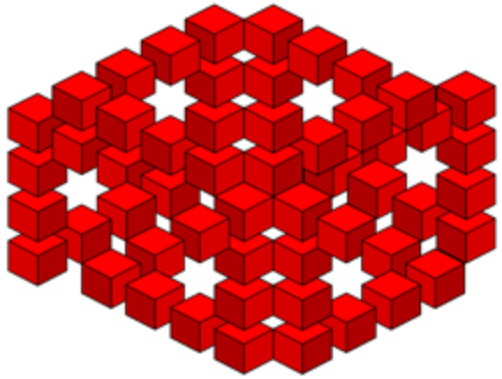
Creating [IoT] Markets



Dr Shoumen Palit Austin Datta

MIT Auto-ID Labs, Research Affiliate, Department of Mechanical Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

Senior Scientist, MD PnP Lab, Partners Healthcare, Massachusetts General Hospital, Harvard Medical School ● sdatta8@mgh.harvard.edu

Digital by Design – IoT is a Design Metaphor

Architecting the Future of Digital Transformation

How can we catalyze growth of IoT/IIoT services?

Where may we expect to grow these markets?

What are the attributes required for growth?

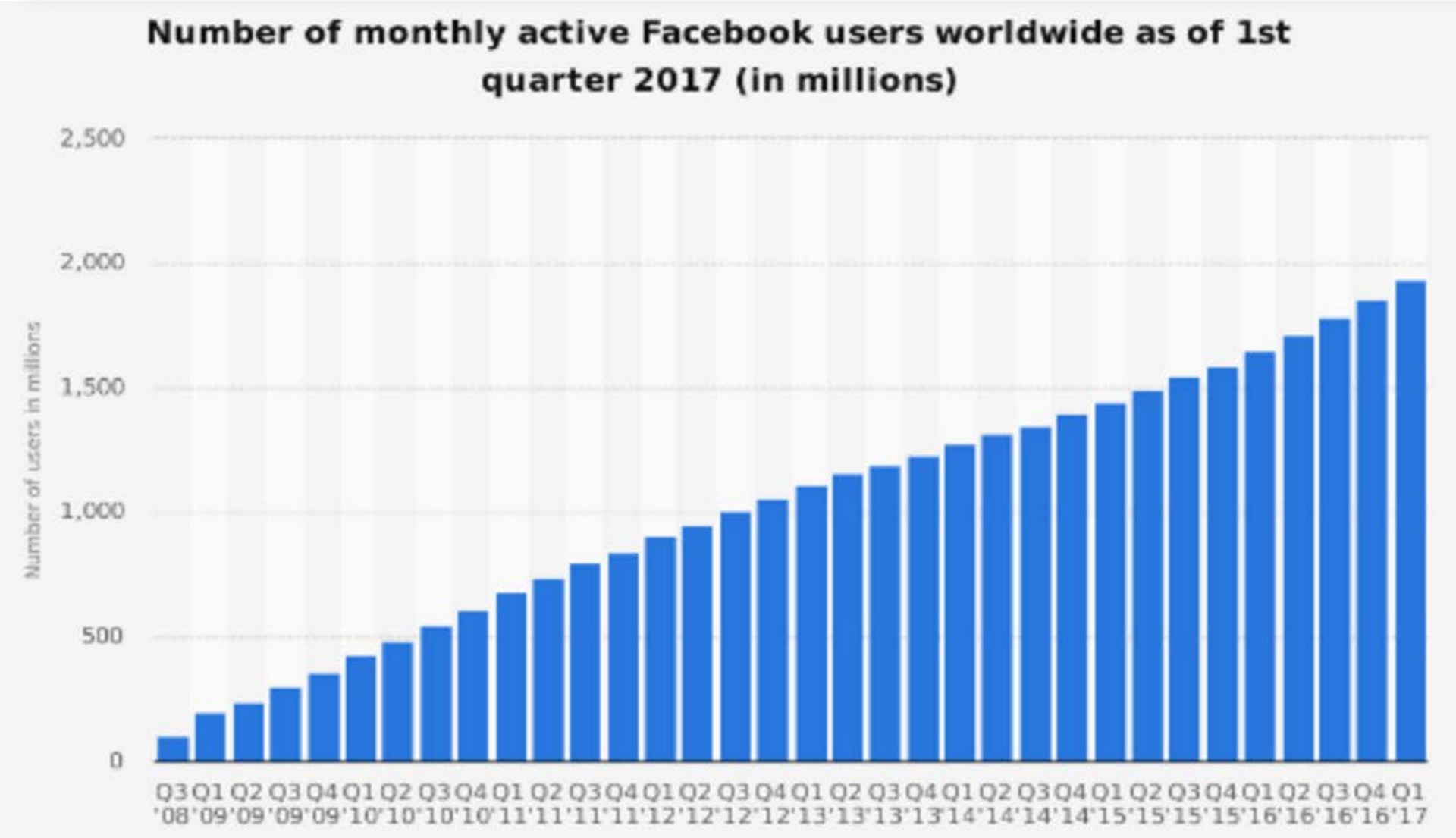
Which verticals are ready for digitalization?

When shall we see economic outcomes?

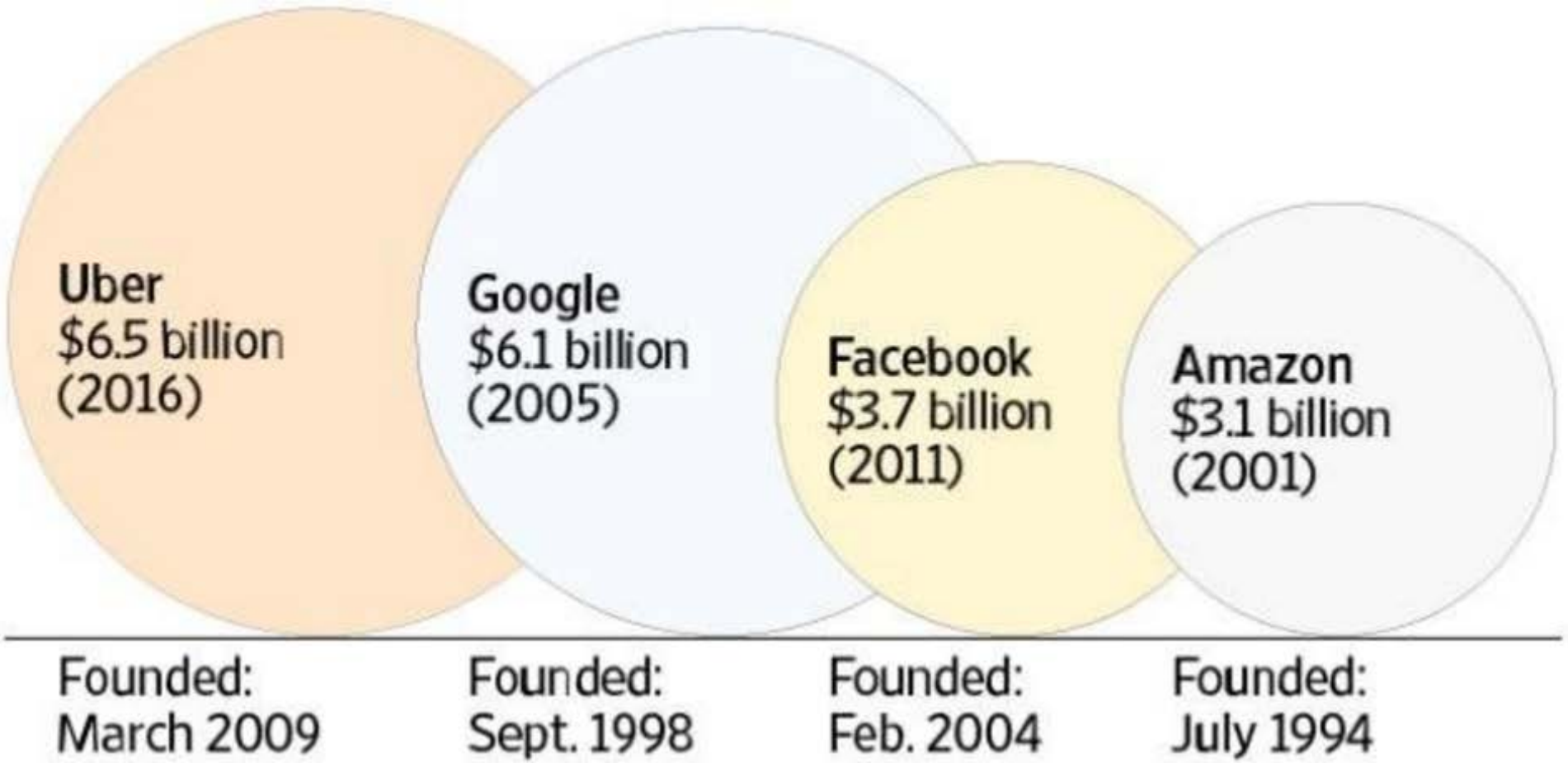
It is imperative to frame, define and ask the correct questions

It is not about the answers

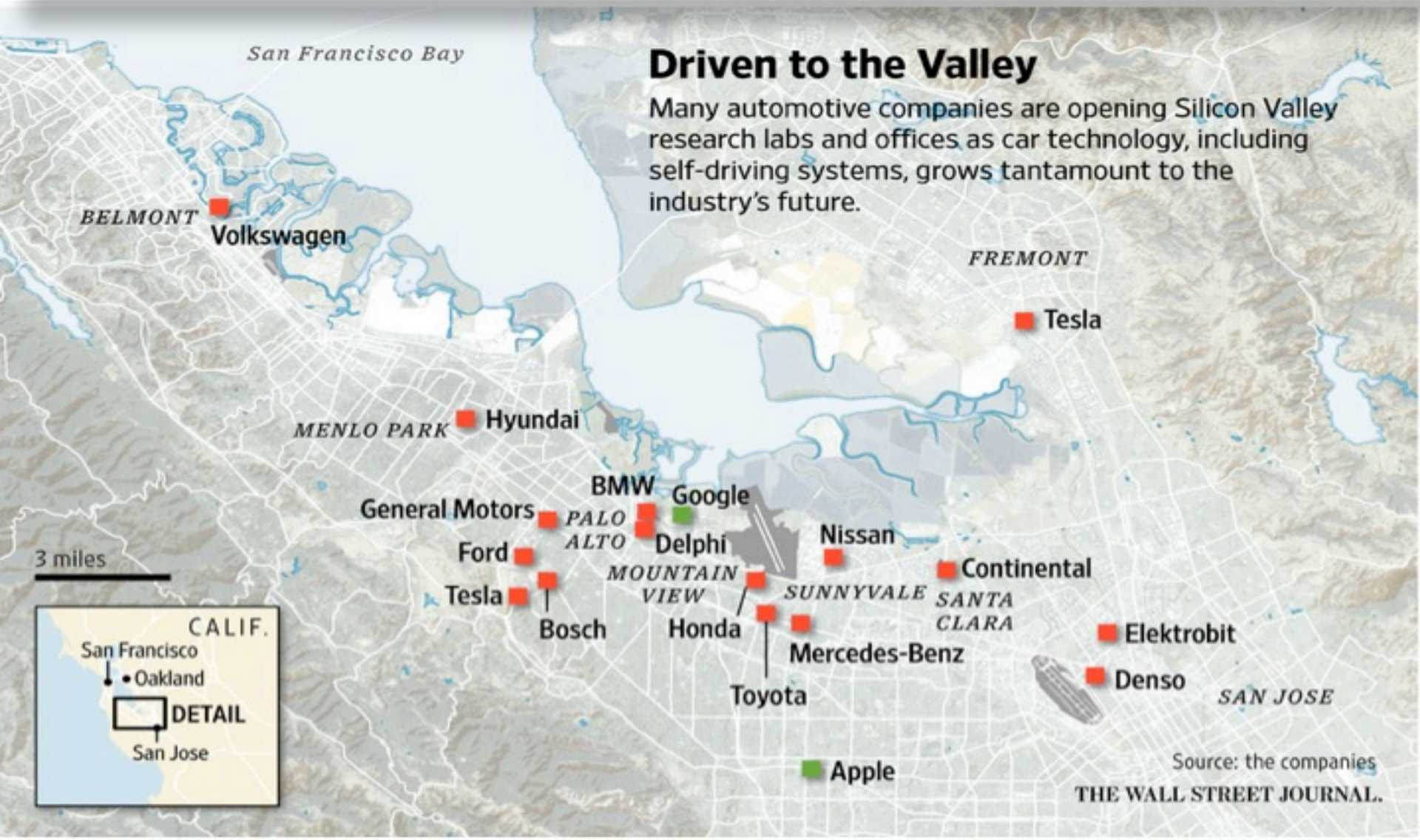
Sexy graphic but is it valuable to your question?



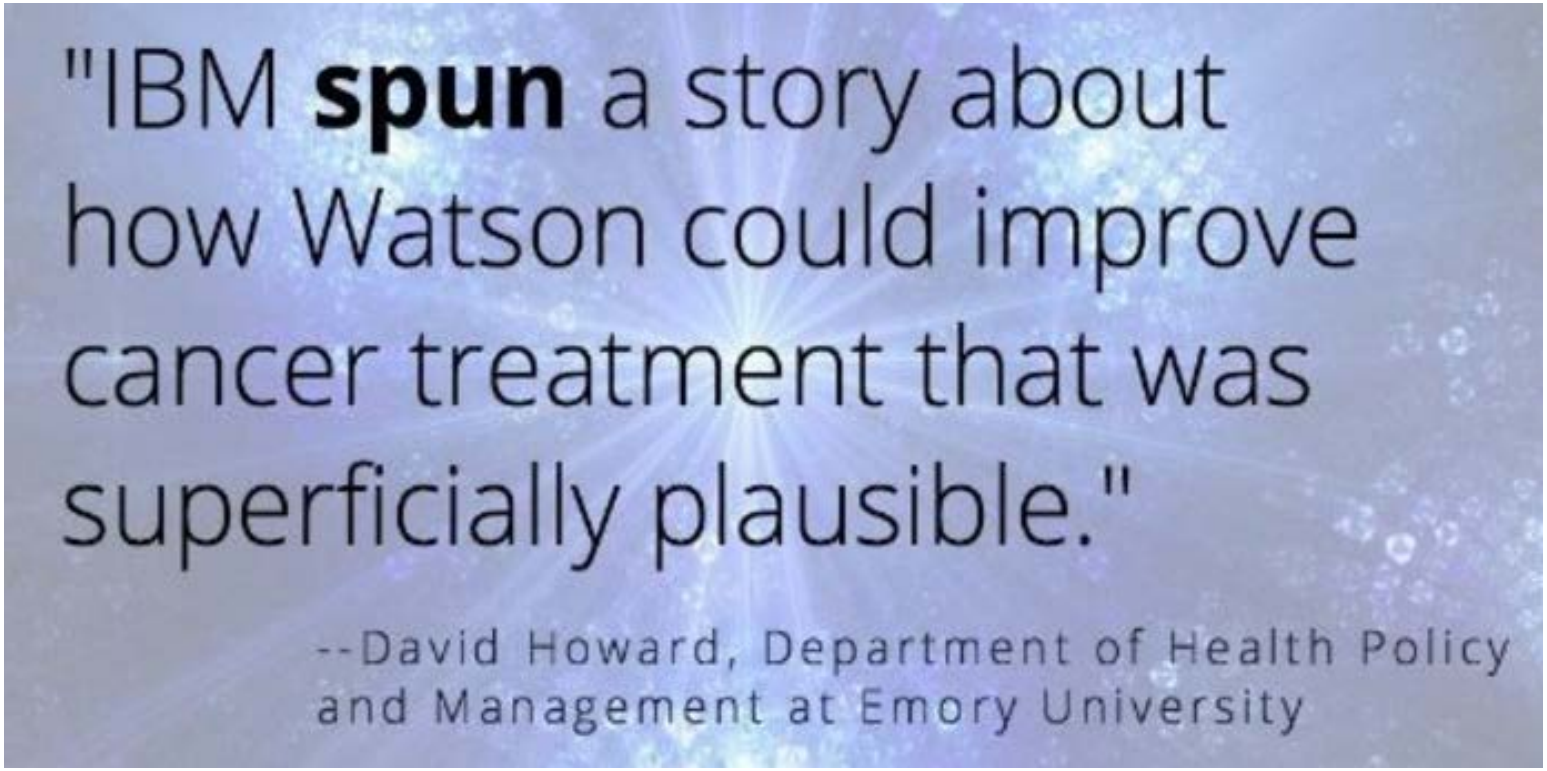
Sexy numbers but can they inform your question?



Sexy cluster but is it relevant to your question?



Sexy marketing but can it pollute your question?



www.healthnewsreview.org/2017/02/md-anderson-cancer-centers-ibm-watson-project-fails-journalism-related

Sexy drivel likely to obfuscate your question?

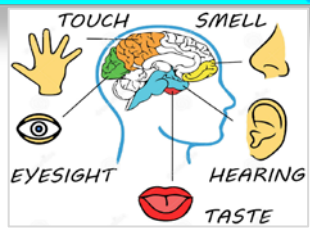
Eaon Pritchard
Advertising douchebag

I doubt even anyone at Accenture knows what this horseshit is supposed to mean

Define key questions for any business or vertical. May use “framework 5” as a reference template.

This is not a panacea. One shoe does not fit all. There is no substitute for vision.

FIVE INEXTRICABLY LINKED SENSES – BIOINSPIRED THINKING



1. Gustaoception
2. Tactioception
3. Audioception
4. Olfacoception
5. Ophthalmoception

FIVE INEXTRICABLY LINKED BASICS FOR ECONOMIC GROWTH

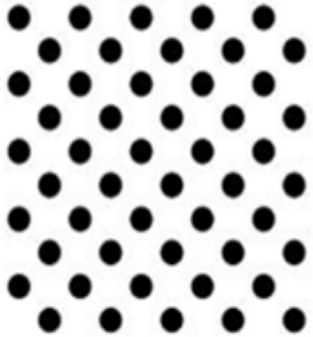
FIVE INEXTRICABLY LINKED DRIVERS IN COMMERCIAL WORLD

FIVE GUIDING PRINCIPLES for ENTREPRENEURIAL INNOVATION

FIVE FOUNDATIONAL STEPS for ENTERPRISE EVOLUTION

FIVE DATA DEPENDENCIES & DRIVERS IN DIGITAL ENTERPRISE

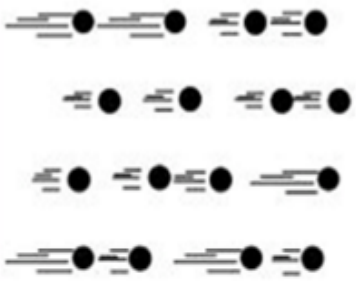
Volume



Data at Rest

Terabytes to Exabytes of existing data to process

Velocity



Data in Motion

Streaming data, requiring milliseconds to seconds to respond

Variety

Data in Many Forms

Structured, unstructured, text, multimedia,...

Veracity

Data in Doubt

Uncertainty due to data inconsistency & incompleteness, ambiguities, latency, deception, model approximations

Value

Data into Money

Business models can be associated to the data

FIVE DATA RELATED DIMENSIONS TO EXTRACT INFORMATION

- Data Management
- Data Architectures
- Data Analytics
- Data Protection
- Data Visualization

FIVE DATA DOMAINS AS DRIVERS FOR GLOBAL DIGITALIZATION

Public administration	EUR 150 billion to EUR 300 billion in new value (Considering EU 23 larger governments)
Healthcare & Social Care	EUR 90 billion considering only the reduction of national healthcare expenditure in the EU
Utilities	Reduce CO_2 emissions by more than 2 gigatonnes, equivalent to EUR 79 billion (Global figure)
Transport and logistics	USD 500 billion in value worldwide in the form of time and fuel savings, or 380 megatonnes of CO_2 emissions saved
Retail & Trade	60% potential increase in retailers' operating margins possible with Big Data
Geospatial	USD 800 billion in revenue to service providers and value to consumer and business end users

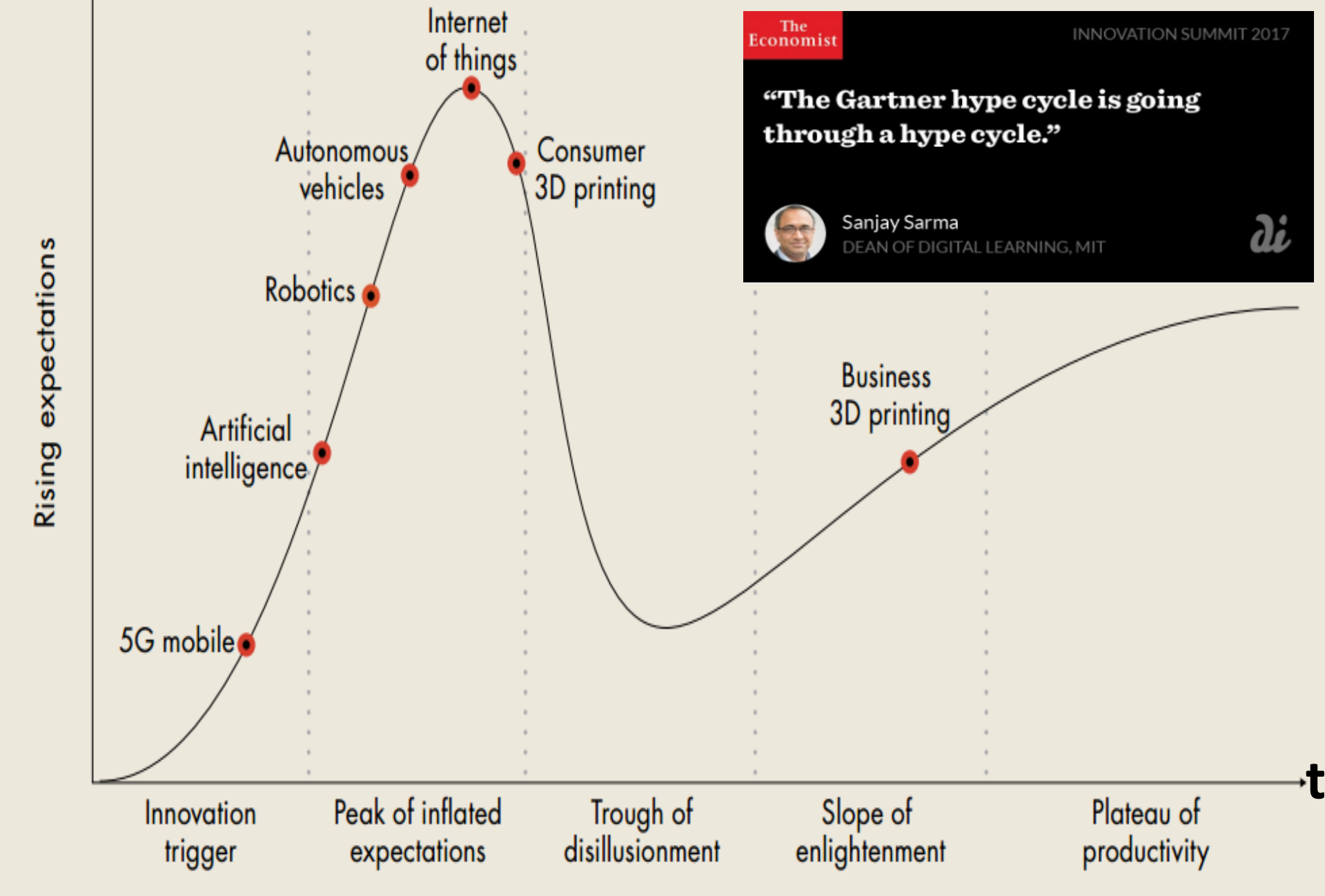
FIVE INEXTRICABLY LINKED STEPS - DIGITAL TRANSFORMATION

- Transparency – Connectivity, Physical-Digital Interface
- Efficiency – Robotics, Automation, Algorithms, Analytics
- Workforce – Demographics, Earning Age, Skills, Education
- Urbanization – Retail, Logistics, Transport, Agriculture, Waste
- Digitalization – Service SCM, systems integration, QoS, Metrics

- Security
- Financials
- Healthcare
- Manufacturing
- Food, Energy, Water

Important to differentiate between facts and fiction served by marketing firms

one such example is provided in the next few pages



What is wrong with this illustration?

Robotics - A Rising Expectation? Robotics is a fundamental R&D driver!

www.pressreleasepoint.com/print/1099823

Several Purdue faculty involved in new manufacturing robotics hub

Posted January 13th, 2017 by Purdue

WEST LAFAYETTE, Ind. — Researchers from three Purdue University colleges have joined governments, universities and nonprofit organizations in establishing a new independent robotics institute for the U.S. Department of Defense's Manufacturing USA.

Richard Voyles, a Purdue Polytechnic Institute professor, was among the representatives Friday (Jan. 13) at the Pentagon in Washington, D.C., attending the announcement of the new Advanced Robotics Manufacturing (ARM) Institute Hub.

The ARM Institute will conduct research and development, developing education and workforce training and providing access to shared capabilities through its regional collaborations. ARM focuses on key industrial sectors—aerospace, automotive, electronics, and textiles—defined by its partners.

Six thrusts will make up the work by the independent institute. Voyles is expected to lead the collaborative robotics thrust.

Purdue is one of 40 academic partners for the institute, which was awarded to American Robotics Inc. The institute is the 14th under Manufacturing USA and eighth led by the Department of Defense.

Purdue Polytechnic Institute Dean Gary Bertoline said he is looking forward to the potential offered by Purdue's involvement in this new institute hub.

"The college and our faculty are very excited to be part of this important institute in advanced robotics manufacturing," he said. "Under the leadership of Richard Voyles, Purdue University will have an important role in this institute that will advance robotics, which is one of the most important technological developments of this era."

Aside from academic partners, 123 industrial and 64 government entities are part of the consortium, which contributed $173 million toward the institute. That will be combined with $80 million in federal funds.

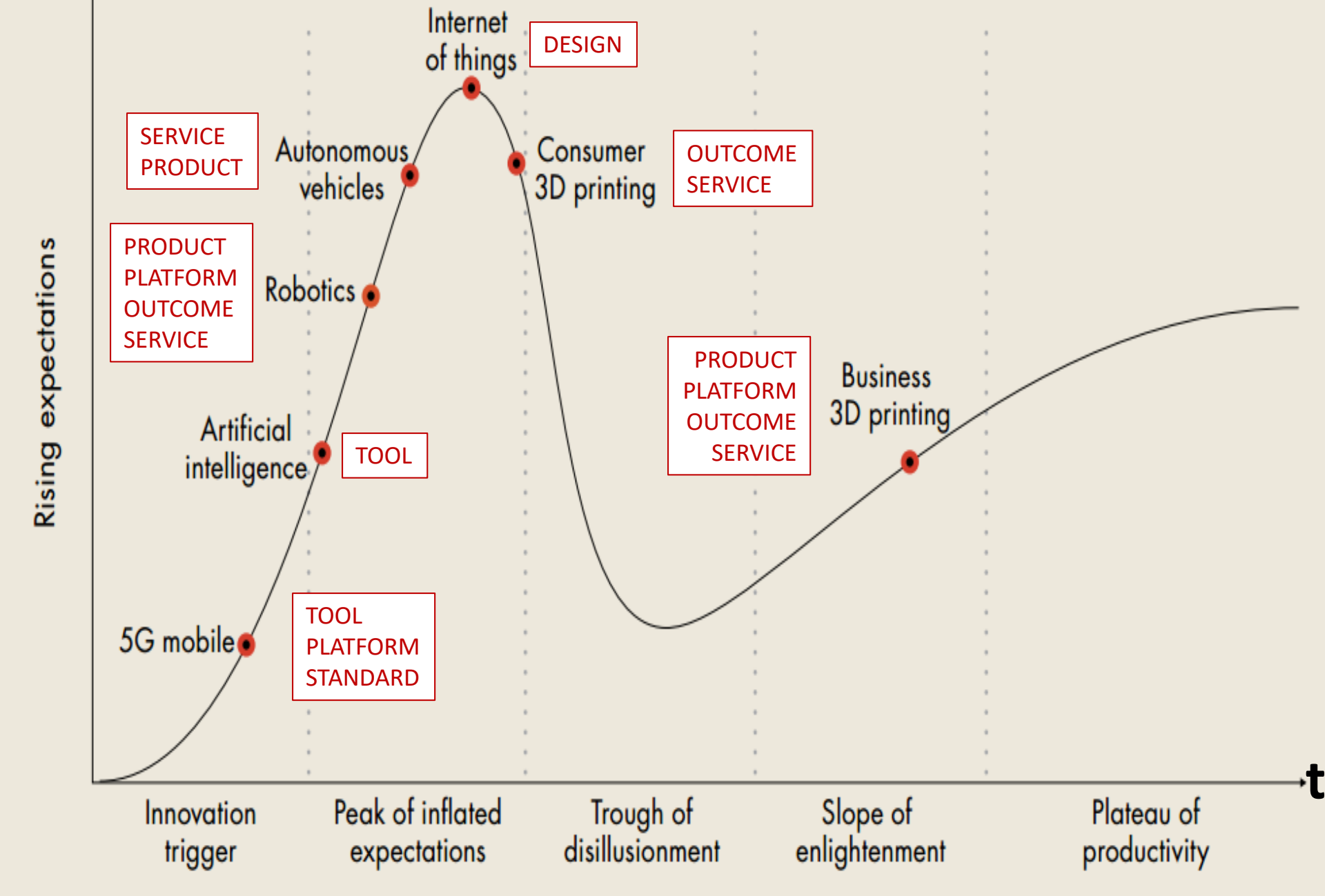
Eleven Purdue faculty members are part of the ARM Institute, including seven from Purdue Polytechnic: Voyles, Xiaoming Wang, Xiumin Diao, Ayhan Ince, Nate Hartman, Austin Creasy and John Piller. Three faculty from the College of Engineering – Dave Cappellerri, Juan Wachs and Steve Shade – and Daniel Aliaga from the College of Science also join the institute.

ARM Institute, through American Robotics Inc., was founded by Carnegie Mellon University and is headquartered in Pittsburgh. Manufacturing USA, initially known as the National Network for Manufacturing Innovation, was first started in 2012.

What’s wrong with this illustration?

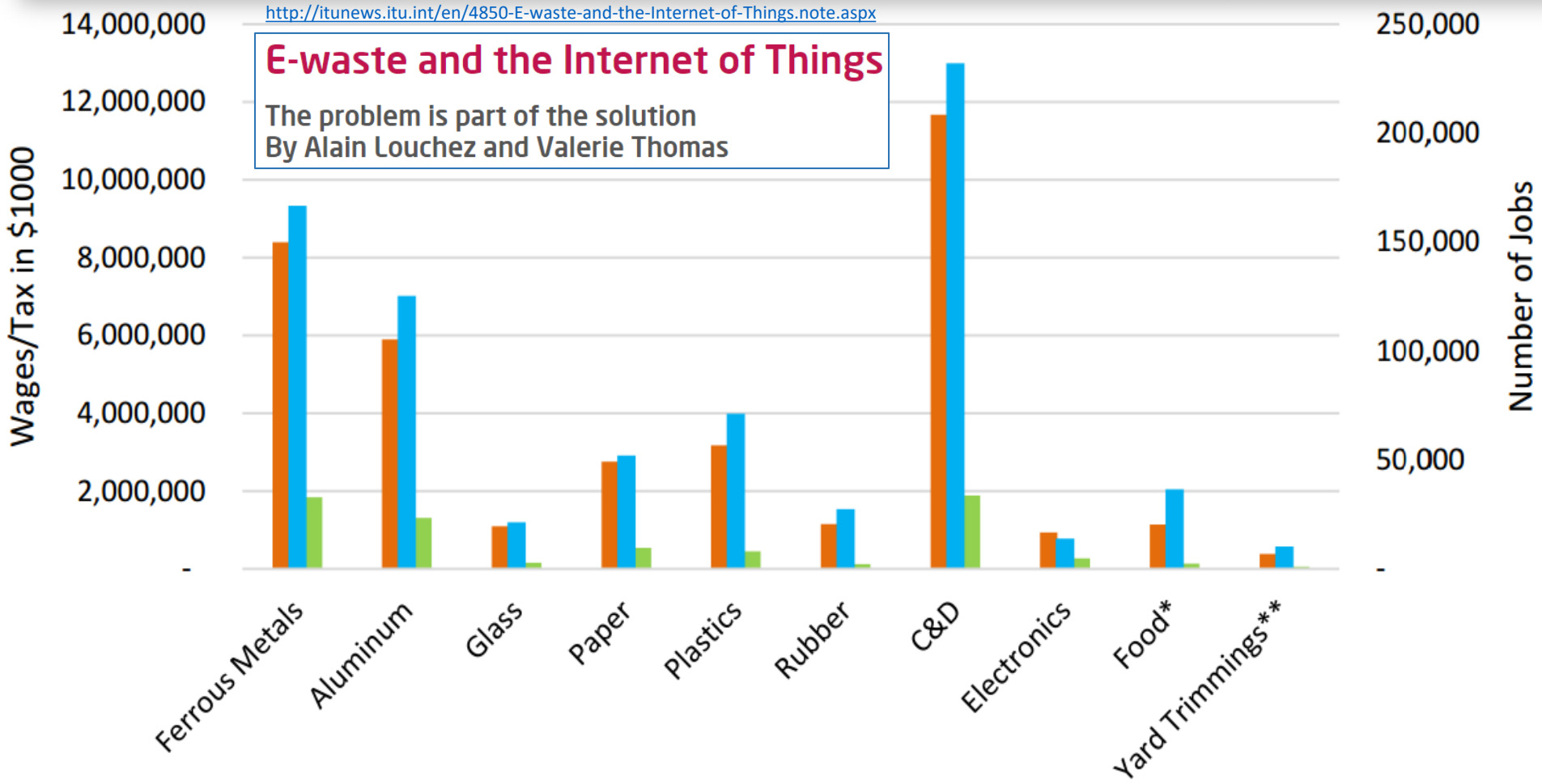
Oblivious about the difference between tools, platforms, products, designs and outcomes?

There is nothing wrong with the illustration if its sole purpose is to serve as a marketing gimmick simply to amplify and drive PR using buzz words du jour.



☑ Illustration = Marketing Gimmick

Where is the imminent e-waste explosion on the hype curve?



*Food category includes animal feed, meal, meat, fats, oils and tallow, as well as community food service

**Yard Trimmings category includes biodiesel, biogas, compost, mulch and wood chips

https://www.epa.gov/sites/production/files/2016-11/documents/final_2016_rei_report.pdf

Markets are about Outcomes

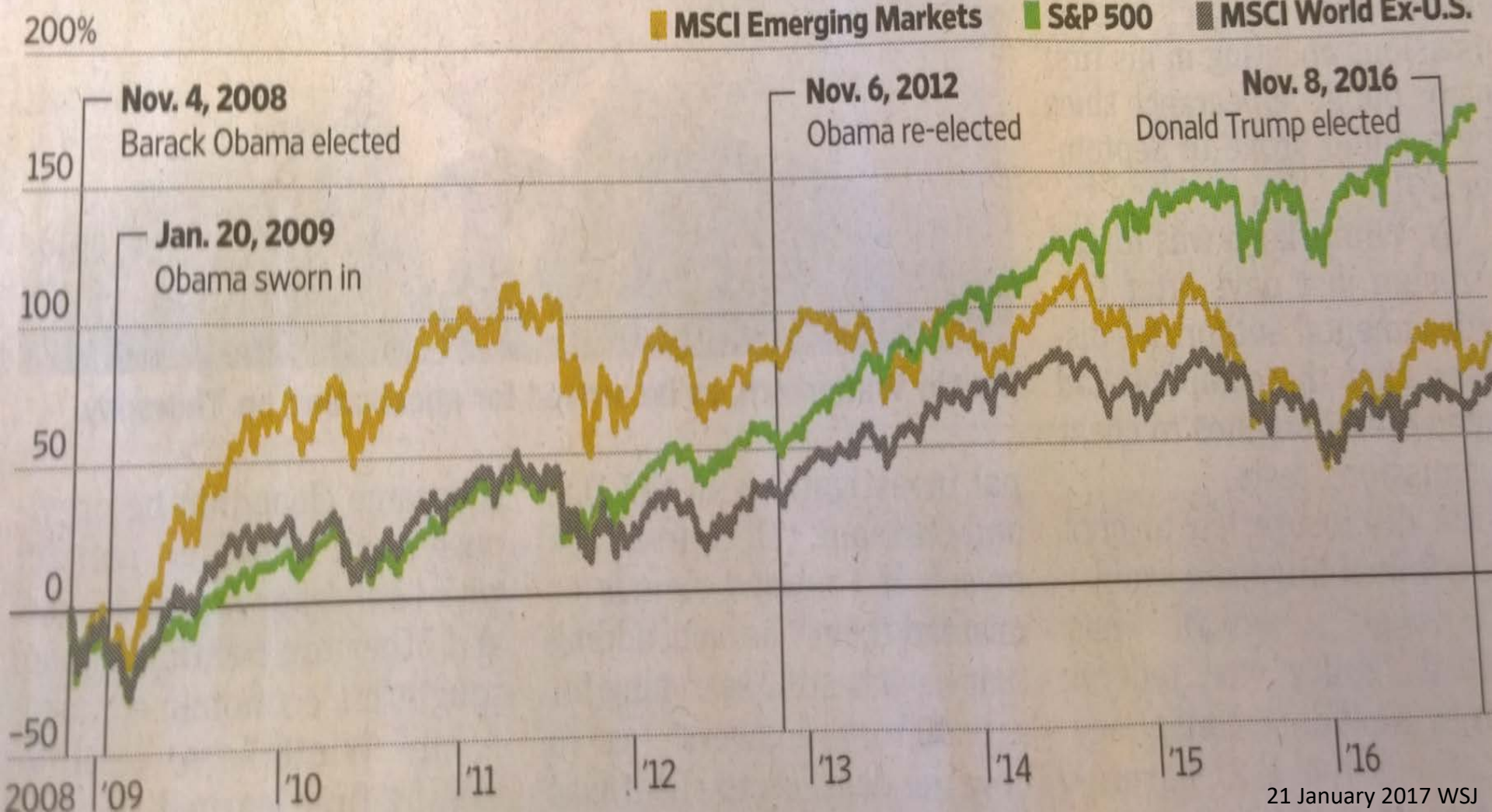
If you cannot provide an outcome (product, service) then there is nothing to buy. Hence, the absence of markets in the absence of desired outcomes.

Demand for outcome generates the strength and penetration in a market. Demand may be obvious (drinking water in Sahara Desert) or demand may be created by introducing unanticipated outcome (iPod).

Obama's Market Legacy

Since Barack Obama was elected, U.S. stocks have had one of their best-ever rallies despite slower-than-usual economic growth.

Total return
Percentage change



21 January 2017 WSJ

President Obama Administration Outcomes

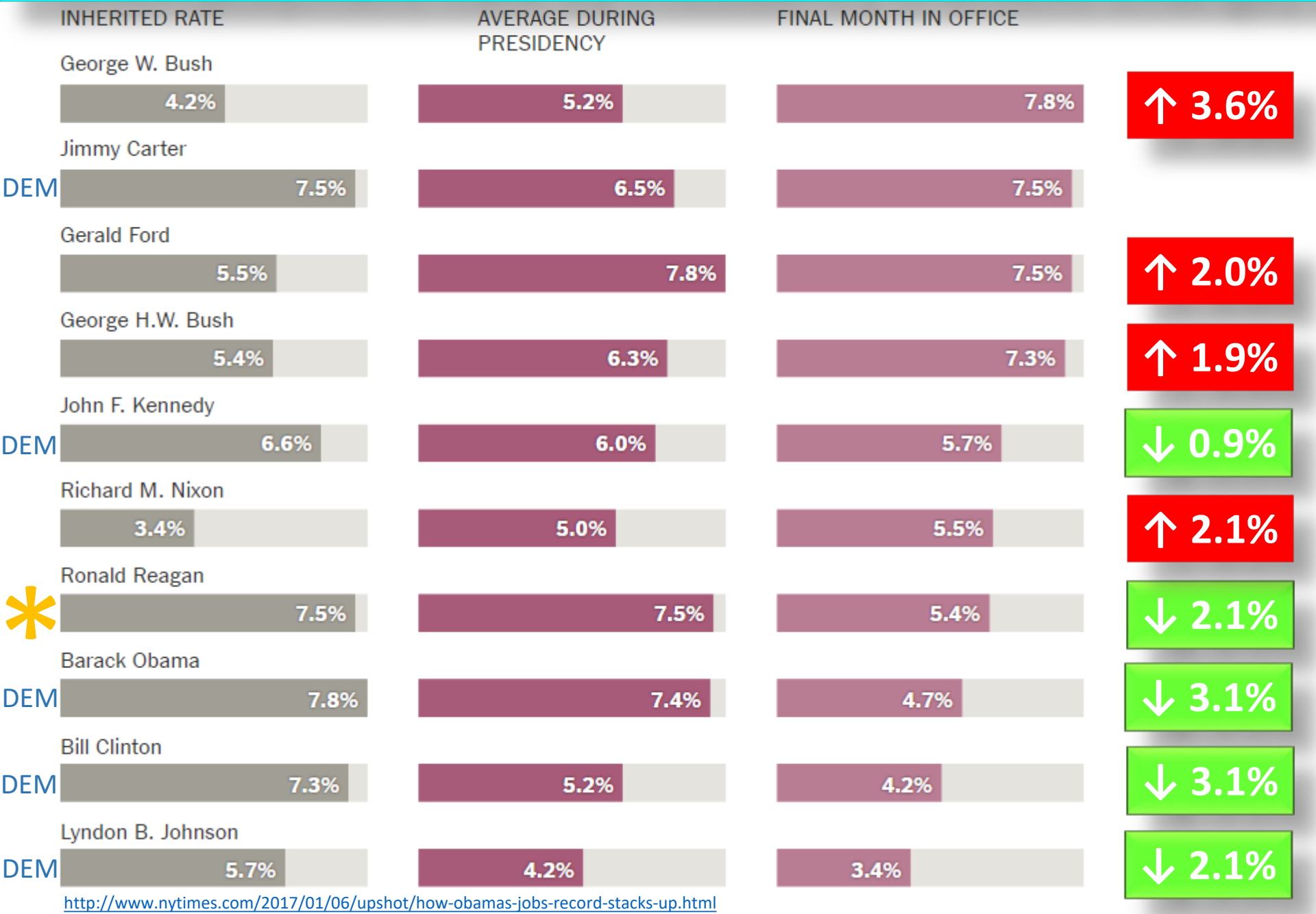
Statistics covering his first month in office through late this year, unless otherwise noted.

Stock markets	Corporate profits	Nat'l debt	Auto sales	Consumer sentiment	Home prices	Real G.D.P.	No. of jobs*	Uninsured Americans	Federal deficit
+180 %	+112 %	+88 %	+85 %	+60 %	+24 %	+15 %	+8 %	−39 %	−58 %

Up, but the deficit is down (see right)

WSJ

Unemployment Rate by Presidency (Percent Change)



http://www.nytimes.com/2017/01/06/upshot/how-obamas-jobs-record-stacks-up.html

S&P 500 annualized percentage change

● Democratic
● Republican

	In office	First election to inauguration	During time in office
● H. Hoover	1929-33	47.1%	-30.8%
● F. D. Roosevelt[1]	1933-45	-49.1	7.5
● H. S. Truman	1945-57	-29.1	8.3
● D. D. Eisenhower	1953-61	33.4	11.8
● J. F. Kennedy[1]	1961-63	-4.3	5.3
● L. B. Johnson	1963-69	14.7	8.2
● R. Nixon[2]	1969-74	10.5	-2.5
● G. Ford	1974-77	Not elected	10.4
● J. Carter	1977-81	-0.6	6.3
● R. Reagan	1981-89	10.0	10.2
● G. H. W. Bush	1989-93	22.7	10.9
● W.J. Clinton	1993-01	15.9	15.2
● G. W. Bush	2001-09	-27.2	-6.2
● **B. Obama**	2009-17	-65.1	13.8
● D. Trump	2017-?	36.1	Not known

Annualized total return under President Obama

	2008 election to 2016 election	During time in office
S&P 500	12.3%	16.3%
S&P 500 industrials	12.8	17.3
S&P 500 consumer discretionary	18.6	22.2
S&P 500 consumer staples	12.9	14.3
S&P 500 technology	16.4	20.0
Developed world ex-U.S.	6.3	9.4
S&P Smallcap 600	13.6	18.9
Junk bonds[4]	10.4	10.7
10-year U.S. Treasury	5.2	3.0
30-year U.S. Treasury	6.0	2.2
Gold	6.7	4.4
WTI crude oil[3]	-5.5	3.6
Trade-weighted dollar[3]	1.7	1.9
Consumer-price index[3]	1.6	1.7
House prices (S&P Case-Shiller)[3]	2.1	2.5

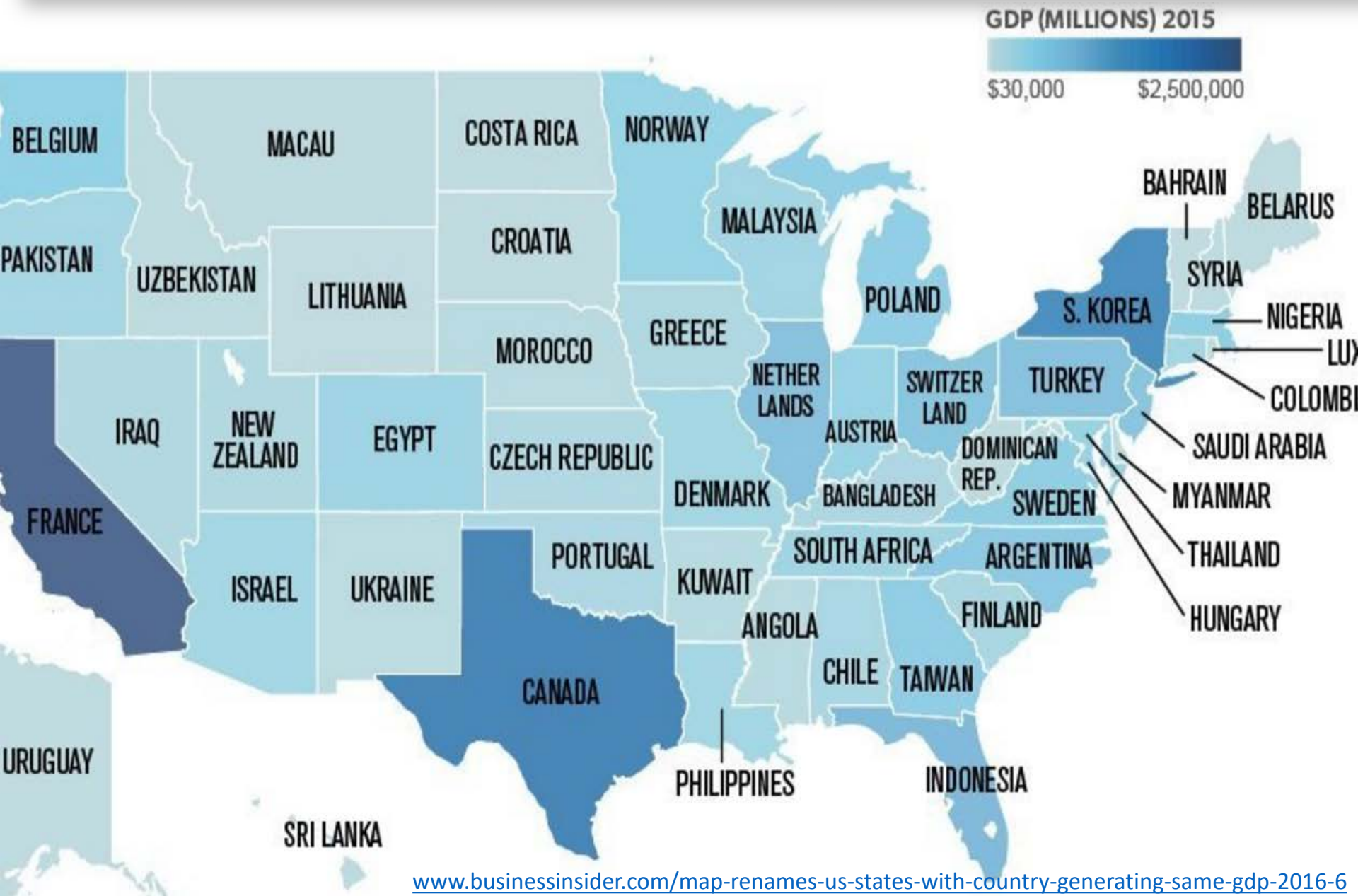
Note: Data through Wednesday [1]Died in office [2]Resigned [3]Price only [4]SPDR Bloomberg Barclays High Yield Bond ETF

Sources: Birinyi Associates, WSJ calculations (presidents); Thomson Reuters

THE WALL STREET JOURNAL.

21 January 2017

Outcome as GDP – US states comparable to countries



www.businessinsider.com/map-renames-us-states-with-country-generating-same-gdp-2016-6

The Economist **Chinese equivalents**

GDP | **GDP per person** | Population | Exports

GDP per person

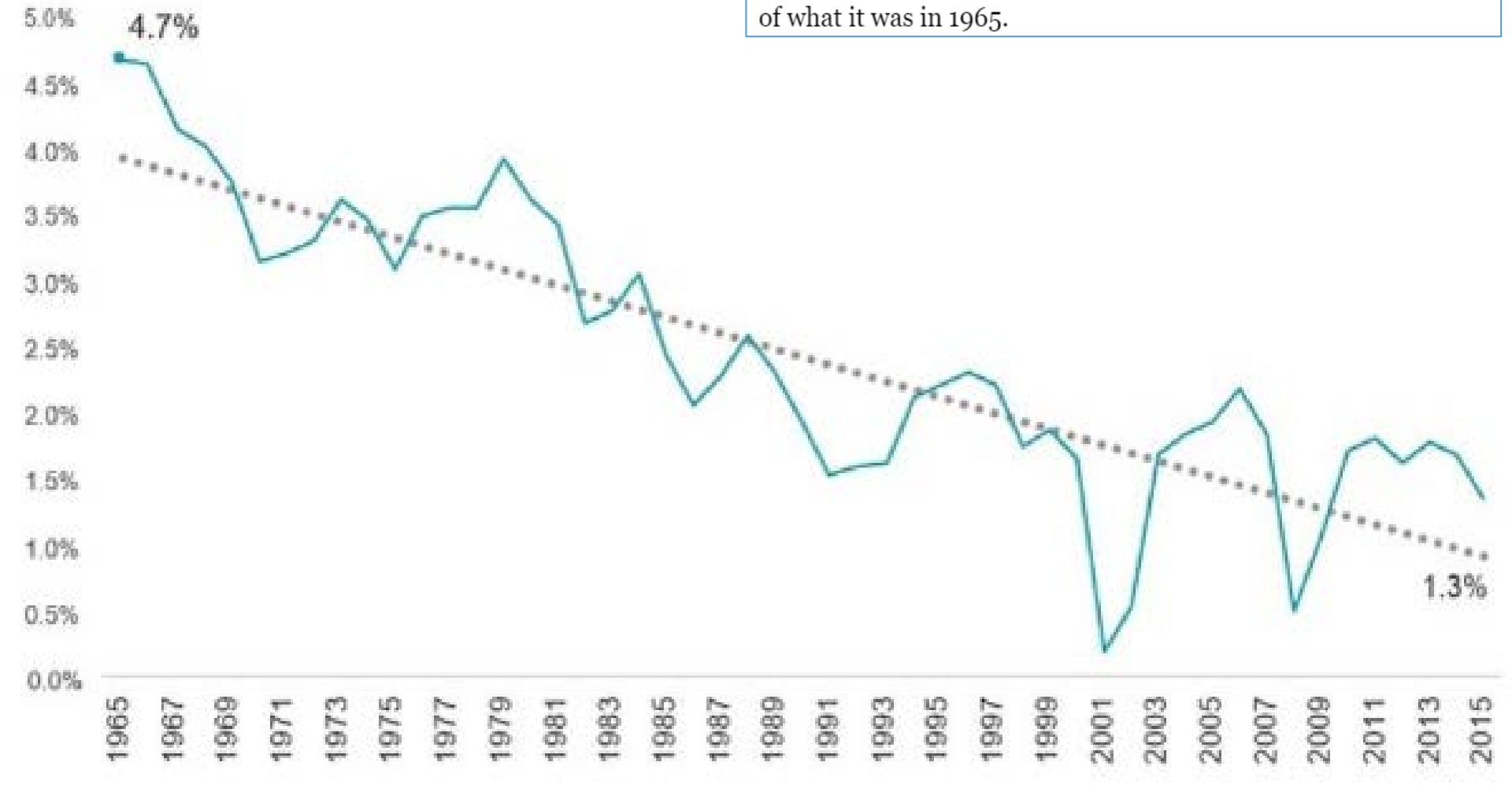
2010, $'000 at PPP*

Select

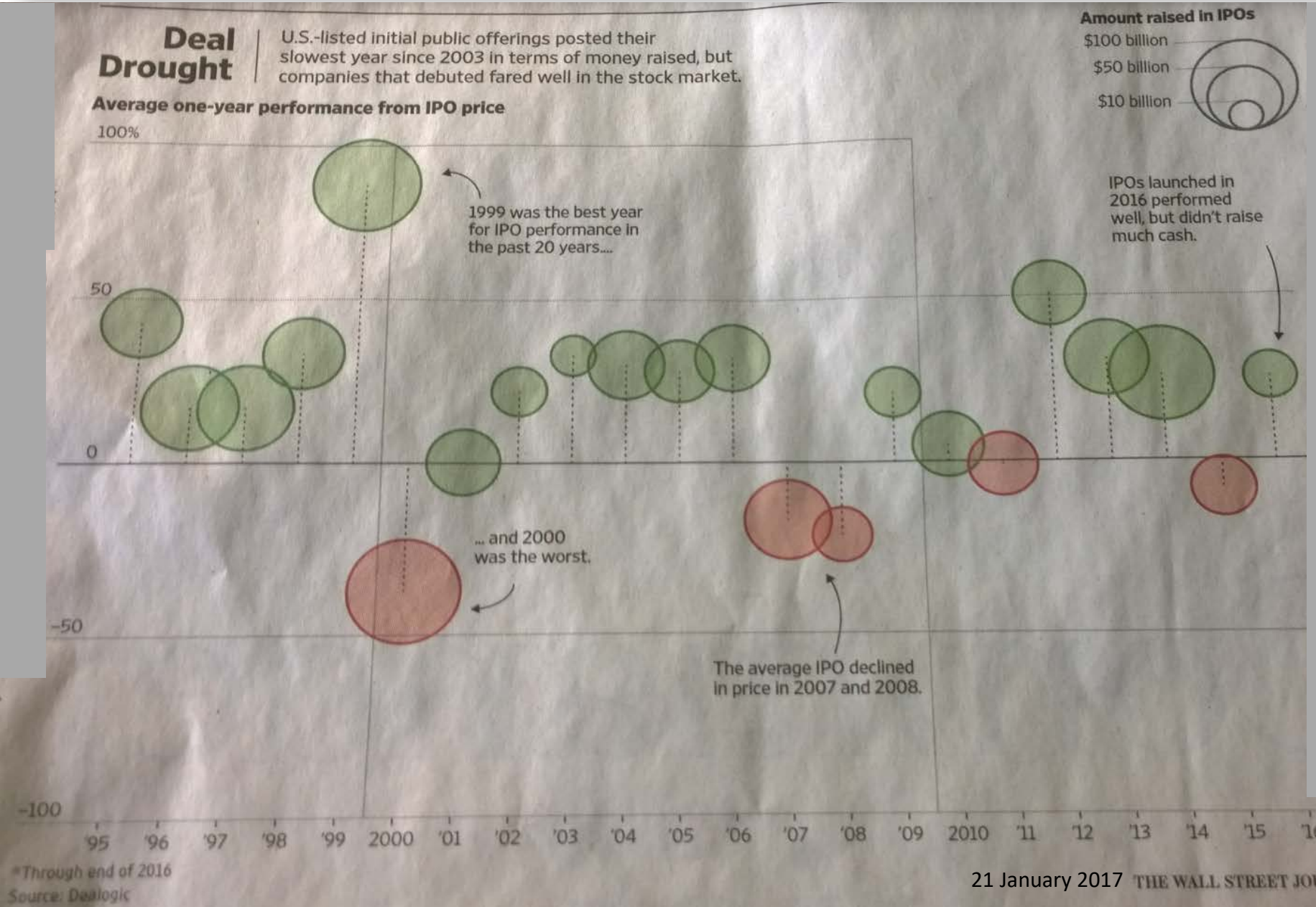
Less than 5 | 5 - <10 | 10 - <20 | 20 - <30 | 30 or more

Poor Outcome? Return on Assets (RoA) of US Firms

The Shift Index is a magisterial study of the performance of 20,000 US organizations from 1965 to 2010. It was put together by Deloitte's Center For the Edge led by John Hagel and John Seely Brown. It shows a general picture of performance decline in the U.S. private sector over 45 years, including the conclusion that the rate of return on assets of these firms is only one quarter of what it was in 1965.



Poor Outcome? US-based Initial Public Offering Market



21 January 2017 THE WALL STREET JOURNAL.

The Practice of the Outcome Economy

Customers don't want a circulation pump …

… they want a cozy and warm home.

J	O	B	S
Job-to-be-Done Context-specific **problem** facing a customer	**Objectives or Outcomes** Functional, emotional, social **metrics**	**Barriers** Factors inhibiting getting job done (**pains / gains**)	**Solutions** Products, services, compensating behaviors

M.W. Johnson: Seizing the white space, 2010

The Principles of the Outcome Economy

The Practice of the Outcome Economy

"People don't want to buy a quarter-inch drill… …they want a quarter-inch hole!"
- Theodore Levitt

Solution
What?

Job
Why?

And they want this hole without

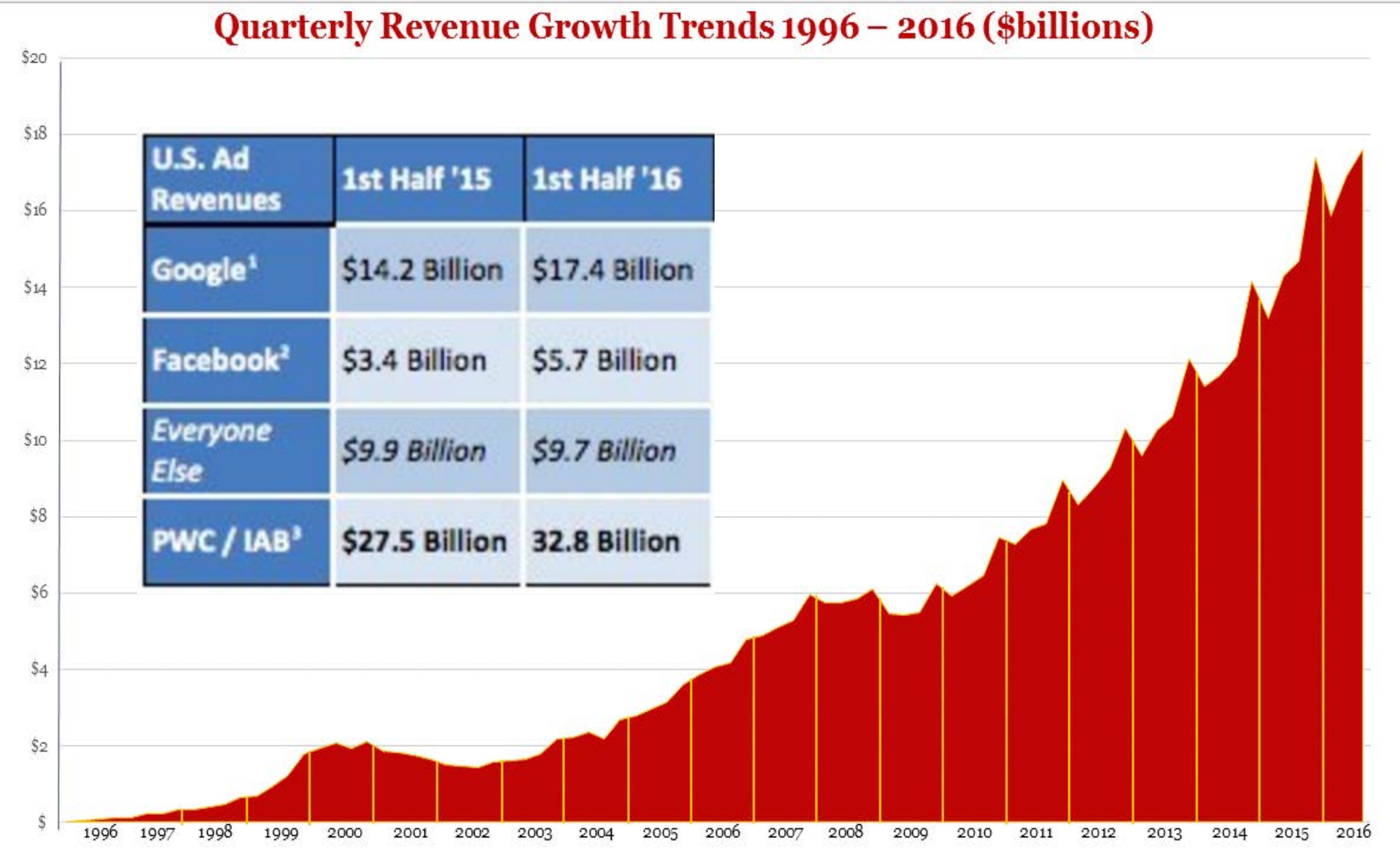
- getting hurt
- falling from a ladder
- having to clean up
- drill a crooked hole
- …

J	O	B	S
Job-to-be-Done Context-specific **problem** facing a customer	**Objectives or Outcomes** Functional, emotional, social **metrics**	**Barriers** Factors inhibiting getting job done (**pains / gains**)	**Solutions** Products, services, compensating behaviors

The Principles of the Outcome Economy

Ad Revenue Growth for Dominant Platforms

www.iab.com/wp-content/uploads/2016/12/q3-2016-internet-ad-revenues-hit-17-6-billion-climbing-20-year-over-year-according-to-iab.gif



U.S. Ad Revenues	1st Half '15	1st Half '16
Google[1]	$14.2 Billion	$17.4 Billion
Facebook[2]	$3.4 Billion	$5.7 Billion
Everyone Else	*$9.9 Billion*	*$9.7 Billion*
PWC / IAB[3]	$27.5 Billion	32.8 Billion

https://www.iab.com/insights/iab-internet-advertising-revenue-report-conducted-by-pricewaterhousecoopers-pwc-2/

Markets are about Outcomes

If business is synonymous with profitability, it follows that success in the context of business outcomes, usually, are driven by the ability to profit.

What drives profitability?

Transaction cost

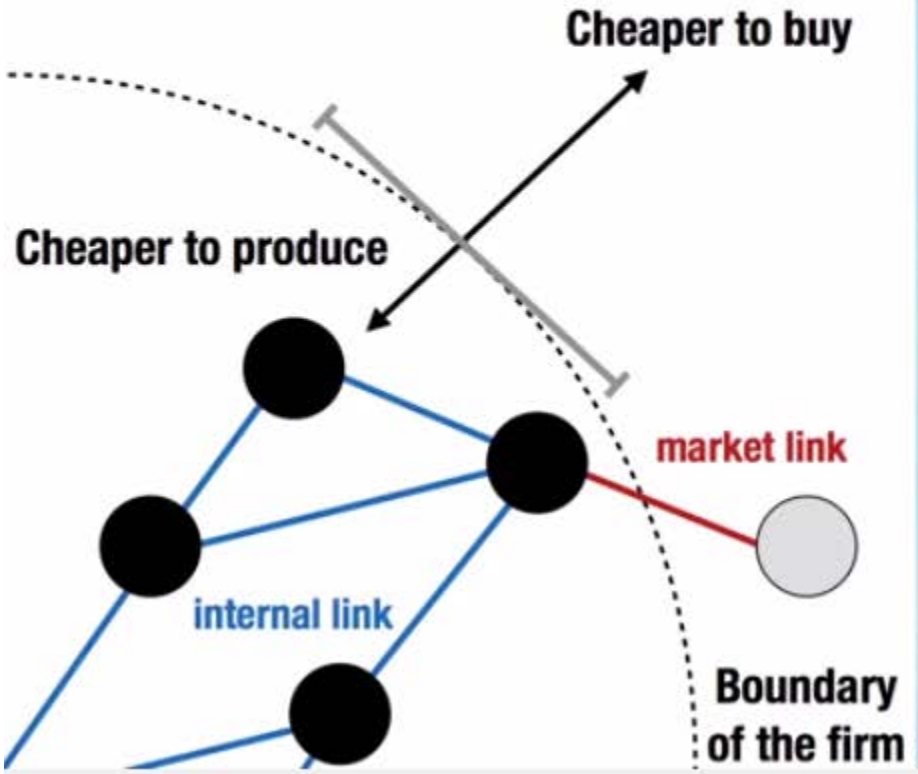
Outcomes which cannot deliver a higher margin of profit by increasing the transaction cost differential are not serving business and industry.

The Nature of the Firm – Transaction Cost

Written in 1937, when Coase was only 26, this paper tackles the question of why people choose to organize themselves in business firms rather than each contracting out for themselves.

Ronald Coase

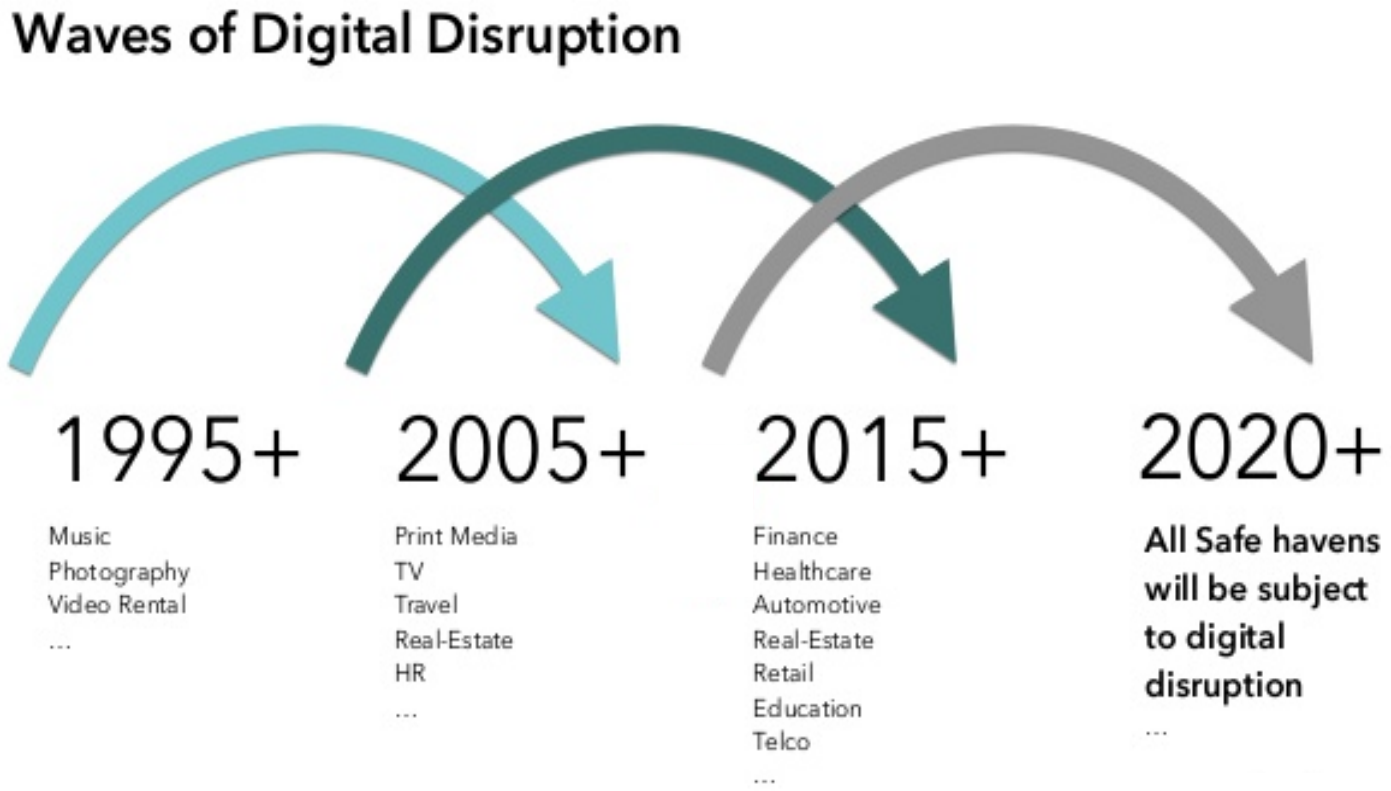
(1910-2013 - Nobel Prize 1991)



OUTCOME

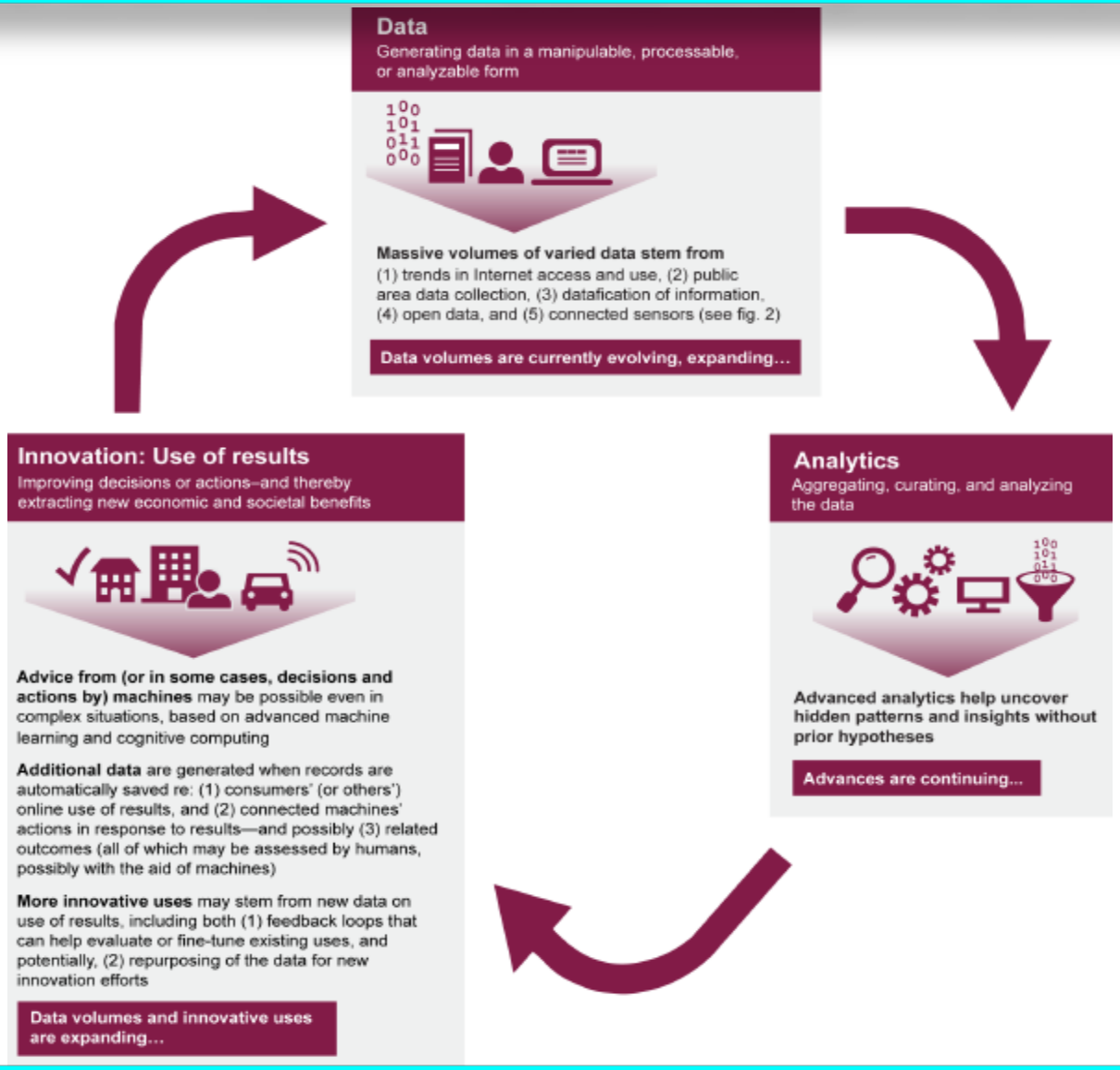
Ronald Coase, an LSE student from 1929–1932. http://bit.ly/COASE-5-PAPERS

Holy Grail – All Roads Lead to Digital Transformation



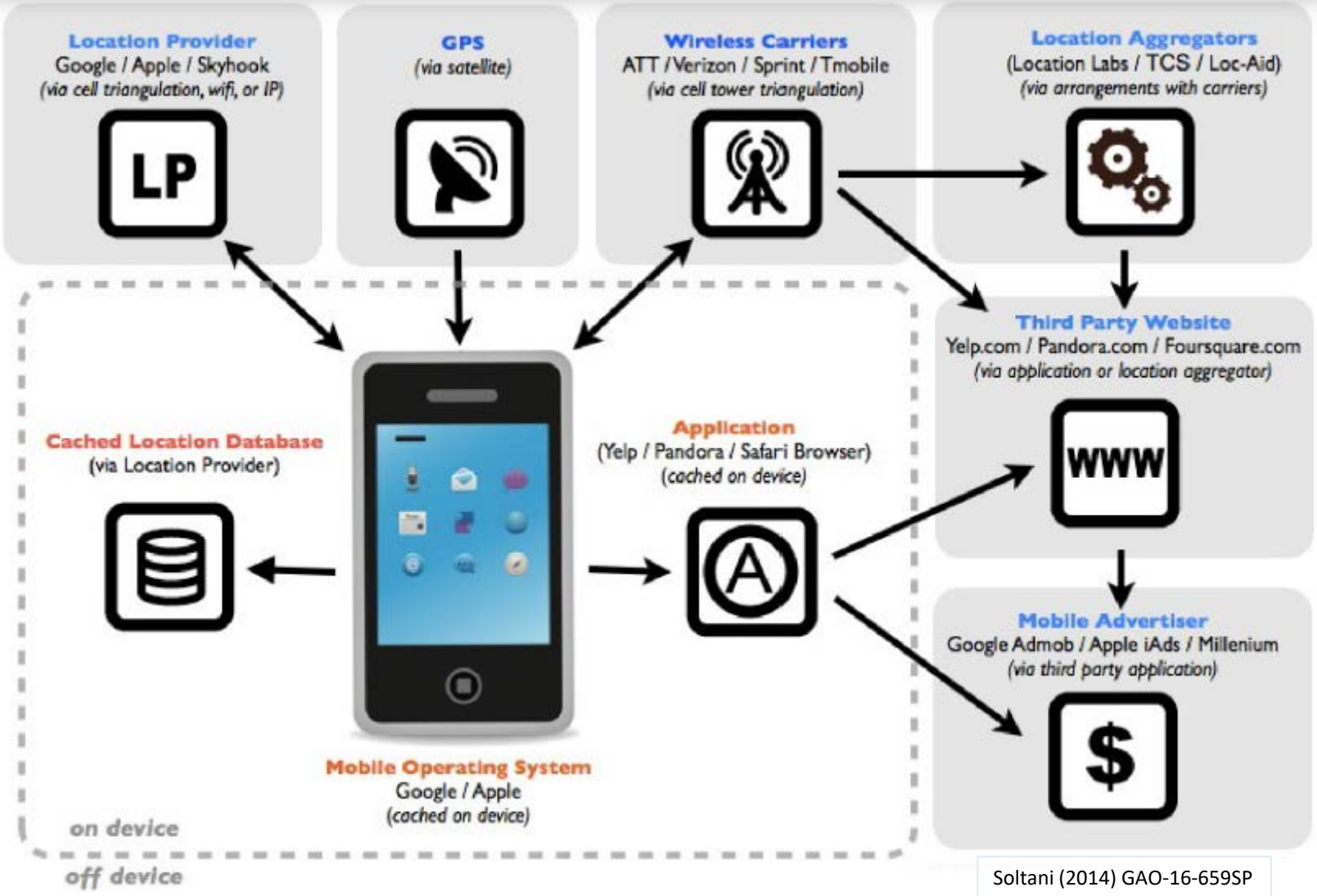
Digital Transformation - Reduce Transaction Cost?

Digital Transformation – Data, Analytics and Innovation



Data, Analytics, Innovation - Reduce Transaction Cost?

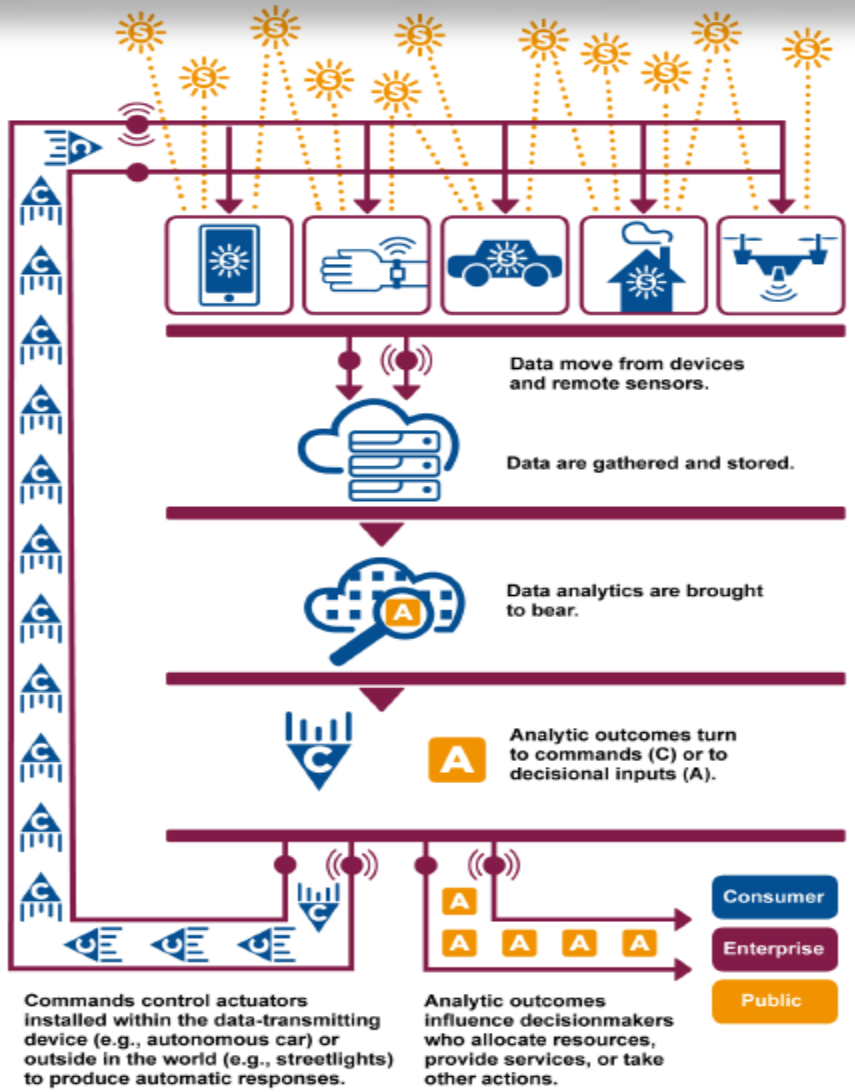
Digital Bread Crumbs? Data, Analytics and Innovation



Soltani (2014) GAO-16-659SP

Digital Footprint at the Edge: Reduce Transaction Cost?

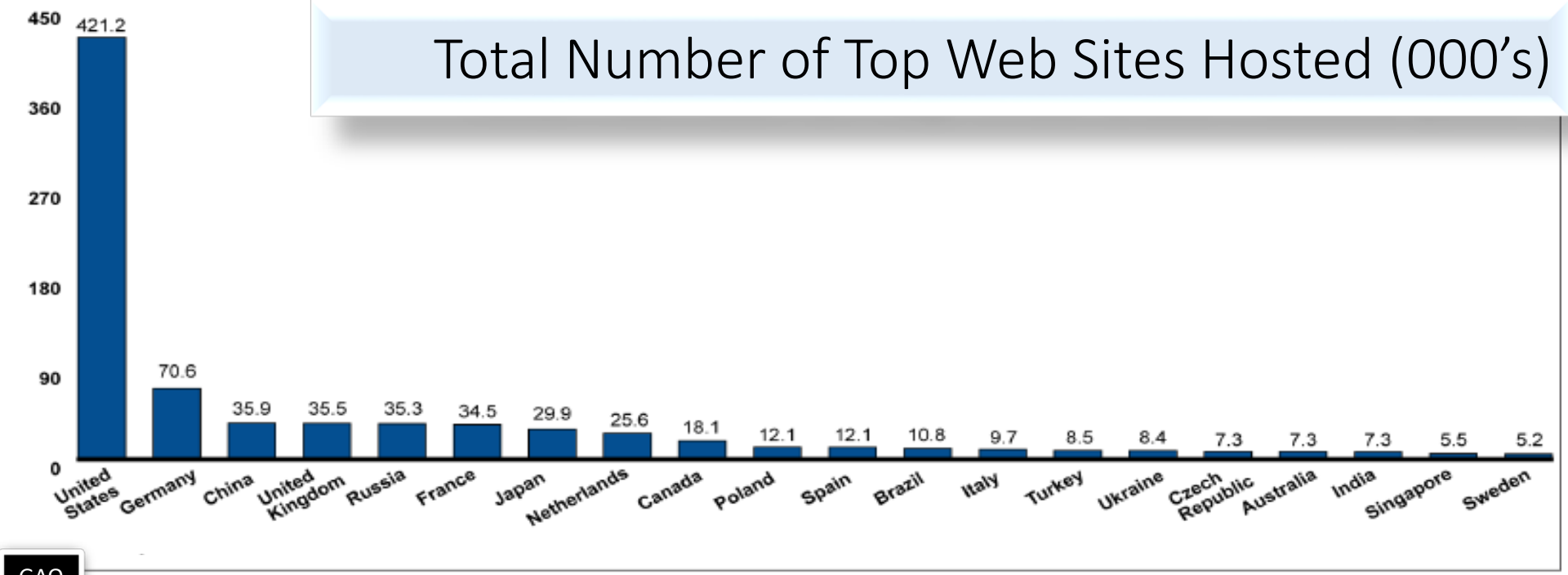
Digital Diaspora – Data, Analytics and Innovation



Source: GAO adapted from Goodman, 2015. | GAO-16-659SP

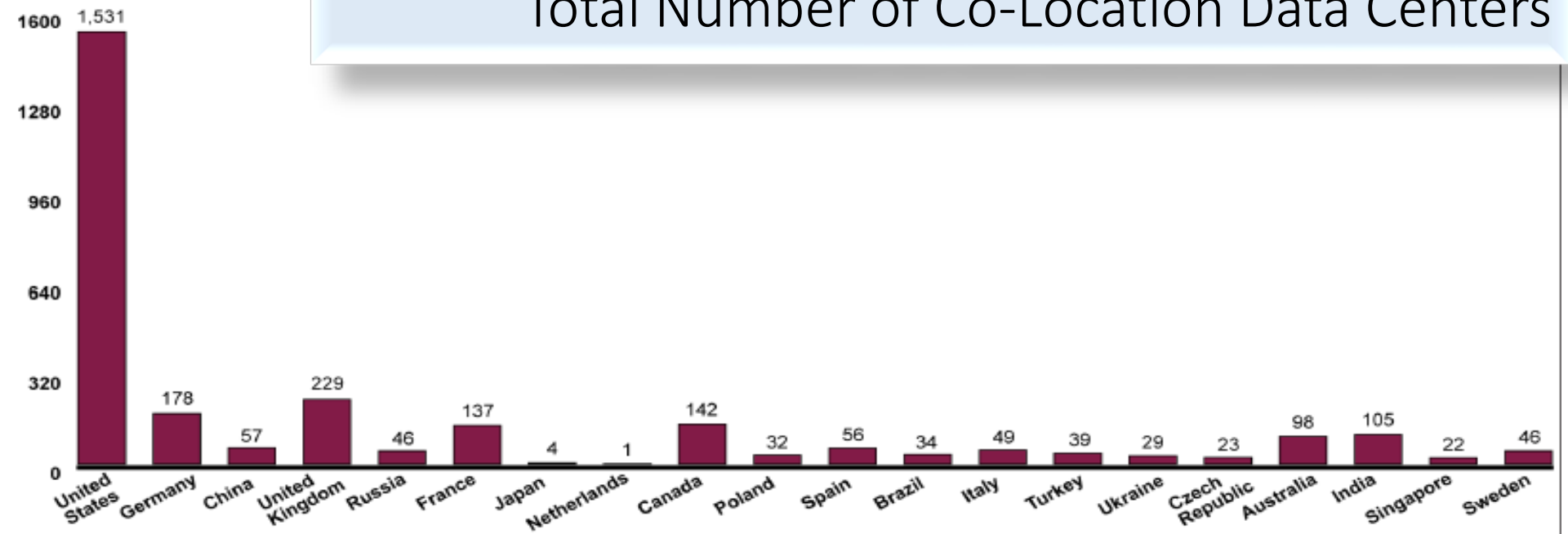
Digital Storage/Distribution - Reduce Transaction Cost?

Total Number of Top Web Sites Hosted (000's)

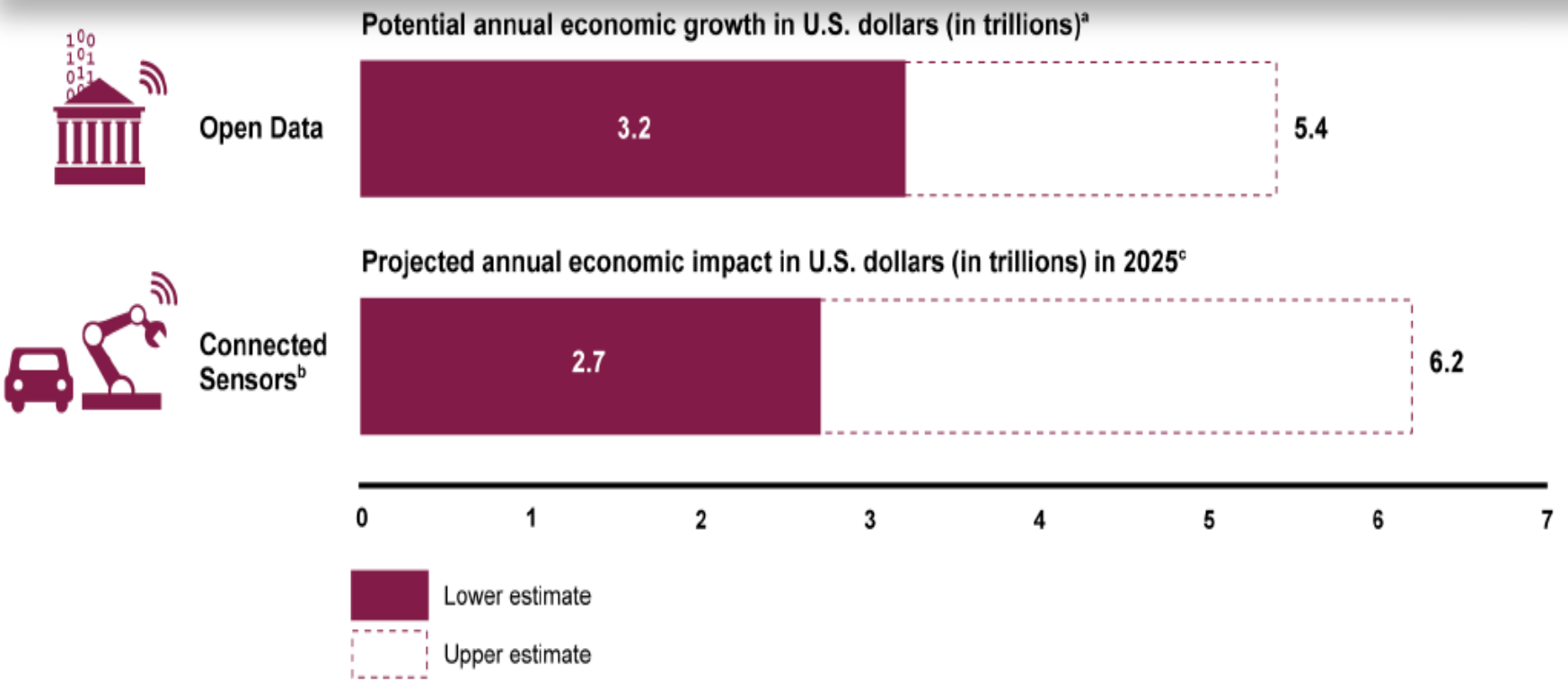


GAO

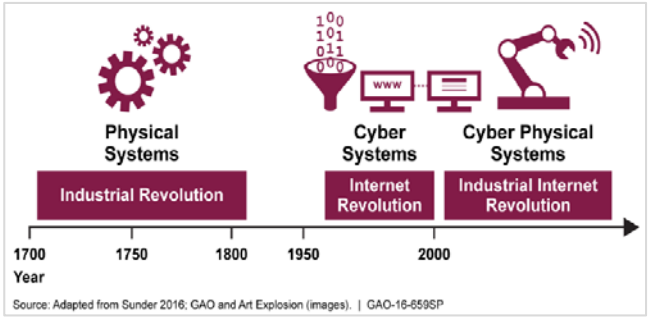
Total Number of Co-Location Data Centers



US GAO - Digital Transformation Opportunities from Data, Analytics and Innovation (DAI)



Source: GAO analysis based on the following: For open data, Manyika, Chui, Groves, et al. (2013; McKinsey Global Institute). For connected sensors, Manyika, Chui, Bughin et al. (2013; McKinsey Global Institute); GAO and Art Explosion (images). | GAO-16-659SP



Note: The estimates shown above are presented here to illustrate the potentially far-reaching nature of varied DAI opportunities. Given possible overlap of the two areas, and possible time-frame issues, these estimates are not additive.

[a]For the open data estimate, Manyika, Chui, Groves, et al. did not specify a future date.

[b]In this report, we use the term "connected sensors" to generally refer to the Internet of Things (IoT), the Industrial Internet, and cyber-physical systems.

[c]For this estimate, Manyika, Chui, Bughin, et al. defined economic impact as including "consumer surplus [and] . . . new revenue that . . . will contribute to GDP growth."

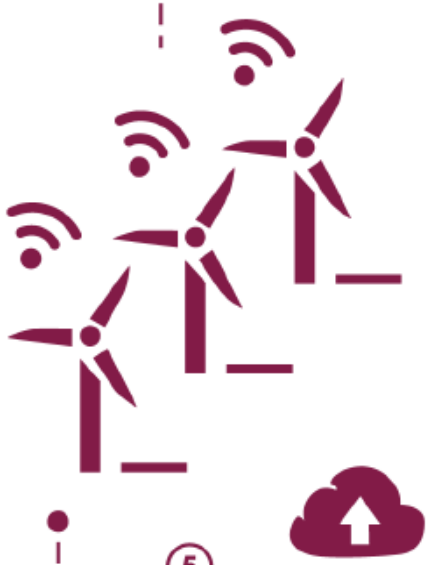
Digital Transformation – Industrial Internet of Things

Intelligent Machines

Through self-monitoring and transmission of sensor data, intelligent machines enable preventative maintenance and move closer to the goal of "no unplanned downtime."

Transmitting Valuable Data

Real-time information on the condition of individual assets reduces the need for higher-cost scheduled maintenance.



1. Self-monitoring turbines transmit sensor data
2. The data that is received and recorded enables the discovery of opportunities to lower maintenance and operating costs
3. Data analysis reveals a need for preventative maintenance
4. The technician is equipped with the right knowledge and tools to quickly and efficiently complete the task at hand
5. Data is sent back to the Industrial Internet, enabling remote collaboration and future use

Optimizing Operations

Operations centers engage in data segmentation and filtering for customized "fleet" views, historical analysis, real-time analysis and forecasting.

Empowering Technicians

The Industrial Internet provides workers with information and resources in real-time, improving productivity and driving more efficient work practices

Increase Business Profit - Reduce Transaction Cost?

Digital Transformation – People and Consumer centric

New York City building utilities benchmarking

Detailed information on energy and water consumption for each non-residential building in New York City was released in 2011 and is used by building operators to benchmark the energy efficiency of their buildings and identify opportunities for improvements.

Real-time train movements

Trafikverket, the transportation agency in Sweden, publishes real-time data on train departure and expected arrival times and track numbers for all trains traveling through the country. Third parties have used these data to create applications that allow travelers and shippers to make better-informed decisions on travel modes and routes.

Available parking spots

Real-time open data about available parking locations has been made available in cities such as Singapore, Chicago, and San Francisco. Applications that use this open data help drivers locate parking spaces, reducing parking search time. These data can also be used in infrastructure planning.

Census

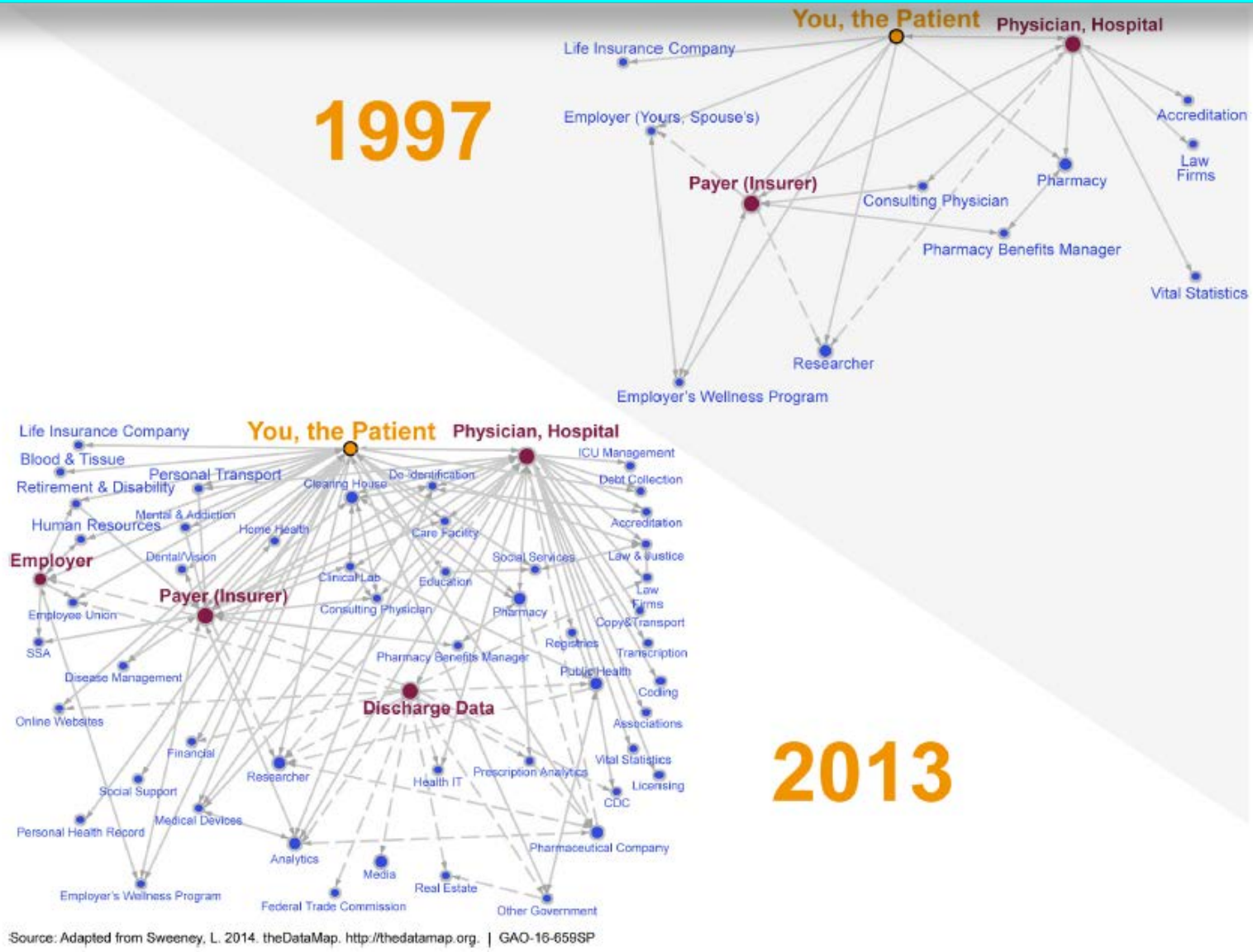
Census data are a classic example of open data. In the United States, the federal government must compile and publish census data periodically, as stipulated in the Constitution. The US census provides detailed information on demographic and socioeconomic trends, down to the zip code level, helping government guide delivery of services (for example, locating schools) and enabling stores to customize formats and merchandise. Other countries release similar information.

Social media entries

Social media are a growing source of wide-ranging information on customer preferences and experiences. Access to the full stream of social media content from a particular platform often requires some kind of commercial arrangement, so it is not fully open along the cost dimension, but it is relatively liquid.[a]

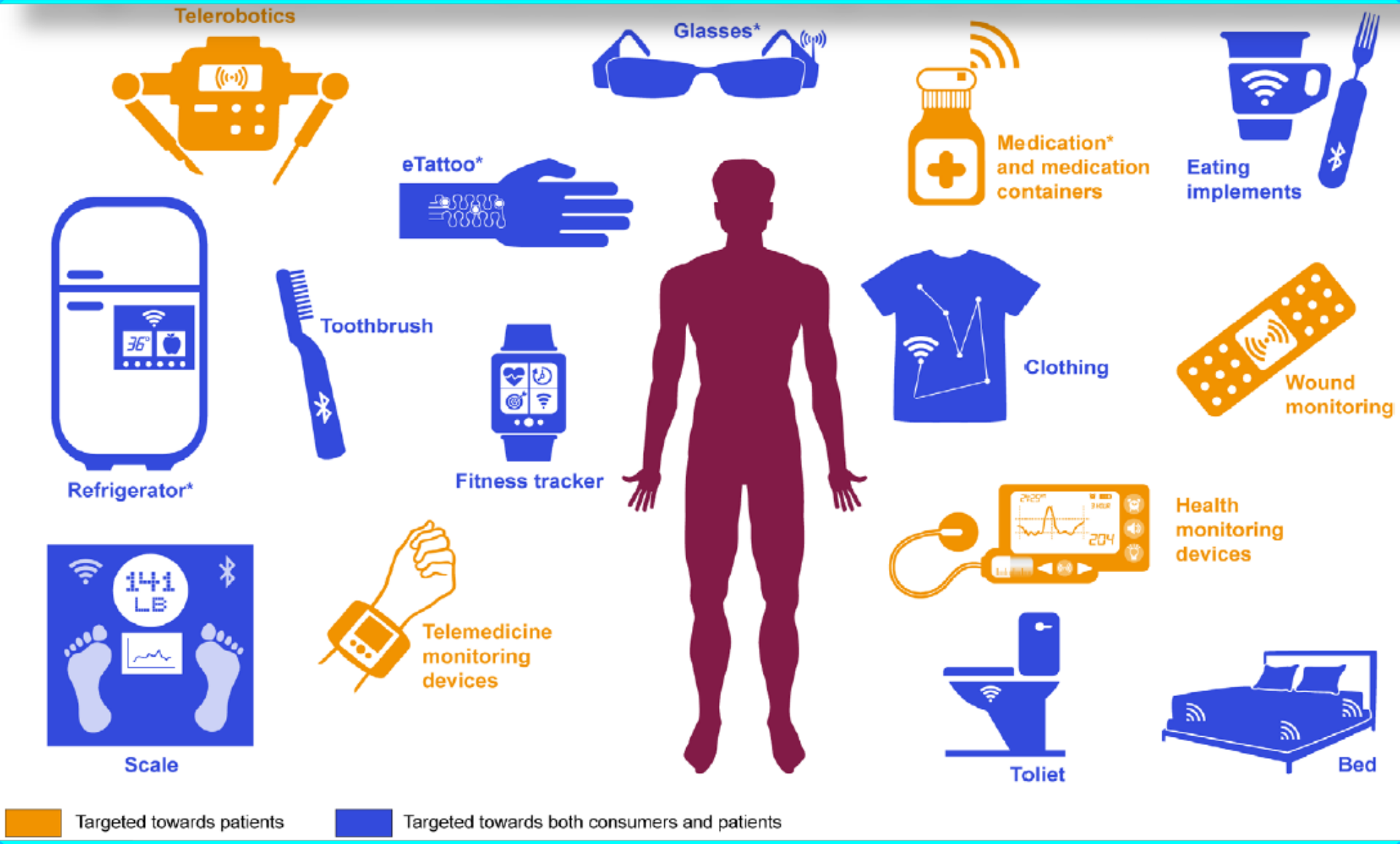
Who will reap the profit if we reduce transaction cost?

Digital Transformation in Healthcare Data 1997-2013



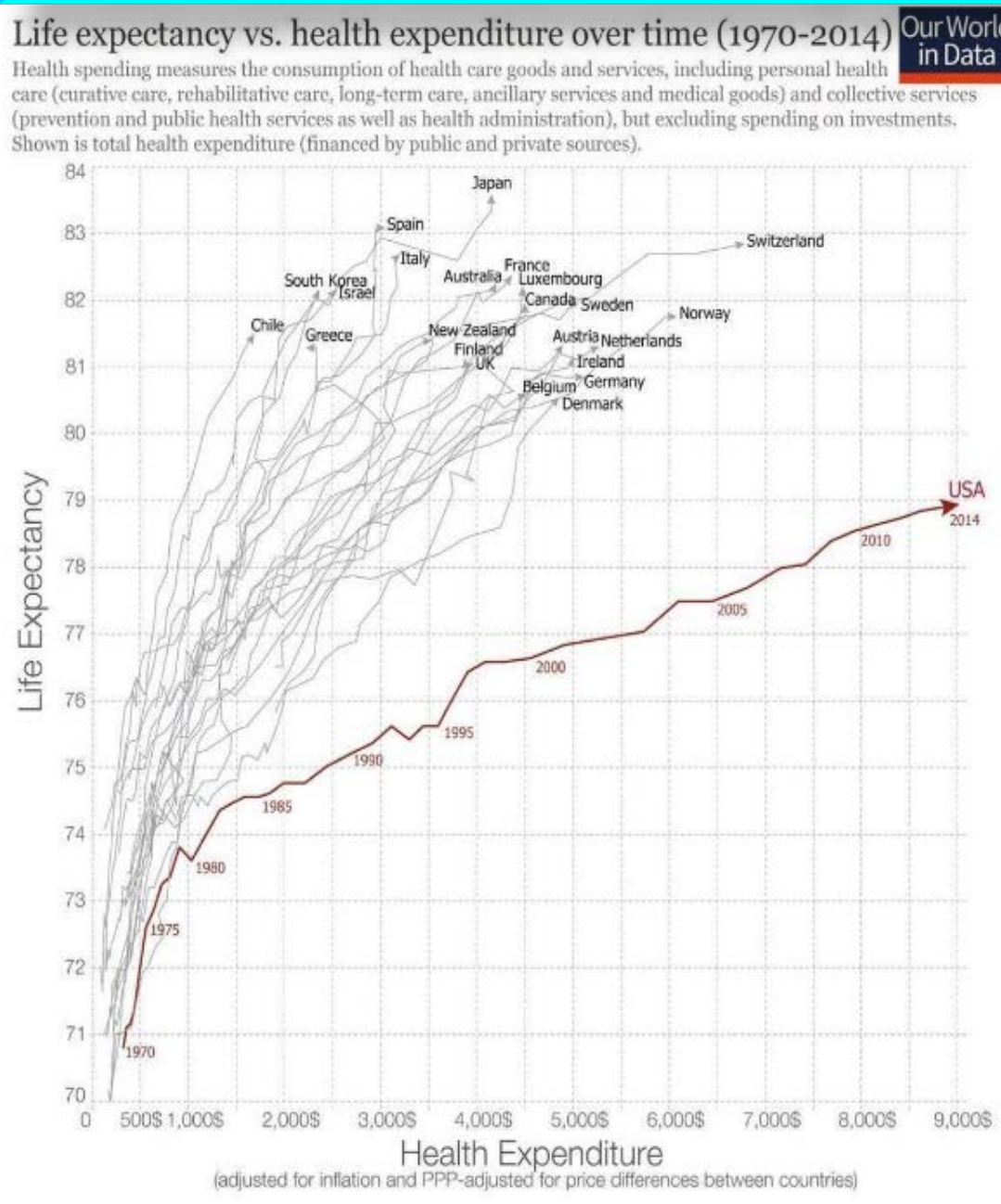
Improve Quality of Care and Reduce Transaction Cost?

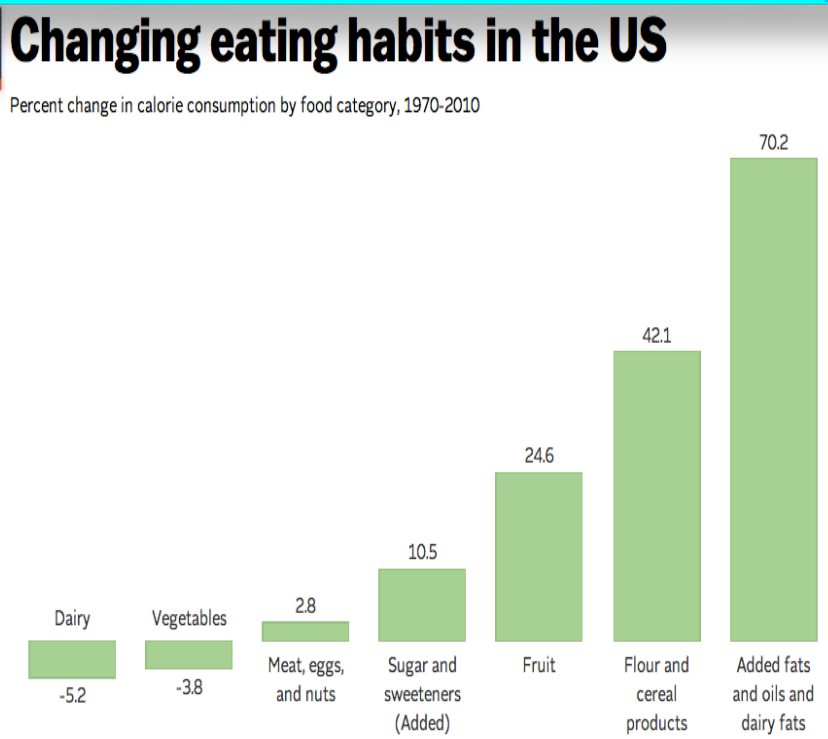
Digital Health – Prevention, People and Patient-centric



Critical need in healthcare to reduce transaction cost

US Healthcare: A Losing Battle? Bad Habits Die Hard





Source: USDA

World Sugar Trade (2010/2011)

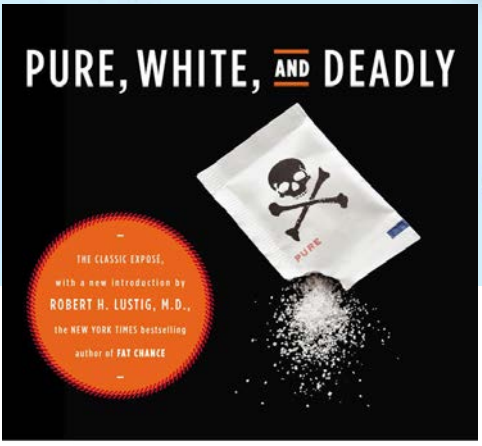
www.SAVEOURSUGAR.eu

SAVE OUR SUGAR

Support a Fair Deal for Cane Refiners

www.nytimes.com/2016/09/13/well/eat/how-the-sugar-industry-shifted-blame-to-fat.html?_r=0

www.npr.org/sections/thetwo-way/2016/09/13/493739074/50-years-ago-sugar-industry-quietly-paid-scientists-to-point-blame-at-fat



How Sugar Is Killing Us and What We Can Do to Stop It

John Yudkin

The sugar industry paid scientists in the 1960s to play down the link between sugar and heart disease and promote saturated fat as the culprit instead, newly released historical documents show.

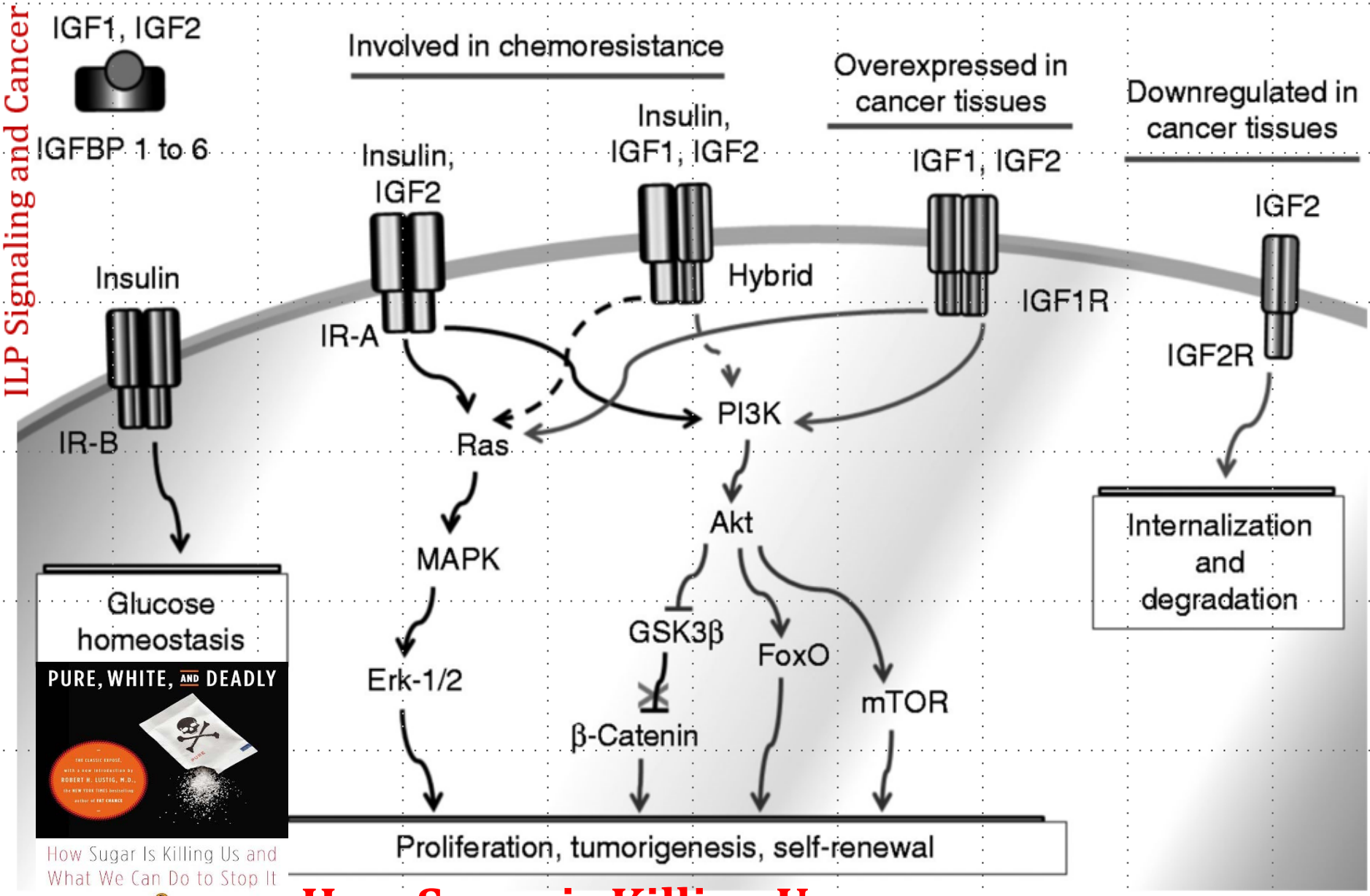
http://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2548255

The documents show that a trade group called the Sugar Research Foundation, known today as the Sugar Association, paid three Harvard scientists the equivalent of about $50,000 in today's dollars to publish a 1967 review of research on sugar, fat and heart disease. The studies used in the review were handpicked by the sugar group, and the article, which was published in the prestigious New England Journal of Medicine, minimized the link between sugar and heart health and cast aspersions on the role of saturated fat.

www.ncbi.nlm.nih.gov/pubmed/5339699

Insulin Resistance and Cancer

ILP Signaling and Cancer



How Sugar Is Killing Us and What We Can Do to Stop It

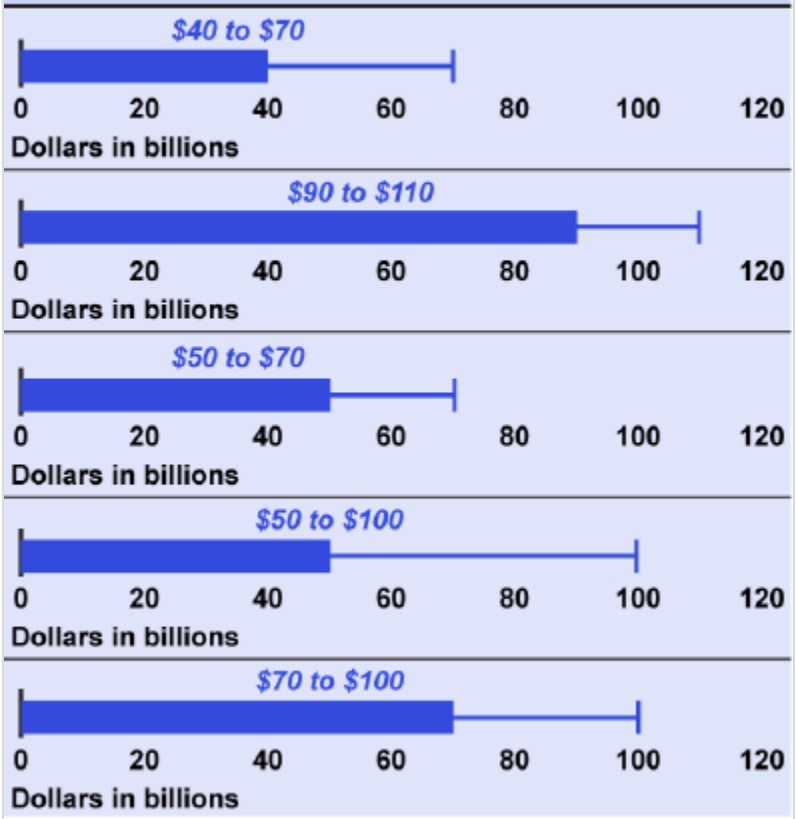
John Yudkin

How Sugar is Killing Us

www.ncbi.nlm.nih.gov/pubmed/23207292

Digital Transformation ↑ Patient-centric Healthcare

Healthcare Category	Key drivers of	Potential savings
Innovation	• Accelerating discovery in research • Improviding trial operations	$40 to $70
Care	• Alignment around proven pathways • Coordinated care across providers	$90 to $110
Provider	• Shifting volume to right care setting • Reducing emergency room/readmit	$50 to $70
Value	• Payment innovation and alignment • Provider-performance transparency	$50 to $100
Lifestyle	• Targeted disease prevention • Data-enabled adherence programs	$70 to $100



GAO-16-659SP

Potential for savings from reducing transaction costs?

Transaction Cost

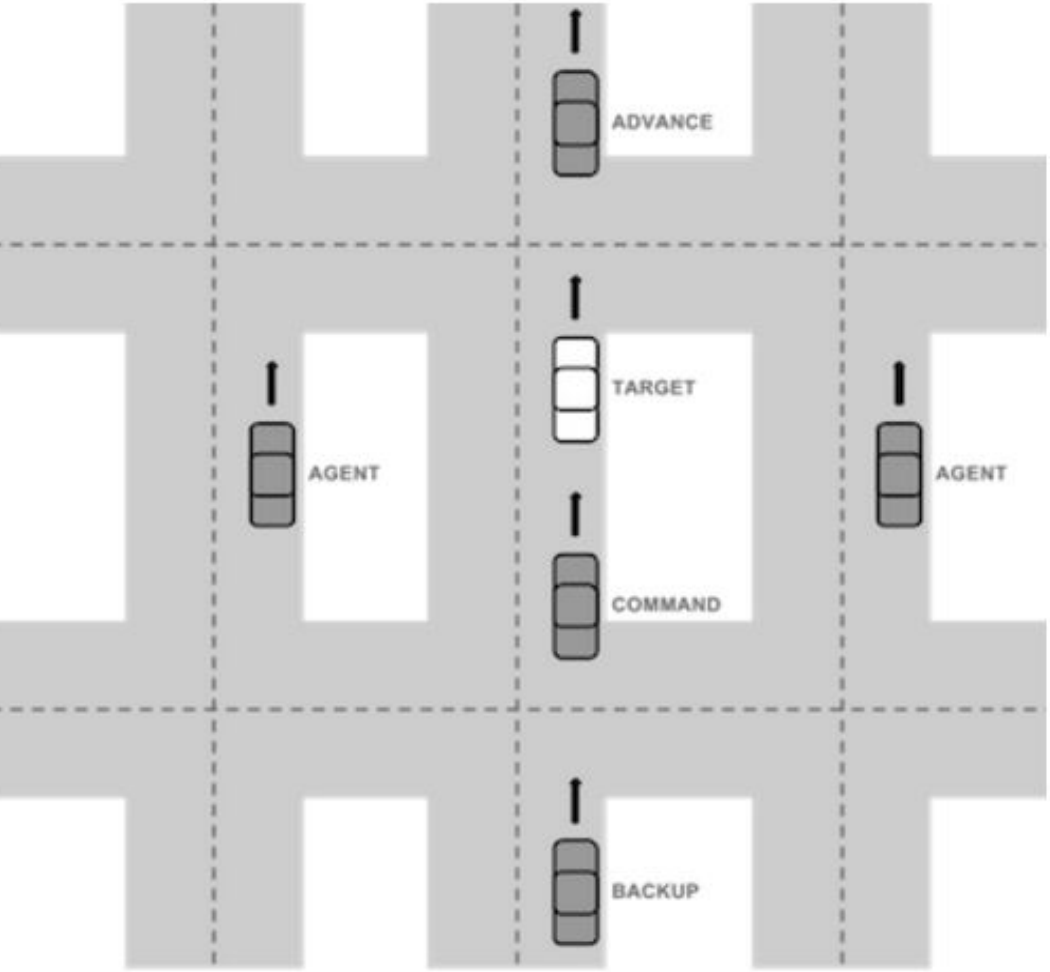
example of yet another dimension from Yale Law School

Cost of FBI surveillance of 325,000 individuals from 7 nations for 4 weeks

(Agent Cost Per Hour × Number of Agents) + (Vehicle Operating × Number of Vehicles)
= ($50/hour × 5) + ($5/hour × 5)
= $275/hour

$60 BILLION

$$\frac{\text{FBI Agent Salary + Benefits}}{\text{Working Hours in a Year}} = \frac{\$98{,}467 + 32{,}495}{2600} = \$50/\text{hour}$$



THE YALE LAW JOURNAL

PRINT ARCHIVE FORUM SUBMISSIONS MASTHEAD ABOUT CONTACT

VOLUME 123 2013-2014

FORUM

Tiny Constables and the Cost of Surveillance: Making Cents Out of *United States v. Jones*

09 JAN 2014

Kevin S. Bankston and Ashkan Soltani

INTRODUCTION

As Judge Richard Posner once said, "Technological progress poses a threat to privacy by enabling an extent of surveillance that in earlier times would have been prohibitively expensive," thereby "giving the police access to surveillance techniques that are ever less expensive and ever more effective."[1] Among these "'fantastic advances'"[2] in surveillance technology is the Global Positioning System (GPS), which provides law enforcement with an inexpensive means to track the precise geographic locations of criminal suspects. The Supreme Court recently addressed this technology in *United States v. Jones*, which considered whether the police's attachment of a GPS device to a suspect's car, and the use of that device to monitor the car's movements along public roads for twenty-eight days, constituted a search under the Fourth Amendment.[3]

Cost of FBI surveillance of 325,000 individuals from 7 nations for 4 weeks

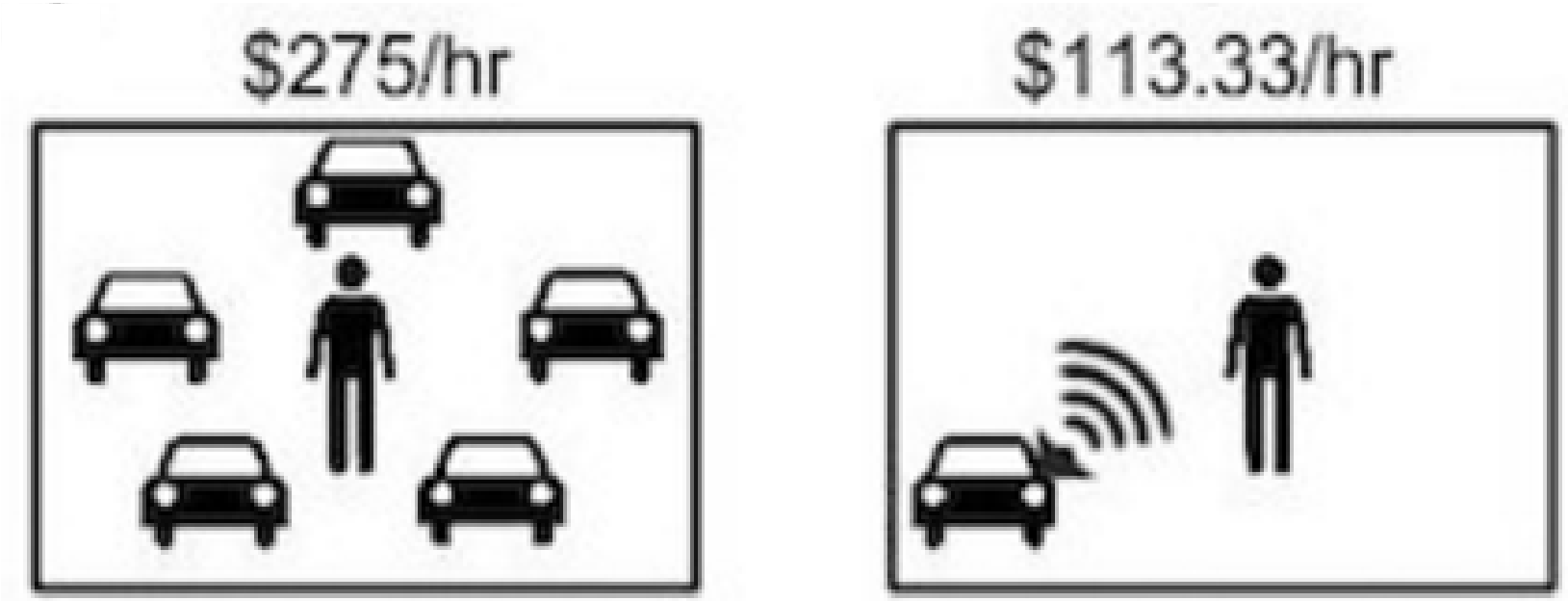
IMSI-catcher is a eavesdropping device to intercept mobile phone traffic and track mobile phone users.

$23 BILLION

$$\frac{\text{Device Install \& Remove Time} \times \text{Agent Cost Per Hour}}{\text{Range of Hours of Investigation}} + (\text{Agent Cost Per Hour} \times 2 \text{ Agents}) + \text{Vehicle Operating Cost Per Hour}$$

$$= \frac{4 \text{ hours} \times \$50}{(24 \text{ to } 627 \text{ hours})} + (\$50 \times 2) + \$5$$

$$= \$105 \text{ to } \$113 \text{ per hour}$$



Cost of FBI surveillance of 325,000 individuals from 7 nations for 4 weeks

$2 BILLION

Cost of FBI surveillance of 325,000 individuals from 7 nations for 4 weeks

Fees for obtaining cell location data $= \frac{\$0.04 \text{ to } \$5.21}{\text{hour}}$

$8 MILLION

Breakdown by Cell Carrier:

AT&T: $100 set up fee + $25/day
- For 1 day of surveillance: $125/24 hours = $5.21/hour
- For 1 month of surveillance:

$$\$100 \text{ set up} + (\$25/\text{day} \times 28 \text{ days}) = \frac{\$800}{28 \text{ days} \times 24 \text{ hours}} = \frac{\$800}{672 \text{ hours}} = \$1.19/\text{hour}$$

T-Mobile: $100/day = $4.17 /hour

Sprint: $30/month
- For 1 day of surveillance: $30/24 hours = $1.25/hour
- For 1 month of surveillance: $30/672 hours = $0.04/hour

$275/hr

$113.33/hr

$10/hr

$0.04/hr

Digital Surveillance – Reduced Transaction Cost

	1 day		1 week		28 days	
Method	Estimated cost	Cost per hour	Estimated cost	Cost per hour	Estimated cost	Cost per hour
Foot Pursuit	$1,200.00	$50.00	$8,400.00	$50.00	$33,600.00	$50.00
Car Pursuit	$2,520.00	$105.00	$17,640.00	$105.00	$70,560.00	$105.00
Covert Foot Pursuit	$6,000.00	$250.00	$42,000.00	$250.00	$168,000.00	$250.00
Covert Car Pursuit	$6,600.00	$275.00	$46,200.00	$275.00	$184,800.00	$275.00
Beeper	$2,720.00	$113.33	$17,840.00	$106.19	$70,760.00	$105.30
IMSI Catcher or "Stingray"	$2,520.00	$105.00	$17,640.00	$105.00	$70,560.00	$105.00
GPS	$240.00	$10.00	$240.00	$1.43	$240.00	$0.36
Cell Phone (AT&T)	$125.00	$5.21	$275.00	$1.64	$800.00	$1.19
Cell Phone (T-Mobile)	$100.00	$4.17	$700.00	$4.17	$2,800.00	$4.17
Cell Phone (Sprint)	$30.00	$1.25	$30.00	$0.18	$30.00	$0.04

$60 billion

100X

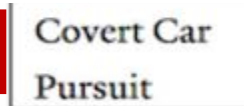
$8 million

Kevin S. Bankston & Ashkan Soltani, Tiny Constables and the Cost of Surveillance: Making Cents Out of United States v. Jones, 123 YALE L.J. ONLINE 335 (2014), http://yalelawjournal.org/forum/tiny-constables-and-the-cost-of-surveillance-making-cents-out-of-united-states-v-jones

Digital Surveillance { You Talk We Listen – NSA }

Kevin S. Bankston & Ashkan Soltani, Tiny Constables and the Cost of Surveillance: Making Cents Out of United States v. Jones, 123 YALE L.J. ONLINE 335 (2014), http://yalelawjournal.org/forum/tiny-constables-and-the-cost-of-surveillance-making-cents-out-of-united-states-v-jones

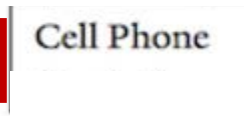
$60 billion



$60 BILLION - for 325,000 targets over 4 weeks

$275.00

$8 million



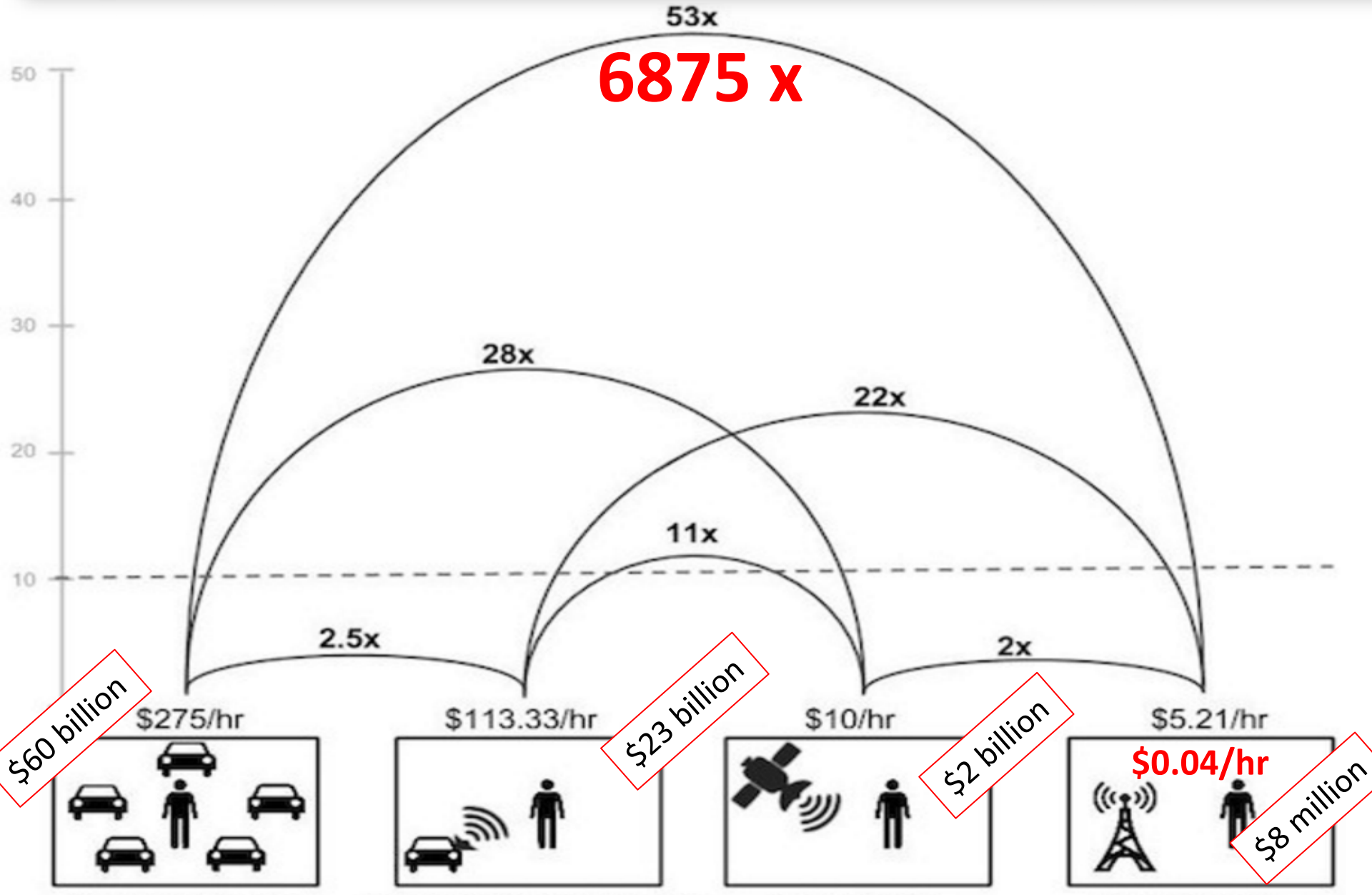
$8 MILLION - for 325,000 targets over 4 weeks

$0.04

Digital Surveillance – Please download the app

“ The Killer App ”

Digital Transformation – Reduce Transaction Cost



Transaction Cost

for public goods – healthcare – save lives

Markets want outcomes and solutions, not numbers

CONVERGE ON ONE PLATFORM ?

Platform and interoperability reduce transaction cost?

Leading causes of death in the USA

1. 597,689 Heart Disease
2. 574,743 Cancer
3. 138,080 Chronic lower respiratory diseases
4. 129,476 Stroke
5. 120,859 Accidents
6. 83,494 Alzheimer's disease
7. 69,071 Diabetes
8. 56,979 Influenza &Pneumonia
9. 47,112 Kidney diseases
10. 41,149 Suicide

www.cdc.gov/nchs/fastats/deaths.htm

● 2010 ● OIG HHS bad hospital care deaths about 180,000 patients in Medicare alone in a year

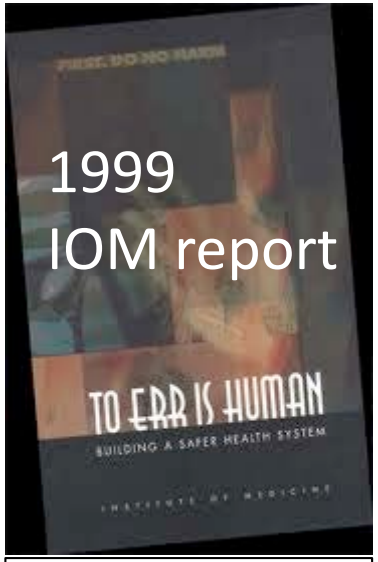
Patient Safety 2013
Exploring Quality of Care in the U.S.

How Many Die From Medical Mistakes in U.S. Hospitals?

A New, Evidence-based Estimate of Patient Harms Associated with Hospital Care

John T. James, PhD

Dr Julian Goldman



98,000
deaths due to error

210,000 – 440,000 deaths

400,000 deaths due to medical mistakes – shared with the US Senate

Deaths by medical mistakes hit records

Tejal Gandhi, MD, president of the National Patient Safety Foundation and associate professor of medicine, Harvard Medical School, spoke at the hearing.

The way IT is designed remains part of the problem

WASHINGTON | July 18, 2014

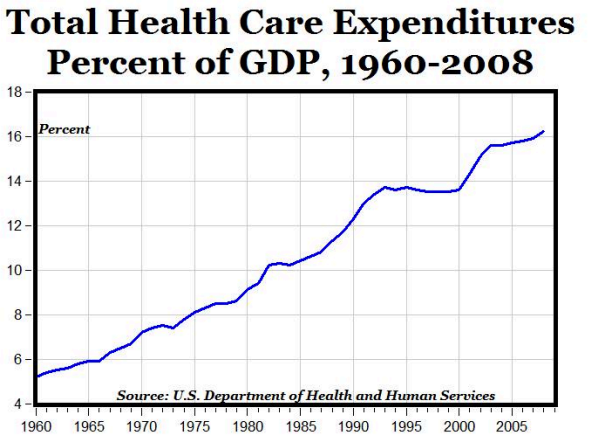
It's a chilling reality – one often overlooked in annual mortality statistics: Preventable medical errors persist as the No. 3 killer in the U.S. – third only to heart disease and cancer – claiming the lives of some 400,000 people each year. At a Senate hearing Thursday, patient safety officials put their best ideas forward on how to solve the crisis, with IT often at the center of discussions.

Hearing members, who spoke before the Subcommittee on Primary Health and Aging, not only underscored the devastating loss of human life – more than 1,000 people each day – but also called attention to the fact that these medical errors cost the nation a colossal $1 trillion each year.

"The tragedy that we're talking about here (is) deaths taking place that should not be taking place," said subcommittee Chair Sen. Bernie Sanders, I-Vt., in his opening remarks.

Third Leading cause of death in the USA ?

1. 597,689 Heart Disease
2. 574,743 Cancer
3. ***Deaths Due to Medical Errors (180,000 - 210,000 - 440,000)***
4. 138,080 Chronic lower respiratory diseases
5. 129,476 Stroke
6. 120,859 Accidents
7. 83,494 Alzheimer's disease
8. 69,071 Diabetes
9. 56,979 Influenza &Pneumonia
10. 47,112 Kidney diseases
11. 41,149 Suicide



Equivalent to at least one 747 airplane crash every day

Nurses blame interoperability woes for medical errors

$30B could be saved each year from better device coordination

March 16, 2015

Each year, a staggering 400,000 people are estimated to have died due to medical errors. What's more, each day there's also 10,000 serious complications resulting from medical mistakes. Part of the blame, nurses are saying, can be attributed to the lack of interoperability among medical devices.

MD PnP™

Getting Connected for Patient Safety™

Change Expectations > Change Technology > Change Healthcare

The Medical Device "Plug-and-Play" (MD PnP) Interoperability Program is promoting innovation in patient safety and clinical care by leading the adoption of patient-centric integration of medical devices and IT systems in clinical environments.

www.mdpnp.org

HOME | ABOUT PROGRAM | PROJECTS | NEWS | EVENTS | PUBLICATIONS & TALKS | OUR LAB | Sitemap

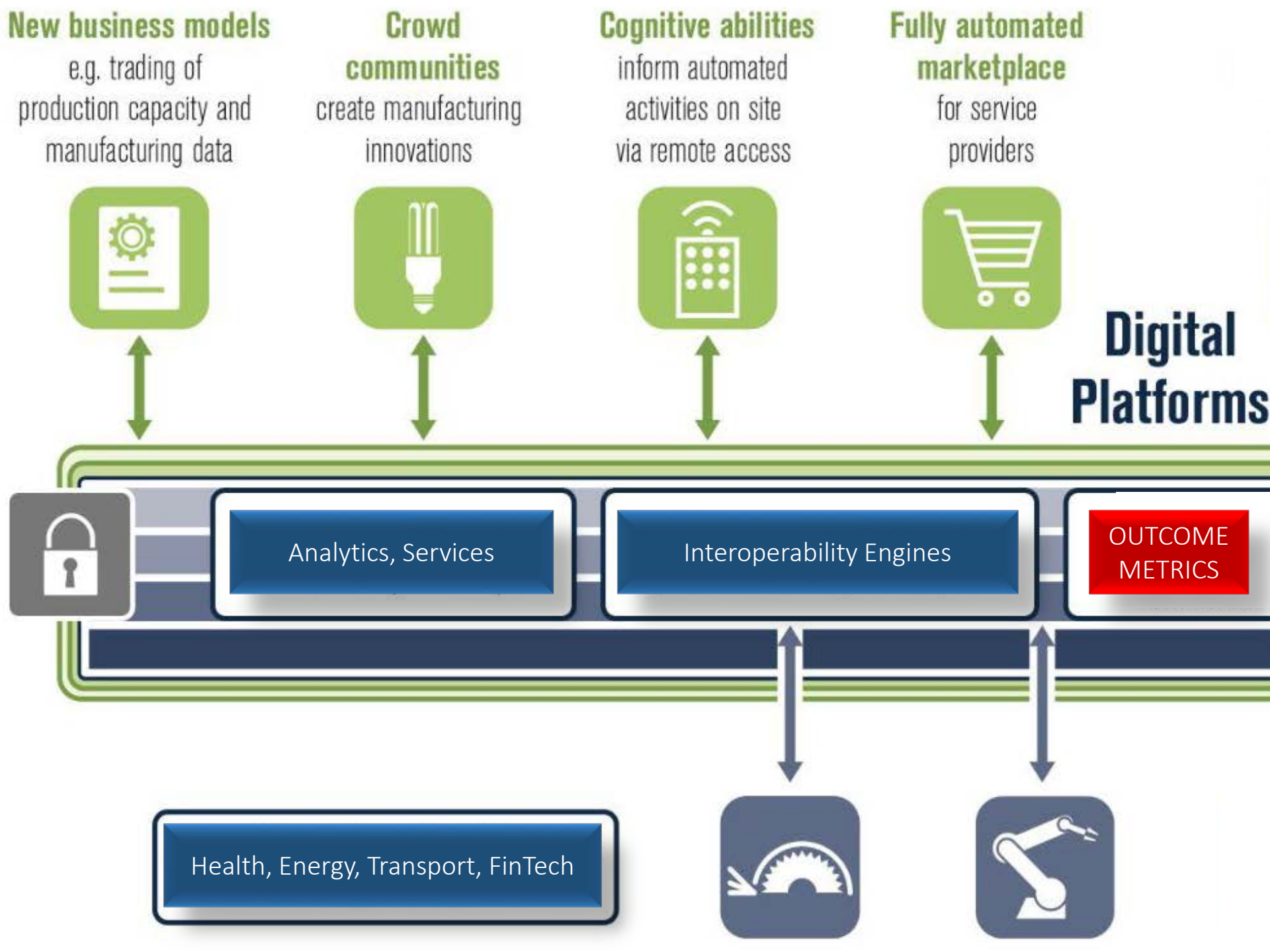
Medical Device "Plug-and-Play" Interoperability Program working on "safe interoperability™" to improve patient safety

MD PnP MedTech Hackathon Open Medical Device and Data Integration Platforms to Support the Management of Ebola

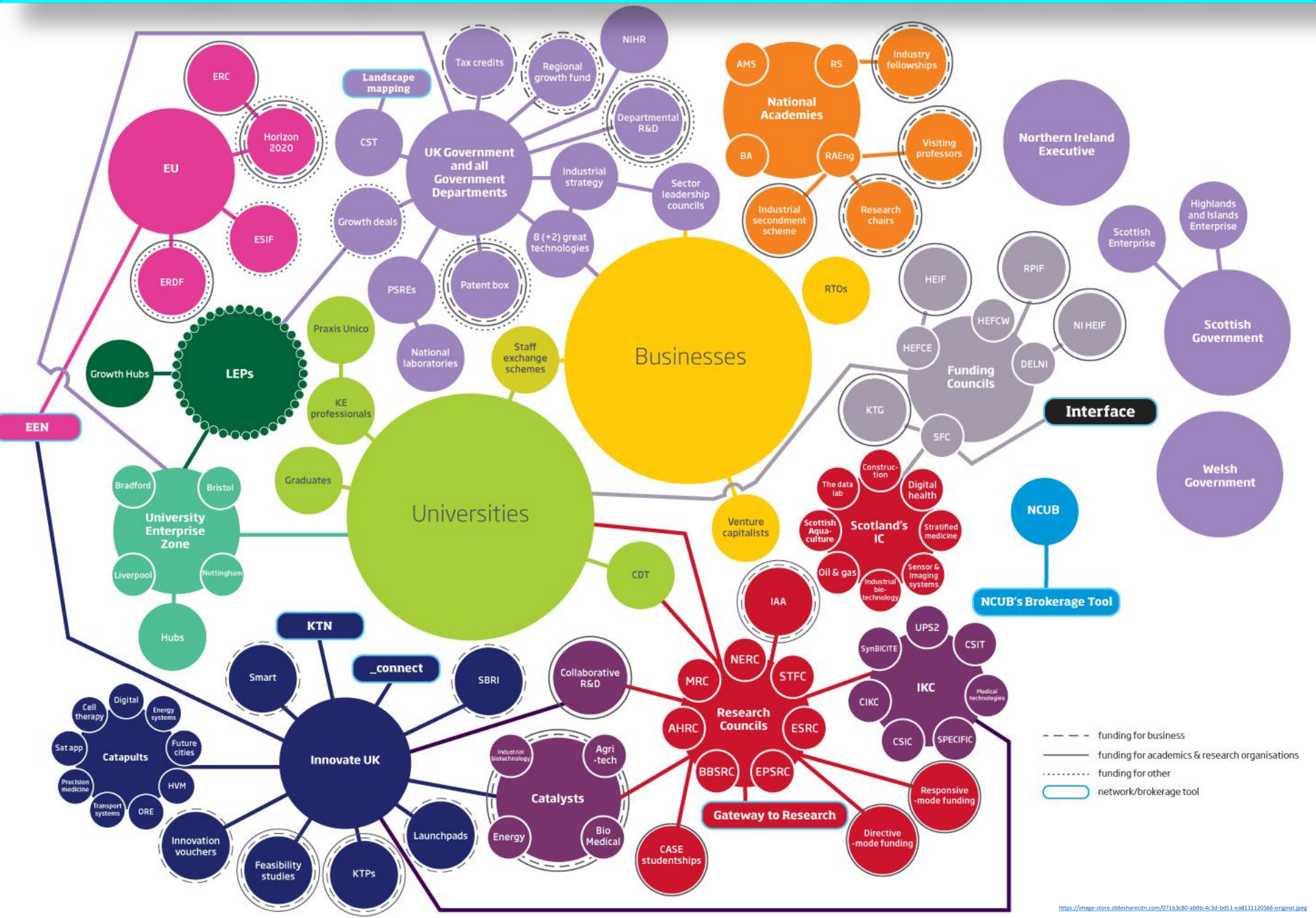
Markets want outcomes and solutions, not numbers

CONVERGENCE ON A PLATFORM

Platform interoperability - reduces death due to errors


New business models
e.g. trading of production capacity and manufacturing data
Crowd communities
create manufacturing innovations
Cognitive abilities
inform automated activities on site via remote access
Fully automated marketplace
for service providers
Digital Platforms
Analytics, Services
Interoperability Engines
OUTCOME METRICS
Health, Energy, Transport, FinTech

Why Convergence of Organized Complexity is essential for Trans-disciplinary Actuation Spectrum



https://image-store.slidesharecdn.com/071b3c80-ab9b-4c3d-bd51-ea8131120566-original.jpeg

Nevertheless, a meeting of such people may be desirable for reasons other than the act of creation itself.

No two people exactly duplicate each other's mental stores of items. One person may know A and not B, another may know B and not A, and either knowing A and B, both may get the idea—though not necessarily at once or even soon.

Furthermore, the information may not only be of individual items A and B, but even of combinations such as A-B, which in themselves are not significant. However, if one person mentions the unusual combination of A-B and another the unusual combination A-C, it may well be that the combination A-B-C, which neither has thought of separately, may yield an answer. www.technologyreview.com/s/531911/isaac-asimov-asks-how-do-people-get-new-ideas/

Let us focus on the last line (below) … let us explore the world to find markets of the future …

the combination A-B-C, which neither has thought of separately, may yield an answer. www.technologyreview.com/s/531911/isaac-asimov-asks-how-do-people-get-new-ideas/

Lower transaction cost

may reduce barriers to reach affordable market of billions

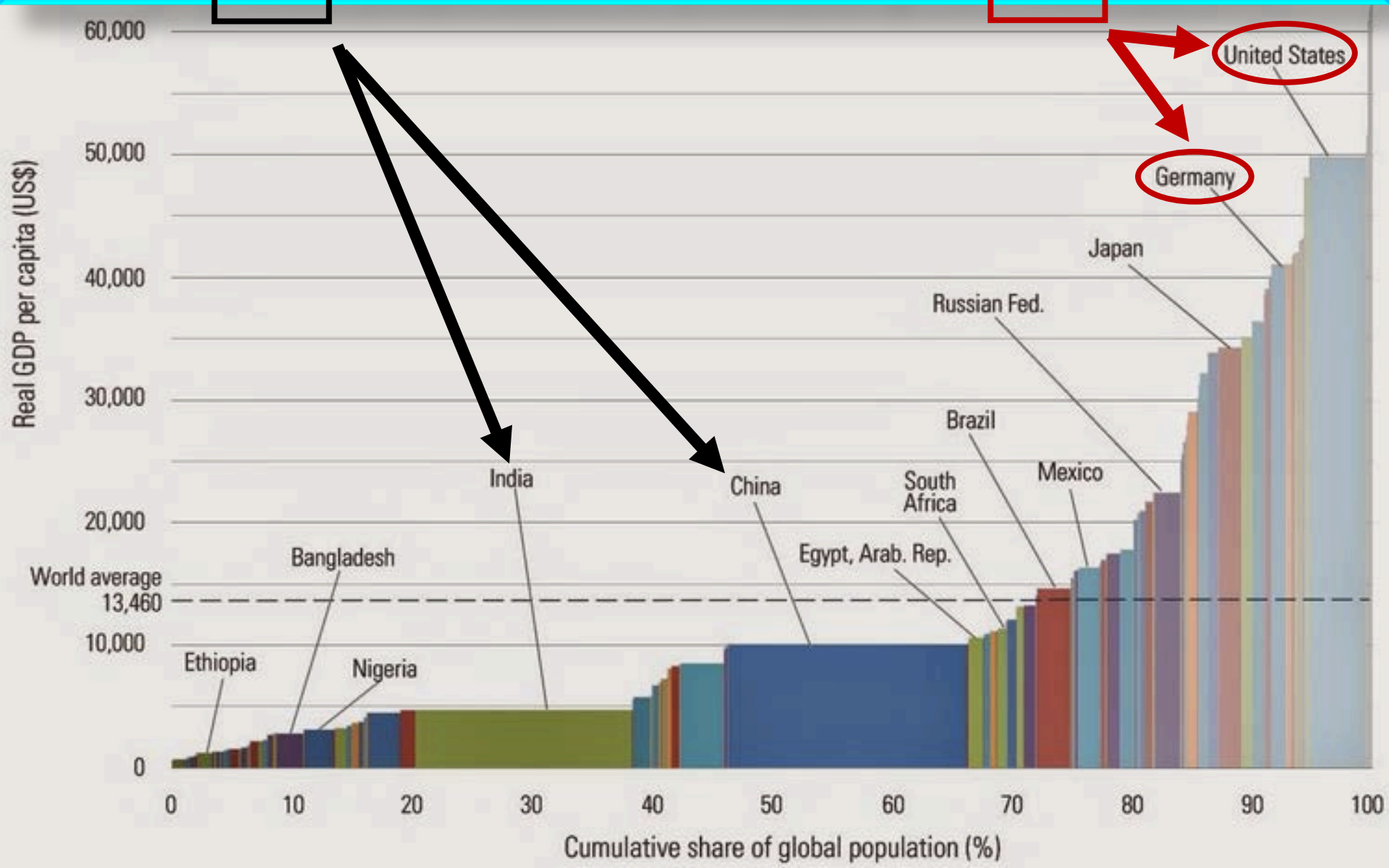
What may these 5+ billion people want and what can they afford to pay ?

1% share of this market of 5+ billion people is about 50 million customers

5 cities offer a market of more than 100 million

Real GDP Per Capita and Share of Global Population (2011)

Serve these people based on proselytizing from these pundits ?



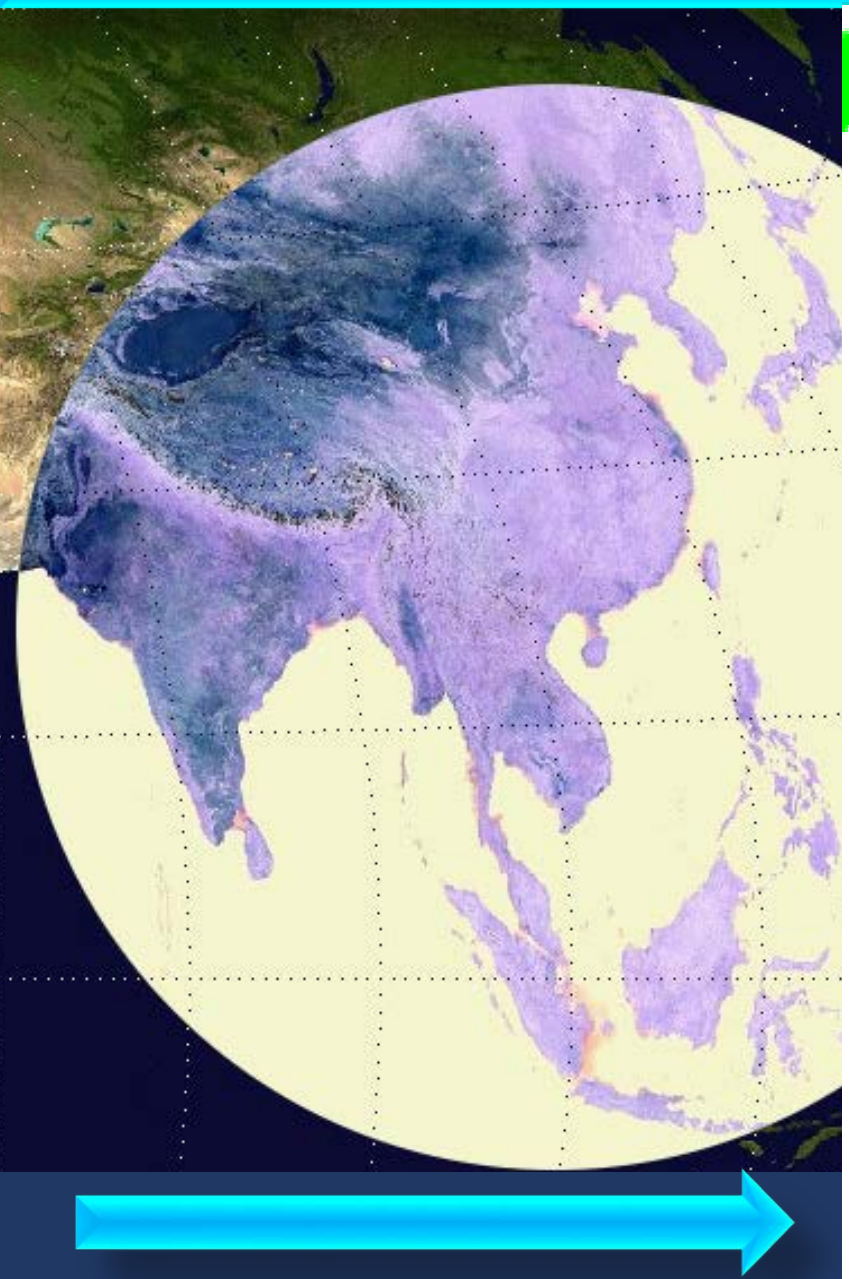
Now re-think, review and re-evaluate the meaning of entrepreneurial innovation in the context of people & feasible transaction cost for solutions, ***not*** technologies.

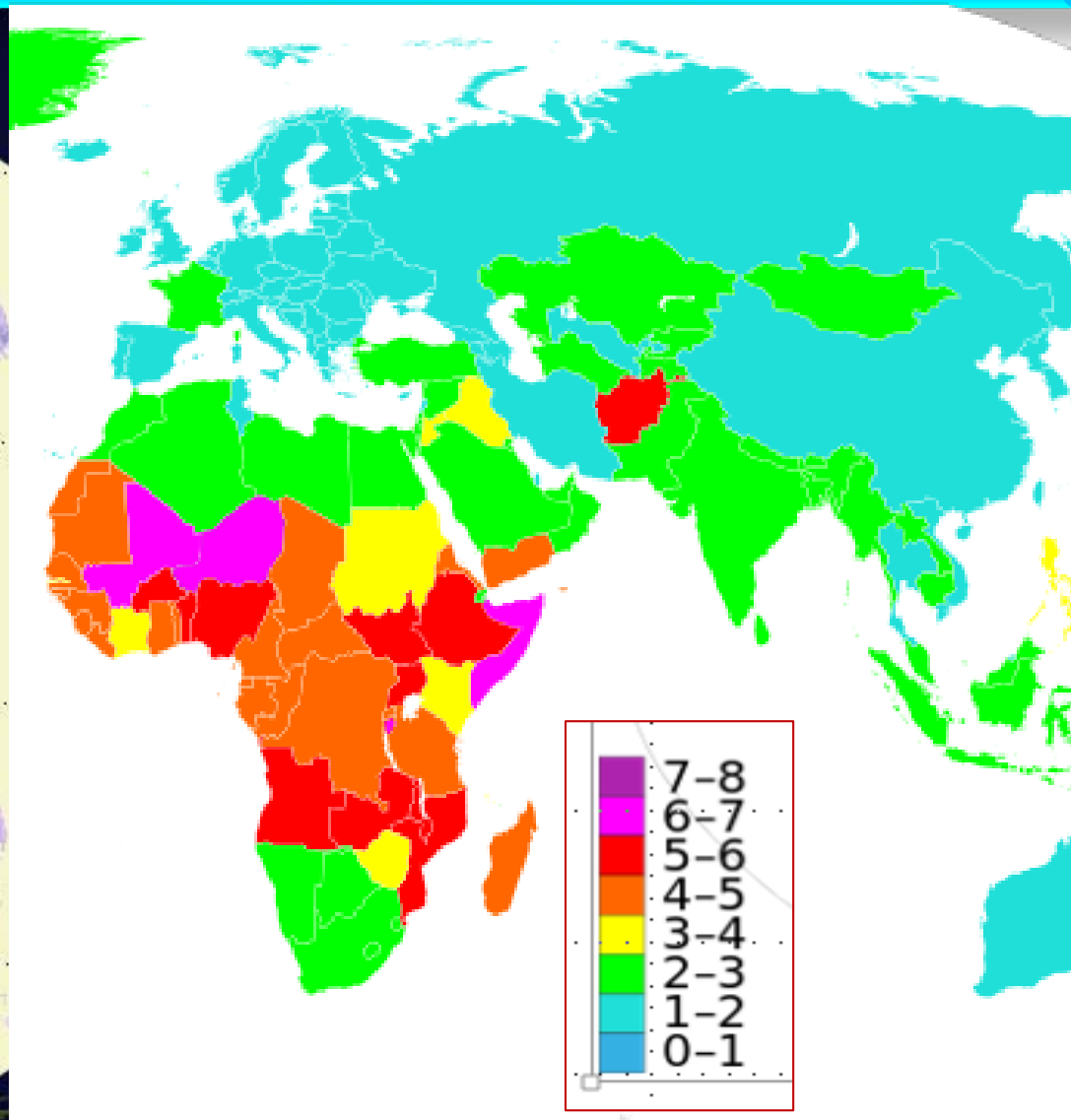
And understand why HBR and other similar "august" journals are Neanderthalic relics of rubbish opinions

At the top of the tree is the Journal Nature with an impact factor of 41.25 (at the time of writing). At the bottom is the HBR with an impact factor of 0.72.

www.oxford-review.com/the-big-difference-between-the-oxford-review-and-the-harvard-business-review-1/

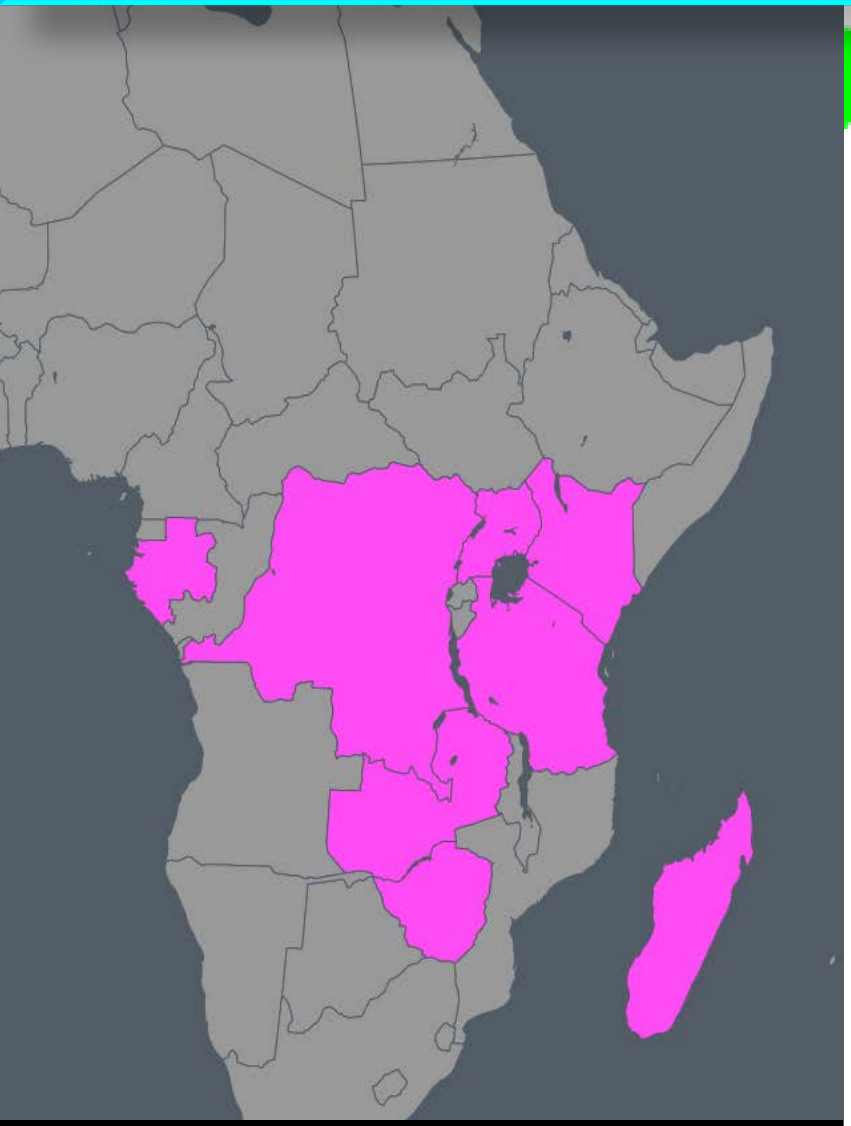
Where will the “needle” move? Where it is driven by the fertility rate!



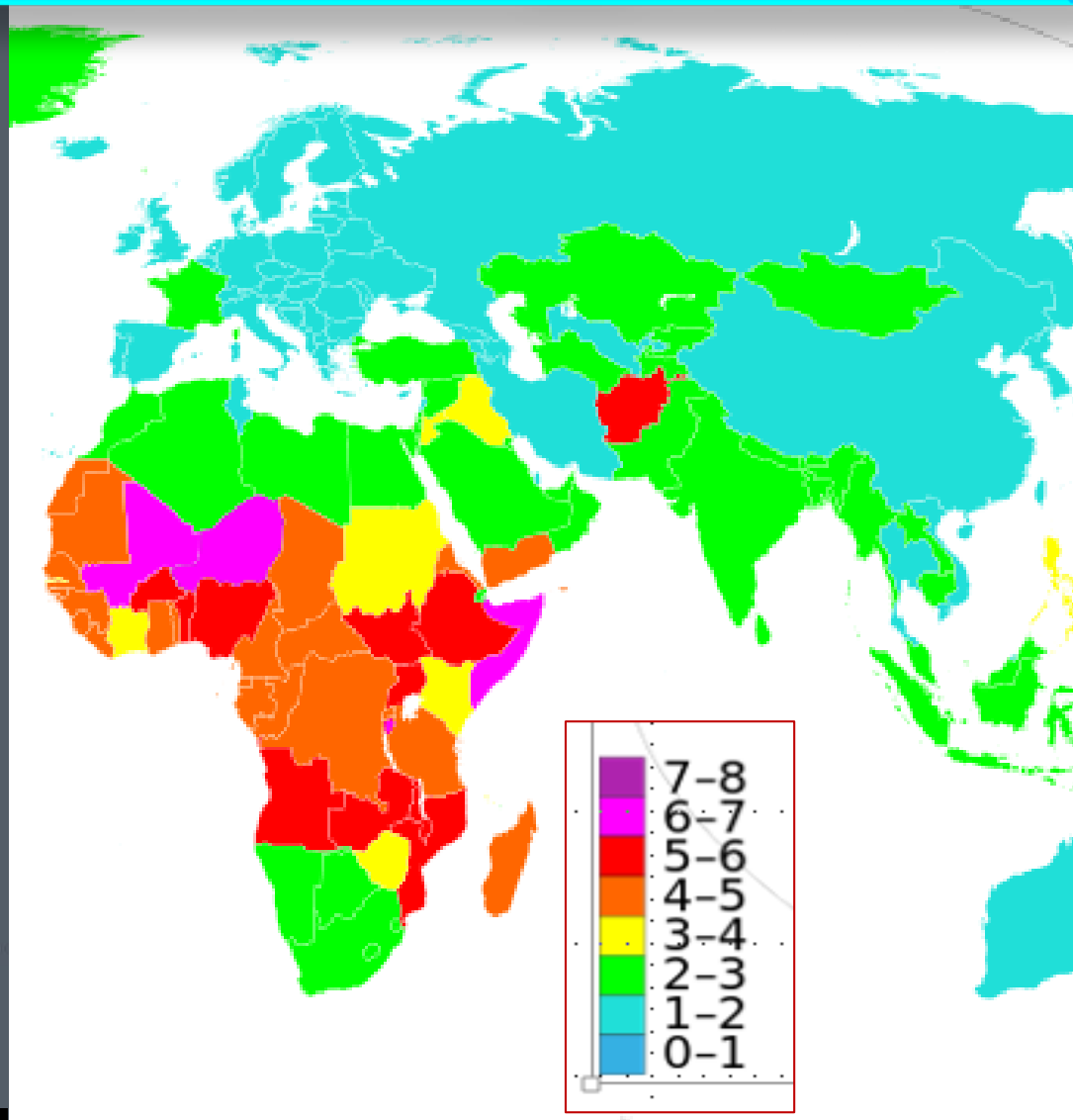


FERTILITY RATE

Billions will need (think business) all the basics but NOT in the same form



Countries – Mobile money accounts outnumber traditional bank accounts

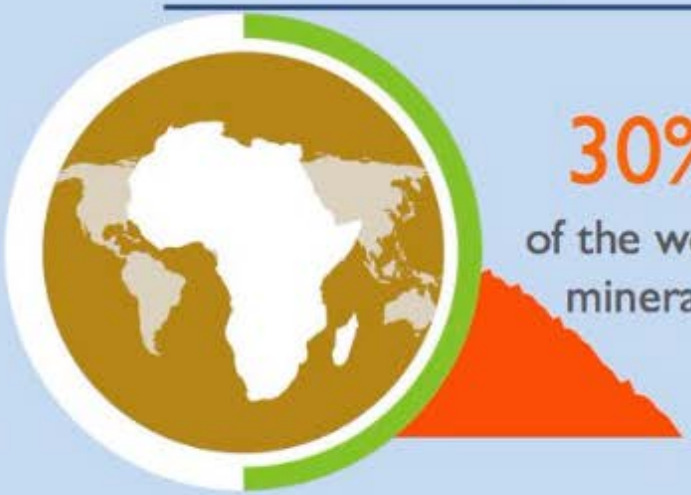


FERTILITY RATE

Untapped potential

50%
of the world's uncultivated arable land is in Africa.

450 M
hectares of uncultivated arable land.



30%
of the world minerals

Wide ranges of climatic and ecological conditions as well as biodiversity

Africa has the highest technical potential for the deployment of Renewable Energy in the world

Value of food markets on the continent

Less than **10%** of Africa's total hydropower potential is exploited.

1.4 million ha of irrigation could be secured based on current or planned dams associated with hydropower development

Inter-Africa trade is just **18%**

Map Info

Photovoltaic electricity out

PVOUT map © 2017 Solargis

Solar Measurement Sites

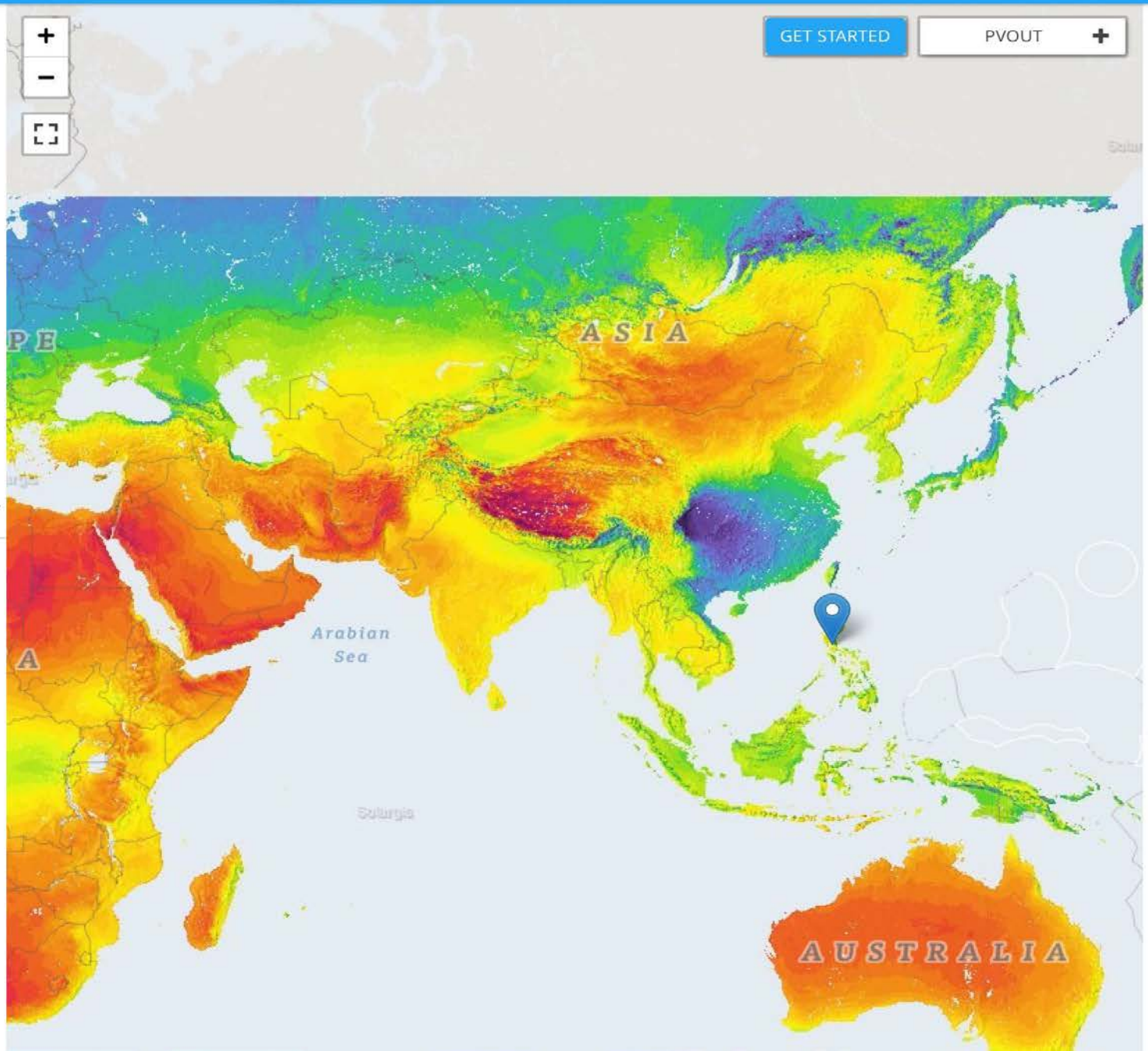
Site Info

Search

14.6042, 120.9822
Manila City, Manila,
Philippines

Site Data | PV Power Calculator

PVOUT	1342 kWh/kWp per year
GHI	1702 kWh/m² per year
DNI	1238 kWh/m² per year
DIF	837 kWh/m² per year
GTI	1734 kWh/m² per year
OPTA	13 ° / 180 °
TEMP	25.8 °C
ELE	13 m



These countries seek solutions not found on the pages of HBR

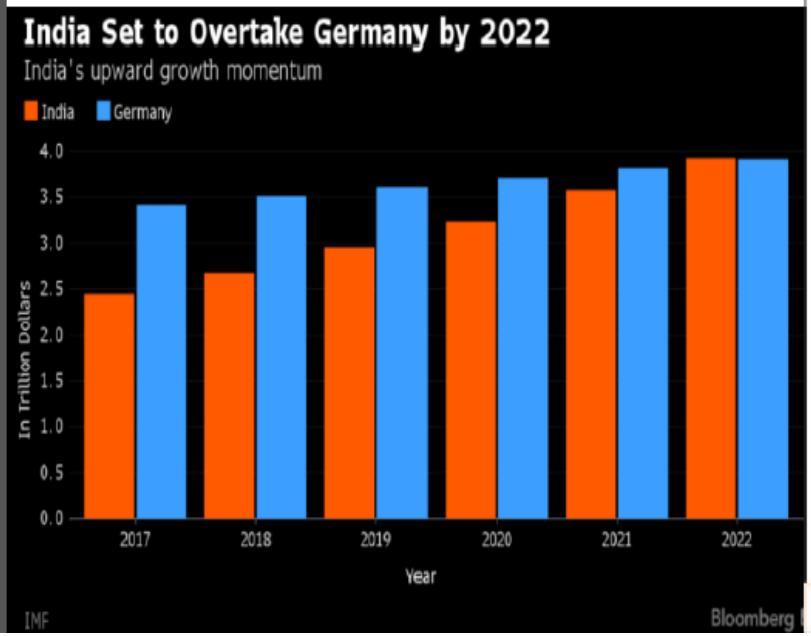
Conundrum

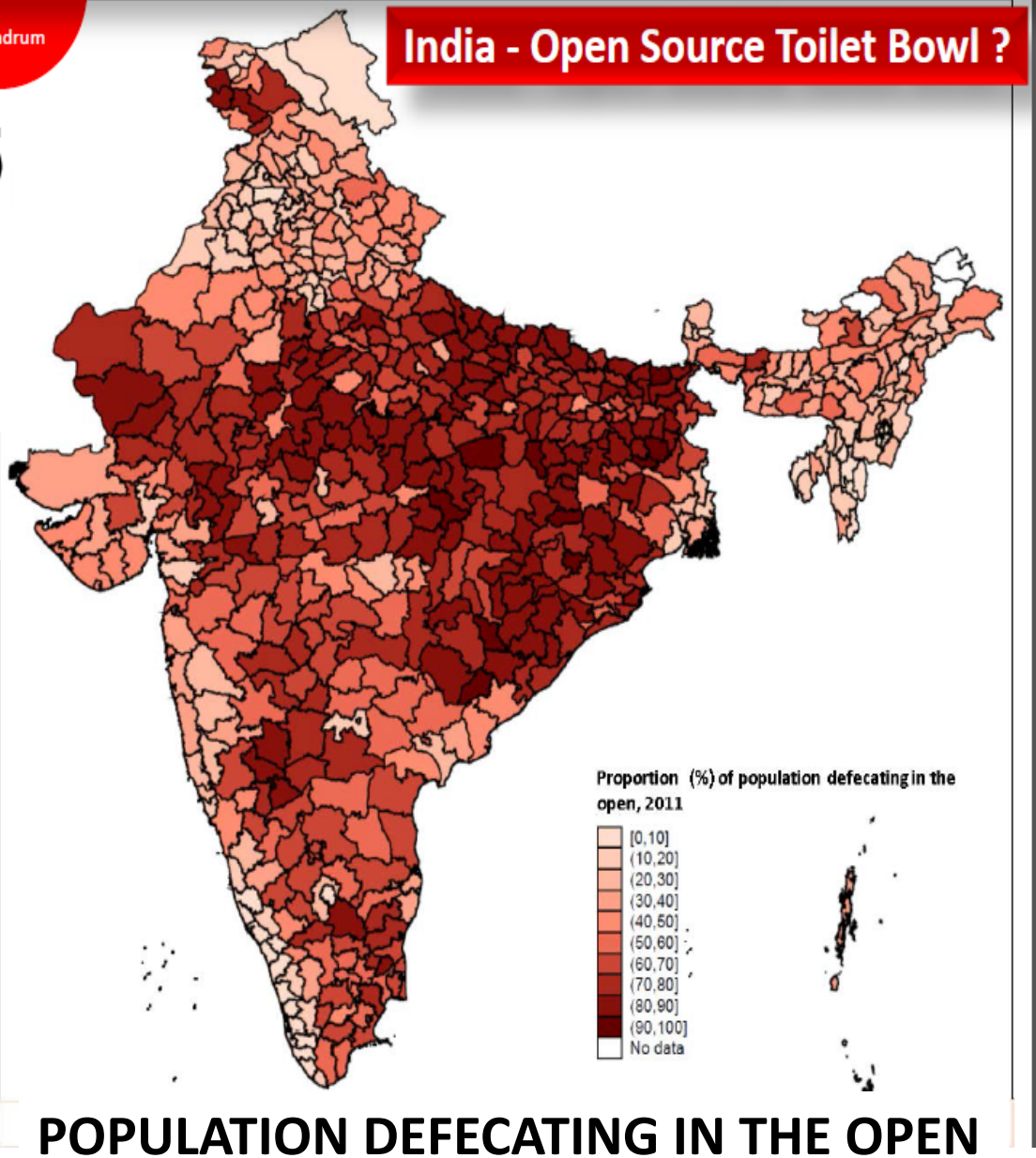
India on Track to Knock Britain Out of World's Top 5 Economies

by **Anirban Nag**

April 27, 2017, 5:00 PM EDT

From BenchMark





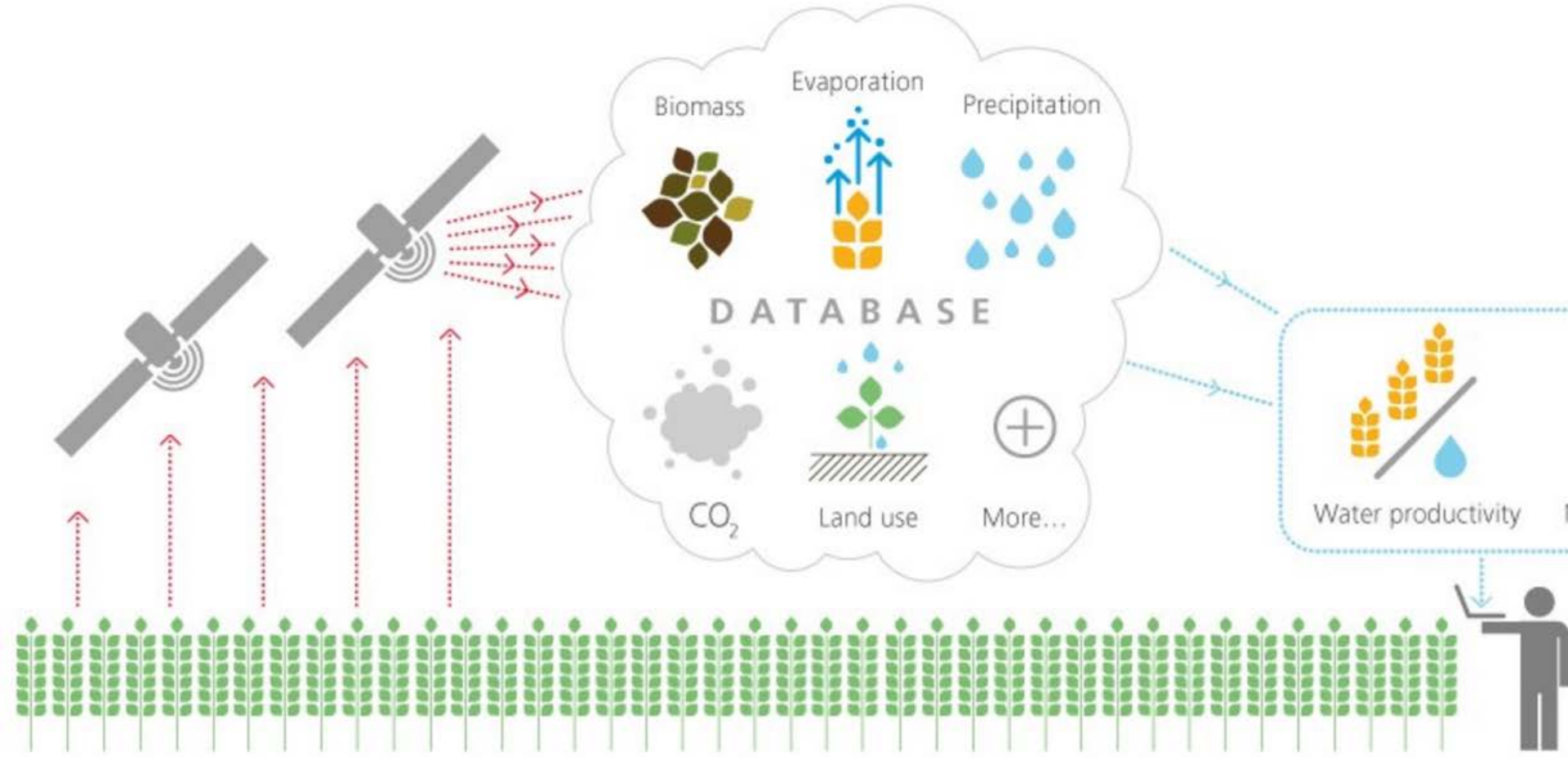
POPULATION DEFECATING IN THE OPEN

Solutions with micro-pay-per-use revenue models will profit

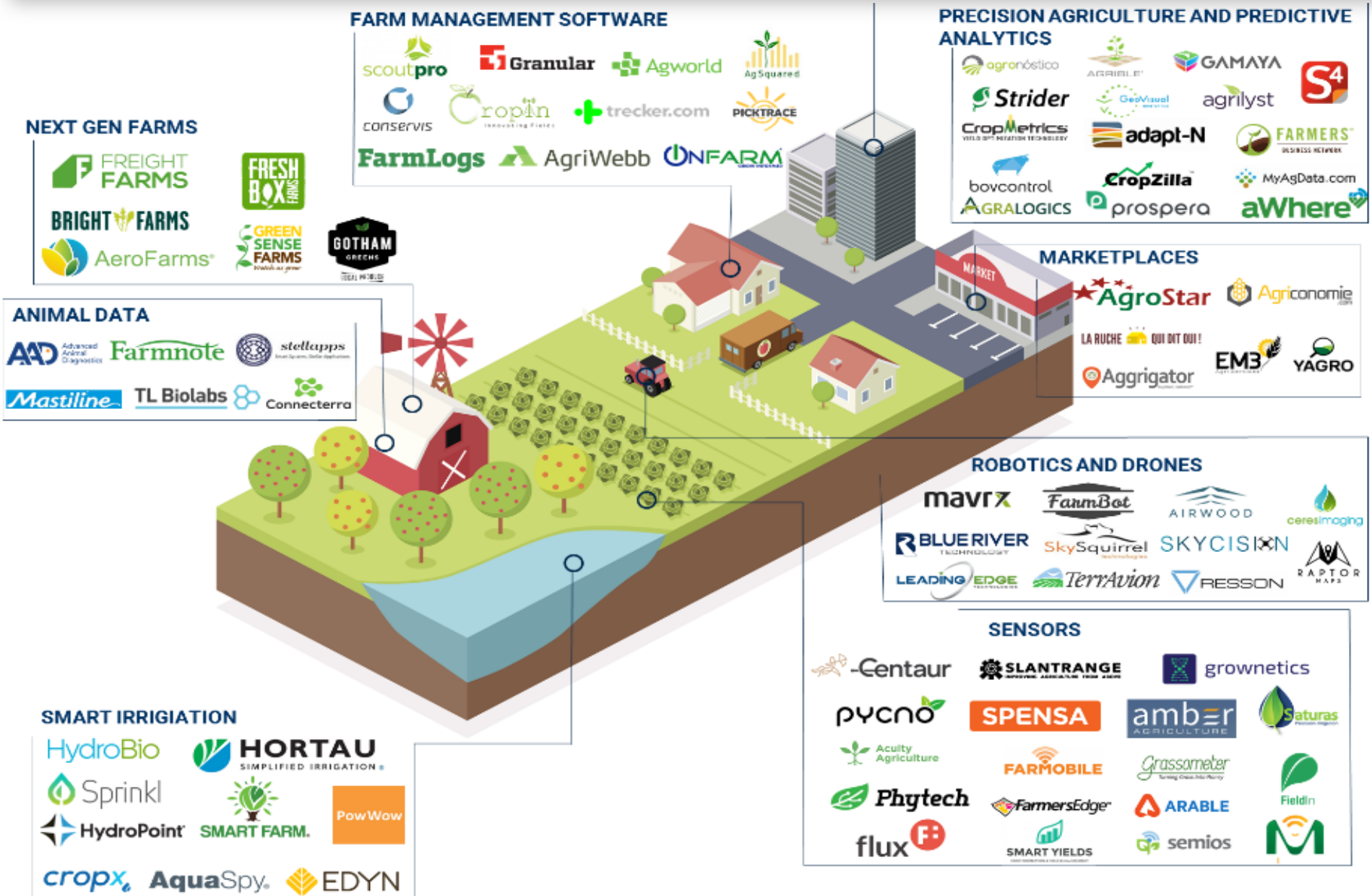
These countries seek solutions to feed billions

Remote sensing for water productivity

	Overview	Database	Water and land productivity assessment	Water accounting	Capacity development	Resources



But may not follow the Gartner Path or Forbes Foibles



These countries seek healthcare for different problems

11 million children die each year in 10 countries mostly from 6 preventable causes (diarrhea, malaria, neonatal infection, pneumonia, preterm delivery, and lack of oxygen at birth).

Healthcare and Medical Internet of Things (MIoT)

https://dspace.mit.edu/handle/1721.1/107893

This modus operandi from 1920

May be reflected in 2020

Lesson – What The New World Does NOT Need

How Social Isolation Is Killing Us

Dhruv Khullar DEC. 22, 2016

Lesson – What The New World Needs

Many roads … different paths … affordable outcomes

From the Past
For the Future

Transport

Travel Behavior, Transport and Autonomous Vehicles

TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 47, 75–88 (1994)

Anthropological Invariants in Travel Behavior

C. MARCHETTI

Humans, like animals, are territorial, naturally.

Anthropological studies suggest that there appears to a mean traveling time per day (aka exposure time), when multiplied by mean speed of movement (an animal) it fixes a distance or a range or territory.

http://www.cesaremarchetti.org/archive/electronic/basic_instincts.pdf

How long is the human exposure time aka territory?

1-hour

Yes, of course, there are exceptions and deviations from the hour rule which fuels transport innovation

How far can you travel in

1-hour

5 km if you are walking

25 km if you are in public bus

50 km if you are in a private vehicle

500 km if you are transported by the Hyperloop

Each way commute time is 30 min. Thus, total exposure

1-hour

5 km (1800's) all in a small compact village/town

25 km (1950's) if your office is located downtown

50 km (2000's) if you live in the sprawling suburbs

500 km (2050's) you use the Hyperloop to the office

From horse drawn coaches, electric trams to Hyperloop: mean travelling time per day is 1 hr

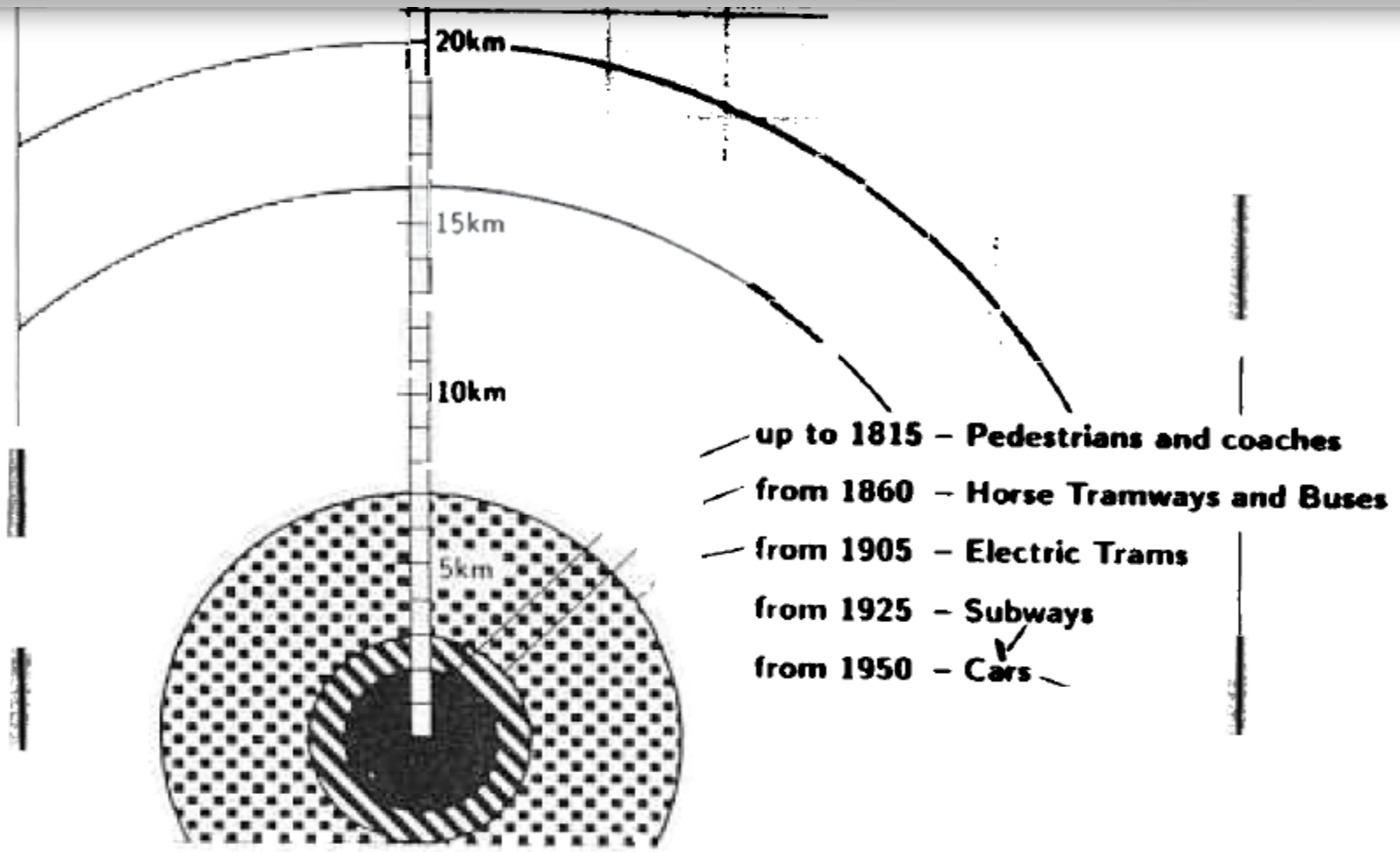


Fig. 2. City dimension and speed of transport: The case of Berlin. The fact that the "daily radius" depends on the speed of transportation is clearly manifested by the evolution of the size of the city of Berlin. The Berlin of 1800 was very compact with a radius of 2.5 km, pointing to a speed of 5 km/hr, the speed of a man walking. With the introduction of faster and faster means of transportation the radius of the city grew *in proportion* to their speed, and is now about 20 km, pointing to a mean speed for cars of about 40 km/hr. The center of the city can be defined, then, as the point that the largest number of people can reach in less than 30 minutes.

http://www.cesaremarchetti.org/archive/electronic/basic_instincts.pdf

Travelling Time Per Day in select global cities exceed Marchetti's Constant (1 hr)

d3jd6fok7tmbl6.cloudfront.net/wp-content/uploads/2014/09/16194620/en_us_Servay_infographics-02-1-1024x640.jpg

Marchetti's constant, a sturdy observation that humans since the Paleolithic Era have always lived roughly 30 minutes from their work even as transport tech evolved from bare feet to carriage to train to automobile. Current commute times of 90-120 minutes will be changed by Hyperloop. Innovation in transport reverts exposure time to 1 hour.

What can Hyperloop do for these travel times?

Creating Markets

Why we're reaching our limits as a one-hour city

April 26, 2004

How we want to use our time will determine how we want to build a metropolis, argues Peter Newman.

You can relate Marchetti's Constant to your life. The average travel time budget, around the world, in every city, is about one hour, per person, per day. If you take half an hour for the journey to work and home again then that's it. If you take less, you'll probably go walking with the dog or something but you'll take about an hour on average.

This is found to apply everywhere. A recent study in Britain showed it had applied in English cities for the past 600 years. We need to have a restorative, reflective time.

What it means is that the city is always one-hour wide. The walking cities of the past - historic, medieval cities - were five to eight kilometres wide. You could walk across them in an hour. Victorian cities, the industrial revolution cities, spread out because the pipes and the rails meant that we could now travel 20 to 30 kilometres. And the city remained one hour wide.

But the new frontier entered essentially by US traffic engineers was to spread the city out further around highways. So the city spread out and in an hour you could go 50 kilometres.

The Marchetti principle does mean that if you have a good public transport system there will be a market for dense, walkable development.

Sydney's commitment to motorways in recent times has been very extensive. Ten billion dollars in a decade is a major determinant of the city's recent character. It has created a more car-dependent city. It is not possible to do other than that. You have had recent announcements about public transport spending, of about $2 billion. Is it enough? What about new lines, especially light rail, what about local priority for biking or walking? And is there a vision to fit all this into?

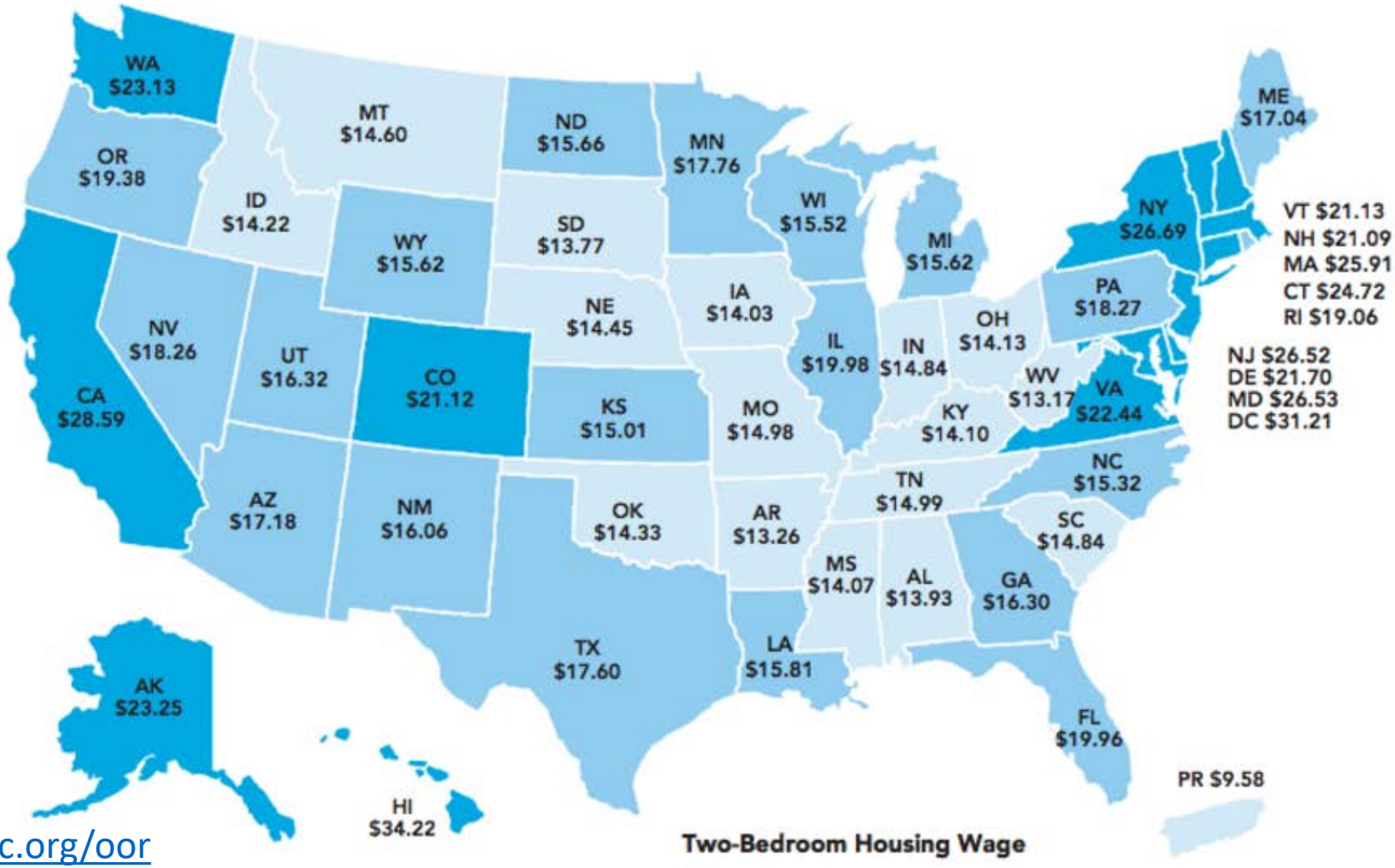
The one-hour-wide city, in Sydney, is reaching its limits. A city that has got 20 people a hectare and 40 kilometres an hour will become dysfunctional after about 2.5 million people. Market-based reurbanisation is flooding in now. There are 100 new rail developments opening in US cities. In Denver, a classic urban-sprawl, car-based city, the light rail is being extended in eight directions.

Sydney is now turning in as its sprawl limits are reached. Public transport options, which are then favoured by that, are at capacity and too slow.

The economics are very powerful. If you look at car use and city wealth, there is no correlation. European cities, which have less than half the car use, are the wealthiest. And even in the US there is very little correlation at all. Some cities put their wealth into public transport and use it - and it works.

Can Hyperloop impact the 2-bedroom housing wage?

Represents the hourly wage that a household must earn (working 40 hours a week, 52 weeks a year) in order to afford the Fair Market two-bedroom rental unit, without paying more than 30% of their income.



http://nlihc.org/oor

California Commutes are 80km or 50miles Approx 1-hour drive

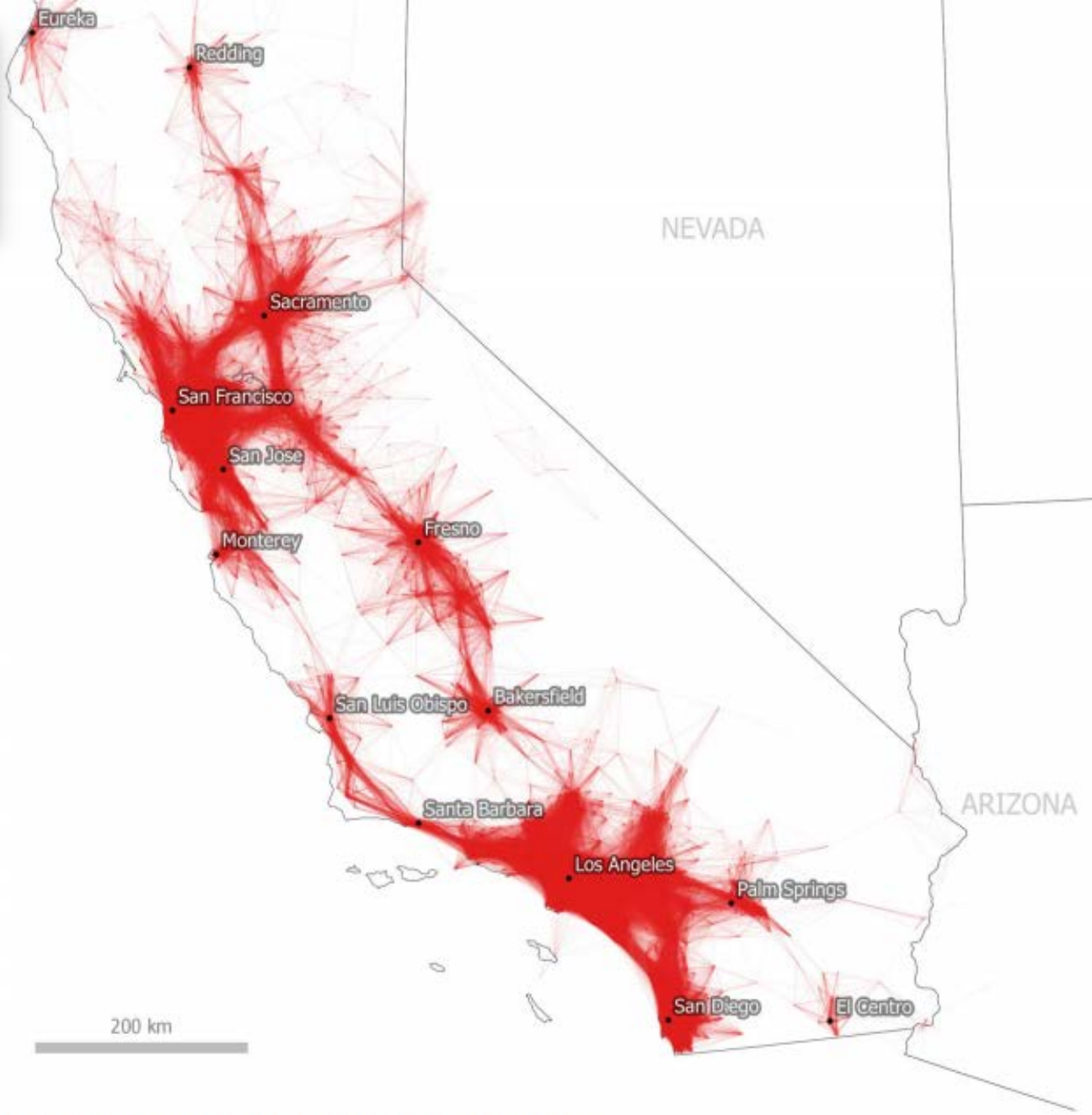


Fig 2. Tract-to-Tract Commutes of 80km/50 miles or less in California.

http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0166083&type=printable

Bay Area Commutes are 80km or 50miles Approx 1-hour drive

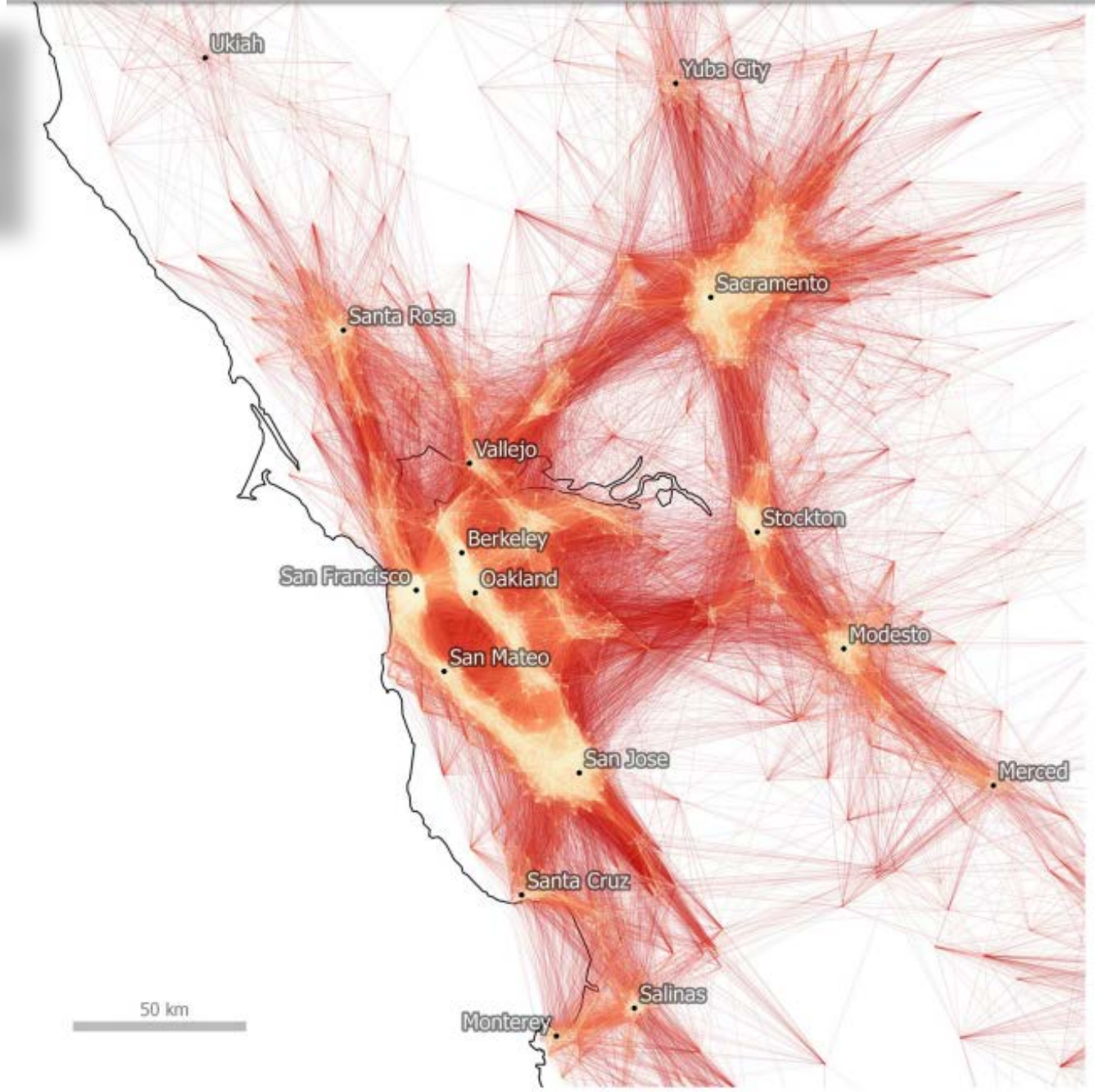
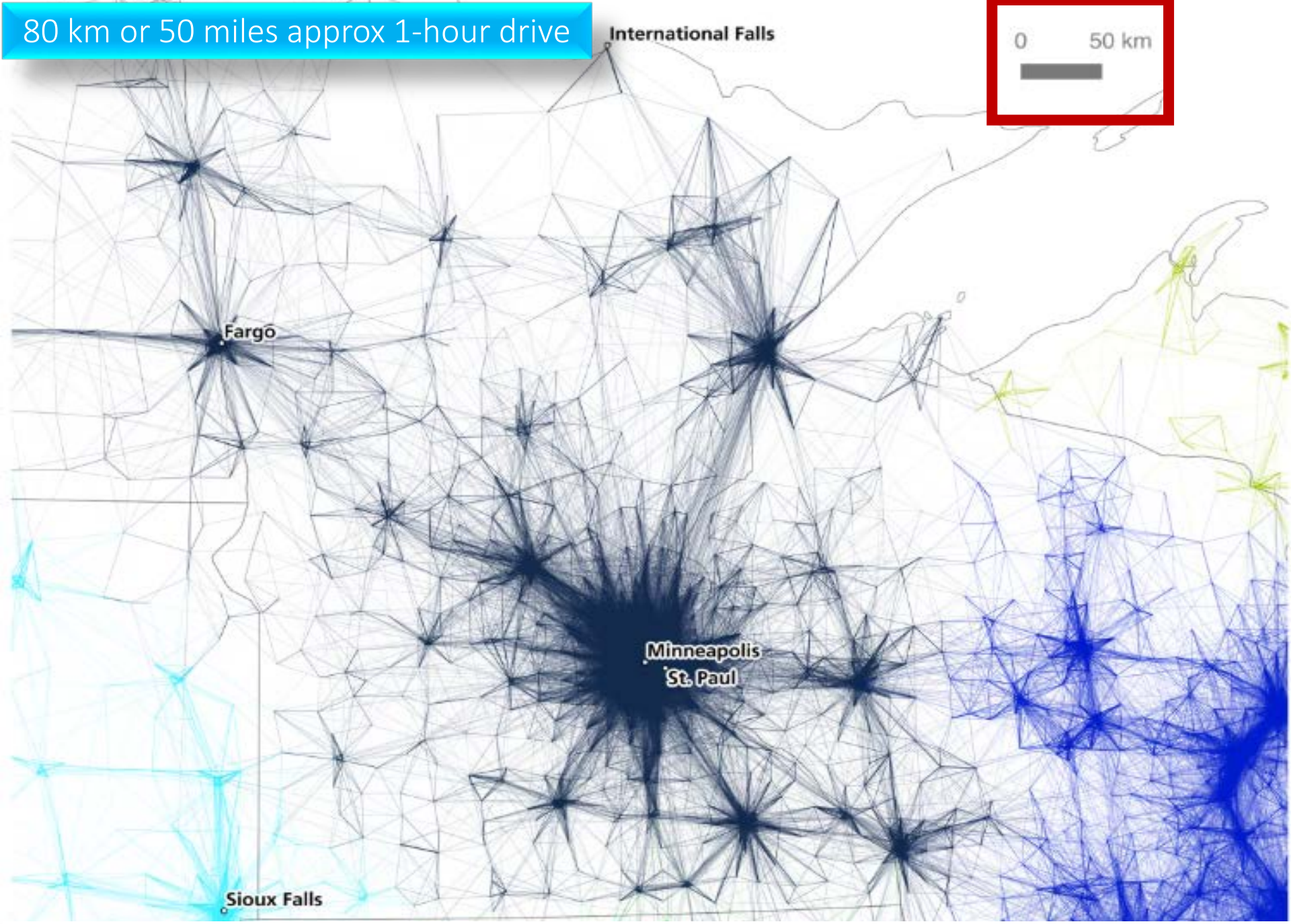


Fig 3. Tract-to-Tract Commutes of 80km/50 miles or less in the Bay Area.

http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0166083&type=printable



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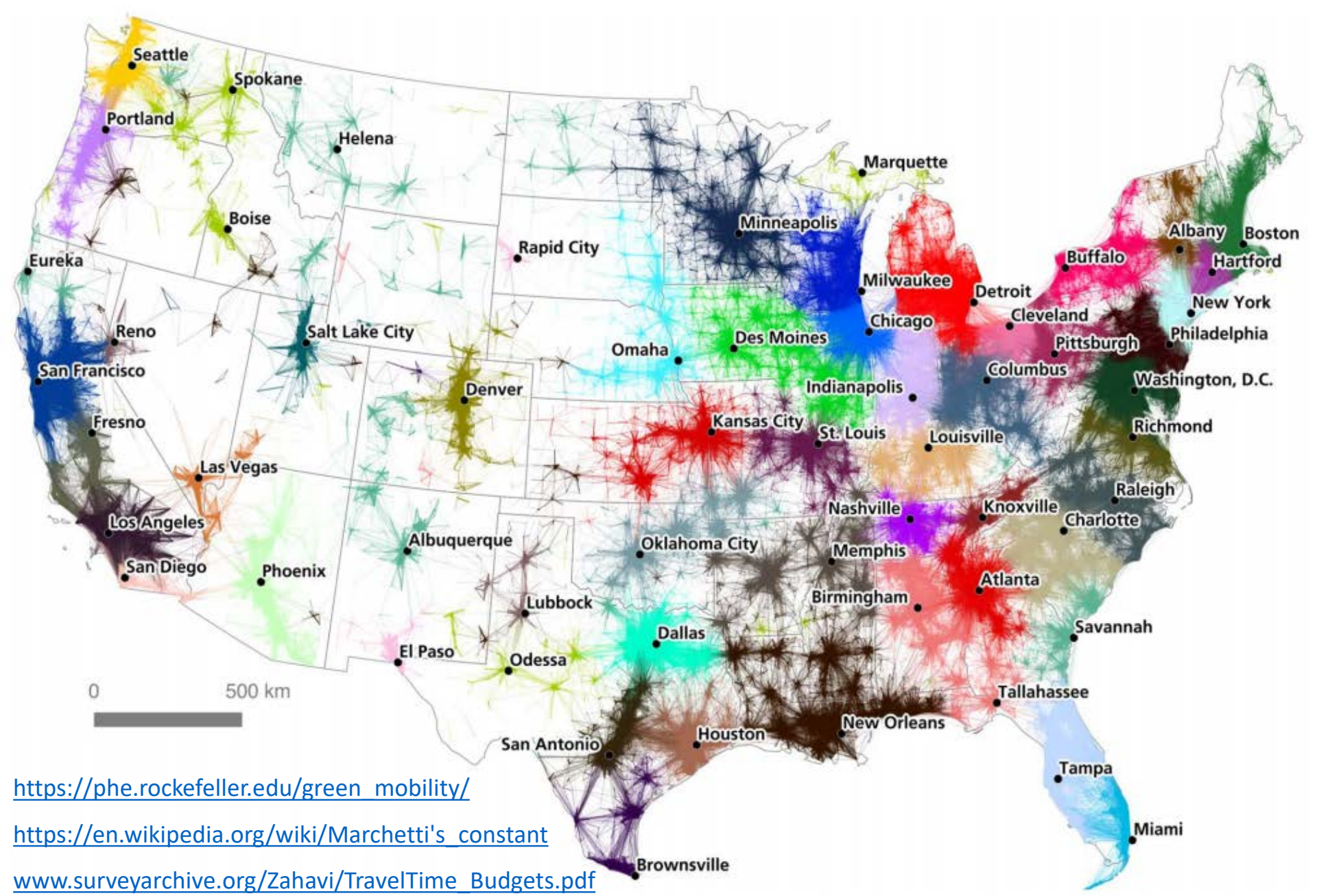


https://phe.rockefeller.edu/green_mobility/

https://en.wikipedia.org/wiki/Marchetti's_constant

www.surveyarchive.org/Zahavi/TravelTime_Budgets.pdf

Fig 6. A commuter flow-based regionalization of the United States.

http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0166083&type=printable

Mean Speed (30 mph) has not changed since Henry Ford's times. The use of cars (10,000 miles per year or about 1 hour per day) is still the current average for calculating vehicle use by auto insurance companies in the US

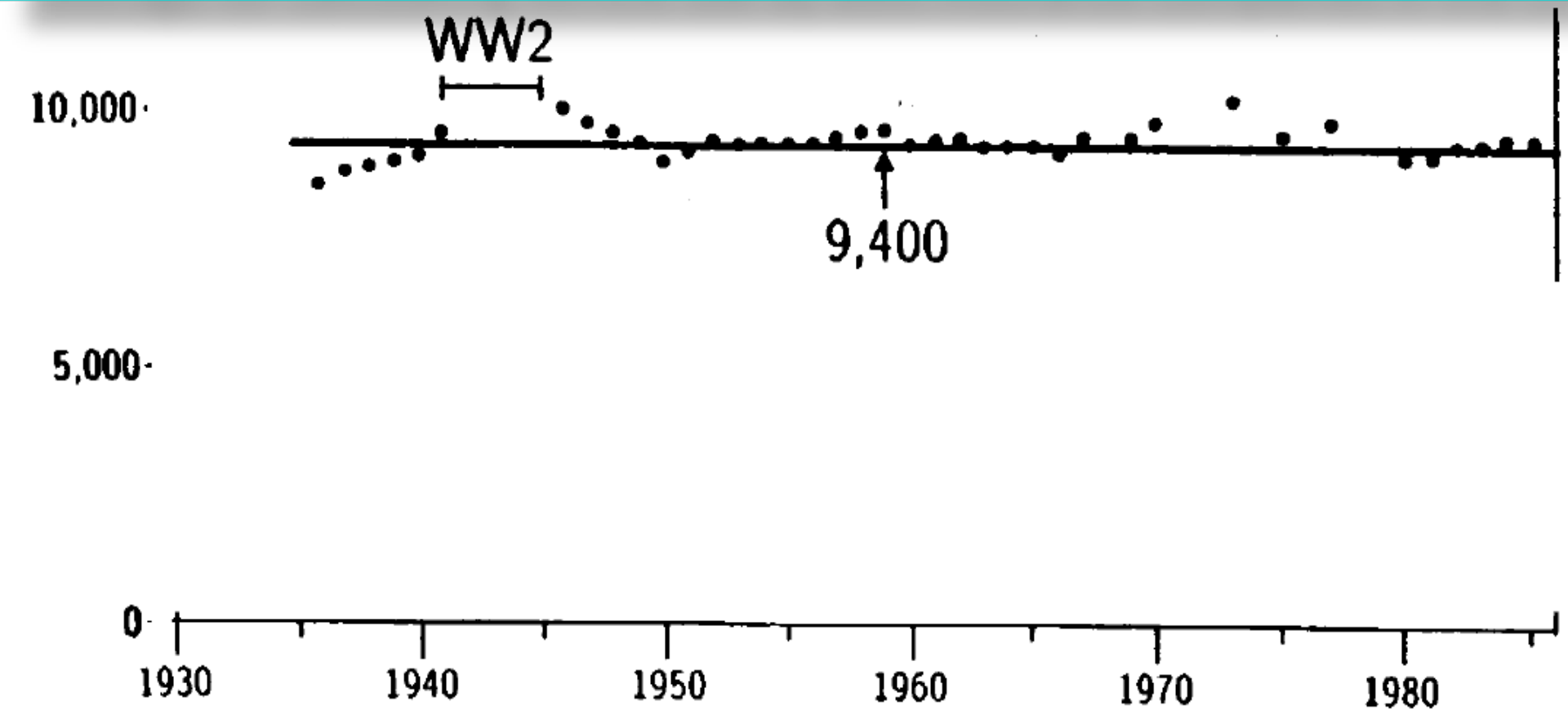


Fig. 13. A historical overview of car mileage in the USA (miles/year). The regularity in the use of cars (about one hour per day) is mirrored in the stability of mileage per year, reported here for the USA. This implies a curious stability in the mean speed, about 30 miles/hr – since Henry Ford's times. Data

www.cesaremarchetti.org/archive/electronic/basic_instincts.pdf

My *Gedankenexperiment*, which I presented at Marrakech in a congress related to the problems of linking Africa (or better the Magreb) to Europe with a bridge or a tunnel across the Gibraltar Strait, was based on the exploitation of the maximum potential of the *Maglev*, the magnetically levitated and driven train. At the Polytechnic of Lausanne a Maglev transportation system about 700-km long linking the major Swiss cities with transit times of 10 minutes has been proposed (Figure 8), with the characteristic of running in an evacuated pipe (air pressure equivalent to a height of 15,000 meters) [3]. The rationale is to have a *small tunnel*, almost fitting the size of the train. Due to the mountainous conformation of Switzerland, such connections have to be made in tunnels for the most part, and the cost of tunneling is dominant over every other component of the system.

Operating in a partial vacuum, however, removes the most important constraint to vehicle speed, as Maglevs move more or less in a frictionless manner on a magnetic cushion. We still have a limitation on the acceleration that humans can take. I assumed 0.5 G or 5 m/sec^2 as an acceptable one. It is the acceleration (for a few precious seconds) of extremely expensive cars, like Ferraris and Porsches.

Operating a Maglev between Casablanca and Paris at constant acceleration (CAM), that is, by accelerating halfway and braking the other half at 0.5 g, the train would cover the distance in about 20 minutes. In other words a woman in Casablanca could go to work in Paris, and cook dinner for her children in the evening. Vice versa for shopping for special items in a special cultural atmosphere. With appropriate interfaces, such trains could carry hundreds of thousands of people per day. *The idea behind this is to save cultural roots without impeding work and business in the most suitable places.* Incidentally, businessmen who can afford the extraordinary cost of air travel in Europe do exactly

www.cesaremarchetti.org/archive/electronic/basic_instincts.pdf

The next logistics evolution - 13 km long - Bridge Africa with Eurasia

The next logistics evolution – 13 km long – Why delay the construction?

They didn't quite meet in the middle - the English side tunnelled farther

By **Oliver Smith**, DIGITAL TRAVEL EDITOR

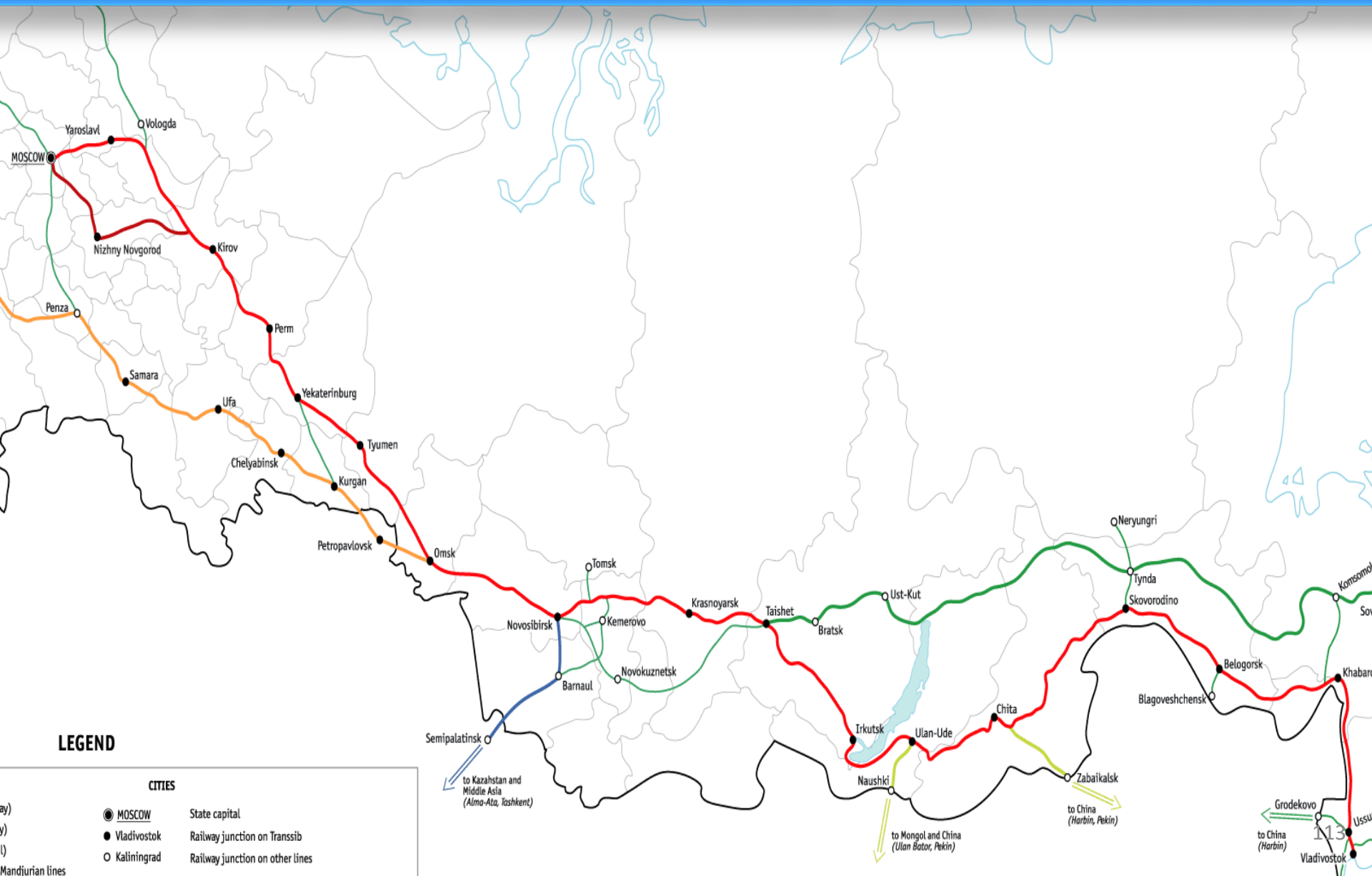
1 DECEMBER 2015 • 12:00AM

1. The Channel Tunnel is 31.4 miles long, making it the 11th longest tunnel in use (the longest is the Delaware Aqueduct, at 85.1 miles), and the fourth longest used by rail passengers. It has the longest undersea portion of any tunnel in the world (23.5 miles).

Engineering marvel..Beneath a mountain in Switzerland lies the world's longest shortcut. The 35.4-mile Gotthard Base Tunnel, the longest tunnel on earth, a $12 billion marvel, took 17 years to dig. Drill heads with 58 seventeen-inch rock-chomping steel "roller cutters" pushed against the stone with a 26-ton force.Swiss Federal Railways trains will whisk up to 15,000 passengers/day through it at 155/hour. One result will be cleaner air: 40 M tons of freight will travel through the tunnel annually, shifting cargo hauled by 650,000 trucks each year from roads onto rails.!! show less

The next logistics revolution – South Africa connects to China

Kouvola to Beijing - TRANS-SIBERIAN / TRANS-MONGOLIAN RAIL



MIT Students Win Competition to Design Hyperloop Pods

14:00 - 1 February, 2016 | by Karissa Rosenfield

the *Maglev*, the magnetically levitated and driven train. At the Polytechnic of Lausanne a Maglev transportation system about 700-km long linking the major Swiss cities with transit times of 10 minutes has been proposed (Figure 8), with the characteristic of running in an evacuated pipe (air pressure equivalent to a height of 15,000 meters) [3]. The rationale is to have a *small tunnel*, almost fitting the size of the train. Due to the mountainous conformation of Switzerland, such connections have to be made in tunnels for the most part, and the cost of tunneling is dominant over every other component of the system.

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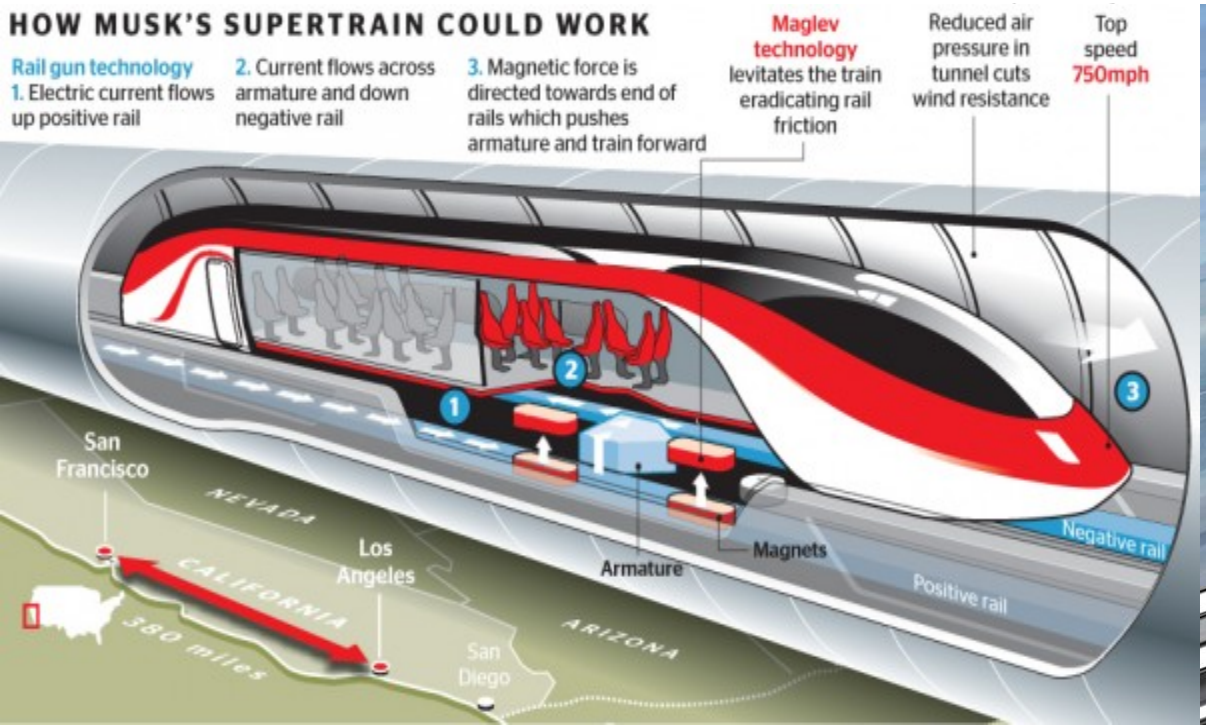


Hyperloop started 1897 by the NY Postal Service

Elon Musk's futuristic vision of a Hyperloop transportation system seems to be inspired from the past. About 100 years ago, large cities around the world used system of pneumatic tubes to send and receive mail (not people).

As part of a demonstration to inaugurate the high-tech mail delivery, pranksters stuffed a live black cat into one of the tubes to send over to the General Post Office in New York.

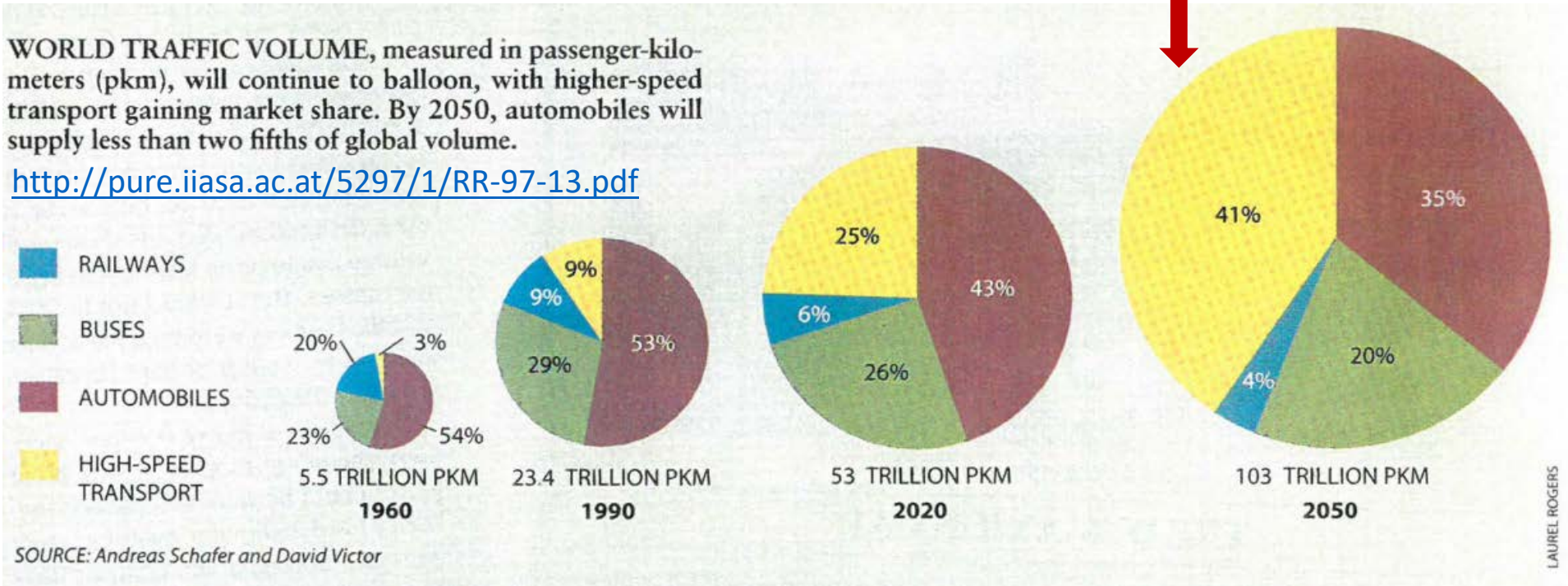
https://en.wikipedia.org/wiki/Pneumatic_tube_mail_in_New_York_City
http://www.pbs.org/newshour/updates/is-traveling-on-hyperloop-a-ticket-to-puke-city/
https://www.yahoo.com/style/bp/hyperloop-inspired-100-years-ago-pneumatic-tubes-cat-204600601.html
http://www.theatlantic.com/technology/archive/2013/08/that-time-people-sent-a-cat-through-the-mail-using-pneumatic-tubes/278629/

As described by an eyewitness , Howard Wallace Connelly, in his 1931 self-published autobiography, "Fifty-Six Years In The New York Post Office — A Human Interest Story of Real Happenings in the Postal Service":

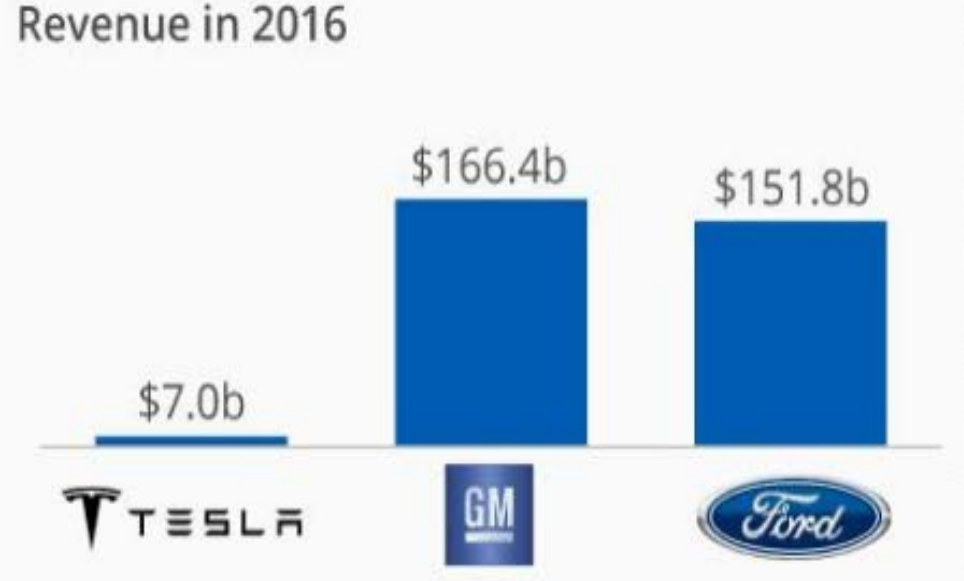
1997 - Prediction by Schafer and Victor (MIT)

By 2050, automobiles will supply less than two fifths of global volume

Share of High Speed Transport in 2050 = 41%



There are many others steps and stations ahead

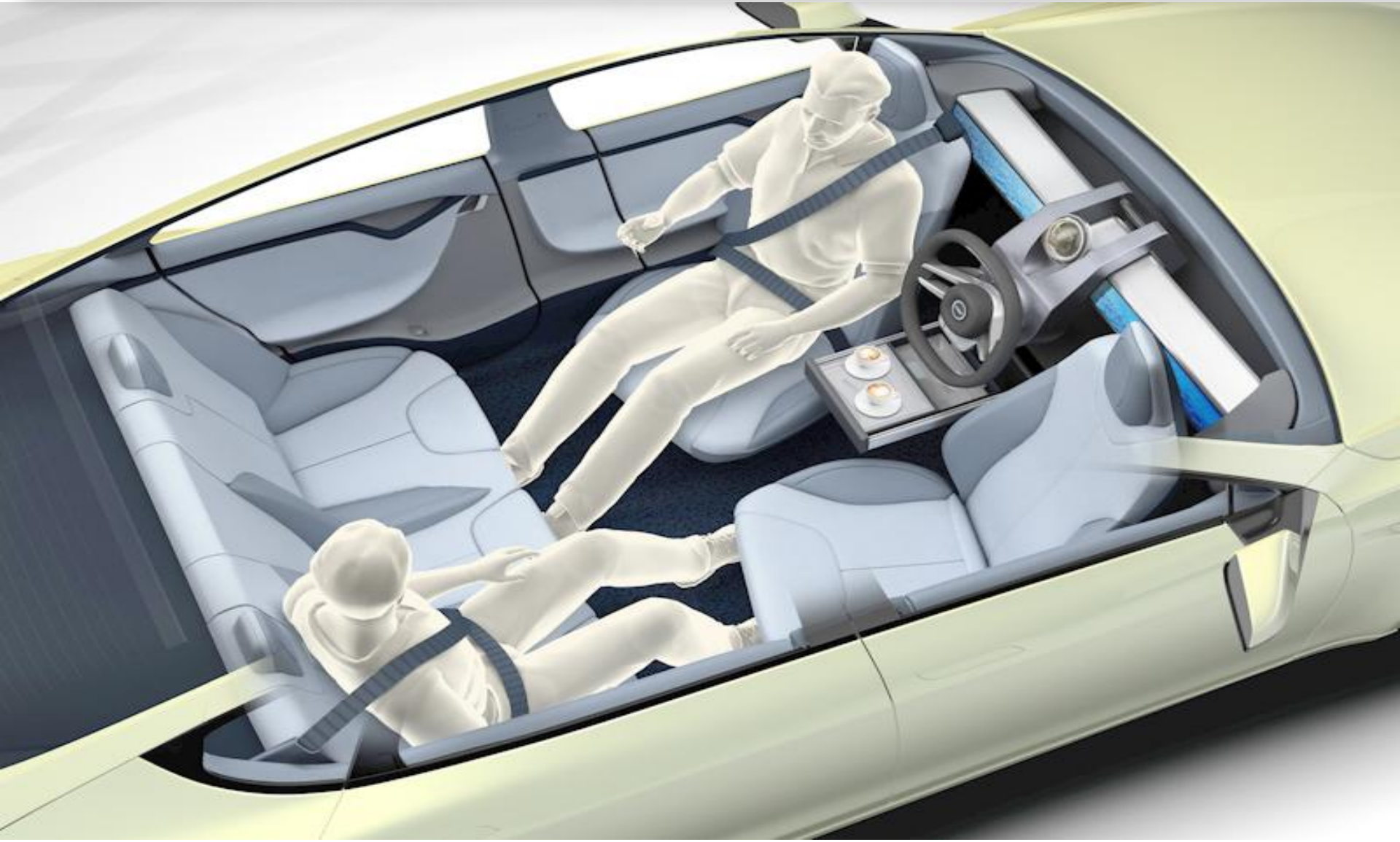


Autonomous Cars?

What happens to them in 2050 ?

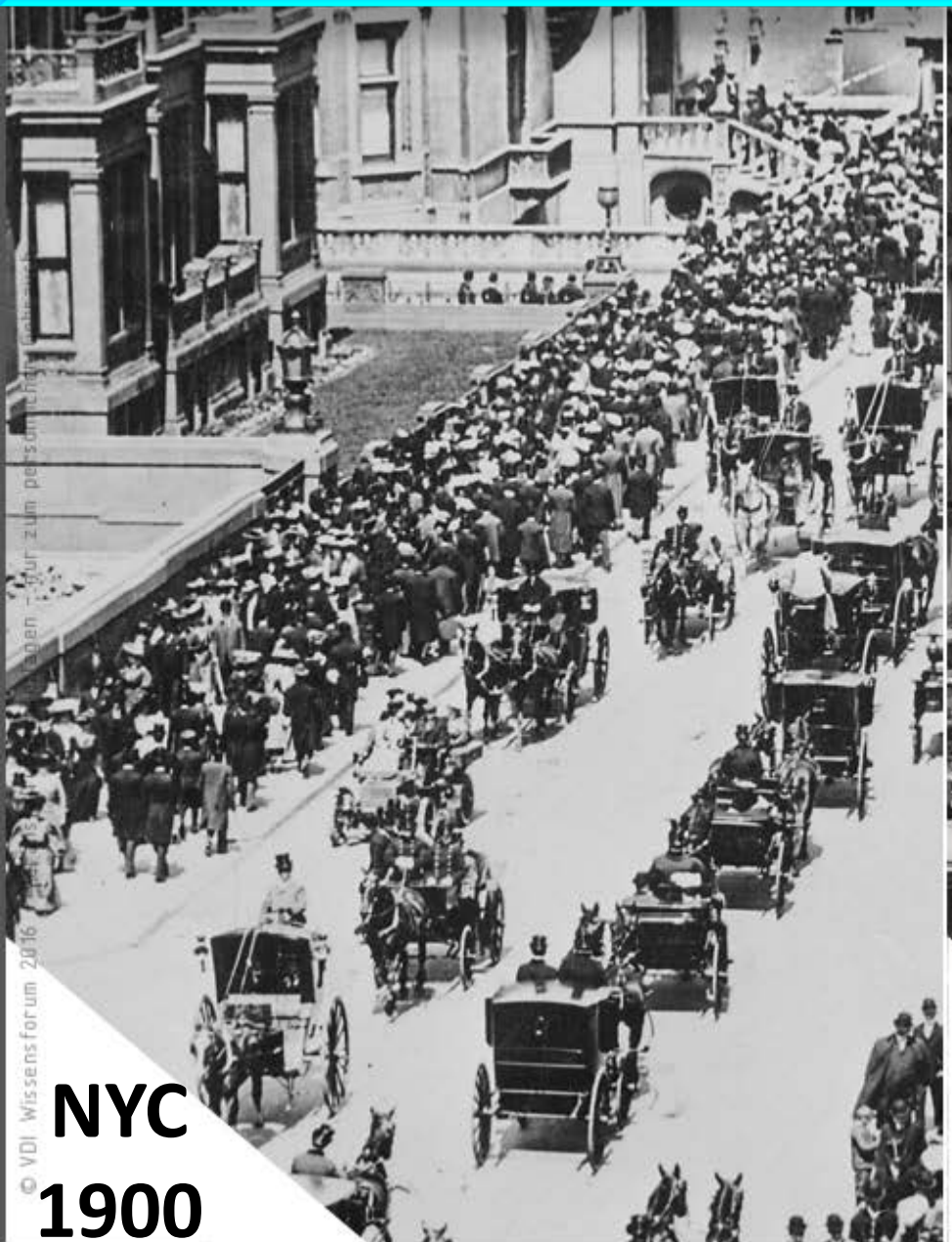
Autonomous Vehicles

Let us explore the journey on the road ahead




35153
57041

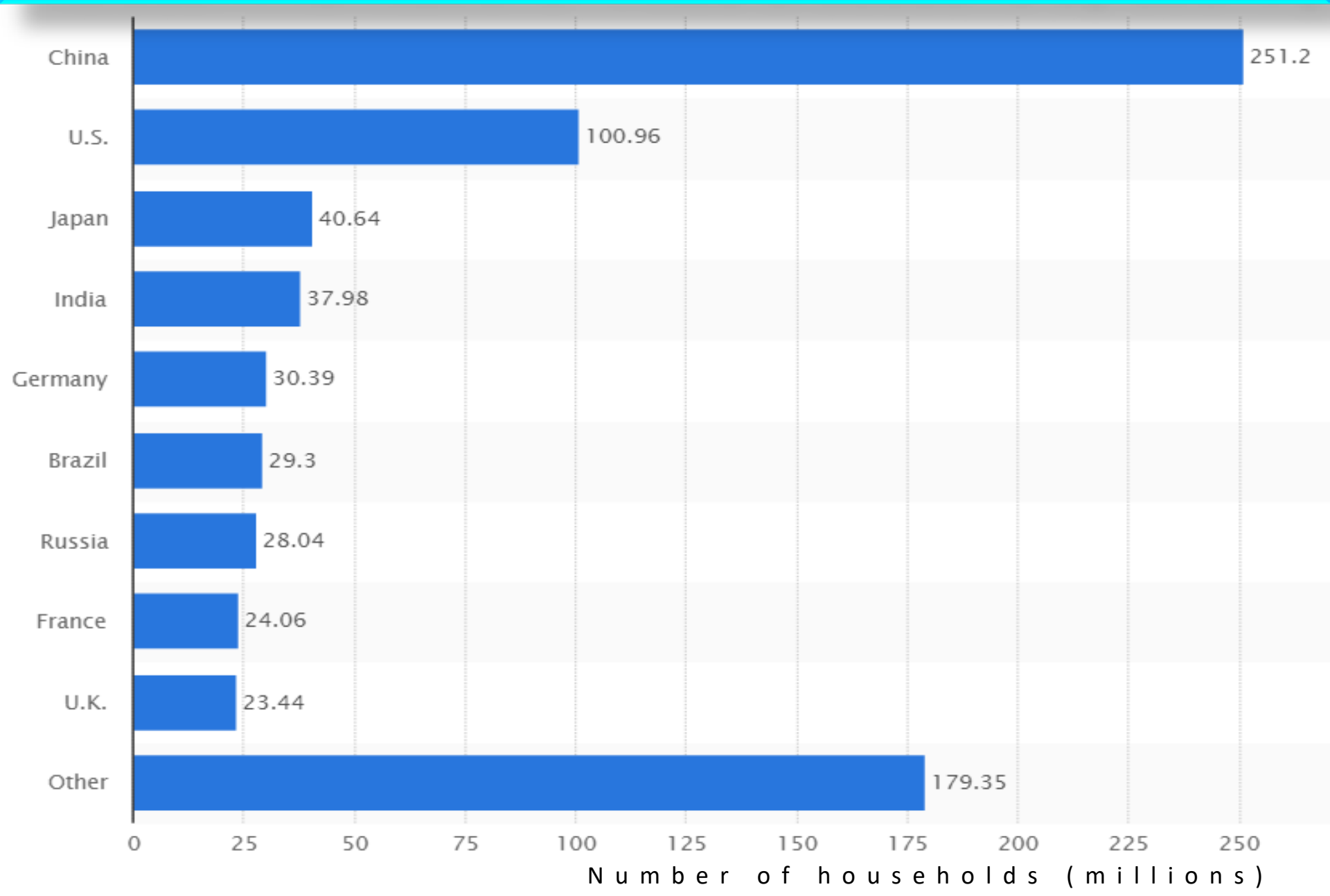
This happened in 13 years! We will have autonomous cars in a couple years. Correct?



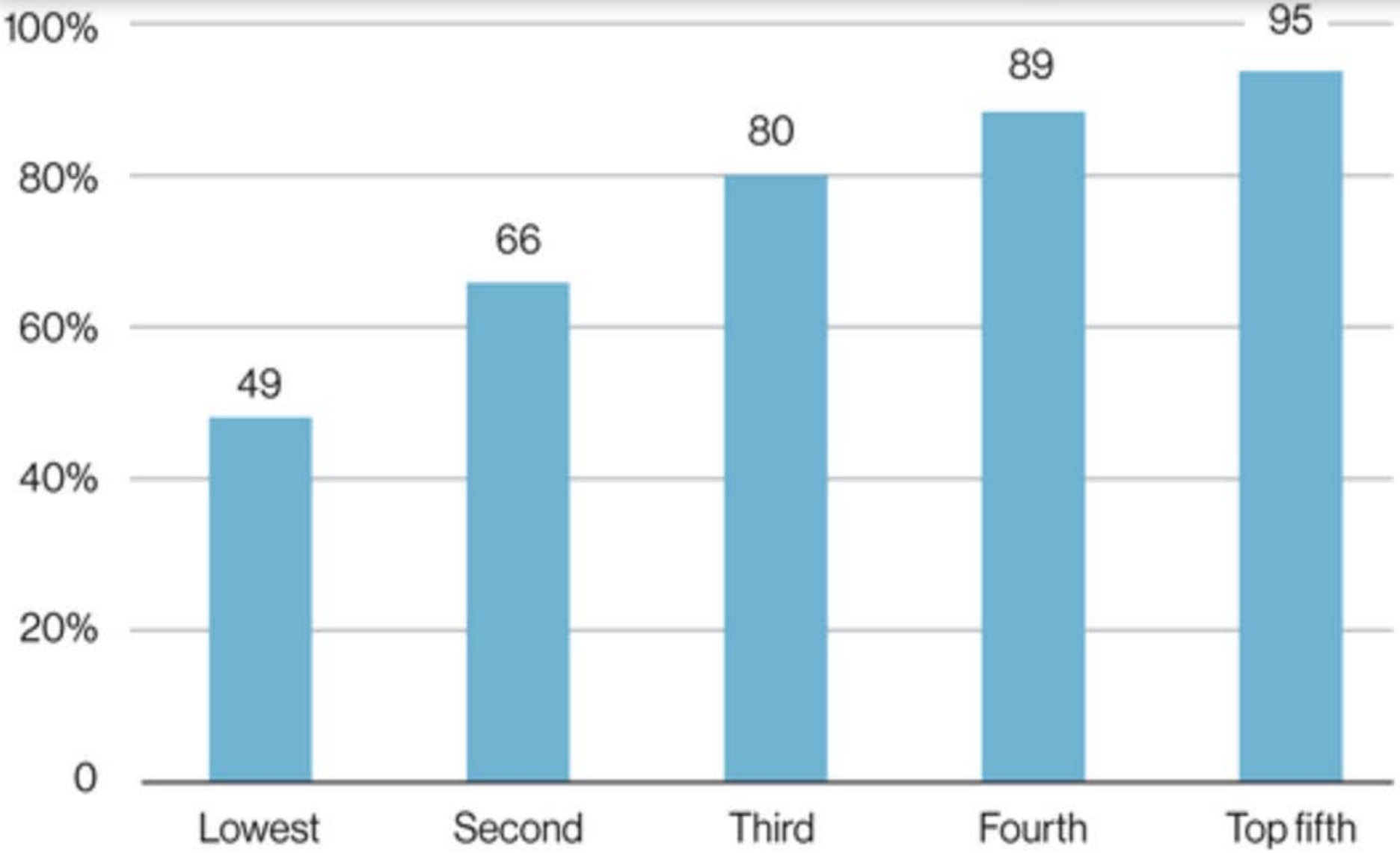
NYC
1900

NYC
1913

Telecommunications - Fixed Broadband by Country

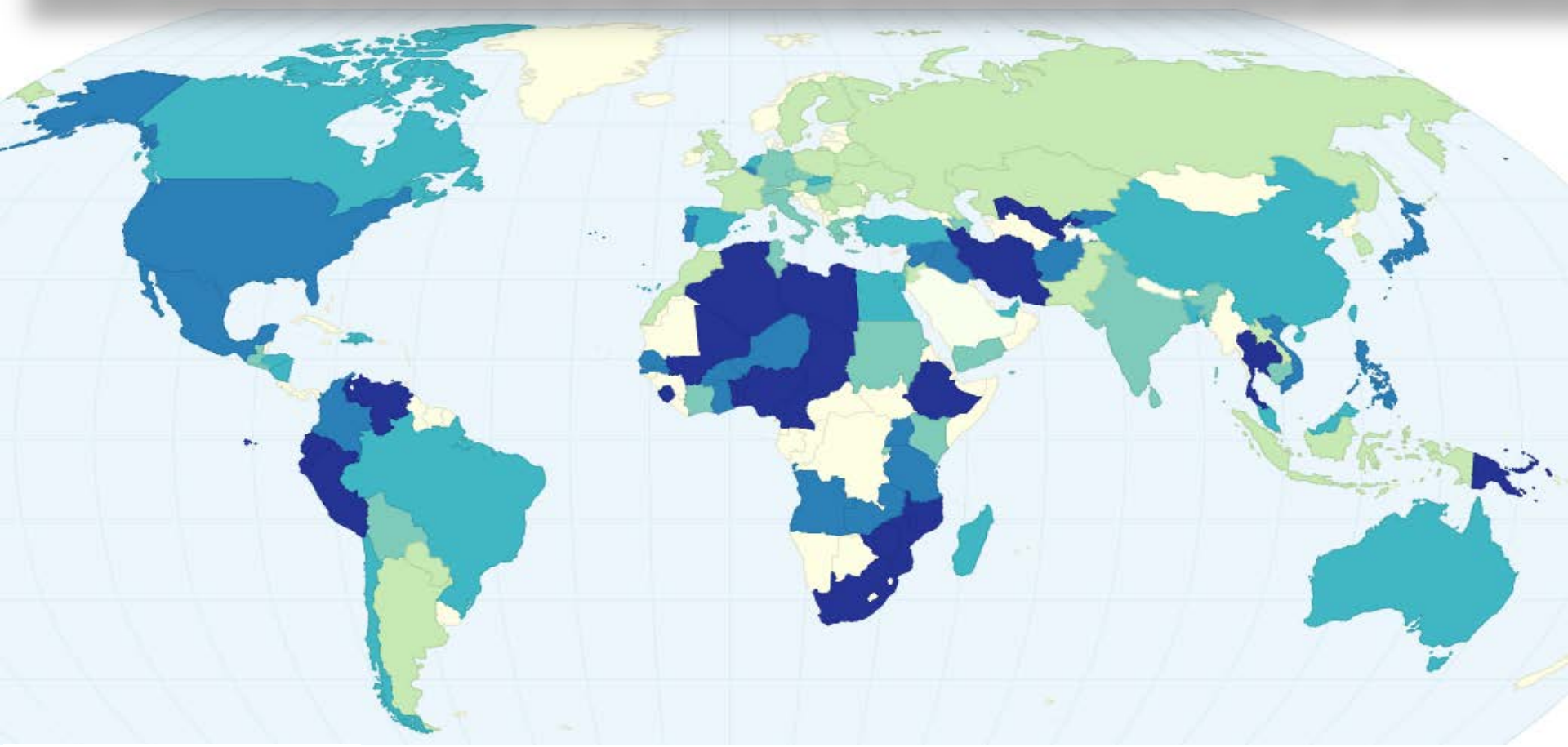


US Internet Use at Home by Income



http://digitaledition.technologyreview.com/technologyreview/january_february_2017?sub_id=hNVmoSnEIMeF&pg=92#pg92 MIT Technology Review (Jan-Feb 2017)

USA Mobile Broadband Plan 10GB=$85/month (2% GNI per person)



- $0.05 - $1.63
- $1.64 - $3.00
- $3.01 - $5.93
- $5.96 - $8.89
- $8.95 - $118.13

In dollars per GB

www.economist.com/blogs/graphicdetail/2013/10/daily-chart-5

http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

Cost of 3G (2013) vs 3G/4G (2016) US Data Plans

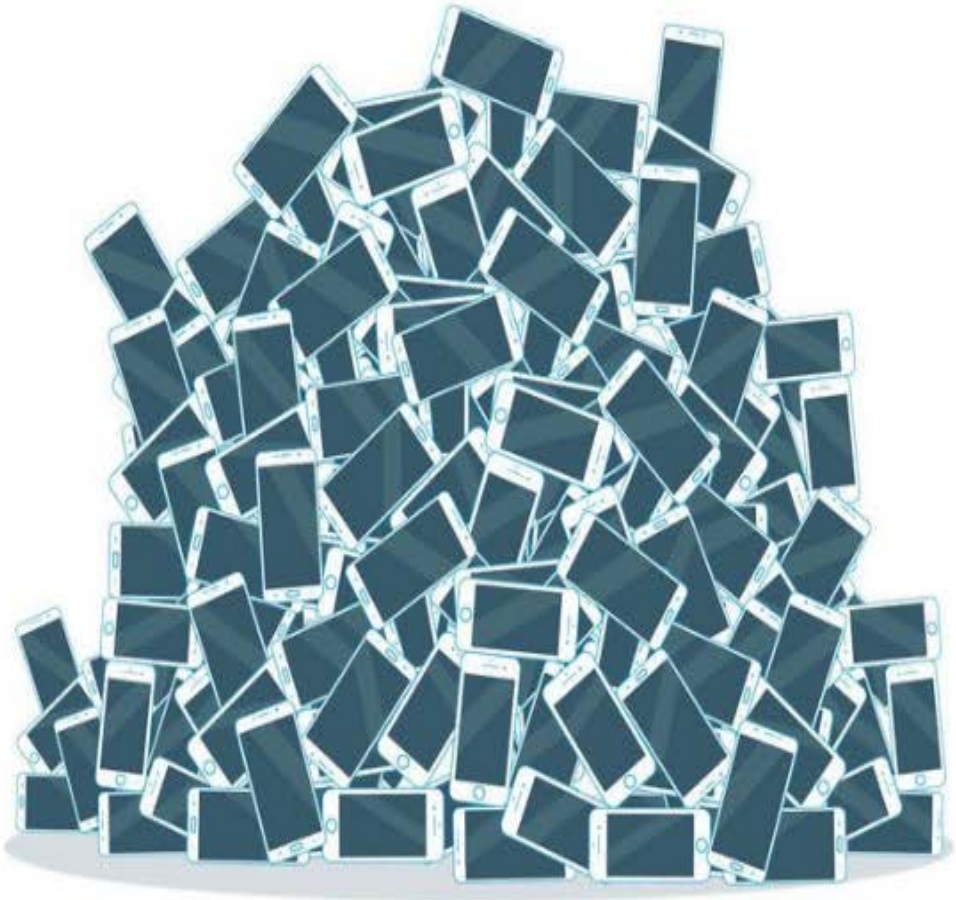
Bandwidth (Gb)	AT&T	Verizon	Sprint	T-mobile
.5				$20
1				
2				
2.5				$30
3			$34.99	
4	$30	$30		
4.5				$40
6	$40	$40	$49.99	
6.5				$50
8		$50		
8.5				$60
10	$60	$60		
10.5				$70
12		$70	$79.99	
14		$80		
15	$90			
16		$90		
18		$100		Not Available
20	$110	$110		
30	$185	$185		
40	$260	$260		
50	$335	$335		

Affordability	B+	C	A+
1GB - 1.5GB			
2GB - 3GB	$40		$20
4GB - 5GB	$50	$50	
6GB - 7GB	$60	$70	$35
8GB	$70		
10GB	$80	$90	$50
12GB	$90		

http://www.toptenreviews.com/services/internet/best-mobile-broadband-providers/

Autonomous car data

In 2020, the average autonomous car may process 4,000 gigabytes of data per day, while the average internet user will process 1.5 gigabytes.

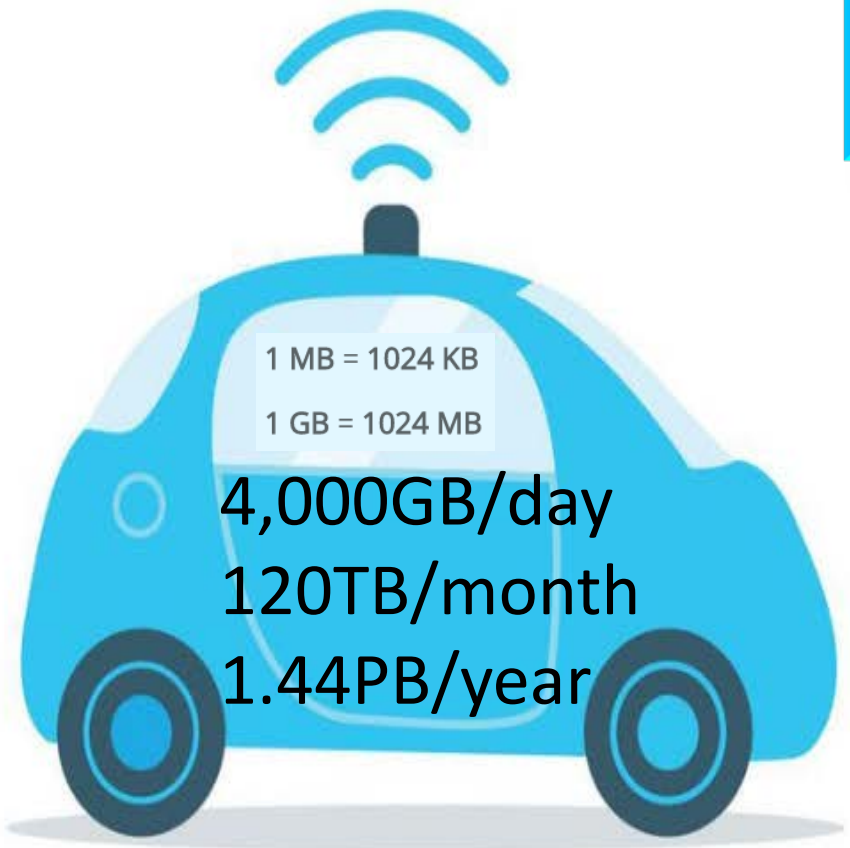


1 autonomous car = 2,666 internet users

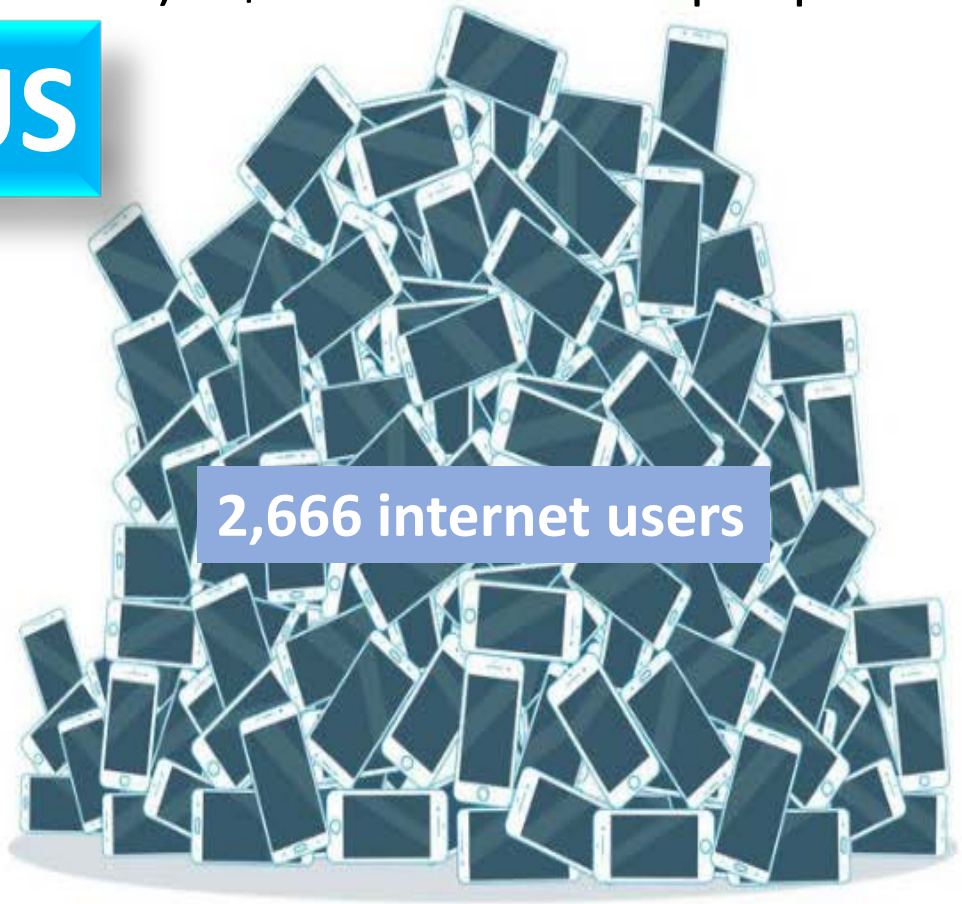
Autonomous car data $12.41 million per car per year

In 2020, the average autonomous car may process 4,000 gigabytes of data per day, while the average internet user will process 1.5 gigabytes.

2016 US Data Plans 10 GB data (per month) = $85 or 2% of GNI per person



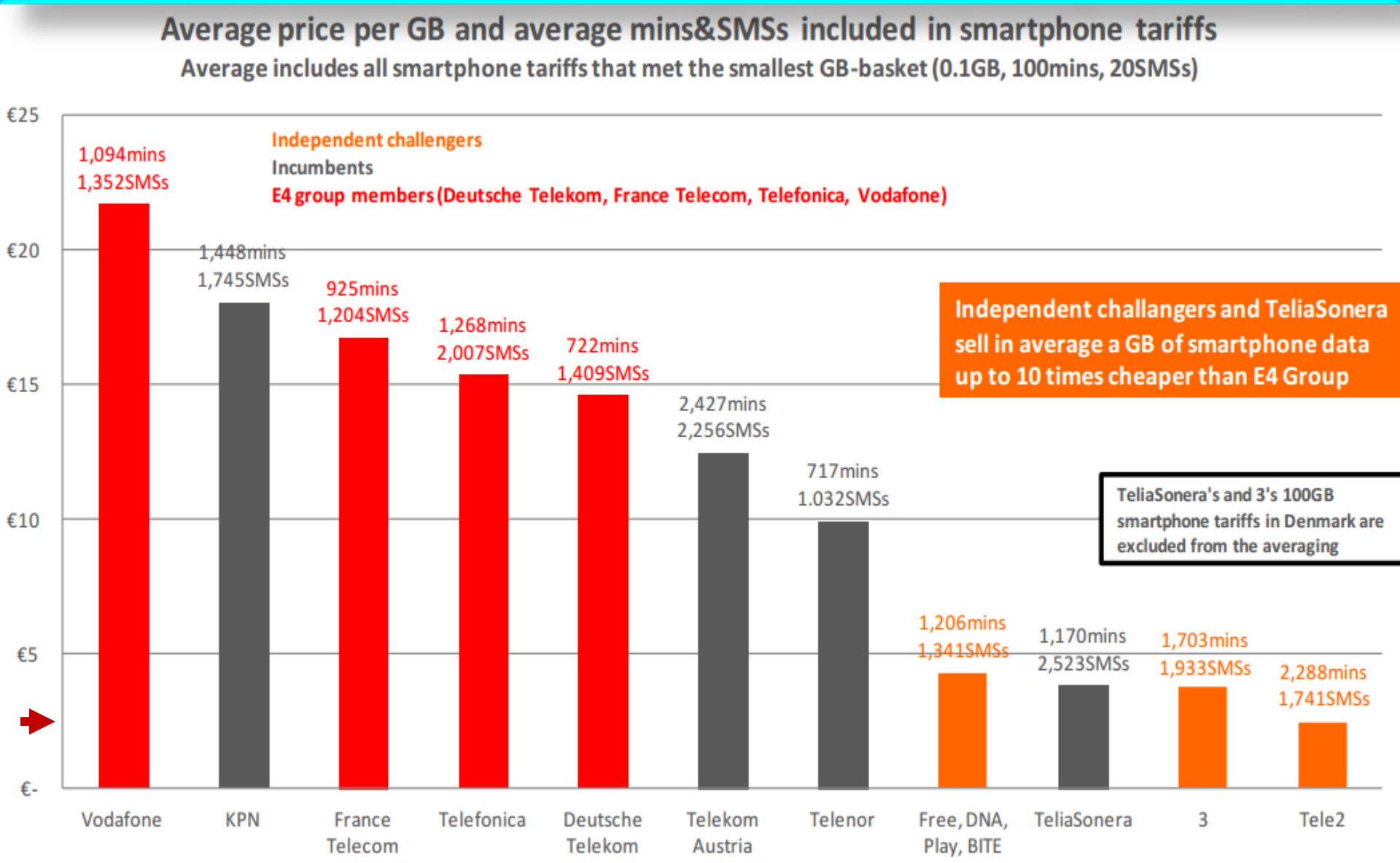
US



➡ African fixed broadband prices are, on average, 64% of GNI per capita

www.oafrica.com/broadband/african-internet-and-broadband-facts-from-measuring-the-information-society-2013-report/

Lowest cost of Mobile Broadband in EU approx. US$26.30/GB (highest US$231.4/GB)

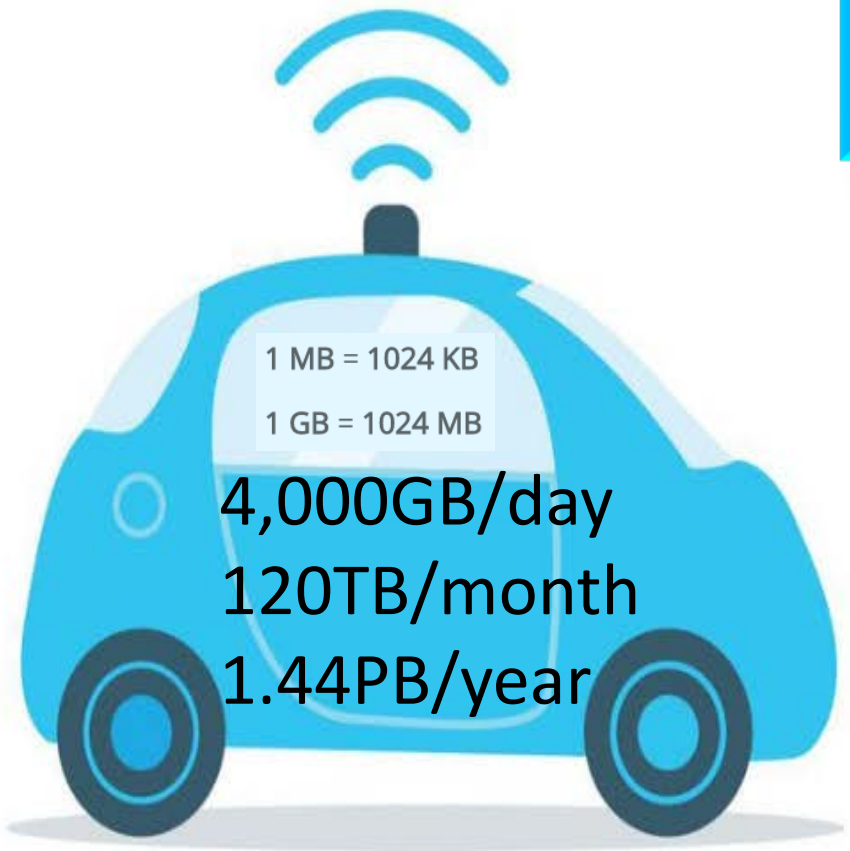


https://ec.europa.eu/digital-single-market/en/news/mobile-broadband-prices-europe-2016
http://www.rewheel.fi/downloads/Rewheel_EU27_mobile_data_cost_competitiveness_report_May_2013_FINAL.pdf

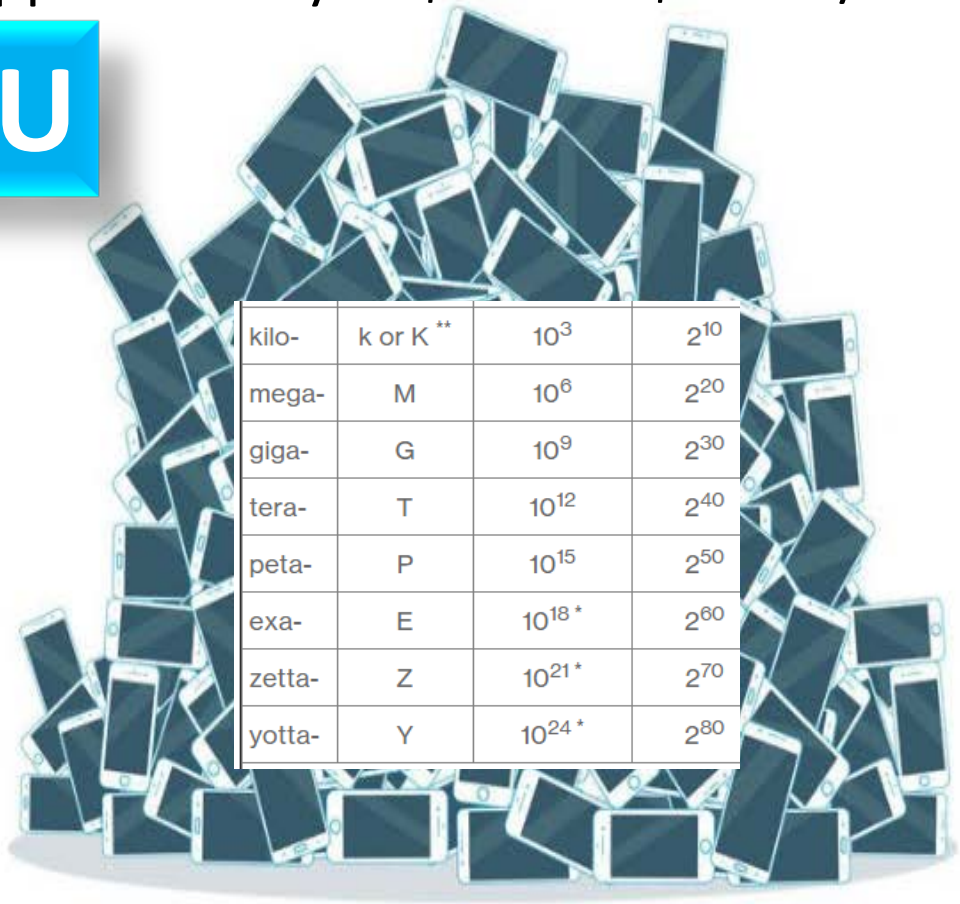
Autonomous car data $38.40 million per car per year

In 2020, the average autonomous car may process 4,000 gigabytes of data per day, while the average internet user will process 1.5 gigabytes.

Lowest cost of 0.1GB data in EU27 approximately US$2.63 or $26.30 / GB



EU



kilo-	k or K **	10^3	2^{10}
mega-	M	10^6	2^{20}
giga-	G	10^9	2^{30}
tera-	T	10^{12}	2^{40}
peta-	P	10^{15}	2^{50}
exa-	E	10^{18} *	2^{60}
zetta-	Z	10^{21} *	2^{70}
yotta-	Y	10^{24} *	2^{80}

1 autonomous car = 2,666 internet users

What may be the key trigger for mass adoption of autonomous vehicles?

US **$12.41 million per car per year**

EU **$38.40 million per car per year**

SIX ORDERS OF MAGNITUDE DECREASE IN COST FOR MOBILE 5G DATA

US **$12.41** **per car per year**

EU **$38.40** **per car per year**

Do you think data usage will be limited to 4,000GB/day or 1.44PB/year?

US	$12.41	per car per year
EU	$38.40	per car per year

6 ORDERS OF MAGNITUDE DECREASE IN COST + 10-FOLD DATA INCREASE

US	$124.10	per car per year
EU	$384.00	per car per year

In reality expect 1000-FOLD INCREASE in DATA for autonomous vehicles

$12,410 **per car per year**

$38,400 **per car per year**

1 Email (Plain Text) = 35 KB → Today's estimate of autonomous vehicle data

1 Minute of Facebook = 1 MB

1 Minute of Web-surfing = 2.5 MB

1 Minute of streaming YouTube (480p) = 4 MB → By 2020, estimate of autonomous vehicle data

1 Minute of streaming music = 1 MB

1 Minute of Skype Call = 360 KB

You earn €35K pa. Can you afford to pay €35K pa for your car's data plan?

$53K
GNI per capita

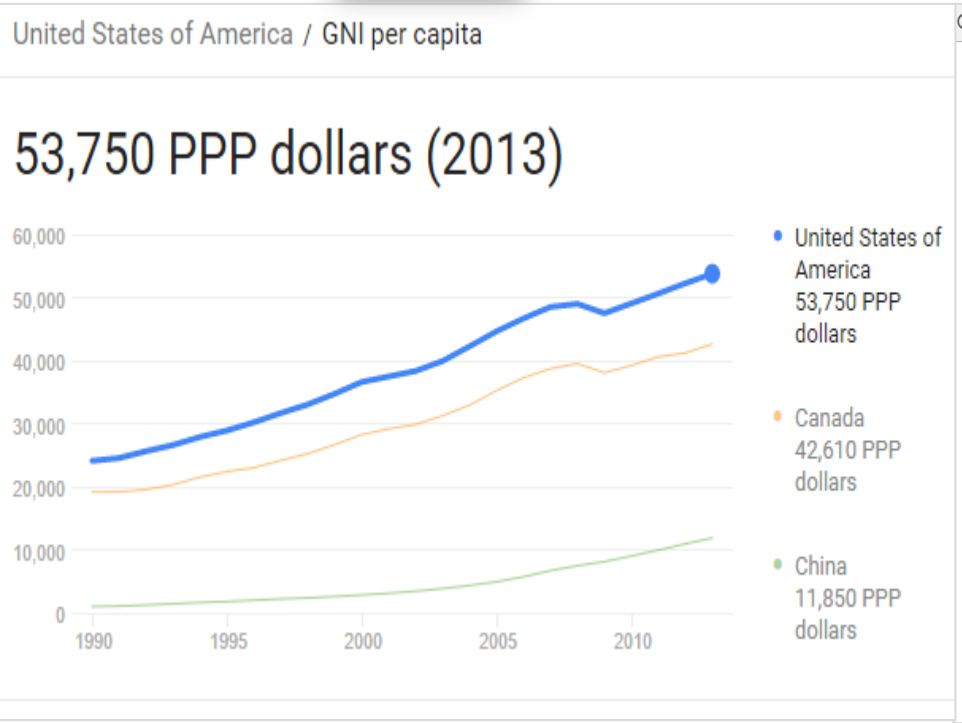
US

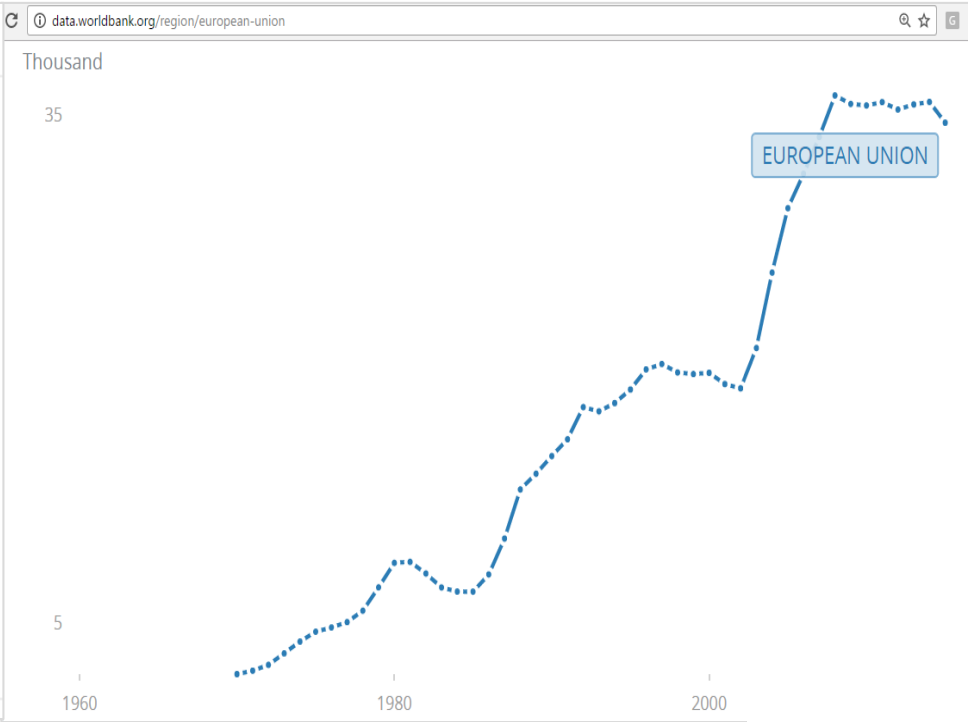
€35K
GNI per capita

EU

$12,410.00 **per car per year**

€35,600.00 **per car per year**





Do you want to own a car or share? At what cost will your autonomous car's data plan fit your budget? 2% of GNI per person? Can technology & economy drive down the cost to that level?

Where is the tipping point for autonomy in freight transport if €35,600 per year is a estimate for (personal use) a private vehicle's data plan?

$53K
GNI per capita

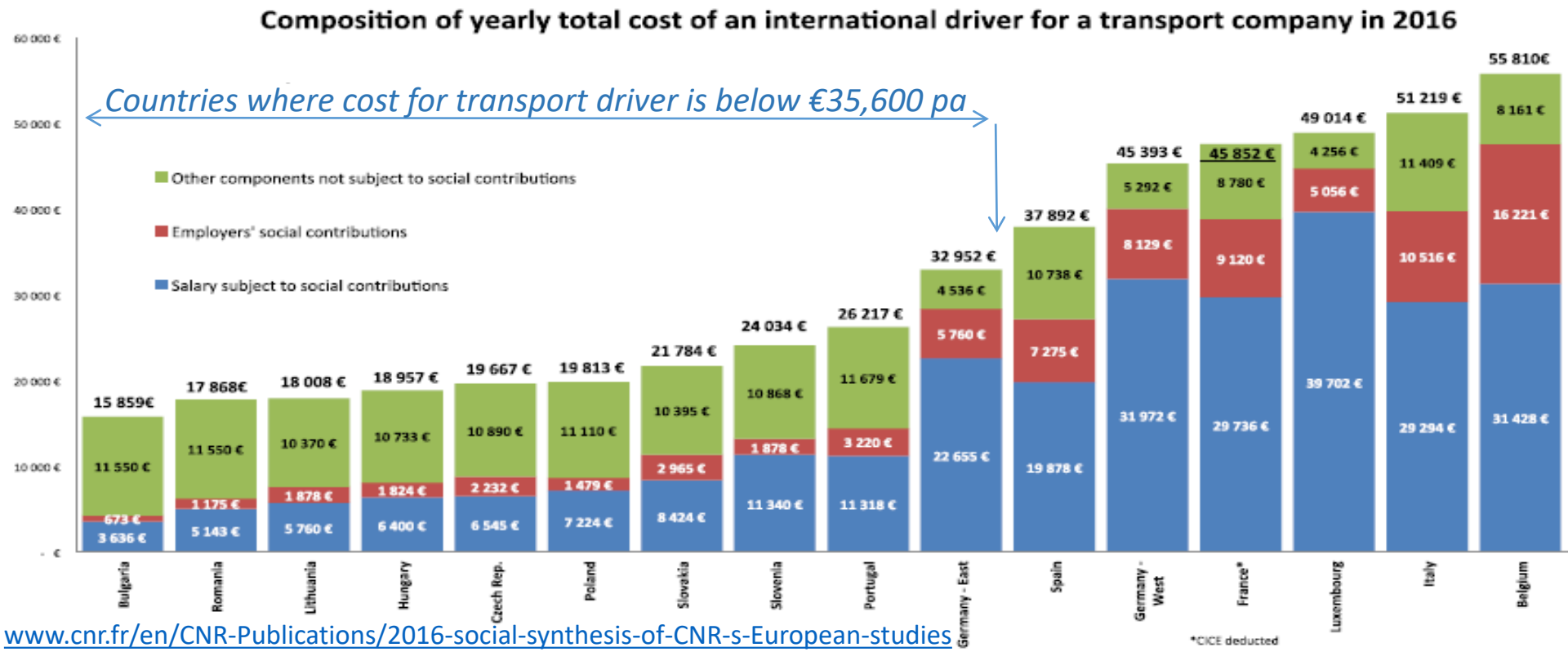
US

$12,410.00 **per car per year**

€35K
GNI per capita

EU

€35,600.00 **per car per year**



www.cnr.fr/en/CNR-Publications/2016-social-synthesis-of-CNR-s-European-studies

If you live in the EU when will you be able to afford your car's data plan?

https://www.nytimes.com/2017/02/09/business/europe-jobs-economy-youth-unemployment-millenials.html

BUSINESS DAY | Feeling 'Pressure All the Time' on Europe's Treadmill of Temporary Work

After graduating with degrees in accounting and finance from a university in Finland, Ville Markus Kieloniemi thought he would at least find an entry-level job in his field. He studied potential employers, tailoring his applications accordingly.

He wound up churning through eight temporary jobs over the next three years. He worked variously as a hotel receptionist and as a salesman in men's clothing stores, peddling tailored suits and sportswear.

"It's hard to manage your finances or even get housing, let alone start a career," said Mr. Kieloniemi, 23, who added depth to his résumé by accepting unpaid office jobs and internships in New York and Spain, mostly at his own expense. "You feel pressure all the time."

Meet the new generation of permatemps in Europe.

While the region's economy is finally recovering, more than half of all new jobs created in the European Union since 2010 have been through temporary contracts. This is the legacy of a painful financial crisis that has left employers wary of hiring permanent workers in a tenuous economy where growth is still weak.

SELF-DRIVING CARS?

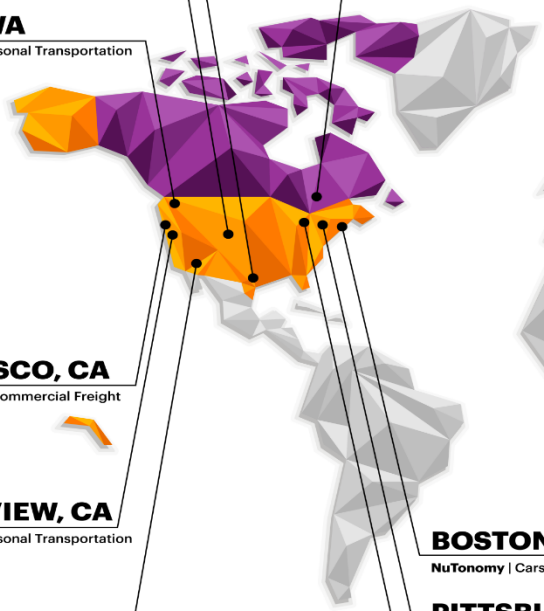
Transportation as we know it is starting to change with the proliferation of self-driving vehicles and technology developed by high-profile companies. This is becoming more evident with new testing sites on public roads and closed courses popping up across the globe every month.

The United States has been at the forefront of the autonomous-vehicle live trial movement, with more than half a dozen sites already in operation. Europe moved first with controlled-environment testing, and is focusing mainly on public transportation projects. In Asia, there are three testing locations with plans for expansion. Late in 2016, the first Canadian testing of self-driving vehicles began in Ontario.

This map charts the current self-driving vehicle testing and deployment locations worldwide.

Personal Transportation | Shuttles | Buses | Food Delivery

Closed-Course Testing | Taxis | Commercial Freight | On Demand



WATERLOO, ONTARIO
University of Waterloo, Erwin Hymer Group & BlackBerry QNX
Car & Van | Personal Transportation

ROTTERDAM, NETHERLANDS
DAF, Daimler, Iveco, MAN, Scania & Volvo
Semi-Trucks | Commercial Freight

WAGENINGEN, NETHERLANDS
WePods.com | Small Shuttles | Shuttles

BAERUM, NORWAY
Kolonial.no | Vans | Food Delivery

HELSINKI, FINLAND
Sohjoa | Buses

AUSTIN, TX
Waymo - Google | Cars | Personal Transportation

FORT COLLINS, CO
Otto - Uber | Semi-Trucks | Commercial Freight

KIRKLAND, WA
Waymo - Google | Cars | Personal Transportation

TOKYO, JAPAN
Toyota | Cars | Personal Transportation

SHANGHAI, CHINA
National Intelligent Connected Vehicle Pilot Zone
All Vehicle Types | Closed-Course Testing

SINGAPORE
NuTonomy | Cars | Taxis
Delphi | Cars | Taxis

SAN FRANCISCO, CA
Otto - Uber | Semi-Trucks | Commercial Freight
Lyft | Cars | On Demand

SION, SWITZERLAND
PostBus & Navya | Buses

MOUNTAIN VIEW, CA
Waymo - Google | Cars | Personal Transportation

BOSTON, MA
NuTonomy | Cars | Personal Transportation

PITTSBURGH, PA
Uber | Cars | Taxis

PHOENIX, AZ
Waymo - Google | Cars | Personal Transportation
Lyft | Cars | On Demand

ANN ARBOR, MI
Mcity - University of Michigan | Research / Testing | Closed-Course Testing

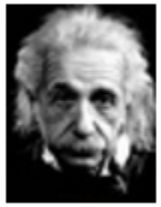
SOURCES

http://news.xinhuanet.com/english/2016-11/12/c_135824781.htm
http://www.nytimes.com/2016/11/08/science/finland-public-transportation-driverless-bus.html
https://www.google.com/selfdrivingcar/
https://www.wired.com/2016/10/ubers-self-driving-truck-makes-first-delivery-50000-beers/
https://www.postauto.ch/en/news/smartshuttle-testing-sion-resumes
http://fox45now.com/news/auto-matters/ubers-self-driving-cars-are-on-the-road-in-pittsburgh-how-are-they-doing
http://fox45now.com/news/auto-matters/most-lyft-rides-will-be-in-autonomous-cars-in-5-years
http://www.hybridcars.com/toyotas-approach-to-self-driving-cars-assist-drivers-dont-replace-them/
http://www.theverge.com/2016/8/25/12637822/self-driving-taxi-first-public-trial-singapore-nutonomy
https://www.bostonglobe.com/business/2016/11/21/boston-and-nutonomy-test-self-driving-car-year-end/5WLYxIJGDpJMjBZHCxYabL/story.html
https://www.theguardian.com/technology/2016/apr/07/convoy-self-driving-trucks-completes-first-european-cross-border-trip
http://www.mtc.umich.edu/test-facility
http://wepods.com/
http://www.telegraph.co.uk/technology/2016/01/28/first-driverless-buses-travel-public-roads-in-the-netherlands/
http://www.shanghaidaily.com/business/biz-special/Autonomous-connected-cars-on-their-way/shdaily.shtml
http://www.cbc.ca/news/business/automated-vehicles-1.3870605

FOR MORE INFORMATION, VISIT: http://insuranceblog.accenture.com/where-in-the-world-are-self-driving-cars/

How long it may take for creative destruction and cannibalization to restructure the global auto industry employing ~50 million people?

www.oica.net/category/economic-contributions/auto-jobs/



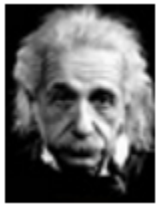
"We can not solve our problems with the same level of thinking that created them"

Autonomous Vehicles

NEW tools, NEW technologies, NEW economic models, NEW transaction cost structures, NEW digital businesses, NEW engineering design, NEW computational paradigms

The NEW normal – SERVICES – not products

Adoption (of autonomous cars) is unrelated to cost of product (car) but determined by the cost of essential services (zero latency, mobile computation, connectivity, cybersecurity, energy recharge)

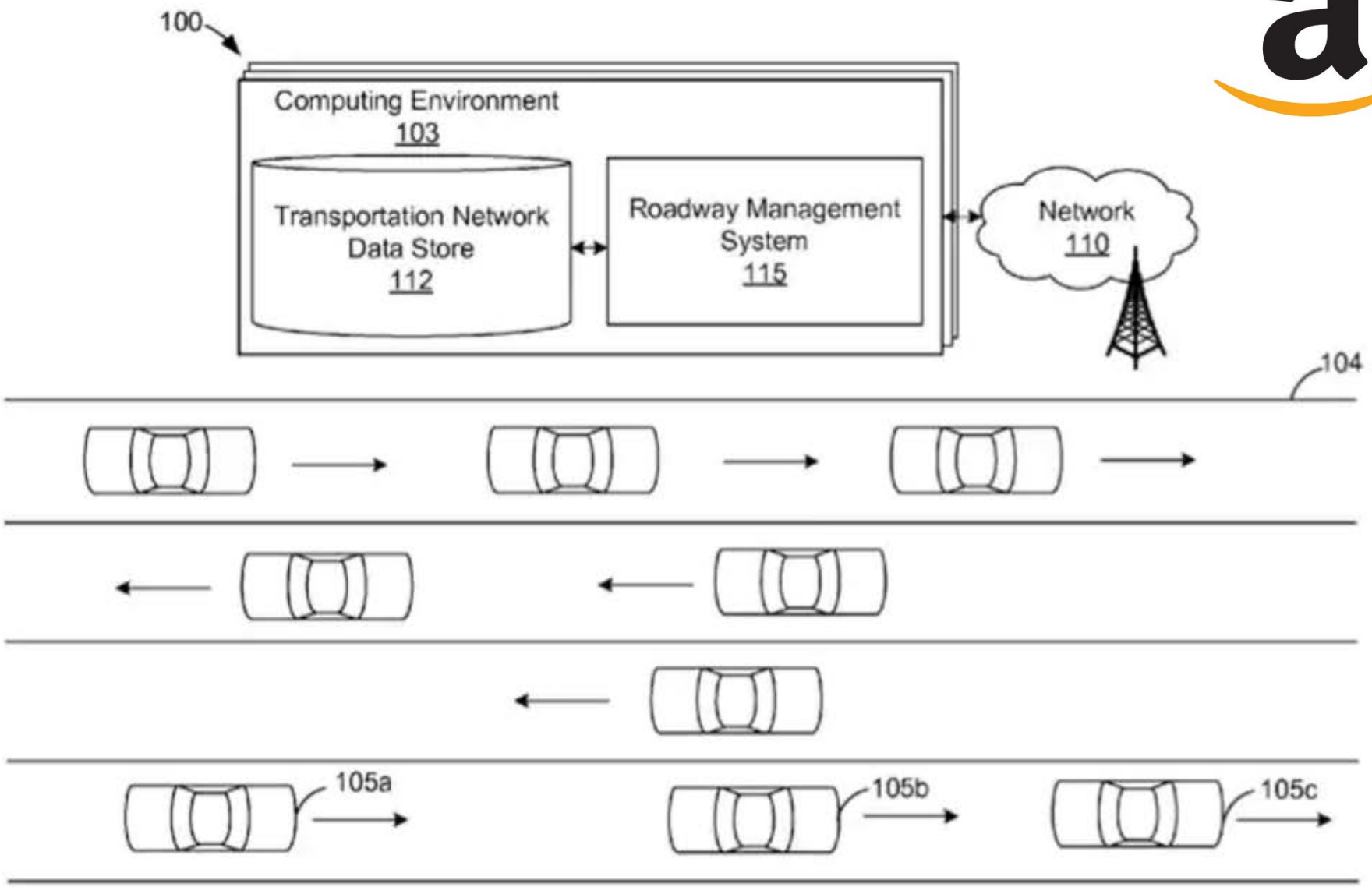


"We can not solve our problems with the same level of thinking that created them"

No large innovation has come from within a system. Tesla didn't come out of the automotive industry. SpaceX didn't come out of Boeing or Lockheed and by the way GM spent millions of dollars trying to do an electric car before Tesla. More money, more resources, more knowledge, too much knowledge. Wal-Mart didn't innovate retail. Amazon did. NBC and CBS didn't innovate media. Facebook, Twitter and YouTube did. Genentech didn't come out of Pharma. It came from a guy who was an associate at Kleiner – Bob Swanson *(in partnership with Herbert Boyer of UCSF).*

http://medcitynews.com/2017/01/vinod-khosla-healthcare-startups-hate/

Reversible lanes pose problem for autonomous cars and trucks, but Amazon has worked out a possible solution

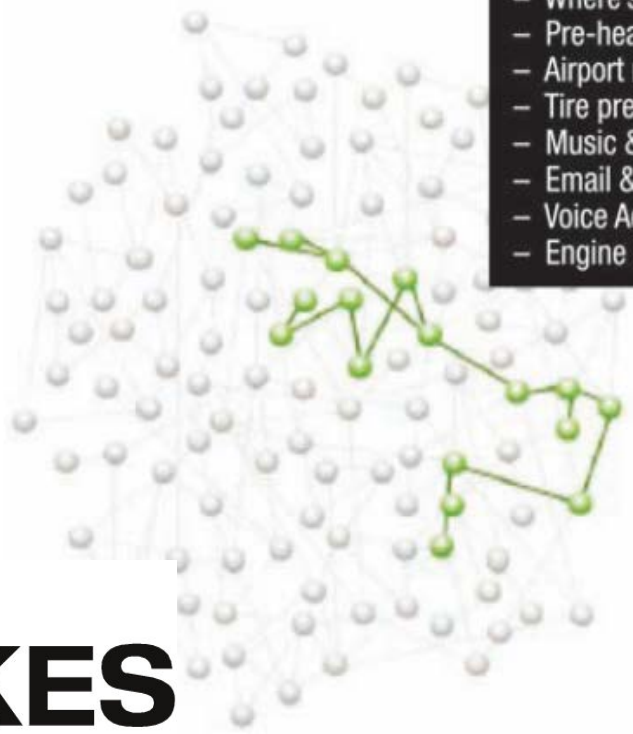


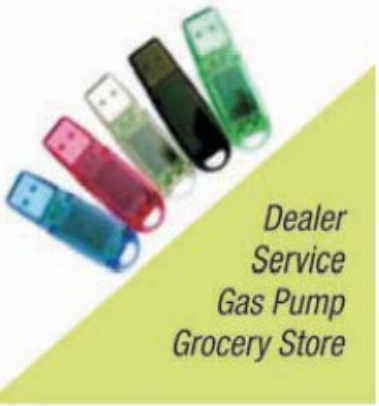
Amazon's self-driving patent proposes a centralised roadway management system that communicates with self-driving cars to help coordinate vehicle movement at a large scale. Photograph: USPTO

2005 – Swap form factor for “atoms” (connect bits, cars, engines, toilets)

12 years later, swappable car batteries are in discussion, but form factor for energy is still large.

On 17th November 2005, during a conversation in my office at MIT, I was requested to write a short article, on future trends in e-business, to be included in a publication to accompany the successful completion of the Tekes supported e-logistics program (ELO) in 2006. It was suggested that I send the completed article in about six weeks to allow for translation in Finnish.





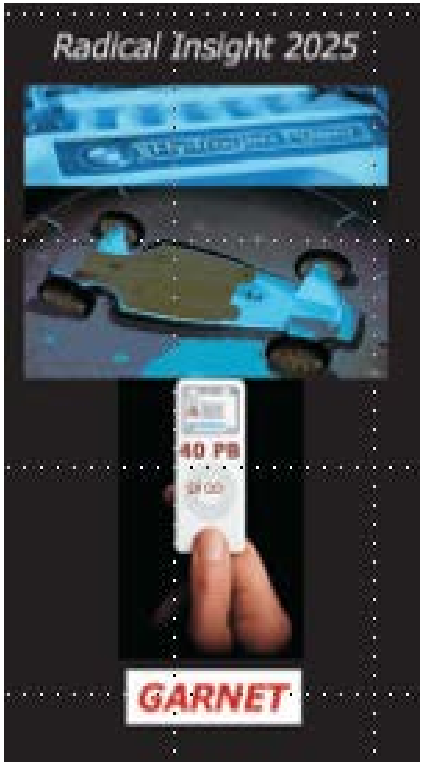
TEKES

2006 Paradigm Shift in Interoperability? https://dspace.mit.edu/handle/1721.1/56251

Swap "atoms" form factor

19. Wigner E. and Huntington H.B. On the possibility of a metallic modification of hydrogen. *J. Chem. Phys.*, 1935, v.3, 764–770.

12 years ago, the idea was of "portability" of atoms [eg: running your car on (metallic) hydrogen]



S. Datta, published (by TEKES in 2006)
https://dspace.mit.edu/handle/1721.1/56251

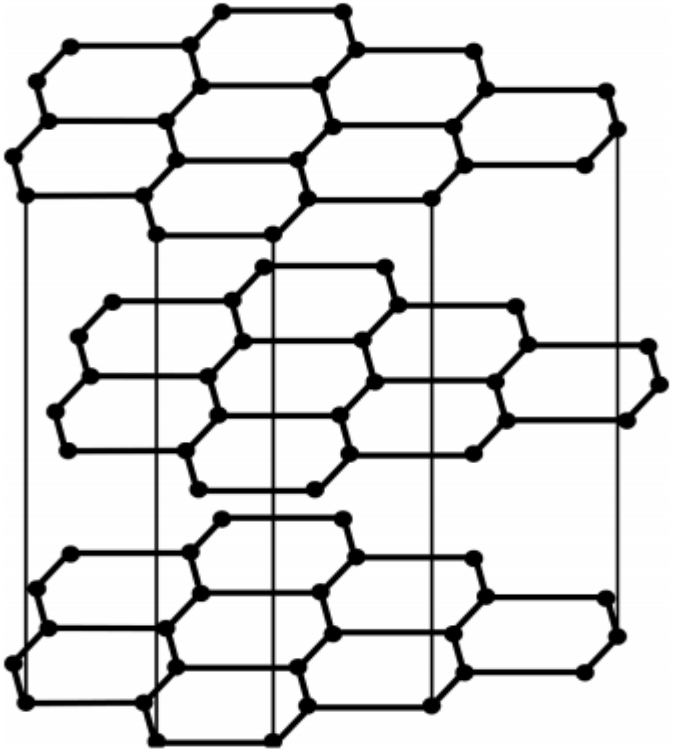


Fig. 1: Schematic representation of the layered lattice of graphite. Wigner and Huntington [19] would propose that most energetically favorable form of metallic hydrogen would assume this crystal structure. http://www.ptep-online.com/index_files/2011/PP-26-07.PDF

J. D. Bernal who first put forward the view that all substances go over under very high pressure into metallic or valence lattices" [19].

The rationale of "portability" of atoms was based on the theory of metastable metallic hydrogen

Harvard scientists announce they've created metallic hydrogen, which has been just a theory

January 26, 2017 |

19. Wigner E. and Huntington H.B. On the possibility of a metallic modification of hydrogen. *J. Chem. Phys.*, 1935, v.3, 764–770.

http://news.harvard.edu/gazette/story/2017/01/a-breakthrough-in-high-pressure-physics/

Swap “atoms” form factor – a different way of thinking about inventory at hand

12 years ago, the idea was of “portability” of atoms [eg: running your car on (metallic) hydrogen]

Drive any vehicle – car, ship, plane, rocket
Use metallic hydrogen in a USB drive form

Swap it anywhere to replenish

Think SCM - near-zero inventory of fuel, the weight of fuel, inventory carrying cost and energy used to carry inventory

https://dspace.mit.edu/handle/1721.1/56251

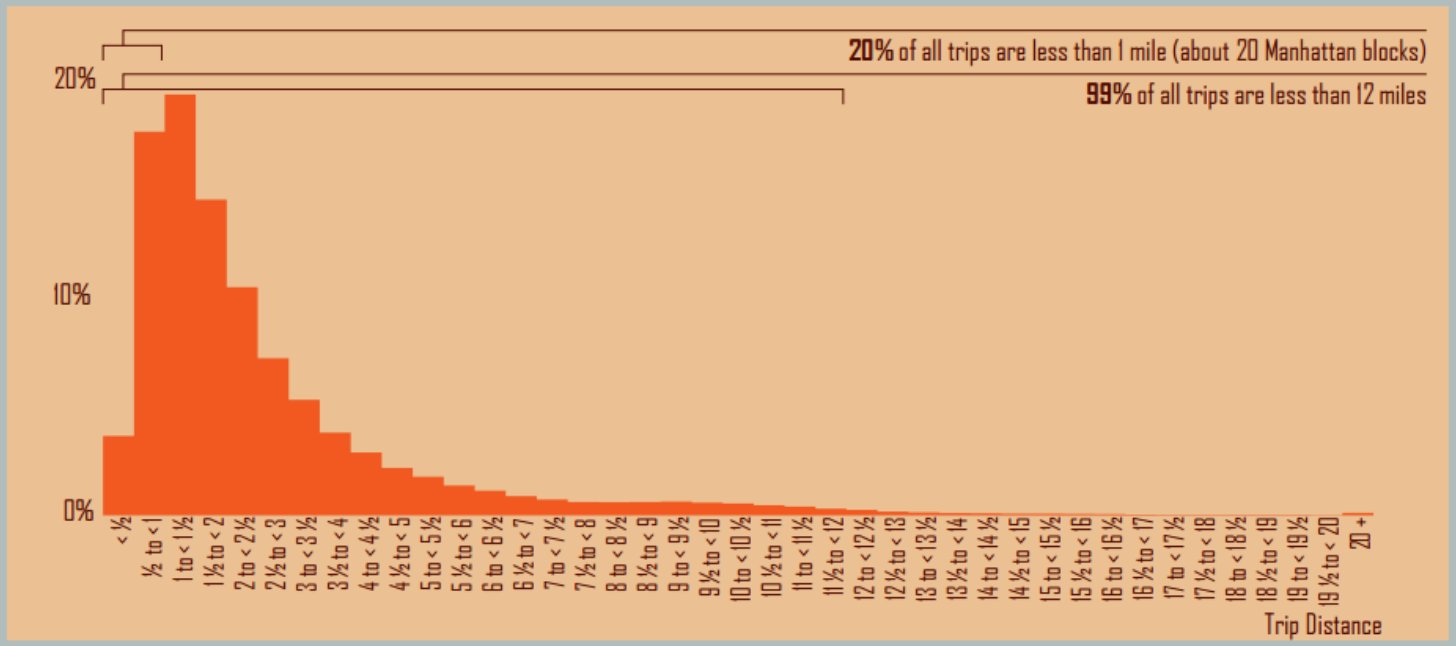
Swap “atoms” form factor – a different way of thinking about a typical taxi ride

http://www.nyc.gov/html/tlc/downloads/pdf/2014_taxicab_fact_book.pdf

Yellow taxis provide an average of

485,000
trips/day

The average trip distance is **2.6** miles



http://map.mathshell.org/download.php?fileid=1706

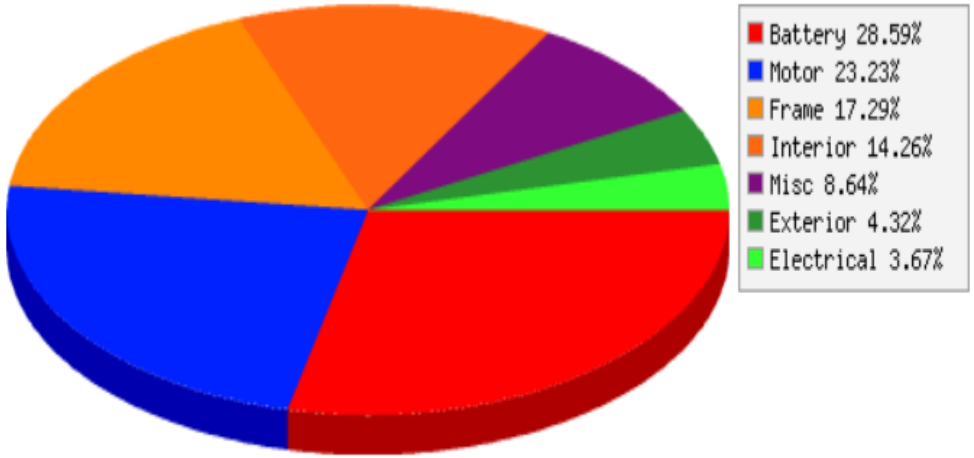
12 gallons

72 lb @ 6 lb/gal

Smaller cars generally have gas tanks that hold **12 gallons** worth of gas, while larger cars can hold 15 or **16 gallons**. For the purpose of this story, let's say gas costs $3.85 a gallon. A car with a **12**-gallon tank costs $46.20 to fill up while a larger car with a 15-gallon tank costs $57.75. Jul 5, 2013

How much energy (inventory) and weight of energy (gas or battery) is a vehicle carrying for an average 2.6 mile trip?

TESLA MODEL S WEIGHT – 4,600+ LB



Battery Pack **1323 lb**

- 1323 lb (1)

Aluminum Space Frame

- ~ 800 lb

Motor / Drivetrain

- ~ 350 lb – electric motor + inverter
- ~ 175 lb – differential
- ~ 250 lb – wheels + tires
- ~ 120 lb – brakes calipers, discs, lines
- ~ 80 lb – air suspension

Interior

- ~ 200 lb – front powered seats + rears
- ~ 190 lb – windshield, windows, hatch
- ~ 150 lb – pano glass and assembly
- ~ 80 lb – carpet, padding, mats
- ~ 40 lb – dash, trim, panels

Exterior

- ~200 lb – doors, frunk, hatch, body

Misc

www.teslarati.com/tesla-model-s-weight/

Swap “atoms” form factor – a different way of thinking about a typical taxi ride

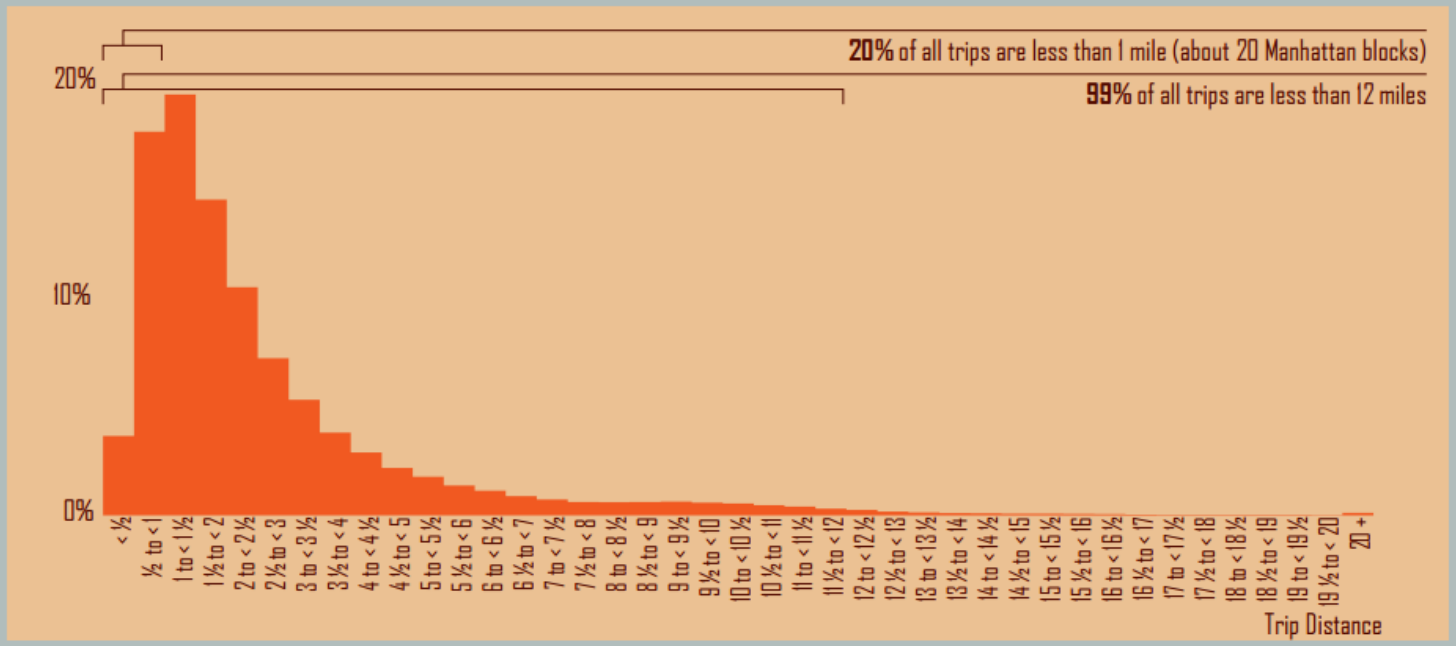
http://www.nyc.gov/html/tlc/downloads/pdf/2014_taxicab_fact_book.pdf

Yellow taxis provide an average of

485,000 trips/day

1300 lb battery for a 2.6 mile trip?

The average trip distance is **2.6** miles



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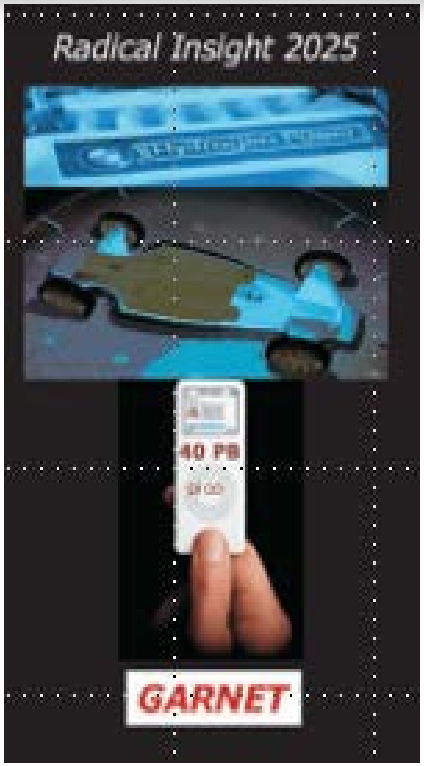
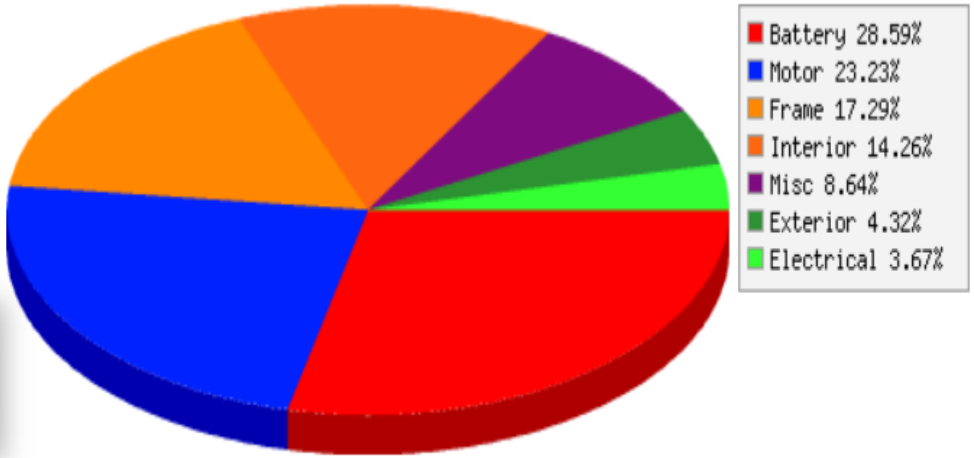
Change the equation!



10 gram Hydro-Stick
(Shoumen Datta, 2017)

TESLA MODEL S WEIGHT – 4,600+ LB



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- ~200 lb – doors, frunk, hatch, body

Misc

www.teslarati.com/tesla-model-s-weight/

Swap “atoms” form factor – Hydro-Stick of metallic Hydrogen is not a panacea

The form factor of energy and its source for transportation may undergo many radical metamorphoses because one solution may not suit all the different type of needs. Tesla’s approach may be overdue for an overhaul.

New ideas. New solutions. New engineering.

Swap “atoms” form factor – a different way of thinking about mobility of matter

Secure | https://www.technologyreview.com/s/531911/isaac-asimov-asks-how-do-people-get-new-ideas/

A person willing to fly in the face of reason, authority, and common sense must be a person of considerable self-assurance. Since he occurs only rarely, he must seem eccentric (in at least that respect) to the rest of us. A person eccentric in one respect is often eccentric in others.

Consequently, the person who is most likely to get new ideas is a person of good background in the field of interest and one who is unconventional in his habits. (To be a crackpot is not, however, enough

ISAAC ASIMOV

The NEW normal – SERVICES – not “things”

Why the Internet of Things is not only about “Things”

IoT is a design metaphor

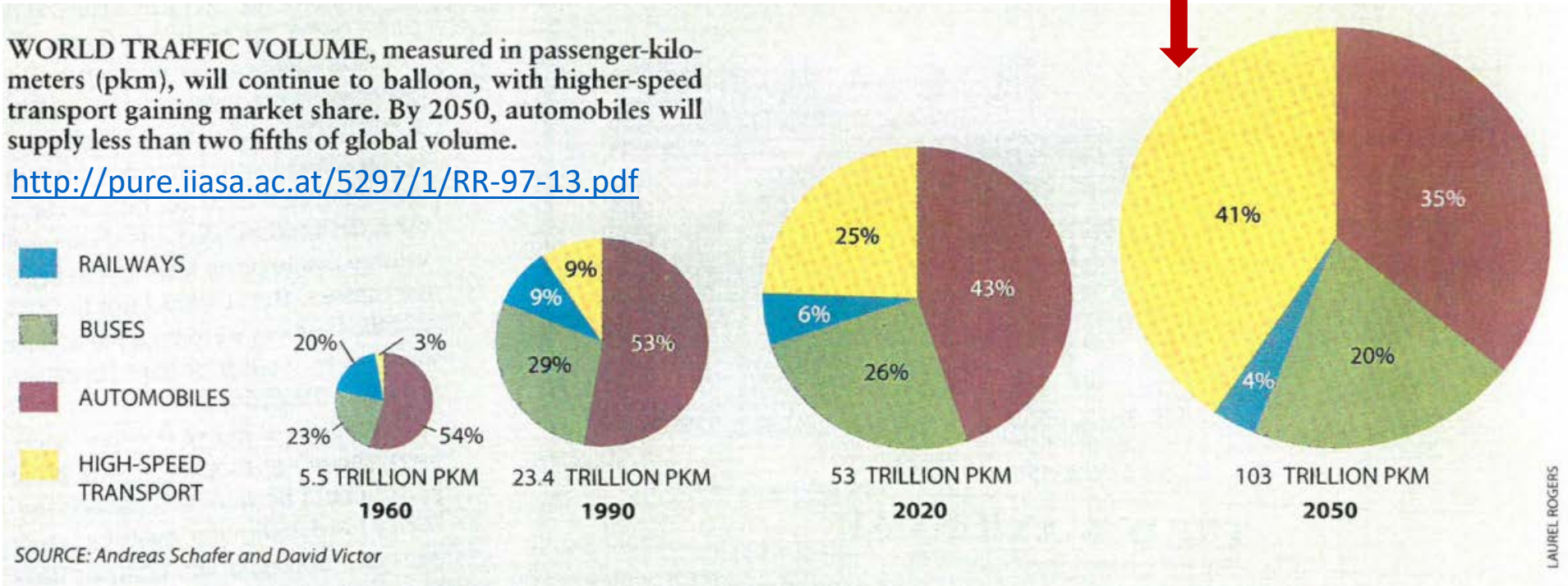
IoT needs identity of things

IoT is identification of things

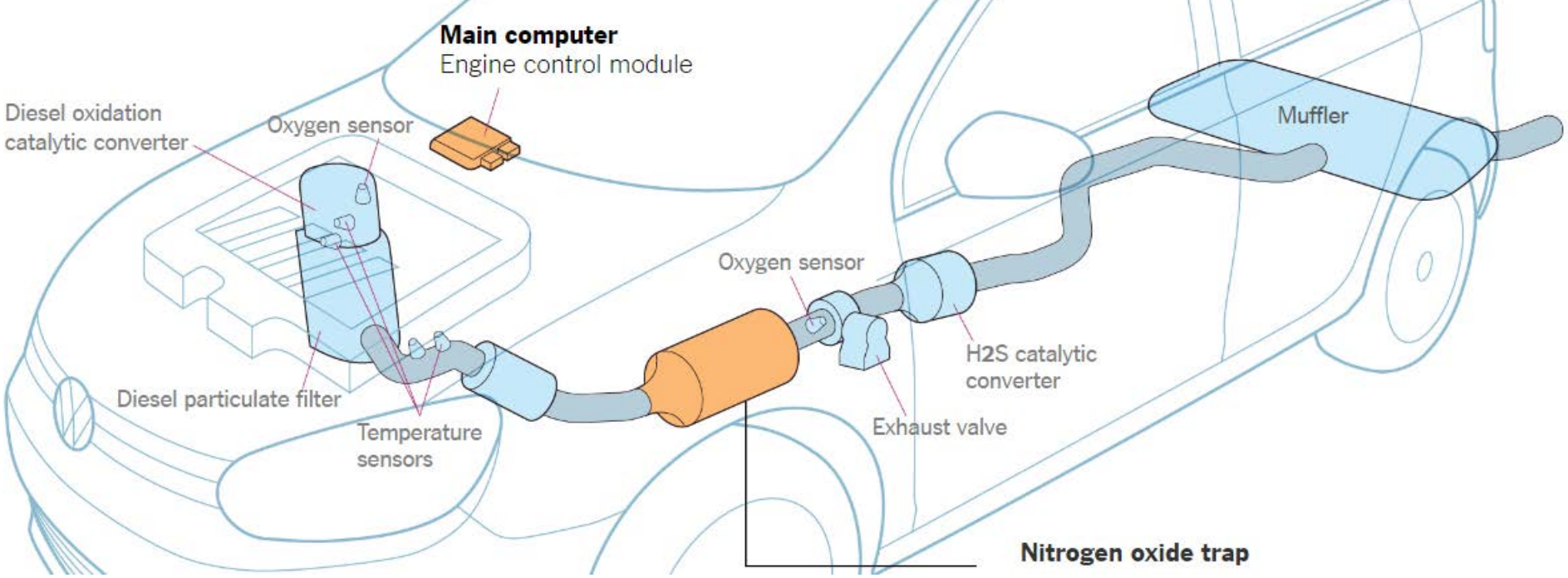
1997 - Prediction by Schafer and Victor (MIT)

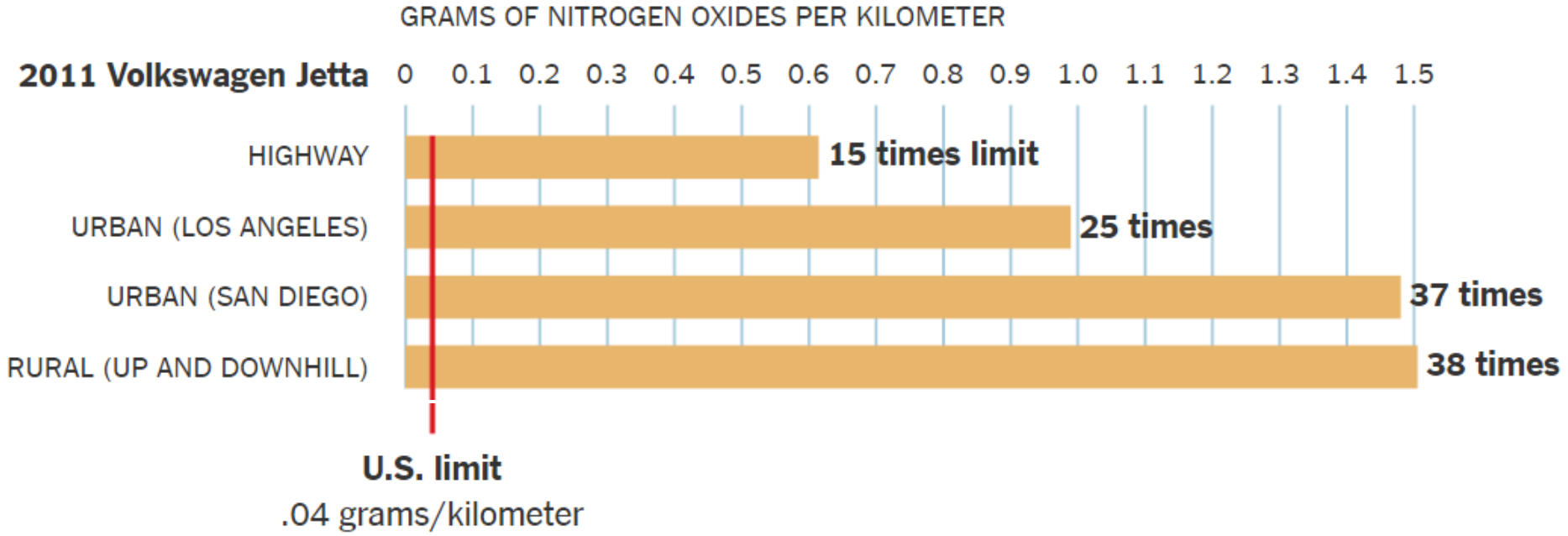
By 2050, automobiles will supply less than two fifths of global volume

Share of High Speed Transport in 2050 = 41%

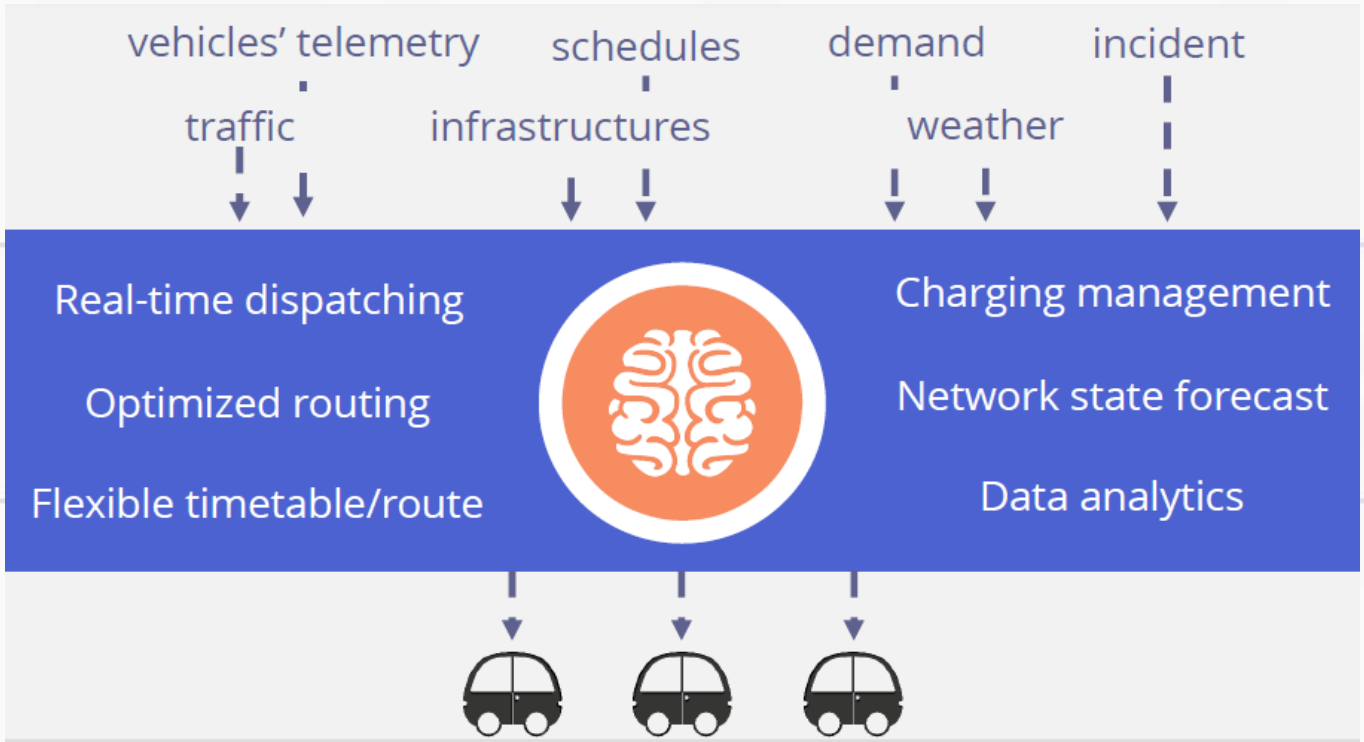


Problems at hand





Source: Arvind Thiruvengadam, Center for Alternative Fuels, Engines and Emissions at West Virginia University



PR about Autonomous Vehicles

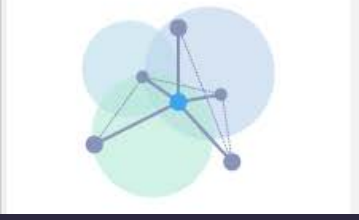
PR about Autonomous Vehicles

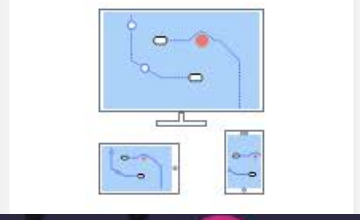
Core Engine

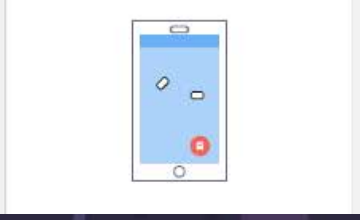
Operator dashboard

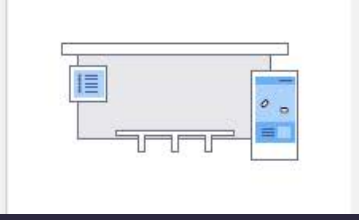
Mobile apps

Traveler info system







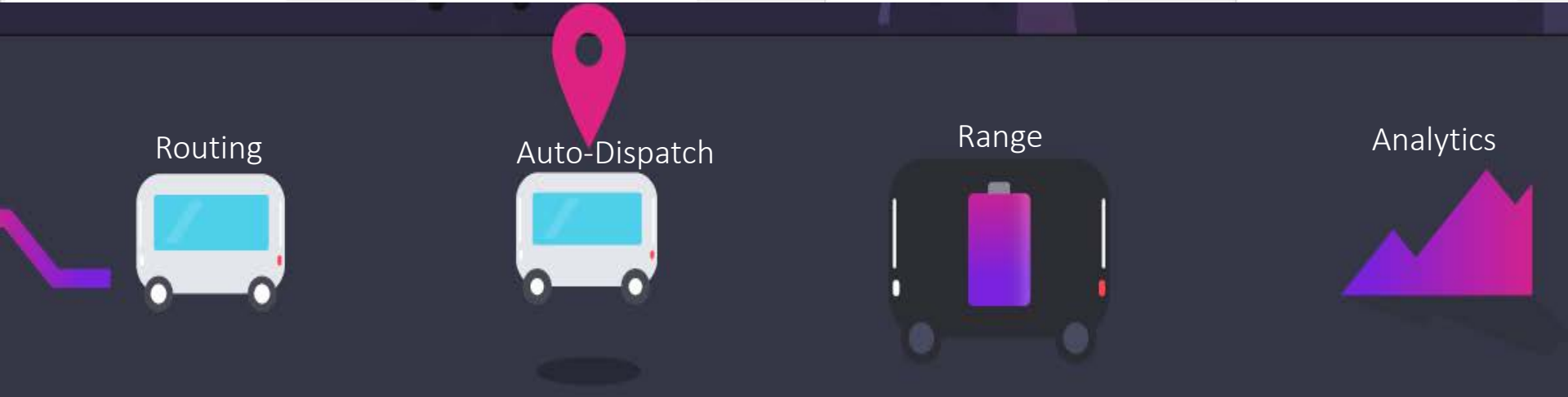


Routing

Auto-Dispatch

Range

Analytics



Autonomous Vehicles

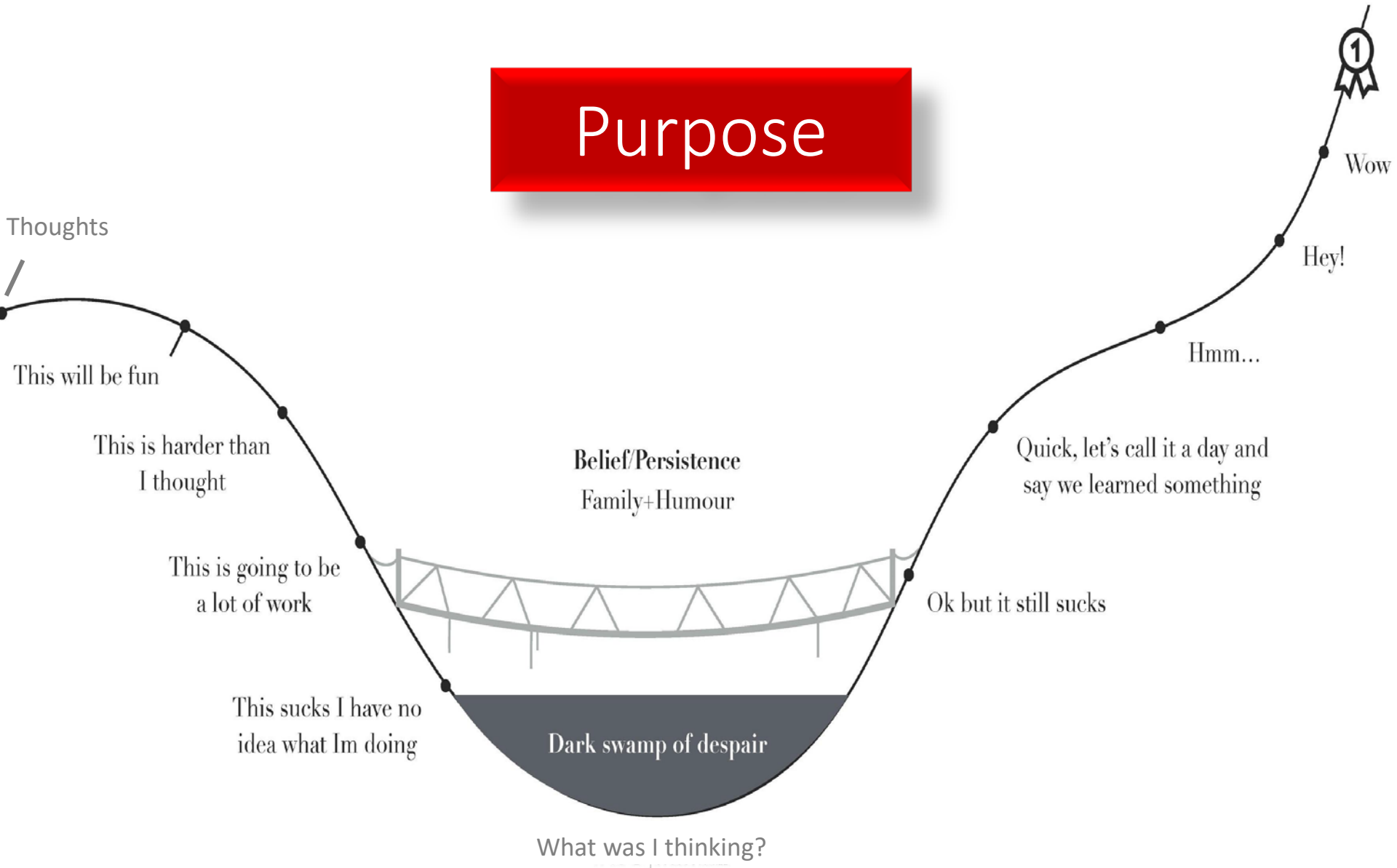
May start to become useful 2035-2040

Autonomous Vehicles need

INFRA-STRUCTURE

TELECOMMUNICATION, ENERGY and OTHER SERVICES

Transforming Vision into Reality

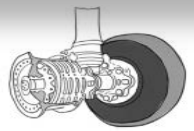


Value of Digital Transformation is guided by Outcomes

Item	Market Value 2006	Market Value Today	% Change
BEST BUY	$28.4B	$14.5B	(49%)
JCPenney	$18.1B	$3.0B	(83%)
KOHL'S	$24.2B	$9.9B	(59%)
★macy's	$24.2B	$13.0B	(46%)
NORDSTROM	$12.4B	$9.8B	(21%)
sears	$27.8B	$1.3B	(95%)
TARGET	$51.3B	$43.8B	(15%)
Walmart	$214.0B	$219.3B	2%
amazon	$17.5B	$351.8B	1,910%

Stupidity of PR, Marketing, Messaging – Cherry on Top

Creating an Illusion of Easy, Quick, Shrink-Wrapped ROI



How does PREDICTIVE MAINTENANCE work?

Slap-on Sensors plus Plug-n-Play Starter Kits – IoT Business Model

Asset:
817 .

Details | Drivers and Risk Factors | Maintenance Log | Explore

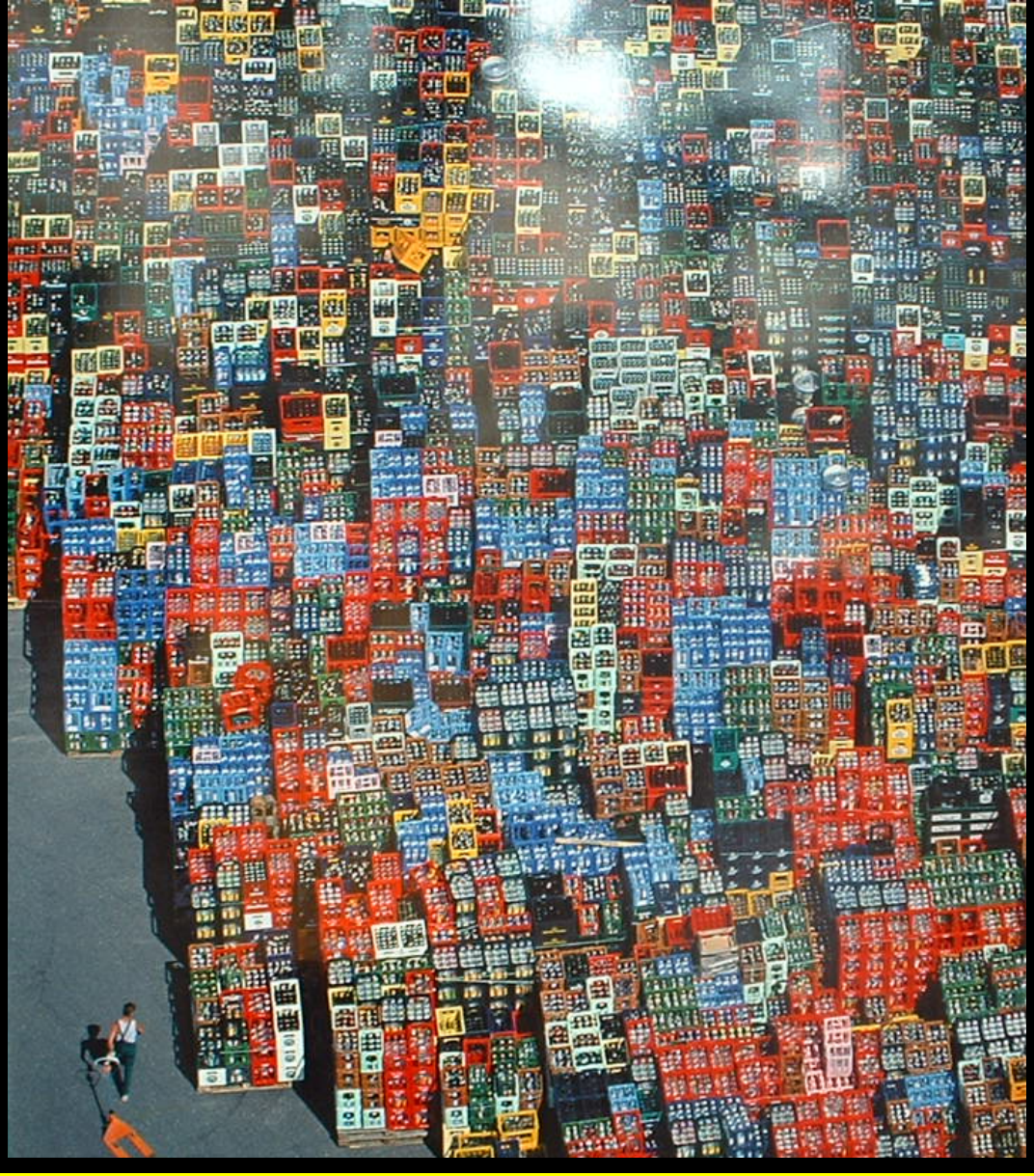
DIAGNOSTIC LOGS

approach	Slow
mass	Large

CURRENT PREDICTION

Predicted Failure Date
12/4/2016

107 Days before next scheduled maintenance on
3/3/2017



Slap on a RFID tag and harvest ROI

Beverage and Beer Crates in Lower Saxony (Germany)

RFID Radio Frequency Identification

1940

RFID born out of Radar effort (WWII)

1948
Harry Stockman invents RFID. Publishes paper, “Communication by Means of Reflected Power”

1950

RFID crawls out

1950
D.B. Harris patents RFID. “Radio transmission systems with modulatable passive responder”

1952
F.L. Vernon “Application of the microwave homodyne”

1959
Identification of Friend or Foe (IFF) long-range transponder system reaches breadboard demonstration stage.

1960

Theory of RFID, field trials planned

1963-1964
R.F. Harrington advances theory with “Field measurements using active scatterers” and “Theory of loaded scatterers”

1966
Commercialization of EAS, 1-bit Electronic Article Surveillance

1970

Early adopters implement RFID

1973
Raytheon's "Raytag"

1977
RCA develops "Electronic identification system"

1975
Los Alamos National Lab (LANL) releases RFID research to public sector, publishes “Short-range radio-telemetery for electronic identification using modulated backscatter”

1976-1977
LANL RFID spin-offs Indentronix and Amtech

1975-1978
Raytheon, Fairchild & RCA develop RFID

1980

Commercial RFID endeavors sprout

1982
Mikron founded; bought by Philips

1987
First RFID road toll collection implemented in Norway

1990

Many RFID standards emerge

1991
TI creates TIRIS to develop and market RFID

1992-1995
Multi-protocol traffic control and toll collection implemented in Texas, Oklahoma, and Georgia (USA)

1998
David Brock and Sanjay Sarma of MIT publishes an idea: ‘Internet of Things’

1999
Auto ID Center created at MIT. Retailers drive to standardize EPC

2000

RFID hype, peaks

2003
UPC and EAN forced by US retailers to promote EPC

2005
Wal-Mart and US DoD fuels the hype curve by demanding suppliers use passive RFID and EPC.

Vast number of RFID companies and ‘short-sight’ enters the market.

Modified from: Han Pang Huang, National Taiwan University
Partial Source: Shrouds of Time – The History of RFID

The Economic Future in Historical Perspective

Paul A. David and Gavin Wright in The Economic Future in Historical Perspective (Oxford University Press, 2003)

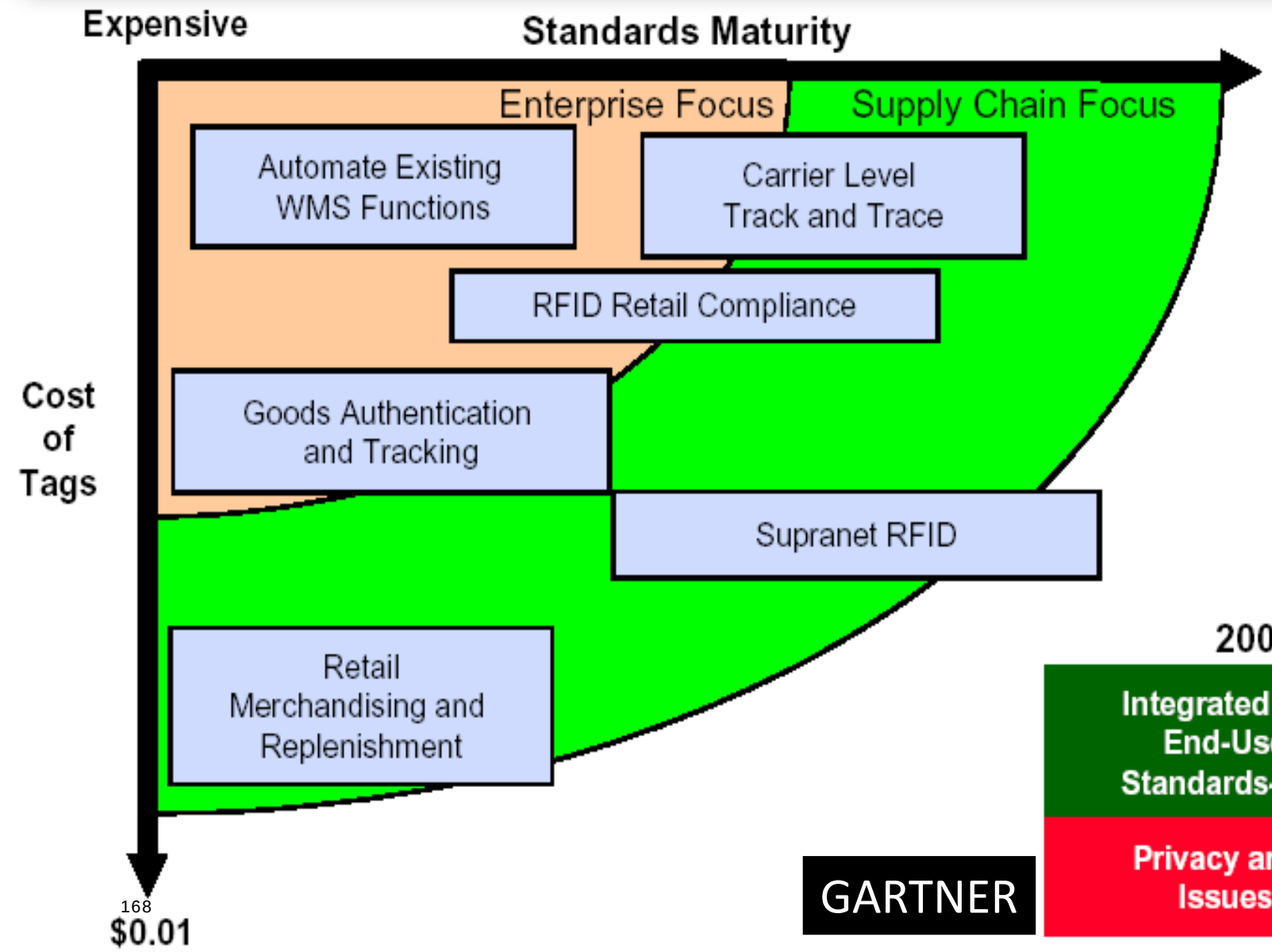
Statistically documented discontinuity can be traced to critical engineering and organizational advances connected with the electrification of industry. These developments marked the culminating phase in the diffusion of the "dynamo" as a general purpose technology that enabled significant fixed-capital savings, while simultaneously increasing labor productivity. A narrow technological explanation of the post-WWI industrial productivity surge proves to be inadequate. It neglects the concurrence of those developments with important structural changes in US labor markets and fails to do justice to the significance of complementarities that emerged between managerial and organizational innovations and the dynamo-based factory technology, on the one hand, and, on the other, between both forms of innovation and macroeconomic conditions of 1920's.

The Economic Future in Historical Perspective

Paul A. David and Gavin Wright in The Economic Future in Historical Perspective (Oxford University Press, 2003)

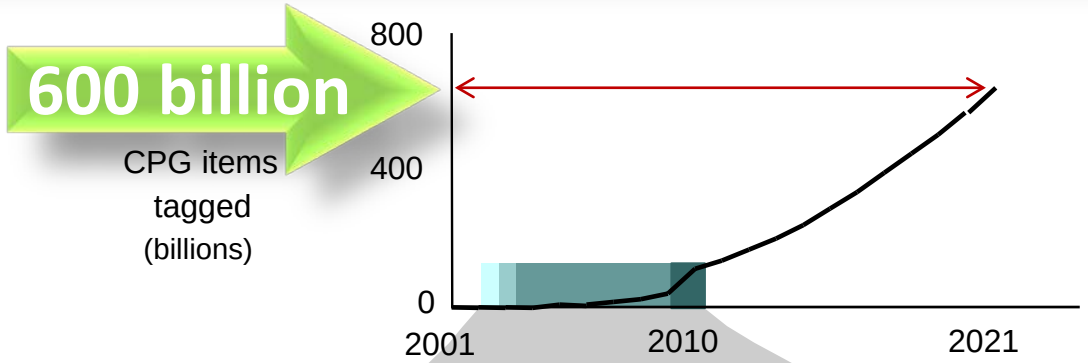
Slow pace of adoption prior to the 1920's was attributable largely to the lack of profitability of replacing still serviceable manufacturing plants adapted to the old regime of mechanical power derived from water and steam. Coexistence of older and newer forms of capital often restricted the scope for exploiting electricity's potential. Prior to 1920, the group drive system of within-plant power transmission remained in vogue. With this system (in which electric motors turned separate shafting sections, so that each motor drove related groups of machines) primary electric motors often were merely added to the existing stock of equipment. With the favorable investment climate of the 1920's, firms had the opportunity to switch from group drive to unit drive transmission, where individual electric motors were used to run machines and tools. Advantages of the unit drive extended well beyond savings in fuel and in energy efficiency. They also made possible single-story, linear factory layouts with reconfigured machine placement permitting flow of materials through the plant that was both more rapid and more reliable. Rearrangement of the factory contributed to cost savings in materials handling operations.

HYPE > Smart Objects in Real-time Adaptive Supply Network

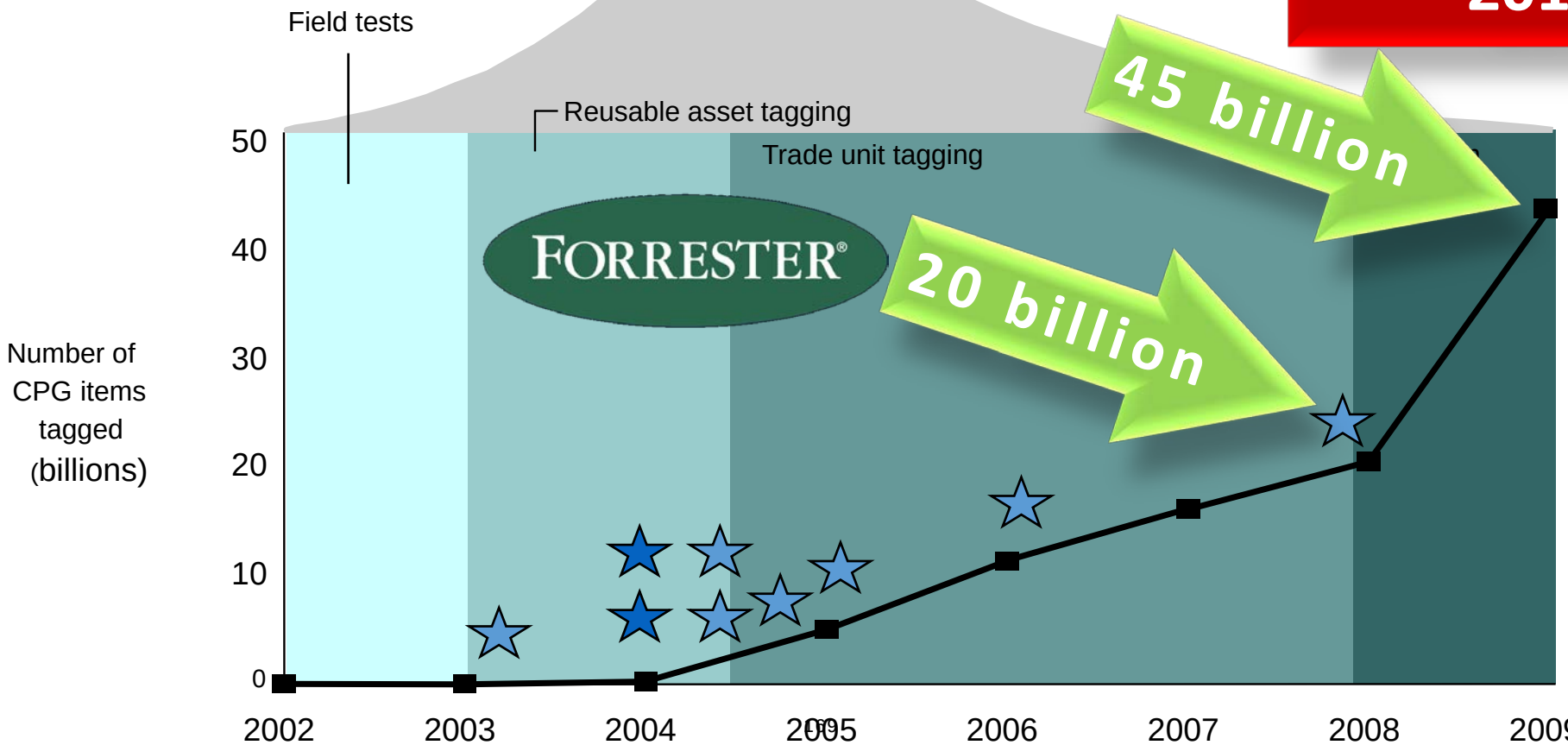


RFID (tagged objects in CPG) Predicted vs Actual

www.idtechex.com/research/reports/rfid-forecasts-players-and-opportunities-2016-2026-000451.asp

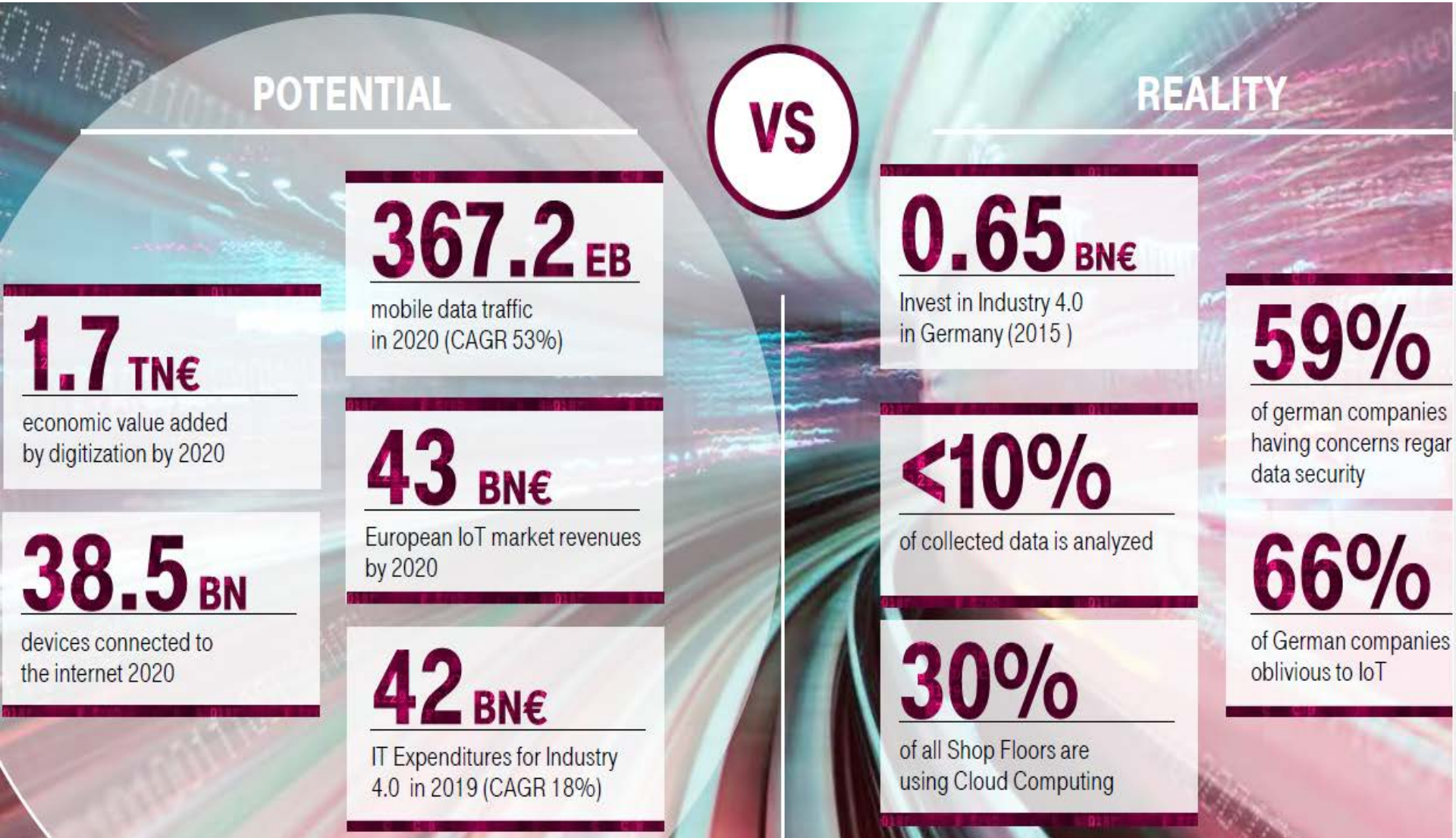


~10 billion RFID tags shipped in 2016



Dé jà vu
IoT

Digital Germany in 2016



Telecommunications Market

US$ 1.3 TRILLION

DATA POOLING
COLLECTING & TRANSMITTING

PARAMETER ANALYSIS
ANALYSIS OF COLLECTED DATA

PATTERN RECOGNITION
AND ACTION TRIGGERING

LAUNCHED

CONDITION MONITORING BASIC

- Plug-n-play basic bundle
  - Standard sensor
  - Connectivity
  - Simple IoT data & cloud/portal

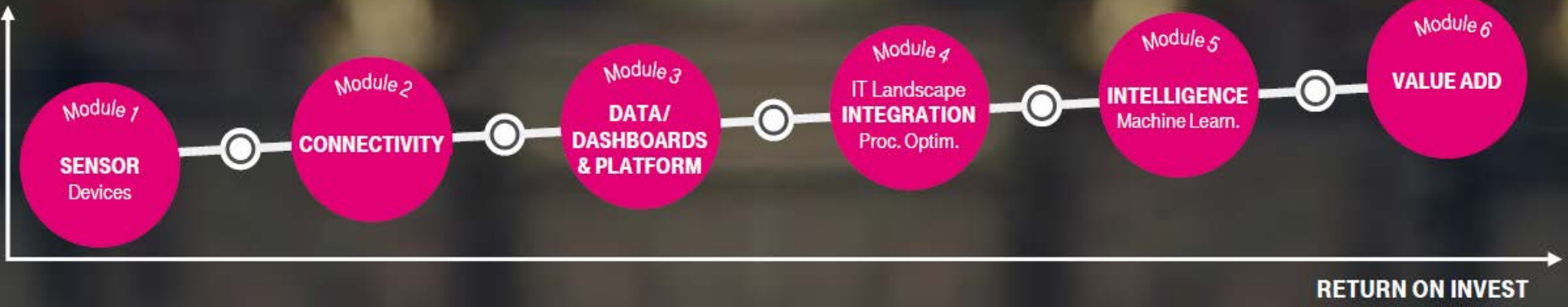
LAUNCHED

PRED. MAINTENANCE STANDARD

- Sensors
- Connectivity
- Cloud and IoT services (incl. already existing M2M services)
- Own customer dashboard for

PRED. MAINTENANCE ADVANCED

- Builds upon the standard bundle
- Additional advanced data analytics services
- Improved sensors
- Highly developed cloud & IoT services.



LOW DATA RATES

600 BIT/S UP TO FEW 100 KBIT/S*

LOW POWER CONSUMPTION

LONG BATTERY LIFETIME
(10 YEARS, 2 AA BATTERIES)

LOW COST

TARGET FOR MODEMS (<€4**)

STANDARDIZED

3GPP RELEASE 13

LTE BASED SECURITY

SIM BASED, AUTHENTICATION,
INTEGRITY, CIPHERING

HIGH NUMBER OF DEVICES

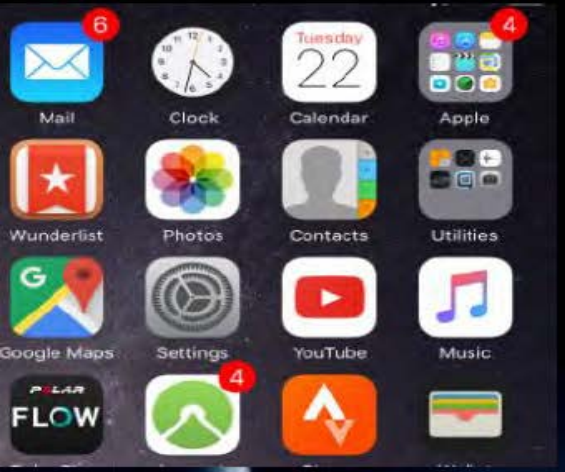
~100.000 CONNECTED PER CELL

Microsoft Azure | CISCO | OPEN TELEKOM CLOUD

CONNECTIVITY

DEVICES

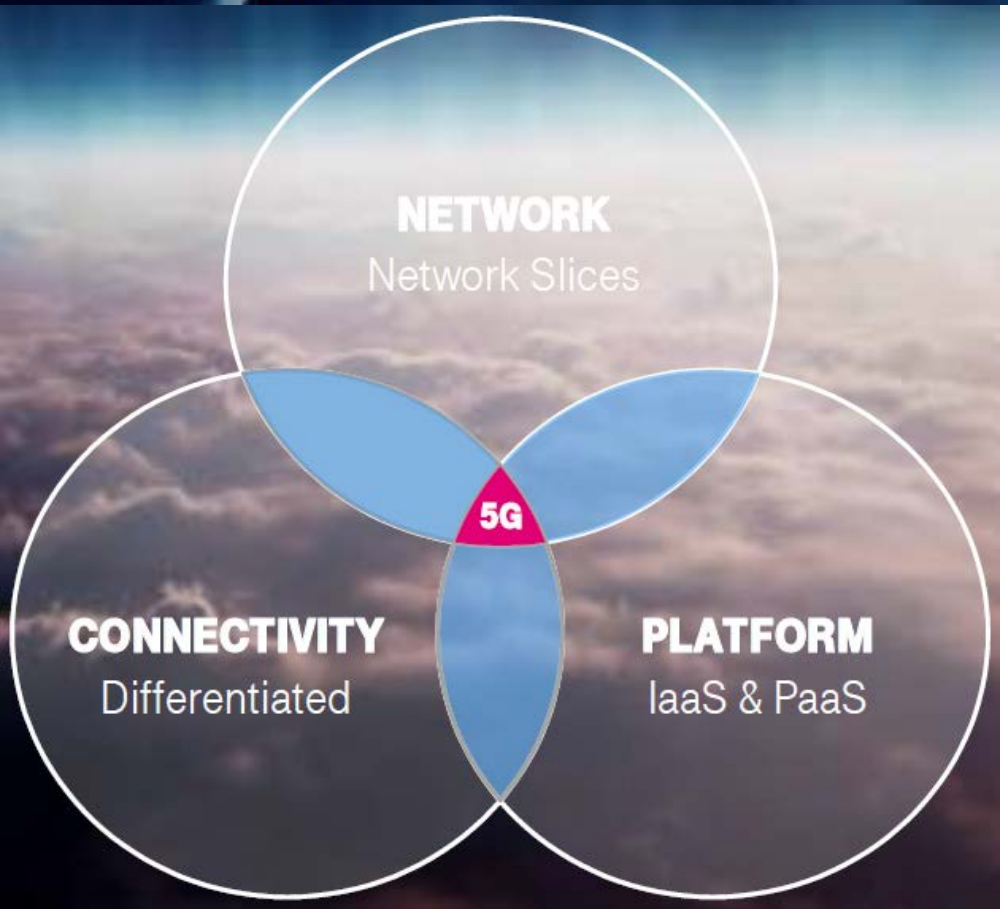
TATA COMMUNICATIONS | Deutsche Telekom | HUAWEI | verizon

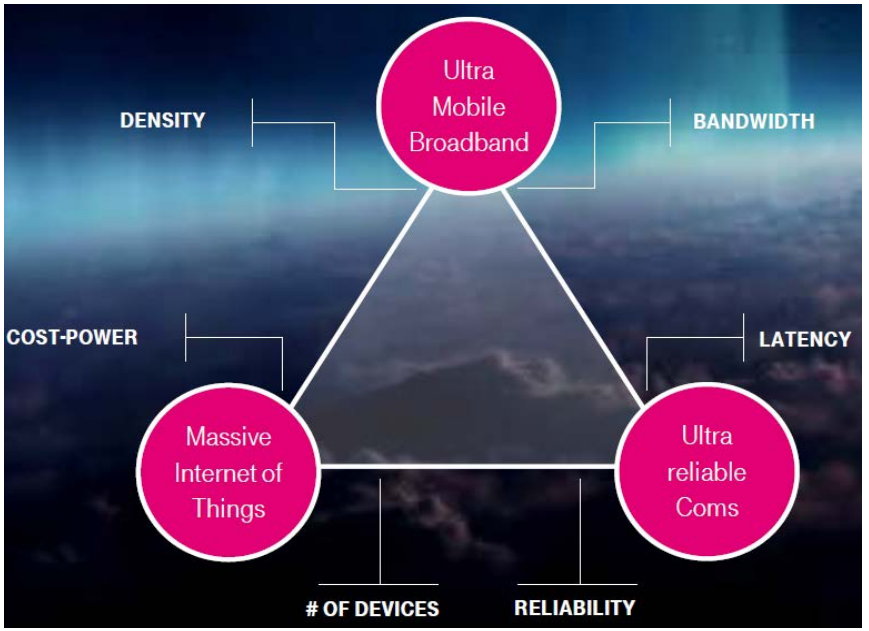


20-30MS

Humans Abhor Latency

< 1MS





It Takes Time

Digital Objects Management

Digital Operations Management

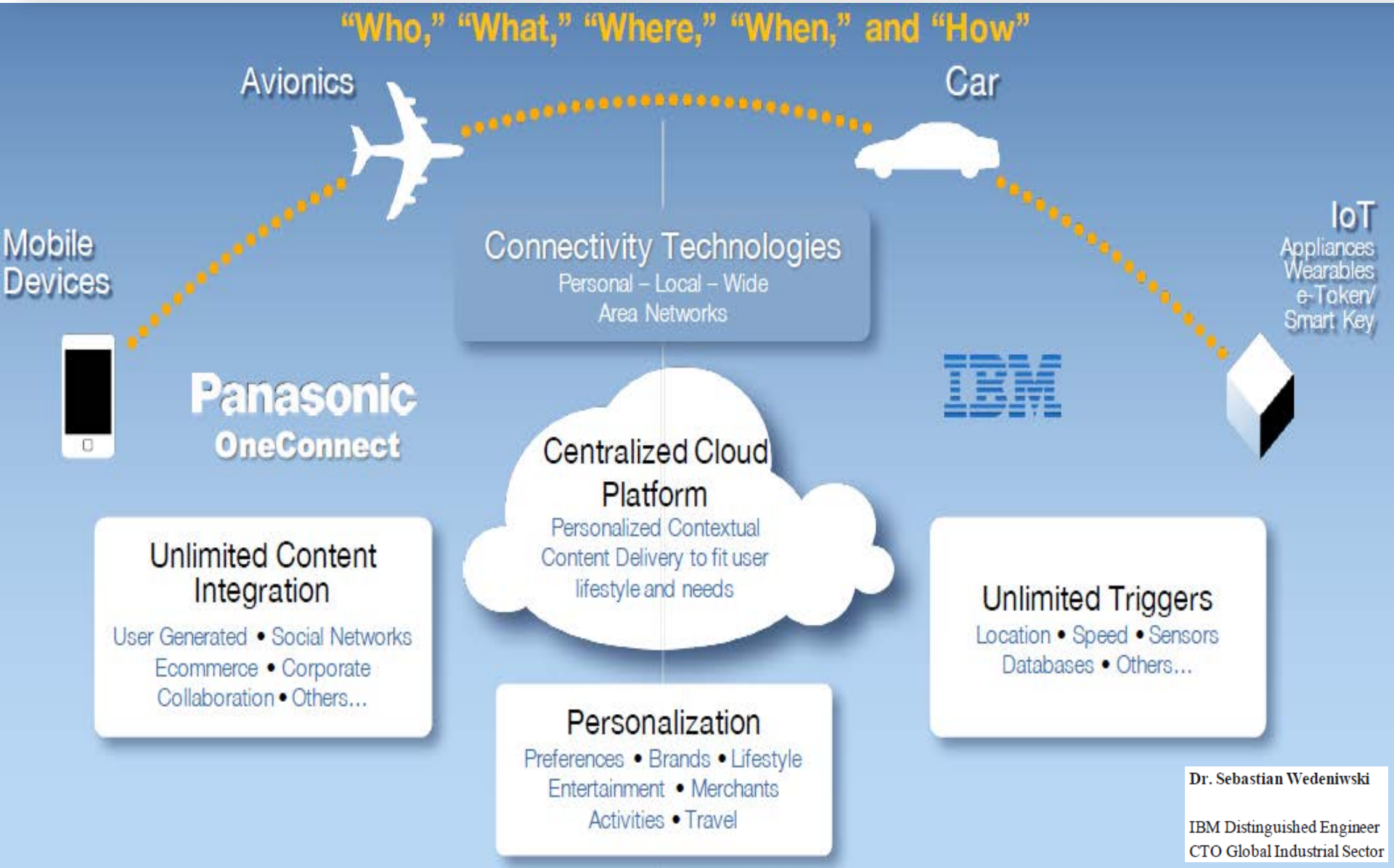
Digital Supply Chain Management

Digital Service Lifecycle Management

Digital Customer Relationship Management

Digital Certification for Security, Privacy, Authentication

IoT Design Metaphor - Contextual Content Connects on Interoperable Platforms



Dr. Sebastian Wedeniwski

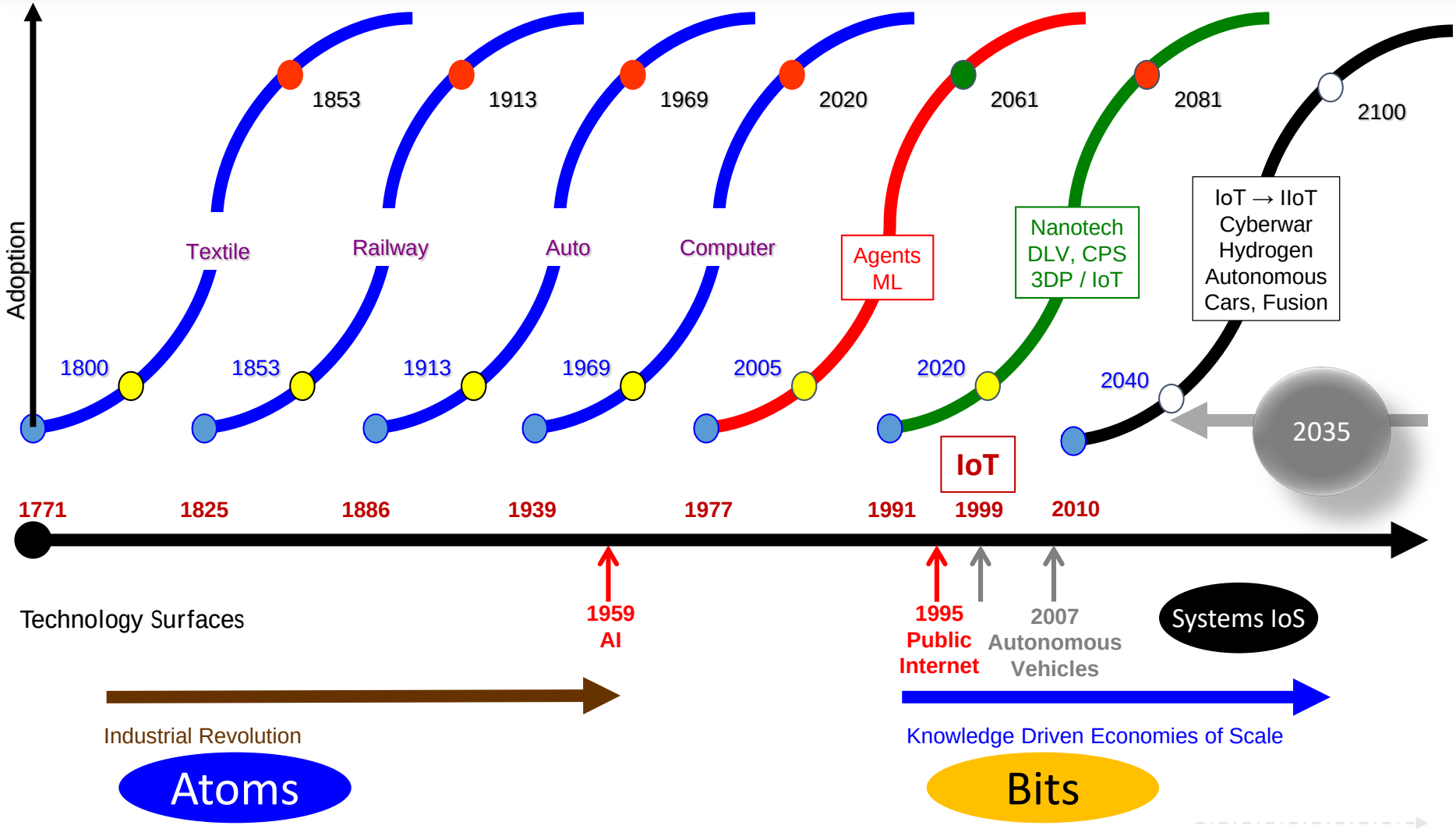
IBM Distinguished Engineer
CTO Global Industrial Sector

Why it takes time

to transform paradoxes to paradigms

Transmutation of the Uncommon - Transaction Cost Economics

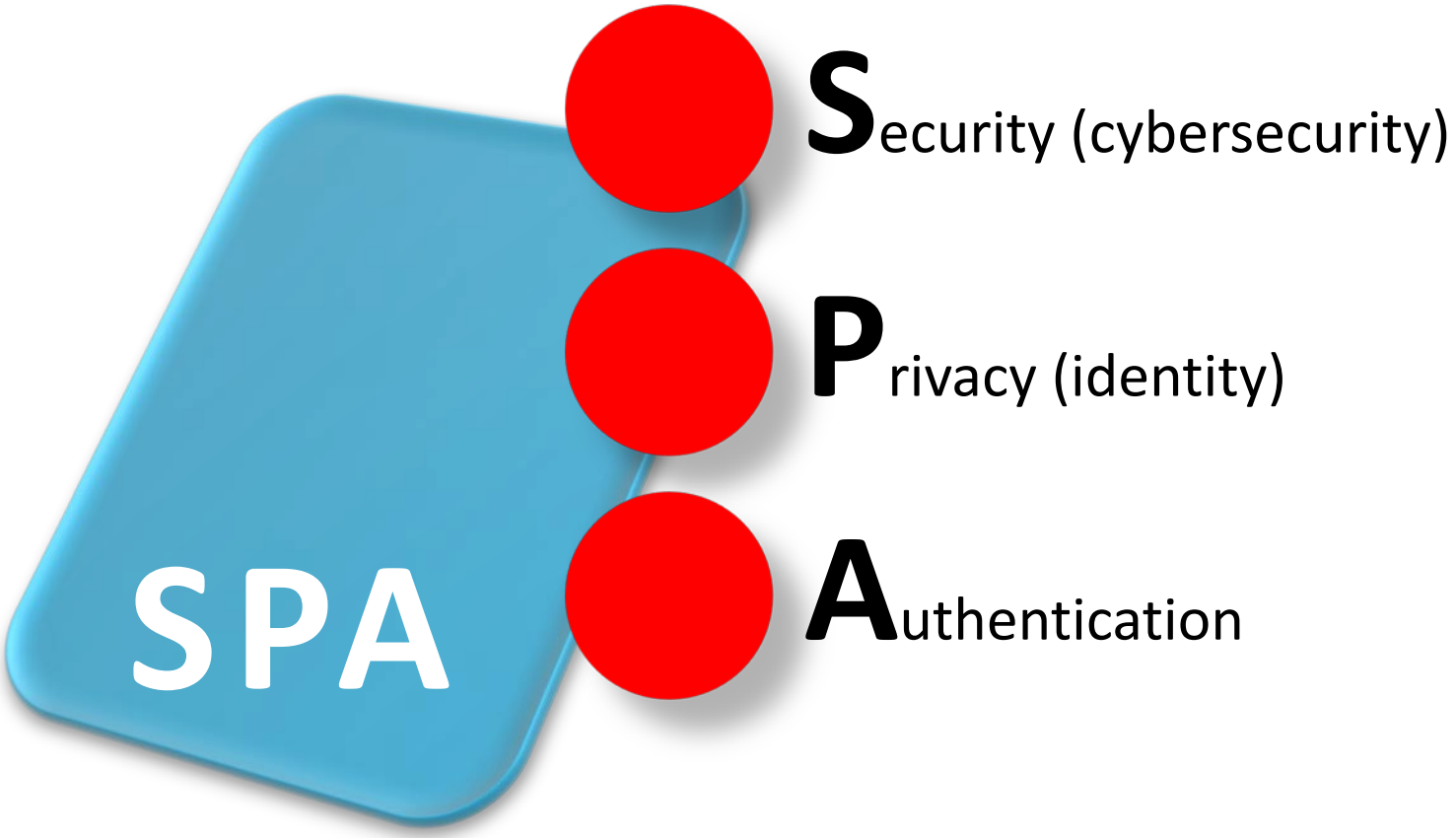
Economic history and data related to Textile, Railway, Automobiles and Computers taken from work by Norman Poire



It takes about 28-30 years for an idea to be socialized before it is accepted and adopted. 1999 was the birth year for IoT concept. Expect exponential growth of IoS ~ 2025-2026.

How to turn Problems to Profitable Solutions

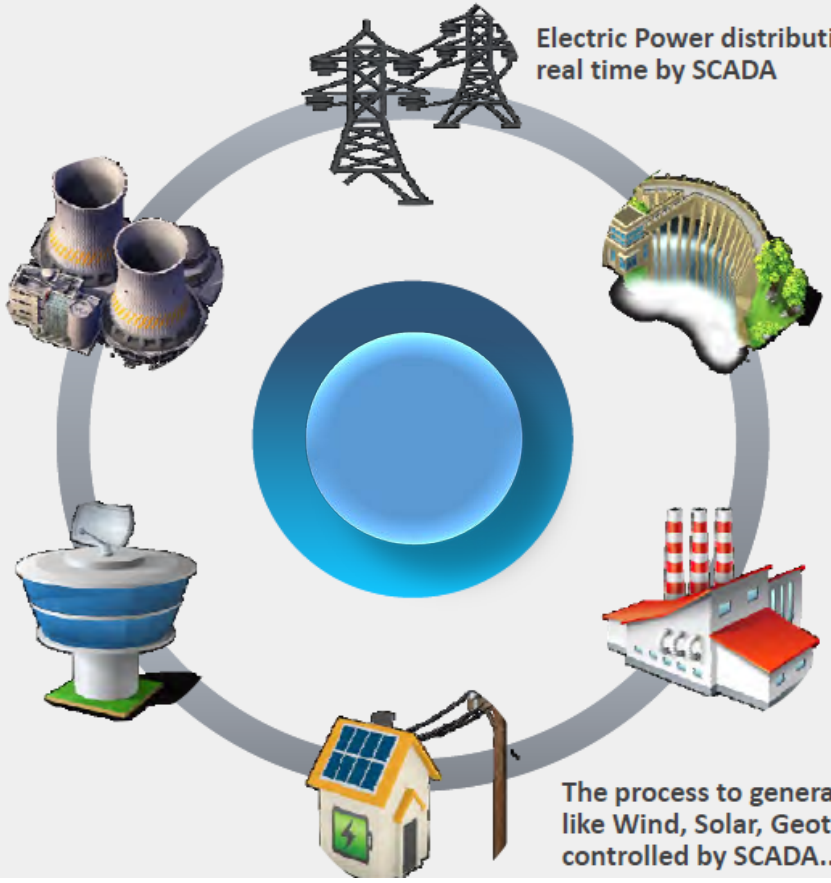
What is slowing down the pace of progress in diffusion and adoption of IoT and IIoT ?



Please remind yourself about these two quotes – great opportunities are often brilliantly disguised as impossible situations and catastrophies or problems are immense opportunities in work clothes.

Cybersecurity was not conceived during the development of Industrial Control Systems

Supervisory Control and Data Acquisition Systems and Programmable Logic Controllers



Electric Power distribution. Substation are controlled in real time by SCADA

Some areas inside a nuclear plant are controlled by SCADA , such as: turbine, centrifuge...

Water Supply network. In water distribution stations SCADA allow the optimum functioning of the pumping systems, obtaining efficient energy usage, optimum administration of the drinkable water.

Railway, air control.. Are controlled by SCADA

In any factory, from car till pens, most part of the factory, like cells, factory-floor, robots.. Are controlled by SCADA.

The process to generate alternative Energy, like Wind, Solar, Geothermal, Biomass, are controlled by SCADA..

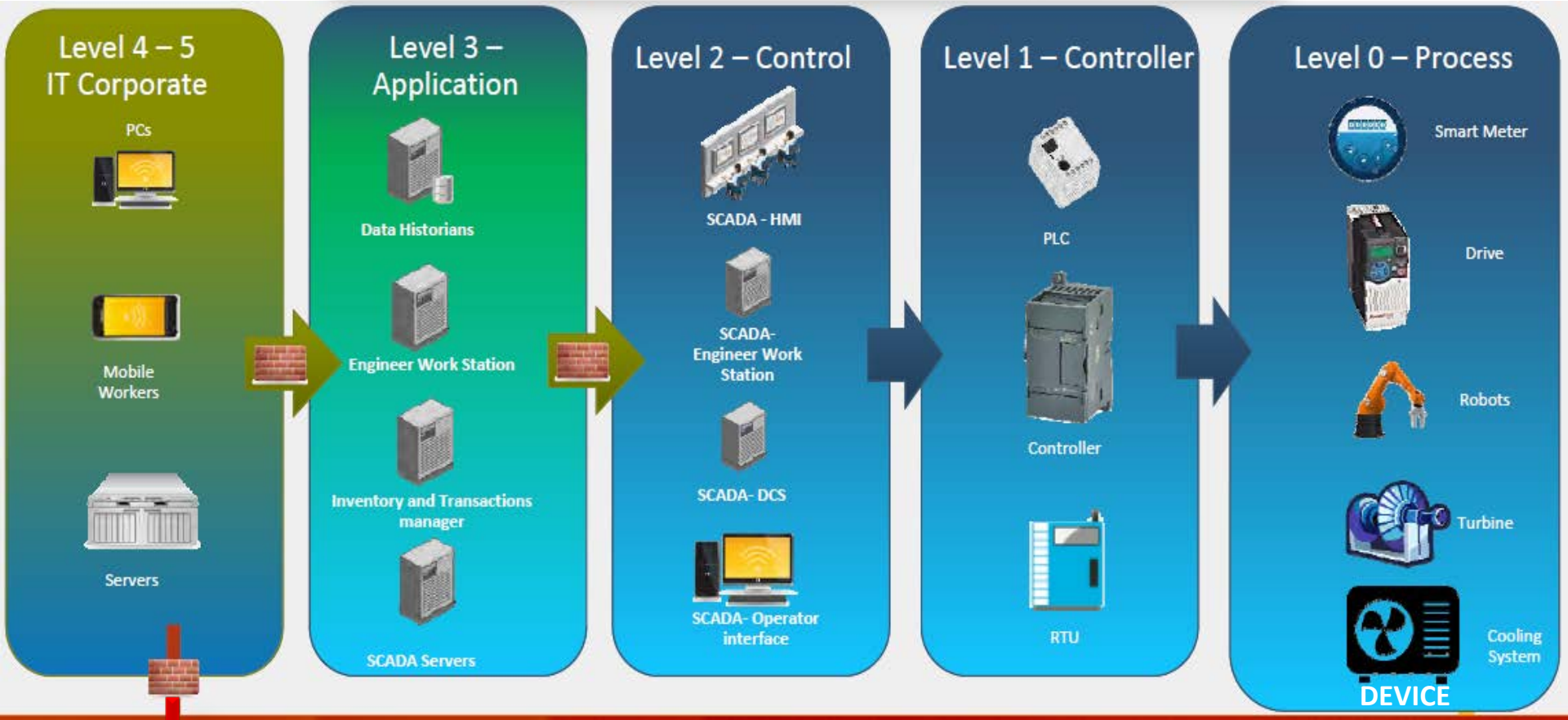
Distributed Control Systems – IT vs OT Chasm

IT		OT
"Open" Easy to install	*Openness*	**"Closed"** Not open to new software after the device leaves the factory
"3" (Mostly UDP, TCP, IP)	*Protocols*	**Thousands of Protocols** (Hundreds in each vertical)
"Updated" (Windows 7, 8, 10, 2008, RH 6, 7)	*Operating Systems (OS)*	**Legacy** (Windows NT, 2003, XP)
3-5 years (Typical Enterprise)	*Lifetime*	**10-20 years**
Mostly **same** Hardware, OS supply chain	*Fragmentation*	Very large number of Hardware, OS implementations
Limited relevance	*Latency*	**Highly critical**
"No Critical" Systems can be updated with more HW	*Performance*	**"Critical"** No impact on performance, legacy HW with small resources

Distributed Control Systems

IT

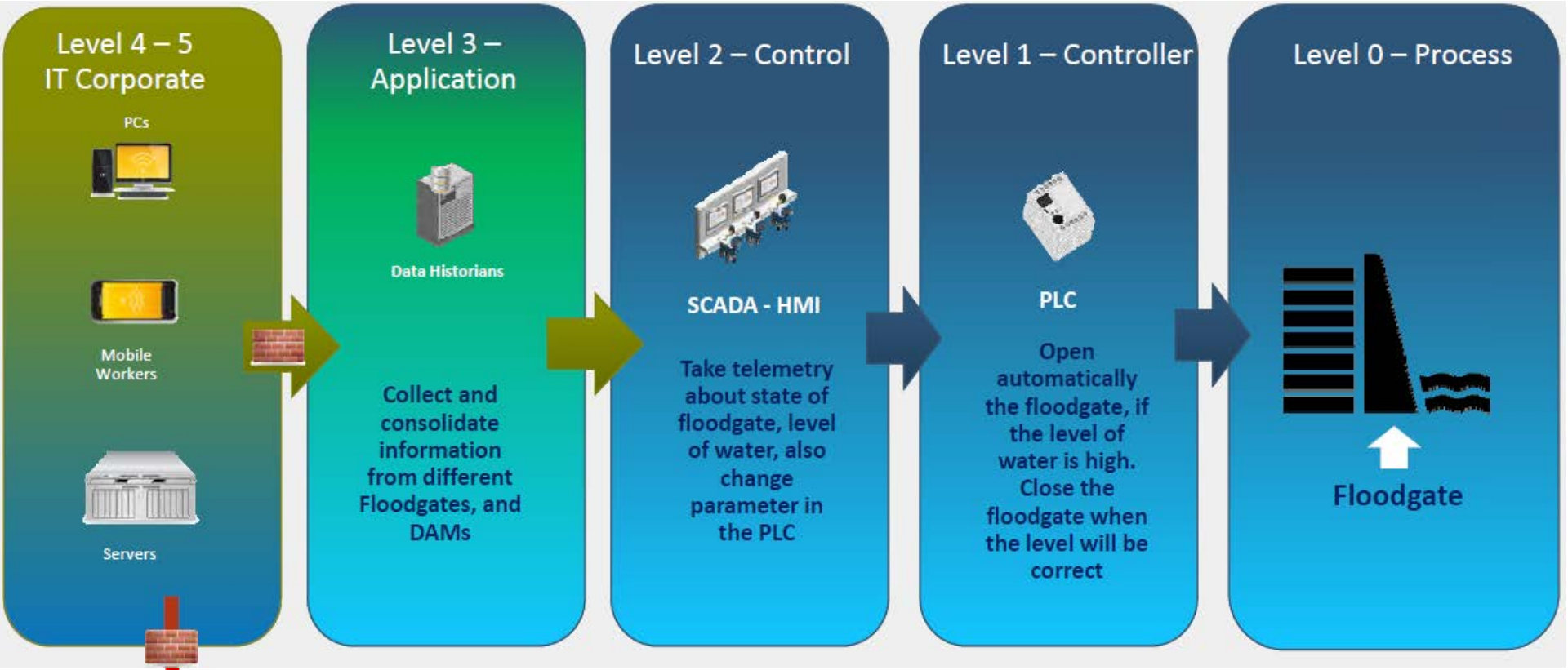
OT



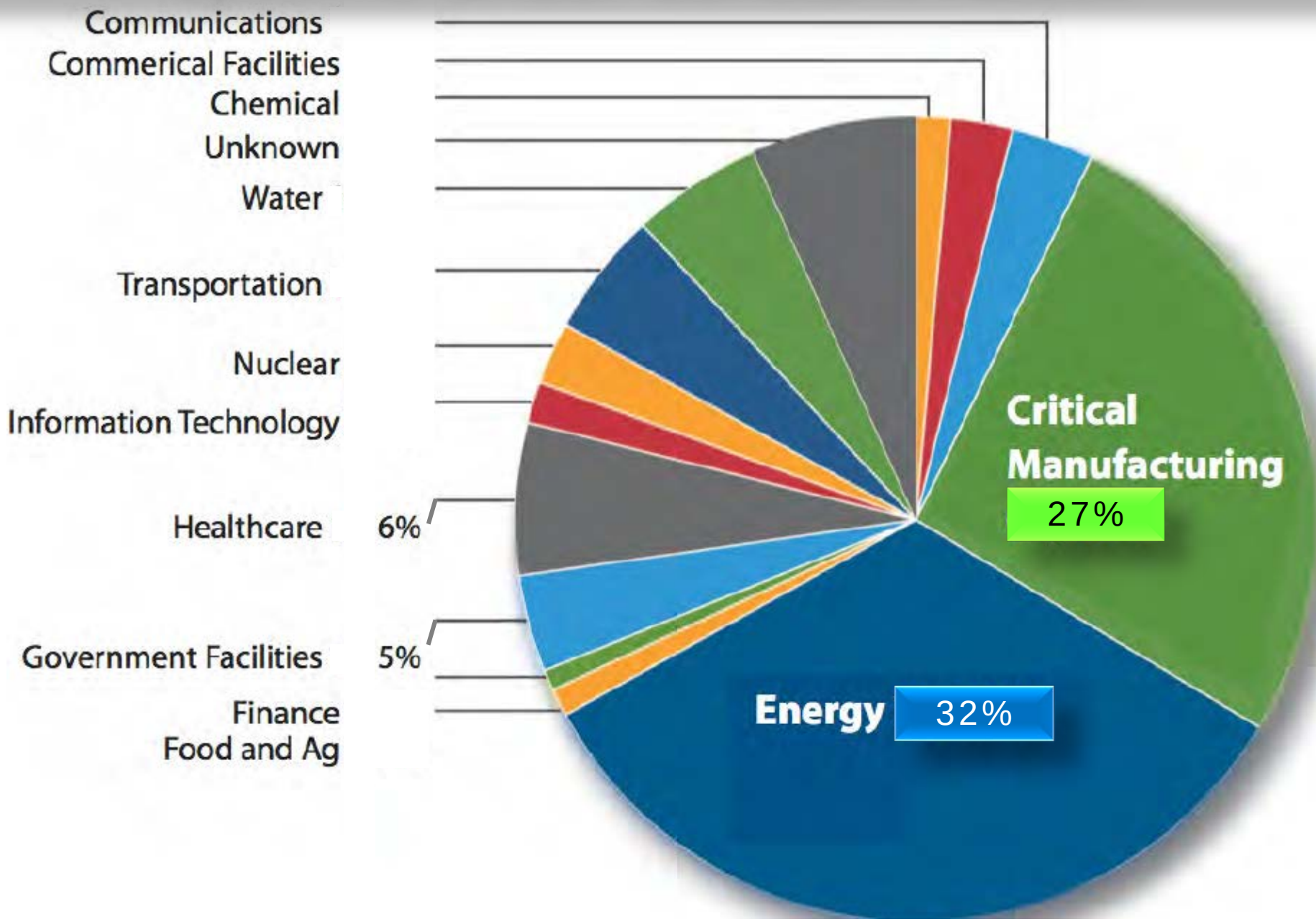
Distributed Control Systems

IT

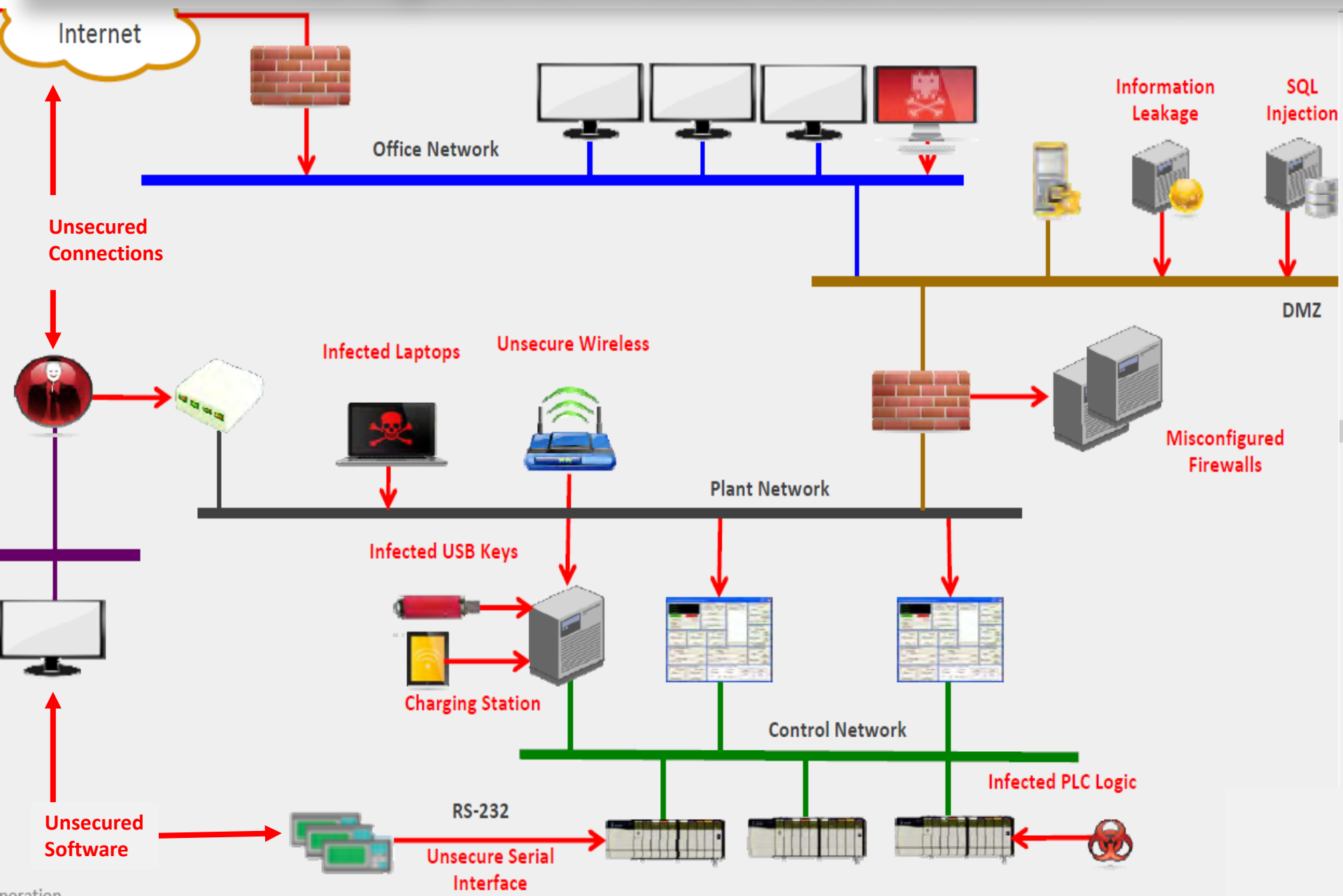
OT



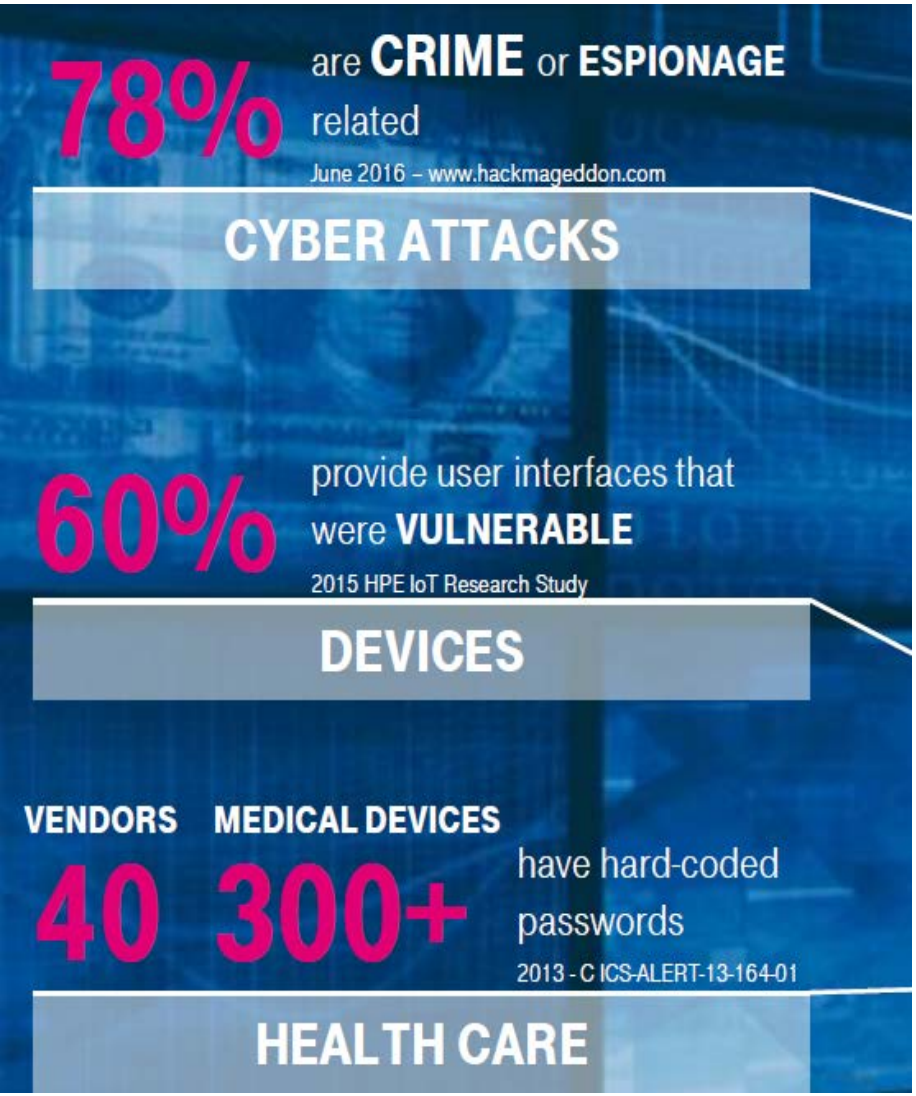
Systems Under Constant Attack

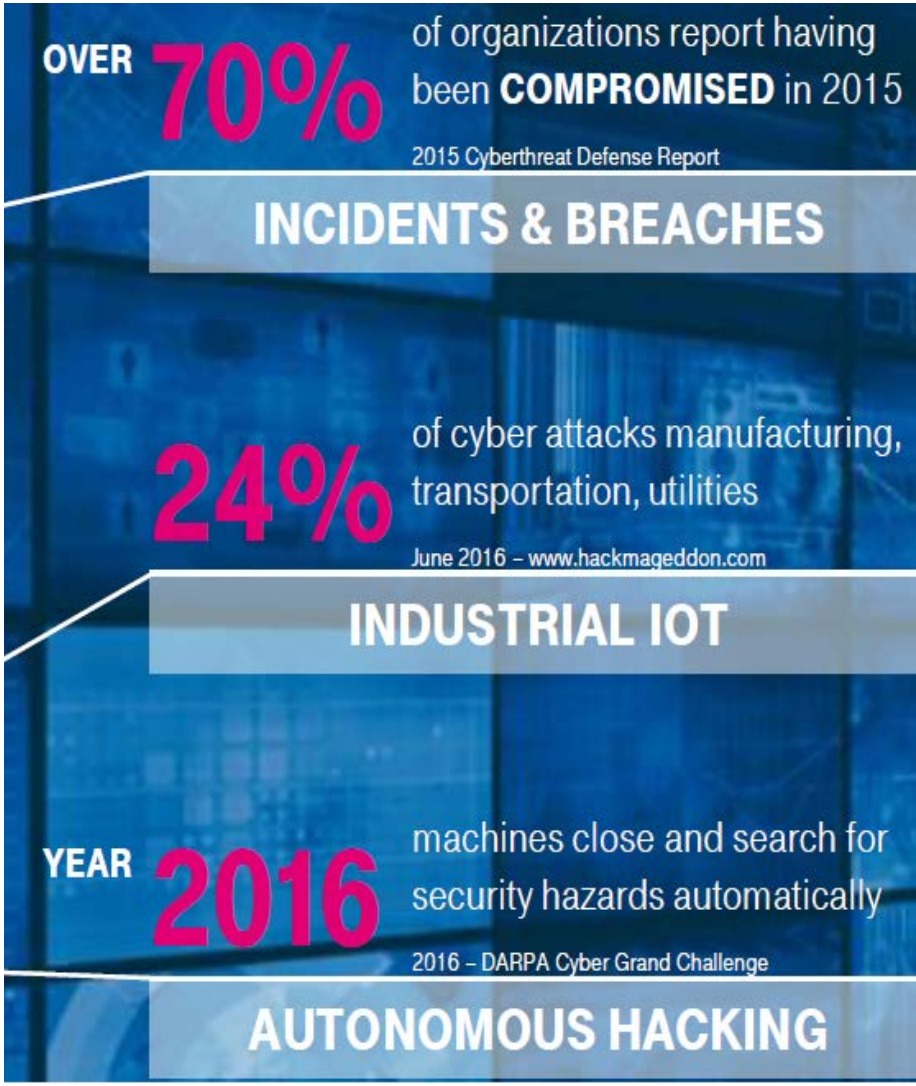


Origins of Potential Threat

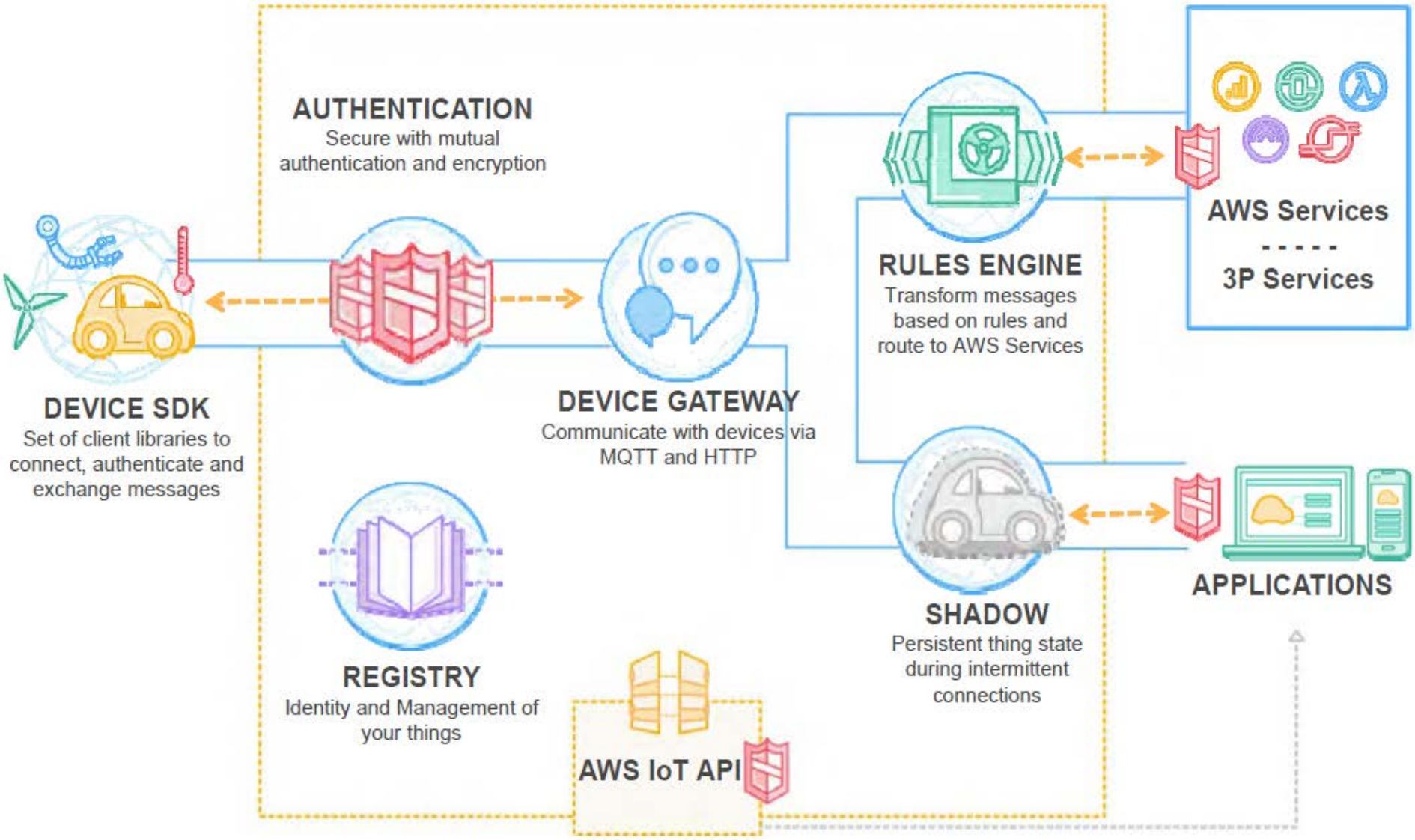


Risk for Systems and Vulnerable Targets

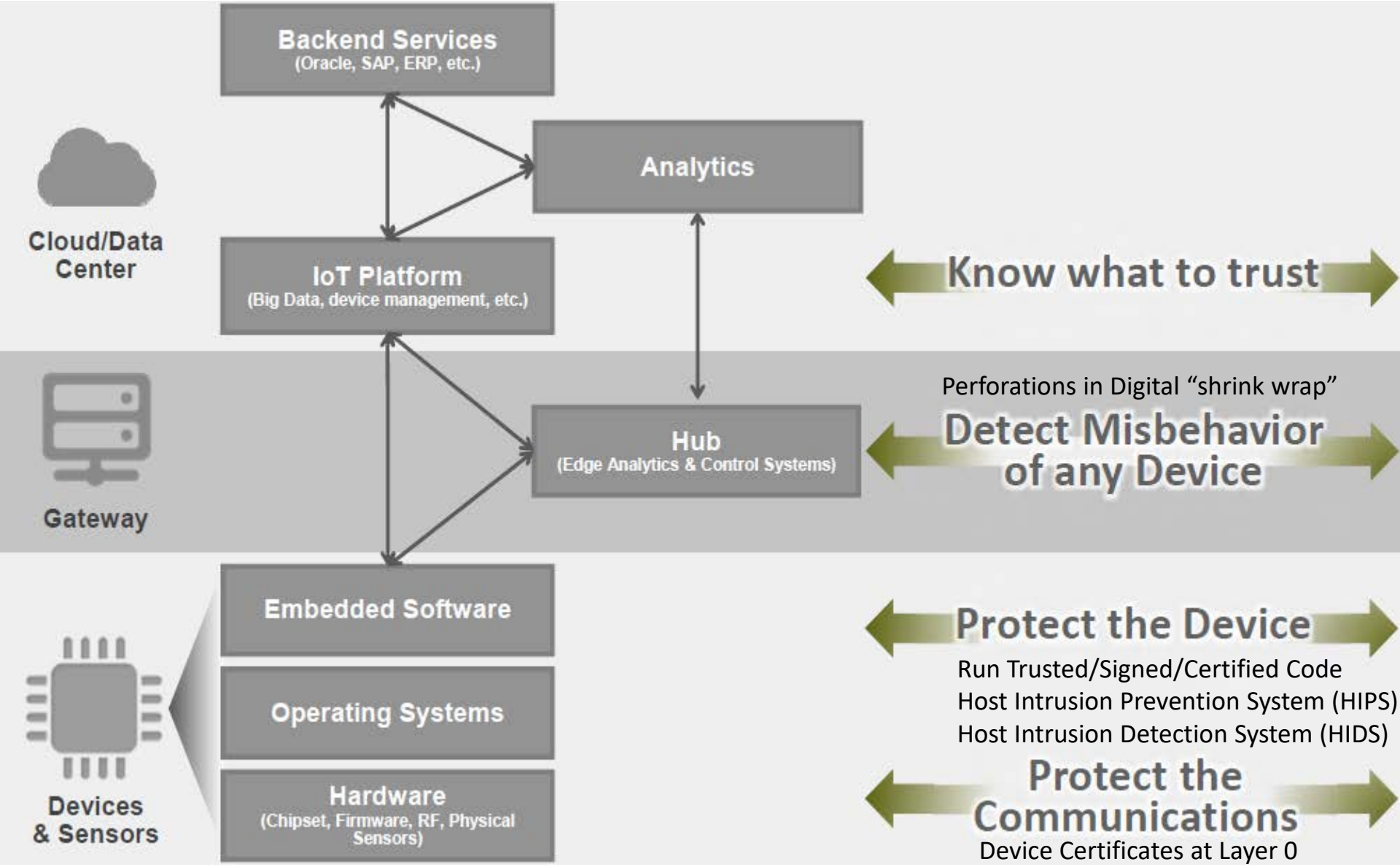




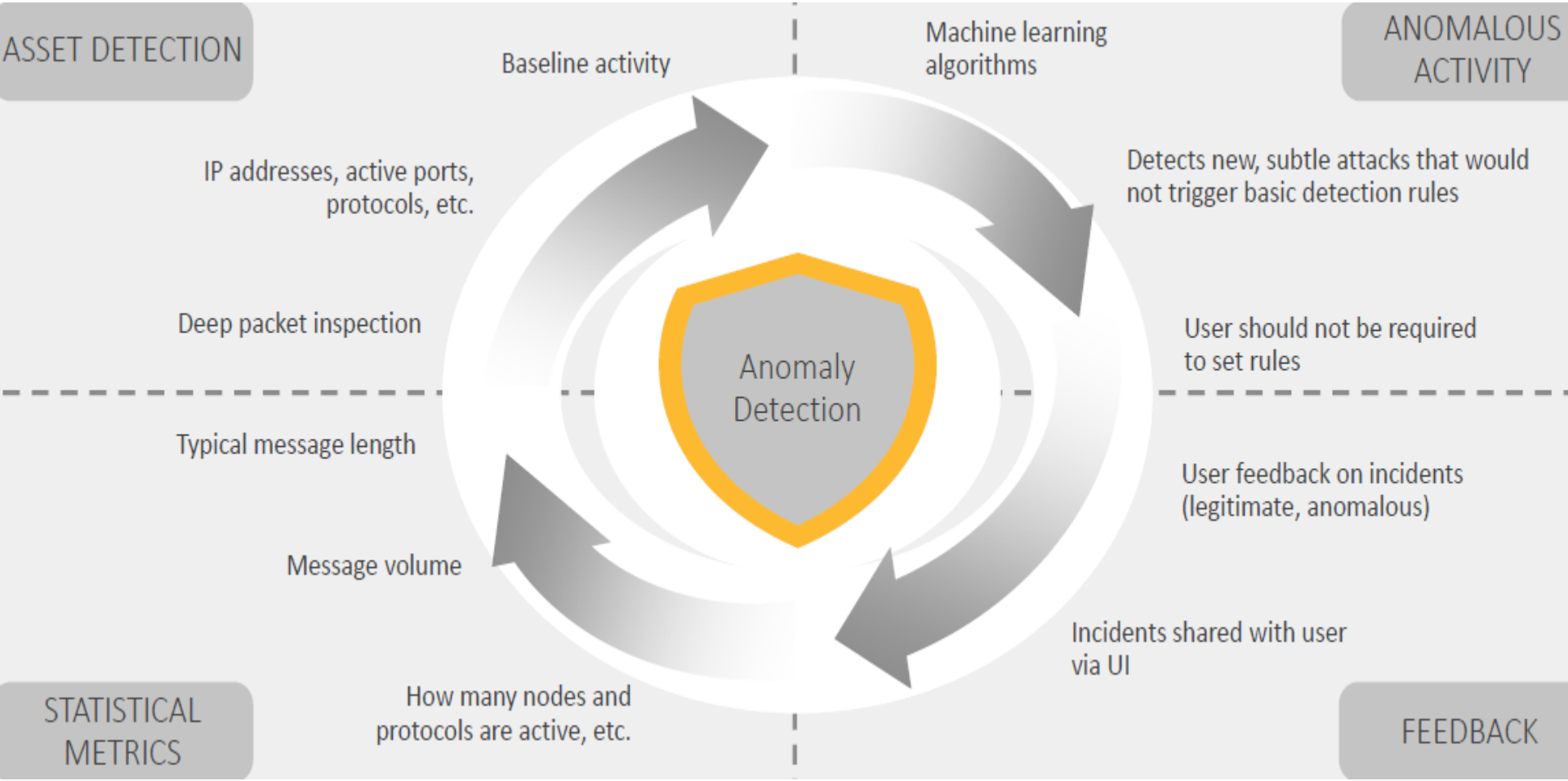
Identification, Identity and Security Steps



Mitigating Threats and Attack



Understanding Networks to Prevent Attack



Every human, every object, every piece of data needs personal security agent(s)

CYBERSECURITY

http://bit.ly/IOT-MIT

https://www.healthit.gov/sites/default/files/Draft_White_Paper_PGHD_Policy_Framework.pdf

https://www.nist.gov/sites/default/files/documents/2017/01/30/draft-cybersecurity-framework-v1.1.pdf

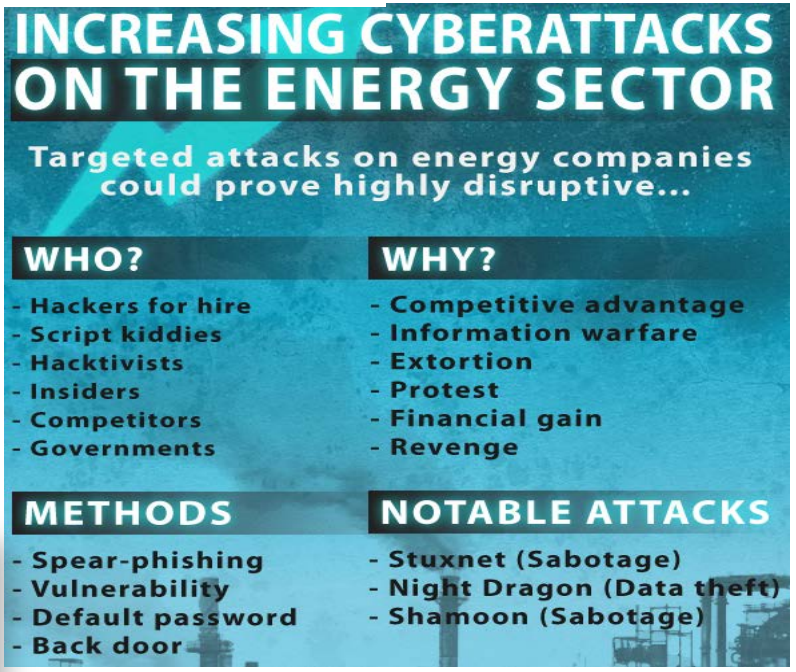
satellite dish-based computer systems VSAT provide broadband Internet access to remote locations, or transmit point of sale credit card transactions, SCADA and other narrowband data. There are over 2.9 million active VSAT terminals in the world, with two-thirds of those devices the U.S., being used in the defense sector to transmit government and classified communications, used by financial industries like banks to transmit sensitive data, and used by the industrial sector such as energy to transmit from power grid substations, or oil and gas to transmit from oil rigs. Over 10,000 of those devices are "open" for targeted cyber attacks.

COMPUTERWORLD

SECURITY IS SEXY

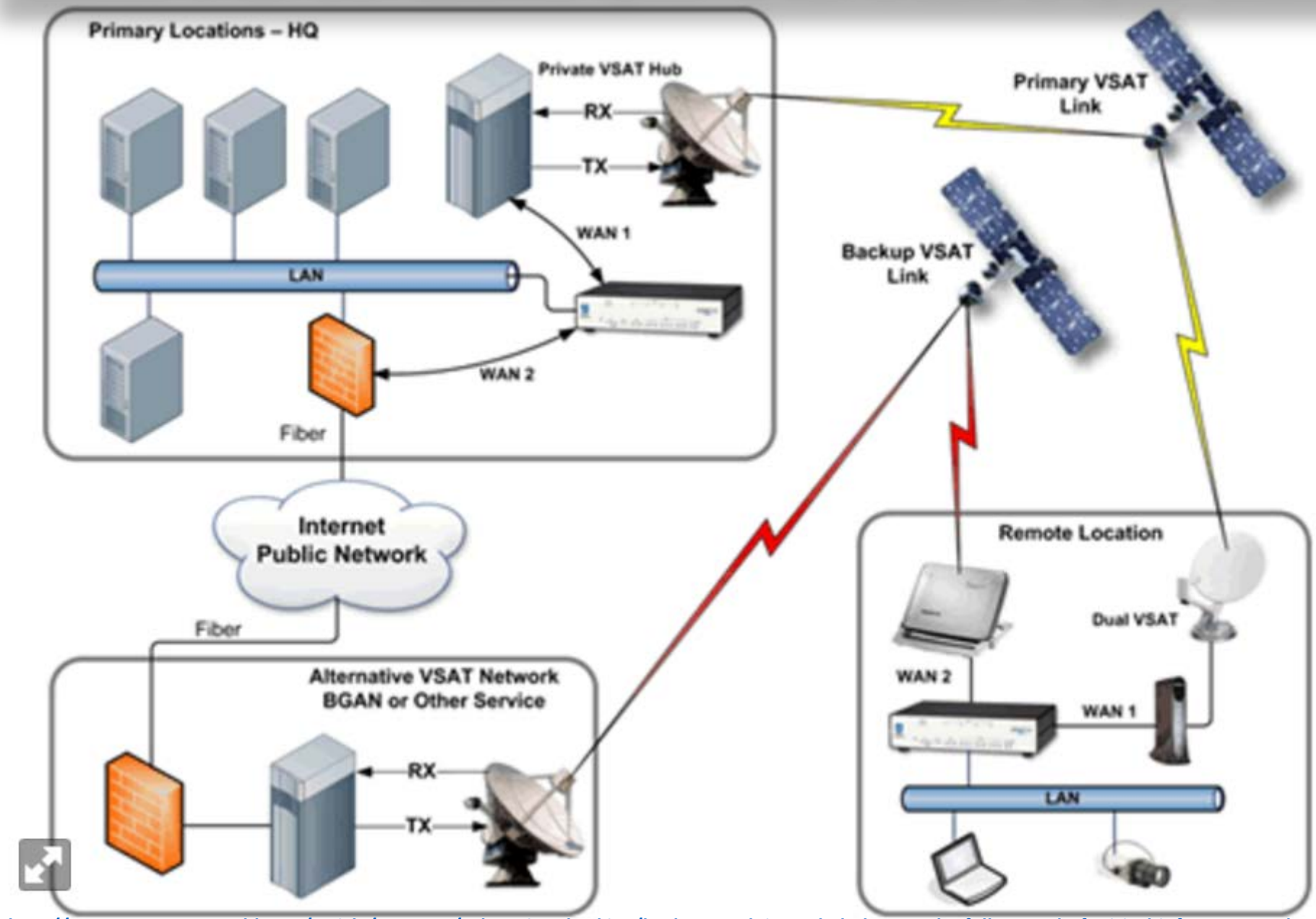
By Darlene Storm

The transmutation of "sexy" in the 21st Century !!



http://www.symantec.com/content/en/us/enterprise/media/security_response/whitepapers/targeted_attacks_against_the_energy_sector.pdf

10,500 small dish satellite systems vulnerable to cyber attacks

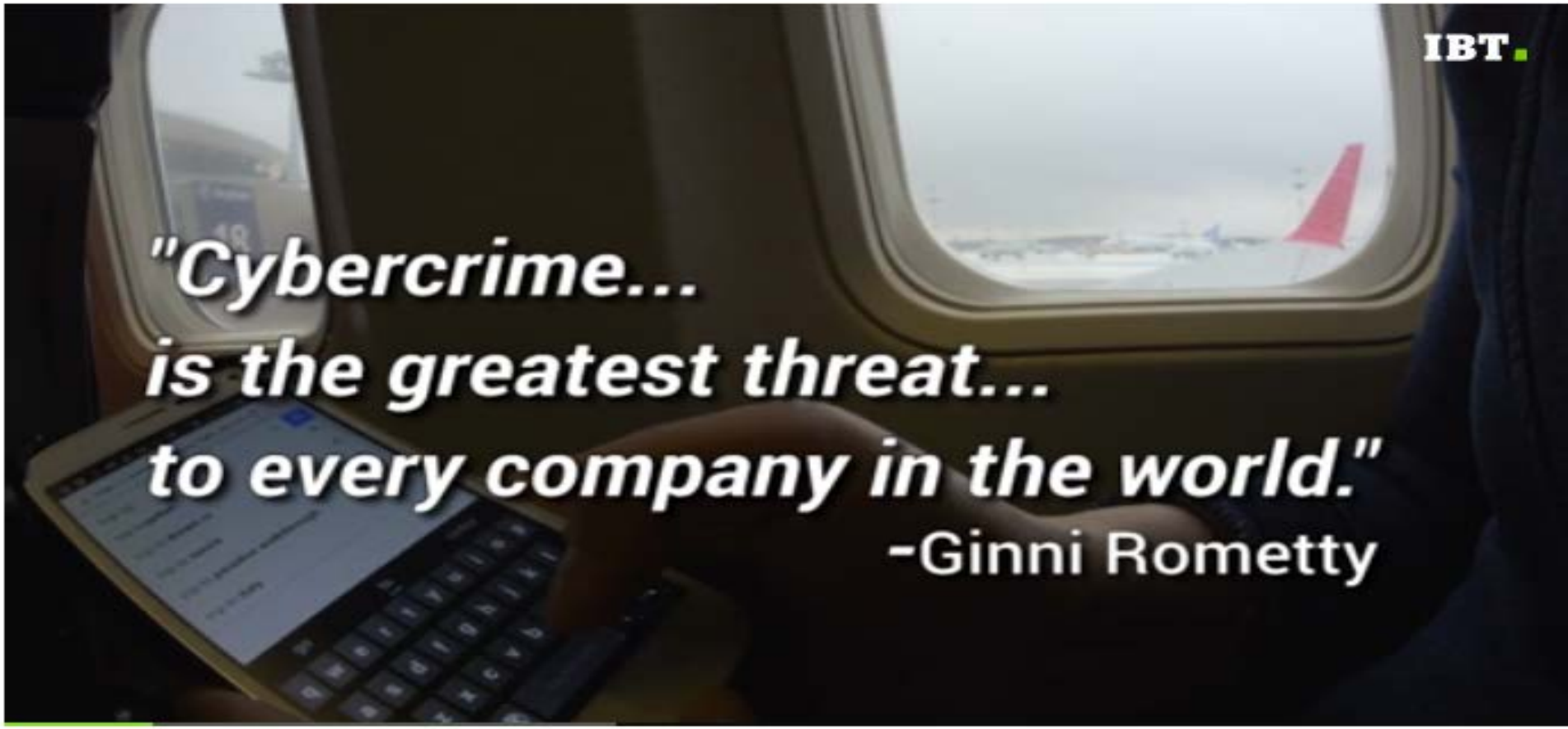


http://www.computerworld.com/article/2475789/cybercrime-hacking/hackers-exploit-scada-holes-to-take-full-control-of-critical-infrastructure.html

Lloyds hit with massive DDoS attack by suspected hackers

The bank was reportedly hit with a targeted attack for two days leaving customers unable to use services.

January 23, 2017



Why hacking is a booming industry (IBTimes US)

US warns of unusual cybersecurity flaw in heart devices

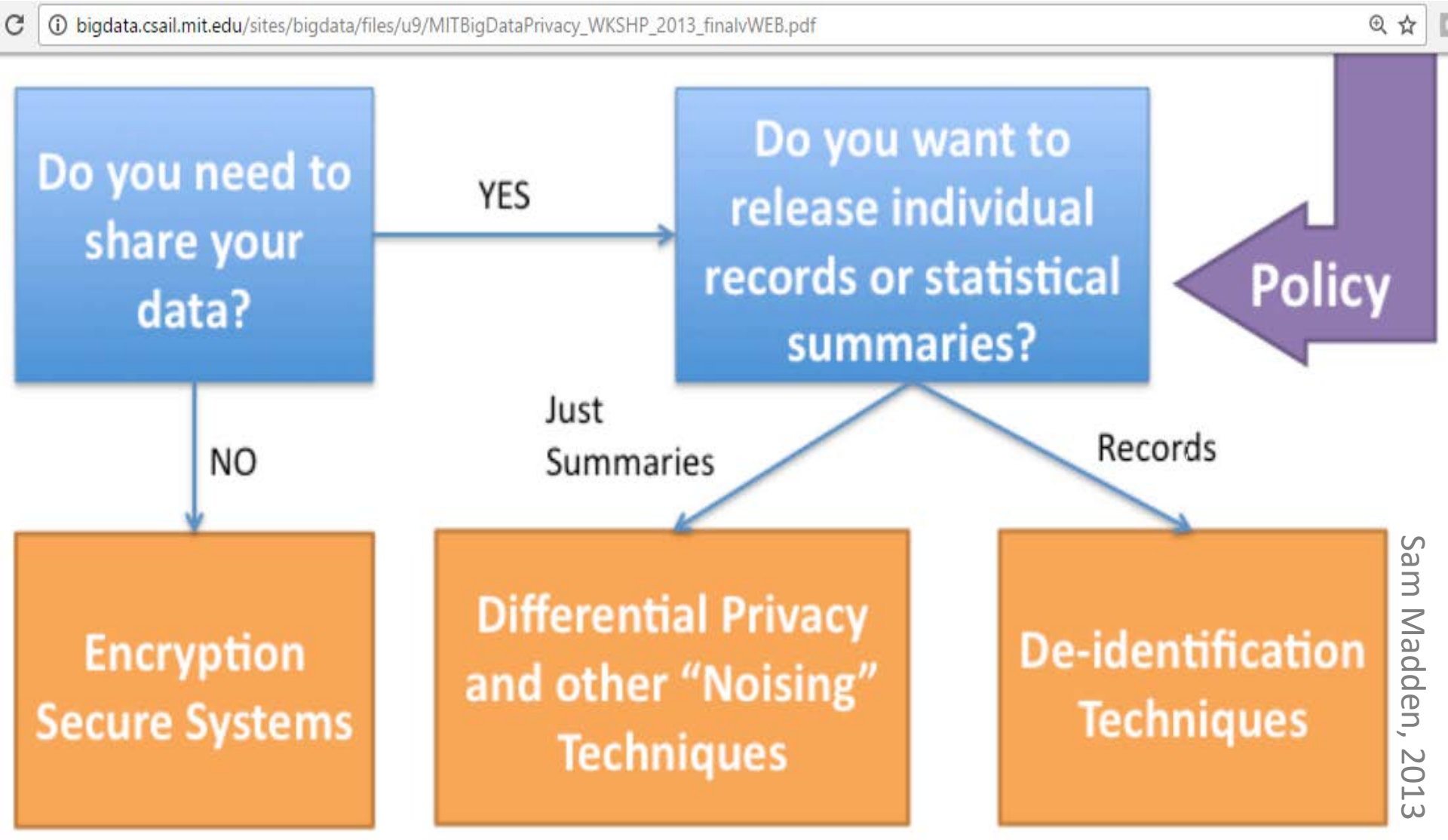
Homeland Security Department is warning the public about an unusual cybersecurity flaw for one manufacturer's implantable heart devices that could allow hackers to remotely take control of a person's defibrillator or pacemaker. The U.S. says security patches will be rolled out automatically over several months to patients with affected St. Jude Medical device transmitters at home, as long as they are plugged into the network. The transmitters send device data back to medical professionals. Abbott Laboratories' St. Jude says it's not aware of any deaths or injuries related to the vulnerability, nor is it aware of any specific device or system that's been targeted. (Glen Stubbe/Star Tribune via AP, File)

The company's Merlin@home Transmitter electronically sends details on the device's performance to a website where the patient's physician can review the information. But that device can also be hacked.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5052027/

Personal Security Agents / Unique Digital ID

Security and privacy are linked, in many instances, for individuals and for personal data (eg health)




IN CASE OF
CYBERATTACK
BREAK GLASS
AND PULL CABLES

R&D Investment in Science and Engineering

Immense Market Growth & Business Opportunities

FOOD, ENERGY, WATER, HEALTHCARE, TELCO, TRANSPORT, FINTECH

http://bit.ly/IOT-MIT

http://bit.ly/Amorphous-Certainties

https://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_exit_memo_final.pdf

The Internet of Things at several government levels in the U.S. (*)

WHITE HOUSE

See U.S. President's National Security Telecommunications Advisory Committee (NSTAC), NSTAC Report *to the President on the* ***Internet of Things***, November 19, 2014. See Report on Securing and Growing the Digital Economy by Commission on Enhancing National Cybersecurity released on December 2nd, 2016.

U.S. HOUSE OF REPRESENTATIVES

See "U.S. Reps. DelBene and Issa announce Creation of the Congressional **Internet of Things** Caucus", Jan 13, 2015. *See* Hearing of House Judiciary Subcommittee on Courts, Intellectual Property and the Internet on the **Internet of Things**, July 29, 2015. *See "Latta and Welch Launch Bipartisan* **Internet of Things"** Working Group", May 24, 2016 *See* H.Res.847 on the **Internet of Things**, Sept. 12, 2016. *See* the hearing of the Subcommittee on Communications and Technology, chaired by Rep. Greg Walden (R-OR) and the Subcommittee on Commerce, Manufacturing, and Trade, chaired by Rep. Michael C. Burgess, M.D. (R-TX), of Wednesday, November 16th, 2016 on "Understanding the Role of **Connected Devices** in Recent Cyber Attacks."

U.S. SENATE

See S. 2607 Bill introduced in the Senate, *Developing Innovation and Growing the* ***Internet of Things*** *Act or the* DIGIT Act, on March 1, 2016 and amended on September 28, 2016 (companion bill: H.R. 5117). *See* Senate Resolution on the **Internet of Things** (S. Res. 110), March 24, 2015. *See* Director of National Intelligence 2016 threat assessment (**IoT** among the global threats) presented to the U.S. Senate Armed Services Committee, Tuesday, February 9, 2016.m*See* Hearing of U.S. Senate Subcommittee on Surface Transportation and Merchant Marine Infrastructure, Safety, and Security titled "How the **Internet of Things (IoT)** Can Bring U.S. Transportation and Infrastructure into the 21st Century," Tuesday, June 28, 2016 Cybersecurity Enhancement Act of 2014 (December 18, 2014). *See* letter from U.S. Sen. Mark R. Warner (D-VA), a member of the Senate Select Committee on Intelligence and co-founder of the bipartisan Senate Cybersecurity Caucus to FCC Chairman Tom Wheeler on IoT security, October 25, 2016 and response from FCC Chairman Tom Wheeler on December 2, 2016 on putting on hold proposed new rules to ensure the security of IoT devices. DIGIT Act was reintroduced in the Senate on January 10, 2017.

(*) This slide reflects only a sample of IoT-related initiatives among others at the Departments of Transportation (e.g., NHTSA), Energy (e.g., ORNL), Justice, Agriculture, Defense (NISPOM),, etc.

U.S. DEPARTMENT OF COMMERCE (NTIA and NIST)

See NIST's work on Cybersecurity Framework, v1.0 of Framework for Improving Critical Infrastructure Cybersecurity released in February 2014 and latest updates

See NTIA's Notice and Request for Comments on the Benefits, Challenges, and Potential Roles for the Government in Fostering the Advancement of the **Internet of Things**, April-June 2016. *See* NIST's Framework for Cyber-Physical Systems, Release 1.0, May 2016. *See* NIST's document on "Networks of 'Things'" (offers foundational science to the **Internet of Things**), July 2016. *See* NTIA Workshop on "Fostering the Advancement of the **Internet of Things**", September 1st, 2016. *See* NTIA-sponsored Meeting on the **Internet of Things (IoT)** Security Upgradability and Patching, October 19, 2016. *See* NITS publishes security guidelines on Internet of Things "Systems Security Engineering" on November 15, 2016. NTIA releases Green Paper on "Fostering the Advancement of the Internet of Things" on January 12, 2017.

DEPARTMENT OF HOMELAND SECURITY

See DHS Publishes "Strategic Principles for Securing the Internet of Things" on November 15, 2016

FEDERAL COMMUNICATIONS COMMISSION

See FCC releases White Paper on "Cybersecurity Risk Reduction" incl. IoT on January 18, 2017

FEDERAL TRADE COMMISSION

See FTC Workshop on "Internet of Things - Privacy and Security in a Connected World", November 19, 2013. *See* FTC report on Internet of Things Security and Privacy, January 27, 2015. *See* Letter from U.S. Representatives Frank Pallone (D-NJ6) and Jan Schakowsky (D-IL9) to FTC Chairwoman Edith Ramirez on IoT security, November 3, 2016

FOOD AND DRUG ADMINISTRATION

See Guidance on Premarket Cybersecurity for Medical Devices (October 2014) and "FDA Embraces **Internet of Things**: New Draft Guidance on Postmarket Cybersecurity for Medical Devices" (January 2016)

Other recent U.S. Administration Initiatives:

September 2015 New " Smart Cities Initiative" to Help Communities Tackle Local Challenges and Improve City Services

*Including creating test beds for "**Internet of Things**" applications and developing new multi-sector collaborative model and other IoT-related projects*

July 2016 New "Advanced Wireless Research Initiative" to help build the fastest networks

*Including the enablement of breakthrough applications for the **Internet of Things***

January 19, 2017

Georgia Tech | Center for the Development and Application of Internet of Things Technologies

Dr Alain Louchez, Managing Director, Georgia Institute of Technology, Atlanta, Georgia
Center for the Development and Application of Internet of Things Technologies (CDAIT)

IoT at the Center of 4th Industrial Revolution around the World

Sample of Individual Country Initiatives (*)

Australia

Siemens leads the (Australian) "Prime Minister's Task Force" to connect Australia to Industry 4.0 and transition the country to a new economy (November 2015) – Note: Internet of Things Alliance Australia (IoTAA) was created in July 2016

Brazil

[Internet of Things Brazilian Association – ABINC] "Associação Brasileira de Internet das Coisas" (October 2015) [Brazil sets out 5-year plan for IoT - 2017 to 2022] – See Brazilian Forum on IoT: Fórum Brasileiro de IoT

Canada

Wavefront was launched in 2007 first focused on wireless and mobile innovation and also now on IoT innovation – Internet of Things Alliance for Canada (IoTA CAN) powered by Wavefront was created in 2015. CASSIOT (Canadian Association for the Internet of Things) was founded in 2014. Digital Canada 150 (DC150) was introduced in 2014.

China

"Made in China 2025" (May 2015), "Internet Plus" (July 2015) "Digital Silk Road" (2015-2016) & "Global Internet of Things Innovation Union Advocacy (June 2016)" ["One Belt One Road"]

France

[New Industrial France] "La Nouvelle France Industrielle (NFI)" (phase 1: September 2013; phase 2: May 2015) [City of Connected Objects] "Cite des Objets Connectes" (2015). Autorité de Régulation des Communications Électroniques et des Postes (ARCEP) launched a public consultation on the Internet of Things (July 19 – September 19, 2016) on "preparing for the IoT revolution": Document #1 and Document #2

Germany

"Industrie 4.0" (developed in the 2011-2013 timeframe) & "Digital Strategy 2025" (April 2016). Reference Architecture Model for Industry 4.0 (RAMI 4.0) was introduced in April 2015. See also Industrial Data Space initiative at Fraunhofer launched at the end of 2014.

India

"Make in India" (2014), "Zero Defect, Zero Effect" (2014), Digital India (2015) & "Center of Excellence for Internet of Things" (2016) [Launched in Bangalore, in July 2016, NASSCOM CoE-IoT, is a joint effort between Government of India and the National Association of Software and Services Companies (Nasscom), Department of Electronics and Information Technology (DEITY) and Education and Research Network (ERNET).] [Indian government working on IoT Policy Framework for home-grown players, October 2016]

Italy

"La Fabbrica del Futuro" (January 2012) & "Industrial National Plan 4.0", for 2017-2020 – EUR 13 billion (September 2016). IoTItaly was launched in October 2015.

Japan

"Robot Revolution Initiative Council" (May 2015), "Industrial Value Chain Initiative" (June 2015) & IoT Acceleration Consortium (October 2015) [Japan's Ministry of Economy, Trade and Industry (METI) and the Federal Ministry for Economic Affairs and Energy (BMWi), Germany, signed a joint statement regarding the Japan-Germany cooperation on Internet of Things (IoT)/Industrie 4.0" (April 2016), Japan and Saudi Arabia agree to cooperate on Internet of Things and Renewables (October 2016)]

Korea

"Manufacturing Innovation 3.0" (June 2014) & "GiGA IoT Alliance" (September 2015)

Mexico

[Center of Innovation in Internet of Things] "Centro de Innovación, Desarrollo Tecnológico y Aplicaciones de Internet de la Cosas (CIIOT)" (June 2016). [The Mexican government and the State of Jalisco announced the launch of a Center exclusively focused on the Internet of Things with the goal of creating an IoT cluster by 2019 through collaboration between academia, industry and government.] "Crafting the future: A Roadmap for Industry 4.0 in Mexico", Ministry of Economy, published in April 2016.

Russia

"Russian government fund and mobile operators create IoT consortium" (July 2016) [First phase of the consortium will consist of establishing a single and open standard of data exchange for the Internet-of-Things network.] "Development of the manufacturing industry and improvement of its competitiveness for the period till 2020" (2013/14) – See Dr. Anton Kobyakov "Challenges of the 21st century: how the fourth industrial revolution is changing the world " 2015

Spain

Ministry of Industry, Energy and Tourism of Spain (MINETUR) launched Connected Industry 4.0 in 2016, i.e., "Industria Conectada 4.0" see also España 4.0 2016 report by Roland Berger sponsored by Siemens.

U.K.

"Innovate UK", "High Value Manufacturing (HVM) Catapult" (October 2011), Future Cities Catapult (2012), Digital Catapult [November 2014), "IOTUK" (September 2015), Internet of Things Research Hub "PETRAS" (January 2016)

U.S.A.

" Smart Manufacturing Leadership Coalition" (2006, inc. in 2012), "Advanced Manufacturing Partnership 2.0" (2013), "National Network for Manufacturing Innovation" (2014), "Smart Manufacturing Innovation Institute "(2016) [see also "ITIF's IoT and Smart Manufacturing" (2016)], IIC's Industrial Internet Reference Architecture (June 2015) and Industrial Internet of Things Security Framework (September 2016)]

(*) In addition to global and regional initiatives such as international IoT alliances among operators (IoT World Alliance, Bridge Alliance, Global M2M Association, etc.); ITU-T SG 20, IEEE IoT Architecture work (IEEE P2413); ISO/IEC JTC 1/WG 10 "Working Group on Internet of Things"; ISO/IEC JTC 1 preliminary report on IoT (2014); ISO/IEC CD 30141 - Internet of Things Reference Architecture (IoT RA); IEC SG8 "Industry 4.0 - Smart Manufacturing"; EU's many IoT-related projects, e.g., Digital Single Market (DSM), Smart Manufacturing projects [from "Building the the Hyperconnected Society"], Factories 4.0 and Beyond & Alliance for IoT Innovation (AIoTI and 12 2015 AIoTI reports on IoT); and future role of Asian infrastructure Investment Bank (AIIB) (June 2015). See also: Arrowhead Framework (4 yr project started in 2013), European initiatives in industry digitization as of April 12, 2016, and EU-IoT Project as of December 2016 (see in particular comprehensive December 2016 Computing Now article). See steps towards European data economy in the EU announced on January 10, 2017.

January 19, 2017

Georgia Center for the Development and Application of Internet of Things Technologies

Dr Alain Louchez, Managing Director, Georgia Institute of Technology, Atlanta, Georgia
Center for the Development and Application of Internet of Things Technologies (CDAIT)

The biggest threat to innovation is internal politics and an **organizational culture**, which doesn't accept failure and/or doesn't accept ideas from outside, and/or cannot change.

CHANGE FOR GOOD?

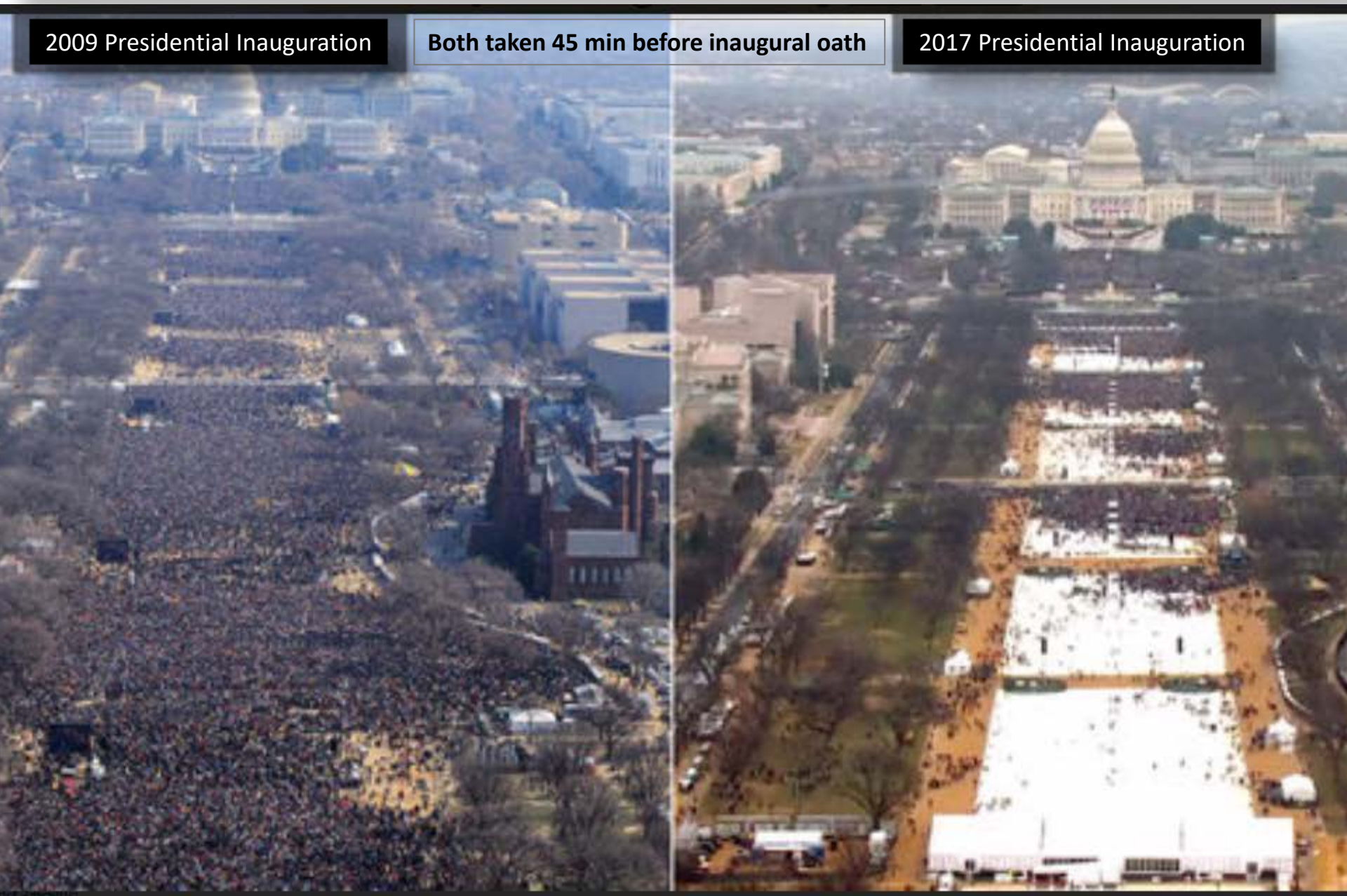
GO WHERE THE MONEY LEADS?

NEW SOCIAL ENGINEERS INFECTING FINLAND?

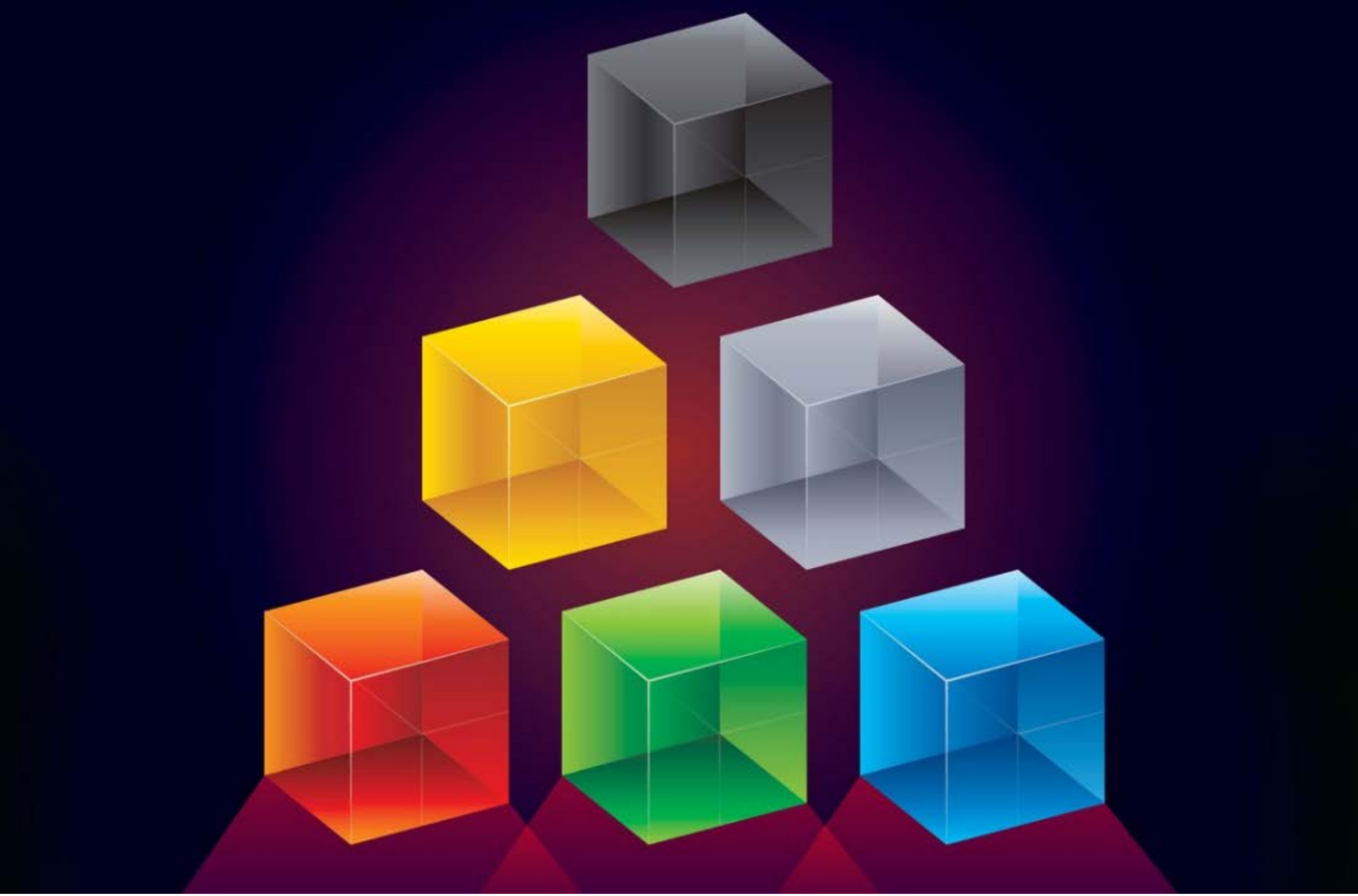
CULTURE CHANGES?

His Highness Sheikh Dr. Sultan bin Muhammad Al Qasimi, Ruler of Sharjah and Kai Mykkänen, the Minister for Foreign Trade and Development, witnessing the signing of a MoU between AUSE and the Council of Oulu Region (Finland). MOU was signed to facilitate cooperation in fields of research and development, education, innovation, trade, science &technology, and business. Hussain Al Mahmoudi, and Tiina Rajala, Director of the Council of Oulu Region, signed the agreement on behalf of their respective organizations in the presence of senior representatives from both parties.

IS ORGANIZATIONAL CULTURE A PREDICTIVE TOOL ??



Exemplar



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