



DATA FOR HUMAN



GIANPAOLO GASPARINI

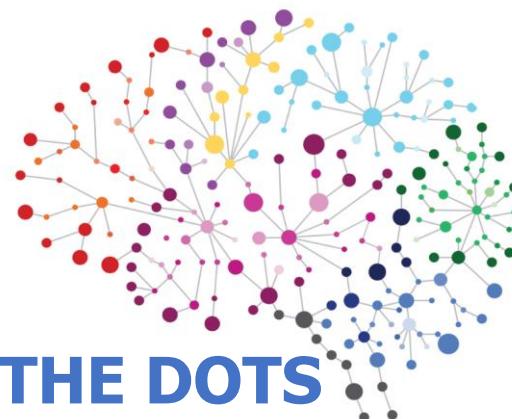


LORENZO SPERANZONI



Living in a safer world: First Pharma Serialization application based on Graph Technology

A GLIMPSE INTO THE FUTURE OF NETWORK-DRIVEN INSIGHTS



CONNECTING THE DOTS

WHO'S LARUS

WE HELP COMPANIES DESIGNING
LARGE-SCALE DATA-DRIVEN SYSTEMS



- DATA PRESENTATION
- DATA ARCHITECTURE
- DATA COMPUTING
- DATA PERSISTENCE



LARUS

[:BASED_IN]



VENICE



WHO'S LARUS

LARUS BUSINESS AUTOMATION

- Founded in **2004**
- Headquartered in **Venice, ITALY**
- Delivering services **Worldwide**
- Mission: "*Bridging the gap between Business and IT*"



LARUS

[:BASED_IN]



VENICE

OUR SPECIALITIES

- Consulting and Developing Solutions on the **Latest Open-Source Technologies**
- Training and Coaching on **Agile & Lean Methodologies**
- Custom Software Design and Development
- Strong focus on **Light-Weight Architectures** and **No-SQL Technologies**



NETWORK-DRIVEN INSIGHTS

CONNECTING THE DOTS

*“Without a doubt, the ability to connect the dots is rare, prized and valuable. Connecting dots, solving the problem that hasn't been solved before, **seeing the pattern before it is made obvious, is more essential than ever before**”*

SETH GODIN

https://en.wikipedia.org/wiki/Seth_Godin



NETWORK-DRIVEN INSIGHTS

A PARADIGM SHIFT

Businesses need to stop merely collecting data points, and start connecting them:

- **The relationships between data points matter almost more than the individual points themselves**

NETWORK-DRIVEN INSIGHTS

THE PROBLEM WITH RDBMS

Ironically, legacy relational database management systems (RDBMS) are **poor at handling relationships between data points.**

Their tabular data models and rigid schemas make it difficult to add new or different kinds of connections.



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NETWORK-DRIVEN INSIGHTS

THE RIGHT TECHNOLOGY

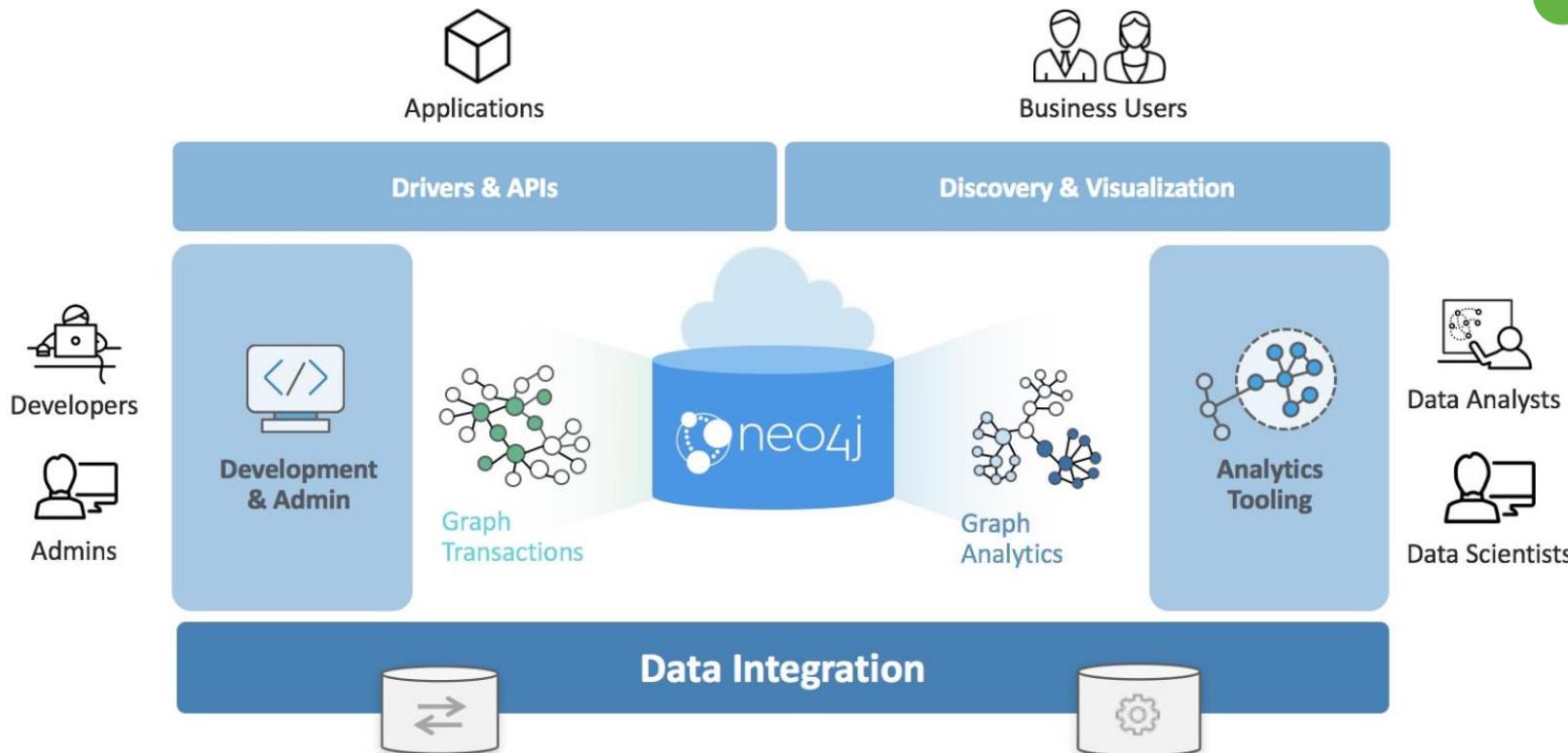
In order to leverage data relationships, your organization needs
**a database technology that stores relationship
information as a first-class entity.**

That technology is a **graph database**.



NEO4J

THE WORLD LEADING GRAPH PLATFORM



<https://neo4j.com/product/>



LARUS NEO4J

First Spikes
in Retail for
Articles'
Clustering



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1



201
4



201
5

Neo4j JDBC Driver



201
6

Neo4j APOC, ETL, GraphQL,
Spark



2017-2018

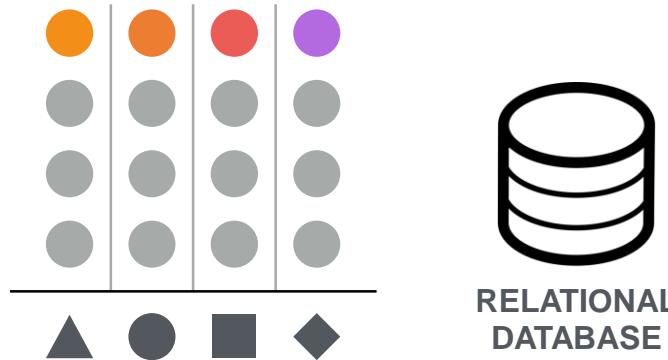


ITALY'S #1 OFFICIAL PARTNER SINCE
2014



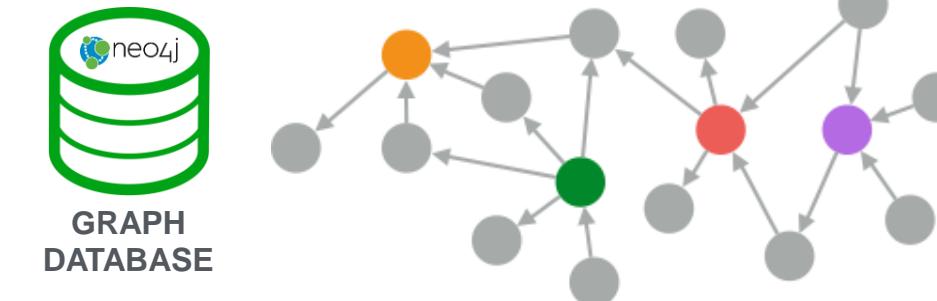
GRAPH THINKING

RELATIONSHIPS IN YOUR DATA HOLD TREMENDOUS VALUE ... JUST USE THEM!



GOOD FOR

- Well-understood data structures that don't change too frequently
- Known problems involving discrete parts of the data, or minimal connectivity



GOOD FOR

- Dynamic systems: where the data topology is difficult to predict
- Dynamic requirements: that evolve with the business
- Problems where the relationships in data contribute meaning & value



GRAPH THINKING

NEO4j USE CASES

Real Time
Recommendations

Master Data Management

Fraud Detection

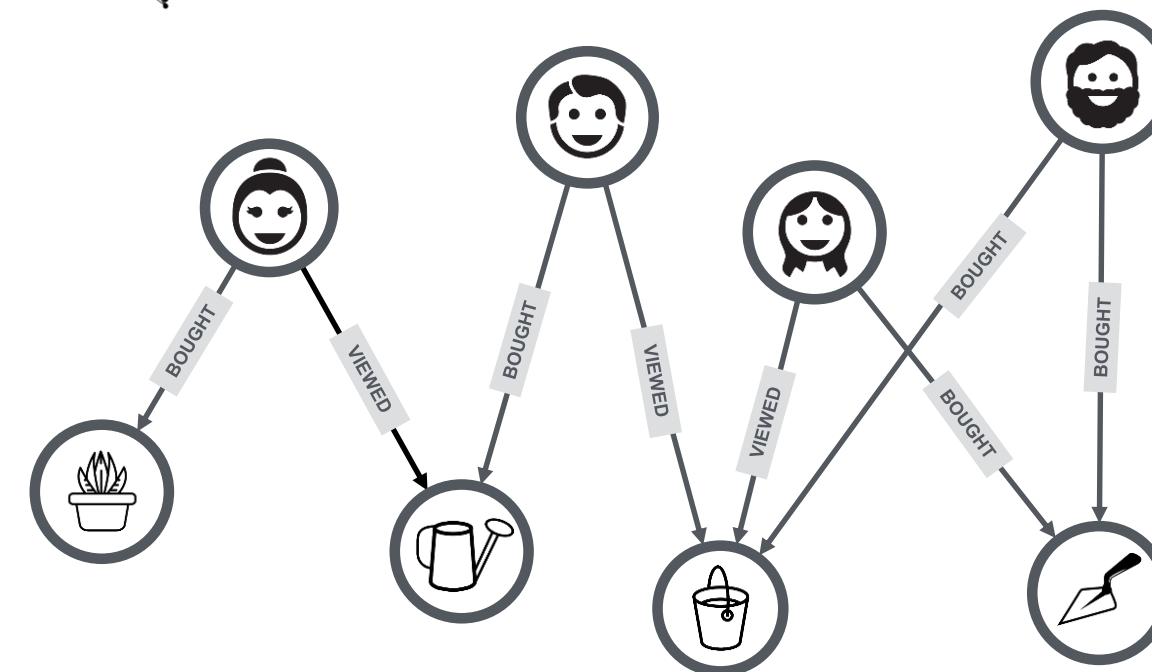
Graph Based Search

Network & IT-Operations

Identity & Access
Management



RETHINK YOUR PROBLEM IN
TERM OF A NETWORK



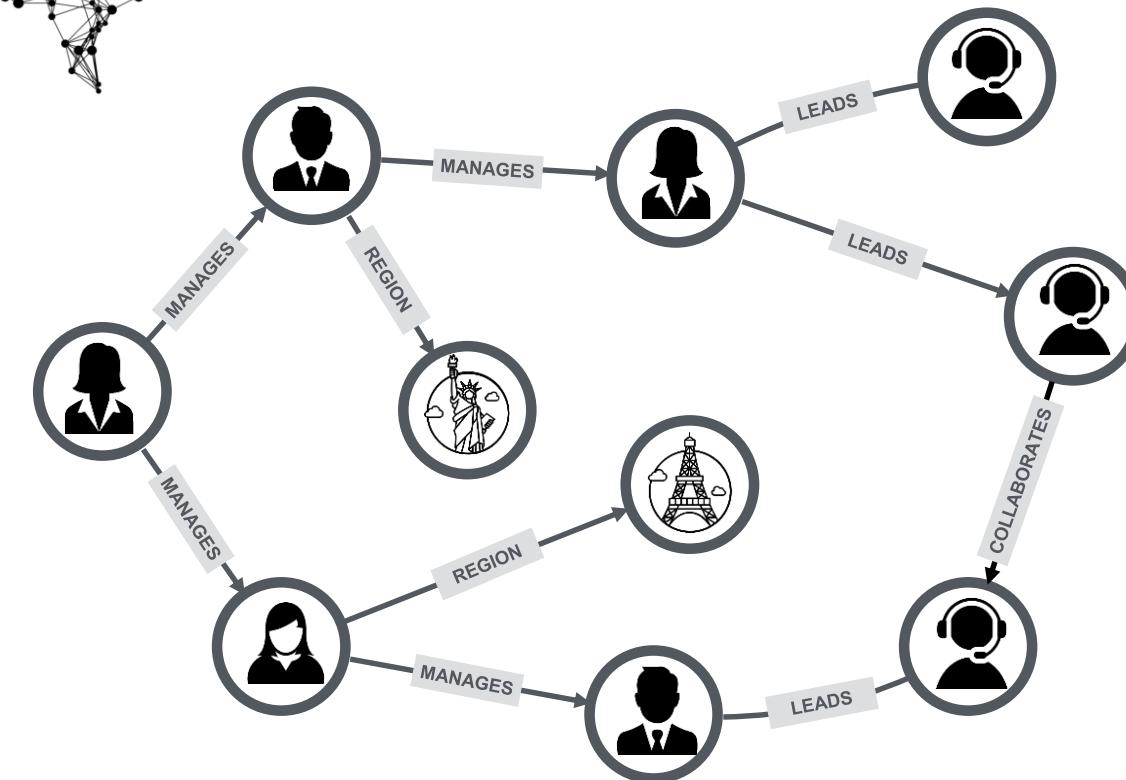
GRAPH THINKING

NEO4j USE CASES

- Real Time Recommendations
- Master Data Management**
- Fraud Detection
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RETHINK YOUR PROBLEM IN TERM OF A NETWORK



GRAPH THINKING

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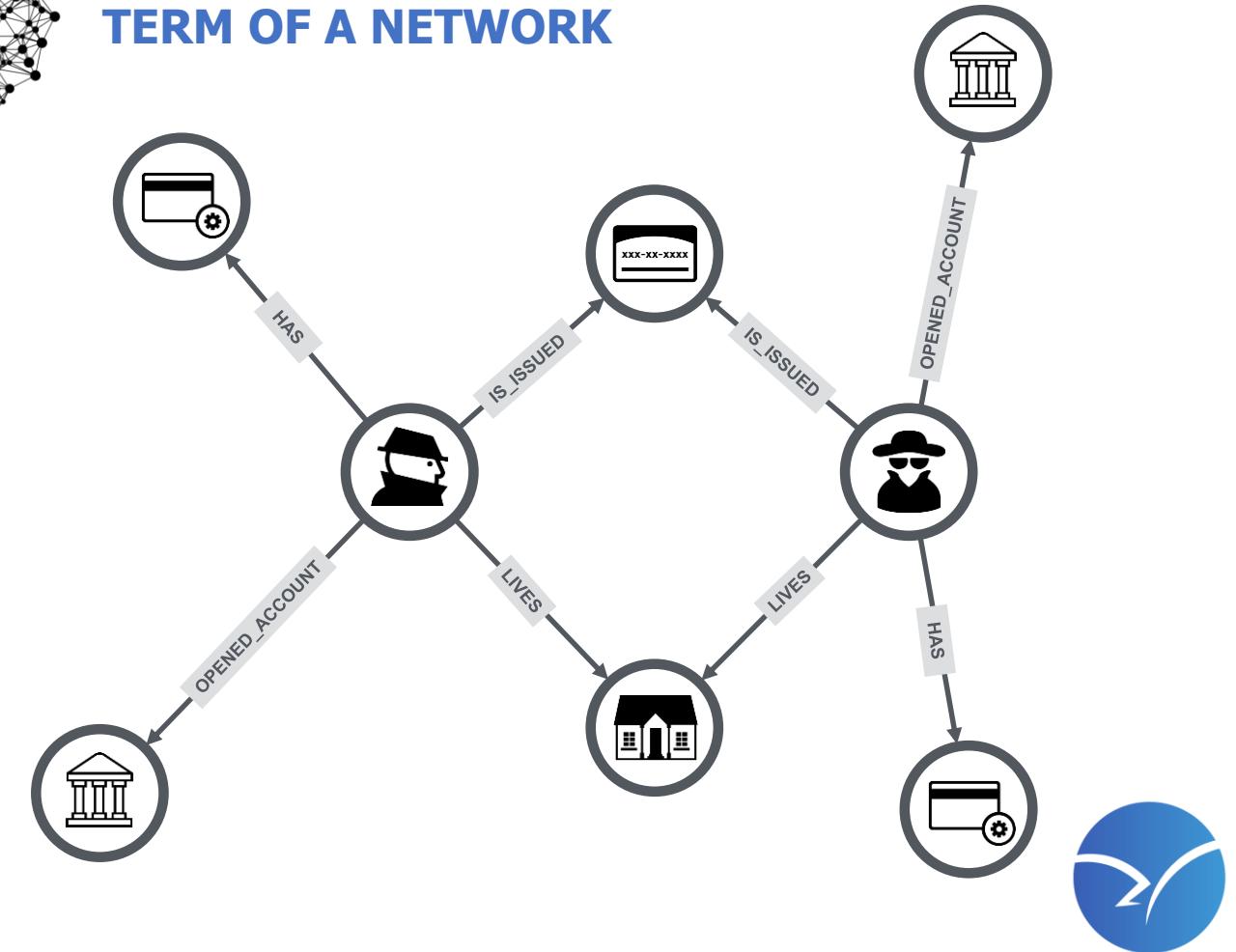
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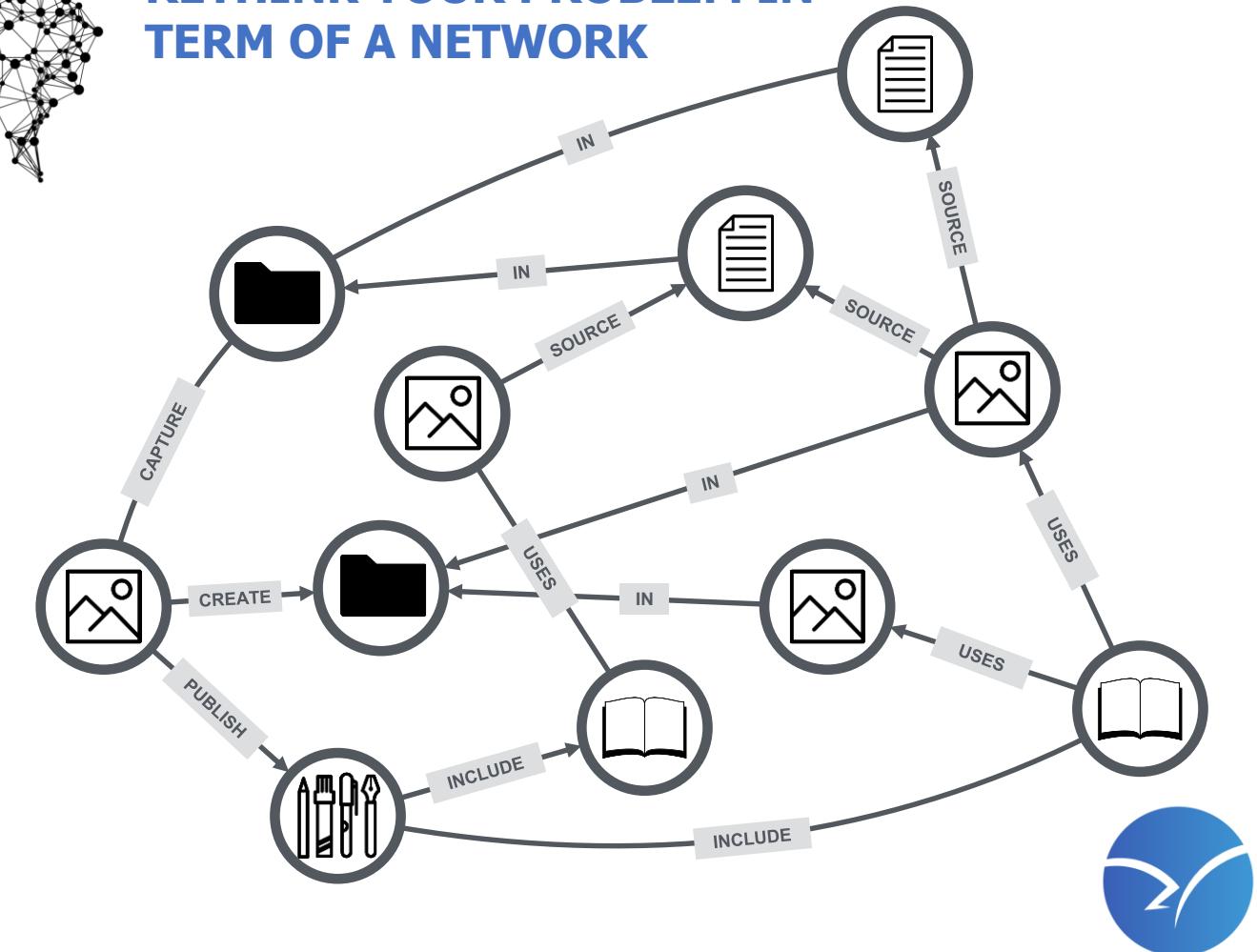
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RETHINK YOUR PROBLEM IN TERM OF A NETWORK



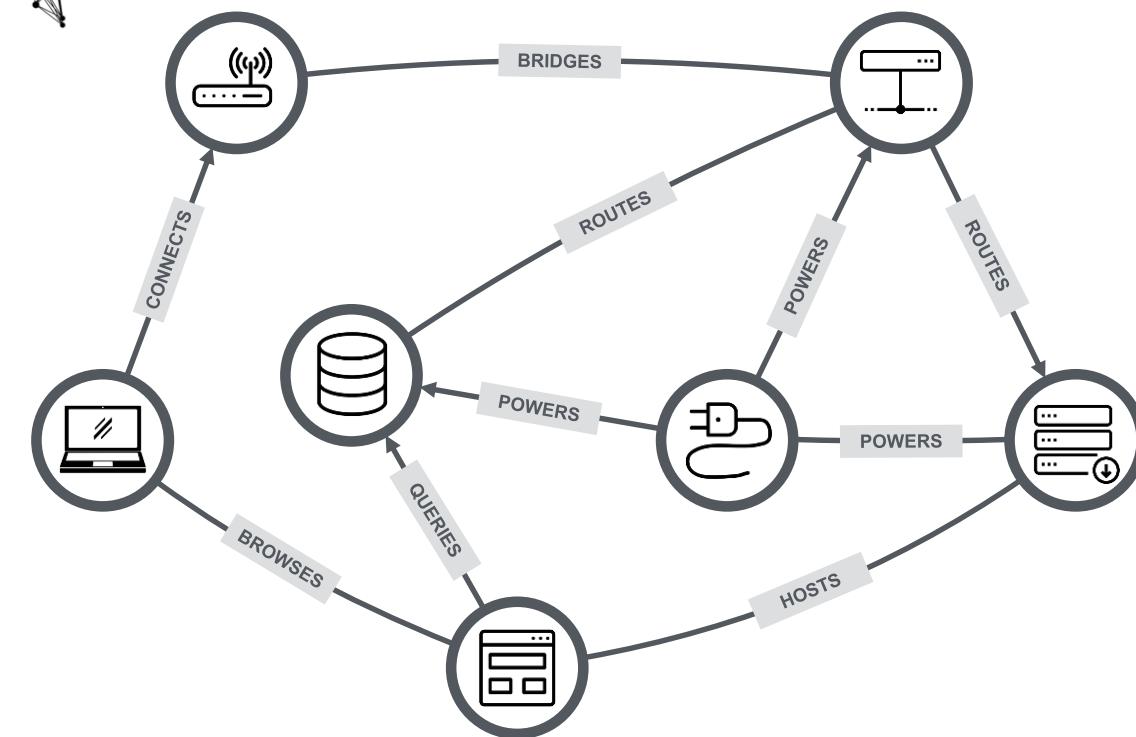
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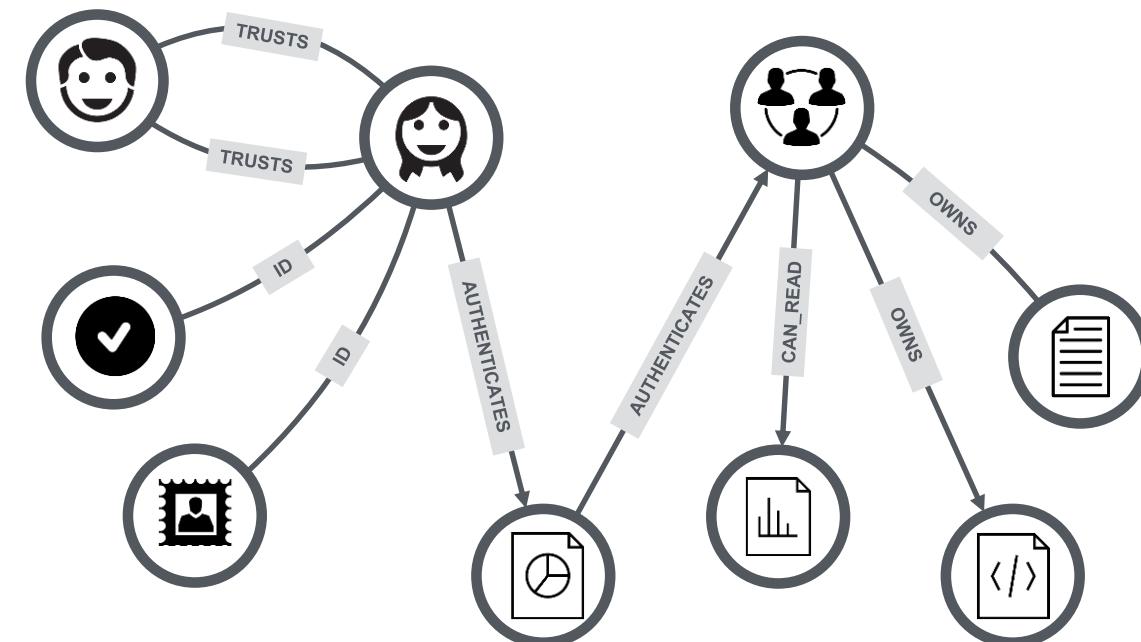
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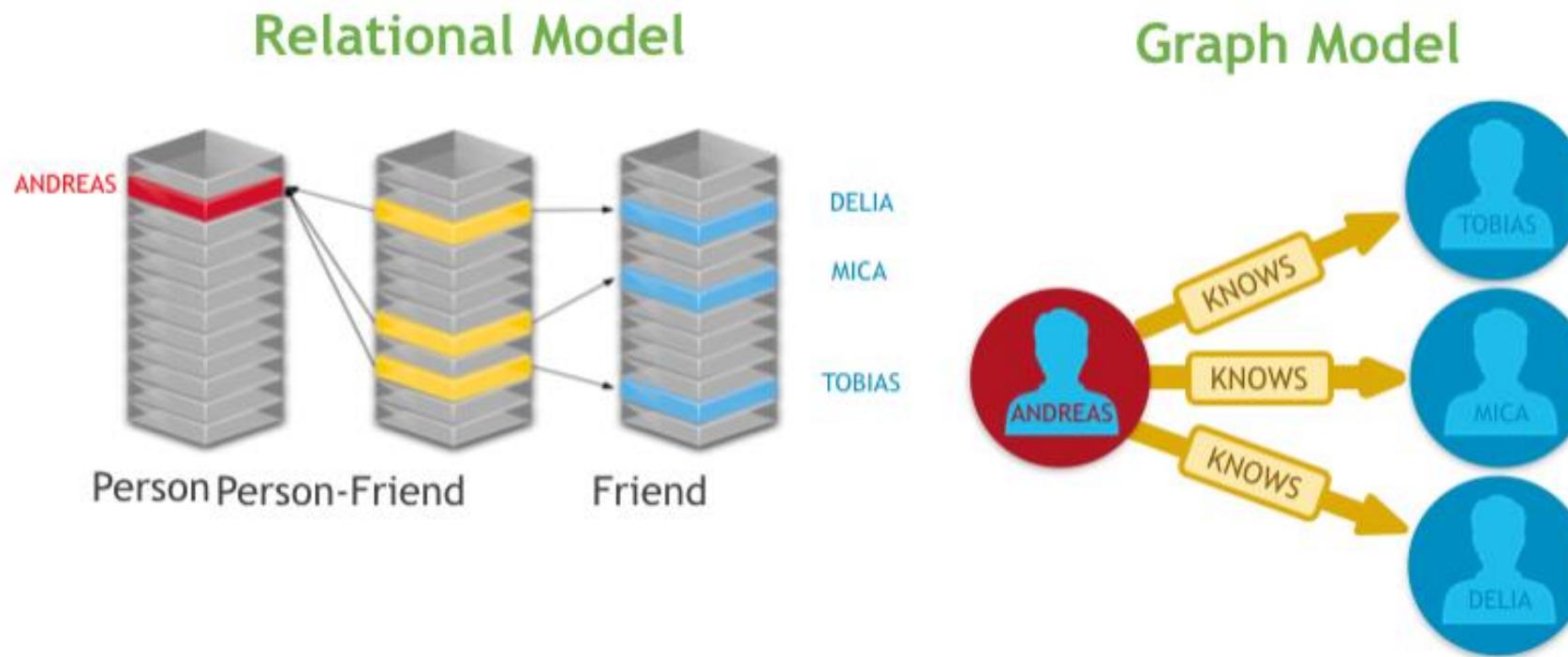


RETHINK YOUR PROBLEM IN TERM OF A NETWORK



NEO4J

RELATIONAL VERSUS GRAPH MODELS



NEO4J

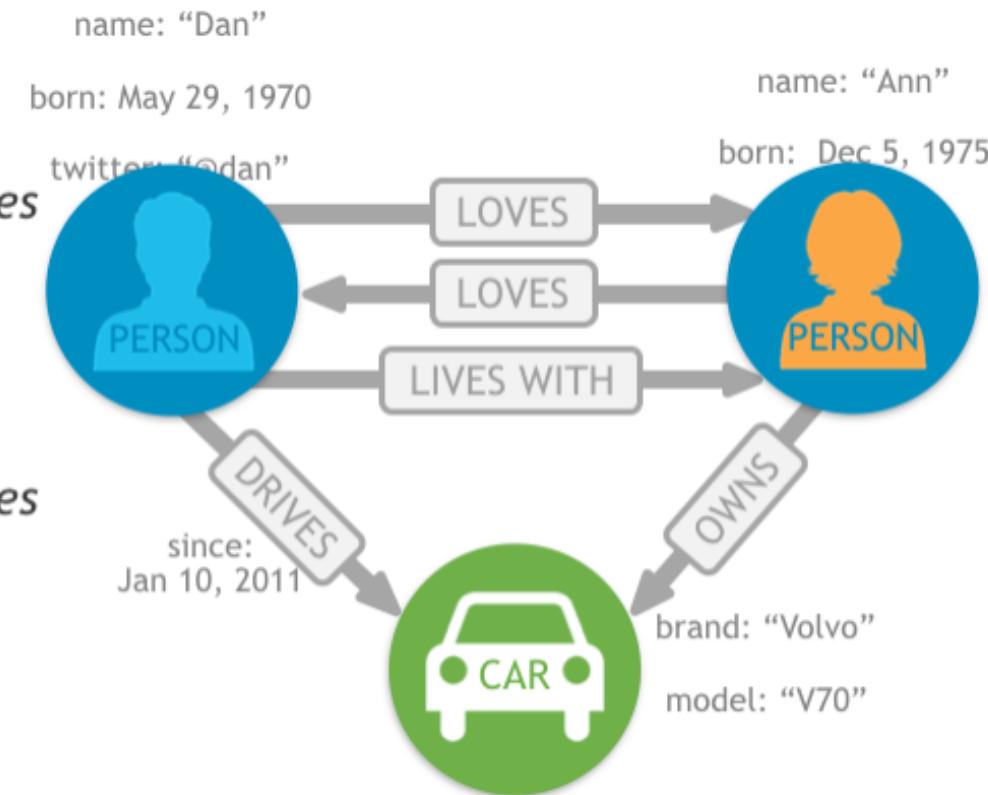
PROPERTY GRAPH MODEL COMPONENTS

Nodes

- The objects in the graph
- Can have name-value *properties*
- Can be *labeled*

Relationships

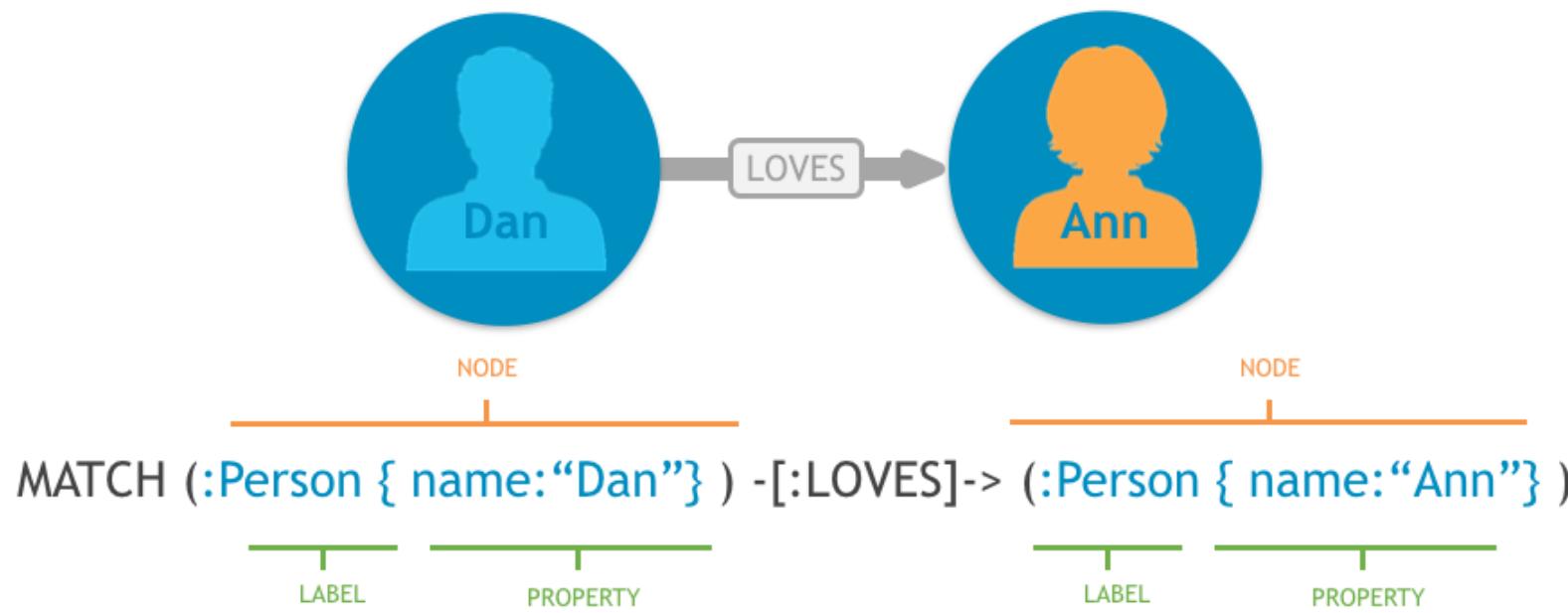
- Relate nodes by type and direction
- Can have name-value *properties*



NEO4J

CYPHER QUERY LANGUAGE

Cypher: Powerful and Expressive Query Language





LIVING TECHNOLOGY FOR A HEALTHIER AND A SAFER WORLD



MISSION

Leading the complete process of **protecting the products** throughout their life-cycle,
Antares Vision delivers the **most comprehensive and scalable global solution** in
inspection systems, track & trace and smart data management.

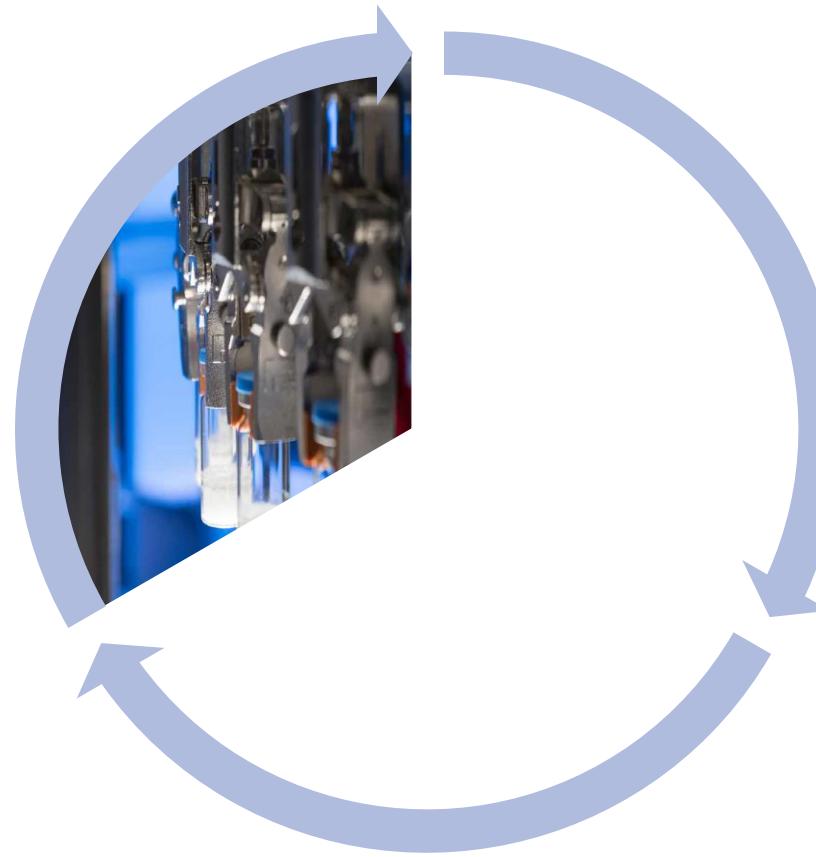
Driven by competence, energy and passion, **we have fun** in providing innovative
technologies and developing strong partnerships with our customers
to co-create added value.



Protecting the products throughout their life-cycle

INSPECTION

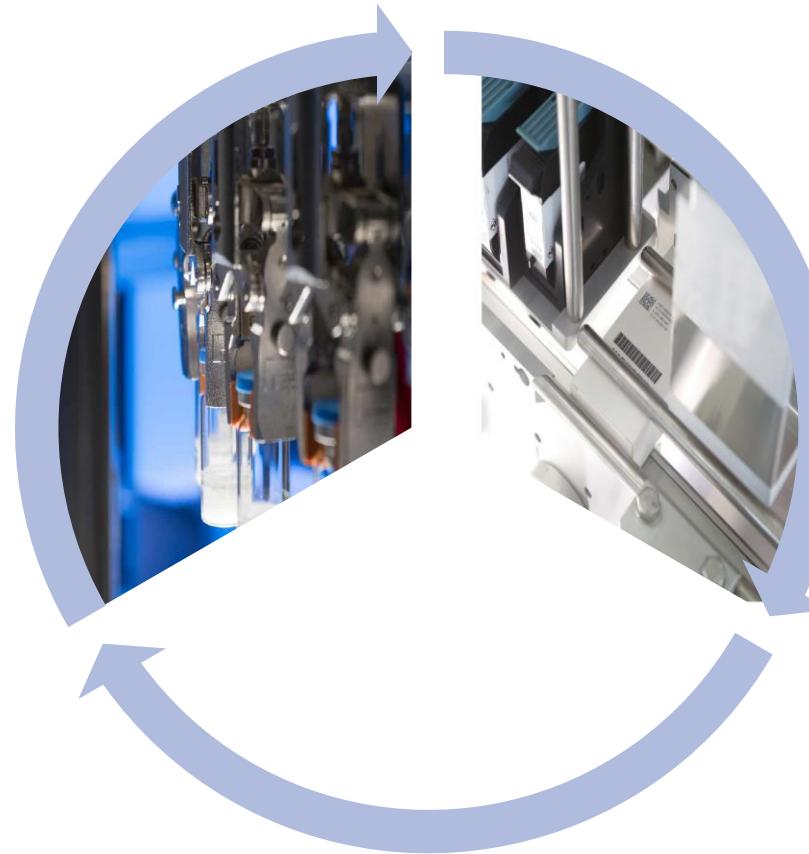
Visual inspection systems and automatic machines to guarantee **integrity** and **conformity** of products, containers and packaging



Protecting the products throughout their life-cycle

INSPECTION

Visual inspection systems and automatic machines to guarantee **integrity** and **conformity** of products, containers and packaging



TRACK&TRACE

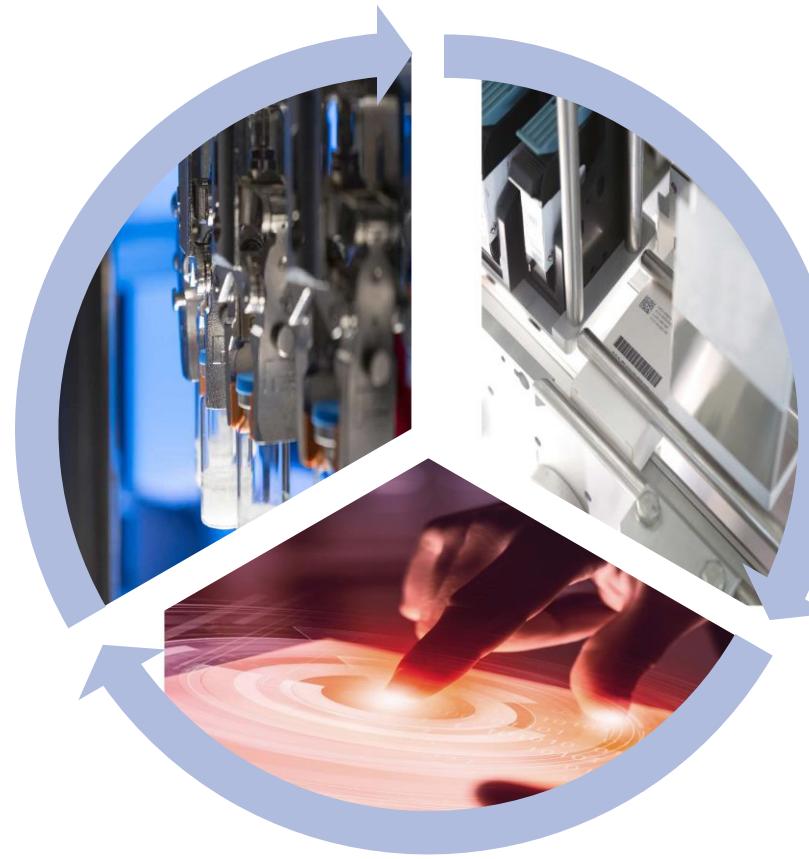
Solutions to identify and trace products from manufacturing to the distribution chain.



Protecting the products throughout their life-cycle

INSPECTION

Visual inspection systems and automatic machines to guarantee **integrity** and **conformity** of products, containers and packaging



TRACK&TRACE

Solutions to identify and trace products from manufacturing to the distribution chain.

SMART DATA MANAGEMENT

New **synergies** and added value through production and packaging processes **data analysis**.



We are Industry 4.0

INSPECTION

Visual inspection systems and automatic machines to guarantee **integrity** and **conformity** of products, containers and packaging



TRACK&TRACE

Solutions to identify and trace products from manufacturing to the distribution chain.

SMART DATA MANAGEMENT

New **synergies** and added value through production and packaging processes **data analysis**.

Antares Vision: a global presence

Local support / Flexibility / Fast & cost-effective service & maintenance

ITALY

Travagliato (BS)
Sorbolo (PR)
NEW! Aprilia (LT)

IRELAND

Galway

USA

Philadelphia

BRAZIL

NEW! São Paulo

SOUTH KOREA

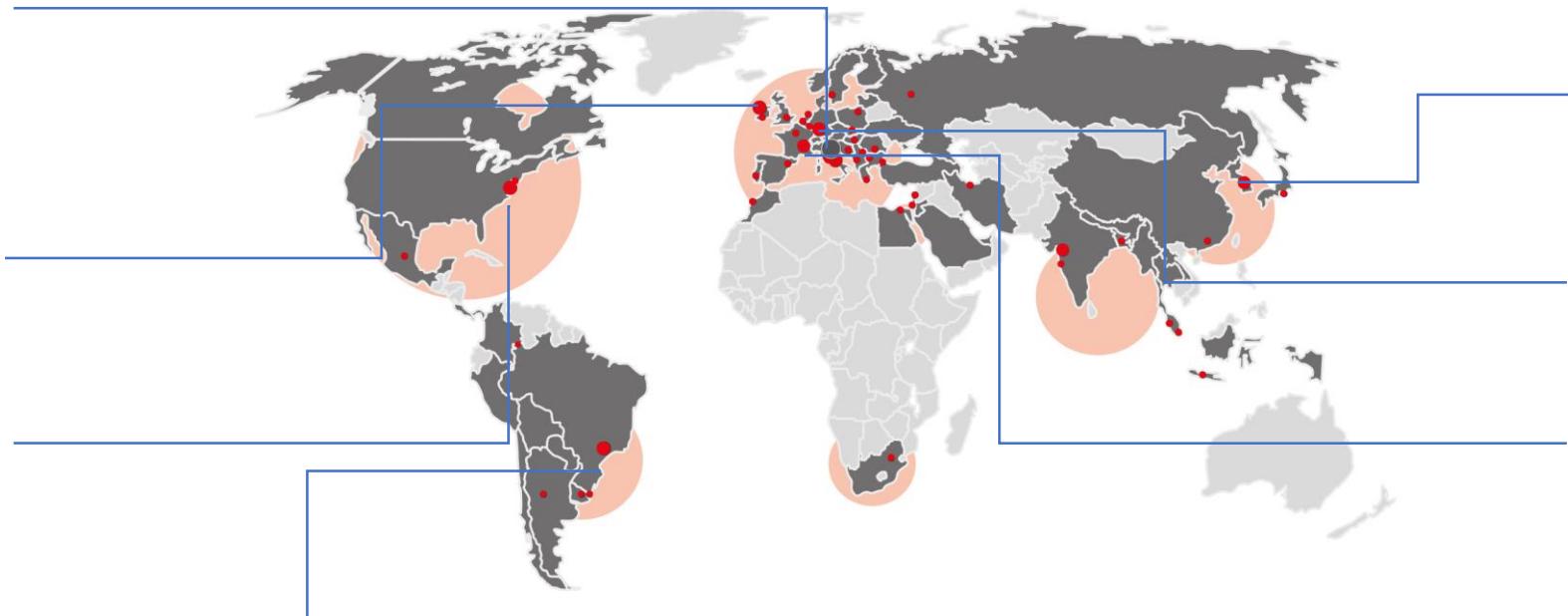
Seoul

GERMANY

Frankfurt

FRANCE

Lyon



9 local headquarters / 30+ local partners / 60+ countries served

Antares Vision: a global presence

Local support / Flexibility / Fast & cost-effective service & maintenance

NEW!

New building
AV Service Business Unit
Brescia ITALY

NEW!

New building
AV Aprilia ITALY

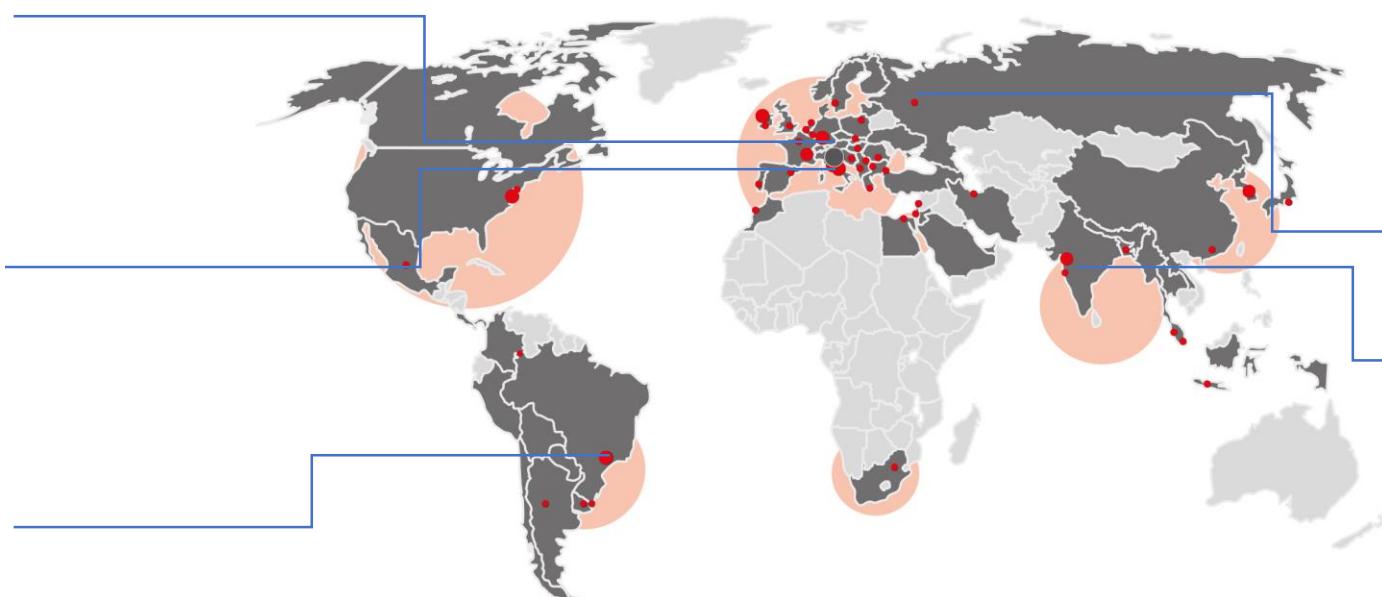
NEW!

New building
AV Latin America

NEW!

Opening in 2018 AV RUSSIA

Opening in 2018
AV INDIA



9 local headquarters / 30+ local partners / 60+ countries served

Antares Vision Facts & Figures



20 anni di esperienza nelle Tecnologie di Visione



25.000+ Camere installate



2.000+ Linee di serializzazione sviluppate nel mondo



45% delle aziende Top Pharma client Antares Vision



500+ forza lavoro in tutto il mondo



60+ Nazioni con presenza Antares Vision

Distribution : Counterfeits Dispensing Point



- **One million people die from fake drugs every year**
- **The pharmaceutical industry loses €10 billion annually directly** as a result of the presence of counterfeit medicines in the EU marketplace working out at 4.4% of sales.
- **The worth of the counterfeiting market is estimated from \$70-200 billion yearly.**

More and more countries are dealing with pharma T&T

The world



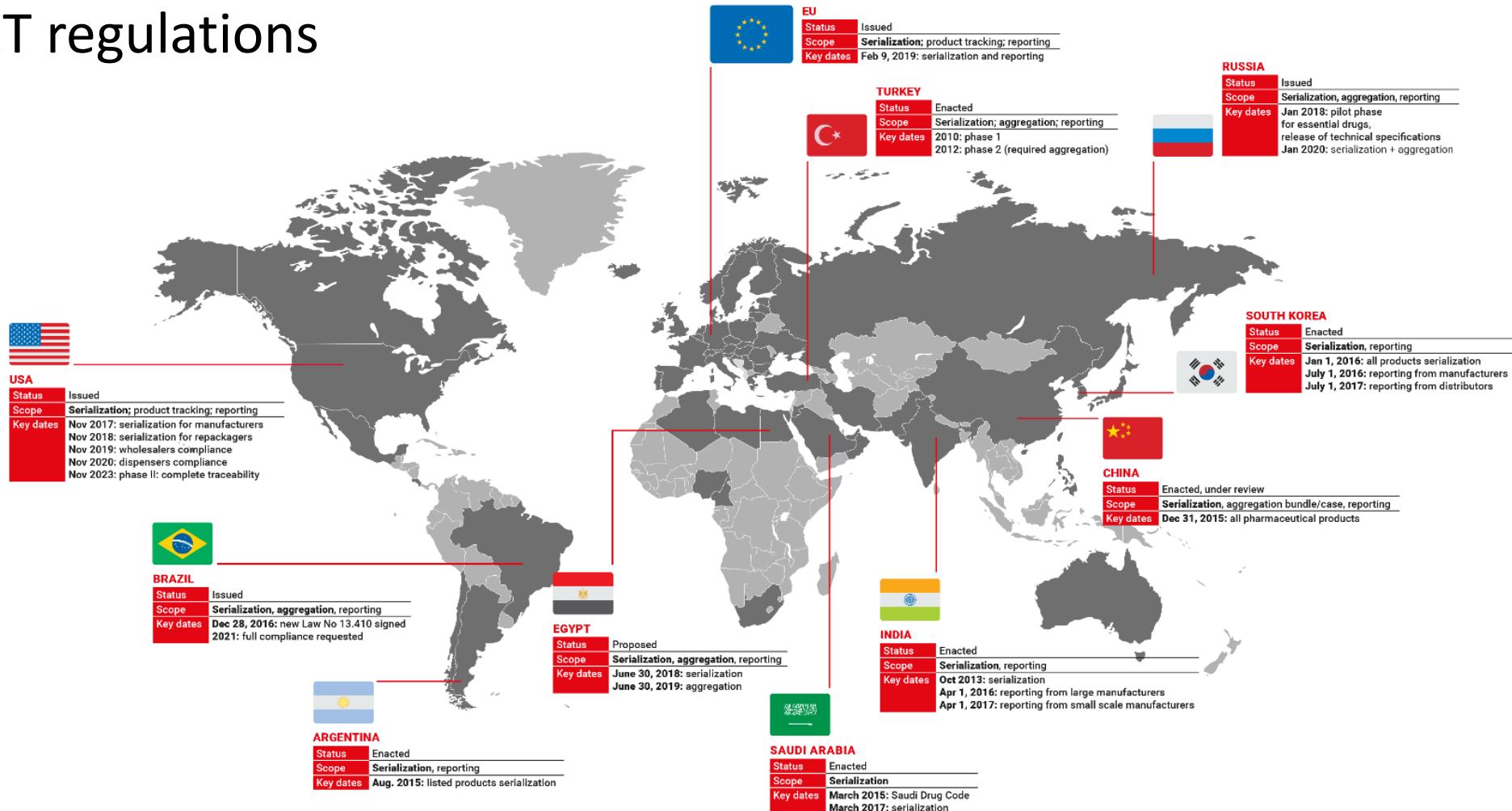
More and more countries are dealing with pharma T&T

Countries with a T&T regulation

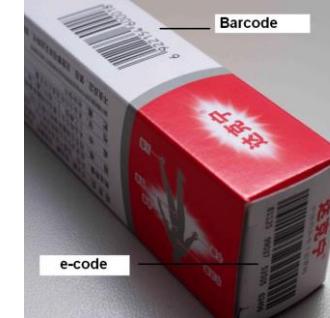


More and more countries are dealing with pharma T&T

Major T&T regulations



The concept of serialization in Track & Trace



- **Pharmaceutical Serialization** = associating a **unique serial number** to each item for sale in addition to the origin, shelf life and batch number.
- **2D Datamatrix** is the most common **form of data encoding system** in pharma serialization.

In some regulation (i.e. China e-code) a barcode is used.



ANTARES VISION

WWW.BNOVA.IT

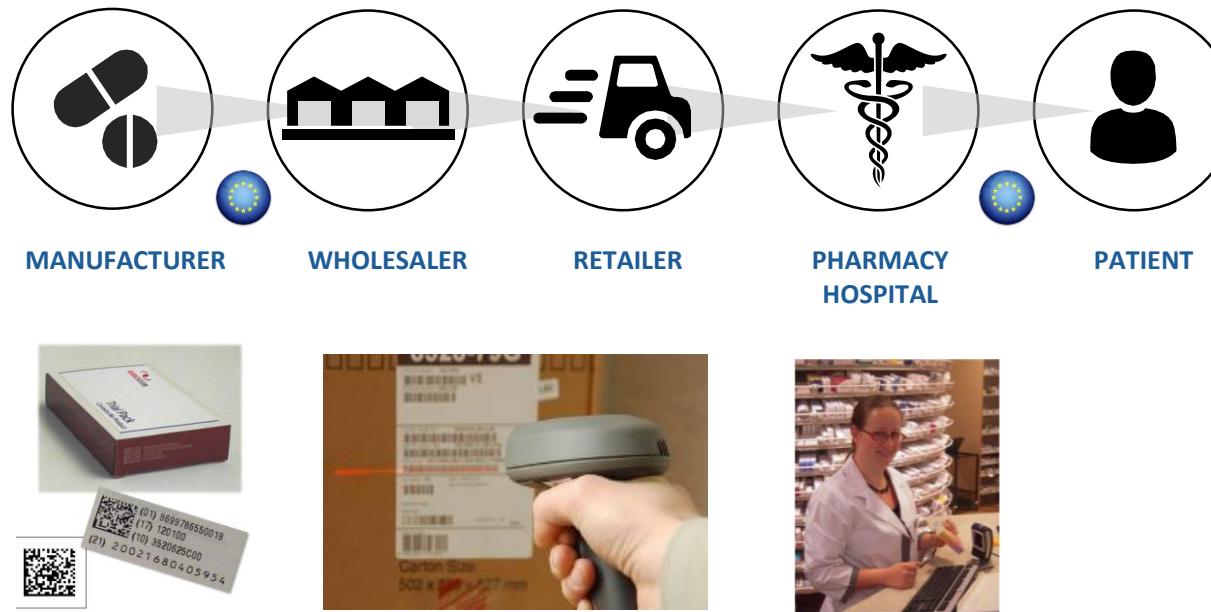
■ INFO@BNOVA.IT

■ 0585 842210

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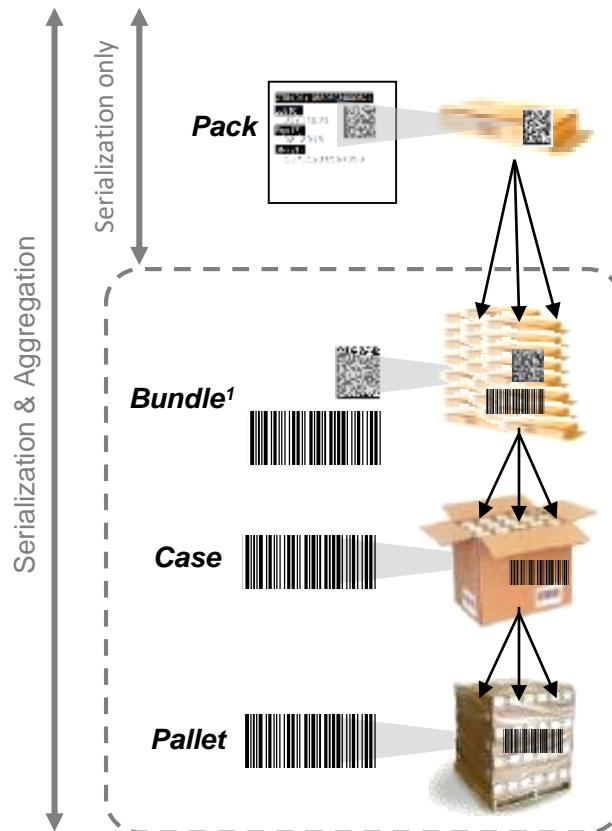


Track & Trace across the supply chain



Serialization is just a part of the **Track & Trace process**, aimed to control the location of an item across time and space within the supply chain.

Track & Trace: “Serialization only” or “Serialization + Aggregation”



“Serialization only” = serialization of secondary packaging (unit of sales)

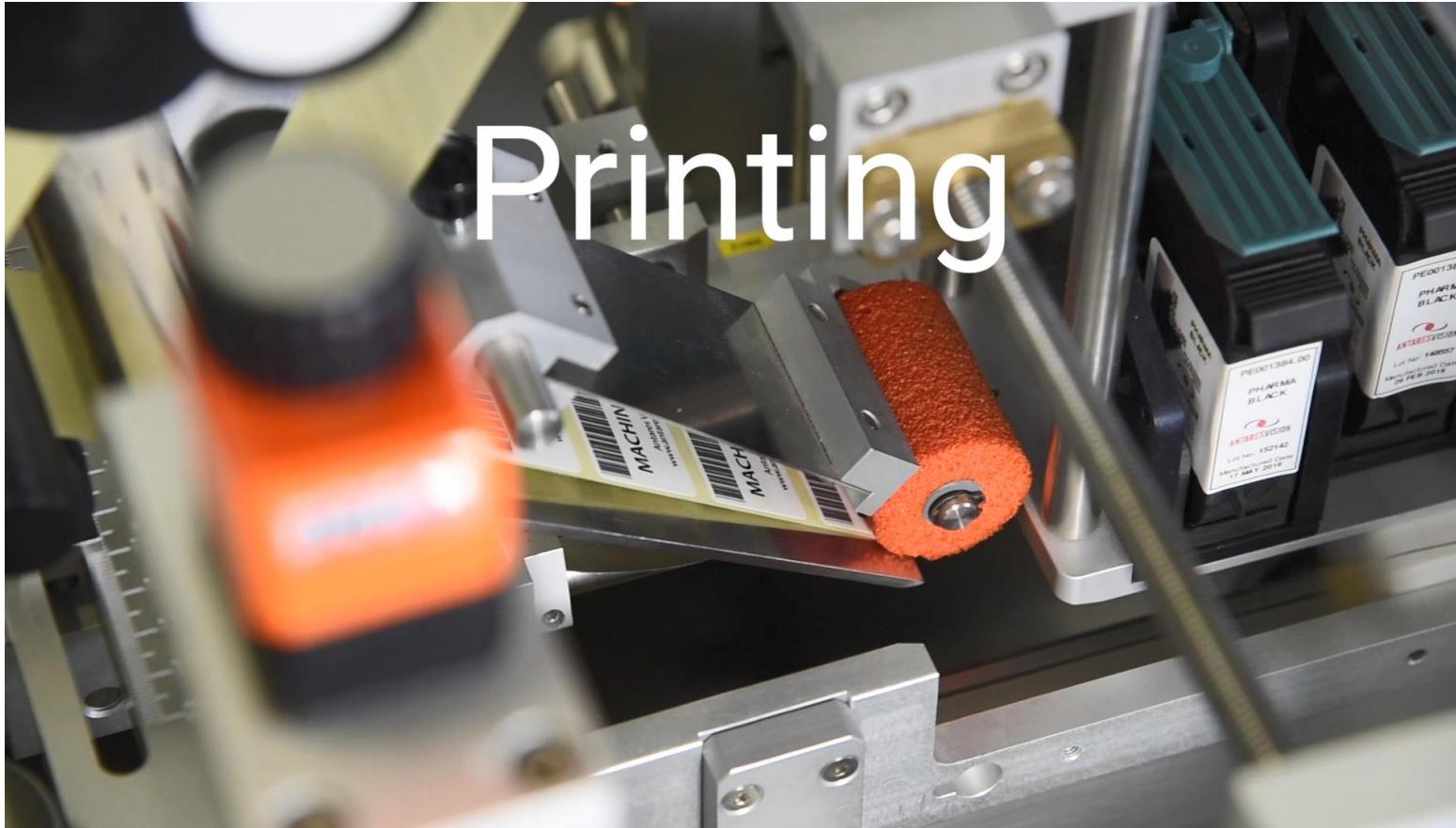
- With a serialized data matrix: product code & serial number (unique identifier)+ batch number + expiry date
- In association when possible with systematic control at point of dispense (patient security)

“Serialization & Aggregation”: Serialization of all logistic units including hierarchy of all serial numbers (between packs, bundles, cases and pallets)

- Allow possibility to record products flow or locate a specific pack in the supply chain (Track & Trace)

¹ Optional and depending on regulation with Data Carrier to use.

Serialization: printing and verifying a serialized code



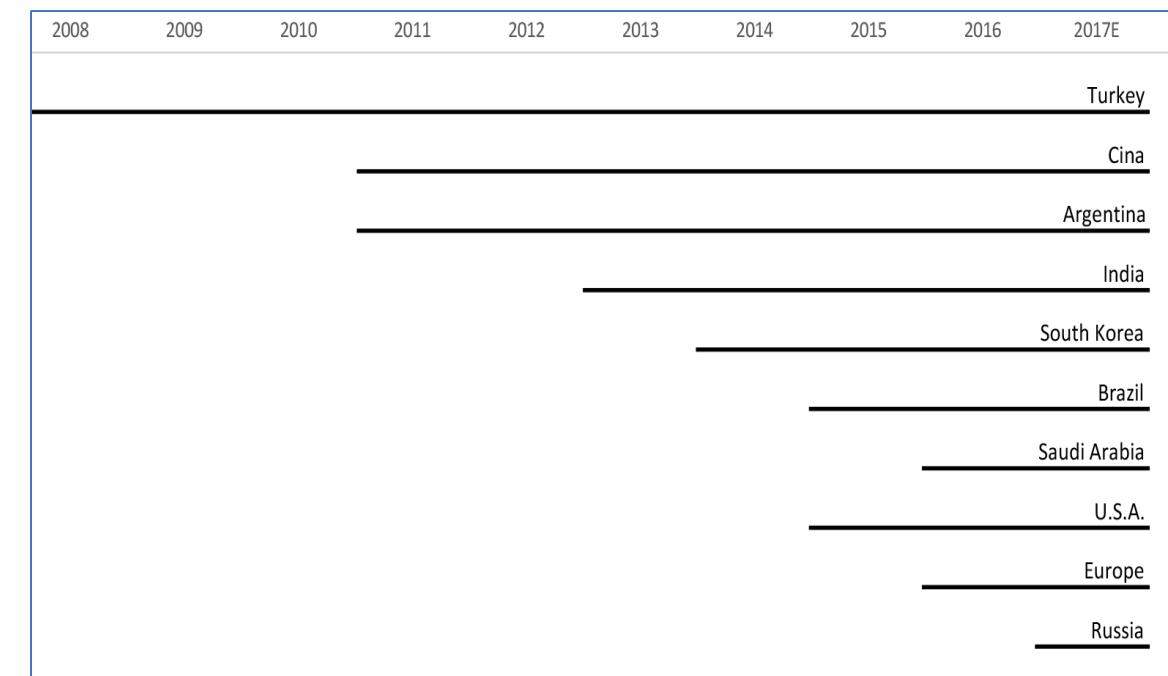
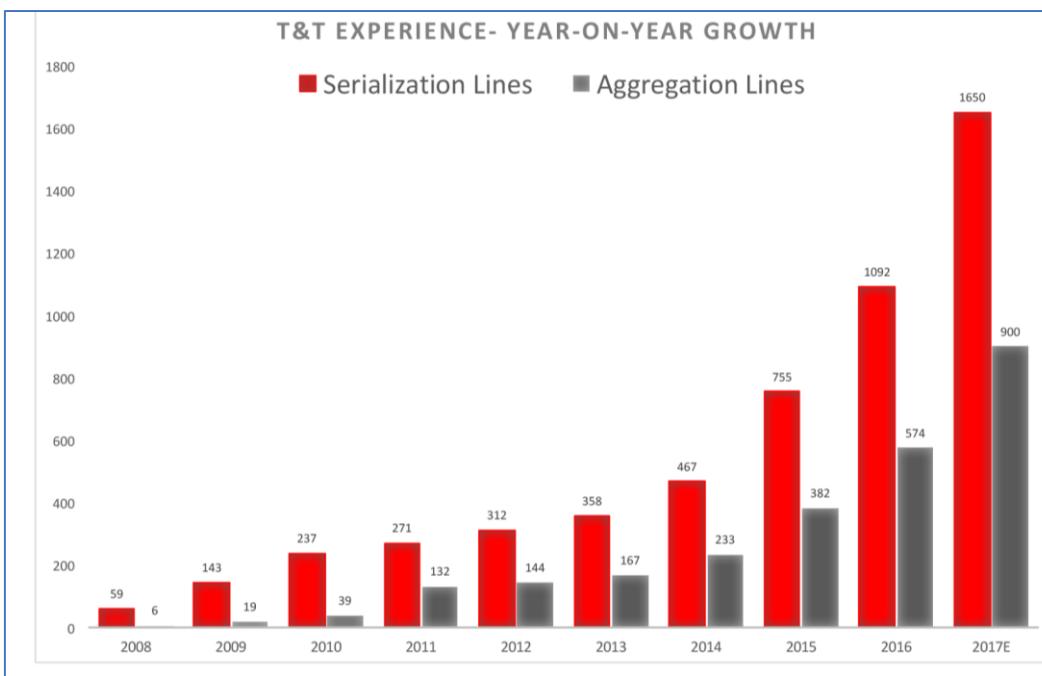
Printing

Automatic aggregation / Video: Antares Vision integration on a IMA BFC CP18 case packer



Growth: T&T Experience year-on-year

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018E
Serialization Lines	59	143	237	271	312	358	467	755	1092	1603	2300
Aggregation Lines	6	19	39	132	144	167	233	382	574	907	1300



The Global Track & Trace challenges



Evolving Standards and Regulations

- **Challenge:** Regulations and standards are continuously evolving and will continue to evolve for the foreseeable future.



Big Data

- **Challenge:** Billions of serials to be kept with thousands transactions each month



Global Supply Network Integration

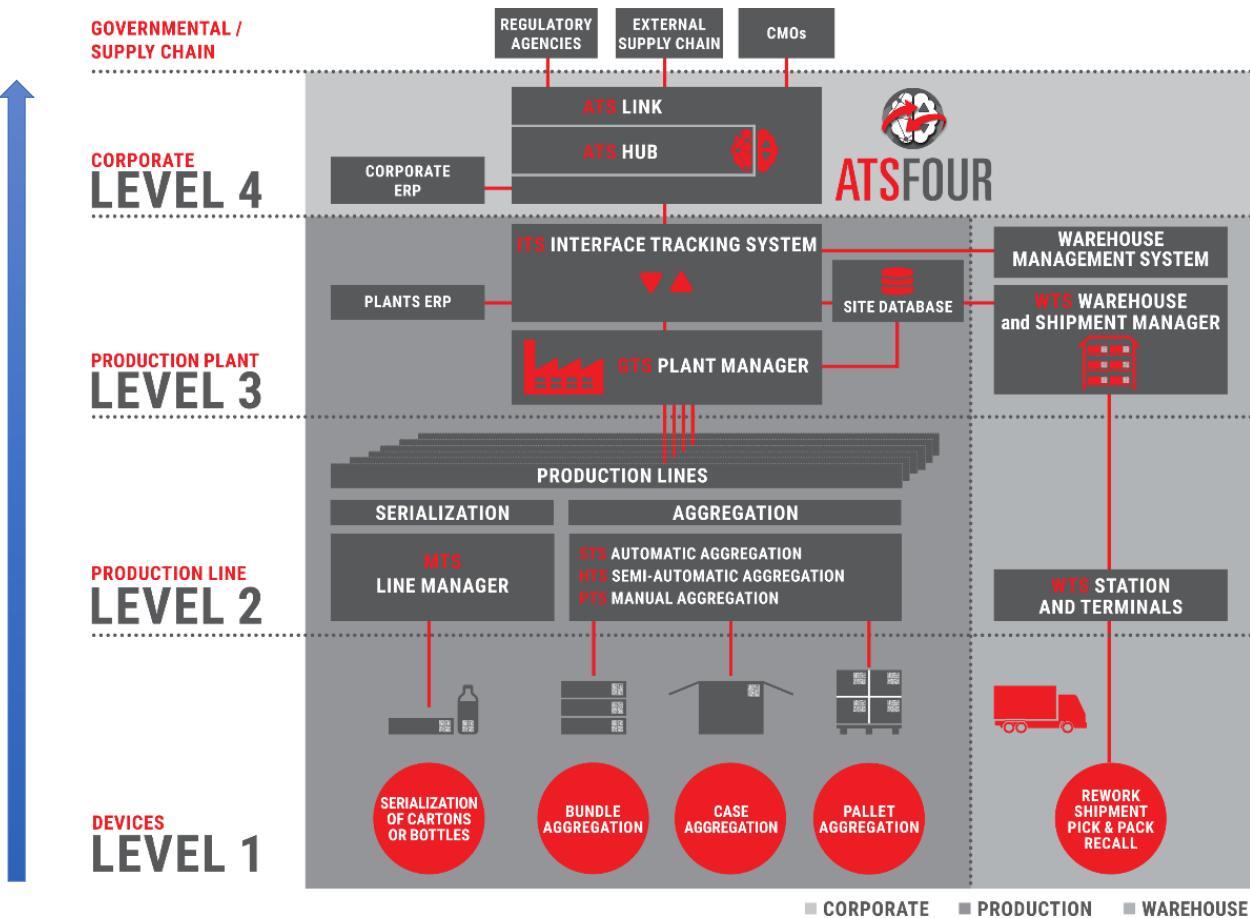
- **Challenge:** Integration of 100s of supply chain partners for track & trace messaging and compliance

From L1 to L4: the most flexible and scalable solution

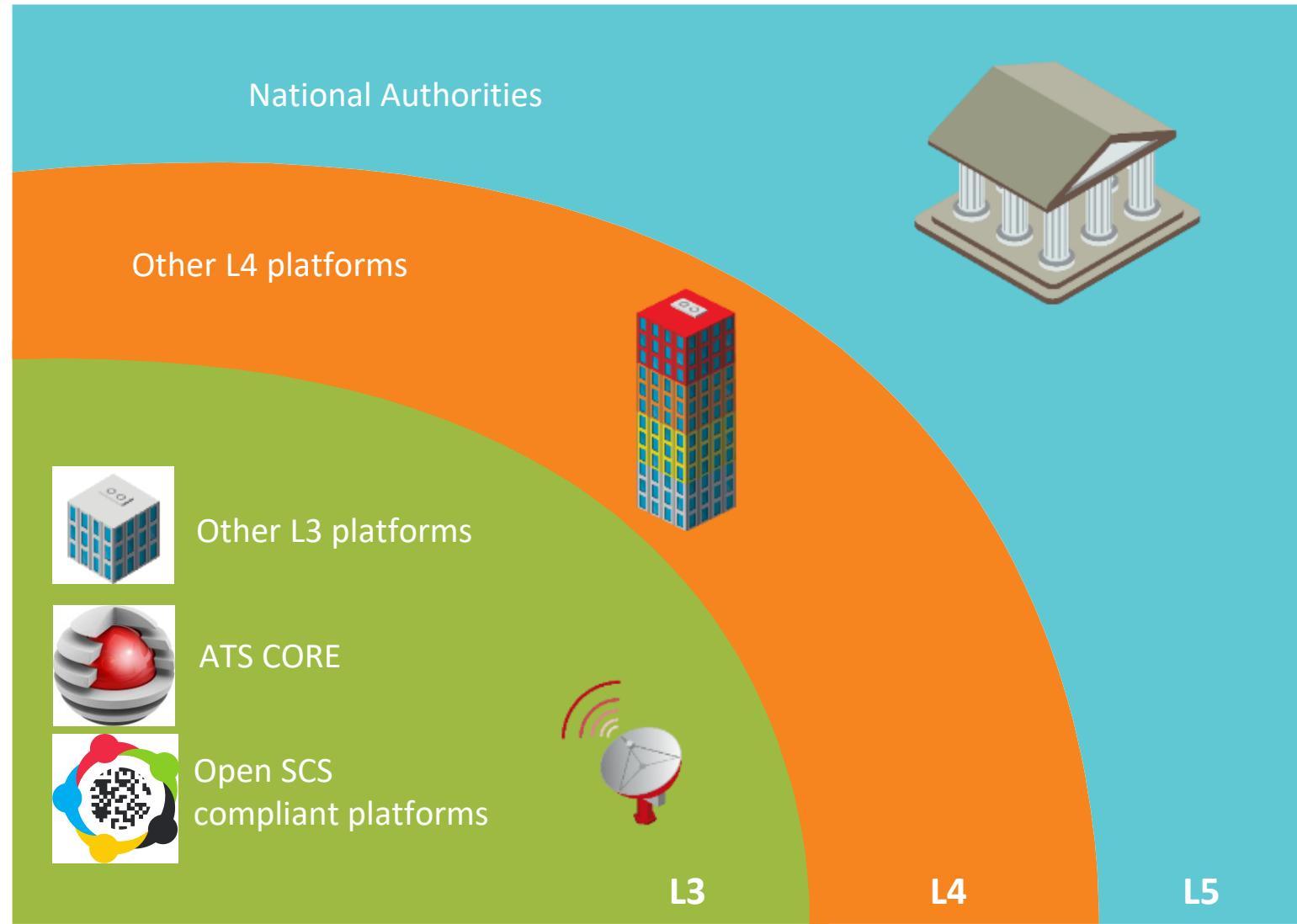
- Authorities notifications
- Supply chain communication
- CMOs



- Serial generation (site)
- Data Repository (site)
- Recipes management/storage
- Line data dispatching
- Production planning



TOTAL CONNECTION for all the software platforms



From Relation to Graph: a quantum leap in Databases

ItemNumbers	
	GTIN
	Type
	AII_URL
	Partition
	Threshold

8	
Item	
	GTIN
	Serial
	Status
	ParentGTIN
	ParentSerial
	WorkOrderID
	Sequence
	FirstPackingTime

All cartons in a Case:

```
SELECT * FROM item  
WHERE ParentGTIN=G1 AND ParentSerial=S1
```

All Cartons in all Cases of a pallet:

```
SELECT Count (*)  
FROM item  
WHERE ParentSerial IN (SELECT Serial FROM item  
WHERE ParentGTIN=G2 AND ParentSerial=S2)  
AND ParentGTIN IN (SELECT GTIN FROM item  
WHERE ParentGTIN=G2 AND ParentSerial=S2)
```

Hierarchical Queries (SQL) – getting real

Get Descendants for any number of levels (CTE)

```

CREATE FUNCTION [dbo].[Descendants] (
    @ContainerNtinId int,
    @ContainerSerial varchar(50))

RETURNS @Descendants TABLE (
    [NtinId] [int] NOT NULL,
    [Serial] [varchar](50) NOT NULL,
    [Status] [smallint] NOT NULL,
    [ParentNtinId] [int] NULL,
    [ParentSerial] [varchar](50) NULL,
    [WorkOrderID] [varchar](30) NOT NULL,
    [Sequence] [int] NOT NULL,
    [Type] [smallint] NOT NULL,
    [QAStatus] [char](1) NOT NULL,
    [NotificationStatus] [smallint] NOT NULL,
    [PartitionId] [smallint] NULL,
    [Flags] [varchar](8) NOT NULL,
    [HelperCode] [varchar](50) NULL
)

as
BEGIN
    DECLARE @minlevel int
    SET @minlevel = dbo.LowestLevelId();

```

With hierarchy

```

as (
    SELECT NtinId, Serial, parentNtinId, parentSerial, PartitionId
    FROM item (NOLOCK)
    WHERE NtinId = @ContainerNtinId
    AND serial = @ContainerSerial
    UNION ALL
        SELECT i1.NtinId, i1.Serial, i1.parentNtinId , i1.parentSerial, i1.PartitionId
        FROM item I1 (NOLOCK)
        JOIN hierarchy H1
        ON (i1.parentNtinId=h1.NtinId AND i1.parentSerial=h1.Serial AND i1.Type
            > @minlevel AND i1.PartitionId=h1.PartitionId)
    )
    INSERT @Descendants
    SELECT i.*
    FROM Item I (NOLOCK)
    JOIN hierarchy h
    ON (i.parentNtinId=h.NtinId AND i.parentSerial=h.Serial AND
    i.PartitionId=h.PartitionId)
    OPTION(RECOMPILE)

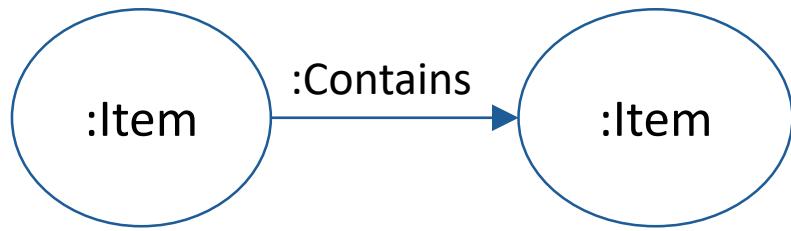
RETURN
END

```

Hierarchical Queries (Cypher)

All cartons in a Case:

```
MATCH (p:Item {Id:"G1S1"}) - [:Contains] -> (c:Item)  
Return c
```



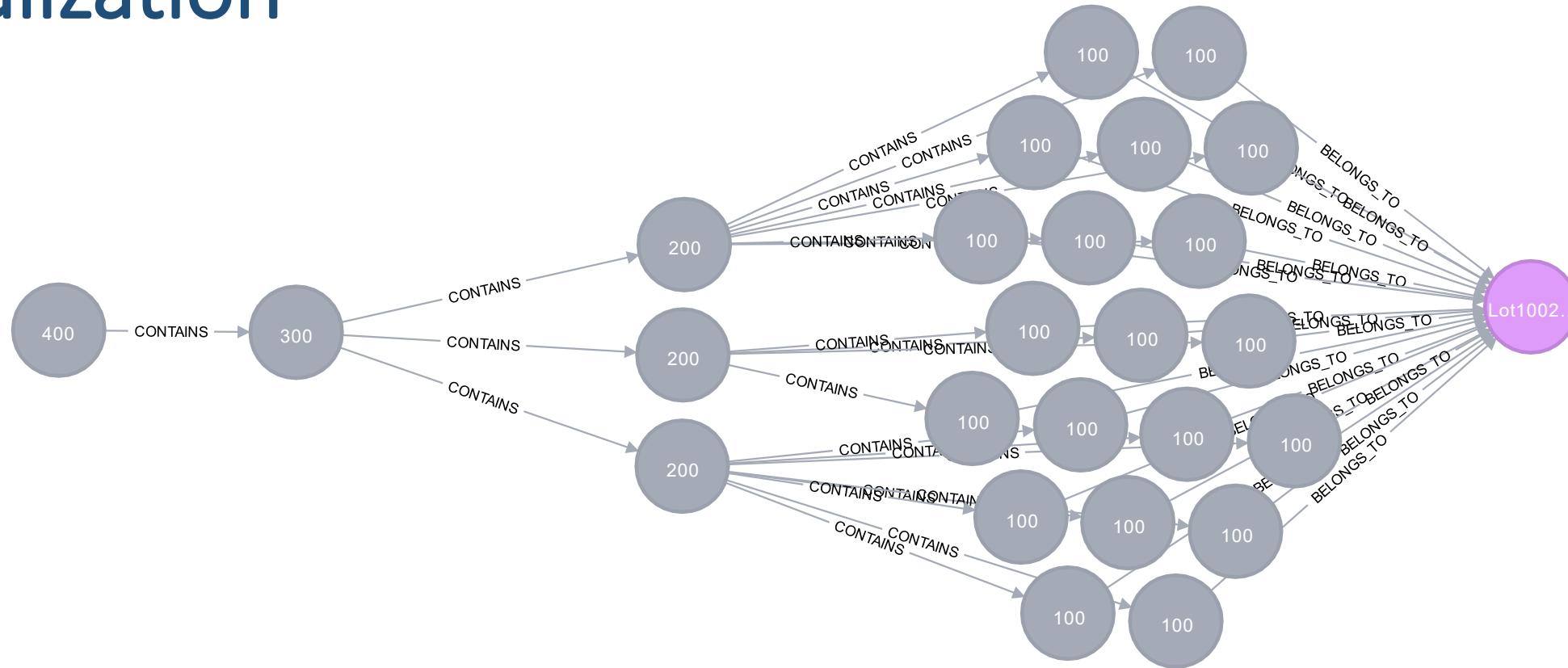
All Cartons in all Cases of a pallet:

```
MATCH (p:Item {Id:"G1S1"}) - [:Contains*] -> (c:Item)  
Return c
```



The * matches all the levels

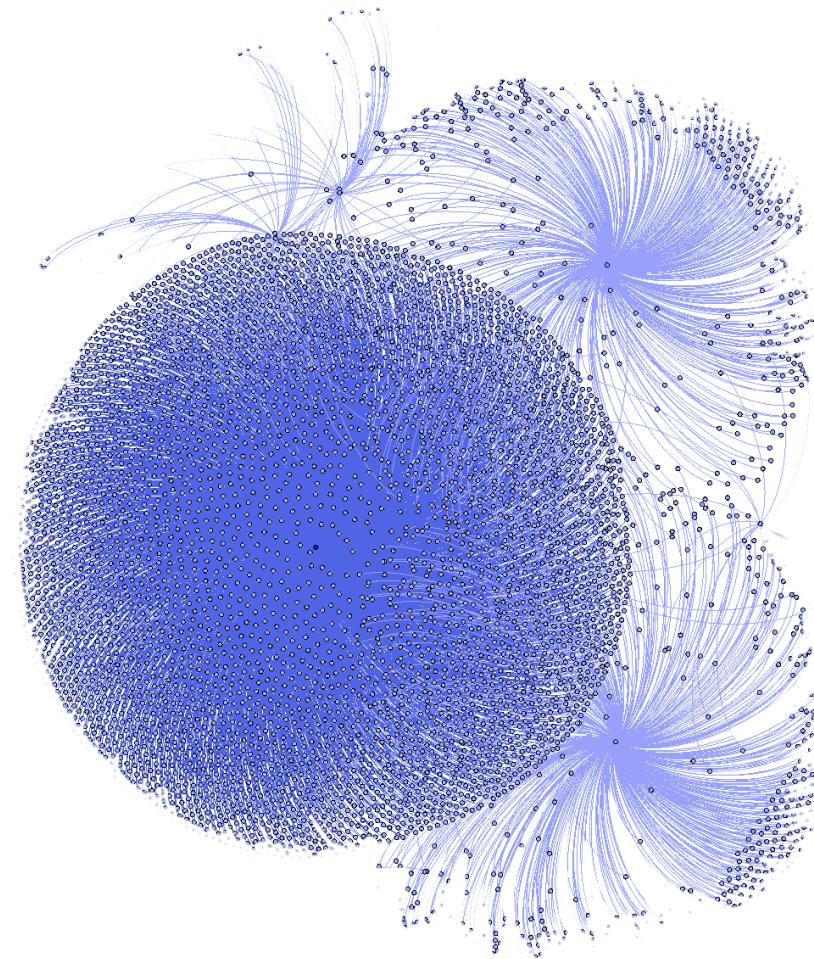
Perfectly fits the parent-child relationships in serialization



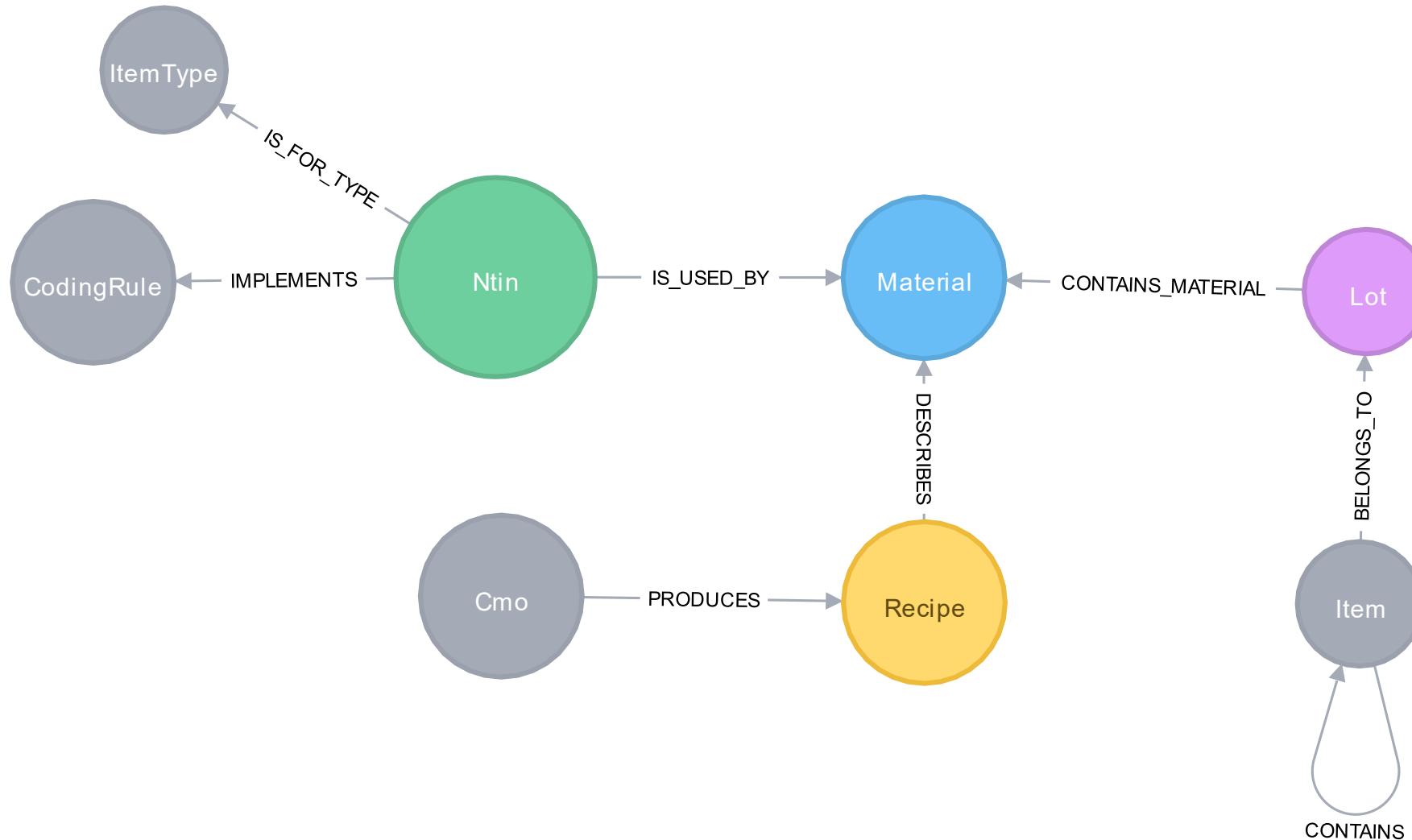
Pallet contains a case containing 3 bundles containing items....all bound to a single lot

Real extraction

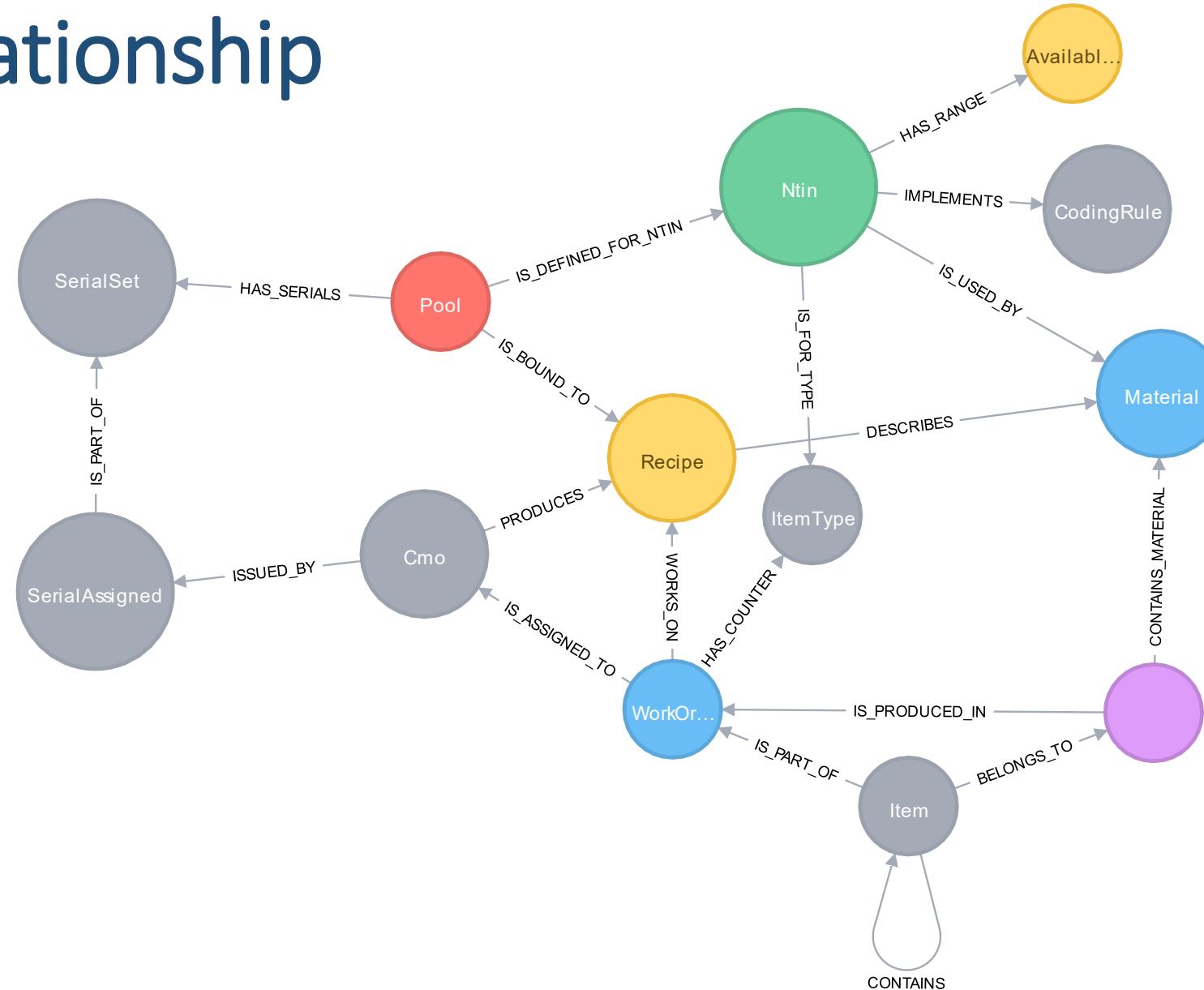
Extraction of packages
from three different Lots



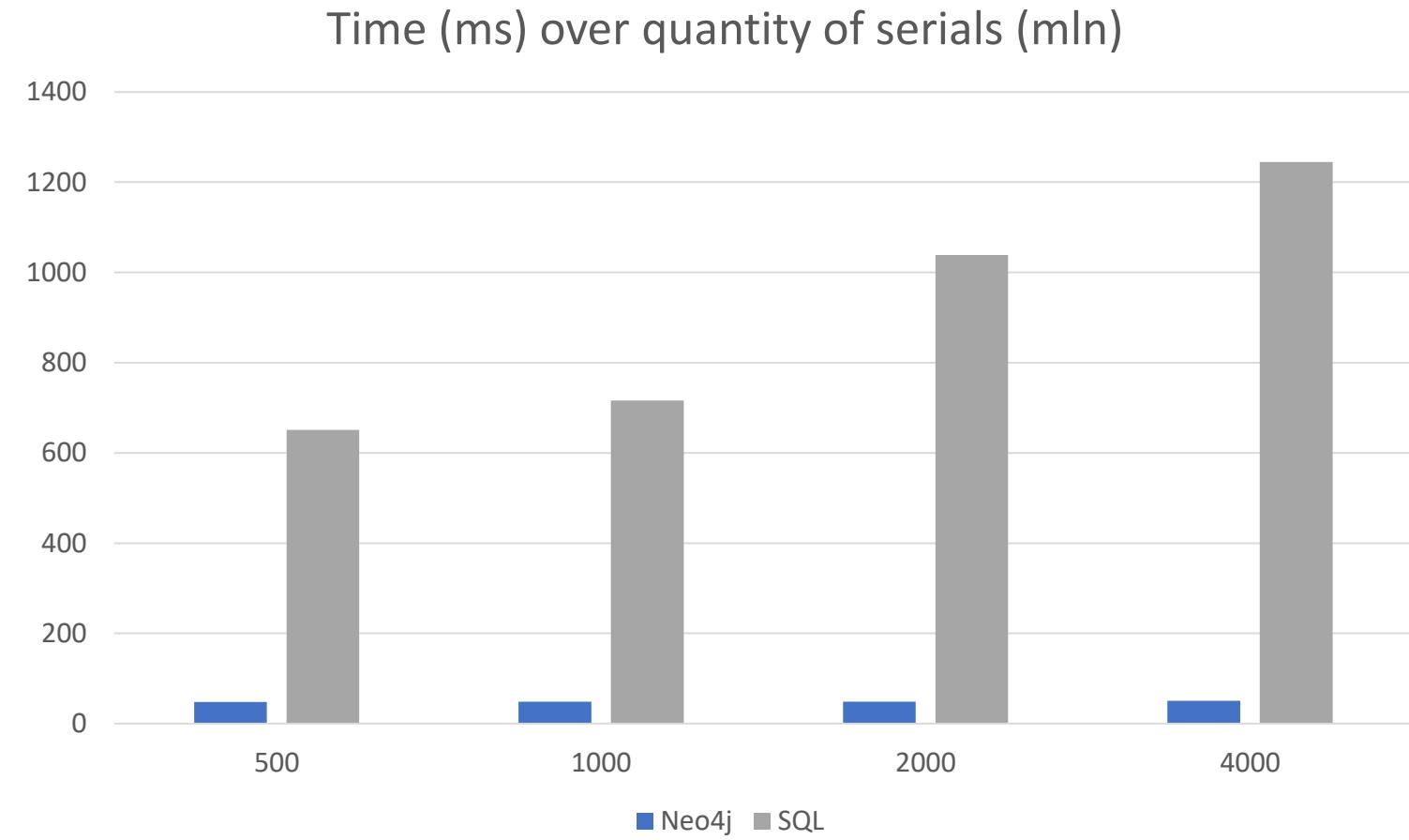
NTIN-Recipe- Material relationships



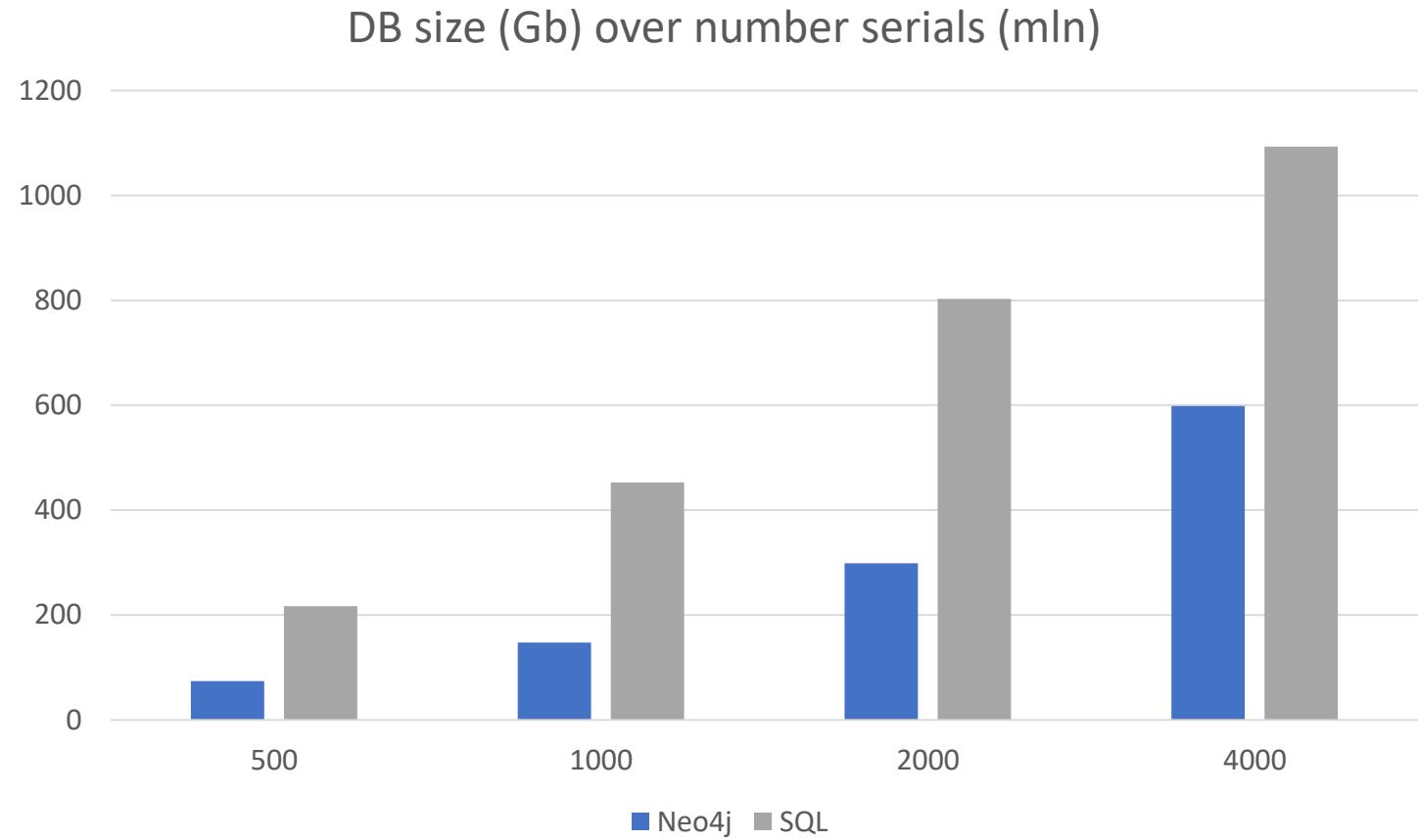
CMOs relationship



X times faster: ie. get Content of a Pallet (4000 items)

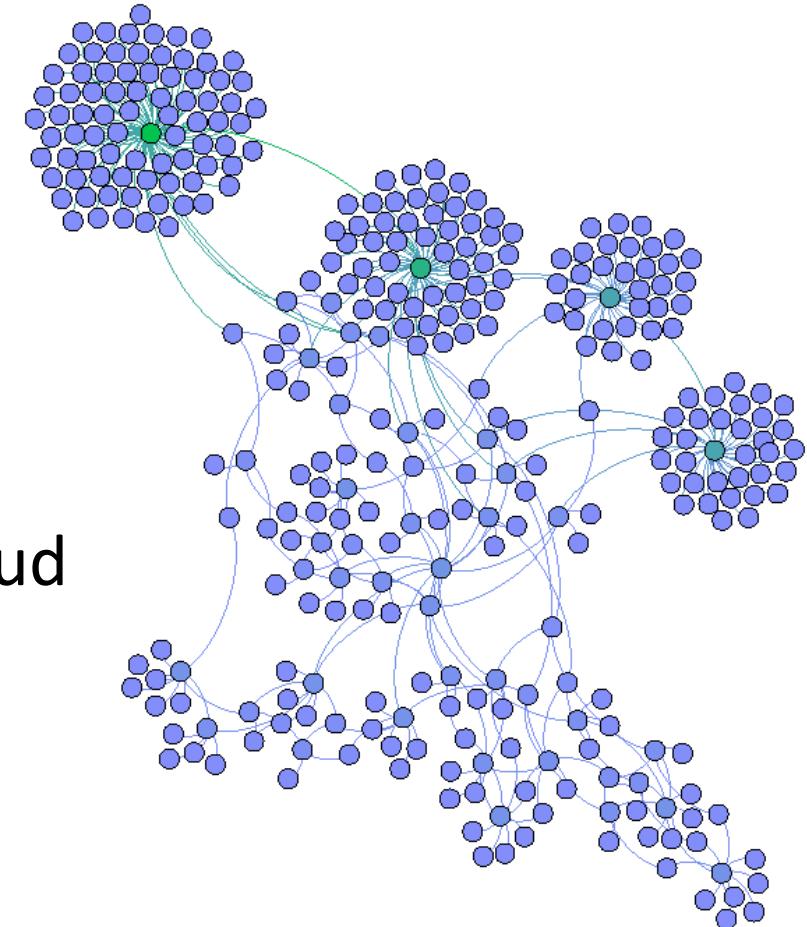


Storage Occupation



Overall of our Experience with Neo4J

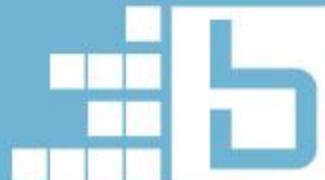
- **Capable:** Tested with 10 Billions of items
- **Performing:** Less than 1 second query time
- **Versatile:** Runs either on premises or in the cloud



GRAZIE PER L'ATTENZIONE

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