

Healthcare Innovations in the Age of the Experience Graph



HiMSS[®]
WISCONSIN *Chapter*

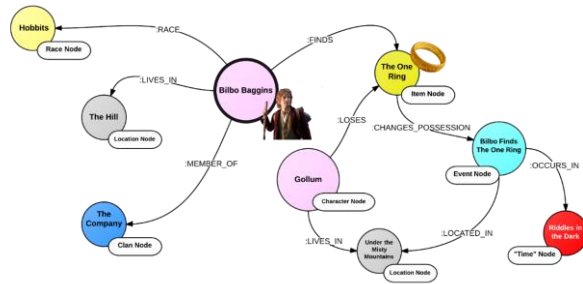
Garry Golden
Forward Elements

May 15, 2019

garrygolden.com/May16



Changes Ahead



Techno-Enthusiast View of Experience Graph



Skeptical View of Experience Graph



Learning More

More of Less Change Ahead?



**Last
ten years**

2009 – 2019



**Next
ten years**

2020-2030



**In the World of
Healthcare Information Technologies**

Decade of Change

2007



2017



2027

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Images Removed

**Every day I make an effort to move toward
what I do not understand.**

- Cellist, Yo-Yo Ma

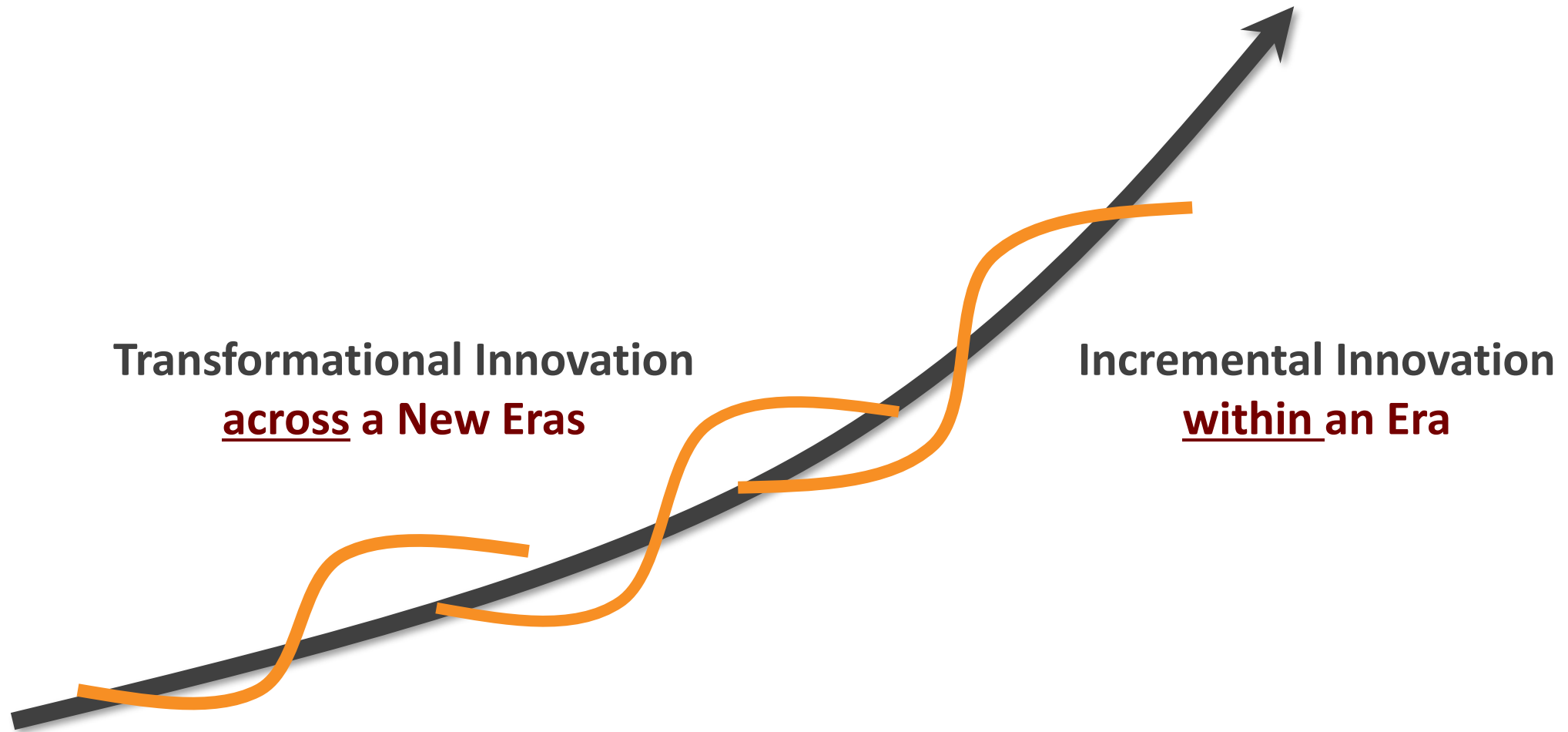
Let's talk about our ability to have ...

- Hindsight
- Insight
- Foresight**

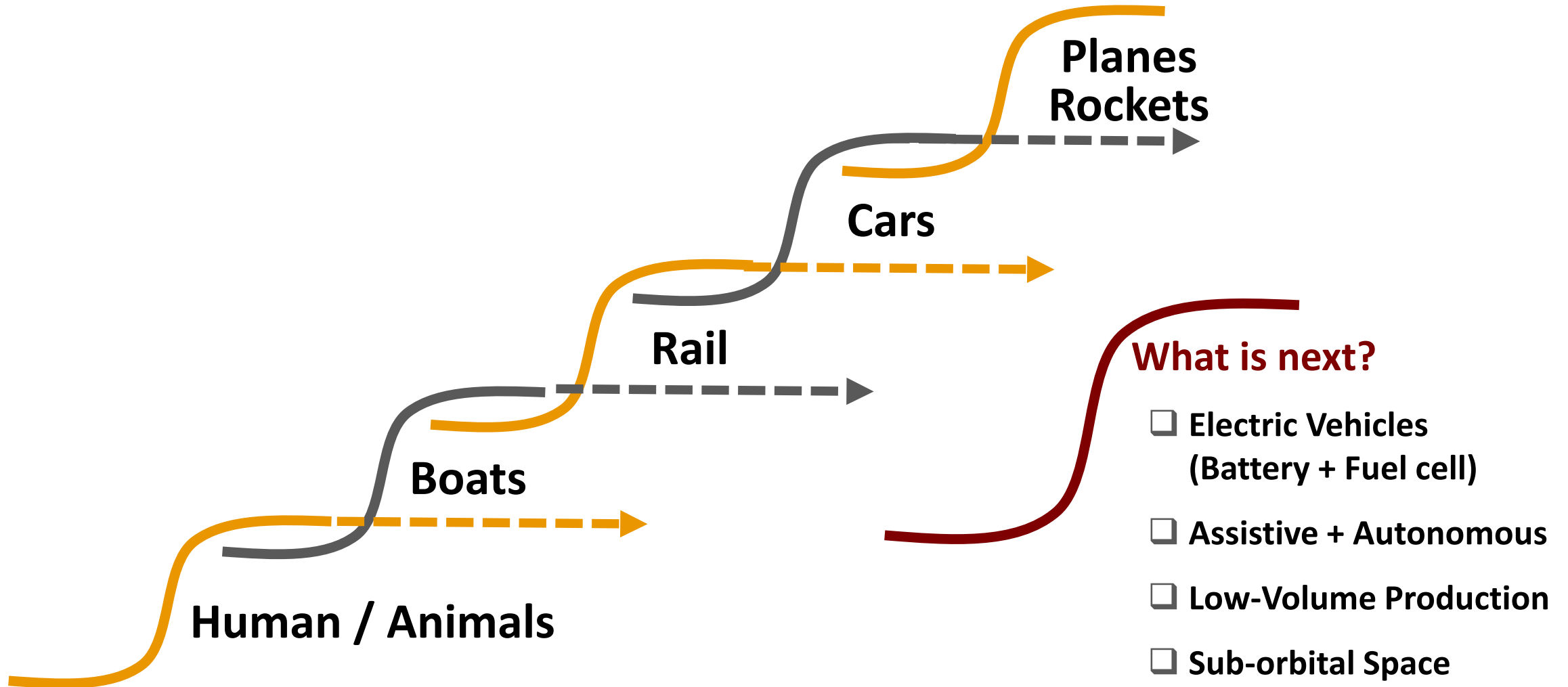


Foresight is the ability to anticipate and lead change

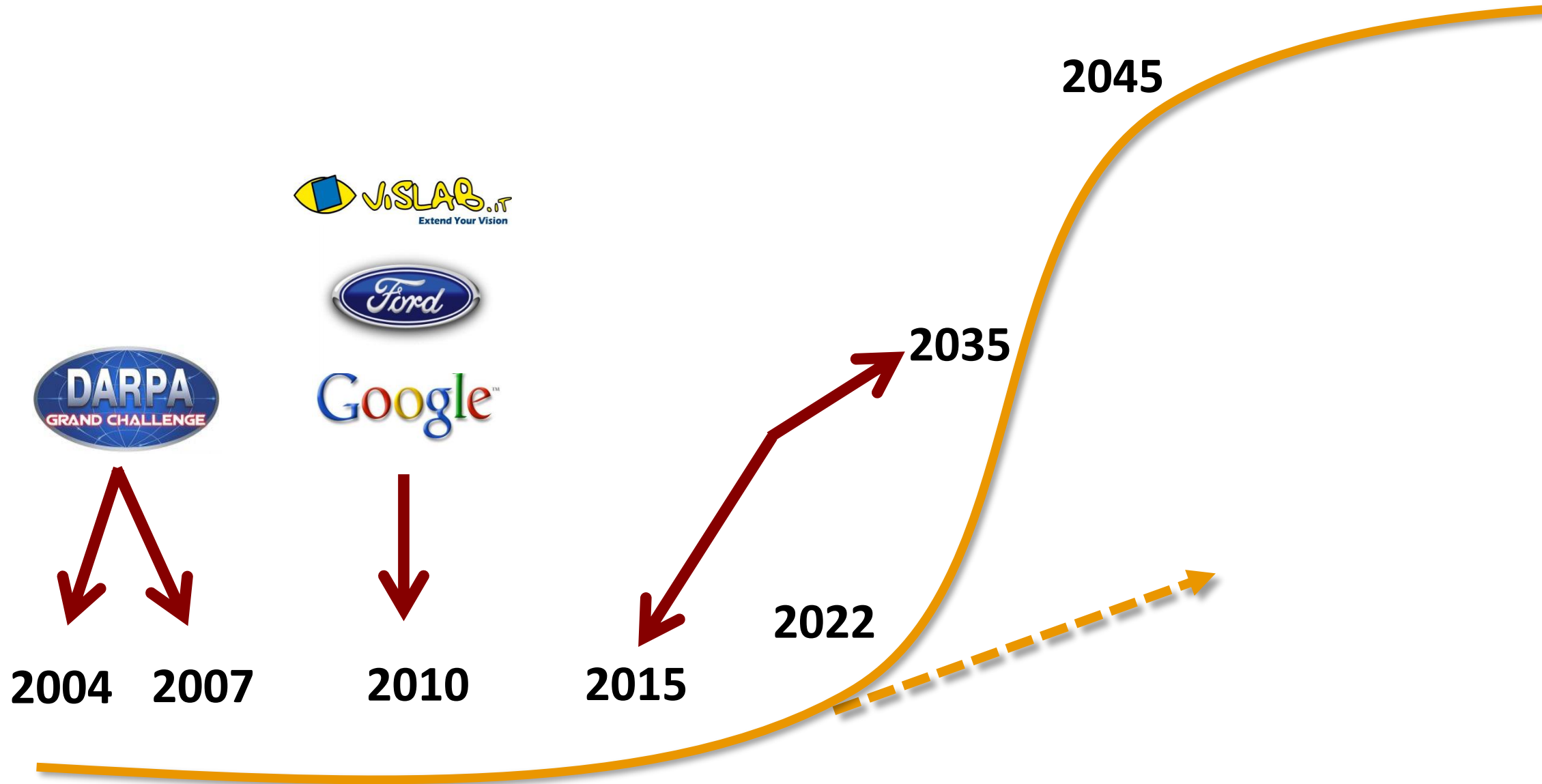
Era-based Dynamics of Change



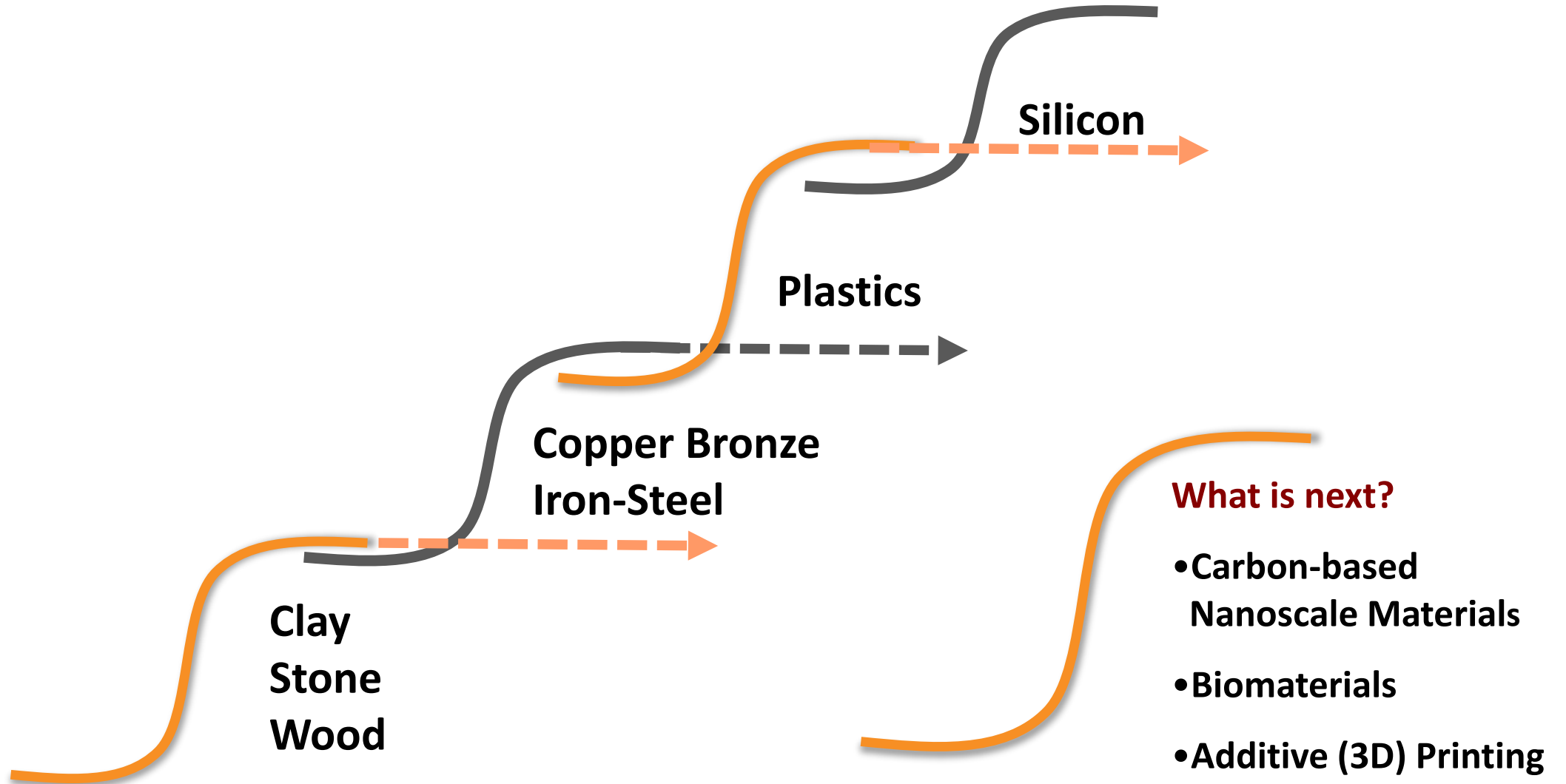
Eras of Mobility



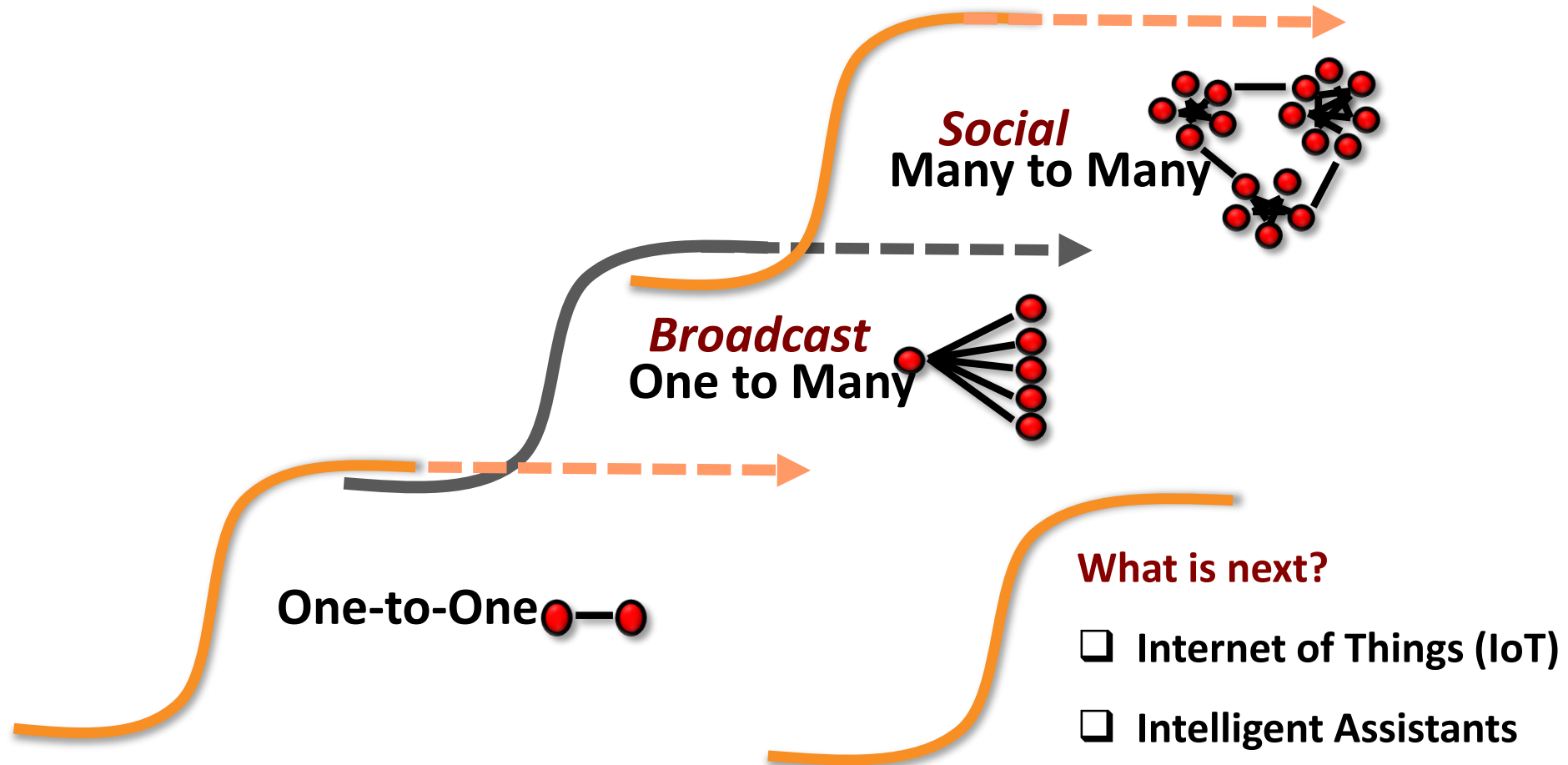
Eras of Change in Mobility



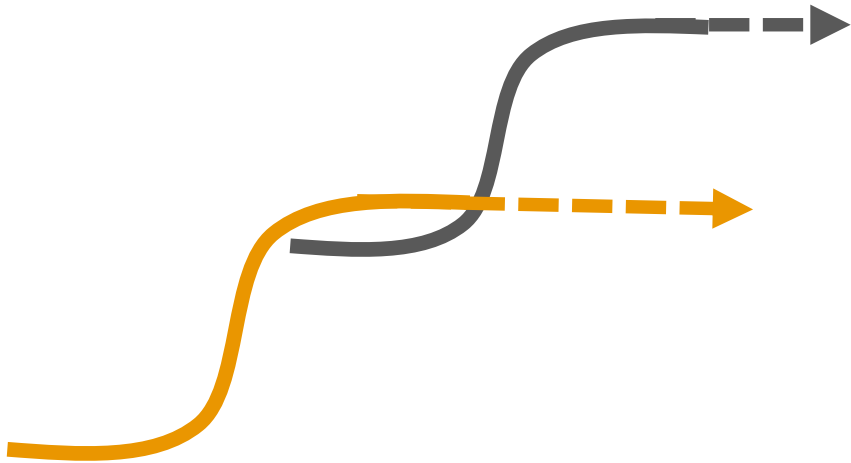
Eras of Materials Manufacturing



Eras of Media & Communication



**How will societies
navigate S-curve
transitions for...?**



Healthcare / Wellness

Population Health; Outcomes-based Care; Genomics

Education / Learning

Life stage to Lifelong; Online to AI-mediated

Agriculture / Farming / Food

Precision Ag; Automation; Urban; Bio-; Small scale farmer

Transportation/Mobility

EVs, AVs, TNCs; Micro-mobility; Empowered Cities

Retail

Online; Hybrid Brick+Mortar; Localization

Media / Communication

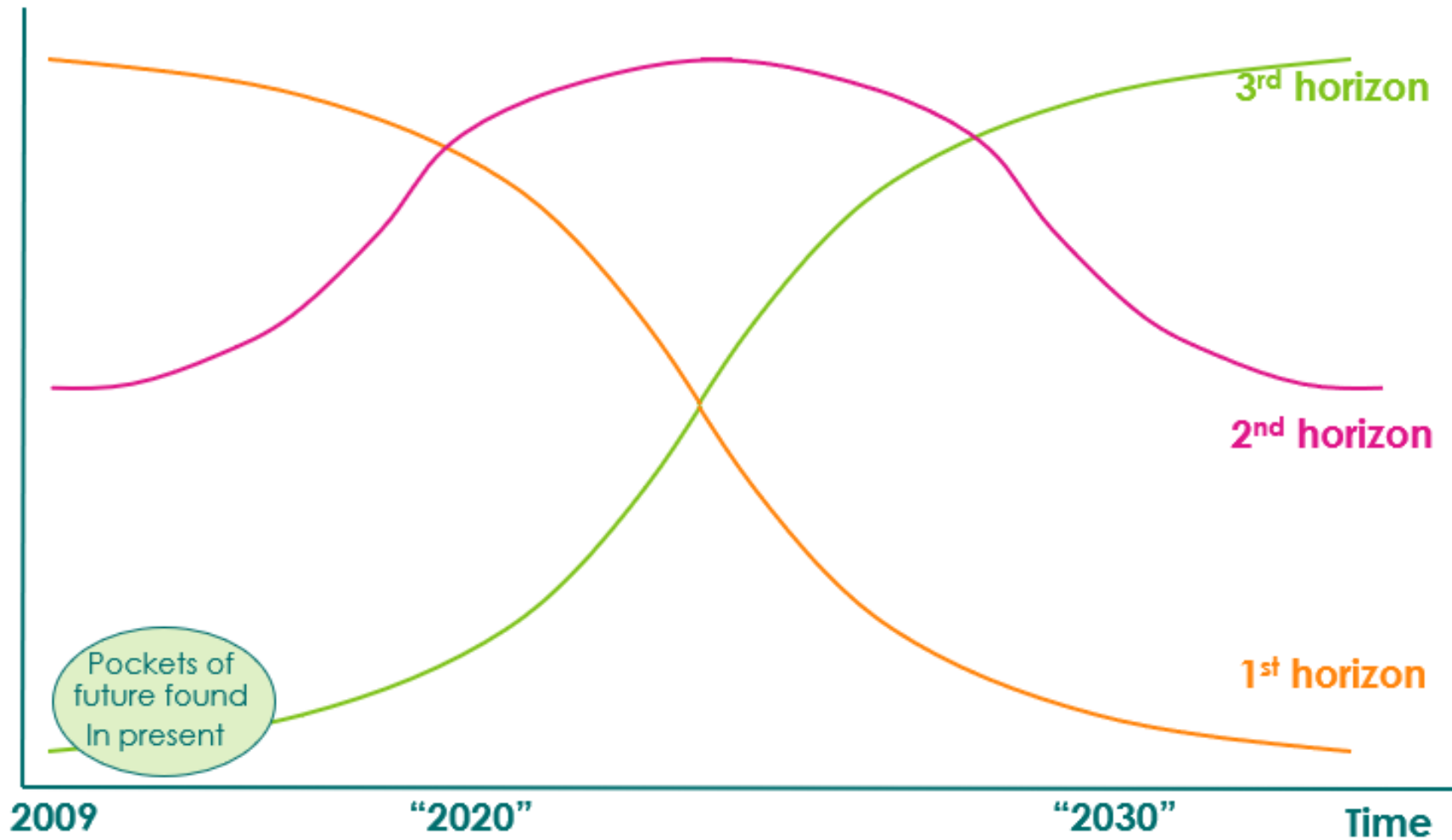
Authentication/Verification; AI; IoT; Agents/Assistants

Entertainment

AI; Mixed Reality

“Three Horizons” Model of Change (Bill Sharpe)

Dominance
of model



Graphic courtesy of Andrew Curry, The Futures Company

What are common themes from today's sessions?

**Next
ten years**

2020-2030



Prognosis

Sanofi Joins Drugmakers' Move to Treat Patients With Software

By James Paton

May 15, 2019, 12:00 AM EDT

- ▶ French pharmaceutical company teams up with Happify Health
- ▶ Timeline for digital development is 'disruptively shorter'

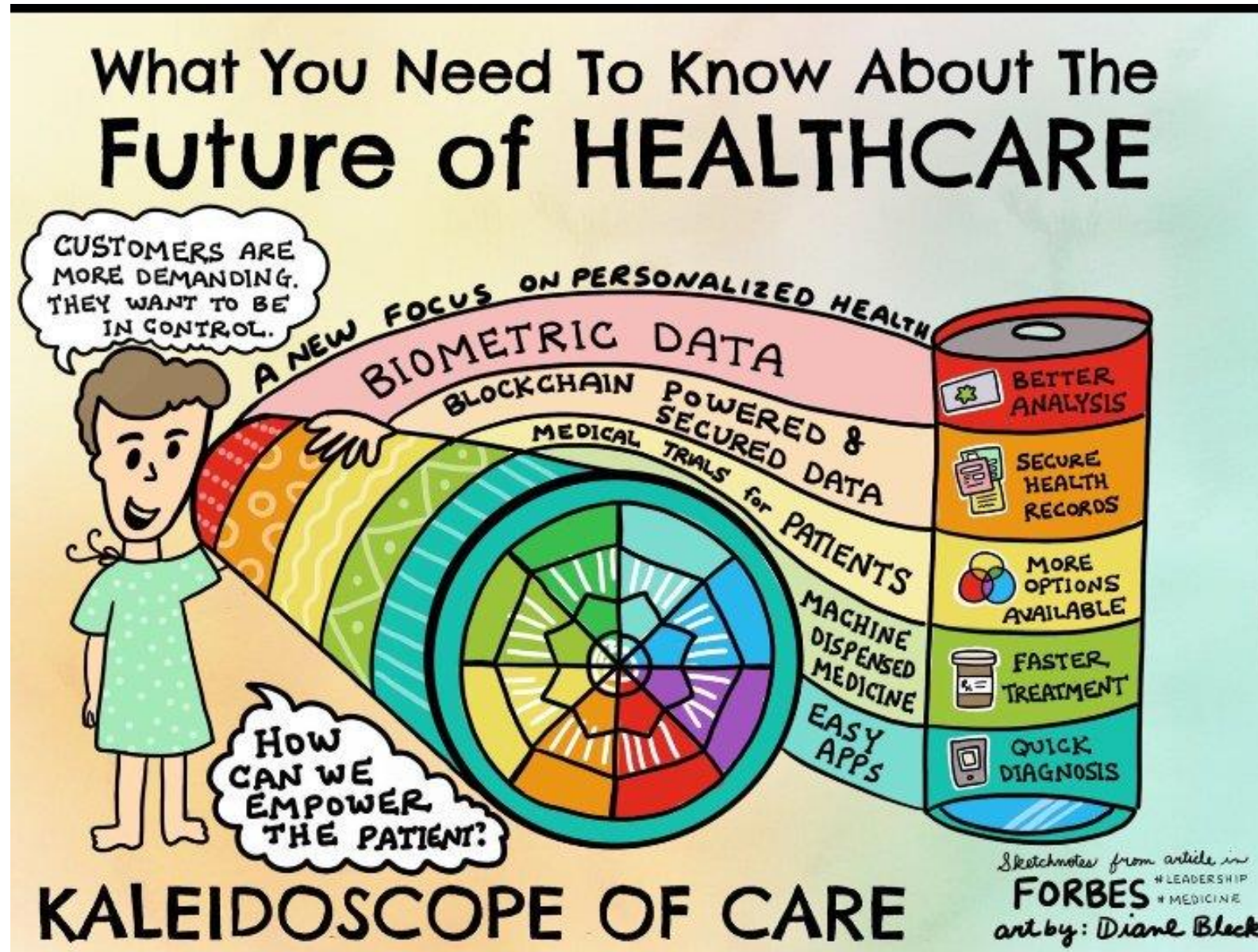
Sanofi is joining other big pharmaceutical companies in expanding beyond pills and injections into a new frontier of tech-based treatments that doctors can prescribe.

happifyTM
HEALTH



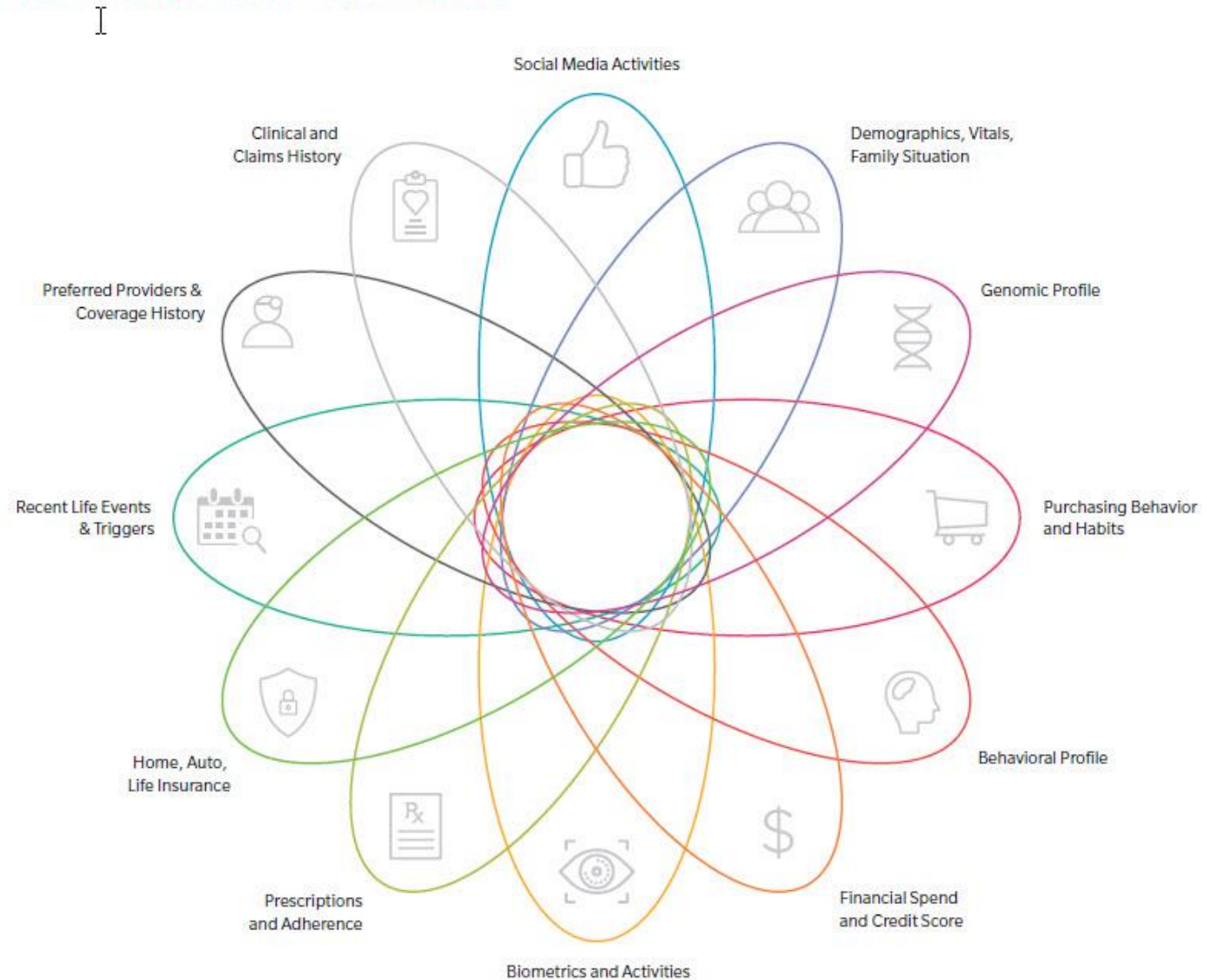
SANOFI

Hype & Expectations for Data, Control, Empowerment & Outcomes



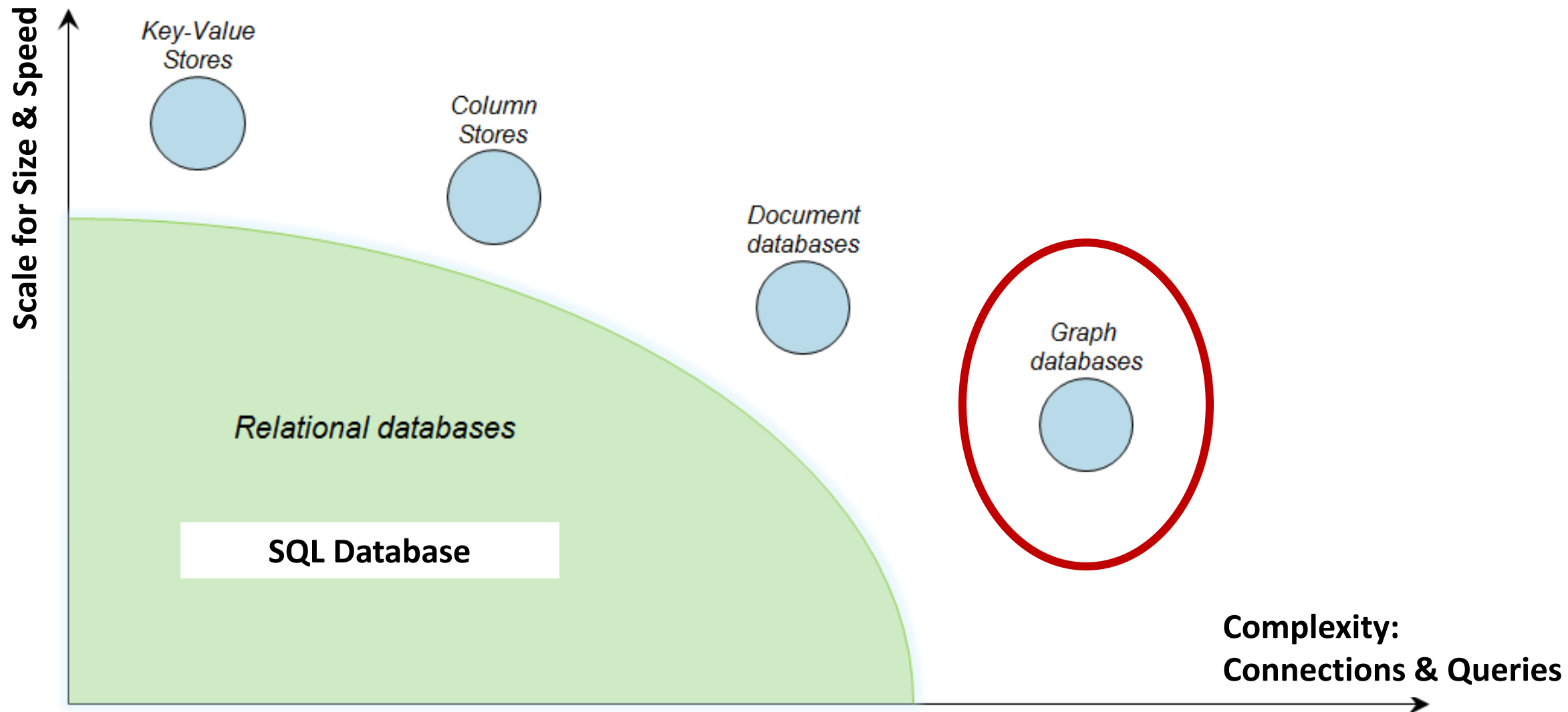
Growing Expectations to Connect the Data and Drive Outcomes

POTENTIAL HEALTH DATA GRAPH COMPONENTS



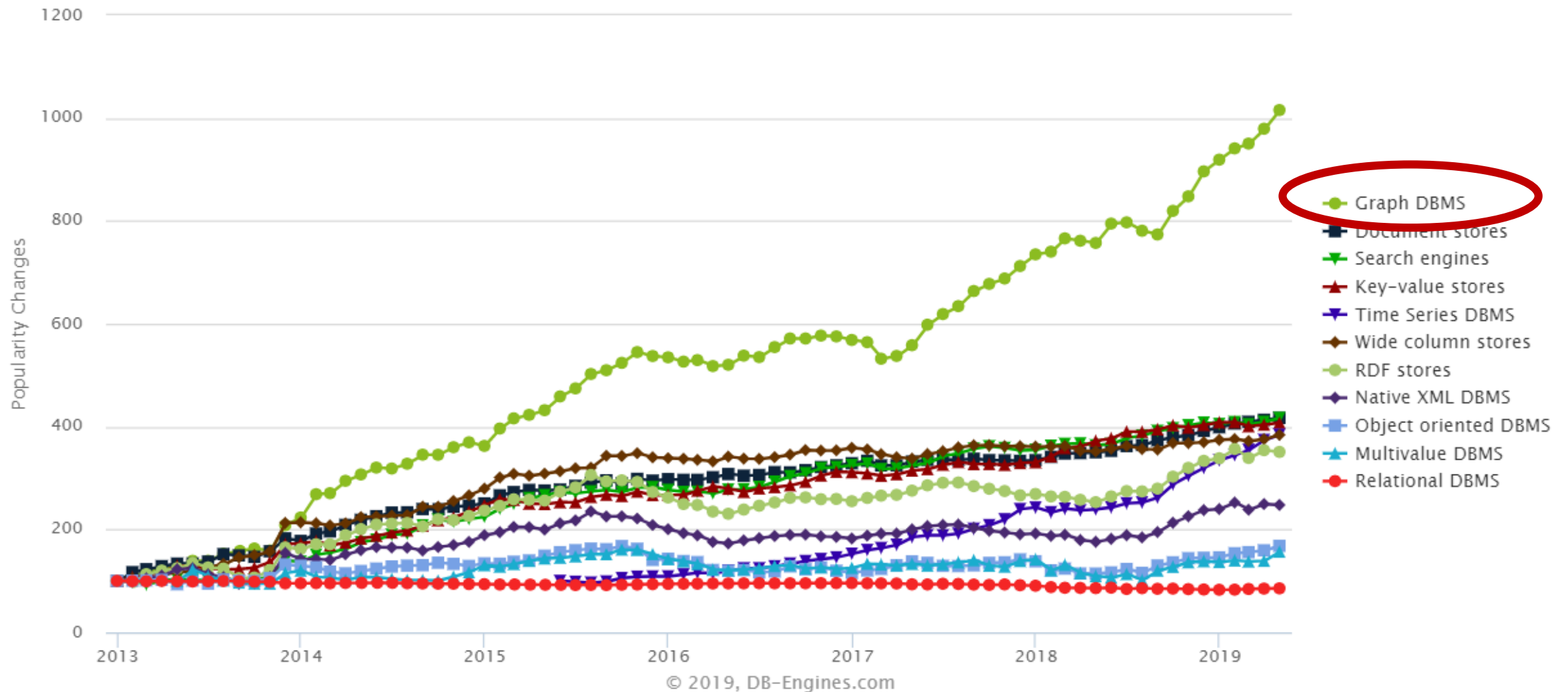
Almost 90 percent of consumers were willing to share personal health data, and nearly 85 percent were willing to share shopping behaviors when there was some kind of return.

Expanding Solutions for Our Datasets

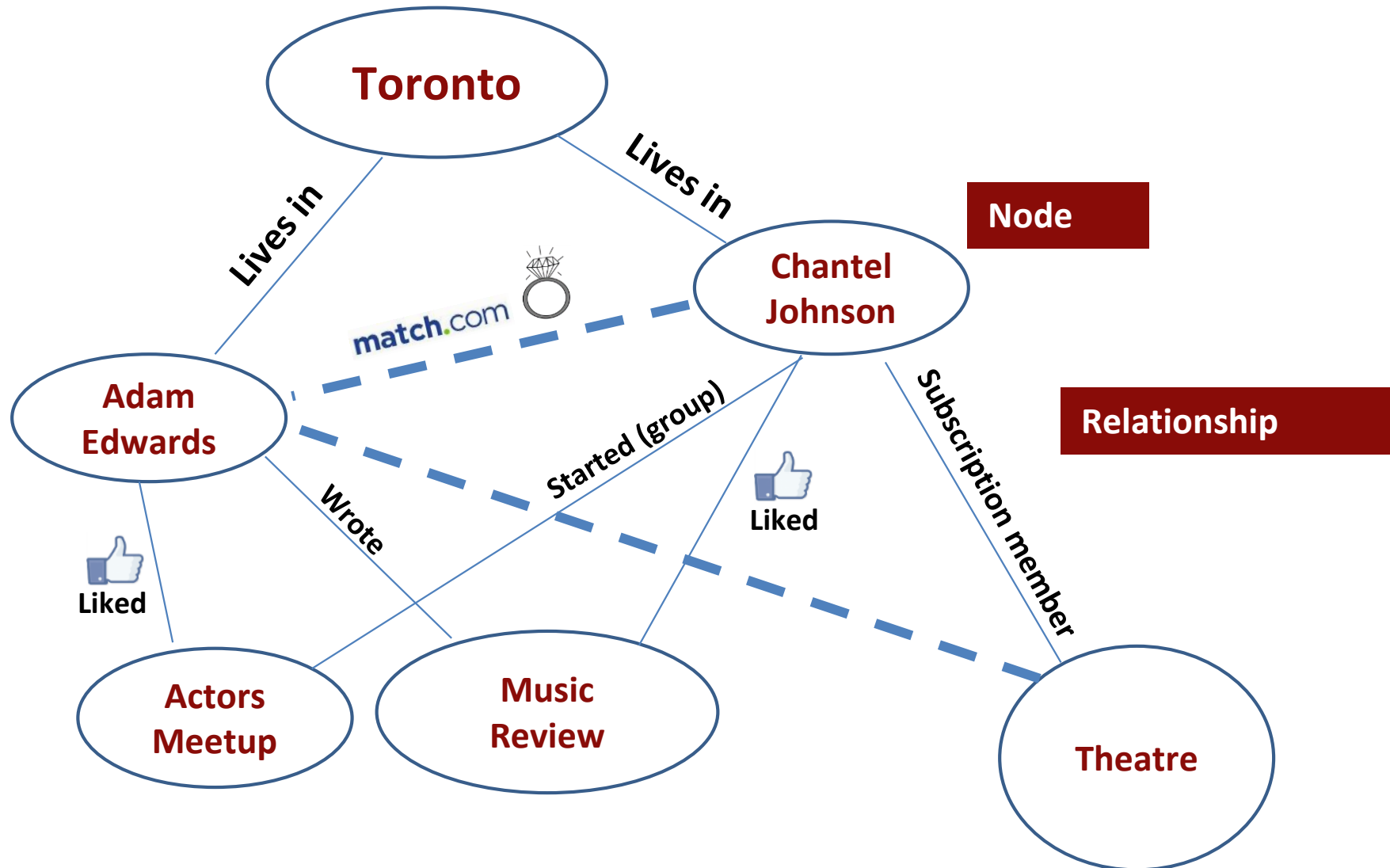


Popularity of 'Graph Databases' to Address Connected Data

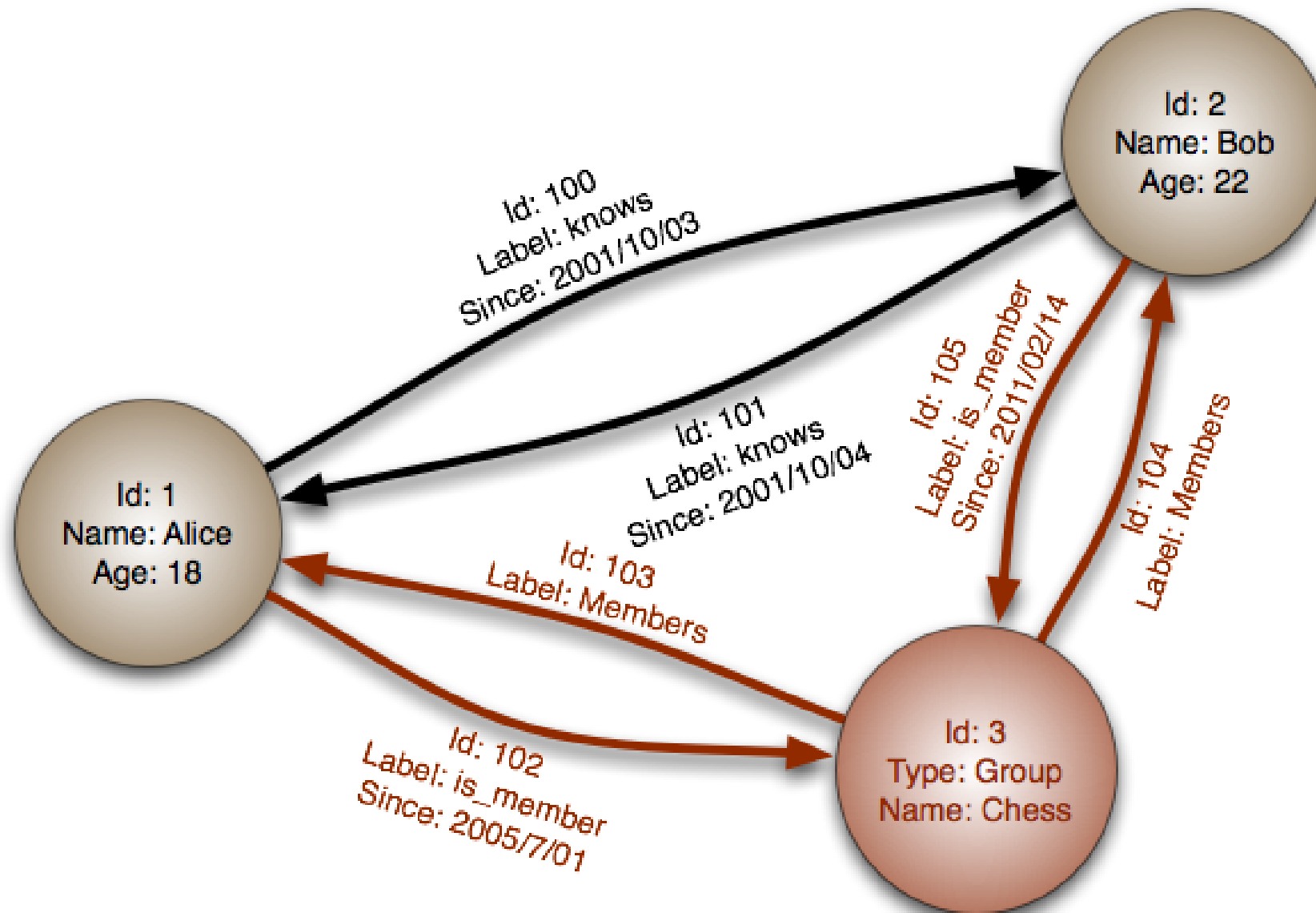
Complete trend, starting with January 2013



Graph Databases = Understanding Relationships & Connections



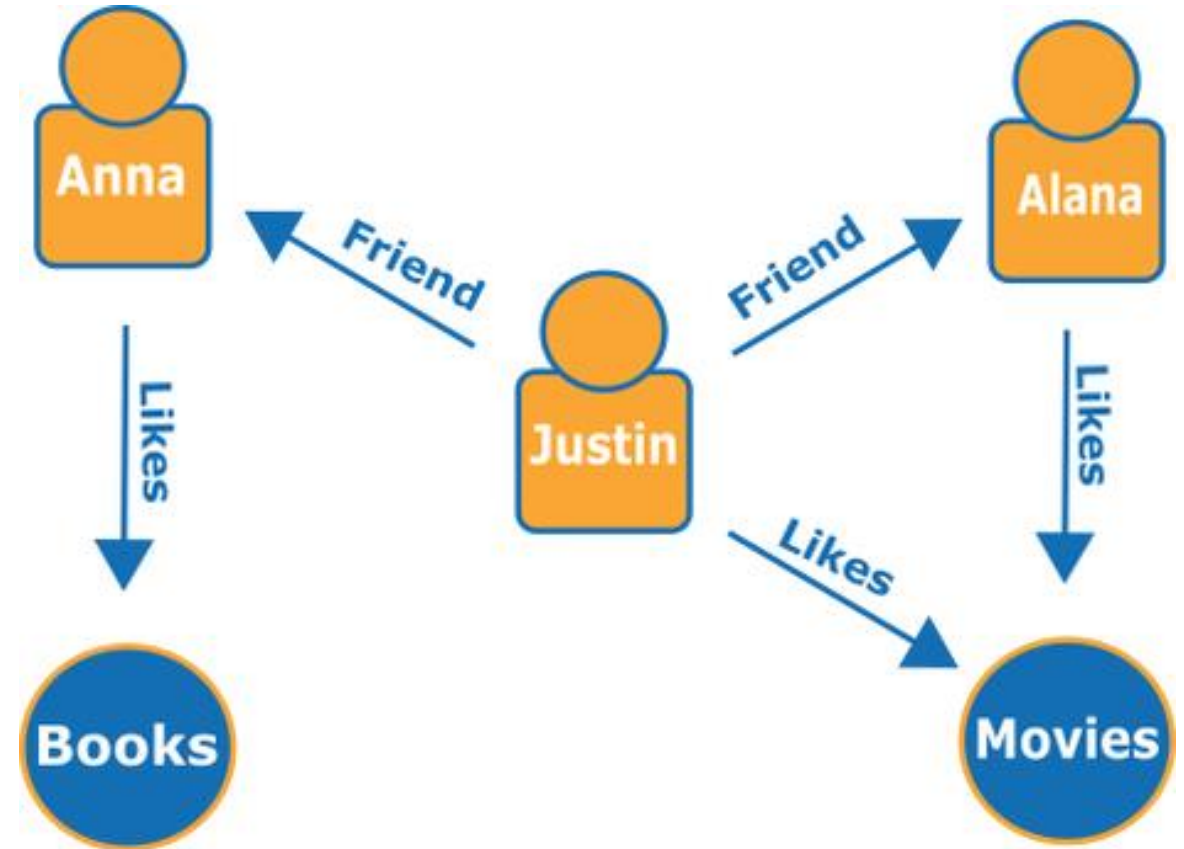
Types: RDF (Semantic) Graphs and (Labeled) Property Graphs



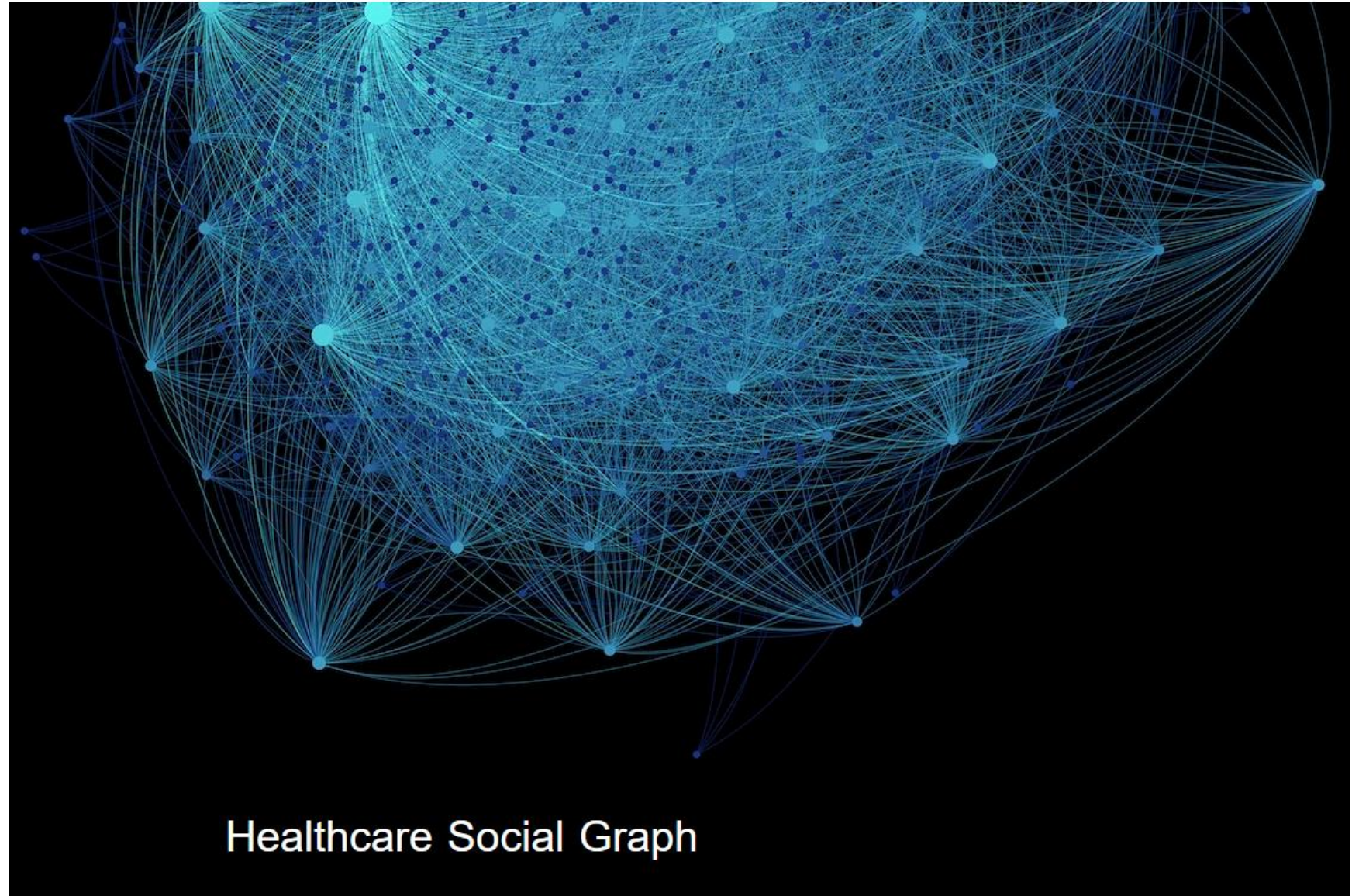
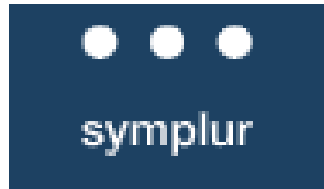
What is a Social Graph?



CEO Mark Zuckerberg:
"Social Graph" in 2007
referring to the network of
connections and relationships
documented by Facebook members



2010 – 2018: What Might Healthcare Learn from ‘Social Network’ Analysis



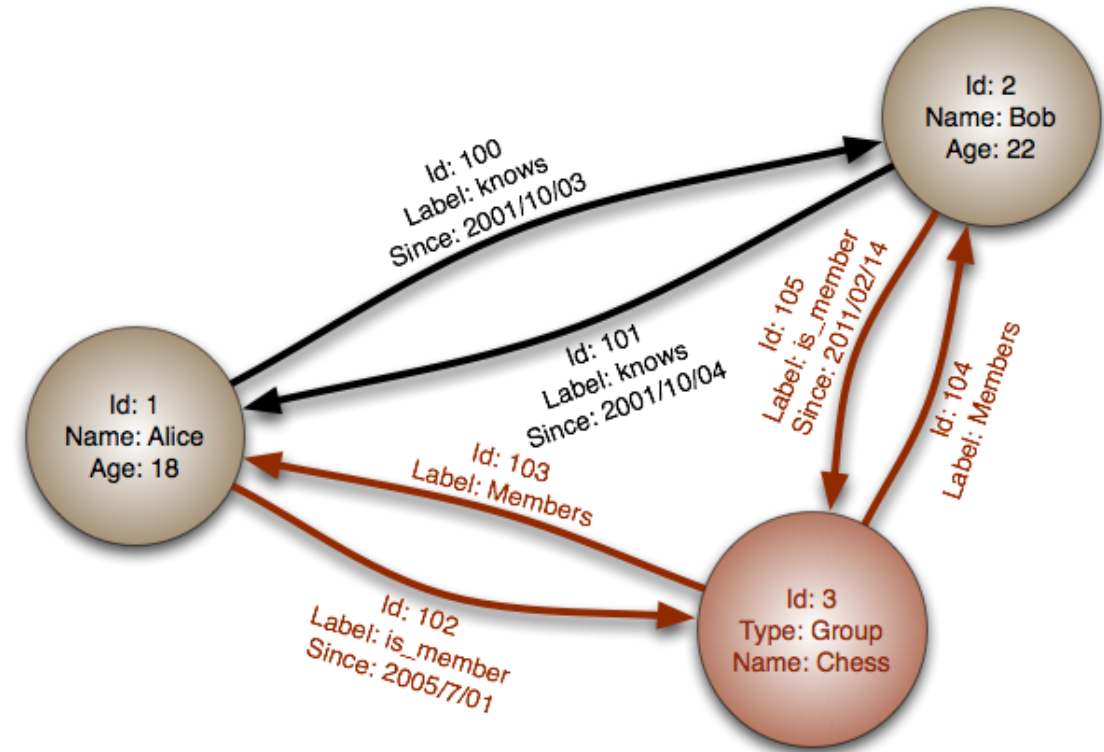
Healthcare Social Graph

Social Graph Meets Healthcare Experiences

People (Patients)	Providers
Turn to Social Media for Information	We need to create content (e.g. podcasts)
Turn to Social Networks for Connections	We need to join and monitor conversations
Social Media Health & Wellness Apps	Create, use and understand <i>apps</i>
...for referrals and recommendations	Manage our online identities
Sharing personal stories and beliefs	Promote stories and counter misinformation
	Clinical studies on conditions, care models, insurance, et al

What might happen in 2020s?

Social Changes based on Influential Role: Social Graph to Experience Graph





In the News

Harvard Business School is piloting a program with **Experience.ai** to capture experience data from learning, project performance and decision processes within case study groups. Harvard's vision is for every student to retain rights to experience data and build a critical personal digital asset for the future.

True

False





Context of the *Creepy Line*

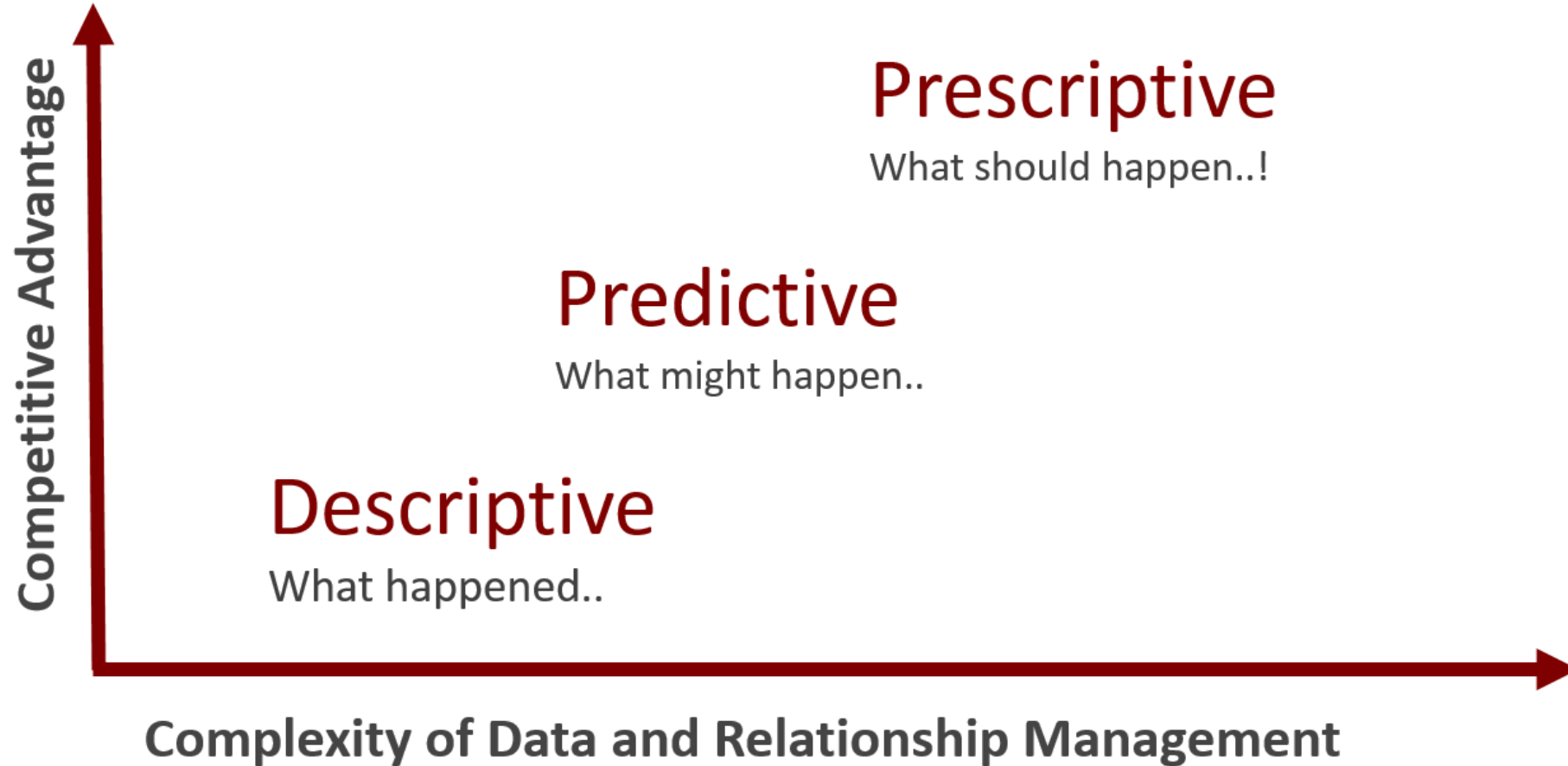
Google

Inevitability of Dealing with the *Creepy vs Compelling Line in..*

Data-driven Health Experiences

Dog Series
Images Removed

Outcomes-based Value Creation Depends on...



Emergence of Data Types & Outcomes-driven World



**Social
Data**



**Health
Data**



**Device +
Infrastructure**



"I did this..."

**Learning & *Doing*
Experience Data**

Signal of Change from Learning & Development (L&D) Community



EXPERIENCE
API

Activity Streams
<Actor, Verb, Object>
“I did this”



Immediate Need: Connect Training to Outcomes

3
hours

Course

EXPERIENCE
API

“I did this...”

Statements

Learning, Performance,
Behavior & Activity

300 hours

Real World

Assumption for 2020s: ExperienceAPI (xAPI) Leaps Beyond Training

Experience Data Appears Inside School, Workplace, Healthcare Settings & Beyond

Scenario: Talent Embraces Experience Capture Analytics

- Sarah **read** an article on blockchain for automating compliance
- Sarah **opened** an Evernote folder on blockchain solutions
- Sarah **watched** a Youtube video introducing the Ethereum blockchain
- Sarah **searched** for Ethereum Meetups in NYC
- Sarah **attended** the Crypto Compliance conference in NYC
- Sarah **created** a List of 'Ethereum Developers' (People) on Twitter
- Sarah **interviewed** *the Head of Blockchain Solutions at JPMorgan*
- Sarah **mentored** *with Joe Lubin co-Founder of Consensys*
- Sarah **completed a course** on Ethereum's Solidity programming language
- Sarah **demonstrated** her pilot Ethereum application at a NYC Meetup
- Sarah **taught** a Coursera MOOC on Ethereum for KYC / AML
- Sarah was hired as Lead Developer of Blockchain Compliance Solutions at Fidelity



"I did this..."
Statements

ExperienceAPI (xAPI) = Learning Record Store (LRS)

Watershed ^{LRS}



Receiving learning records from external applications via xAPI



Storing learning records



Being able to return learning records to external applications when requested via xAPI

Enterprise L&D: Early Adopters are Scaling

How did we do it?: Where are we now?

April 2018:

Over 3 million statements so far

Over **110,000** learners who are sending xAPI statements

We are using **1** LRS system which is segmented by data for each country

Last three months increased our total by 1 million statements

Summer 2019:

We will have **250,000+** learners using it and sending xAPI

We will have a global learning analytics community of around 100 people whose role (full/part) is to look at learning data and help transform our learning

Brought to you by

W
Watershed

**xAPI xAPRIL Spotlight:
Volume & Privacy**

pwc

Sarah Lindsell
Global Chief Learning Strategist at PwC

Steve Tomlinson
Global Senior Learning Architect at PwC

Start small and grow...this is a long journey

ExperienceAPI (xAPI) Case Study: Caterpillar



EXPERIENCE
API



ExperienceAPI (xAPI) L&D integration with focus on training for Service, Sales, Leadership & Marketing.

When trying to help someone learn, the team considers these three vital questions:

1. Where does the learner want to go?
2. What does the learner know?
3. How can we develop the individual?



Understanding
LMS/CMS Activity



Expanding
Video-based Analytics

ExperienceAPI (xAPI) – for Simulation Training

CenarioVR

+

EXPERIENCE
API

“I did this...”



Computer Vision inside Care Settings



The world's first deep learning enabled video camera for developers

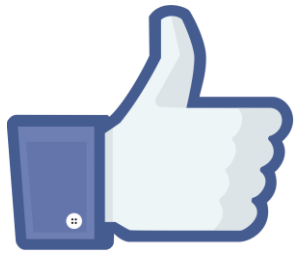
AWS DeepLens helps put deep learning in the hands of developers, literally, with a fully programmable video camera, tutorials, code, and pre-trained models designed to expand deep learning skills.

[Buy Now](#)

[Register your DeepLens](#)



Scenario for 2020s: Early Adopters Embrace Experience Analytics



EXPERIENCE
API

Organizations Will Not Be Prepared for Broad Implications

Assumption to Explore

**By 2025, Experience Data Will Become
Our Most Valuable Digital Asset**


and Controversial

If we capture experience data...



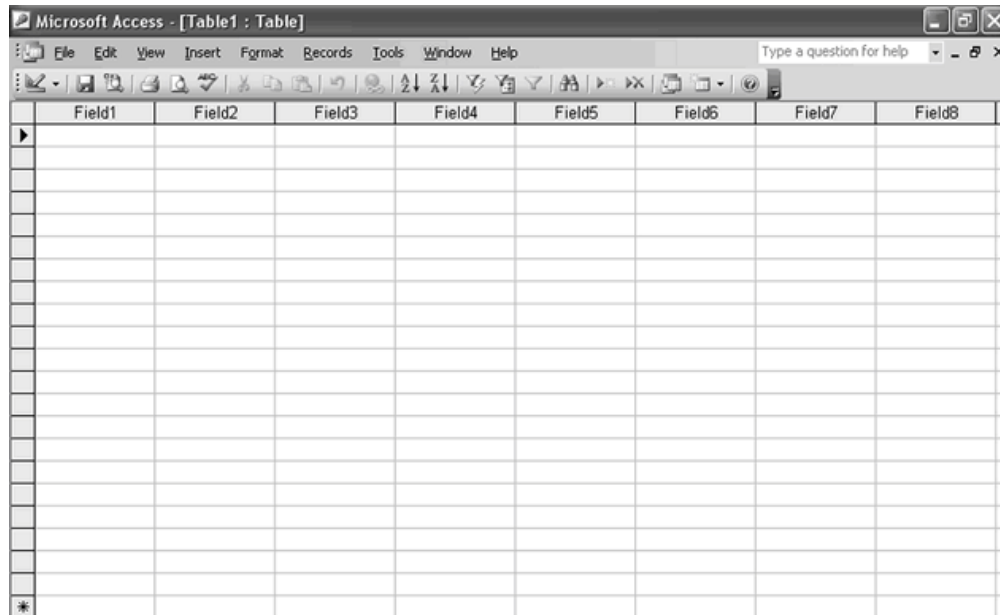
“I did this...”
Statements

How do we approach regulations?

How do we avoid the creepy line?

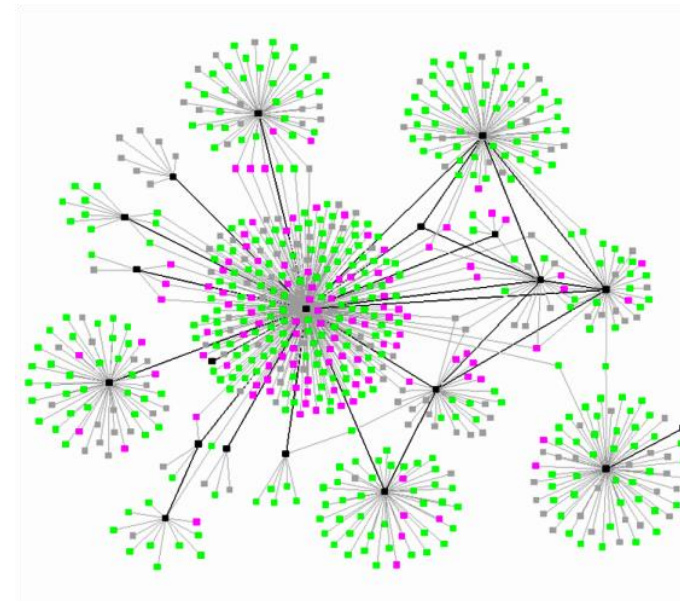
How do we make sense of it?

Experience Data Needs a Connected Data Foundation



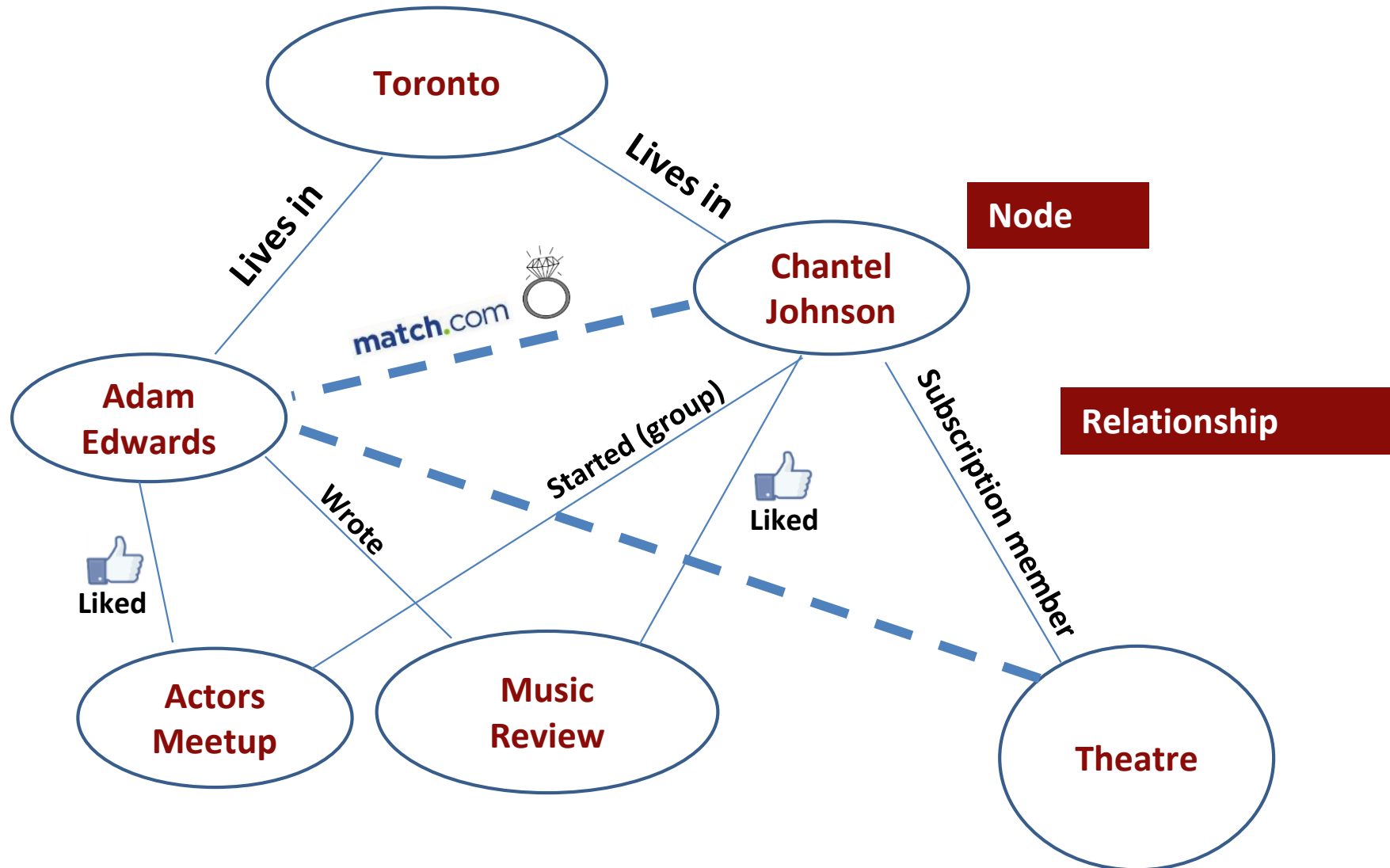
A screenshot of the Microsoft Access application window. The title bar reads "Microsoft Access - [Table1 : Table]". The menu bar includes "File", "Edit", "View", "Insert", "Format", "Records", "Tools", "Window", and "Help". Below the menu bar is a search box with the text "Type a question for help". The main area displays a table with 8 columns labeled "Field1" through "Field8" and approximately 20 empty rows. A small asterisk icon is visible in the bottom-left corner of the table area.

Tables = Past

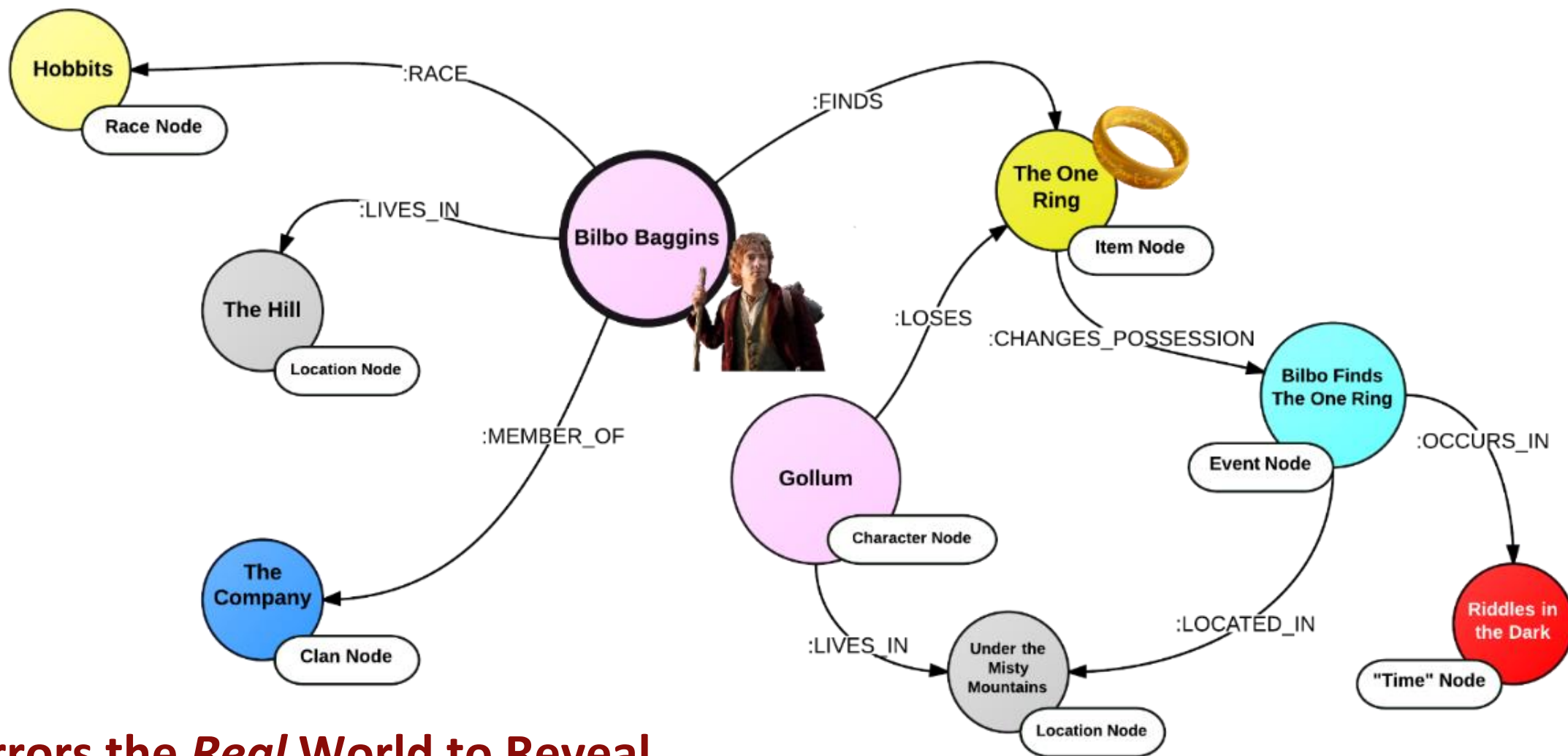


Graph Thinking = Future

Graph Databases = Understanding Relationships & Connections



Experience Data + Graph for Understanding Journey vs Outcomes



Mirrors the *Real World* to Reveal
Influencer Profiles, Decision Pathways and Recommendations

Early Signals of Efforts to Connect Dots on Work Experiences

Neo4j Blog

Evaluating Investor Performance Using Neo4j, GraphXR and ML

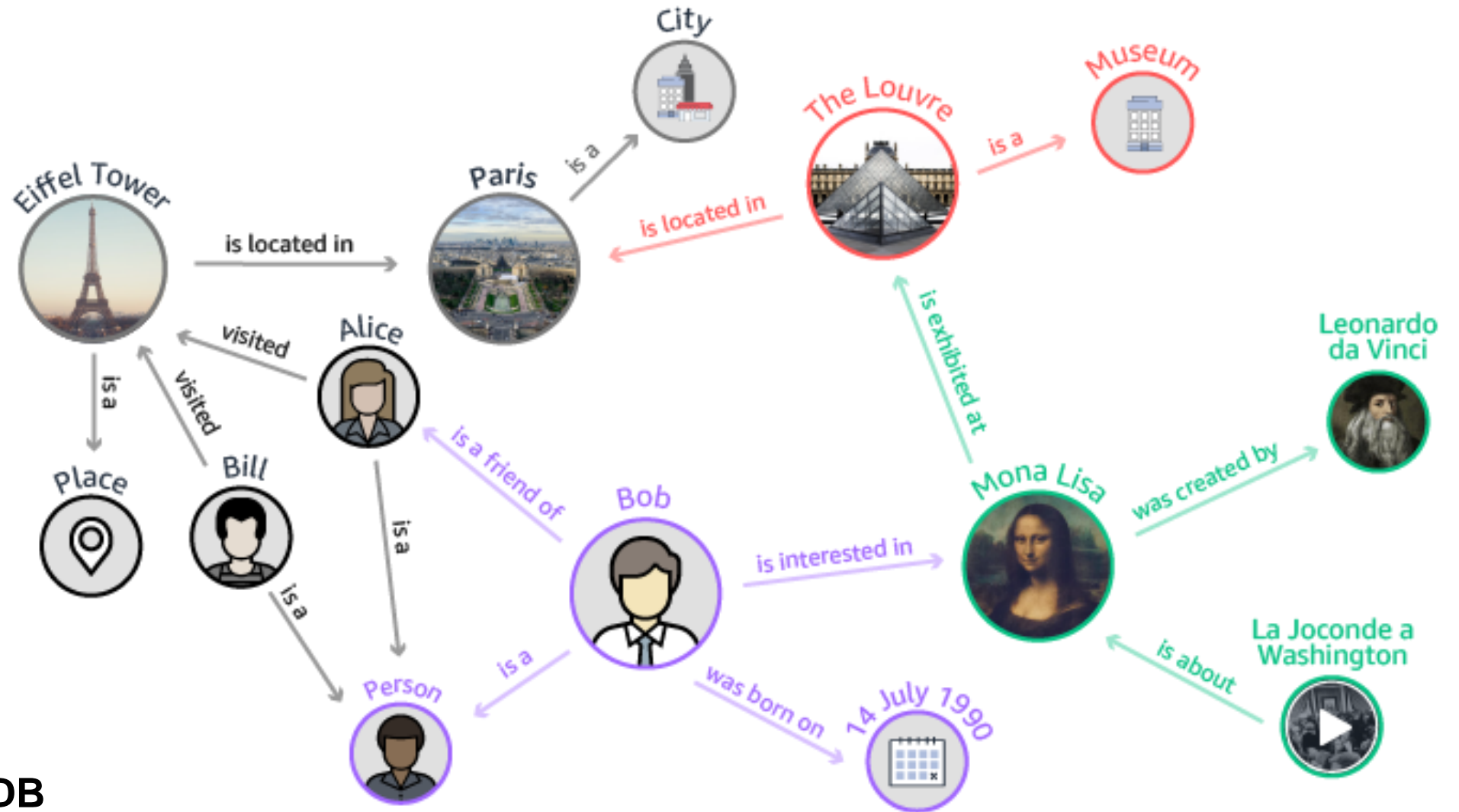


Understanding Our Local Economies



Members – Companies – Jobs – Skills – Schools – Knowledge

Bullish Case for Graph Analytics: Mainstream IT Solutions



Neptune Graph DB

Legacy SQL Database Brands Now Pushing 'Knowledge Graphs'

ORACLE

Artificial Intelligence

April 12, 2019

Introduction to Knowledge Graphs in Healthcare



Rhicheek Patra

SENIOR MEMBER OF TECHNICAL STAFF

The healthcare industry is of utmost importance and focuses on the development of various systems that enable prolonged health through proper diagnoses, predictions, and treatments. Despite the drive to continually innovate and improve patient outcomes, the domain of healthcare services is plagued with manual processes that slow down doctors and employees - such as writing summary notes, correlating measurements, suggesting diagnoses, going through the patient's personal/family history, or looking for past similar cases. While the recent progress made in "Electronic Health Records" (EHRs) is promising, the information captured is not much easier to process due to the huge volume of data. Even with EHRs now being easily accessible and normalized, they usually convey much more information than a doctor can make sense of.

This EHR data itself contains information and data of various kinds, i.e., structured and unstructured, from laboratory measurements and vital signs, to physician notes and radiology imaging. Recent studies in psychological science show that humans can process at most four interacting variables at the same time, supporting the idea that computer-assisted healthcare is the future of the domain. Therefore, the primary value that machine learning brings in healthcare is its ability to process huge datasets of different data types (ex: images, text) beyond the scope of human capability. Furthermore, machine learning can aid doctors in reliably and efficiently

Return of (Vendor Hype) for Enterprise Knowledge Graphs

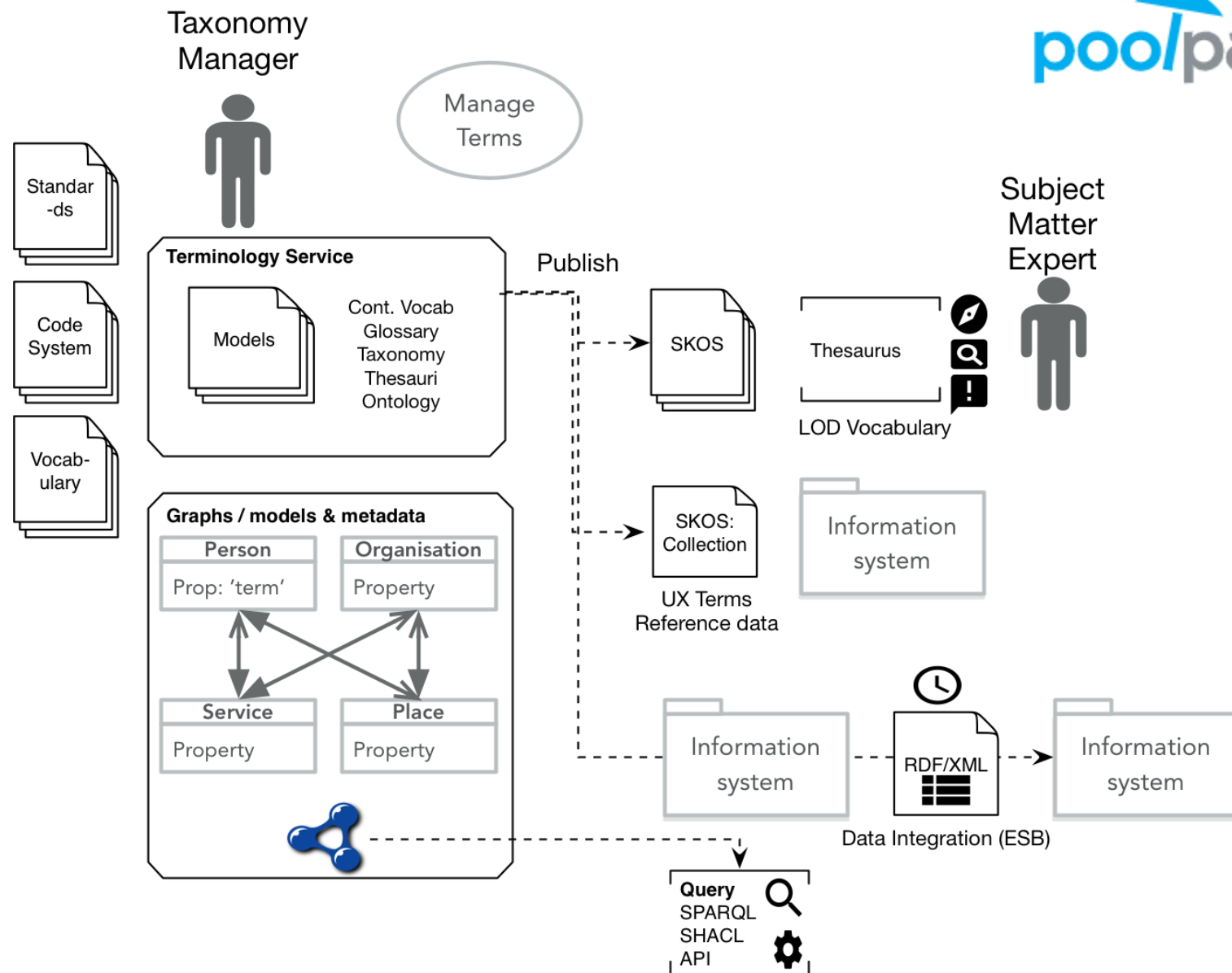


Structured as an additional virtual data layer, the Knowledge Graph lies on top of your existing databases or data sets to link all your data together at scale – be it structured or unstructured.

Knowledge Graphs for Internal Processes



**Build a Layer:
Experience Graph
Meets Knowledge Graph**



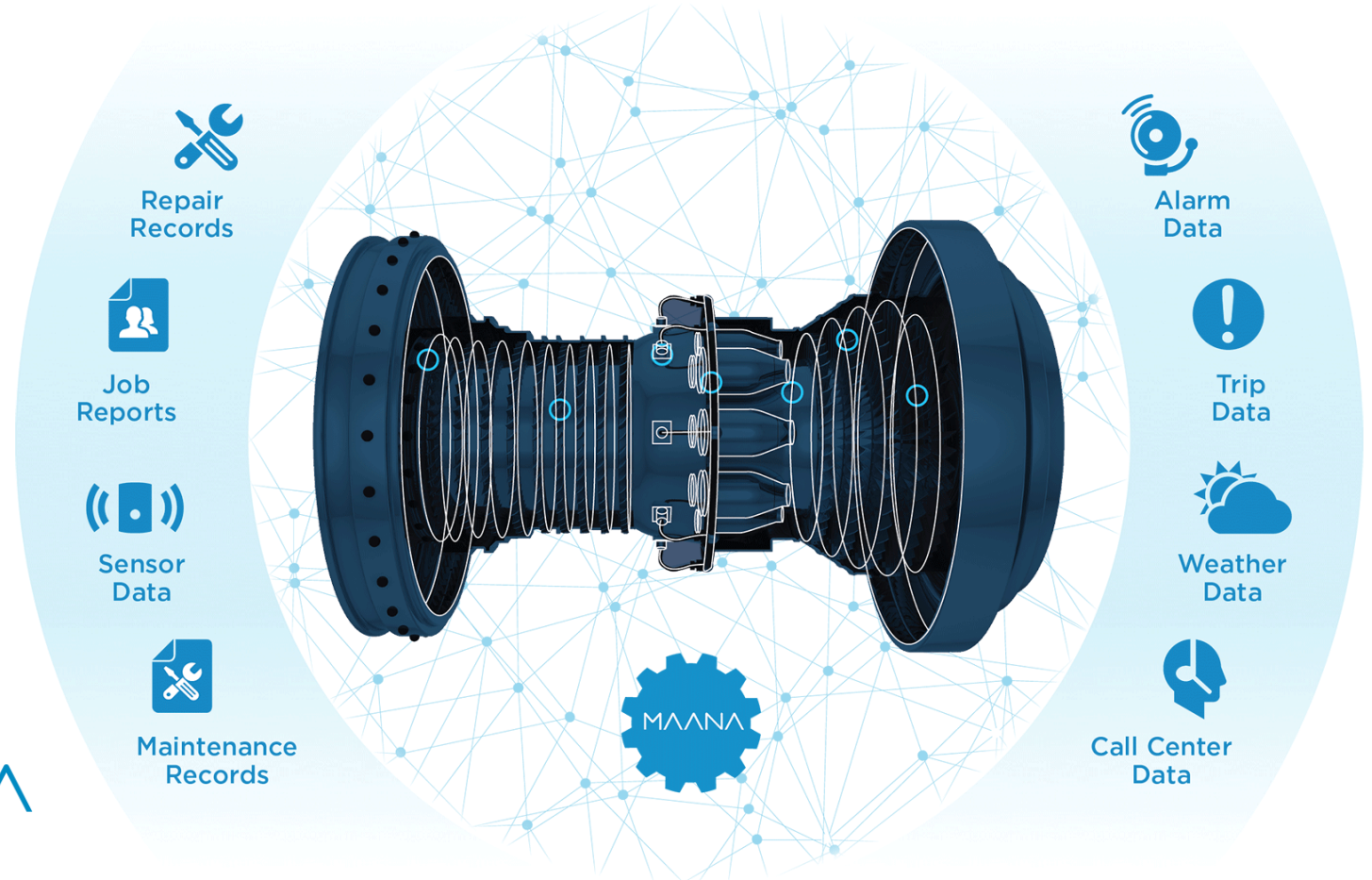
Knowledge Graphs as Connective Tissue for Silos

Maana Knowledge Graph

EXPERIENCE
API

We can know who did
what with each platform

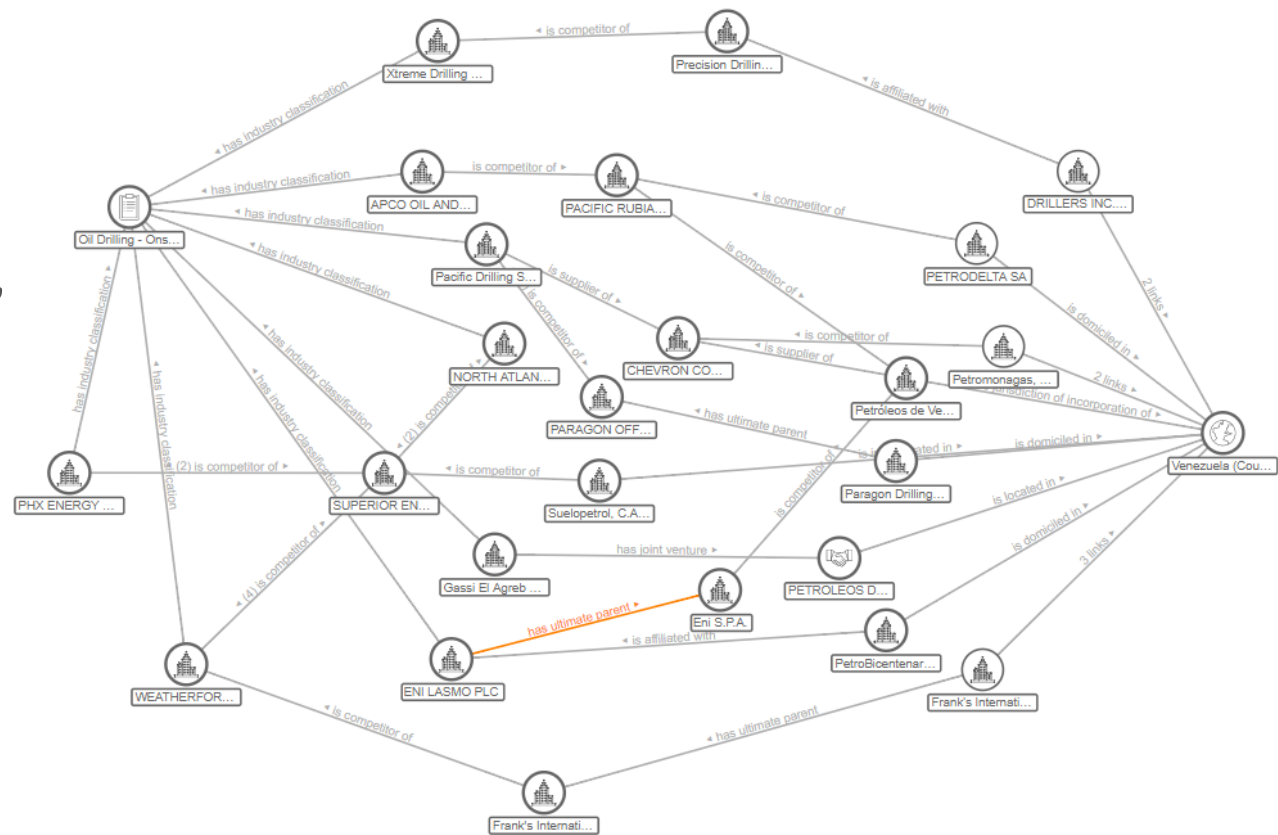
MAANA



Knowledge Graphs as Stand Alone Products



A linked data feed of Thomson Reuters financial content sets with a pre-identified set of relationships, helping you to uncover previously undetected connections within and across data sets.



Momentum in Idea of a 'Knowledge Graph'

Lexipedia

What is a medical knowledge graph?

A medical knowledge graph is a particular type of knowledge base that organizes itself around the relationship between the nodes or entities that make up the graph. Articulating this data as a graph allows for the use of graph-based approaches to querying and working with the data.

For example, three type of nodes in the Lexigraph are drugs, anatomy parts, and diseases. Disease nodes are connected to each other; for example Diabetes Type I (node 1) and Diabetes Type II (node 2) are both types of Diabetes (node 3).

Created by **Lexigram**
Designed for Your Team.
Crafted for Value-Based Care.

How do we have an informed conversations with vendors?

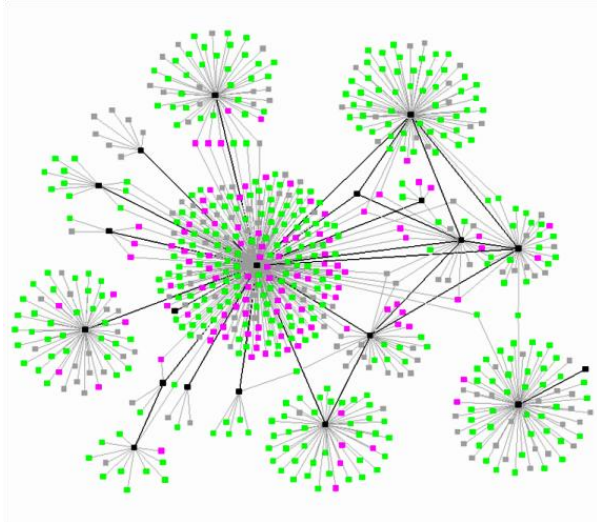


Knowledge Models for Pharma & Healthcare

The pharma & healthcare industry is known for its collaboration across different organisations. Innovation is enabled by knowledge sharing based on well established industry standards. Benefit from an extensive library of highly specific knowledge models.



Healthcare Innovations: Era of xAPI + Experience Graph



EXPERIENCE
xAPI

“I did this...”

- ❑ **Moving Beyond the Resume**
- ❑ **Connecting Clinical & Research**
- ❑ **Fraud Detection / Cyber Security**
- ❑ **Patient Experiences**

Healthcare Innovations: Moving Orgs Beyond the Resume



Resume



Portfolio



Performance

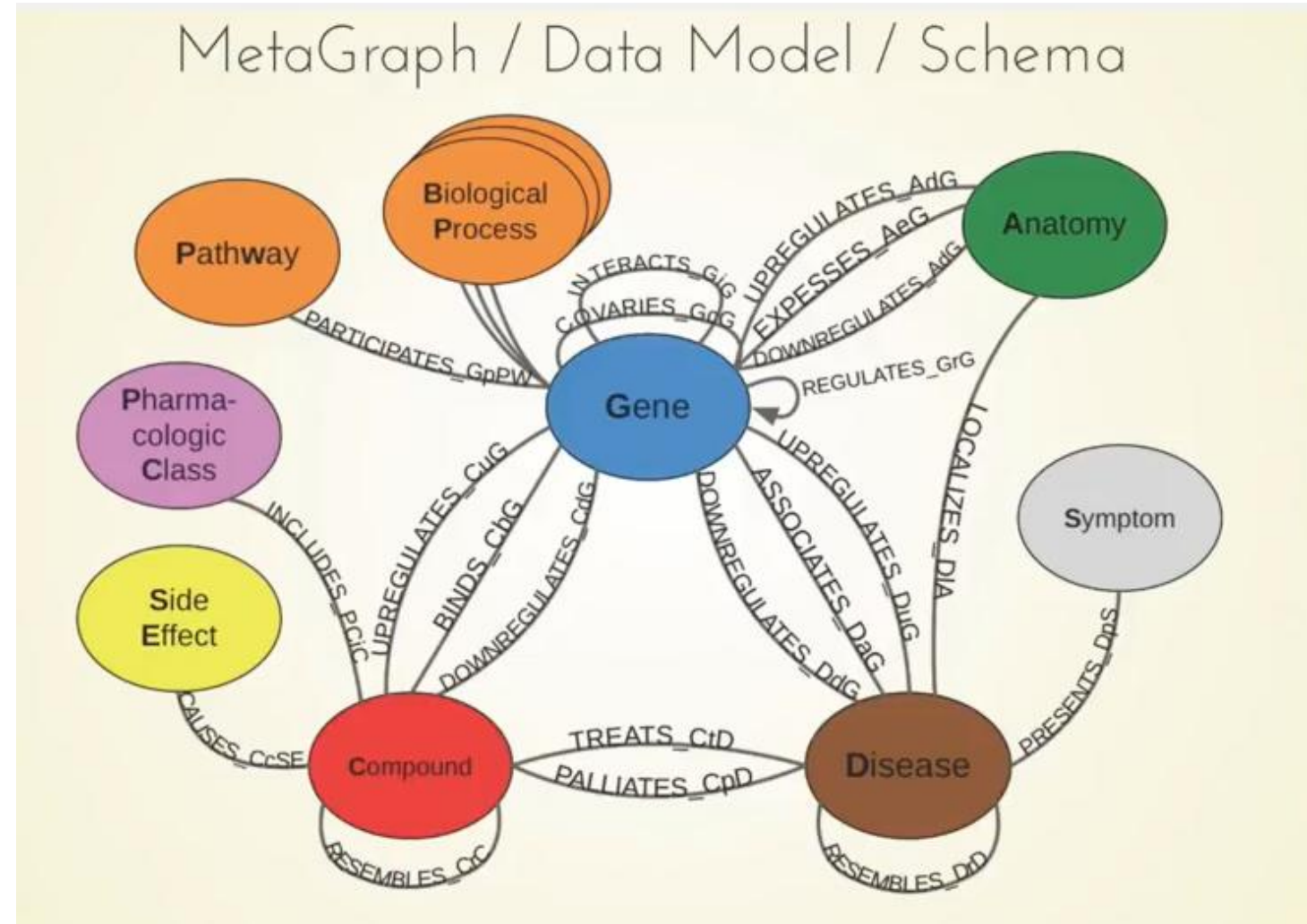


How might we better understand ourselves and share our stories?

Healthcare Innovations: Rapid Adoption in Bio Sciences

Will our clinical care be connected to leading edge research graphs?

(GenCoNet; Hetnets)



Healthcare Innovations: Clinical Care + Research



Graphs to fight diabetes
Dr. Alexander Jarasch
Head of Data and Knowledge Management
The German Center for Diabetes Research (DZD)

GraphConnect
Powered by Neo4j

Meta data

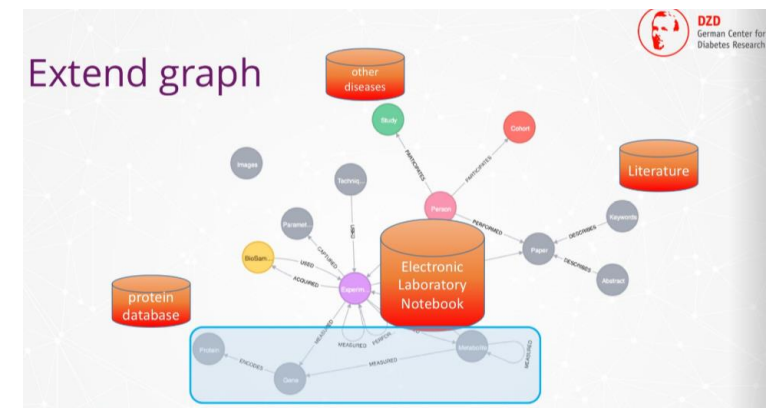
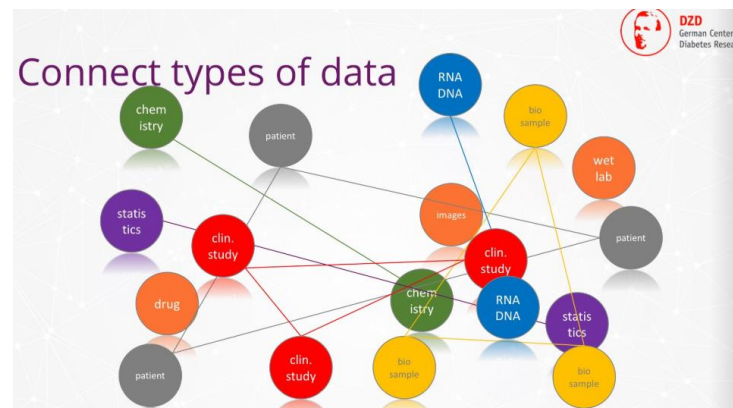
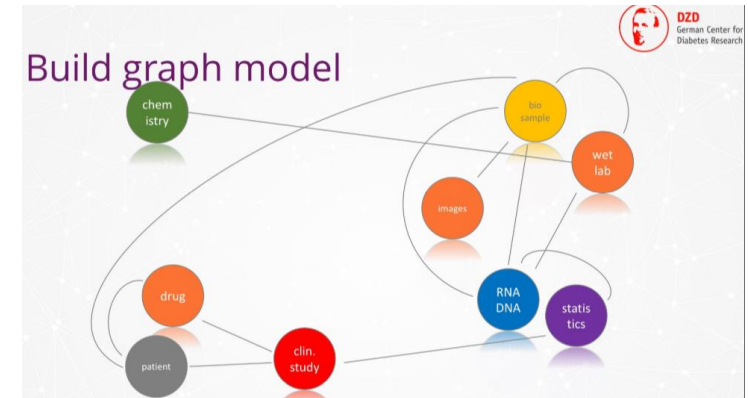
name: pancreatic dissection
format: TIFF
dimension: 3840x2160
amount: 125
staining: no staining
microscope: Zeiss Light sheet Z1
location: Dresden

name: IL-6
unit: mg/ml

sample: blood
organism: pig
amount: 50ml
aliquots: 362
location: Freezer68

title: „about diabetes and Alzheimer's“
PMID: 1255864
doi: http://dx.10213d
year: 2016
journal: Diabetes

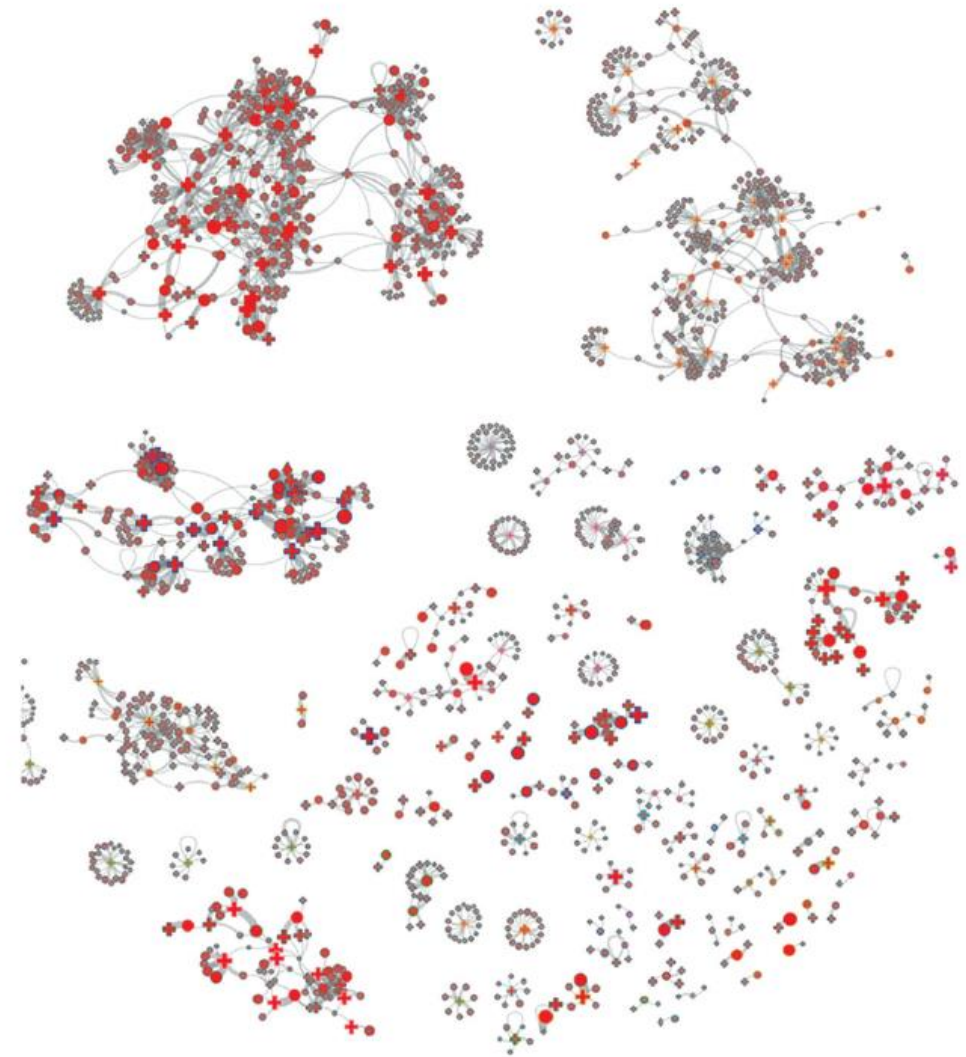
GraphConnect
Powered by Neo4j



Shifted Motion slides

Graph Analysis for Detecting Fraud, Waste, and Abuse in Health-Care Data

*Juan Liu, Eric Bier, Aaron Wilson, John Alexis Guerra-Gomez,
Tomonori Honda, Kumar Sricharan, Leilani Gilpin, and Daniel Davies*



The Missing Link

Common Experience Data

Standard for People to Share Data
with Healthcare Providers and
Consumer grade Health Service



Do we need to create a
Health Version of Standard?

What to expect in next few years?



Amir Bar • 1st


Global Advisor – Knowledge & Processes Analytics at Halliburton

1d




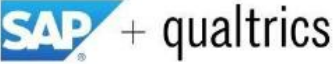
This is yet another proof that “experience data” is essential for any business operation.

...see more

**SAP**
1,328,212 followers
2d + Follow

SAP and Qualtrics join forces, adding the beliefs, sentiments and emotions of customers and employees to the system managing 77% of the world's transactions. Together, now shaping breakthrough experiences and r ...see more

JOINING FORCES TO POWER THE EXPERIENCE ECONOMY



3 Likes

Watch to Watch: Experience Data + Blockchain

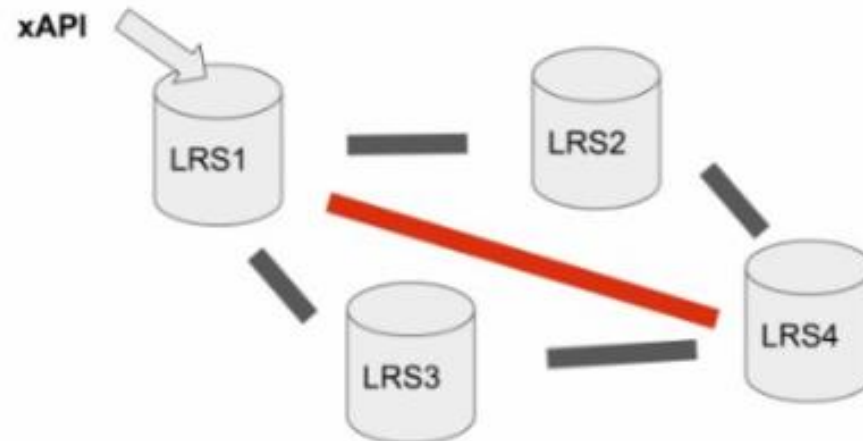


xAPI Gnome @xAPIGnome · 4h

#xAPICohort Team Blockchain explores how blockchain can work with #xAPI:

Blockchain Benefits

- Data is immutable (change is allowed, but only in pre-defined way)
- Access Management (only involved parties can see the data)
- Auditing
- Data Validity
- Secure Data Transmission





Smart Credentials

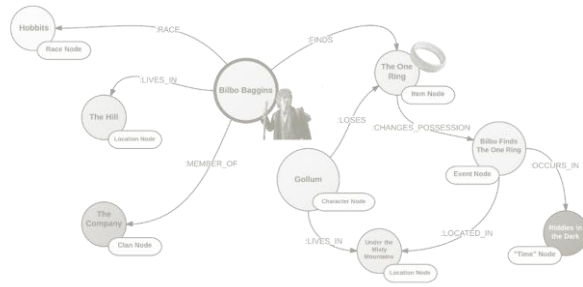
Is this blockchain platform the end of paper certificates?

Verified, trusted and secure credentials underpinned by blockchain

Introducing Smart Credentials, a blockchain platform, which allows credentials to be issued, carried and shared globally in real time. In this video, follow Kyle's journey as he is able to take control over his data through sharing and revoking access of his credentials to third parties including hiring managers who are able to reduce the cost of overheads associated with verification.



Changes Ahead



Techno-Enthusiast View of Experience Graph



Skeptical View of Experience Graph



Learning More

Change is Hard: People & Organizations Will Not Change



Upside: Experience Data and Graph Efforts Enable Us to Change

ELECTRONIC MEDICAL RECORD ADOPTION MODEL

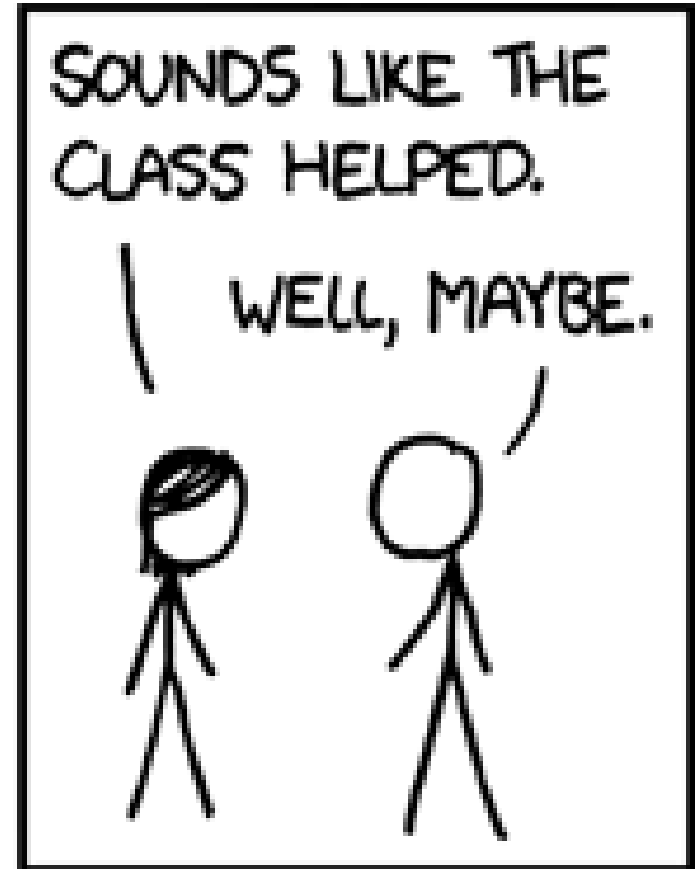
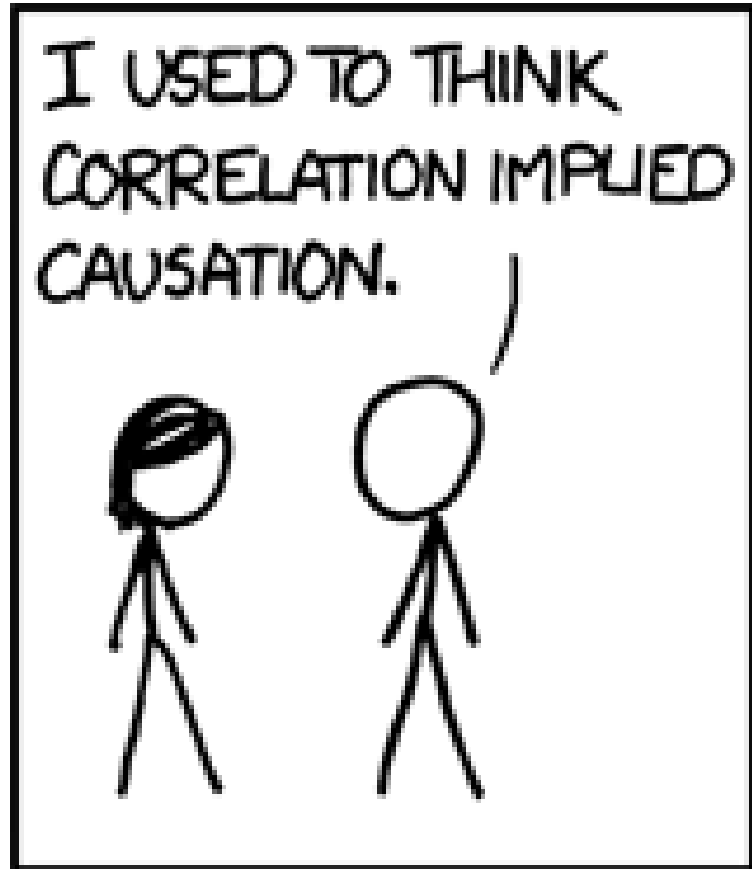


STAGE 7	Complete EMR; External HIE; Data Analytics, Governance, Disaster Recovery, Privacy And Security
STAGE 6	Technology Enabled Medication, Blood Products, And Human Milk Administration; Risk Reporting; Full CDS
STAGE 5	Physician Documentation Using Structured Templates; Intrusion/Device Protection
STAGE 4	CPOE With CDS; Nursing And Allied Health Documentation; Basic Business Continuity
STAGE 3	Nursing And Allied Health Documentation; EMAR; Role-Based Security
STAGE 2	CDR; Internal Interoperability; Basic Security
STAGE 1	Ancillaries - Laboratory, Pharmacy, And Radiology/Cardiology Information Systems; PACS; Digital Non-DICOM Image Management
STAGE 0	All Three Ancillaries Not Installed

ADOPTION MODEL FOR ANALYTICS MATURITY
HIMSS Analytics **AMAM**

STAGE 7	Personalized Medicine & Prescriptive Analytics
STAGE 6	Clinical Risk Intervention & Predictive Analytics
STAGE 5	Enhancing Quality Of Care, Population Health, And Understanding The Economics Of Care
STAGE 4	Measuring And Managing Evidence Based Care, Care Visibility, And Waste Reduction
STAGE 3	Efficient, Consistent Internal And External Report Production And Agility
STAGE 2	Core Data Warehouse Workout: Centralized Database With An Analytics Competency Center
STAGE 1	Foundation Building: Data Aggregation And Initial Data Governance
STAGE 0	Fragmented Point Solutions

More Data Does Not Mean Better Decisions or Outcomes



Vendors will Not Sustain Efforts with Low Adoption

Microsoft is closing its HealthVault patient-records service on November 20

Microsoft's HealthVault personal-health-record service is closing on November 20 and any data left in it at that time will be deleted, Microsoft officials are telling users via e-mail.



By Mary Jo Foley for All About Microsoft | April 5, 2019 -- 20:12 GMT (13:12 PDT) | Topic: Cloud



Explore HealthVault

Discover apps & devices

Sign up or sign in →

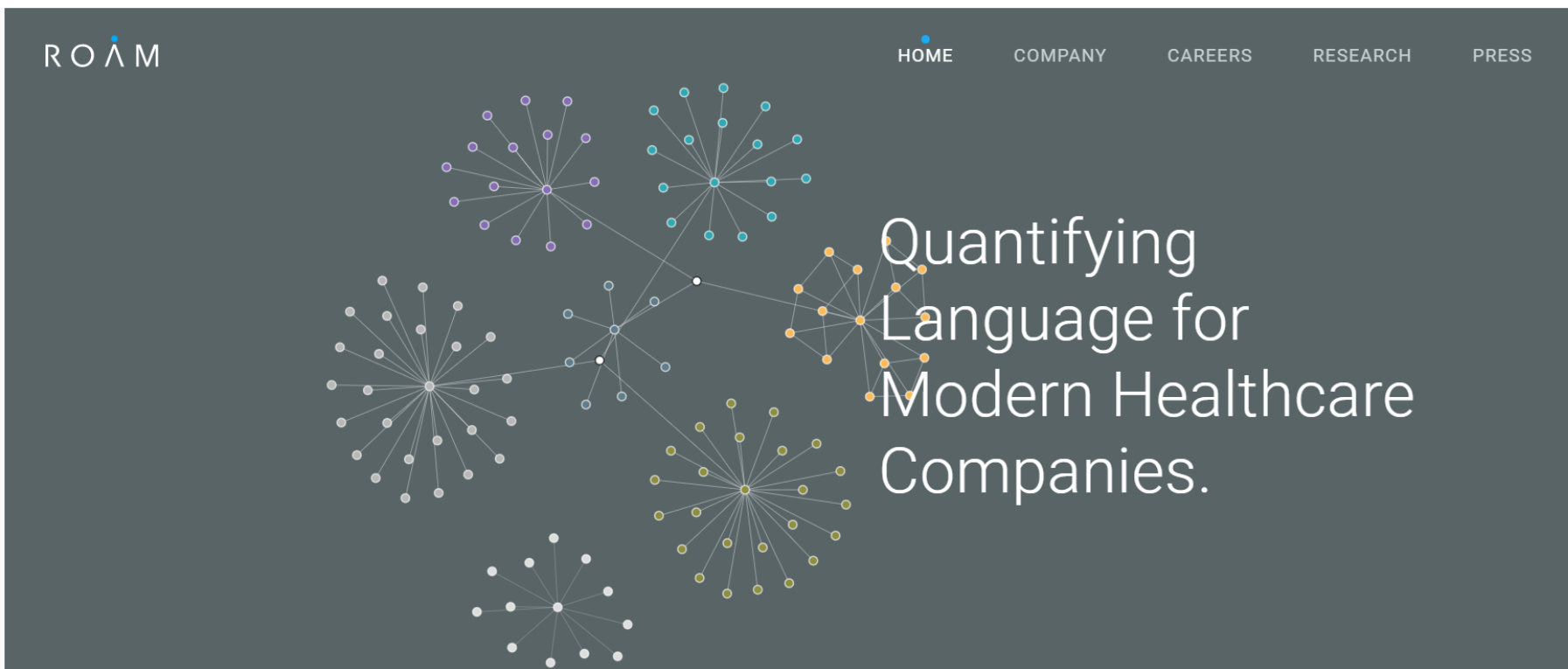
Thank you for using HealthVault. As of November 20, 2019, HealthVault will no longer be supported. Please see the notice you may have received. If you have any questions, please reach out to [HealthVault Customer Support](#).

Take control of
your health.

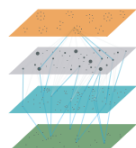
Explore HealthVault →



Upside: Graphs Useful for Other Things: ML, AI, Natural Language



Roam is building the natural language processing infrastructure for modern healthcare systems.



The most valuable intelligence in healthcare is locked away in language data and siloed in disparate systems of record. Data driven healthcare requires the ability to mine those systems in order to quantify language at scale. Roam's platform unlocks the value of text data across various sources and enables companies to organize and structure that information at-scale to drive high-value business use cases



HOSPITAL
SYSTEMS &
PROVIDERS



HEALTHCARE IT
& SERVICE
PROVIDERS

Social Critiques of Experience Graph

Audrey Watters

I am an education writer, an independent scholar, a serial dropout, a rabble-rouser, and ed-tech's Cassandra.



**Techno-solutionism
Often Fails**

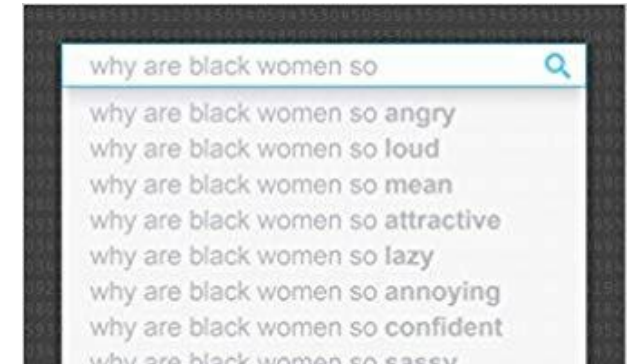


Hack Education

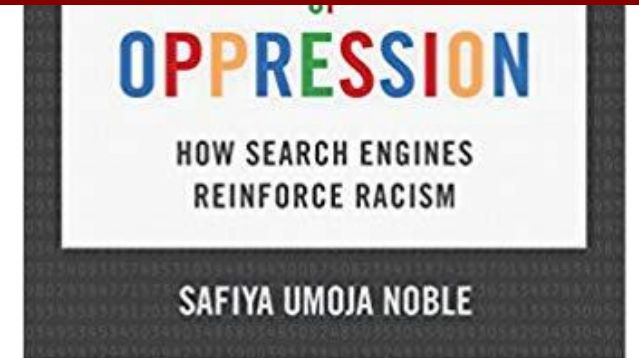
The History of the Future of Education Technology



**Obsession with
Performance Metrics**



**Reinforces Societal
Bias and Divides**



Foresight = Preparing for What if

What if...

Patients and Employees begin to see value in their experience data?

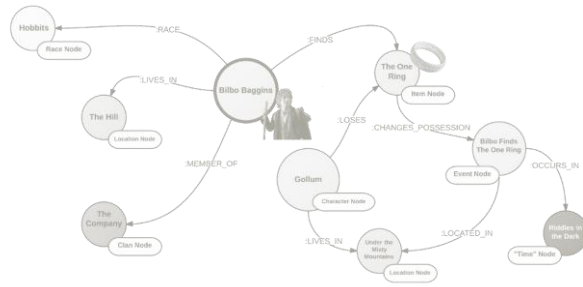
What if...

How we structure our connected data can transform the patient experience?





Changes Ahead



Techno-enthusiast View of Experience Graph



Skeptical View of Experience Graph



Learning More

ExperienceAPI (xAPI) + Learning Record Store (LRS)

**Experience Analytics
Learning Record Stores**

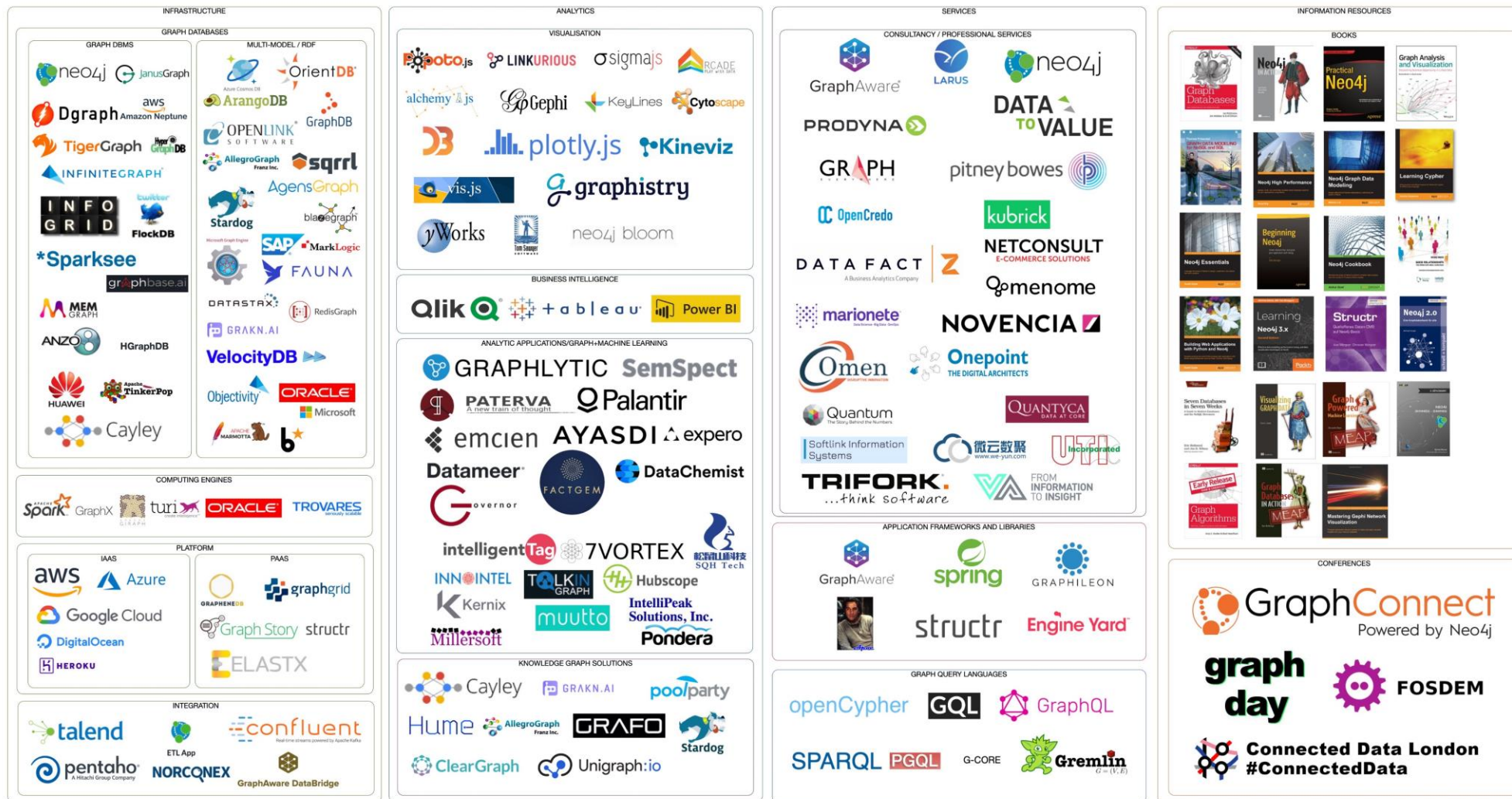
 Yet Analytics

Watershed  LRS

 xapiapps

Catching up the Present of 'Graph'

GRAPH TECHNOLOGY LANDSCAPE 2019



Graph Analytics



Garry Golden

garrygolden@gmail.com

(Two Rs)

PDF & Resources:

garrygolden.com/May16

