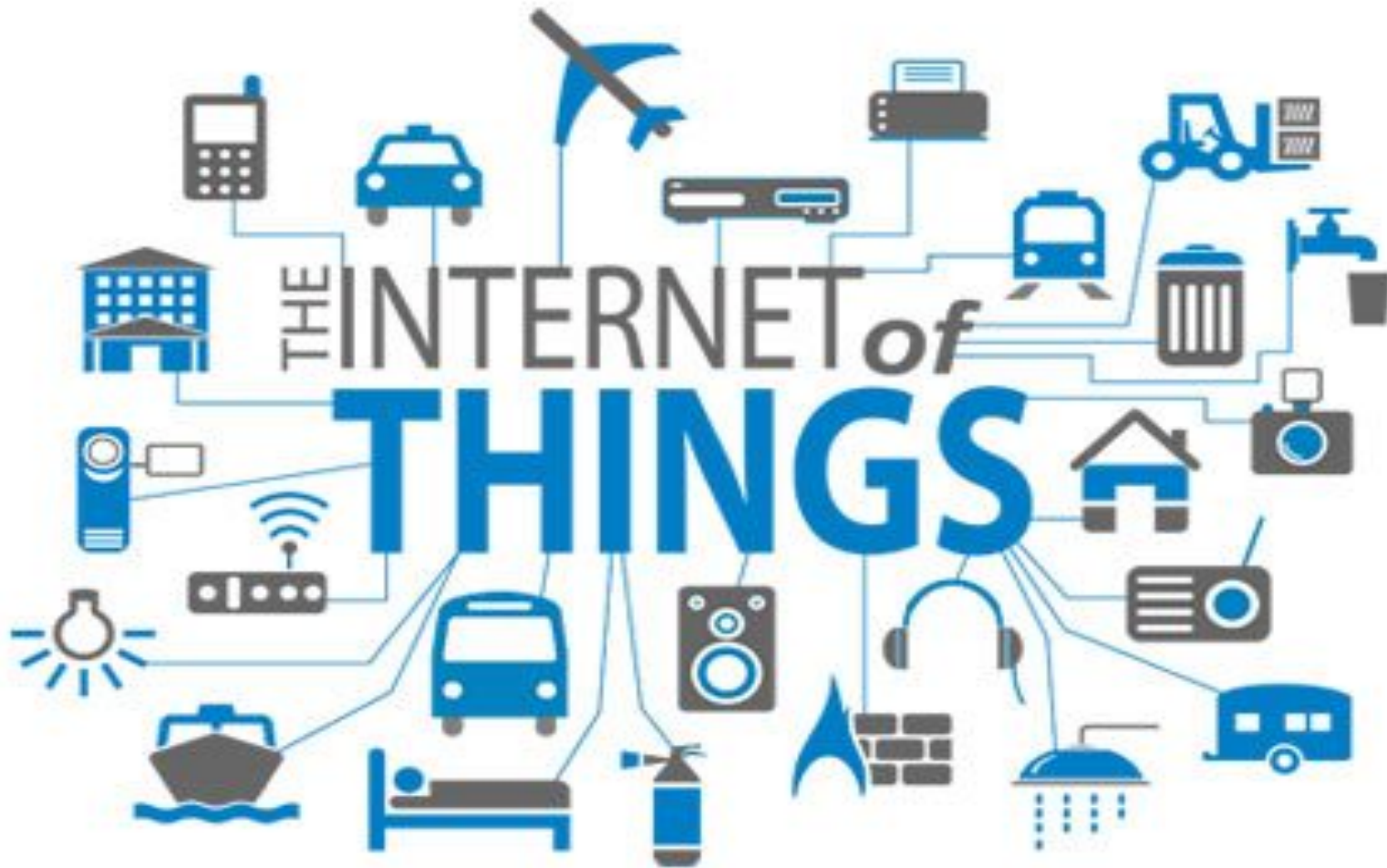


Internet of Things : Economic Perspective

Akanksha Maurya



Internet of Things



Internet vs Internet of Things

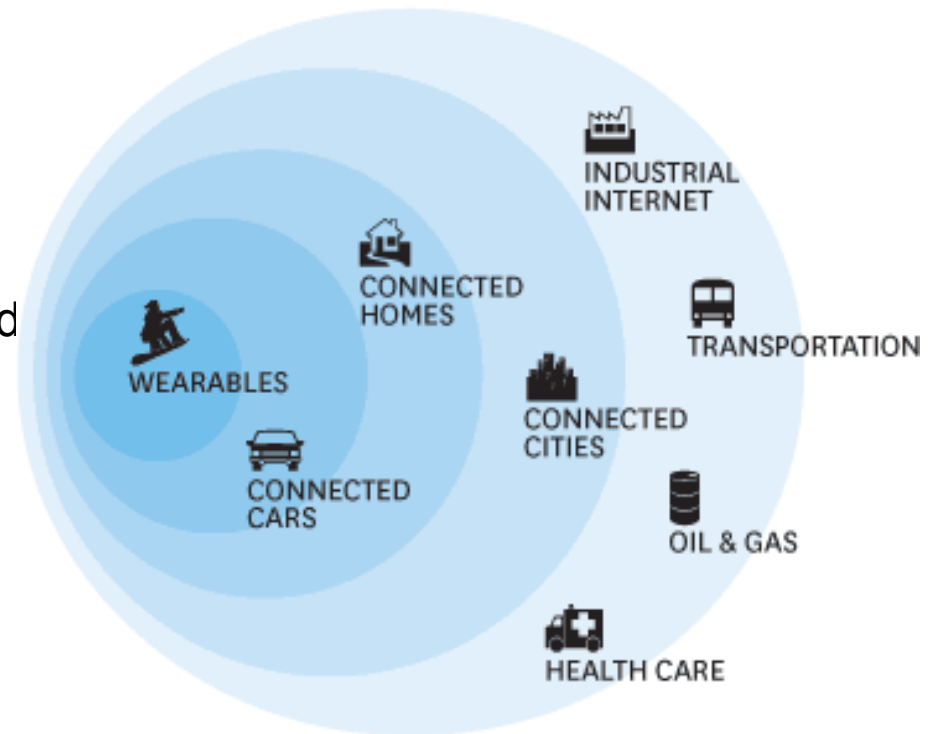


- Invisible vs flashy hardware
- Trillion vs billions of network nodes
- Last mile bottleneck vs highway
- Machine centric vs user centric
- Focus on sensing vs communication

Internet of Things Landscape

- “Smart” Consumer Technologies
- Wearables
- “Smart” Manufacturing and Infrastructure Technologies
- Intelligent Vehicles and Unmanned Transportation

THE INTERNET OF THINGS LANDSCAPE



SOURCE GOLDMAN SACHS GLOBAL INVESTMENT RESEARCH

HBR.ORG

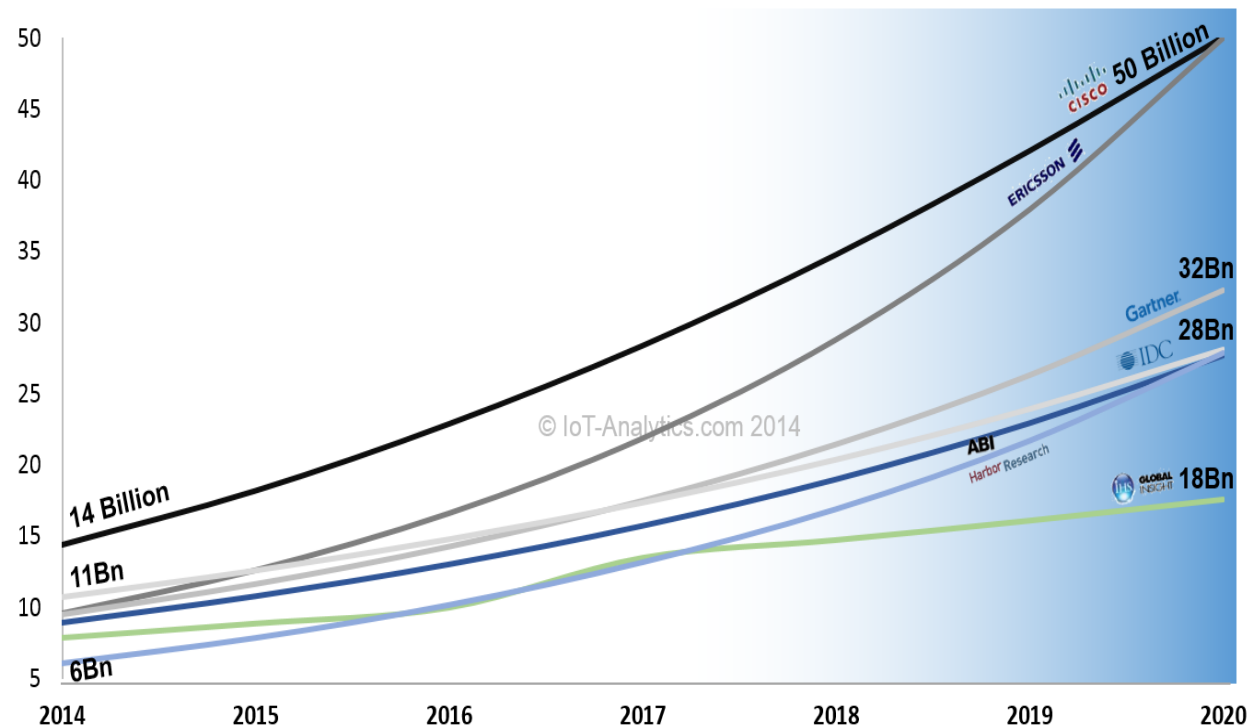
Industry Estimates: Number of Devices



Global IoT/IoE device forecasts

Source	Date	CAGR ¹ 2014-'20
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of worldwide connected devices² (in Billion)



	2013	23%
	2010	-
	2013	23%
	2014	17%
	2014	29%
	2014	21%
	2014	14%

Note: Some forecasts only for specific years, in that case all other years in between are extrapolated based on the corresponding growth rate; Ericsson does not specify today's number of connected devices – therefore: Average of all other studies assumed as starting point in 2014

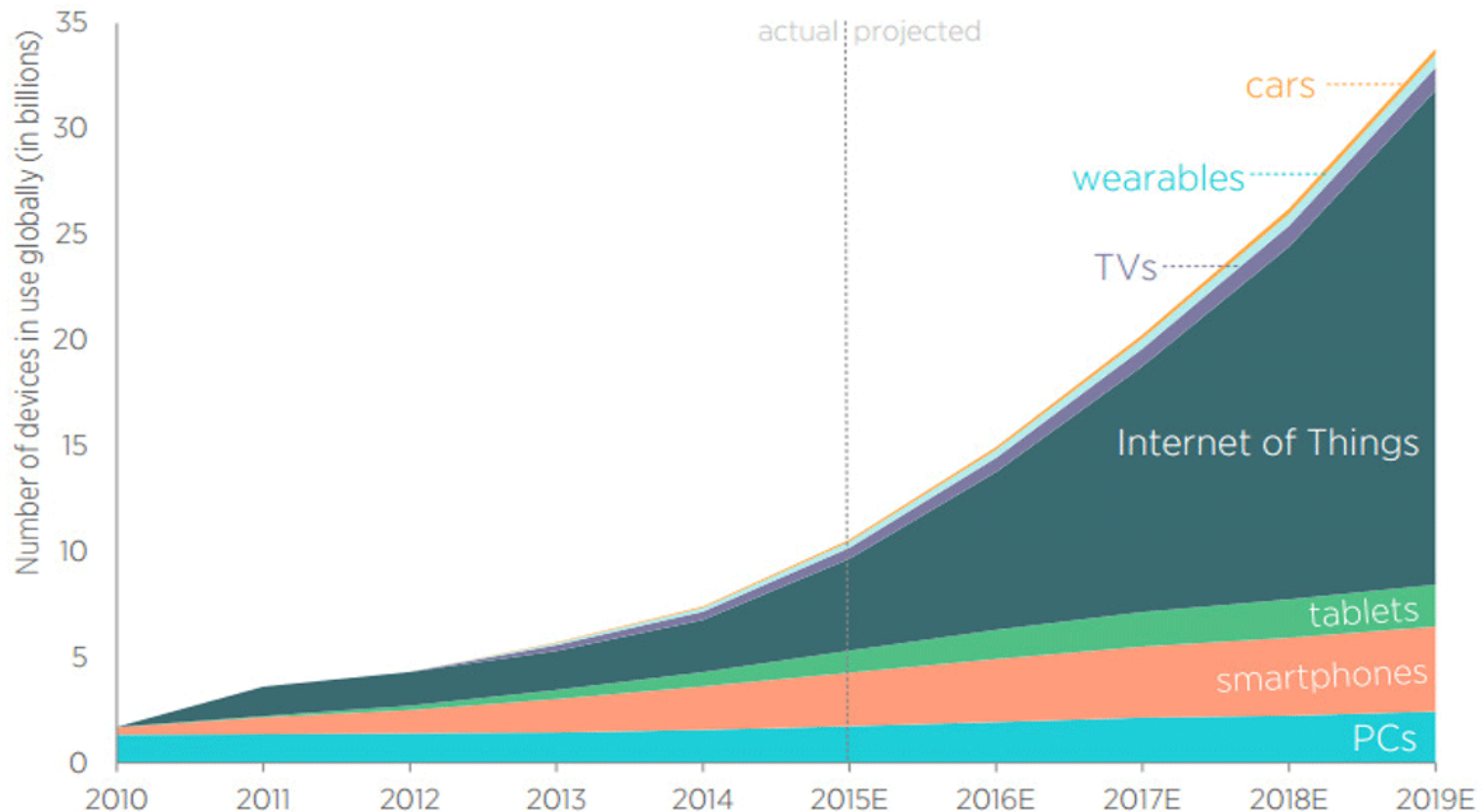
1. CAGR = Compound annual growth rate 2. Connected devices includes all autonomous connected things (every forecaster has own definition) - does NOT include computers, mobile devices, tablets

Sources: Cisco, Ericsson, ABI Research, Gartner, IHS, IDC, Harbor Research, IoT-Analytics.com

Industry Estimates: Number of Devices



Figure 2. The Internet of Everything: Devices in Use Globally



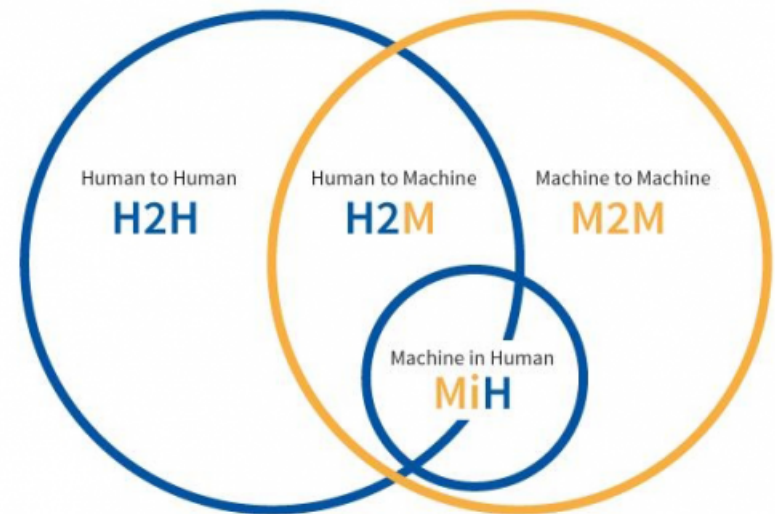
Source: John Greenough, "The Internet of Everything 2015," *Business Insider Intelligence*. Produced by Adam Thierer and Andrea Castillo, Mercatus Center at George Mason University, 2015.

Internet of Things: Value Drivers



- Based on machine-to-machine communication
 - Simplified manual proximity trigger
 - Automatic proximity trigger
 - Automatic sensors trigger
 - Automatic product security
- Based on the integration of users
 - Simple direct user feedback
 - Extensive user feedback
 - Mind changing feedback

THE INTERNET OF THINGS



IoT Value Drivers



- Simplified manual proximity trigger

Business Value	Customer Value	Example
• Increase job satisfaction • Consumer self-service • Reduces labor cost • Increases data accuracy	• Self-Service • Speed • Convenience	• Self- check out in library • Access control in buildings • Pet tagging

IoT Value Drivers



- Automatic proximity trigger

Business Value	Customer Value	Example
• Fraud-related costs • Process failure cost • Labor costs • High-granularity data for process improvement	• Convenience • Accuracy	• Asset tracking • Theft prevention • Car keys

IoT Value Drivers

- Automatic sensors trigger

Business Value	Customer Value	Example
• Process efficiency • Process effectiveness • Additional level of data granularity for process improvement	• Quality of products • Quality of Service	• Condition Monitoring • Networked smoke detectors • Smart Meters

IoT Value Drivers



- Automatic product security

Business Value	Customer Value	Example
• Cost of process failure due to fraud • Process security cost	• Increase in trust	• Anti counterfeiting • Access control • Pedigree

IoT Value Drivers



- Simple direct user feedback

Business Value	Customer Value	Example
• Process becomes more Accurate • More flexible • Faster	• Increase in convenience and entertainment value	• Perishable goof that tells its quality • Digital enhanced games • Direction indicating car keys

IoT Value Drivers



- Extensive user feedback

Business Value	Customer Value	Example
• New customer contact • New advertisement opportunity • Additional service revenues	• Increase convenience • Individualized information	• Price comparison • Audio tagging • Allergy test • Deep product information

IoT Value Drivers



- Mind changing feedback

Business Value	Customer Value	Example
• Enables new emotional product features • Active selection of attractive customer segment • Align business goals with green goals	• Help to improve life and act responsible in many different ways	• Improve health : smart toothbrush • Avoid risks : crash recorders • Save energy: smart meter apps

Projected Economic Benefits



- Substantial economic and social benefits
 - Cost savings, value creation, productivity improvements, and general economic growth.
- Improved industrial monitoring and automation techniques
 - Quickly pinpoint inefficiencies, minimize waste, and streamline processes.
- Consumer health measurement technologies
 - Promote preventative health practices and identify risk factors while emergency response communications can provide near-instant care in life-threatening situations.
- “Smart” city technologies :
 - Improve service delivery and save resources through infrastructure monitoring and automatic optimization.

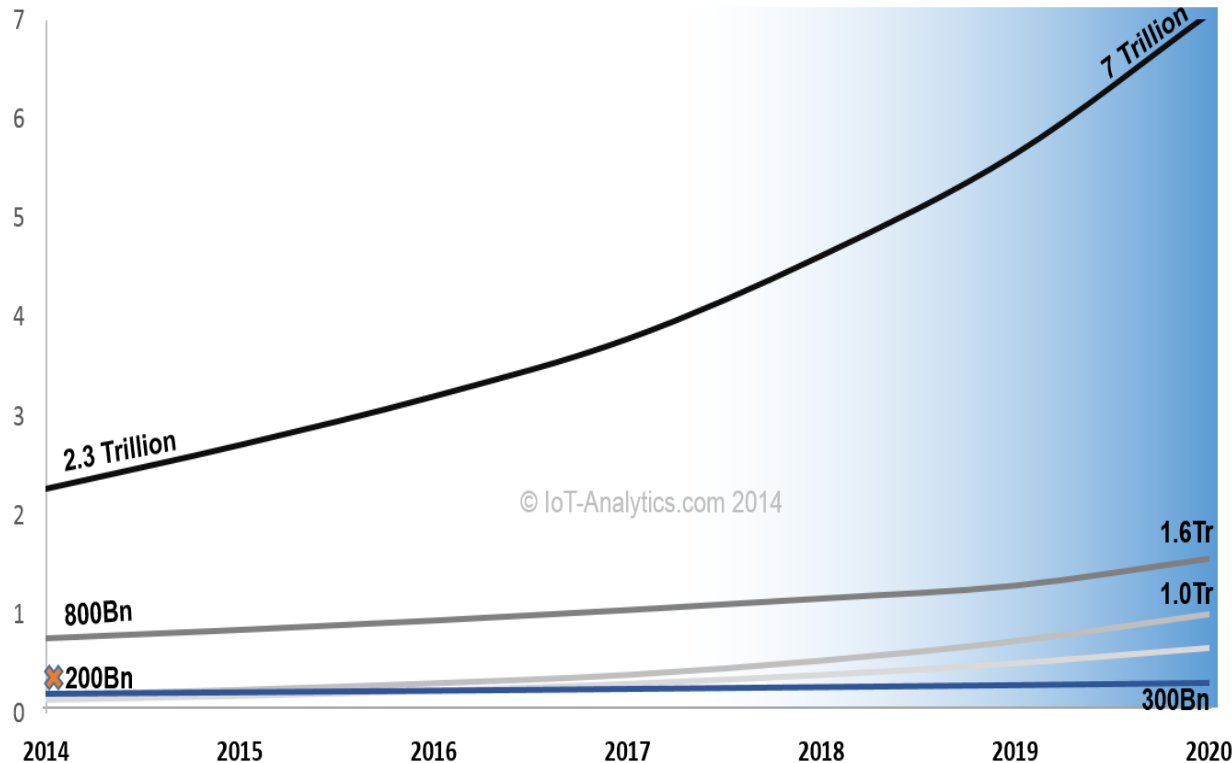
Industry Estimates: Revenue



Global IoT/IoE revenue forecasts

Source	Date	CAGR ¹ 2014-'20
--------	------	-------------------------------

Annual revenue of the IoT market (in Trillion USD)



	2014	21%
	2014	13%
	2014	33%
	2014	31%
	2013	-

Note: Some forecasts only for specific years, in that case all other years in between are extrapolated based on the corresponding growth rate
 1. CAGR = Compound annual growth rate 2. Gartner's starting point 2014 not known. Assumption: Same starting point as Markets&Markets
 Sources: Gartner, IDC, Harbor Research, Visiongain, Markets&Markets, IoT Analytics

Reference point: Combined revenue of Apple, Google, and Facebook together in 2014

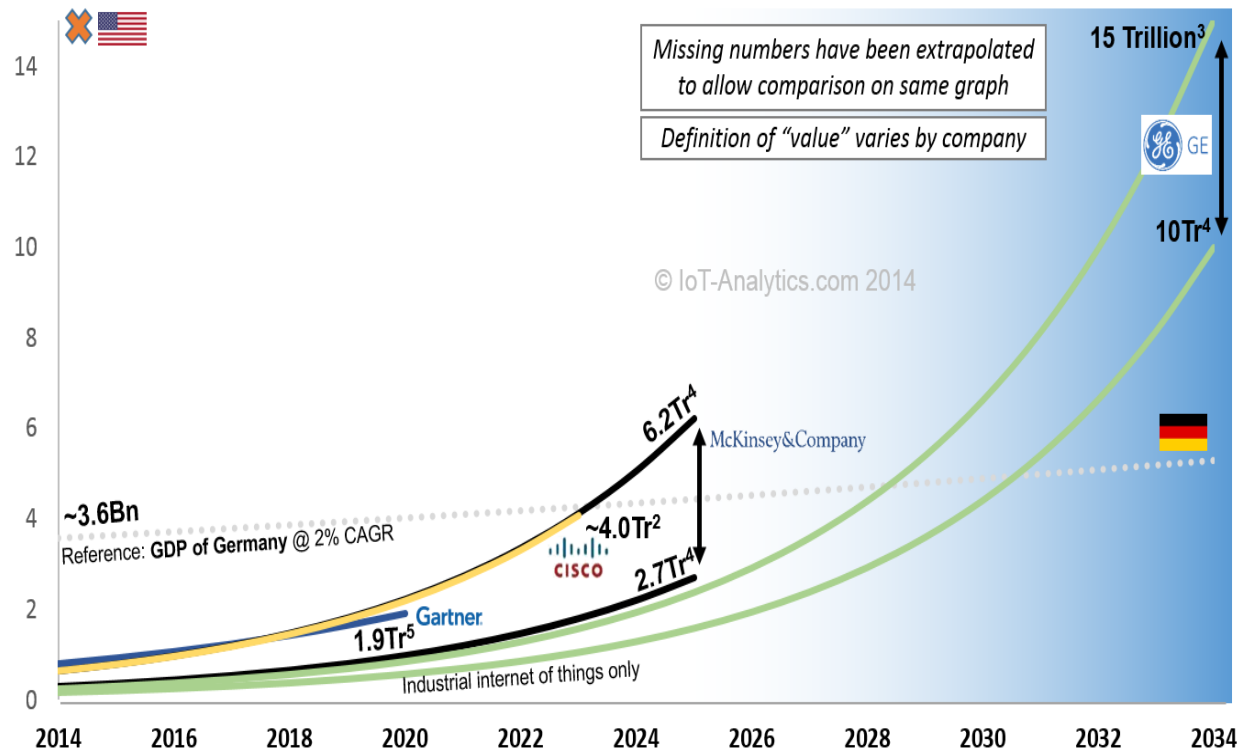
Industry Estimates: Economic Value



IoT Analytics – Quantifying the connected world

Global IoT/loE economic value forecasts

Annual economic value of the IoT market (in Trillion USD)



Source	Date	Original quote ¹
McKinsey&Company ⁽⁴⁾	2013	"IoT has the potential to create economic impact of \$2.7-6.2 trillion annually by 2025"
GE ⁽³⁾ Industrial internet only	2012	"Industrial Internet could add \$10-15 trillion to global GDP in 20 years"
CISCO ⁽²⁾	2013	"\$19 trillion in loE value is at stake in the next decade"
Gartner ⁽⁵⁾	2013	"IoT will result in \$1.9 trillion in global economic value-add in 2020"
Germany		GDP of the total economy

1. Wording as initially published 2. Cisco "value at stake" has been forecast as \$19 trillion over total decade. Value has been spread over 10 years assuming the same annual growth rate as Cisco's IoT device forecast 2014-2020 3. GE's "potential GDP impact" was forecasted as \$10-15 trillion in 20 years. Value for the previous years has been assumed using the average IoT device growth rate 2014-2020 of 21% 3. McKinsey's "potential economic value-add" for the years 2014-2024 calculated taking the average IoT device growth rate 2014-2020 of 21%. 5. Gartner's numbers have been calculated using Gartner's annual IoT revenue growth 2014-2020 of 8%.
Sources: McKinsey, General Electric, Cisco, Gartner, IoT Analytics

Reference point: Total GDP of the USA in 2014

Setting-Based Economic Value



- Bottom-up modeling methodology to estimate the potential economic value

- Looking through the lens of individual applications and industries is inadequate

- *Settings*, the physical environments in which these various systems and applications are deployed

A “settings” lens helps capture all sources of value; we identify nine settings where IoT creates value

Setting	Description	Examples
 Human	Devices attached to or inside the human body	Devices (wearables and ingestibles) to monitor and maintain human health and wellness; disease management, increased fitness, higher productivity
 Home	Buildings where people live	Home controllers and security systems
 Retail environments	Spaces where consumers engage in commerce	Stores, banks, restaurants, arenas—anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
 Offices	Spaces where knowledge workers work	Energy management and security in office buildings; improved productivity, including for mobile employees
 Factories	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory
 Worksites	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
 Vehicles	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircraft, and trains; condition-based maintenance, usage-based design, pre-sales analytics
 Cities	Urban environments	Public spaces and infrastructure in urban settings; adaptive traffic control, smart meters, environmental monitoring, resource management
 Outside	Between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations), and flight navigation; real-time routing, connected navigation, shipment tracking

SOURCE: McKinsey Global Institute analysis

McKinsey's Projections



- The Internet of things offers a potential economic impact of \$4 trillion to \$11 trillion a year in 2025



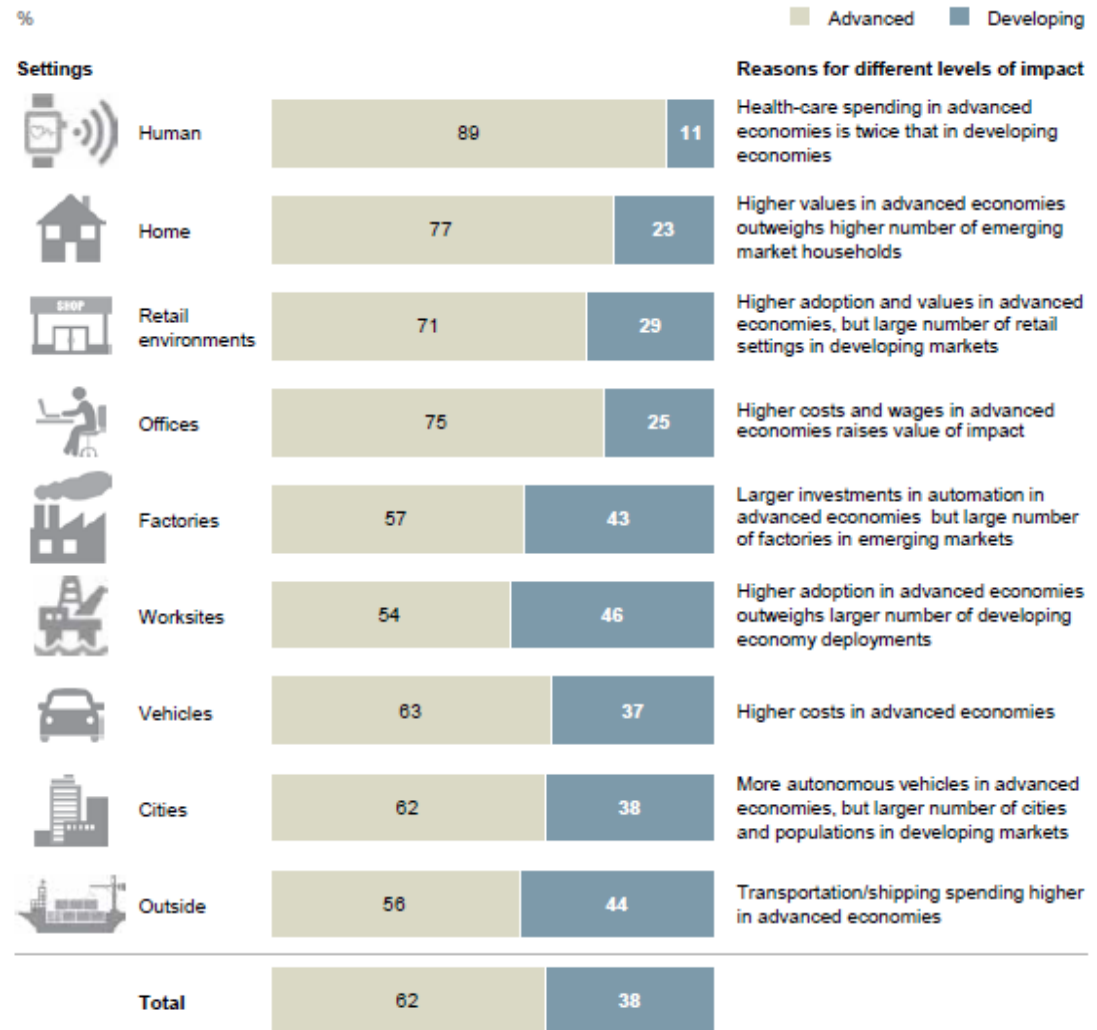
¹Adjusted to 2015 dollars; for sized applications only; includes consumer surplus. Numbers do not sum to total, because of rounding.

McKinsey&Company | Source: McKinsey Global Institute analysis

Developing vs Advanced Countries



- More value from IoT could be created in advanced economies, but the number of deployments could be higher in the developing world



NOTE: Numbers may not sum due to rounding.

SOURCE: McKinsey Global Institute analysis

- “Adoption depends on having certain technologies, organizational capabilities, and policies in place. It will also require collaboration among supplier companies and among suppliers, users, and policy makers...”
- Key Enablers
 - Technology
 - Interoperability
 - Privacy and Confidentiality
 - Security
 - Intellectual Property
 - Business Organization and Culture
 - Public Policy