data modeling zone

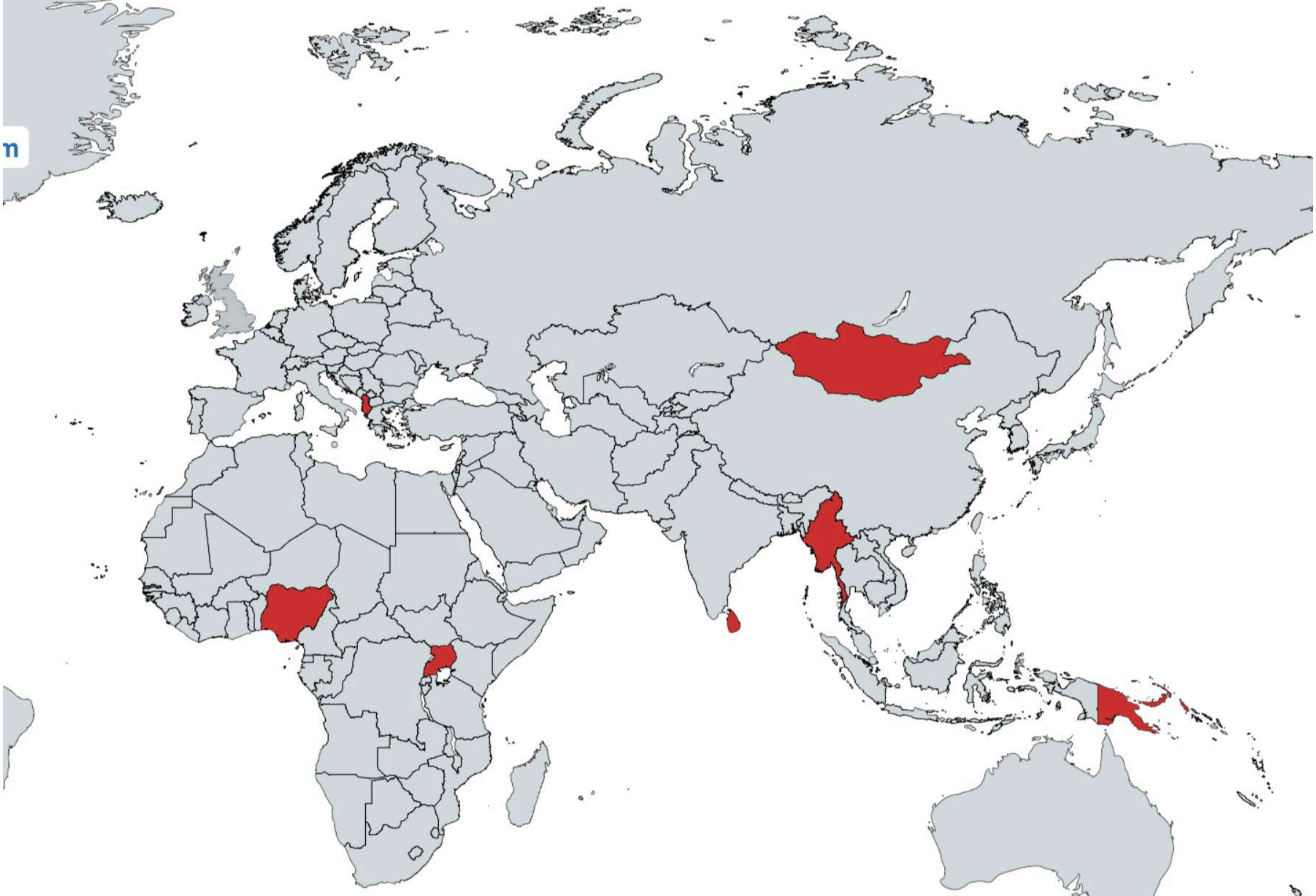
Zero Copy Integration

Feb 2024

Dave McComb

semantic arts

Zero Copy Integration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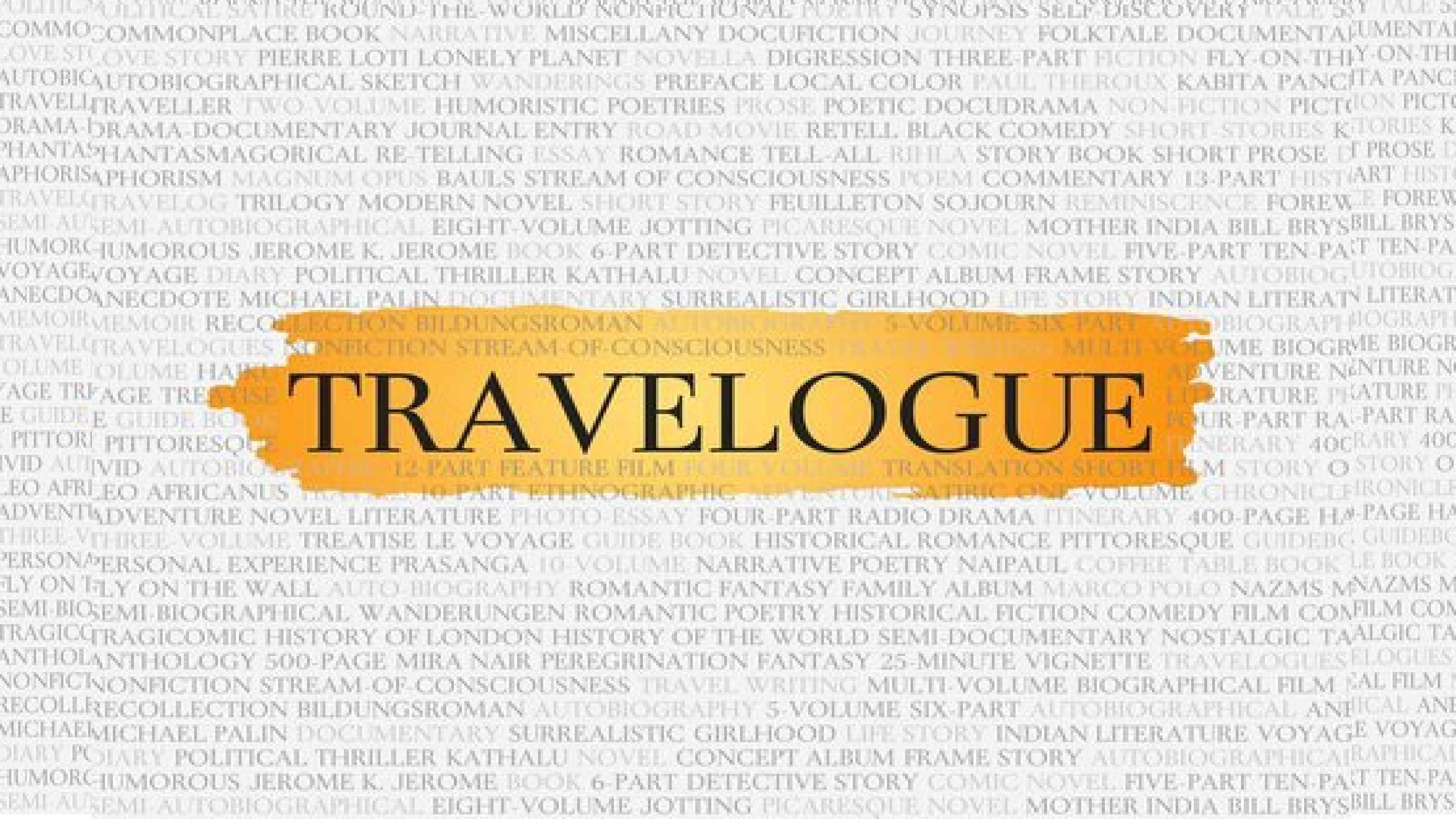
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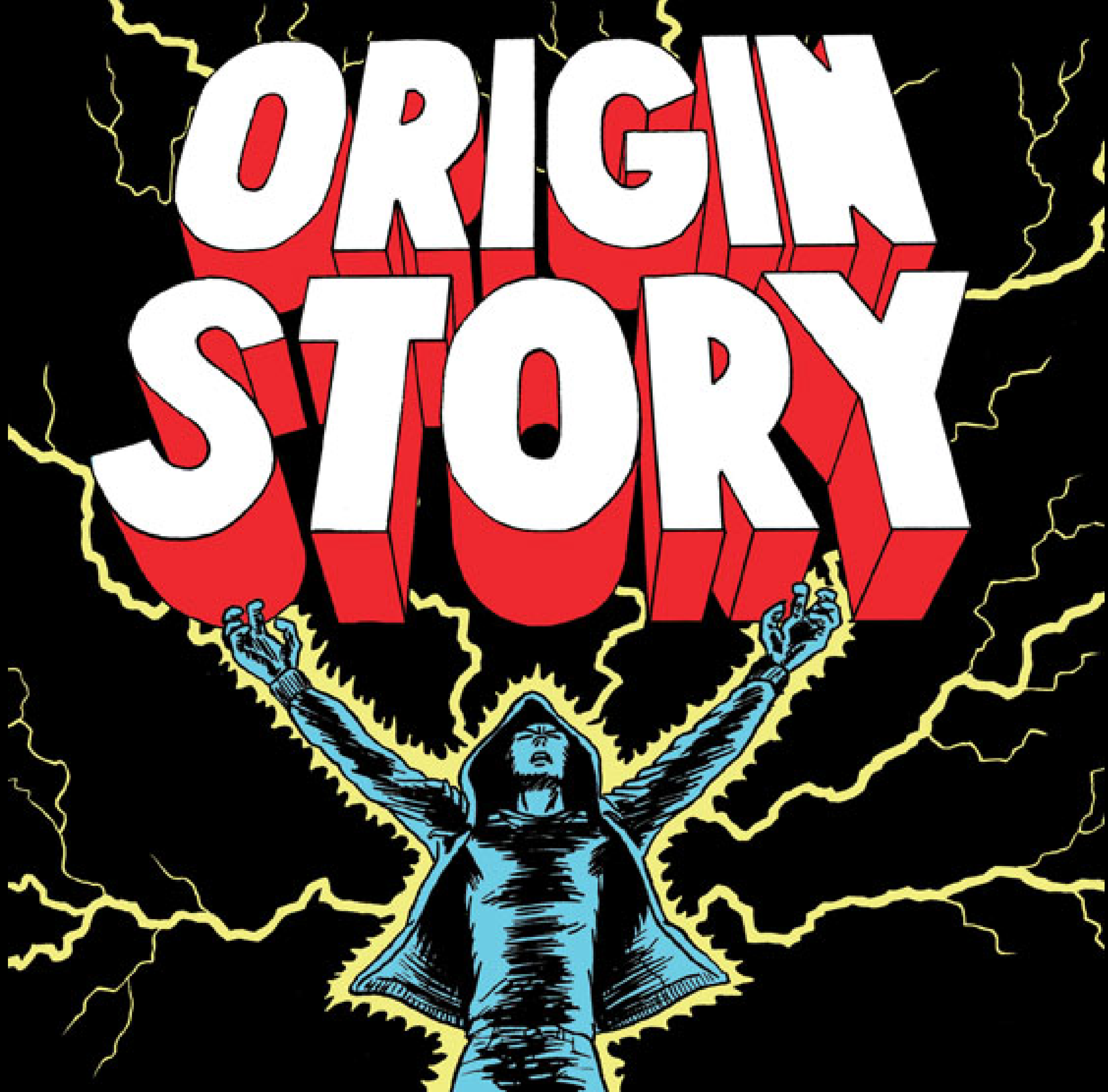
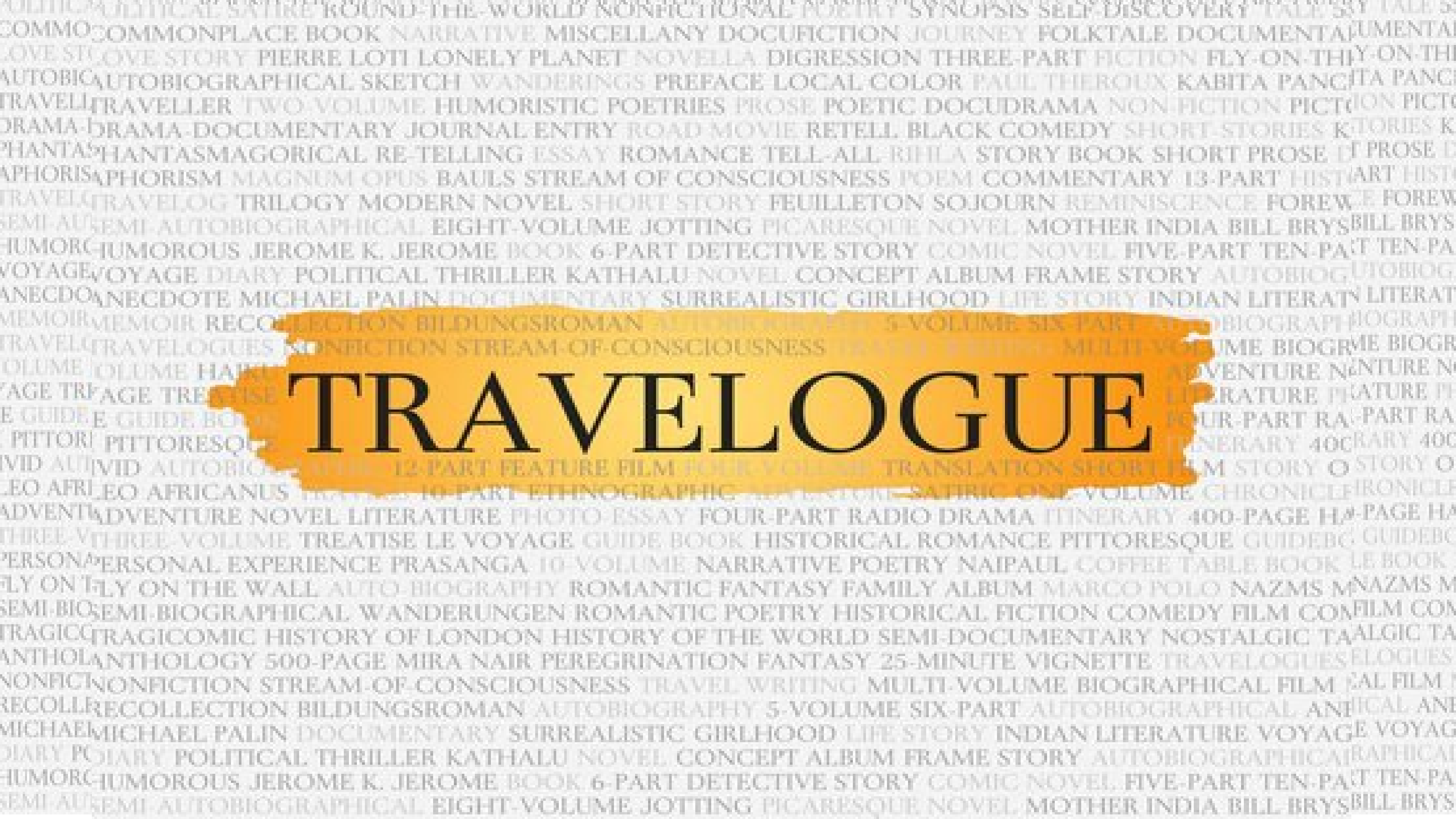
> “There is a reason that truth is stranger than fiction.
> Fiction has to be believable.”
>
> J.C. McComb



ORIGIN
STORY



TRAVELOGUE

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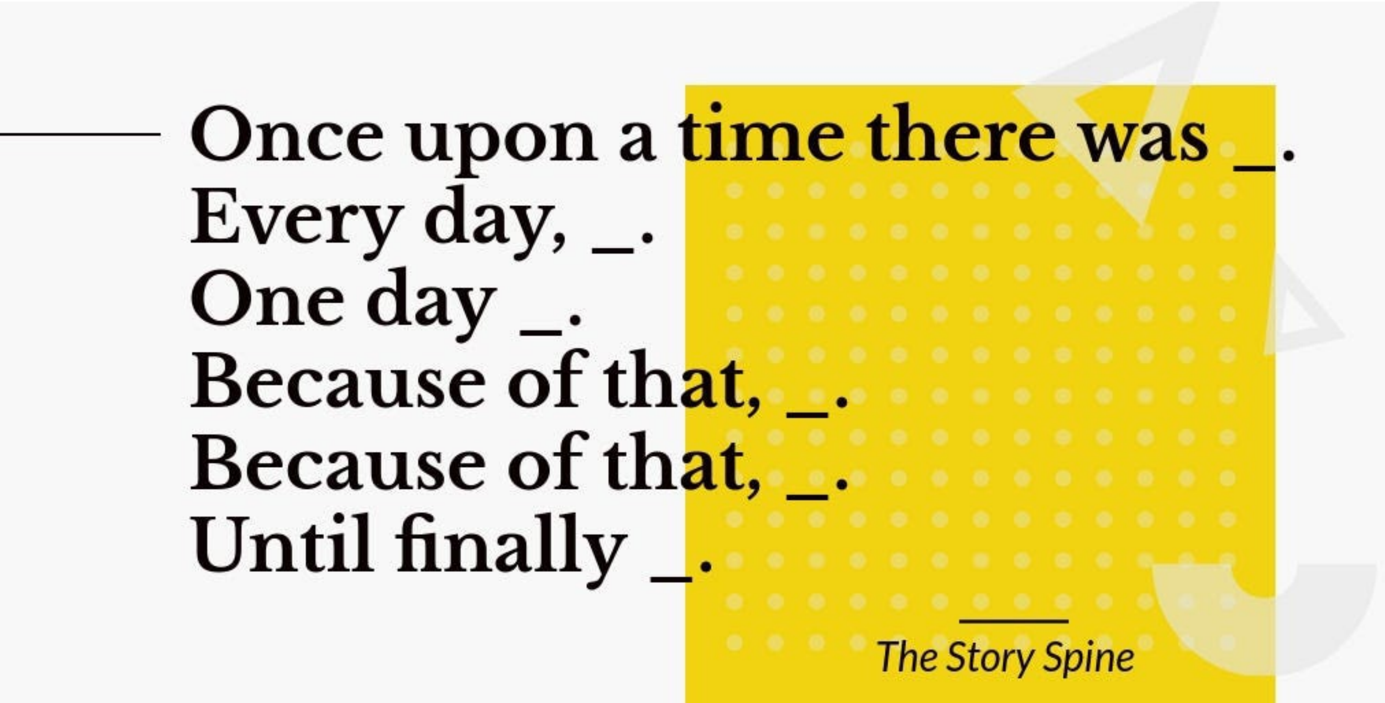
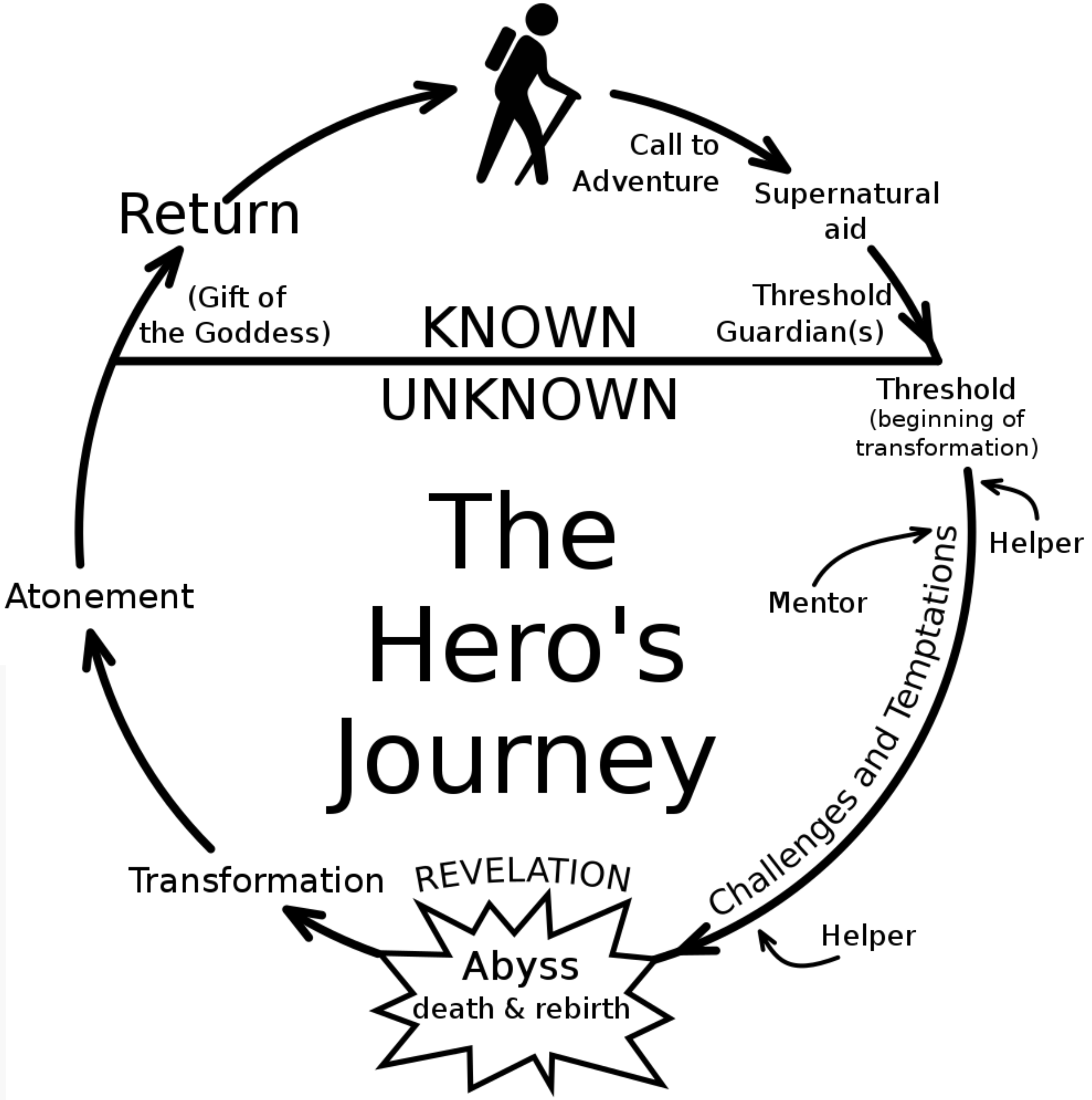


Once upon a time there was _.
Every day, _.
One day _.
Because of that, _.
Because of that, _.
Until finally _.

The Story Spine



Every day (year) another attempt to solve mega corps data problems

ERP

Data Warehouse

Big Data

Blockchain

Cloud

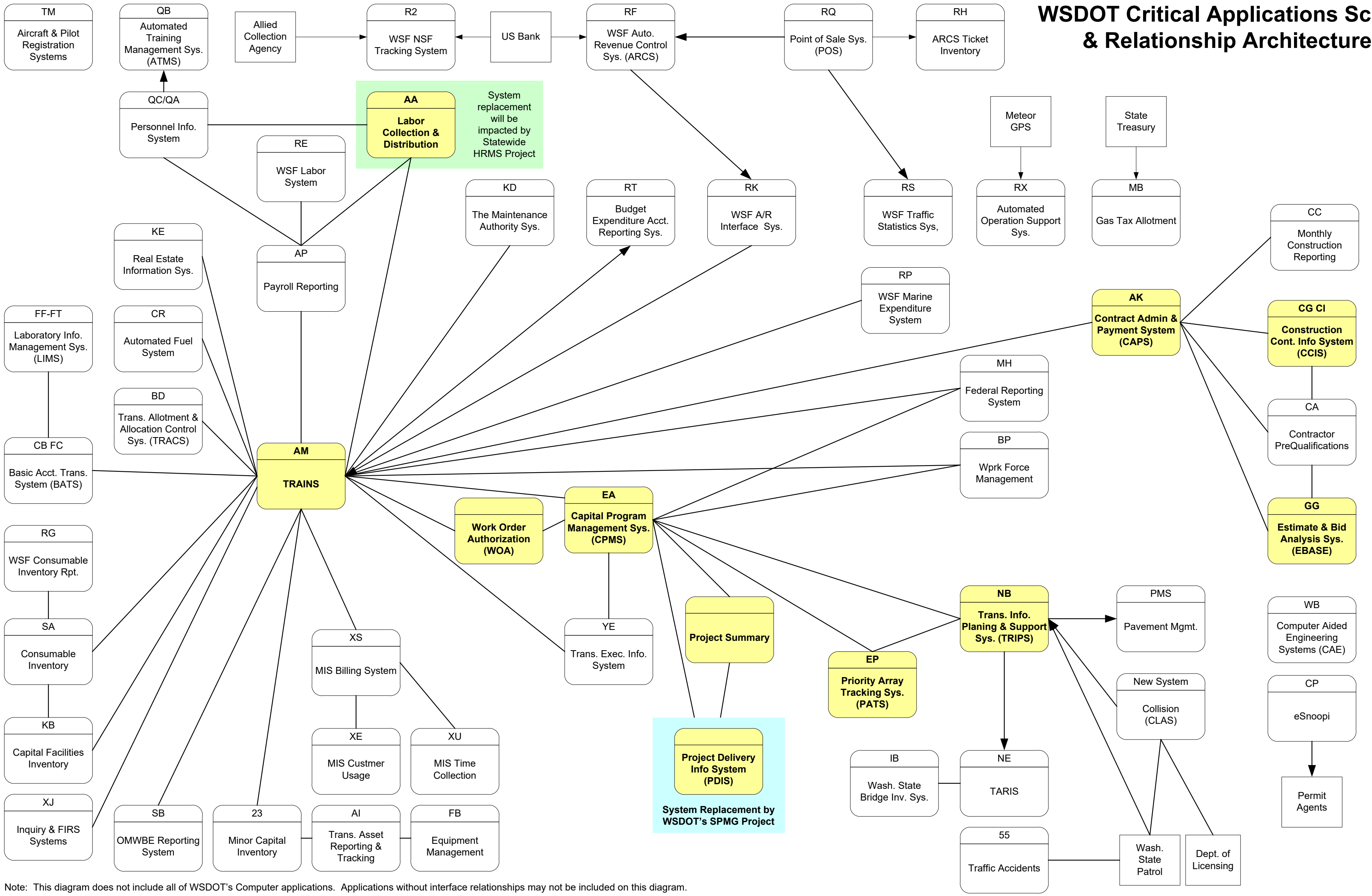
Datalake

Data Fabric

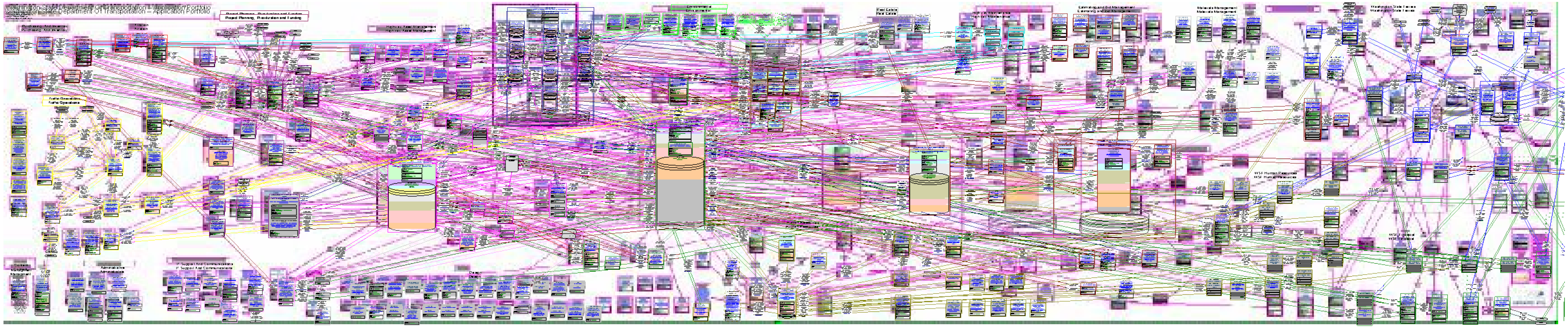
Snowflake

ChatGPT/ LLM

WSDOT Critical Applications Scope & Relationship Architecture


TM
Aircraft & Pilot Registration Systems
QB
Automated Training Management Sys. (ATMS)
Allied Collection Agency
R2
WSF NSF Tracking System
US Bank
RF
WSF Auto. Revenue Control Sys. (ARCS)
RQ
Point of Sale Sys. (POS)
RH
ARCS Ticket Inventory
QC/QA
Personnel Info. System
AA
Labor Collection & Distribution
System replacement will be impacted by Statewide HRMS Project
RE
WSF Labor System
Meteor GPS
State Treasury
KD
The Maintenance Authority Sys.
RT
Budget Expenditure Acct. Reporting Sys.
RK
WSF A/R Interface Sys.
RS
WSF Traffic Statistics Sys,
RX
Automated Operation Support Sys.
MB
Gas Tax Allotment
CC
Monthly Construction Reporting
KE
Real Estate Information Sys.
AP
Payroll Reporting
RP
WSF Marine Expenditure System
AK
Contract Admin & Payment System (CAPS)
CG CI
Construction Cont. Info System (CCIS)
FF-FT
Laboratory Info. Management Sys. (LIMS)
CR
Automated Fuel System
MH
Federal Reporting System
BD
Trans. Allotment & Allocation Control Sys. (TRACS)
CA
Contractor PreQualifications
CB FC
Basic Acct. Trans. System (BATS)
AM
TRAINS
BP
Wprk Force Management
EA
Capital Program Management Sys. (CPMS)
Work Order Authorization (WOA)
GG
Estimate & Bid Analysis Sys. (EBASE)
RG
WSF Consumable Inventory Rpt.
XS
MIS Billing System
NB
Trans. Info. Planing & Support Sys. (TRIPS)
PMS
Pavement Mgmt.
WB
Computer Aided Engineering Systems (CAE)
SA
Consumable Inventory
YE
Trans. Exec. Info. System
Project Summary
EP
Priority Array Tracking Sys. (PATS)
New System
Collision (CLAS)
CP
eSnoopi
KB
Capital Facilities Inventory
XE
MIS Custmer Usage
XU
MIS Time Collection
Project Delivery Info System (PDIS)
System Replacement by WSDOT's SPMG Project
IB
Wash. State Bridge Inv. Sys.
NE
TARIS
Permit Agents
XJ
Inquiry & FIRS Systems
SB
OMWBE Reporting System
23
Minor Capital Inventory
AI
Trans. Asset Reporting & Tracking
FB
Equipment Management
55
Traffic Accidents
Wash. State Patrol
Dept. of Licensing

Note: This diagram does not include all of WSDOT's Computer applications. Applications without interface relationships may not be included on this diagram.



Washington State Department Of Transportation – Application Portfolio

See things as they really are

SECRETARY OF STATE

STATE OF WASHINGTON

Periodic Table of Gist

PS Physical Substance	G GeoRegion									M Magnitude	U Units
PI Physically Id Item	Or Organization	Co Content	Ge Generative Content	Ev Event	Ta Task	Ob Obligation	TR Temporal Relation	TP Time Period	Cn Collection	IP Intellectual Property	Re Reference

Periodic Table of Gist

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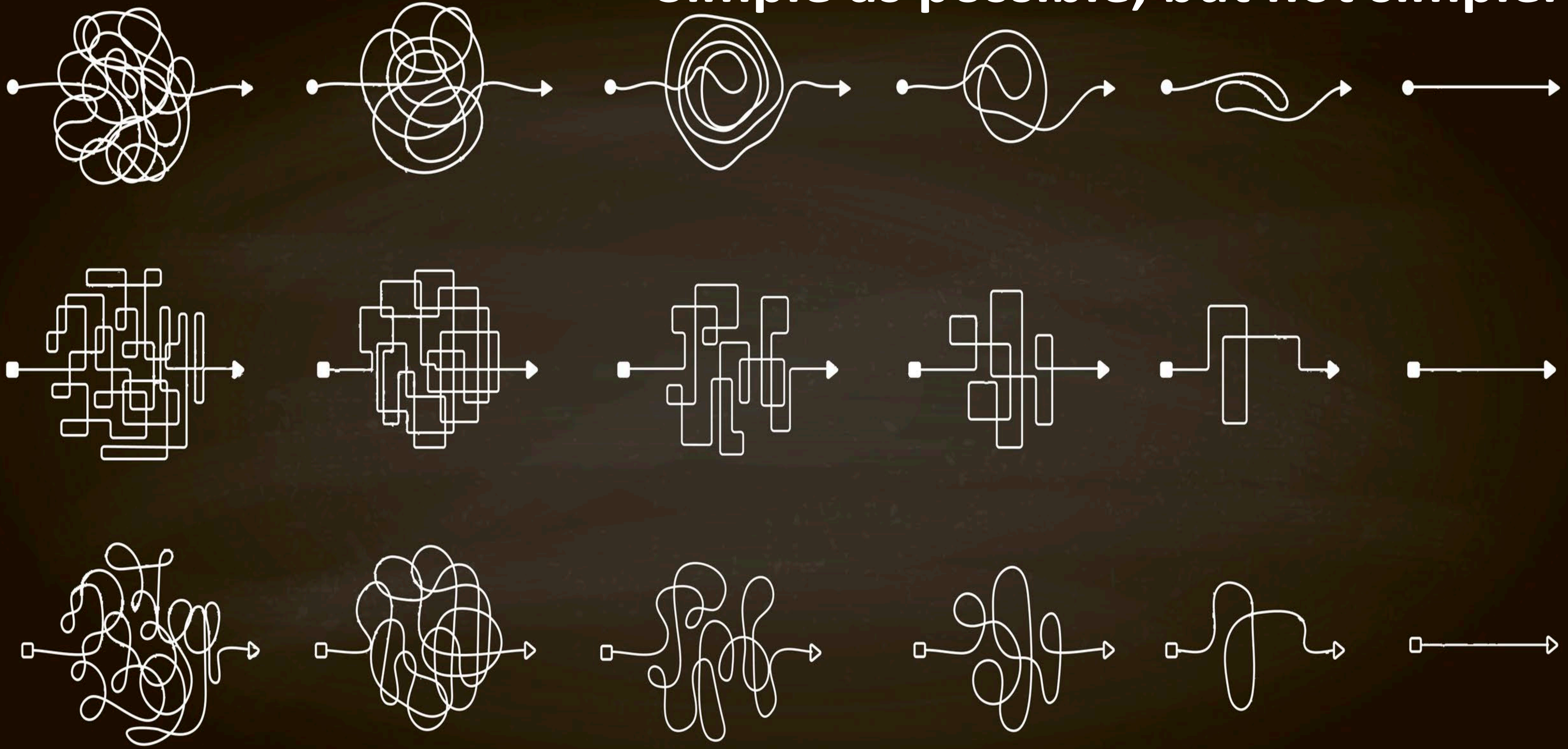
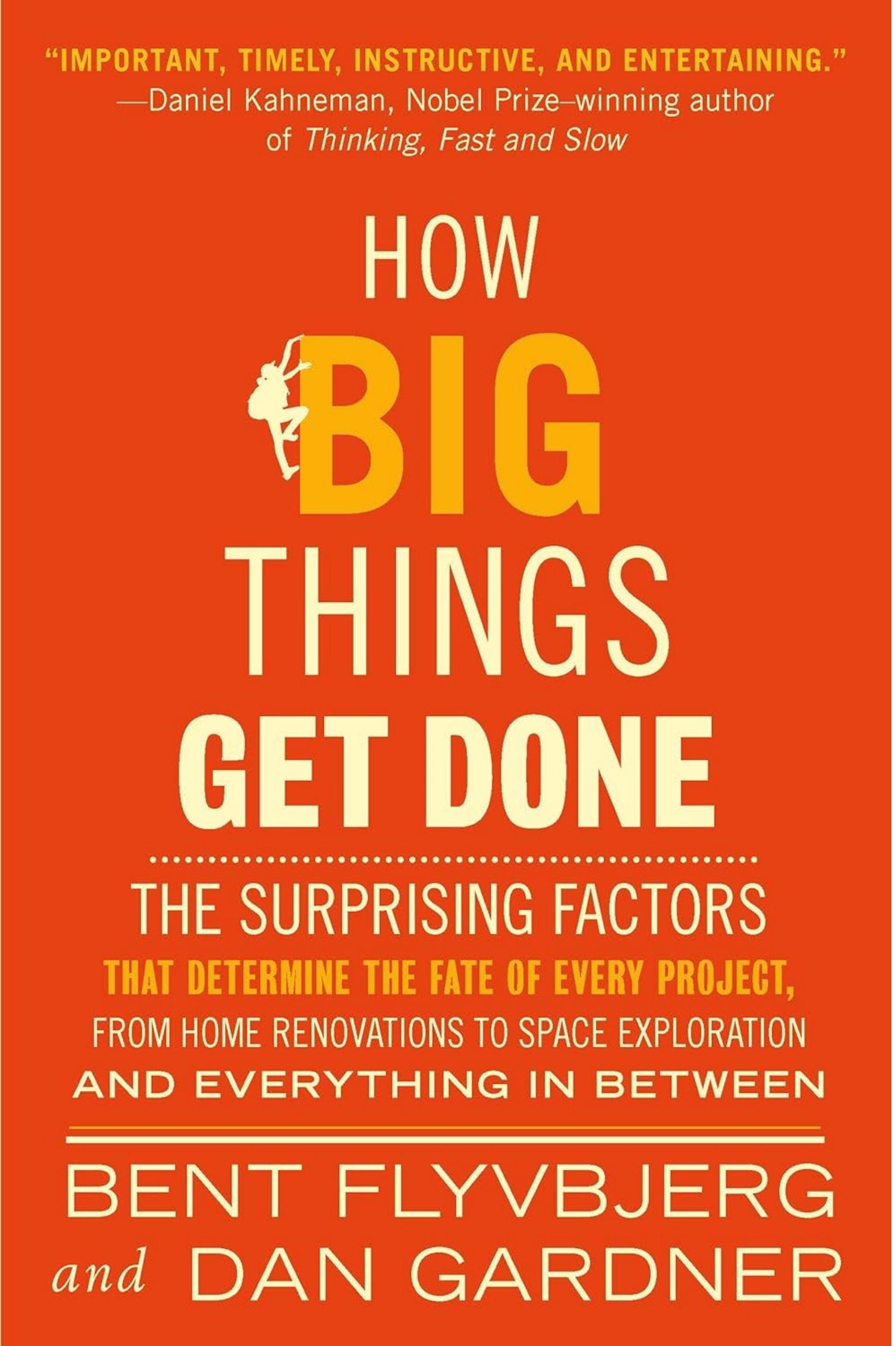
PI Physically Id Item	Or Organization	Co Content	Ge Generative Content	Ev Event	Ta Task	Ob Obligation	TR Temporal Relation	TP Time Period	Cn Collection	IP Intellectual Property	Re Reference
Pe Person		ID ID	Te Template	BE Business Event	Pr TProject	Ag Agreement	As Assignment	PP Pay Period	Pa Pay Stub	Br Brand	C Category
St Stuff		Ad Address	Fo Form		CP Client Project	LA Labor Agreement	Ow Ownership	AP Acct Period	FS Financial Stetment	K Knowledge	CL Computer Language
Bu building		Do Document	Ve View								HL Human Language
Eq Equipment											

Simple as possible, but not simpler



Modularize

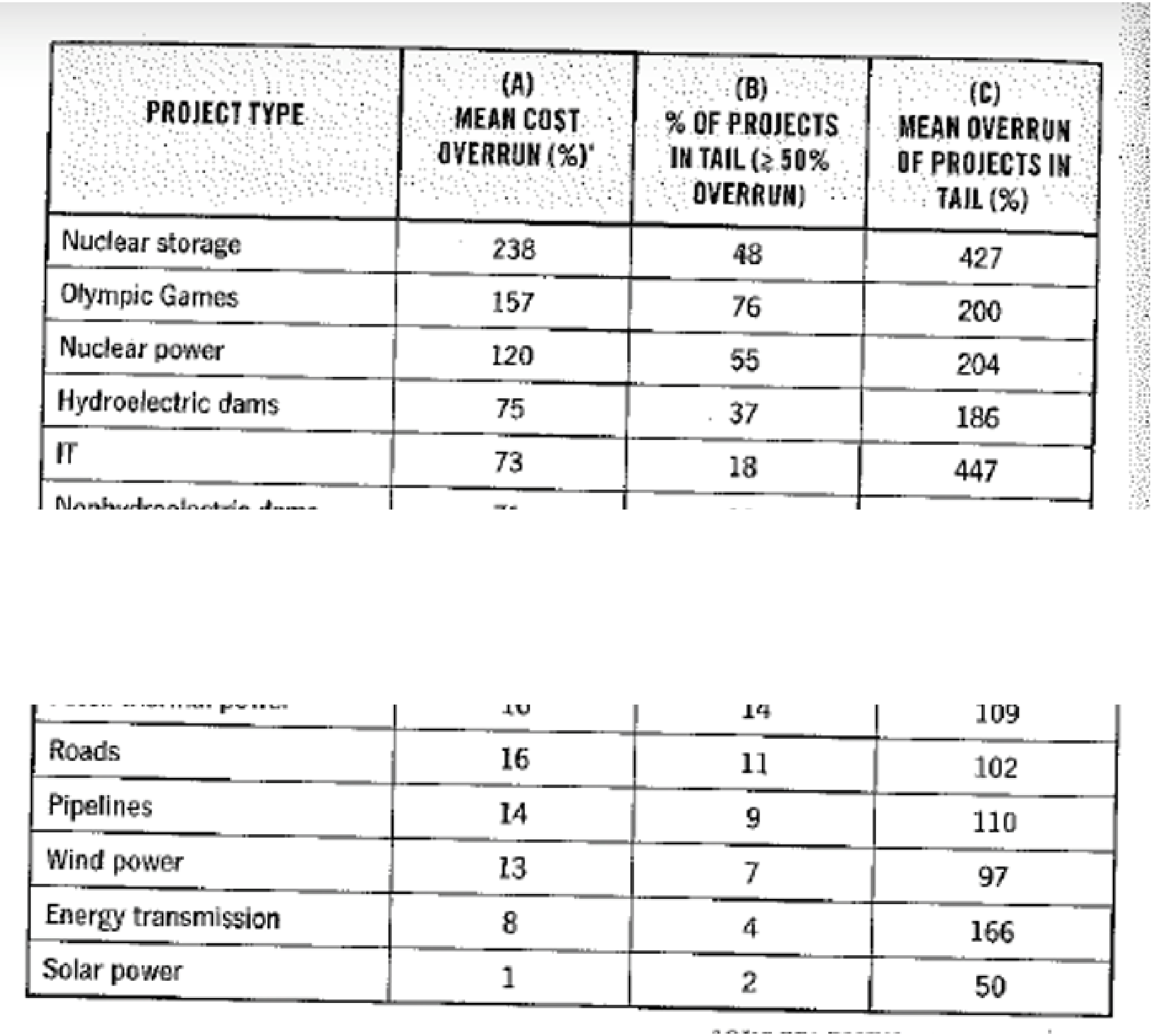


"IMPORTANT, TIMELY, INSTRUCTIVE, AND ENTERTAINING."
—Daniel Kahneman, Nobel Prize–winning author
of *Thinking, Fast and Slow*

HOW BIG THINGS GET DONE

THE SURPRISING FACTORS
THAT DETERMINE THE FATE OF EVERY PROJECT,
FROM HOME RENOVATIONS TO SPACE EXPLORATION
AND EVERYTHING IN BETWEEN

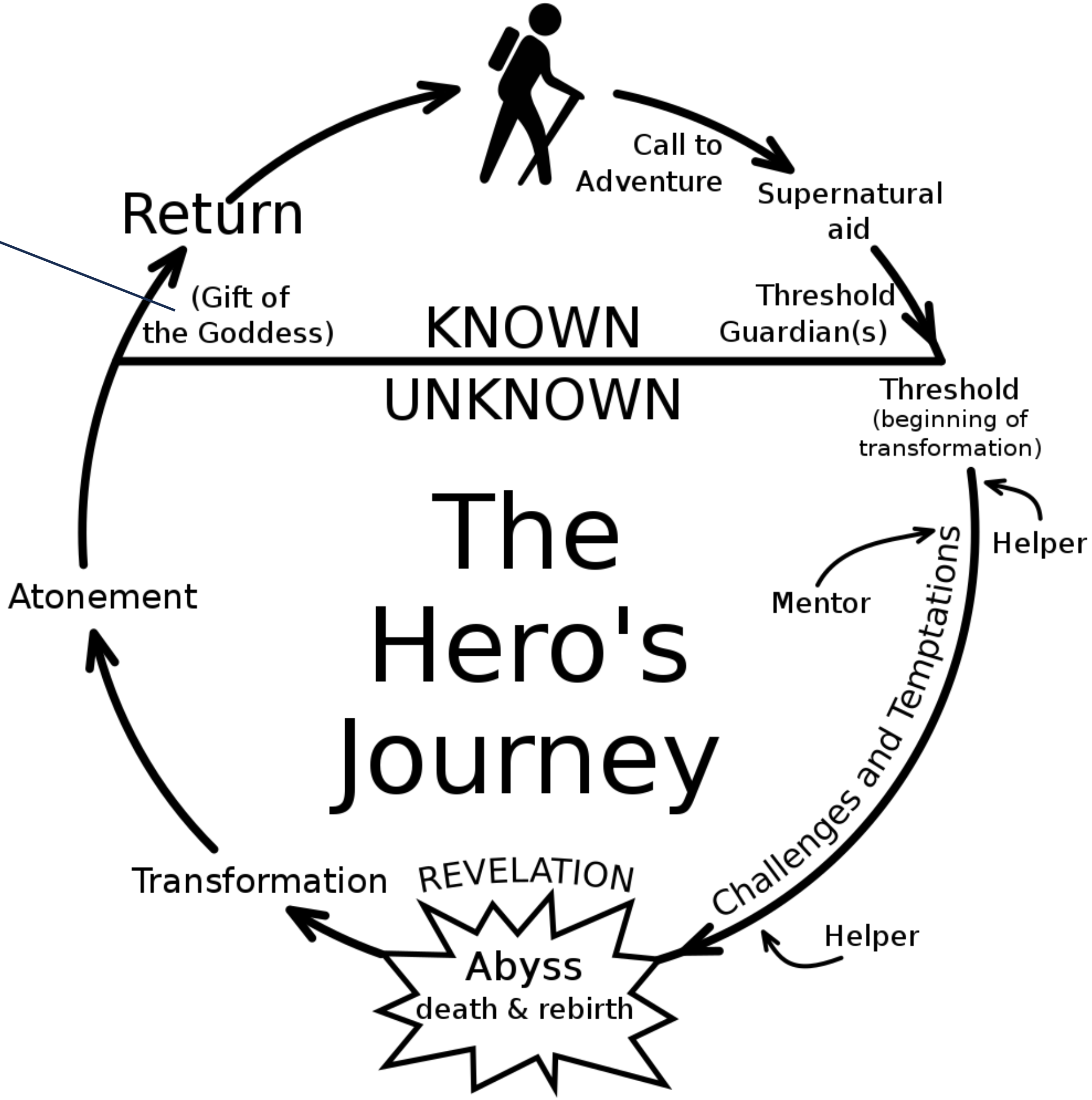
BENT FLYVBJERG
and DAN GARDNER



PROJECT TYPE	(A) MEAN COST OVERRUN (%)*	(B) % OF PROJECTS IN TAIL (≥ 50% OVERRUN)	(C) MEAN OVERRUN OF PROJECTS IN TAIL (%)
Nuclear storage	238	48	427
Olympic Games	157	76	200
Nuclear power	120	55	204
Hydroelectric dams	75	37	186
IT	73	18	447
Nonhydroelectric dams	[illegible]	[illegible]	[illegible]
Fossil thermal power	16	14	109
Roads	16	11	102
Pipelines	14	9	110
Wind power	13	7	97
Energy transmission	8	4	166
Solar power	1	2	50

The "Boon"

An approach to Data Hamonization and Legacy Reduction focused on organic growth and modular delivery



The Way

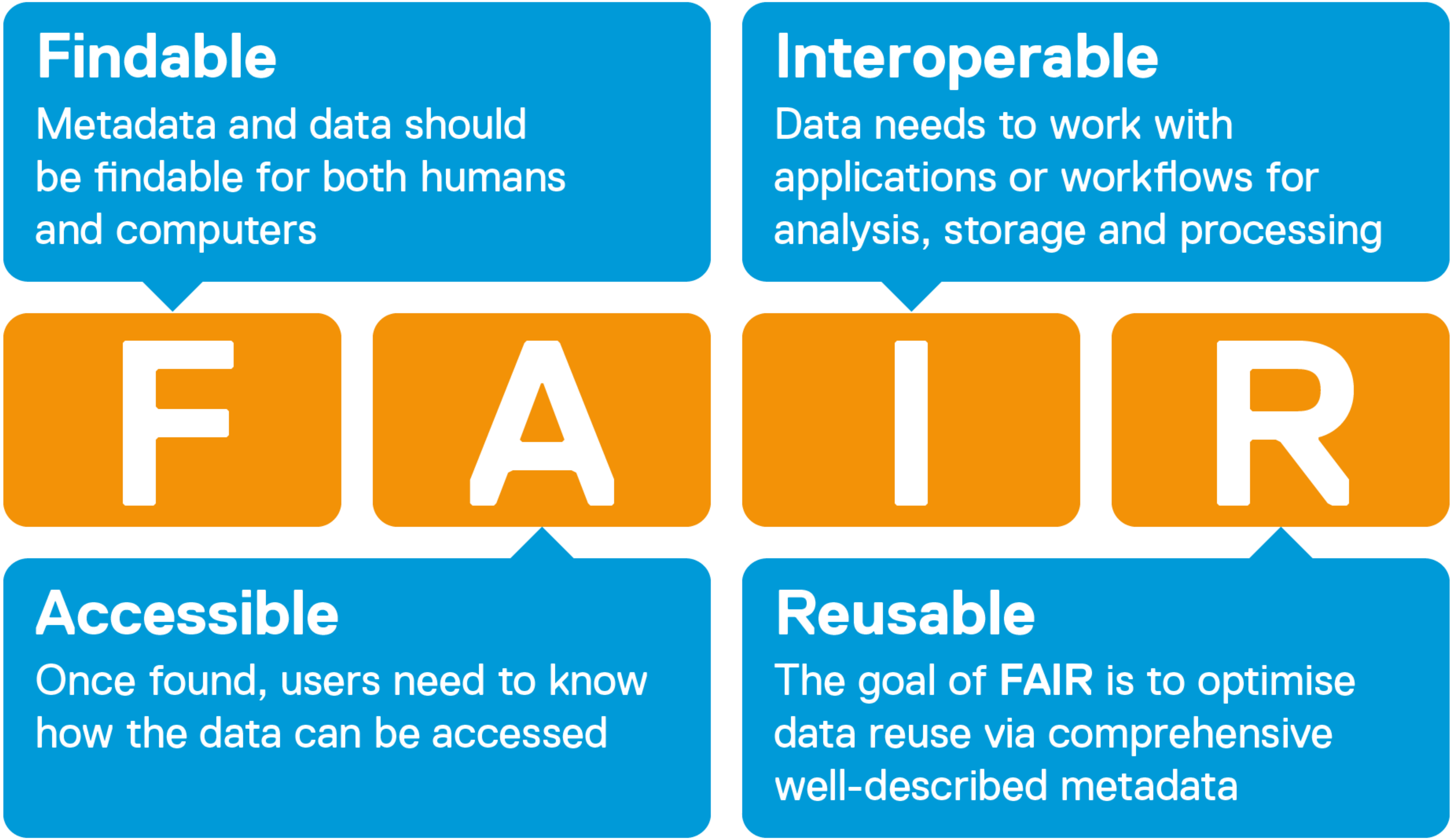
We call it: Data-Centric

In a data-centric enterprise there is a single, simple data model at the core of their information landscape

Not thousands of data models

Not millions of data elements, but fewer than a thousand

And the information the firm manages is either co-located with a live version of the model, or federatable from it.



Findable

Metadata and data should be findable for both humans and computers

Interoperable

Data needs to work with applications or workflows for analysis, storage and processing

F A I R

Accessible

Once found, users need to know how the data can be accessed

Reusable

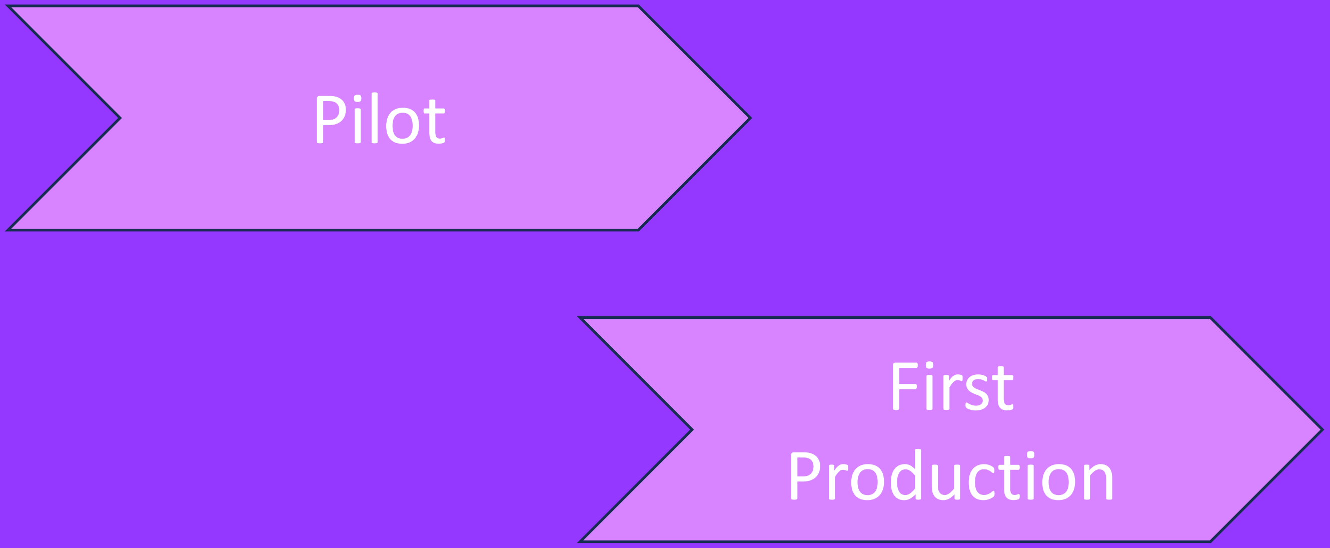
The goal of **FAIR** is to optimise data reuse via comprehensive well-described metadata

What does the journey look like?

Pilot

- Design first version of your Enterprise Ontology
- Implement a Knowledge Graph in a Sandbox
- Load and integrate at least 2 previously poorly integrated datasets

What does it really look like?

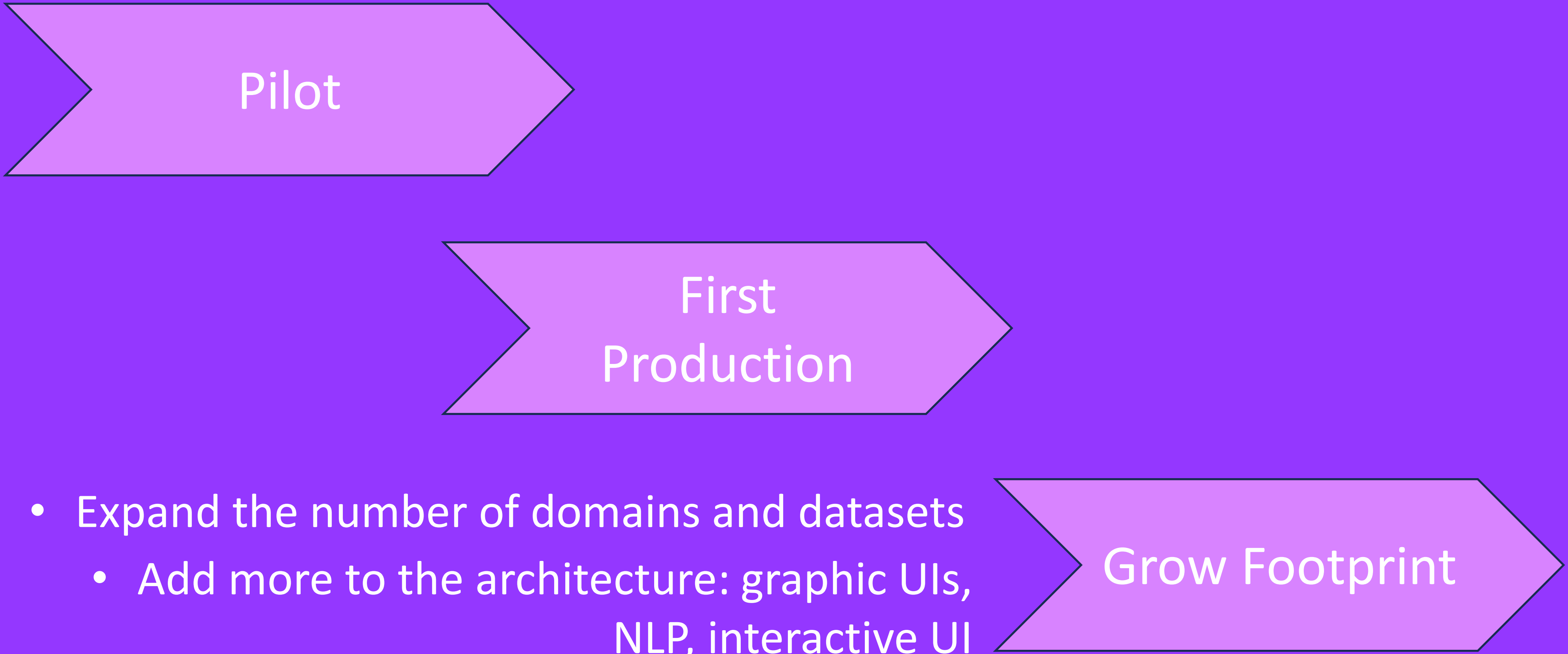


Pilot

First Production

- Select and implement first version of new arch
- Harden your data ingestion pipelines
- Put something in production

What does it really look like?

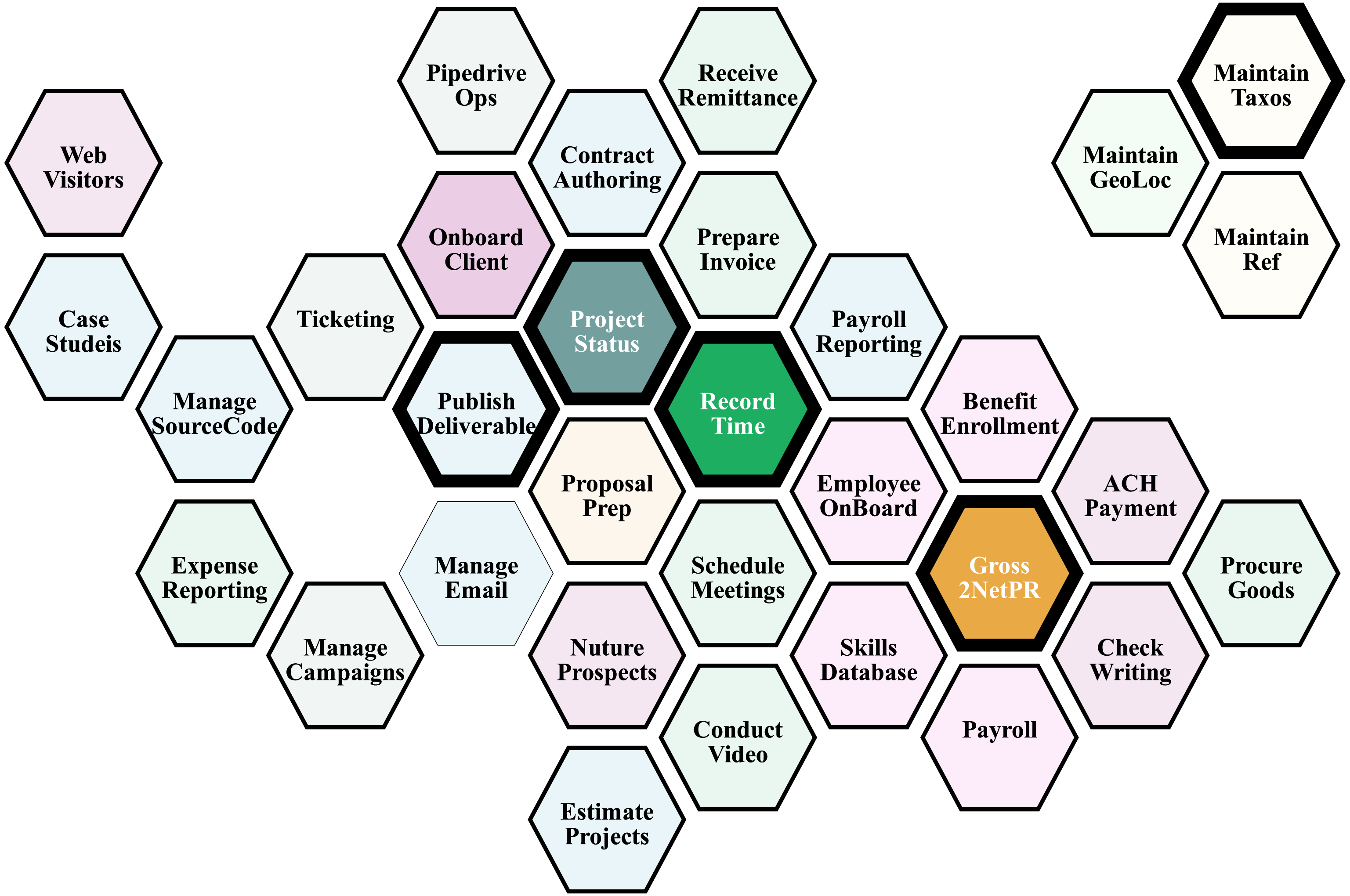


Pilot

First Production

Grow Footprint

- Expand the number of domains and datasets
  - Add more to the architecture: graphic UIs, NLP, interactive UI



Pipedrive Ops

Receive Remittance

Maintain Taxos

Web Visitors

Contract Authoring

Maintain GeoLoc

Onboard Client

Prepare Invoice

Maintain Ref

Case Studeis

Ticketing

Project Status

Payroll Reporting

Manage SourceCode

Publish Deliverable

Record Time

Benefit Enrollment

Proposal Prep

Employee OnBoard

ACH Payment

Expense Reporting

Manage Email

Schedule Meetings

Gross 2NetPR

Procure Goods

Manage Campaigns

Nuture Prospects

Skills Database

Check Writing

Conduct Video

Payroll

Estimate Projects

ZERO-COPY INTEGRATION

"How do we accelerate the new digital solutions while simultaneously increasing data control?"

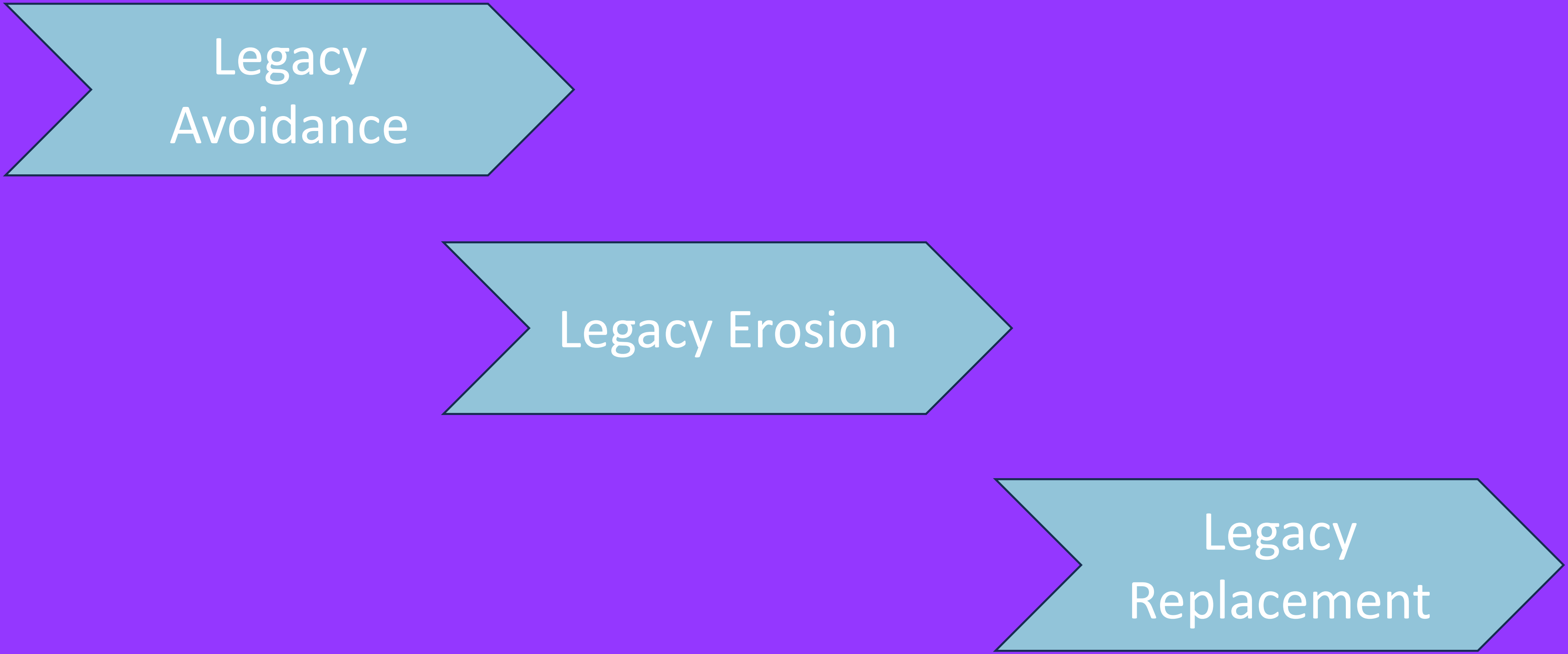
- Every CXO, everywhere

Data
Collaboration
Alliance

Dan Demers & Karanjot Jaswal

cinchy

As you mature, more opportunities open up



Legacy Avoidance

Legacy Erosion

Legacy Replacement

Who is doing this? Digital Native Firms

The Google Knowledge Graph (from acquisition of Applied Semantics (2003) and Metaweb (2010))

Amazon’s Product Graph and AWS Neptune (Graph as a Service)

Facebook (Open Graph) , LinkedIn (Liquid), Airbnb (Property Graph), Apple (Siri)

The best time to plant a tree is 20 years ago

The second best time is today

Who is doing this? Forward Thinking Mainstream Firms

Morgan Stanley, UBS, Broadridge

Amgen, Merck, Novartis, Abbvie

Ikea, Nokia, Schneider-Electric

S&P, Wolters Klewer, Lexis Nexis

Montefiore Healthcare

Several notable smaller firms such as

Institute for Defense Analyses, Schema App, Food Pairing.ai , Center for Internet Security

To pursue these ideas further

- Sign the Data Centric Manifesto:
  http://www.datacentricmanifesto.org
- DCAF: https://www.dcaforum.com
- Case studies and white papers: https://www.semanticarts.com/work/
- TDAN: https://tdan.com/?s=McComb
- Gist: https://www.semanticarts.com/gist/
- Software Wasteland:
  https://technicspub.com/software_wasteland/
- The Data-Centric Revolution:
  https://technicspub.com/data-centric/
- Me: mccomb@semanticarts.com

The end

The journey starts

- Once upon a time
- Our hero (could be you) lived in the land of Mega Corp
- Every day, our here spent their time, designing data models, mapping one data set to another, catalogging data, identifying critical data elements, doing data governance or stewarding some data
- *** inciting incident *** Until one day they were visited by a fairy godmother / consultant who began to ask embarrassing questions, such as: why do you have some many databases, so many silos, so many applications? Do you even know how many you have? Do you know how much you spend on all this fragmentation?

- *** Because of that *** they were forced to wander in the pointless forest, island of misfit toys
- Where they gather three new superpowers
  - The ability to see things are they really are
  - The ability to make things as simple as possible, but no simpler
  - The power of true modularity

Most people have noticed this

- And taken action
- First ERP
- One of the first reactions was the data warehouse
- Then systems integration
- Then the “API” memo
- SOA
- Web Services
- Then big data
- Then application rationalization
- Application Modernization
- Data Lakes
- Data Mesh
- Data Fabric
- Data Lakehouse
- They understood neither the extent , the root cause or the portenail

Most people have noticed this

- What they do about it is interesting
- And typically only partially addresses their problem

Occassionally

- People notice that what they are doing doesn’t make sense
- They are replacing a $1M system with a $100M system that is 10% better
- How big things get done
- Modularly

We begin to hear from other travellers

- There are ways out of the quagmire
- But most of them get you in deeper
- I can go on endlessly about things that don’t work, or that work but cost 10, 100 even 1000 x what they could
- But let’s talk about what does work

How big things get done

- Slight diversion to a study of how big projects get done
- Mass transit to Nuclear Power to Hosting Olympic Games
- It is close to the worst on average overrun
- And is the top on the “long tail”

The hero’s calling

- At some point the hero hears the calling
- After several rejections
- And they leave the normal world
- And begin their journey

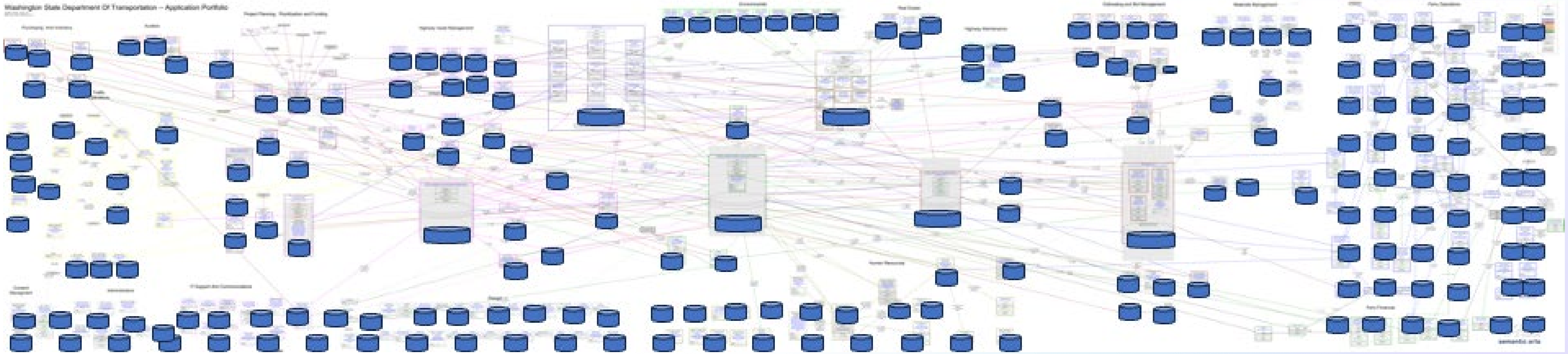
There are a couple of ways this might go

- They might decide to go on their own
- This might end well (does occasionally)
- Or flame out. There are a lot of ways this can end badly
- Or they might get a guide

Transformation Projects

- Happy data-centric transformation projects are all alike.
- Unhappy projects each unhappy in their own way

Each database has its own schema


Washington State Department Of Transportation – Application Portfolio
semantic arts

Every use case was hard coded to those schemas

Typically each new attribute adds thousands of lines of code to the system that manages it

Enterprises have lots of application systems

The pattern we've seen over several dozen firms is there are about one multi-user supported application for every ten employees.

Large Bank

80,257 employees

11,000 applications

Mid – tier Professional Services Firm

1,500 employees

166 applications

Even Small Firms

30 employees

5 major apps (10 total)

Is this a problem?

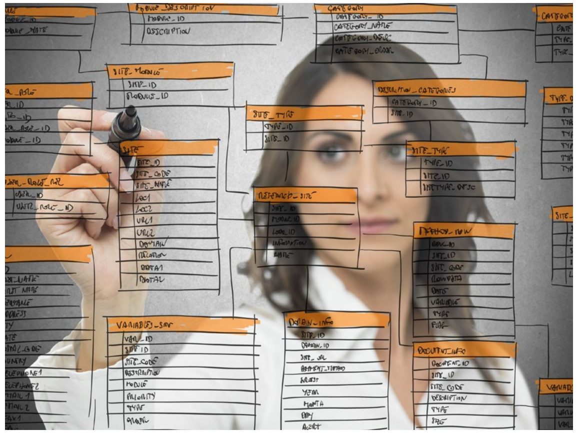
Yeah

Most firms lament the fact that they have all these data silos but continue on because it is hard to imagine anything else.

The Collective Complexity

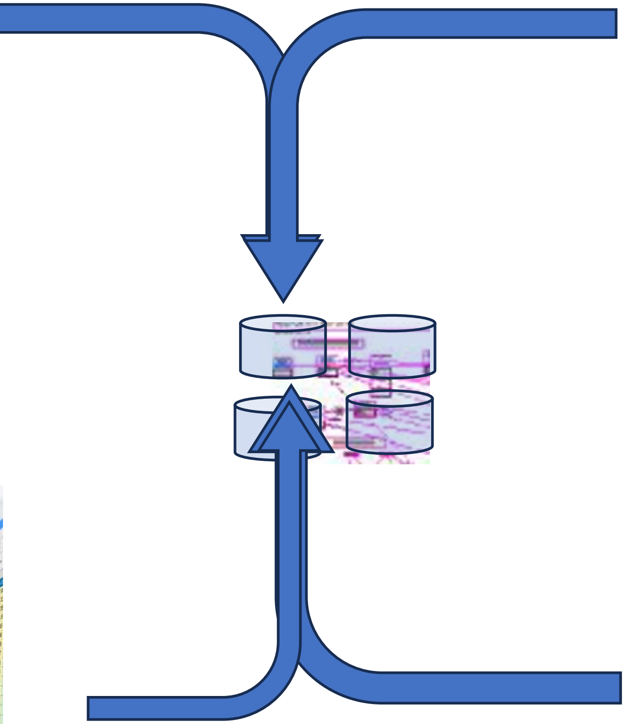
- From our experience
- Each data model is far more complex than it needs to be to solve the problem at hand
- Simple data models have hundreds of tables and thousands of attributes/ columns
- Large data models have thousands of tables and tens of thousands of columns
- Once you get to be a mid sized company, you are managing millions of data distinctions

You all are part of the problem

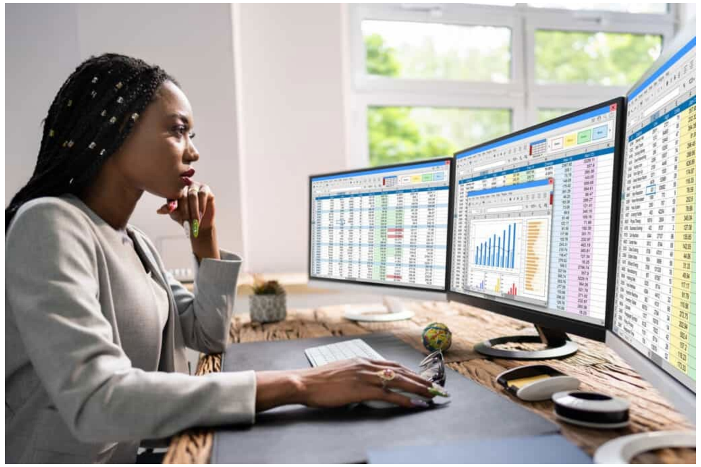


Data modeler

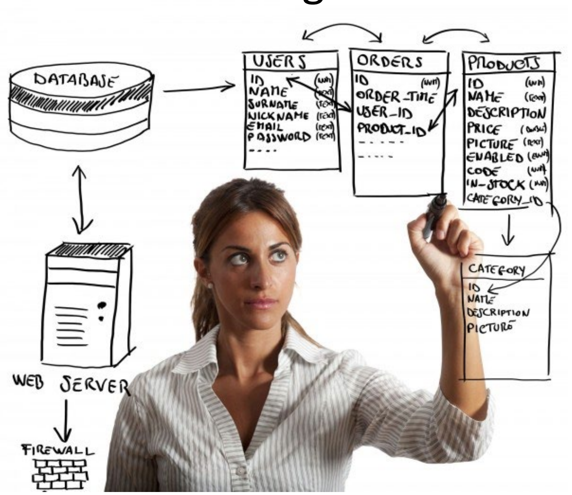
Data Steward



Database Administrator



Data Engineer



BLOCKBUSTER

MARATHON
ARCO
MARATHON
QUALITY DRIVEN
1600
EXPO
QUALITY DRIVEN FROM COAST TO COAST.

There is Another Way

In a data-centric enterprise there is a single, simple data model at the core of their information landscape

This is implementable and instantiated. And it has the potential to replace any of your legacy systems.

A short history of things that didn’t solve the data sprawl problem

ERP Systems

- Promise: have one big application with all your data and you won't need to do data integration
- What really happened:
- ERP systems became massively complex (a typical SAP implementation populates 90,000 tables and nearly 1 million columns).
- Very few companies got more than half their data in an ERP system, and then were faced with the very hard challenge of integrating with a complex, rigid and mostly opaque environment

Data Warehouses

- Promise: Too hard to report off hundreds of application databases. Extract key data from each, conform to a single model and report from data warehouse
- What really happened:
- The ETL process became a bottleneck (leading to data lakes)
- The warehouses themselves became hopelessly complex
- Data warehouses could not replace any legacy functionality, indeed they were dependent on them

Data Lakes

- Promise: The “T” in ETL was too hard and taking too long. Just extract and load the data into a central place and let the data scientists sort it out
- What really happened:
- Most data lakes are hopeless dumps of data of varying quality and veracity
- It has become harder than ever to find authoritative copies of data

Enterprise Data Models

- Promise: Create a single model of the data of an enterprise to guide eventual conformance
- What really happened:
- EDM projects took years to complete and were often cancelled long before completion
- Those that were completed were largely ignored by business leaders who were busy buying packaged software (that didn’t conform to the EDM)

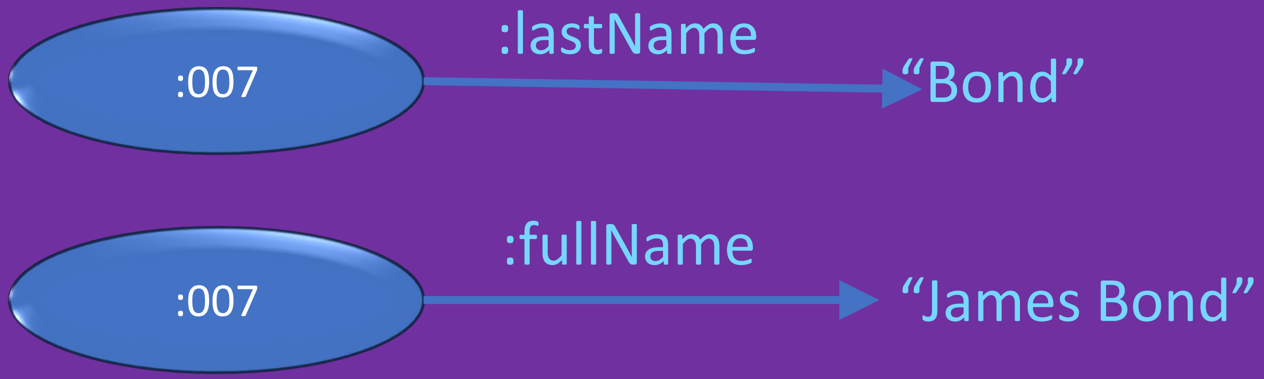
What makes Data-Centric Different?

- There are technological differences
- And methodological differences

Technical Differences

Everything is triples in a graph

Agent	LastName	Full Name
006	Renton	Andy Renton
007	Bond	James Bond



Technical Differences

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Agent	LastName	Full Name
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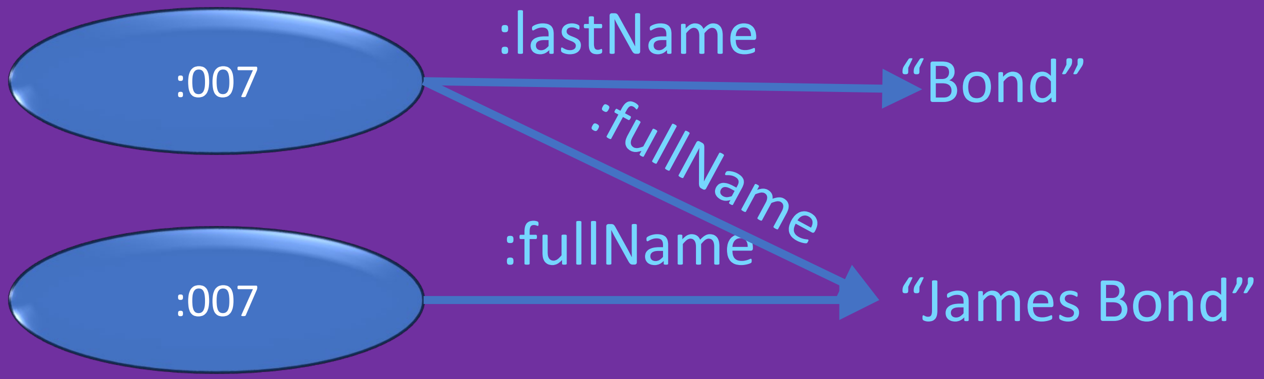
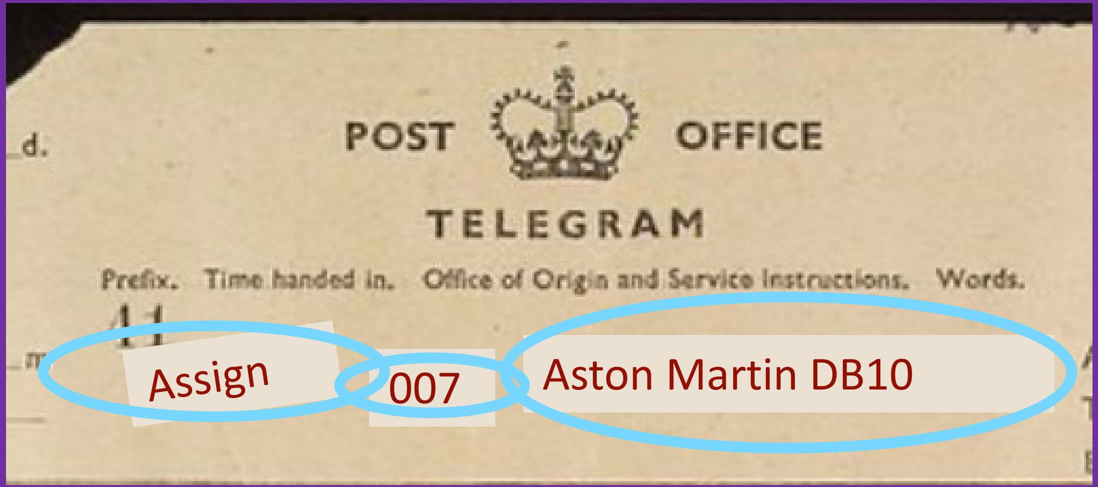




d.

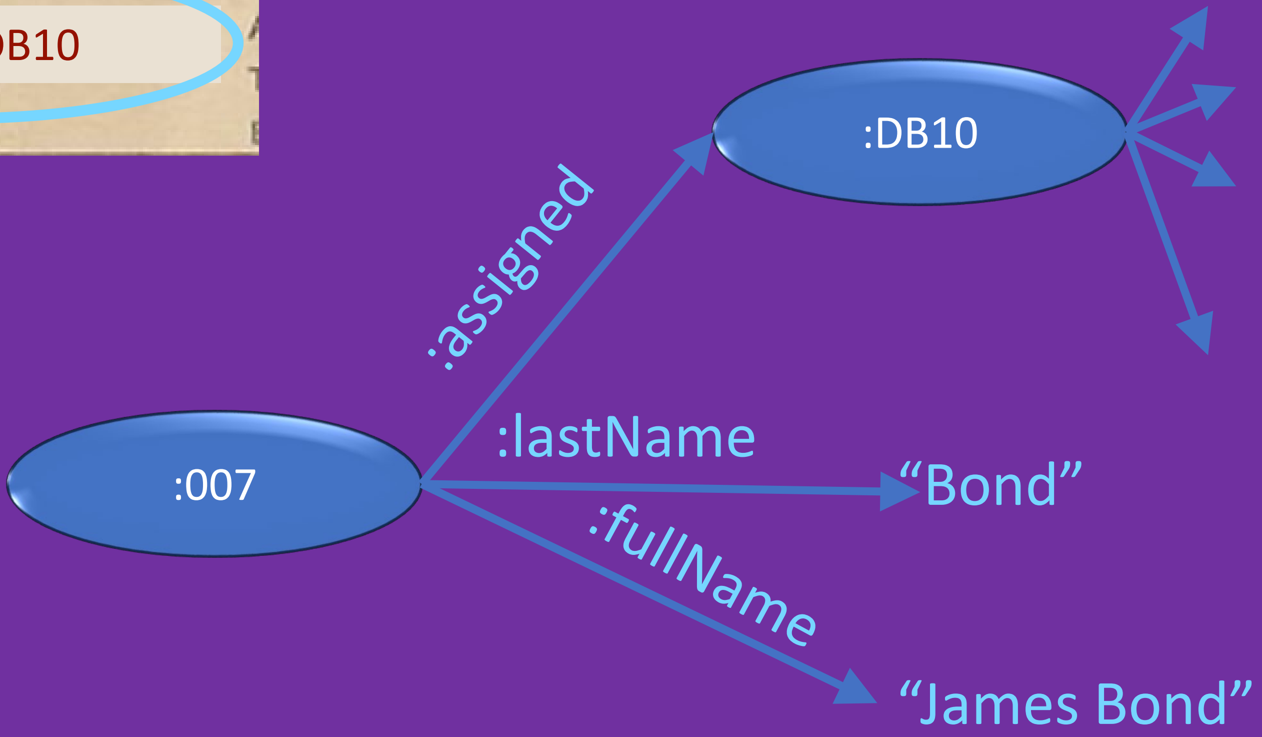
POST OFFICE

TELEGRAM

Prefix. Time handed in. Office of Origin and Service Instructions. Words.

Assign 007 Aston Martin DB10

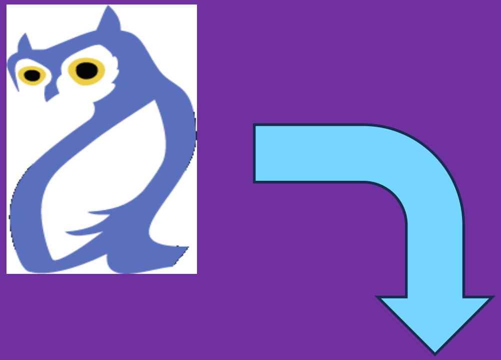
Agent	LastName	Full Name
006	Renton	Andy Renton
007	Bond	James Bond

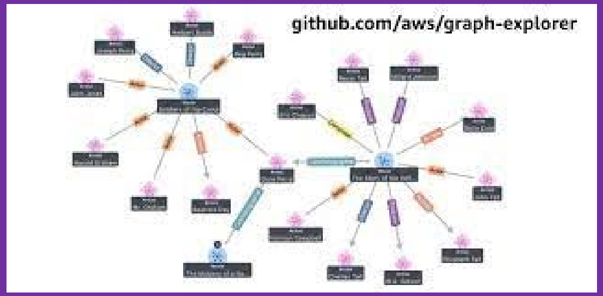


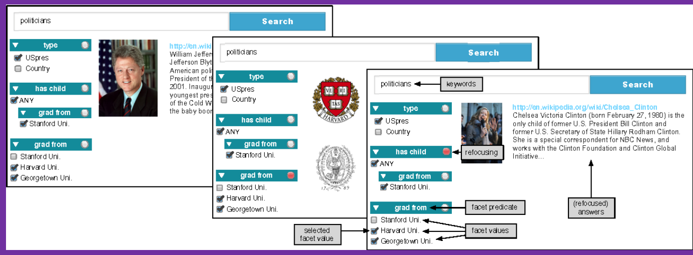
Technical Differences

- Everything is a triple (data, metadata, maps etc)
- Triples are stored in Graph Databases
- W3C standards to avoid vendor lock in
- RDF for low effort integration and “follow your nose” UIs
- SPARQL for simplicity and also for the ability to federate over Knowledge Graphs and traditional databases
- OWL for unambiguous meaning

The simplest configuration




github.com/aws/graph-explorer



http://en.wiki
William Jeffer
Jefferson Blyt
American poli
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2001. Inaugur
youngest pres
of the Cold W
the baby boor

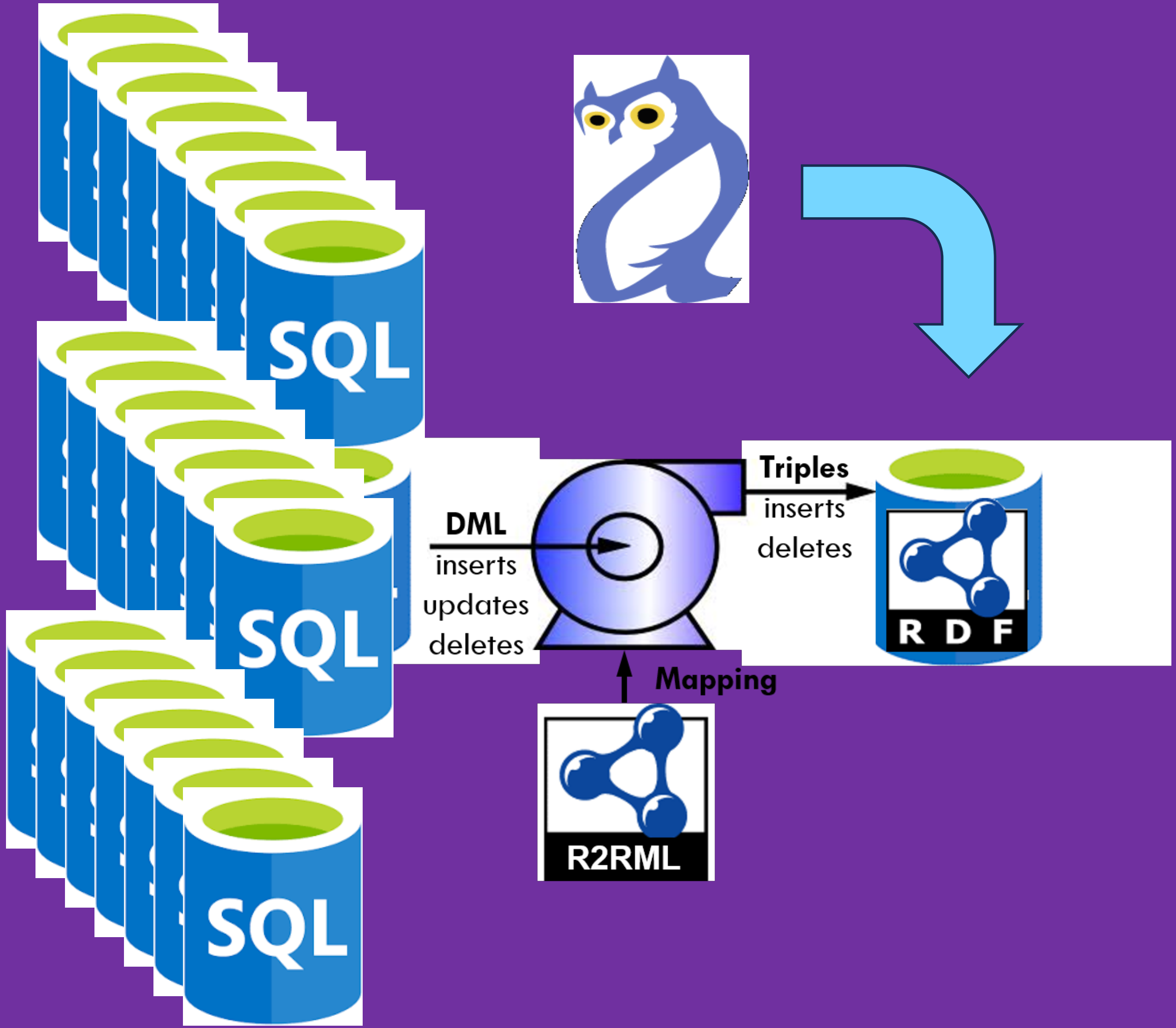
http://en.wikipedia.org/wiki/Chelsea_Clinton
Chelsea Victoria Clinton (born February 27, 1980) is the only child of former U.S. President Bill Clinton and former U.S. Secretary of State Hillary Rodham Clinton. She is a special correspondent for NBC News, and works with the Clinton Foundation and Clinton Global Initiative...

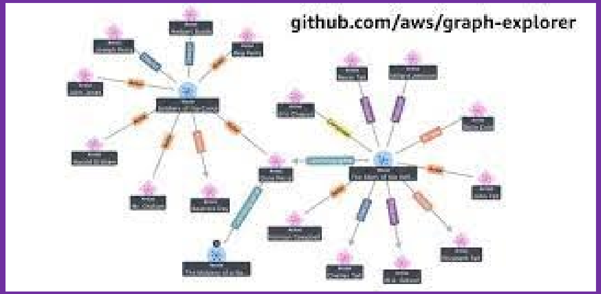
Methodological Differences

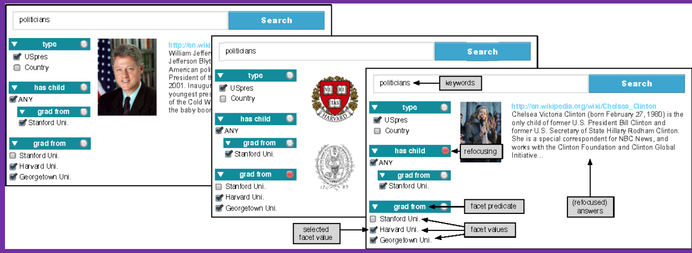
- Think big/ start small to get some early wins without painting yourself in a corner
- Modular approach to take on a chunk at a time
- Grow an architecture that can replace functionality typically found in applications

Where does Zero Copy Integration Come In?

Rémeallbethtshis?







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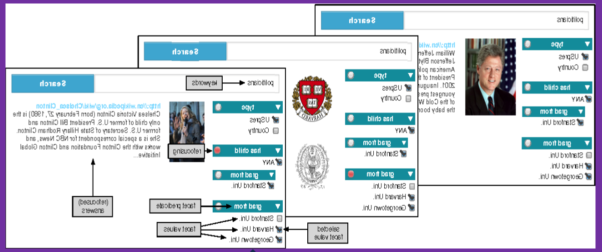
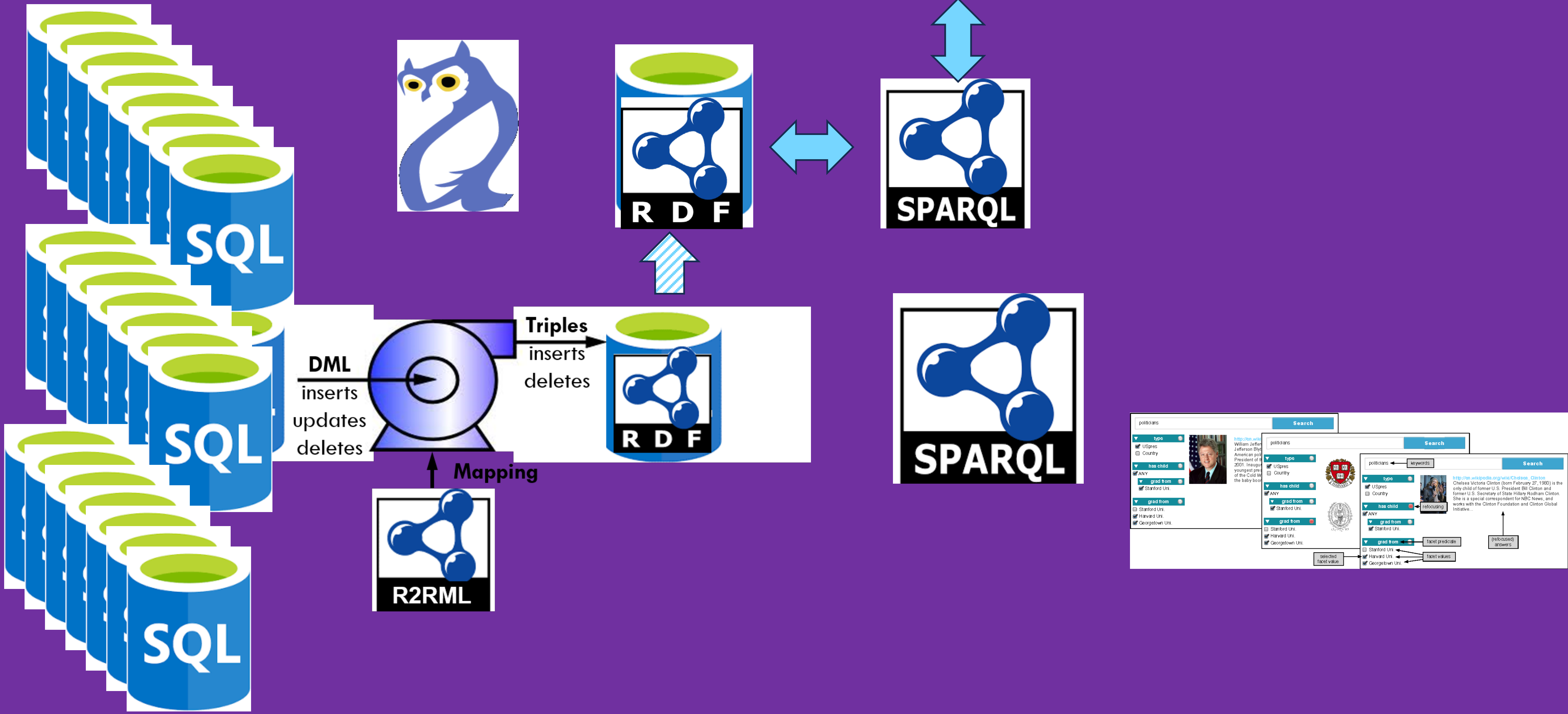
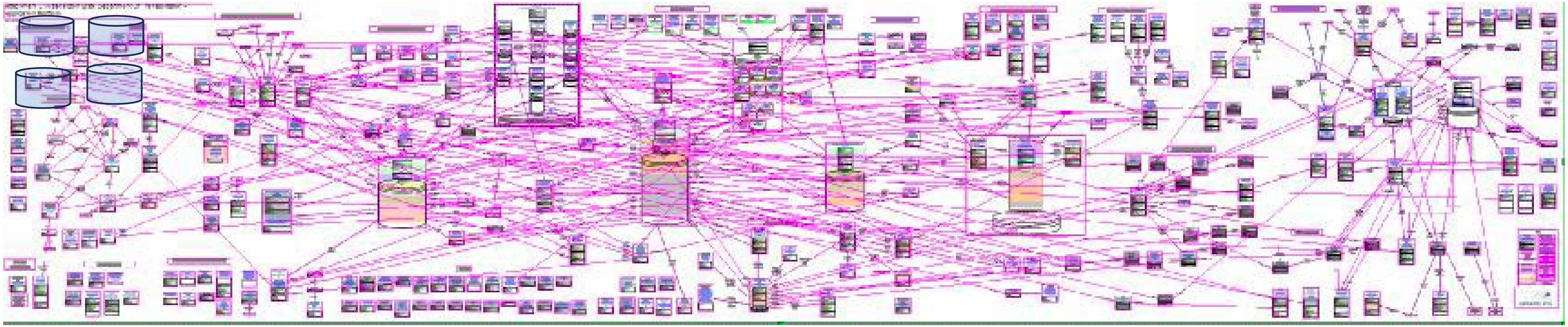
Now a new KG app …





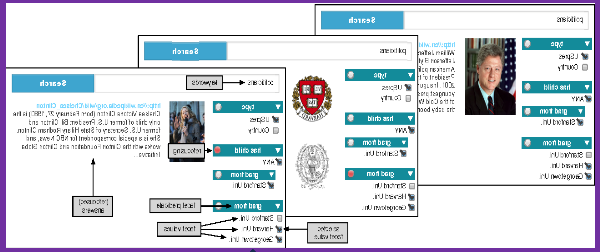
Remember this…

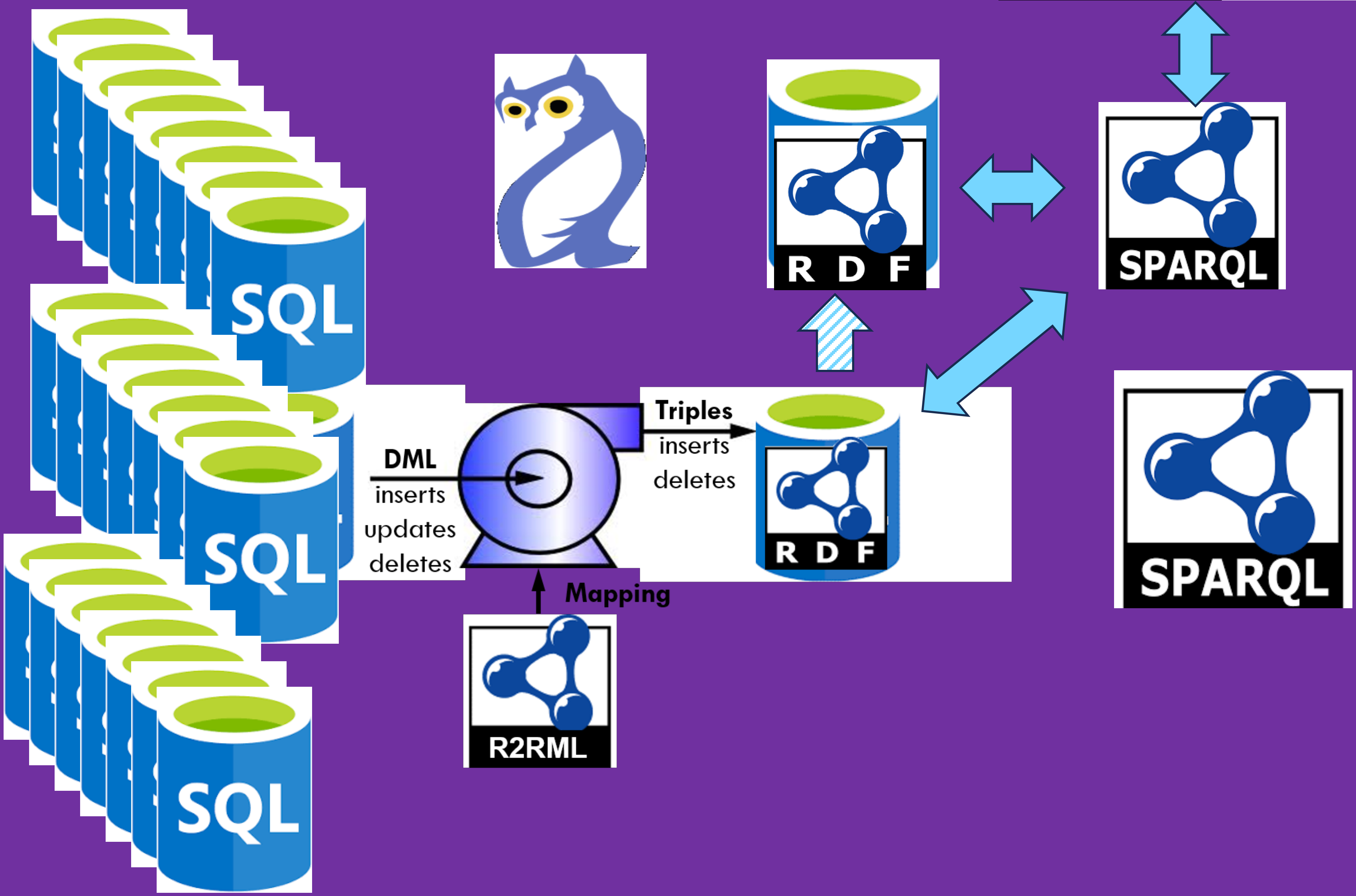


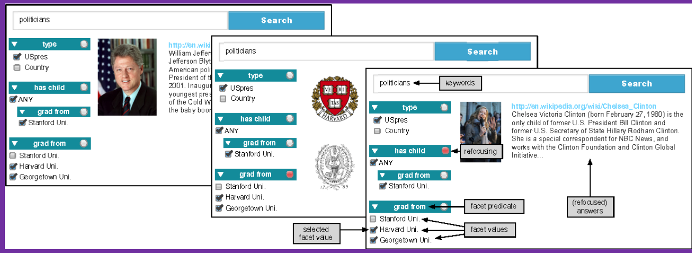
It is an ”architecture” based on copying

Every line is a map and a copy

This is an architecture built on the the ability to avoid copying







politicians ← keywords | Search

▼ type
☑ USpres
☐ Country

▼ has child ← refocusing
☑ ANY

▼ grad from
☑ Stanford Uni.

▼ grad from ← facet predicate
☐ Stanford Uni.
☑ Harvard Uni.
☑ Georgetown Uni.

selected facet value

facet values

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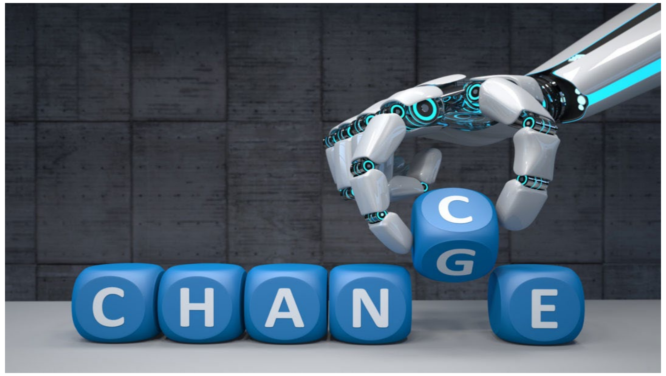
(refocused) answers

Zero Copy Integration

Messes with people’s heads

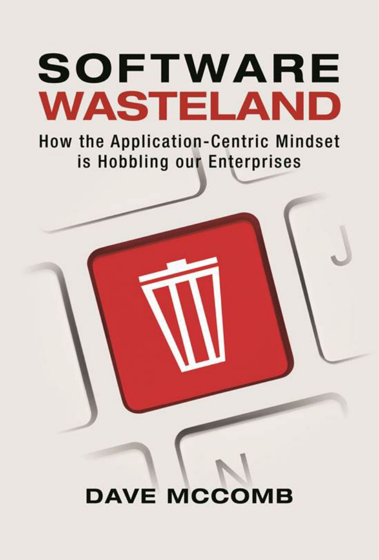
Take Aways

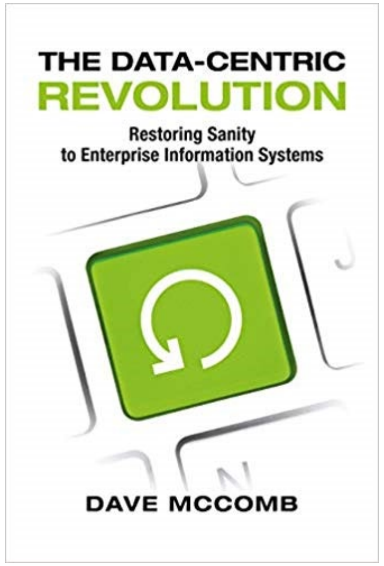
- Application-Centric Development and its’ enabler, Systems Integration are the root cause of most Enterprise Information dysfunction
- The way out requires:
  - A new mindset – start with the data
  - Done well, you can get to Zero Copy Integration
  - You’ll need some new infrastructure – Graph Databases that Federate
  - And a Pilot Project



To Pursue These Ideas Further

I will be signing these books at our booth


SOFTWARE WASTELAND
How the Application-Centric Mindset is Hobbling our Enterprises
J
N
DAVE MCCOMB


THE DATA-CENTRIC REVOLUTION
Restoring Sanity to Enterprise Information Systems
J
N
DAVE MCCOMB

semantic arts

Additional Resources

The Data-Centric Manifesto (read & sign)

http://www.datacentricmanifesto.org

Data-Centric Executive Course (from Infocratic)

https://www.datacentricexecutive.com

Estes Park Group (DC Architecture) and Gist Forum (upper ontology)

https://www.semanticarts.com

TDAN (4 Data-Centric Articles / years * 8 years)

https://tdan.com/?s=McComb

mccomb@semanticarts.com

(map)

- By analogy, I could do a travelog on exotic travel locations that I’ve been to, such as: Nigeria, Egypt, Uganda, Albania, Sri Lanka, Myanmar, Papua New Guinea and Mongolia
- What would be the outcome?
- Any one who had been to any of those places would approach me afterward to compare notes
- Most of you would have learned something about far away places that you will never visit
- And a very few will be inspired by the talk to go to one of those places. That would make me happy

This is a travelogue.

- The Journey towards Data-Centric
- Toward the end of the travelogue we will describe what zero copy integration is, but it won’t really won’t make sense until you’re on the journey

Before we start the story

- Much of what I’m going to say sounds far fetched
- It may sound a bit academic, or speculative
- This is all grounded in hundreds of data-centric projects
- Let me give you a bit of my background, just to put a bit of real world pragmatism to what I’m about to present

My origin story (1/5)

- Andersen Consulting (Accenture)
- Built and implemented a lot of enterprise applications
- Built and implemented two major ERP systems from ground up
- But eventually got jaded at the arbitrariness of design and the brittleness of implementation
- Left Andersen and began looking for a better way
- One part of that better way was the study of semantics
- Another was model driven development

Origin Story (2/5)

- We rolled what we had learned into a .com in the mid 1990's
- We built a semantic model of health care
- And a semantic model of applciations themselves
- From the later we were able to build "no code" applications (before that term was coined – we got the first patent) for a variety of health care apps including Patient Centered Outcomes, Clinical Trial Recruiting, and a Urology Clinic Management System.
- We were preparing to go public in late 1999. We had our investment bankers, lawyers, auditors etc. and were well into the process

Origin Story (3/5)

- When the SEC wanted to test a limit.
- Prior to this time, as long as you had fewer than 500 investors, it was assumed you had not done your own “public offering”
- They wanted to see if that limit should be lower, and went looking for someone going public with between 400 and 500 investors
- We had 410
- Our road show and public offering got delayed until we could prove that we knew all these people personally.
- While we were going through this process in early 2000 the dot come bubble burst

Origin Story (4/5)

- The senior people in the company, myself included, hadn’t been paid for six months, and the company was deeply in debt
- We couldn’t access any of the technology or the patents, and investors were nowhere to be found
- So we decided to consult on what we had learned
- We started Semantic Arts in June 2000
- TBL officially launched the Semantic Web in April 2001
- We thought this would take off like the World Wide Web and we were in front of the wave
- It didn’t

Origin Story (5/5)

- For several years we sold traditional IT projects (feasibility studies, strategic plans, enterprise architectures) and perfected our semantic craft behind the scenes
- Finally some forward thinking companies wanted ‘ontologies’ designed
- We designed several enterprise ontologies over a five year period
- But eventually discovered that they were not being implemented. They were shelfware
- We gradually shifted into helping clients implement these semantically inspired systems
- And created what we call the Data-Centric Revolution

Semantic Arts

- Is a professional services firm. We don’t sell software or hardware or clouds or anything other than our consulting services
- We currently have 30 employees and have been growing 20-25% per year for the last 5 years
- Our clients include some large well known firms such as Morgan Stanely, Amgen, Standard & Poors, Schneider-Electric and Procter & Gamble.
- But also some more modest sized companies who you may not have heard about including: Juniper Networks, the Institute for Defense Analyses, The Center for Internet Security, Omatics and Payzer.
- The journey that we are about to discuss came from our learnings in over 100 projects focused on data-centric implementation
- We believe that we have uncovered the way to modernize applications in a modular, low risk fashion.But we’re getting ahead of ourselves. Back to the story

Narrative

- I’ve presented this a few times, and the feedback suggests it wasn’t universally received
- I reflected on this
- I realize that it makes sense to people who have been on the Data-centric journey for a while, in fact it’s kind of profound when you get to the point where it makes sense
- The term was coined by Dan Demers of Cinchy who is deeply committed to data-centric
- But it is counter intuitive to anyone in a traditional environment

And

- My dad used to say “There is a reason that truth is stra

SO

- If this presentation won’t make sense until you are on the data-centric journey
- And most of you are not
- What to do
- I decided to do a travelogue on a journey you’re unlikely to take
- Why would I do that?