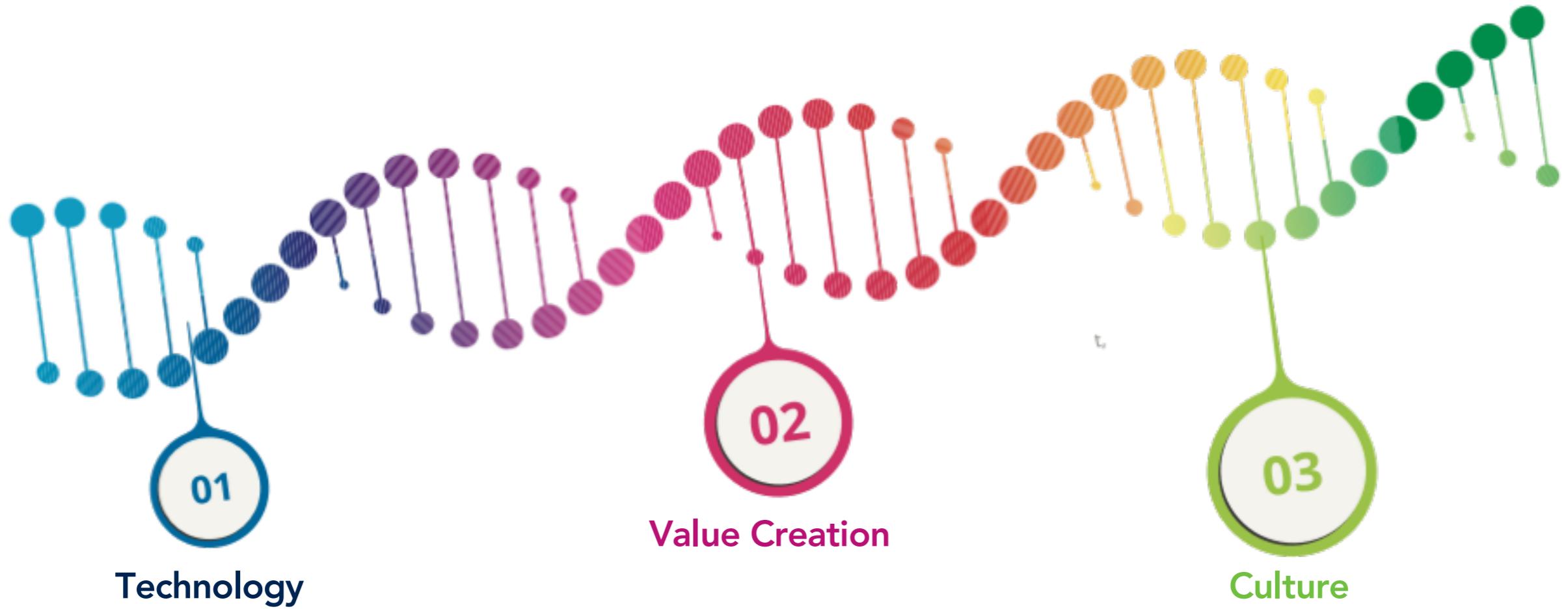


DNA of Blockchain



It's a Matter of Trust.



Ok...Start with Trust. Anything Else?!

Public vs. Private (is this just a shared ledger?)

Network Nodes

Tokens

Protocols

Consensus (mining complexity)

Scaling

Smart Contracts

Key Management

On-Chain vs. Off-Chain

Partial Ownership, ...

But #becraeful!

- *Garbage in, tamper-proof garbage forever*
- *Mapping real-world to digital*
- *Identifying things & people*
- *Scaling governance*
- *Legacy (i.e. all) data*



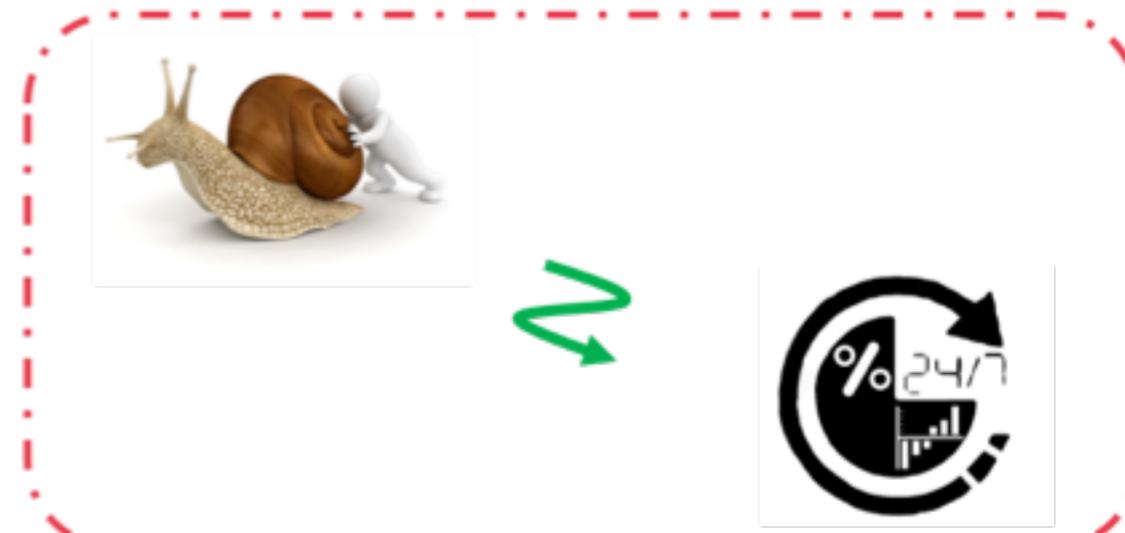
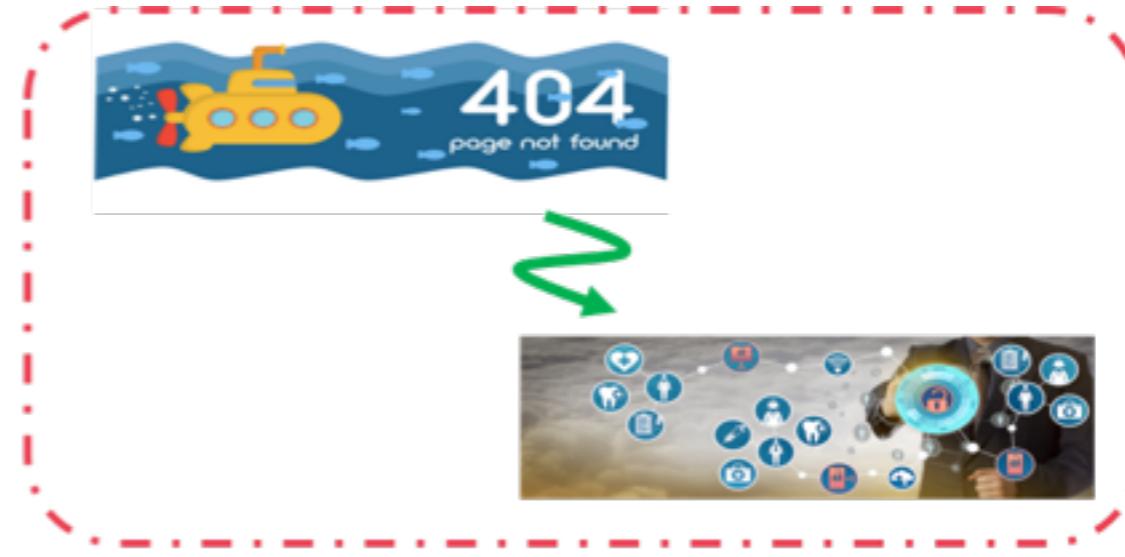
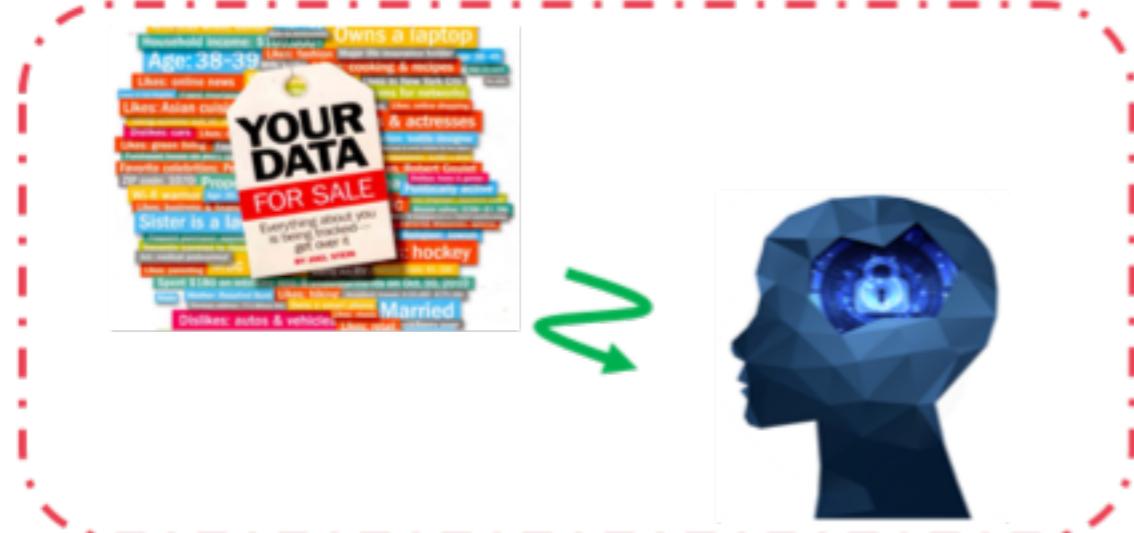
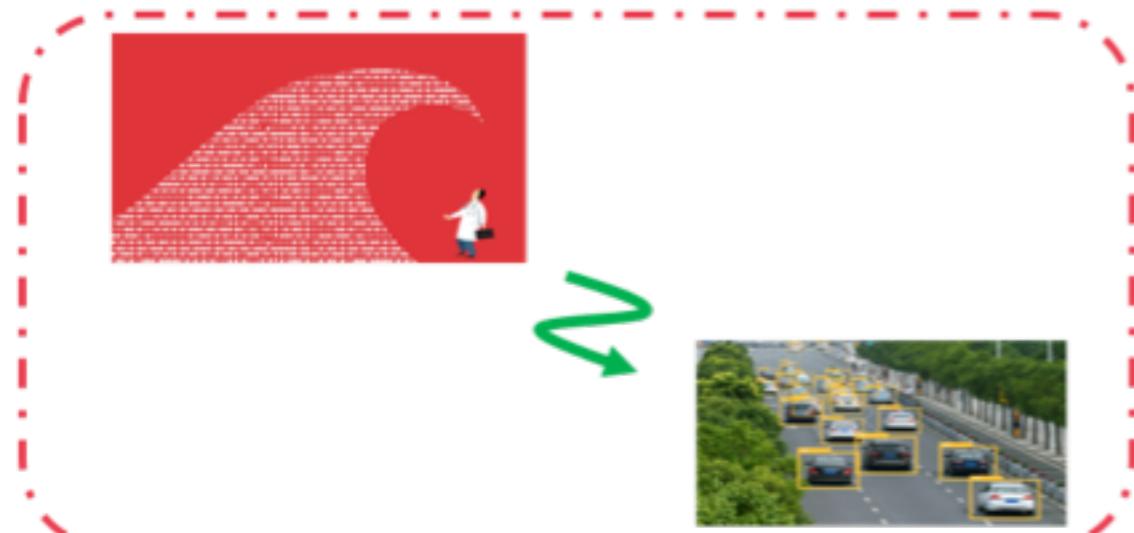
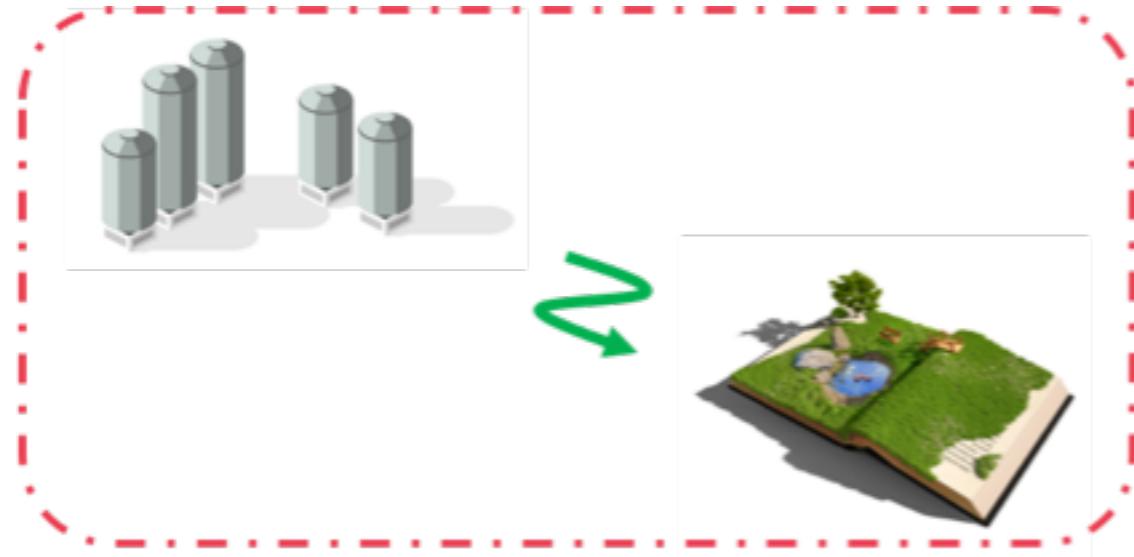
Use Cases for Public Causes

*Aid Supply Management
Emergency response
Public Health Data Surveillance
Dangerous Substance Tracking
Death Certificate Exchange
Opioid Tracking
Population Health Management
Counterfeit Drug Tracking
Public Health Communication
Inventory Tracking
Inter-agency data exchange*

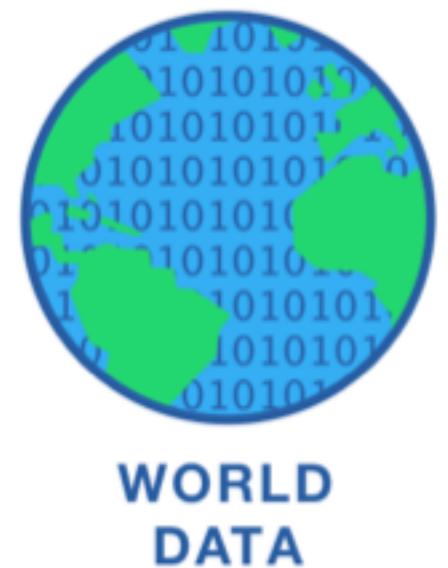
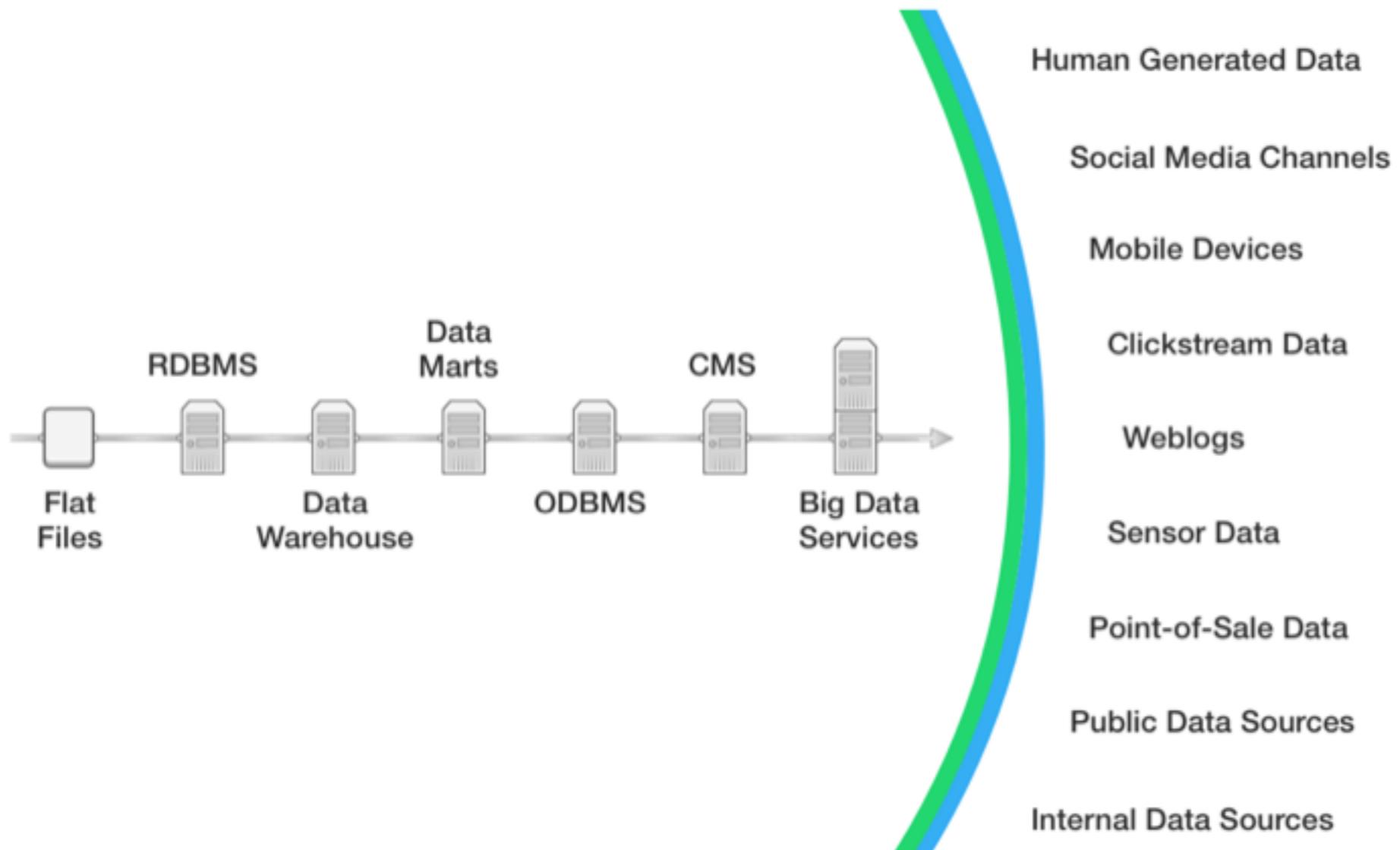


...

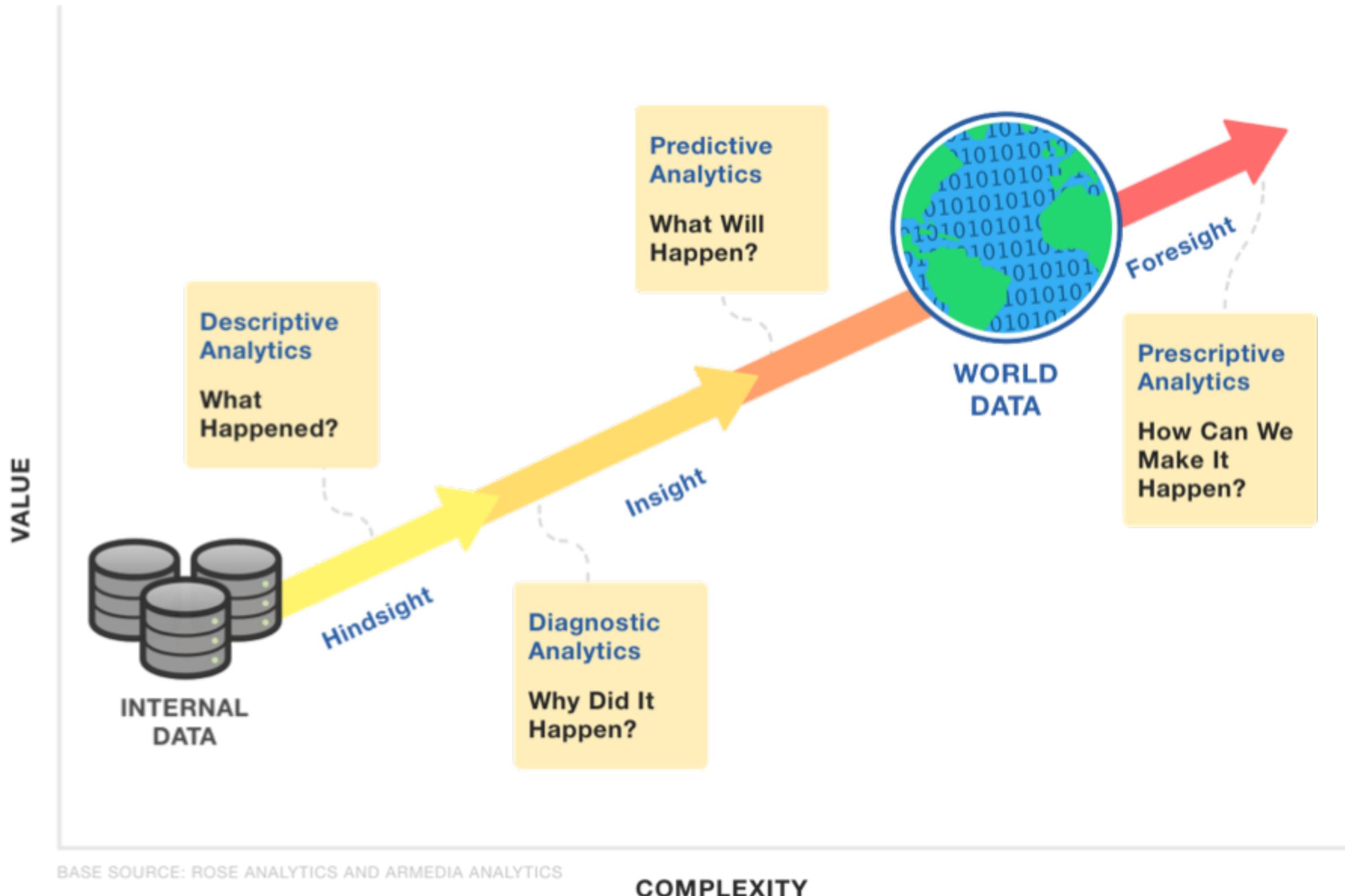
Where is the Data?



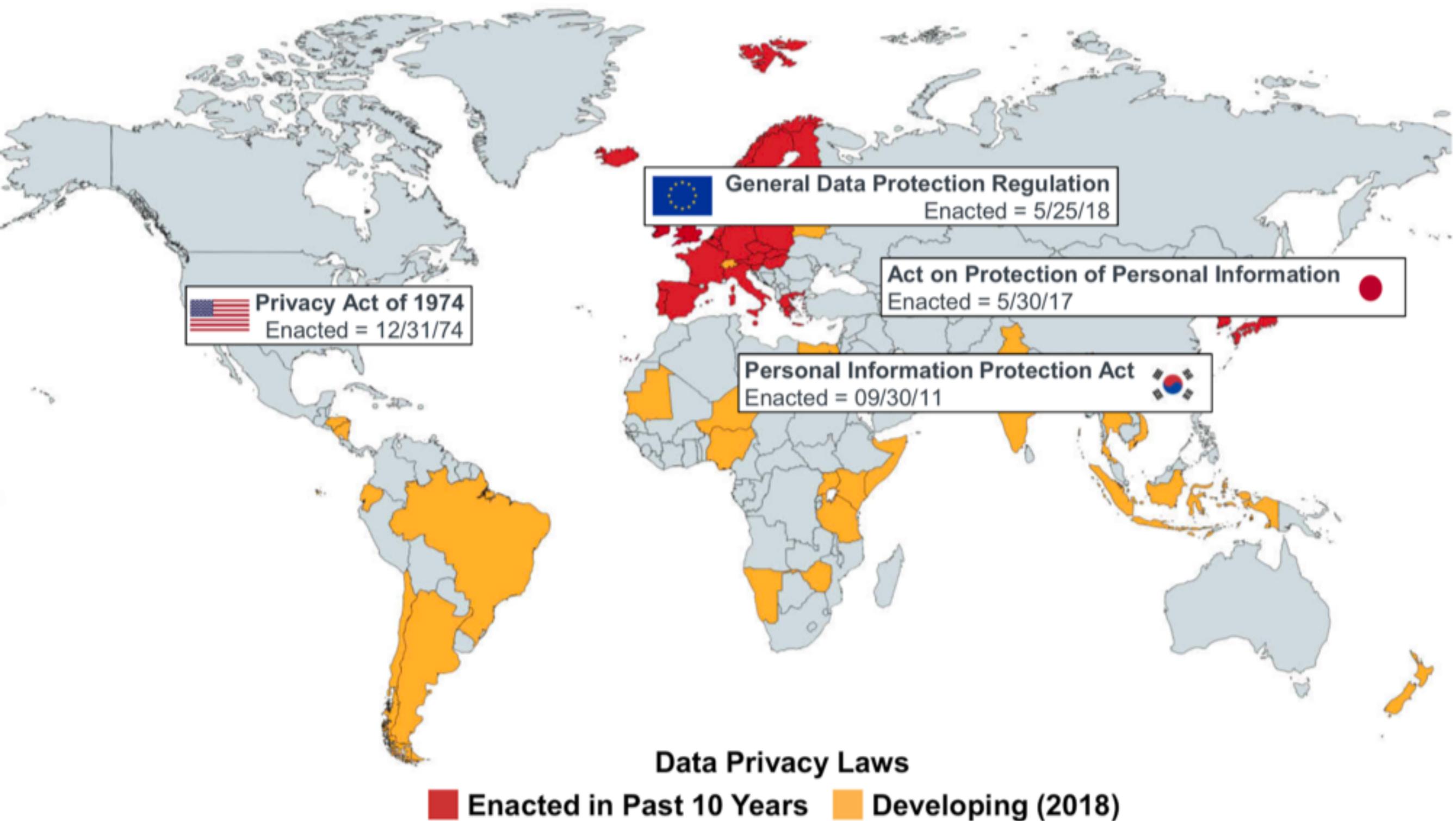
Getting to World Data

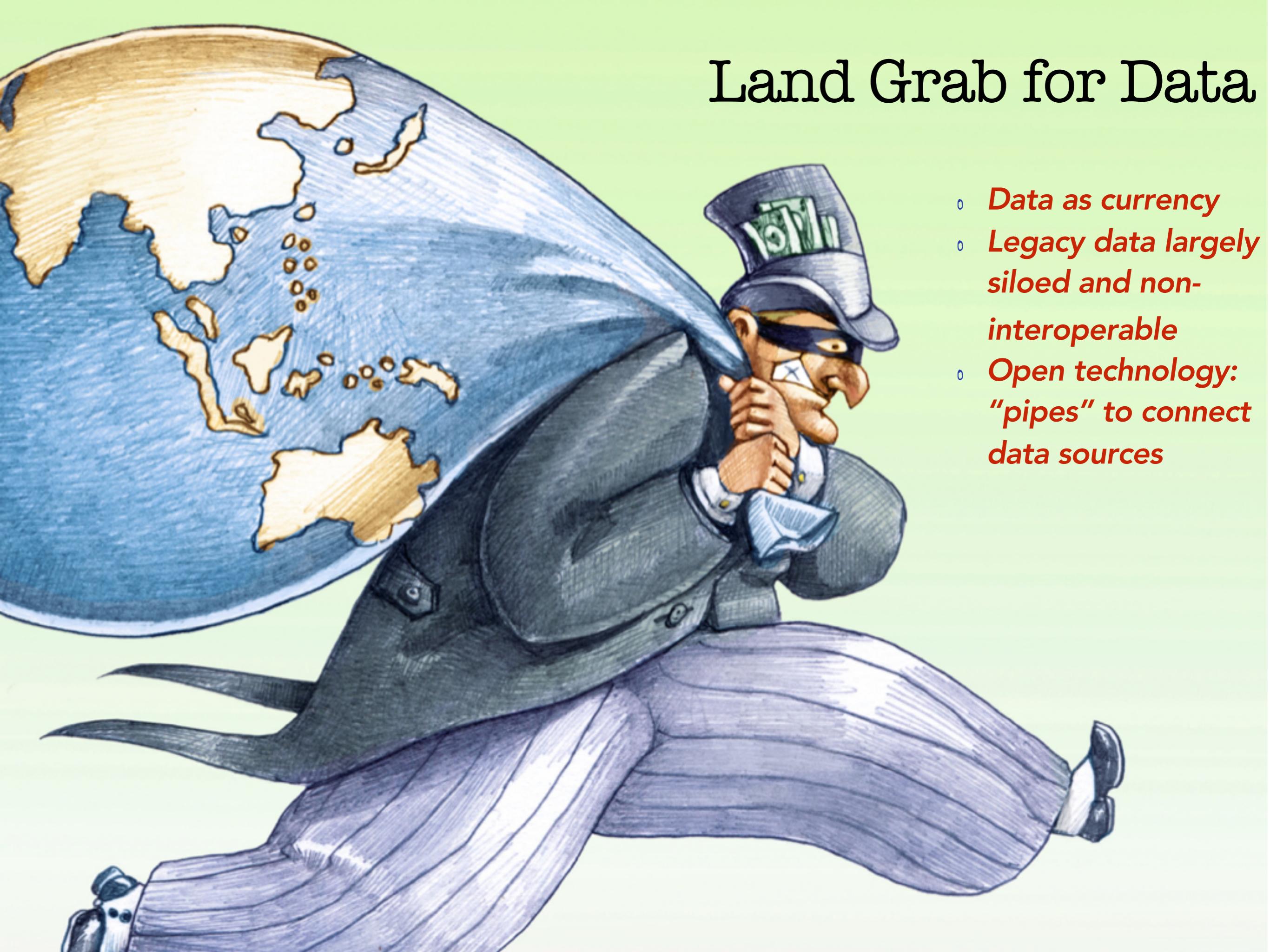


Data Insight Continuum



Asia | EU | Americas - Rising Regulatory Focus on Data Collection and Sharing





Land Grab for Data

- **Data as currency**
- **Legacy data largely siloed and non-interoperable**
- **Open technology: “pipes” to connect data sources**

It's bigger than Blockchain!



<http://bit.ly/SWThemePark>

Theme Park Layers



De-siloing Data: Before >> After

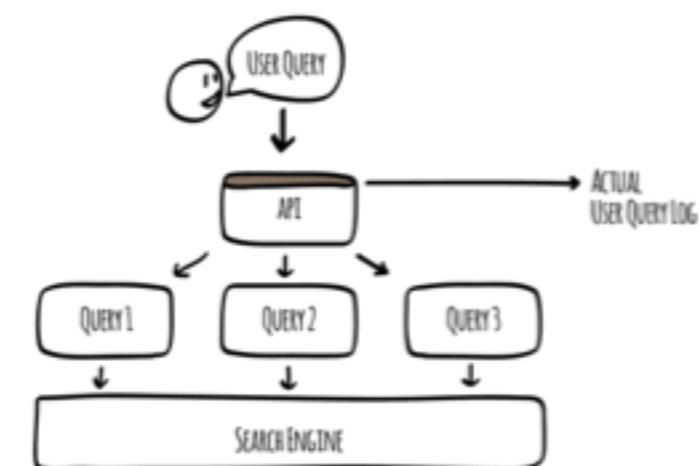
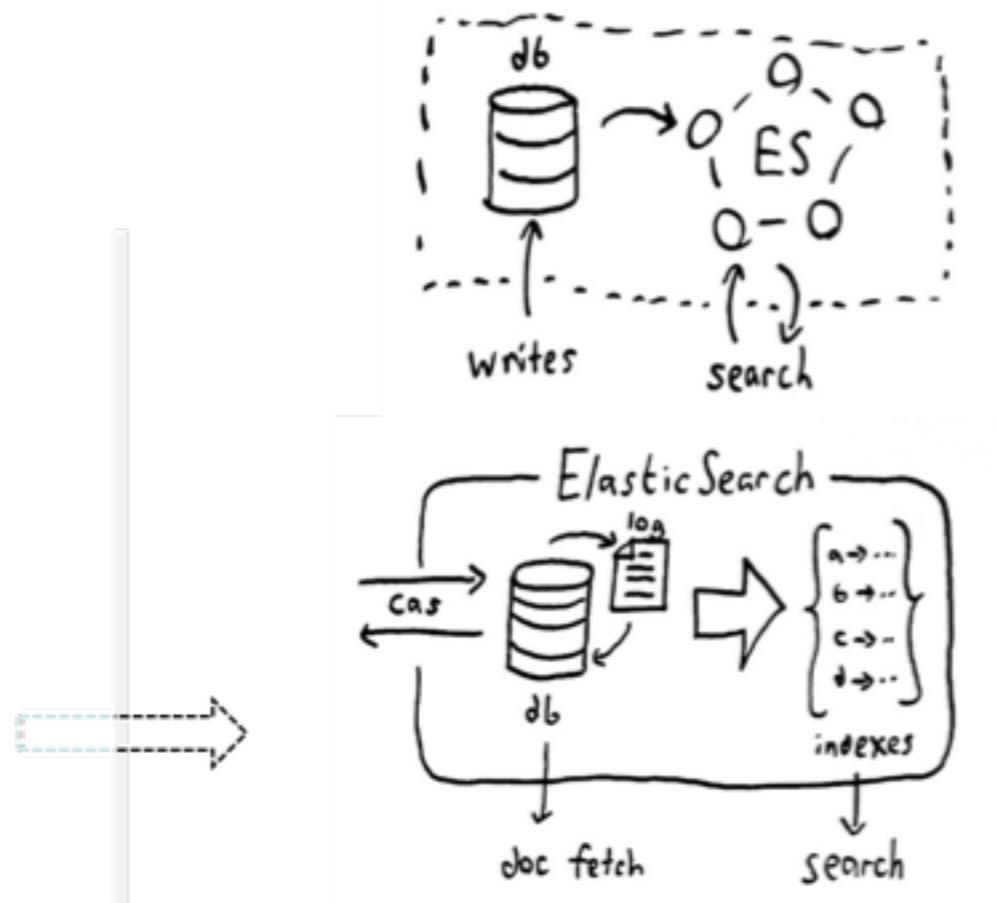


```
USE [AdventureWorks]
SET STATISTICS IO ON
SELECT
    v.[VendorID]
    ,v.[Name]
    ,coalesce(c.[Title], '') + ' ' + c.[FirstName] + coalesce(' ' + c.p
[MiddleName], '') + ' ' + c.[LastName] + coalesce(' ' + c.[Suffix], ' '
 '')
FROM [Purchasing].[Vendor] v
INNER JOIN [Purchasing].[VendorContact] vc
ON vc.[VendorID] = v.[VendorID]
INNER JOIN [Person].[Contact] c
ON c.[ContactID] = vc.[ContactID]
SET STATISTICS IO OFF
```

Results

```
166 rows(s) affected
Table 'Contact'. Scan count 0, logical reads 330, physical reads 0, read-ahead reads 0
Table 'VendorContact'. Scan count 104, logical reads 208, physical reads 0, read-ahead reads 0
Table 'Vendor'. Scan count 1, logical reads 4, physical reads 0, read-ahead reads 0
```

{Schemas, Views, SQL Queries}



{Data Types, Indexes, APIs}

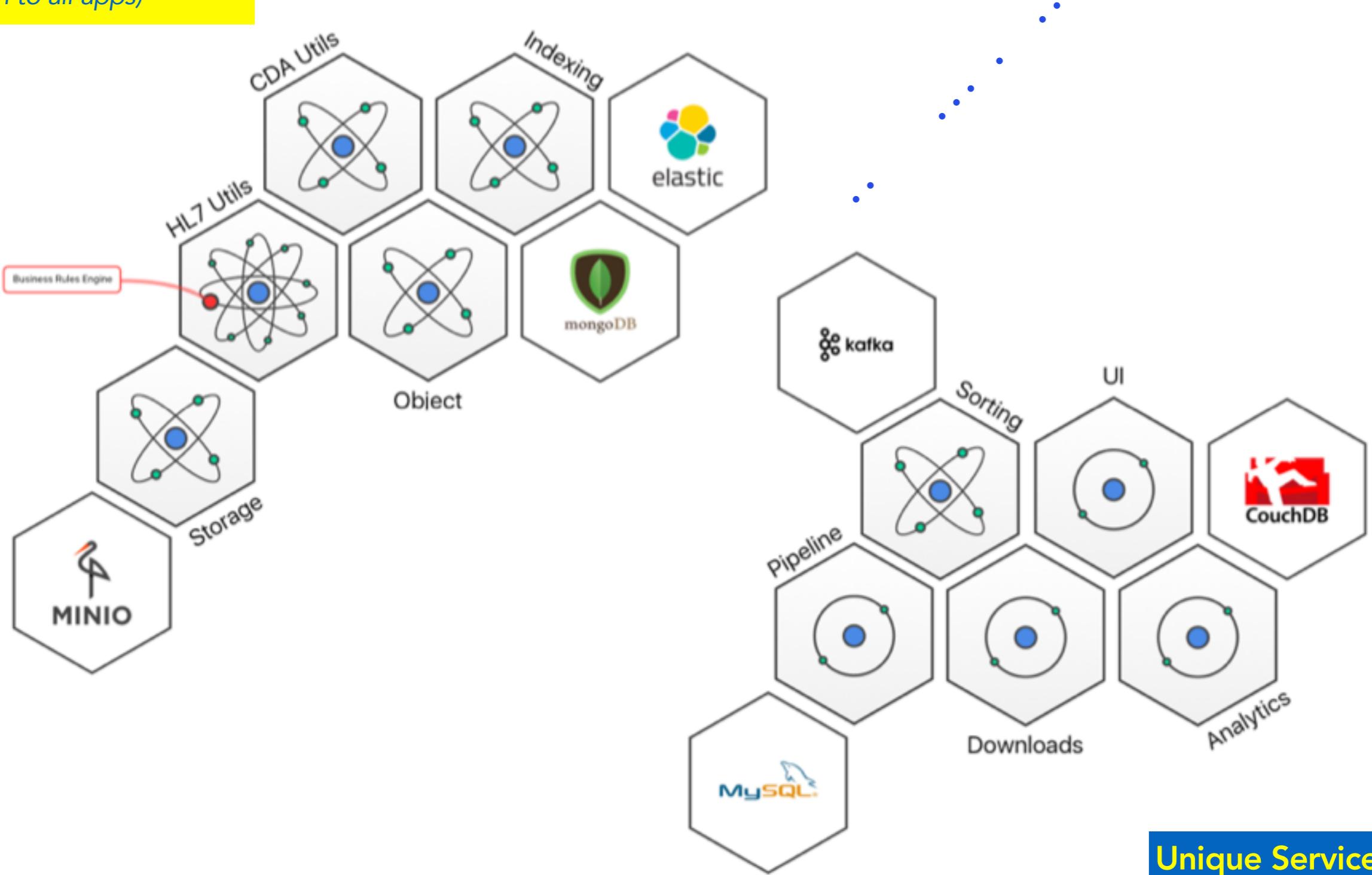
Software Functions as Open APIs



Microservices (atomic to multifunctional)

Building Software with Open APIs

Foundational Services
(common to all apps)



Unique Services
(specific to this one app)

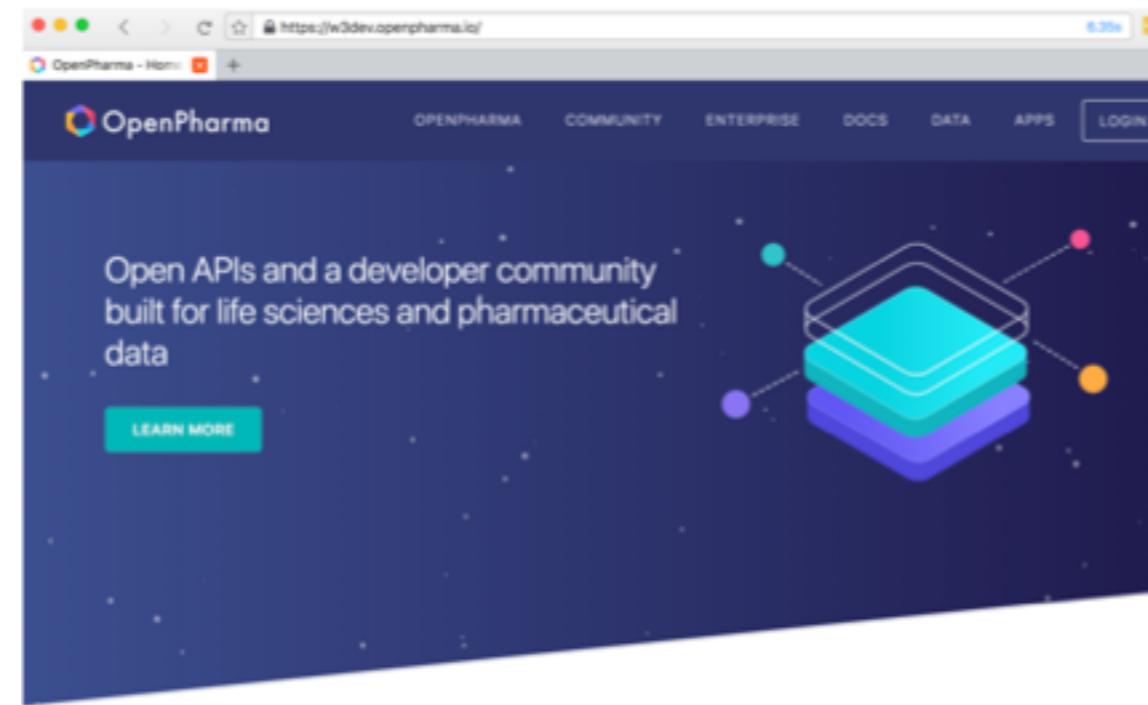
The World is Developing Open

Contributors to Open Software on Github

Rank	Company	Employees Contributing
1	Microsoft	4,550
2	Google	2,267
3	Red Hat	2,027
4	IBM	1,813
5	Intel	1,314
6	Amazon.com	881
7	SAP	747
8	ThoughtWorks	739
9	Alibaba	694
10	GitHub	676
11	Facebook	619
12	Tencent	605
13	Pivotal	591
14	EPAM Systems	585
15	Baidu	584
16	Mozilla	469
17	Oracle	455
18	Unity Technologies	414
19	Uber	388
20	Yandex	351
21	Shopify	345
22	LinkedIn	343
23	Suse	325
24	ESRI	324
25	Apple	292

Relevant Open Technologies...

[Early Preview: w3dev.OpenPharma.io](https://w3dev.openpharma.io/)

A comparison of three open technology platforms displayed side-by-side in a browser window. The top row shows the openPharma homepage (https://w3dev.openpharma.io/), the middle row shows the CDC Open Technology homepage (http://ms-caserver-dev01.biotech.cdc.gov/xlr/open.cdc.gov/), and the bottom row shows the openFDA API Endpoints statistics page (https://openfda-api-endpoints.cdc.gov/statistics).

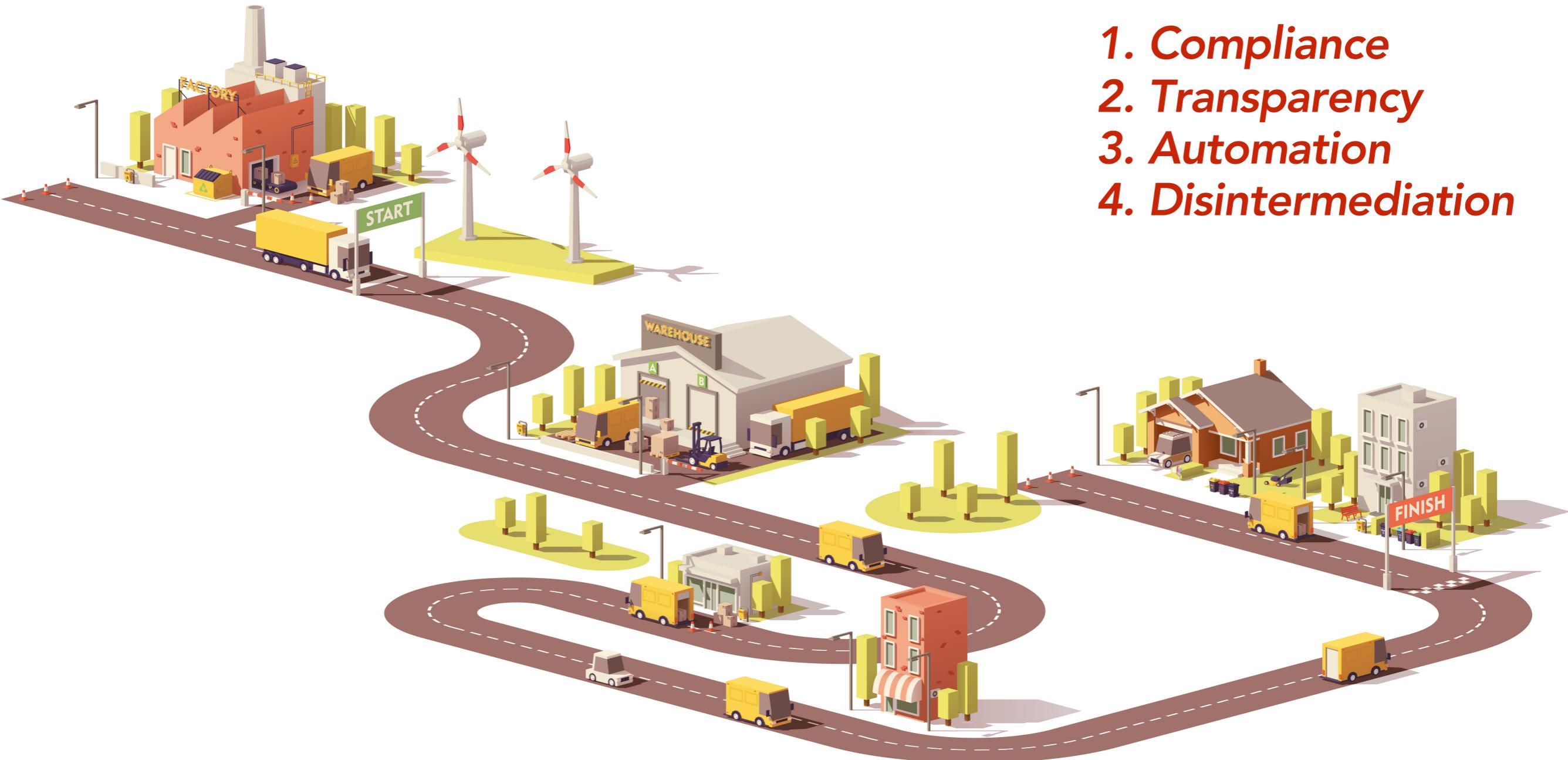
openPharma (Top Row):
The homepage features a dark blue background with a central graphic of stacked 3D bars and connecting nodes. Text on the left reads "Open APIs and a developer community built for life sciences and pharmaceutical data".

CDC Open Technology (Middle Row):
The homepage features a dark blue background with a central graphic of stacked 3D bars and connecting nodes. Text on the left reads "Explore open-source data, code and APIs and join a developer community with CDC Open Technology".

openFDA API Endpoints (Bottom Row):
The page title is "Statistics". It includes a note: "Do not rely on openFDA to make decisions regarding medical care. Always speak to your health provider about the risks and benefits of FDA-regulated products. We may limit or otherwise restrict your access to the API in line with our Terms of Service." Below this, it says "API Usage Statistics Statistics". A sub-note states: "This page provides an overview of the usage of the API endpoints by the community." It features two main sections: "Total API Calls since Launch Over 75 Million" and "API Calls in the Past 30 Days: 4,209,757". The "Size of Dataset" table lists data for Drugs, Foods, and Devices.

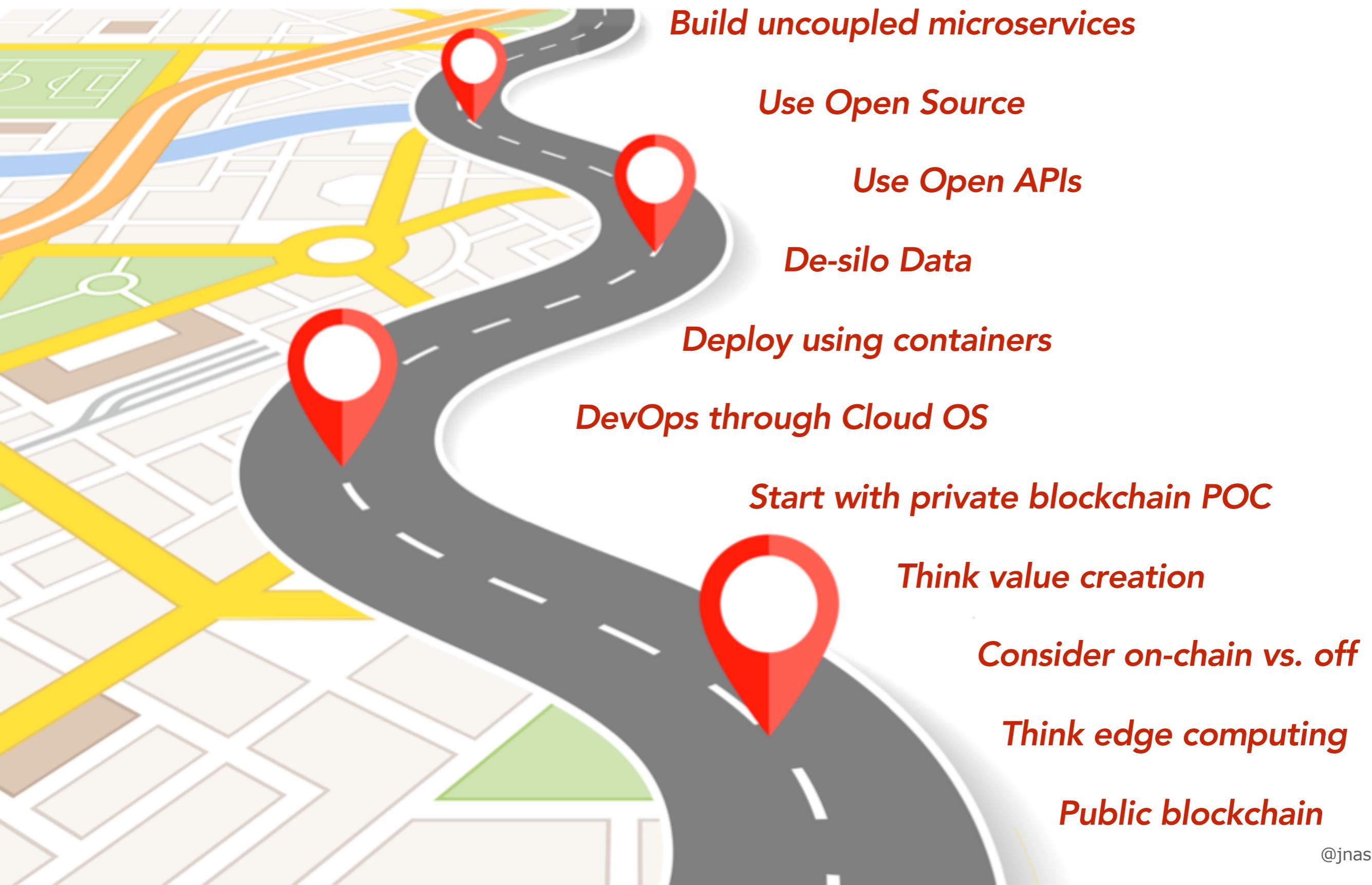
Category	Report Type	Count
Drugs	Labeling	119,112
	Adverse Event Reports	8,068,496
	Enforcement Reports	7,781
Foods	Adverse Event Reports	65,523
	Enforcement Reports	14,695
Devices	Classifications	6,403
	Registration and listing	247,118
	Premarket Approvals (PMAs)	36,792

Supply Chains at Heart of Life Sciences



1. **Compliance**
2. **Transparency**
3. **Automation**
4. **Disintermediation**

Leaping Ahead: Road to Blockchain



Could've Said This at the Beginning!

Blockchain is relevant for public causes

Think **public blockchain** long-term for many use cases

- Private to public (permissioned to permissionless)
- Think off-chain (what's real-world, where's the data)
- Think tokens to attribute value creation

Easiest use cases to address are **internal supply chain**

[FIRST] Compliance & transparency = improvement

[LATER] Automation & disintermediation = transformation

Separate **noise from signal**

- Scaling, interoperability, protocols, performance, ease of use... all evolving at record pace. Don't get hung up here
- Focus on prioritization and continued experimentation

Invest in the **right people**

- Start with right culture, open technologies, DevOps

