Everything is connected

Combating entropy in software

Entropy in Physics

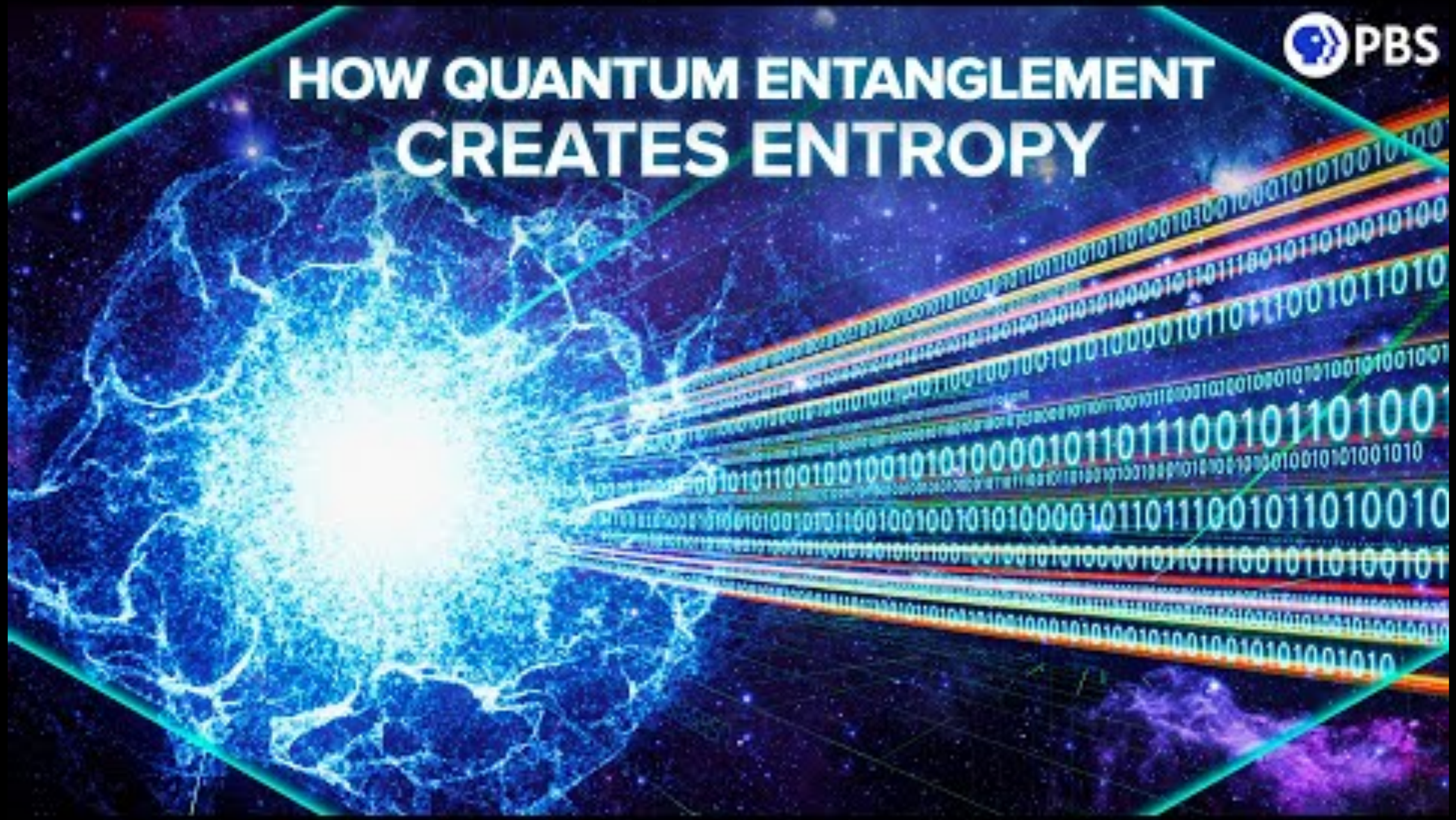
All systems move in the direction of increasing entropy.

According to Boltzmann, systems move in the direction of increasing entropy because such states have a greater number of configurations, and the equilibrium state of highest entropy is the state with the greatest number of molecular configurations. [Attard]

[Attard] Phil Attard, in Thermodynamics and Statistical Mechanics, 2002

Quantum wave function

- Quantum coin toss has both states simultaneously, with 50% probablity
- Once observed, quantum function collapsed into one state
- Another quantum coin, entangled will automatically have the other state


PBS
HOW QUANTUM ENTANGLEMENT
CREATES ENTROPY

Software architecture

Tier architecture

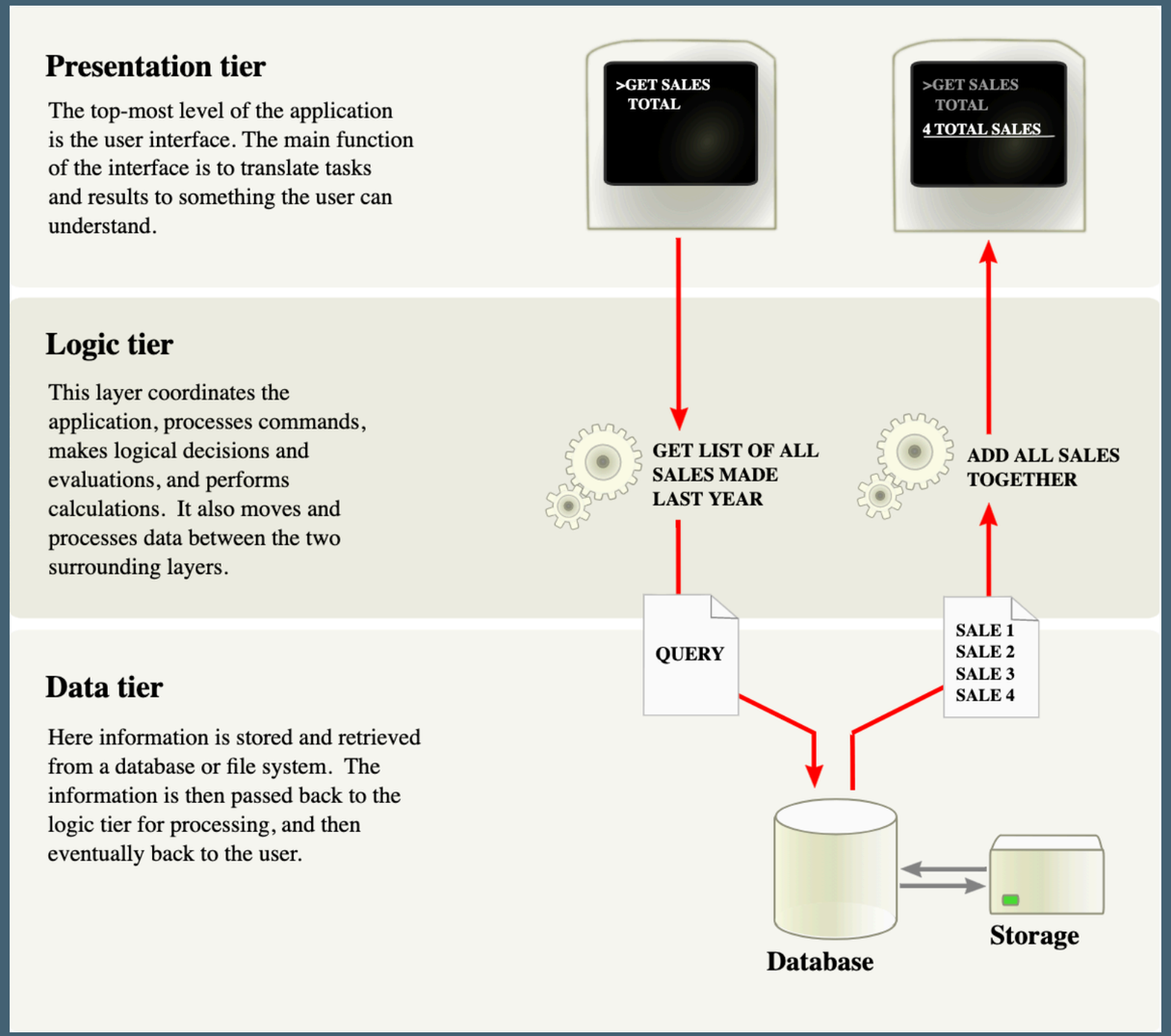
Every tier in a software system has its own view of part of the larger data model.

» database model

» business layer

» application layer

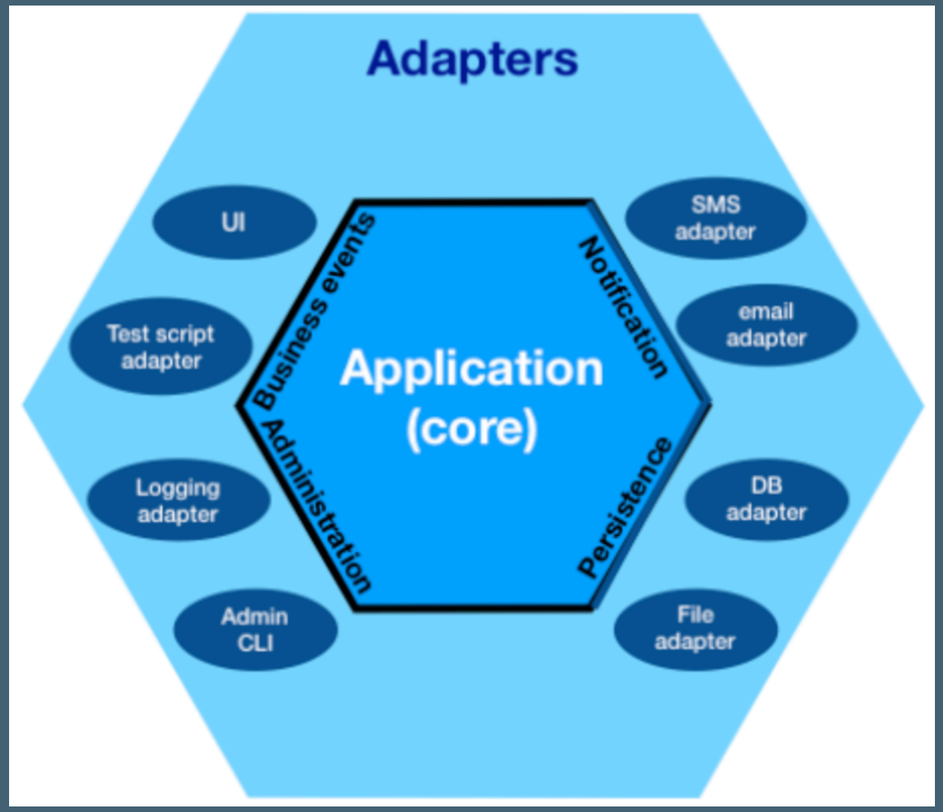
» presentation layer



Hexagonal architecture

The hexagonal architecture divides a system into several loosely-coupled interchangeable components, [...].

Each component is connected to the others through a number of exposed "ports". Communication through these ports follow a given protocol depending on their purpose.



Paul Baran's Networks Barabasi

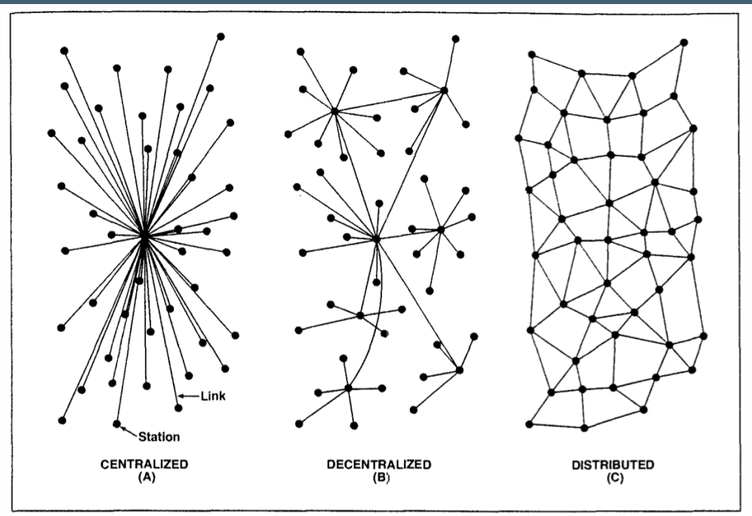
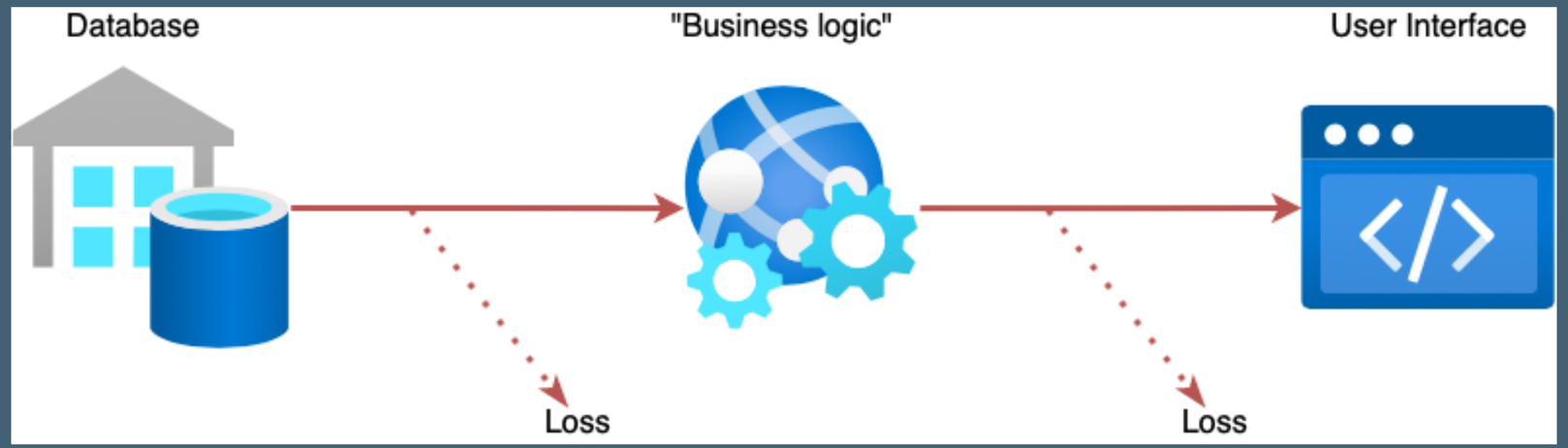


Figure 11.1 Paul Baran's Networks. *In 1964, Paul Baran began thinking about the optimal structure of the Internet. He suggested that there were three possible architectures for such a network—centralized, decentralized, and distributed—and warned that both the centralized and decentralized structures that dominated communications systems of the time were too vulnerable to attack. Instead, he proposed that the Internet should be designed to have a distributed, mesh-like architecture. (Reproduced with permission of Paul Baran.)*

Barabasi Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life

Entropy in software

Every time data changes representation when moved between components, entropy increases.



When entropy increases

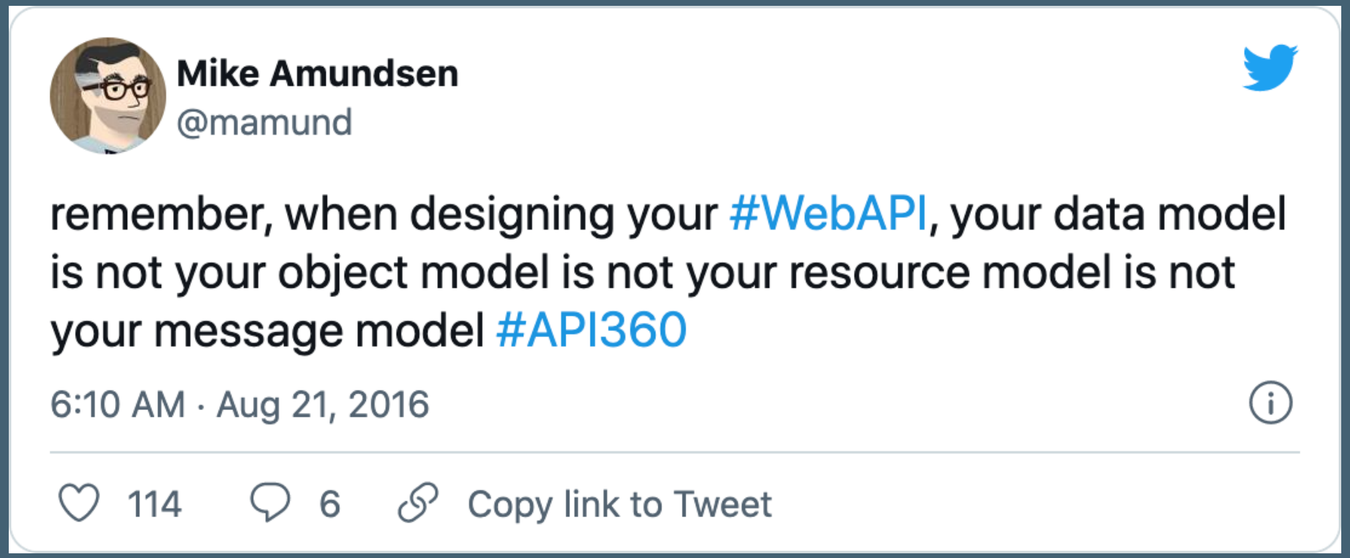
- Diverging models
- Technical differences
- Human-only (API) documentation
- Generated code
- Miscommunication

Designing for lower entropy

Everything is a resource

if you're brave enough

Or is it? mamund

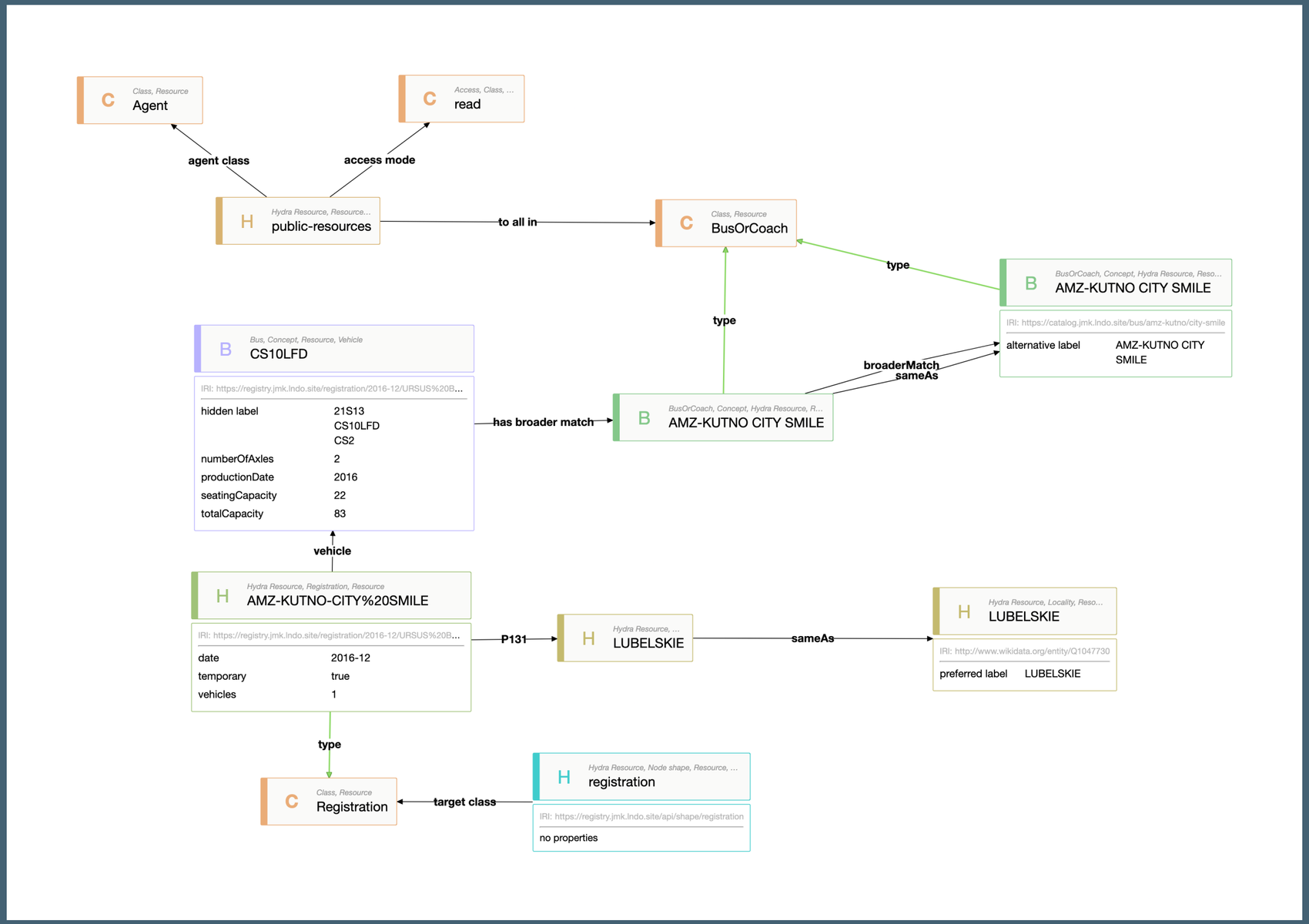


mamund https://twitter.com/mamund/status/767212233759657984

Linked Data

- Everything has an URI (resource)
- All resources are part of a "global API"
- Follow (open) web standards; make data useful to others
  - uniform resource representations (**RDF**, **SHACL**)
  - shared vocabularies (**schema.org**, domain-specific, others)
  - interaction (**HTTP/REST**, **SPARQL**, **Hydra**)

Example: Resource meta-model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registration
IRI: https://registry.jmk.lndo.site/api/shape/registration
no properties

Demo

Explore data

Drive UI

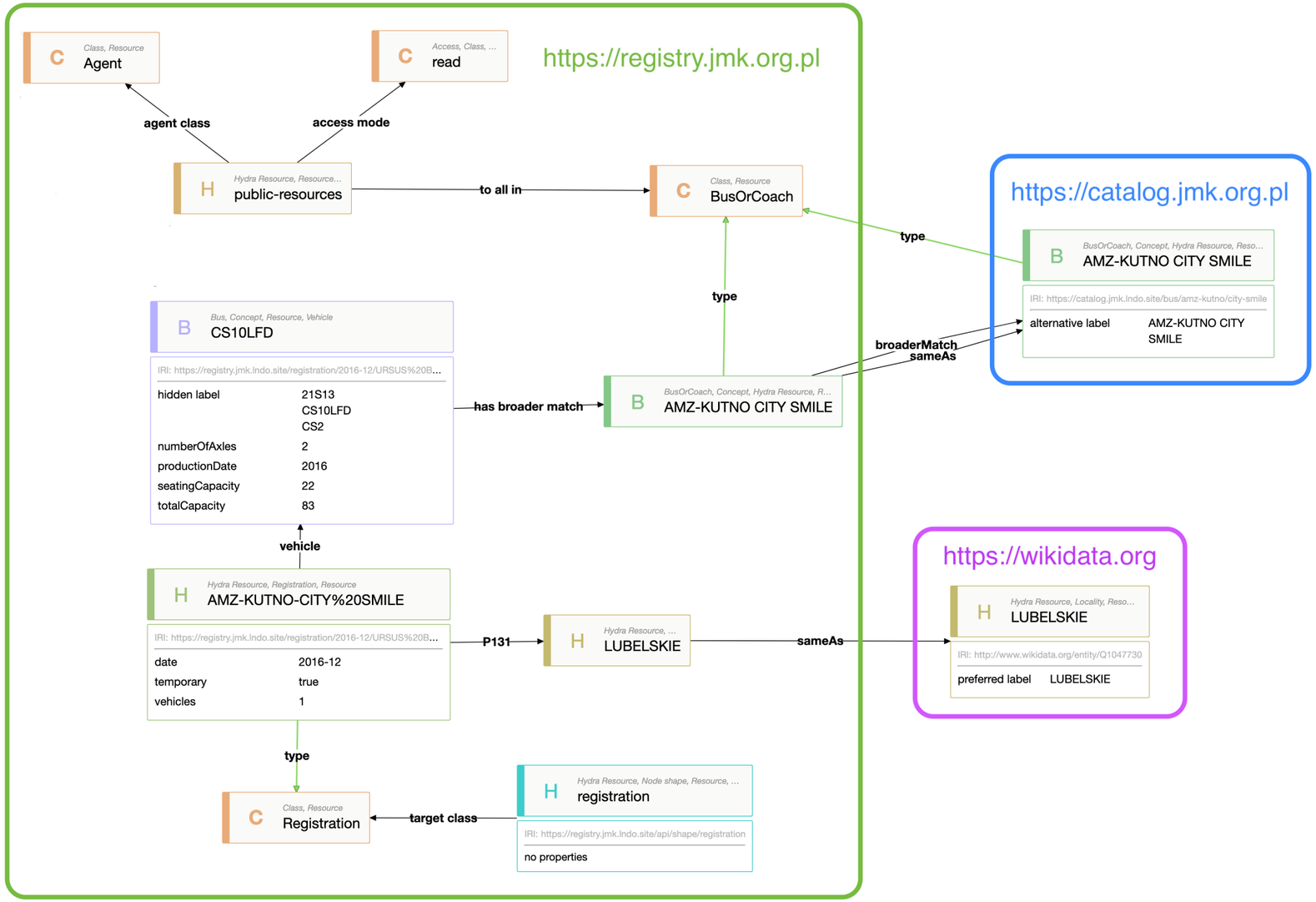
Example: Crossing boundaries

Geographic Entities

Identifiers local to each component, troublesome to correlate

Voivodeship	Component 1	Component 2	Component 3
Dolnośląskie	1	7	D
Mazowieckie	2	9	M
Śląskie	3	3	S
Opolskie	4	10	O

…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C Access, Class, … read
agent class
access mode
H Hydra Resource, Resource… public-resources
to all in
C Class, Resource BusOrCoach
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B Bus, Concept, Resource, Vehicle CS10LFD
IRI: https://registry.jmk.lndo.site/registration/2016-12/URSUS%20B…
hidden label 21S13 CS10LFD CS2
numberOfAxles 2
productionDate 2016
seatingCapacity 22
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preferred label LUBELSKIE
type
C Class, Resource Registration
target class
H Hydra Resource, Node shape, Resource, … registration
IRI: https://registry.jmk.lndo.site/api/shape/registration
no properties

Query across boundaries

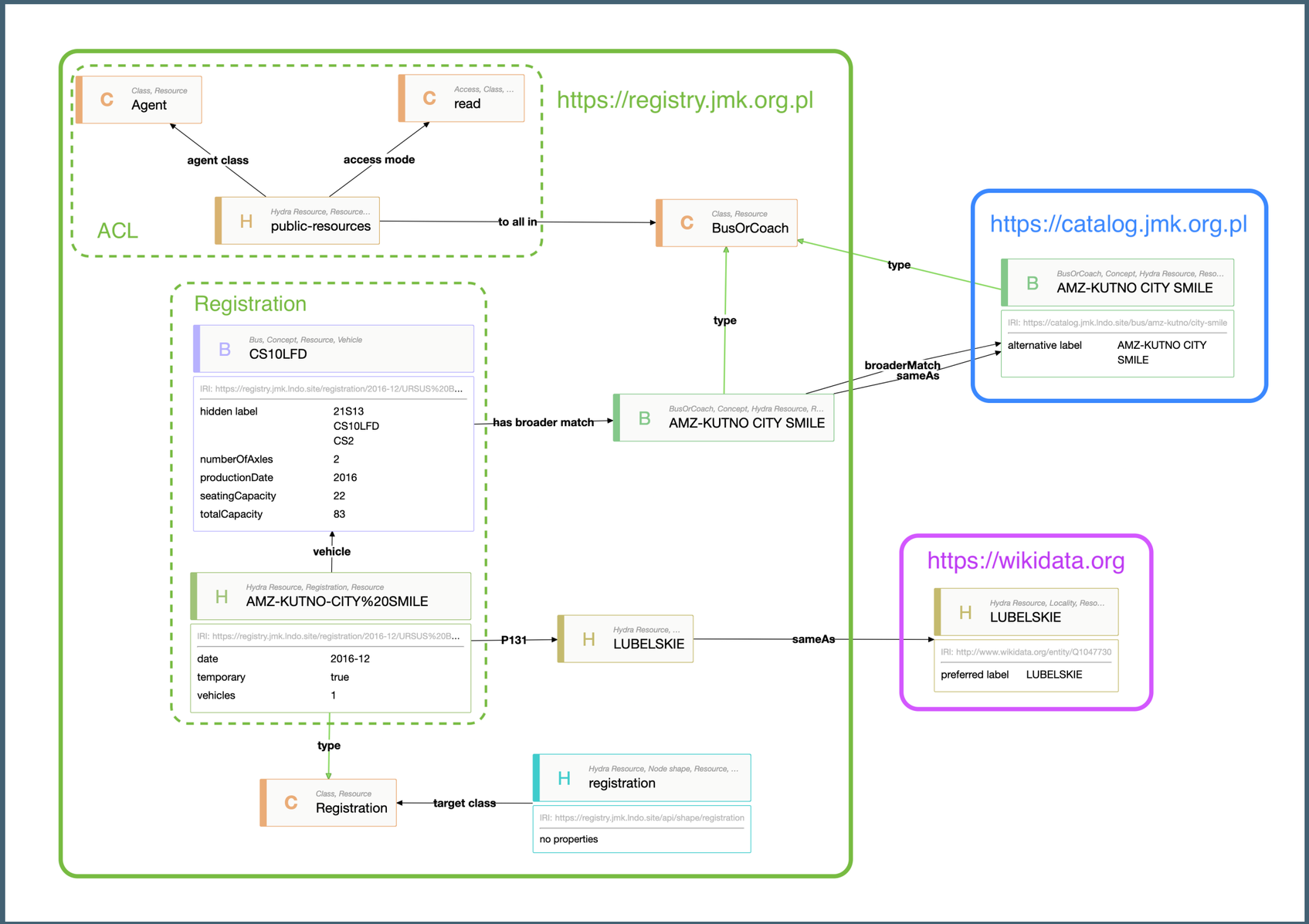
Not only merge data from multiple sources, but also connect at runtime

Directly to the source system

This is called a federated query

```
PREFIX jmk: <https://jmk.org.pl/vocab#>
PREFIX wd:  <http://www.wikidata.org/entity/>
PREFIX wdt: <http://www.wikidata.org/prop/direct/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

select ?reg
where {
  # select registration and their locations
  ?reg a jmk:Registration ; wd:P131 ?loc .

  # find population on wikidata
  service <https://query.wikidata.org/sparql> {
    # only first administrative divisions
    ?loc wdt:P31/wdt:P279 wd:Q10864048 .

    # find their population to filter
    ?loc wdt:P1082 ?population .
  }

  filter (xsd:int(?population) > 2000000 )
}
```

Example: Linking domains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Registration
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preferred label LUBELSKIE
type
C Class, Resource Registration
target class
H Hydra Resource, Node shape, Resource, … registration
IRI: https://registry.jmk.lndo.site/api/shape/registration
no properties

Authorization

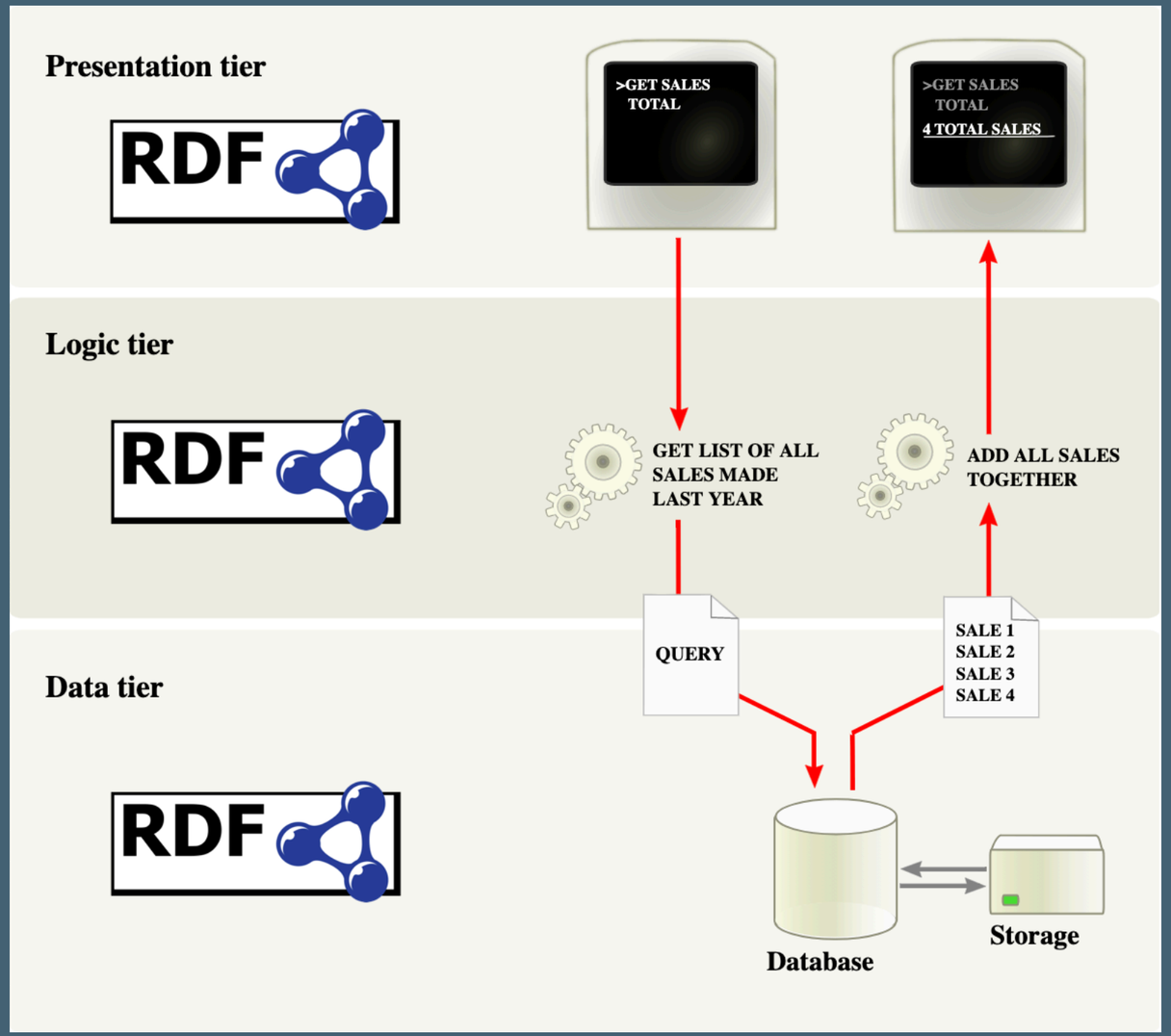
- Is also a resource
- Linked and queried directly
- Can be part of API
- Same database or distributed
- Another standard, by Tim Berners-Lee

```
PUT /api/authorize/moderators-update-articles
Content-Type: application/ld+json

{
  "@context": {
    "@vocab": "https://example.com/api/",
    "acl": "http://www.w3.org/ns/auth/acl#"
  },
  {
    "@type": "acl:Authorization",
    "acl:agentGroup": "Moderators",
    "acl:accessToClass": "schema:Article",
    "acl:mode": "acl:Write"
  }
}
```

Summary

- » Model everything as a graph
- » Uniform representation
- » Lossless data integration
- » Distributed by nature



Bonus - mix & match

Domain-Driven Design

- Embed ubiquitous language in universal model
- Model (sub)graphs as aggregates and entities

Event driven

- Model events as resources
  - W3C Activity Streams
- Link to other resources

CQRS

- Execute commands locally
  - individual graph
- Query globally
  - across all graphs

Gotchas

Learning curve

» Graph feels alien

» Basic building blocks for complex solutions

» Hard to find talent

» Limited learning resources

RDF != Neo4j etc.

» Open vs Closed

» Queries and analytics

Not a silver bullet

» But comes damn close IMO 😄

The Data-Centric Manifesto

Data is the center of the universe; applications are ephemeral.

These are the key principles of the data centric manifesto:

1. Data is a key asset of any organization.
2. Data is self-describing and does not rely on an application for interpretation and meaning.
3. Data is expressed in open, non-proprietary formats.
4. Access to and security of the data is a responsibility of the data layer, and not managed by applications.
5. Applications are allowed to visit the data, perform their magic and express the results of their process back into the data layer for all to share.

http://www.datacentricmanifesto.org

Other ways to think about the data centric revolution

principles

NOW: Application-Centric

- Exorbitant, often prohibitive, cost of change.
- Data is tied up in applications because applications own data.
- Every new project comes with a big data conversion project.
- Data exists in wide variety of heterogeneous formats, structures, meaning, and terminology.
- Data integration consumes 35%–65% of IT budget.
- Hard or impossible to integrate external data with internal data.

FUTURE: Data-Centric

- Reasonable cost of change.
- Data is an open resource that outlives any given application.
- Every new project taps into existing data stores.
- Data is globally integrated sharing a common meaning, being exported from a common source into any needed format.
- Data integration will be nearly free.
- Internal and external data readily integrated.

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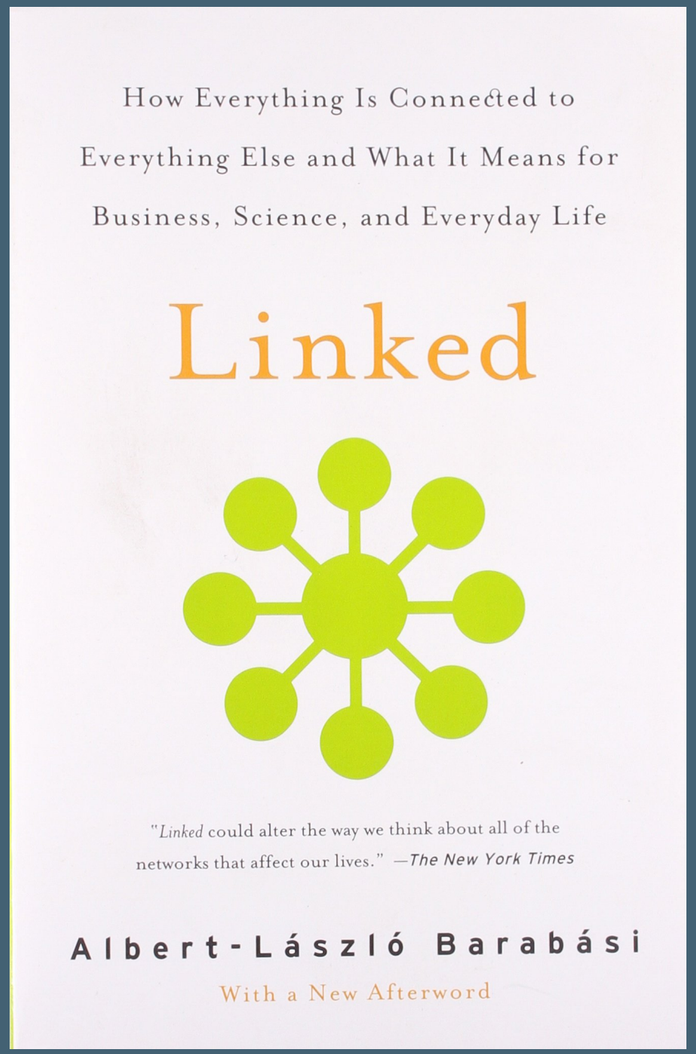
principles http://www.datacentricmanifesto.org/principles/



Where do we go from here? The answer is simple. We must remove the wrapping. The goal before us is to understand complexity. To achieve that we must move beyond structure and topology and start focusing on the dynamics that take place along the links. Barabasi

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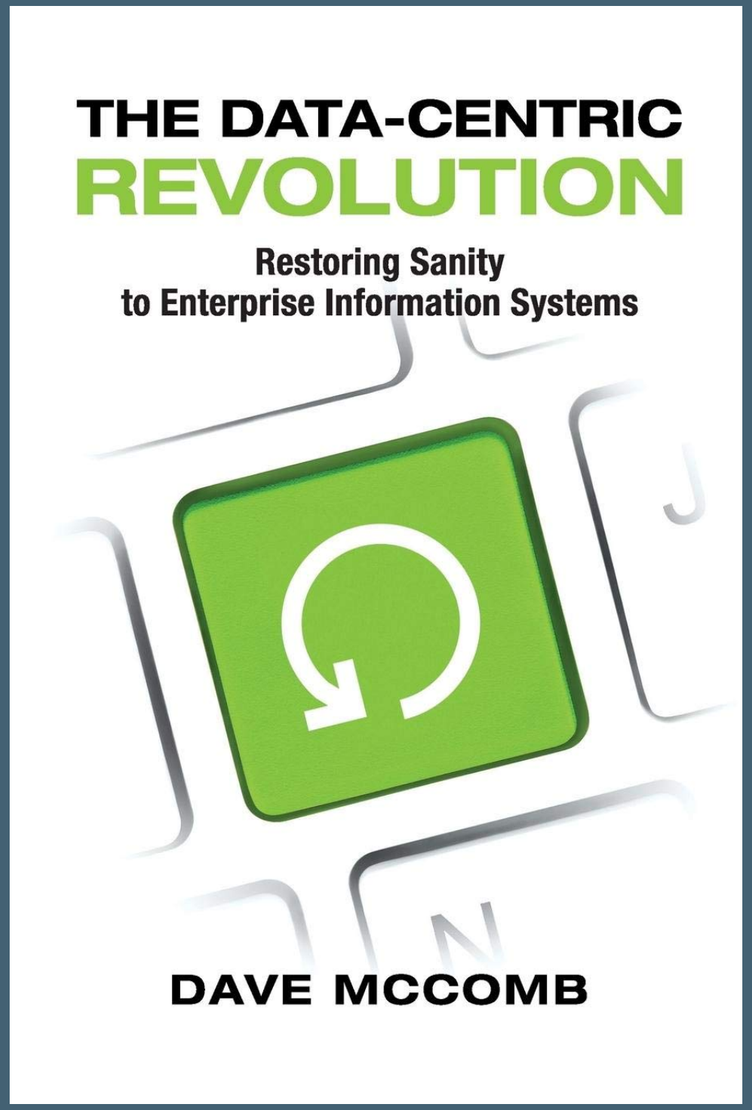
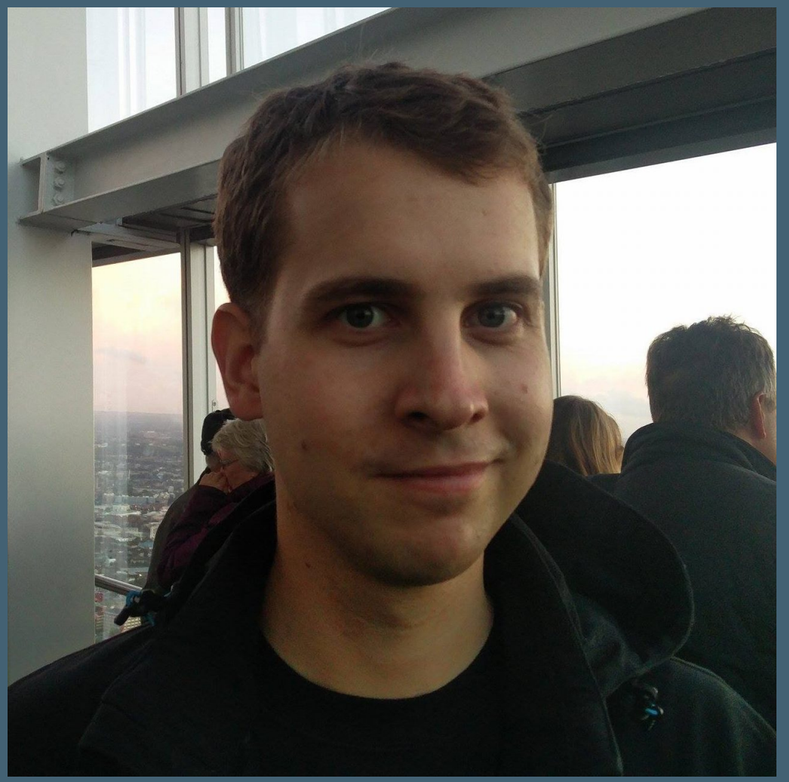
Barabasi Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life


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


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

Thank you for listening

Tomasz Pluskiewicz



tpluscode

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https://t-code.pl