

The Path to Wellness through Big Data

Personalized Medicine Initiative (PMI), PHEMI Systems, Hortonworks



Speakers



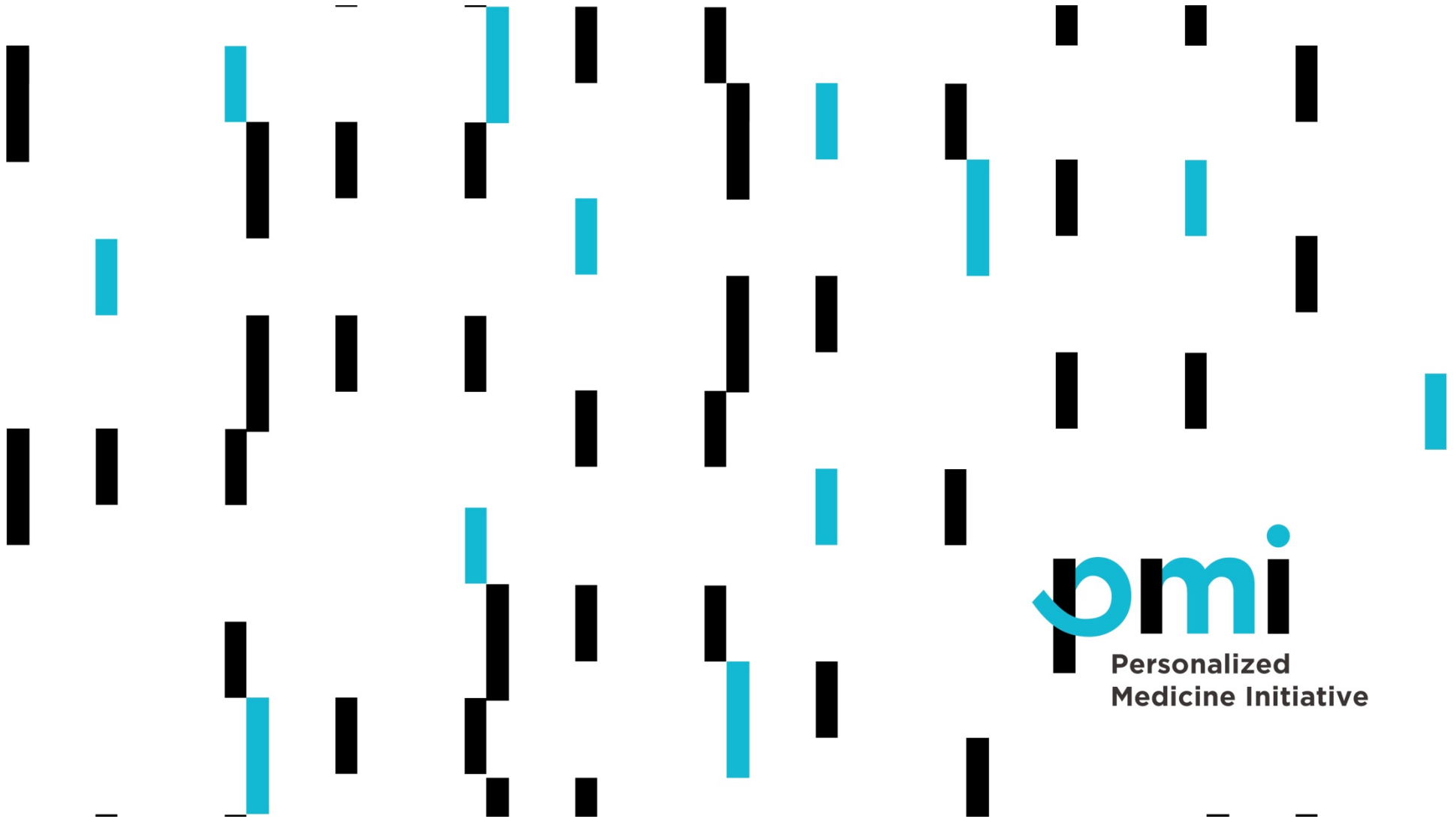
Dr. Robert Fraser
COO
Personalized Medicine
Initiative (PMI)

Dr. Fraser has a strong background and success rate in the development of targeted therapeutics. Driven by the need to better target the therapy to the individual to improve its safety and efficacy, he joined Dr. Cullis in 2011 to establish the PMI for British Columbia.



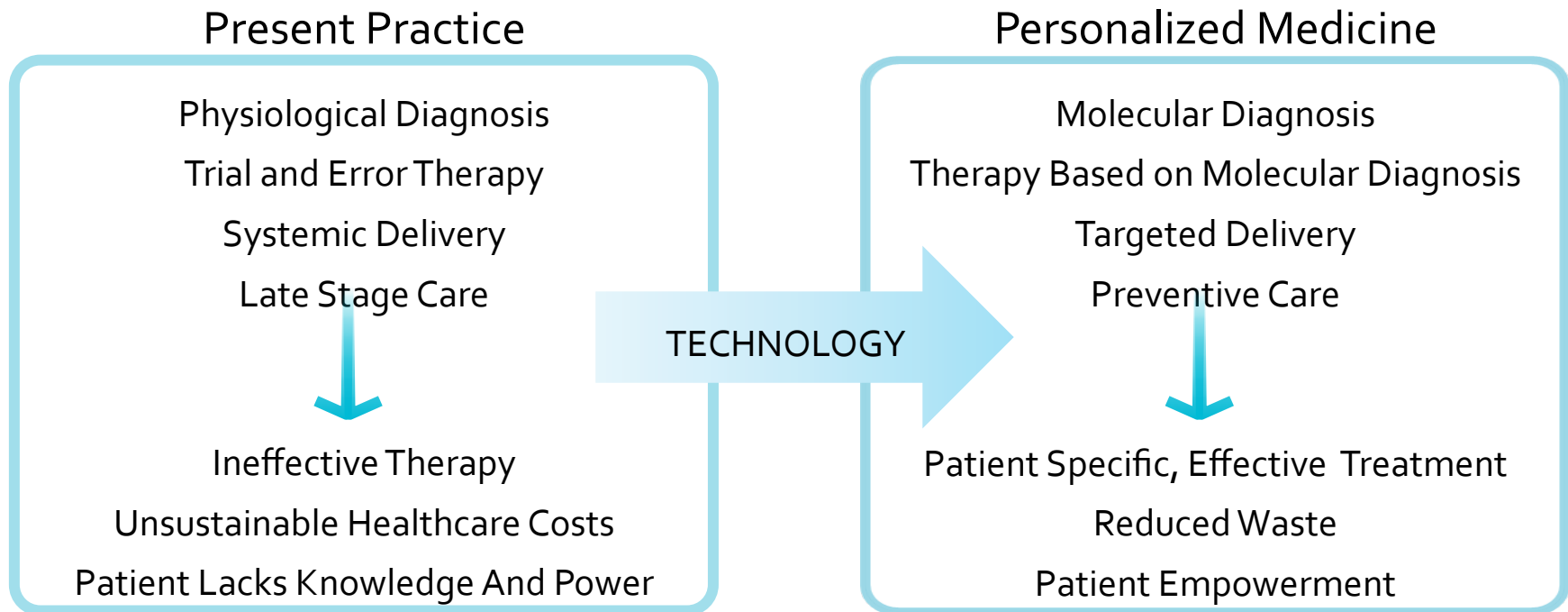
Roy Wilds
Dir. Product Management,
PHEMI Systems

Roy is responsible for PHEMI Central™ product development, and has been using big data technologies since 2007 to extract insights from data. Roy was the data mining team lead for multiple research teams, and has helped build protection tools for various data mining operations.



pmi
Personalized
Medicine Initiative

Personalized Medicine: A Massive Change In Medical Practice Driven By New Technologies That Characterize Individuals at the Molecular Level



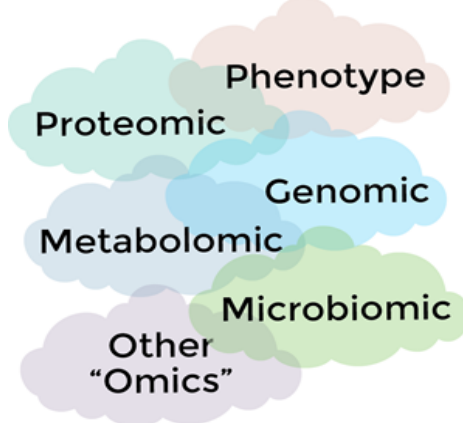


Vancouver-based not-for-profit organization

Vision:

Introduce an individualized approach to preventive and curative healthcare based on the molecular makeup of the individual and their disease

Molecular “Omic” Analyses

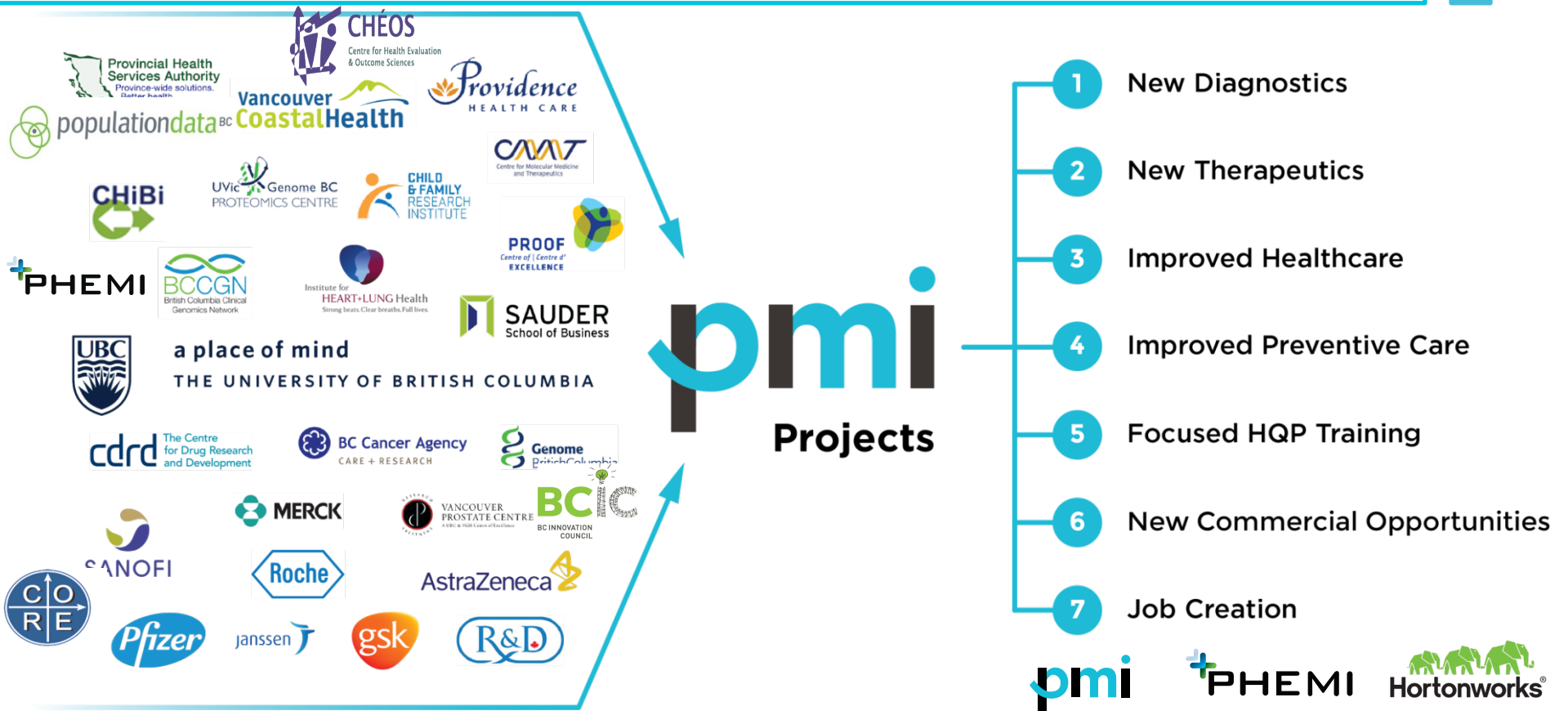


Your Personal Molecular Data Cloud

Benefits

- More effective and safer therapeutics
- Better matching of treatment to disease
- More effective preventive medicine; patient empowerment
- More efficient healthcare
- Identification of new drug targets and therapeutics

The PMI is Tightly Coupled With Clinical, Life Science and Natural Science Research Capabilities in BC



PMI Has Four Major Objectives (Roadmap for Bringing Personalized Medicine to Canadians)

1. Make a Whole System Change

- Engage government and other stakeholders to make the system changes necessary for implementation of personalized medicine

2. Engage Stakeholders

- Establish a coalition of stakeholders to drive implementation of personalized medicine and realize economic benefits

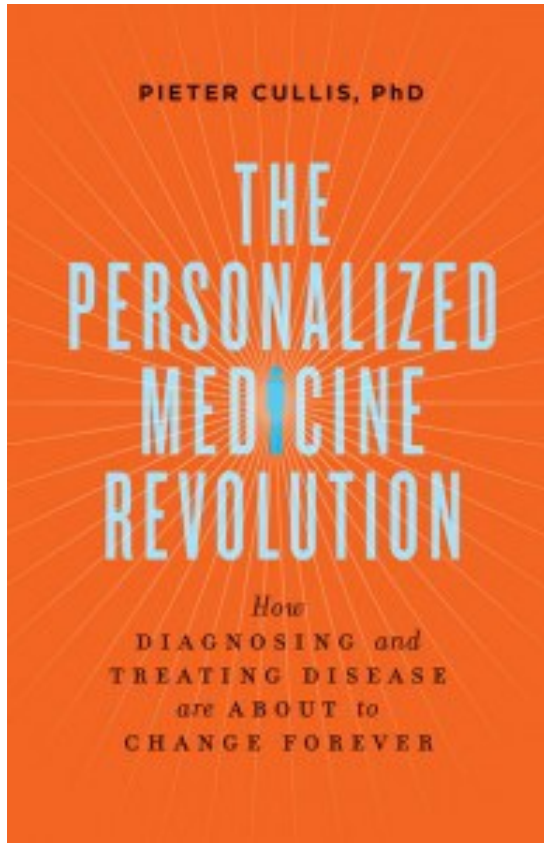
3. Take Advantage of Near-Term Opportunities

- Build on the strengths in personalized medicine already present in BC and Canada

4. Construct a Patient-Centred Clinical Database for BC and Canada

- Generate a database containing Omic data clouds for 25,000 Canadians over the next 5 years for enhanced preventive medicine and improved treatments for patients with disease

Personalized Medicine: The Time is Now



Roadmap for Bringing Personalized Medicine to British Columbians

“Preventing, Diagnosing and Treating Disease
Are Soon to Change Forever”

molecular you

HEALTH
PRECISION



Molecular You Corporation

MYCO provides:

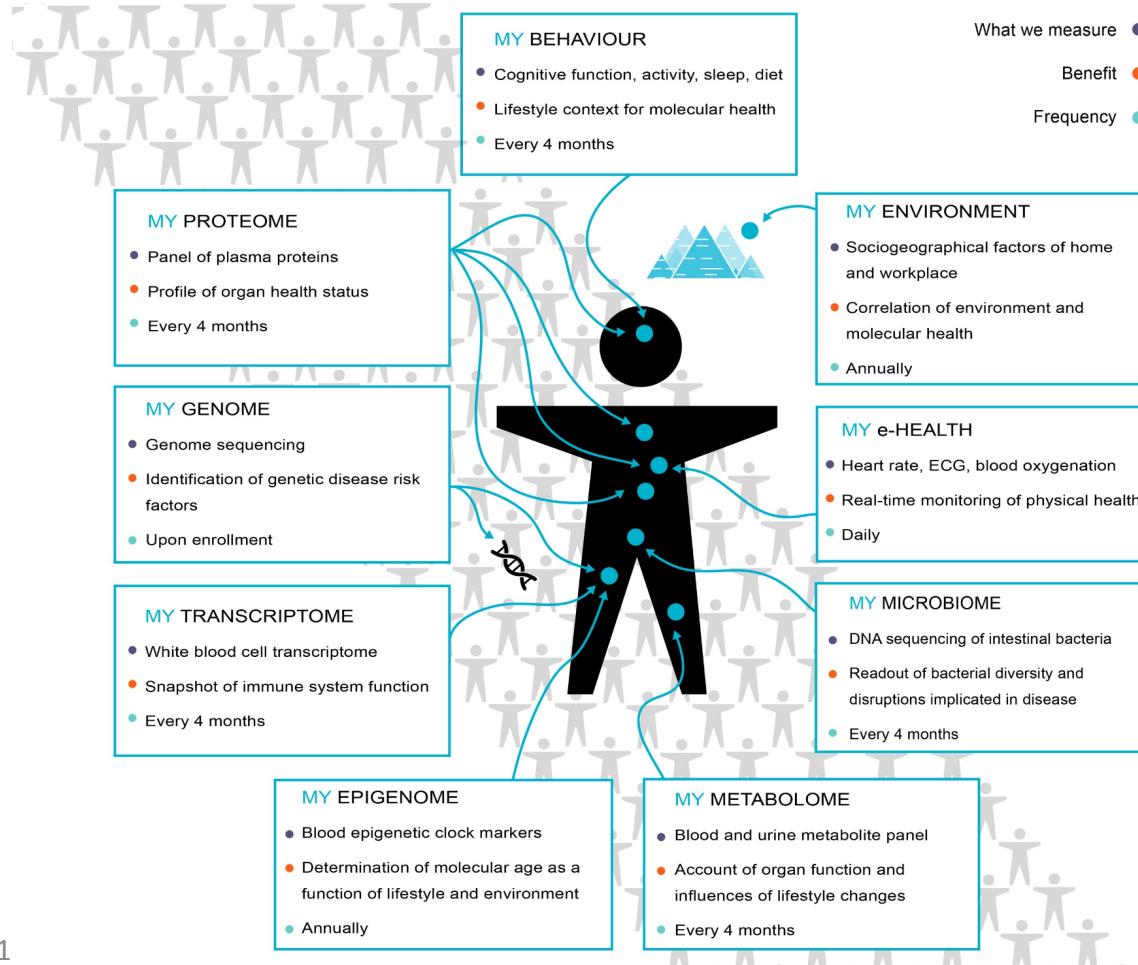
- a comprehensive, molecular-level health monitoring program for preventive medicine to detect early disease and monitor response to therapy.
- a molecular analysis program to stratify disease to better match treatment to the individual patient

THE MOLECULAR YOU PROGRAM

- Whole exome sequencing up front
- Every four months:
 - Proteomic analysis of blood (>200 proteins)
 - Metabolomic analysis of blood (>200 metabolites)
 - Microbiomic analysis of colon (>1,000 bacteria)
 - Download continuous monitoring of vital signs (heart rate etc.)
 - Bioinformatic analysis of data (early signs of disease, response to therapy etc.)
 - Consultation with healthcare professional to interpret data



Molecular You: Data Cloud for Precision Health



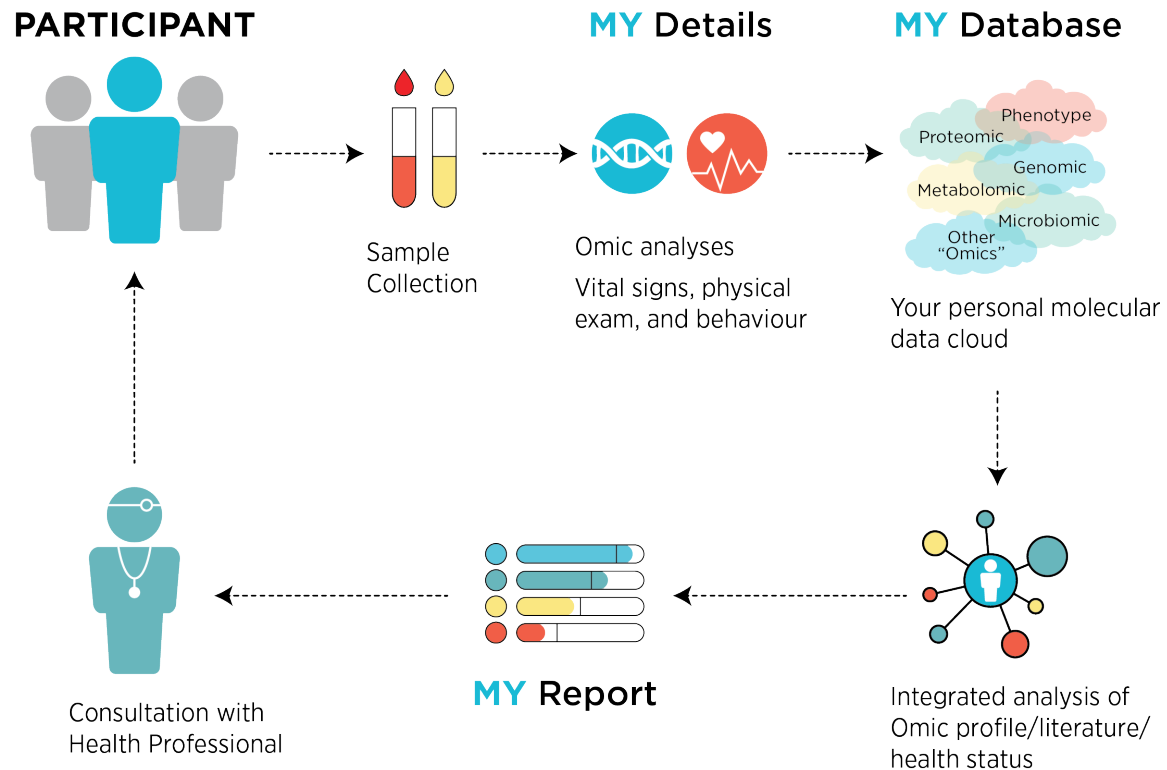
Molecular You : Competitive Advantages

- ❑ BC and Canada have single payer system
 - Inherent interest in cost containment
 - Potential for reimbursement if value demonstrated
- ❑ MYCO is tightly integrated into the medical system
 - Family practice
 - Hospital-based specialists
- ❑ Population is multi-ethnic
- ❑ Advanced bioinformatic capabilities



- ❑ Partnered with PHEMI with operational, secure “Big Data” database
- ❑ Infrastructure is in place to gather, analyze and share Omic data with approved stakeholders

Molecular You Program

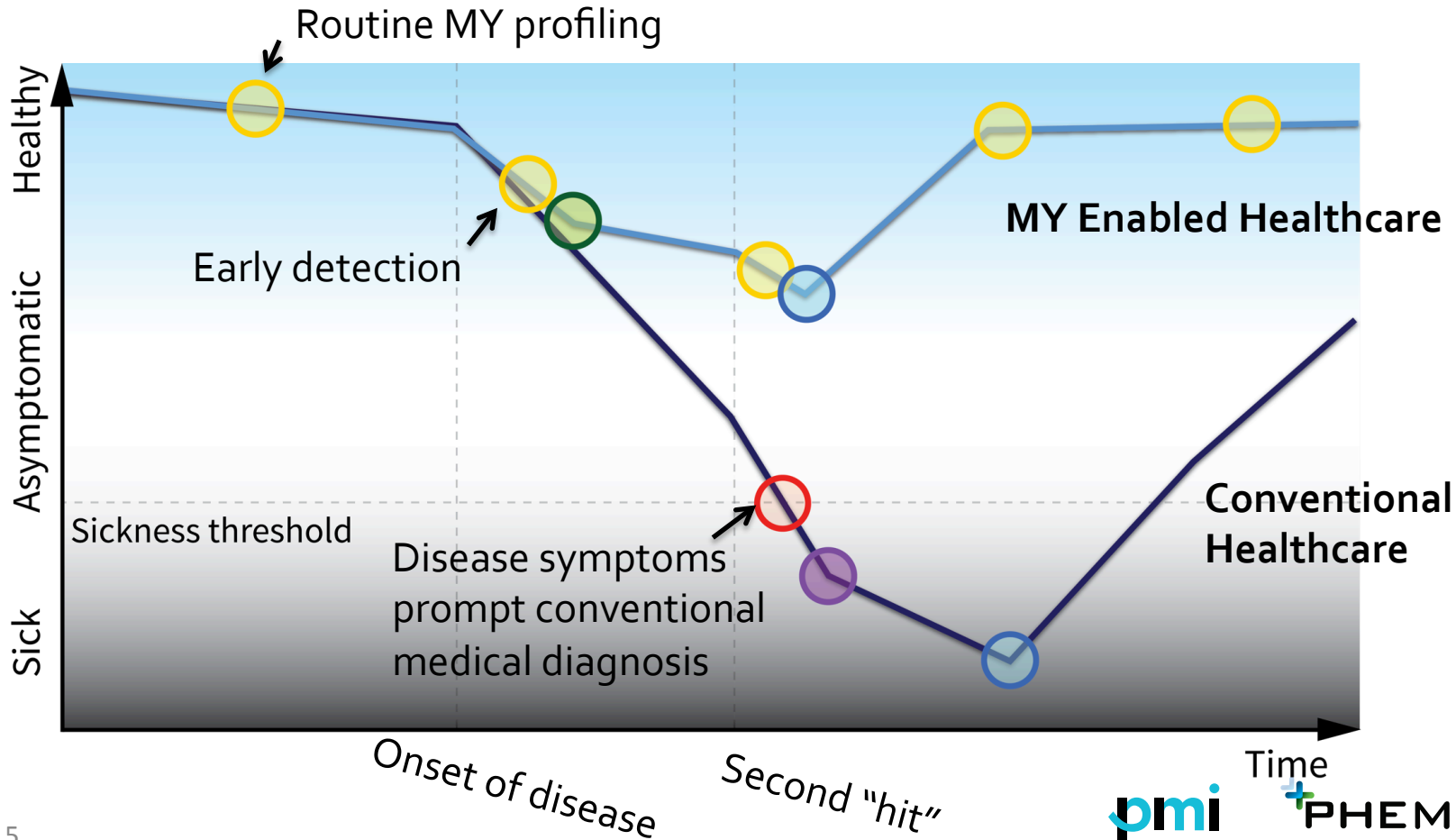


Molecular You for Preventive Health Care



- ❑ Identify biomarkers of health and disease
- ❑ Early indication of disease or disease risk
 - Reveal hereditary conditions/risks
 - Mine molecular you data-cloud to detect early signs (or trends towards) disease
 - Treat disease at its earliest state
- ❑ Monitor effectiveness of interventions
 - Determine most healthful diet for you
 - Effectiveness of physical activity
 - Effectiveness of drug regimens

Molecular You: Preventive Healthcare Direct to Consumer

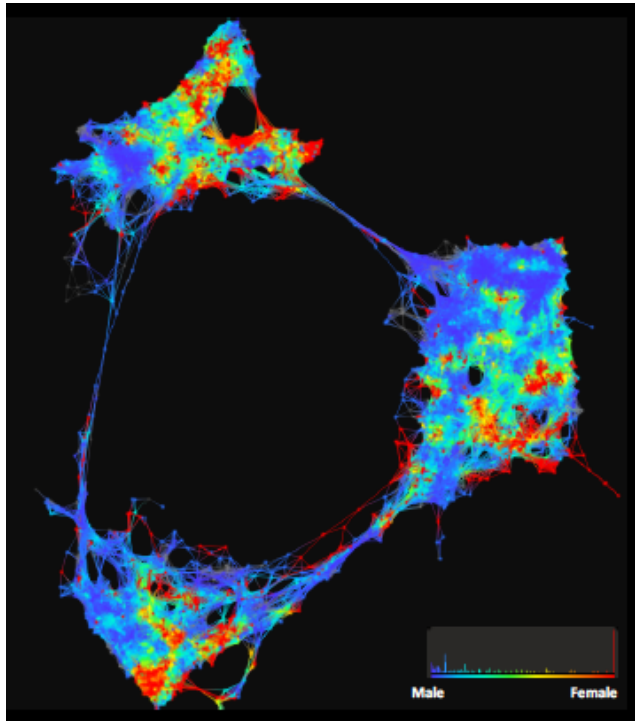


Molecular You Applications: Improvement of Treatments for Ill People

- ❑ Construct molecular you data clouds for cohorts of people suffering from prevalent diseases
 - Determine biomarkers to identify patients who will respond to standard therapies
 - Identify patient cohorts requiring new therapeutic interventions
 - Identify alternative treatments for people who will not respond to standard therapy
 - Eliminate trial and error, one size fits all approach
 - Improve outcomes, reduce costs
 - Data will support reimbursement strategy



Diabetes Type 2,3 and 4; Are there more?



- ❑ Analysis Type 2 Diabetics in 30K Patient Database
- ❑ Clustered into risk of different comorbidities (no genetics)
- ❑ Re-analysis with genetics indicated a correlation of disease clusters with patient genetic profile

Molecular You Applications: Improvement of Treatments for Ill People

- ❑ Select patients / disease cohort
 - Mental Health (Alzheimer's, Parkinson's, depression, anxiety etc)
 - Heart (Atrial Fibrillation, heart failure)
 - Cancer
 - Pulmonary (Asthma, COPD)
 - Hypertension/ Cardiovascular
 - Osteoarthritis
 - Diabetes
 - Kidney Disease



Molecular You: A Revolution in Health Precision

- ❑ Empowering the individual to take care of their health
 - Direct to consumer marketing to enable the individual to practice preventive healthcare
- ❑ Empowering the medical system to identify the most effective treatments for the individual
 - Stratifying disease into molecularly different subsets, matching therapy to these subsets of disease
 - Improve outcomes, reduce costs
- ❑ Establishing a data base that can be productively mined for biomarkers associated with disease and new targets for therapeutics

The Path to Wellness Through Big Data

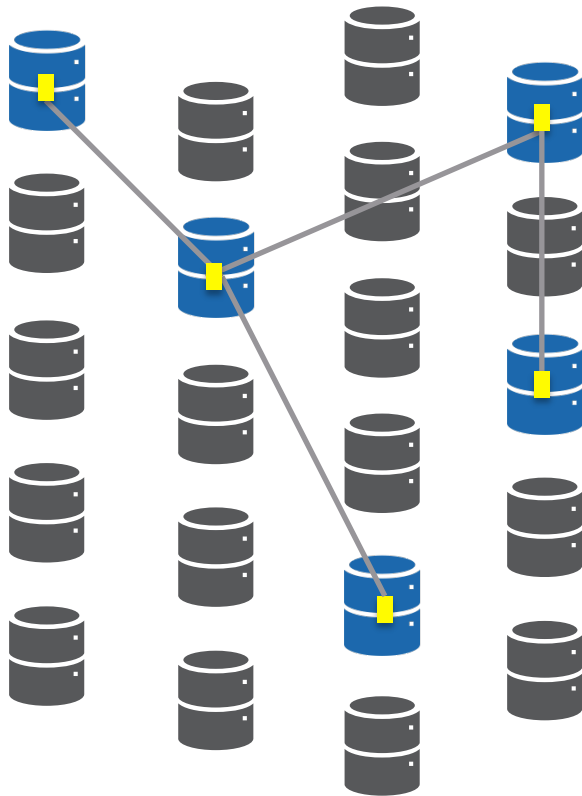
Personalized Medicine Initiative Relies on PHEMI Central to Share Data Securely



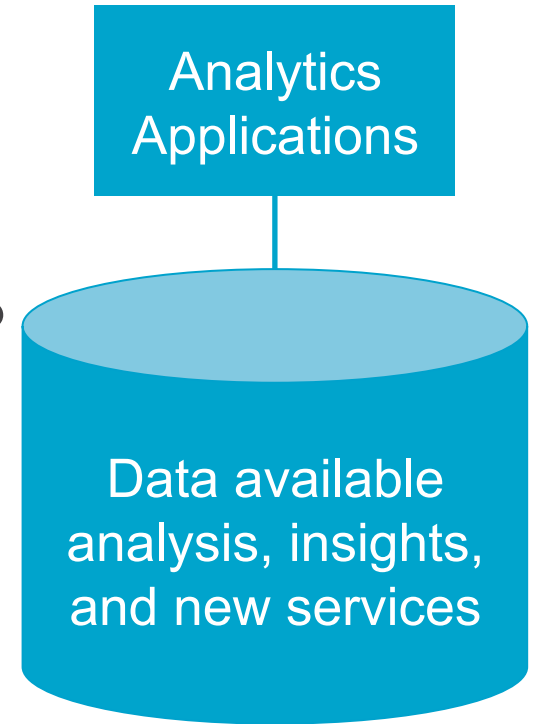
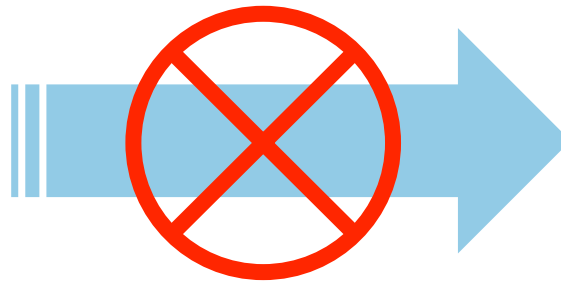
Big Data. Shared. Simply. Securely.

Roy Wilds, Director of Product Management
PHEMI Systems
rwilds@phemi.com

The Data Dilemma

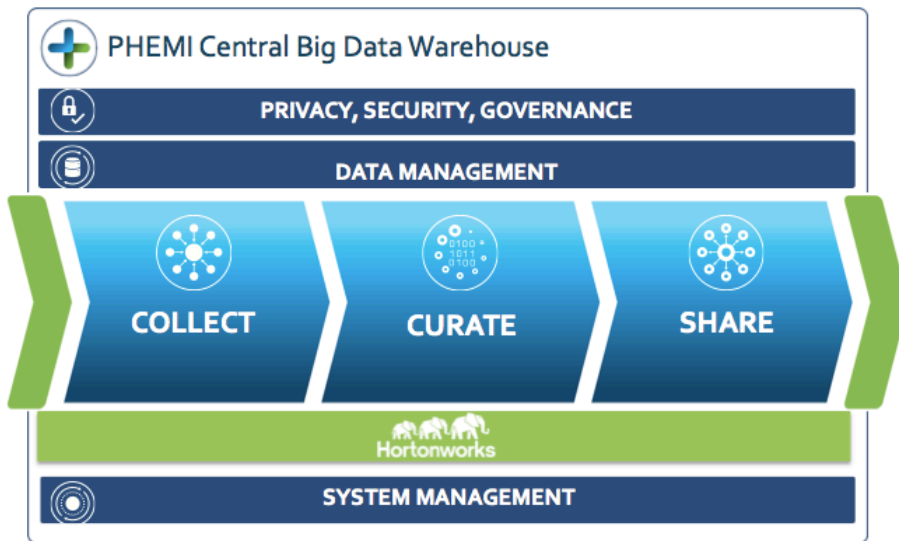


Share and Protect?

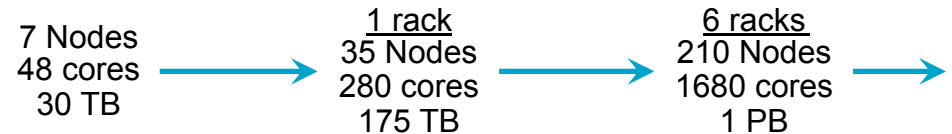


How do I **share data**
for **secondary use**
without compromising **privacy,**
security, and governance?

PHEMI Central Big Data Warehouse

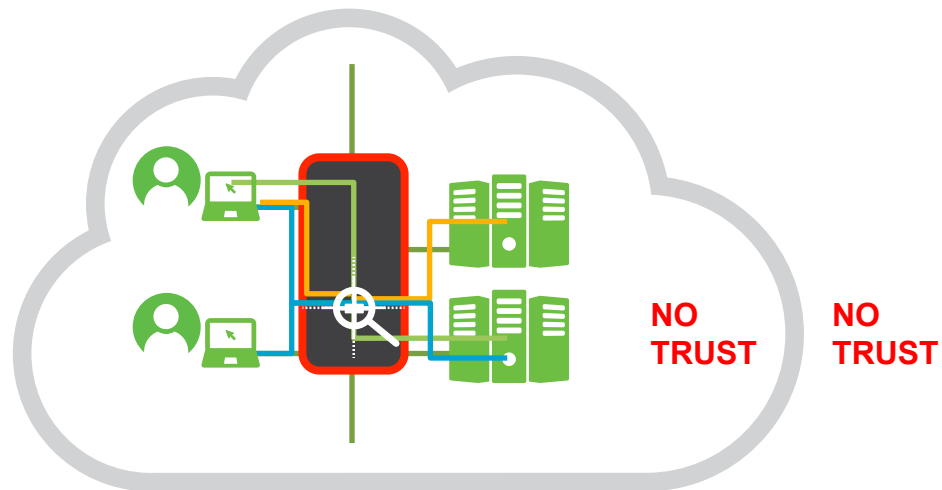


Data Management software runs on commercial servers on customer premise or in AWS cloud



The Zero Trust Data Approach: Don't Trust Anyone

Zero Trust Networks

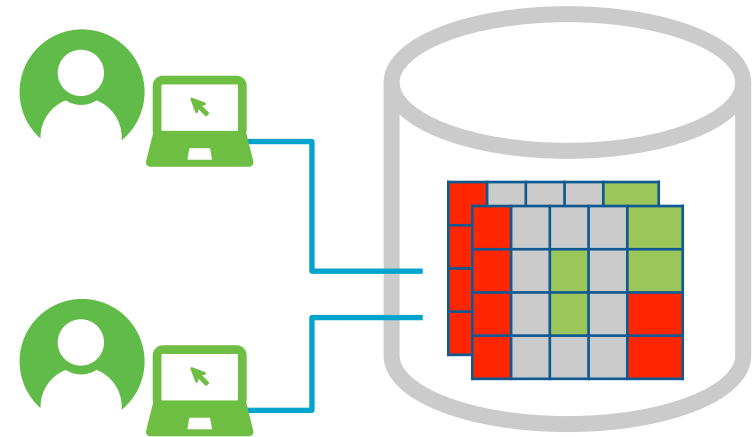


Access to subnet

Based on:

- Information in IP packet header

Zero Trust Data



Access to data

Based on:

- People and device attributes
- Data characteristics

Why Zero Trust Data is Important for Healthcare

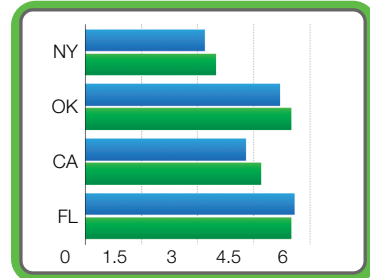
Clinician Full Patient Health Record

Patient Name: Stan
 PHN: 13542
 Address: 123 Any Street, Town, NY
 Zip Code: 10029
 DOB: 15-05-62
 Weight: 187
 LDL: 2.7
 HDL: 1.1
 Triglycerides: 2.0
 Total Cholesterol: 4.2
 :

Researcher Report on cholesterol by age and gender, including masked patient data and calculated values

DOB	Sex	LDL	HDL	Triglyc	Total Chol
**--62	M	2.7	1.1	2.0	4.2
**--47	M	2.8	1.6	1.4	4.7
**--83	F	3.2	1.6	1.6	5.1
**--55	F	1.7	1.3	2.1	3.5
**--79	M	2.9	1.9	1.7	5.1
**--68	F	1.9	1.8	1.3	3.96
**--75	F	3.0	1.5	1.5	4.8
**--55	M	2.9	1.4	1.1	4.5
:	:	:	:	:	:

Statistician Histogram summary of patient cholesterol rates across the US, no PHI



Patient Lab test results optimized for patient.

Patient Name: **Stan** PHN: 13542
 Test Date: **2015-10-09**
 Lab: Metrolab
 Your cholesterol level: **2.8 mmol/L**
 Target cholesterol level: **1.7 mmol/L**
 ✓ You are 8% closer to your goal!
 ♥ Your heart health rating is 6.5

+ PHEMI Central Big Data Warehouse

PD

Name	PHN	State	DOB	Sex	LDL	HDL	Triglyc	...
Stan	13542	NY	15-05-62	M	2.7	1.1	2.0	
Emil	26534	OK	27-12-47	M	2.8	1.6	1.4	
Carol	94613	TX	03-06-83	F	3.2	1.6	1.6	
Padma	57236	FL	16-09-55	F	1.7	1.3	2.1	
Qing	46478	CA	08-05-79	M	2.9	1.9	1.7	
Madhavi	92741	NV	01-03-68	F	1.9	1.8	1.3	
Jenny	13562	OR	13-09-75	F	3.0	1.5	1.5	
Amir	35253	WA	28-08-55	M	2.9	1.1	1.1	
:	:	:	:	:	:	:	:	:

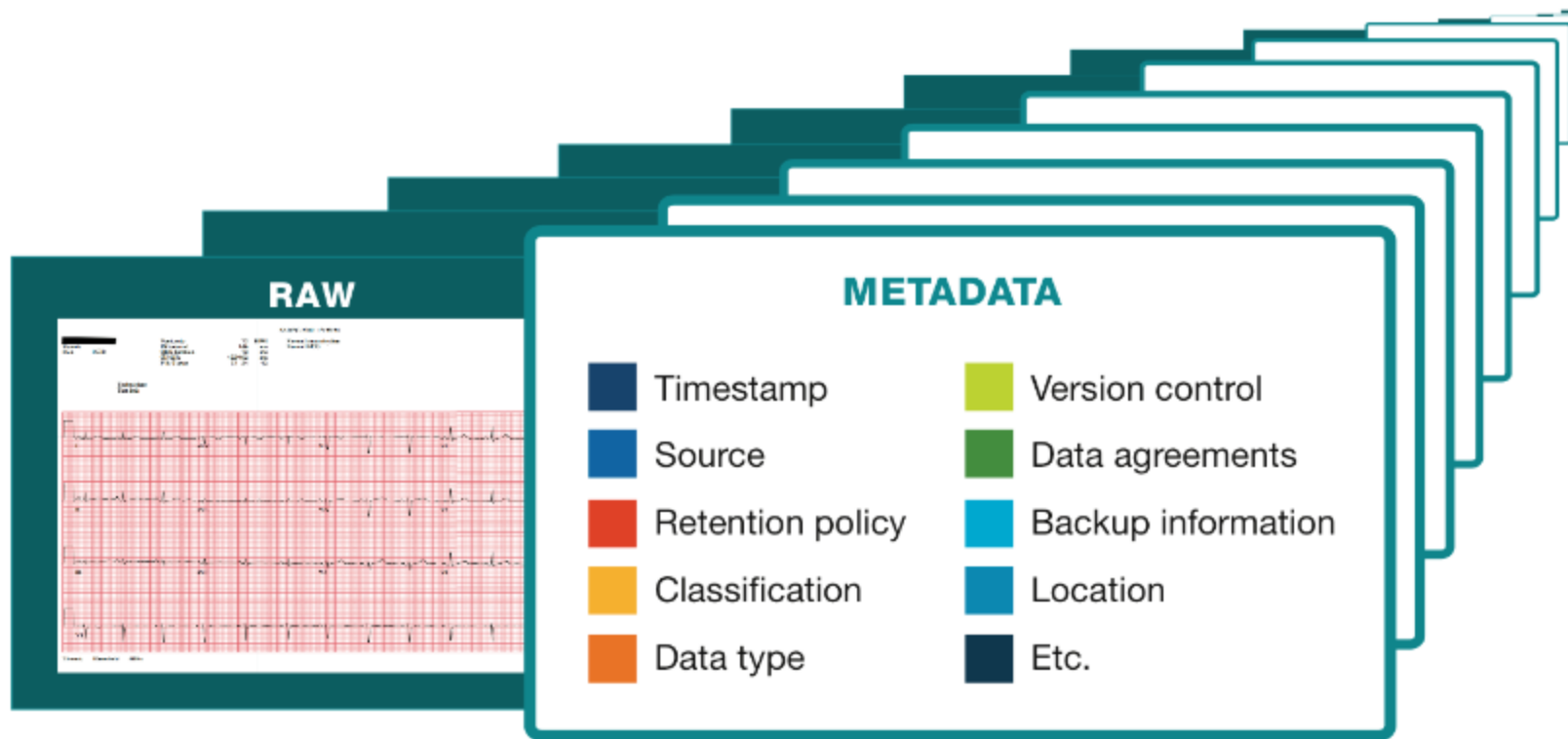
DATASET



How We Implement Zero Trust Data in PHEMI Central

Metadata

Billions of Assets



User Attributes

Access Control Based on User Attributes

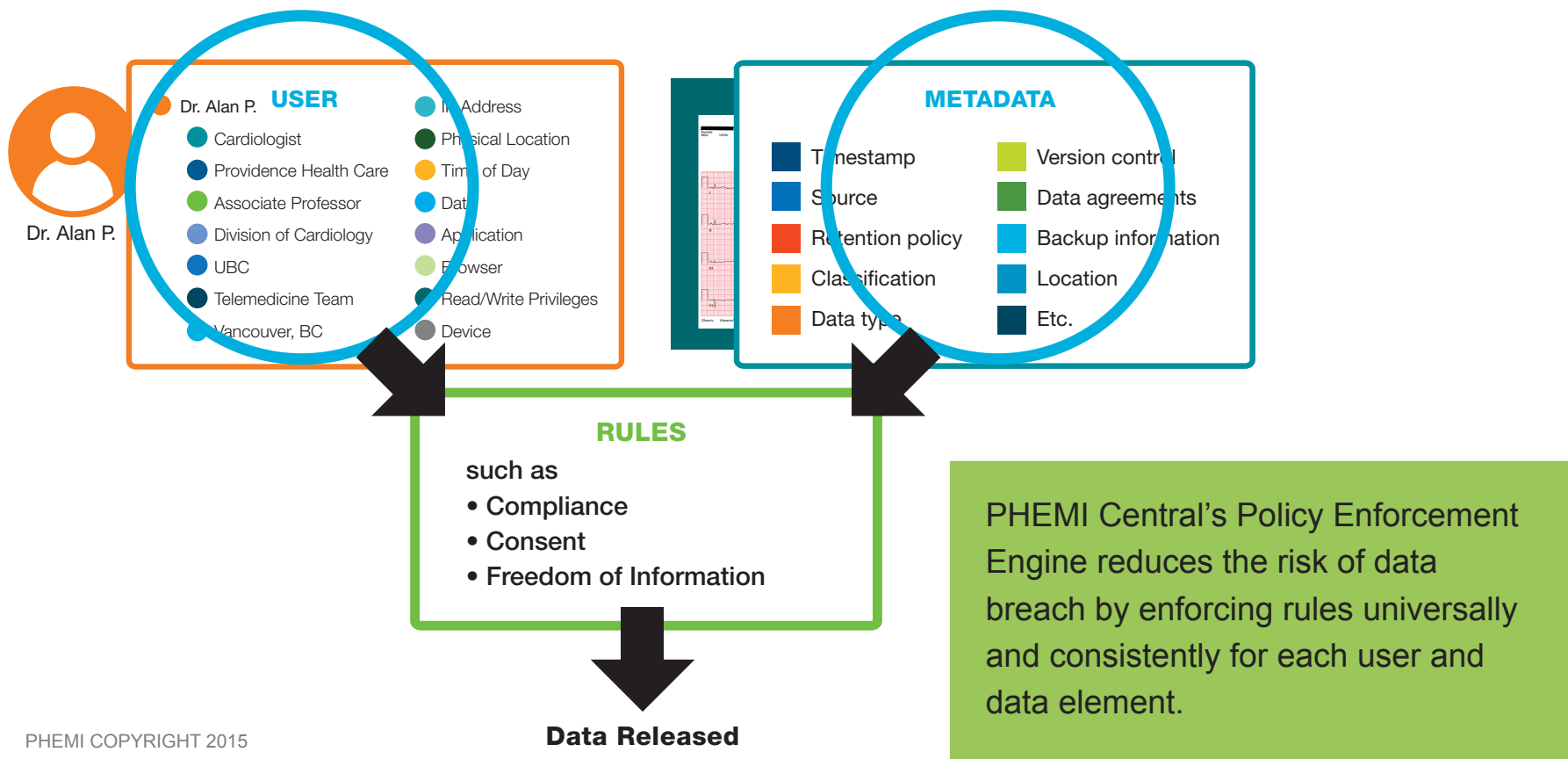


Dr. Alan P.

- Dr. Alan P.
- Cardiologist
- Providence Health Care
- Associate Professor
- Division of Cardiology
- UBC
- Telemedicine Team
- Vancouver, BC
- IP Address
- Physical Location
- Time of Day
- Date
- Application
- Browser
- Read/Write Privileges
- Device


Protect

Zero Trust to Read Data



Benefits of Zero Trust Data

Defend information assets at the data layer



Allow access based on extensible metadata and user attributes

Automatically maintain privacy and confidentiality



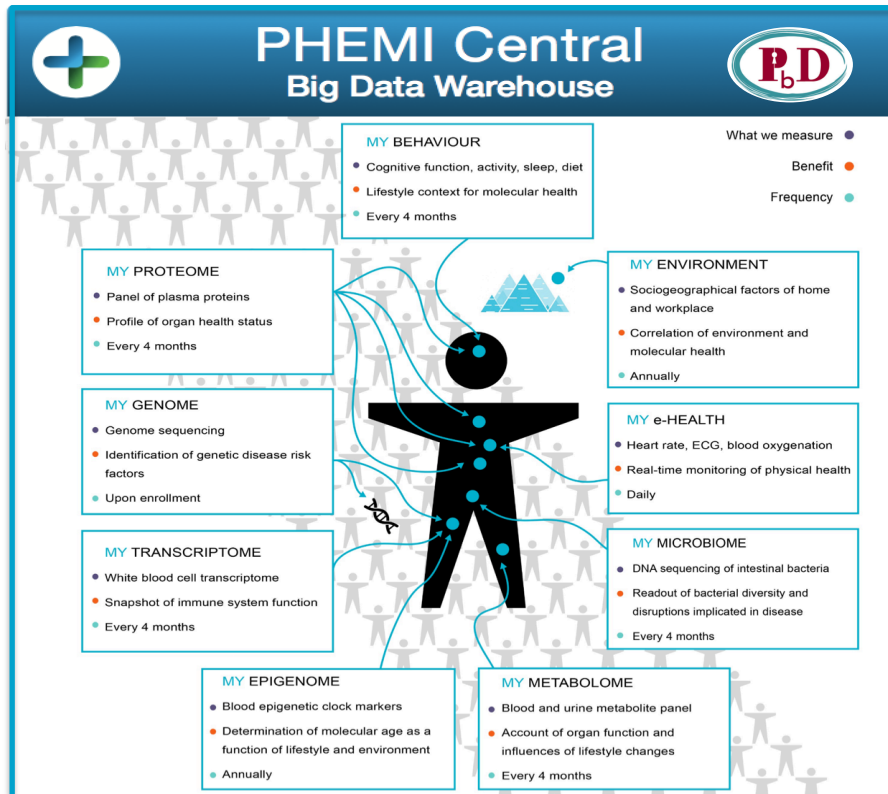
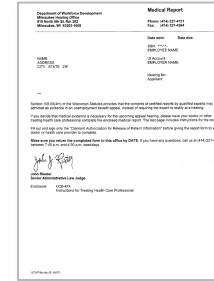
Dynamically virtualize data and manage consent, data sharing

Scale economically and accelerate big data returns



Simplify and reduce time and cost for new data, new applications, new users

Molecular You: Using Big Data for Wellness



- Early warning system
- Prevent, delay, mitigate
- Quarterly molecular screening
- Grow to 25,000 patients
- 15+ varied data sources
- Longitudinal study
- Rich research



Thank You

Roy Wilds, PhD

Director of Product Management, PHEMI Systems

rwilds@phemi.com

Questions?

Personalized Medicine Initiative / Molecular You

<http://personalizedmedicineinitiative.ca>

Zero Trust Data: Solving the Data Dilemma

<http://phemi.com/learn/resources/whitepapers/zero-trust-data/>

Hortonworks and PHEMI Partnership

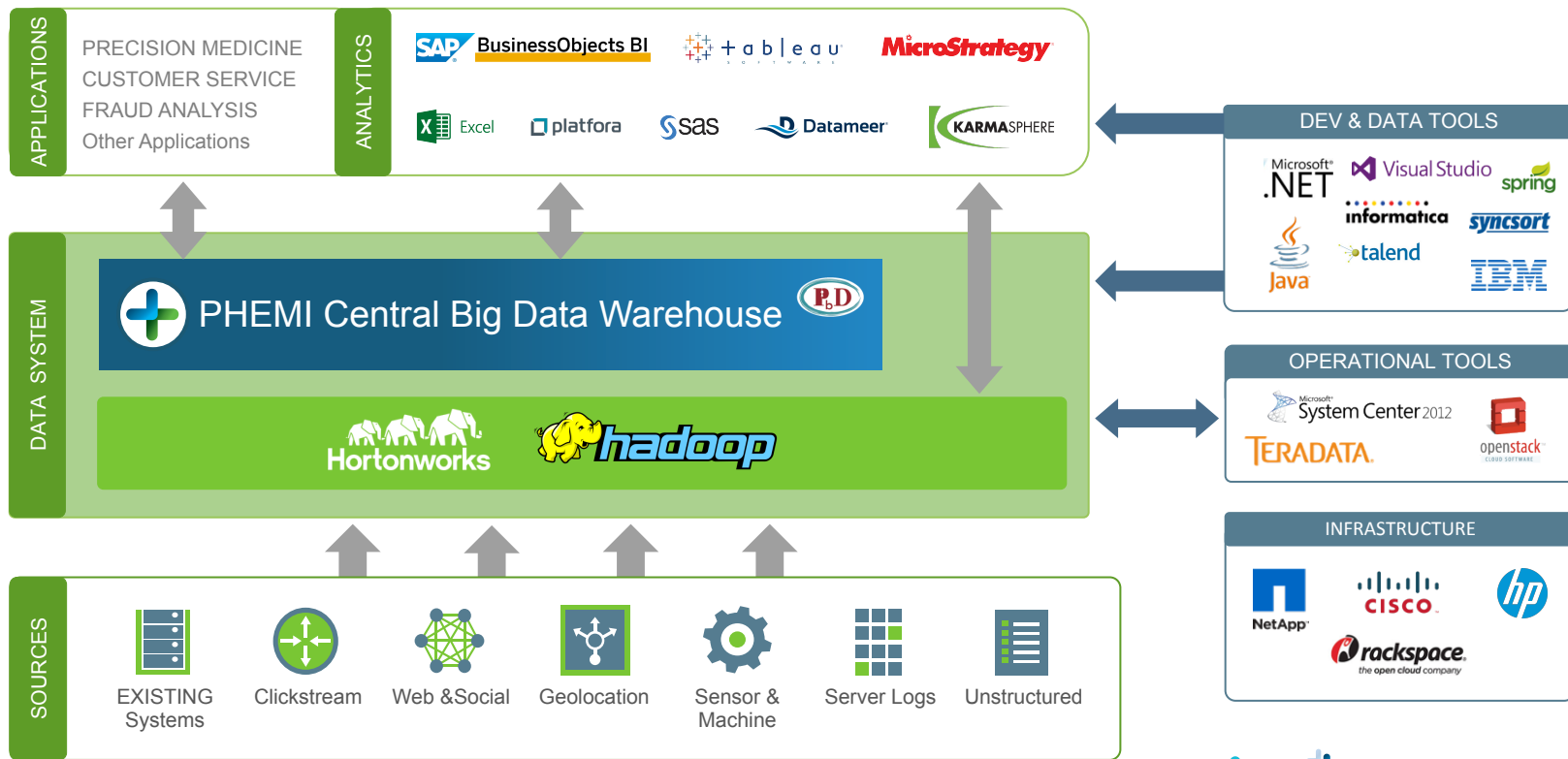
<http://hortonworks.com/partner/phemi>

Health Care and Big Data

<http://hortonworks.com/industry/healthcare/>

PHEMI Big Data Warehouse in the Modern Data Architecture

Integrated data management system based on Hortonworks Data Platform

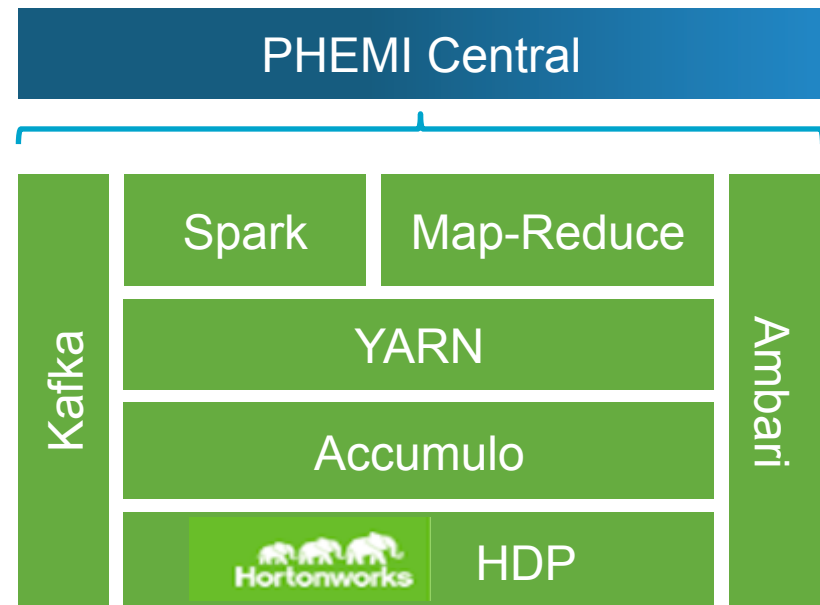


PHEMI Architecture Components

Privacy, Security, and Governance “out of the box”



- Distributed, scalable base
- PHEMI Central
 - Coordinates and manages all processes
 - Abstracts and simplifies distributed concepts
 - Audits and manages data and interactions



Thank You