IO INFORMATICS
REAL BENEFITS, REAL USE CASES

INNOVATE – INTEGRATE - ACCELERATE

Robert Stanley, CEO

April 24, 2014
AGENDA

• [BRIEF!] COMPANY OVERVIEW
• TECHNICAL ADVANTAGES
• TOOLS AND METHODS
• USE CASES
IO INFORMATICS - SEMANTIC INTEGRATION FOR HCLS

✓ Practical, Experienced Team
  • IP from 2000, founded in 2003; Knowledge and Applications Engineering Teams in US and Europe

✓ World Class Science Advisory Board
  • ISC Scientific Publications, Max Planck Institute, UBC / St. Paul’s Hospital, Stanford University / NCBO, UBC, PROOF Centre / St. Paul’s Hospital, W3C, …

✓ Working Groups
  • HCLS Data Sharing, Personalized Medicine, HCLS Semantics

✓ Standards and Practices Contributions
  • W3C, Pistoia Alliance, NCBO, Bio-IT Best Practices, …
WORKING TOGETHER

• EXPERTISE
  • RENOWNED SCIENTIFIC ADVISORY BOARD (STANFORD, MPI MUNICH, PROOF, W3C, ISC)
  • IN-HOUSE DATA MODELING AND DOMAIN EXPERTISE
  • WORKING GROUPS (INDUSTRY, ACADEMIA, GOVERNMENT)
  • PARTICIPATION IN INTERNATIONAL CONSORTIA (W3C, PISTOIA ALLIANCE)

• AWARDS
  • BEST PRACTICES AWARD
  • BEST IN SHOW, BEST SCIENTIFIC POSTER

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END TO END LIFE SCIENCES FOCUS

Software and Services:
Data linking, integrated access, research and decision support

CLINICAL
UBC Prostate Cancer Centre, PROOF Centre, MD Anderson Center, …

PHARMACEUTICAL
AstraZeneca, Merck, Novartis, Sanofi, …

GOVERNMENT
Food and Drug Administration (FDA), National Institutes of Health (NIH), …

* Multiple IQ-OQ installs; selective extraction, external security reviews; E&O insured

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JUST A FEW OF THE CHALLENGES

✓ **MISSING DATA, MISSING CONNECTIONS**
  • Healthcare and Life Science research and Precision Medicine Outcomes require agile, meaningfully linked data! “Big Data” needs semantic integration…

✓ **COST TO START**
  • Traditional integration (RDBMS or federation) requires costly schema definition before starting

✓ **COST TO MAINTAIN**
  • Traditional integrations are not built for global interoperability and are complex and costly to extend or modify

✓ **NEW WAREHOUSES ARE NOT THE ANSWER**
  • Traditionally integrated data is still not interoperable with other resources
SEMANTIC TECHNOLOGIES
MEETING CHALLENGES, DELIVERING VALUE
THE SEMANTIC DIFFERENCE

✔ RDF IS AGILE, EXTENSIBLE AND BUILT FOR INTEROPERABILITY

- Semantic data is much easier to connect, visualize and extend
- It is not an isolated RDBMS schema, a contested standard data description, or a proprietary middleware translation layer
- It is a globally standardized description framework that links data

✔ In addition to agility, extensibility and interoperability; emergent properties include network visualization, faceted browsing, machine inference, and pattern recognition
For advanced integrations, you can apply multiple ontologies, thesauri, scripting, automated inference.
SENTIENT KNOWLEDGE EXPLORER

• UNIQUE VALUE
  • MOST TRANSPARENT AND STANDARDS-COMPLIANT RDF MODELING TOOL
  • MOST COMPLETE INTEGRATION OF KNOWLEDGE ENGINEERING RESOURCES (ONTOLOGIES, VOCABULARIES / NOMENCLATURES / THESAURIS, LOD/LLD, SPARQL ENDPOINTS)
  • SUPPORTS MULTIPLE SEMANTIC DATABASE BACK-ENDS
  • VISUAL SPARQL QUERY BUILDER
  • EASE OF USE, LOW LEARNING CURVE = BEST TOOL FOR COMMUNICATING DATA MODELS WITH SUBJECT MATTER EXPERTS (SMEs)
RAPIDLY GROWING PUBLIC RESOURCES
2007
TOOLS AND METHODS
PRODUCTS AND PRACTICES
SENTIENT PRODUCT SUITE

CORE DATA MANAGEMENT

- Import Assistant
- Data Manager
- Image Interactor

KNOWLEDGE APPLICATIONS

- Knowledge Explorer
- Web Query
- Custom Web Applications (ASK)

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DATA MANAGER

- Automated input and organization of data from any source
- Communication link with applications and instruments
- File sharing and audit controls
- Link, annotate and search
**IMAGE INTERACTOR**

- **INTERACT WITH VIRTUALLY ANY IMAGE**
- **NON-DESTRUCTIVE PROCESSING**
- **CREATE WORKSPACES**
- **ADD ANNOTATIONS**
- **TRACK & REPLAY PROCESSING HISTORY**

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**Knowledge Explorer**

- **Semantic Integration of Knowledge Sources**
- **Import, Edit and Merge Ontologies**
- **Use virtually any file (RDF, N3, NT, TTL, PSI-MI, OWL, EXCEL, delimited text) or database output**
- **Visualize and query across large networks**
- **Find hidden relations and create unified knowledgebases**
WEB QUERY

• INTEGRATED SEARCH (RELATIONAL / SEMANTIC / WEB SERVICE / SENTIENT STORE)

• REVIEW, SEARCH & CHART DATA AND METADATA

• INTERACT DIRECTLY WITH ANALYTICAL APPLICATIONS

• EXPORT TO EXCEL, TEXT, HTML, XML, RDF OR KNOWLEDGE EXPLORER
ASK™
APPLIED SEMANTIC KNOWLEDGEBASE

- EXEMPLARY ENTERPRISE KNOWLEDGE APPLICATION
- VISUALIZATION, VALIDATION OF SYSTEMS-ORIENTED HYPOTHESES
- PRECISION MEDICINE SCREENING
- SCORE-BASED DECISION SUPPORT
USE CASES
TIME, MONEY, LIVES SAVED
EXAMPLE CUSTOMER BENEFITS

✓ “Questions that used to take my team six months to answer… are now answered in six seconds.”

- AstraZeneca, Patient Safety Science Lead (presented at CSHALS, February 2014)

✓ “I’ve been trying to get this biomarker profile out of our data for several years now. I just got my answer in this project review meeting.”

- Executive Research Director, Top 3 Pharma, comment on new production deployment
EXAMPLE CUSTOMER BENEFITS

✓ “[By reducing integration time and flexibility, the technology] has allowed us to transition to a more integrated approach.”

– FDA Center for Veterinary Medicine

Ability to integrate and analyze new data rapidly reduces (pathogen exposure) response time from days to hours.

✓ “[The] ability to consume and intuitively represent a wide variety of data-types - from images to quantitative data - and more importantly, display that data in ways that make the significant features immediately obvious to our biologist end-users, has allowed us to move to a completely new level of data analysis.”

– Managing Directory, PROOF Centre (UBC, St. Paul’s Hospital)

Initial integration reduced from about 18 months est. to about 9 months…
Integration of gene, protein, clinical and reference sources for combinatorial marker-based screening of patients for COPD event risk, likelihood of organ failure.
Assess effectiveness of different combination treatments for prostate cancer based on multi-platform genomic and proteomic marker profiles and patient match
CORONARY PLAQUE RUPTURE RISK ASSESSMENT IN ACUTE ATHERIOSCLEROSIS

Inflammatory response pre-cursor marker confirms onset of plaque rupture and helps accelerate response acute atherosclerosis
Genomic, proteomic, and imaging endpoints across species to discover species-independent biomarkers applicable to human adverse events and diseases.
RESULT: ACTIONABLE INTEGRATION ACROSS MULTIPLE RESOURCES FOR PATHOGEN DETECTION
TOXICITY CLASSIFICATION
IDENTIFICATION OF TYPES OF TOXICITY (NIST ATP)

Development of multi-modal gene expression and metabolic biomarkers to classify and identify types of toxicity

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Semantic integration provides immediate report verification and manufacturing based on effect of compound formulation on drug stability and purity.
**Benefits Summary**

- **Agile**
  - Semantic technologies reduce effort, time and cost to deliver and maintain integration-oriented knowledgebases and applications

- **Extensible, Transformative**
  - Ontologies and RDF provide building blocks for changing or growing integrations

- **Immediate Payoff**
  - Much shorter time to start and complete
  - R&D concepts rapidly translate to networks and applications
  - Projects that were possible but impractical are made practical

- **Interoperable Resources, Emergent Properties**
  - Public data and ontology resources instead of expensive database packages
  - Pattern discovery and enrichment, inference, rich interrogation

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SUMMARY

- **Combined Strength, Core HCLS Focus**
  - *Best Tools and Team combination to link Healthcare / Life Science data*
  - *Best Domain Expertise and Practical Insights in Applied Knowledge Engineering*

- **Experience in Interoperability**
  - *Synergistic Work with Complementary Technologies*

- **Most Comprehensive**
  - *Best Access to HCLS data, Ontologies and Public LOD / LLD Resources*

- **Mature Products, Lowest Learning Curve**
  - *Shortest Path to Value and Return-on-Investment*
SELECTED REFERENCES

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"Correlation Network Analysis and Knowledge Integration"  

WEBSITE: http://www.io-informatics.com
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