



EUROPEAN CENTRAL BANK

EUROSYSTEM

ECB Operations Managers Group Meeting

5 October 2017, ECB, Frankfurt

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Artificial Senses

Measuring finance and the economy

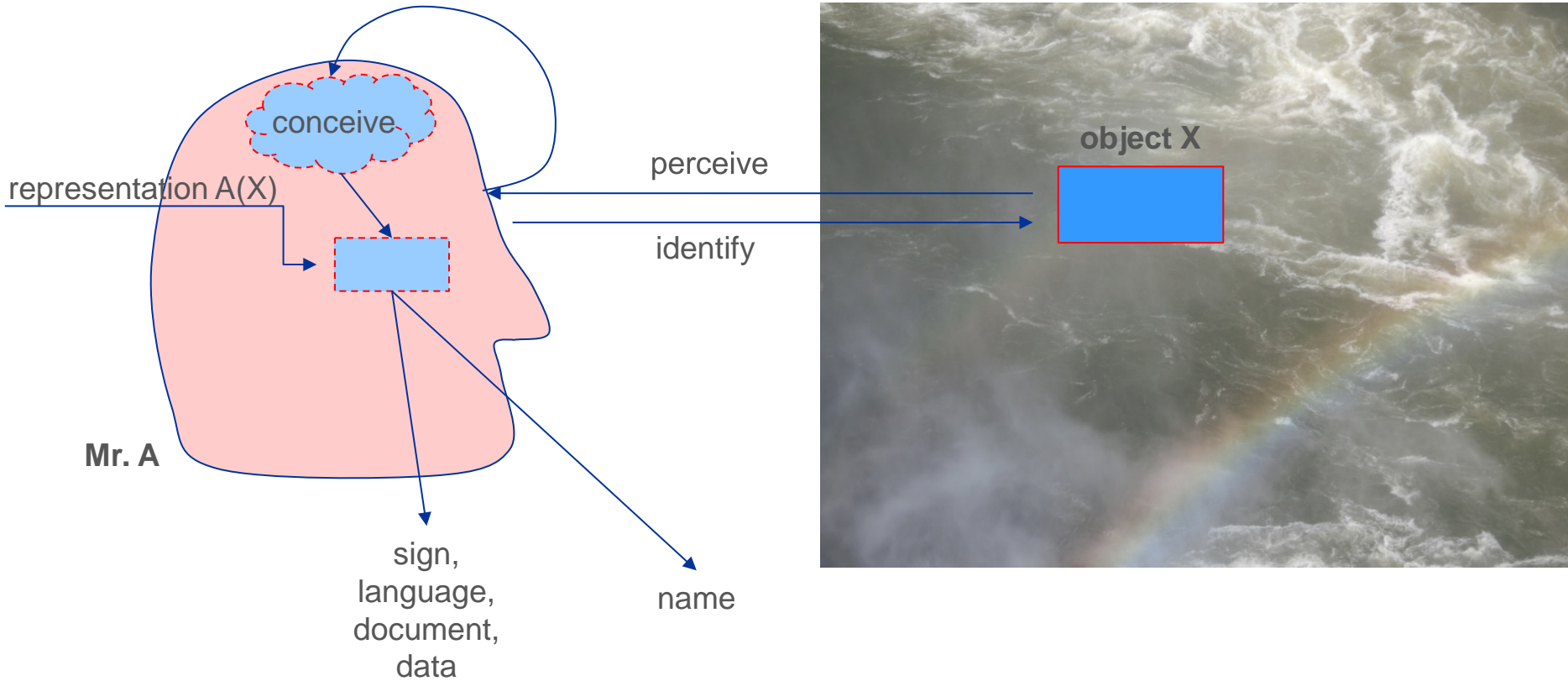
at the speed and scale relevant in the digital age

—

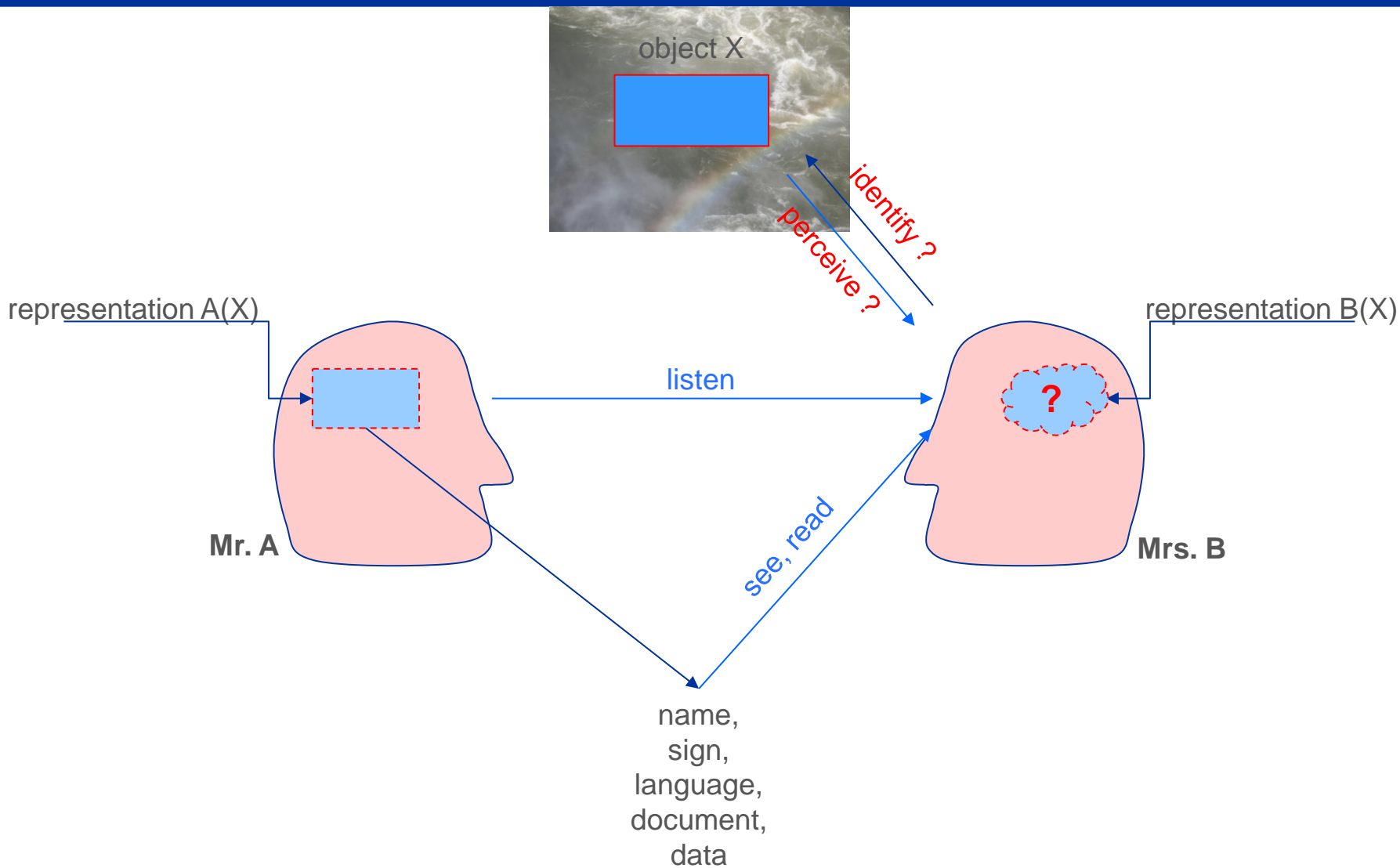
vision, architecture, infrastructure

warm-up and context

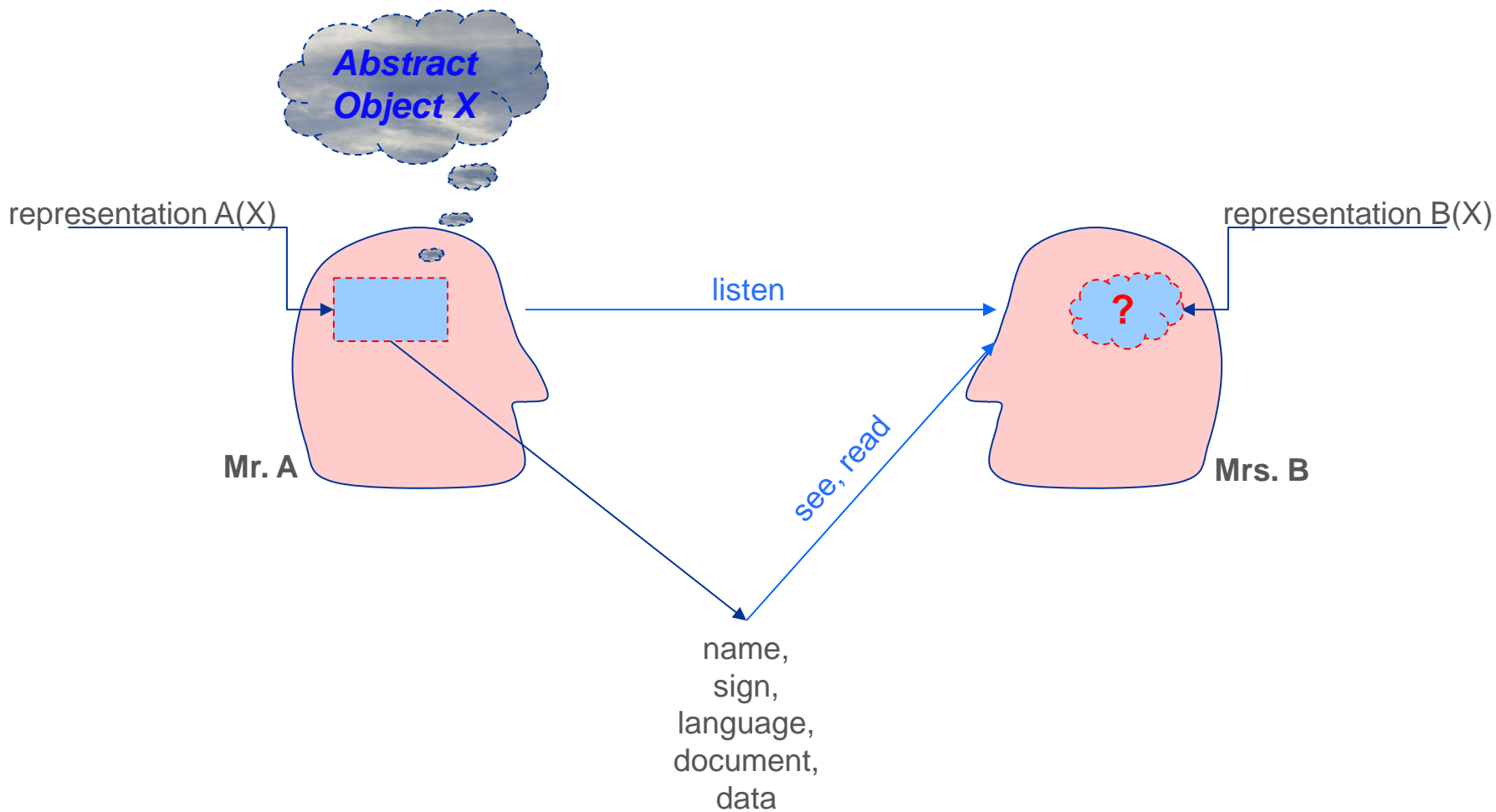
Object recognition and identification in a complex environment



Recognition and identification of material objects

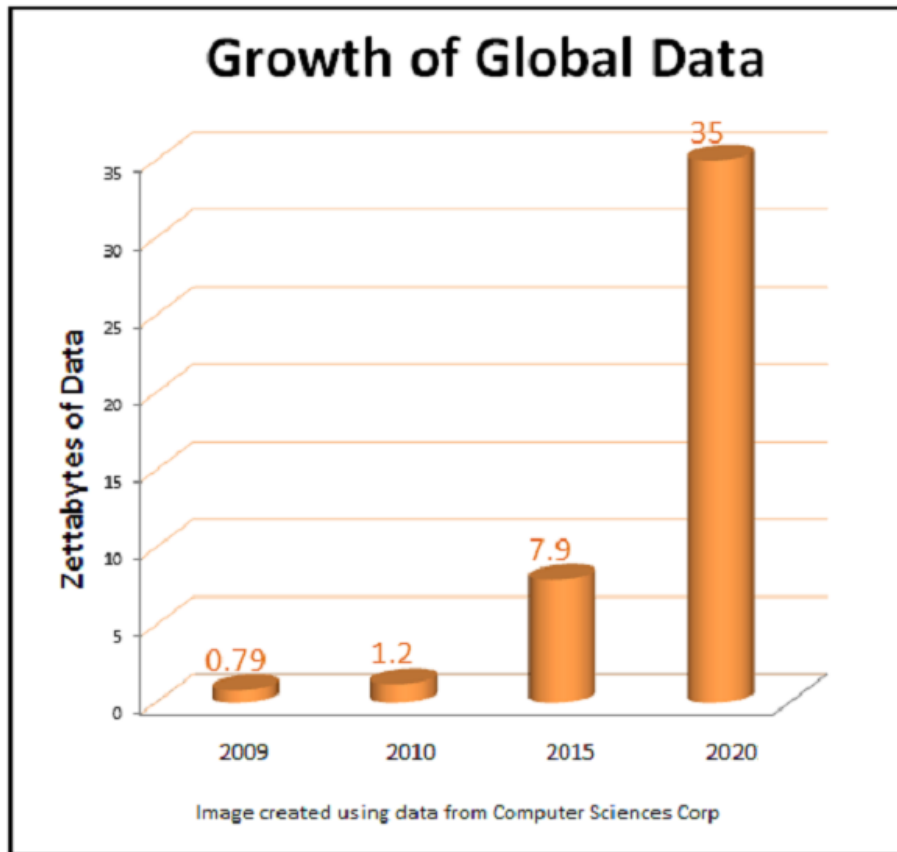


Recognition and identification of abstract objects



- **What when many names and documents, from many sources, representing abstract objects, are stored by many people, independently, in many computers, condensed into data that is separated from documents and authors, and travels alone to other computers, via other people or directly?**
- **When data is processed into new data in many places in the network?**
- **When data generated through computing travels on?**
- **When processed data is used to generate human-readable statements?**
- **When data volumes are too high, paths too long and hard-to-know for the reader to validate her understanding of the statement?**
- **What when some of that data is used to steer machines that act for real?**

What can we do to responsibly trust the outcomes and use them further?



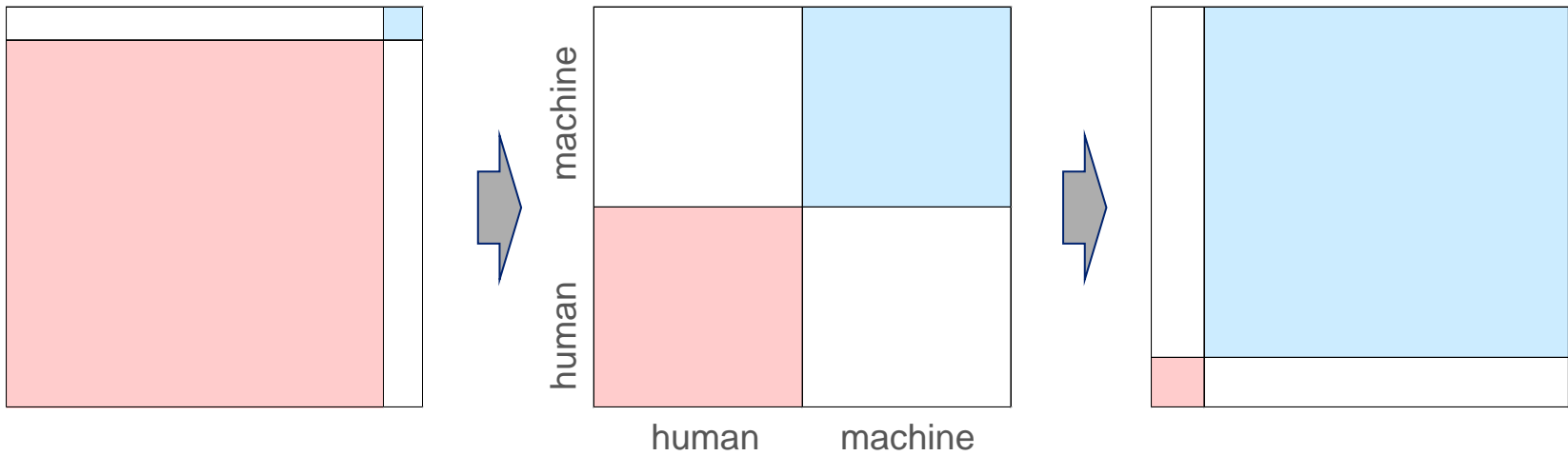
30-50% annual growth of data in finance
50% unstructured

1 Zettabyte = 1 ZB = 10^{21} byte = 1 Bn Tb

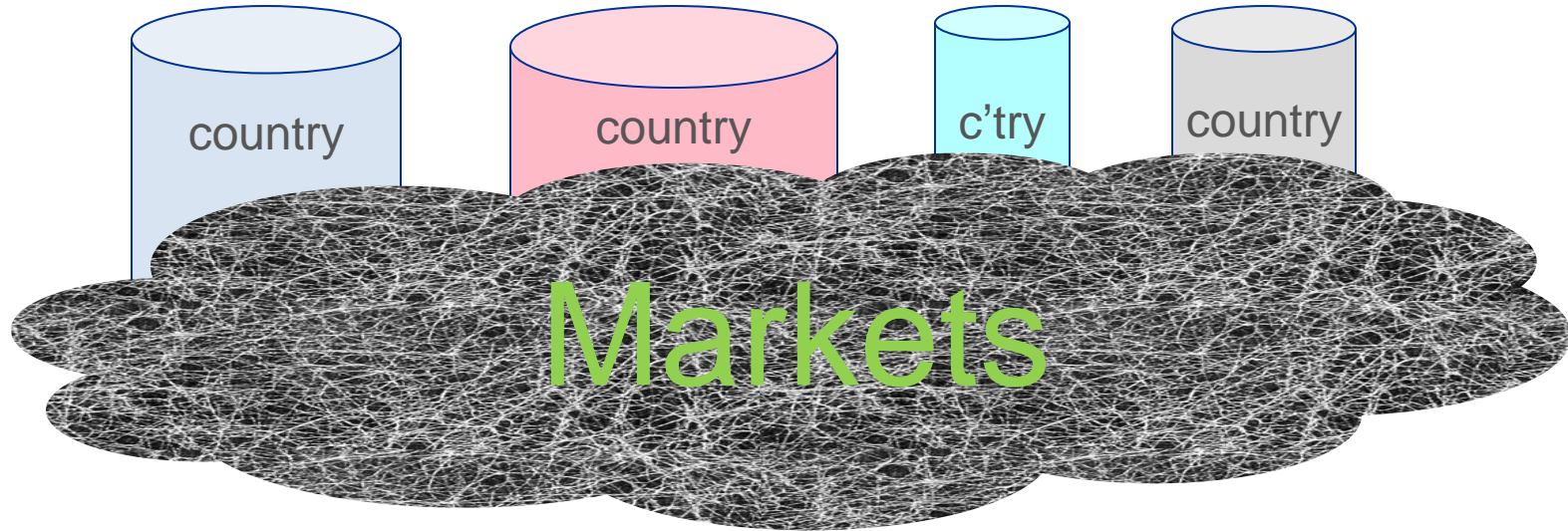
Data volumes are exploding, more data has been created in the past two years than in the entire previous history of the human race.

By 2020, our accumulated digital universe will grow from 4.4 ZB in 2015 to around 44 ZB.

The digital explosion has changed the conversation among humans



Technology made the world smaller and the markets bigger



Technology gives every market participant global reach

Markets grow globally integrated

Countries and markets are increasingly orthogonal realities

Countries need national measurement, but

“Local” is now just one view on an integrated global reality

statistics (i.e. measurement)

and

the digital age

The report shows a growing gap in value chain and globalisation statistics:

- More demands on statistics as the world grows more complex and globalised
- Shrinking capability to capture the finer details needed to build a bigger picture
- *Statistics improve, but while we keep improving the world changes even faster*

“Data gaps lead to policy gaps”:

“Because the picture of economic globalization provided by current official statistics is incomplete, the causal links to economic welfare indicators such as employment and wages tend to be weak and unconvincing, allowing a set of highly charged, politically motivated, and unproductive debates over the basic facts”

The report concludes that progress requires data, old and new, to be:

“all tied together by enterprise identifiers that make ownership clear, even when it extends across borders”, calling for an “integrated international data platform”, “international business registers” that identify the ownership structures of enterprises across borders”

- Securities database: CSDB
- Statistical registers: EGR, RIAD
- Reporting schemes: Anacredit, EMIR, SFT
- Business registers: DG JUST's BRIS: Business Register Interop^{tn} System
- Data Standardisation: DG FISMA's Financial Data Standardisation project

That is not enough

Why?

- The world we measure is globally integrated at micro-level, in real time;
- Many systems exchange data, across borders, sectors and functions.
- Multiple ways to refer to a same object harm quality and cost of data.
- When things get faster, more global and complex, feasibility suffers, then stops.
- If we all refer to an object the same way, processes are faster, safer, cheaper
- For legal entities, that points to a need for globally unique identification,
- For use by all, across all sectors: business, administration, statistics, etc
- Ideally, statistical data systems should all use the same entity identifier that businesses (reporting agents) and administrations use in their systems. Globally.

measurement and control

The San hunter shoots his arrow, kills the prey.

His senses are sufficient.

He doesn't need measurement.

The pilot of a night flight sees airport lights,

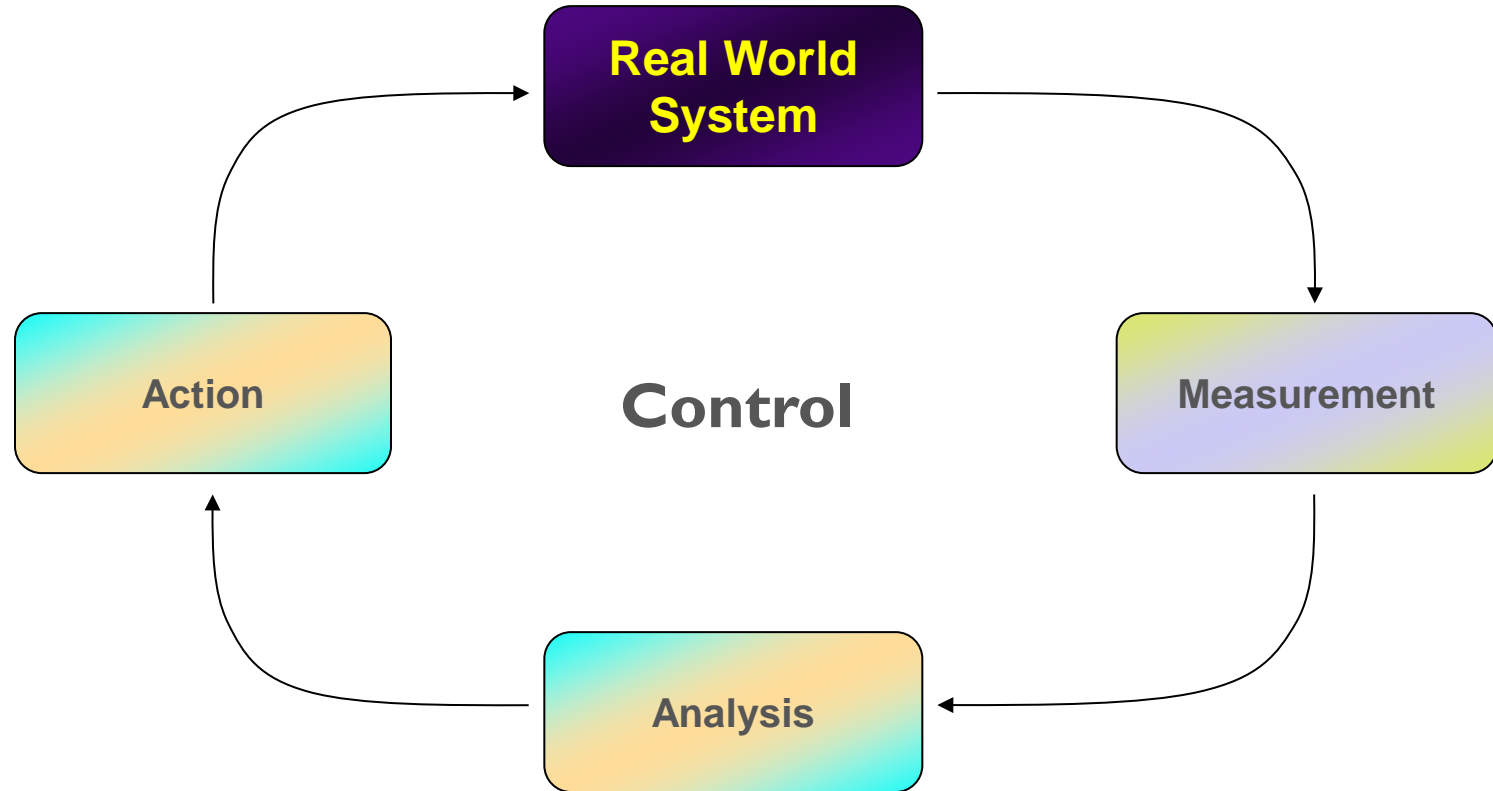
Yet he needs measurement of altitude, speed, etc. to land safely.

His senses need to be augmented through measurement.

Our senses don't perceive finance at all,

We need artificial senses.

We need measurement, i.e. statistics, and more.



- **Measurement is a necessary condition for staying in control**
- **Measurement is effective only if at scale and speed of the system measured**
- **For modern finance, the relevant scale is global, the relevant speed is real time.**
- **Control and Risk are sides of the same coin. Control suits engineering better.**

- Economic and financial statistics are akin to artificial senses
- Artificial senses should work at the speed and scale of the system observed
- The demands of the digital, global world suggest:

Four additional specifications for statistics, for reflection:

- Global integration of measurement
 - Speed of measurement near real time
 - Flexibility, to remain effective when surprises happen
 - Fast drill-down to enable fine diagnostics & surgical intervention
-
- Existing means might not stretch far enough.
 - Some radical departures might be needed.
 - The new specifications offer collateral benefits also for business.

**Real-world
Heterogeneity**

in

Languages

Data practices

Technical systems

Legal systems

Cultures

VS.

**Technology-driven
Need for Homogeneity**

in

Language

Data practices

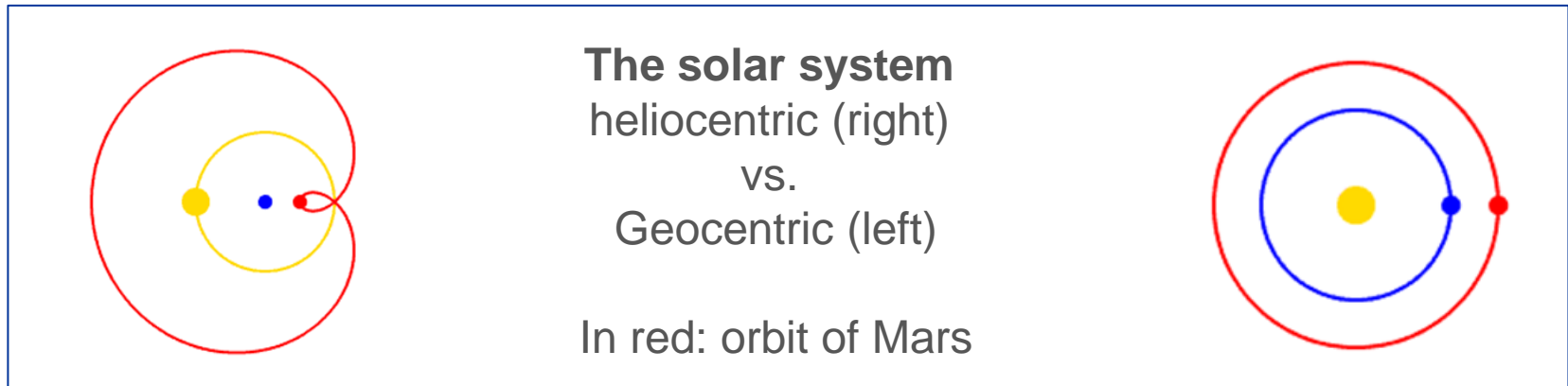
Technical systems

- The problem has grown global and deep, beyond direct solution design
- Another, an evolutionary strategy is needed:
 - Implement feasible change that delivers fast improvements and has
 - Transformational power to inspire and enable more positive change

Vision

Vision: technical tool, not flight of fancy

- A way we choose to view the world
- A representation that structures our perception, shapes our action



- *“All models are wrong; some models are useful”* George E.P. Box, statistician
- *“It is the theory that decides what we can observe”* Albert Einstein
- *“Combining visions gives us more possibilities”* Hans Poser, philosopher

Vision 1

A set of

Closed Systems

(national economies)

with

Perturbations

(international trade and
investment)

VS.

Vision 2

A Global Network

of

Contracts

among a

Global Population

of

Agents

Vision

Implications for measurement

For a business: my exposures, my counterparties, my environment

For any business, the relevant system is now effectively global – either directly or indirectly; impacts can unfold fast across continents and sectors.

For an authority: *de jure, my function in the system, in my jurisdiction*
de facto, in the digital age: the whole system, globally

All authorities, whatever function and jurisdiction they are responsible for, look at and interact in the same system. There is no more “*ceteres paribus*”.

In the digital age, we all share the same, global, relevant system

Complexity is, when the system doesn't fit in one head

otherwise, we could figure it out...

we need data to build information our brains (and machines) can handle

Corollary: the system is likely to surprise us

otherwise we would have figured it out...

hence we are likely to face questions we didn't expect and

we will need data we didn't collect in advance. We couldn't have known...

In the digital age, even large-scale developments can unfold very fast

we must know quickly what is happening, to act timely and safely;

data we need but don't have must be collected at once and

all that data must be analysed in real time. Ideally.

When a (potentially) critical development appears, there is mutual benefit in all parties coming to rapid agreement on facts, analysing from there and coordinating actions where and when needed and possible.

Can we do that? Also when things accelerate and surprise us?

A starting point could be:

all perceive the same “reality”; our perceptions are consistent

BUT

What “reality” can that be in a global, abstract system?

Reality could be those abstract things we all, across society, agree upon.

Where can such wide consensus on abstract things be found?

The most powerful and constant engine of social consensus is law:

- Law confers a quasi-physical quality of reality, also on abstract objects
- Law establishes the existence and identity of parties and contracts
- Law can mandate basic representation of such abstract objects

- **Each entity that can formally be party to a contract,**
- **Each formal contract**

is recognised in one of the legal systems that exist in the world

That idea could lead us to the common goal to build

A single, global system for representing each and every party and contract that is recognised by a legal system somewhere.

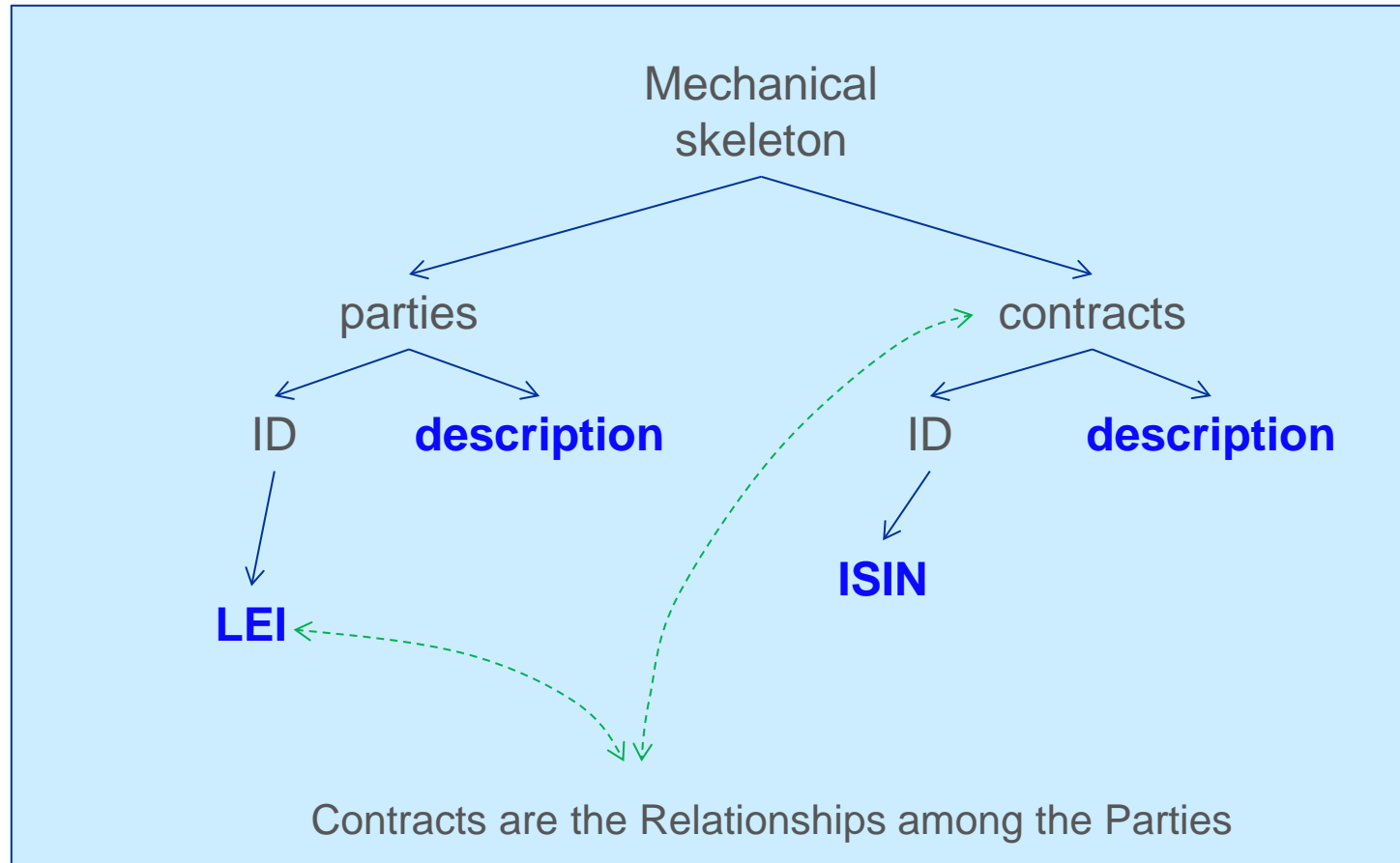
A kind of “mechanical skeleton” of finance and the economy

- Identity and basic description of each party, each contract
- Strictly standardised identifiers and basic data
- Public good
- Serving as operational infrastructure for industry and authorities alike
- Designed and operated in good global, inter-sectoral cooperation

Core system: the “mechanical skeleton” - the facts in the abstract system

Formal social consensus is established by law:

Abstract objects anchored in law are socially real. They are facts.



G20-backed, publicly governed, privately operated Global LEI System is a start.

Vision 1

A set of

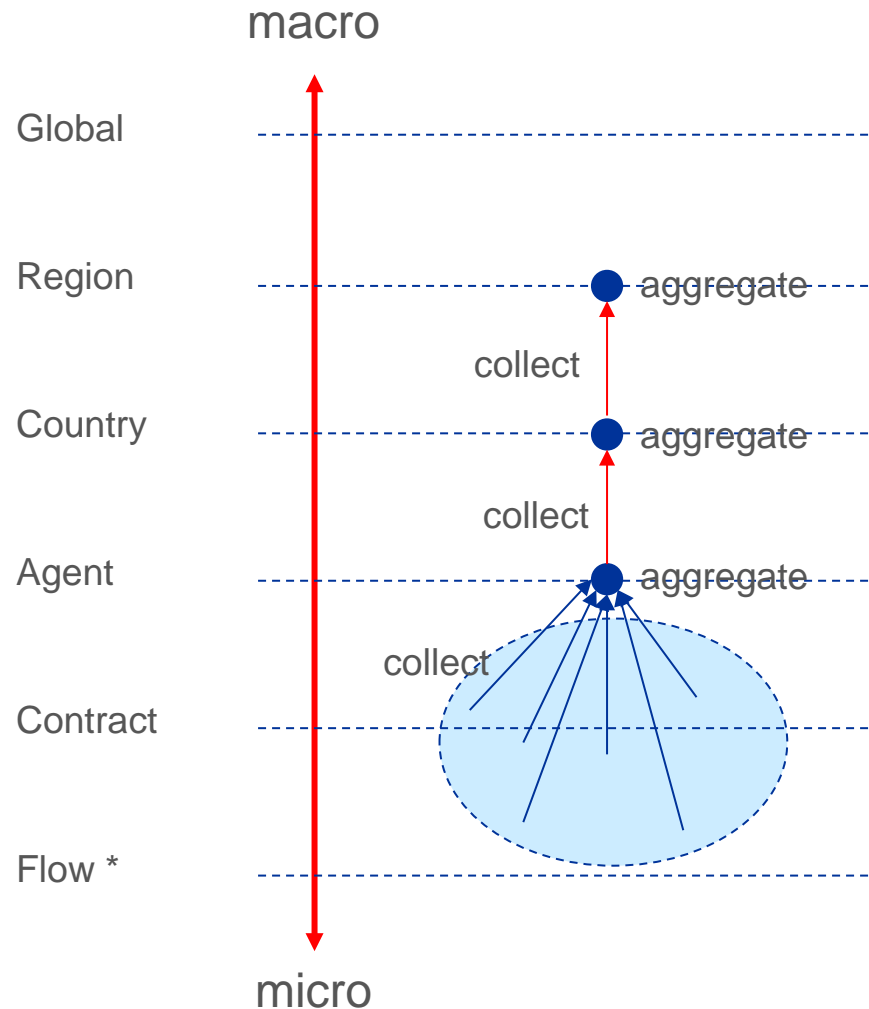
Closed Systems

(national economies)

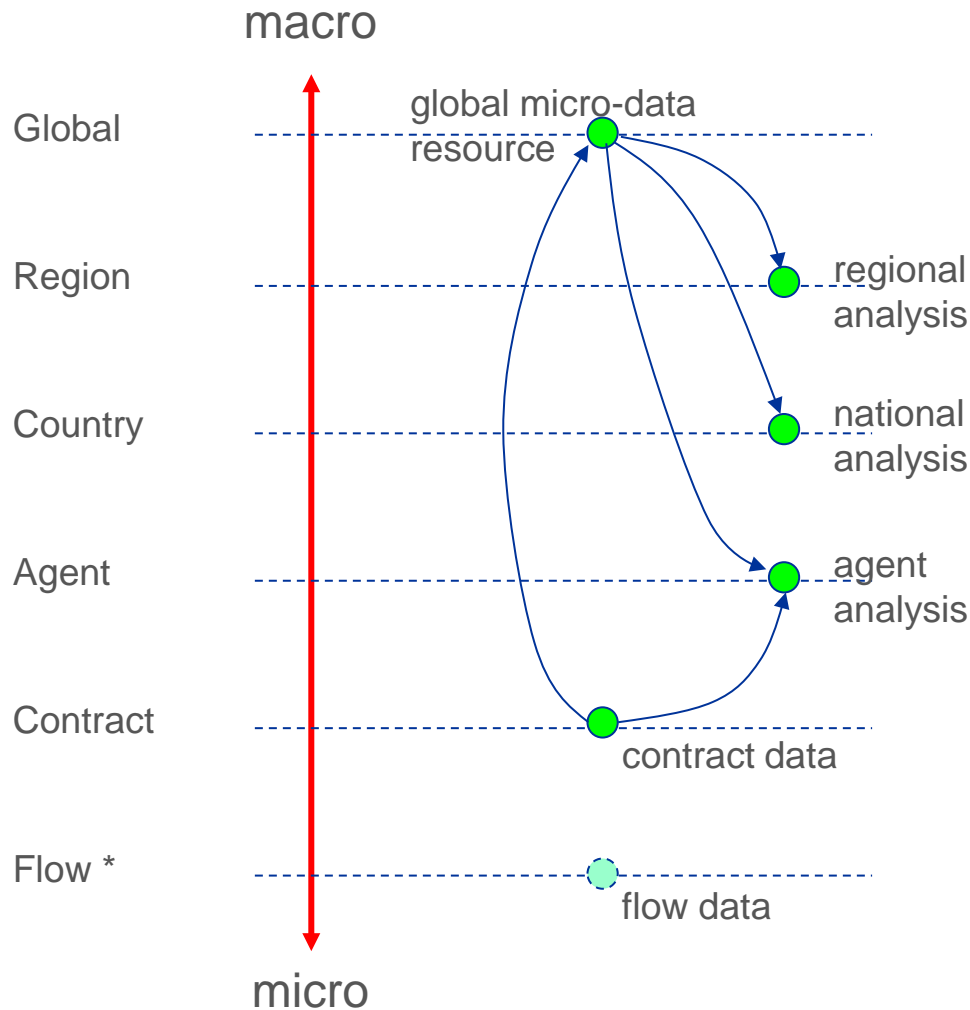
with

Perturbations

(international trade and investment)



* cash, goods, services



Vision 2
A Global Network
of
Contracts
among a
Global Population
of
Agents

* cash, goods, services

Implications of vision for measurement: data practices matter

data practices	digital age **	not really compatible	could deliver good measurement could reduce cost and risk in business has transformational power
	“pen-&-paper” age *	slow crude expensive	not feasible
		Vision 1	Vision 2

- * humans create data specifically for statistics & reporting, reduce volume at source
- ** not afraid of large data volumes. Data from operations straight into measurement

Contractual footprint of a country:

- All agents with a relationship to government; all contracts linking them to others

Contractual footprint of a corporate group:

- All agents “belonging” to the group; all contracts linking them to other agents

Exposures of an agent:

- Contractual footprint: 1st generation – 2nd generation – etc.
- Idea: notion of “flows of liability” across the system; detection of concentrations

International value chain analysis:

- Chains of contracts across the economy

➤ *Existing concepts could be measured better; new ones might be imagined*

Sophisticated Data

high-level concepts

- Harmonised language
- Broad standards (e.g. accounting, statistical standards, dictionaries)

Skeleton-derived Data

- Standardised language
- Standardised calculation formulae
- Embedded in regulatory reporting

Skeleton Data

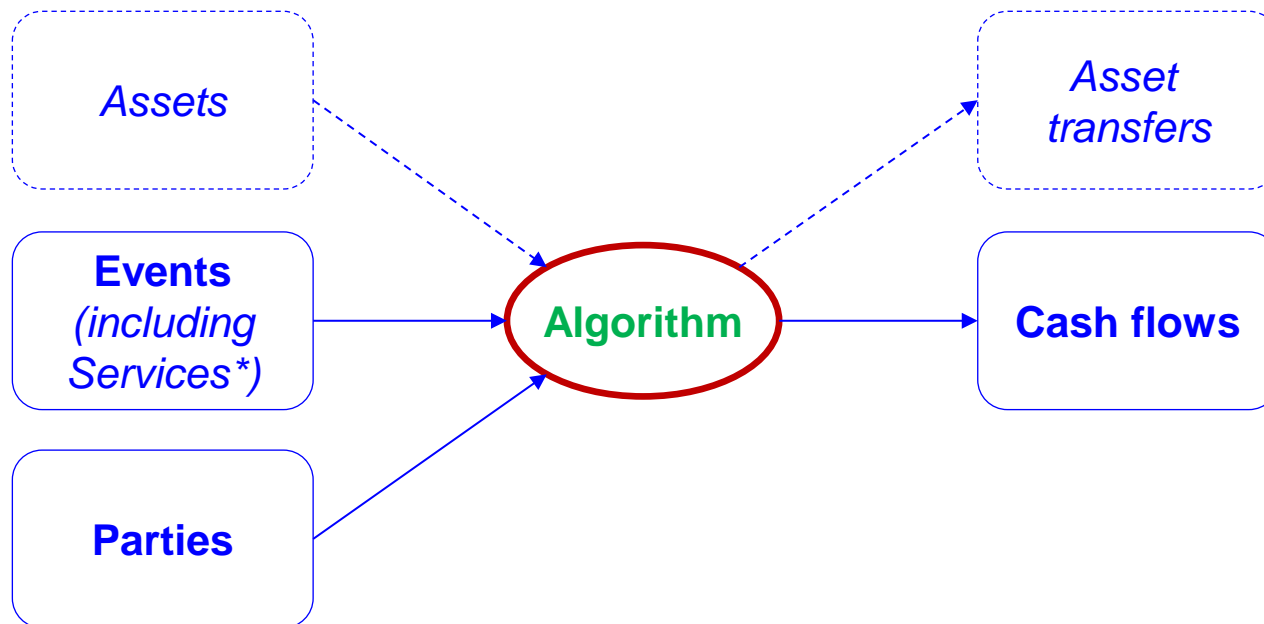
socially agreed “facts”

- Objects anchored in law
- Globally standardised
- Stored in a public-good Utility
- Mandated by law

Algorithmic Contract Type Unified Standard

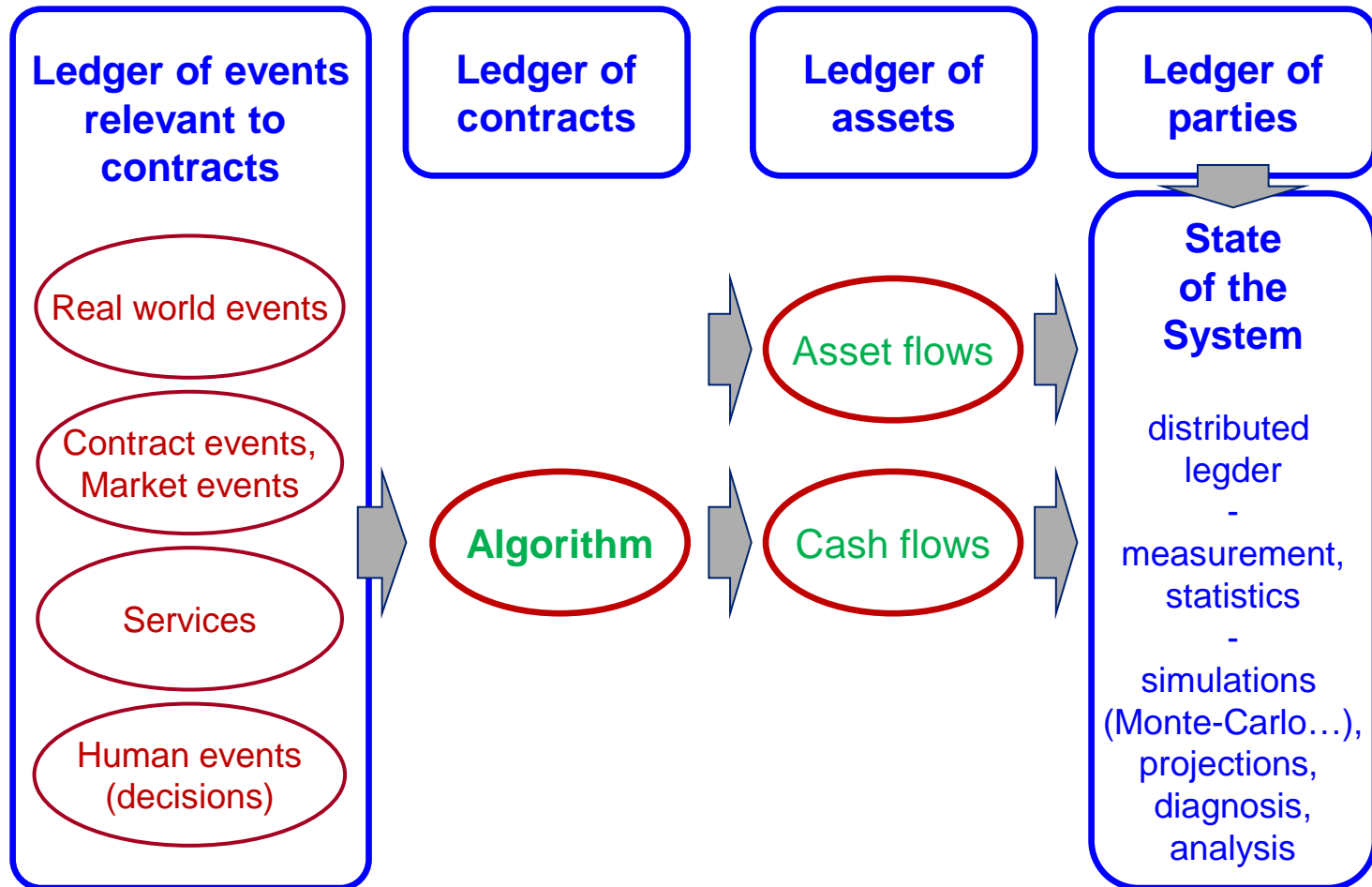
The ACTUS logic:

- The contract seen as a mathematical function that represents parties' agreement about
- who pays how much to whom, when and under what circumstances?



** delivery of a service can be seen as an event in this conceptual framework*

- ACTUS could represent a diverse population of contracts in a single language



- ACTUS could complete the Skeleton infrastructure

Institutional fragmentation

Fragmented measurement

- Coexistence** • **New things become possible**
 &
Mutual Benefit • **Some things get better**
 • **Other things stay as are**

One global data infrastructure

Integrated global reality

Identity
and
Representation of identity

Identity is cultural and political - It will remain local and diverse

Representation of identity must be globally standardised, for all

- To ensure effectiveness of large, networked information system
- To enable trust in data systems too large, complex and fast for human brains

A first step has been implemented:
the
Global Legal Entity Identifier System
is
operational

The
Global LEI System
is a
Public Good Infrastructure
that offers a
globally standardised representation
of the
identity granted by local authority to a legal entity

Market logic points to late adopter behaviour:

- LEI benefits to a business once all its counterparts have an LEI
- Early adopters have early cost, slow return and the risk of not being followed
- Late adopters have immediate benefits, lower costs and lowest risk
- *There is no incentive for early LEI adoption through pure market forces*

Market forces likely to kick in once LEI adoption is certain:

- The LEI has characteristics of an infrastructure
- Certainty of full coverage increases value, lowers risk, eases investment
- Beyond a critical coverage threshold, market forces will accelerate adoption
- *Legally mandated registration is the necessary first step*

Chicken and Egg: Authorities can put in the decisive Chicken

*“The current situation is very costly for market participants. The many different proprietary identifiers and local identifiers cause difficulties as they are incomplete, overlapping, and insufficiently accurate and do not guarantee a level playing field. While the drawbacks of the current situation are known and undisputed, resistance to change by the markets is due to the fact that **unique identifiers are a public good. They need to be introduced and maintained by legislation.** The mandatory requirement to use the LEI should be extended to all financial instruments and not only to specific market segments.”*

Keynote by Vítor Constâncio, Vice-President of the ECB, at the joint conference of the EU Commission and ECB on European Financial Integration, Brussels, 19 May 2017

http://www.ecb.europa.eu/press/key/date/2017/html/ecb.sp170519_1.en.html

Legal compulsion is essential for data quality and a level playing field among industry participants

August 6, 2014 11:41 pm

Regulators must mandate use of the Global LEI System

From Mr Kenneth E Bentsen, Jr.

...and up-regulate markets we are today. Encouragingly, authorities in the EU, US and Canada have taken steps to mandate the use of LEIs. While this is encouraging, the Financial Stability Board should urge regulators and policy makers across the globe to prioritise the use of LEIs as part of their toolkit for promoting financial stability. It's time to take this commonsense effort

across the finish line.

Kenneth E Bentsen, Jr, Chief Executive, Global Financial Markets Association, Washington, DC, US

Source: Financial Times; letter responding to an article by Gillian Tett «a bubble gum fix for finance»

GLEIS

facts, figures, status

The global **LEI ROC Charter**

The **ROC**
(Regulatory Oversight Committee)

Executive Committee

The **GLEIF**
(Global Legal Entity Identifier Foundation)

Board of Directors

LOU 1
(Local
Op. unit)

LOU 2
(Local
Op. unit)



LOU n
(Local
Op. unit)

Governance:

ROC participation	as members	as observers
Organisations	72	19
of which: EU	5	
Int	4	3
Countries	45	10

Operations:

- Over 540.000 LEIs issued
- Level 2 data: collection started in May
- 30 LEI issuers, of which 8 LOUs, 22 pre-LOUs
- Further candidates applying to become LOUs

The GLEIS delivers **Level 1 data**

- ID card of the entity represented
- No real legal issues

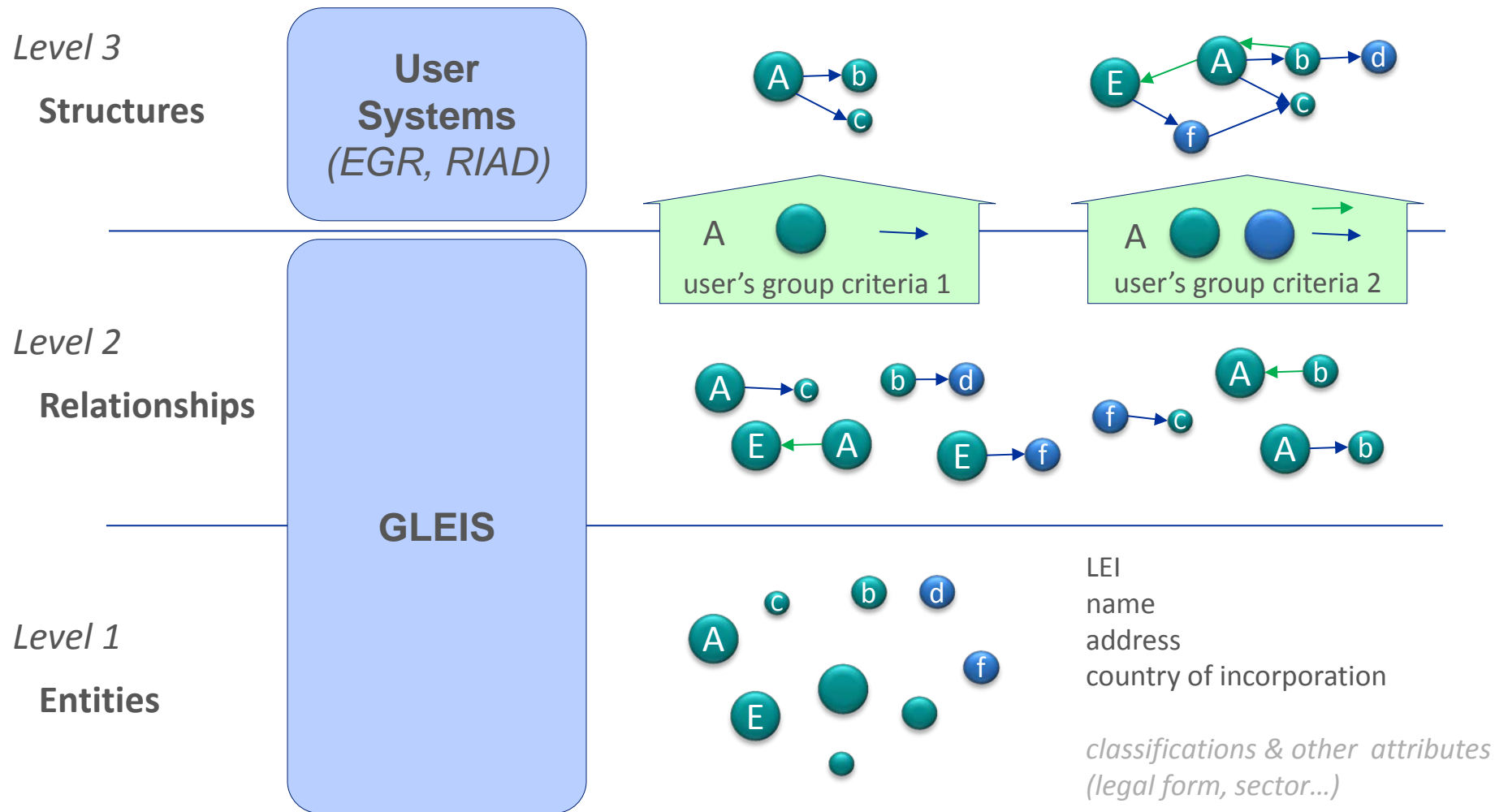
The GLEIS will deliver **Level 2 data**

- Relationship data
- Link entities identified at level 1
- First generation: immediate / ultimate parents, accounting consolidation
- Some legal issues (e.g. confidentiality)

The GLEIS does not deliver **Network / group representations**

- Can be built from Level 1 and Level 2 data by users, e.g. EGR, RIAD
- Likely to be highly diverse, tailored to user needs
- Potential for commercial value-added products

What will the Global LEI System offer? What is the users's domain?



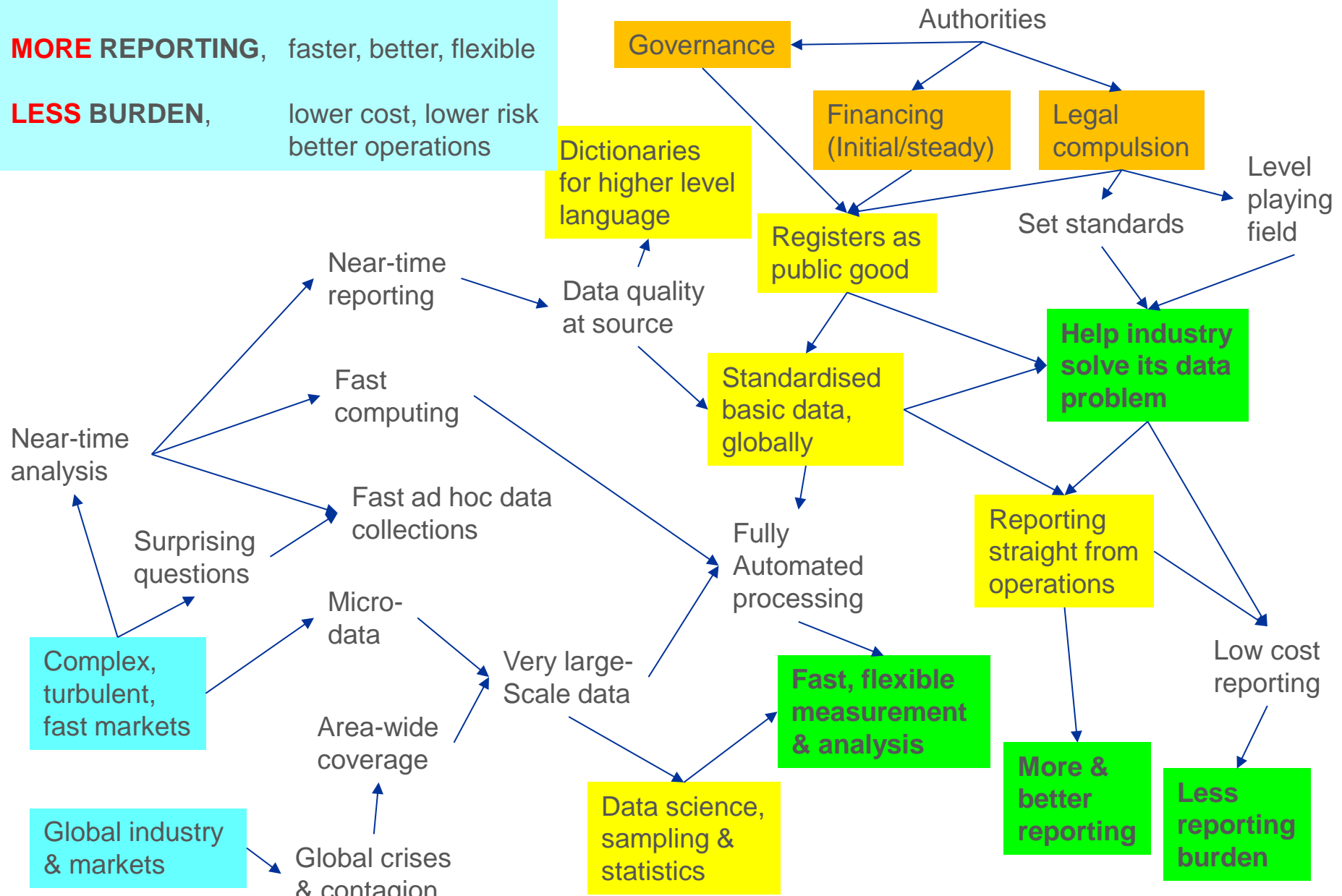
- Entities and the relationships among them (e.g. contracts) represent facts: same for all
- Entities and relationships are building material for (group) structures
- (Group) structures reflect the users' very individual choices and views

... and finally

Authorities as Architects of the Data Ecosystem

MORE REPORTING, faster, better, flexible

LESS BURDEN, lower cost, lower risk better operations





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EUROSYSTEM

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