Increasing Translational Research Bandwidth:
The Value of Integrative Informatics Platforms

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Co-Director, Biomedical Informatics Shared Resource, Comprehensive Cancer Center

Improving People's Lives
through innovations in personalized health care

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Medical Center

Overview

1. **Motivation**
   - OSUMC “living laboratory”
   - P4 medicine and evidence generation
   - The role of translational science
2. **Creating a Learning Healthcare System**
   - Conceptual model
   - caBIG solutions
3. **Discussion**
   - Lessons learned
   - Next steps

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My Career in One Slide

- **1995-1999**
  - Programmer/Analyst @ UCSD Shiley Eye Center
- **1999-2000**
  - Biomedical Informatics Masters Student @ Columbia University Department of Biomedical Informatics
- **2000-2003**
  - Director of Biomedical Informatics @ CLL Research Consortium (UCSD, Moores Cancer Center
- **2003-2006**
  - PhD Student & NLM Fellow @ Columbia University Department of Biomedical Informatics
- **2006-2010**
  - Assistant Professor of Biomedical Informatics @ OSU
  - Director of Biomedical Informatics @ OSU CCTS
  - Co-Director of Biomedical Informatics @ OSU CCC
  - Translational Research Informatics Architect @ OSUMC
- **2010-Present**
  - Associate Professor and Chair of Biomedical Informatics @ OSU
  - Executive Director of Center for IT Innovation in Healthcare @ OSU
- **Research Interests:** Clinical Research Informatics, Translational Bioinformatics
  - Knowledge Discovery
  - Multi-site Electronic Data Interchange Platforms
  - Workflow Modeling
  - Human Factors/HCI

UCSD Shiley Eye Center


UCSD Moores Cancer Center


Columbia University Medical Center

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OSU Medical Center

- **OSU Medical Center**
  - University Hospital - 918 beds
  - James Cancer Hospital - 178 beds
  - Ross Heart Hospital - 160 beds
  - Dodd Hall (Rehabilitation) - 72 beds
  - OSU East Hospital - 174 beds
- **Statistics**
  - 55,316 patient admissions
  - 979,951 outpatient visits
  - 114,137 ED visits
  - 15,562 inpatient surgeries
  - 17,949 outpatient surgeries
  - Operating revenue of $1.58B
- **Rankings & Points of Pride**
  - USN&WR (19 years):
    - ✓ 11 specialties ranked
    - ✓ Top 20 cancer program
    - ✓ Medical school ranked 11th among public institutions (gain of 17 positions since 2003)
  - Top 100 “wired hospital”
  - Founding member of P4MI
  - Over 2000 active clinical trials
  - $1B in expansion activities (2010-2015)

NCI CCC
A Comprehensive Cancer Center Designated by the National Cancer Institute

CTSA
Clinical & Translational Science Awards

U.S.News America's Best Hospitals 2009-10

U.S.News America's Best Medical Schools 2010

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Delivering P4 Medicine

Use **bio-marker** technologies to predict risk of disease

Use **risk profile** to plan preventive care delivery

Design and deliver **adaptive therapies**

Patients are actively **involved in healthcare**

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Informatics and P4 Medicine

Goal = generate evidence necessary to support PHC delivery

- **Challenges:**
  - Capture, representation and management of high-throughput, multi-dimensional data
    - Phenotype
    - Bio-molecular markers
    - Environmental factors
    - Patient-reported data
  - Reasoning
    - Hypothesis generation
    - Decision support
  - Rapid execution of research
    - Observational
    - Interventional
    - **Beyond organizational boundaries!**

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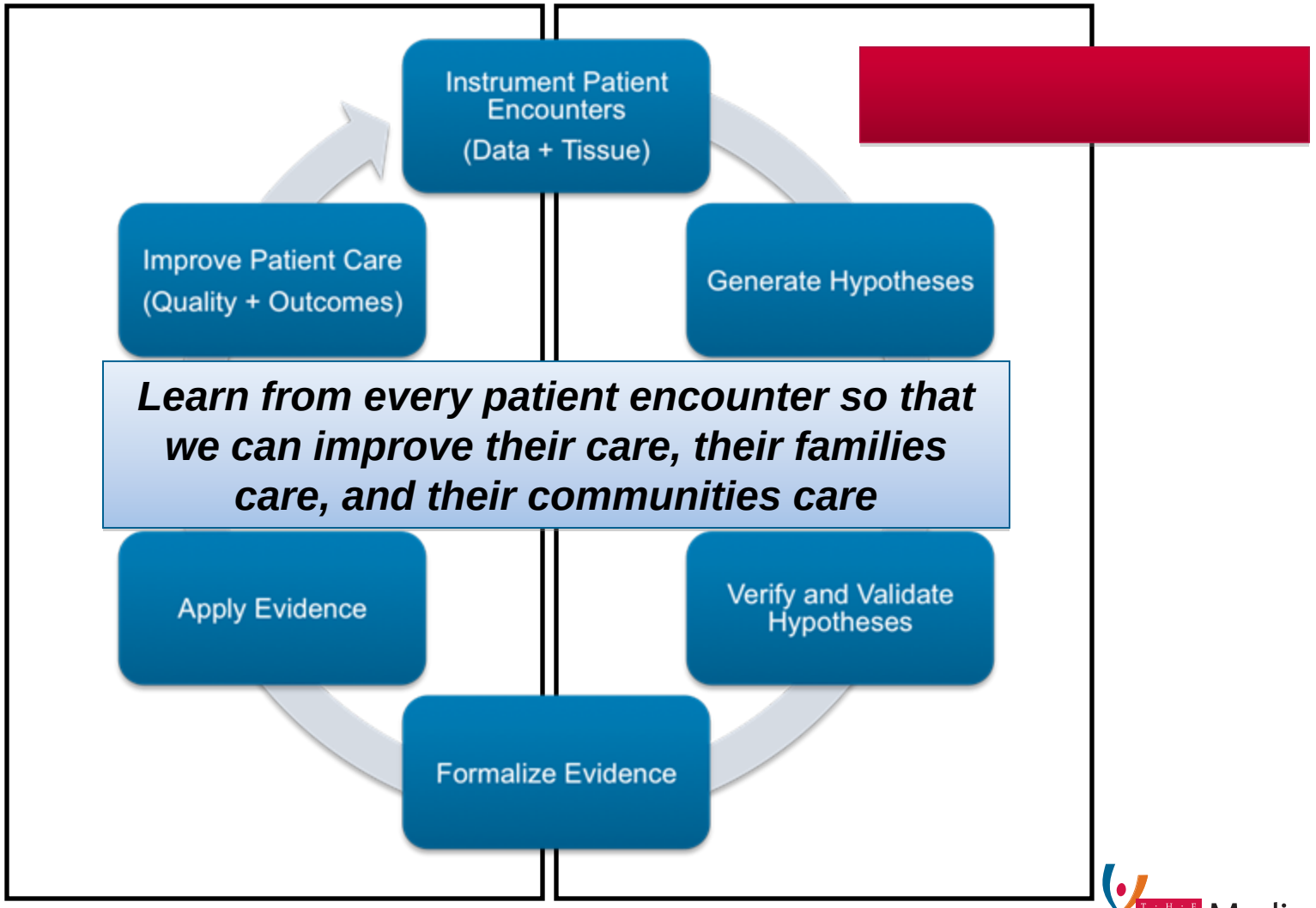
Foundational Premise: Learning from Every Patient and Improving Care



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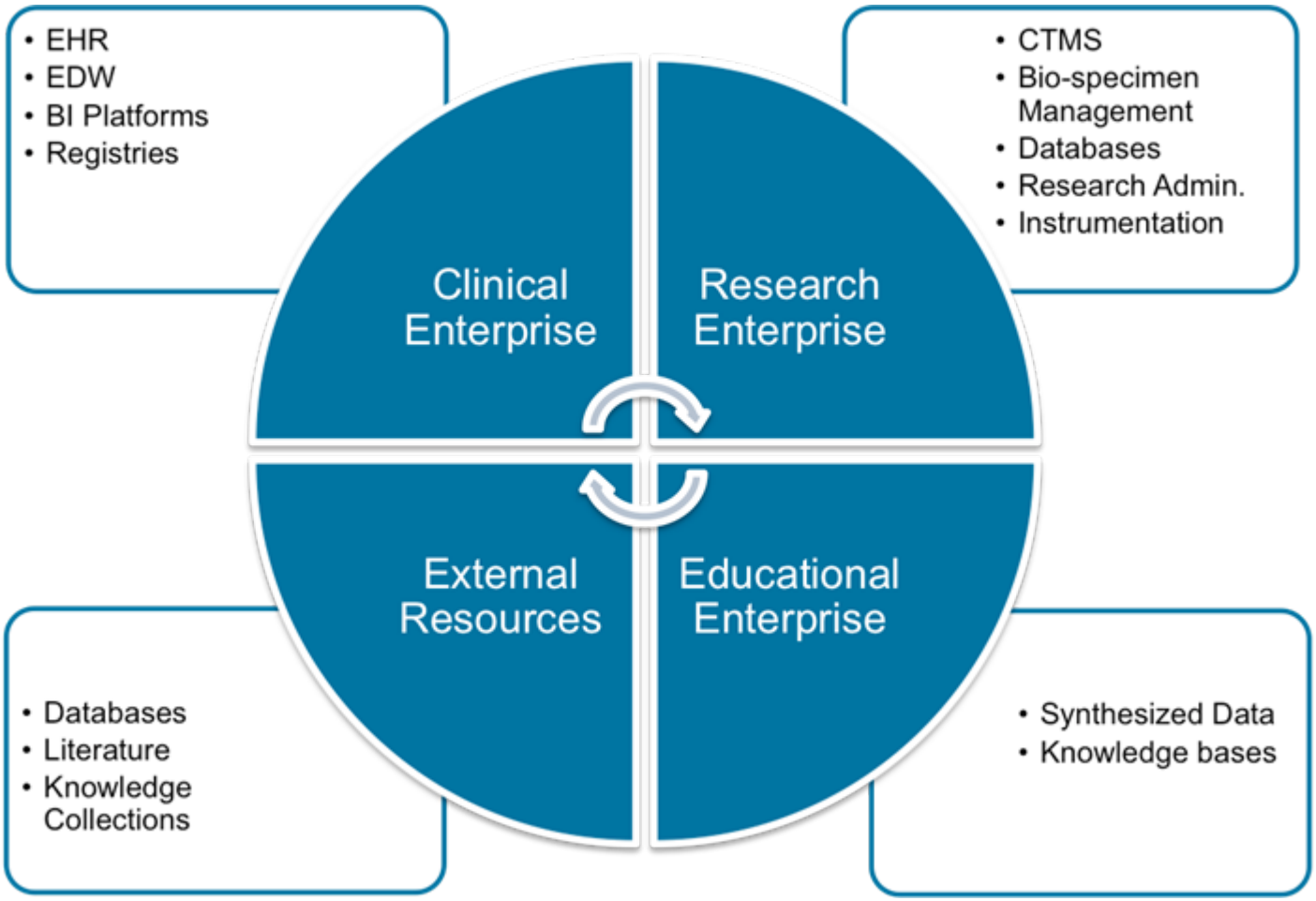
Potential Data & Knowledge Resources



Challenges to Realizing P4 Medicine: The Informatics Perspective

- **Integration**
  - Overcoming traditional organizational boundaries
  - Bridging silos of data, information, and knowledge
- **Reasoning**
  - Scalable approaches to syntactic and semantic interoperability
  - Making optimal use of available data to ask and answer important questions and generate new evidence
  - Multi-modal decision support
- **Application**
  - Suitability of current HIT platforms
  - Delivery of translational biomedical knowledge collections
  - Cognitive, human factors, and workflow implications

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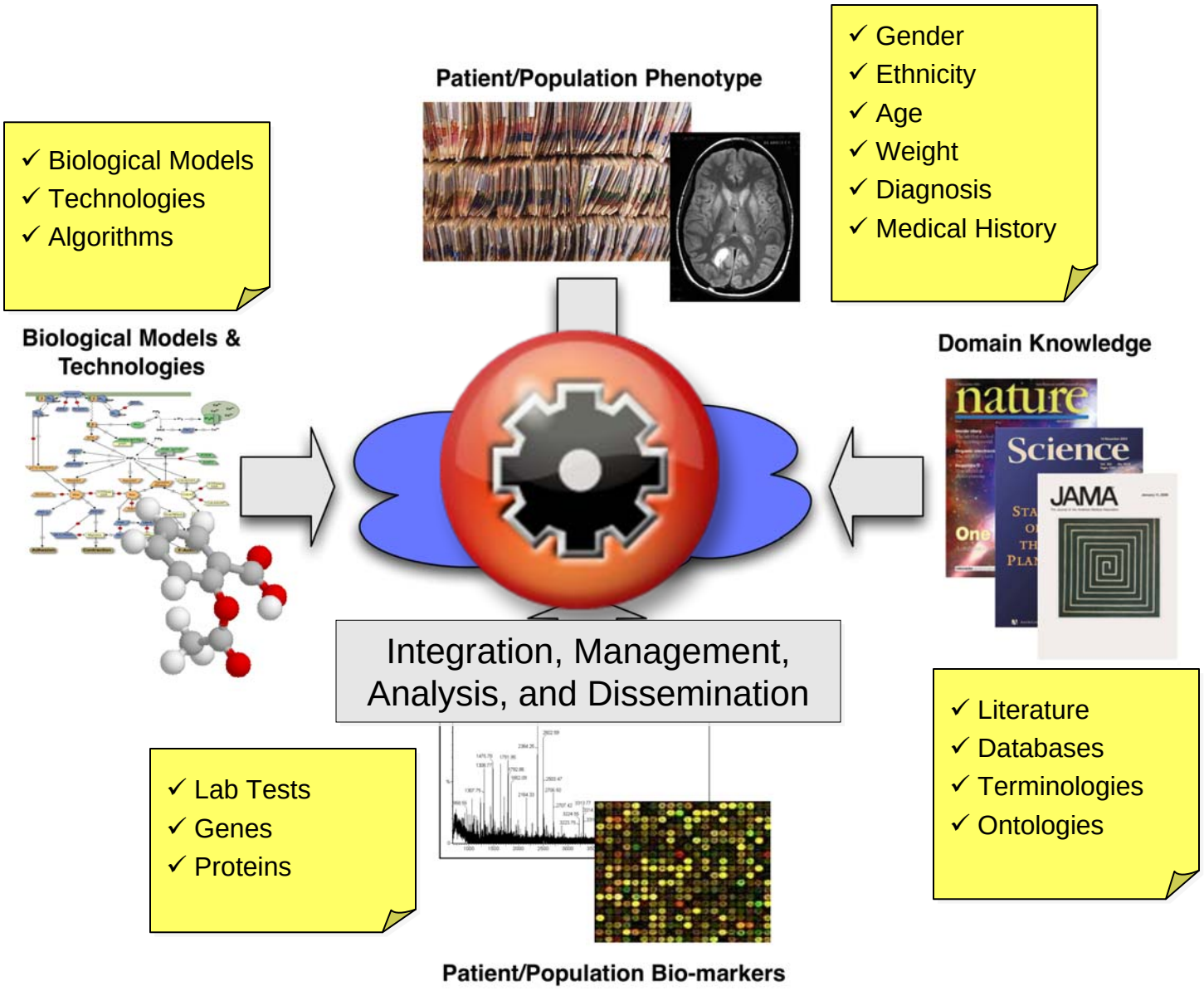
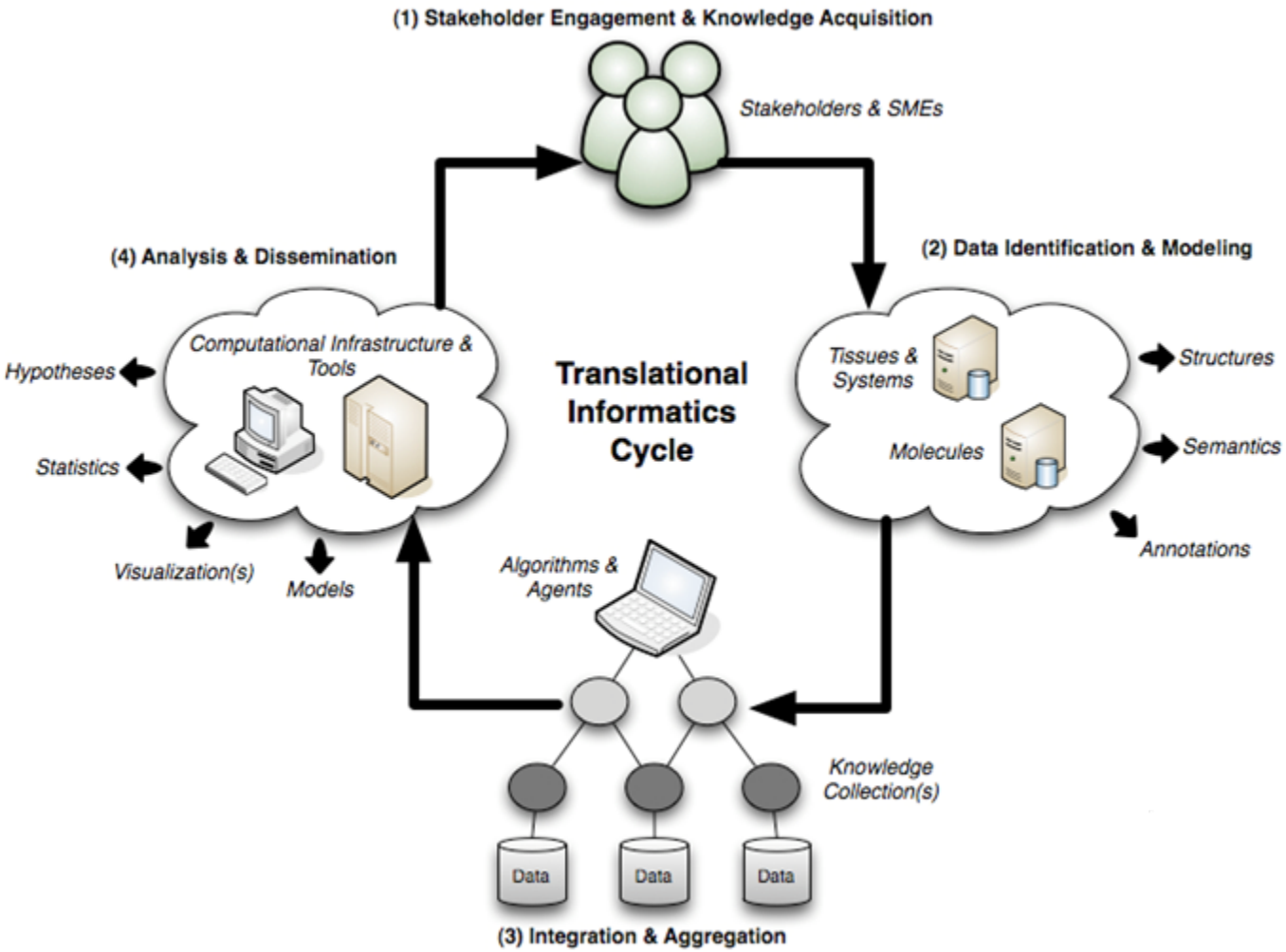
Translational Science and Biomedical Informatics



Foundational Design Pattern



Payne PR et al. *Translational informatics: enabling high-throughput research paradigms*. In: Physiol. Genomics 39: 131-140, 2009

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Example Use Case

- **Focus On:**
  - Data Federation
  - Semantics
  - Multiple Data Types:
    - Clinical Phenotype
    - Bio-specimen Management
  - Knowledge Discovery Tools
- **Translational Research Informatics and Data Management Grid (TRIAD)**

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TRIAD Approach: Leveraging caBIG Technologies

- caGrid is a grid-based informatics platform created by the NCI's caBIG initiative, and used to provide a national research data sharing infrastructure.
- The OSU CCTS has extended caGrid to create TRIAD (Translational Research Informatics and Data Management Grid), a domain-agnostic version of caGrid, deployed for use locally and by the national CTSA consortium.

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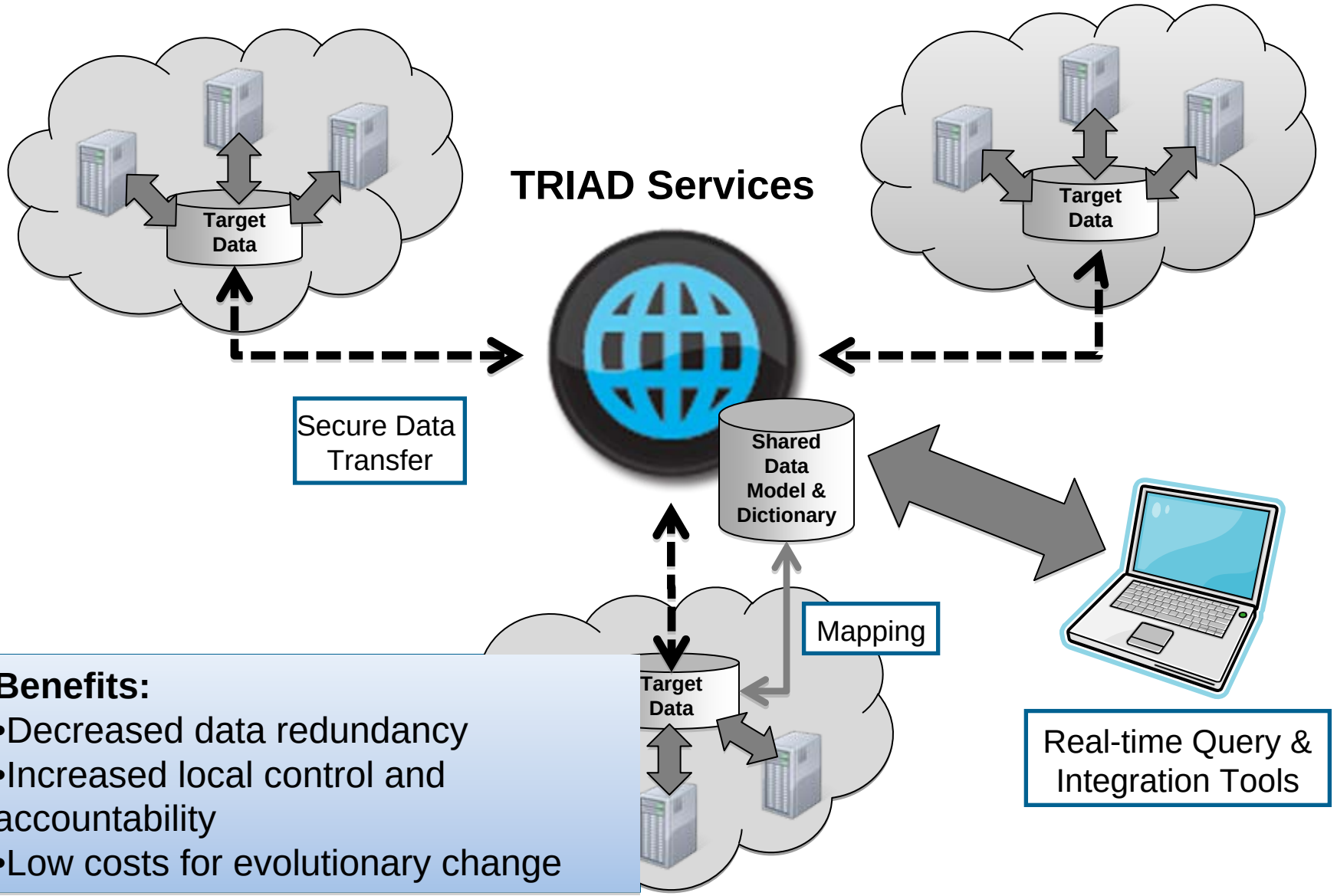
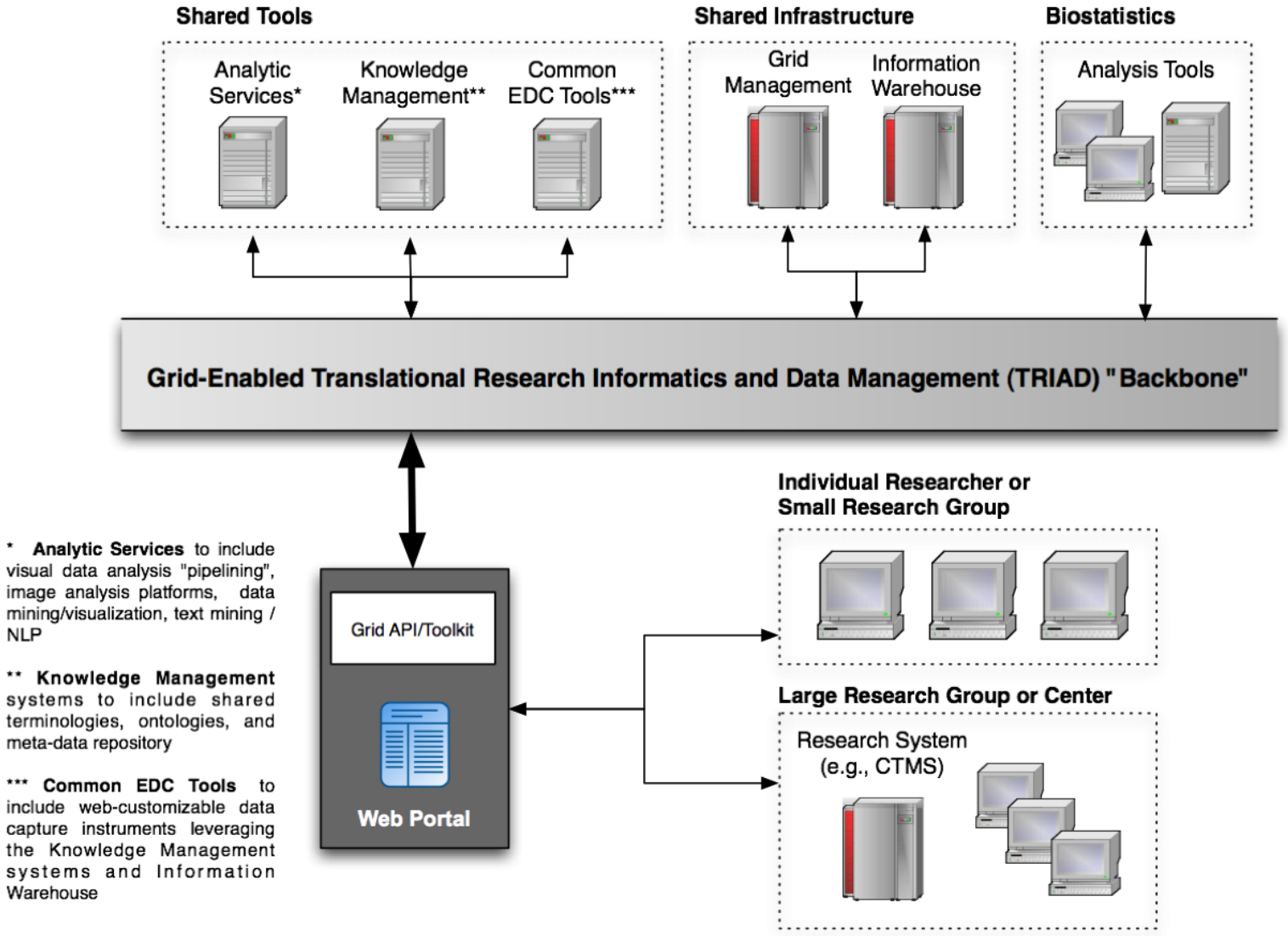
Data Federation Using caGrid/TRIAD



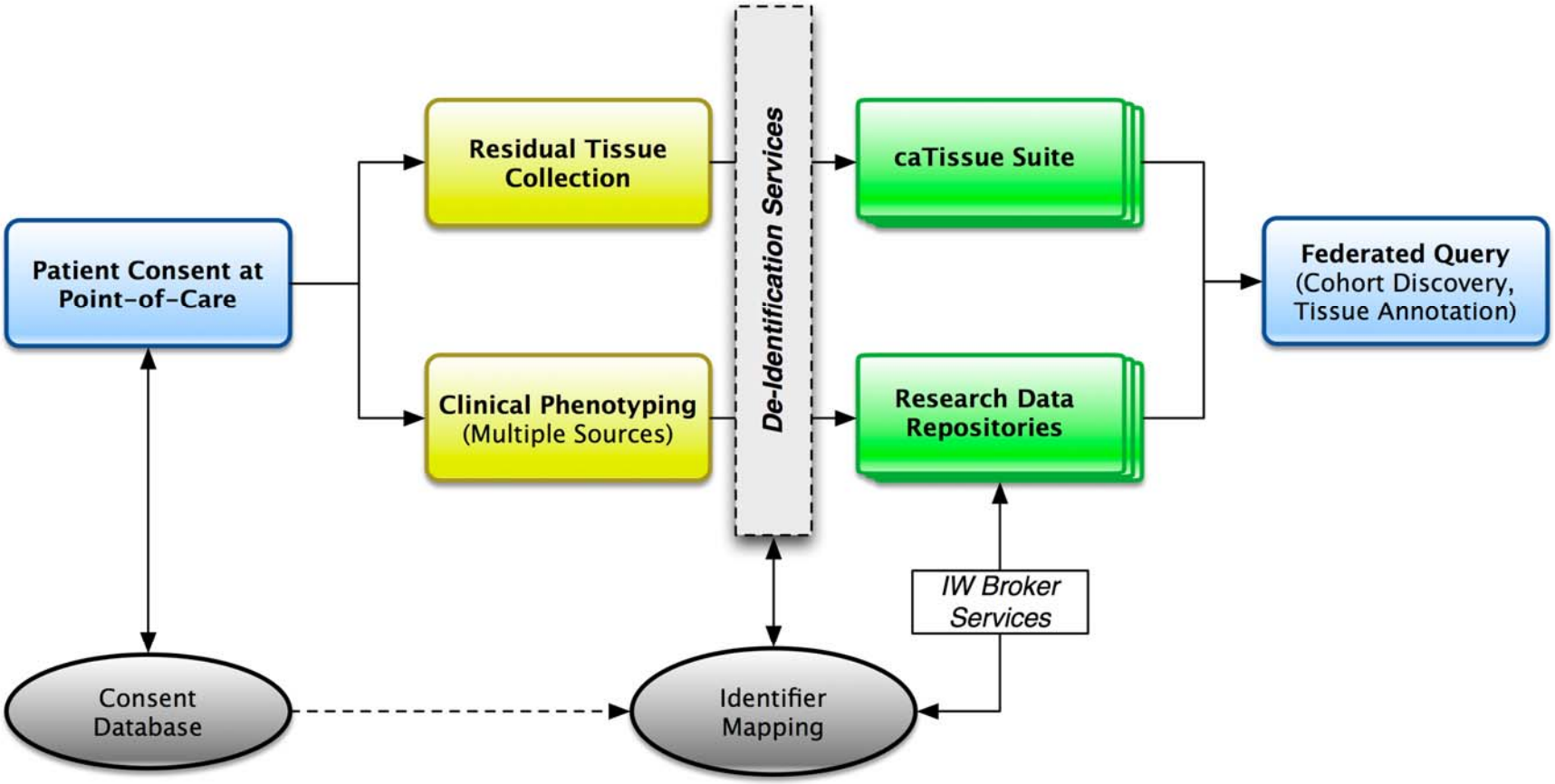
Benefits:

- Decreased data redundancy
- Increased local control and accountability
- Low costs for evolutionary change

TRIAD Architecture @ OSUMC



Example Use Case: Linking Bio-specimens and Clinical Phenotype Data



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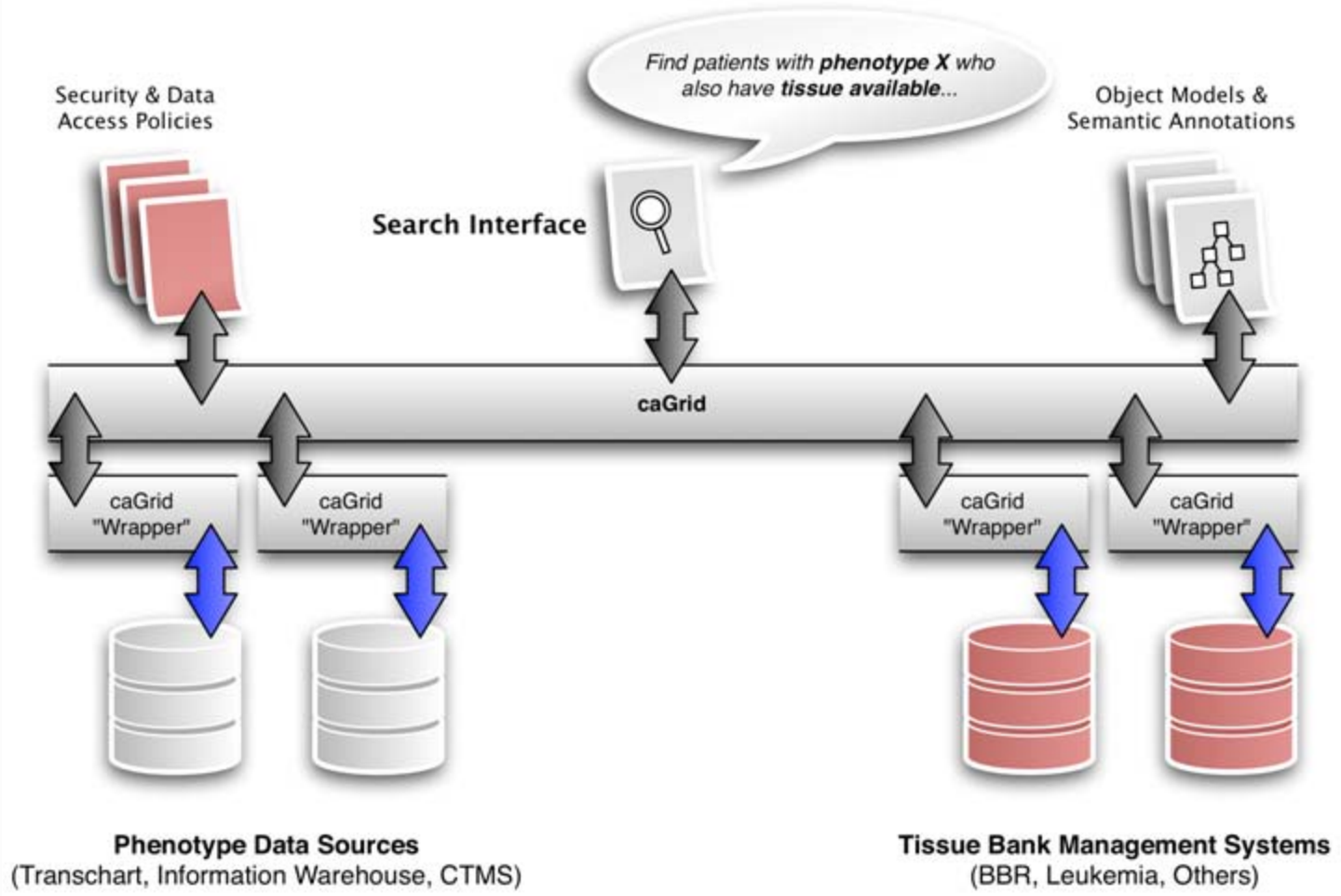
Functional Architecture



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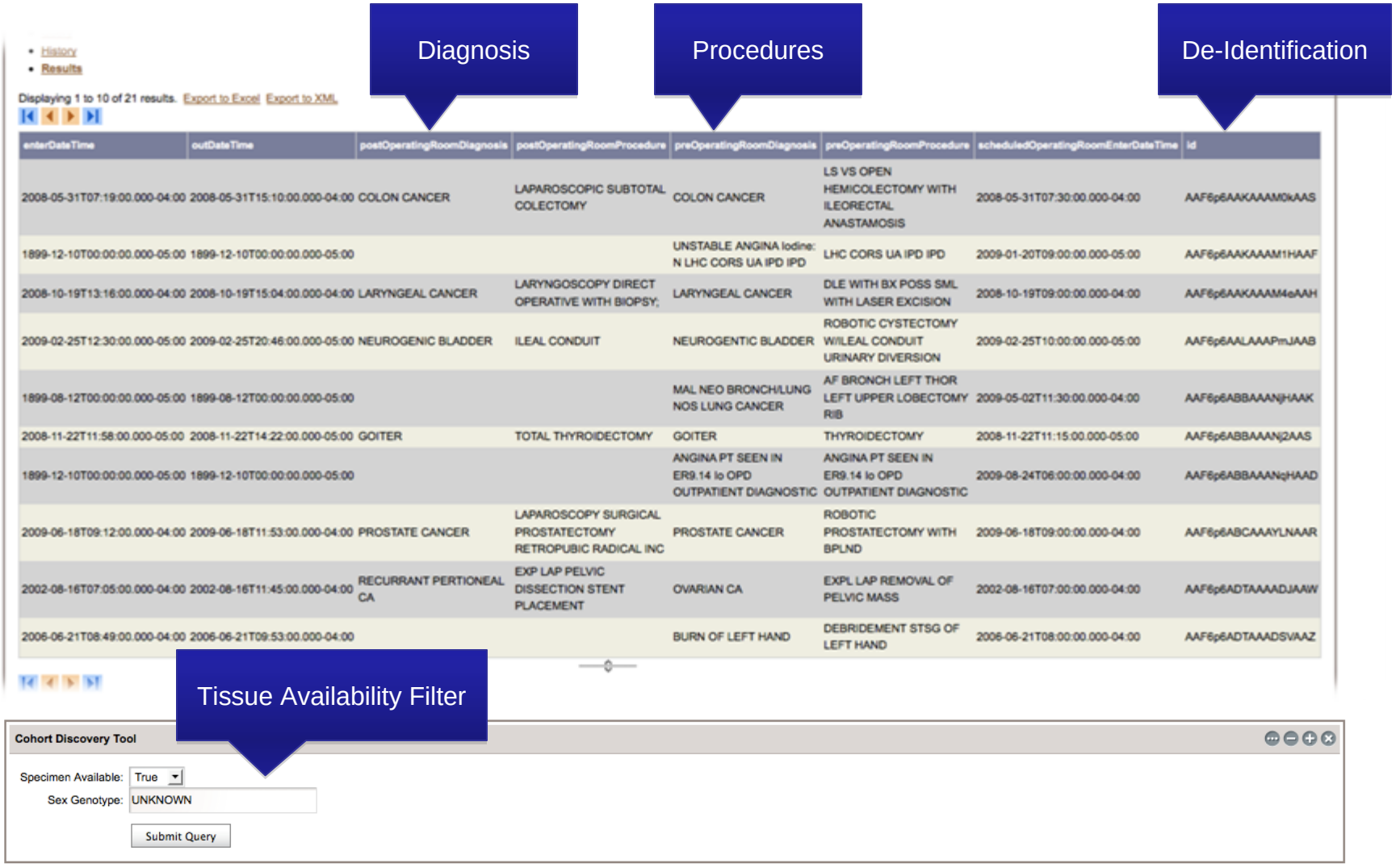
Cohort Discovery Portal Interface



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2008-10-19T13:16:00.000-04:00	2008-10-19T15:04:00.000-04:00	LARYNGEAL CANCER	LARYNGOSCOPY DIRECT OPERATIVE WITH BIOPSY;	LARYNGEAL CANCER	DLE WITH BX POSS SML WITH LASER EXCISION	2008-10-19T09:00:00.000-04:00	AAF6p6AAKAAAM4eAAH
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Fundamental Objective of Applied Informatics

Delivering timely and contextually appropriate data, information, and knowledge in support of basic science, clinical and translational research, clinical care, and public health.

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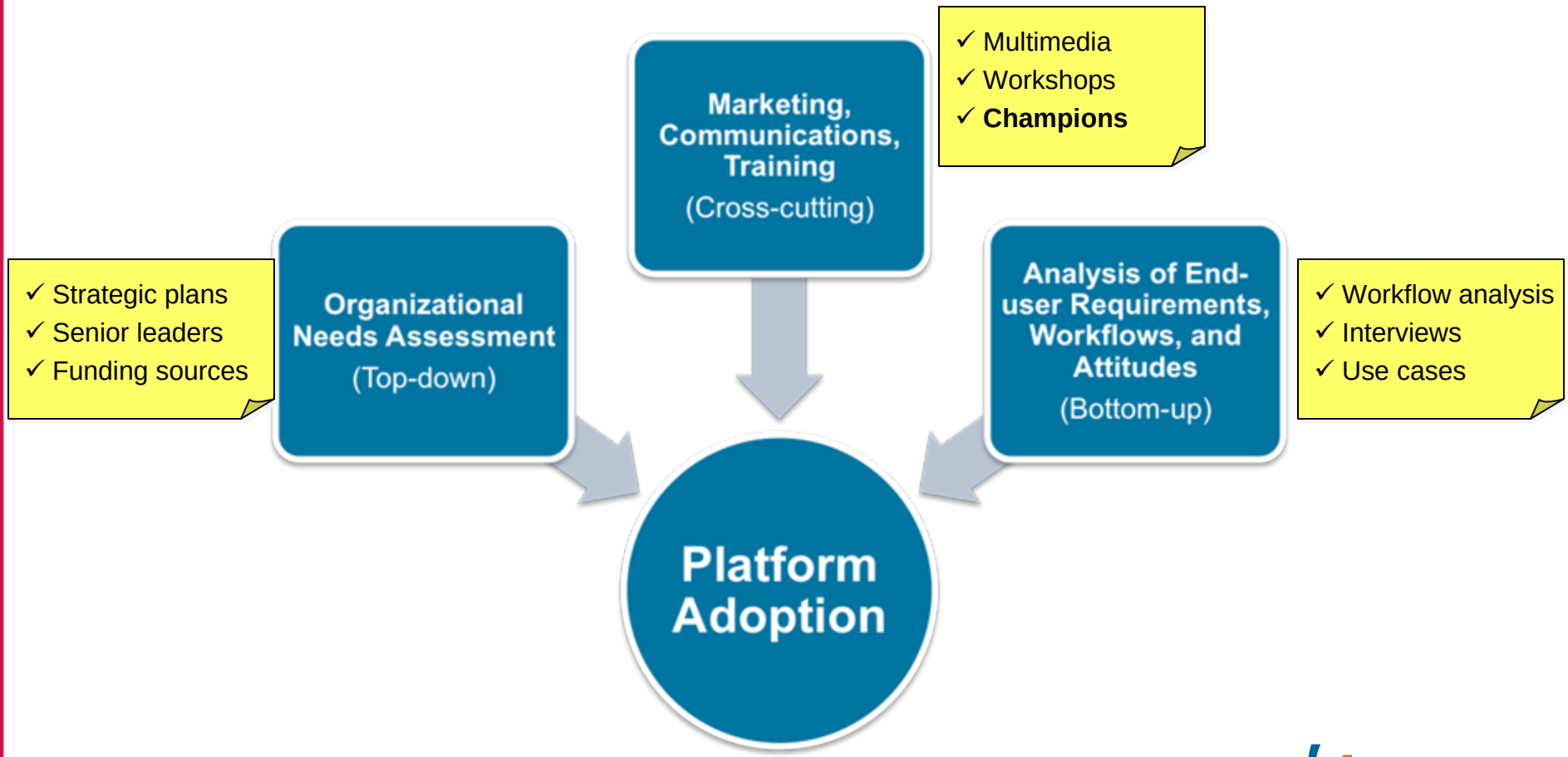
caBIG as a Foundation

Organizational Goal	Corresponding caBIG Platforms
Improve Clinical Research Capacity ✓ Clinical Studies ✓ Secondary Use ✓ Reporting	• **caArray** (Array Data Management) • **caTissue** (Biospecimen Management) • **C3PR** (Patient Registry) • **Patient Study Calendar** • **caAERS** (Adverse Event Reporting) • **C3D** (Protocol Management, EDC, Review/QA)
Support Teams ✓ Social networking ✓ Resource sharing ✓ Data sharing	• **caGrid** (Electronic Data Interchange) • **caXchange** (Lab Data Service Bus) • **C3D Connector** (C3D “Wrapper”) • **Lab Viewer** (Clinical System “Wrapper”) • **LexEVS** (Terminology Management) • **Semantic Media Wiki** (Annotated Wiki) • **NBIA** (Image and Annotation Sharing)
Accelerate T1 Translation ✓ Knowledge translation ✓ Hypothesis generation	• **caGWAS** (GWAS query processing) • **GenePattern** (Genomic Data Analysis) • **geWorkbench** (Biomarker Data Analysis) • **caIntegrator** (Translational Data Analysis)

Overcoming Barriers: Socio-technical Approaches to Enabling Platform Adoption



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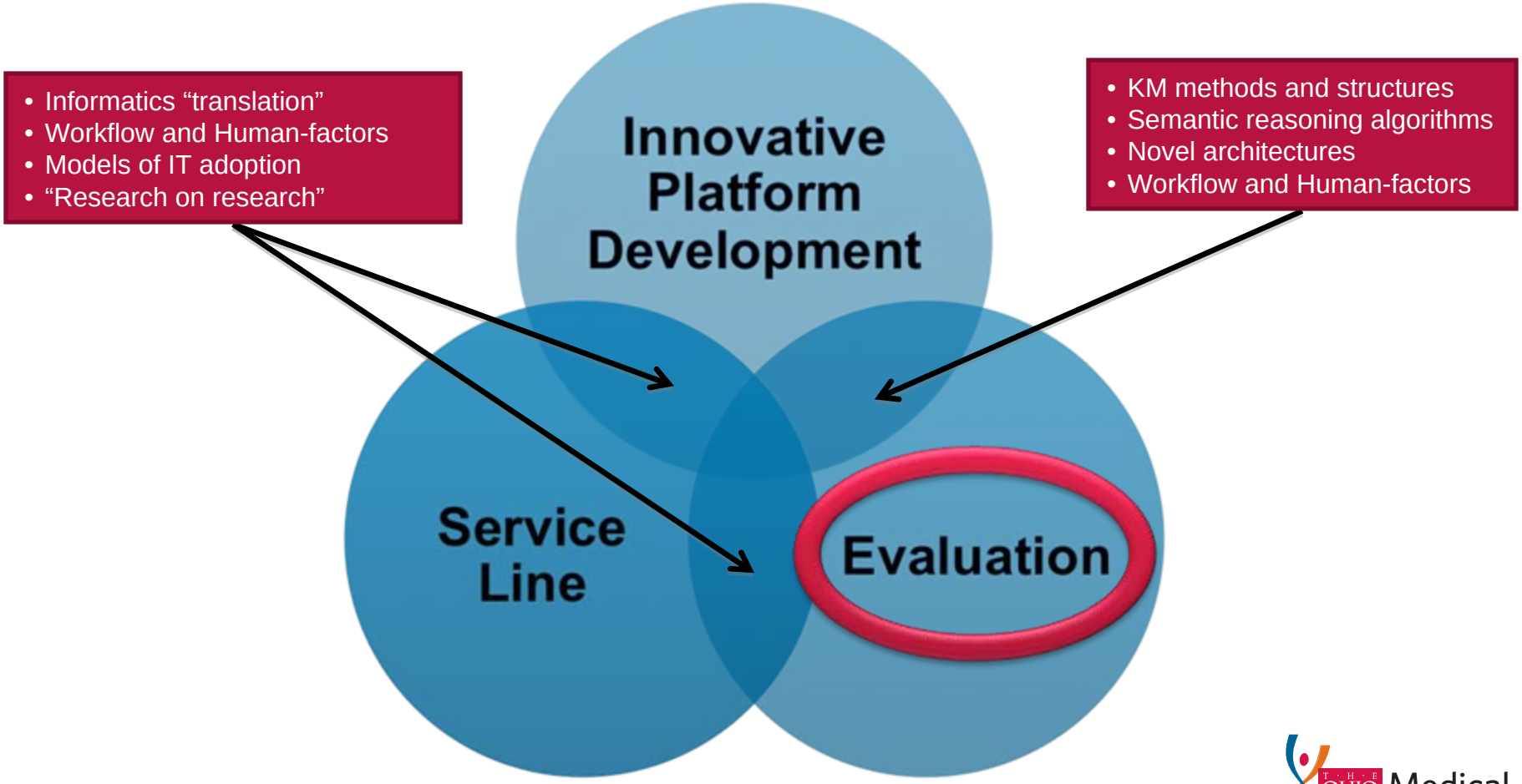
Next Steps: Combining Science & Service



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