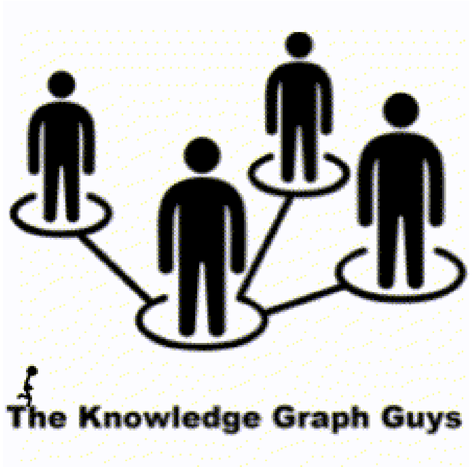
The Power of Networks

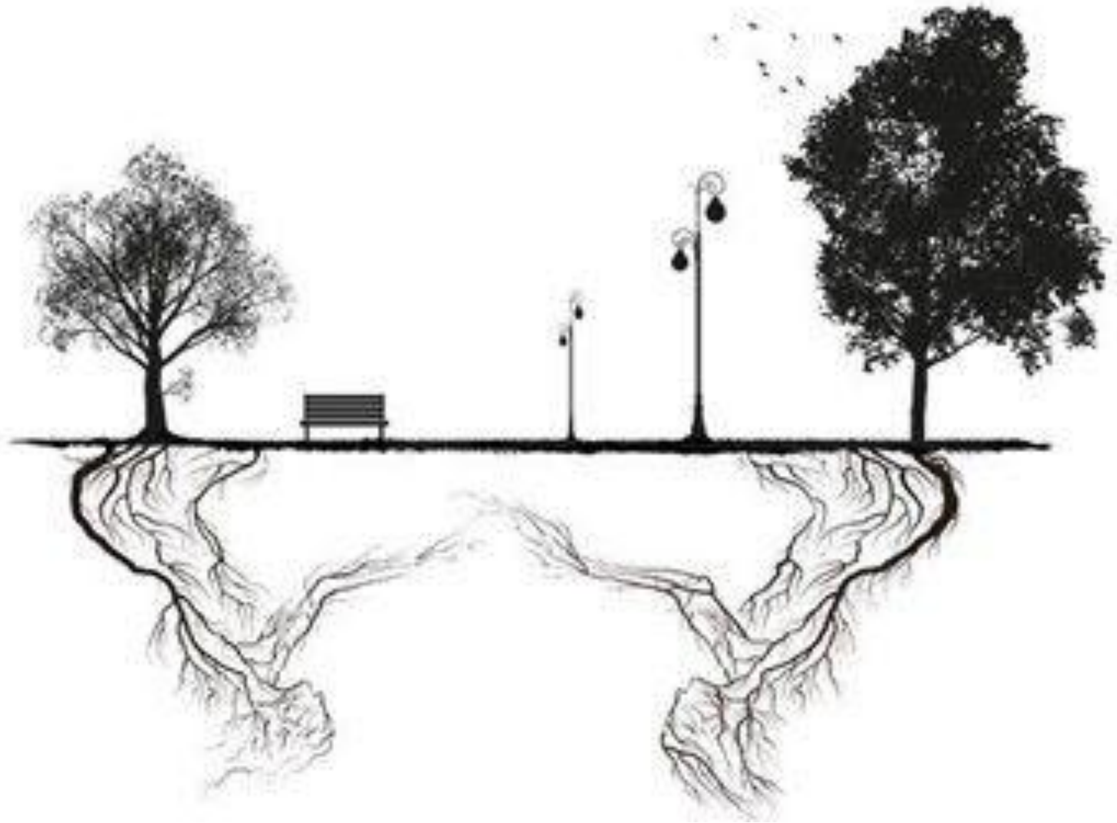
Why The European Railways Needs a Knowledge Graph



What Makes a Great Railway Network?

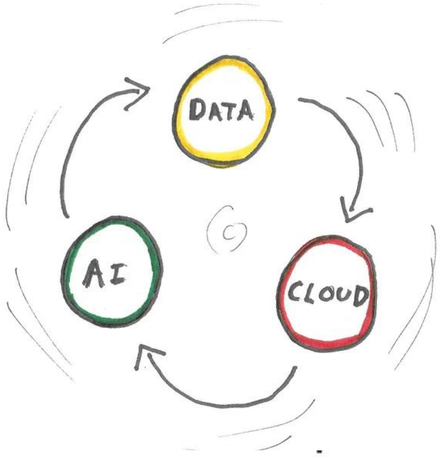
- Rich connectivity between stations
- Minimal friction between journeys
- Designed around actual routes people take
- Branches and trunks – like nature
- Common Standards

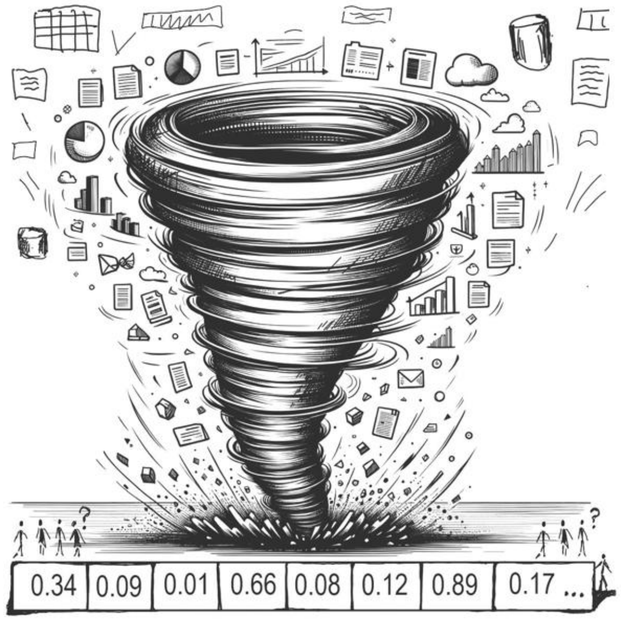
Networks Are Nature’s Pattern

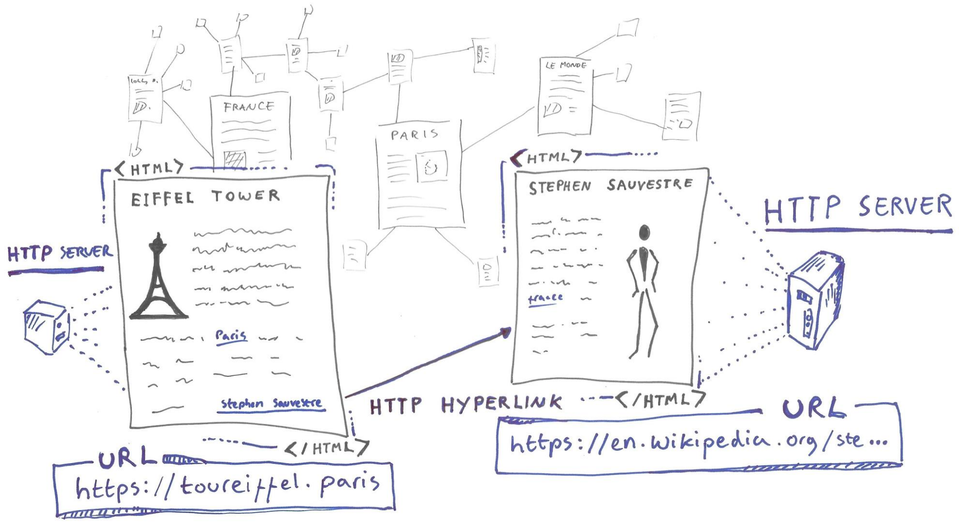


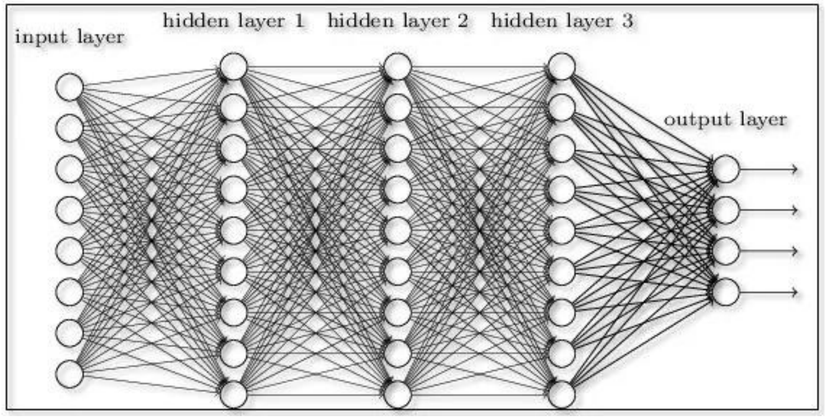
- Root systems
- Ecosystems
- Blood vessels
- Brains

Our Digital Infrastructure is Also a Network









- The Internet: **networked** computers
- The Web: a linked **network** of documents
- Neural **networks**: trained on text connections

But Our Structured Data is Still in Boxes!

PEOPLE

Person ID	First Name	Order ID	Household
1111	Ben	2222	21 Longview Road
1112	Bob	3333	22 Longview Road

ORDERS

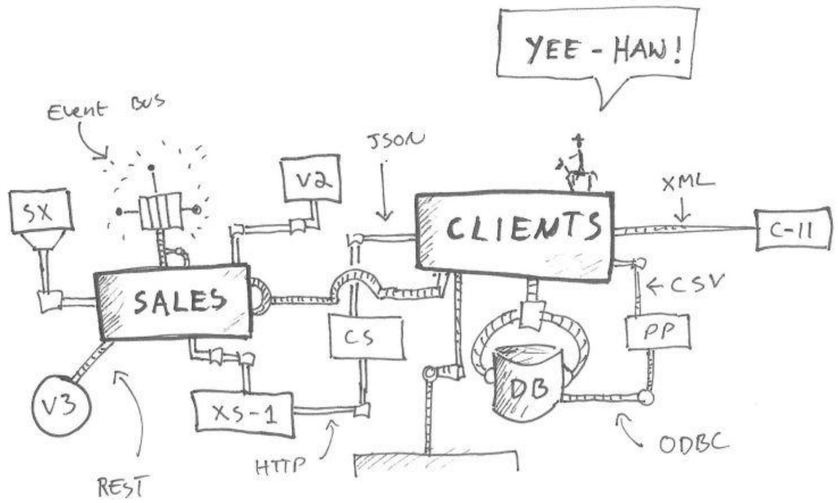
Order ID	Amount	Product ID
2222	$15.99	55555
3333	$83.00	55556

PRODUCTS

Product ID	Type	Name	Stock	Category
55555	Movie	Bridesmaids	20	RomCom
55556	Movie	Fight Club	70	Action

COLUMNS

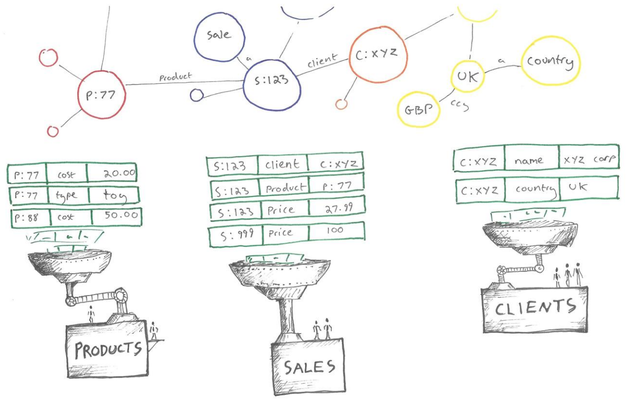
Model ID	Table	Column	Description
1	Person	First name	The persons name
2	Person	Order ID	The ID of the order

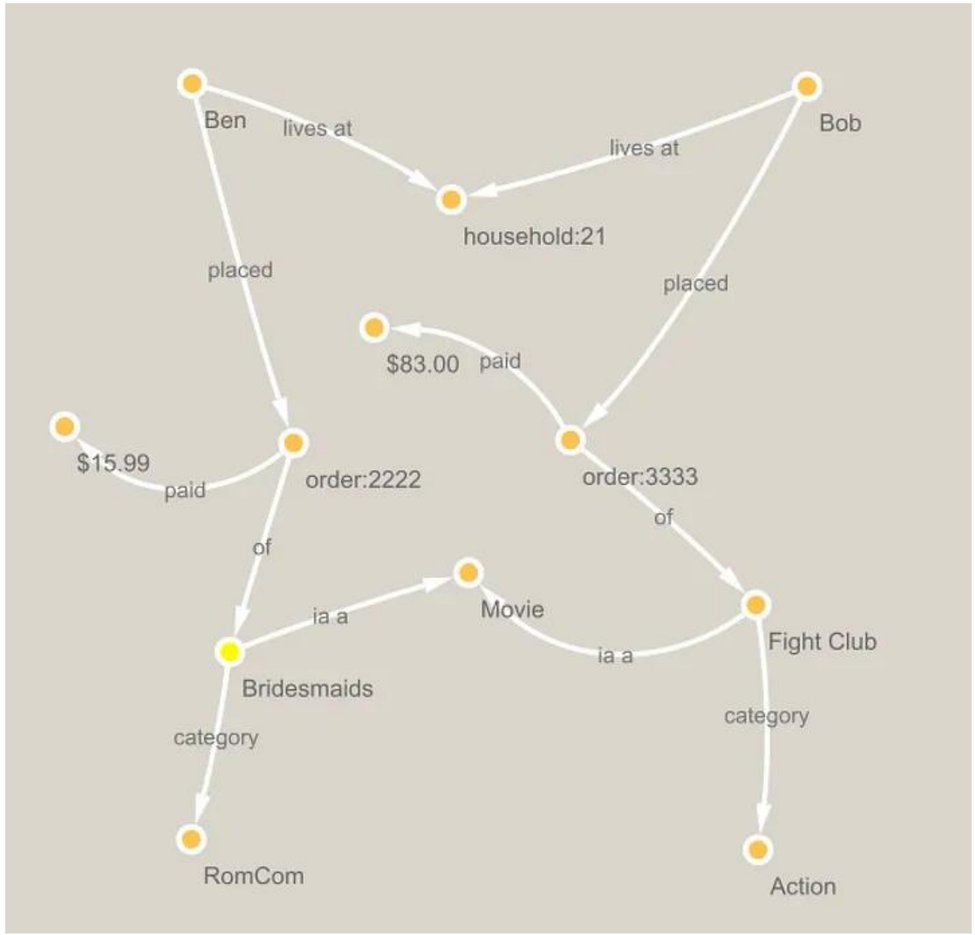


- **Tables**, silos, files
- Primary/foreign keys – at best
- **Data** is the odd one out - it is in a **Box** - not in a Network!

The Solution: A Network of Data

Item	Relationship	Object
Person: Ben	Placed Order	**Order: 2222**
Person: Ben	Household	**Household: 21 Longview**
Order: 2222	Amount	$15.99
Order: 2222	Product	**Product: Bridesmaids**
Product: Bridesmaids	Type	Movie
Product: Bridesmaids	Category	RomCom
Person: Bob	Placed Order	**Order: 3333**
Person: Bob	Household	**Household: 21 Longview**
Order: 3333	Amount	$83.00
Order: 3333	Product	**Product: Fight Club**
Product: Fight Club	Type	**Movie**
Product: Fight Club	Category	Action
Movie	Type	Concept
Movie	Property	**First Name**
First Name	Description	The persons name

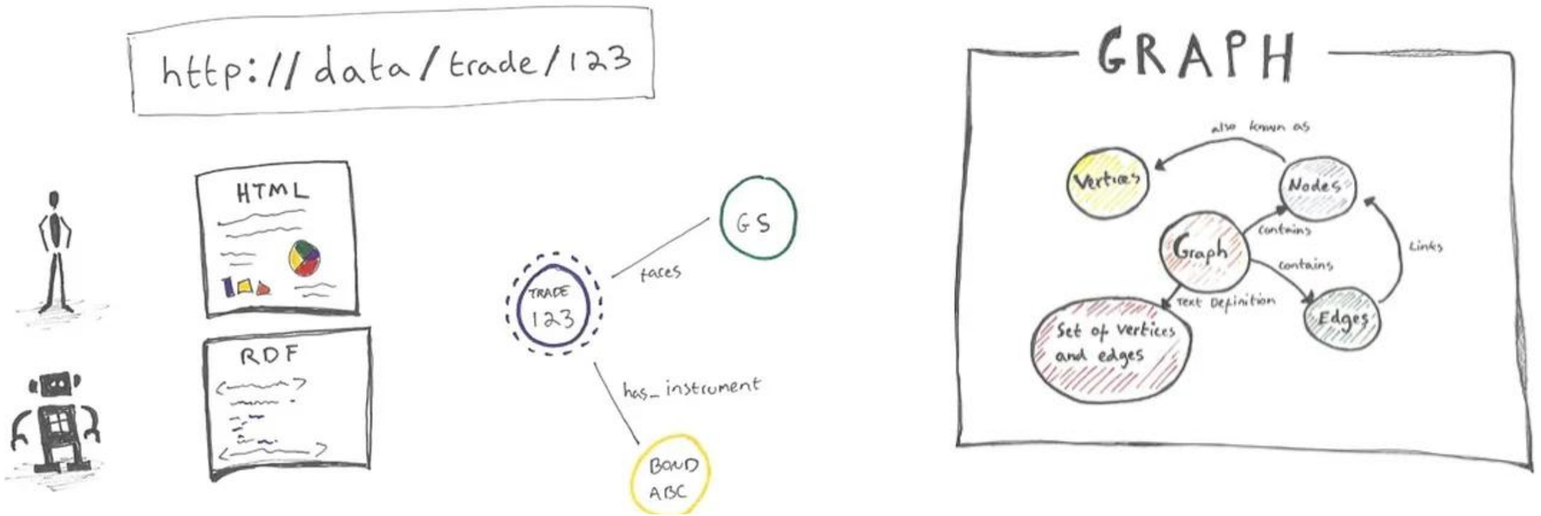


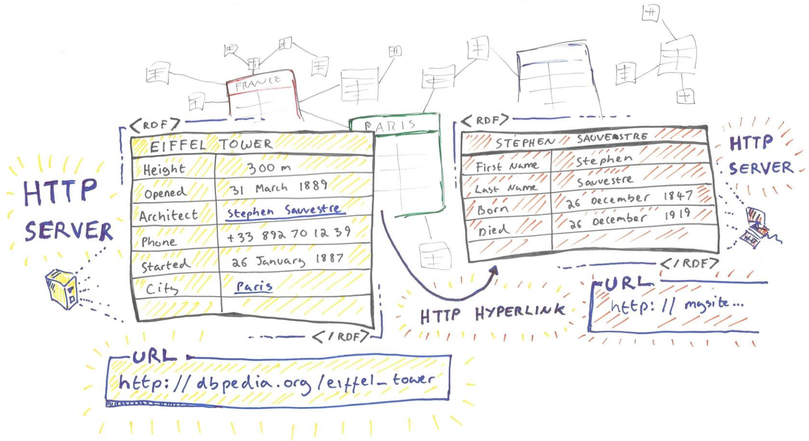


- Interconnected
- Distributed
- Machine-understandable

What is a Knowledge Graph?

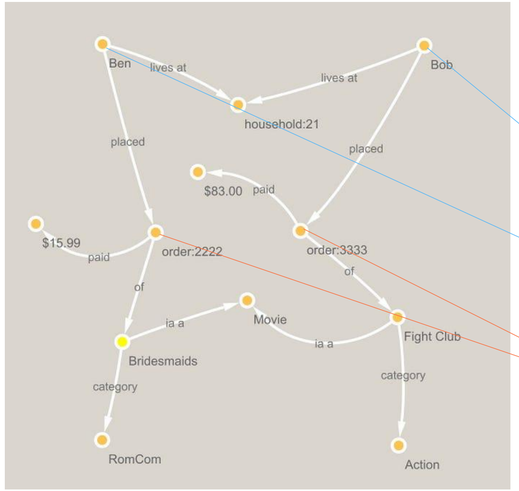
Item Link	Relationship Link	Object Link
https://abc.org/person/ben	https://abc.org/schema/placedOrder	https://abc.org/order/2222

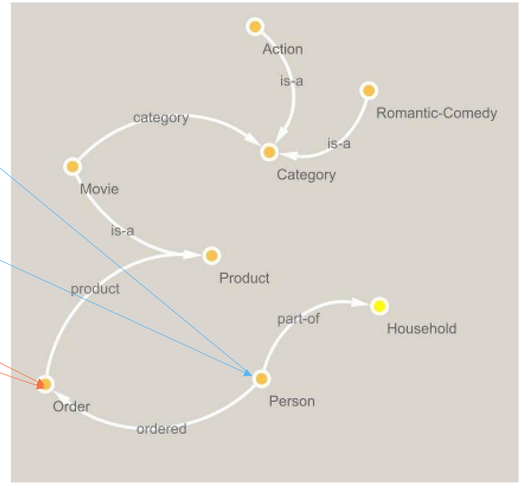


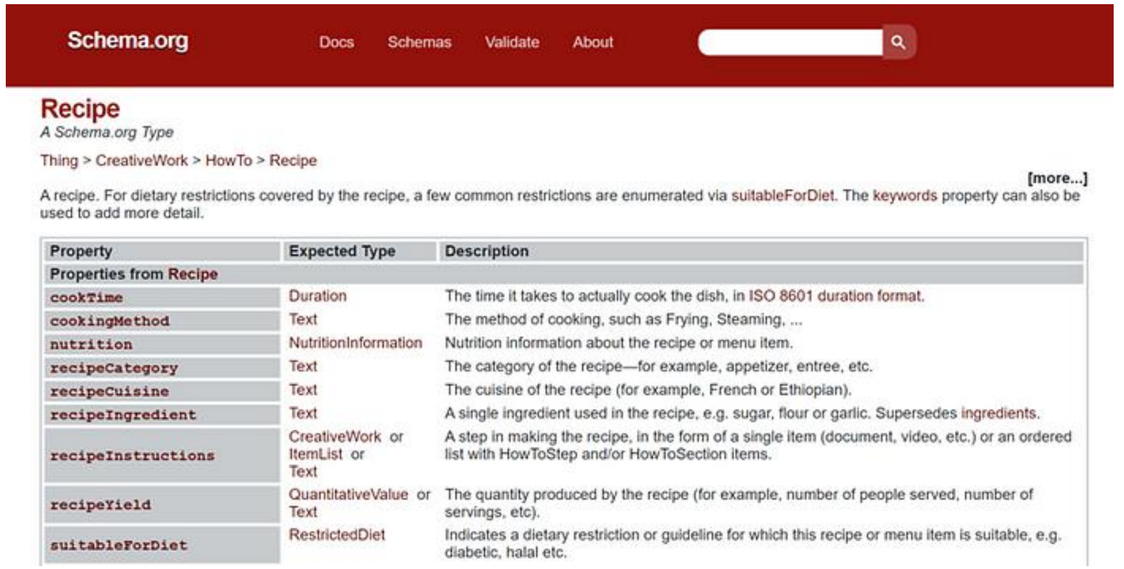


- Every item has a URL and the URLs Hyperlink to each other
- Use RDF to describe data like HTML described documents
- Use shared vocabularies to define meaning

What is an Ontology?

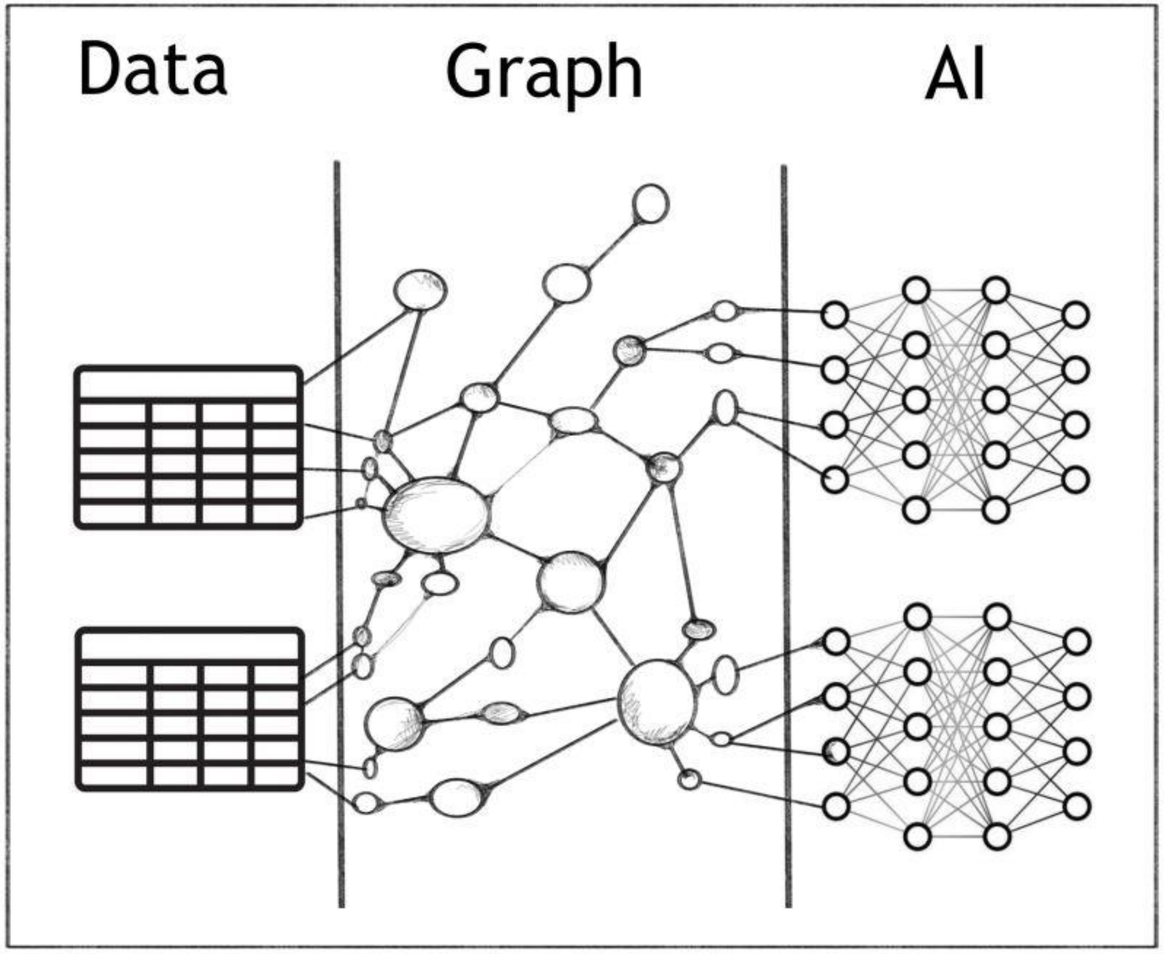






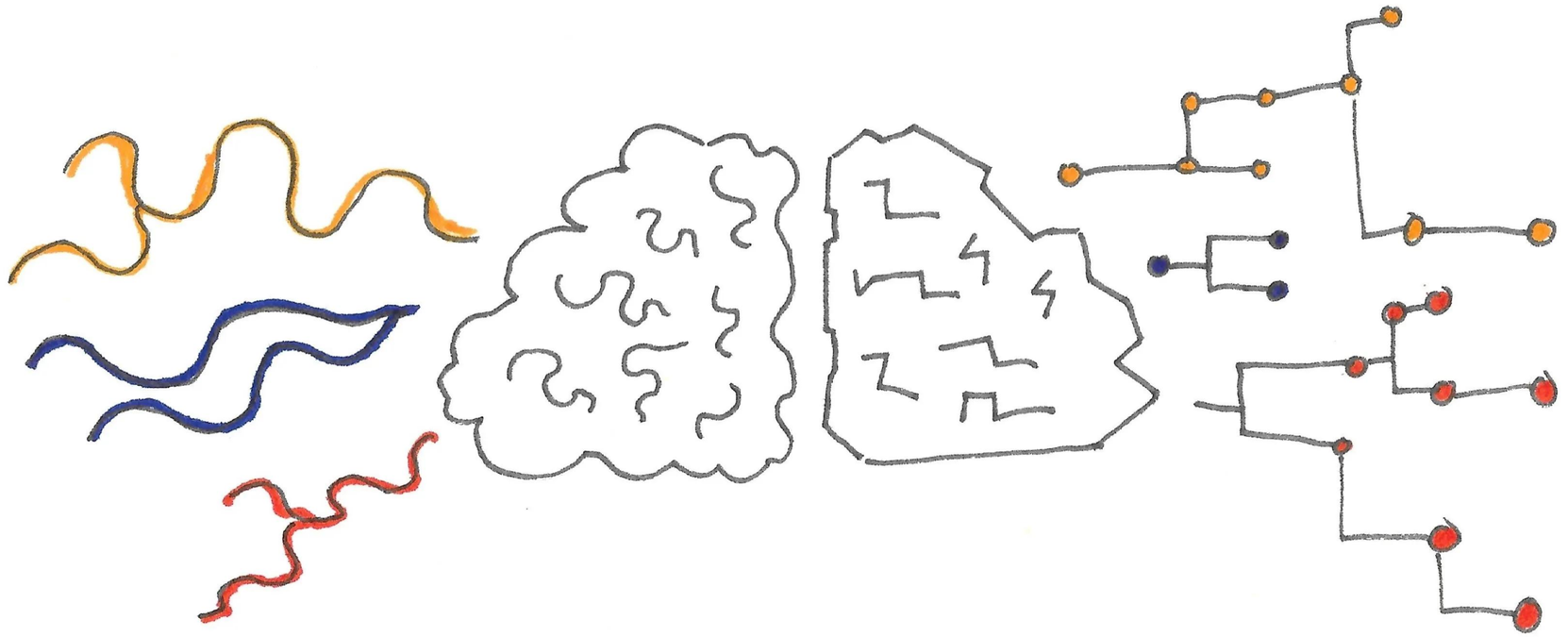
- Model **Meaningful** Abstractions
- Share the Ontologies using HTTP

Why This Matters for Rail



- Rail data becomes machine-navigable
- Supports AI, reasoning, automation
- Builds a digital twin of rail infrastructure

The New Shift: Physical ↔ Digital

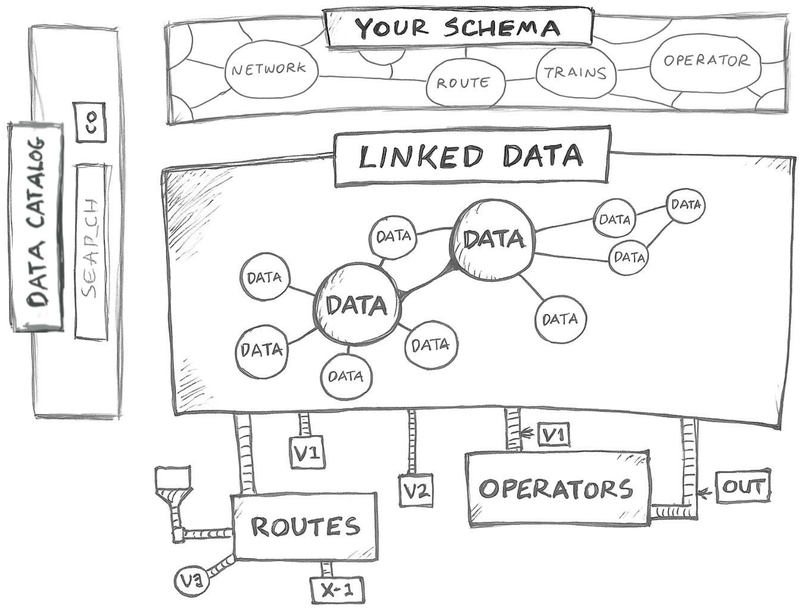


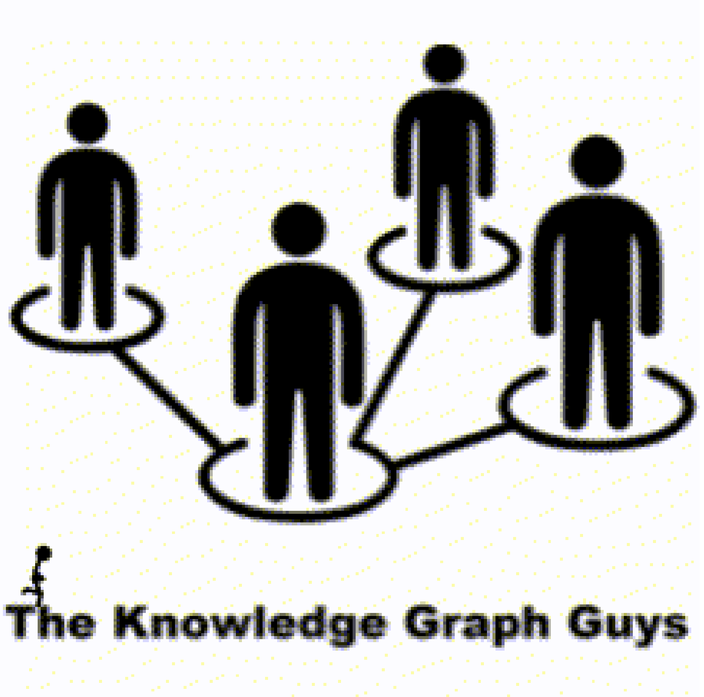
- Simulate the real world with digital twins
- Manage complex systems digitally
- Use Neural Networks and Computer Networks to Improve Rail Networks

Final Thought

A well-organised railway network is a sign of a healthy society.

In the age of AI a well-organised data network is the sign of a healthy railway.




The Knowledge Graph Guys