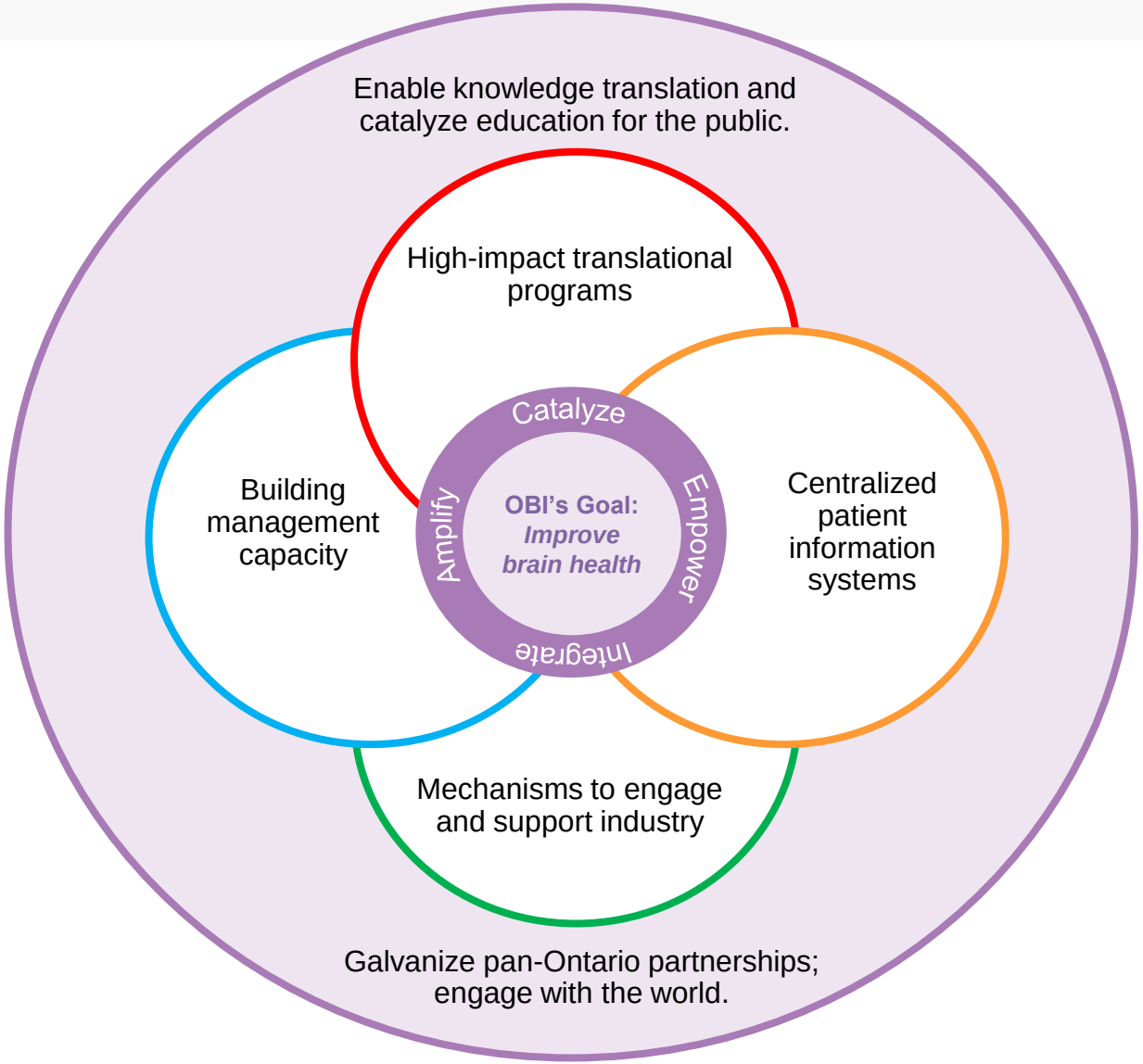
OBI's Innovation System



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The OBI Model

5 Integrated Discovery Programs

35+ Institutions

35+ Companies

5+ Data Types

5400+ Patients

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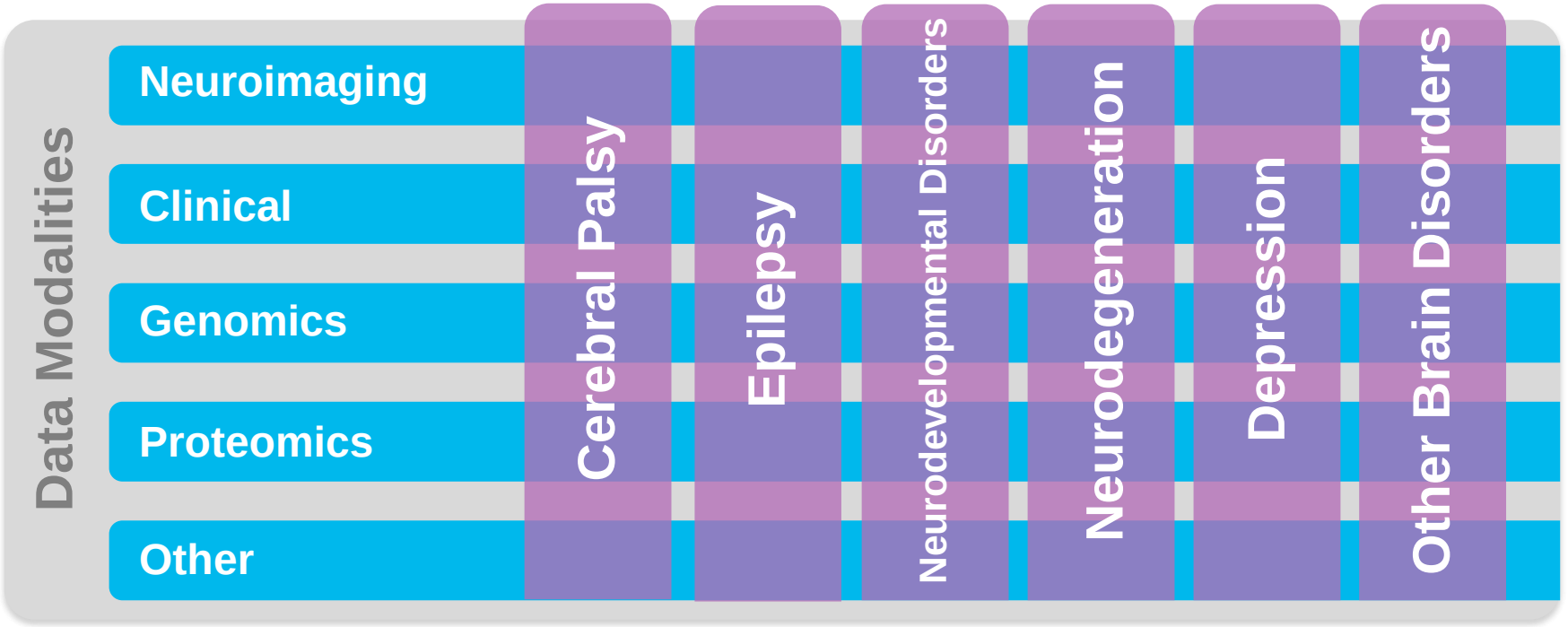
OBI's Big Data Opportunity

Integrated Discovery Programs



Brain-CODE is an extensible large-scale informatics platform that manages the acquisition, storage, integration, and analytics of multidimensional data collected from patients with a variety of brain disorders

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OBI Values and Big Data

- Gathering big data in health research must be driven by a scientific vision and system innovation
- Data sharing is key for effective collaboration, partnership, and discovery
- Engage patients, researchers, and industry through an effective collaboration platform
- Security and privacy are critical
- Important to enable researchers/clinicians with the best tools in data management and analytics

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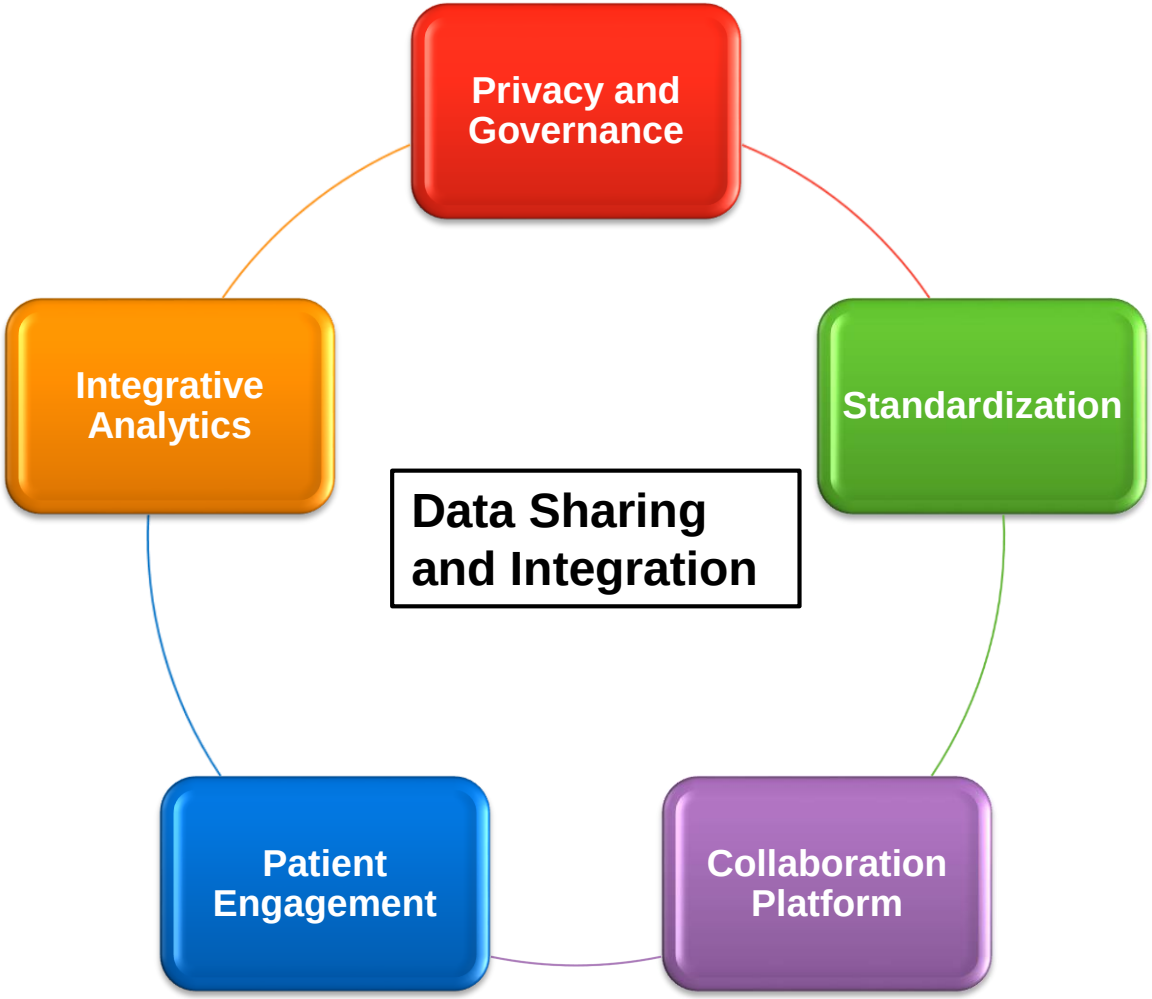
Brain-CODE's Components



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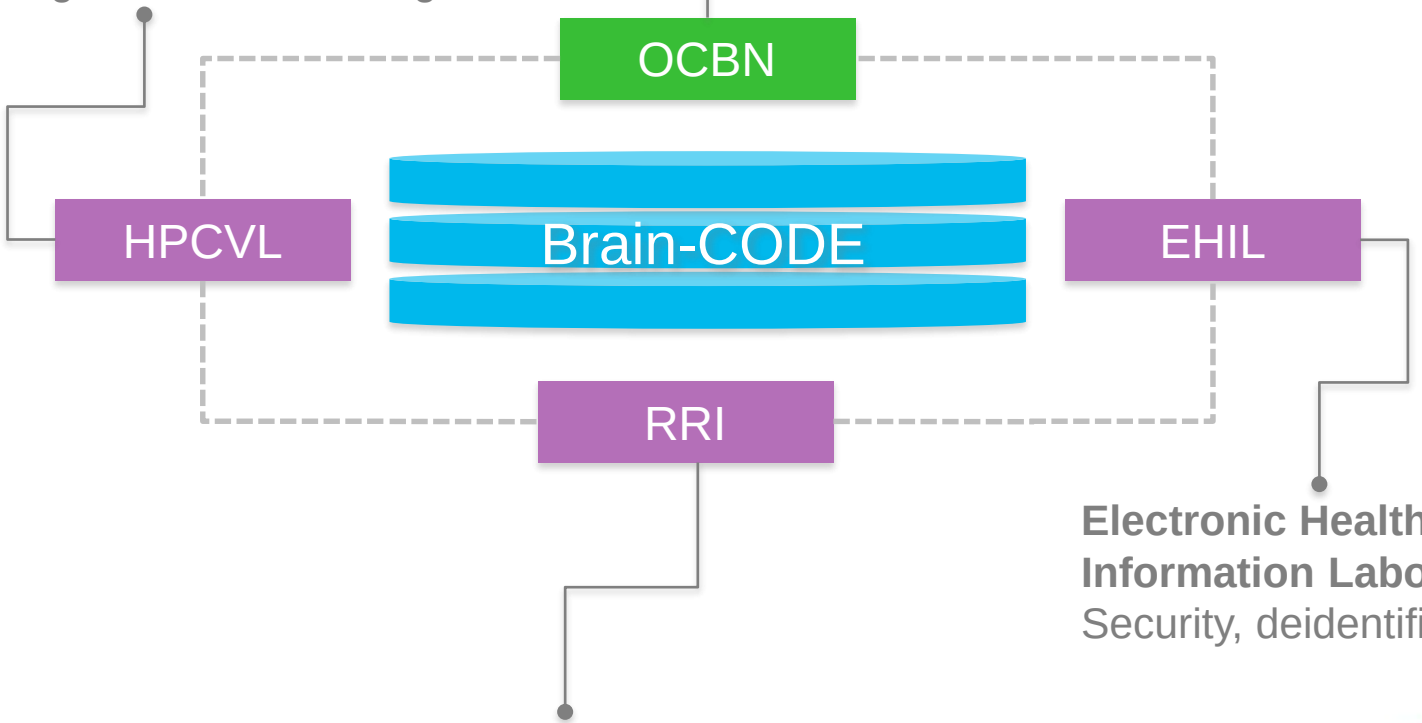
Brain-CODE
Expert Leadership

InDOC consortium

High Performance Computing Virtual Laboratory
HPC and large-scale data storage

Ontario Cancer Biomarker Network
Molecular biomarker management, InDOC lead



Electronic Health Information Laboratory
Security, deidentification

Rotman Research Institute
Neuroinformatics

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Expert Leadership

International Advisory Committee

Name	Institution
Dr. Daniel Marcus	Washington University at St. Louis
Dr. Rodrigo Lopez	European Bioinformatics Institute
Dr. Charles Peck	Neuroinformatics consultant
Dr. Ann Cavoukian	Information and Privacy Commissioner of Ontario
Dr. Sean Hill	International Neuroinformatics Coordinating Facility, Karolinska Institute

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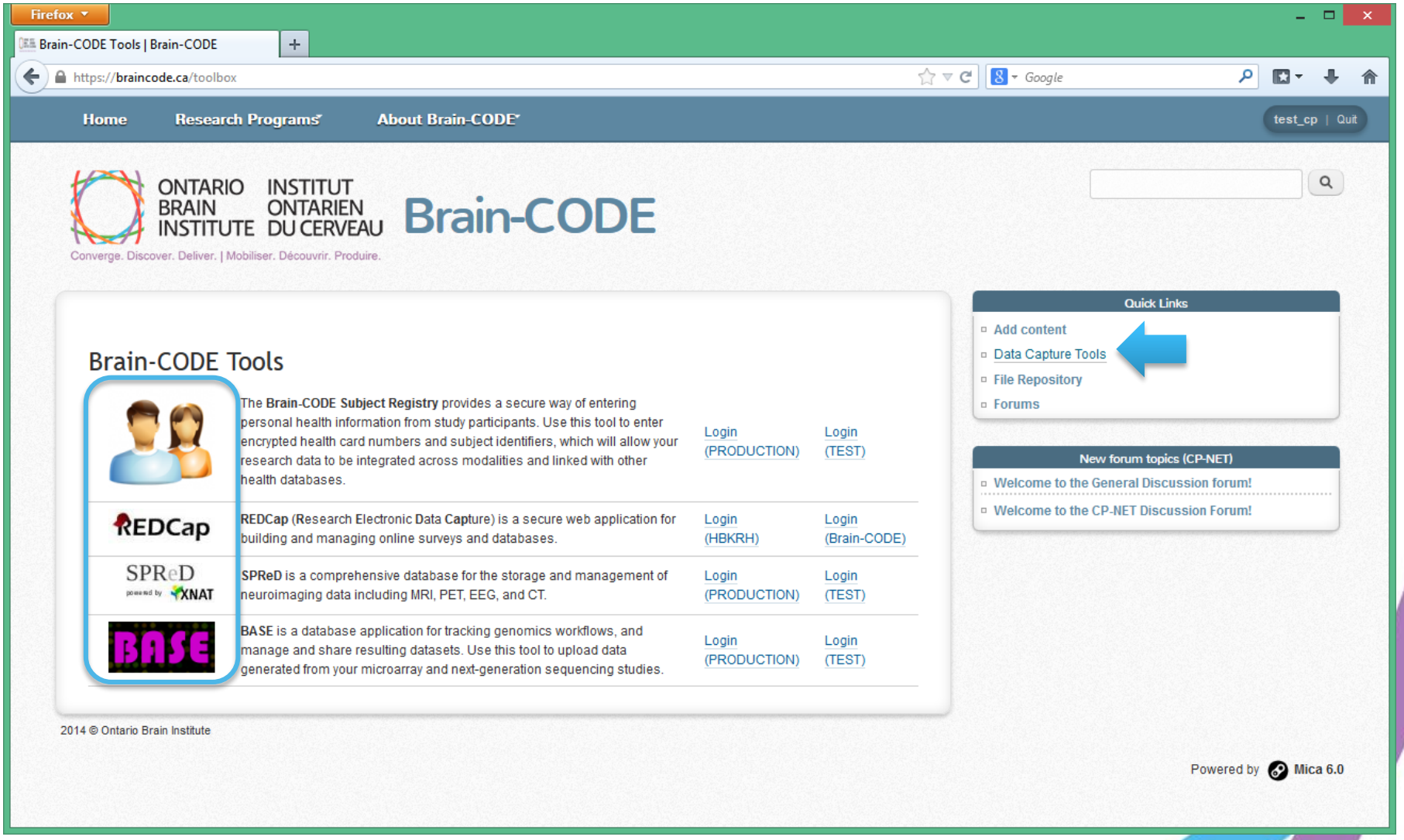
Brain-CODE right now



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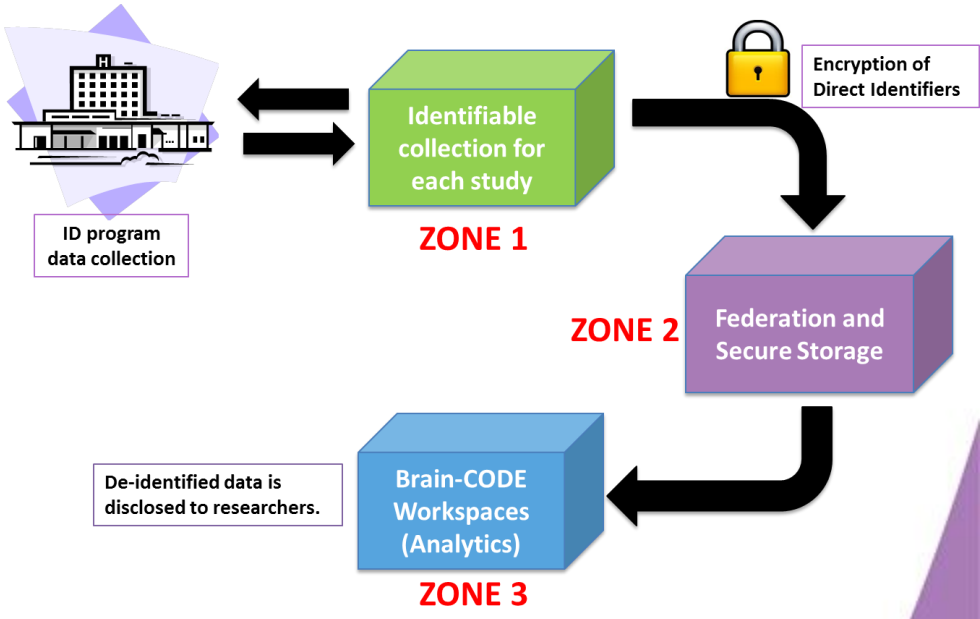
Privacy and Security

- The OBI and Brain-CODE adhere to high levels of data privacy and security:
  - **Physical, technical, and process security:** Encryption and de-identification tools, security of data transfer and storage infrastructure.
  - **Privacy systems**: OBI has been designated ***Privacy By Design*** ambassador. Conceptual Privacy Impact Assessment (PIA) completed (October 2012) in consultation with the Information and Privacy Commissioner of Ontario. Updated PIA March 2014; Threat and Risk Assessment (TRA) initiated.
  - **Governance**: Extensive policy framework and governance apparatus ensures ongoing compliance with regulatory and REB requirements.

The path of data:

Updated zone-based infrastructure



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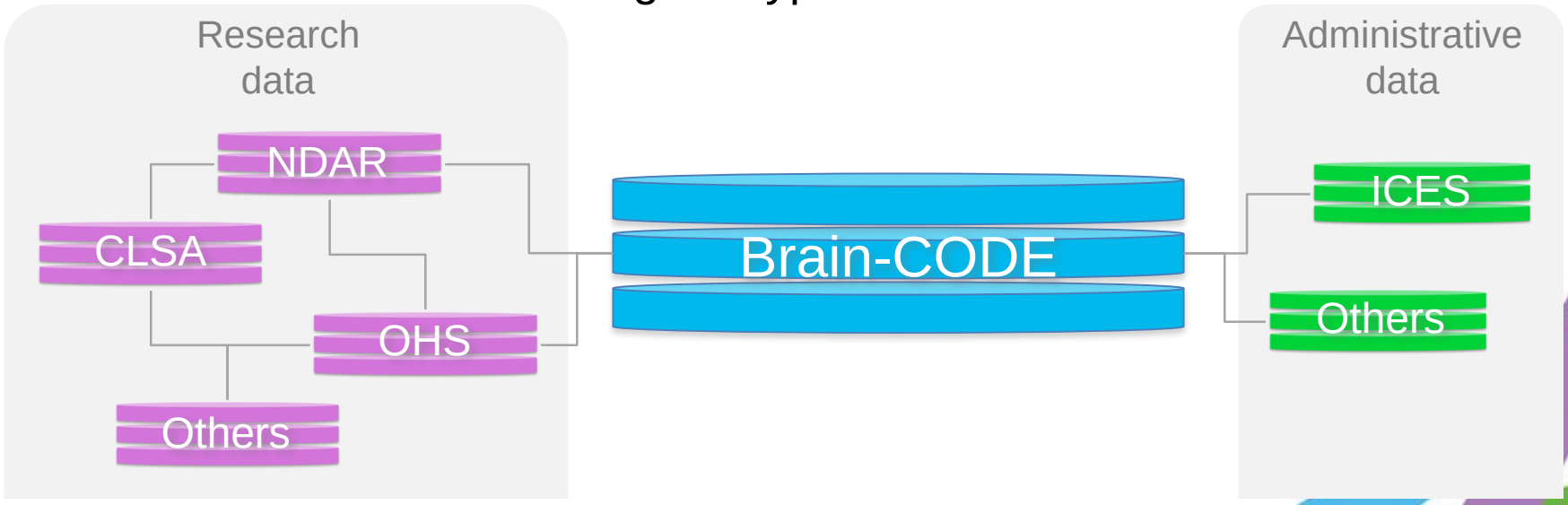
Federation

- Secure linkages of Brain-CODE's data with other databases
  - Leverages existing resources
  - Augments our data
  - Richer data for analytics
- We will be federating with multiple strategic partners and plan to expand
  - Pilot with ICES – using encrypted health card numbers



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Governance

- Data integration and sharing → platform for discovery - Participation Agreement
- Informatics Governance Policy
  - Data Sharing Policy
  - Privacy Policy
  - Breach Policy
- Standardized consent language
- OBI funding contingent on promoting system-wide innovation, enhancing partnerships and collaborations and sharing data

Moving towards the cloud

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Cloud Services and Shared Resources

- **What do we mean by the cloud?**
  - Shared capabilities – software as a service, platform as a service, infrastructure as a service
  - Cost consciousness – economies of scale
  - Security considerations improving
- **Innovation and the cloud**
  - Uptake of cloud model has been slow in Canada – security concerns and fear of change
  - Cloud model important for innovation – analytics, spin-offs, easy access to resources

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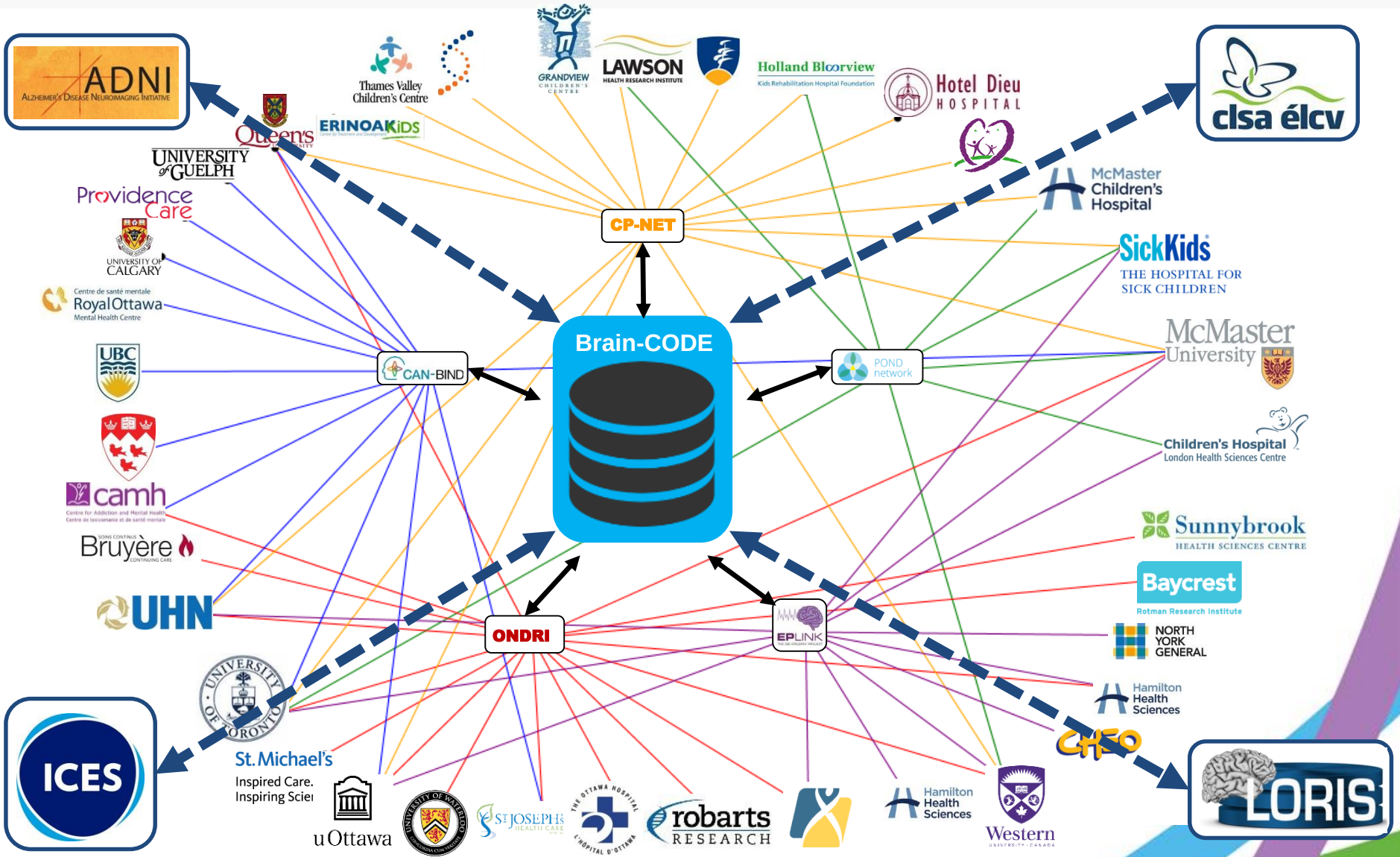
Data Integration Across the Province



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What does the cloud mean for OBI's Brain-CODE?

- Importance of a fast, reliable, and secure network for data transfer – ORION
- Managing the network across the province – hardware, software, governance
- Making use of the latest technologies for efficiency and efficacy of data access and analytics
- Fits into our collaboration, integration, and leveraging model
- Potential for cost savings

Looking ahead

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Data vs. knowledge

- There is plenty of data out there and more every day
- How can we make better use of tools to actually understand the data?
  - Accessibility to software, hardware, security
  - Lowering barriers to use of tools and capabilities
- Building Brain-CODE's analytics capacity

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Analytics Capacity:

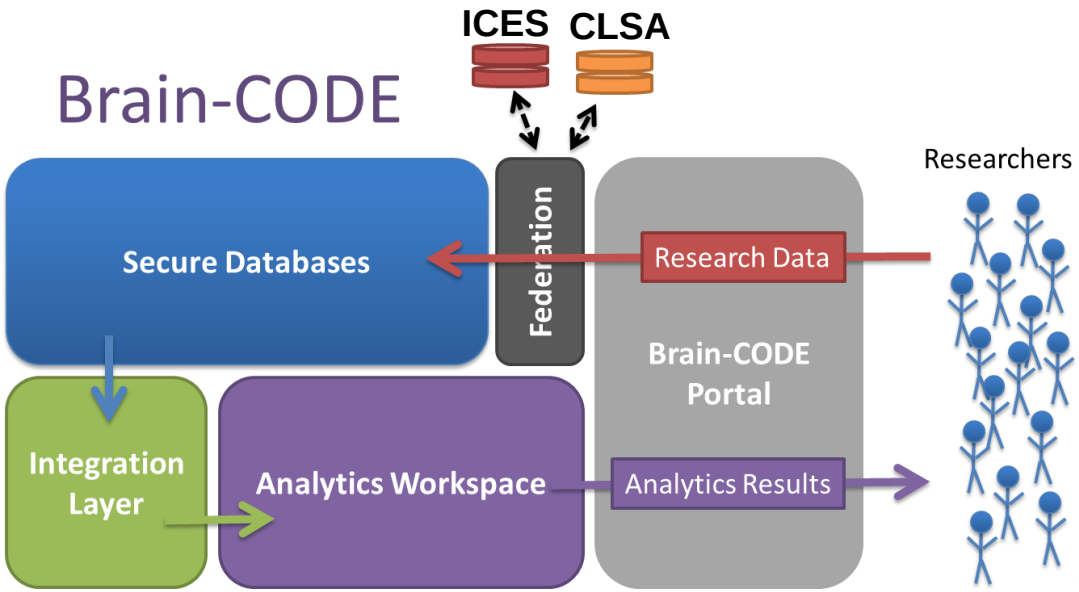
Drawing value from integrated data

Features:

- Diverse toolset to cater to multiple neuroscience data types and linked datasets
- Facilitate sharing and tracking of research data
- Capacity for integrated data analysis
- Training of Data Scientists
- Advisory service for researchers
- Clinical trial recruitment operations
- Encryption and data security services
- Resources for SMEs

Outcomes:

- Cross modality discoveries
- Clinical trial recruitment
- Partnerships and Collaborations
- Augmented data sets
- Engaging the patient



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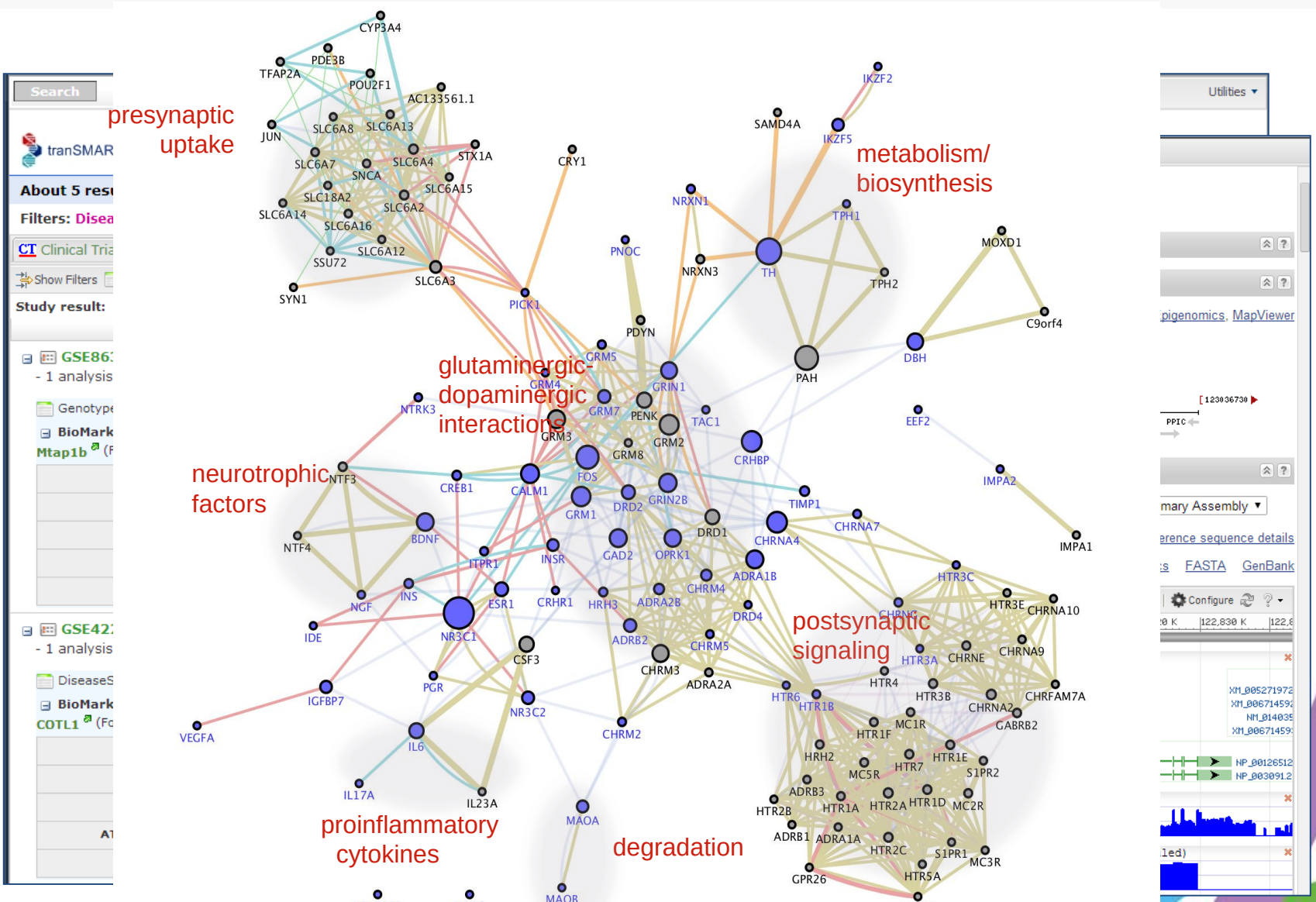
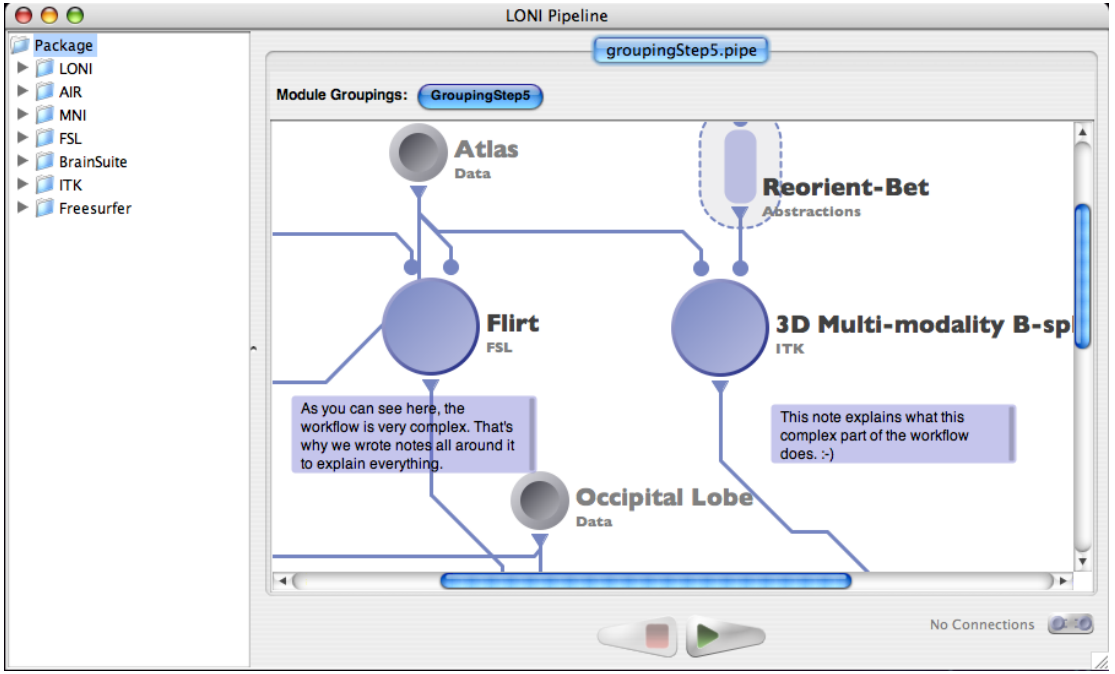
Molecular Data



Imaging Data

Growing analytics capabilities…

LONI pipeline on SGE grid engine for flexible, configurable processing



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Building capacity

- Managing a complex collaborative network
- Fast and reliable network is critical
- Access to the latest methods and technologies
- Shared services
  - Infrastructure as a Service
  - Federation and Analytics capabilities
  - Centralized licences – cloud model

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Questions/comments

Thank you

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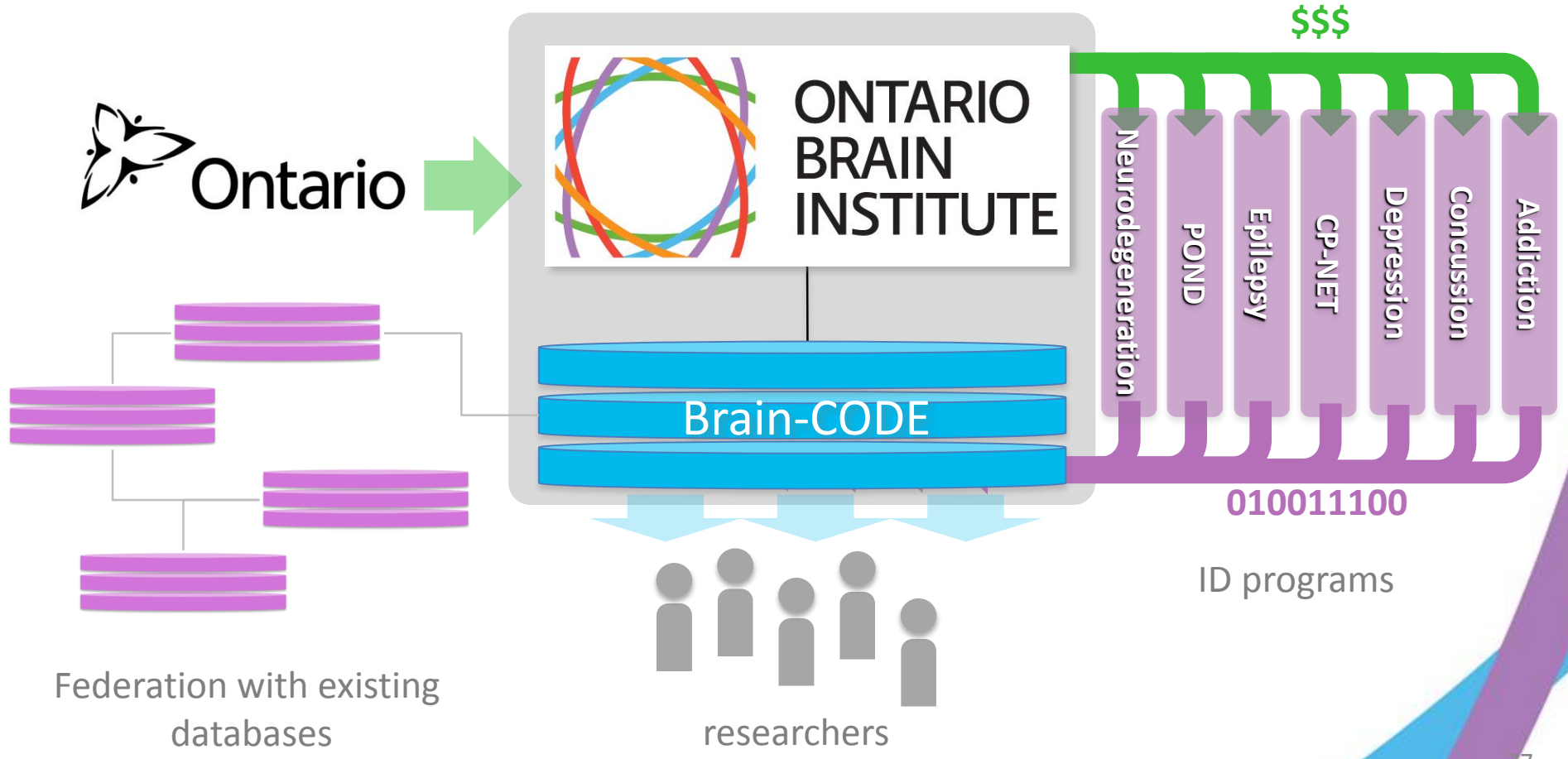
Brain-CODE

Brain-CODE: Inputs and outputs



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Standardization

- Efficient comparison of data (analysis) can only be done when the data is available in a homogeneous format, comparing apples ↔ apples
  - Standardized entry at data collection sites
- The OBI has implemented several methodologies to ensure standardization including:
  - **Common data elements (CDEs)**: where applicable, the OBI ensures that researchers adopt existing CDEs (*e.g.*, NIH, OHS) for data reporting.
    - Demographic, Clinical, and Imaging CDEs developed through Delphi consensus process
    - All available at: https://www.braincode.ca/content/standards
    - InDOC developing CDE electronic Case Report Forms (eCRFs) as part of data capture applications

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Privacy Policy and Practices

- encrypted and de-identification tools
- Secure data transfer
- Confidentiality agreements
- Information Security Policy
- Breach policy
- User accounts verified
- Privacy Impact Assessment (PIA) completed, Threat and Risk Assessment (TRA) underway