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Presented to

CERN openlab

Oracle in Healthcare

CERN openlab “IT in Healthcare” Workshop

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EMEA Healthcare and Life Sciences Industry Solutions Group
November 11, 2014

ORACLE HEALTHCARE

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Program Agenda

1. Setting the scene
2. What is the opportunity?
3. How can Oracle help?
4. Oracle experience
5. Discussion

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Oracle Addresses the Full Healthcare and Life Sciences Ecosystem

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Market and Trends

Shifting Payment Models

Changing Science

Increasing Data Volumes

Regulatory Pressures

Point Applications
Limited, not scalable, and reinforce silos

Homegrown Tools
Expensive to build and maintain

Established Solutions
Often proprietary, closed, and inflexible

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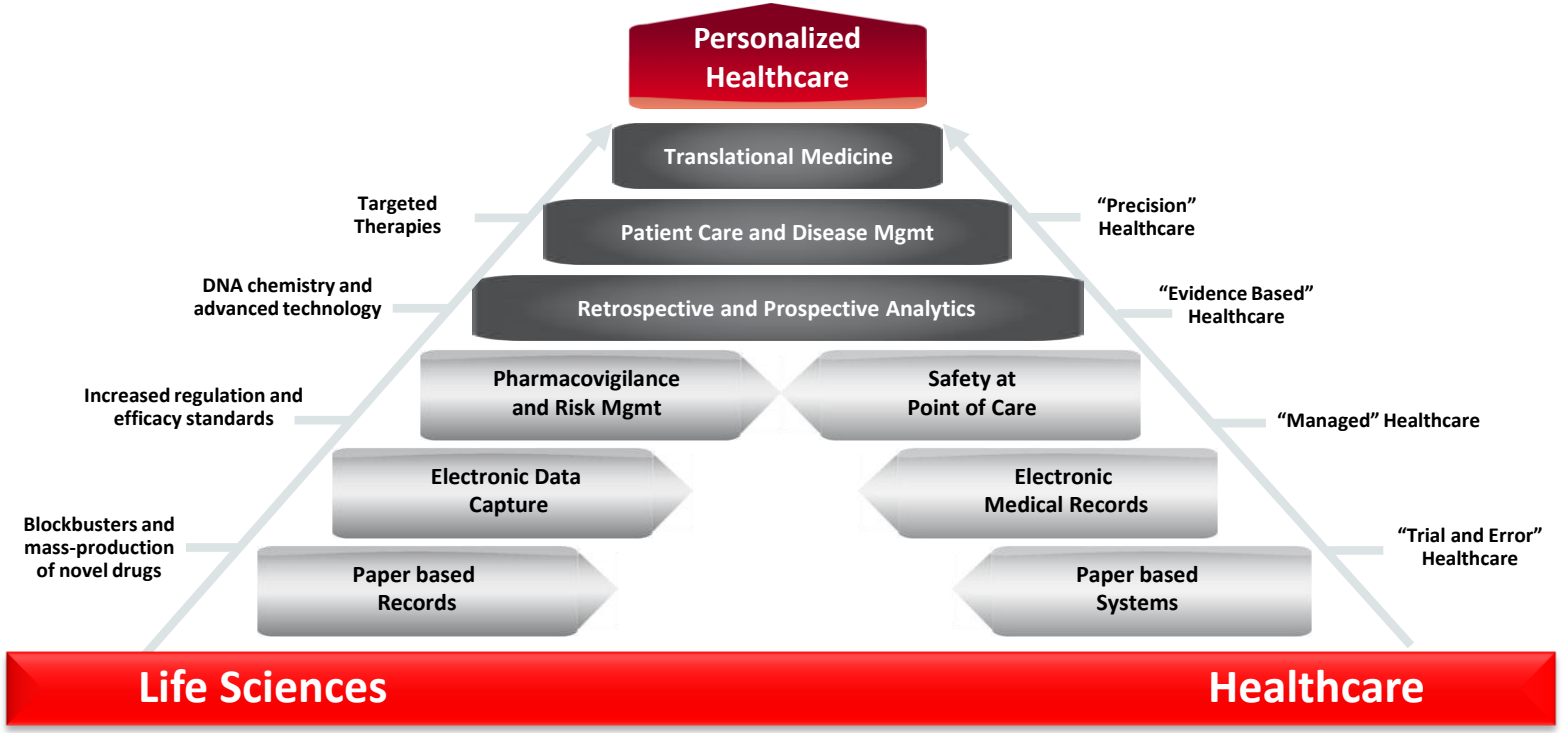
Convergence Between Healthcare and Life Sciences Leading to Personalized Healthcare



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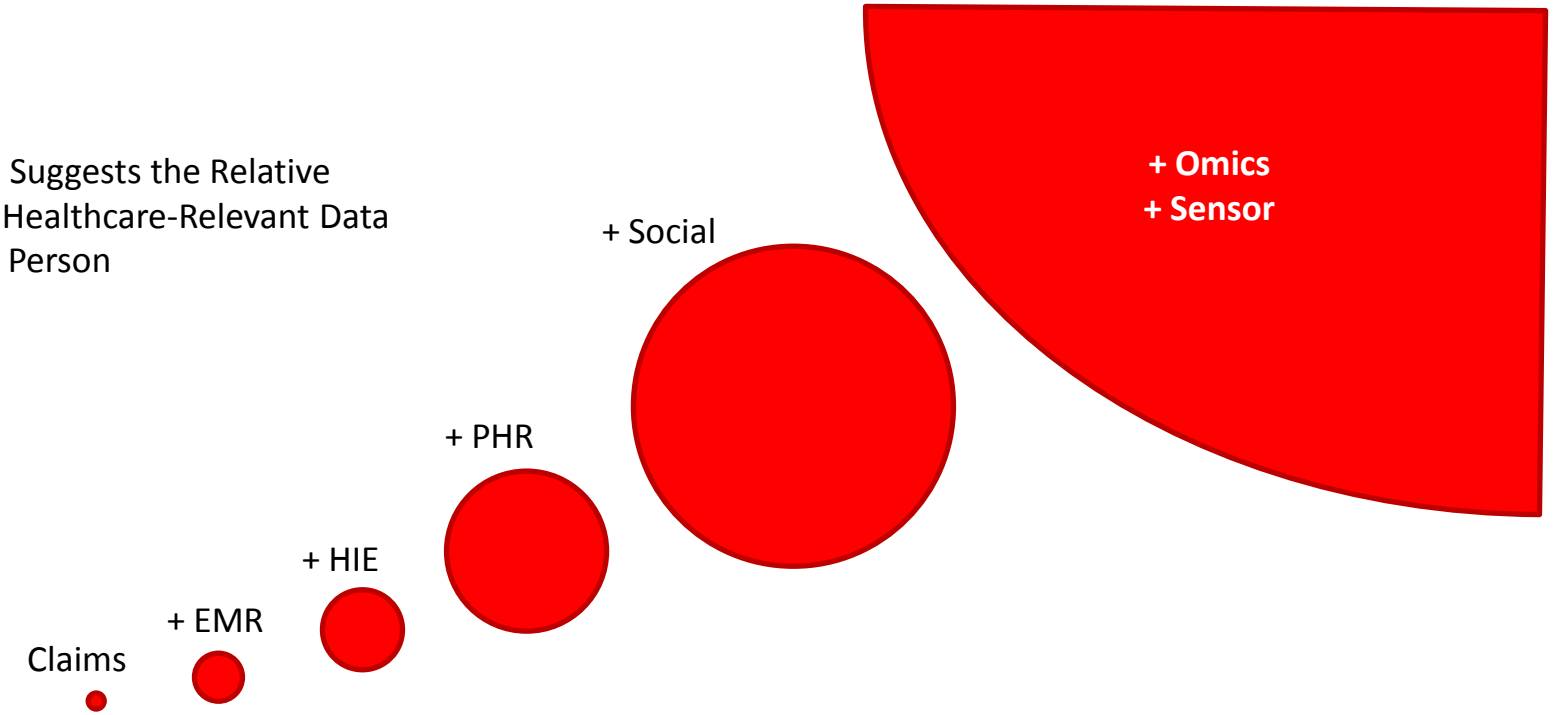
In the Coming Decade Healthcare Data Will Be Big, Real Big

Circle Area Suggests the Relative Volume of Healthcare-Relevant Data on a Given Person



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A Big Data Example

With existing data

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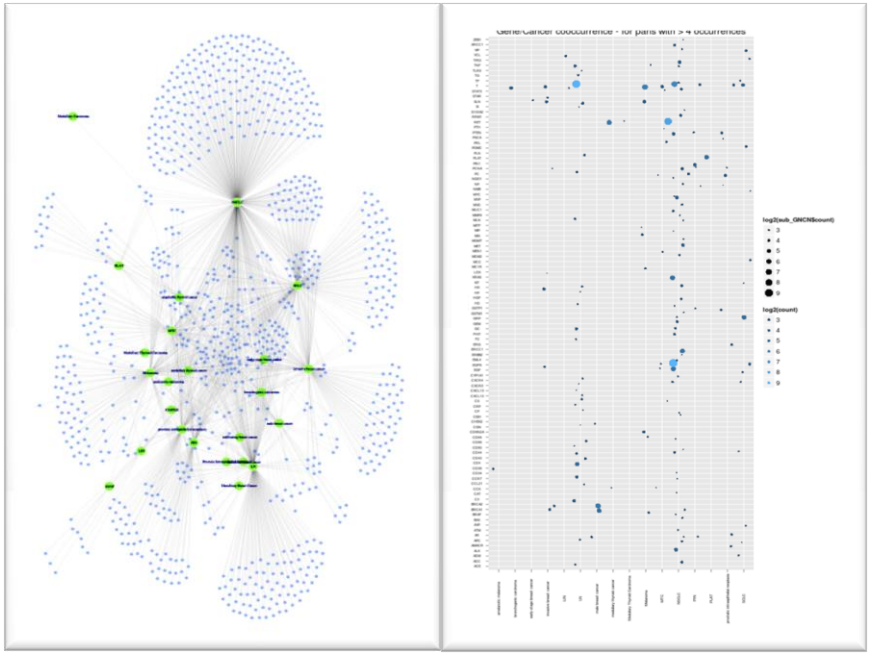
National Cancer Institute, Oracle & SAIC

Identifying Relationships between Gene to Cancer Interaction

- Analyzed 20 million medical publication abstracts in order to cross-reference the relationships between 17000 genes and five major cancer types
- Cross-referenced genes from 60 Million patients and miRNA for a simulated 900 Million population
- Results: understanding additional layers of the pathways these genes operate in and the drugs that target them is expected to help researchers accelerate their work in areas of importance for all humanity



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CTOVISION.COM

CONTEXT FOR THE CTO, CIO, CISO AND DATA SCIENTIST

BIG DATA ANALYSIS CLOUD COMPUTING CTO BOOKS SOCIAL MEDIA WEB2.0 SPA

EVENT NEWS GADGETS ANDROID THE FUTURE TECH HUMOR NATIONAL SECURITY ROBO

You are here: Home / Analysis / The winner of the 2012 Government Big Data Solutions Award is the NCI Frederick National Laboratory

The winner of the 2012 Government Big Data Solutions Award is the NCI Frederick National Laboratory

November 20, 2012 By BobGourley

Like +1 Tweet Share Pin it

The Government Big Data Solutions Award was established to highlight innovative solutions and facilitate the exchange of best practices, lessons learned and creative ideas for addressing Big Data challenges. The Top Five Nominees of 2012 were chosen for criteria that included:

- Focus on current solutions: The ability to make a difference in government missions in the very near term was the most important evaluation factor.
- Focus on government teams: Industry supporting government also considered, but this is about government missions.
- Consideration of new approaches: New business processes, techniques, tools, models for enhancing analysis are key.

"Our mouths were open in amazement"

– Dr. Robert Stephens
– Director of Bioinformatics, National Cancer Institute

http://ctovision.com/2012/11/the-winner-of-the-2012-government-big-data-solutions-award-is-the-national-cancer-institute/

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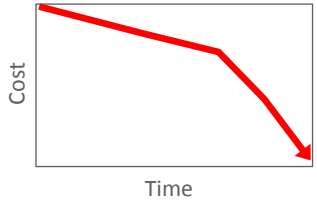
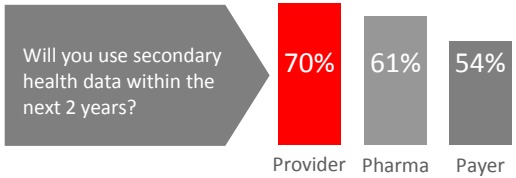
Industry Trends

Significant reduction in cost of genome sequencing



Increase in real-world data



Aggregation and analysis of Big Data

More than half of clinical trials already have a molecular biomarker component

Patient stratification to identify population subsets most likely to respond to a therapy

Cloud technologies are enhancing R&D collaboration

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Our Vision

Facilitate researchers access to clinical and genomics patient data across the world to advance medical research and its translation to better healthcare

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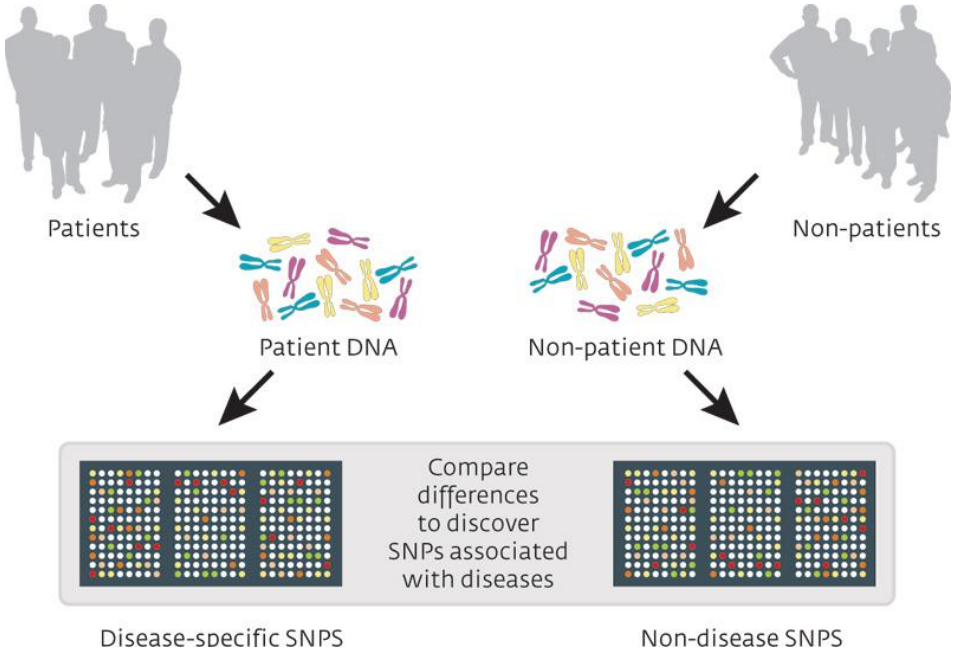
Translational Research

On the path to Personalized Medicine



Ability to discover high quality biomarkers which in turn will enable early detection, rapid effective treatment and improved quality of care for patients with considerable associated cost savings ("right treatment for the right patient")

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A Healthcare Research Database

The opportunity for Medical Researchers

Research Entity

- Attract quality scientists by enabling them with access to data
- Attract more clinical trials by using data for Trial certainty
- Break down organizational barriers between Clinical, Research, Biostatisticians, IT, Business and across institutions to enable knowledge sharing
- Enable convergence of Science, Medicine, Biotech and ICT to produce next generation products and personalized genomic medicine

Industry

- Identify markers that will predict needs and risks of patients so interventions can be pre-emptive.
- Improve hypotheses and decision making – fail early
- Quickly and easily identify cohorts with similar characteristics
- Move from trial's looking for patients to trials designed specifically for patients, fast tracking clinical trial process from years to months
- Benefit from global collaboration around hard to find diseases and mutations

Technology

- Collapse research cycle times and minimize demands on IT by providing self-service analytics to researchers and clinicians
- Integrate the data once and re-use for many purposes
- Increase productivity and break barriers to entry by providing an open platform – Oracle tools, customer tools, researcher tools
- Flexible Oracle platform - only buy and use the Oracle components you need
- Better TCO by leveraging prebuilt healthcare components

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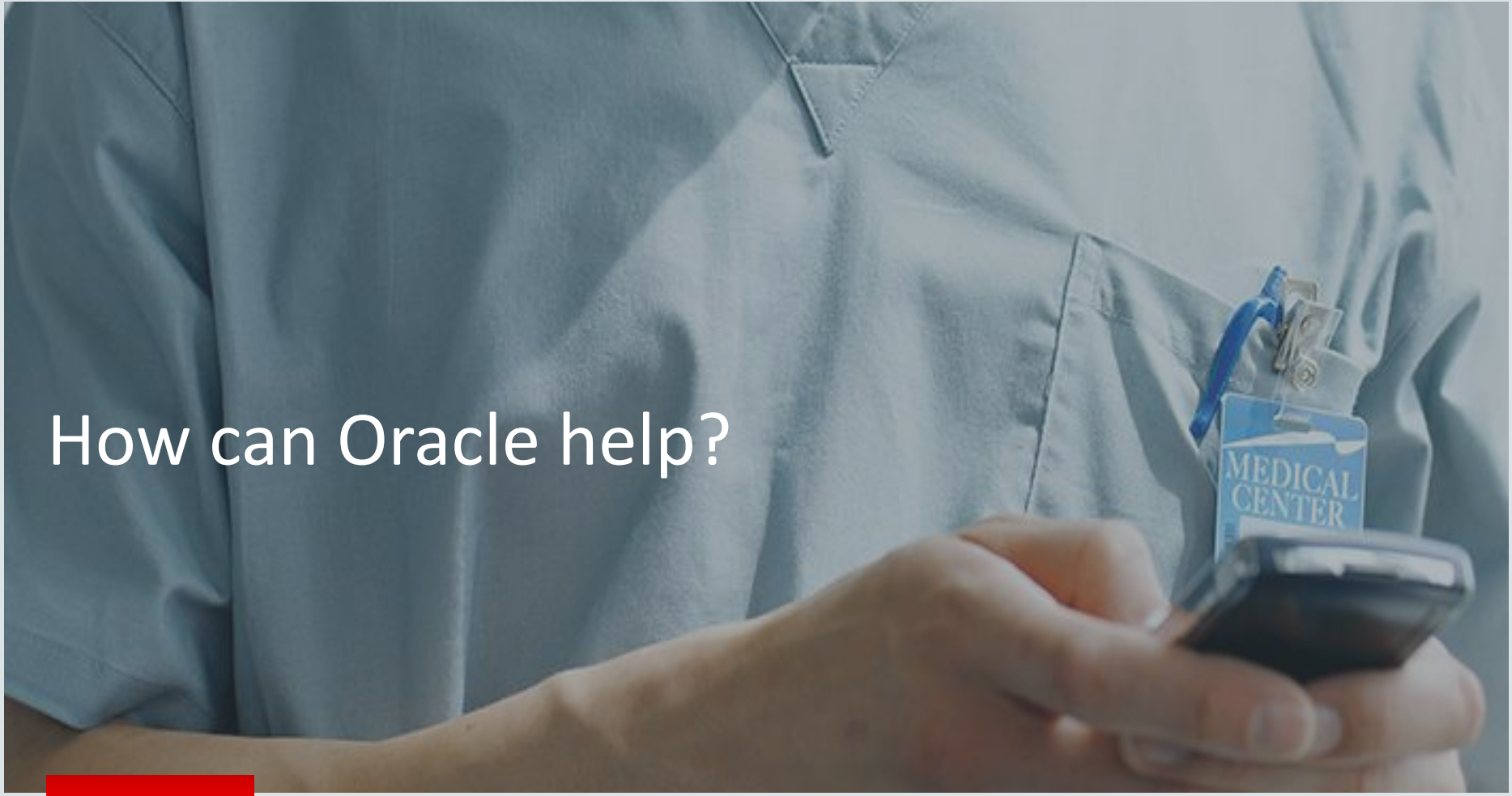
How can Oracle help?



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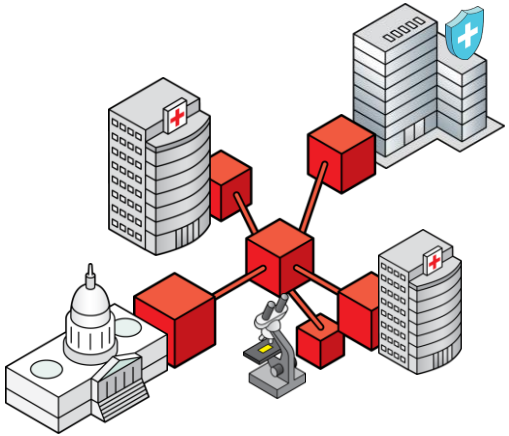
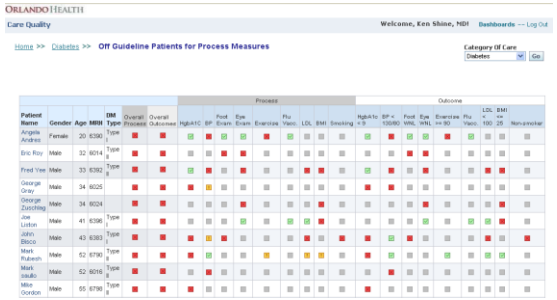
Oracle Connected Health

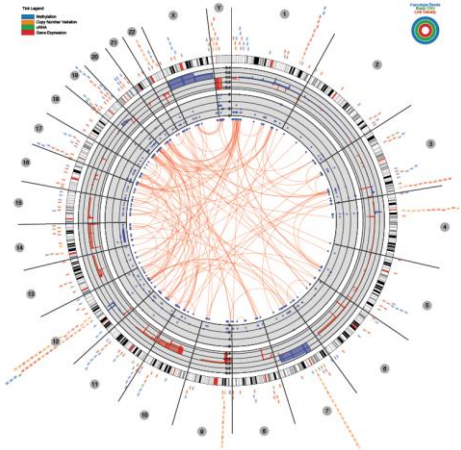
Increasing outcomes through an interoperable healthcare ecosystem and allowing for the subsequent analysis of health data across facilities and organizations



- **Healthcare Interoperability**
  Provide a unified patient medical summary to improve outcomes, increase healthcare efficiency and reduce costs



- **Healthcare Analytics**
  Use healthcare data for disease management and surveillance, comparative effectiveness research, population health analysis, etc.



- **Medical Research**
  Combine healthcare + omics data to empower researchers in translating science into clinical treatments faster, and with greater certainty

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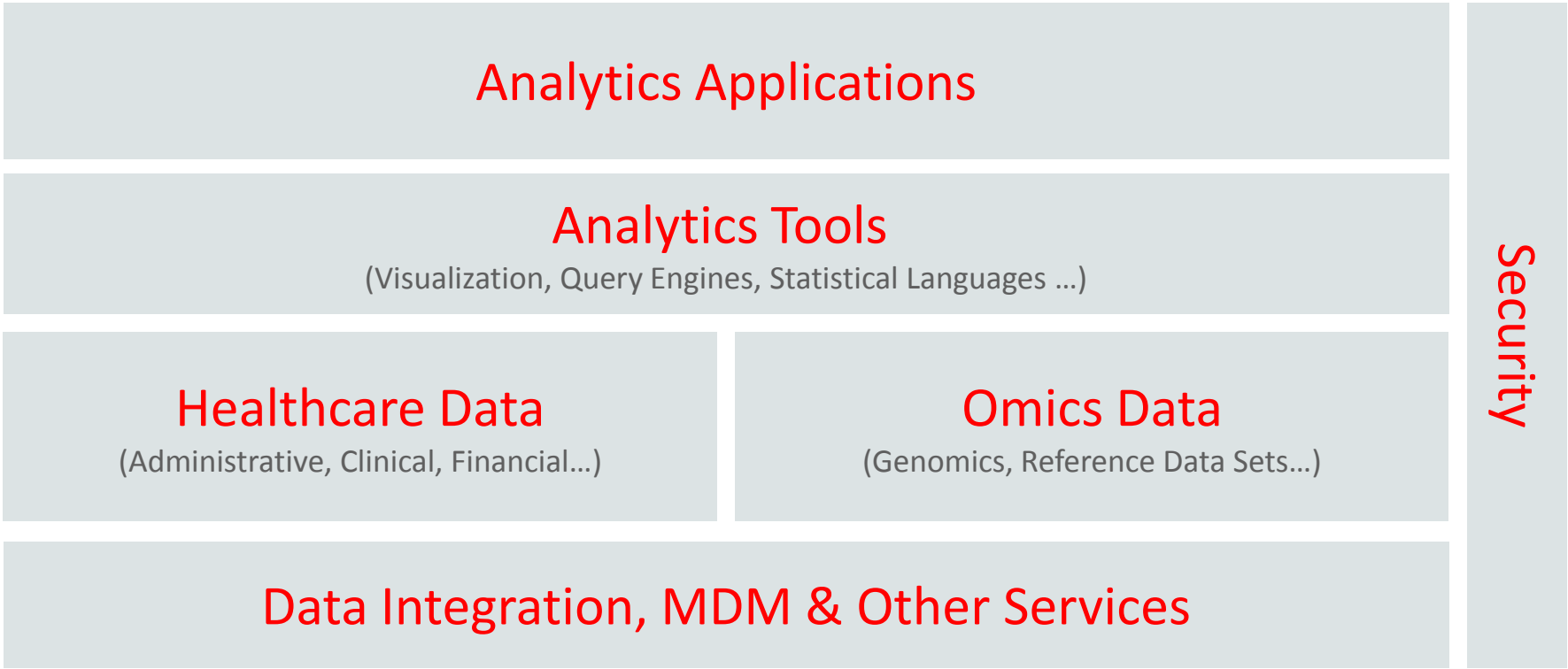
Platform for Healthcare Analytics & Medical Research



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Platform for Healthcare Analytics & Medical Research

Cohort Exploration

Cohort Analytics

Customer/ Partner Custom Analytic Apps

Statistical Apps (e.g. Survival Analysis)

World-wide Researcher Collaboration (HSN)

Analytics Applications

Reporting | Dashboards | Ad Hoc Queries | Strategy Management | R Statistical Language | Big Data/Hadoop | Bring your own

Mobile Analytics | Information Discovery | Data Mining | Scorecard | Real Time Decisions | Unstructured Data Analysis | Spatial

Analytics Tools

Healthcare Data

ETL from sources → Interface Tables → Consolidation, Integration & Validation → Healthcare Data Model

Omics Data

Data from sources → Ensembl, HUGO, Swiss-Prot… / VCF, GEP CGI, MAF… → Load / Annotate → Omics Data Model

De-Identification | Terminology Services | Unit of Measures | Secure Files | Data Quality | Data Quality Governance | In-memory analysis

Re-Identification | Patient Linkage | NLP | Job Scheduling | ETL | End to End Data Lineage | HW/SW Integration

Data Integration, MDM & Other Services

Security

Authentication | Provisioning

Role Based Security | Authorization

Row level Security | Directories

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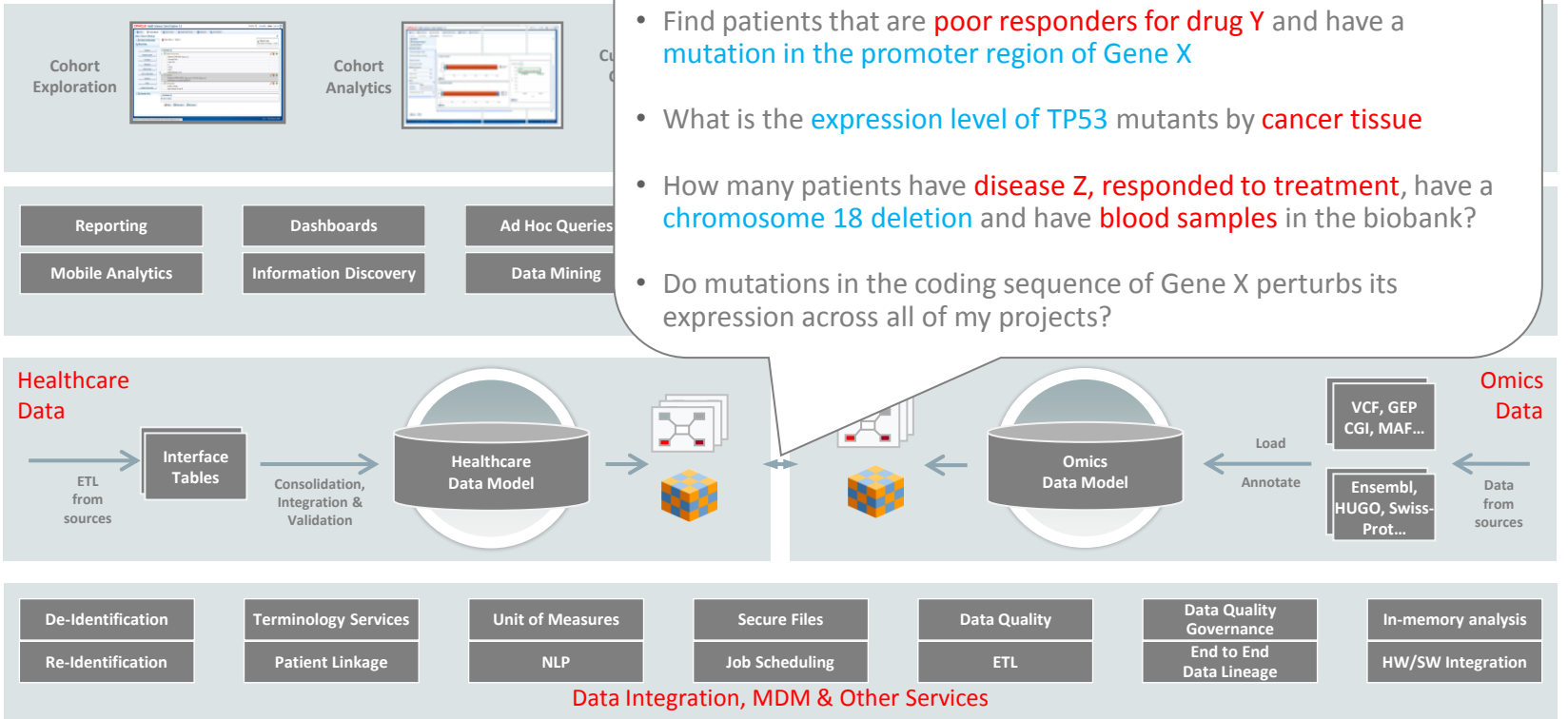
Platform for Healthcar

The power of Clinical and Genomics data in one single platform

- Find patients that are poor responders for drug Y and have a mutation in the promoter region of Gene X
- What is the expression level of TP53 mutants by cancer tissue
- How many patients have disease Z, responded to treatment, have a chromosome 18 deletion and have blood samples in the biobank?
- Do mutations in the coding sequence of Gene X perturbs its expression across all of my projects?



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Platform for Healthcare Analytics & Medical Research

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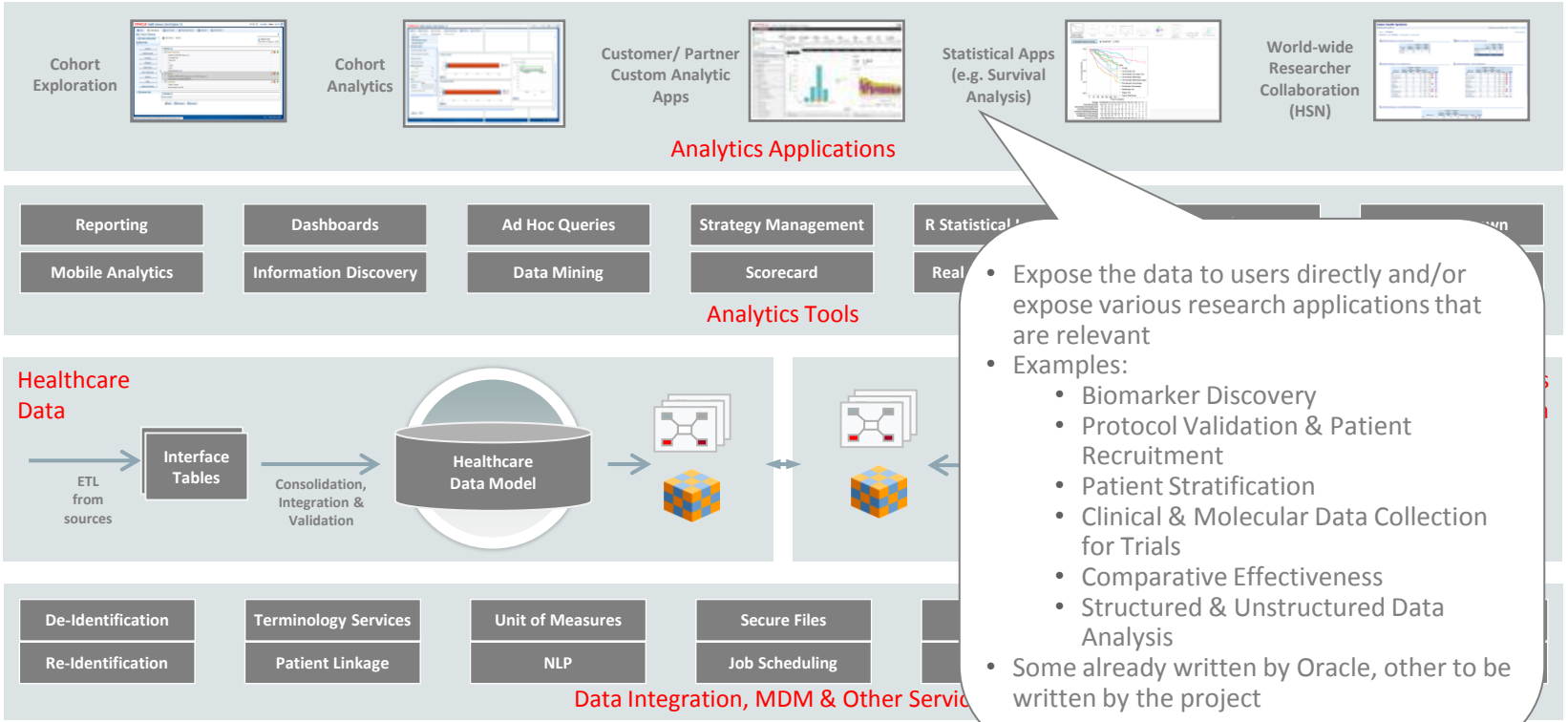
Platform for Healthcare Analytics & Medical Research



- Expose the data to users directly and/or expose various research applications that are relevant
- Examples:
  - Biomarker Discovery
  - Protocol Validation & Patient Recruitment
  - Patient Stratification
  - Clinical & Molecular Data Collection for Trials
  - Comparative Effectiveness
  - Structured & Unstructured Data Analysis
- Some already written by Oracle, other to be written by the project

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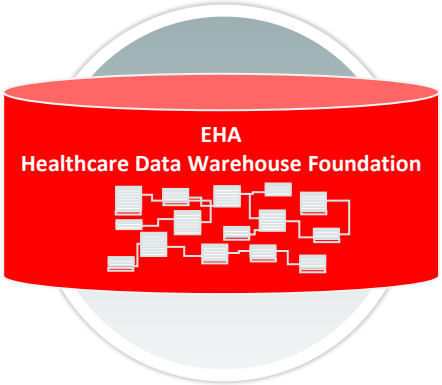
Oracle Enterprise Healthcare Analytics (EHA)

Healthcare Data Warehouse Foundation (HDWF)



Integrated View of Clinical, Financial, Operational, & Research Data Across the Provider Enterprise

- Logical & 3NF Optimized Physical Model
  - Logical Data Model: 1000+ entities and 5,500+ attributes
  - Physical Data Model: 538 tables and 12,000 columns (5742 non-key columns)
- Engineered specifically for Providers to lower DW/Analytics development cost, time, & risk
  - Well organized model makes it easy for analytic application developers
  - HDWF design also facilitates data capture, cleansing, and integration
  - HDWF enables rapid deployment of pre-built apps from Oracle & our partner ecosystem
  - Data model is extensible, scalable, secure
  - Supports enterprise-grade software & hardware tools from the world's leading enterprise software vendor

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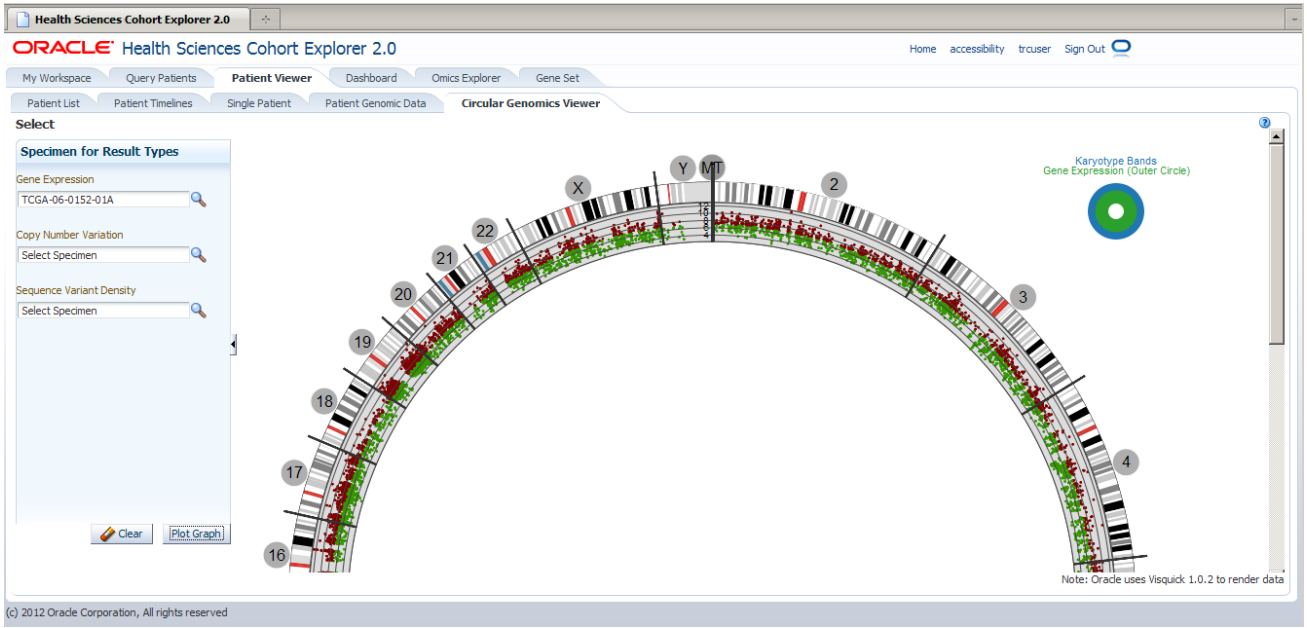
Oracle Translational Research Center

Cohort Explorer



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Real-Time Big Data Queries No Longer a Dream

Oracle Omics Data Bank Performance

% of Use Cases	Response Time
56	< 1 Second
38	1 – 10 Seconds
6	10 – 30 Seconds
0	30 – 60 Seconds
0	60+ Seconds

100k Genomes, 100 Concurrent Users

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Next Level: the Oracle Health Sciences Network

Secure, Global, Cloud-Based Collaboration R&D

Ensuring:

- Protocol design and validation
- Patient recruitment
- Provides participants full control over their data
- Protects institutional IP
- Respects patient consent
- Enables real-time collaboration

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What customers have achieved

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MD Anderson

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center

CASE STUDY

Background / Needs

- Moon Shots initiative to **cure 6 cancers in 5 years**
- **One source of truth** for all data
  - Improve data availability to the enterprise
  - Scalable to address 30-40% data growth per year
- Rapid **time to value**

Results With Oracle

Fast implementation – in use within 6 months

Streamlined pharmacy operations and **achieved significant ROI**

Supporting more than 1 million patients spanning a 70-year period

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UPMC

UPMC
LIFECHANGINGMEDICINE

CASE STUDY

Background / Needs

- **Aggregate data** from 200+ sources
- **Integrate** healthcare and payer data
- Provide **better clinical insights** for:
  - Treatment effectiveness
  - Cost variations
  - Disease prevention
- **Simplify data delivery** for analysis

Results With Oracle

Integration of clinical and genomic information

Preliminary **identification of genes and pathways** unique to pre- and post-menopausal breast cancer patients

Consolidation of multiple data marts

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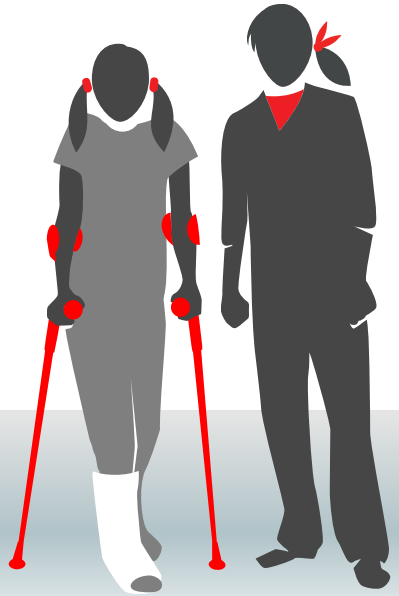

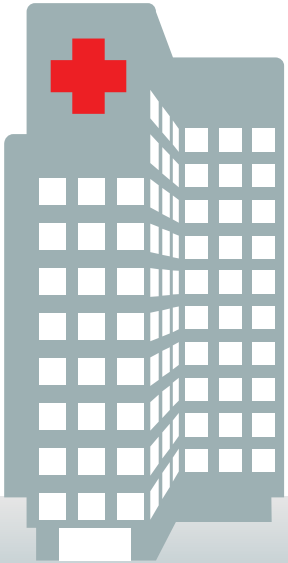

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Engineered to Work Together

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