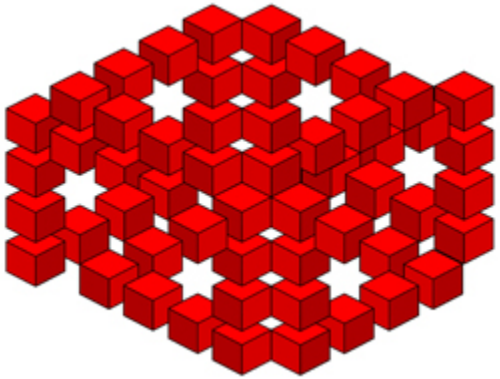
Gemeinsamer Sinn der verbundenen Zukunft - nicht nur Lippenbekenntnis



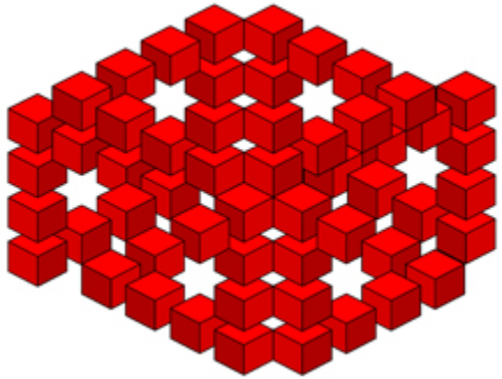
Dr Shoumen Palit Austin Datta

MIT Auto ID Labs

http://autoid.mit.edu/iot_research_initiative ● MIT Auto-ID Labs ● http://autoid.mit.edu

Research Affiliate, Department of Mechanical Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

Common Sense of the Connected Future



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http://bit.ly/IOT-MIT

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icri

AUTO-ID CENTER

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

AUTO-ID LABS

MIT Auto-ID Labs initiative to extend Auto-ID Center ideas which catalyzed RFID systems and germinated the concept of IoT in 1999. AIDL's IoT Collaborative Research Initiative (ICRI) expects to build on the Cloud of Things ideas and engage with an even broader "binary" vision where invention and innovation may advance digital transformation through engineering design. Research related to IoT by design may enhance industrial internet of things. We invite ideas to stimulate research necessary for new tools and technologies. IoT use in diverse verticals (energy, healthcare, manufacturing, robotics, finance, analytics) must address fundamental questions about connectivity, data and how systemic IoT by design may drive social entrepreneurship. We expect collaborative research to induce creative convergences while fully embracing innovation uncertainty.

AUTO-ID CENTER

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AUTO-ID LABS

Research - IoT System of Systems including Autonomy, Algorithms, Analytics and Ubiquitous Connectivity

Dr Shoumen Palit Austin Datta

Research Affiliate, Department of Mechanical Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

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Fundamentals

ELUSIVE QUEST FOR EDUCATION

Moonshot ● https://github.com/chrislgarry/Apollo-11

```
904   P40AUTO         TC      MAKECADR        # HELLO THERE.
905                   TS      TEMPR60         # FOR GENERALIZED RETURN TO OTHER BANKS.
906   P40A/P          TC      BANKCALL        # SUBROUTINE TO CHECK PGNCS CONTROL
907                   CADR    G+N,AUTO# AND AUTO STABILIZATION MODES
908                   CCS     A               # +0 INDICATES IN PGNCS, IN AUTO
909                   TCF     TURNITON        # + INDICATES NOT IN PGNCS AND/OR AUTO
910                   CAF     APSFLBIT        # ARE WE ON THE DESCENT STAGE?
911                   MASK    FLGWRD10
912                   CCS     A
913                   TCF     GOBACK          # RETURN
914                   CAF     BIT5            # YES, CHECK FOR AUTO-THROTTLE MODE
915                   EXTEND
916                   RAND    CHAN30
917                   EXTEND
918                   BZF     GOBACK          # IN AUTO-THROTTLE MODE -- RETURN
919   TURNITON        CAF     P40A/PMD        # DISPLAYS V50N25 R1=203 PLEASE PERFORM
920                   TC      BANKCALL        # CHECKLIST 203 TURN ON PGNCS ETC.
921                   CADR    GOPERF1
922                   TCF     GOTOP00H        # V34E TERMINATE
923                   TCF     P40A/P          # RECYCLE
924   GOBACK          CA      TEMPR60
925                   TC      BANKJUMP        # GOODBYE.  COME AGAIN SOON.
```

A moonshot, in a technology context, is an ambitious, exploratory and ground-breaking project undertaken without any expectation of near-term profitability or benefit and also, perhaps, without a full investigation of potential risks and benefits.

The Woman Who Helped Put The First Man On The Moon

MARGARET HAMILTON

Margaret Hamilton

- 35.2% of chemists are women;
- 11.1% of physicists and astronomers are women;
- 33.8% of environmental engineers are women;
- 22.7% of chemical engineers are women;
- 17.5% of civil, architectural, and sanitary engineers are women;
- 17.1% of industrial engineers are women;
- 10.7% of electrical or computer hardware engineers are women; and
- 7.9% of mechanical engineers are women

https://ngcproject.org/statistics

Margaret Hamilton came onto the scene a bit later, when programming computers was less a confidential government initiative and more a niche scientific pursuit. She had studied math, and got a job as a programmer at MIT to support her husband (who was attending Harvard) and daughter. Her capacity was quickly recognized and she was tapped to work with the Apollo program, creating the mission's onboard flight systems.

November 22, 2016 ● The White House

On July 20, 1969, minutes before the astronauts aboard the Apollo 11 lunar module were about to make their historic landing on the moon, alarms sounded.

The computer running the lunar module was trying to shift to a radar system. If the system were allowed to make the shift, the mission would have to be aborted, and the astronauts would have to turn their spacecraft around and return to earth.

Fortunately, a different set of instructions took control of the computer, and the mission continued. The Apollo 11 lunar module landed, and astronaut Neil Armstrong became the first man to step onto the surface of the moon.

This past summer, the computer code that ran the systems responsible for putting Armstrong and his colleague Buzz Aldrin on the moon was published in its entirety on Github, a popular open source platform that software developers use to publish and edit each other's code.

The code was developed by a team of software engineers at MIT's Software Engineering Lab led by Margaret Hamilton. Hamilton was honored by NASA in 2003,

Margaret Hamilton, MIT

At the award ceremony in the White House, President Obama said Hamilton represents "that generation of unsung women who helped send humankind into space."

http://nces.ed.gov/programs/digest/d12/tables/dt12_349.asp
https://nsf.gov/statistics/2016/nsb20161/uploads/1/nsb20161.pdf

COMPUTER SCIENCE

WOMEN

BS in CS

1983-84 37.1%

2010-11 17.6%

	Bachelor's degrees					Master's degrees			Doctor's degrees		
	Total										
	Number	Annual percent change	Males	Females	Females as a percent of total	Total	Males	Females	Total	Males	Females
	2	3	4	5	6	7	8	9	10	11	12
1970-71	2,388	†	2,064	324	13.6	1,588	1,424	164	128	125	3
1971-72	3,402	42.5	2,941	461	13.6	1,977	1,752	225	167	155	12
1972-73	4,304	26.5	3,664	640	14.9	2,113	1,888	225	196	181	15
1973-74	4,756	10.5	3,976	780	16.4	2,276	1,983	293	198	189	9
1974-75	5,033	5.8	4,080	953	18.9	2,299	1,961	338	213	199	14
1975-76	5,652	12.3	4,534	1,118	19.8	2,603	2,226	377	244	221	23
1976-77	6,407	13.4	4,876	1,531	23.9	2,798	2,332	466	216	197	19
1977-78	7,201	12.4	5,349	1,852	25.7	3,038	2,471	567	196	181	15
1978-79	8,719	21.1	6,272	2,447	28.1	3,055	2,480	575	236	206	30
1979-80	11,154	27.9	7,782	3,372	30.2	3,647	2,883	764	240	213	27
1980-81	15,121	35.6	10,202	4,919	32.5	4,218	3,247	971	252	227	25
1981-82	20,267	34.0	13,218	7,049	34.8	4,935	3,625	1,310	251	230	21
1982-83	24,565	21.2	15,641	8,924	36.3	5,321	3,813	1,508	262	228	34
1983-84	32,439	32.1	20,416	12,023	37.1	6,190	4,379	1,811	251	225	26
1984-85	39,121	20.6	24,737	14,384	36.8	7,101	5,064	2,037	248	223	25
1985-86	42,337	8.2	27,208	15,129	35.7	8,070	5,658	2,412	344	299	45
1986-87	39,767	-6.1	25,962	13,805	34.7	8,481	5,985	2,496	374	322	52
1987-88	34,651	-12.9	23,414	11,237	32.4	9,197	6,726	2,471	428	380	48
1988-89	30,560	-11.8	21,143	9,417	30.8	9,414	6,775	2,639	551	466	85
1989-90	27,347	-10.5	19,159	8,188	29.9	9,677	6,960	2,717	627	534	93
1990-91	25,159	-8.0	17,771	7,388	29.4	9,324	6,563	2,761	676	584	92
1991-92	24,821	-1.3	17,685	7,136	28.7	9,655	6,980	2,675	772	669	103
1992-93	24,519	-1.2	17,606	6,913	28.2	10,353	7,557	2,796	805	689	116
1993-94	24,527	=	17,528	6,999	28.5	10,568	7,836	2,732	810	685	125
1994-95	24,737	0.9	17,684	7,053	28.5	10,595	7,805	2,790	887	726	161
1995-96	24,506	-0.9	17,757	6,749	27.5	10,579	7,729	2,850	869	743	126
1996-97	25,422	3.7	18,527	6,895	27.1	10,513	7,526	2,987	857	721	136
1997-98	27,829	9.5	20,372	7,457	26.8	11,765	8,343	3,422	858	718	140
1998-99	30,552	9.8	22,289	8,263	27.0	12,843	8,866	3,977	806	656	150
1999-2000	37,788	23.7	27,185	10,603	28.1	14,990	9,978	5,012	779	648	131
2000-01	44,142	16.8	31,923	12,219	27.7	16,911	11,195	5,716	768	632	136
2001-02	50,365	14.1	36,462	13,903	27.6	17,173	11,447	5,726	752	581	171
2002-03	57,433	14.0	41,950	15,483	27.0	19,509	13,267	6,242	816	648	168
2003-04	59,488	3.6	44,585	14,903	25.1	20,143	13,868	6,275	909	709	200
2004-05	54,111	-9.0	42,125	11,986	22.2	18,416	13,136	5,280	1,119	905	214
2005-06	47,480	-12.3	37,705	9,775	20.6	17,055	12,470	4,585	1,416	1,109	307
2006-07	42,170	-11.2	34,342	7,828	18.6	16,232	11,985	4,247	1,595	1,267	328
2007-08	38,476	-8.8	31,694	6,782	17.6	17,087	12,513	4,574	1,698	1,323	375
2008-09	37,994	-1.3	31,215	6,779	17.8	17,907	13,063	4,844	1,580	1,226	354
2009-10	39,589	4.2	32,410	7,179	18.1	17,953	13,017	4,936	1,599	1,250	349
2010-11	43,072	8.8	35,478	7,594	17.6	19,446	13,956	5,490	1,588	1,267	321
Percent change											
2000-01 to 2005-06	7.6	†	18.1	-20.0	†	0.9	11.4	-19.8	84.4	75.5	125.7
2005-06 to 2010-11	-9.3	†	-5.9	-22.3	†	14.0	11.9	19.7	12.1	14.2	4.6

https://www.census.gov/hhes/school/files/ACS-CPS-CCD_02-18-14.pdf

5,807 female US high school students took AP Computer Science (15 million students in US HS)

media.collegeboard.com/digitalServices/pdf/research/2013/Program-Summary-Report-2013.pdf

	SCHOOLS	STUDENTS IN 9TH GRADE	10TH GRADE	11TH GRADE	12TH GRADE	Not HS	<9TH GRADE	NOT STATED	MALE	FEMALE	2012 PROGRAM TOTAL	2013 PROGRAM TOTAL	% CHANGE 2012-2013	NO. OF COLLEGES
ART HISTORY	1,912	230	3,326	7,369	11,370	11	5	412	7,960	14,763	22,650	22,723	0	1,219
BIOLOGY	10,161	2,373	23,016	77,642	97,228	161	34	2,735	84,656	118,533	191,773	203,189	6	2,696
CALCULUS AB	13,559	423	5,051	66,896	206,312	783	79	3,270	147,404	135,410	266,994	282,814	6	2,945
CALCULUS BC	6,386	365	2,872	27,136	72,372	671	59	1,008	62,164	42,319	94,403	104,483	11	1,800
CHEMISTRY	8,444	219	10,089	76,909	50,998	392	20	1,379	75,066	64,940	132,425	140,006	6	2,200
CHINESE LANGUAGE & CULTURE	1,460	907	2,265	3,573	3,195	15	34	132	4,603	5,518	9,357	10,121	8	400
COMPUTER SCIENCE A	3,249	738	5,607	10,657	13,583	65	39	428	25,310	5,807	26,103	31,117	19	1,200
MACROECONOMICS	4,359	531	3,113	15,444	86,757	721	7	1,646	60,885	47,334	99,903	108,219	8	2,100
MICROECONOMICS	3,569	193	2,846	13,388	49,283	745	12	1,038	39,491	28,014	62,351	67,505	8	1,800
ENGLISH LANGUAGE & COMP.	11,407	258	11,117	403,936	53,316	122	14	7,514	182,283	293,994	443,835	476,277	7	3,000
ENGLISH LITERATURE & COMP.	13,497	54	1,900	43,611	334,592	261	11	5,147	144,911	240,665	380,608	385,576	1	3,200
ENVIRONMENTAL SCIENCE	4,896	3,525	7,432	40,266	65,046	48	10	1,961	53,683	64,605	108,839	118,288	9	2,200
EUROPEAN HISTORY	4,700	1,040	65,783	15,707	25,551	47	0	1,750	51,810	58,068	108,854	109,878	1	2,000
FRENCH LANGUAGE & CULTURE	3,280	240	1,249	5,614	13,232	21	70	299	6,660	14,065	19,769	20,725	5	1,200
GERMAN LANGUAGE & CULTUR	1,200	81	361	919	3,474	9	34	88	2,564	2,402	4,754	4,966	4	700
GOVT. & POL. - COMP.	1,229	110	1,958	3,935	14,001	13	1	299	10,540	9,777	18,402	20,317	10	1,100
GOVT. & POL. - U.S.	8,193	4,806	19,803	31,991	195,151	159	16	3,832	123,033	132,725	239,513	255,758	7	2,800
HUMAN GEOGRAPHY	3,049	67,070	18,935	11,142	14,692	33	32	2,457	51,706	62,655	98,679	114,361	16	1,700
ITALIAN LANGUAGE & CULTURE	339	8	67	330	1,528	2	7	38	741	1,239	1,806	1,980	10	300
JAPANESE LANGUAGE & CULTU	610	93	272	684	1,148	2	2	33	954	1,280	2,177	2,234	3	300
LATIN - VERGIL	1,104	14	353	2,150	4,076	4	1	69	3,356	3,311	6,424	6,667	4	600
MUSIC THEORY	2,945	215	2,266	6,331	9,033	6	27	314	10,274	7,918	18,161	18,192	0	1,251
PHYSICS B	5,654	317	3,253	34,038	50,410	118	48	1,079	58,436	30,827	80,584	89,263	11	2,033
PHYSICS C - E&M	2,190	27	271	2,698	15,945	214	7	218	14,880	4,500	17,380	19,380	12	796
PHYSICS C - MECH	3,714	48	530	6,973	34,509	298	20	480	31,689	11,169	38,630	42,858	11	1,300
PSYCHOLOGY	6,924	538	16,175	89,610	128,670	185	33	3,751	88,603	150,359	220,361	238,962	8	2,818
SPANISH LANGUAGE	7,310	5,072	19,175	48,926	54,668	45	4,802	2,571	51,345	83,914	129,674	135,259	4	2,276
SPANISH LITERATURE	1,602	322	1,428	6,174	10,469	5	1	386	6,571	12,214	17,919	18,785	5	1,026
STATISTICS	7,357	428	8,032	32,553	125,329	644	164	2,358	83,380	86,128	153,859	169,508	10	2,637
STUDIO ART - DRAWING	3,446	23	420	3,150	11,537	5	0	1,462	3,974	12,623	16,188	16,597	3	1,400
STUDIO ART - 2-D DESIGN	3,923	46	769	4,786	17,187	10	1	2,129	6,599	18,329	23,591	24,928	6	1,700
STUDIO ART - 3-D DESIGN	1,344	2	91	647	3,059	1	0	367	1,244	2,923	3,840	4,167	9	700
U.S. HISTORY	12,176	1,899	46,883	370,643	16,523	89	16	6,837	207,441	235,449	427,796	442,890	4	2,800
WORLD HISTORY	5,783	15,397	181,457	20,222	7,964	42	670	4,355	105,279	124,828	210,805	230,107	9	2,188
TOTAL NO. OF EXAMS TAKEN		107,612	468,165	1,486,050	1,802,208	5,947	6,276	61,842	1,809,495	2,128,605	3,698,407	3,938,100	6	
TOTAL NO. OF STUDENTS		102,356	395,045	818,812	852,782	2,572	6,124	40,887	986,137	1,232,441	2,099,948	2,218,578	6	

You want to make money ?

Dreaming about the digital supply chain ?

E-COMMERCE LOGISTICS

Delhivery · DEPOSCO · Ecom Express · temando · YKS · 百世 · Shyp · narvar · ShipBob · FineEx · Packlink · LOGINEXT · MPO · shippo · HubLogix · sendle · bringg · mandaē · MetaPack · LOCUS · convey · 风先生 · FarEye · easypost

INVENTORY MANAGEMENT

ecomdash · SALESWARP · RELEX · tradegecko · stitchlabs · SHIPEDGE · skuIQ · optoro

FREIGHT & SUPPLY CHAIN VISIBILITY

FLEXPORT · FREIGHTOS · Olymtech · 3GTMS · FR8.guru · iContainers · freightsolutions · PRECYSE · PINC · awarepoint · WEFT · project44 · ICIX · VENIAM · IoT · HAVEN · INTTRA · clearmetal · riskmethods

WAREHOUSING

FLEXE · Grabit · 3PLCentral · PEOPLEVOX · shiphero · SKUVAULT · sewio · 6 RIVER SYSTEMS · SEEGRID · RoboCV · MAGAZINO · GREYORANGE · Hstar Technologies · I am robotics · fetch · LOCUS · CLEARPATH · KINETIC · GETVU · BALYO · MiR

WYNDHAM HOTEL GROUP	airbnb
1974	2008
8000	0
32,000	2000
$7 Bn	$30 Bn

LAST-MILE DELIVERY

GOJEK · NewDada · POSTMATES · GROFERS · 云鸟 · NO.1 VAN · shadowfax · 人人快递 · zipline · OPINION · 飘天下 · stuart · LALAMOVE · NINJA VAN · ParcelPoint · Flirtey · Doorman · Loggi · MATTERNET · fetchr · dropoff · Glovo · Routific

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ENTERPRISE RESOURCE PLANNING

infor · IQMS · taulia · brightpearl · SOURCE INTELLIGENCE · CentricSoftware · elementum · TRADESHIFT · Llamasoft · Kenandy · B2B CENTER · Steelwedge · E2OPEN · RSi Retail Solutions · SIGHT MACHINE · arena · EXOSTAR · rootstock · fusionops · nulogy

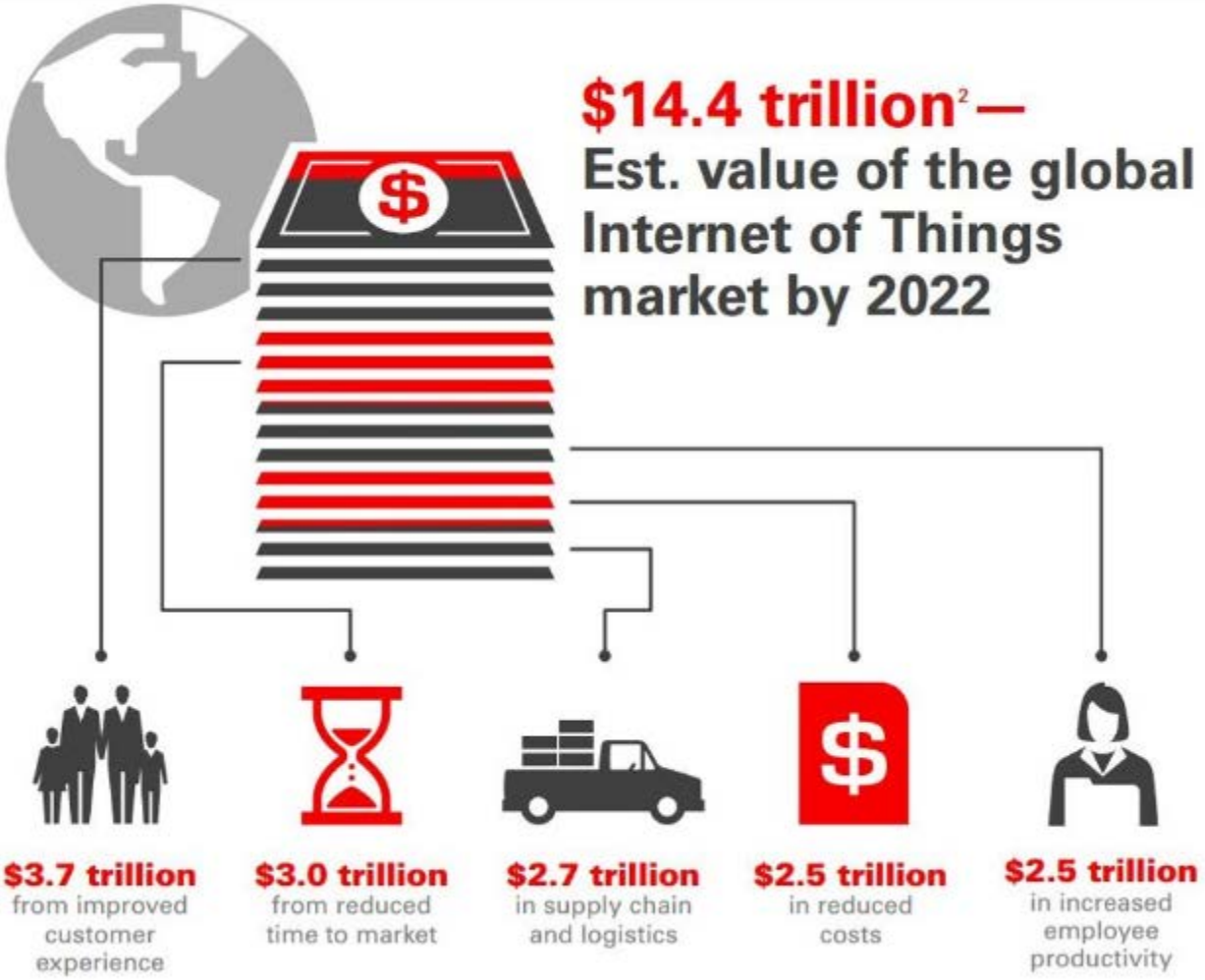
SENSORS / ASSET TAGGING

ALIEN · OmniID · SCANDIT · altierre · TEGO

CBINSIGHTS

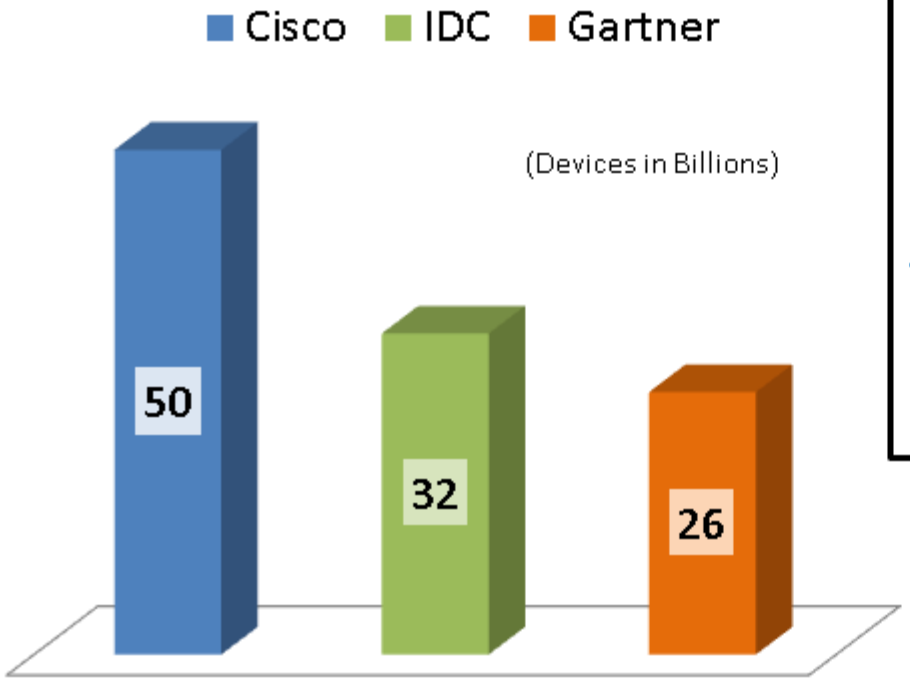
Gartner: Emerging Digital Industrial Economy Built On Internet Of Things Will Add Trillions In Economic Value

www.forbes.com/sites/louiscolumbus/2015/12/27/roundup-of-internet-of-things-forecasts-and-market-estimates-2015/#5bf70b2648a0



It may never happen if we do not educate women in science and engineering (WISE)

IoT Market Size Estimate by 2020



Number Connected Devices Estimate by 2020

IoT market estimates by

- **Cisco** – Leading Networking OEM which is betting big on IoT
- **IDC** – Premier global market intelligence firm
- **Gartner** – Leading Technology Research Firm

Irrespective of the variance in the estimates, one thing is crystal clear……

IoT is a…

Trillion ($1,000,000,000,000) dollar market
comprising of
Billions (1,000,000,000) of connected devices

References

- *2014 CES Key note by Cisco CEO John Chambers*
- *IDC*
- *Gartner*

* Value at Stake – Market Size will be % of this number

Twitter-ionic Education ?

Tweet pour de bon

Élysée
@Elysee

Follow

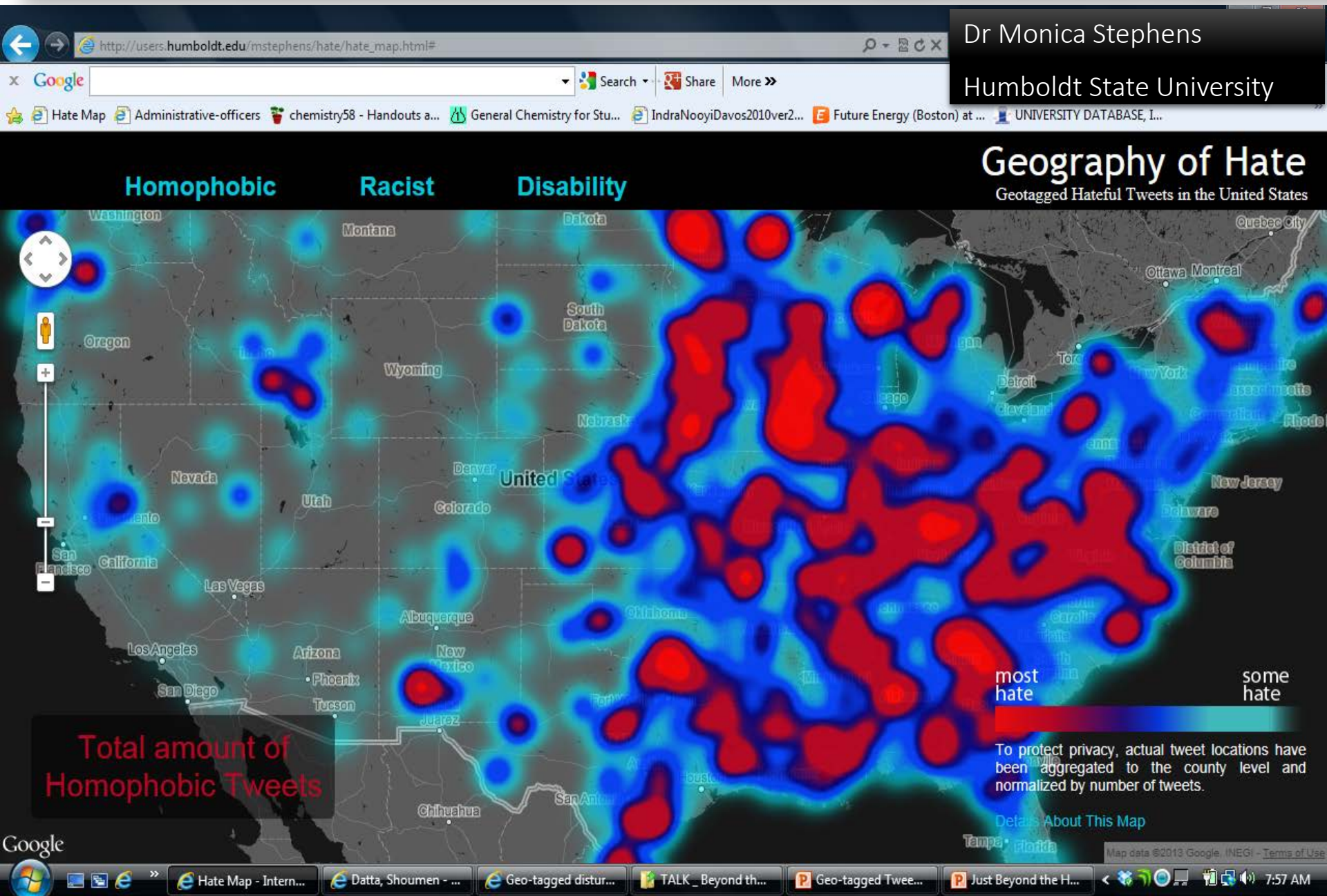
.@fhollande rencontre plusieurs personnalités indiennes francophiles, dont l'actrice Aishwarya Rai #IndePR

2:10 AM - 26 Jan 2016

Twitter Data Analytics from Geo Tagged Social Signals

Dr Monica Stephens

Humboldt State University

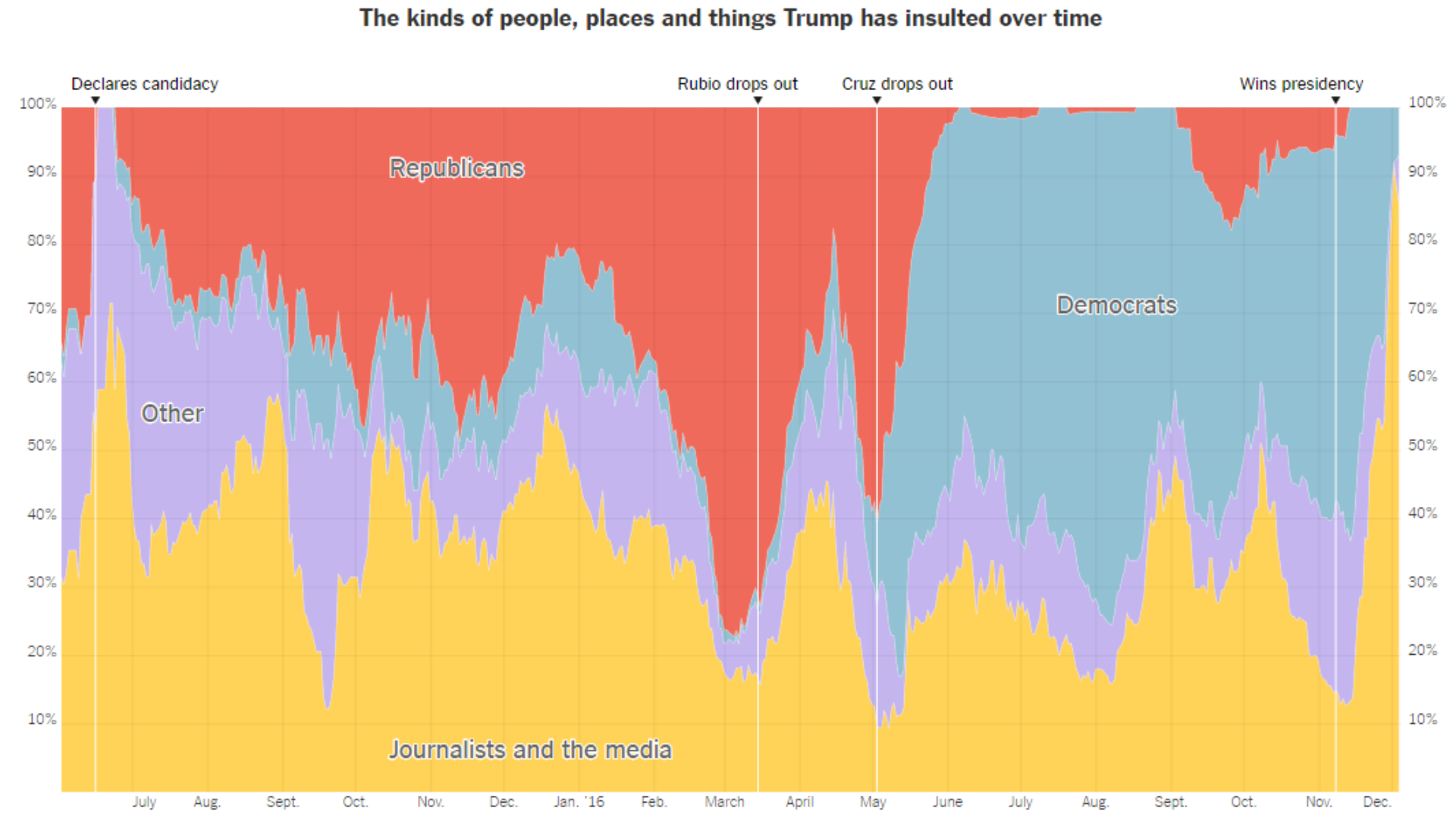


WISE – opportunity cryptic in catastrophy ?

www.nytimes.com/interactive/2016/12/06/upshot/how-to-know-what-donald-trump-really-cares-about-look-at-who-hes-insulting.html

THE UPSHOT | How to Know What Donald Trump Really Cares About: Look at What He's Insulting

MORE



Raison d'être

Tackling gender inequality could add $12tn to world economy, study finds

Researchers say extra GDP output could come from reforms, such as allowing more women in workforce in countries where they currently face restrictions

A woman working at a salt pan in Mumbai. Due to gender inequality, only 17% of India's GDP comes from women. The figure is 40% in the US and western Europe. Photograph: Divyakant Solanki/EPA

Tackling gender inequality and boosting women's opportunities in the labour market could add $12tn (£7.8tn) to annual global GDP over the next decade, according to new research.

Der wichtigste Grund

http://bit.ly/GENDER-INEQUALITY

Wenn Sie Autos verkaufen wollen, helfen, die Straßen zu bauen

If you want to sell cars

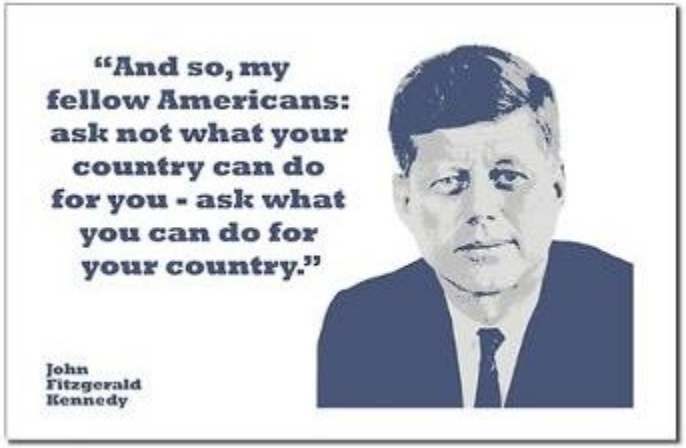
help to build the

roads

Ask not what IoT can do for you

Ask what you can do for IoT

support WISE, educate women in STEM




bodybymilk.com
Smash hit by Hayden. Body by milk.
You don't have to be a hero to feel invincible. That's why i drink milk. The protein helps build muscle and some studies suggest teens who choose it tend to be leaner. Cheers to that.
got milk?

https://www.washingtonpost.com/news/wonk/wp/2014/06/20/the-mysterious-case-of-americas-plummeting-milk-consumption/

Sections

The Washington Post

20 June 2014

The mysterious case of America's plummeting milk consumption

Americans, on average, drink 37 percent less milk today than they did in 1970, according to data from the USDA. Forty years ago, per capita consumption was nearly one and a half cups per day; now it's nearer to 0.8. While the fallout spans every type of cow's milk—whole, low fat, and skim—it's been most unkind to the full fat variety. Whole milk per capita consumption has tumbled by 78 percent since 1970 (from more than 1.1 cups per day to fewer than .24).

http://bit.ly/GOT-MILK

Whole milk consumption plummets since 1970

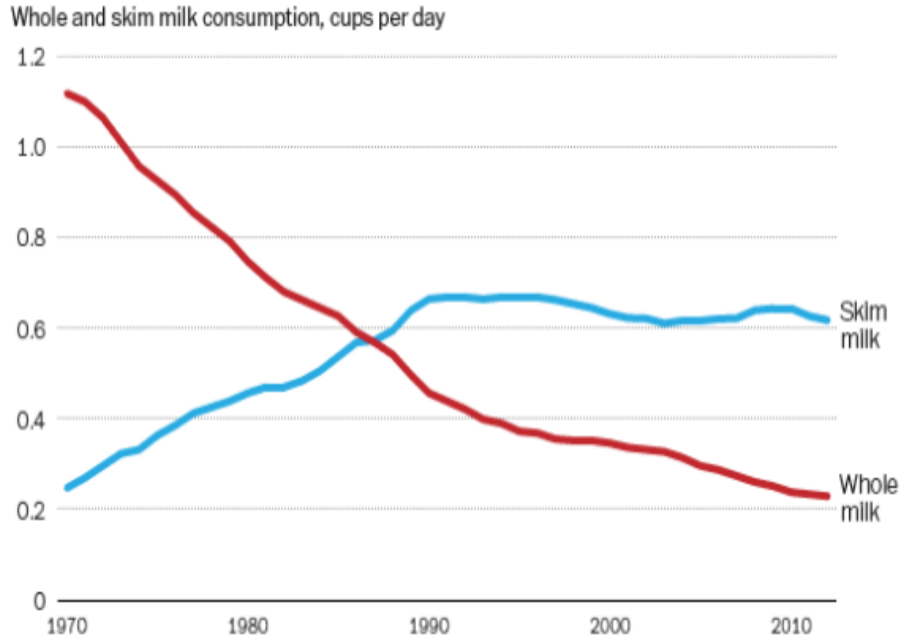
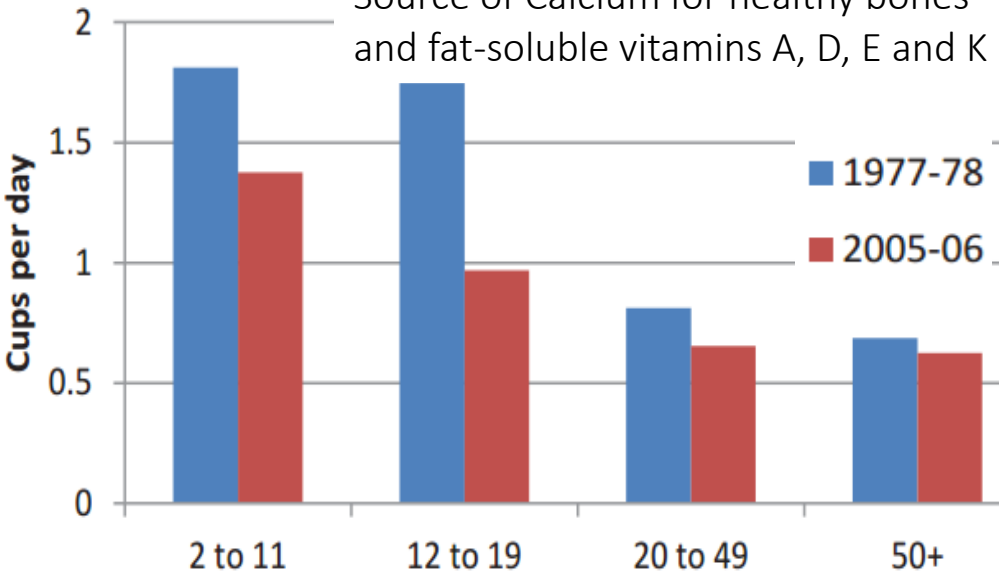


Figure 2: Mean Intake of Fluid Milk

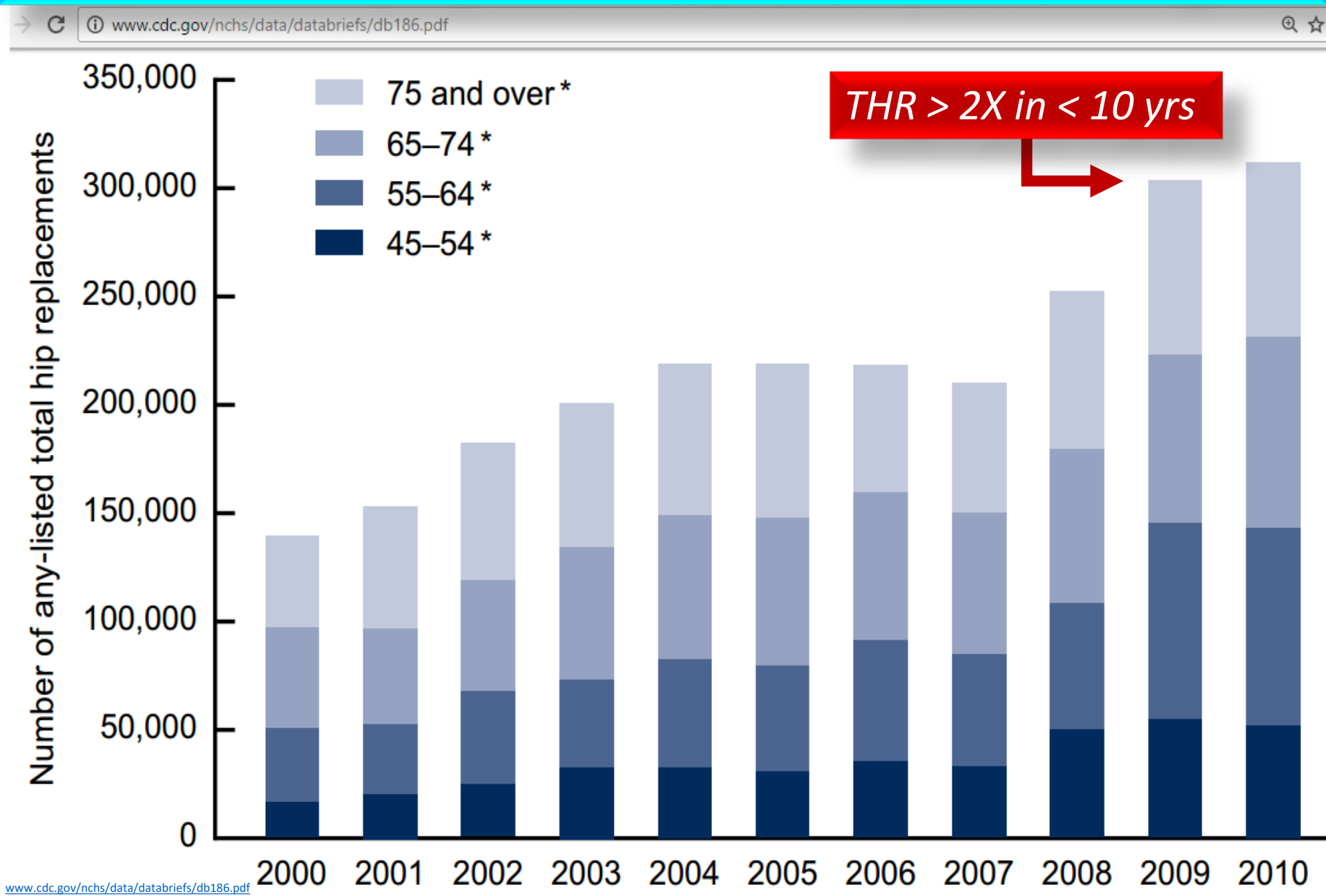
Source of Calcium for healthy bones and fat-soluble vitamins A, D, E and K



Causality

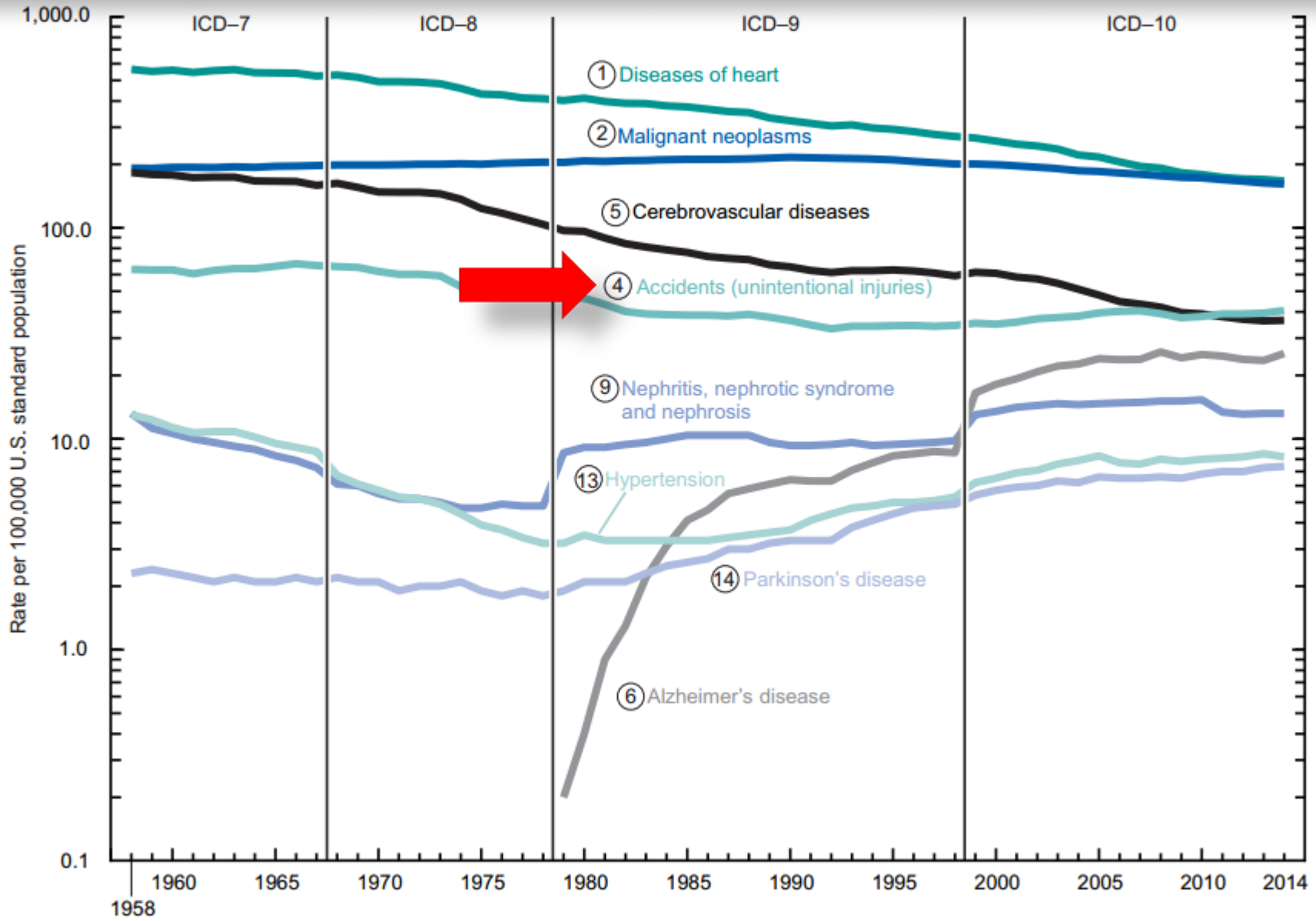
significant correlation?

326,100 total hip replacements (US, 2010) 95% cases age 45+



www.cdc.gov/nchs/data/databriefs/db186.pdf

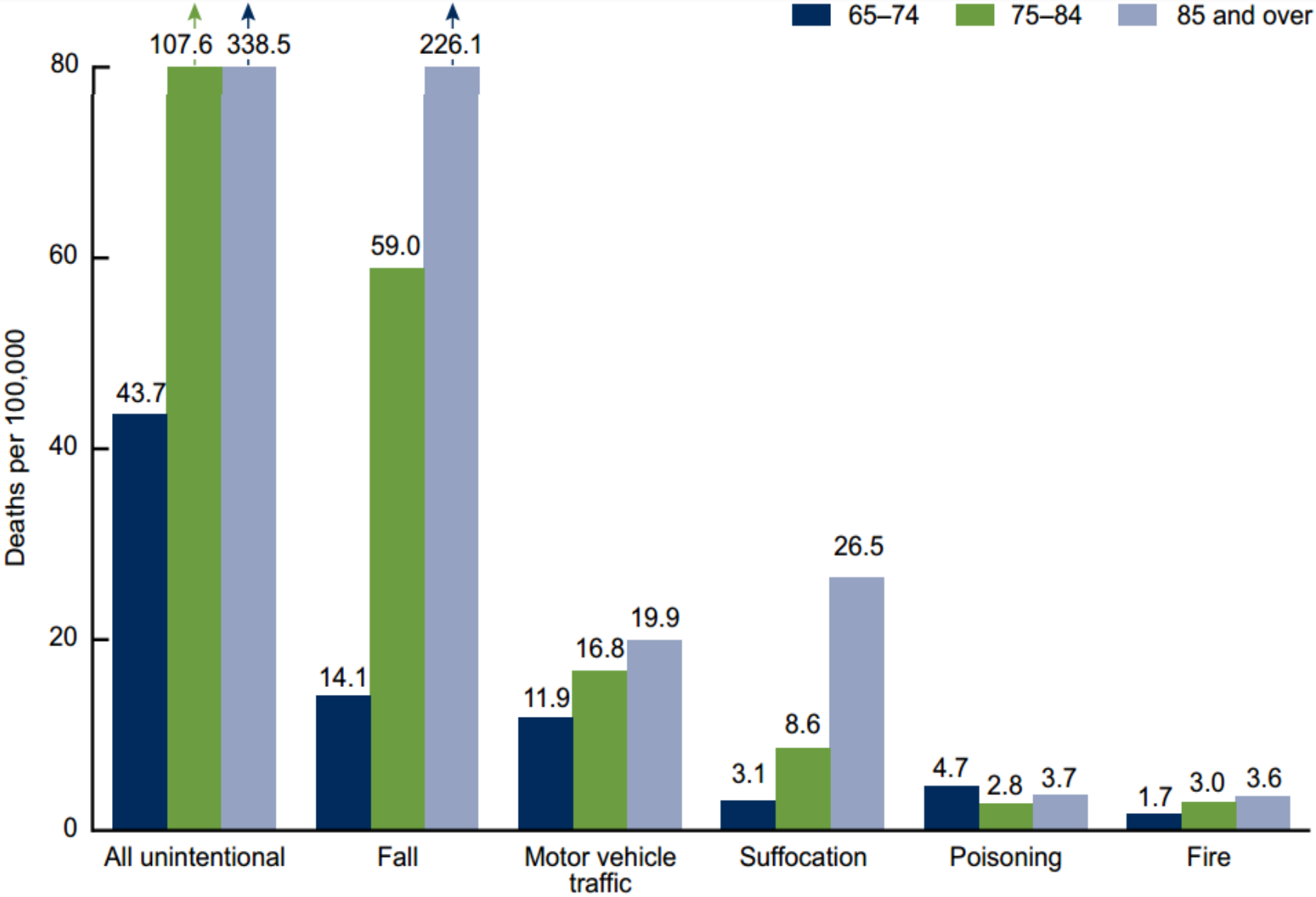
Age-adjusted rates for leading causes of death in US



NOTES: ICD is the *International Classification of Diseases*. Circled numbers indicate ranking of conditions as leading causes of death in 2014.
SOURCE: NCHS, National Vital Statistics System, Mortality. http://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_04.pdf

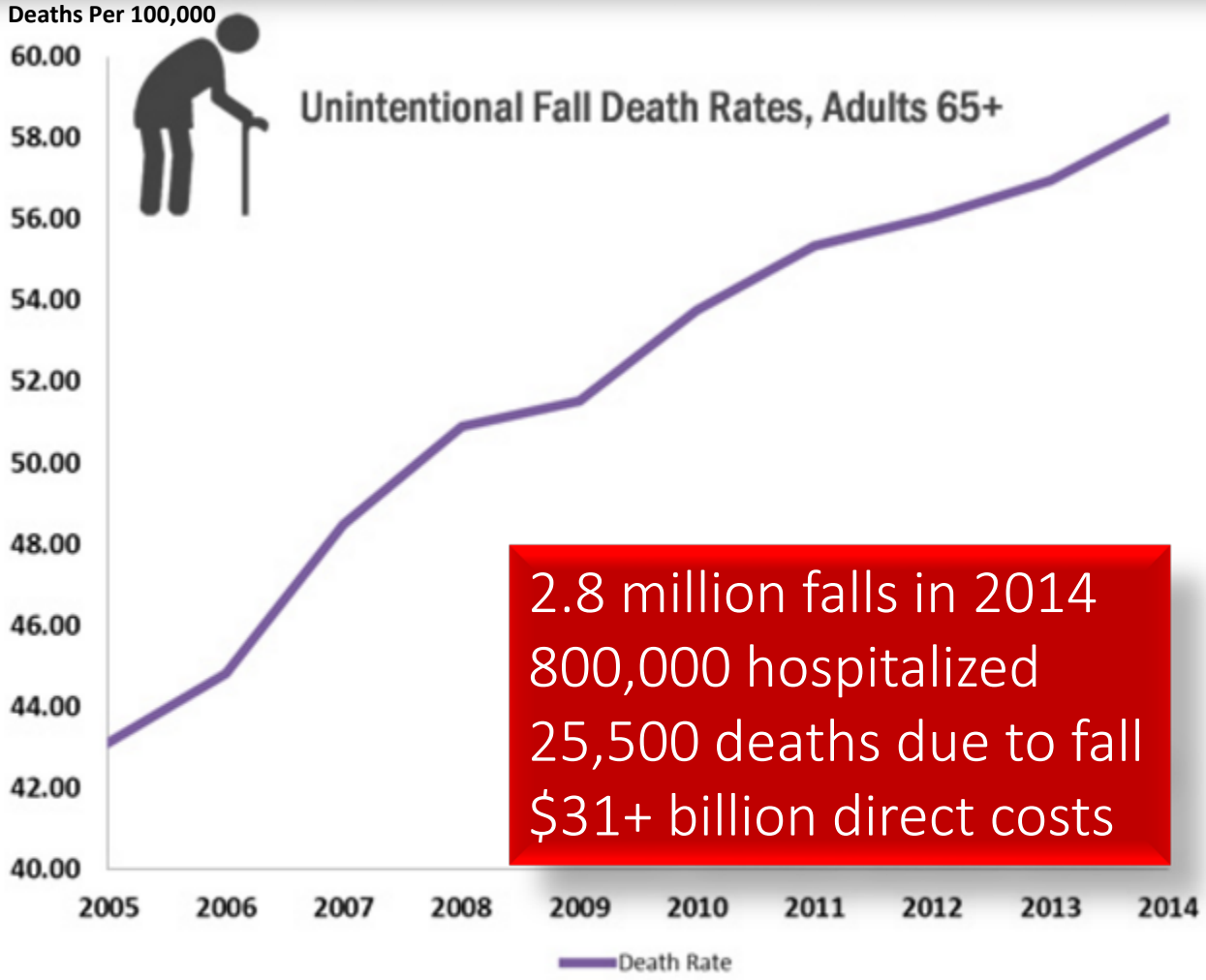
Cause of death for US adults aged 65+ (2012–2013)

www.cdc.gov/nchs/data/databriefs/db199.pdf



Hip fractures and brain injuries may follow from fall

- One out of five falls causes a serious injury such as broken bones or a head injury.[3,4]
- Each year, 2.8 million older people are treated in emergency departments for fall injuries.[5]
- Over 800,000 patients a year are hospitalized because of a fall injury, most often because of a head injury or hip fracture.[5]
- Each year at least 300,000 older people are hospitalized for hip fractures.[6]
- More than 95% of hip fractures are caused by falling,[7] usually by falling sideways.[8]
- Falls are the most common cause of traumatic brain injuries (TBI).[9]
- Adjusted for inflation, the direct medical costs for fall injuries are $31 billion annually.[10] Hospital costs account for two-thirds of the total.

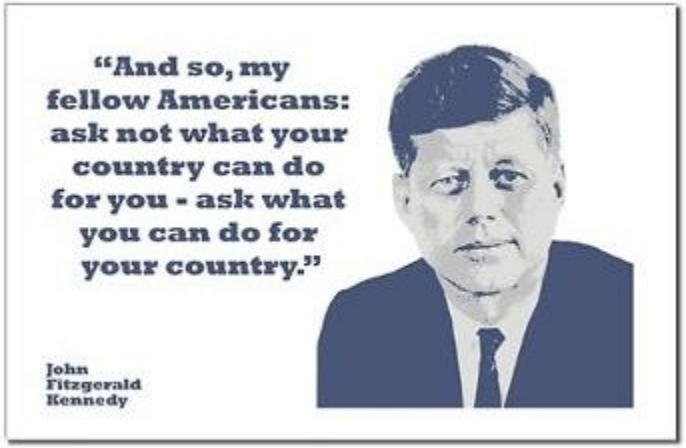


http://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html

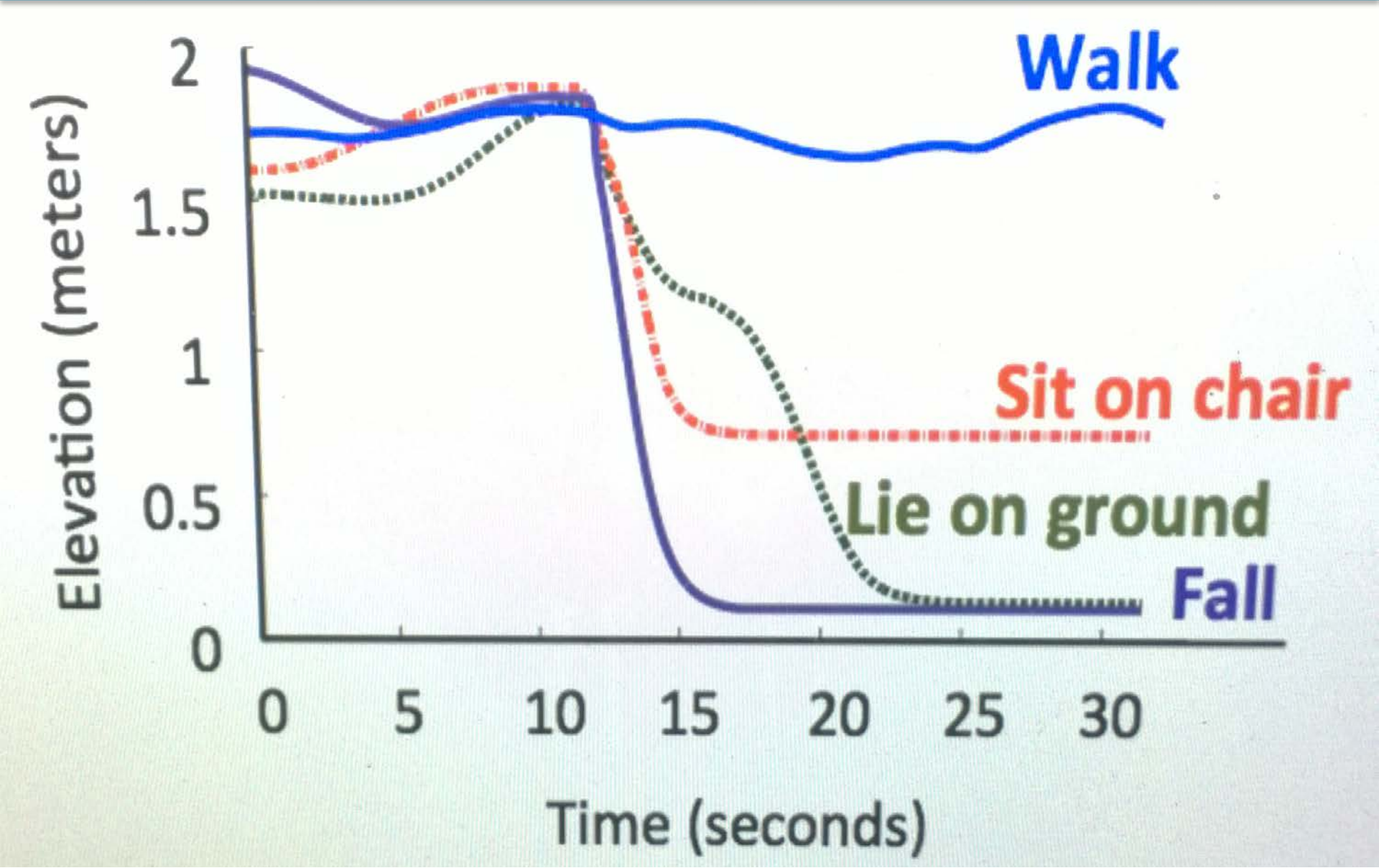
Ask not what IoT can do for you

Ask what you can do for IoT

to reduce deaths due to fall

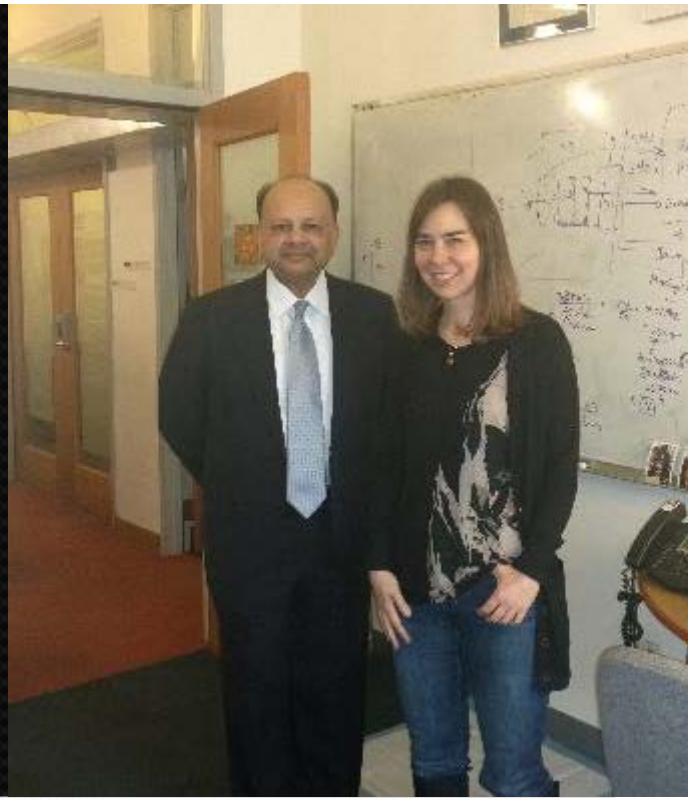


Fall Detection – Wire less, Sensor less, Without Wearables



Ambient RF Reflection Data – Professor Dina Katabi, Wireless Center, CSAIL, MIT

Professor Dina Katabi (MIT) presenting RF Reflection to President Obama (White House Demo, 4 August 2015)



President Obama invites MIT entrepreneurs to give demo at the White House http://bit.ly/President-Obama-with-Dina-Katabi

http://newsoffice.mit.edu/2015/president-obama-meets-mit-entrepreneurs-white-house-demo-day-0806

After the fall …

More than 30 million+ people may need implants

TKA and THA Replacement Potential	USA 325,000,000 population	EU-28 505,000,000 population	India 1.333 billion population	China 1.384 billion population
1% prevalence Knee and Hip combined	3,250,000	5,050,000	13,330,000	13,840,000
Total US folks TKA or THA	6.7 + 4.5 million 11,200,000			

- EU Ageing http://ec.europa.eu/eurostat
- Prevalence http://bit.ly/AAOS-2014

http://www.ors.org/Transactions/56/0214.pdf

Total Knee Replacement (TKR)

Age group	Female	Male
<50	0.1%	0.1%
50-59	1.8%	1.2%
60-69	5.5%	3.6%
70-79	10.1%	7.3%
80-89	11.0%	8.8%
90+	7.4%	7.4%

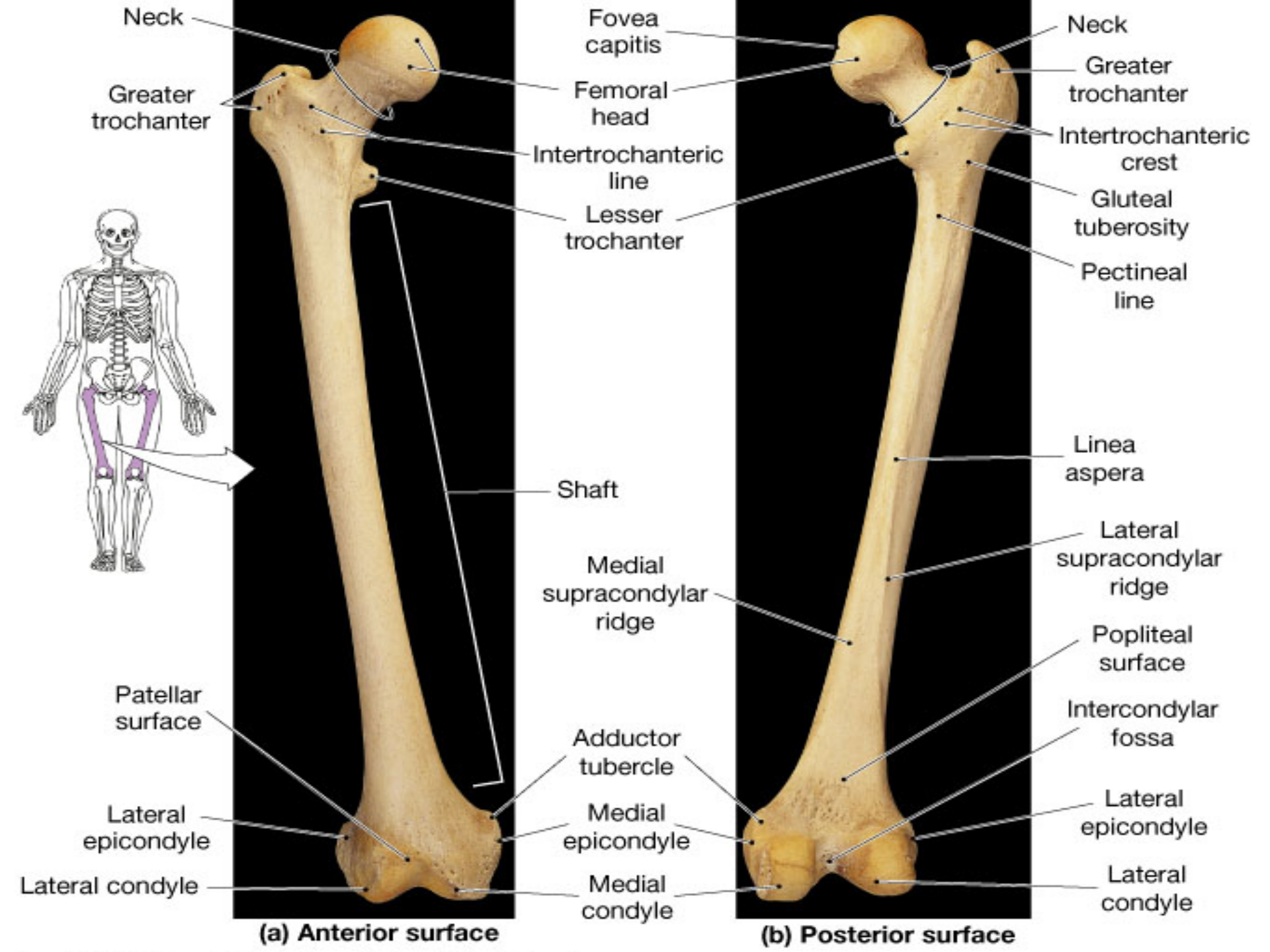
- 4.7 million (3.0 million women, 1.7 million men) individuals with total knee replacement in 2010

Total Hip Replacement (THR)

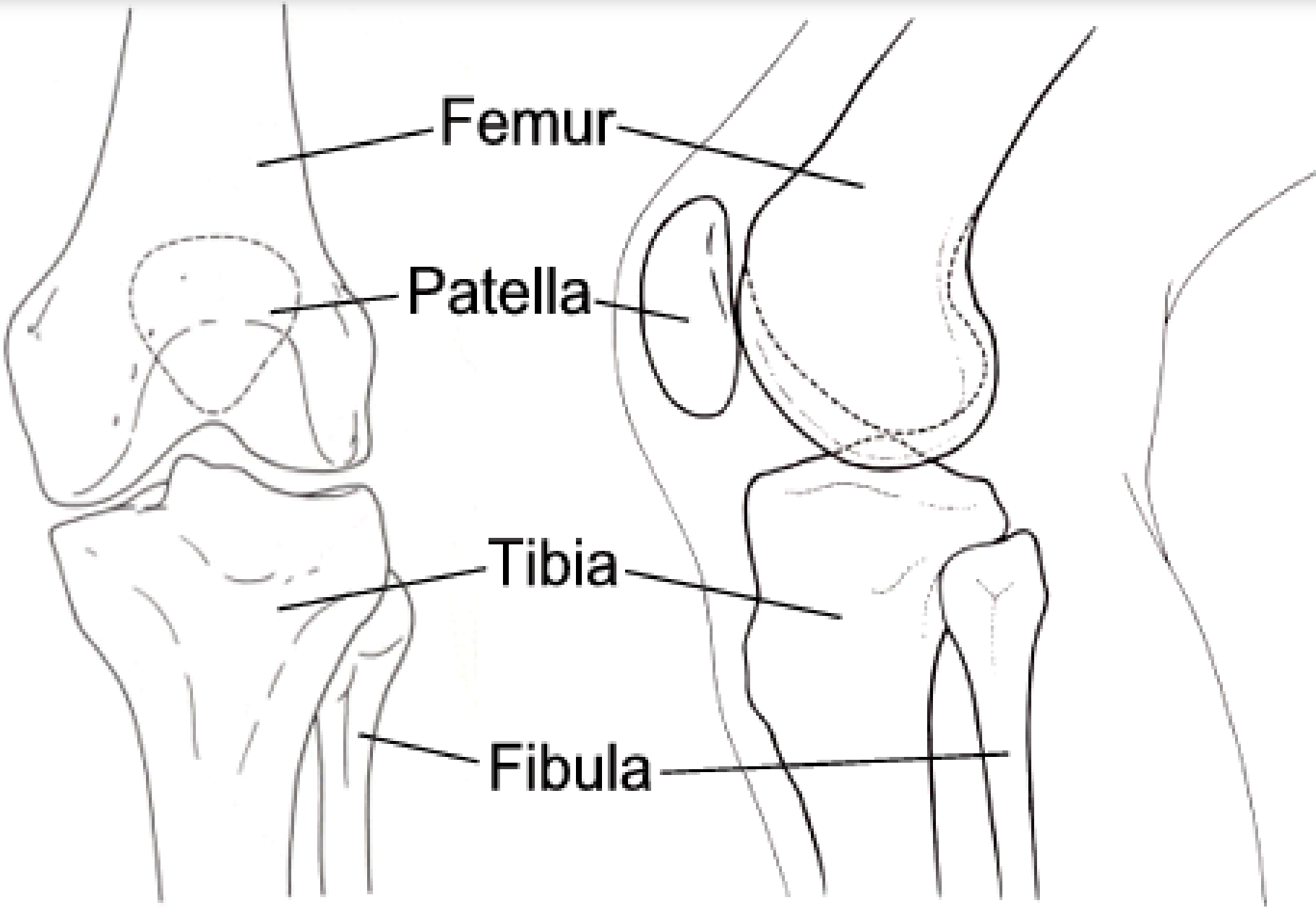
Age group	Female	Male
<50	0.1%	0.1%
50-59	0.8%	1.0%
60-69	2.1%	2.1%
70-79	4.4%	3.8%
80-89	6.3%	4.8%
90+	6.1%	4.8%

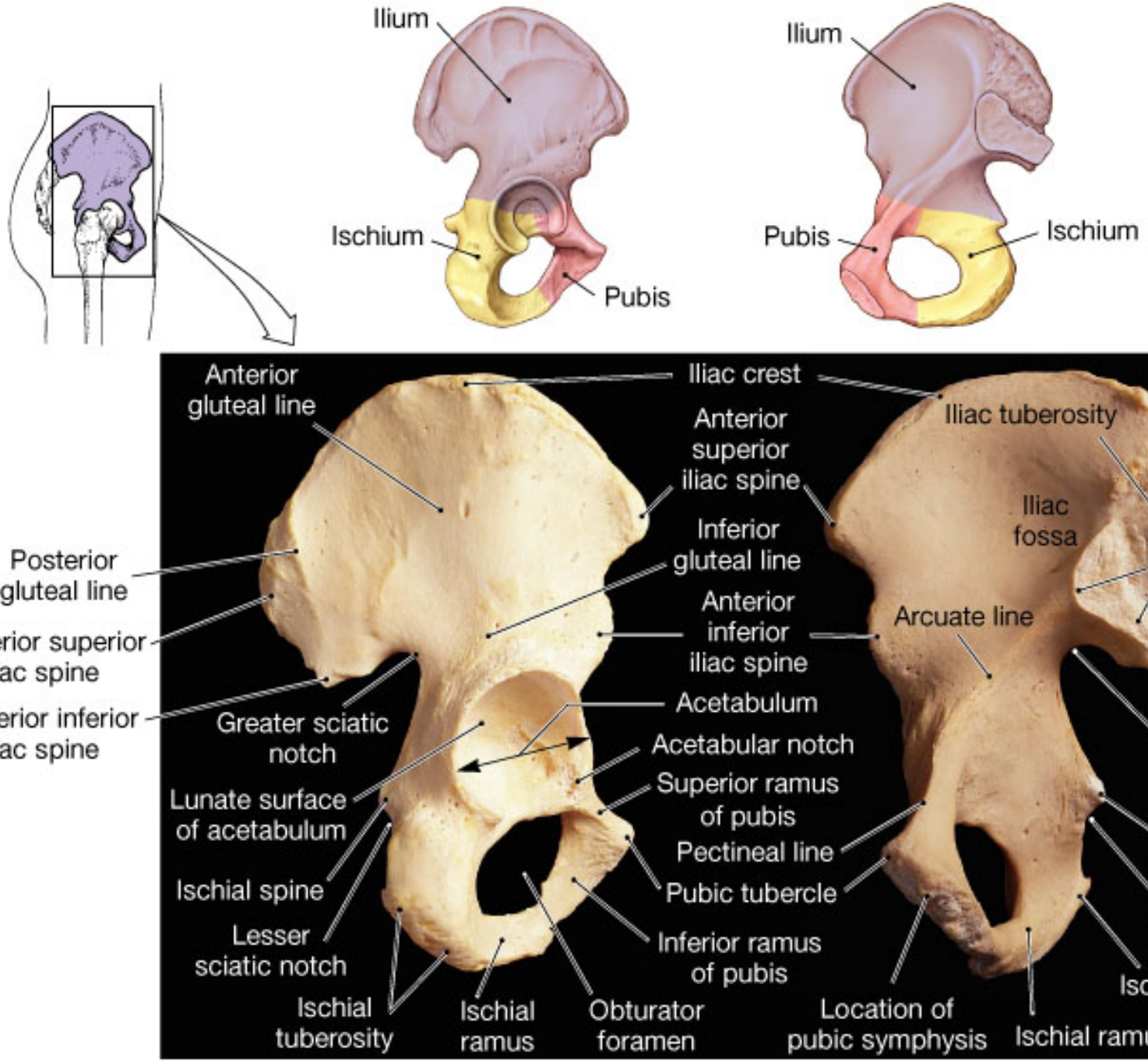
- 2.5 million (1.4 million women, 1.1 million men) individuals with total hip replacement in 2010

www.mayoclinic.org/medical-professionals/clinical-updates/orthopedic-surgery/study-hip-knee-arthroplasty-shows-7-2-million-americans-living-with-implants


Neck
Greater trochanter
Fovea capitis
Femoral head
Intertrochanteric line
Lesser trochanter
Shaft
Medial supracondylar ridge
Patellar surface
Adductor tubercle
Lateral epicondyle
Medial epicondyle
Lateral condyle
Medial condyle
(a) Anterior surface
Neck
Greater trochanter
Intertrochanteric crest
Gluteal tuberosity
Pectineal line
Linea aspera
Lateral supracondylar ridge
Popliteal surface
Intercondylar fossa
Lateral epicondyle
Lateral condyle
(b) Posterior surface

Anatomy of Knee Joint

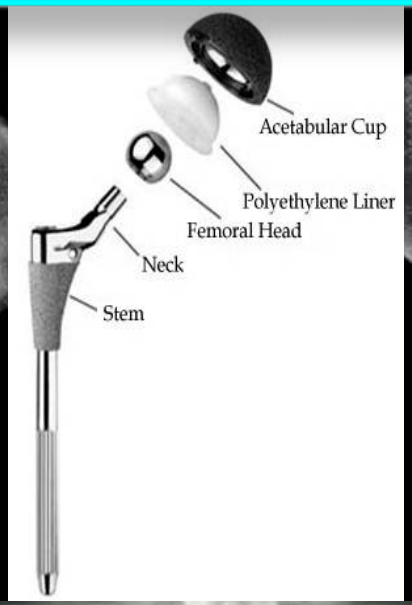


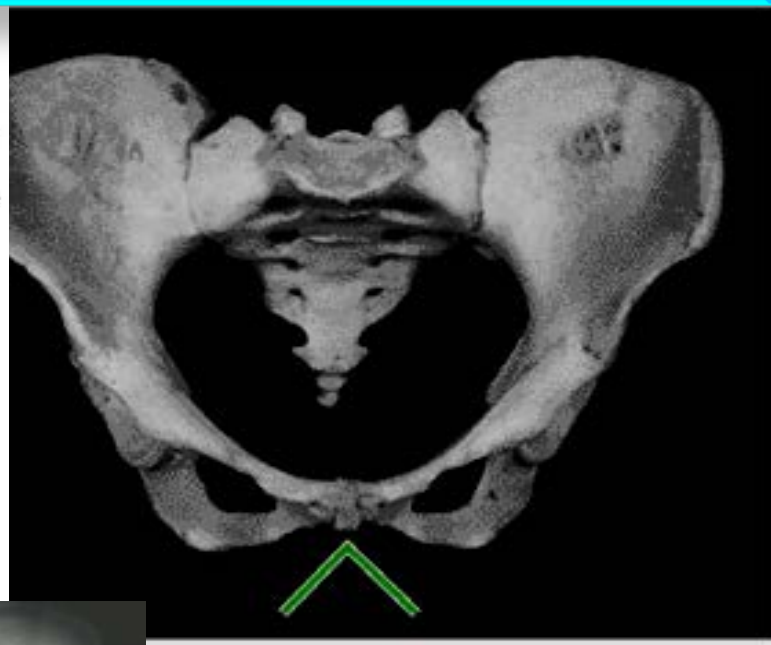


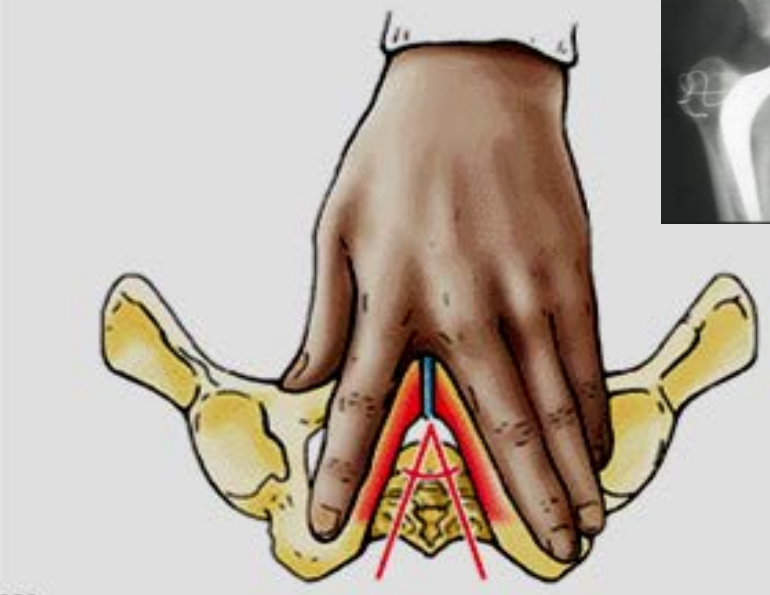
(a) Right os coxae, lateral

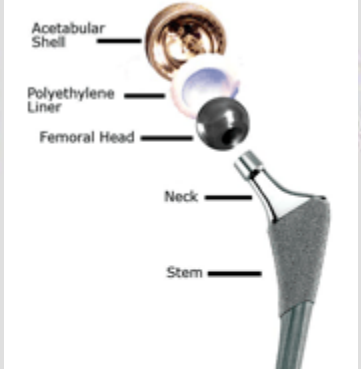
(b) Right os coxae, medial view

Total Hip Arthoplastry - Are All Acetabular Caps Created Equal?

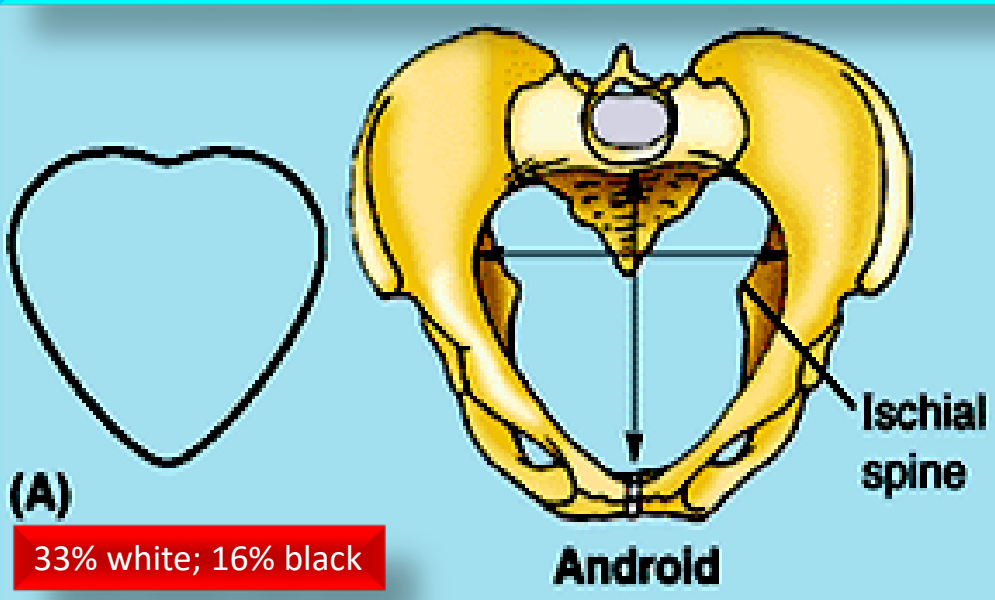




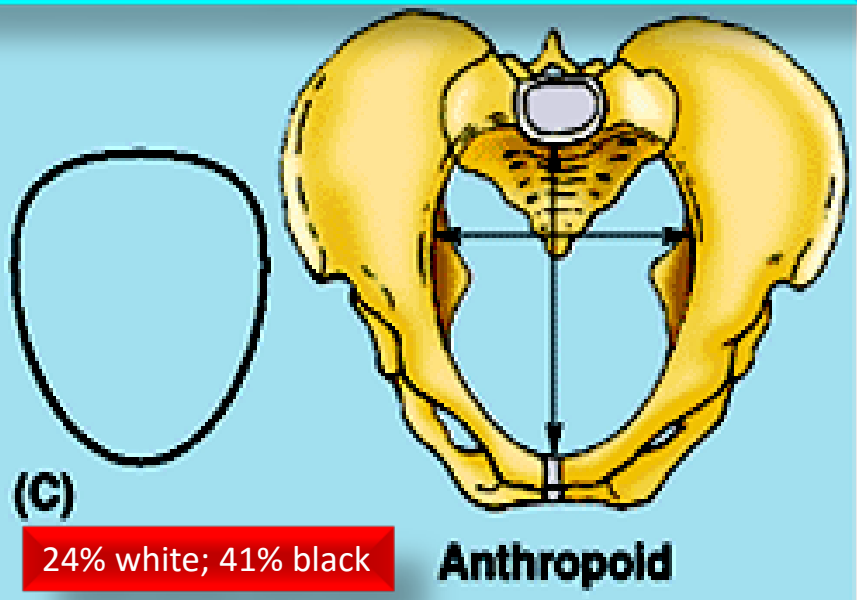




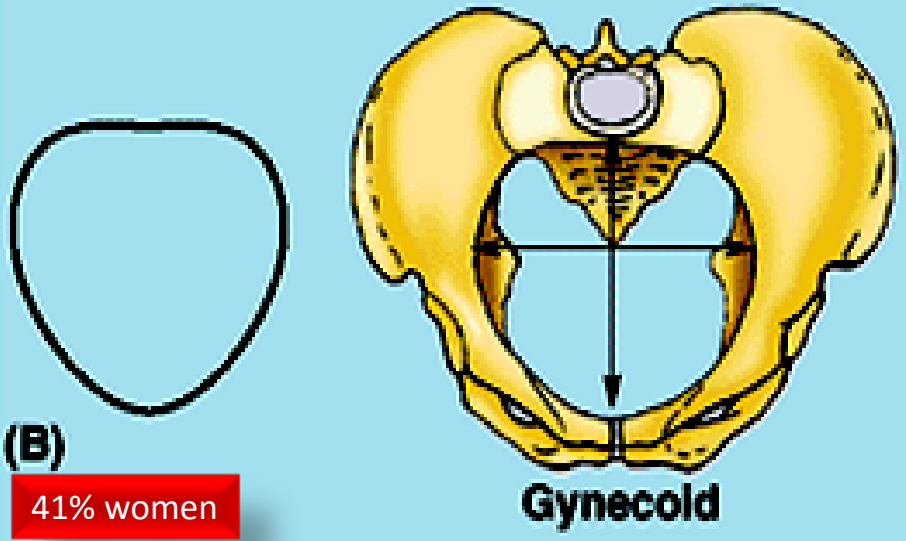
Total Hip Arthoplastry - Are All Female Hips Created Equal ?



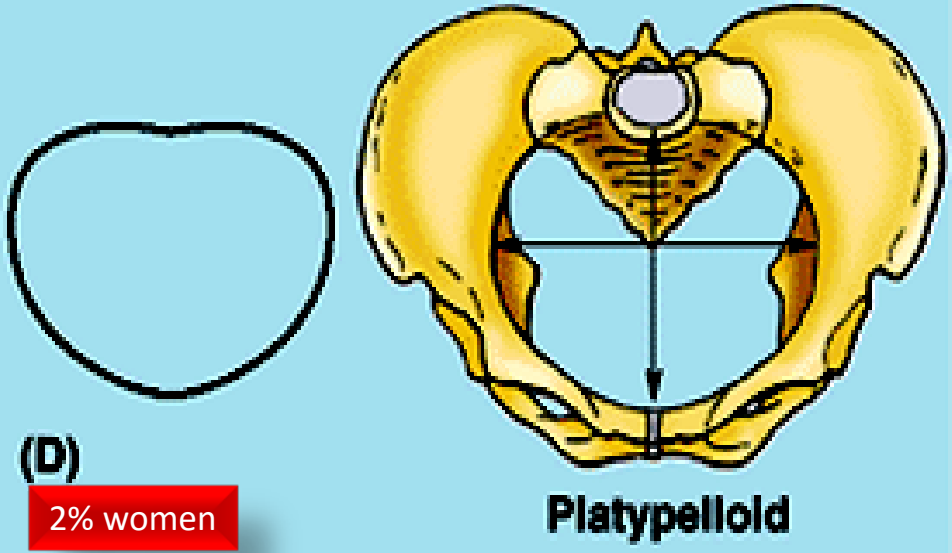
33% white; 16% black



24% white; 41% black



41% women



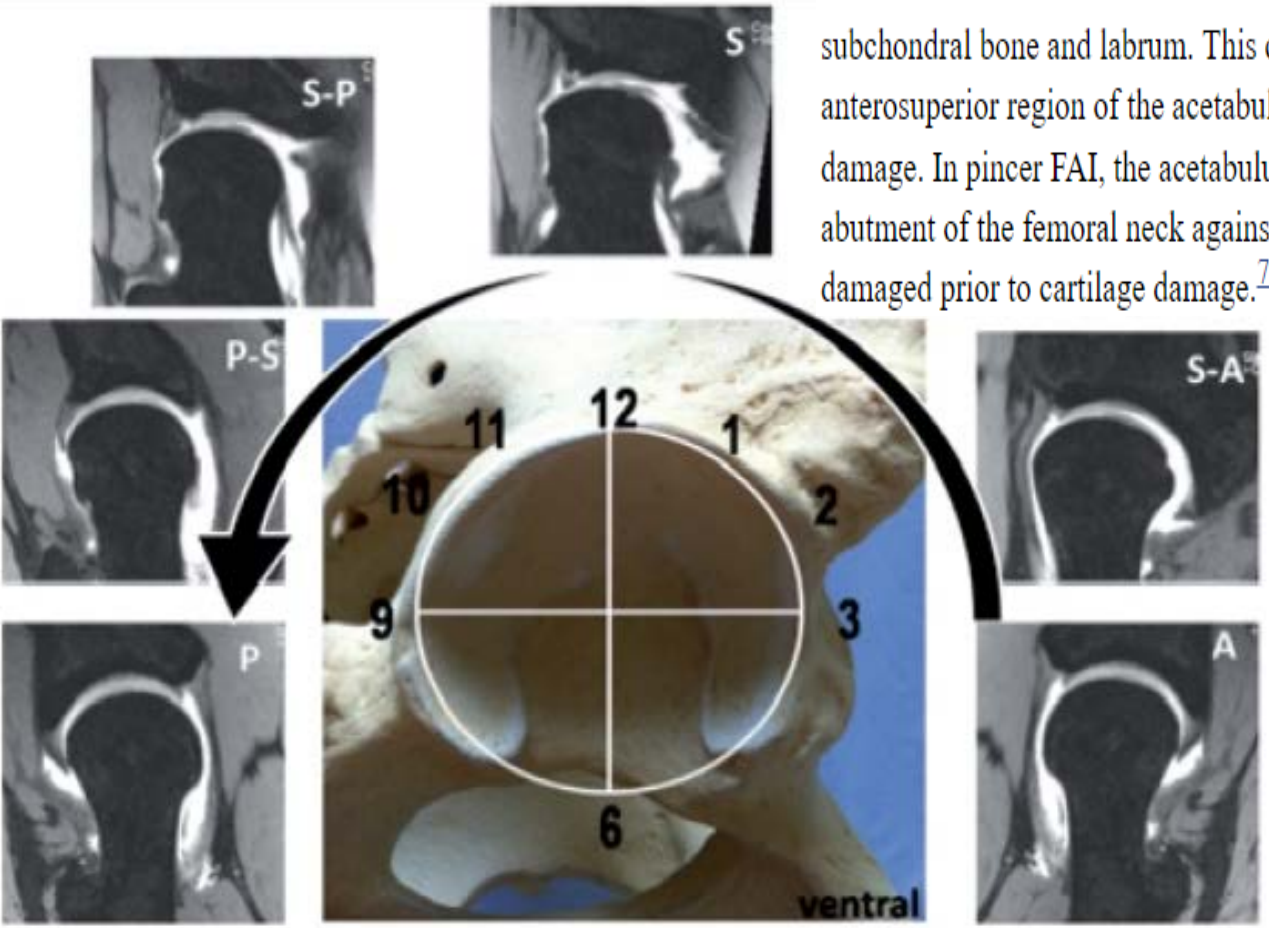
2% women

One shoe doesn't fit all

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3206516/

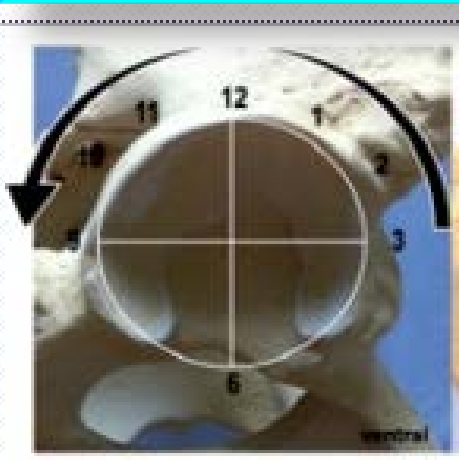
Femoroacetabular Impingement

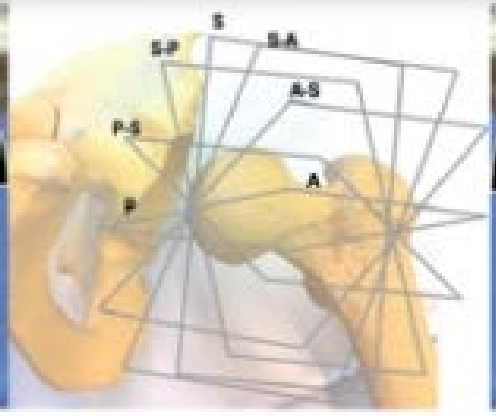
The concept of femoroacetabular impingement (FAI) as a major contributor to the development of premature hip OA has been recognized and accepted all over the world. Table 2 demonstrates the remarkable number of publications in PUBMED concerning *femoroacetabular impingement* within the past decade. The cam-lesion is the reduced head-neck offset and bashes against labrum and acetabular cartilage during flexion and internal rotation. This mechanism may cause cartilage delamination from the subchondral bone and labrum. This carpet phenomenon is located mostly in the anterosuperior region of the acetabulum.[68–70] as well as causing intraarticular cartilage damage. In pincer FAI, the acetabulum might be too deep globally or locally, causing an abutment of the femoral neck against the acetabulum so that the labrum might be damaged prior to cartilage damage.[71–75] Further causes for FAI are rotational anomalies

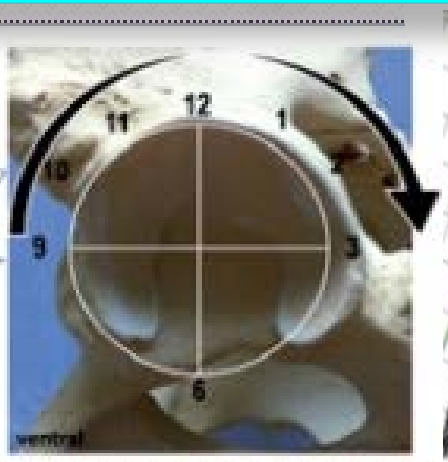


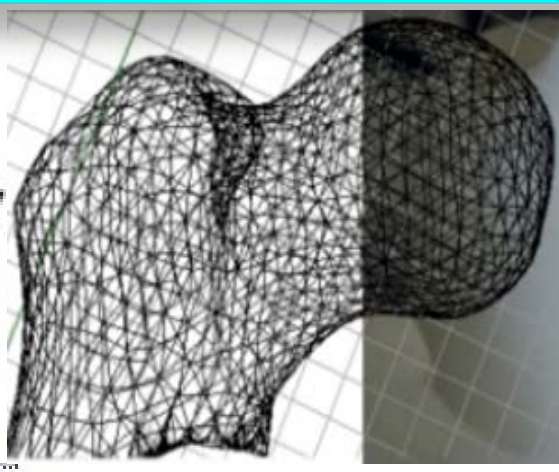
Connect ➲ Converge ➲ Compile

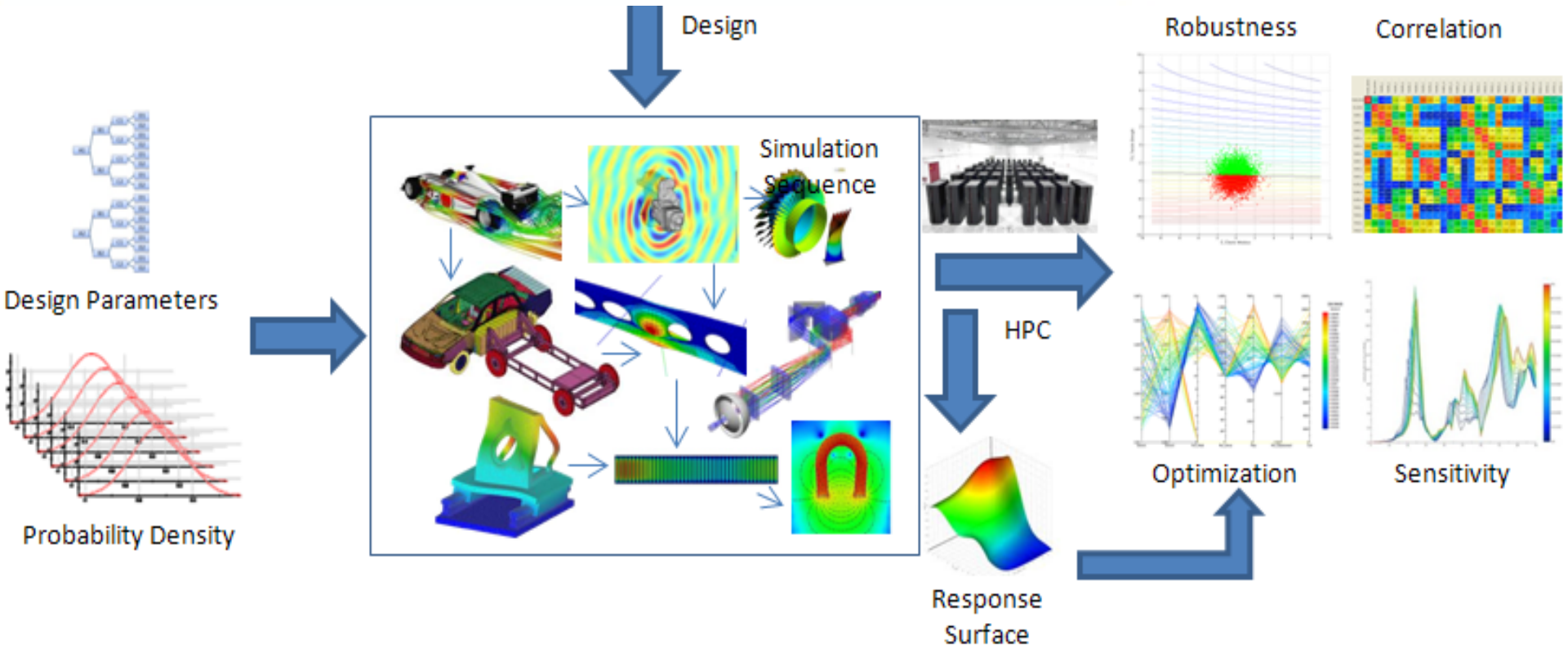
Hip arthroplasty (MRI/MRA) data integrated design & 3D Print







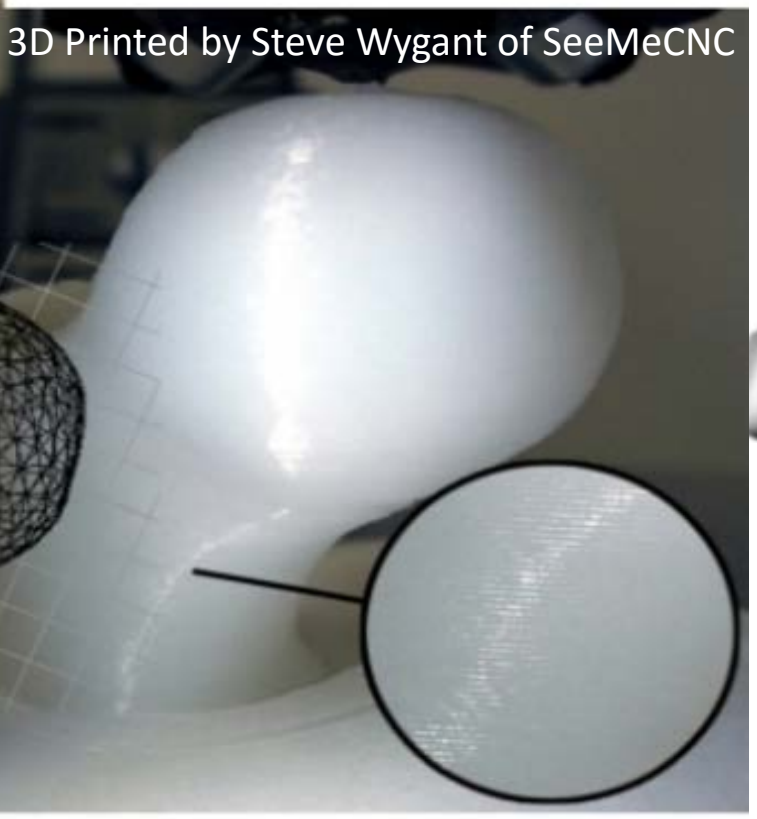


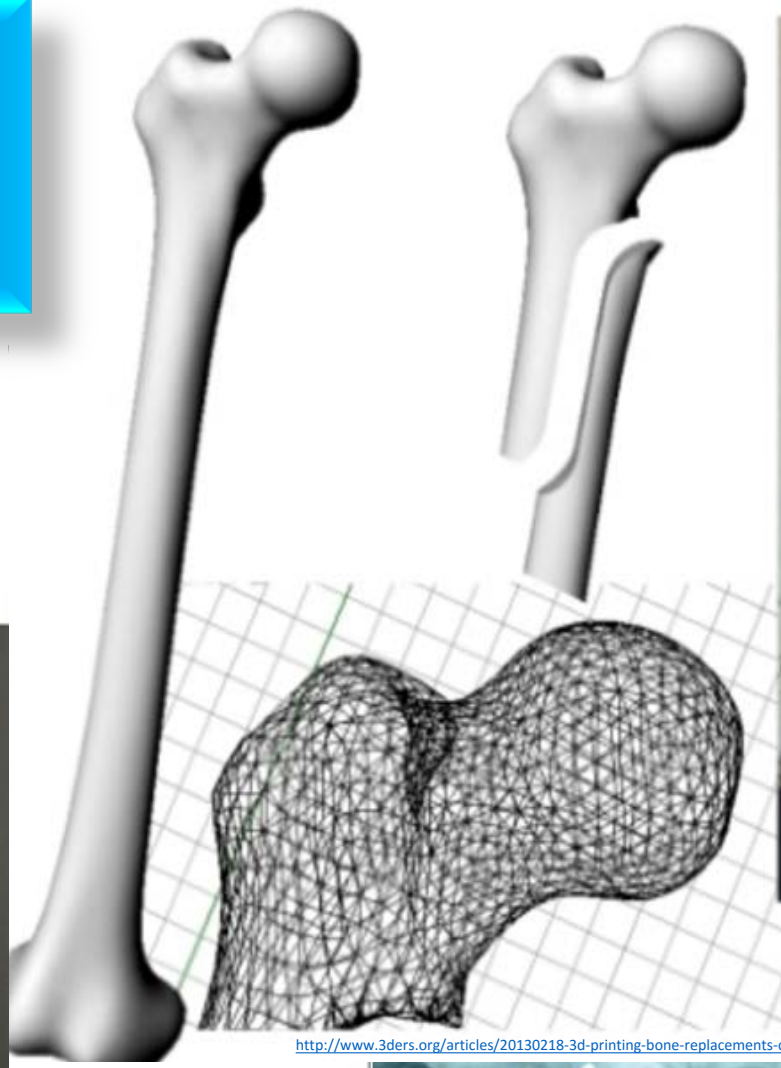


Connect ➲ Converge ➲ Communicate to 3D Printer

Upper Femur

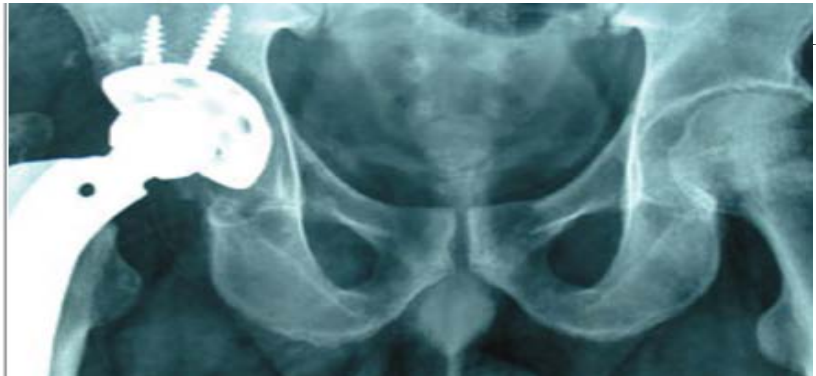
3D Printed with 9572 psi tensile strength 618 nylon co-polymer





http://www.3ders.org/articles/20130218-3d-printing-bone-replacements-cartilage-replacements-medical-devices-with-618-nylon.html

http://bit.ly/AAOS-2014




DESIGN, MANUFACTURING, AND ANALYSIS SOFTWARE TOOLS (CAx)
• Cloud-computing Enabled Multi-User.
• Template-driven Design.
• Embedded Social Media, VoIP, and Skype.
• Design Rules and Analysis tools for Optimization.
• High-fidelity Physical Models.
RAPID MANUFACTURING TECHNOLOGY
• Design Next-generation LAMP equipment.
• Process control architecture.
• Mold Material Systems for Diverse Alloys
• Process chains for optimized Castings.
• Technology Transition and Continuous Upgrades.
DESIGN
DEVELOP
DEMONSTRATE
QUALIFY
CyMAC
RAPID QUALIFICATION
• Digital Inspection Systems
• Laser, White-light, Blue-light Scanning
• Computed Tomography
• Metallography
• Flow Testing
• Natural Frequency and Modeshape Analysis.
• CFD Model Calibration with Hot Cascade Crystals.
MANUFACTURING DEMONSTRATION FACILITY
• World's first CyMAC demonstration facility.
• Initially based on LAMP beta machine built at Georgia Tech.
• Pilot production line.
• Install Commercial machine.
• Operational 6 months from start and open to OEMs 1 year of start.
• Produce and qualify challenge parts

C Y M A C

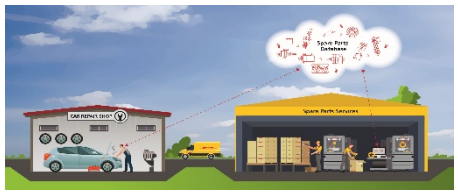
The Future Vision of a CeMS-DDM based Digital Factory

Cloud-enabled Design, Manufacturing and Analysis Software Tools

- Multi-user collaborative design
- Embedded social media and live communication tools
- Design optimization and analysis tools
- High-fidelity physics-based models

Parts shipped as bitstreams, process parameters, support structure optimization,and design rules shipped back from process learning.

Industrial Internet



DDM Technologies

- Equipment and supporting software.
- Fleet of networked LAMP machines on site at Foundries and OEMs.
- Fleet of networked SLE machines on site at OEMs, MROs, DoD repair depots.
- Fleet of networked LAMP and SLE machines at DDM's production facility.

Industrial Internet

Industrial Internet

Production Control Systems

- Real-time process control.
- Machine and material health monitoring.
- Build history archiving.
- Digital inspection systems.
- Feedstock material development and optimization.
- Next-generation equipment designs.
- Component performance Testing and validation.

Part build history analysis, machine capability and feature manufacturability analysis, iterative design and process optimization, optimized inspection and testing protocols.

Machine performance history analysis, Feedstock material optimization, Process control optimization, Next-generation DDM machine design evolution.

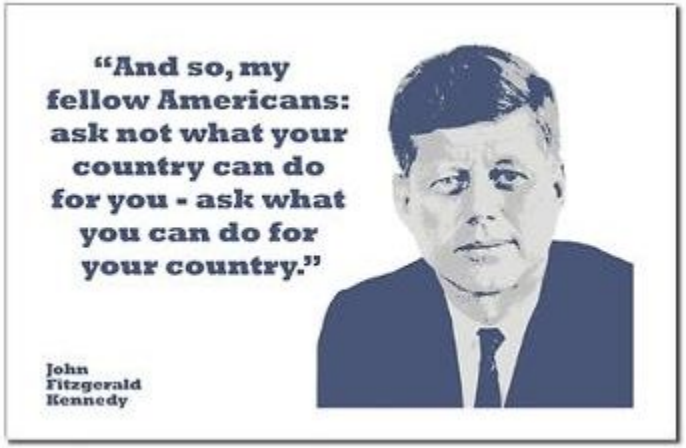
Margrit Harting, Maresa Harting-Hertz, Dietmar Harting, Chancellor, President, Philip Harting

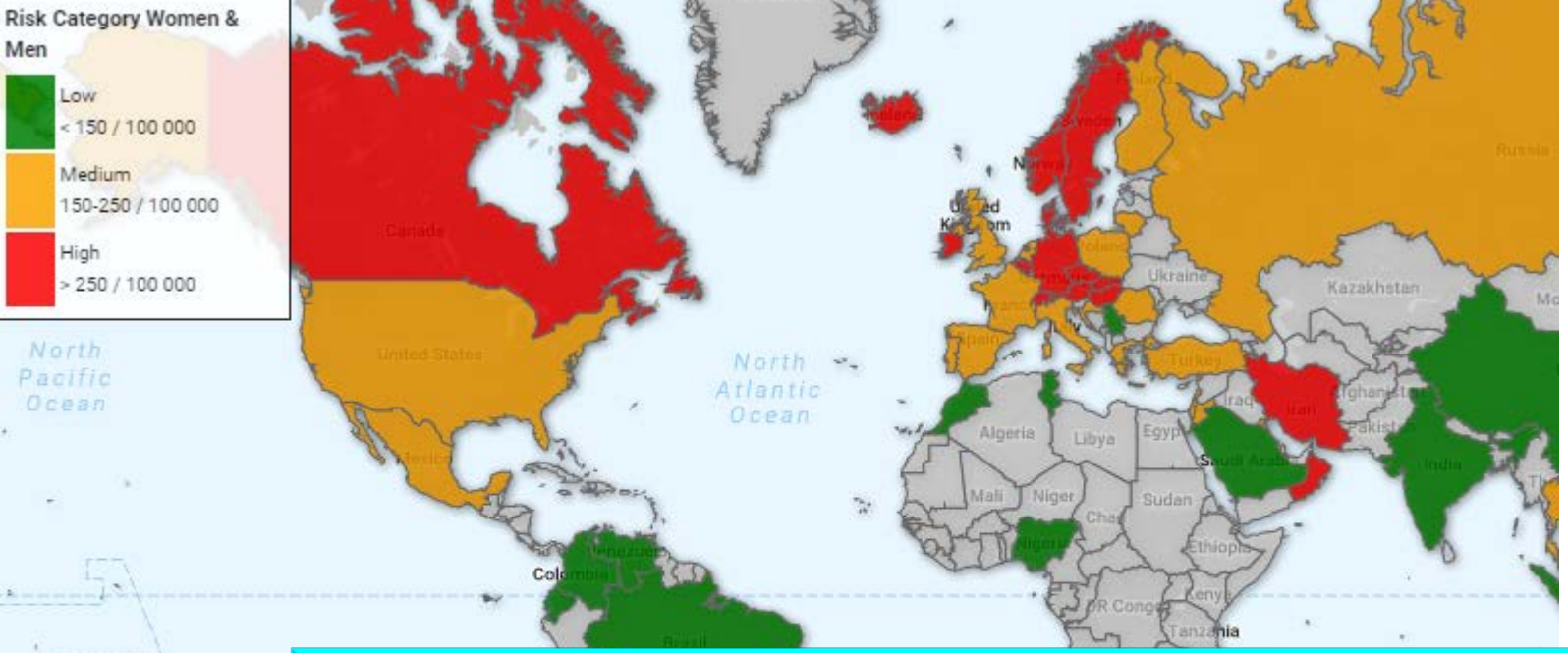
Figure 2. Suman Das shows an investment casting mold (right) fabricated by large-area maskless photopolymerization and a turbine blade casting (left).

Ask not what IoT can do for you

Ask what you can do for IoT

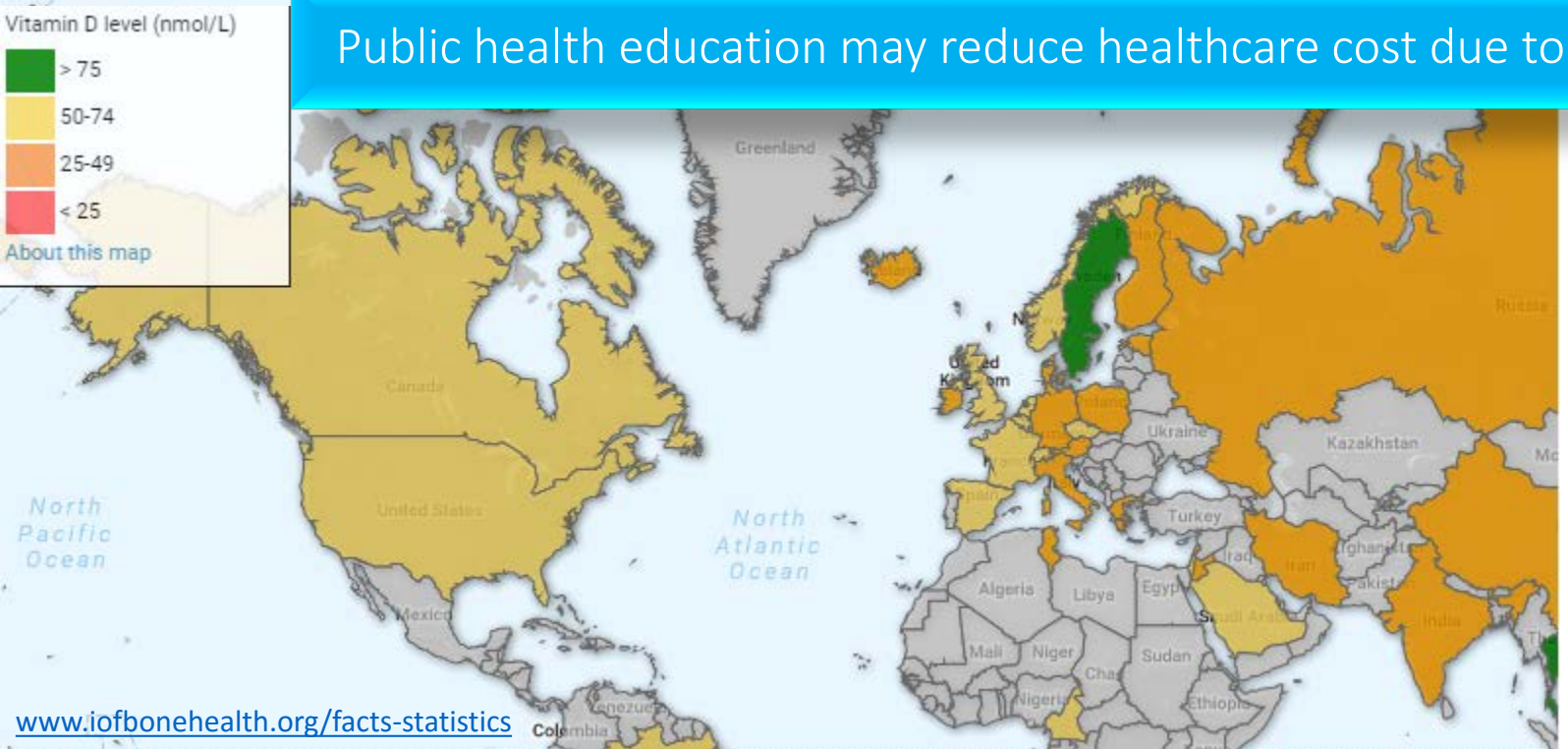
to reduce onset of osteoporosis





HIP FRACTURE

Public health education may reduce healthcare cost due to osteoporosis



VITAMIN D LEVELS

www.iofbonehealth.org/facts-statistics

E-Business logistics, visions, innovations and research

ELO – E-Business Logistics Technology Programme 2002–2005

Editor Heikki Kekäläinen

Technology Review 196/2006

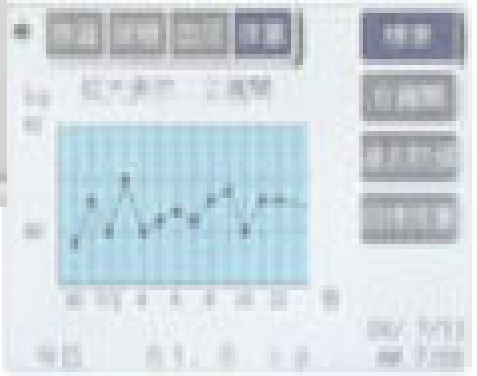
Figure 28. Innovation Down the Toilet?

Tekes

Technology Review 196/2006
Helsinki 2006

Pay-Per-Pee Home Health Monitor - Advancing Preventive Medical Primary Care Wireless Toilet Bowl Connected to Health IoT Systems or Hospital Systems

Digital Metabolomics in Precision Medicine



Weigh-scale, BMI, FOBT, urine analysis, sugar, ketone body analysis, blood pressure monitor, pulse oximeter, networked to phone via WiFi and/or Bluetooth with biometrics and face recognition for secure communication with physician and hospital or clinic, globally.

1st Point of Contact for Retail Medicine and Preventive Medical Primary Care ?

€1.99 for Bone Density • €1.99 Mammogram

PDEXA SCAN
BONE MINERAL
DENSITY PROFILE

Monitor Nr. 662 vom 19.06.2014

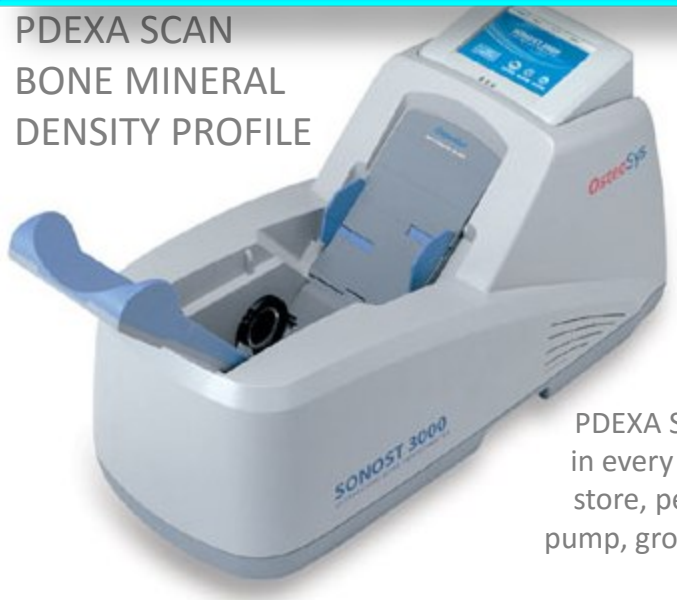
Brustkrebs-Vorsorge: Mehr Schaden als Nutzen?

Bericht: Ursel Sieber, Frank Konopatzki, Jan Schmitt

Brustkrebs-Vorsorge: Mehr Schaden als Nutzen? | 10:36 min | 19.06.2014 | Monitor (WDR) | Das Erste

Integrated system detects fall in bone density and correlates with reduced purchase of milk. Prevention for osteoporosis starts early. Avoids fall, trauma and morbidity from broken bones. Connected health IoT data.

PDEXA SCAN
BONE MINERAL
DENSITY PROFILE



PDEXA SCAN in every drug store, petrol pump, grocery

Osteoporosis

EU → 28 million in 2010 to 34 million in 2025 (increase of 23%)

US → 44 million (represents 55% of people aged 50+)

Brazil → 10 million (1 in every 17)

India → 36 million (2013)

China → 70 million (50+). Cost of treatment USD1.5 billion in 2006. Estimated US$12.5 billion in 2020 and US$265 billion in 2050.

CVS Special $0.99 for 1-quart Milk • $1.99 for Bone Density • $2.99 Mammogram

http://bit.ly/BONE-HEALTH

Health IoT

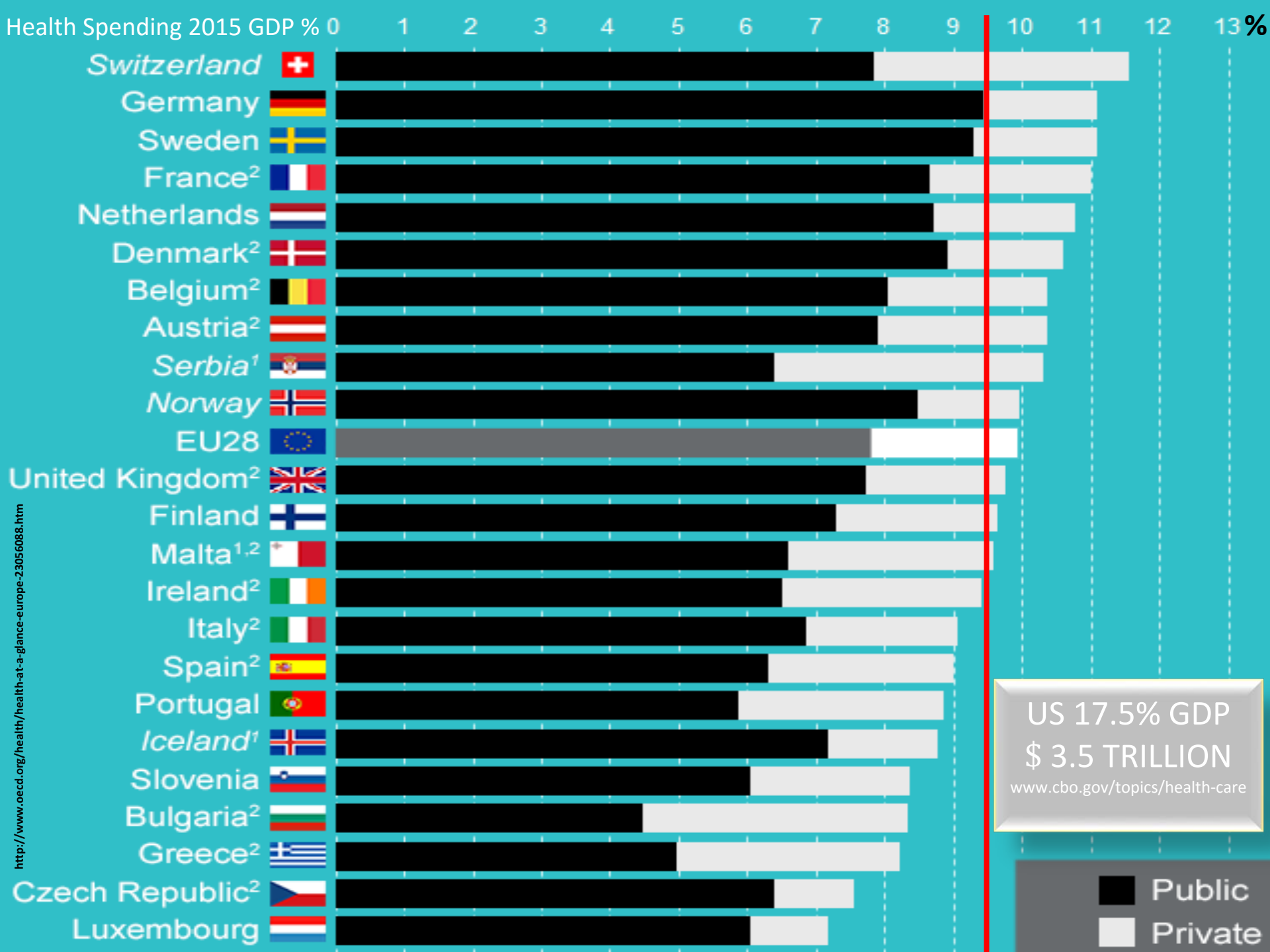
CONNECT

GROCERY STORE PURCHASE LOG

In 2008, Indonesia had 34 DXA machines, half of them in Jakarta (population 237 million) which translates to 0.001 machine per 10,000 population. The equivalent recommended number for Europe is 0.11 (per 10,000)

Demand for healthcare

expected to grow in volume and acuity


Health Spending 2015 GDP %
0 1 2 3 4 5 6 7 8 9 10 11 12 13 %
Switzerland
Germany
Sweden
France²
Netherlands
Denmark²
Belgium²
Austria²
Serbia¹
Norway
EU28
United Kingdom²
Finland
Malta¹,²
Ireland²
Italy²
Spain²
Portugal
Iceland¹
Slovenia
Bulgaria²
Greece²
Czech Republic²
Luxembourg
http://www.oecd.org/health/health-at-a-glance-europe-23056088.htm
US 17.5% GDP
$ 3.5 TRILLION
www.cbo.gov/topics/health-care
Public
Private

Projected US Population - 2012 to 2050 (in thousands)

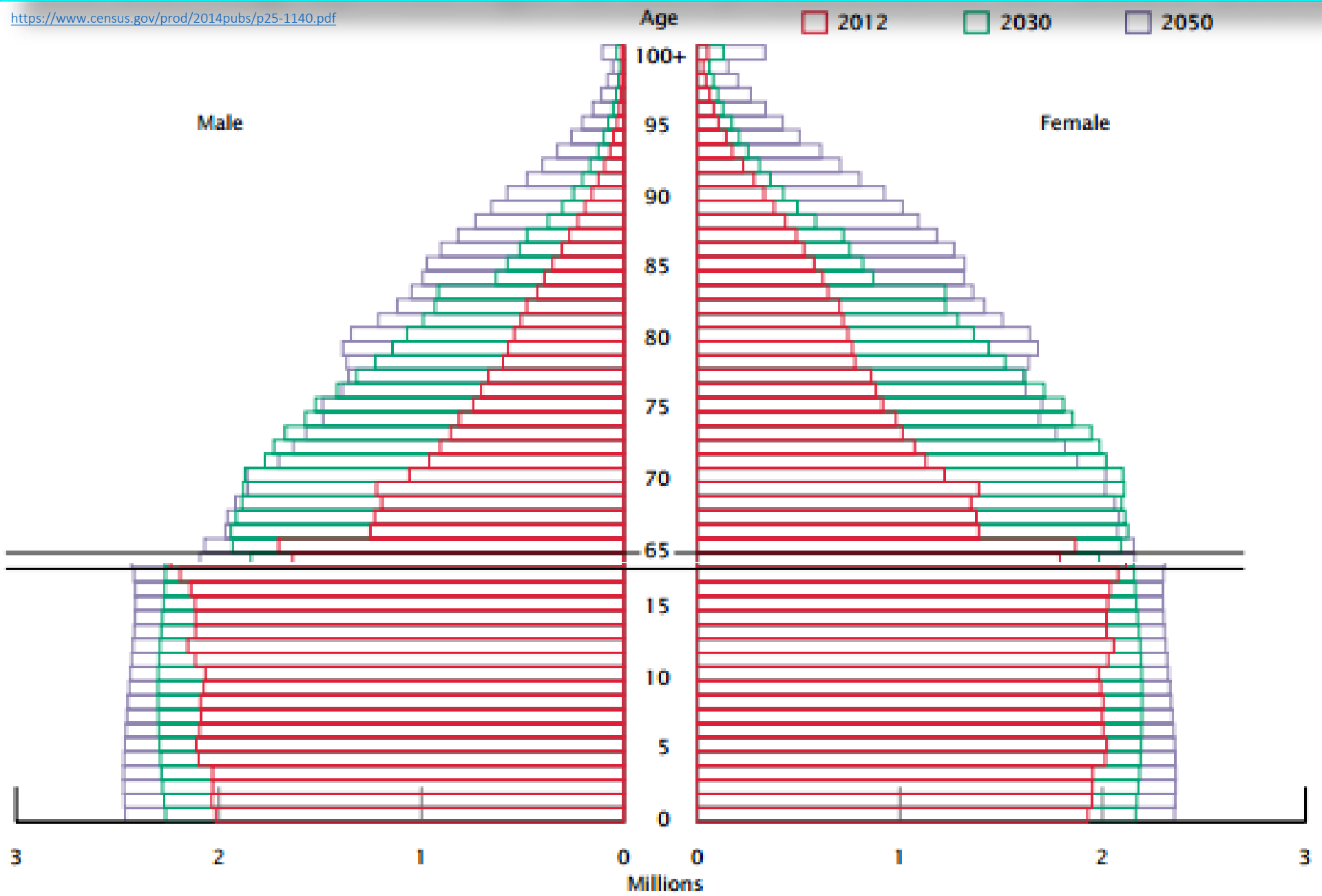
Is the US healthcare cost sustainable? In 2015, almost $3 trillion or equivalent to 17.5% of US GDP

Age	2012	2020	2030	2040	2050
NUMBER					
Total	**313,914**	**333,896**	**358,471**	**380,016**	**399,803**
Under 18 years	73,728	76,159	80,348	82,621	85,918
18 to 64 years	197,041	201,768	205,349	217,675	230,147
65 years and over	43,145	55,969	72,774	79,719	83,739
65 to 69 years	13,977	18,052	20,077	18,090	20,144
70 to 74 years	10,008	14,744	18,516	17,374	17,410
75 to 79 years	7,490	10,010	14,722	16,640	15,243
80 to 84 years	5,783	6,470	10,513	13,501	12,963
85 years and over	5,887	6,693	8,946	14,115	17,978
PERCENT					
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Under 18 years	23.5	22.8	22.4	21.7	21.5
18 to 64 years	62.8	60.4	57.3	57.3	57.6
65 years and over	13.7	16.8	20.3	21.0	20.9
65 to 69 years	4.5	5.4	5.6	4.8	5.0
70 to 74 years	3.2	4.4	5.2	4.6	4.4
75 to 79 years	2.4	3.0	4.1	4.4	3.8
80 to 84 years	1.8	1.9	2.9	3.6	3.2
85 years and over	1.9	2.0	2.5	3.7	4.5

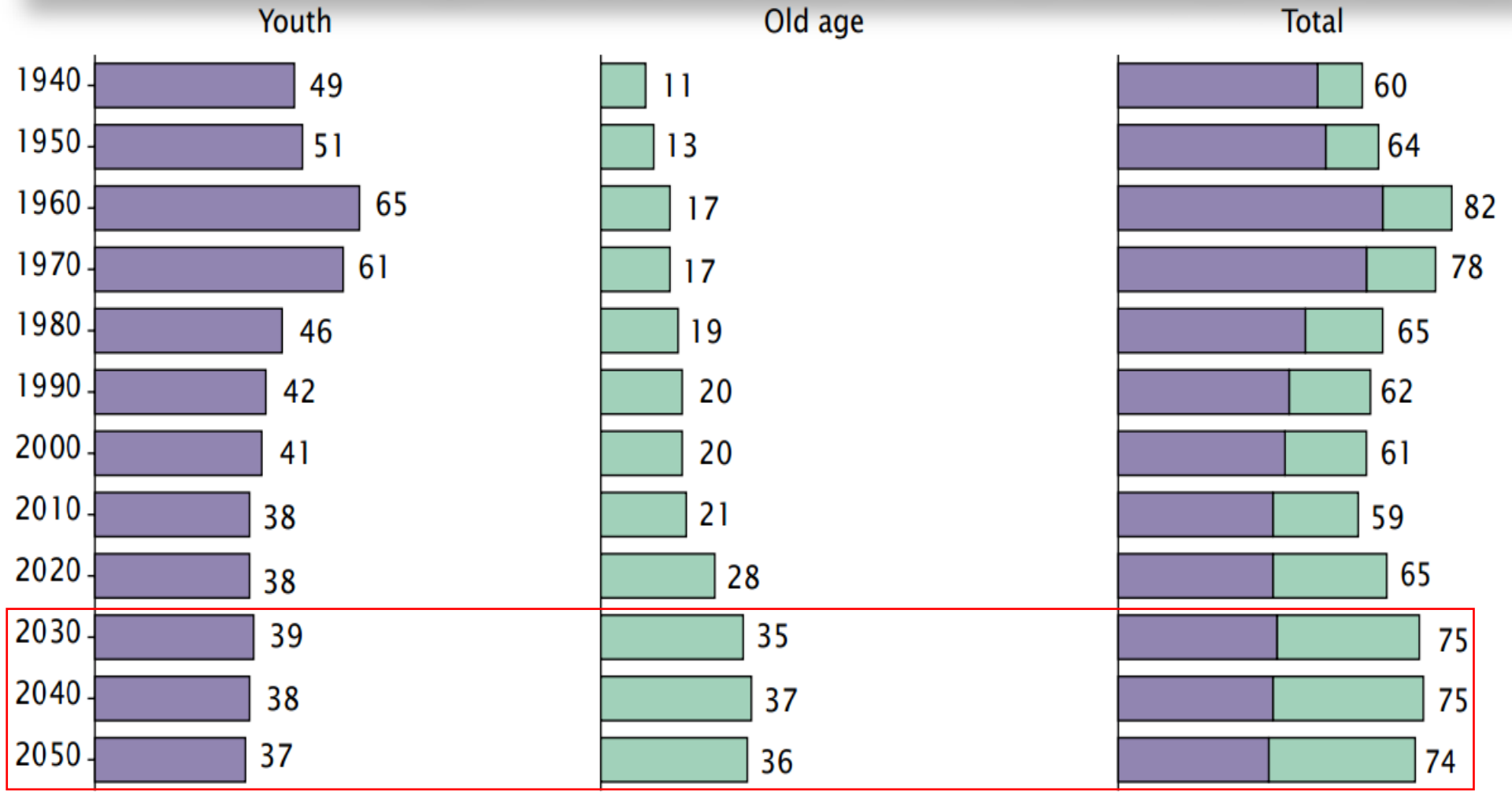
https://www.census.gov/prod/2014pubs/p25-1140.pdf

US Demographics Age & Sex predictions for 2030-2050

https://www.census.gov/prod/2014pubs/p25-1140.pdf



Imminent Changes in the US Dependency Ratio (1940-2050)



Dependency ratios provide a way to examine the changing age structure of the younger as well as older populations. Dependency ratios are an indicator of the potential burden of the dependent population, approximated by those under 18 years and those 65 years and over, on those in the working-age population. The ratios are calculated by dividing the number of people in the dependent age groups by the number in the working ages and then multiplying by 100: ● https://www.census.gov/prod/2014pubs/p25-1140.pdf

$$\text{Total dependency} = \left(\frac{\text{Population under 18 years} + \text{Population 65 years and over}}{\text{Population 18 to 64 years}}\right) * 100$$

$$\text{Old-age dependency} = \left(\frac{\text{Population 65 years and over}}{\text{Population 18 to 64 years}}\right) * 100$$

$$\text{Youth dependency} = \left(\frac{\text{Population under 18 years}}{\text{Population 18 to 64 years}}\right) * 100$$

In 2013, more than 8.4 million surgeries performed in the US

Age and principal operating room procedure[1]	Number of discharges with operating room principal procedure			Total inflation-adjusted national costs: 2013 dollars (in millions)[2]		
	2000	2005	2013	2000	2005	2013
All ages						
Hospital discharges with an operating room principal procedure[3]	8,743,631	9,964,151	8,414,072	$117,663	$162,038	$157,891
Laminectomy (back surgery)	285,636	248,800	167,380	2,393	2,352	2,363
Heart valve procedures	79,719	93,802	102,425	3,488	5,058	5,264
Coronary artery bypass graft (CABG)	337,972	221,325	157,720	10,836	8,625	6,510
Percutaneous coronary angioplasty (PTCA) (balloon angioplasty of heart)	581,183	727,912	403,550	8,899	13,743	8,454
Insertion, revision, replacement, removal of cardiac pacemaker or cardioverter/defibrillator	66,286	160,629	87,465	1,887	5,804	3,067
Colorectal resection (removal of part of the bowel)	253,780	274,599	237,285	5,152	6,371	5,562
Appendectomy	269,089	298,829	201,700	1,991	2,594	2,061
Cholecystectomy (gall bladder removal)	389,079	376,158	318,145	4,097	4,649	4,168
Hysterectomy	580,019	550,659	211,050	3,842	4,094	2,138
Cesarean section	898,859	1,258,990	1,136,704	4,869	7,028	6,887
Treatment, fracture or dislocation of hip and femur	237,615	251,071	241,510	3,103	3,917	4,148
Arthroplasty knee (knee replacement)	318,854	533,216	700,740	4,471	8,510	11,563
Hip replacement	295,940	369,634	457,195	4,582	6,447	7,927
Spinal fusion	204,320	322,610	405,245	3,551	8,194	11,635

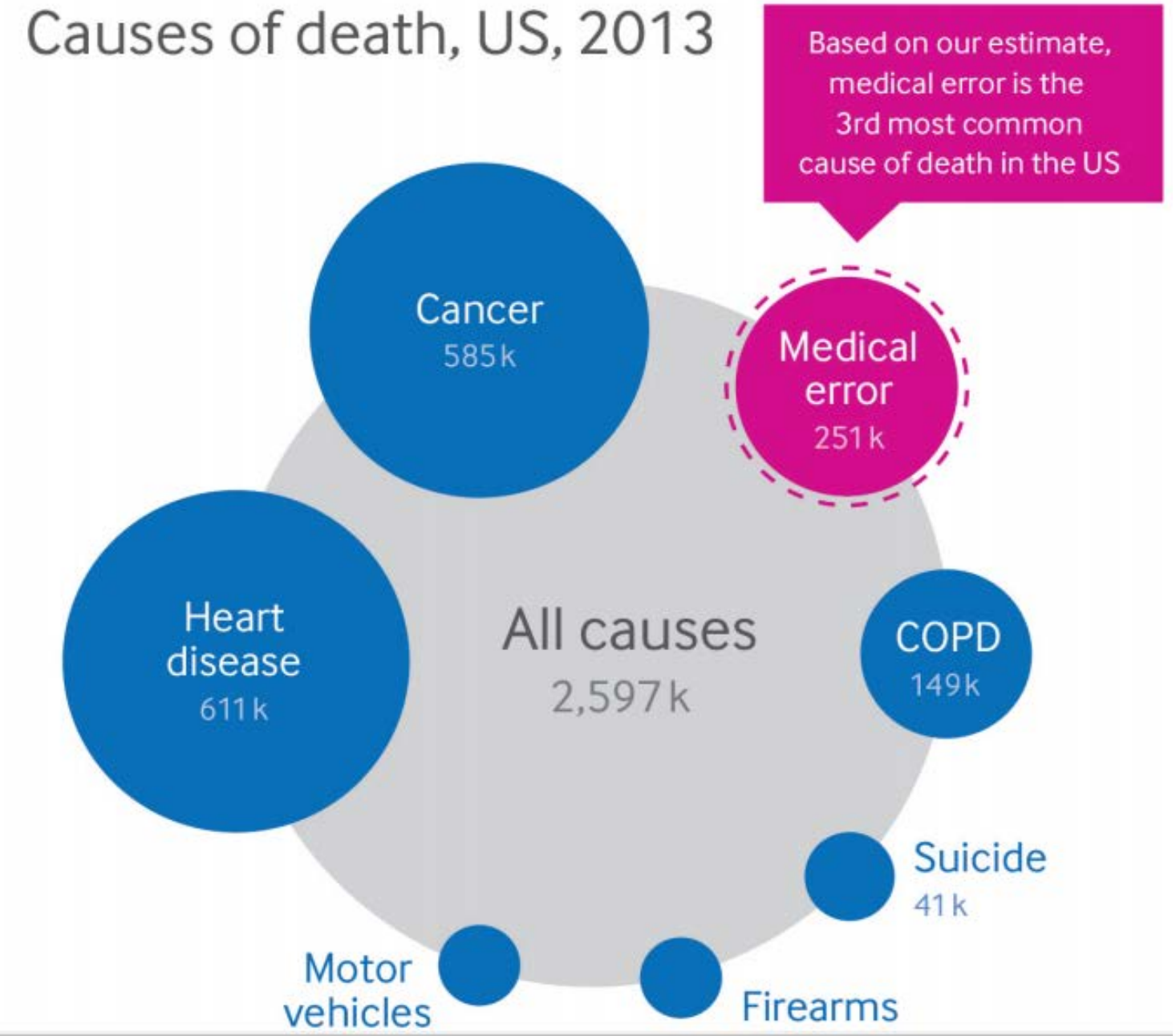
www.cdc.gov/nchs/hus/contents2015.htm#096 ● www.newyorker.com/magazine/2015/05/11/overkill-atul-gawande

The variability in the healthcare industry

and the lack of device and systems interoperability is a significant problem and cause of death in the USA.

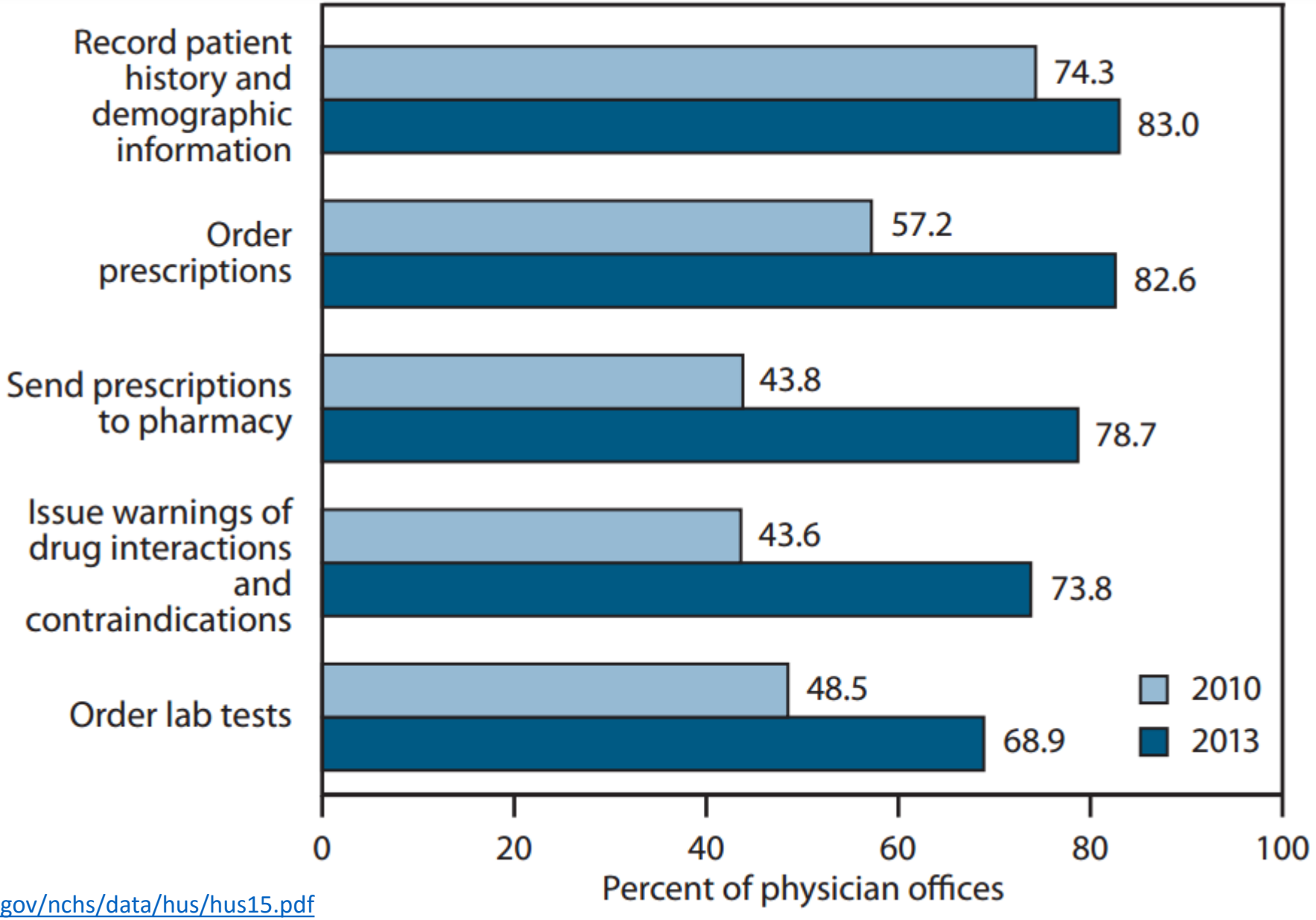
www.west-info.eu/files/Medical-error—the-third-leading-cause-of-death-in-the-US1.pdf

Medical errors cost $20 billion pa & $1 trillion pa in lost productivity.



E R R O R

Error – Interoperability of electronic health records ?



www.cdc.gov/nchs/data/hus/hus15.pdf

1,100 EHR vendors: $37billion cost [Meaningful Use]

Rank	Vendor Name	Number of Physicians in Practice					
www.practicefusion.com/blog/ehr-adoption-rates		1 to 3	4 to 10	11 to 25	26 to 40	41+	Overall
1	Epic	9.8%	21.4%	33.9%	40.1%	43.5%	12.4%
2	eClinicalWorks LLC	10.7%	8.9%	5.1%	2.8%	1.0%	10.3%
3	Allscripts	7.6%	10.8%	10.7%	9.9%	7.0%	8.2%
4	**Practice Fusion**	**7.9%**	**1.2%**	**0.2%**	**0.0%**	**0.0%**	**6.5%**
5	NextGen Healthcare	4.8%	7.7%	7.9%	3.9%	3.5%	5.4%
6	Cerner Corporation	3.5%	5.7%	8.7%	10.5%	9.0%	4.1%
7	athenahealth, Inc	4.0%	2.8%	1.2%	0.6%	0.5%	3.7%
8	GE Healthcare	2.9%	5.6%	6.4%	8.0%	4.5%	3.5%
9	Greenway Health	3.3%	4.6%	2.6%	0.6%	1.0%	3.5%
10	McKesson	3.3%	2.4%	2.0%	4.7%	1.5%	3.1%
11	AmazingCharts.com, Inc.	2.6%	0.4%	0.0%	0.0%	0.0%	2.1%
12	MEDITECH	1.7%	2.3%	3.8%	2.2%	1.0%	1.9%
13	13 e-MDs, Inc.	1.9%	1.1%	0.4%	0.3%	0.0%	1.7%
14	Care360, Quest Diagnostics	1.8%	0.3%	0.1%	0.0%	0.0%	1.5%
15	Office Ally	1.3%	0.2%	0.0%	0.0%	0.0%	1.1%
16	MEDENT-Community Computer Service Inc.	1.0%	1.4%	0.6%	0.0%	0.0%	1.1%
17	NexTech Systems Inc.	1.1%	0.5%	0.0%	0.0%	0.0%	0.9%
18	Aprima Medical Software, Inc	1.0%	0.6%	0.2%	0.3%	0.0%	0.9%
19	ADP	1.0%	0.3%	0.0%	0.0%	0.0%	0.9%
20	TRAKnet Solutions	1.0%	0.3%	0.0%	0.0%	0.0%	0.9%
21	All Other Vendors (466)	27.8%	21.5%	16.2%	16.3%	27.5%	26.5%
	TOTAL	100%	100%	100%	100%	100%	100%

Deliberate Deception of Epic Proportions ($37 billion+)
EHR vendors do not want interoperability, by design
EHR systems do not “talk” to each other, by design

1,1000 EHR systems including over 600 for providers accepting US Medicare.

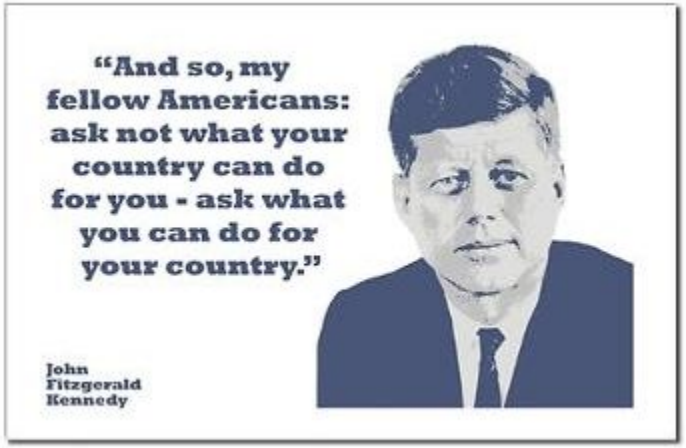
With an EHR system, if you are a competing vendor and can’t access the clinical record on my system, you lose and I win. If I’m with a bigger system, the provider will be in a position to put pressure on the smaller collaborators to switch (if they bother). Often, one doctor’s office will print out the patient record, fax it to another doctor and their office will re-key the record (this happens this way since email is not HIPAA compliant).

The cost of this is ultimately born by insurance and taxpayers, since the doctor has to pay extra staff to do all this re-keying and therefore incentivized to bill as many procedures as possible just to cover office costs. It’s a downward spiral for the consumer by design. The greed of the EHR vendors is a reason for errors.

Ask not what IoT can do for you

Ask what you can do for IoT

to reduce deaths due to medical errors



03 - HEALTHCARE

http://autoid.mit.edu/iot_research_initiative

Or please go to http://bit.ly/AIDL-SD and find the URL linked to IoT.

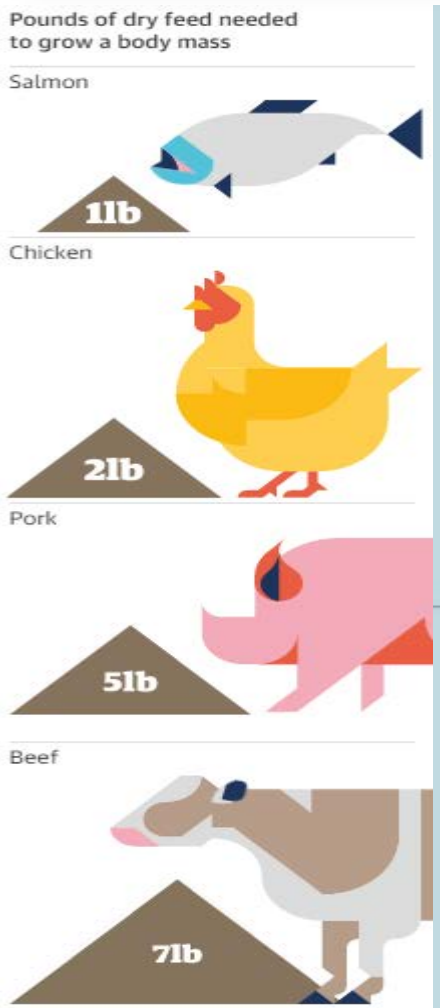
On the IoT page please find zipped folder “REVIEW IOT” middle of the page. Inside zipped folder please find the pdf 03-Healthcare

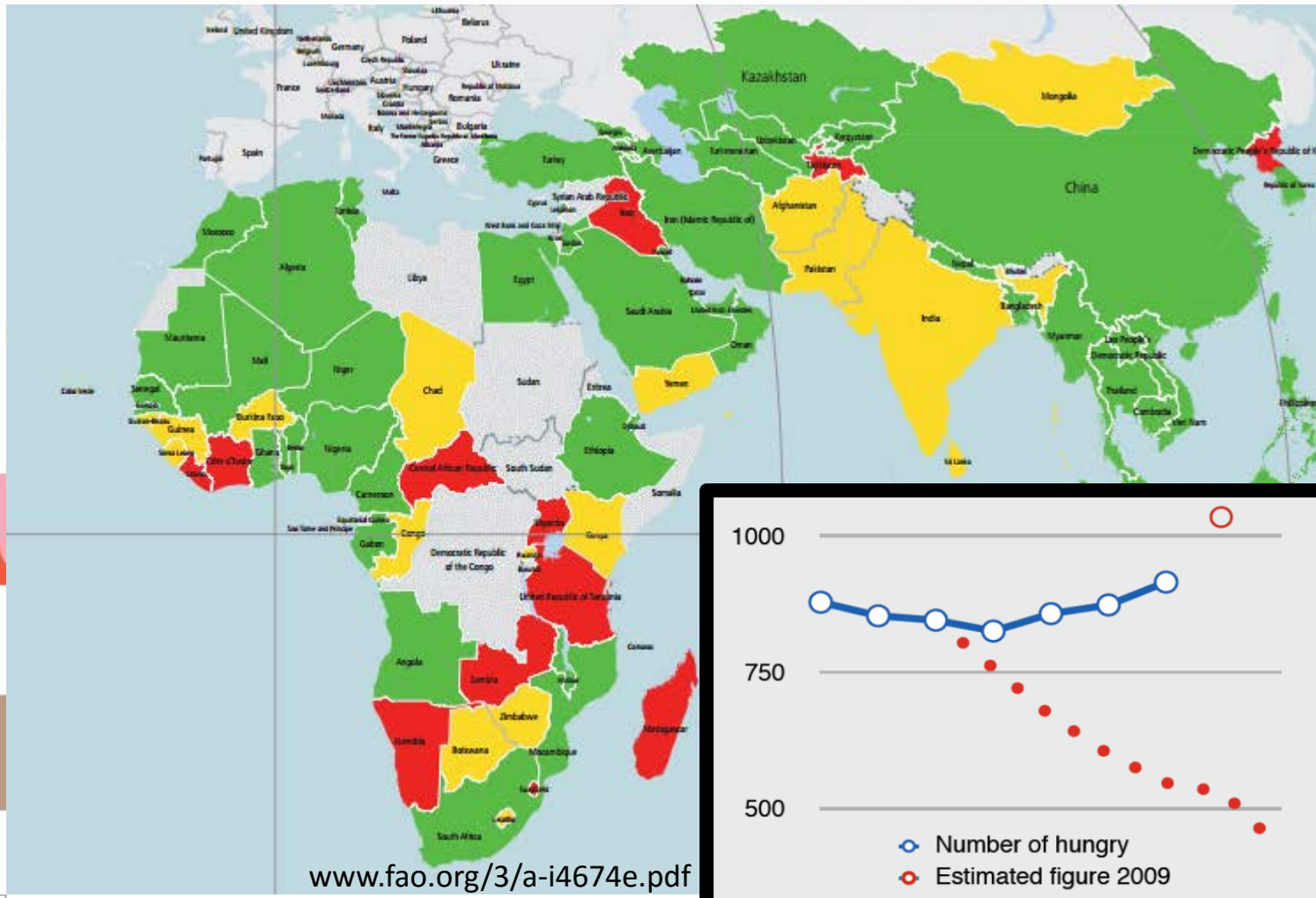
Dr Shoumen Datta ● shoumen@mit.edu

Food is essential to Health

An estimated 9 billion people to feed in 2050

www.un.org/sustainabledevelopment/blog/2015/07/what-progress-has-been-made-in-ending-global-poverty/





www.fao.org/3/a-i4674e.pdf

The End of Plenty
by Joel K Bourne

http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

People waste about 68% of the food in US

More than two-thirds of total food wasted – which is ~ 63 million tons

Value wasted ~ $150 Billion (total food wasted value US$218 Billion)

43

million tons

$150

Billion

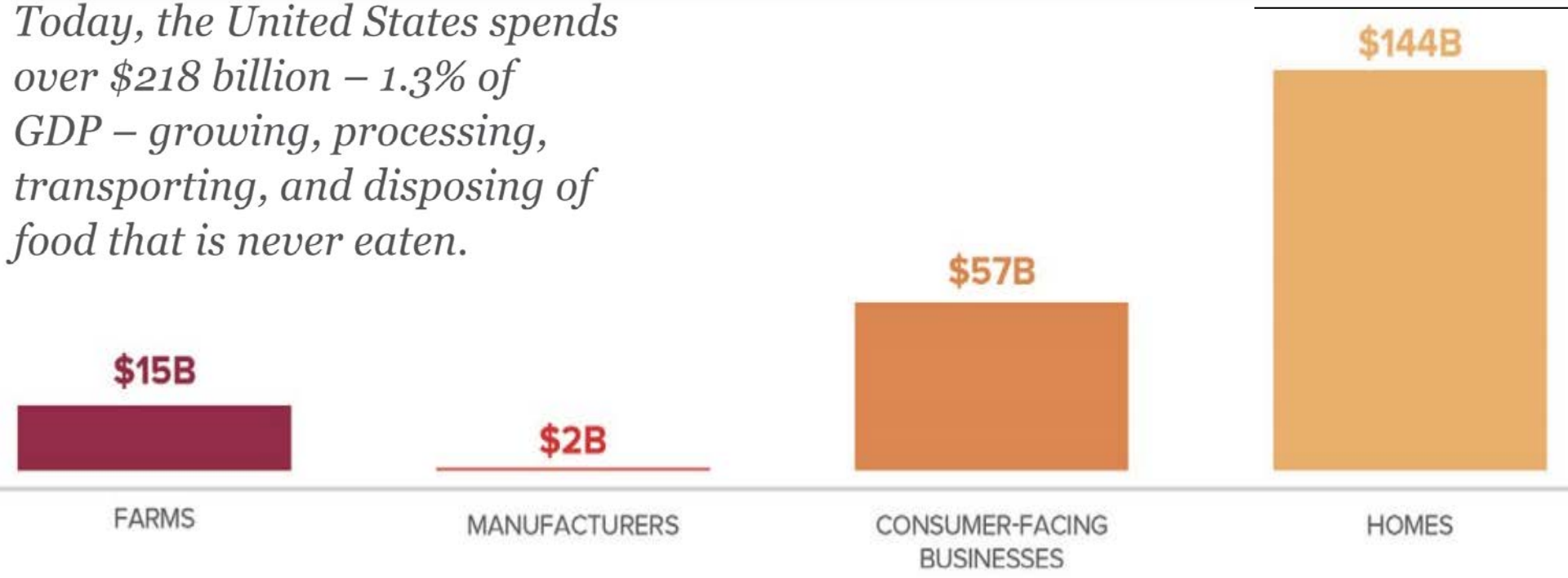
US Report ● http://www.refed.com/downloads/ReFED_Report_2016.pdf

EU Report ● http://data.consilium.europa.eu/doc/document/ST-10730-2016-INIT/en/pdf from www.eu-fusions.org/

We, people in US, are the culprits - 68% FOOD WASTE

FOOD WASTE - 63 million tons, $218 billion, 1.3% GDP

Today, the United States spends over $218 billion – 1.3% of GDP – growing, processing, transporting, and disposing of food that is never eaten.

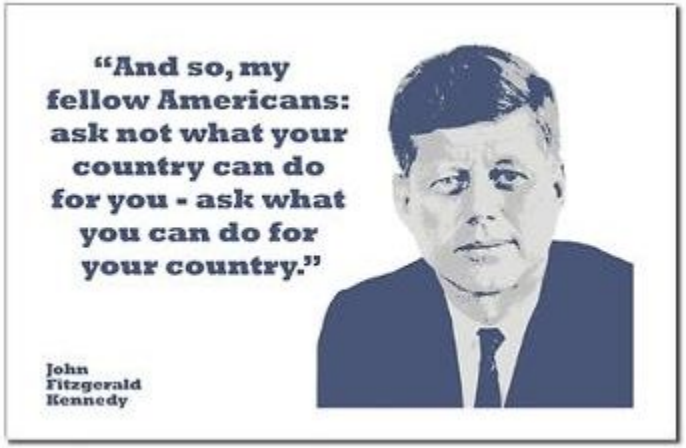


http://www.refed.com/downloads/ReFED_Report_2016.pdf

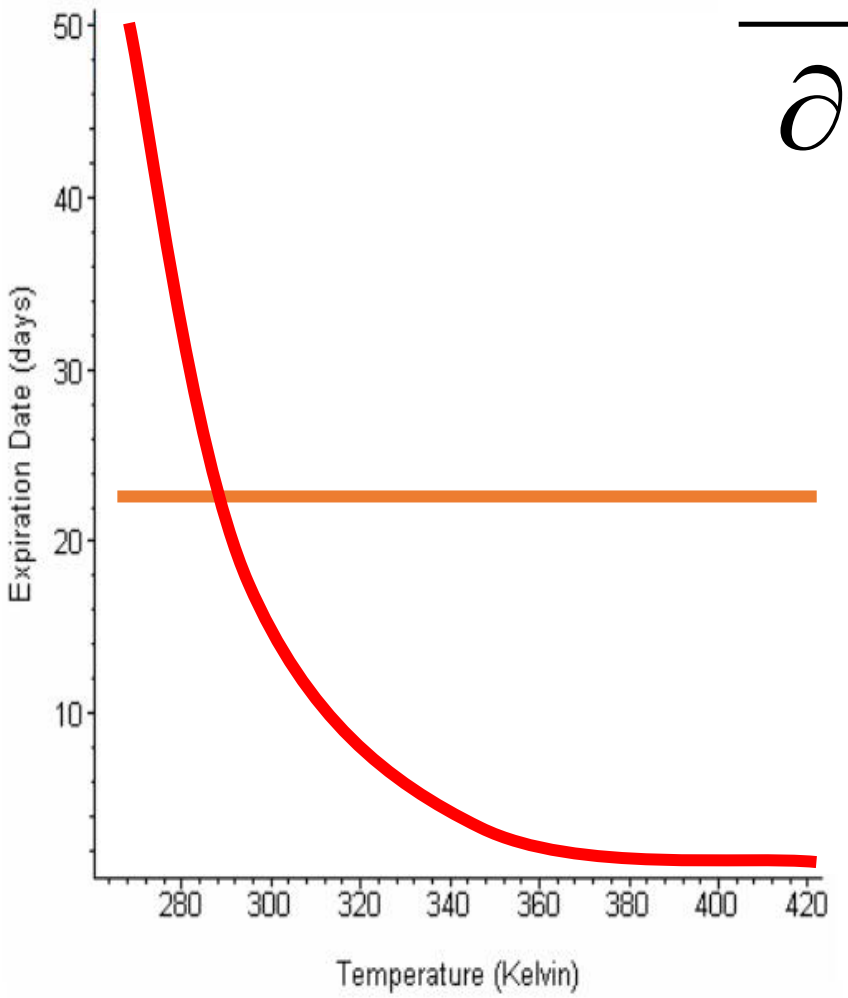
Ask not what IoT can do for you

Ask what you can do for IoT

to reduce food waste



Storage



$$\frac{\partial Q}{\partial t} = -k_1 \mathrm{e}^{\left[-\frac{E_a}{R_g T(t)}\right]} Q^n$$

Variables

- E_a Activation energy
- k_1 Arrhenius constant
- n Order of the reaction
- T Temperature
- Q Quality
- t Time

2003

Shelf Life

Food Quality

Name: ⊞ Food Quality
Description: ⊞ Food Quality based Arrhenius
Developer: ⊞ Natick Army Laboratories
ID: EPC: 010300908808BF60000000AA
Comp: ⊞ $0.25 per month
Type: Analytic
Rate: ⊞ 1 to 10,000 sec
Algorithm: ⊞

Name: ⊞ Activation Energy

Name: ⊞ Arrhenius Constant

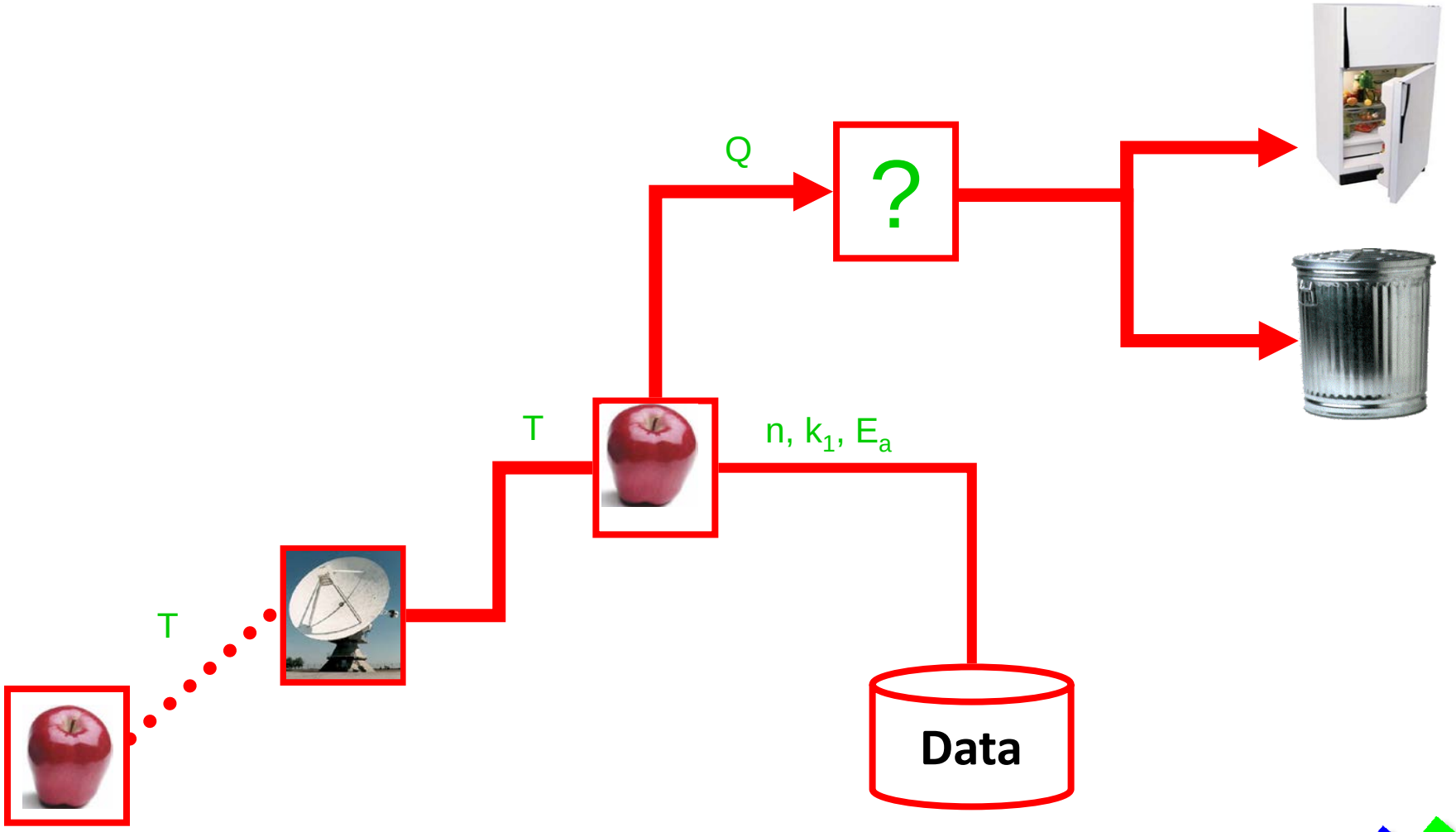
Name: ⊞ Temperature

Name: ⊞ Quality

Name: ⊞ Order of Reaction
Description: ⊞ Order of Reaction
Symbol: n
Access: Read
ID: EPC: 01020084191000001289731
Class: Scalar
Type: Int
Unit:
Default: 1

2003

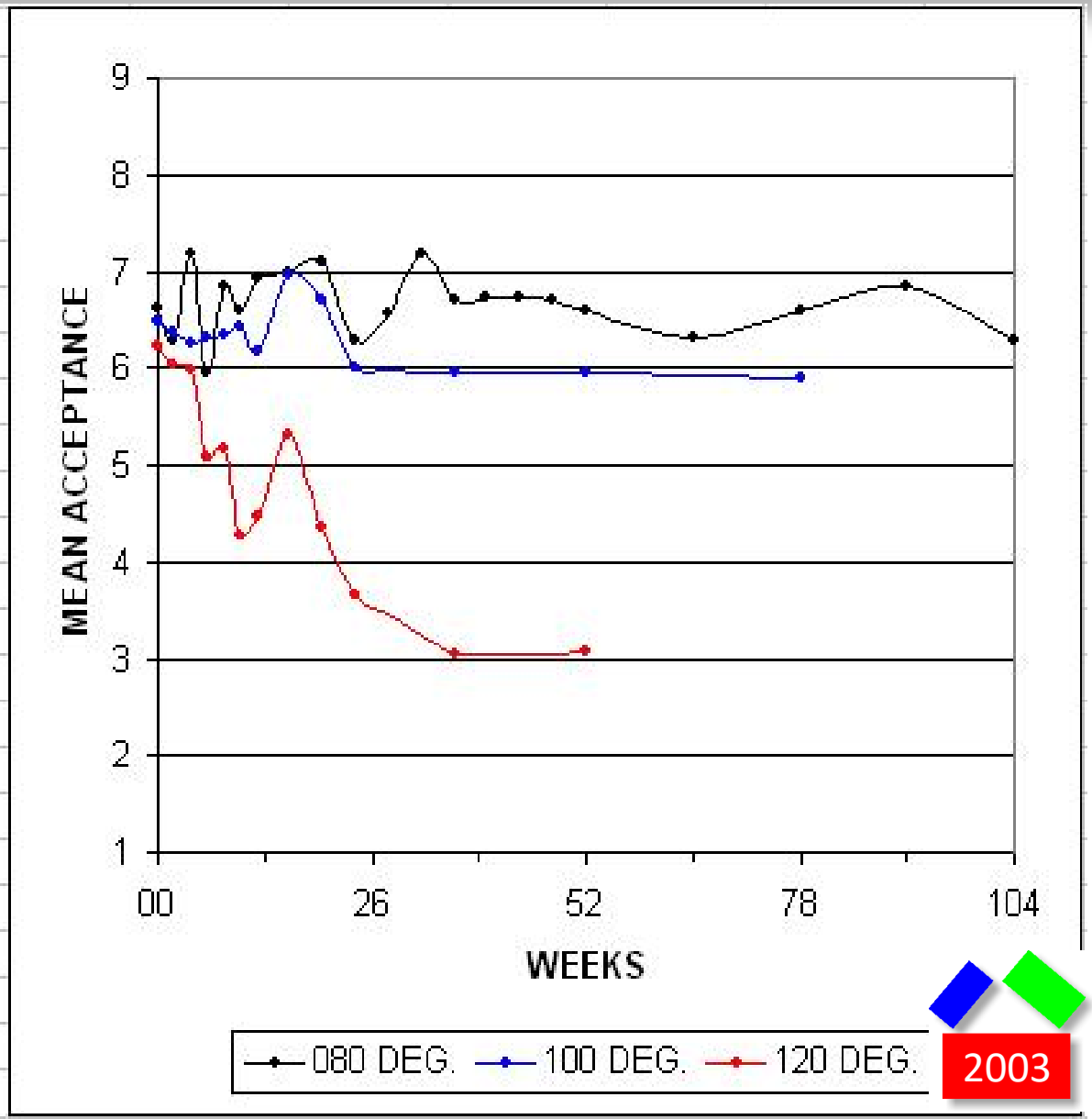
Shelf Life ➲ Answers (not numbers)



2003

Monitoring Perishables (MRE Simulation)

WKS	080 DEG.	100 DEG.	120 DEG.
00	6.622	6.486	6.243
02	6.282	6.359	6.026
04	7.194	6.250	5.972
06	5.949	6.308	5.077
08	6.850	6.350	5.175
10	6.600	6.429	4.286
12	6.944	6.167	4.472
16	7.000	6.947	5.316
20	7.111	6.694	4.361
24	6.300	6.000	3.667
28	6.579		
32	7.189		
36	6.694	5.944	3.028
40	6.730		
44	6.730		
48	6.703		
52	6.583	5.944	3.056
65	6.316		
78	6.583	5.889	
91	6.842		
104	6.300		
130			
156			



MRE Temperature Sensor Data

File Help

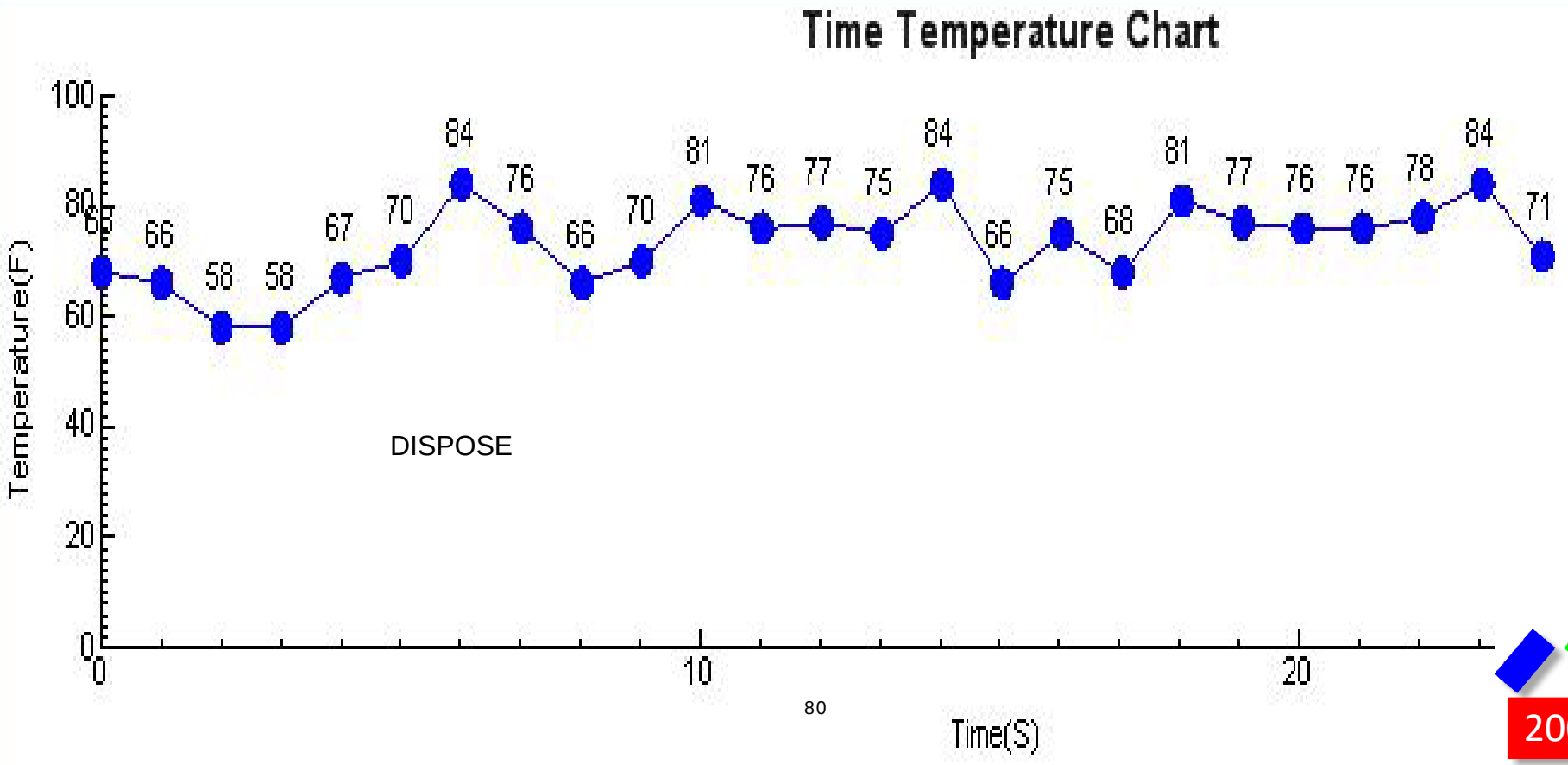
Please Select an MRE:

01.0000A89.00016F.000169DC1

Start Temperature Sensor

Stop Temperature Sensor

Day: Friday, May 23, 2003
Time: 11:23:07 AM
Temperature: 71



DISPOSE

2003

MRE Application

MRE Quality Application

Please Select an MRE:

01.0000A89.00016F.000169DC1

Quality: 50 -100 Issue, 20 - 49 Inspect, 0 - 19 Discard

ISSUE

INSPECT

DISPOSE

DISPOSE

Discard

Time and Temperature Data:

--1Monday, April 28, 200312:17:32 PM81
Monday, April 28, 20039:44:10 PM64
Friday, May 23, 200311:18:54 AM59
Friday, May 23, 200311:18:55 AM49
Friday, May 23, 200311:18:56 AM53
Friday, May 23, 200311:18:57 AM54
Friday, May 23, 200311:18:58 AM56
Friday, May 23, 200311:18:59 AM42
Friday, May 23, 200311:19:00 AM54
Friday, May 23, 200311:19:01 AM54
Friday, May 23, 200311:19:02 AM42

2003

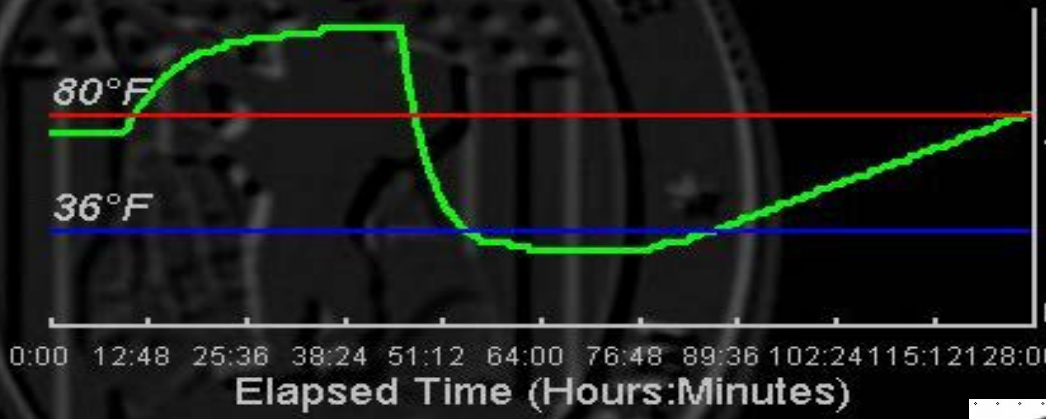
RFID + Temperature Sensor ● Convergence of Systems

MIT Auto-ID Center co-founders Sanjay Sarma and David Brock

Temperature History for Vegetarian Meals

Vegetarian Meals

00 03

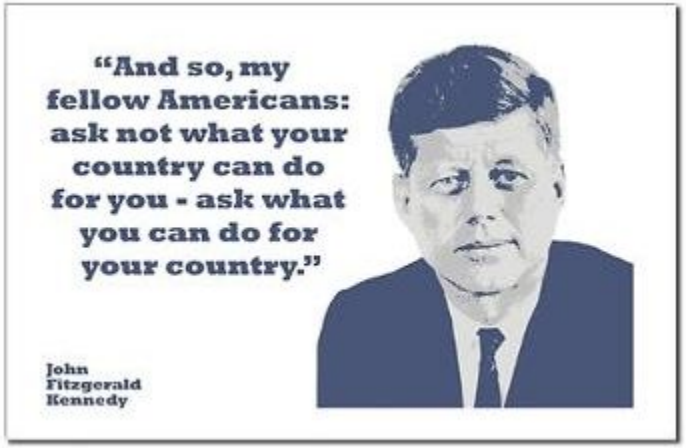


AUTO-ID CENTER

Ask not what IoT can do for you

Ask what you can do for IoT

to monetize connectivity and convergence



McKinsey finds it's all talk and little action with data analytics in most companies

2 Comments

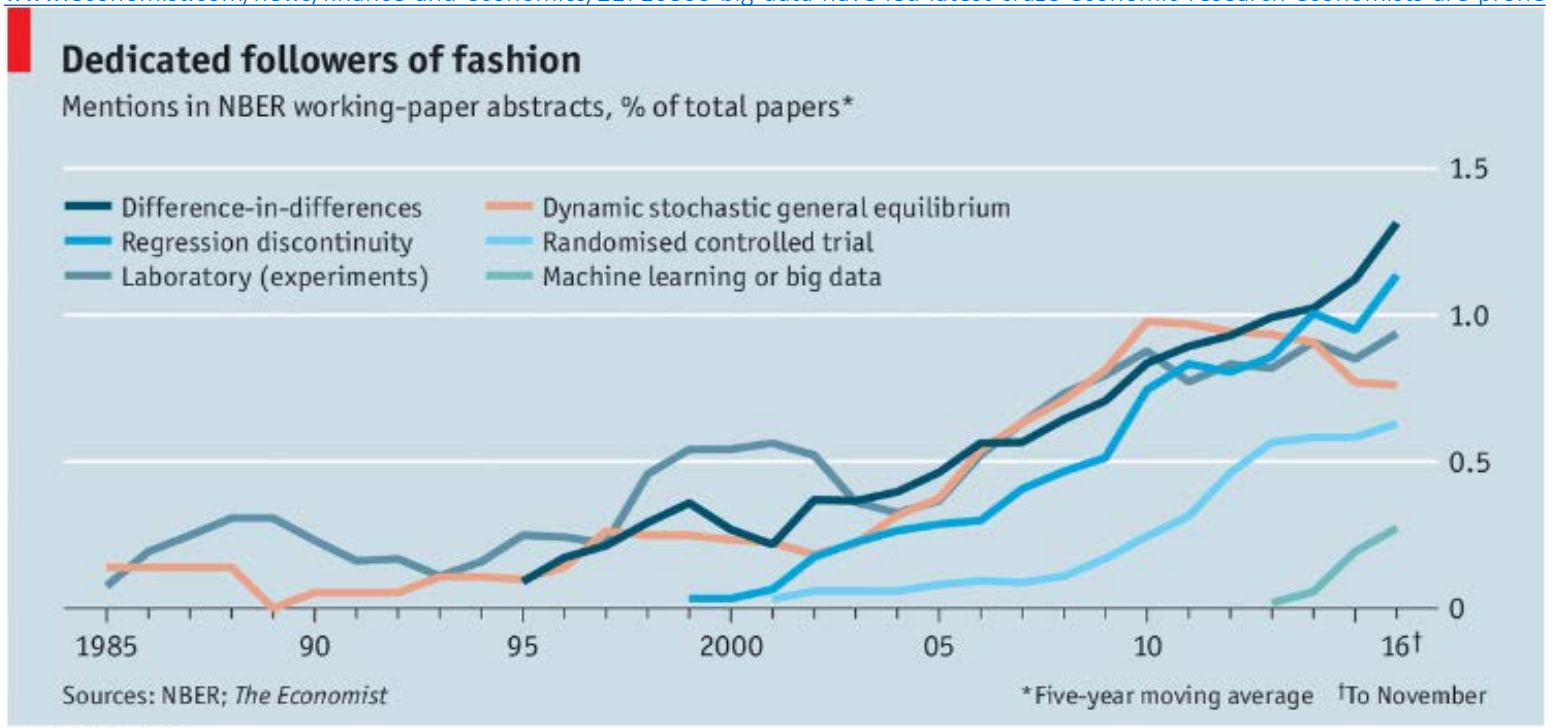
Sumit Chakraberty
10:07 PM at Dec 7, 2016

Economists are prone to fads – ML and Big Data are the latest

Big data have led to the latest craze in economic research

Nov 26th 2016

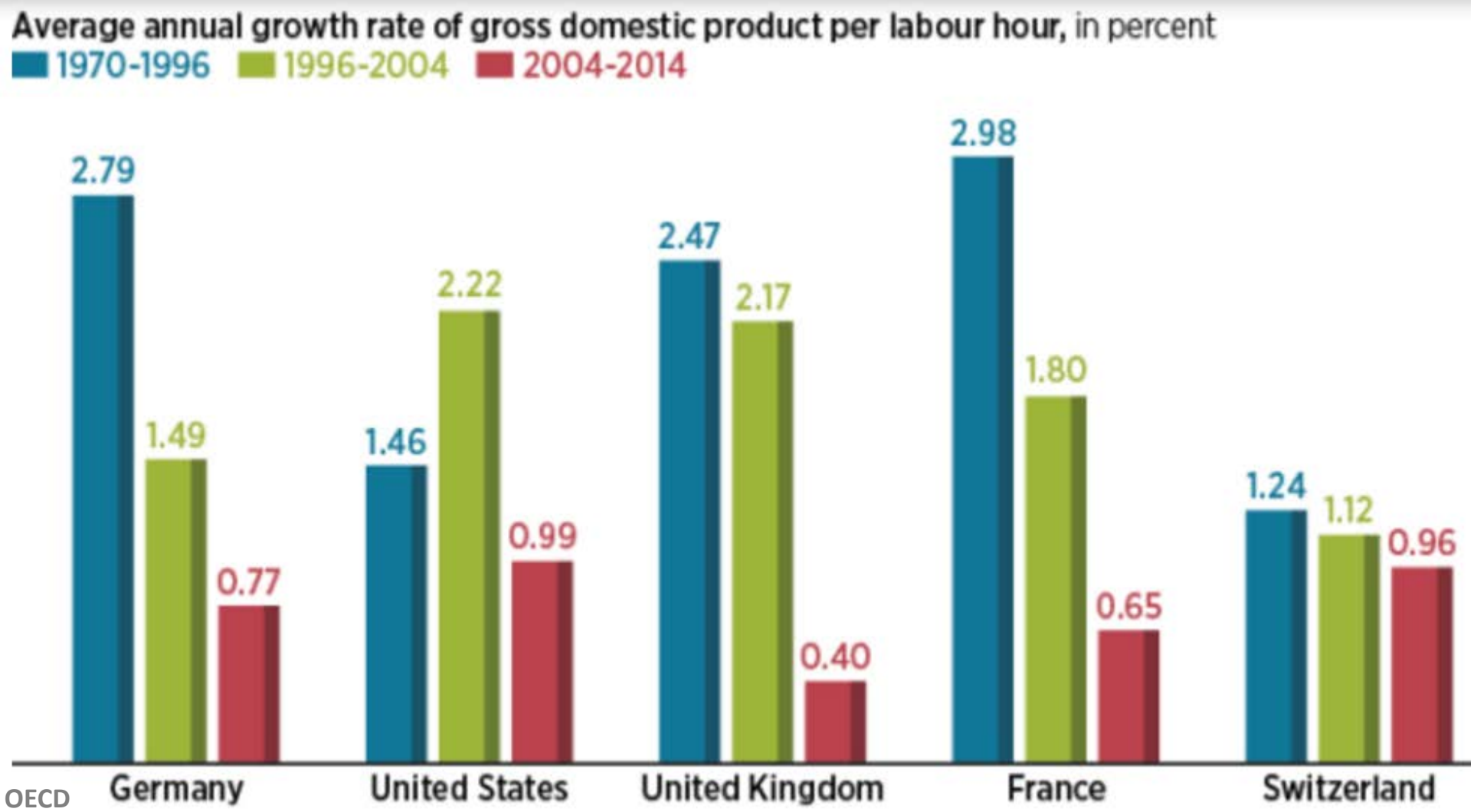
www.economist.com/news/finance-and-economics/21710800-big-data-have-led-latest-craze-economic-research-economists-are-prone



Economist.com

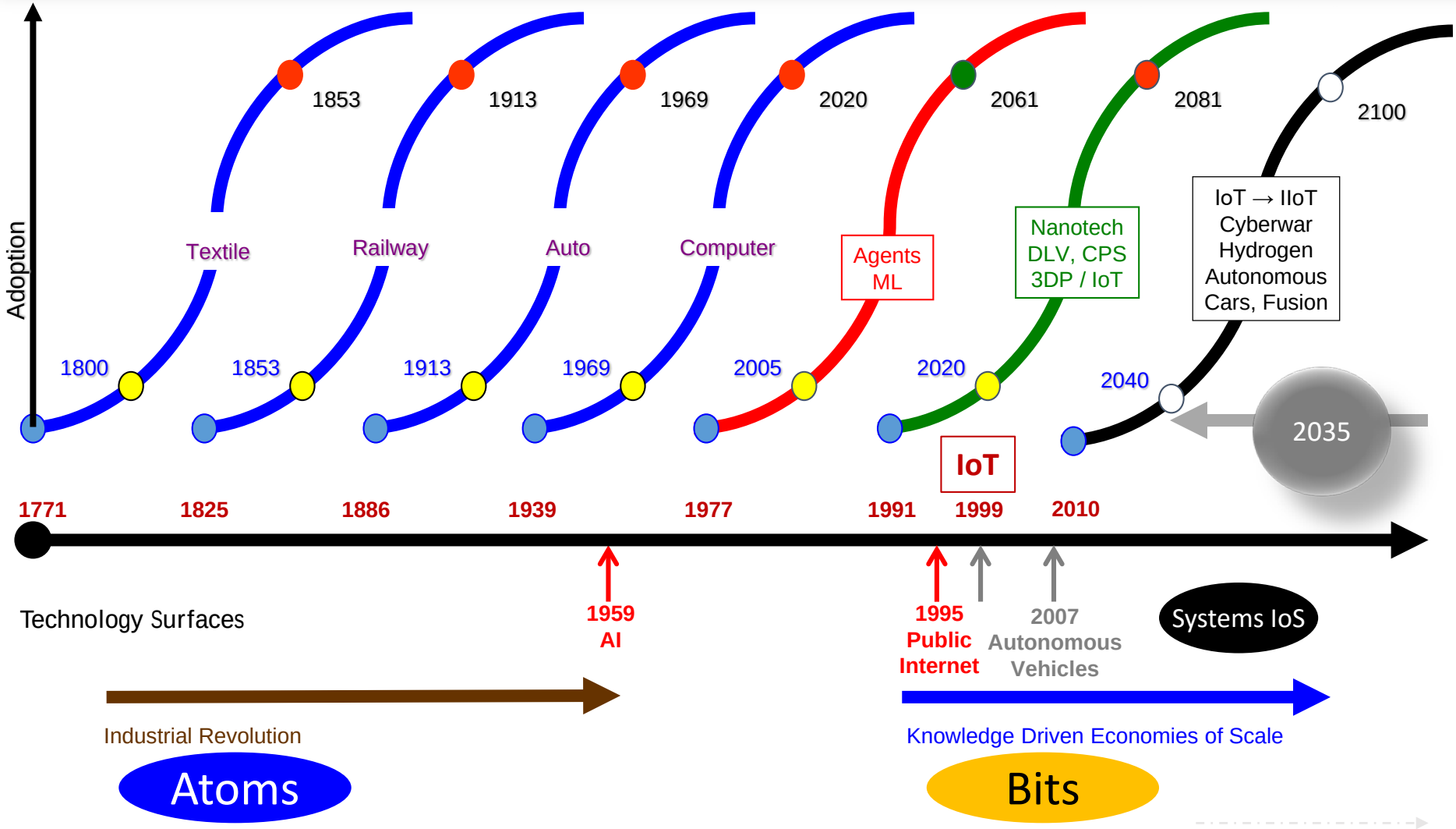
While most economics models assumed people were basically rational, Kahneman and Tversky demonstrated that human decision-making is biased in systematic, predictable ways. Many of the biases they described have now become famous — loss aversion, endowment effect, hindsight bias, the anchoring effect, and were described in Kahneman's brilliant book, "Thinking, Fast and Slow." www.nytimes.com/2016/11/25/opinion/does-decision-making-matter.html

Productivity Growth Has Slowed Down? It takes about 30 years



Transmutation of the Uncommon - Transaction Cost Economics

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

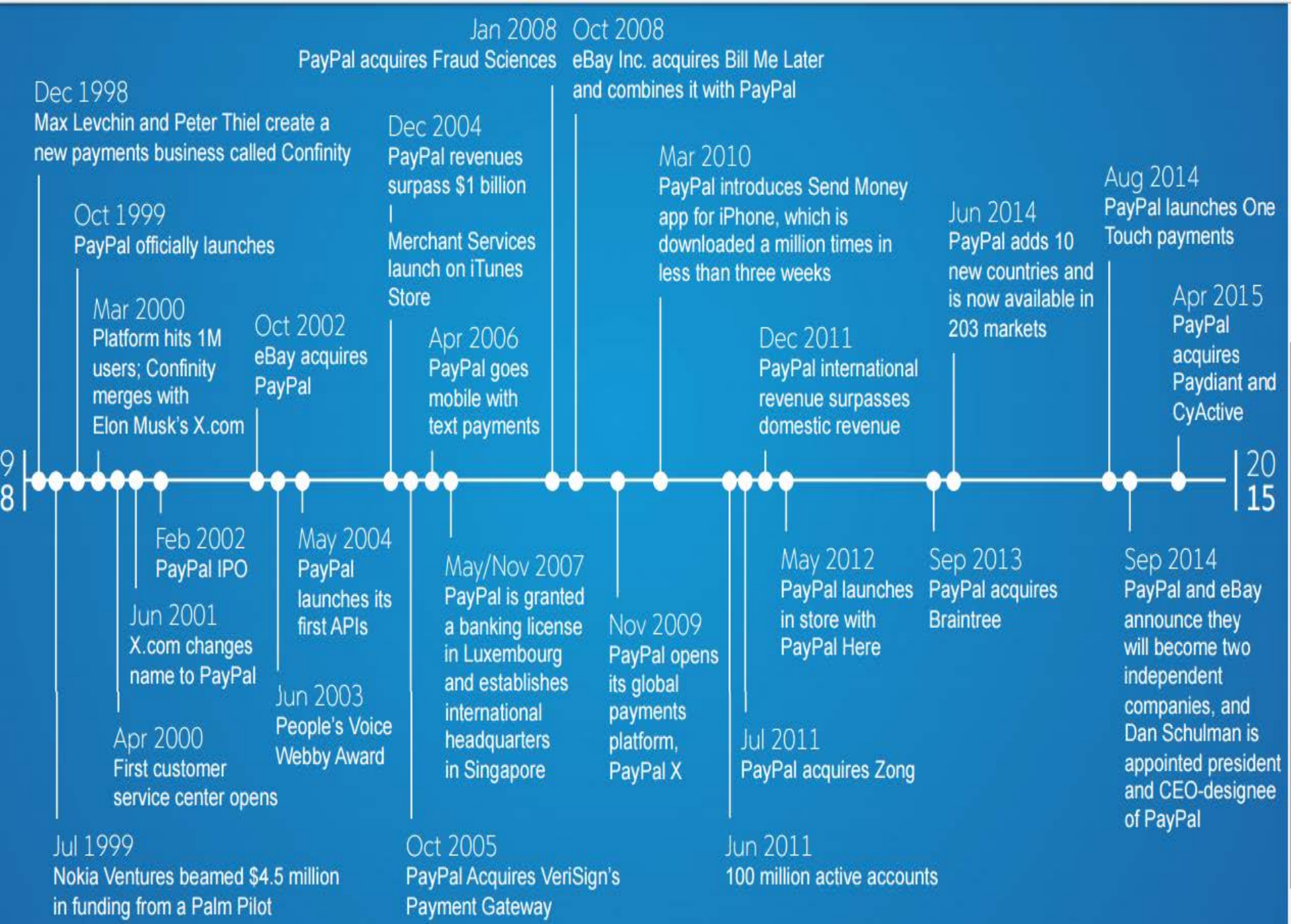


It takes about 28-30 years for an idea to be socialized before it is accepted and adopted. 1999 was the birth year for IoT concept. Expect exponential growth of IoS ~ 2025-2026.

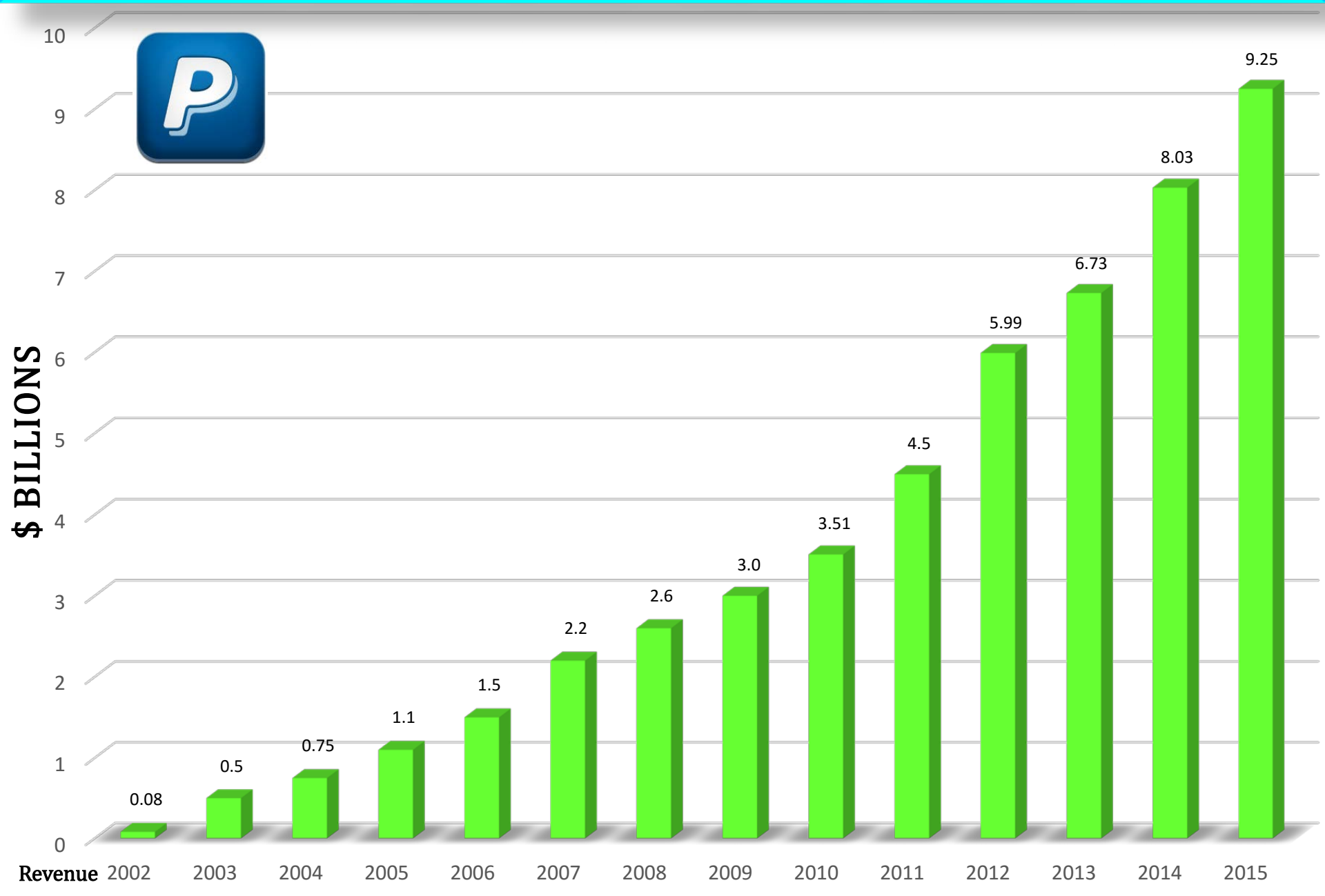
Transmutation of the Uncommon - The Dead Weight of Old Technology?

Eine neue wissenschaftliche Wahrheit pflegt sich nicht in der Weise durchzusetzen, dass ihre Gegner überzeugt werden und sich als belehrt erklären, sondern vielmehr dadurch, dass die Gegner allmählich aussterben und dass die heranwachsende Generation von vornherein mit der Wahrheit vertraut gemacht ist. (Max Planck)

A new scientific truth does not, generally speaking, succeed because the opponents are convinced or declare themselves educated, however because they die and the new generations from the beginning learn about it as the truth. (Max Planck)



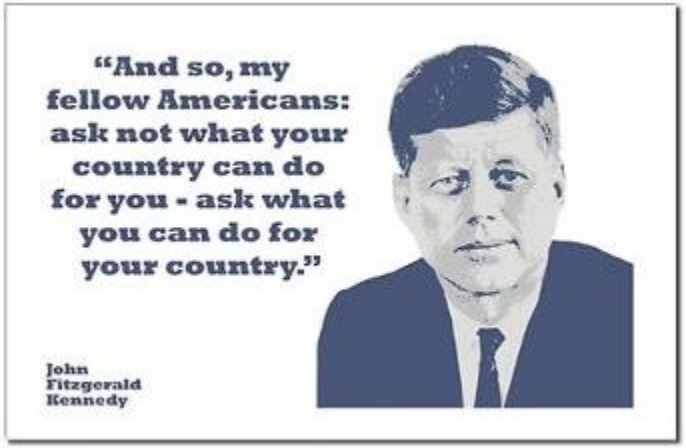
Transaction Cost Economics – The Micro-Revenue Revolution



Ask not what IoT can do for you

Ask what you can do for IoT

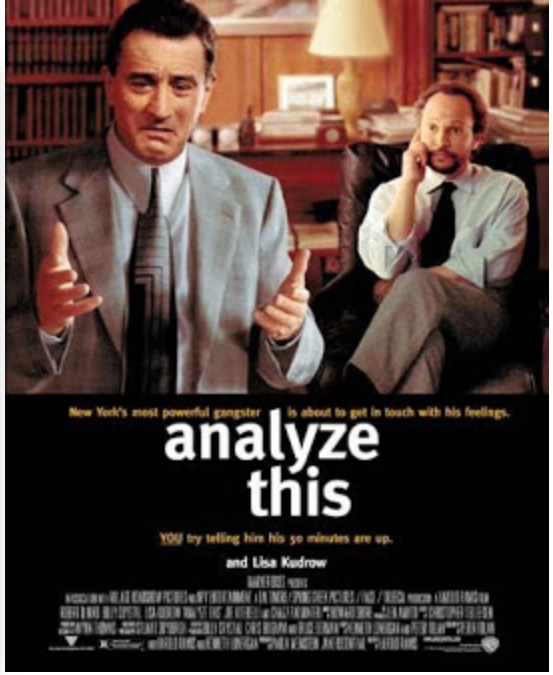
in order to profit from mass monetization



MICRO-REVENUE

from each distributed point of contact

US $50



MILLION

PAY-PER-ANALYTICS ➲ Depending on QoS outcome?

Who will you pay? Who will bill? Who guarantees QoS?

Samsung, UCSF Partner to Accelerate New Innovations in Preventive Health Technology

Pair Will Work to Validate Promising New Sensors and Analytics for Next-Generation Digital Health Solutions

WHO WILL
RECEIVE HOW MUCH
OF THE PAYMENTS ?

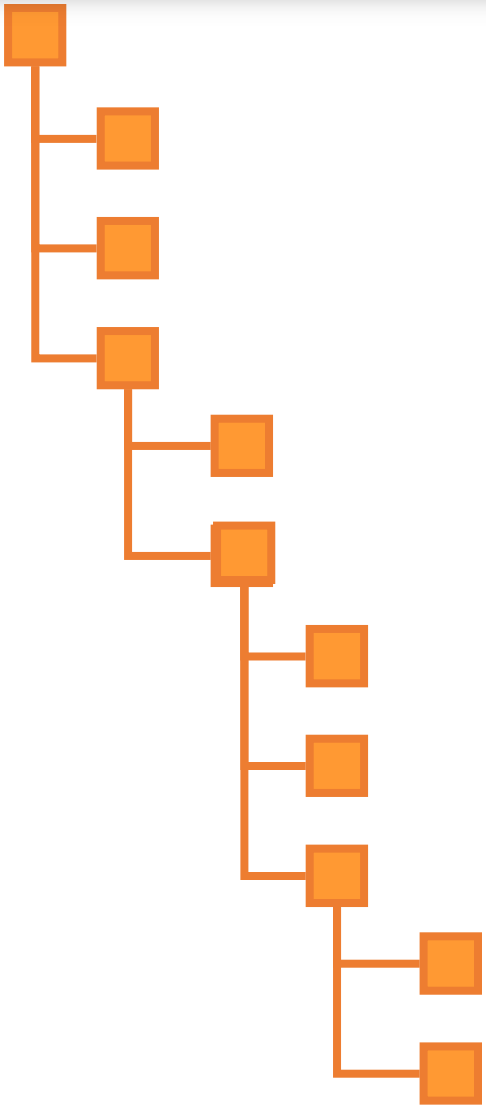
HOW DO YOU
KNOW SERVICE
WAS DELIVERED ?

PAY-PER-ANALYTICS model in a SERVICE ECOSYSTEM ?

CUSTOMER
PAYS ONLY FOR QUALITY
OF SERVICE DELIVERED

WHO INTEGRATES
THE END-2-END
SERVICE PLATFORM?

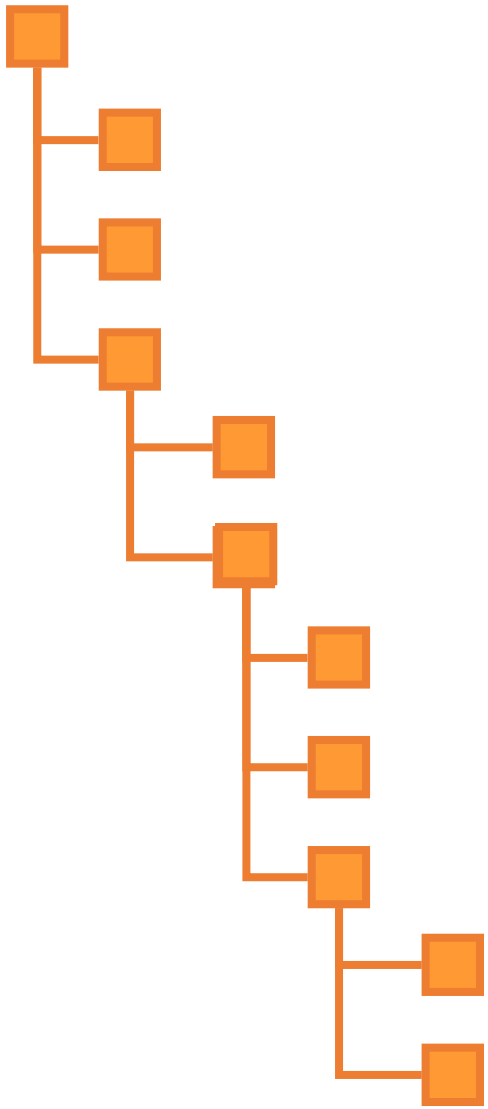
PAY-PER-INSTANCE from PoC in SERVICE ECOSYSTEMS



Sets, Subsets, Identification, Relation, Data – Unique Digital Ledger Entry

WHO WILL
RECEIVE HOW MUCH
OF THE PAYMENTS ?

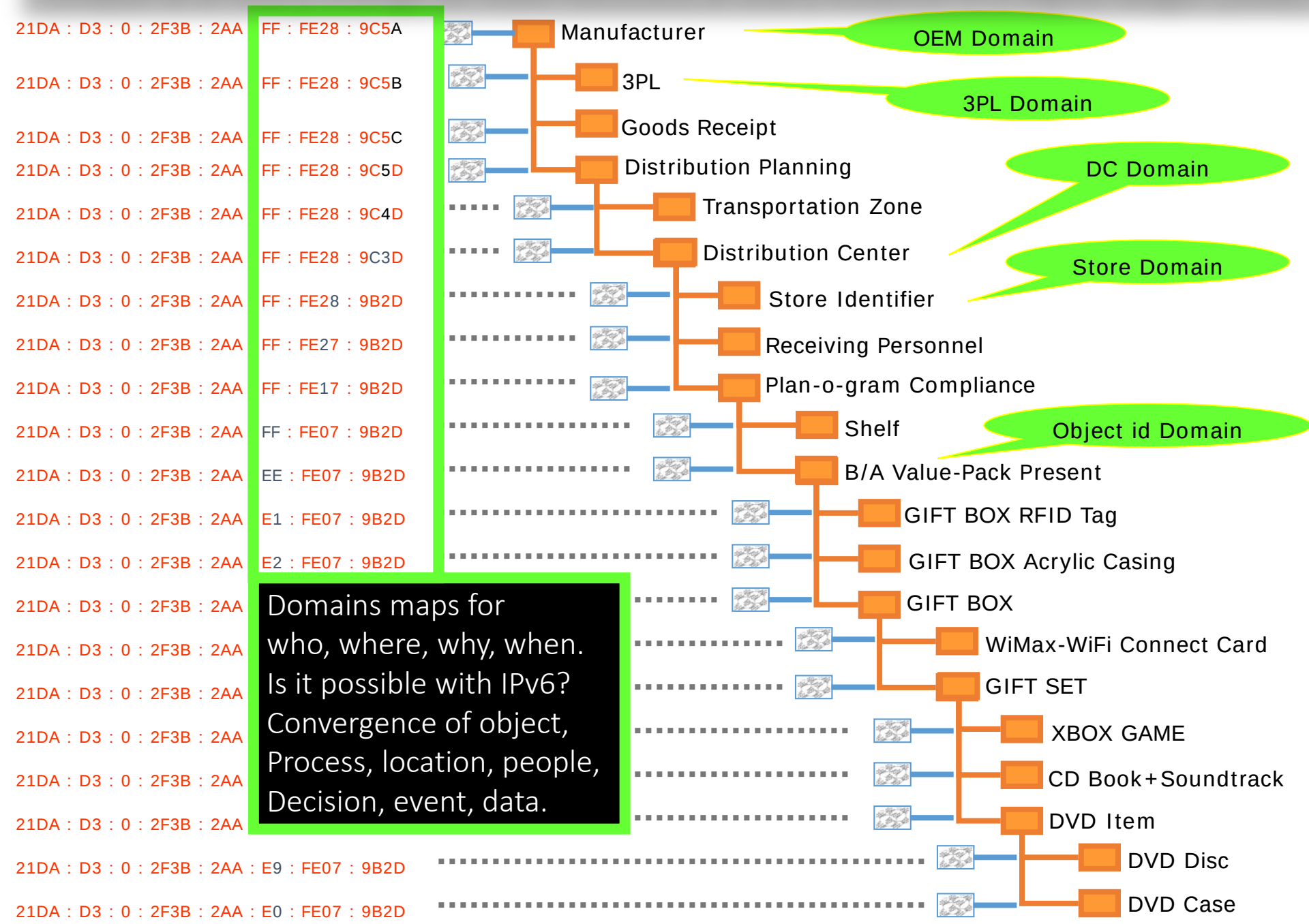
HOW DO YOU
KNOW SERVICE
WAS DELIVERED ?



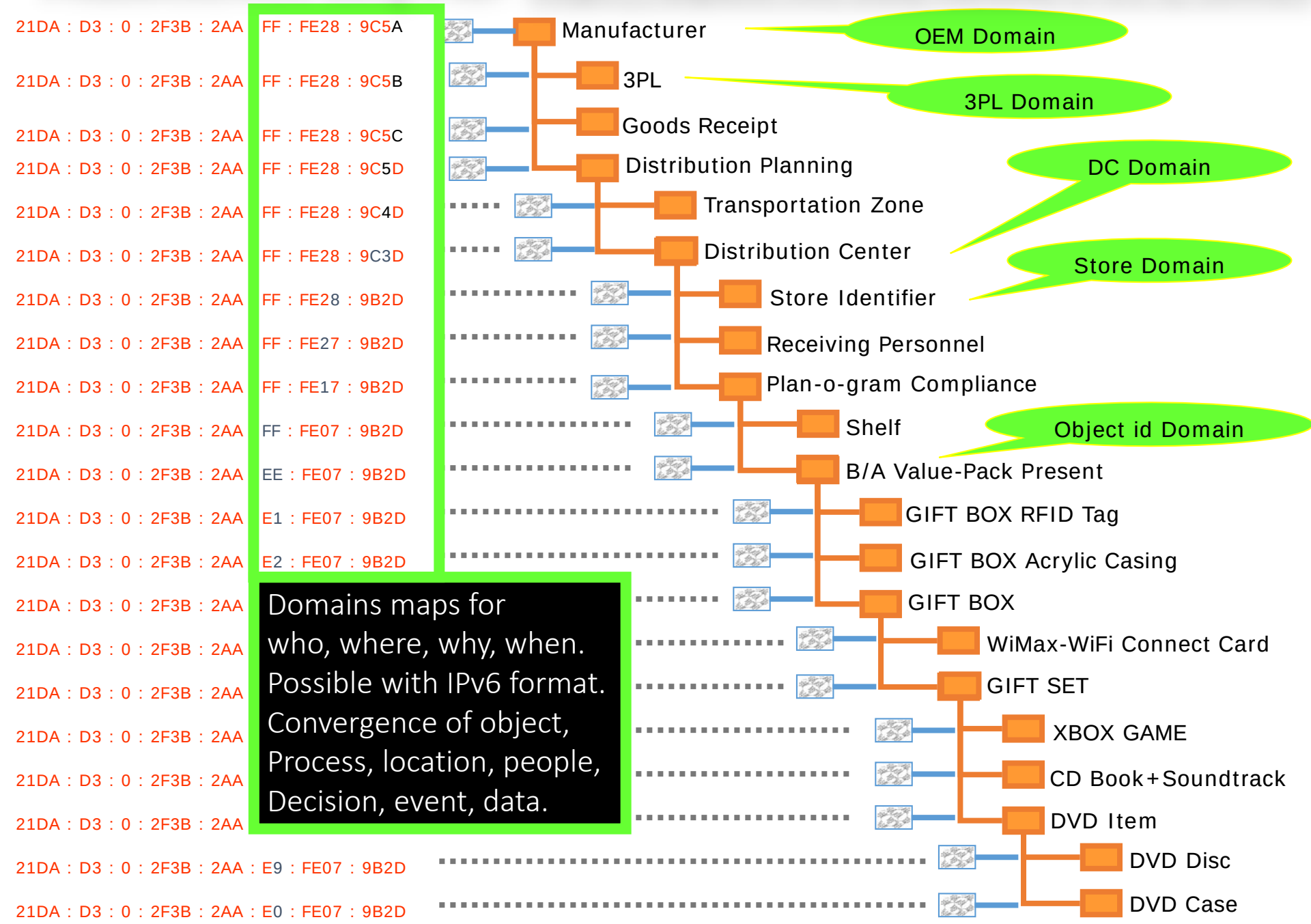
CUSTOMER
PAYS ONLY FOR QUALITY
OF SERVICE DELIVERED

WHO INTEGRATES
THE END-2-END
SERVICE PLATFORM?

Unique id of every change (in state function) at every instance in a digital ledger (2006)



PreBLOCKCHAIN using IPv6? https://dspace.mit.edu/handle/1721.1/104429



Healthcare worries in FinTech
3,550 crypto-coins and other non-currency applications of distributed digital ledgers don't talk to each other!

Why the prelude to distributed digital ledger focus on the IPv6 format?

Standards-Interoperability

WWW "internet" grew from 13 million users in 1994 to 4 billion in 2016, due to set of common standards for displaying and sharing information. It didn't "just happen" – individuals and entities came together (IETF, W3C) to bridge and help foster standards.

Windhover Principles, CBDC, Chain, R3CEV, InterLedger, HyperLedger are efforts (?) in progress for Fintech. http://bit.ly/MIT-WINDHOVER

Symbol	Name	Mined Coins	Difficulty	Price	Volume	Marketcap	Logarithmic
BTC	Bitcoin	16,019,637	286766000000	1.00 BTC	106,409.52 BTC	12,618,638,920.00 USD	
LTC	Litecoin	48,702,029	67726.9	0.01 BTC	71,352.66 BTC	194,114,486.40 USD	
TRUMP	Trump	1,000,000,000	0	0.07 mBTC	1.43 BTC	58,919,960.00 USD	
XEM	NEM	8,999,999,999	0	4.53 µBTC	88.21 BTC	32,114,529.00 USD	
DOGE	DogeCoin	97,102,803,758	23847.7	0.27 µBTC	85.14 BTC	20,651,761.06 USD	
SHIFT	Shift	1,000,000,000	0	0.02 mBTC	1.01 BTC	17,250,630.00 USD	
NXT	Nxt	1,000,000,000	0	0.01 mBTC	38.74 BTC	5,978,643.00 USD	
PPC	Peercoin	21,421,191	13.053	0.30 mBTC	41.75 BTC	5,062,043.77 USD	
VIRAL	Viral	1,000,000,000	0	3.85 µBTC	0.51 BTC	3,032,645.00 USD	
AUR	Auroracoin	14,206,697	248.975	0.15 mBTC	1.03 BTC	1,678,706.86 USD	
QRK	Quarkcoin	248,250,110	677.182	4.50 µBTC	0.56 BTC	879,963.30 USD	
IFC	InfiniteCoin	90,596,277,249	0	0.01 µBTC	0.51 BTC	713,627.06 USD	
EAC	EarthCoin	9,346,468,332	237.106	0.09 µBTC	4.13 BTC	662,599.06 USD	
FTC	Feathercoin	97,440,952	189.802	0.01 mBTC	1.49 BTC	593,310.61 USD	
CLAM	CLAMS	624,000	0	0.89 mBTC	24.83 BTC	436,380.29 USD	
ZET	ZetaCoin	160,594,207	29126.7	3.13 µBTC	0.17 BTC	395,945.28 USD	
DVC	Devcoin	7,519,170,050	14338200000	0.06 µBTC	0.75 BTC	355,370.86 USD	
NVC	Novacoin	774,262	324.544	0.53 mBTC	2.17 BTC	323,239.78 USD	
WDC	WorldCoin	53,342,916	11.3756	0.01 mBTC	1.61 BTC	305,892.27 USD	
TIPS	Fedoracoin	127,010,319,285	277.966	0.00 µBTC	2.52 BTC	267,773.10 USD	
MEC	MegaCoin	18,353,750	10.557	0.02 mBTC	12.22 BTC	260,664.11 USD	
VTC	VertCoin	10,413,700	283.47	0.03 mBTC	3.07 BTC	230,418.79 USD	
ROYAL	Royal	1,000,000,000	0	0.20 µBTC	0.12 BTC	157,540.00 USD	
BQC	BBQCoin	35,687,158	3.544	0.01 mBTC	0.17 BTC	156,857.85 USD	
DGC	Digitalcoin	14,808,023	3.9736	0.01 mBTC	0.55 BTC	133,439.53 USD	
DMD	Diamond	369,496	0.939	0.30 mBTC	0.94 BTC	88,043.59 USD	
DRACO	DTToken	88,888,888	0	1.05 µBTC	0.23 BTC	73,518.64 USD	
NOBL	NobleCoin	752,475,000	5.972	0.11 µBTC	0.63 BTC	65,199.66 USD	
DIME	Dimecoin	206,602,469,376	0	0.00 µBTC	0.11 BTC	54,680.72 USD	
MZC	Mazacoin	307,130,100	2142480	0.22 µBTC	0.13 BTC	53,223.79 USD	
NET	Netcoin	209,704,698	13.783	0.16 µBTC	0.15 BTC	26,429.54 USD	
WAVES	OCEANWAVE	1,000	0	0.32 mBTC	53.69 BTC	249.70 USD	

www.cryptocoincharts.info/coins/info

US NIST CyberPhysical Systems Reference Architecture

www.nist.gov/programs-projects/reference-architecture-cyber-physical-systems

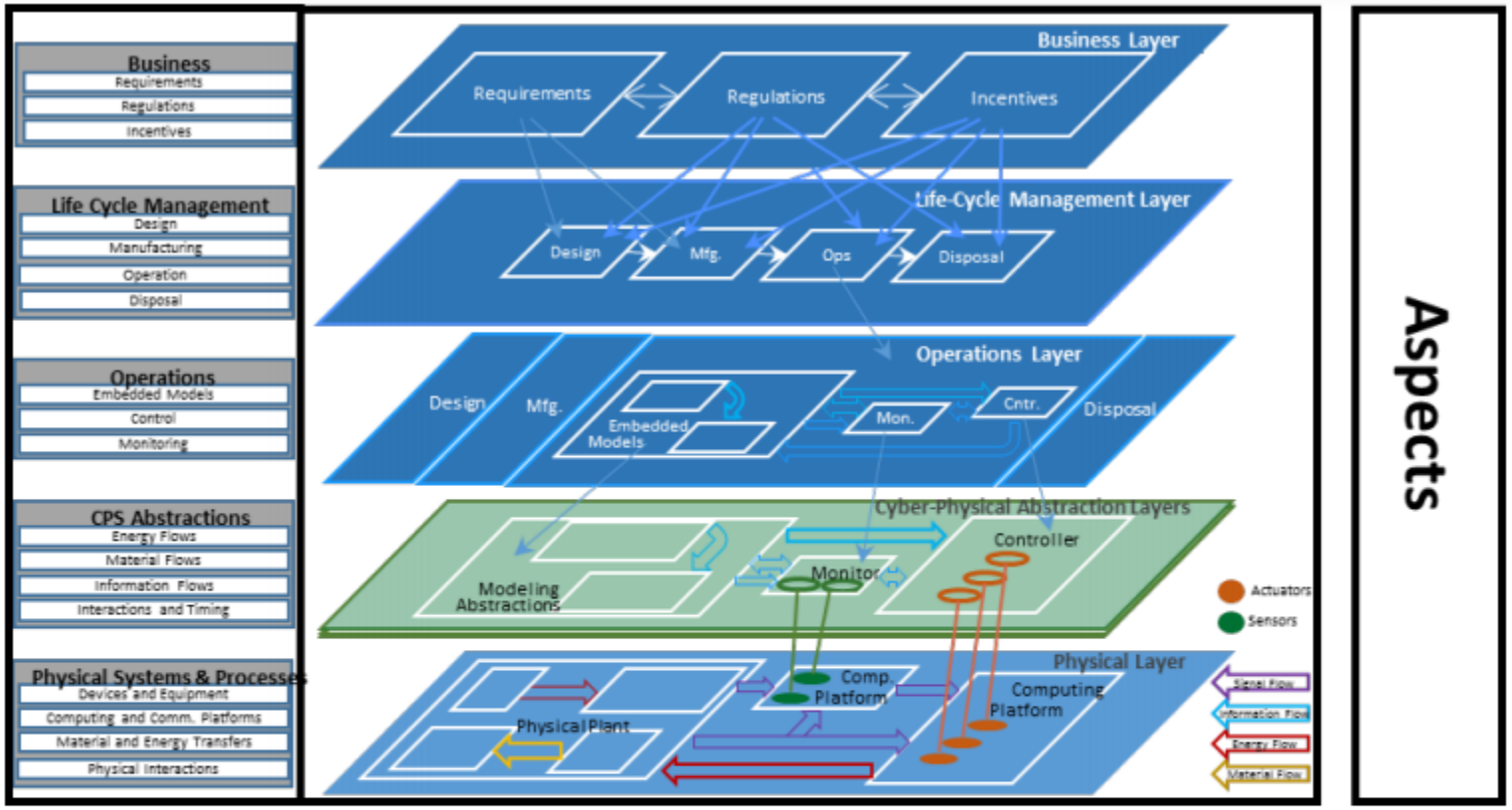


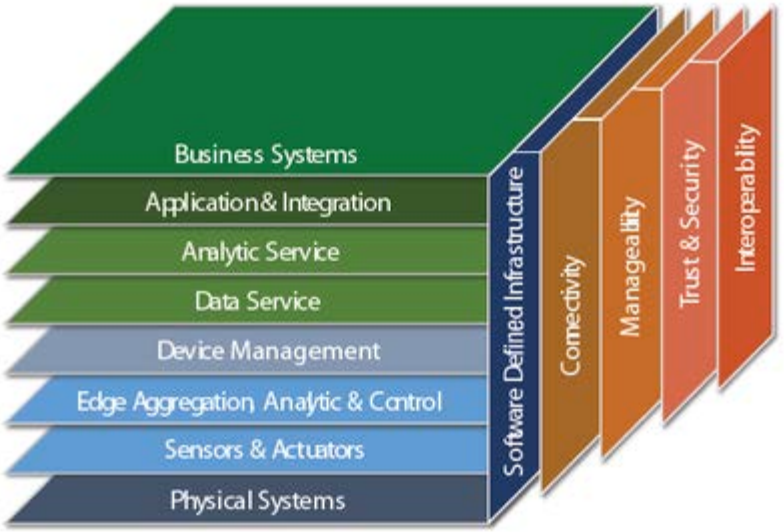
Figure 11: Realization Facet

Figure 11 captures key conceptual layers of the realization facet. Each layer is associated with concepts, components, and notional architectures that can be instantiated into layer- and domain-specific CPS architectures.

CPS PWG Draft Framework for Cyber-Physical Systems, Release 0.8

https://s3.amazonaws.com/nist-sgcps/cpspwg/pwgglobal/CPS_PWG_Draft_Framework_for_Cyber-Physical_Systems_Release_0_8_September_2015.pdf

IIoT Architectural Framework https://www.iiconsortium.org/IIRA-1-7-ajs.pdf



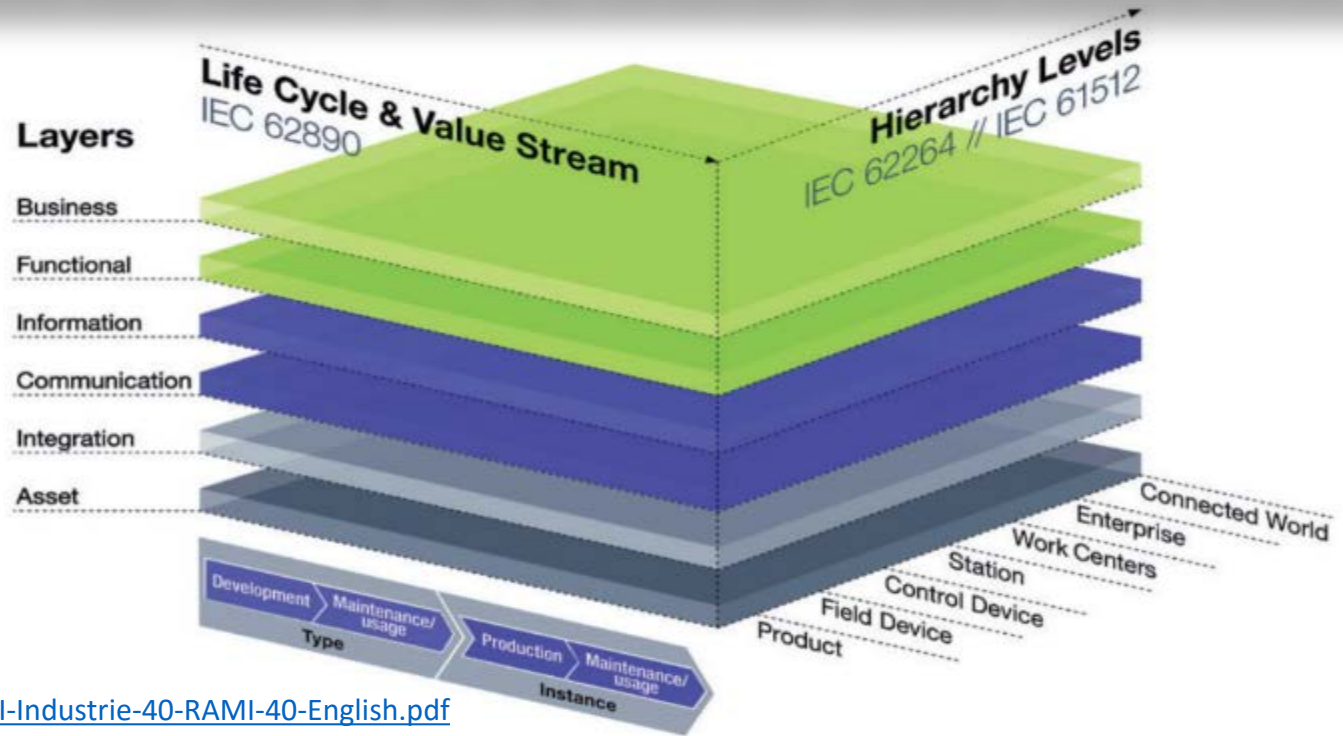
CPS, IIoT, IoT

Global Standards

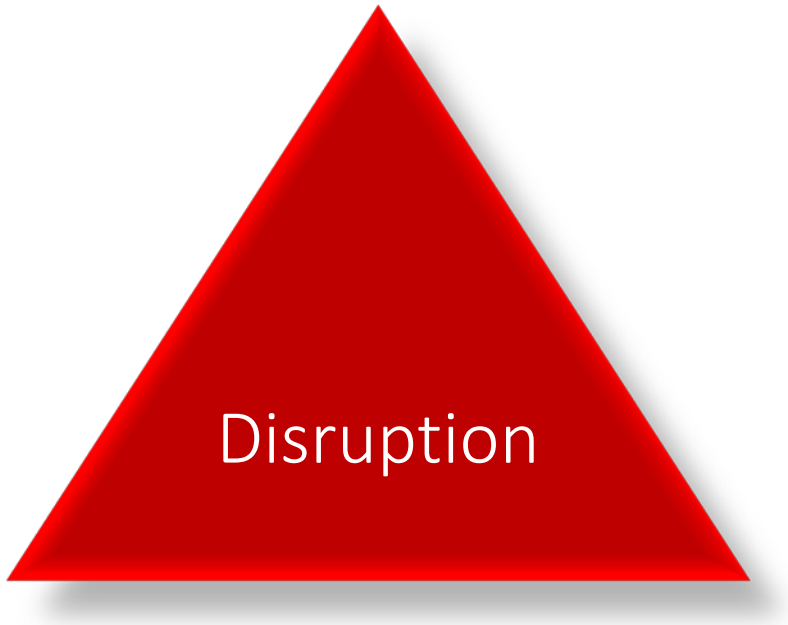
Reference Architectures

Elusive Quest for Interoperability

IIoT Reference Architecture from Industrial Internet Consortium (L) and Industrie 4.0 (R)



www.zvei.org/Downloads/Automation/ZVEI-Industrie-40-RAMI-40-English.pdf


Disruption

5 MB hard drive being shipped out of IBM (1956)

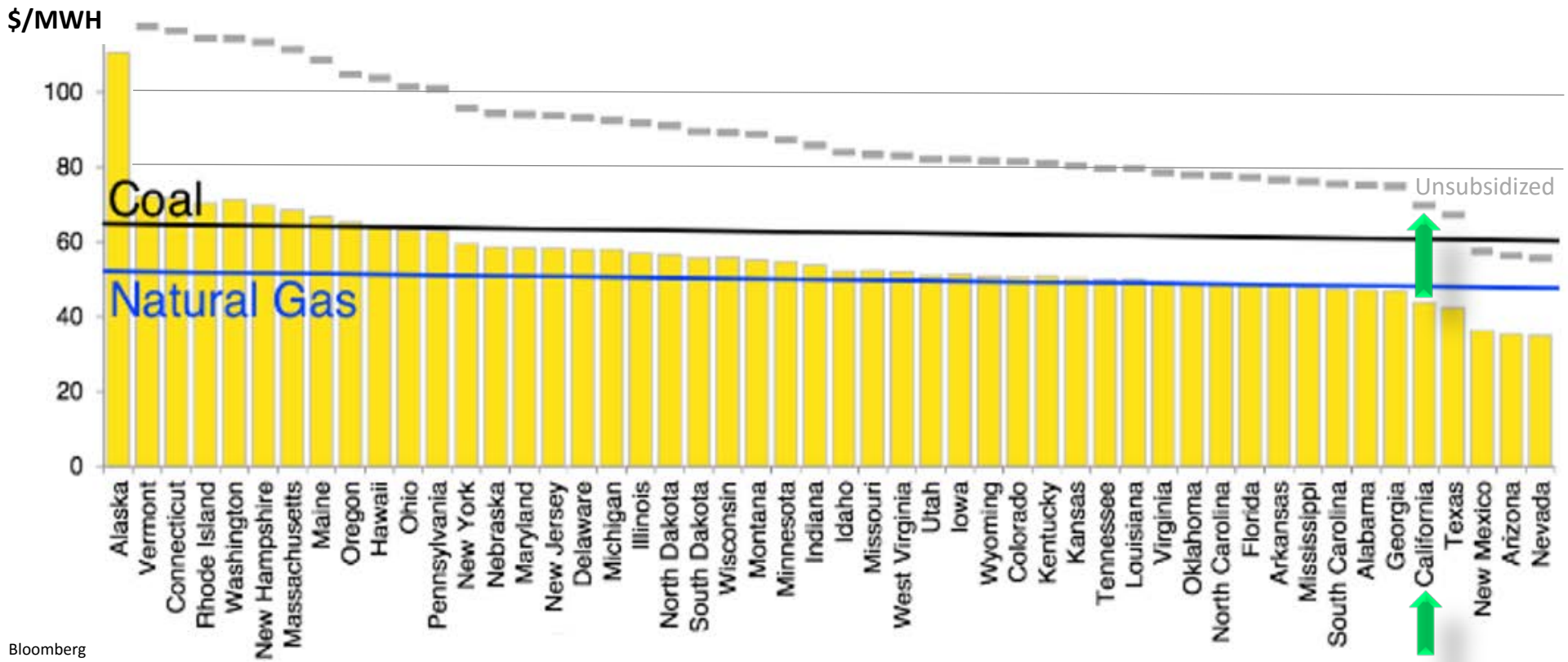
2 TB hard drive slightly larger than a credit card (2015)

Transformative Disruptions

Transmutation of the Uncommon creates the Common Sense

„The electric light did not come from the continuous improvement of candles“

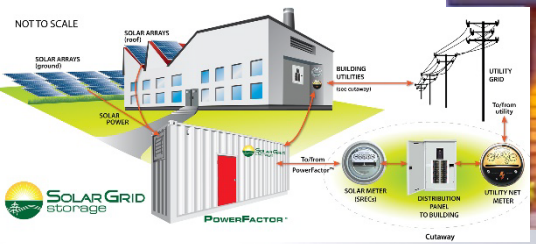
Oren Harari

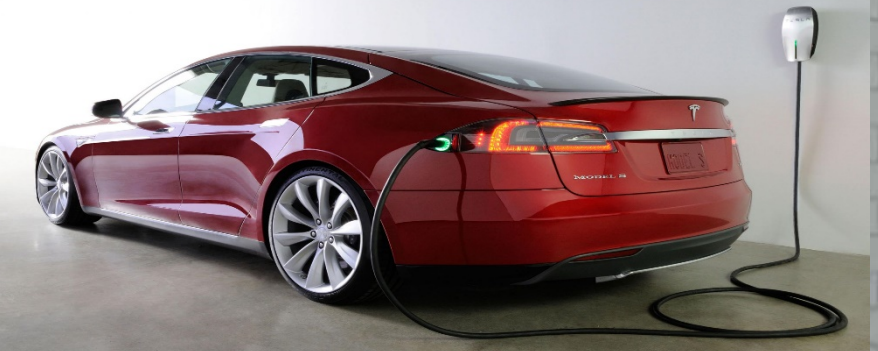


Bloomberg

The Emergence of Distributed Digital Mitochondria – Global Reversal from Smart Grids
Don’t plug the car in your home - Plug the home in your car - Mobile Nano-Grid Energy

Elon Musk just showed us the grand unification of batteries, and a stunning solar rooftop.





Disruptive – Hype by Design ?

Clayton Christensen's "disruption" is a marketing hype. The principles of disruption were distorted to create the hype. But, true disruptions do exist. They are few and far between (electricity, laser, automobiles, internet). The thesis of disruption applies to about less than 10% of the examples provided in the book *The Innovator's Dilemma*.

The Claytonian Disruption – A Deliberate Deception

How Useful Is the Theory of Disruptive Innovation?

Magazine: Fall 2015 • Research Feature • September 15, 2015 • Reading Time: 35 min

Andrew A. King and Baljir Baatartogtokh

Strategy, Innovation, Innovation Strategy, Developing Strategy

Few academic management theories have had as much influence in the business world as Clayton M. Christensen's theory of disruptive innovation. But how well does the theory describe what actually happens in business?

http://bit.ly/FABRICATED

www.newyorker.com/magazine/2014/06/23/the-disruption-machine

ANNALS OF ENTERPRISE JUNE 23, 2014 ISSUE

THE DISRUPTION MACHINE

What the gospel of innovation gets wrong.

By Jill Lepore

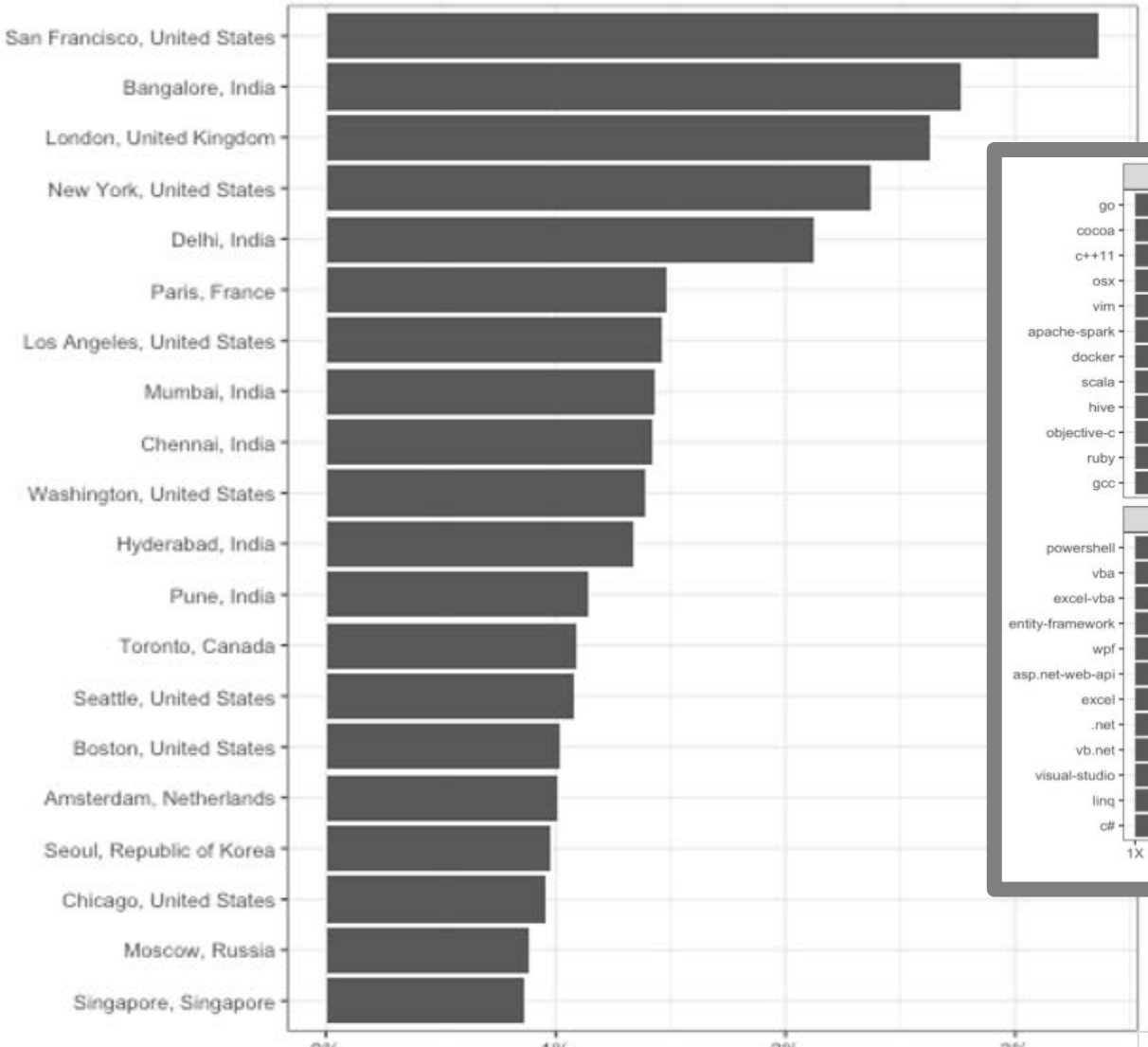
In the last years of the nineteen-eighties, I worked not at startups but at what might be called finish-downs. Tech companies that were dying would hire temps—college students and new graduates—to do what little was left of the work of the employees they'd laid off. This was in Cambridge, near M.I.T. I'd type users' manuals, save them onto 5.25-inch floppy disks, and send them to a line printer that yammered like a set of prank-shop chatter teeth, but, by the time the last perforated page coiled out of it, the equipment whose functions those manuals explained had been discontinued. We'd work a month here, a week there. There wasn't

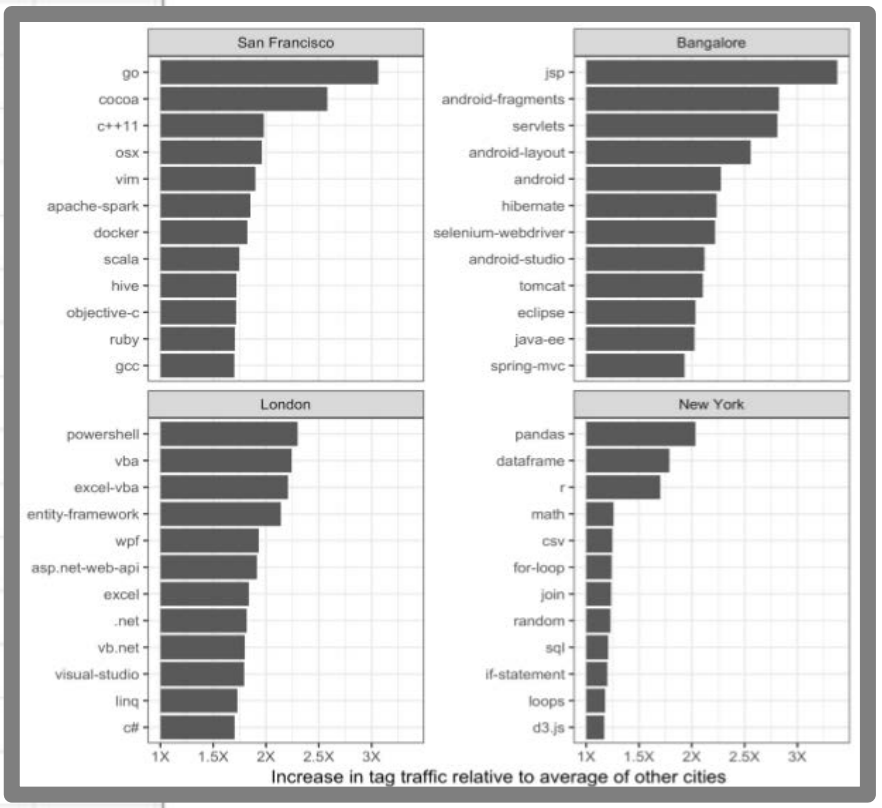
Disruption is a theory of change founded on panic, anxiety, and shaky evidence.

ILLUSTRATION BY BRIAN STAUFFER

The Elusive Quest for Disruption ➲ How To ?

Think Different - Use different parameter - Type of Questions

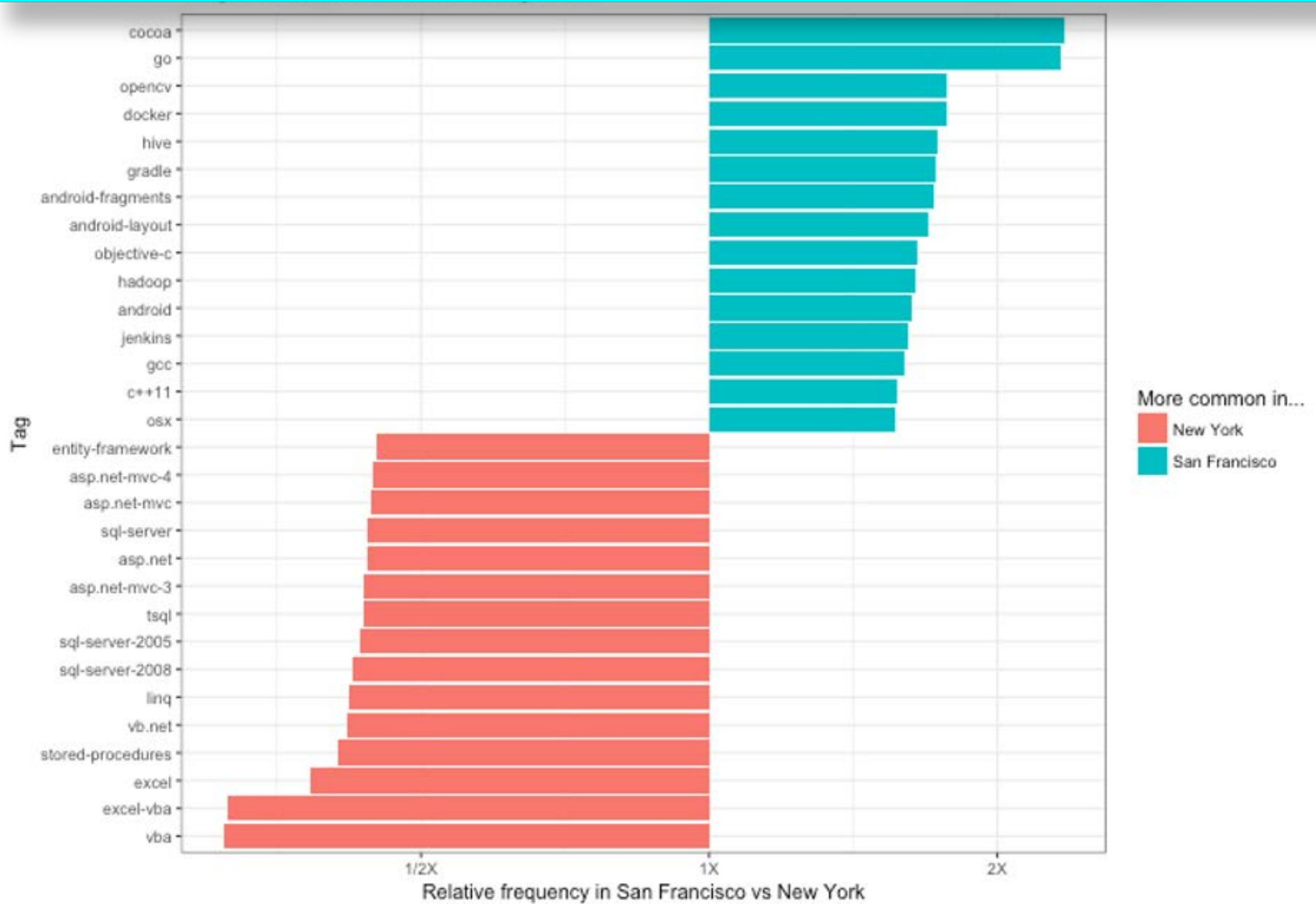




http://stackoverflow.com/

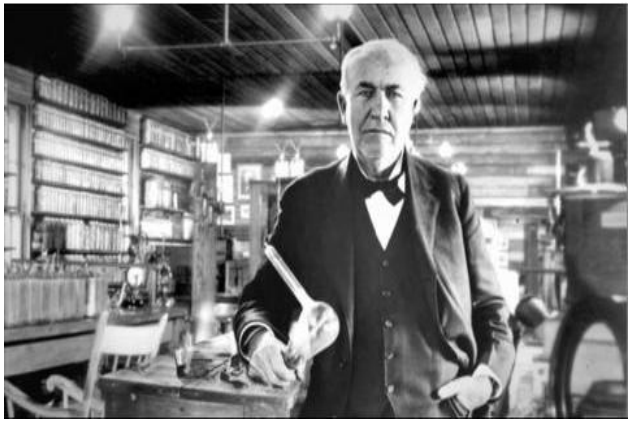
Stack Overflow is Q&A site for programmers

Difference in Tag Traffic – MS dominates NYC while Apple, Google in SFO



The Elusive Quest for Disruption ➲ How To ?

The principle of total energy under the curve



The concept of energy under the curve is directly analogous to an economy's money supply at a given time. Both the energy and the money supply are known amounts. The money is going to be spent by someone (device is going to output its energy). The key is for the money to be spent where it has the most benefit (light bulb must produce visible light) or customer's preference.

In engineering parlance, there is a phrase called 'energy under the curve.' This refers to the total energy output of a device—light bulb, acoustic transducer —as measured on a graph across a range of frequencies. While every effort is made to maximize the amount of energy output from that device, in the end it's still a finite amount. The key to best performance is getting the device to deliver energy that is ***usable***. A light bulb may produce x lumens of energy, but it won't do much good if its output is predominately at ultraviolet frequencies that are invisible to the human eye. An acoustic transducer (speaker) can be modified to produce more or less energy at different frequencies, but the total acoustic energy produced by that specific speaker is finite. The engineers can move the energy output from one frequency region to another, but the 'total energy under the curve' remains the same.

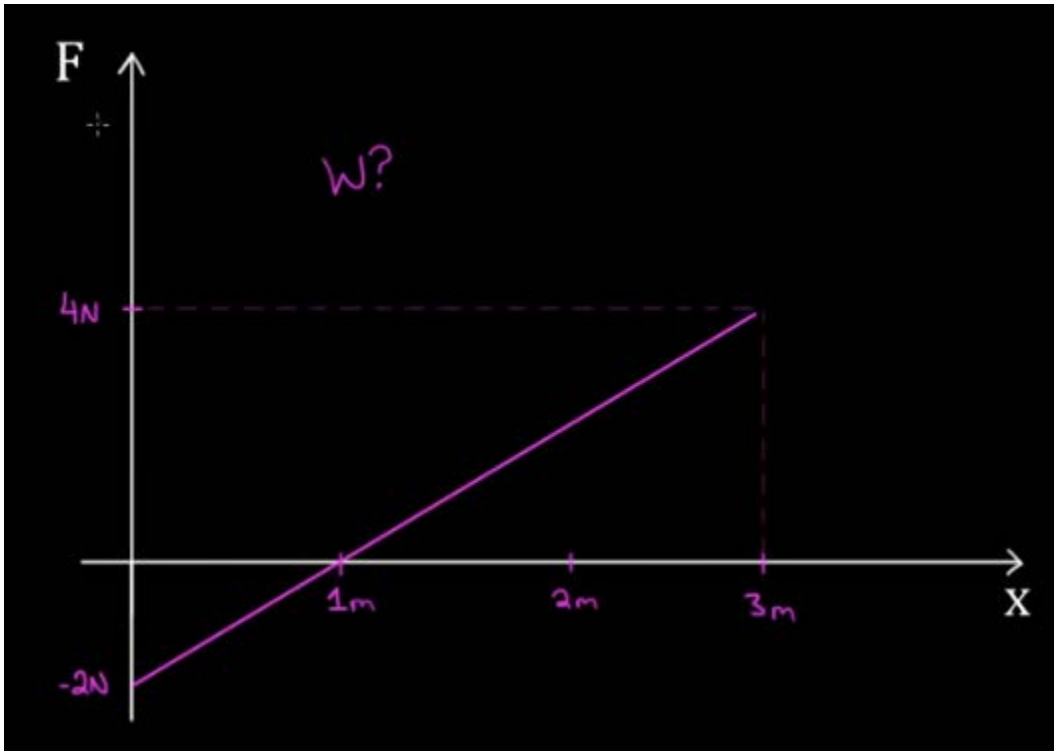
www.americanthinker.com/2004/09/the_light_bulb_economy.html

Abstraction from Principles of Natural Laws as Strategic Metaphors in Business

Analogous to bio-inspired systems, such as, ANN.

Work = Change in Energy

Work = area under the curve



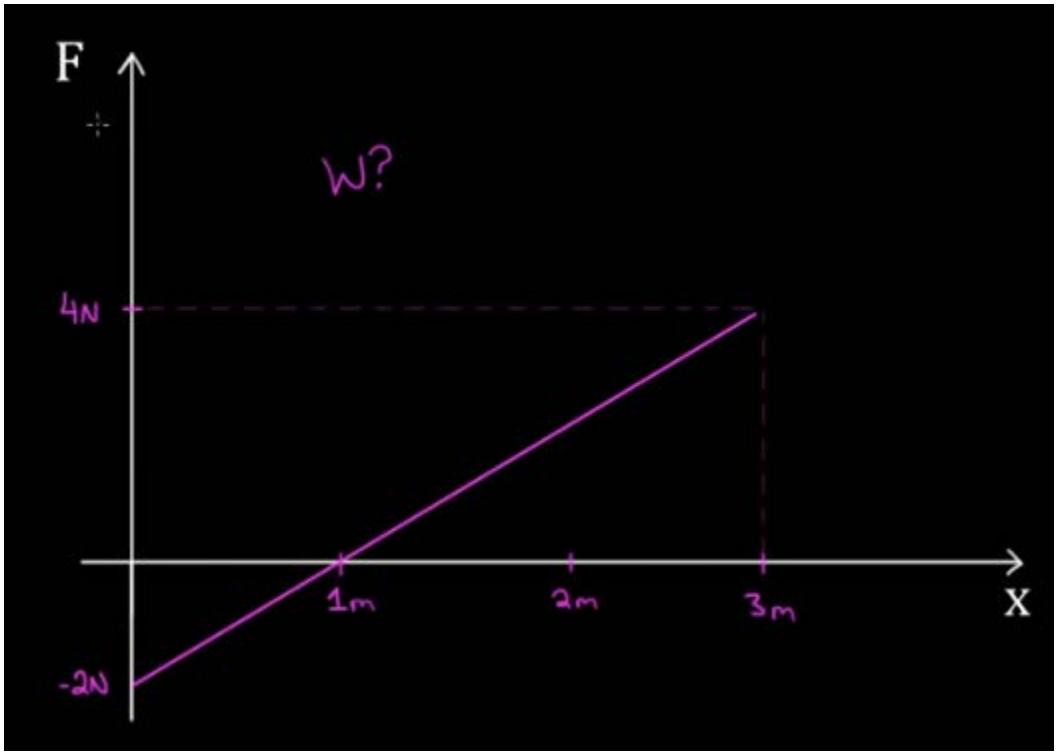
Work = fdCosΘ = mgh = Change in Energy (Joules)

The principle of total energy under the curve

TUTORIAL ● www.khanacademy.org/science/physics/work-and-energy/work-and-energy-tutorial/v/work-as-area-under-curve

Economic Complexity – Simplicity of the fundamental concept

The principle of total energy under the curve



Work = area under the curve

Work = fdCosΘ = mgh = Change in Energy (Joules)

TUTORIAL ● www.khanacademy.org/science/physics/work-and-energy/work-and-energy-tutorial/v/work-as-area-under-curve

This mad pursuit – template to think differently about factors affecting economic complexity and profitability

- Natural Laws govern science an engineering which has generated all ideas and tools used in business or industry agnostic of time or geography.
- Can business/industry integrate the design thinking (as metaphors) from natural laws to rethink enterprise strategy, development and profitability?
- Abstraction of the principles based on natural laws are fundamental, universal and global pillars of knowledge. They are not fake, fabricated or artifacts brimming with blither, prattle and twitter, such as, “disruptive” or “open innovation” or “intelligent” for self-promotions, marketing and PR.
- The template is not manufactured to drive consulting billable hours or the drivel from 2 X 2 “best practice” dogma advertised in a “magic quadrant”
- Integration of design metaphors based on natural laws with other time-tested robust principles, such as, transaction cost economics and game theory, may generate pragmatic frameworks or principles or practice.
- These frameworks are not expected to be a panacea to serve all verticals and solve all dilemma. They may be applicable to a few or many, which remains unknown, at this time. Several such frameworks are possible due to a plethora of laws and theories in natural science and philosophy.

Rationale for natural laws as design metaphors to guide strategy, innovation and profit

The principle of total energy under the curve is applicable in many science and engineering fields. The first law of thermodynamics governs the conservation of energy. Hence, energy can neither be created nor destroyed. Doing work is a change in energy, not a loss or gain.

The rationale is to use energy as a metaphor for money supply. The supply of money in an economic scenario is assumed to be constant with respect to the time necessary for a business operation (launch of a new product or service). Printing money to boost economy is a caveat but the frequency with which it happens makes it less relevant for this scenario.

The amount of money is non-volatile and we know the general distribution of actors who may spend how much (predictable / projectable with errors). The latter may indicate market capacity for a product/service with an estimated demand (classically untrue). The price pattern may be fitted with models or model-free scenarios under certainty and uncertainty. Back propagation algorithms may be used to fine tune generative or discriminative models by combining different conceptual ideas. http://cs229.stanford.edu/notes/cs229-notes2.pdf

To engineer innovation and profit from models, assumptions and estimates, it is necessary to understand the variables/parameters which can be changed to increase your profit even if the money supply remains unchanged (total energy under the curve is constant). Studying the natural laws and mapping the variables to business metaphors may be one way to use nature's optimization protocols as a compass for business strategy. The quest is to recognize those "levers" among business metaphors and specifically enhance those functionalities (characteristics/attributes) to improve profitability. Modifying strategic parameters to boost profit must also take into account established economic principles, such as, transaction cost.

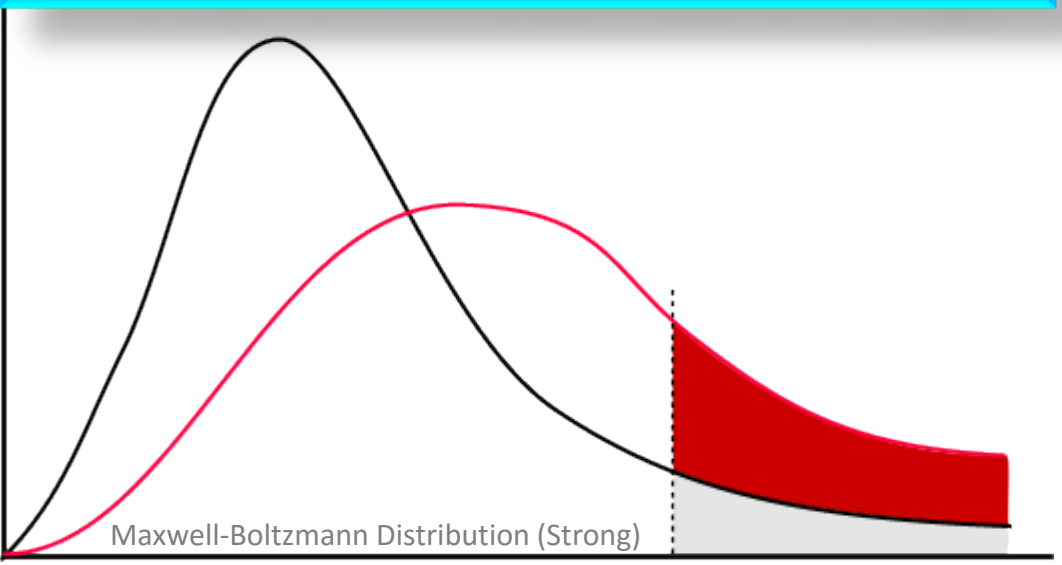
Combine Concepts & Ideas + Theme from The Standard Model

There are four fundamental forces at work in the universe: the strong force, the weak force, the electromagnetic force, and the gravitational force. They work over different ranges and have different strengths. Gravity is the weakest but it has an infinite range. The electromagnetic force also has infinite range but it is many times stronger than gravity. The weak and strong forces are effective only over a very short range and dominate only at the level of subatomic particles. Despite its name, the weak force is much stronger than gravity but it is indeed the weakest of the other three. The strong force is the strongest of all four fundamental interactions.

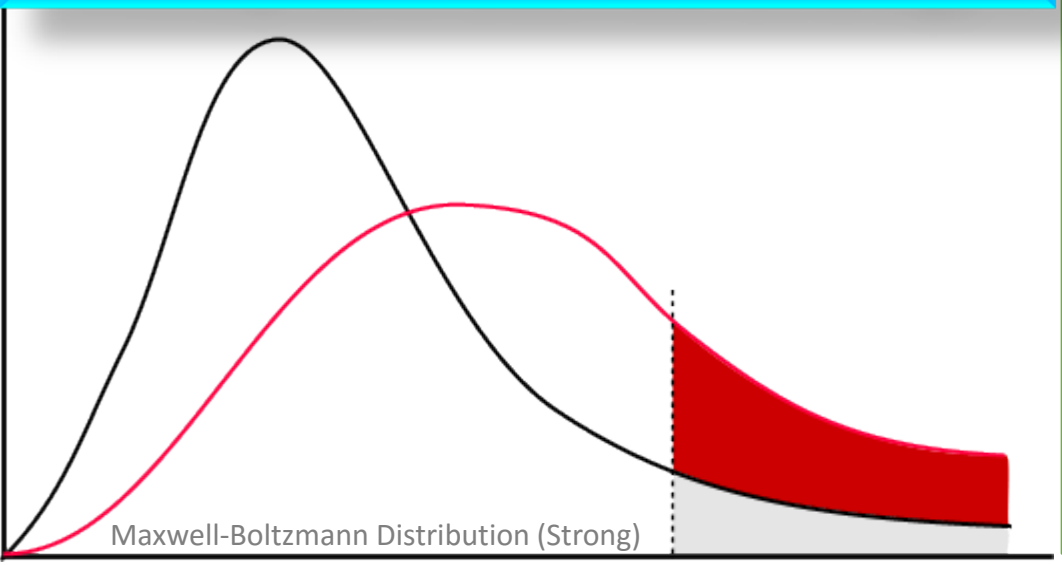
Three of the fundamental forces result from the exchange of force-carrier particles, which belong to a broader group called “bosons”. Particles of matter transfer discrete amounts of energy by exchanging bosons with each other. Each fundamental force has its own corresponding boson – the strong force is carried by the “gluon”, the electromagnetic force is carried by the “photon”, and the “W and Z bosons” are responsible for the weak force. Just discovered by the LIGO team, the “graviton” is the force-carrying particle of gravity. The “grand unification” is in progress.

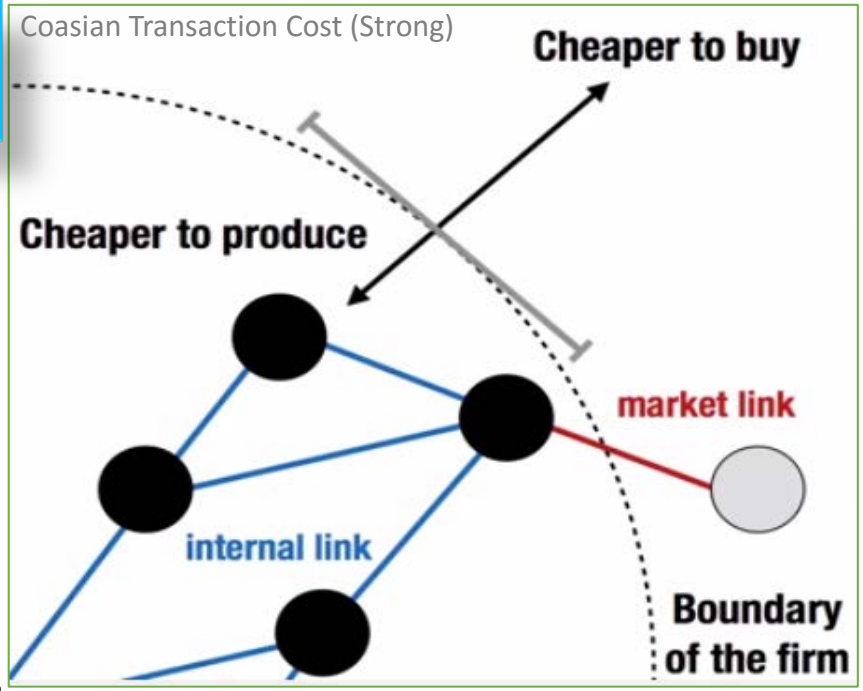
http://news.mit.edu/2016/ligo-first-detection-gravitational-waves-0211 ▪ https://www.ligo.caltech.edu/mit
https://home.cern/about/physics/standard-model ▪ www.prospectmagazine.co.uk/science-and-technology/large-hadron-collider-discovered-graviton

Metaphors in Business Strategy ?

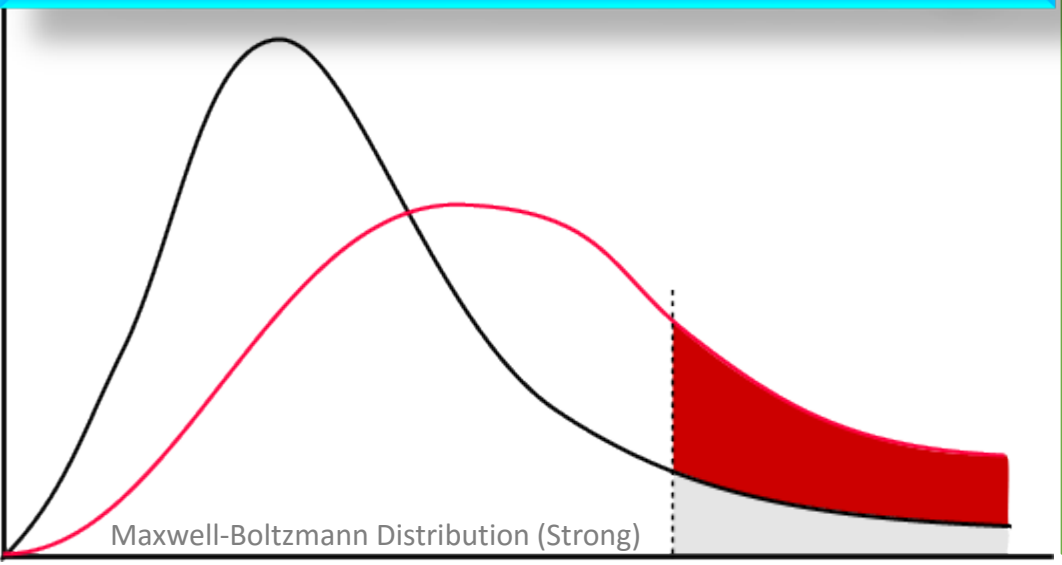


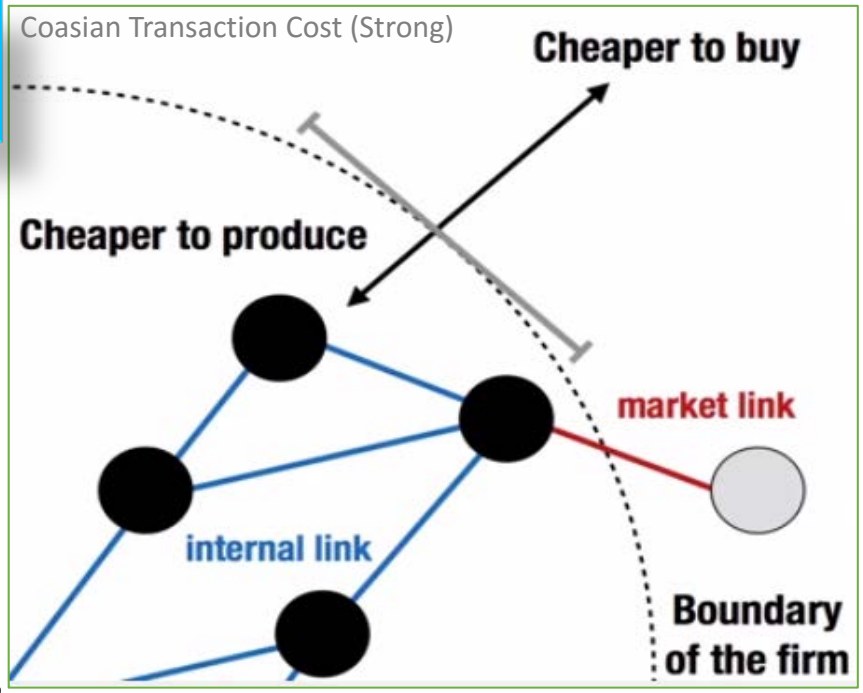
Principles in Business Strategy ?

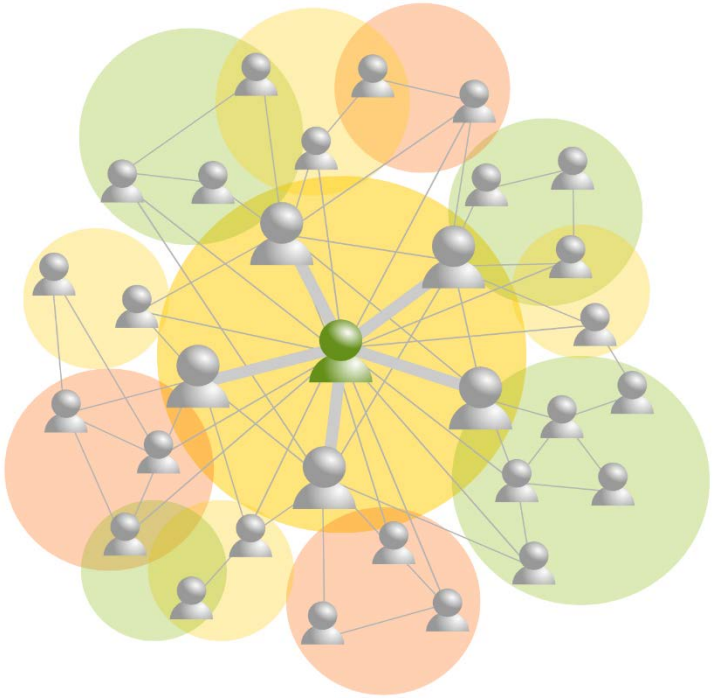




Networks in Business Strategy

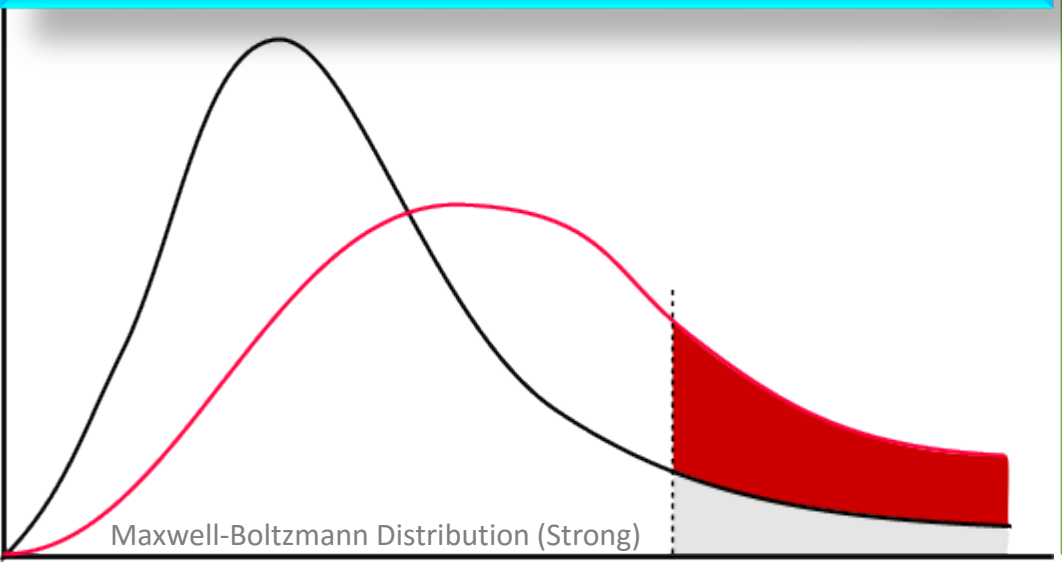




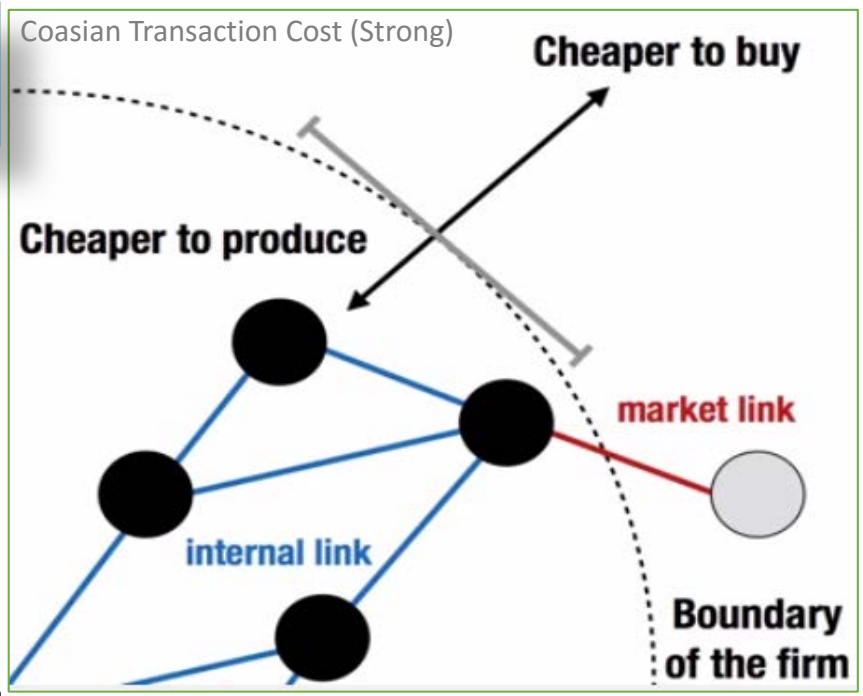


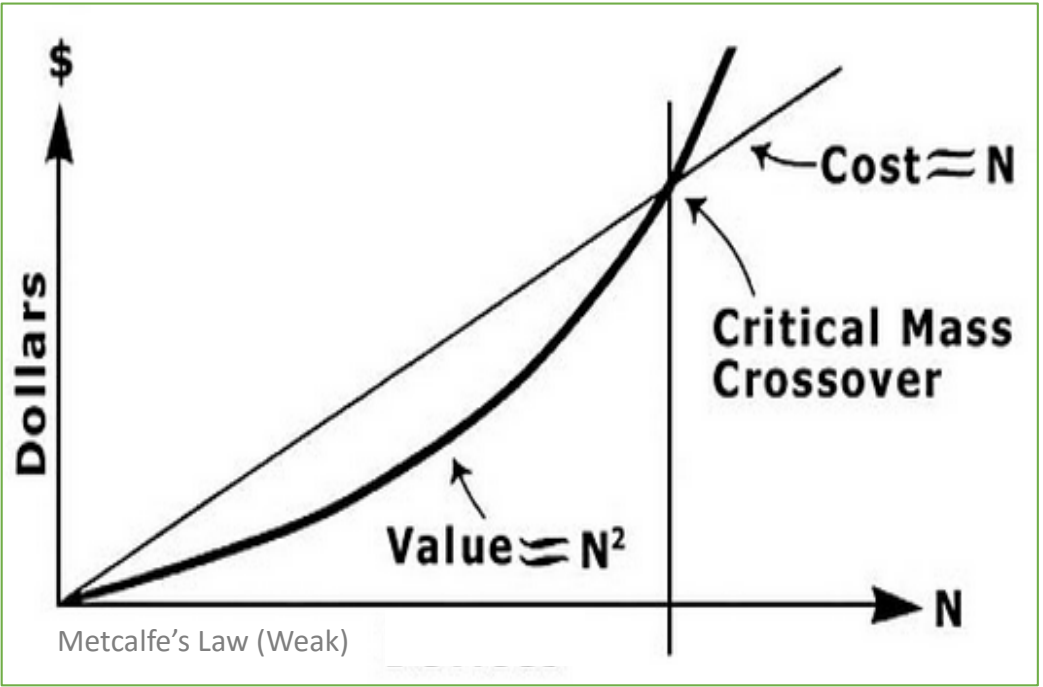
Granovetterian Embeddedness and Fukuyaman Trust (Long Range)

Four Ideas for Business Strategy?

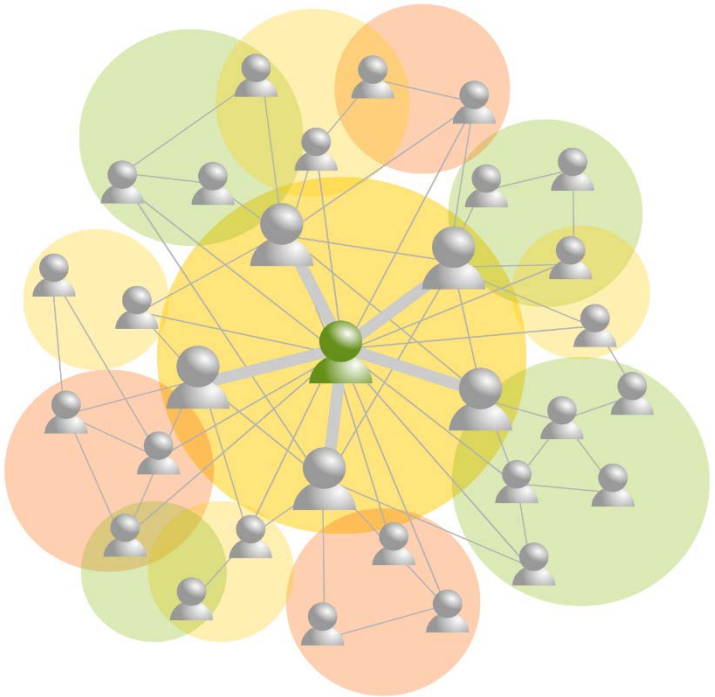


Maxwell-Boltzmann Distribution (Strong)



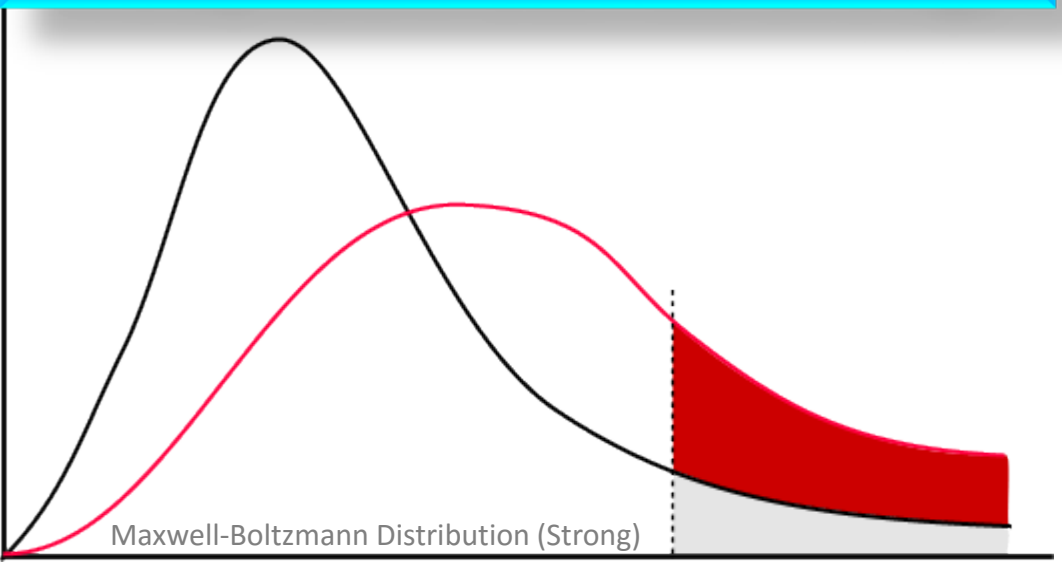


Metcalfe's Law (Weak)

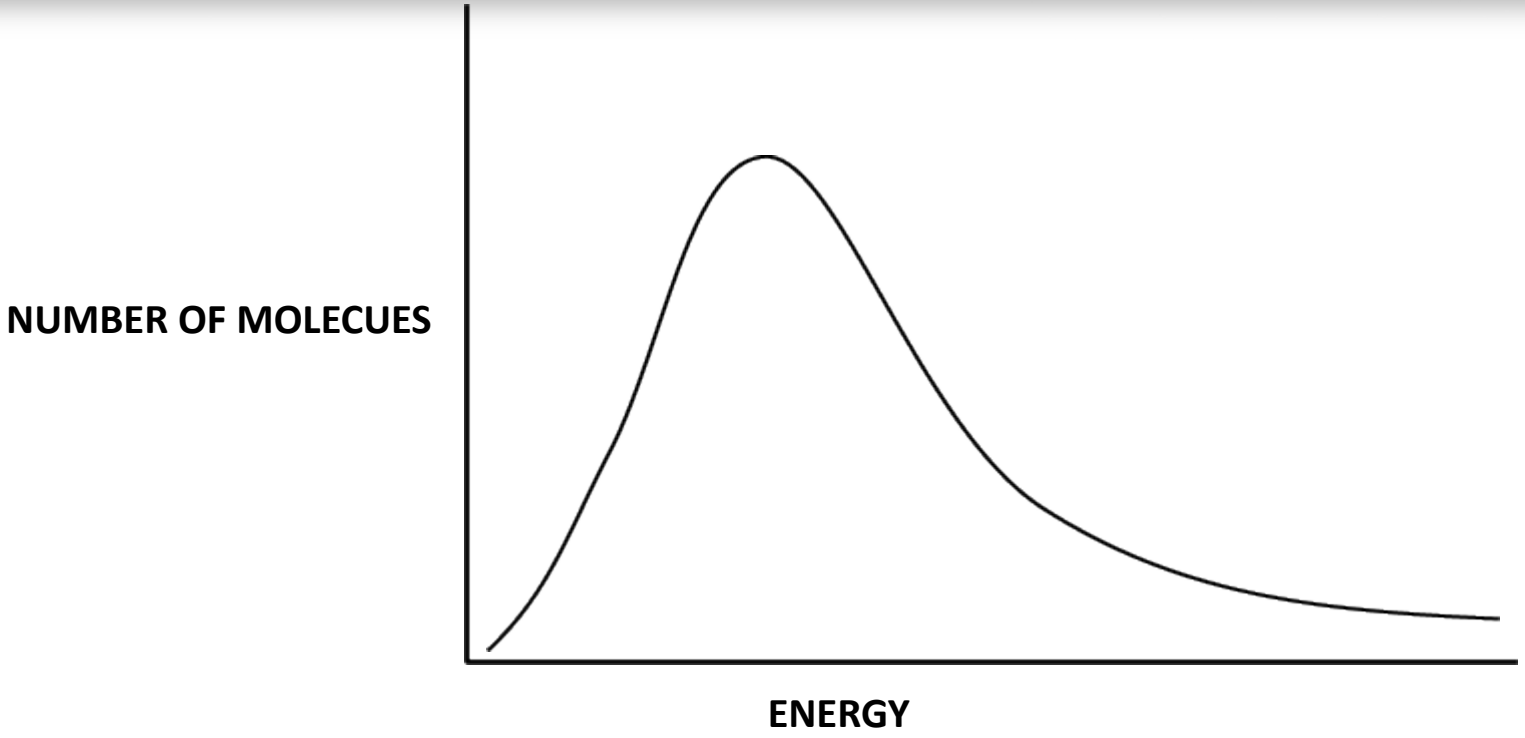


Granovetterian Embeddedness and Fukuyaman Trust (Long Range)

Metaphors in Business Strategy ?

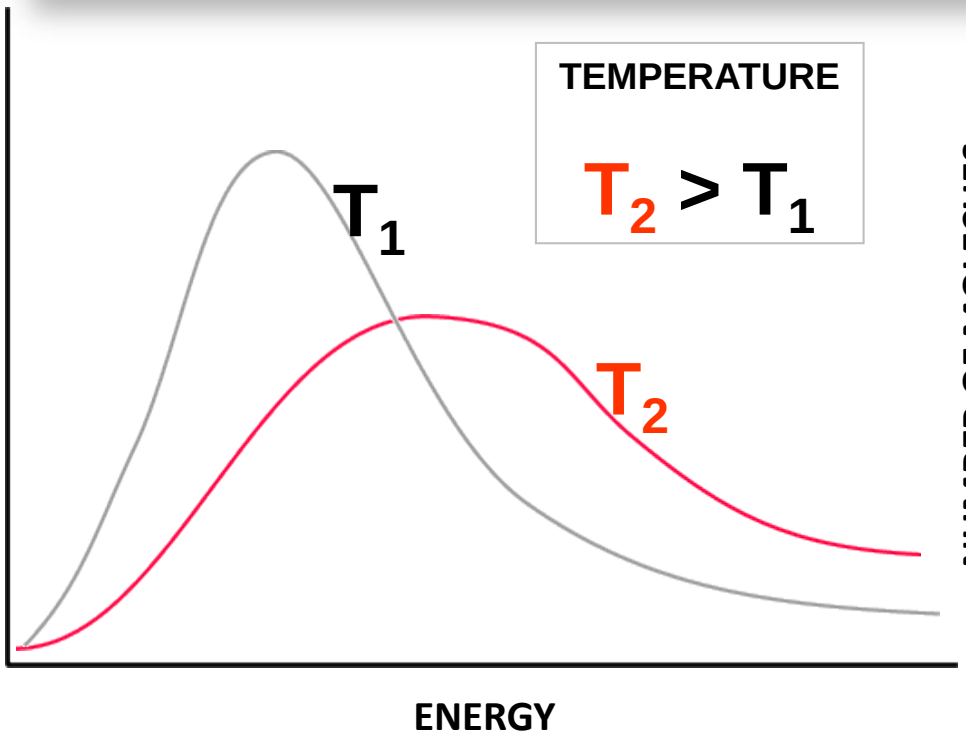


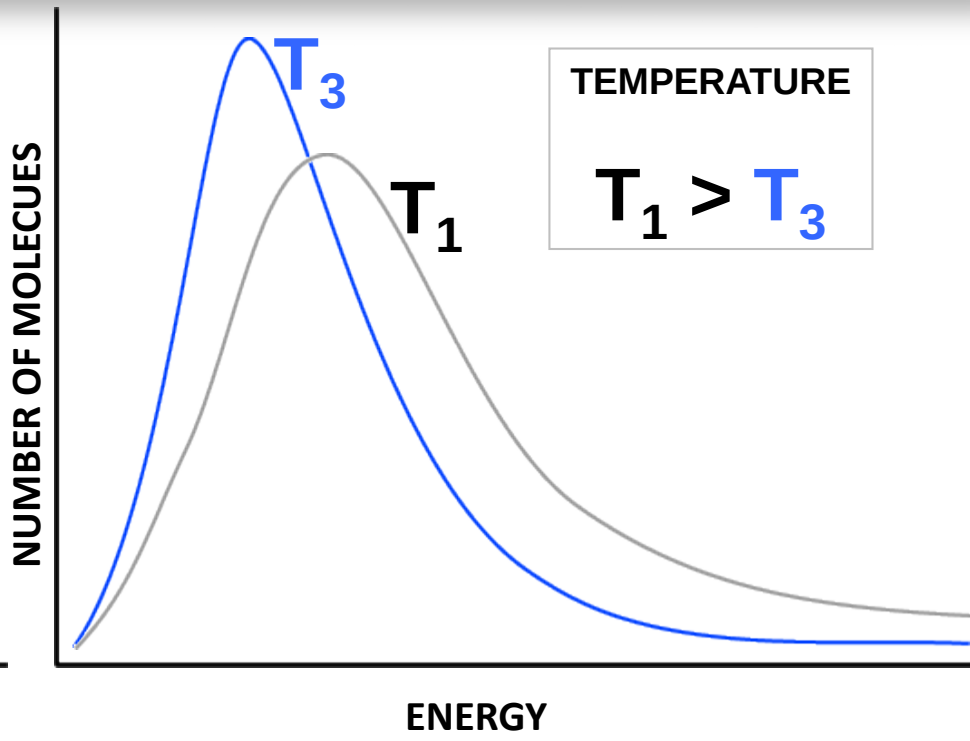
Maxwell-Boltzmann Distribution – Total Energy Under The Curve



Because of the many collisions taking place between gas molecules, there is a spread of molecular energies and velocities (applicable to liquids). Few particles have low energy/velocity, some have high energies/velocities but most are likely to have intermediate velocities, hence a Gaussian distribution of energy. The area under the curve is a measure of the total number of particles/molecules (total amount of energy).

Maxwell-Boltzmann Distribution – Temperature Dependency (Factor)





Increasing the temperature

- shift to higher energies/velocities
- curve gets broader and flatter

due to greater spread of values

- area under the curve stays constant,

corresponds to total number of particles

Decreasing the temperature

- shifts to lower energies/velocities
- curve gets narrower and pointed

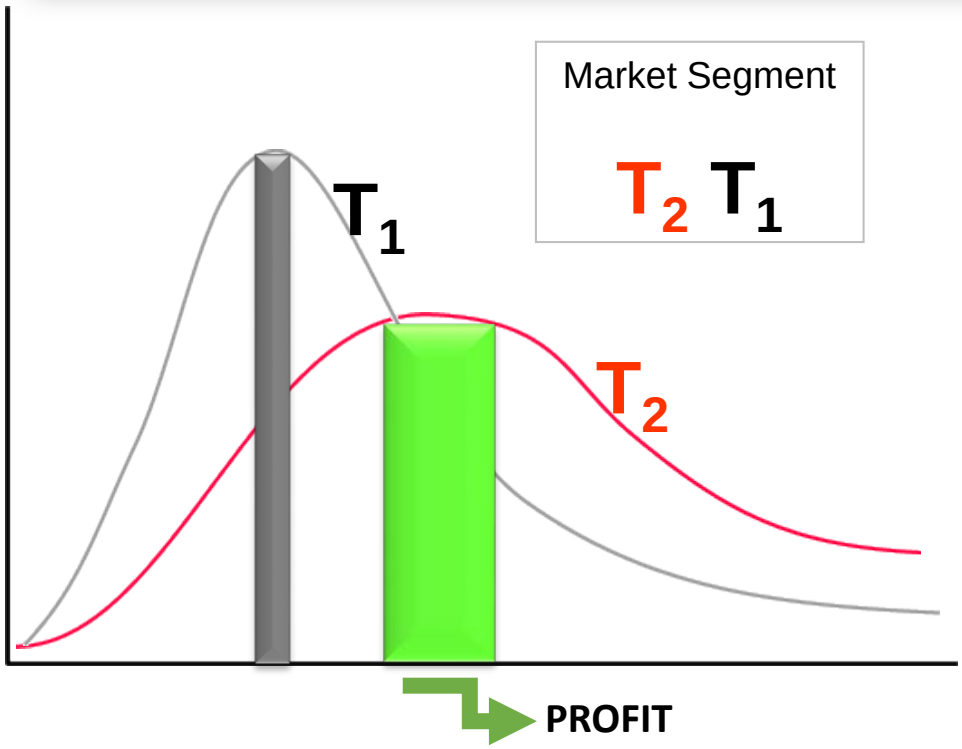
due to smaller spread of values

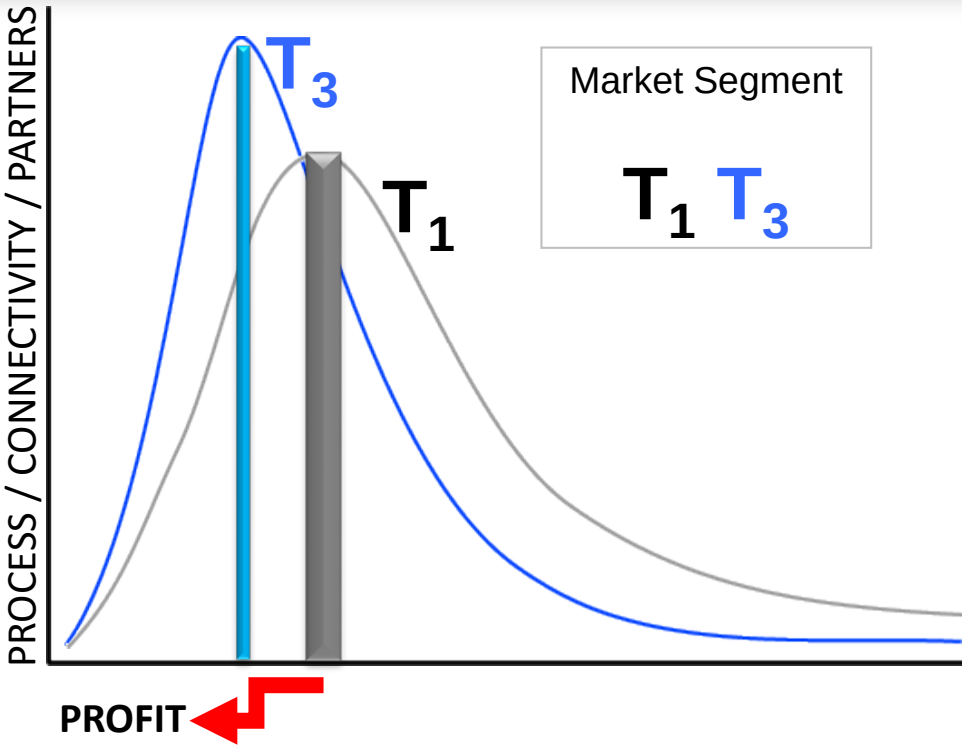
- area under the curve stays constant,

corresponds to total number of particles

http://slideplayer.com/slide/4137679/ • www.gresham.ac.uk/lecture/transcript/download/james-clerk-maxwell/

In Business – What could be strategic metaphors for temperature?





Increasing ? profit base $\sum T_2$

- your share of profit increases?
- curve gets broader and flatter

due to what – lower average margin?

- area under the curve stays constant,

corresponds to total money flow (y-axis)

- area under green bar vs short thick tail

Decreasing ? profit base $\sum T_3$

- your share of profit decreases?
- curve gets narrower and pointed

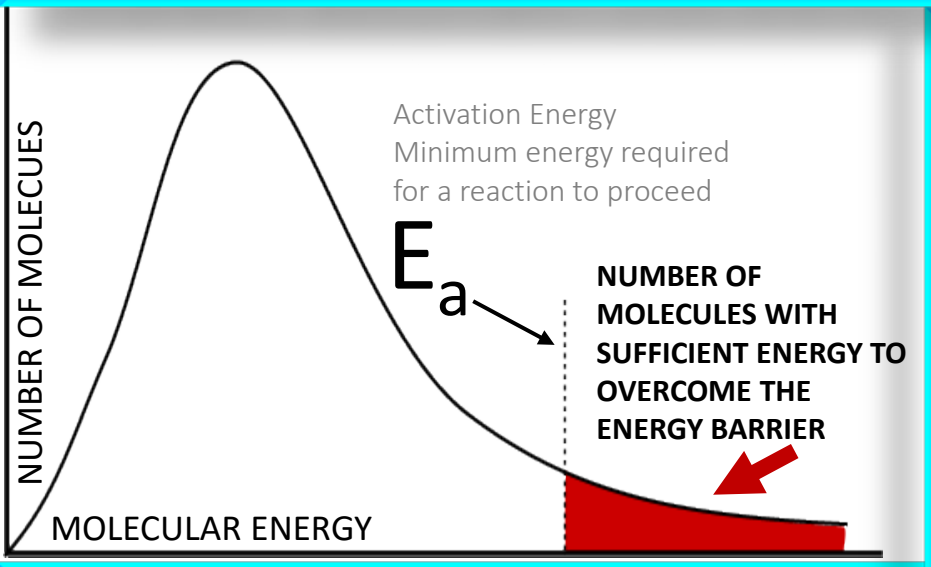
due to what – higher average margin?

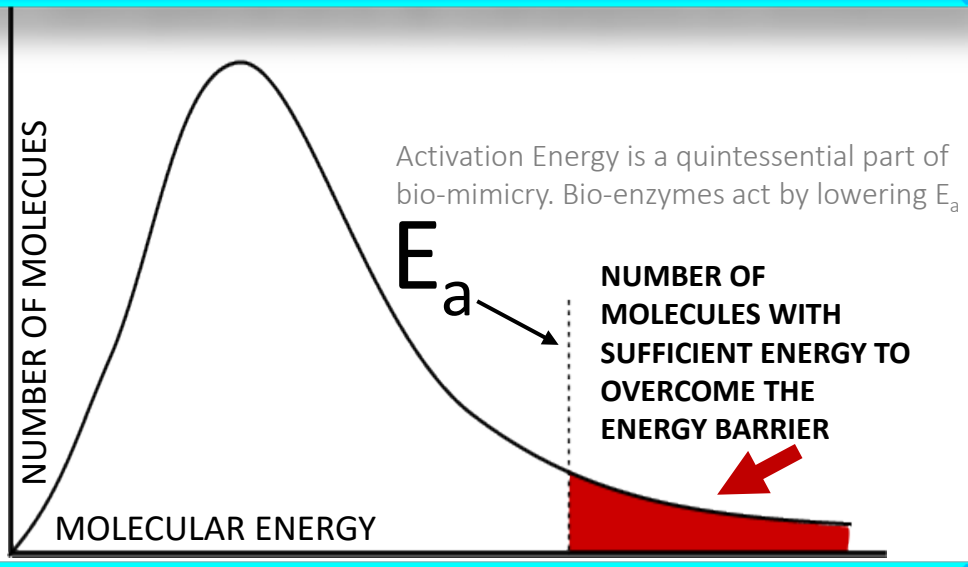
- area under the curve stays constant,

corresponds to total money flow (y-axis)

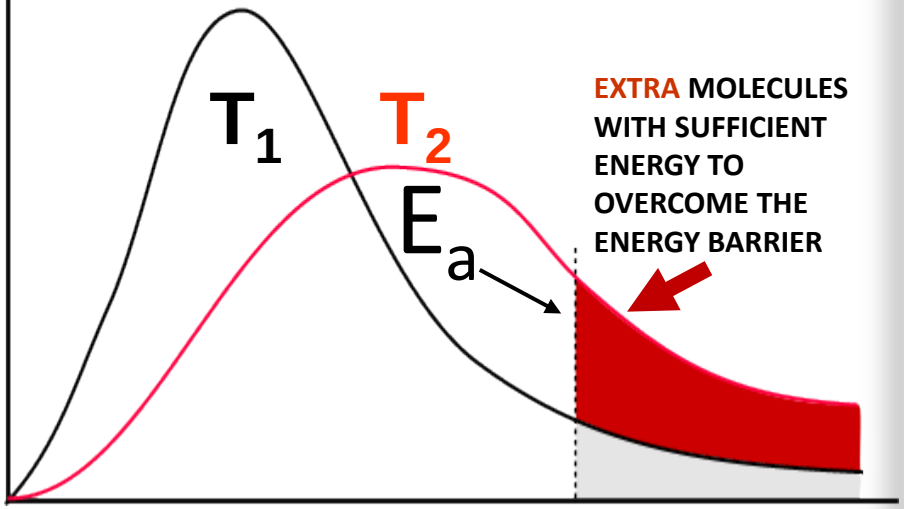
- area under blue bar vs long thin tail

Maxwell-Boltzmann Distribution – Temperature & Catalysis in Kinetics

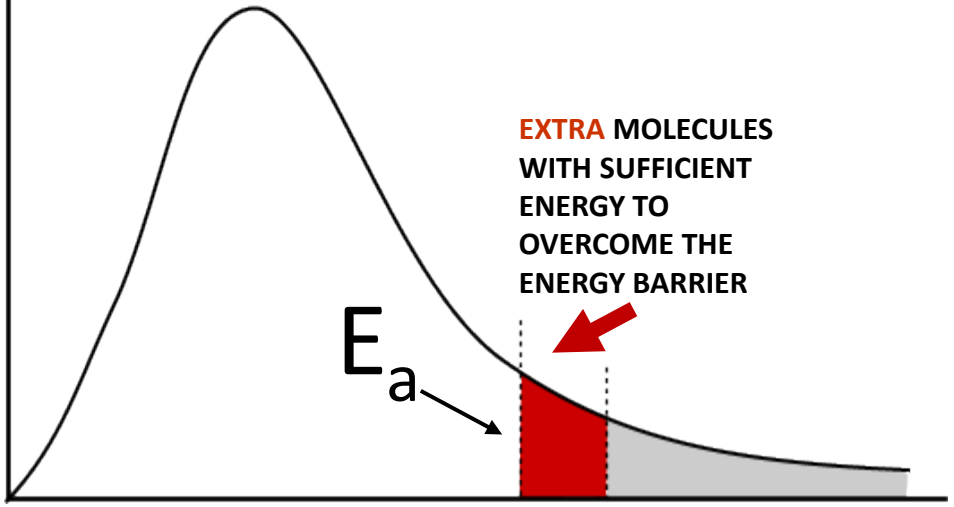




INCREASE TEMPERATURE ▪ $T_2 > T_1$



CATALYSTS Lower Activation Energy ➲ E_a



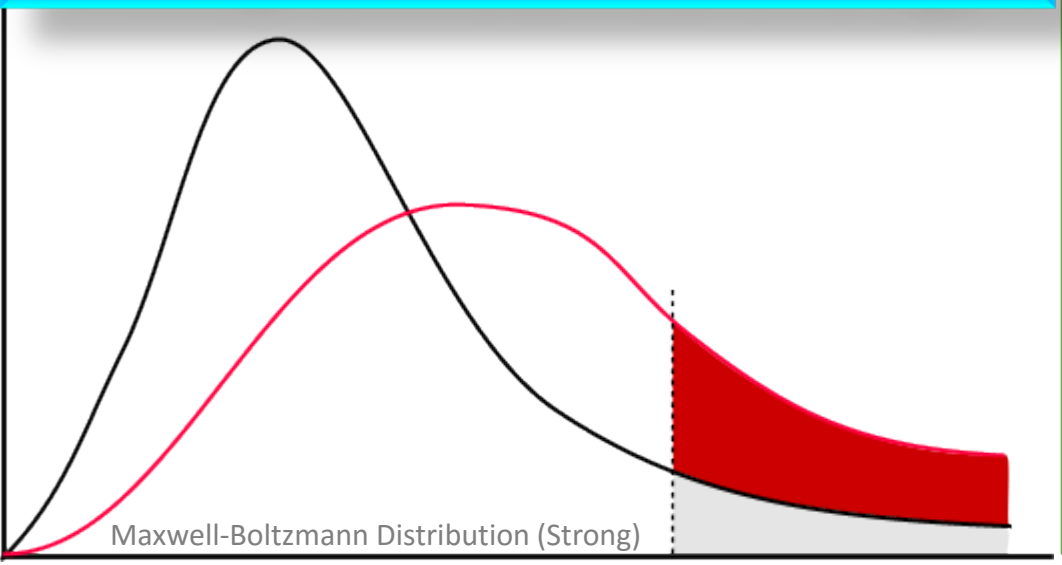
Modifying temperature or adding a catalyst increases the number of molecules with sufficient energy to react but the total number of molecules and the total energy under the curve remains unchanged.

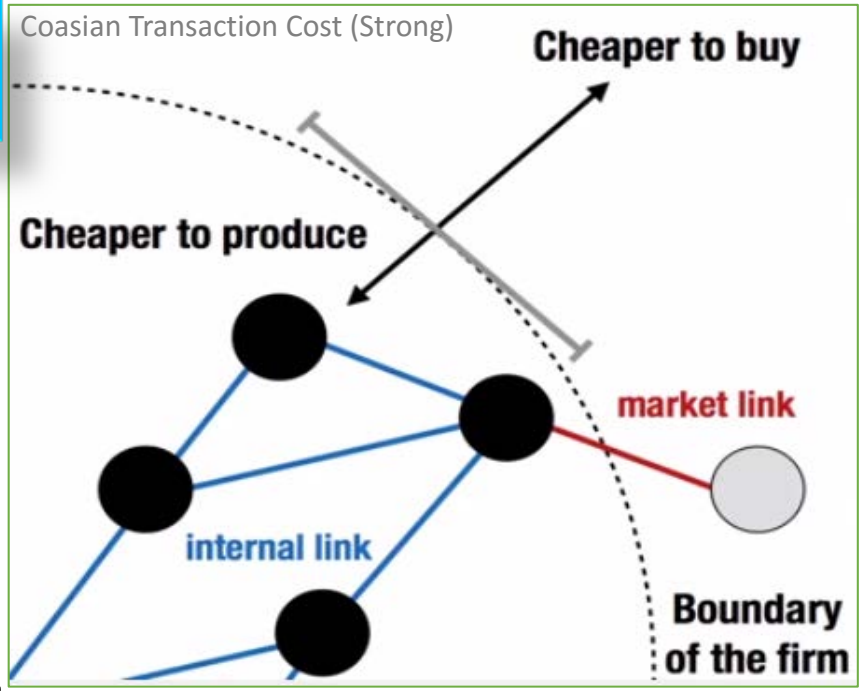
In Business – Kinetics is Key (Rate and Flow)

- **Rate and flow are the basis of most equations**
- **Rate and flow modifies rates of reaction kinetics**
- **Transform the concept of kinetics to metaphorically match business drivers, parameters, dependencies**
- **Map equivalence relationships (design metaphors)**
  - increasing the rate of reaction kinetics maps to finding strategies to increase profit margin or percentage of profit
  - lowering rate of reaction may map to lowering barriers to market entry by adding a "catalyst" to lower activation energy
  - Business catalysts – partnerships (ecosystem) to gain market share or offer better quality of service or use of platforms or adopting/sponsoring/creating standard(s).

Map business factors to parameters in natural laws and then mimic the natural law processes and procedures in business strategy. Natural laws are time-tested through planetary evolution.

Principles in Business Strategy ?



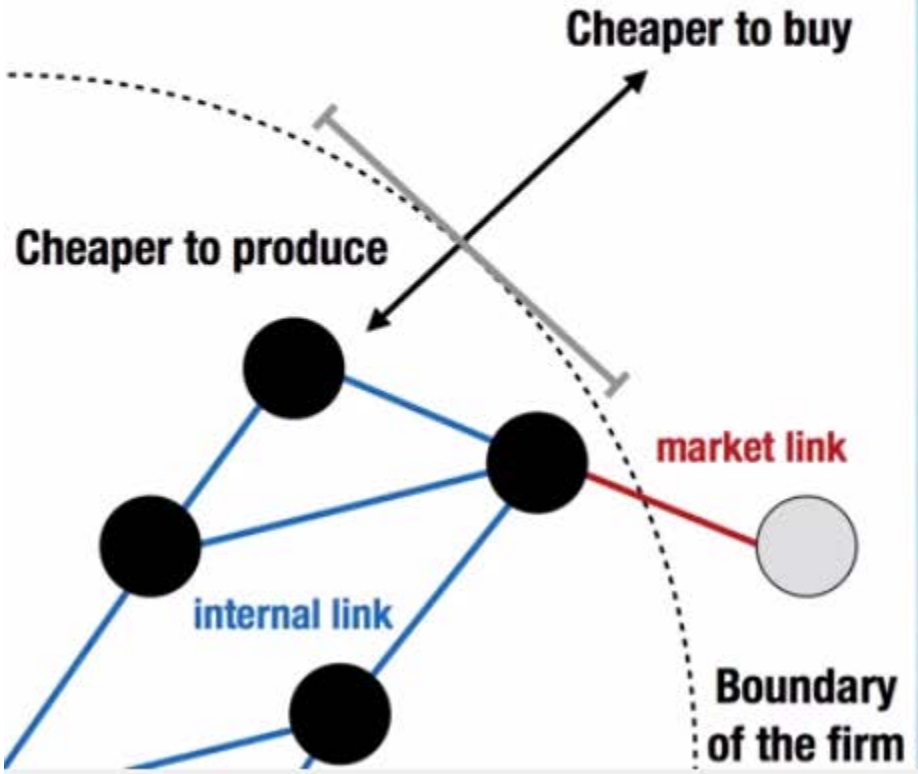


Who makes products? The Nature of the Firm

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

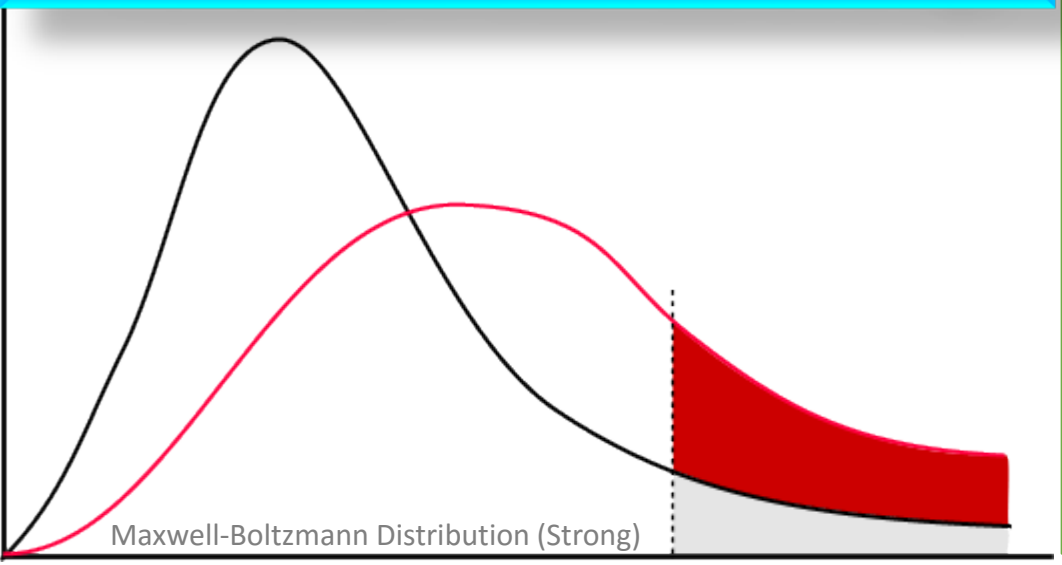
(1910-2013 - Nobel Prize 1991)

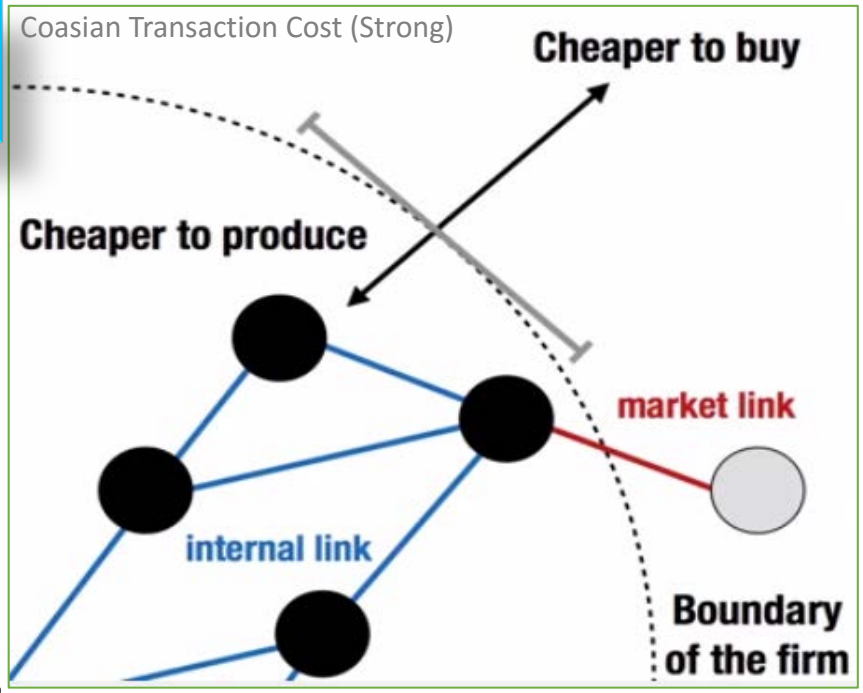


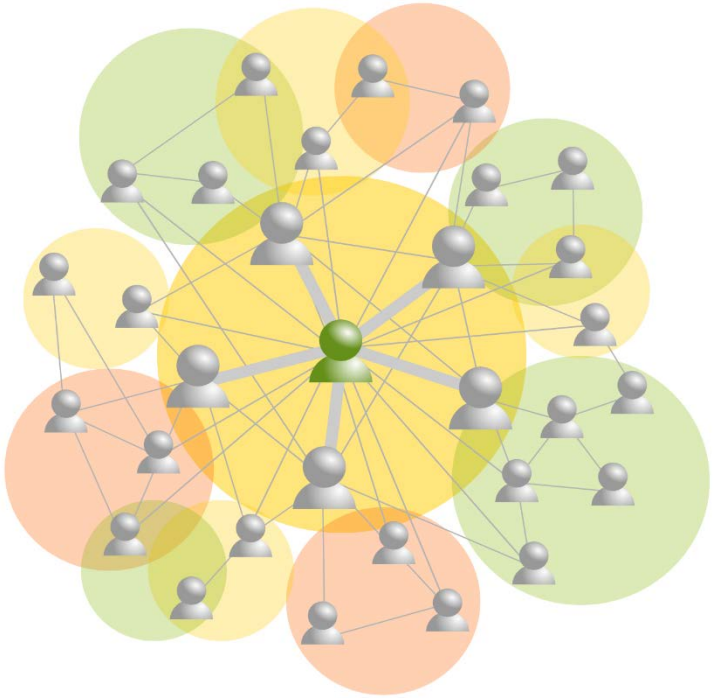
NETWORKS

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

Networks in Business Strategy







Granovetterian Embeddedness and Fukuyaman Trust (Long Range)

Dynamic Distribution of Weighted Relations

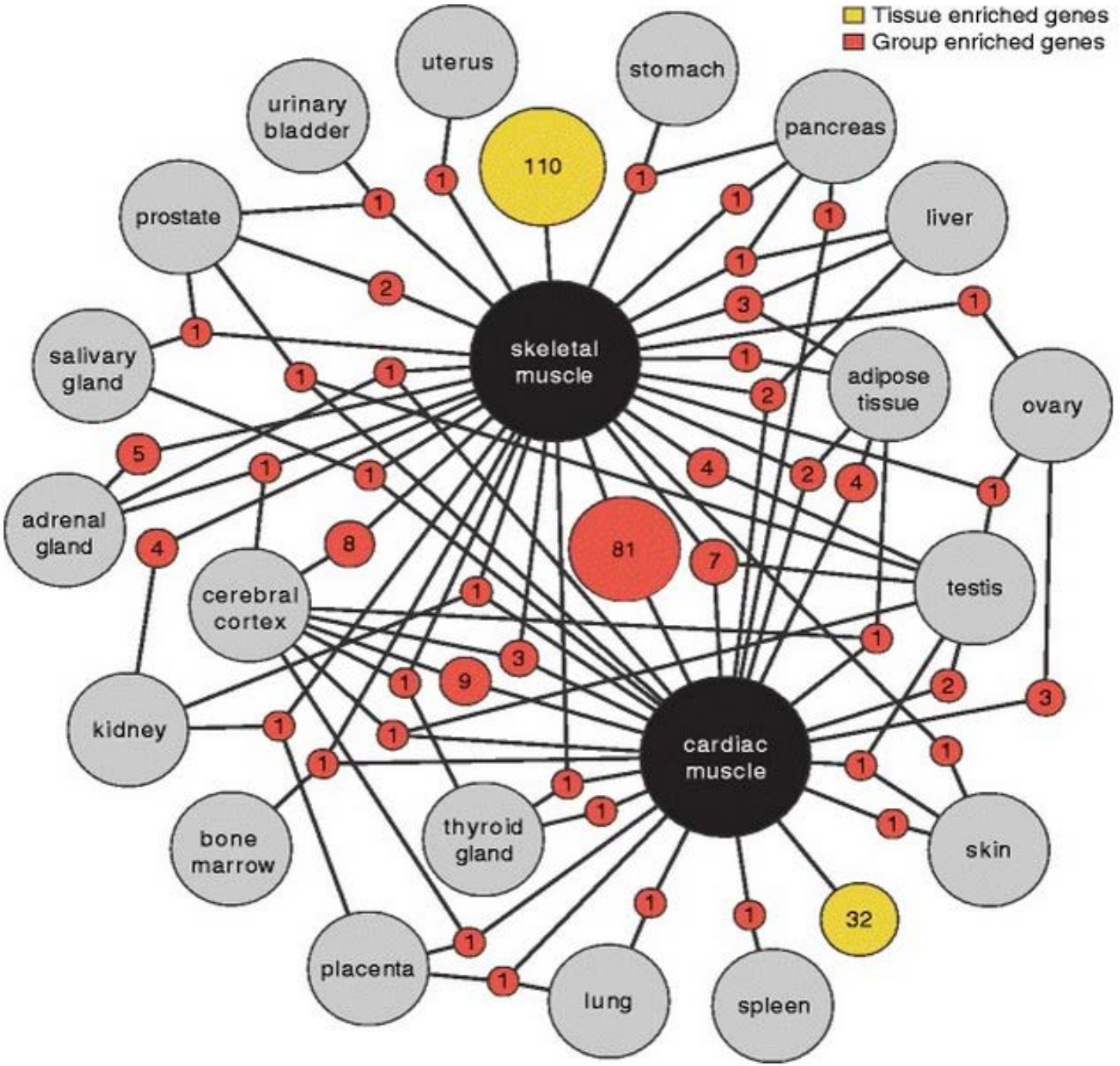
between

Networks

Ecosystems

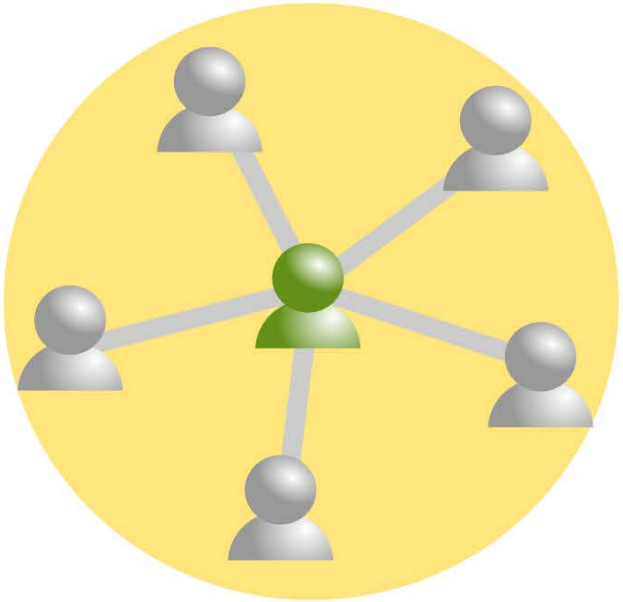
and

System of Systems

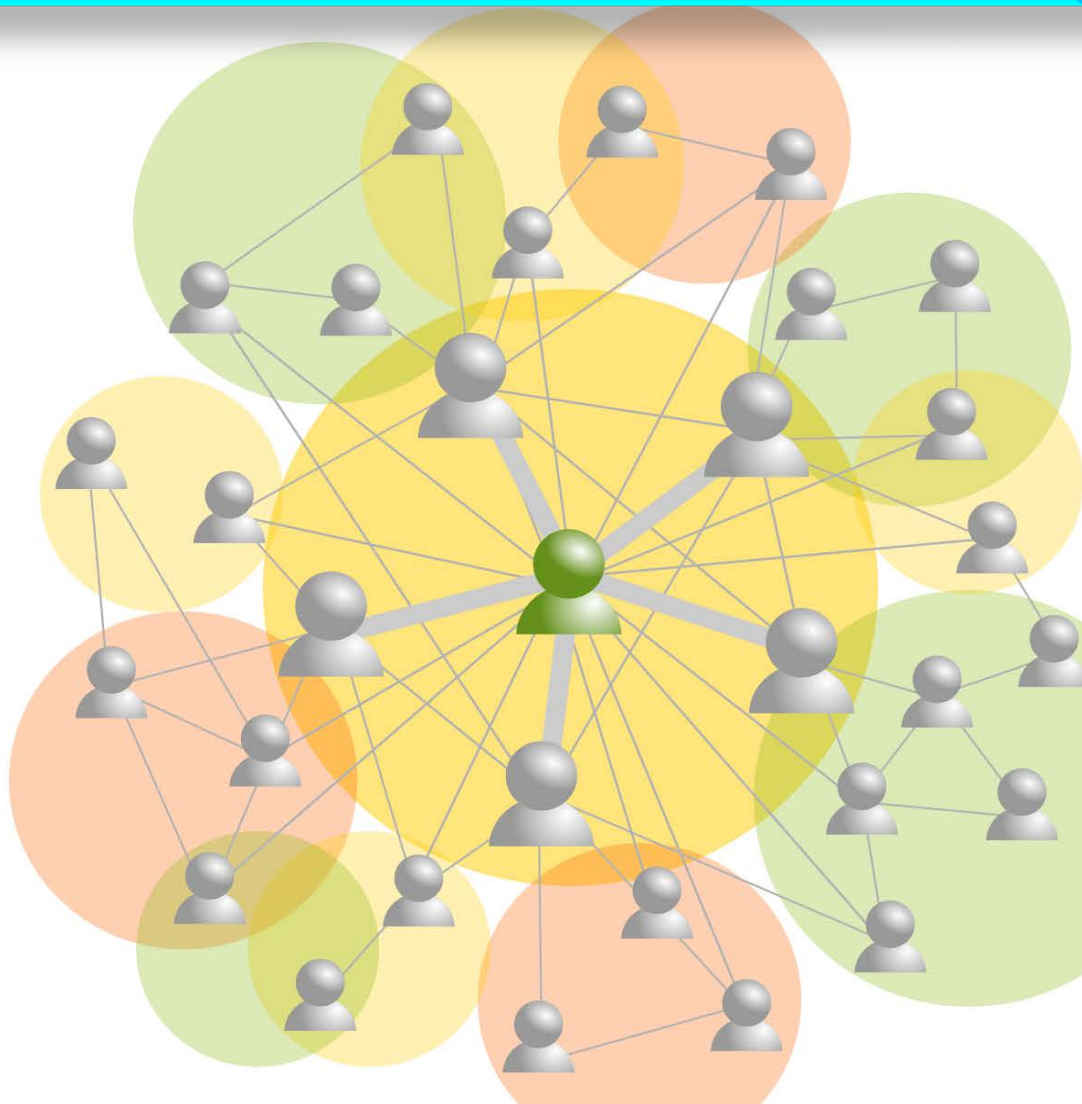



MARK GRANOVETTER

Strength of Weak Ties

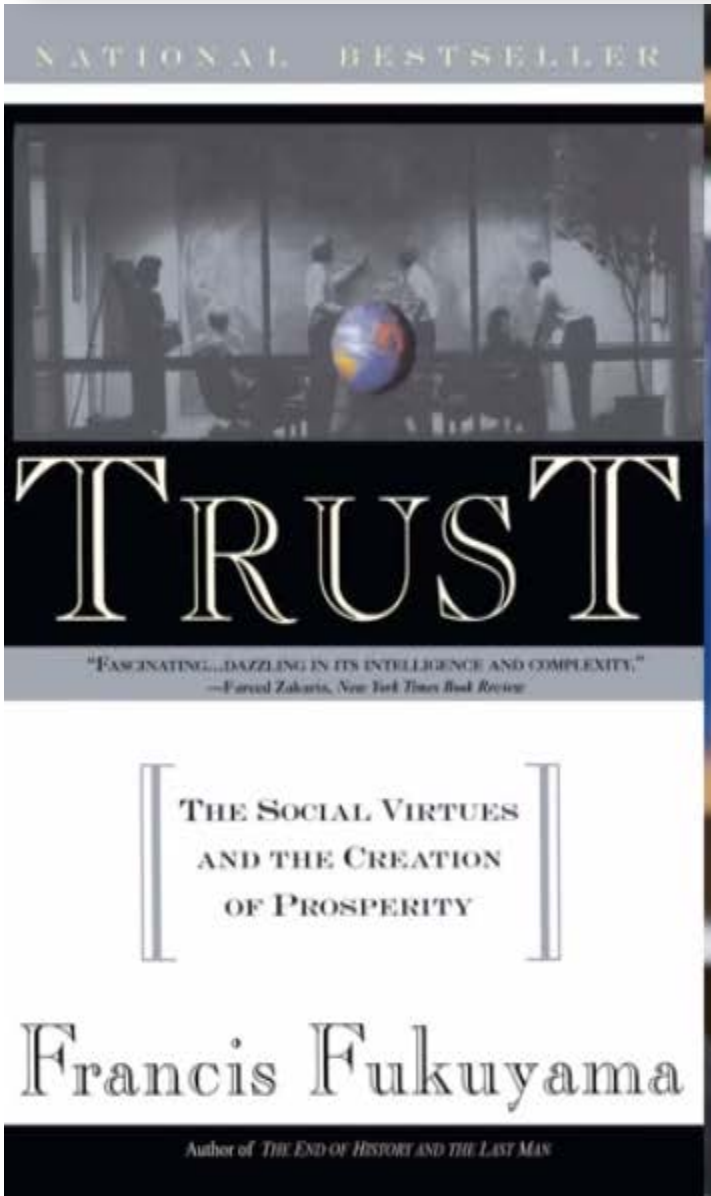


Strong Ties

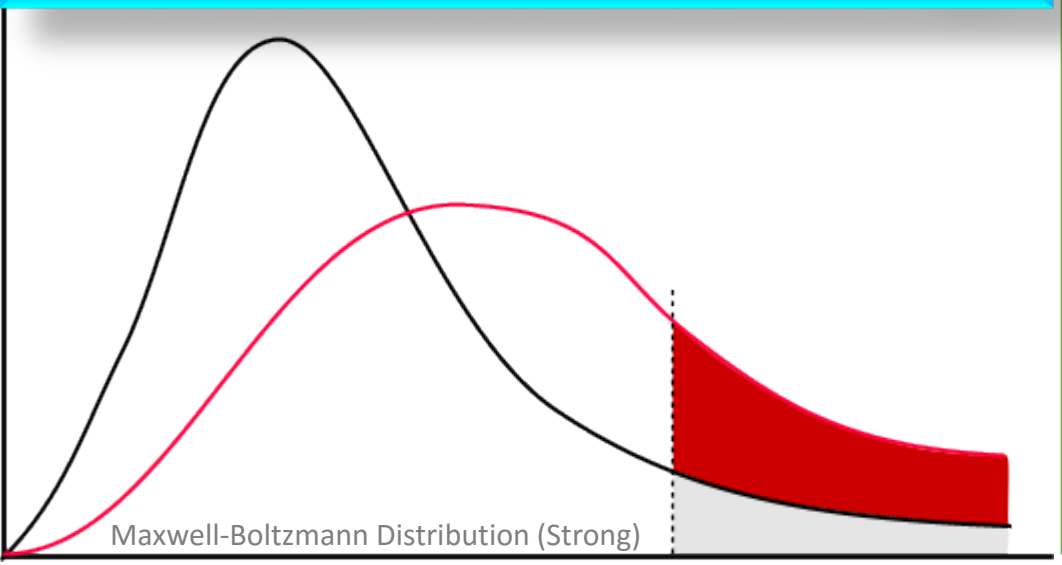


http://bit.ly/MARK-GRANOVETTER

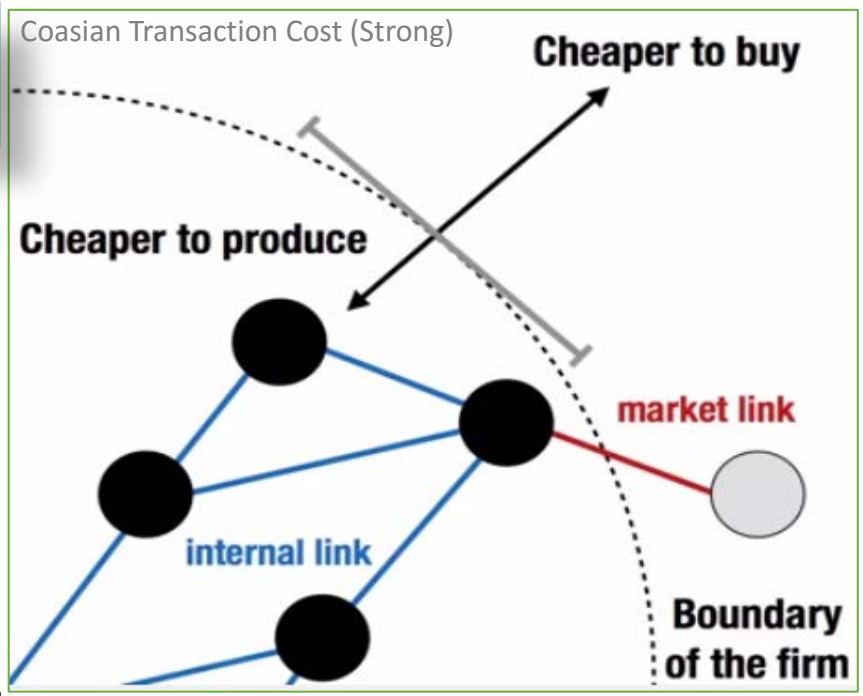
Trust in Networks – Evolution of Cybersecurity?

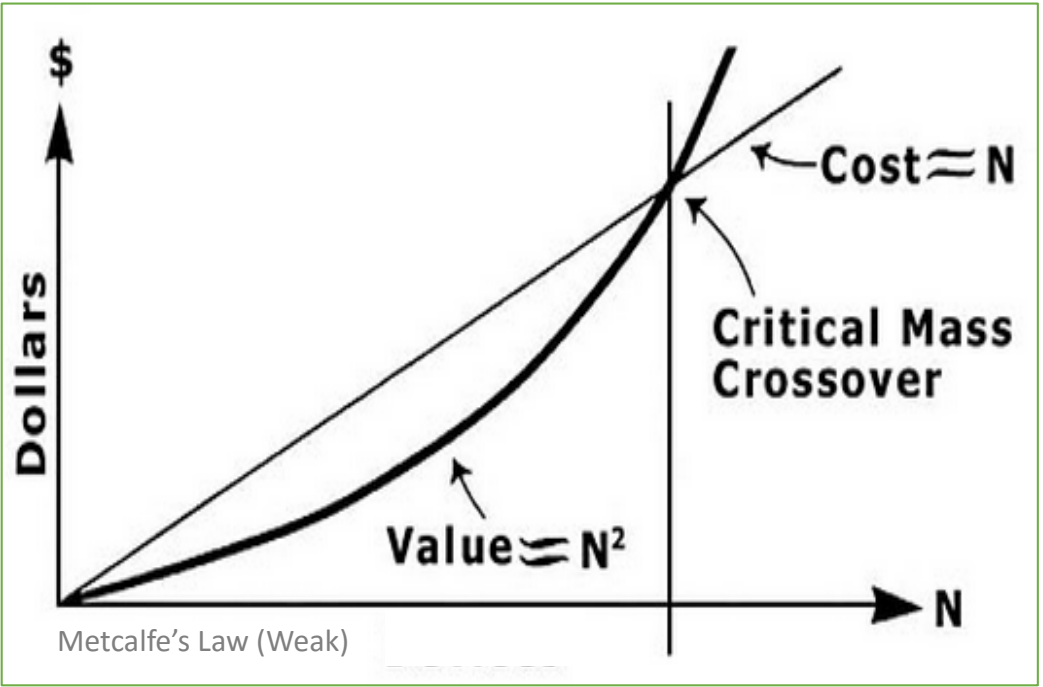


Four Ideas for Business Strategy?

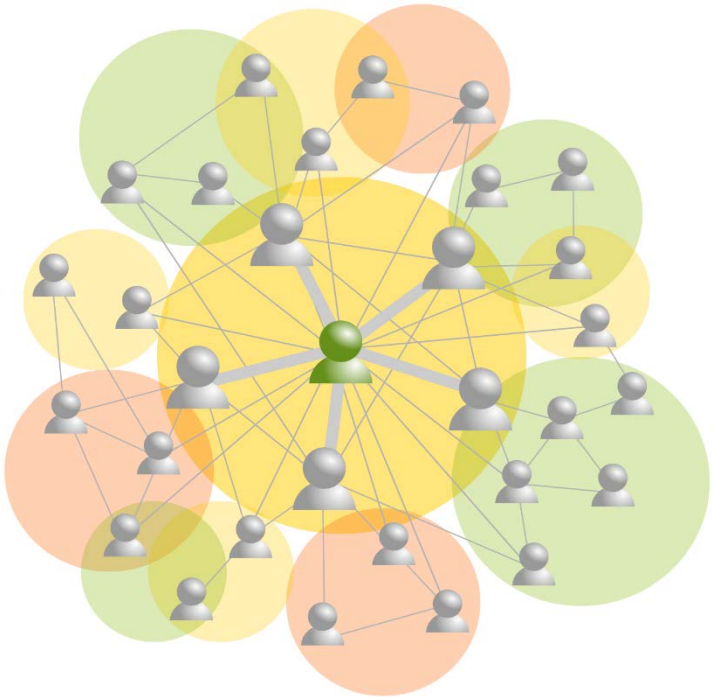


Maxwell-Boltzmann Distribution (Strong)



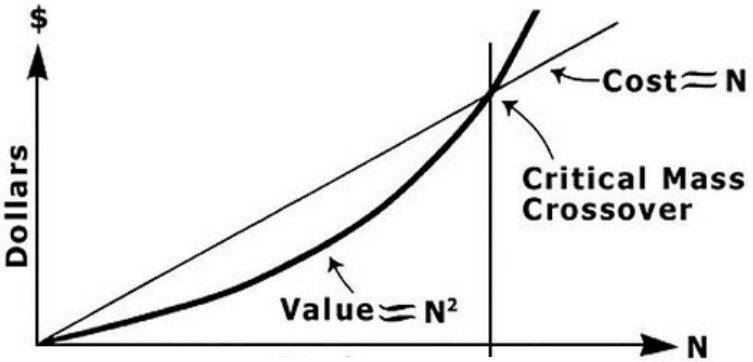


Metcalfe's Law (Weak)



Granovetterian Embeddedness and Fukuyaman Trust (Long Range)

The Systemic Value of Compatibly Communicating Devices Grows as the Square of Their Number:



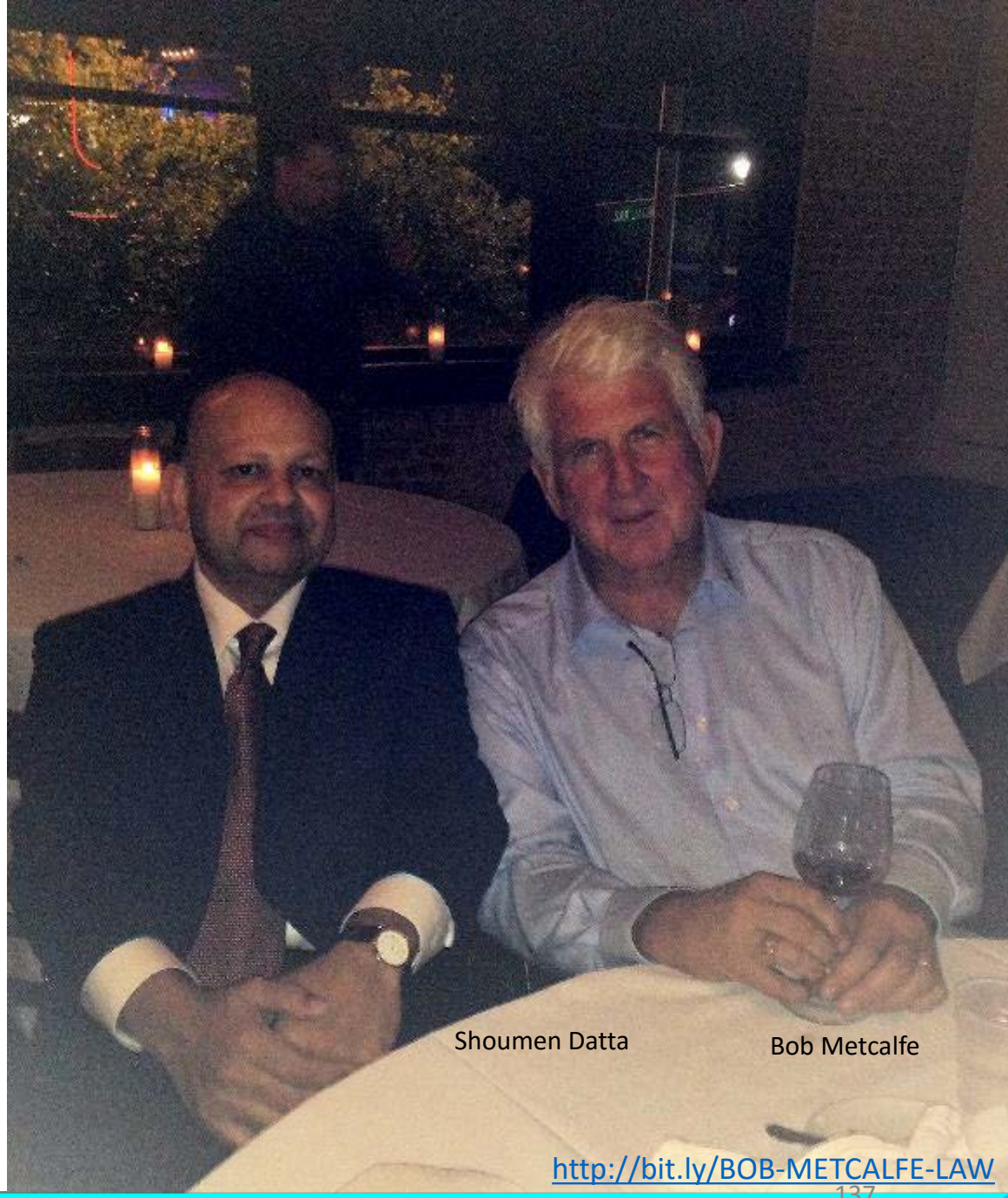
Local Area Networks

Networks / not Devices

The unit of measurement along the X-axis is "compatibly communicating devices", not users. The credit for the "users" formulation goes to George Gilder who wrote about Metcalfe's Law in Forbes ASAP on September 13, 1993. However, Gilder's article talks about machines and not users. Anyway, both the "users" and "machines" formulations miss the subtlety imposed by the "compatibly communicating" qualifier, which is the key to understanding the concept.

Bob, who invented Ethernet, was addressing small LANs where machines are visible to one another and share services such as discovery, email, etc. He recalls that his goal was to have companies install networks with at least three nodes. Now, that's a far cry from the Internet, which is huge, where most machines cannot see one another and/or have nothing to communicate about... So, if you're talking about a smallish network where indeed nodes are "compatibly communicating", I'd argue that the original suggestion holds pretty well.

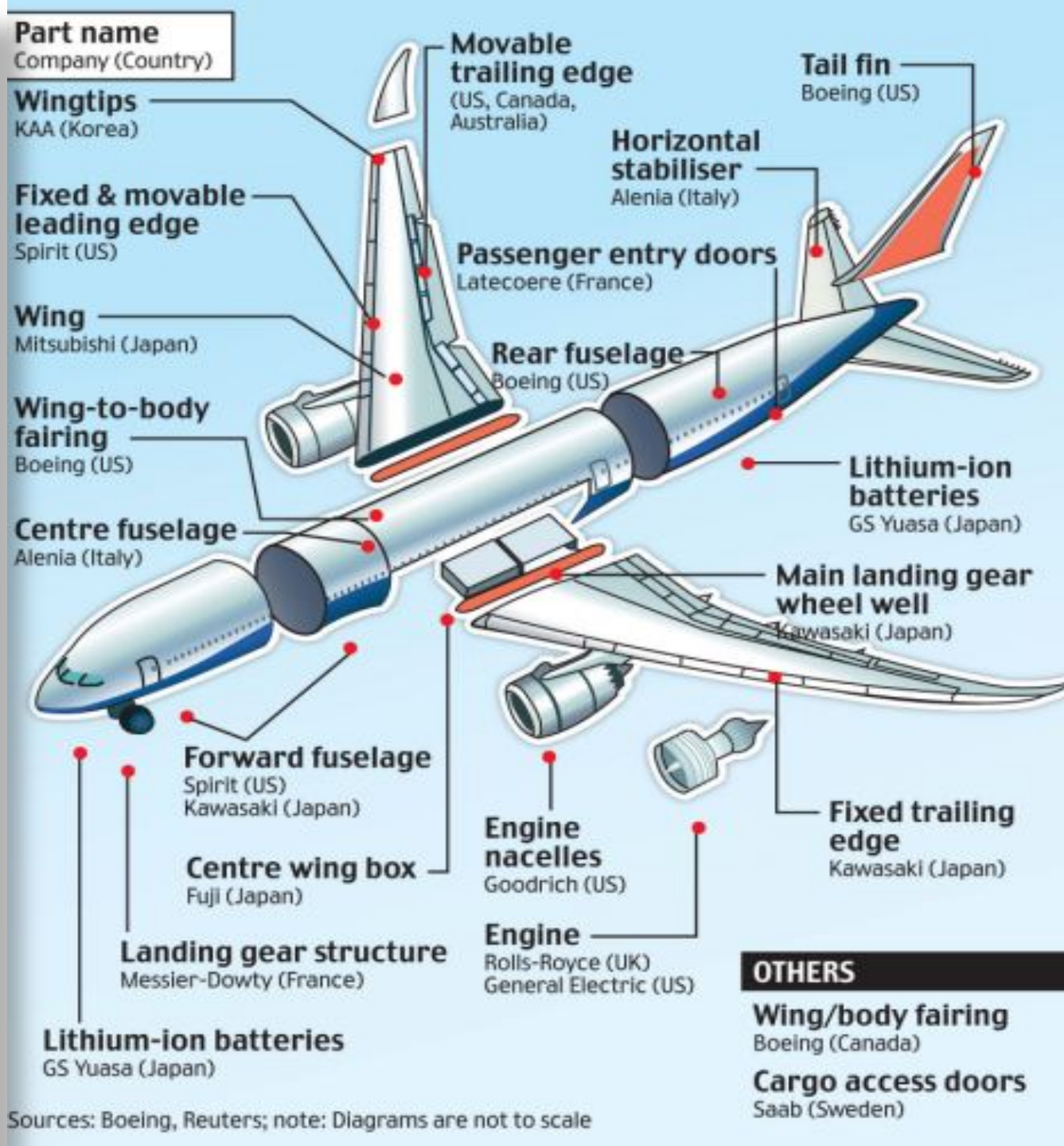
The authors of the IEEE article take the "users" formulation and suggest that the value of a network should grow on the order of O(nlogn) as opposed to $O(n^2)$. Are they correct? It depends. Is their proposal a meaningful improvement on the original idea? No.



http://bit.ly/BOB-METCALFE-LAW

Robert Melancton 'Bob' Metcalfe (Apr 7, 1946) co-invented the Ethernet, founded 3Com and formulated the Metcalfe's Law

SUPPLIER NETWORKS



We must communicate and converge – PLATFORMS

Tools for information arbitrage and interoperability

natural language, syntax and semantics

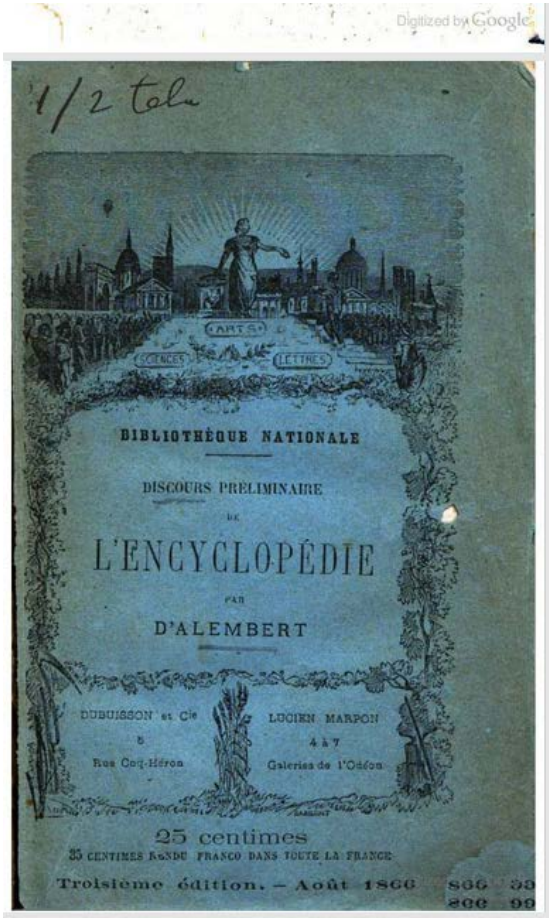
The Department of History

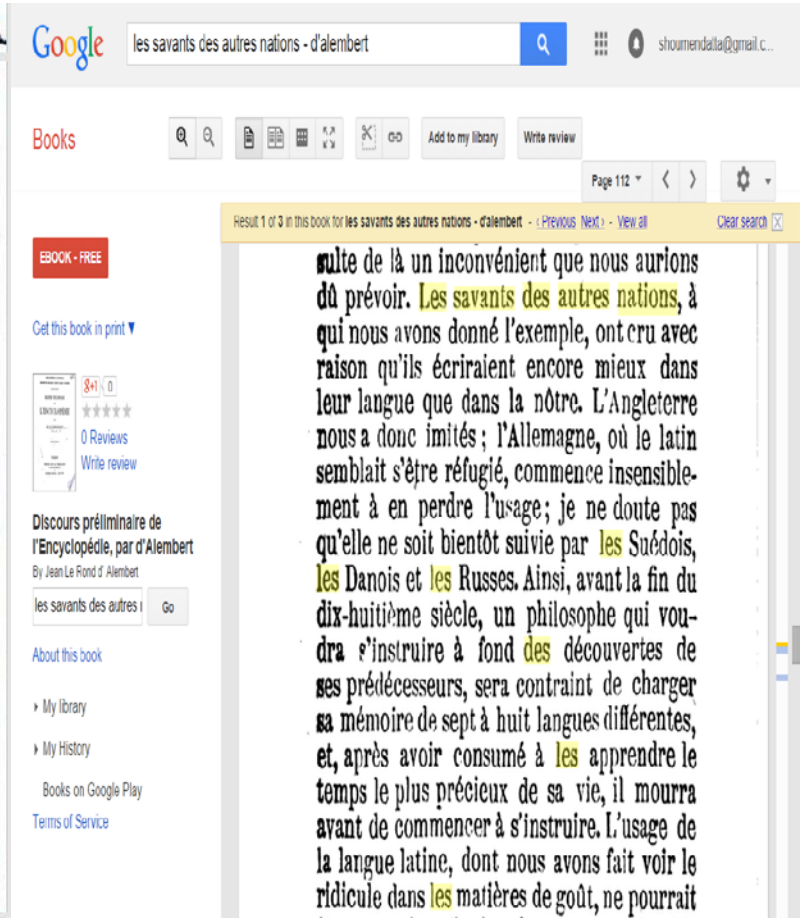
MICHAEL D. GORDIN

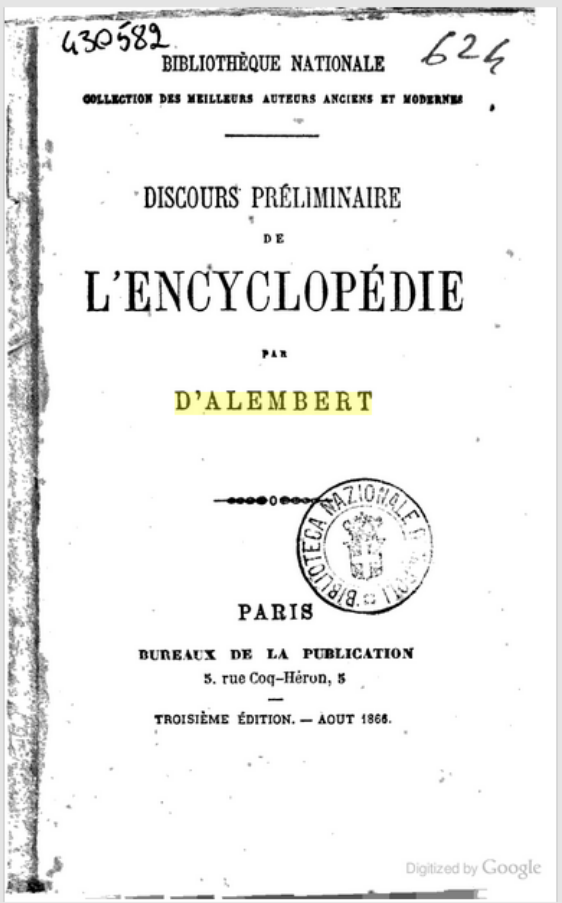
424 pages | 9 halftones | 6 x 9 | © 2015

English is the language of science today. No matter which languages you know, if you want your work seen, studied, and cited, you need to publish in English. But that hasn't always been the case. Though there was a time when Latin dominated the field, for centuries science has been a polyglot enterprise, conducted in a number of languages whose importance waxed and waned over time—until the rise of English in the twentieth century.

Discours preliminaire de l'Encyclopedie par Jean le Rond D'Alembert (1866)



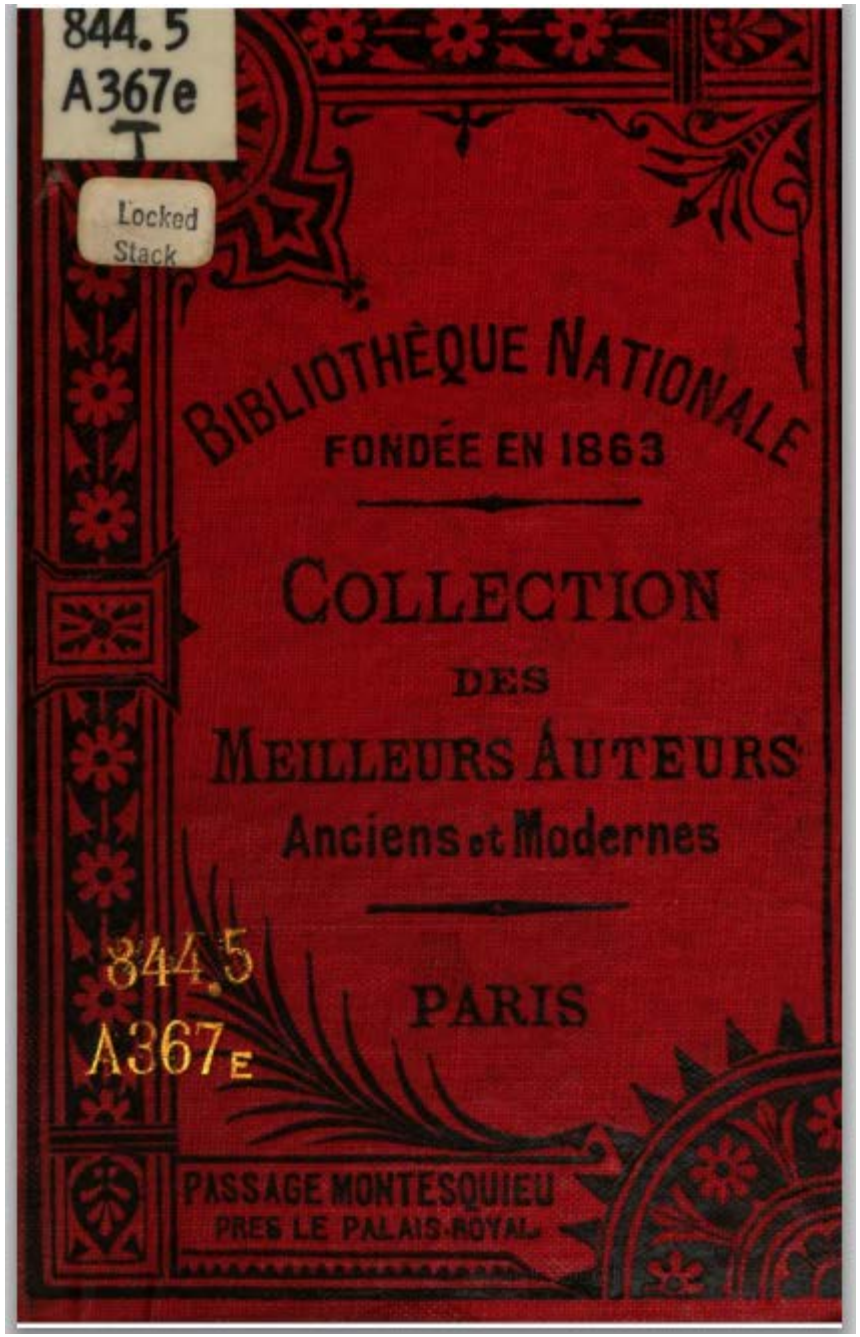




Les savants des autres nations, à qui nous avons donné l'exemple, ont cru avec raison qu'ils écriraient encore mieux dans leur langue que dans la nôtre. L'Angleterre nous a donc imités ; l'Allemagne, où le latin semblait s'être réfugié, commence insensiblement à en perdre l'usage ; je ne doute pas qu'elle ne soit bientôt suivie par les Suédois, les Danois et les Russes. Ainsi, avant la fin du dix-huitième siècle, un philosophe qui voudra s'instruire à fond des découvertes de ses prédécesseurs, sera contraint de charger sa mémoire de sept à huit langues différentes, et, après avoir consumé à les apprendre le temps le plus précieux de sa vie, il mourra avant de commencer à s'instruire.

Jean le Rond D'Alembert
1866

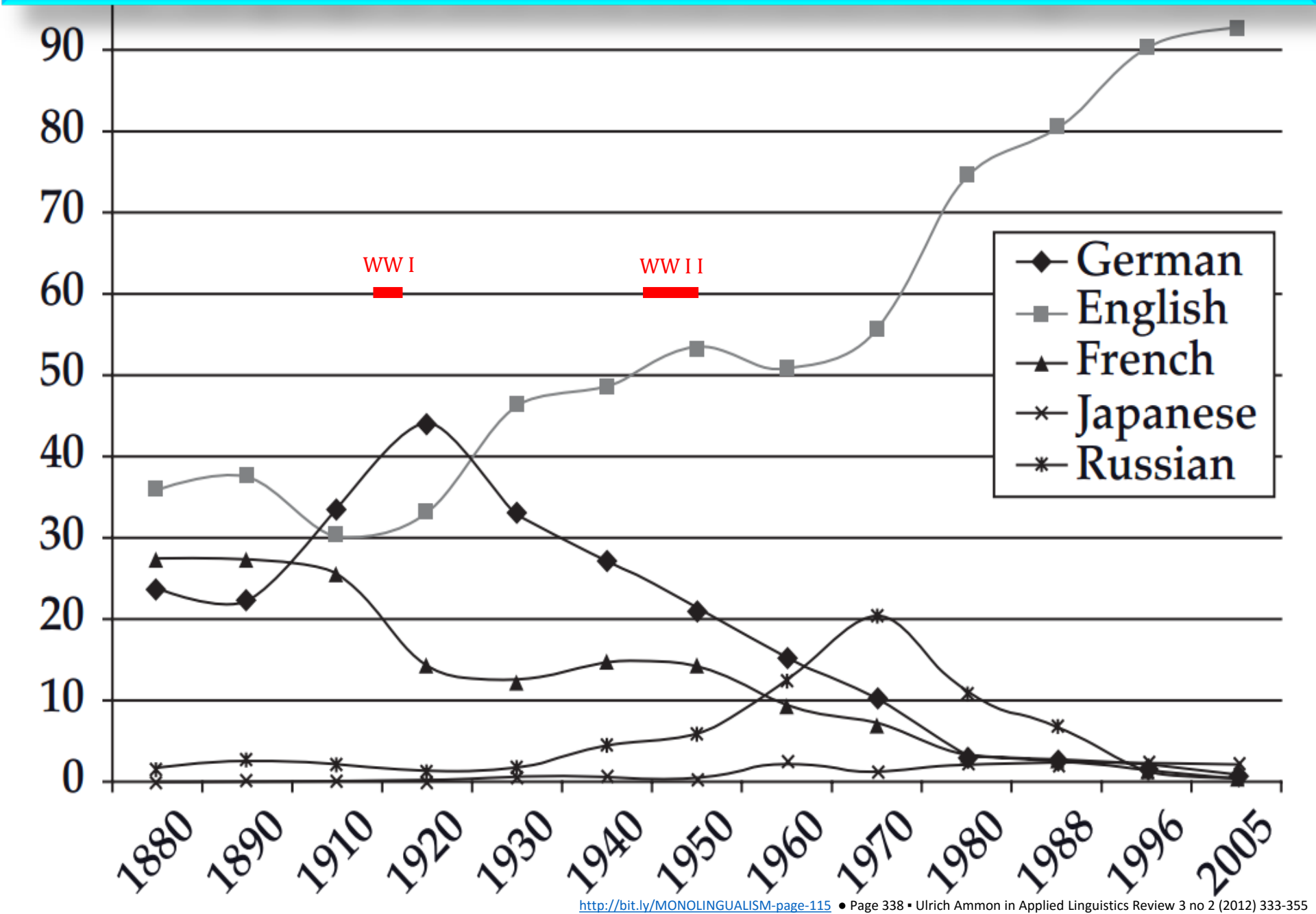
Scientific Babel by Michael D. Gordin (2015)



The scholars of other nations, to whom we have provided an example, believed with reason that they would write even better in their language than in ours. England has thus imitated us; Germany, where Latin seems to have taken refuge, begins insensibly to lose the use of it: I do not doubt that it will soon be followed by the Swedes, the Danes and the Russians. Thus, before the end of the 18th century, a philosopher who would like to instruct himself about his predecessor's discoveries will be required to load his memory with 7 to 8 different languages; and after having consumed the most precious time of his life in acquiring them, he will die before having begun to instruct himself.

Jean le Rond D'Alembert (1866)

“The” Language of Scientific Information Arbitrage – Platform



Why you need to collaborate, why you need ecosystems, why you need to be a part of a

PLATFORM

Data, Semantics, Information, Intelligence

Cybersecurity ● Digital Twins ● Digital Diffusion ● Disequilibrium ● Internet of Systems

MIT Auto ID Labs

Intelligence in AI ?

https://dspace.mit.edu/handle/1721.1/104429

Thank you

Dr Shoumen Palit Austin Datta

Research Affiliate, Department of Mechanical Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

http://autoid.mit.edu/iot_research_initiative ● MIT Auto-ID Labs ● http://autoid.mit.edu

Why you need to collaborate, why you need ecosystems, why you need to catalyze

CONVERGENCE

Analytics, Interoperability, Non-obvious Relationships

CONVERGE

CONNECT

Bits

Atoms

Events

Instances

Networks

People

Process

Products

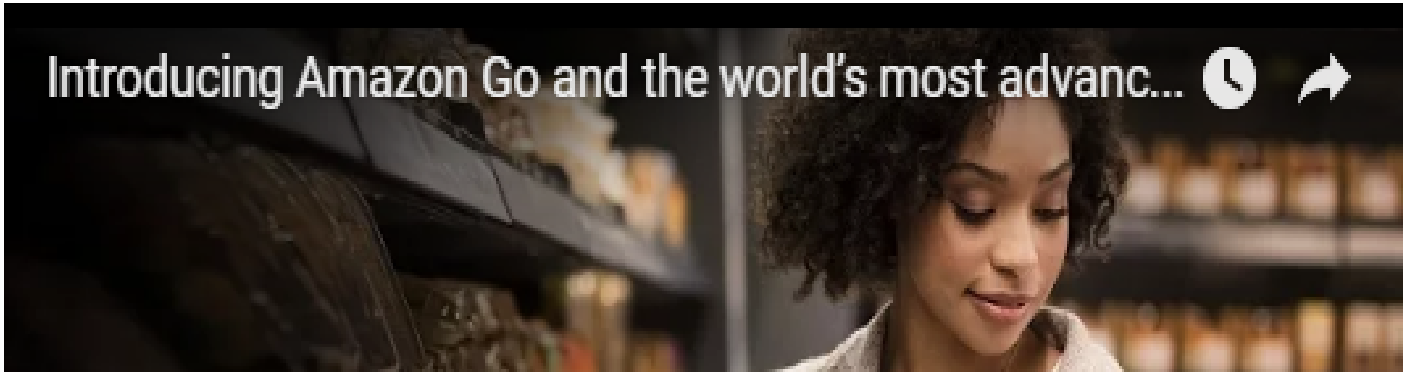
Decisions

Systems

Only Amazon Could Make a Checkout-Free Grocery Store a Reality

DESIGN | GEAR | SCIENCE

That doesn't mean it's vapor, though. In fact, retail tech specialists and computer vision experts agree that Amazon's advertised system is entirely plausible given the state of artificial intelligence, RFID, sensor and machine learning technologies today. No one's put all of the pieces together in the way Amazon appears to have done—but then again, nobody else is Amazon.



Sense of the Future – incomplete but neither uncommon nor disconnected

CONNECT

Bits

Atoms

Events

Instances

Networks

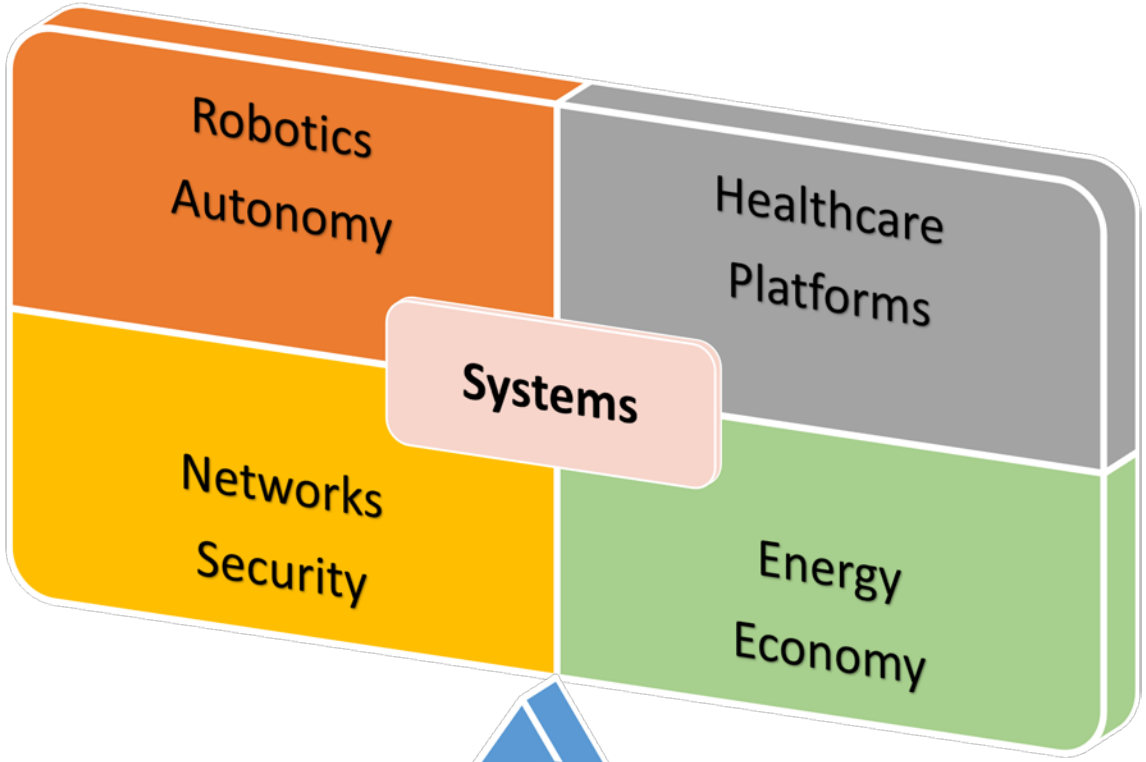
People

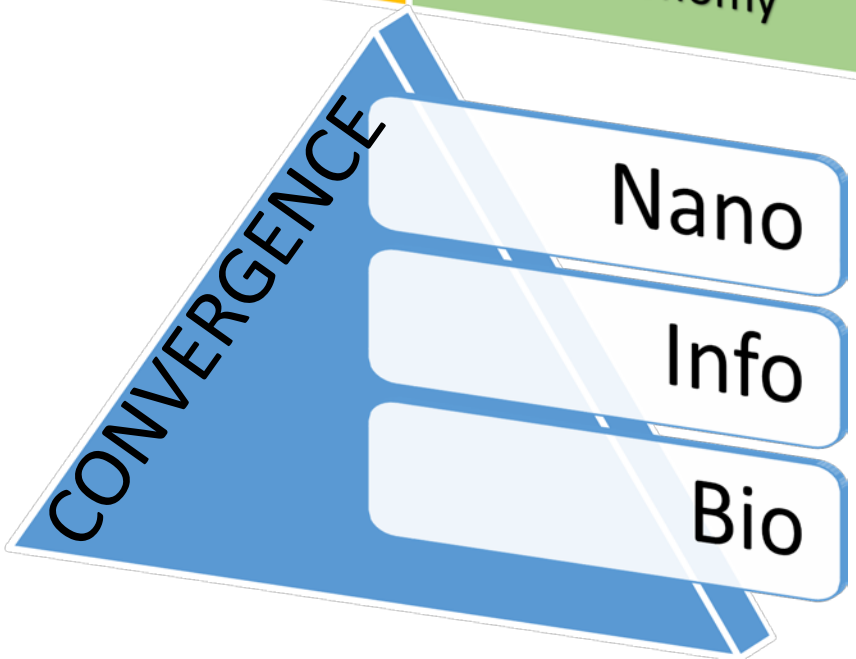
Process

Products

Decisions

Systems





GRANOVETTER

FUKUYAMA

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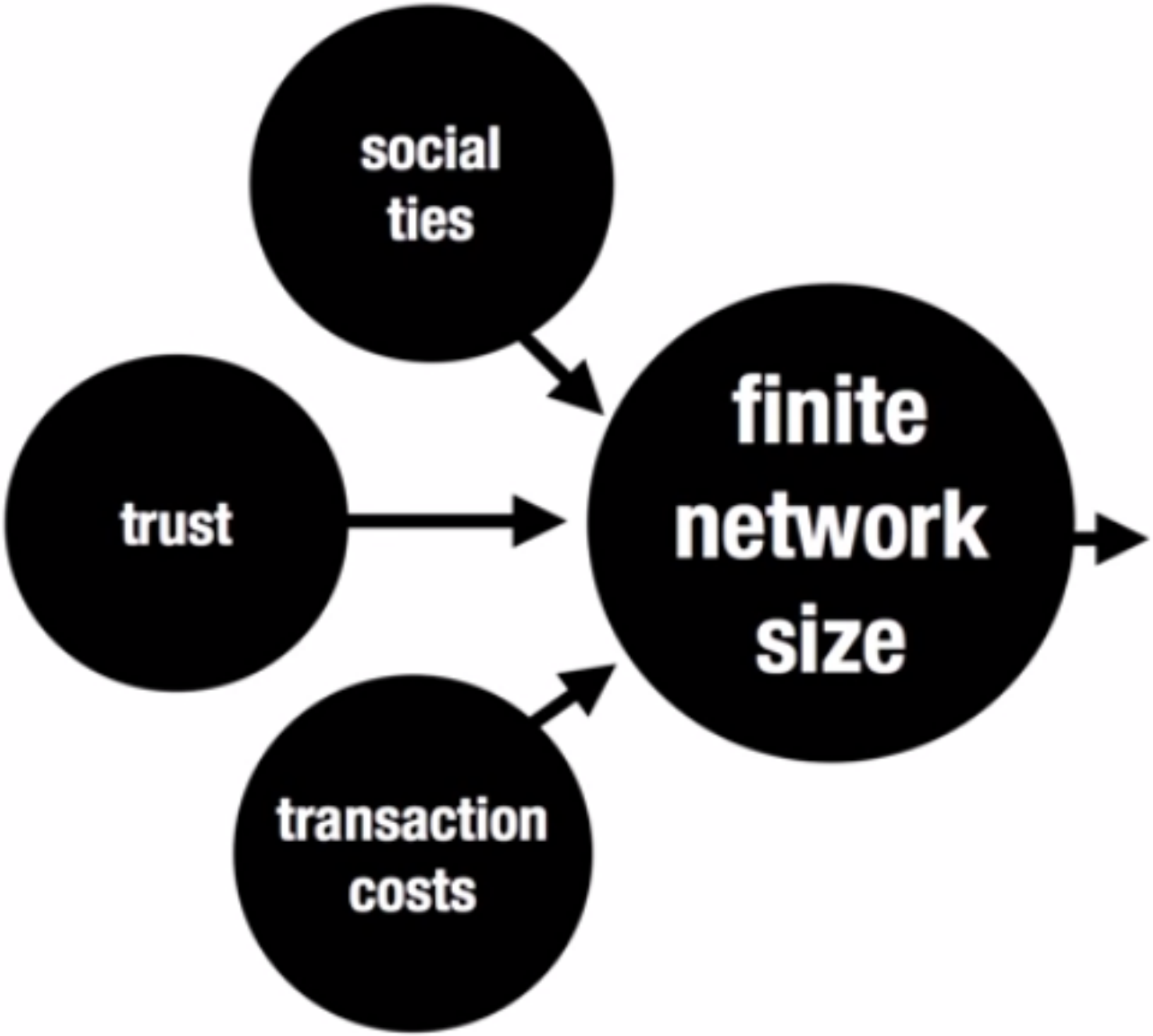
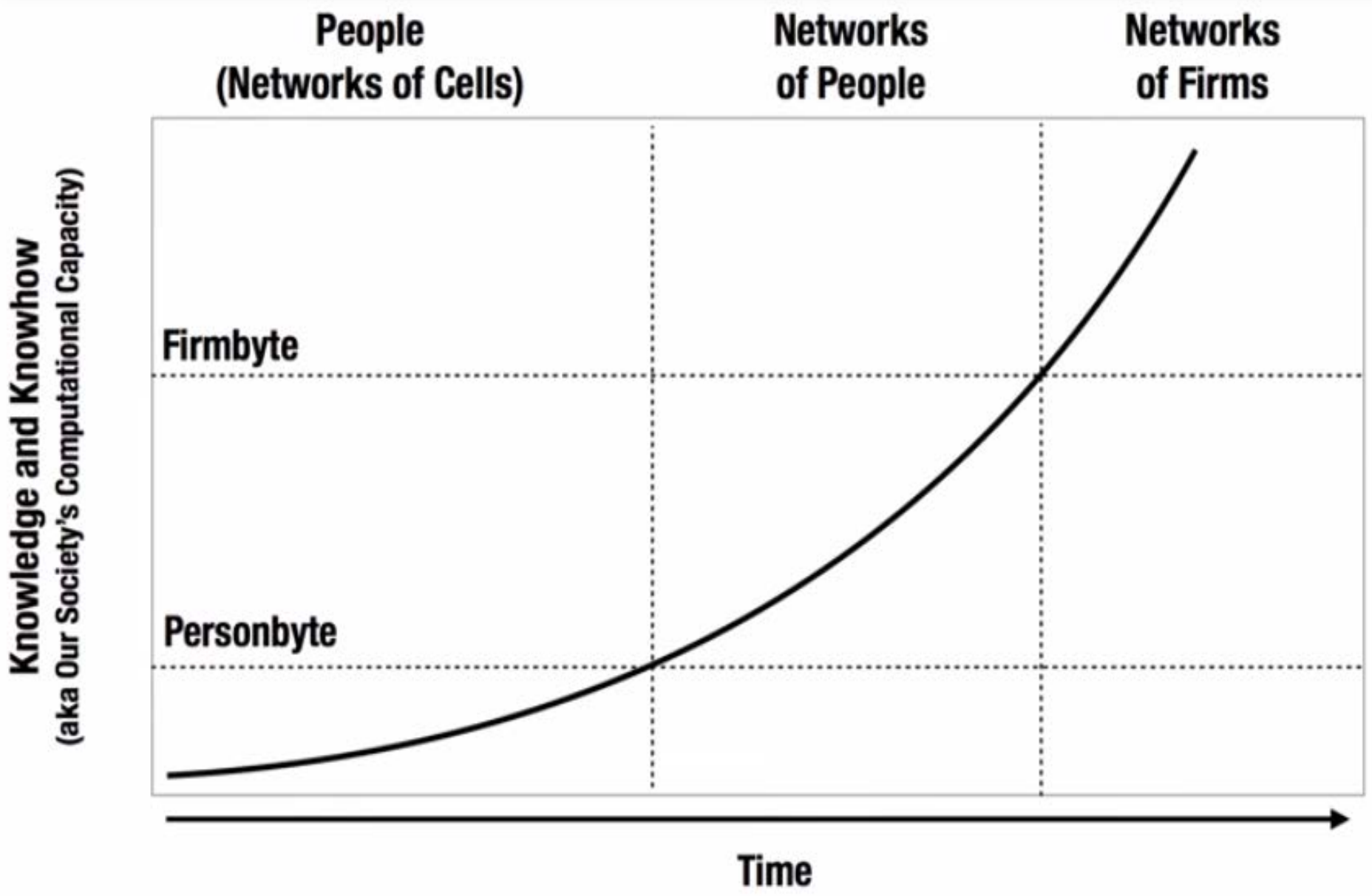
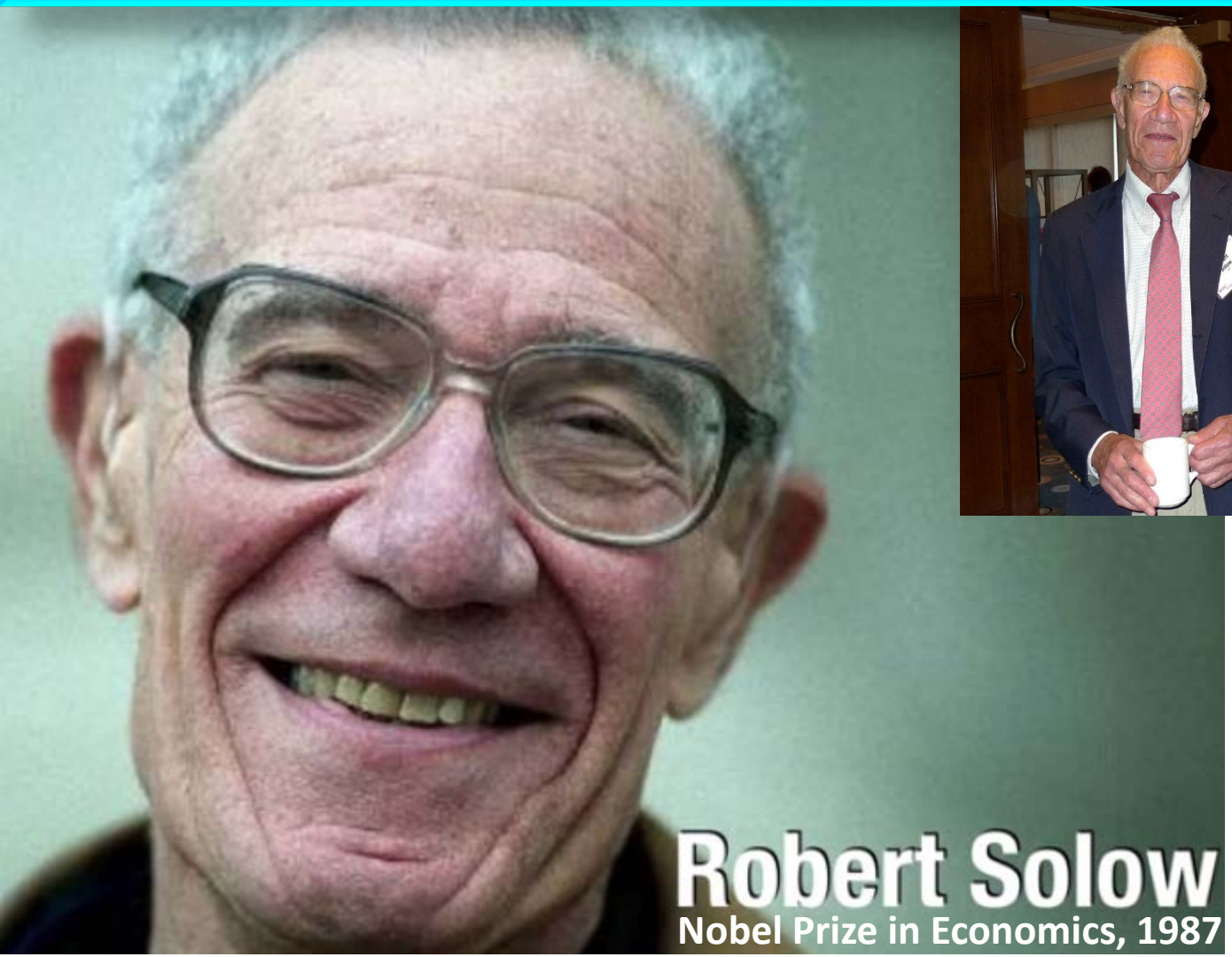


Economic Complexity - Information, Labor, Capital, Growth



Data from capital and labor only could not explain economic growth



The Role of Technology

Solow's model of economic growth, often known as the Solow-Swan neo-classical growth model as the model was independently discovered by Trevor W. Swan and published in "The Economic Record" in 1956, allows the determinants of economic growth to be separated out into increases in inputs (labour and capital) as well as technical progress. Using his model, Solow (1957) calculated that about four-fifths of the growth in US output per worker was attributable to technical progress.

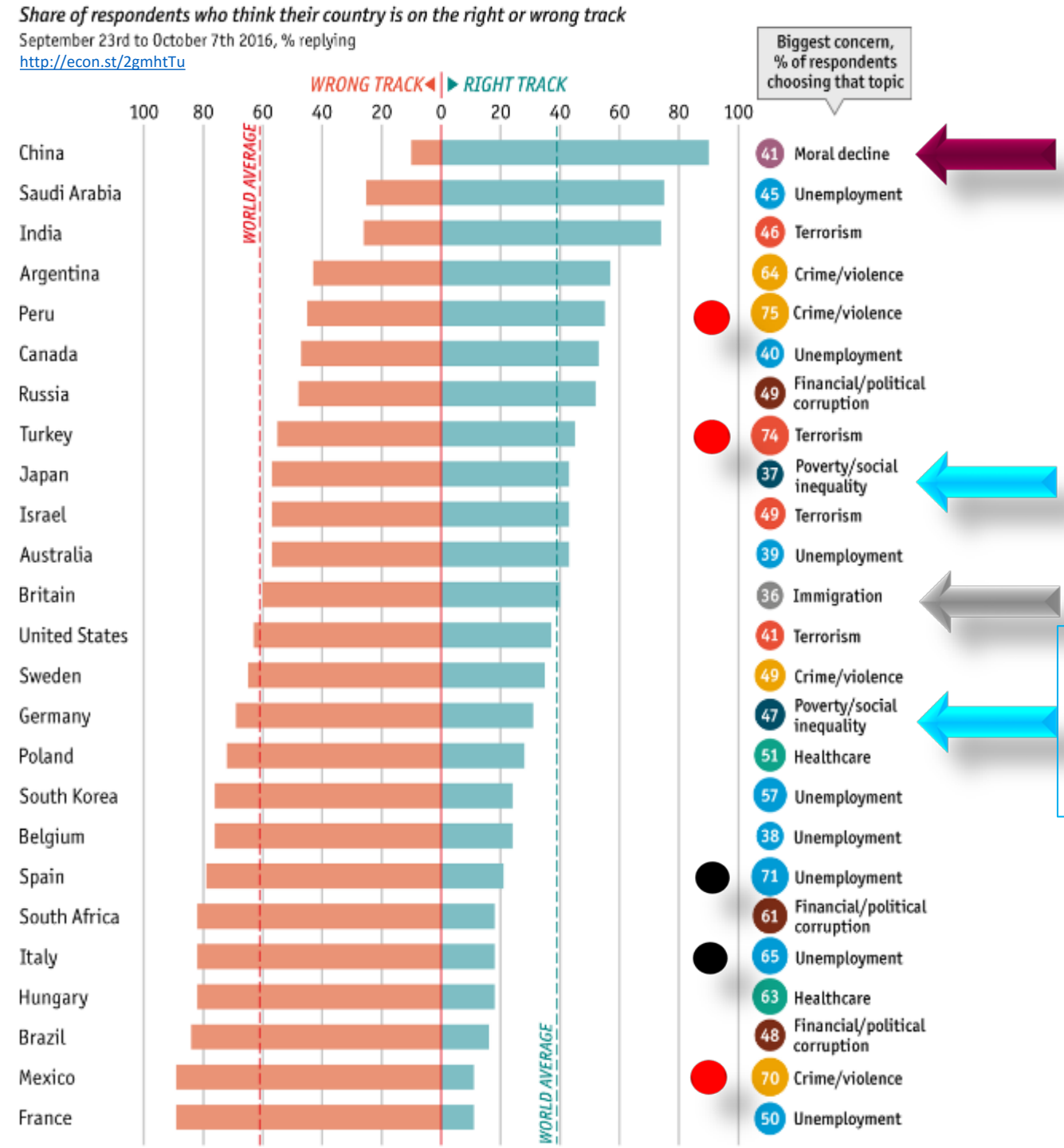
http://bit.ly/ROBERT-MERTON-SOLOW-MIT

Big ideas offer big dividends but needs complementarity and

Leadership

Entrepreneurship

LEADERSHIP ?



47% of German respondents concerned about inequality. Two-thirds of respondents think Germany on wrong track.

● *Almost two-thirds*

● *Almost two-thirds*

Big ideas offer big dividends but may have stormy beginnings

In 1830, Ferdinand de Lesseps, a French diplomat in Cairo, dreamed of linking Europe and Asia (Mediterranean and Red Seas) by cutting a canal through 118 miles of arid land at a cost of FFR 200 million. In November 1869, the Suez Canal opened and fewer than 500 ships passed through in 1870. Dividends failed to materialize on "shares of passion" and Egyptians, desperate for cash, sold the shares to Great Britain for GBP 4 million. Last year (2015), more than 17,000 ships passed through the Suez Canal generating more than US$5 billion in revenues for Egypt (www.suezcanal.gov.eg/TRstatHistory.aspx?reportId=4).

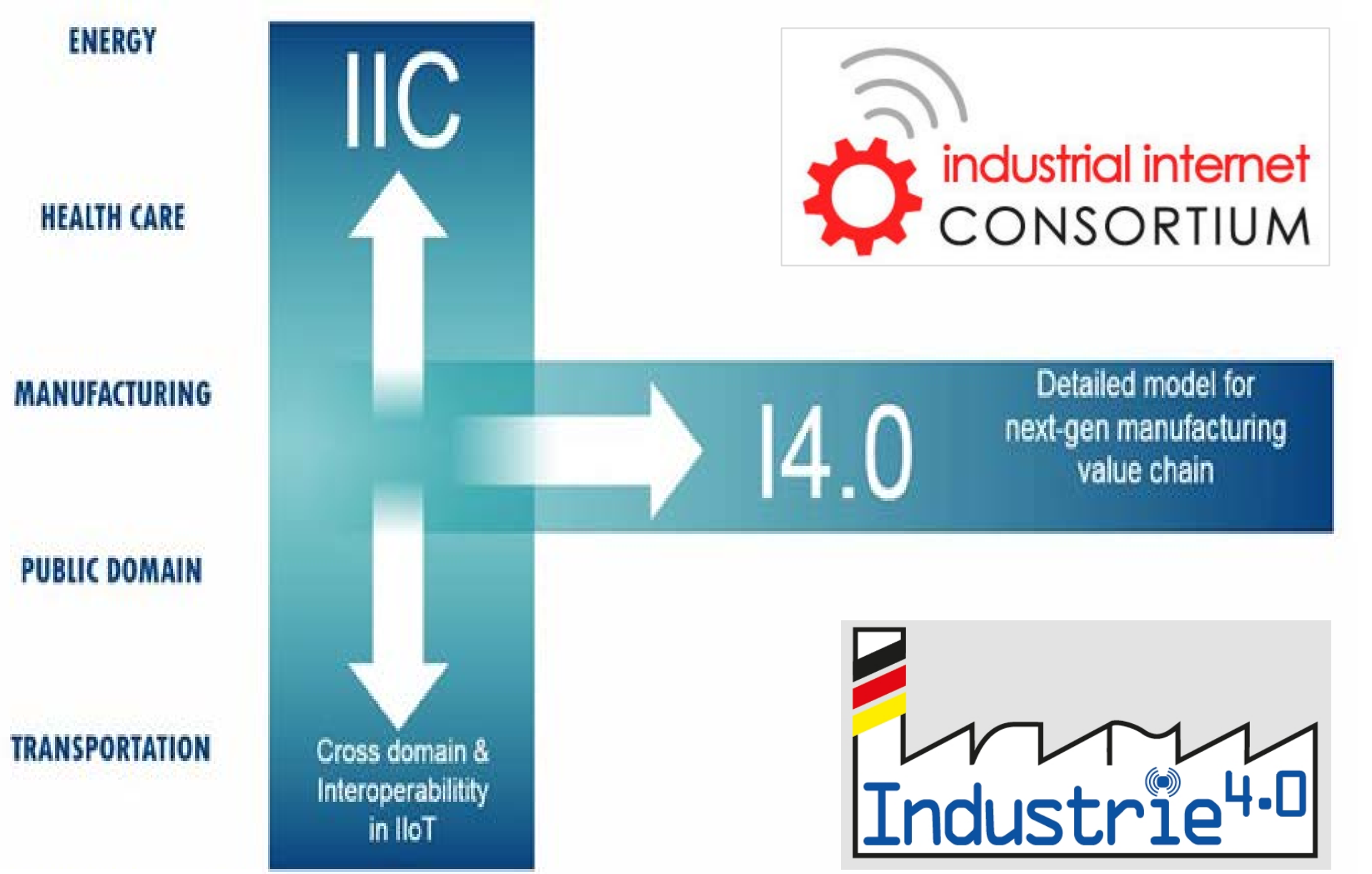
***Parting the Desert: The Creation of the Suez Canal* by Zachary Karabell**

In 1880, Ferdinand de Lesseps formed a company to replicate his feat in Panama. This travail was undone both by weather and tropical diseases (yellow fever, cholera, malaria) which killed 22,000 laborers. In 1904, US President Theodore Roosevelt deployed the US Army Corps of Engineers to complete the Panama Canal at a cost US$352 million and 5,609 lives were lost. On 15 August 1914, the first ship passed through the Canal. In 1918, after four years in operation, less than 5 ships passed through the Panama Canal, daily. The 1,000,000th ship to pass through the Panama Canal was the Chinese freighter the Fortune Plum, on 4 Sep 2010. Now 13,000-14,000 ships pass each year. In 2015, it generated US$2.61 billion in revenue.

***The Path Between the Seas: The Creation of the Panama Canal* by David McCullough**

In the 20th century, the 31 mile tunnel linking England to the Continent started in 1987 fueled by GBP5 billion from banks and 112,000 British investors. In its first 3 years since May 1994, The Chunnel saw fire and gross expenses around GBP 2 billion. In 1997, the original investors suffered losses when the banks seized shares in exchange for restructuring the crushing debt. By 2001, more than 16 million passengers and nearly 2.5 million tonnes of freight passed through the tubes. In 2015, more than 10 million passengers were transported in high speed trains and 2.5 million cars and coaches crossed The Chunnel. Rail freight exceeded 1.5 million tonnes and 1.5 million trucks made the crossing. In 2015, the revenue exceeded €1.2 billion.

***The Chunnel: The Amazing Story of the Undersea Crossing of the English Channel* by Drew Fetherston**



Source http://www.plattform-i40.de/I40/Redaktion/EN/PressReleases/2016/2016-03-02-kooperation-iic.html

Evolution

quintessential to civilization

1905 - General Electric – GE "House of the Future" built for H W William of GE at 1105 Avon Rd, Schenectady, NY 12308

The Technical World Magazine

Volume IV SEPTEMBER, 1905 No. 1

203633 ELECTRIC KITCHEN,
RESIDENCE OF H.W.HILLMAN, SCHENECTADY, N.Y.

Electricity as Housemaid

By Sidney James

IN prehistoric times men built houses without stoves or chimneys—crude structures roughly put together or hollowed out of rocky hillsides. To-day they are about ready to do the same thing, but in a different way; and the modern house without a chimney, while not yet actually realized, is a possibility of the near future, which will represent the very latest triumph of scientific progress and mechanical skill as applied to domestic welfare.

Electricity has made this possible, without sacrifice of comfort or convenience. The subtle current, in fact, has been so harnessed and trained to serve man's uses that it has become an indispensable factor, not only in the larger field of commercial and municipal life, where its usefulness was first developed, but also in the domestic life of the home. Here at last it comes, insisting, with claims that cannot be gainsaid, that it is the best of house-servants. It is untiring, responds promptly to call at any hour of the day or night, cares naught for holidays or special privileges, and is the very genius of comfort, cleanliness, and good health.

The first house ever built to illustrate the complete application of electricity to the uses of domestic life, is shown in the accompanying cut. It is the home of Mr. H. W. Hillman, of Schenectady, N. Y.,

http://nyheritage.nnyln.org/cdm/ref/collection/p16694coll20/id/5858
http://history.nnyln.net/cdm/ref/collection/p16694coll20/id/5862

publicrecords.directory/search.php

PUBLIC RECORDS SEARCH

INSTANTLY SEARCH PUBLICLY AVAILABLE DATA ON ANYONE!

START HERE - Try searching a friend, relative, yourself, or someone else you might know...

FIRST NAME: JOSEPH

LAST NAME : SALVO

This connection is confirmed

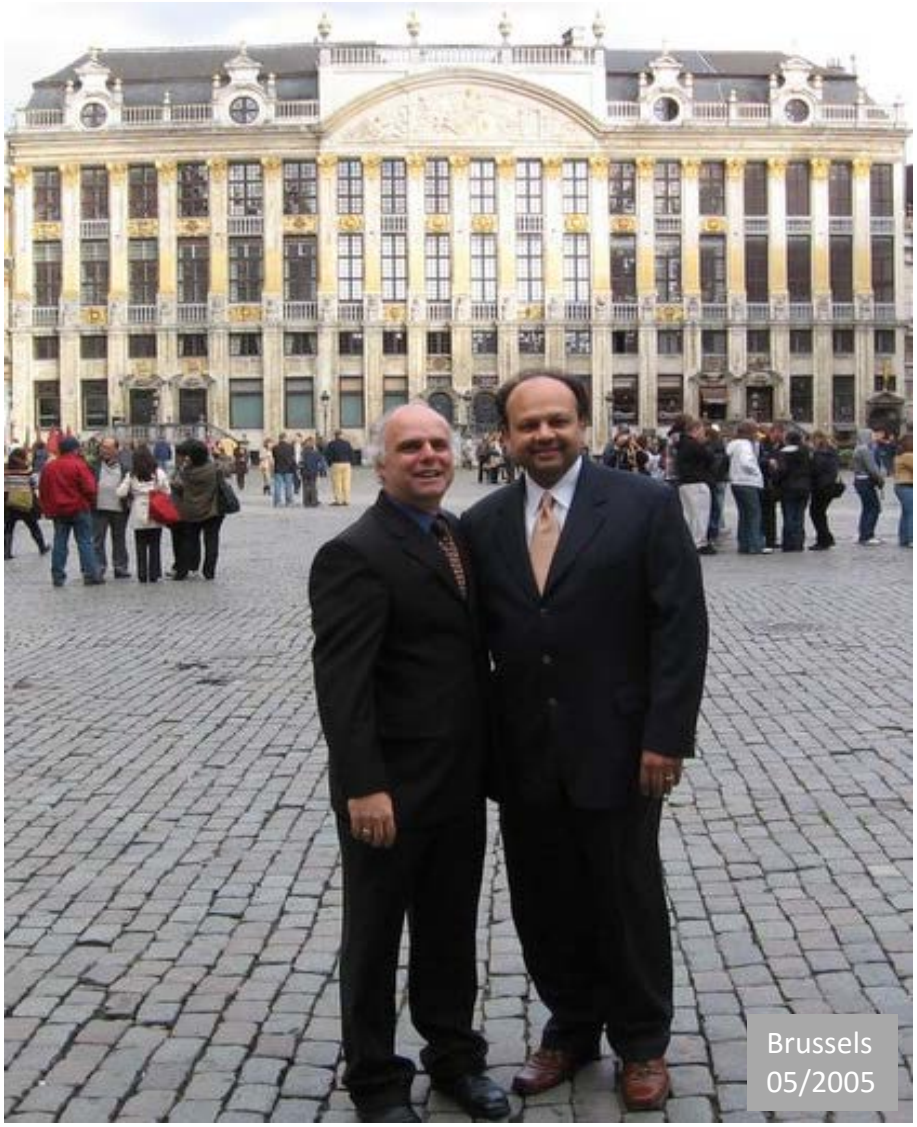
Who is Salvo?

Joseph F Salvo age 56

Also known as: Joseph F Salvo From: Schenectady, NY

1155 Avon Rd #1,Schenectady, NY 12308

Who is Joseph Salvo at 1105 Avon Rd, Schenectady, NY 12308

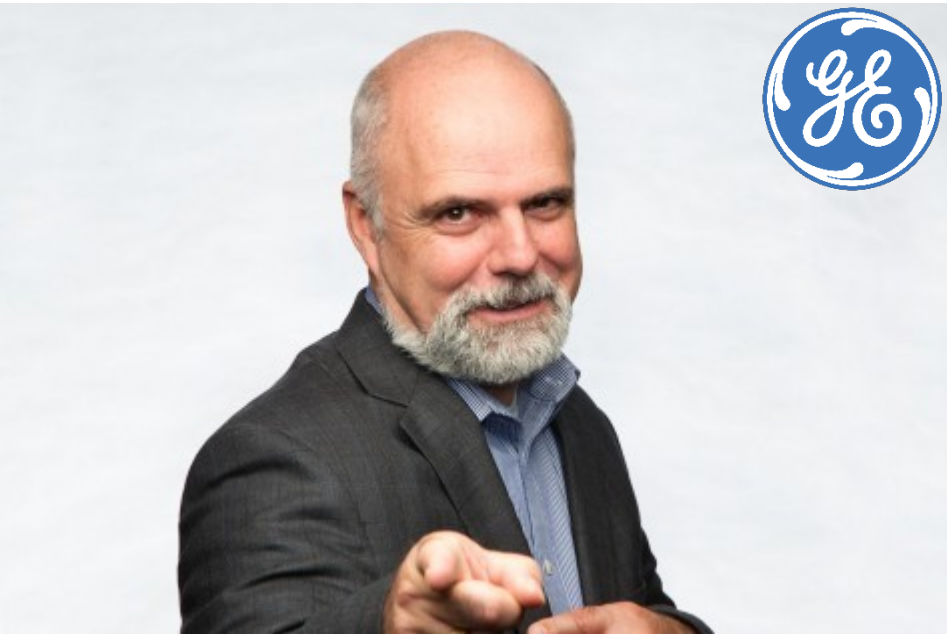


Joseph Salvo (left) and Shoumen Datta (right)

Dr Joseph Salvo

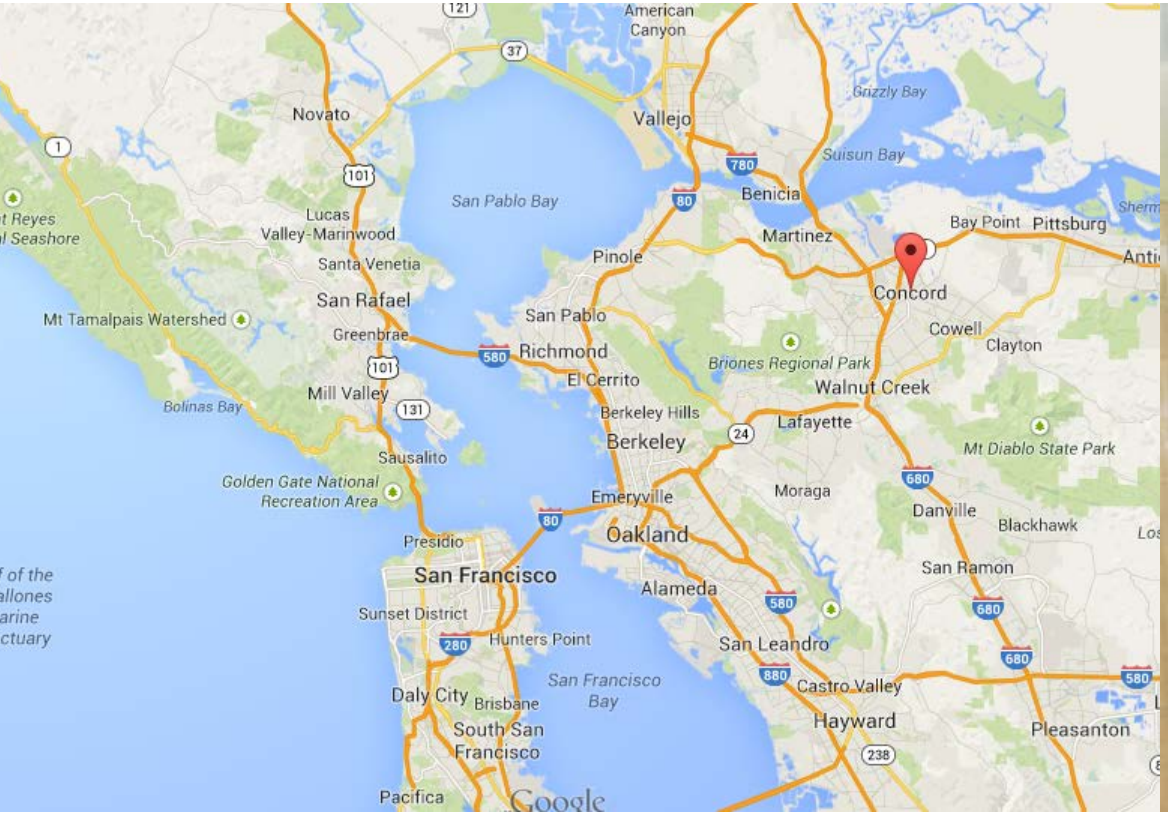
- ☑ Director, GE Global Research Center, NY
- ✋ Founder, Industrial Internet Consortium

industrial internet CONSORTIUM



IIC

Diffusion of the Internet – NetDay – 9th March 1996



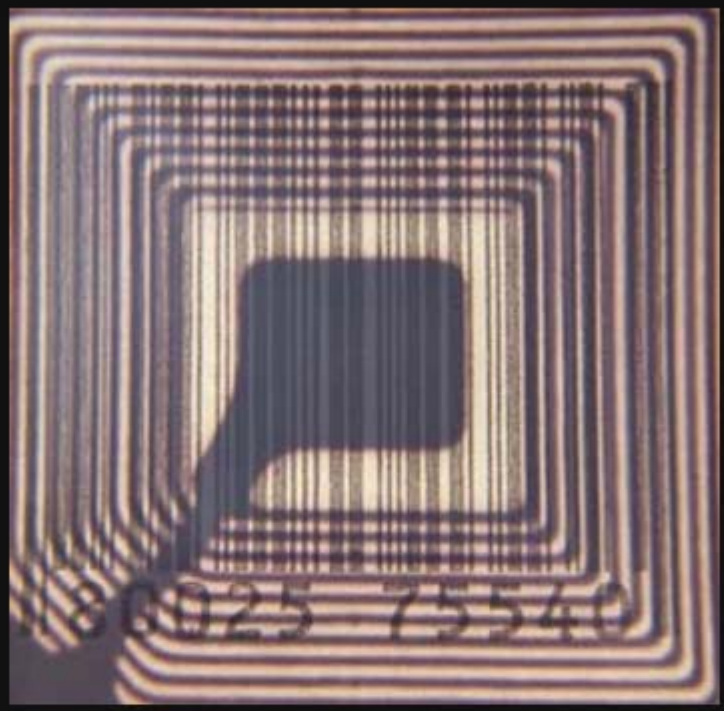
President Bill Clinton installing computer cables with Vice President Al Gore on NetDay at Ygnacio Valley High School (Concord, CA - March 9, 1996)

Global Automobile Manufacturers in Silicon Valley

FT

1999 – MIT Auto ID Center

AUTO-ID CENTER



RFID tag developed by the Auto-ID Center

Paving the way for commercialized RFID solutions

Professor Sanjay Sarma, MIT, Co-Founder, MIT Auto ID Center 1999
IoT was coined at the MIT Auto ID Center by Kevin Ashton (~ 2000)

Professor David Clark, Research Scientist, MIT
Chief Architect (1981-1989) of DARPA & IETF

http://bit.do/SANJAY-ODL

The Birth of the Internet of Things and the nascent Industrial Internet

1953

In my story "Sally," published in 1953, I described computerized cars that had almost reached the stage of having lives of their own. In the last few years, we do indeed have computerized cars that can actually talk to the driver. (*Robot Dreams* by Isaac Asimov aka Isaak Ozimov)

1987

Herbert Simon (June 15, 1916 – February 9, 2001) in his paper "*The Steam Engine and the Computer: What makes technology revolutionary*" framed his thoughts about the computer, "*you have to make friends with it, talk to it, let it talk to you.*"

1991

Mark Weiser (July 23, 1952 – April 27, 1999) of Xerox Palo Alto Research Center coined the term "ubiquitous computing" and suggested in 1988 that computers may *"weave themselves into the fabric of everyday life"* and influence the future of business (*Scientific American, 1991*).

2000

The seminal paper *The Networked Physical World* by Sanjay Sarma *et al* spread the concept of the Internet of Things (IoT) through the creation of the Auto ID Center at MIT.

2013

After sixty years of *Robot Dreams*, the evolution of the internet and the industrial revolution merged to conceive and create the Industrial Internet Consortium (03/27/2014) to catalyze global economic growth (www.iiconsortium.org). Sponsored by 5 founders with $1T market cap.

At the beginning ● How did the IoT concept / industrial internet start ?

The grand vision of the Industrial Internet may have started circa 1988 with the work of Mark Weiser of Xerox Palo Alto Research Center (XPARC) who predicted that computers may *"weave themselves into the fabric of everyday life"* and influence the future of business as well as lifestyle technologies, in his 1991 article in the *Scientific American*. The release of the commercial internet in 1995 paved the way for the Industrial Internet of the future. In 1998, Sanjay Sarma (MIT) extended the idea of using RFID tags to use RFID tags in supply chain management (http://bit.ly/SANJAY-SARMA). The price of the RFID tag had to be reduced and Sarma suggested RFID tags contain only a reference number EPC (electronic product code) rather than any actual data about the object. It was against the conventional wisdom. At the time, RFID tags were used and designed to contain data about the object or product. By eliminating need for data storage on the tag, the cost of the RFID tags were reduced. Sarma designed the EPC to act as an unique URL to access the object data stored on the Internet. In 1999, Sarma along with David Brock and Sunny Siu co-founded the MIT Auto ID Center to transform this vision made possible by the "emerging" medium and the platform of the internet. The internet was still immature to act as a catalyst to augment business processes and industrial productivity. Sarma, Brock and Siu were later joined by Kevin Ashton, a marketing manager at Proctor & Gamble who was loaned to the Auto ID Center at MIT. Auto ID Center at MIT developed the EPC and other technical concepts and standards prevalent today in the global RFID industry. Sarma, Brock and Ashton coined the term Internet of Things which envisioned objects /things connected to object-specific data on the internet which could be accessed using the unique EPC on the tag attached to the object. IoT is a vision, not a technology. In 2000, a paper by Sarma *et al* summarized the IoT concept as it related to the network society in general.

MIT-AUTOID-WH-001 ▪ *THE NETWORKED PHYSICAL WORLD* ▪ http://tinyurl.com/Industrial-Internet

Prof Sarma talked about the origin of IoT at the MIT Sloan Symposium http://tinyurl.com/MIT-IoT-1998

I was a part of the Auto ID initiative since 1999 as a member of the Technology Board at Auto ID Center.

Published in the Proceedings of CHI '97, March 22-27, 1997, © 1997 ACM

Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms

Hiroshi Ishii and Brygg Ullmer
MIT Media Laboratory
Tangible Media Group
20 Ames Street, Cambridge, MA 02139-4307 USA
{ishii, ullmer}@media.mit.edu

ABSTRACT

This paper presents our vision of Human Computer Interaction (HCI): "Tangible Bits." Tangible Bits allows users to "grasp & manipulate" bits in the center of users' attention by coupling the bits with everyday physical objects and architectural surfaces. Tangible Bits also enables users to be aware of background bits at the periphery of human perception using ambient display media such as light, sound, airflow, and water movement in an augmented space. The goal of Tangible Bits is to bridge the gaps between both cyberspace and the physical environment, as well as the foreground and background of human activities.

This paper describes three key concepts of Tangible Bits: interactive surfaces; the coupling of bits with graspable physical objects; and ambient media for background awareness. We illustrate these concepts with three prototype systems – the metaDESK, transBOARD and

BITS & ATOMS

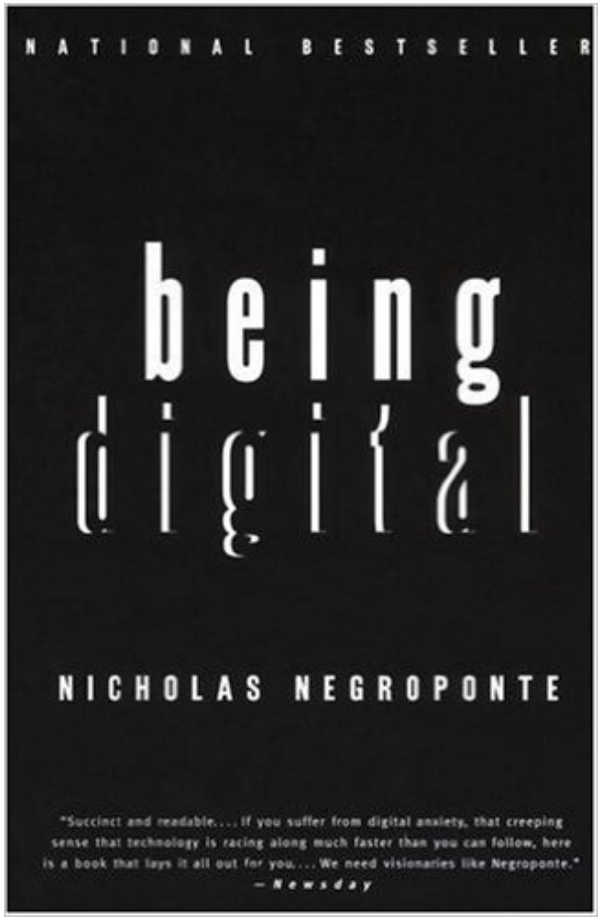
We live between two realms: our physical environment and cyberspace. Despite our dual citizenship, the absence of seamless couplings between these parallel existences leaves a great divide between the worlds of bits and atoms. At the present, we are torn between these parallel but disjoint spaces.

We are now almost constantly "wired" so that we can be here (physical space) and there (cyberspace) simultaneously [14]. Streams of bits leak out of cyberspace through a

Figure 1 Sketches made at Collection of Historical Scientific Instruments at Harvard University

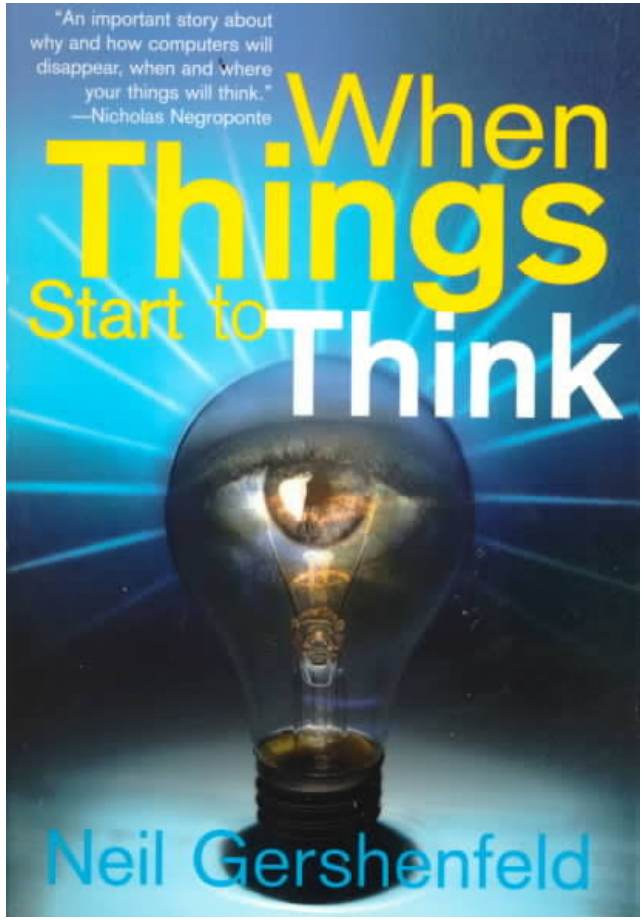
Immersion in Digital Diaspora

1995



MIT Media Lab

2000

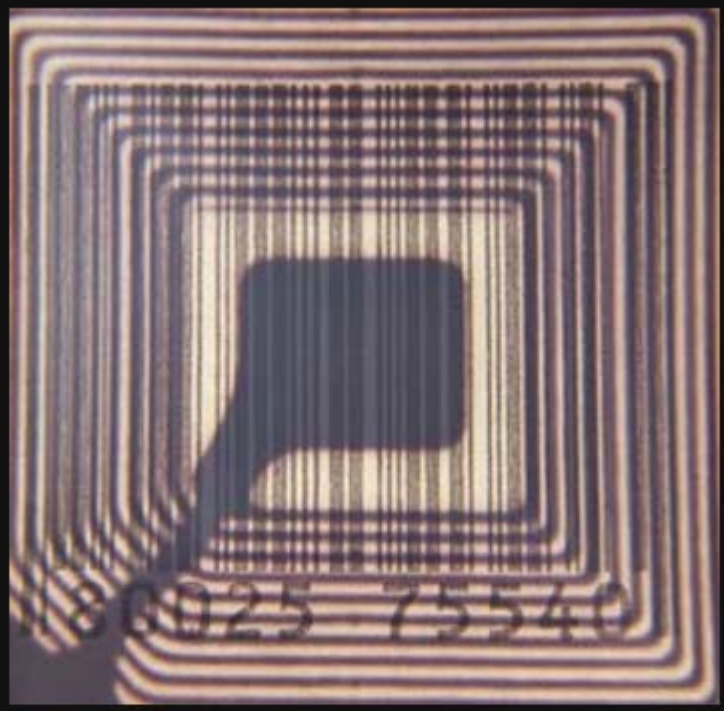


MIT Center for Bits and Atoms

1999 – MIT Auto ID Center and The Internet of Things

AUTO-ID CENTER

MASSACHUSETTS INSTITUTE OF TECHNOLOGY



RFID tag developed by the Auto-ID Center

Paving the way for commercialized RFID solutions

Kevin Ashton coined "Internet of Things"
during his job at MIT Auto-ID Center

Published October 1, 2000. Distribution restricted to Sponsors until January 1, 2001.

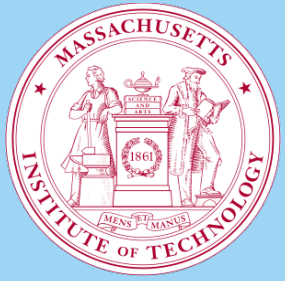
WHITE PAPER

The Networked Physical World

Proposals for Engineering the Next Generation of Computing, Commerce & Automatic-Identification

Sanjay Sarma, David L. Brock & Kevin Ashton

MIT AUTO-ID CENTER MASSACHUSETTS INSTITUTE OF TECHNOLOGY, 77 MASSACHUSETTS AVENUE, BUILDING 3-449G, CAMBRIDGE, MA 02139-4307



ABSTRACT

The Auto-ID Center at the Massachusetts Institute of Technology is a new industry sponsored lab charged with researching and developing automated identification technologies and applications. The Center is creating the infrastructure, recommending the standards, and identifying the automated identification applications for a networked physical world. All technologies and intellectual property developed at the Auto-ID Center are freely distributed. This white paper outlines the Auto-ID Center's key conclusions and research progress after its first year of research.

Digitalcourage

1987

Registered association

Politics, freedom, privacy

Bielefeld, Germany

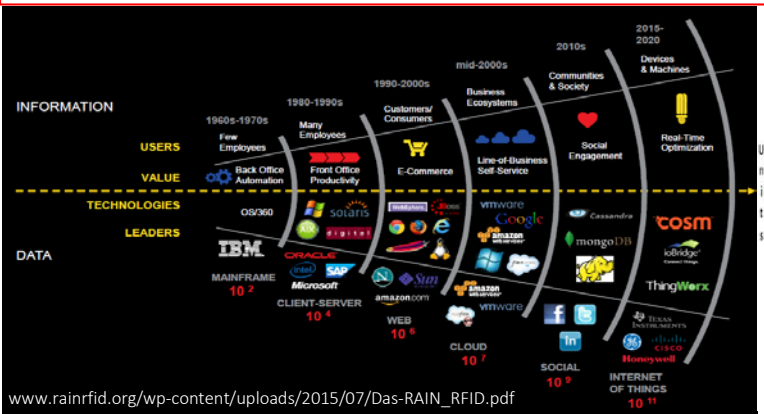
digitalcourage.de

Since October 2003

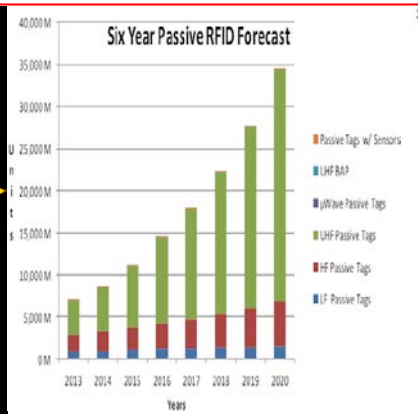
Industrie 4.0

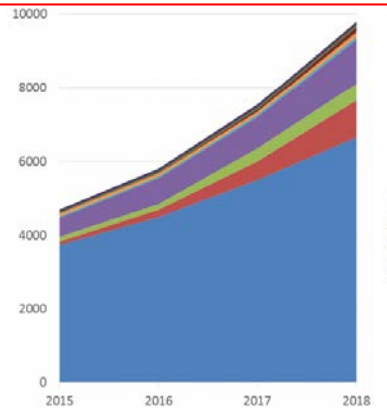
Digitalcourage – until Nov 2012 as **FoeBuD**

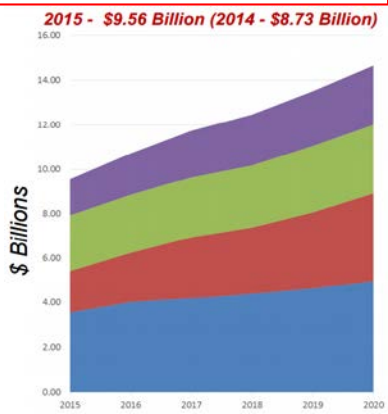
*Verein zur **F**örderung des **ö**ffentlichen **b**ewegten und **u**nbewegten **D**atenverkehrs*



www.rainrfid.org/wp-content/uploads/2015/07/Das-RAIN_RFID.pdf



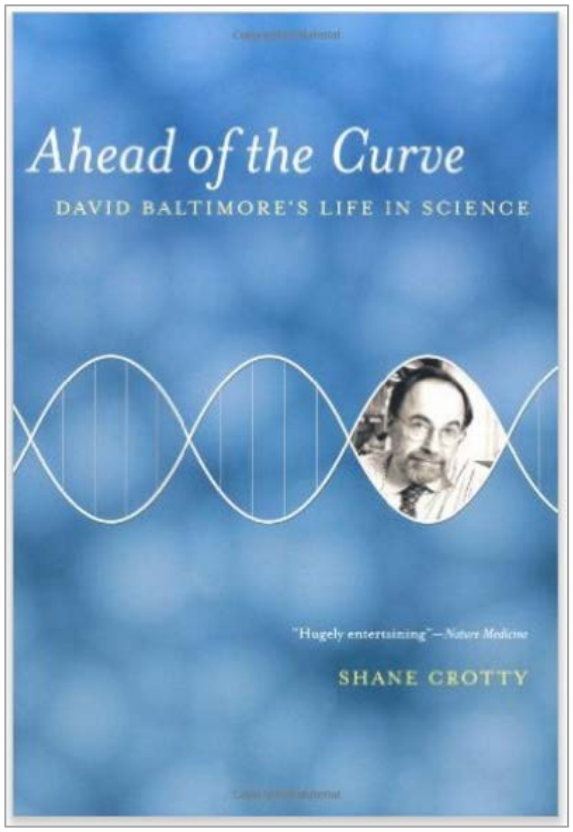




Die Revolution verschlingt ihre Kinder, bevor sie stattfinden kann.

The revolution devours its children before it can even take place.
[Georg Büchner]

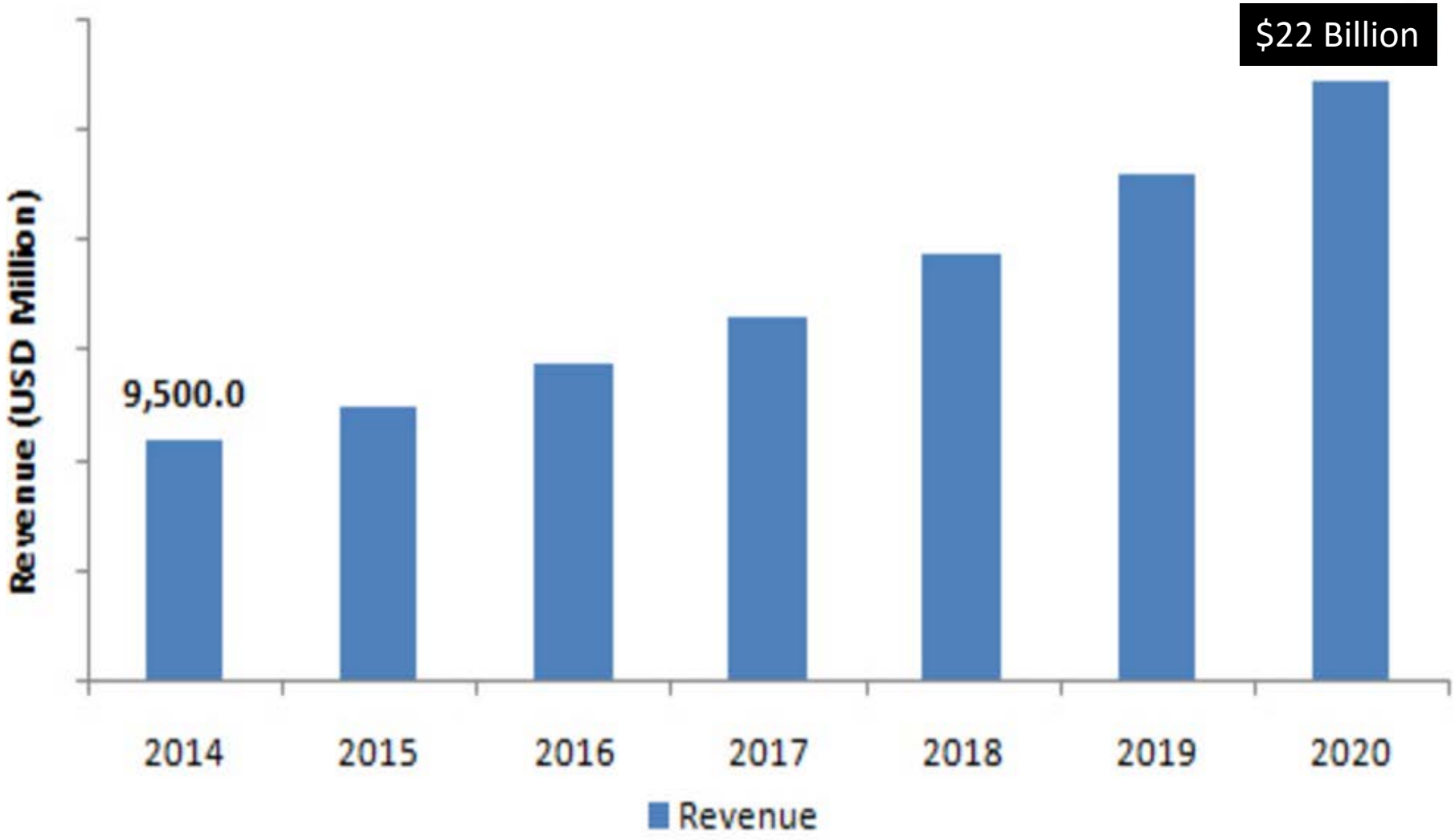
BREAK THE RULES



In early spring 1976, the Cambridge City Council, led by Mayor Alfred Vellucci, proposed a moratorium on genetic engineering research within the Cambridge city limits, which would effectively shut down labs at both MIT and Harvard. Relations between the universities and the city had always been strained; from time to time Vellucci threatened to turn Harvard Yard into a parking lot. With Harvard planning on building a high-hazard-level recombinant DNA facility, the Cambridge City Council was extremely concerned. Vellucci declared, "It's about time the scientists began to throw all their goddamned shit right out on the table so that we can discuss it." Until Vellucci could be convinced otherwise, recombinant DNA work in Cambridge was postponed.

Scientists from the two universities were summoned before the city council to discuss the safety of genetic engineering. Baltimore was heavily involved, as were a number of biologists in the area on both sides of the issue. *Science* described the Cambridge City Council hearings as an "interesting phenomenon of a 'public' debate on recombinant DNA that really amount[ed] to a debate between two scientific camps slugging it out in public." Baltimore went before the city council on June 23, defending genetic engineering research and attempting to prevent the Mayor's proposed ban. Mark Ptashne of Harvard also testified, stressing that "no known dangerous organism has ever been produced" by recombinant DNA. To this a city councilor shot back, "Just what the hell do you think you're gonna do if you *do* produce one?" No one would give an inch. Mayor Vellucci declared, "I have learned enough about recombinant DNA molecules in the past few weeks to take on all the Nobel Prize winners in the city of Cambridge!"

Global RFID Market Revenue, 2014 - 2020 (USD Million)



STANFORD
39,9000

30,200 active companies

STANFORD
5.4 million

4.6 million people employed

STANFORD
$2.7 trillion

$1.9 trillion in annual revenues

Reaction from a Head of State

http://bit.ly/Stanford-Entrepreneurship

Country/Economy	GDP Nominal (billions of $)			
	2016	share	Rank	2020
United States	18,561.930	24.7	1	21,927
China	11,391.620	15.1	2	16,458
Japan	4,730.300	6.29	3	5,506
Germany	3,494.900	4.65	4	4,008
United Kingdom	2,649.890	3.52	5	2,928
France	2,488.280	3.31	6	2,851
India	2,250.990	2.99	7	3,297
Italy	1,852.500	2.46	8	2,046
Brazil	1,769.600	2.35	9	2,214
Canada	1,532.340	2.04	10	1,856
Korea	1,404.380	1.87	11	1,747
Russia	1,267.750	1.69	12	1,698
Australia	1,256.640	1.67	13	1,574
Spain	1,252.160	1.66	14	1,457
Mexico	1,063.610	1.41	15	1,325

STANFORD

MIT

http://web.mit.edu/innovate/entrepreneurship2015.pdf

http://economics.mit.edu/files/1909

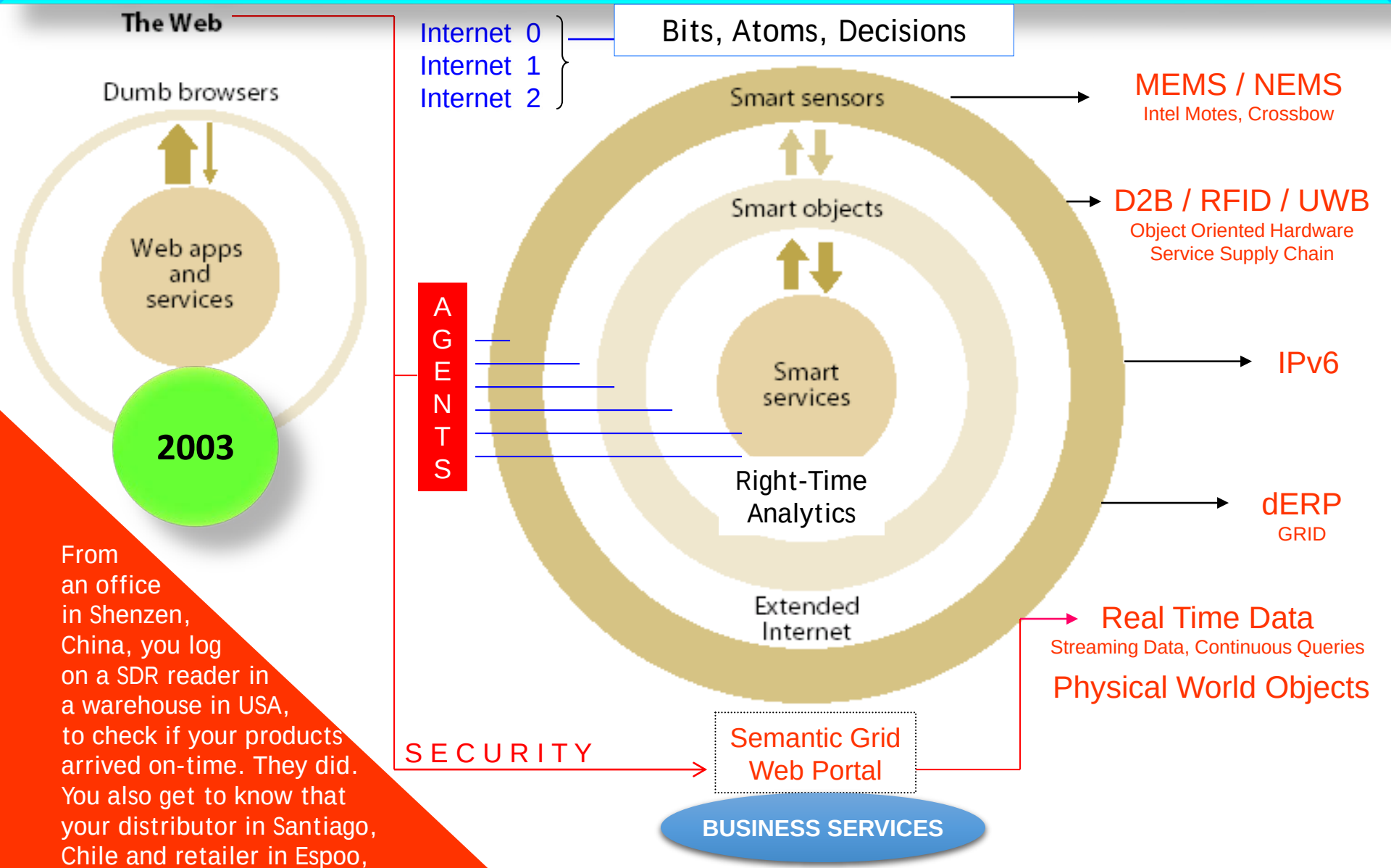
A new report estimates that, as of 2014, MIT alumni have launched 30,200 active companies, employing roughly 4.6 million people, and generating roughly $1.9 trillion in annual revenues.

Design Metaphor

Networked Physical World

IoT

Integrating Ubiquitous Analytics in Real-Time with Data, Information, Application



From an office in Shenzen, China, you log on a SDR reader in a warehouse in USA, to check if your products arrived on-time. They did. You also get to know that your distributor in Santiago, Chile and retailer in Espoo, Finland also checked the delivery status, moments before you logged on.

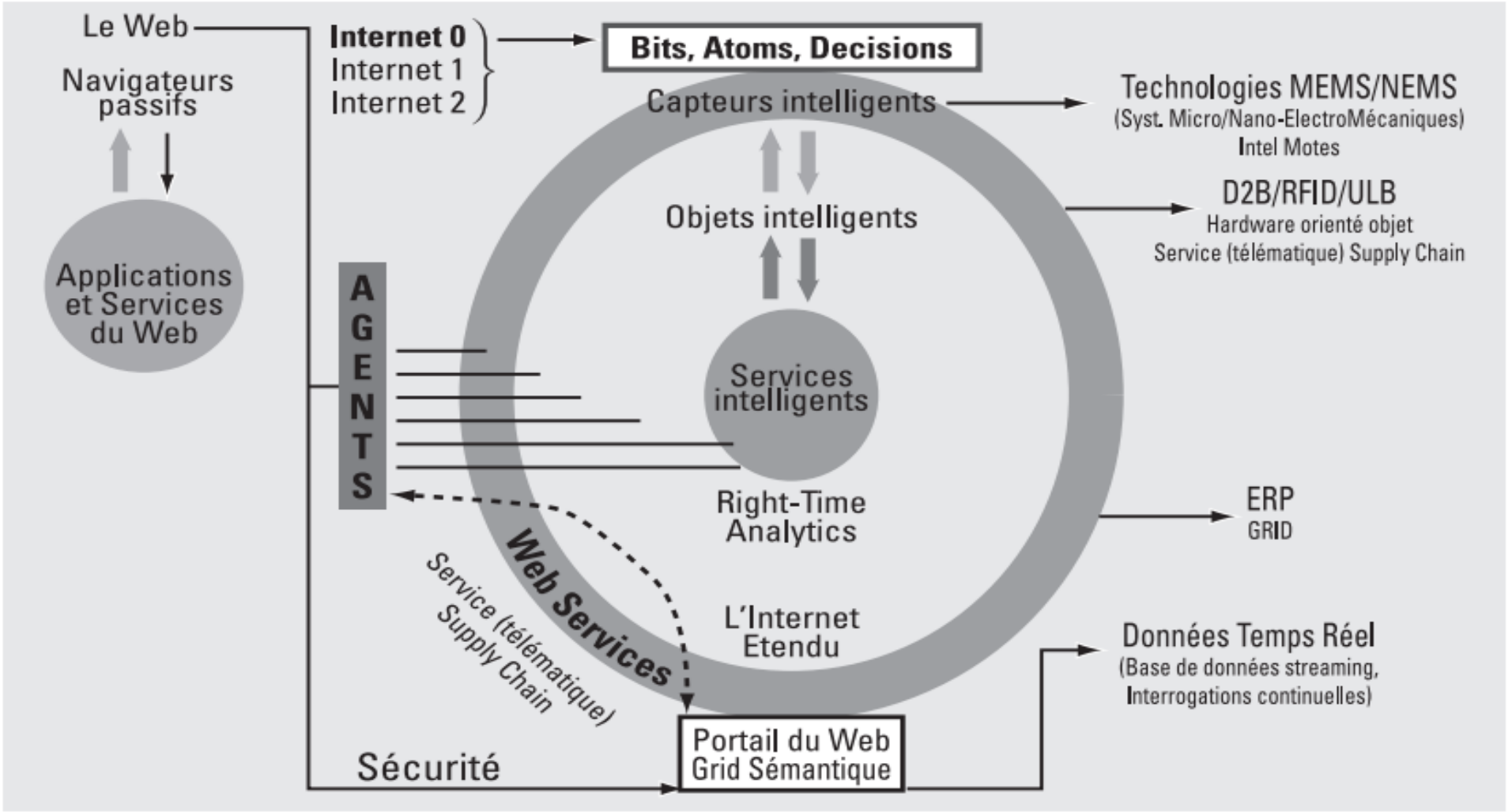
SDR Data Interrogators as Ubiquitous Internet Appliances in IoT (2003)

2004

ADAPTER, OPTIMISER, PRÉVOIR
La convergence des concepts, des outils, des technologies et des normes peut-elle accélérer l'innovation ?

Dr Shoumen DATTA
Chercheur, Département Ingénierie des Systèmes, Forum pour l'Innovation dans la chaîne logistique
Directeur général de l'Ecole d'Ingénierie, Massachusetts Institute of Technology

Figure 3 : Pour l'émergence de systèmes décisionnels adaptifs, il est nécessaire de mettre en communication bits, atomes et décisions.



Depuis un bureau à Shinzen en Chine, vous vous connectez à un lecteur SDR situé dans un entrepôt aux Etats-Unis de manière à vérifier si vos produits sont arrivés en temps voulu. Ce fut le cas. Vous allez aussi apprendre que votre distributeur à Santiago du Chili et votre détaillant à Espoo en Finlande ont eux aussi vérifié où en était la livraison quelques instants avant vous

About Big Data before "Big Data" → Econometric Models ARCH/GARCH (Datta, 2004)

$$Y_t = \beta_0 + \sum_{j=1}^{N_y} \varphi_j \, Y_{t-j} + \sum_{k=1}^{k} \sum_{i=1}^{N_{X_{KT}}} \alpha_{ki} \, X_{kt-i} + \varepsilon_t$$

$$\sigma_t^2 = \theta_0 + \theta_1 \varepsilon_{t-1}^2 + \theta_2 \varepsilon_{t-2}^2 + \ldots + \theta_q \varepsilon_{t-q}^2$$

La variance du terme d'erreur aléatoire dépend non seulement des valeurs précédentes de ε (t-1, t-2,..., t-q) mais aussi des valeurs précédentes de la variance σ^2(t-1, t-2, ..., t-p).

$$Y_t = \beta_0 + \sum_{j=1}^{N_y} \varphi_j \, Y_{t-j} + \sum_{k=1}^{k} \sum_{i=1}^{N_{X_{KT}}} \alpha_{ki} \, X_{kt-i} + \varepsilon_t$$

$$\sigma_t^2 = \theta_0 + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \tau_j \varepsilon_{t-j}^2 \quad \textbf{(6)}$$

http://hdl.handle.net/1721.1/41907

E-Business logistics, visions, innovations and research

ELO – E-Business Logistics Technology Programme 2002–2005

Editor Heikki Kekäläinen

Technology Review 196/2006

Figure 26. Radical Insight?

Tekes

Technology Review 196/2006
Helsinki 2006

Monetizing IoT

Multi-disciplinary convergence

SCM Data Collaboration (http://bit.ly/SCM-DATA-SHARING)

Economic History of GPT (http://bit.ly/PAUL-DAVID-GPT)

Information Asymmetry (Akerlof, Spence, Stiglitz)

The Nature of the Firm (Ronald Coase)

Role of Technology (Robert Solow)

(The Actual) Metcalfe's Law

Trust in Social Networks

Systems Science

Graph Theory

Platforms

Analytics

Connect, Converge, Communicate

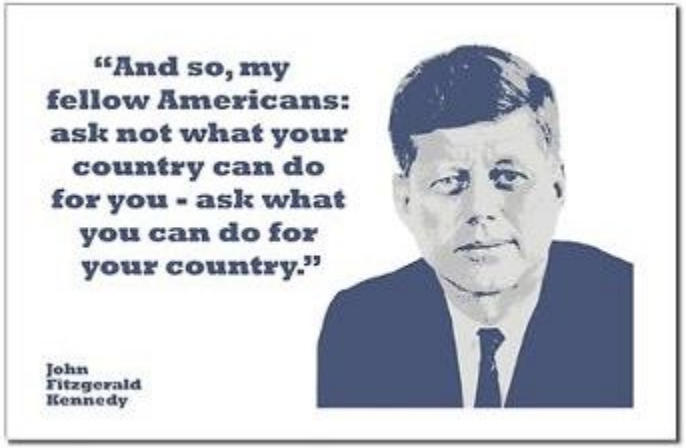
Think Different

http://bit.ly/IOT-MIT

Ask what you can do for

education and research to teach people what machines cannot do

Fill the digital dustbin with the sensational and the conventional opinion about technology eliminating jobs. Quite the opposite. Billions of people could become prosperous. Property rights and identification are in crisis. Healthcare access is still only for a few. Education is key. Distributed digital ledger tools, healthcare platforms, remote sensing and digital learning may transform economies for the better.



MIT Auto-ID Labs initiative to extend Auto-ID Center ideas which catalyzed RFID systems and germinated the concept of IoT in 1999. AIDL's IoT Collaborative Research Initiative (ICRI) expects to build on the Cloud of Things ideas and engage with an even broader "binary" vision where invention and innovation may advance digital transformation through engineering design. Research related to IoT by design may enhance industrial internet of things. We invite ideas to stimulate research necessary for new tools and technologies. IoT use in diverse verticals (energy, healthcare, manufacturing, robotics, finance, analytics) must address fundamental questions about connectivity, data and how systemic IoT by design may drive social entrepreneurship. We expect collaborative research to induce creative convergences while fully embracing innovation uncertainty.

AUTO-ID CENTER

icri

AUTO-ID LABS

Research - IoT System of Systems including Autonomy, Algorithms, Analytics and Ubiquitous Connectivity

Dr Shoumen Palit Austin Datta

Research Affiliate, Department of Mechanical Engineering, Massachusetts Institute of Technology ● shoumen@mit.edu

http://autoid.mit.edu/iot_research_initiative ● MIT Auto-ID Labs ● http://autoid.mit.edu