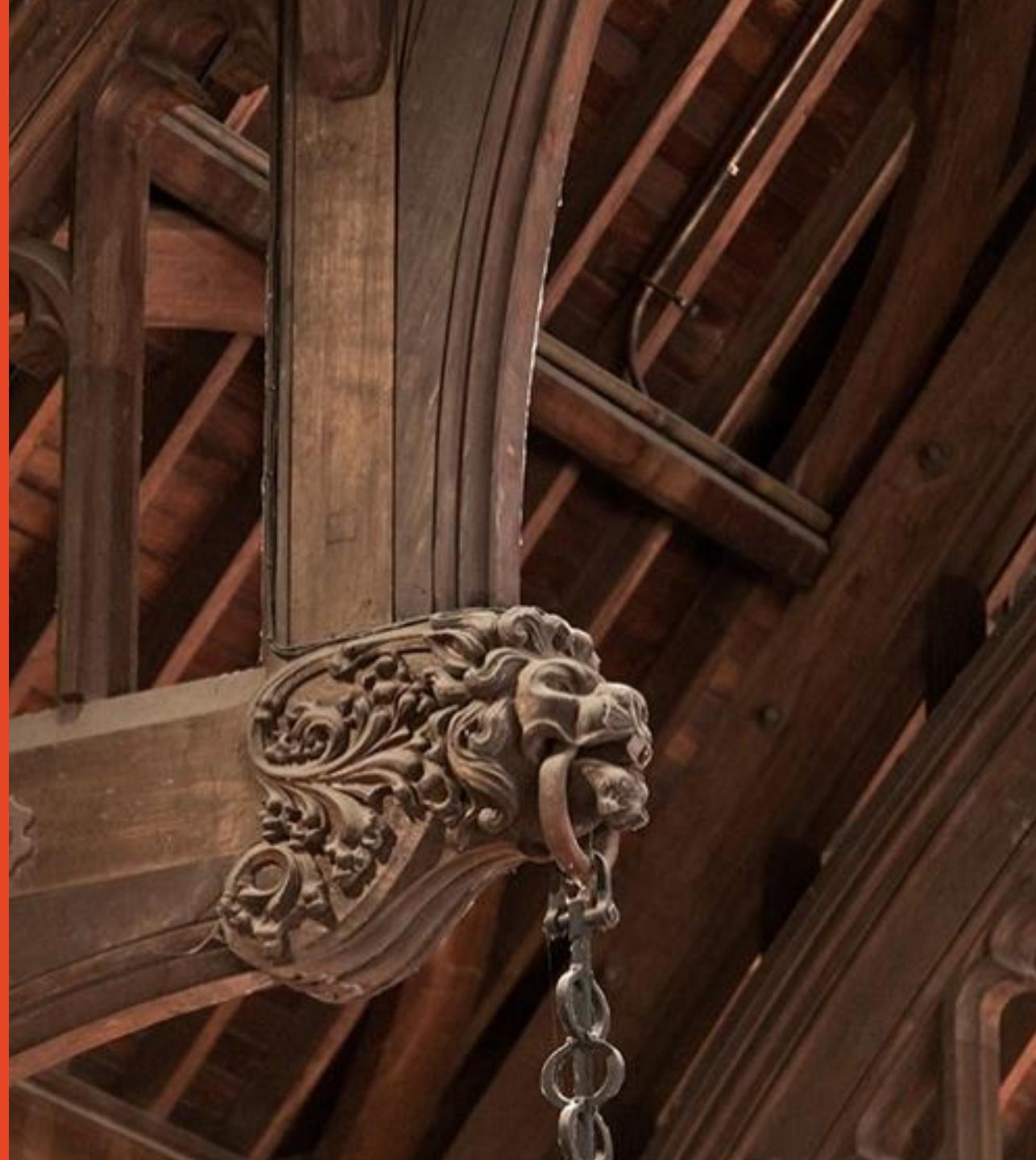


INFO5992 Understanding IT Innovations

Week 4: Disruptive Innovation

A/Prof Jinman Kim

Semester 1, 2018



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UoS Outline

Week	Lecture Topics	Activity	Assessments
1. 5 Mar	UoS Introduction; Definition of IT Innovation; IT Innovation System; IT Innovation in Australia	Tute 1 – Welcome to your tutorial; Importance of innovation to a Country	Form Groups
2. 12 Mar	Introduction to Technological / IT innovation; Examples of IT innovation in industry sectors; Type and Source of Innovation	Tute 2 – Massive Open Online Courses – Enabling technologies and Peer-review	
3. 19 Mar	Dynamics of Technological / IT Innovation; Adoption of Technology; Dominant Design	Tute 3 – Dominant design in the Smartphone market	Individual Report Introduction
4. 26 Mar	Disruptive Innovation; Industry Value Chain; Value Network analysis	Tute 4 – Cognitive IT services and its value chain	Quiz intro
Easter Break			
5. 9 Apr	Distributed innovation I: Open / Closed innovation; Platform innovation; Web APIs;	Tute 5 – Web API considerations	MCQ Group presentation Introduction
6. 16 Apr	Distributed innovation II: Crowd innovations; Free and Open source software;	Tute 6 – Open source Geolocation and Maps	
7. 23 Apr	Distributed innovation III: User innovation; Open Data	Tute 7 – Sharing Economy from a Distributed Innovation Context	
8. 30 Apr	Innovation by Start-up companies and Opportunities	Tute 8 – Business Model Canvas	
9. 7 May	Organisational Culture; Structure supporting innovation	Tute 9 – Group Presentation preparations and feedback	MCQ Report Submission
10. 14 May	IT Innovation Management	Group Presentation	Group Presentation submissions
11. 21 May	Innovation ecosystem; Sydney's innovation ecosystem	Peer-Review Marking	
12. 28 May	Judging IT Innovations	Tute 10 – Developing a Judging criteria for IT Innovation project	
4. 30 Jun	UoS Review; UoS comments / questions	Tute 11 – Technology innovations in IT Management	Peer-review

Agenda

- Disruptive Innovation
- Tutorial 4 – Innovative Tech Practice – Cognitive services
- Reminder – Presentation Group topics
- Quiz preparations

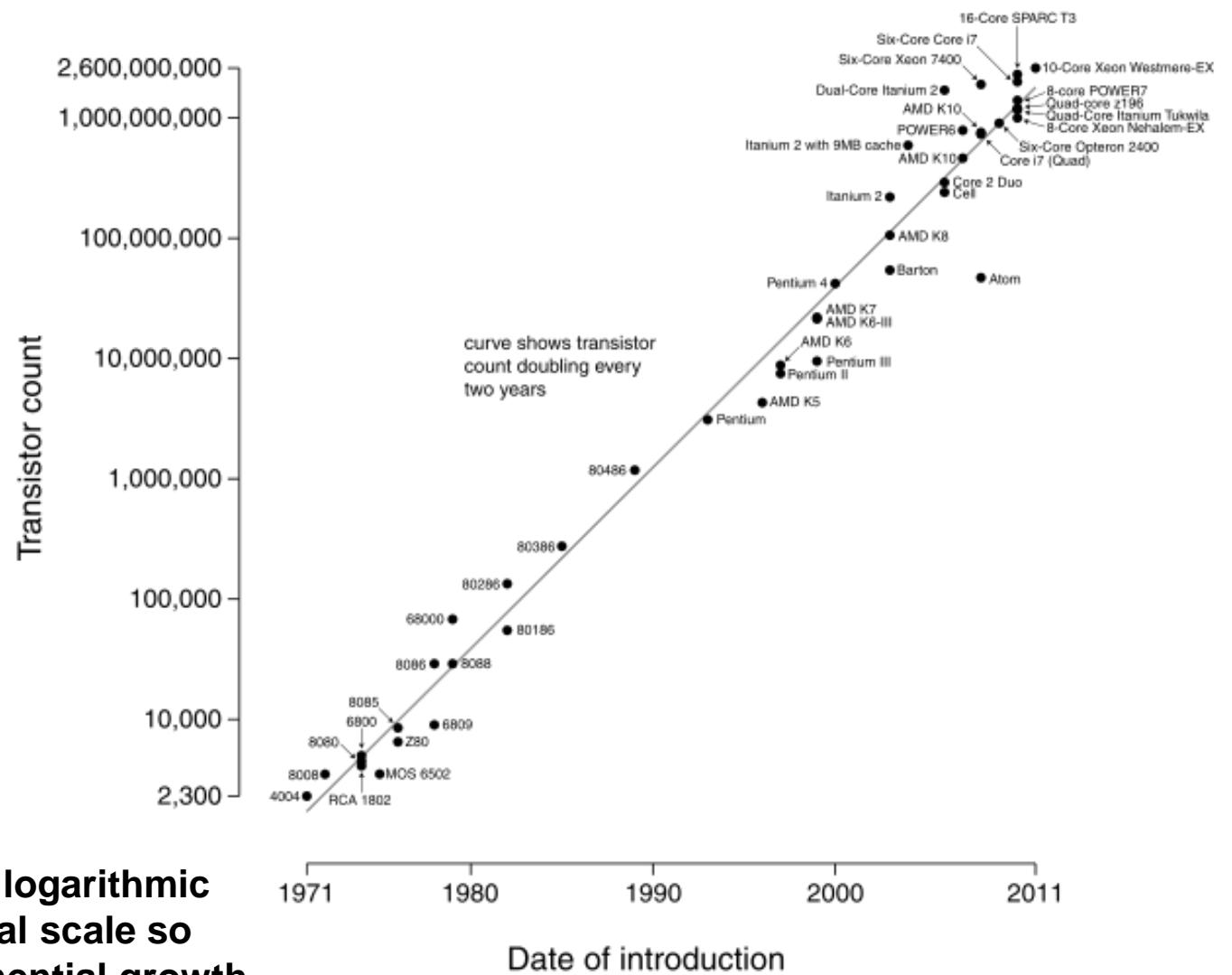
Technology Evolution

Moore's Law



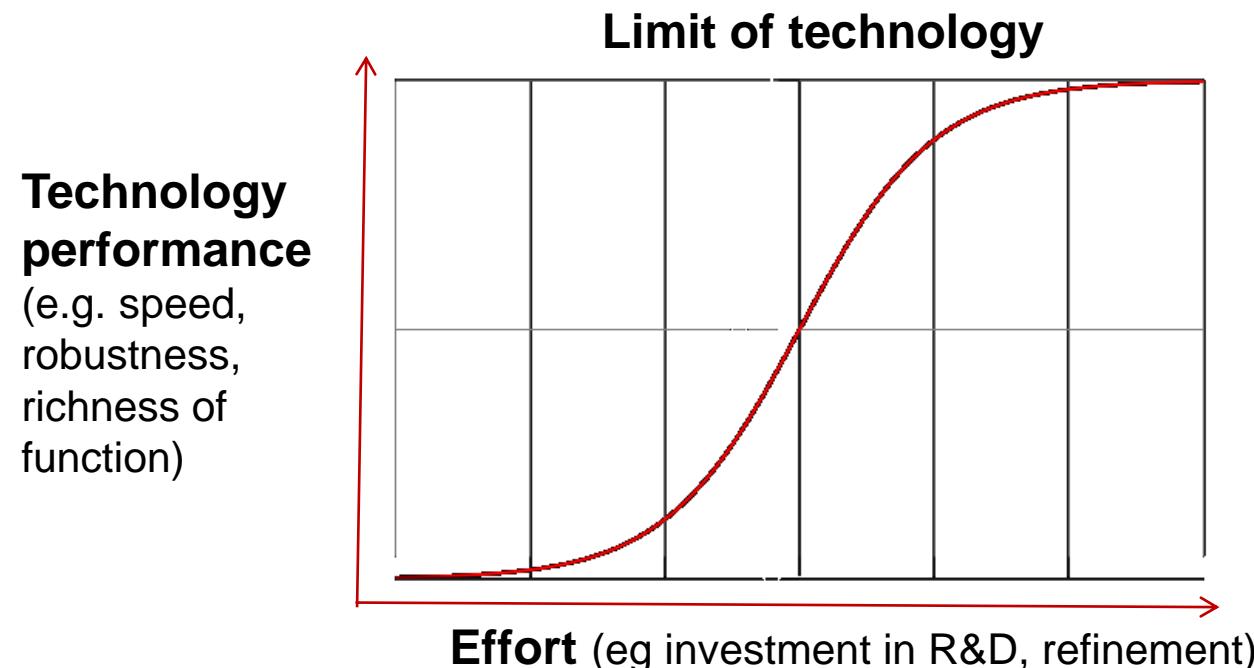
- Gordon Moore, co-founder of Intel
- He noticed that transistor count on an integrated circuit doubles every 2 years
- The curve here has continued to be exponential but many say it will slow down as physical limits are met

Microprocessor Transistor Counts 1971-2011 & Moore's Law

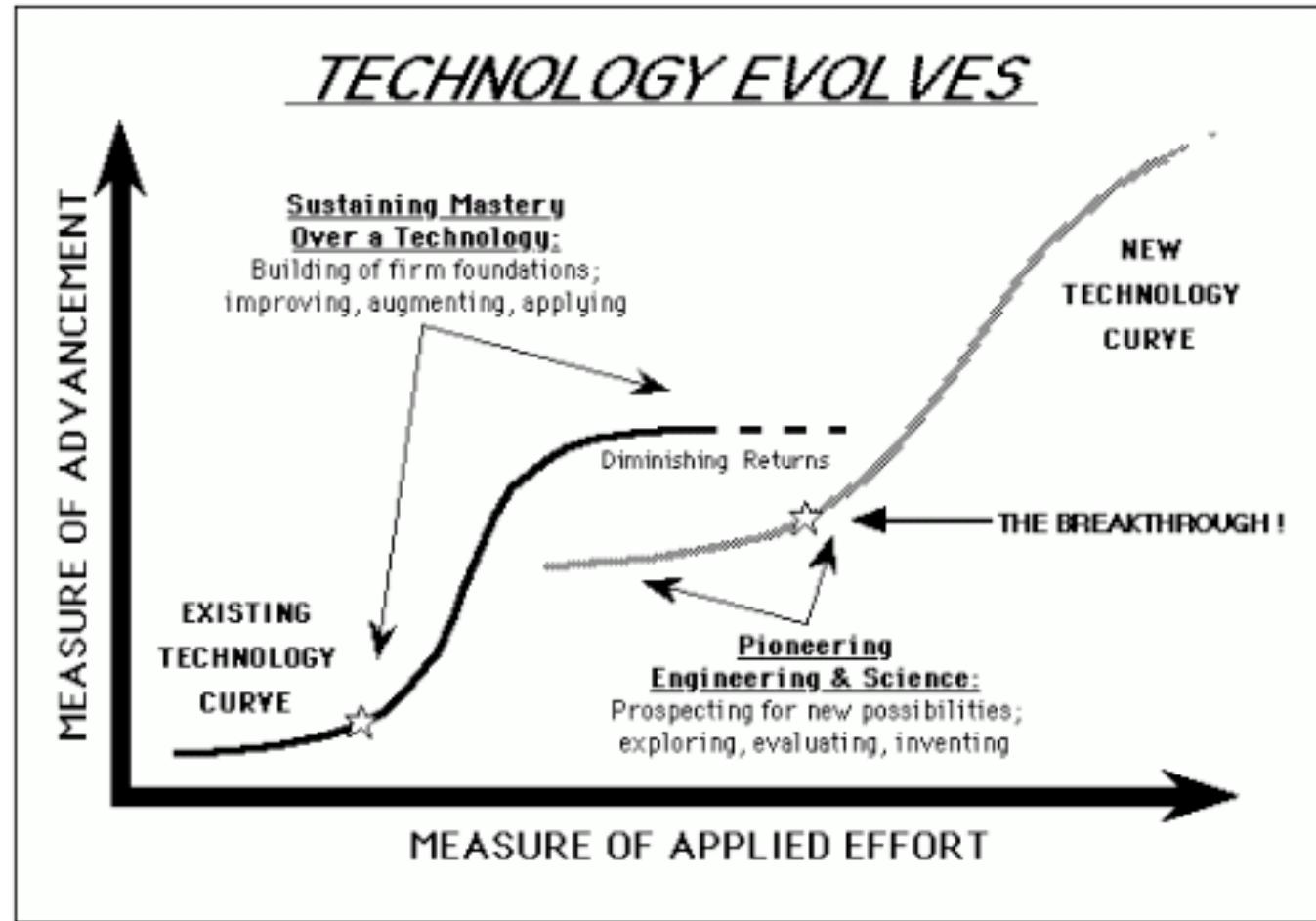


Technology Performance over time

- The “technology performance S-curve”
- Used to show and predict performance improvement of a technology
- Shows that the performance of a technology starts slowly, then improves approximately exponentially, then slows and eventually saturates



Technology evolving



<http://olegmoskalev.net/index.php/the-food-project/34-why-do-people-waste-food/92-research-aims-a-methodology>

Adapted from Attacker's Advantage (Foster, 1986).

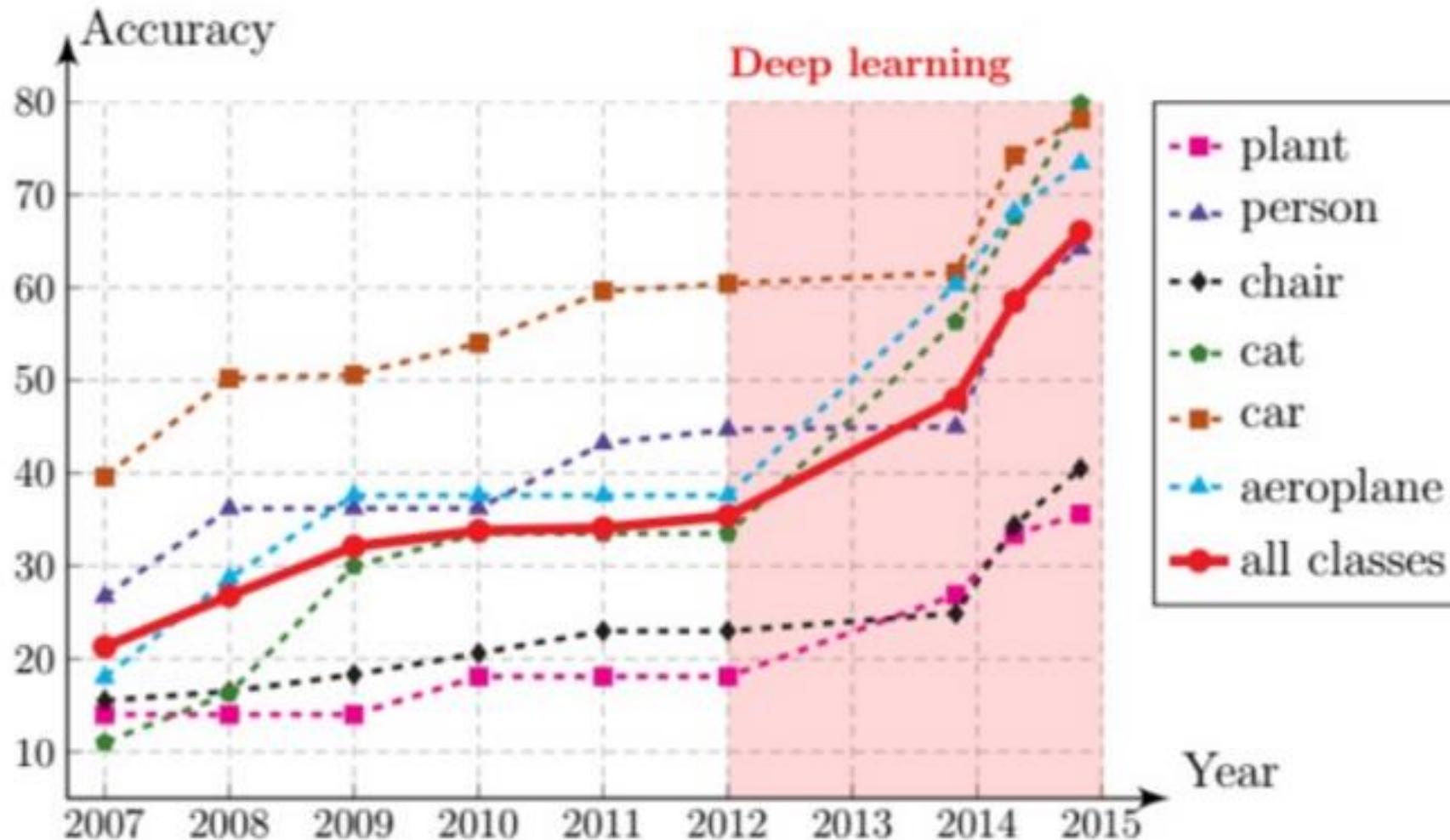
Recap Week 1 - Innovation as “Creative Destruction”



Schumpeter

- **Creative destruction – waves that restructure entire industries and markets in favour of those who grasp and adapt to technological changes faster!**
- The fact that nearly 9 of every 10 Fortune 500 companies in 1955 are gone, merged, or contracted demonstrates that there's been a lot of market disruption, churning, and **Schumpeterian creative destruction** over the last six decades.

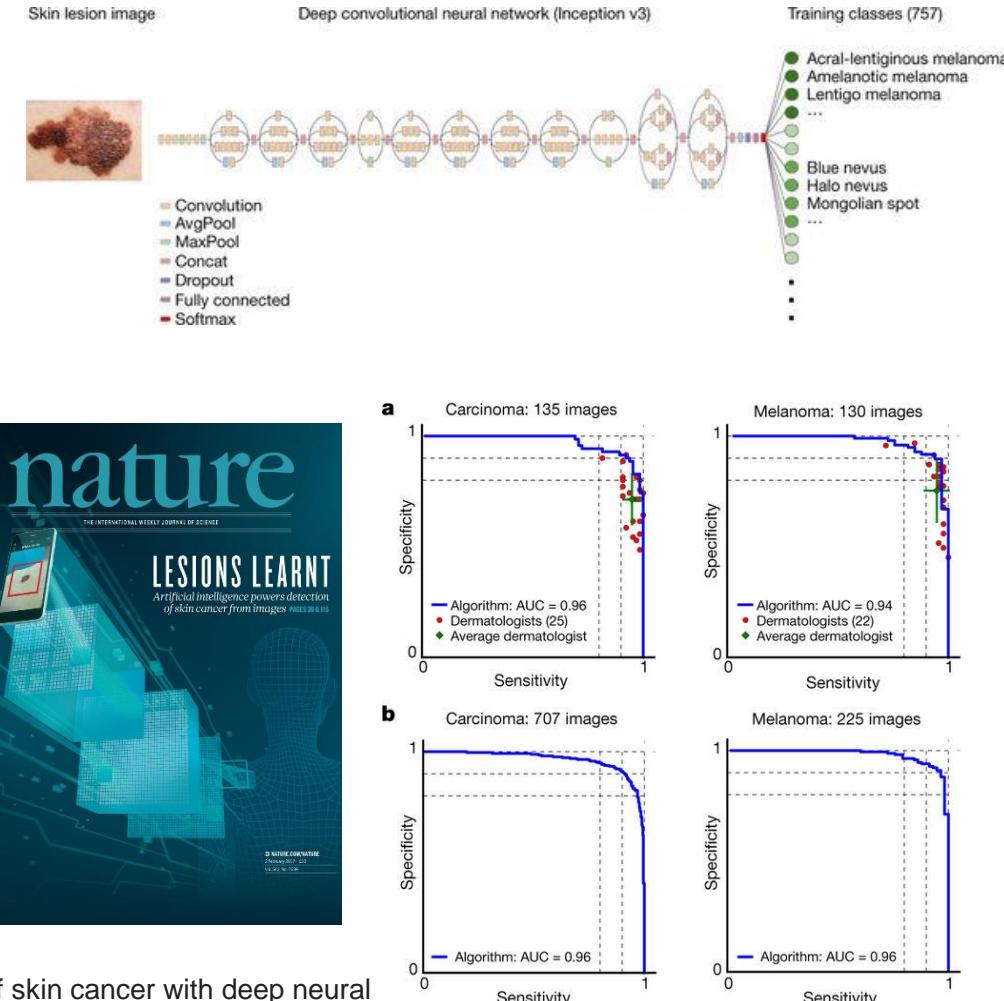
Example: Breakthrough in Computer Vision



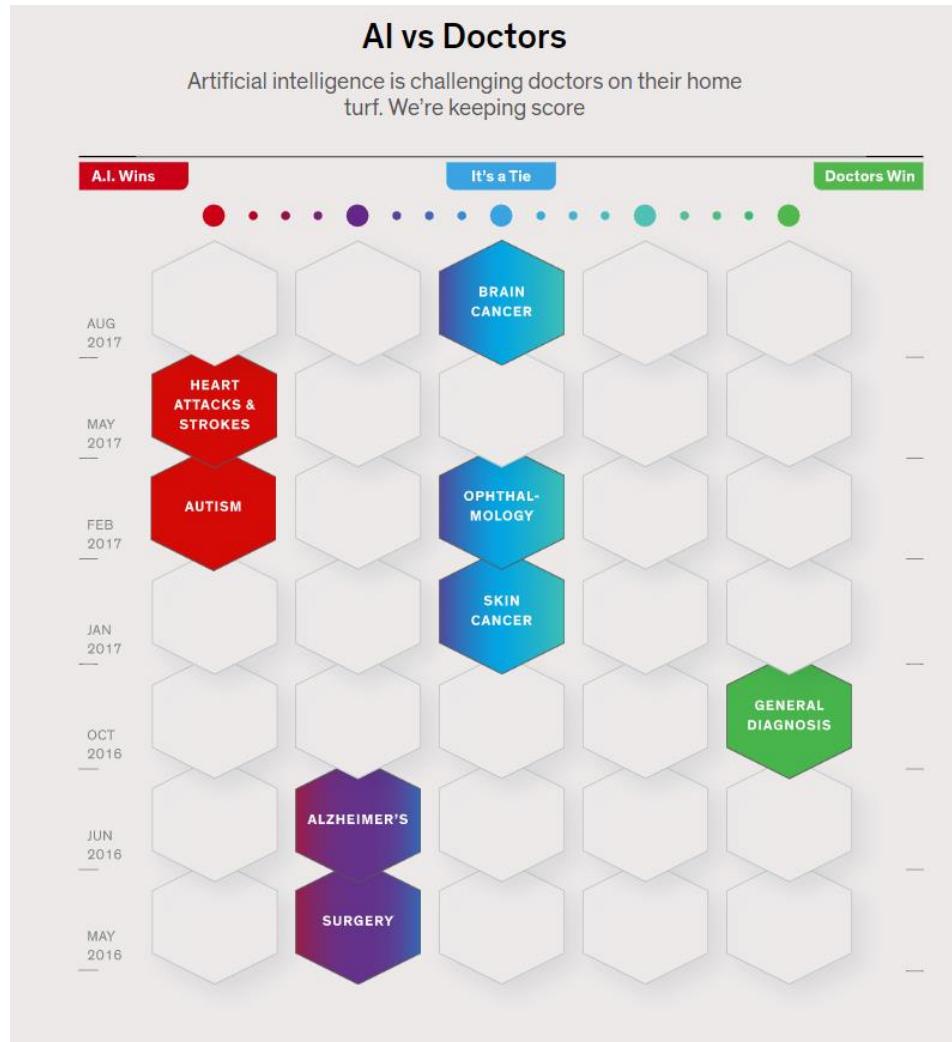
presentation given at the Deep Learning Meetup Stockholm, 20 April 2015
<http://www.slideshare.net/roelofp/deep-learning-a-birdseye-view>

Nature – Deep Learning in Medical Applications

- Dermatologist-level classification of skin cancer with deep neural networks
 - 5.4M new cases of skin cancer every year in US
 - Melanoma is the most deadly skin cancer type
 - 5-year survival rate for melanoma is ~99% if detected in its earliest stages, 14% if detected in its latest stages
 - Trained >100K images
 - Google Inception architecture
 - Achieve similar performance to the dermatologists



AI vs Doctors



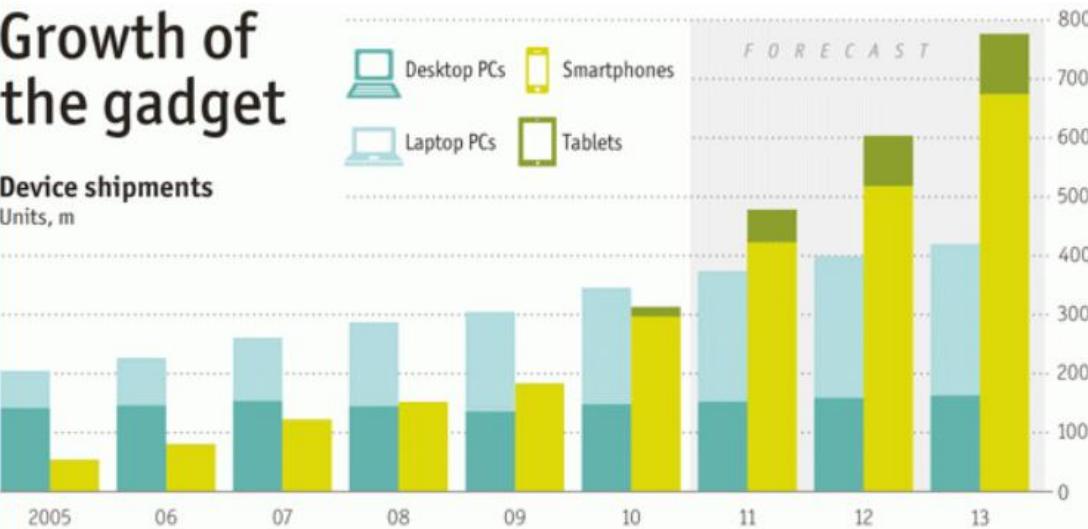
- win/tie/loss – 4, 3, 1
- E.g., Predict heart attacks & strokes in 10 years
 - AI correctly predicted extra 355 ($4998/7404$) studies compared with human

Personal Computer Market

Growth of the gadget

Device shipments

Units, m



Devices in use:

100m PCs
in 1993

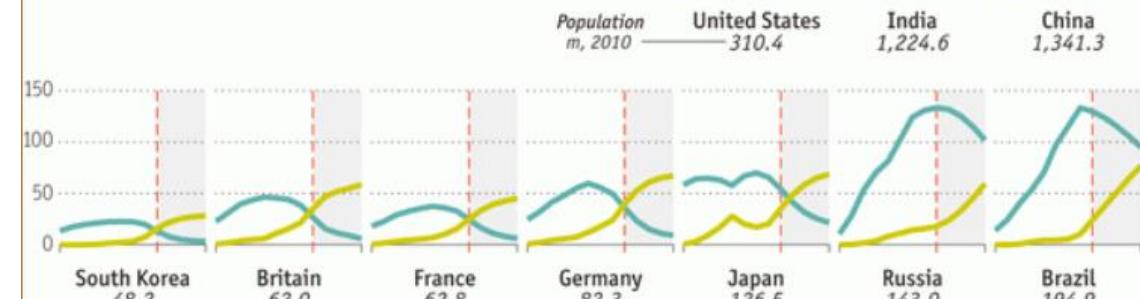
1bn PCs
in 2008

10bn
Mobile connected devices
by 2020*

Mobile phones in use

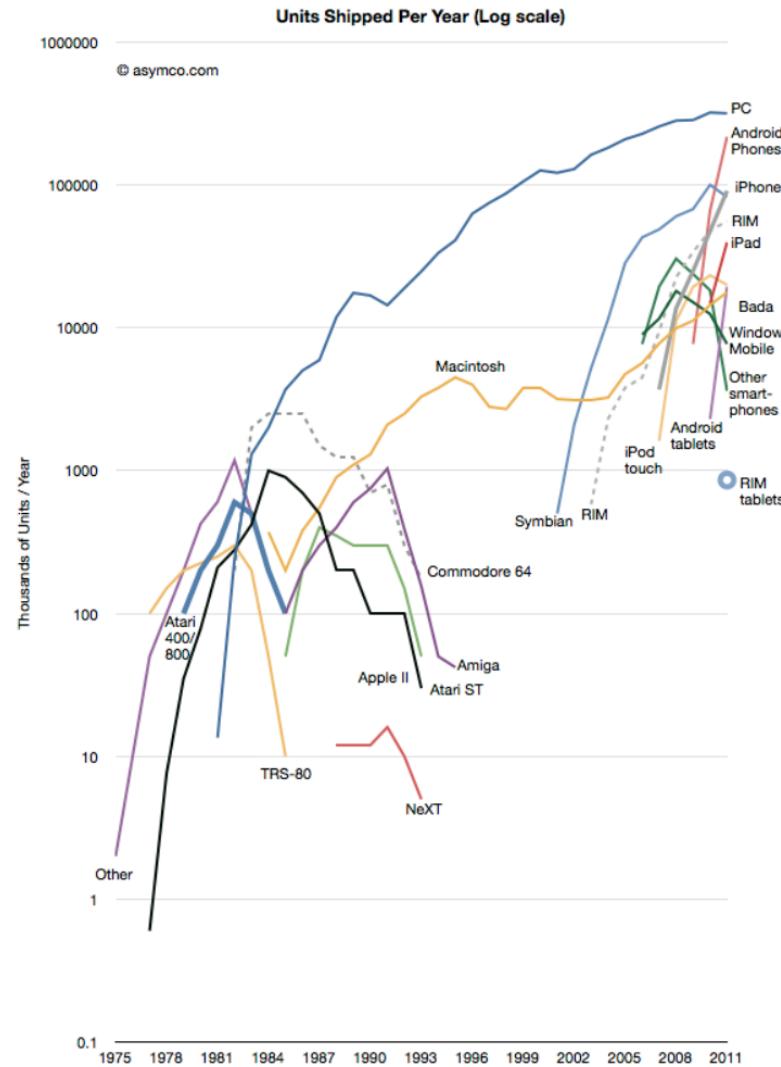
m, 2003-15

2011 Forecast

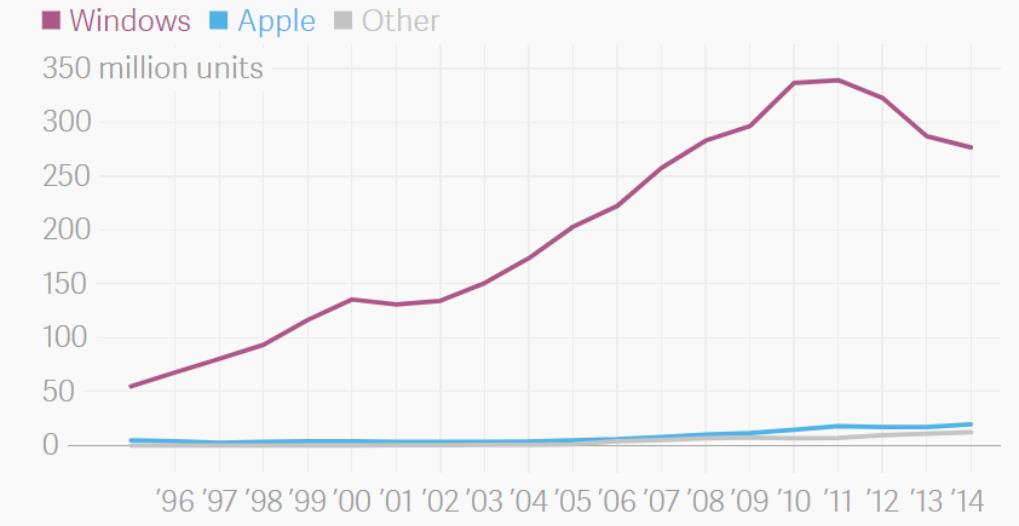


<https://www.economist.com/node/21531109>

Rise and Fall of PC



Computer sales by operating system

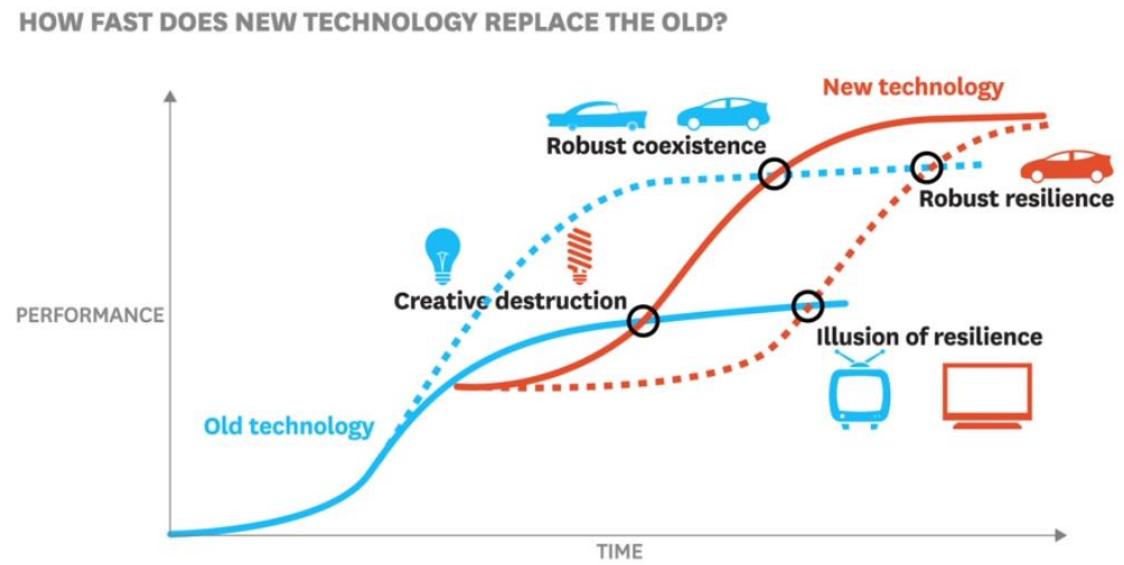


<https://qz.com/486492/the-20-year-rise-and-fall-of-microsoft-windows-from-1995-to-now/>

<http://www.asymco.com/2012/01/17/the-rise-and-fall-of-personal-computing/>

Right Tech, Wrong Time

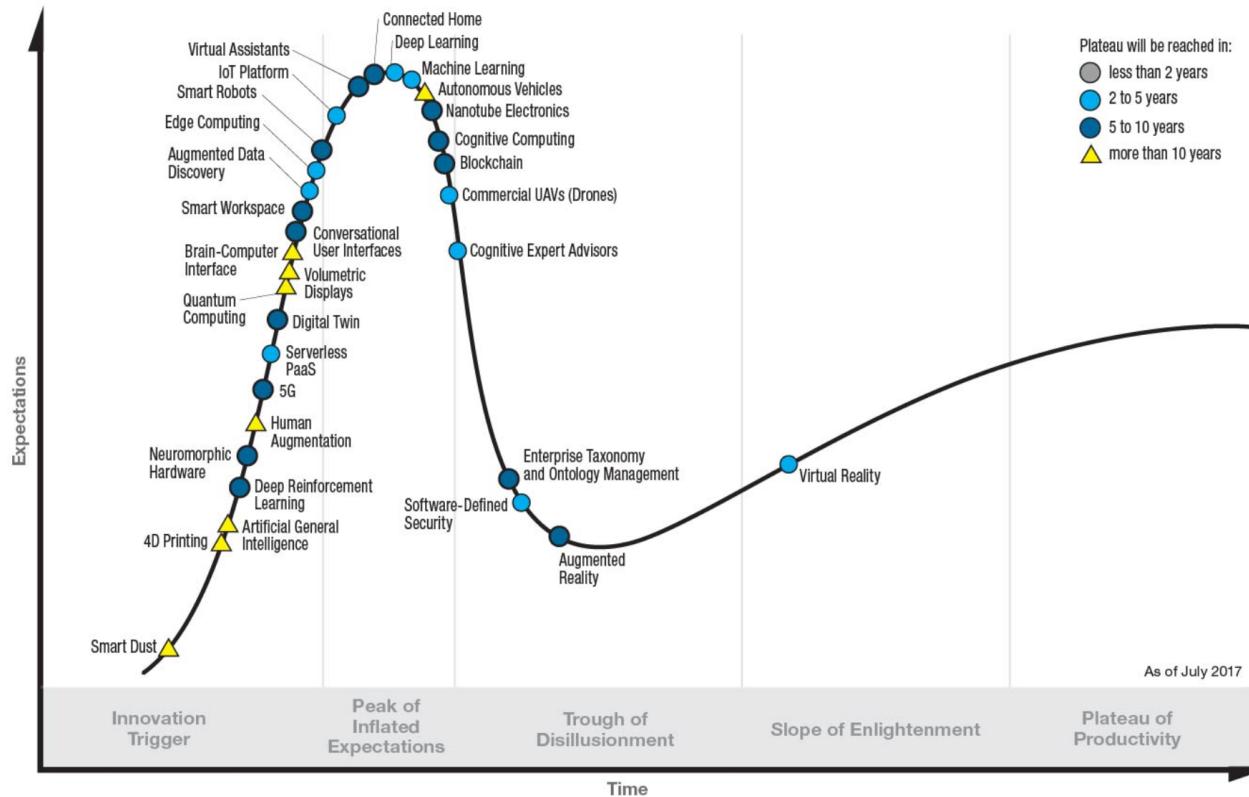
- **Creative Destruction** – Fastest Substitution – fastest to adapt
- **Robust coexistence** – Gradual substitution – when both the old and the new coexists
- **Robust resilience** – Slowest substitution – adopts technology but slowly
- **Illusion of resilience** – Stasis followed by rapid substitution when old technology do not adapt and fade



<https://hbr.org/2016/11/right-tech-wrong-time?referral=00060>

Modelling the maturity and adoption of new technologies: the “Hype Cycle” 2017

Gartner Hype Cycle for Emerging Technologies, 2017

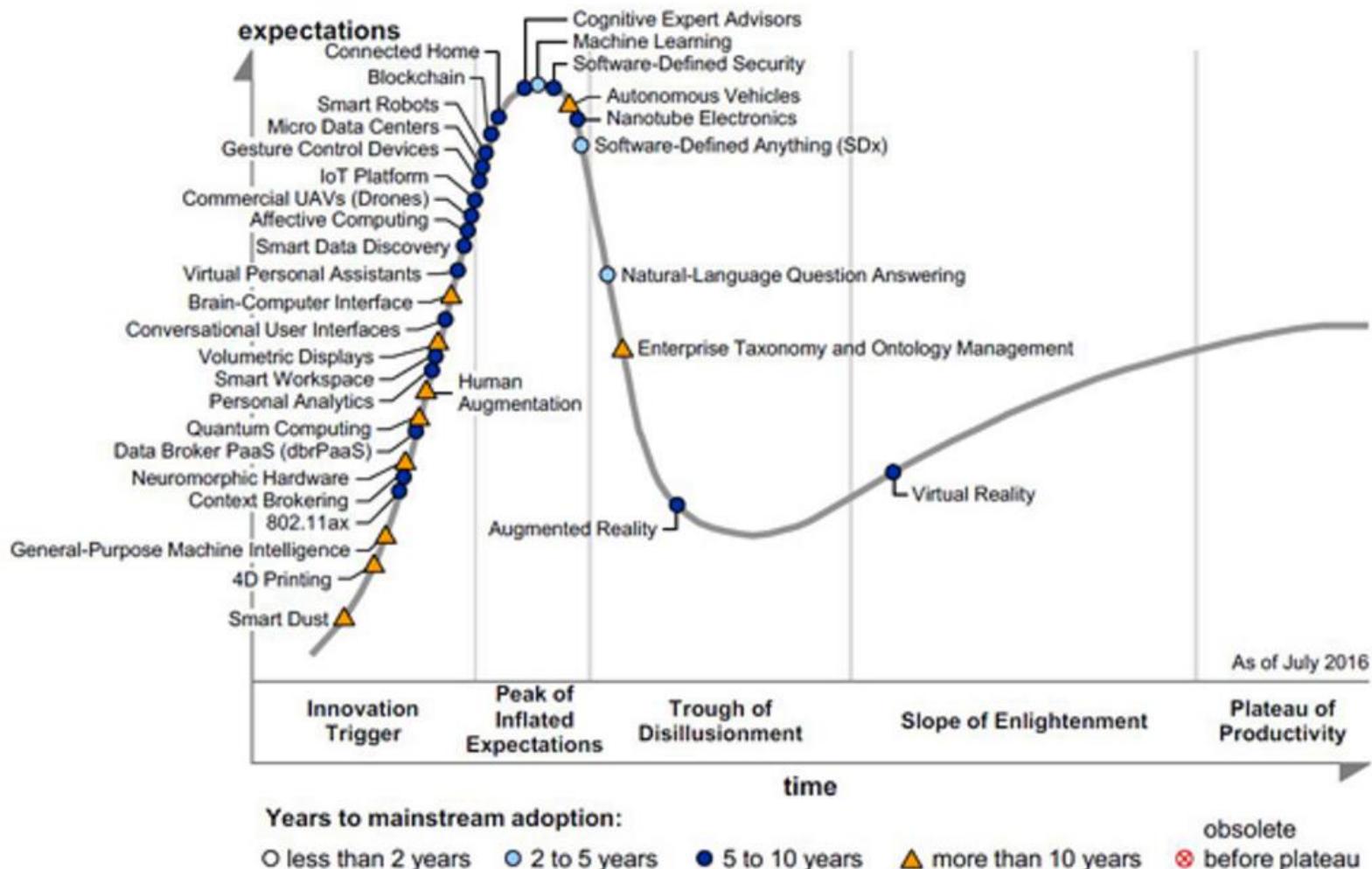


gartner.com/SmarterWithGartner

Source: Gartner (July 2017)
© 2017 Gartner, Inc. and/or its affiliates. All rights reserved.

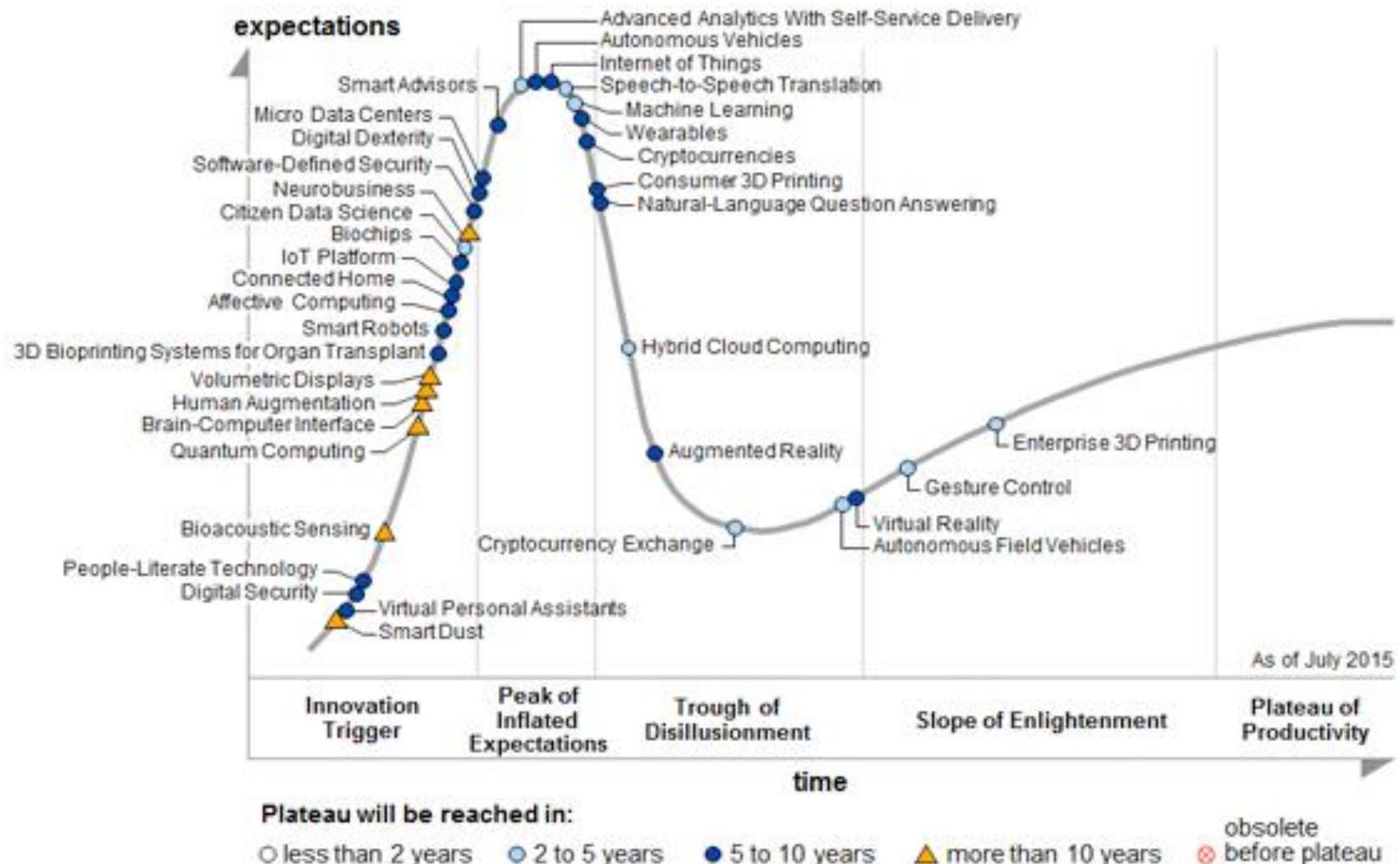
Gartner

Modelling the maturity and adoption of new technologies: the “Hype Cycle” 2016



Source: Gartner (July 2016)

Modelling the maturity and adoption of new technologies: the “Hype Cycle” 2015



Source: <http://www.gartner.com/newsroom/id/3114217>

The Gartner Hype-Cycle

- Uses:
 - Strategic planning of technology development
 - Companies considering adoption of a technology
 - Investors investing in technology
- Some criticisms
 - Development of each Gartner Hype-Cycle is not done scientifically – it is the opinions of market analysts at a point in time
 - Technologies may appear already on the slope of enlightenment or disappear
 - It only works for technologies that follow this model (eg it doesn't deal well with technologies that never succeed or are quickly superseded)
 - As it is widely-used, it is partly self-fulfilling (i.e. people may not adopt technologies as they don't appear mature in the hype-cycle)
- Summary: Use with care

Disruptive Innovation

“Disruptive Innovation”



Clayton Christensen,
Economist (Harvard
University) and
business strategist

- Clayton Christensen introduced the concept of “disruptive technology” (1995), later reframing it to be “disruptive innovation” (1997)
- Author (or co-author) of well-known books including:
 - The Innovator’s Dilemma (1997)
 - The Innovator’s Solution (2003)
 - Disrupting class (2008)
 - The Innovator’s Prescription (2008)
 - The Innovative University (2011)
- Good site for disruptive innovation topics:
 - <https://hbr.org/topic/disruptive-innovation>

Disruptive Technology to Disruptive Innovation?

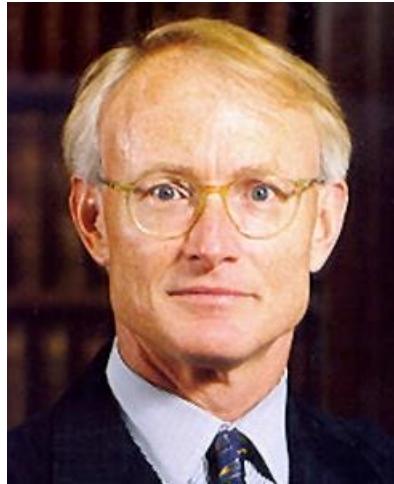
- Why did Christensen change from “disruptive technology” to “disruptive innovation” ?
- Recognized that few technologies are intrinsically disruptive or sustaining in character
- It is the ***business model*** that the ***technology enables*** that creates the disruptive impact
- Christensen's ***evolution from a technological focus to a business-modelling focus*** is central to understanding the evolution of business at the market or industry level

<https://www.startupgrind.com/blog/sg-2016-welcoming-clayton-christensen-godfather-of-disruptive-innovation/>

“Disruptive Innovation”

- “Disruptive innovations” disrupt markets
- They create new markets or change the **value network** in an existing market.
- Term “value network” first used by Clayton Christensen
- Similar concept to “industry value chain” but usually **more focused on the whole system** rather than for a specific product/service type
- To understand “**value network**”, we must study “**value chain**”

Disruptive Innovation affects “Value Chain”



- Michael Porter introduced the concept of “value chains” (1985)
- In best-selling book: “Competitive advantage: Creating and sustaining superior performance”
- The father of company strategy.
- Most cited author in business and economics.

Michael Porter
(Harvard University)
Expert on competition and
company strategy

images.businessweek.com

Porter's “Value Chain”

- Typically describe how value is added within different business units of a company
- **Products pass through stages and value is added at each stage**
- More suited to manufacturing physical goods than IT

- Has been extended to show how **value flows** through an **industry**
- **In this course, we will only be talking about value chains within industries, not internally within companies**

Industry value chains

- An industry value chain is how value is created and passed on between participants in an industry
- Diagrams can show how value flows through the industry
- Value may be from licensing a technology, selling a product, providing a service, etc

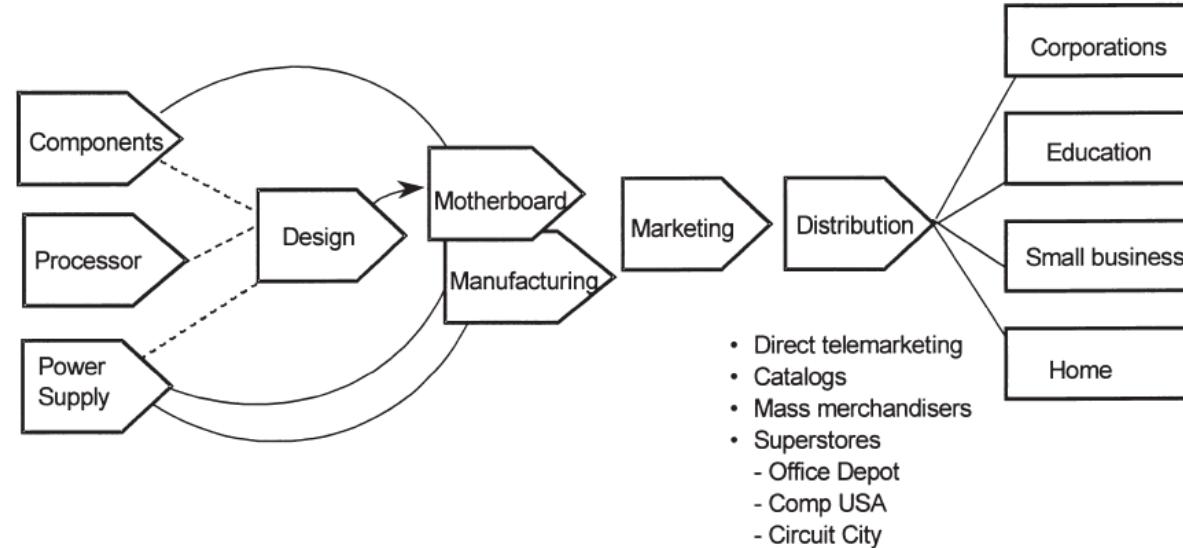
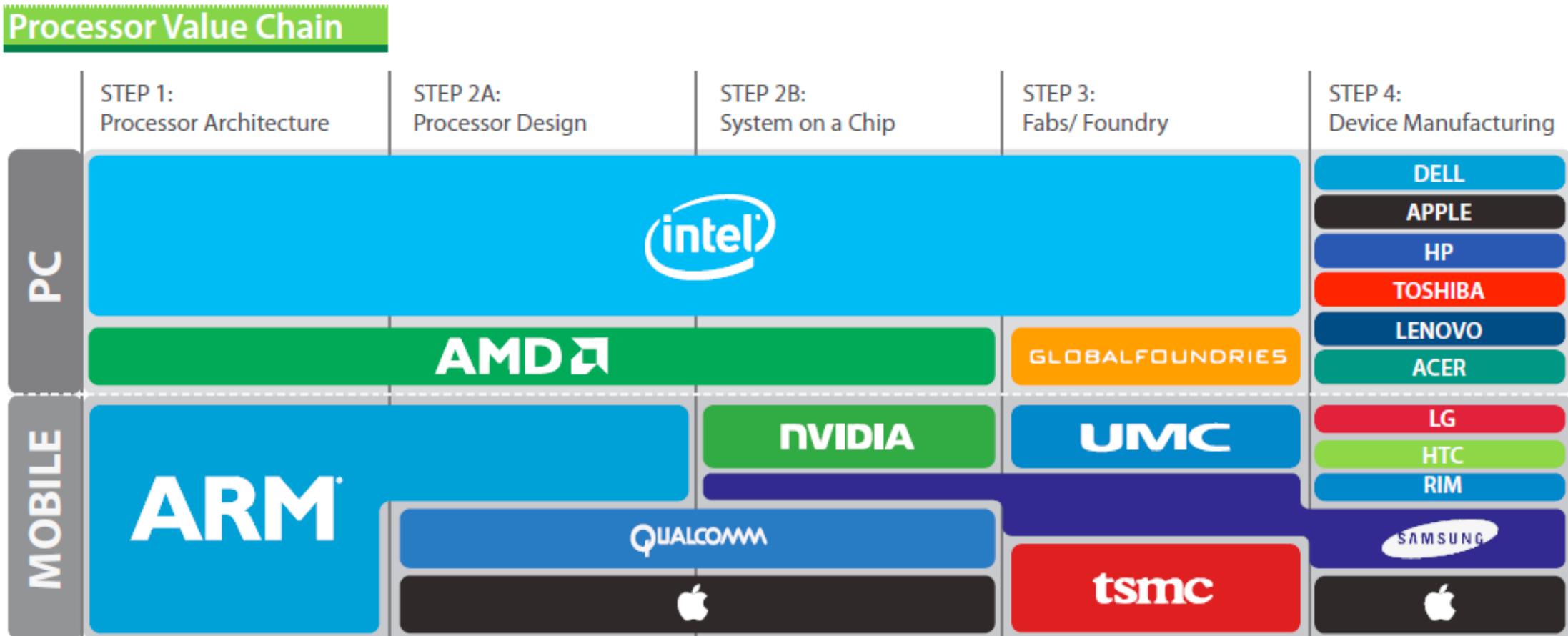


FIGURE 5. Building toward enacted value chain; a typical computer firm.

Source of figure: Kothandaraman and Wilson, "The Future of Competition: Value-Creating Networks" (2001)

Example industry value chain: Microprocessors



Source: <http://iveybusinessreview.ca/cms/1070/intel-outside-breaking-into-mobile-3/> 2012

Example industry value chain: Internet Value Chain (2011)

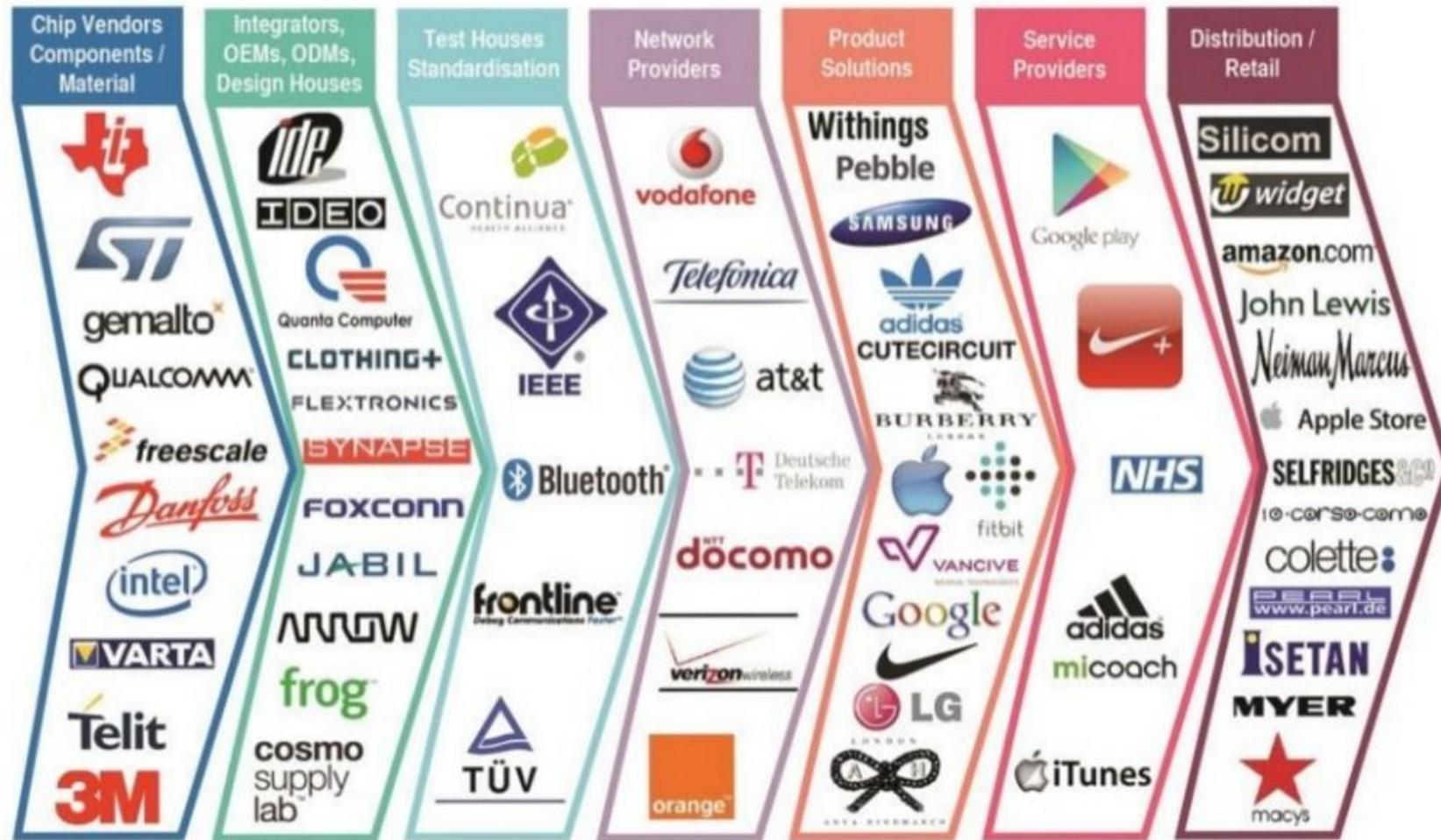
ATKEARNEY

Overview of the Internet Value Chain



Source: A.T. Kearney <http://slideplayer.com/slide/7999438/>

Example industry value chain: Wearable Technology (2013)



<http://www.slideshare.net/JohannaMischke/convergence-between-cloud-internet-of-things-and-wearable-technologies>

Example industry value chain: Autonomous Vehicles (2016)



<https://www.engineering.com/IOT/ArticleID/13270/What-Tech-Will-it-Take-to-Put-Self-Driving-Cars-on-the-Road.aspx>

Back to “Disruptive Innovation”

- “Disruptive innovations” disrupt markets
- They create new markets or change the **value network** in an existing market.



<https://hbr.org/2015/12/what-is-disruptive-innovation>

Typical results of disruption of a market

- = Change the value network in the market (how value is created and captured)
- Change the product categories in the market
- Change the type of companies involved in the market
- Change the actual companies in the market
- Change the business models being used in the market
- Change the relationships between companies in the market
- Change the power relationships in the market

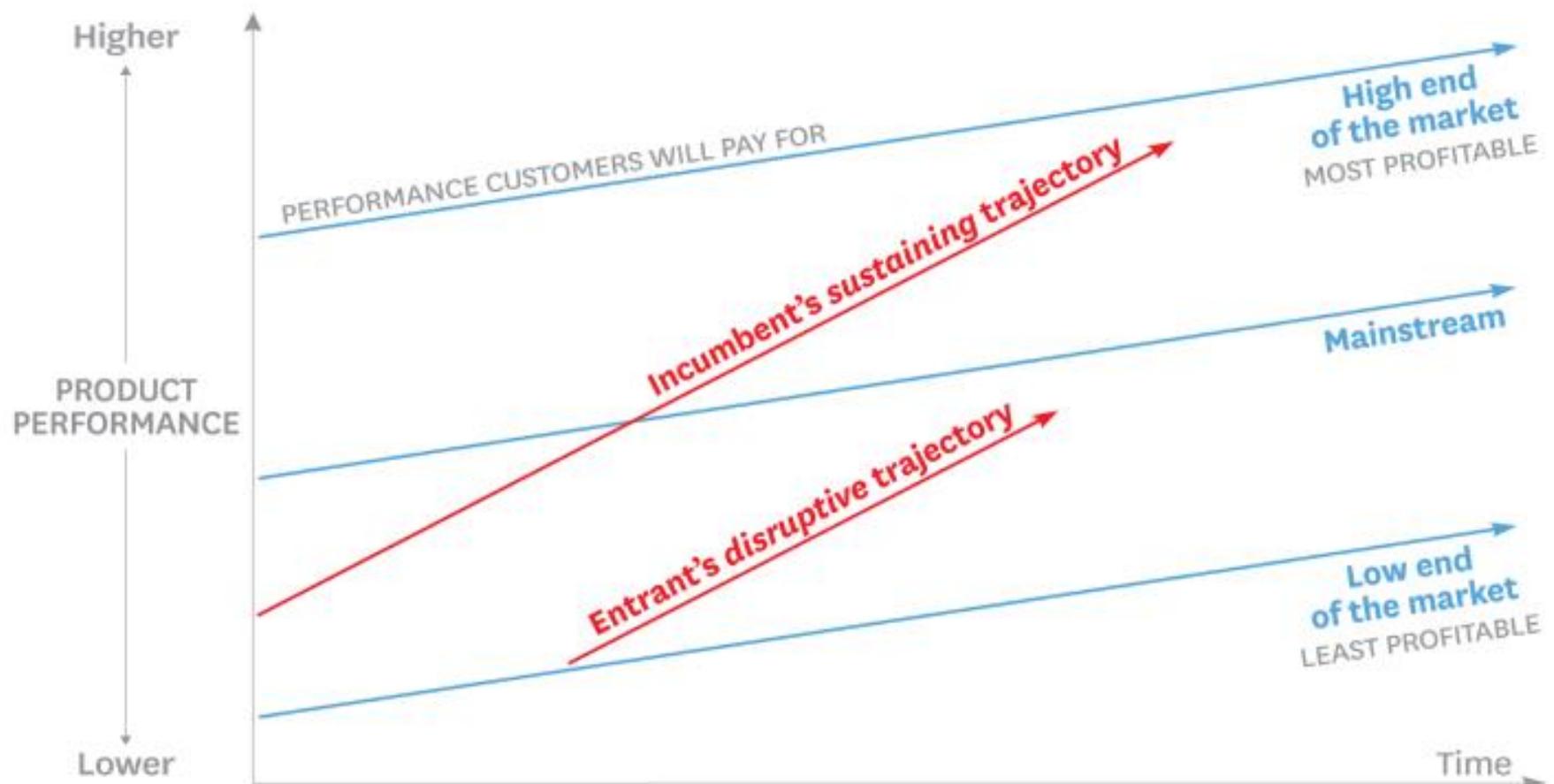
“The Innovator’s Dilemma”

- Christensen identified the “innovator’s dilemma”...
- Effective established companies study the needs of their customers
- The companies innovate to meet these customer needs
- The companies sell new products/versions to their customers
- The most important existing customers are the high-end ones who spend the most so the focus is on them
- The dilemma is that the more a company focuses on the needs of their high-end customers, the more likely it is that they will miss opportunities in emerging technologies
- Examples:
 - Kodak and digital camera
 - Microsoft and their Operating System...
 - Blockbuster and online movie streaming

Disruptive Innovation

- According to Christensen, innovations can be either disruptive or sustaining
- “**Disruptive innovations**” disrupt markets
 - i.e. they create new markets or change the value network in an existing market
- “**Sustaining innovations**” sustain markets
 - i.e. there is no change to the value network in the market

The disruptive innovation model



SOURCE CLAYTON M. CHRISTENSEN, MICHAEL RAYNOR, AND RORY MCDONALD
FROM "WHAT IS DISRUPTIVE INNOVATION?" DECEMBER 2015

© HBR.ORG

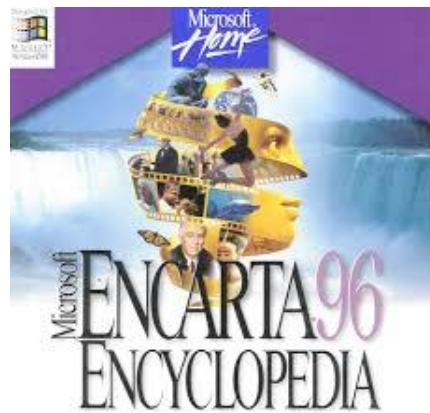
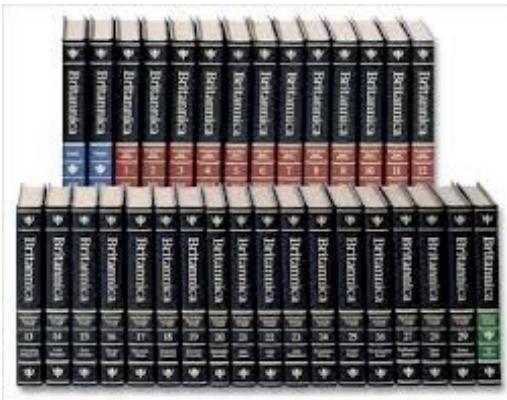
<https://hbr.org/2015/12/what-is-disruptive-innovation>

Types of disruptive innovation

- Christensen distinguishes between:
- “**low-end disruption**” – there are customers who do not need the full functionality or performance of products already on the market so cheaper alternatives can take over.
- “**new-market disruption**” – there are customers who have needs that were not being addressed by existing products

Example of low-end disruptive innovation: Online encyclopedias

- Traditional encyclopaedias (eg Encyclopaedia Britannica) and software/online encyclopaedias (eg Microsoft Encarta) were well established
- Wikipedia was initially criticised as anyone could edit it and some thought it could never be reliable
- Ease of use and good community editing model led to Wikipedia eventually replacing most use of encyclopaedias



Example of low-end disruptive innovation:

Stock photos



- Getty Images was an established photo licensing business (founded 1995)
 - Customers paid for stock photos
- iStockphoto was a crowdsourcing stock imagery site launched in 2000
 - Stock photos were initially free but then they introduced micropayments for photo contributors
- Comparison example:
 - iStockphoto: approx \$1 (taken by amateurs)
 - Getty images: approx \$40 (taken by professionals)
- Volume of crowdsourced photos continually increased and quality continually improved
- Getty couldn't compete with iStockphoto
- Getty bought iStockphoto for \$50m in 2006

Example of low-end disruptive innovation: Ride-sharing



- Started in the 90s but not successful as the needed technology not widespread
- When GPS, smartphones and social networks were widely available, realtime ride-sharing became practical
- In 2011, realtime ride-sharing companies started operating in San Francisco
- In 2012, the Californian authorities fined companies Lyft, Uber, Sidecar and Wingz \$20,000 each and said that they must stop operating services
- In 2013, an agreement was reached and the authorities created a new service category “Transport Network Companies”

Is Uber really a Disruptive Innovation at all?

- “Disruptive innovations” disrupt markets
 - (i.e. they create new markets or change the value network in an existing market)
- In order for a business to be disruptive, it must gain a foothold in a low-end market that had been ignored by the incumbent
- Otherwise, the disruptor must create an entirely new market, turning non-customers into customers. Uber doesn’t fit into either of those boxes: it targets people who already use taxi services, and it doesn’t provide a particularly lower-end or cheap experience.
- A truly disruptive business begins with low-quality offerings, then eventually captures the mainstream market by improving quality.

<https://hbr.org/2015/12/what-is-disruptive-innovation>

Disruptive innovation



UBER



- Bitcoin bypasses traditional banks and clearinghouses with **blockchains** technology.
- Coursera and edX, among others, threaten business schools with **massive open online courses** (MOOCs).
- Tencent (e.g., WeChat) outcompetes in Internet services through microtransactions.
- Uber sidesteps the license system that protects taxicab franchises in cities around the world.
- AirBNB is also redefining the industry as it sidesteps regulatory system of the hotel industry and introduce social aspect of consumerism.
- Netflix destroyed the movie rental industry by providing new distribution business model to customers; now also a content producer – a big one at that

Managing disruption: An interview with Clayton Christensen

- Euchner, J. (2011). Managing disruption: an interview with Clayton Christensen. *Research-Technology Management*, 54(1).
- Canon disrupting the photocopy market where Xerox was dominant
- Intuit disrupting the small business accounting market with QuickBooks
- **Intel resisting disruption by developing the low-cost Celeron processor**
- Cisco disrupting the voice comms market with VoIP support in routers
- **Kodak not dealing with disruption from digital photography**

Christensen on disruptive innovation 20 years on (February 2016)



From start of podcast to 5:38 <http://a16z.com/2016/03/03/disruption-clay-marc/>

Summary – Types of disruptive innovation

Type of Innovation	Type of Diffusion to which It Maps	Description	Example
Sustaining Innovation	High-end encroachment	The new product first encroaches on the high end of the existing market and then diffuses downward.	Pentium IV relative to Pentium III
Disruptive Innovation	Low-end encroachment	The new product first encroaches on the low end of the existing market and then diffuses upward.	
New-Market Disruption	Fringe-market low-end encroachment	Before encroachment begins, the new product opens up a fringe market (where customer needs are incrementally different ^a from those of current low-end customers).	5.25 inch disk drive relative to 8 inch drive
	Detached-market low-end encroachment	Before encroachment begins, the new product opens up a detached market (where customer needs are dramatically different ^a from those of current low-end customers).	Cell phone relative to land line
Low-End Disruption	Immediate low-end encroachment	Low-end encroachment begins immediately upon introduction of the new product.	Discount relative to department stores

* The distinctions between fringe and detached markets and between incrementally and dramatically different preferences are illustrated in the disk-drive examples provided herein.

Source: Schmidt and Druhl (2008)

Summary

- Established companies doing the right thing (i.e. listening to their customers) may not see disruptive innovations coming
- Established companies can learn to notice potentially disruptive innovations at an early stage and act
- Understanding value chains/networks is useful:
 - If you are an established company:
 - In understanding emerging threats
 - In designing a strategy to disrupt a market
 - If you are a startup:
 - In disrupting a market
 - If you are in corporate IT:
 - In understanding how products and solutions may change

References

- V. Alee and O. Schwabe, Value Networks and the true nature of collaboration, Verna Alee Associates 2011
- C.M. Christensen, The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail, Harvard Business Press, 1997.
- C.M. Christensen, Innovation and the General Manager, McGraw-Hill/Irwin, 1999.
- C.M. Christensen and M.E. Raynor, The Innovator's Solution: Creating and Sustaining Successful Growth, Harvard Business Press, 2003.
- M. E. Porter, Competitive Advantage: Creating and sustaining superior performance, New York Free Press, 1985.
- G.M. Schmidt and C.T. Druehl. “When is a disruptive innovation disruptive?”, The Journal of Product Innovation Management, vol. 25:347–369, 2008.

Tips on Report Assessment

- Good to see majority of the groups formed
- For those who are not enrolled, come talk to me at the end of the Lecture
- Topics – have you selected your three? Make sure to submit to Canvas by **Week 4 Thursday 29th March.**
 - Will return the topics back to you by the end of the week so you can start on the topic from the break.
- In week 5, will present the presentation assessment – it links directly to the written one
- For a group of 5, 6 or 7, each student gets 1000 words for industry examples

Case Study

Cognitive Computing

Hey Cortana,

Book a 1 hour guest lecture tonight at 6pm in my calendar with Jinman and Lawrence. Jinman will give you details of the location.

Sent from my Windows 10 phone

This meeting has been scheduled for 1 hour on Monday, Aug 21 at 6:00 PM AEST.

Warmly yours,

Cortana | <https://calendar.help>

Scheduling Assistant to Lawrence Crumpton

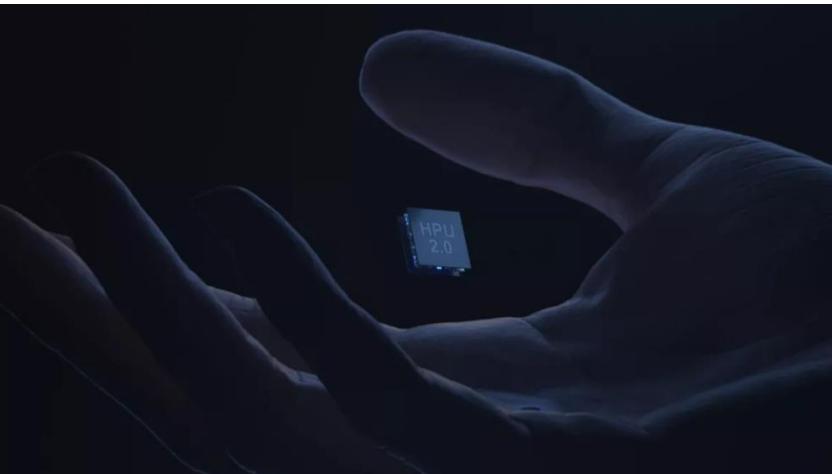
About Calendar.help



Calendar.help does one thing really well: schedule your meetings.

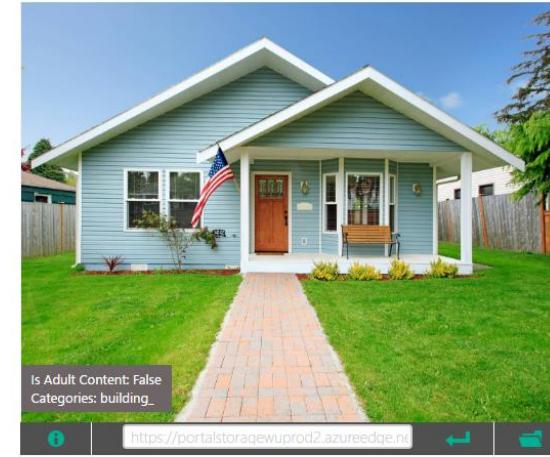
With the speed of artificial intelligence and the personal touch of a human assistant, Calendar.help takes care of business.

<https://calendar.help/about>

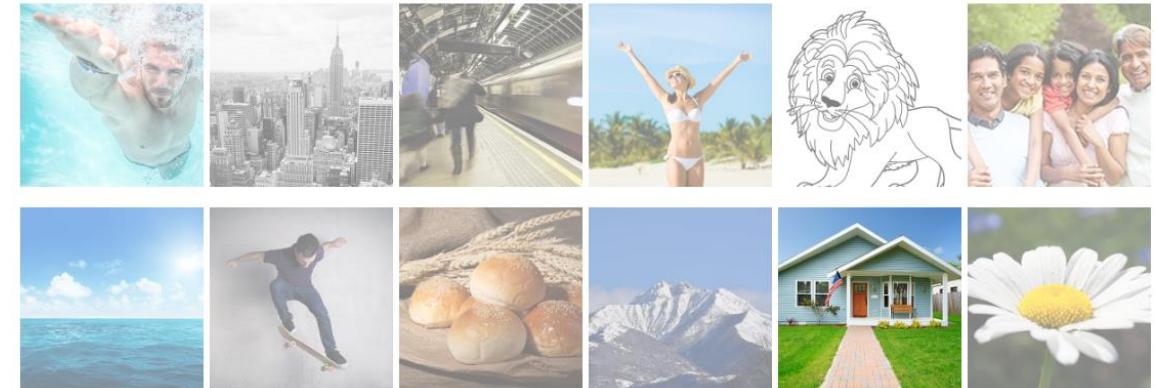


<https://www.theverge.com/2017/7/24/16018558/microsoft-ai-coprocessor-hololens-hpu>

About Sign In



Features:	
Feature Name	Value
Description	{ "type": 0, "captions": [{ "text": "a large brick building with green grass in front of a house", "confidence": 0.7066413633930043 }] }
Tags	[{ "name": "grass", "confidence": 0.9999991655349731 }, { "name": "outdoor", "confidence": 0.9999172687530518 }, { "name": "sky", "confidence": 0.9959491491317749 }, { "name": "building", "confidence": 0.9946784973144531 }, { "name": "house", "confidence": 0.990241825805969 }, { "name": "green", "confidence": 0.7997785806655884 }, { "name": "lawn", "confidence": 0.764438569547458 }, { "name": "residential", "confidence": 0.36003026366233826 }]
Image Format	Jpeg
Image Dimensions	1500 x 1155
Clip Art Type	0 Non-clipart



<https://www.microsoft.com/cognitive-services/en-us/computer-vision-api>

Cognitive Services

- There are many cognitive services available, recently, that lets you use powerful cognitive services, such as computer vision and language processing
- For example, Microsoft Cognitive Services let you build apps with powerful algorithms using just a few lines of code. They work across devices and platforms such as iOS, Android, and Windows, keep improving, and are easy to set up.
- Google's CloudPlatform lets you run your application using the same technology and tools used at Google

CLOUD VISION API

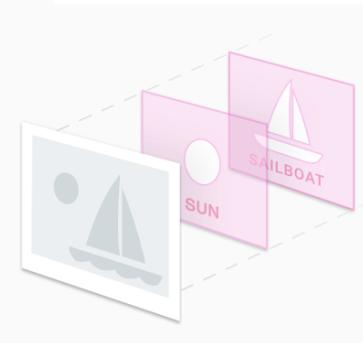
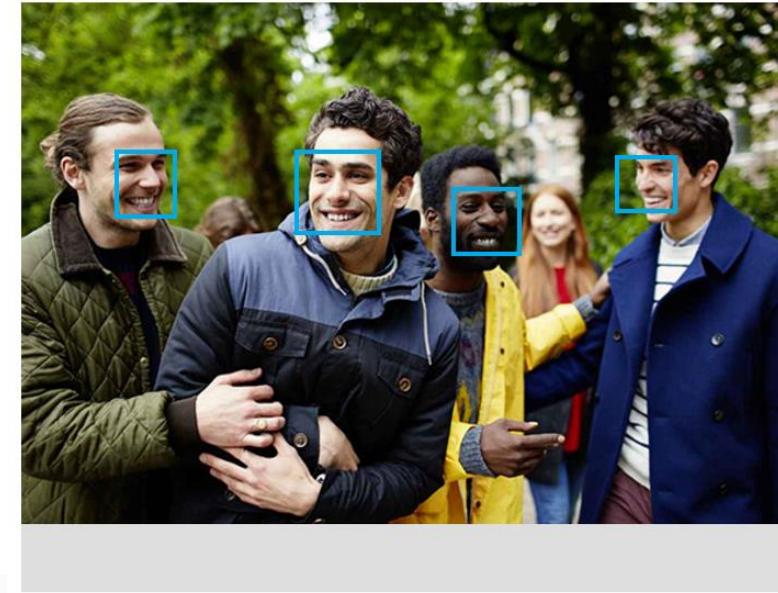
Derive insight from images with our powerful Cloud Vision API

TRY IT FREE

VIEW DOCUMENTATION

Powerful Image Analysis

Google Cloud Vision API enables developers to **understand the content of an image** by encapsulating **powerful machine learning models** in an easy to use REST API. It quickly **classifies images** into thousands of categories (e.g., "sailboat", "lion", "Eiffel Tower"), **detects individual objects and faces within images**, and finds and reads printed words contained within images. You can build metadata on your image catalog, moderate offensive content, or enable new marketing scenarios through image sentiment analysis. **Analyze images uploaded in the request** or integrate with your image storage on Google Cloud Storage.



<https://cloud.google.com/vision/>

Detection result:
4 faces detected

JSON:

```
[  
 {  
   "faceRectangle": {  
     "top": 114,  
     "left": 212,  
     "width": 65,  
     "height": 65  
   },  
   "scores": {  
     "anger": 1.0570484E-08,  
     "contempt": 1.52679547E-09,  
     "disgust": 1.60232943E-07,  
     "fear": 6.00660363E-12,  
     "happiness": 0.9999998,  
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   }  
 },  
 {  
 }
```

<https://azure.microsoft.com/en-gb/services/cognitive-services/?v=17.29>

CLOUD VISION API

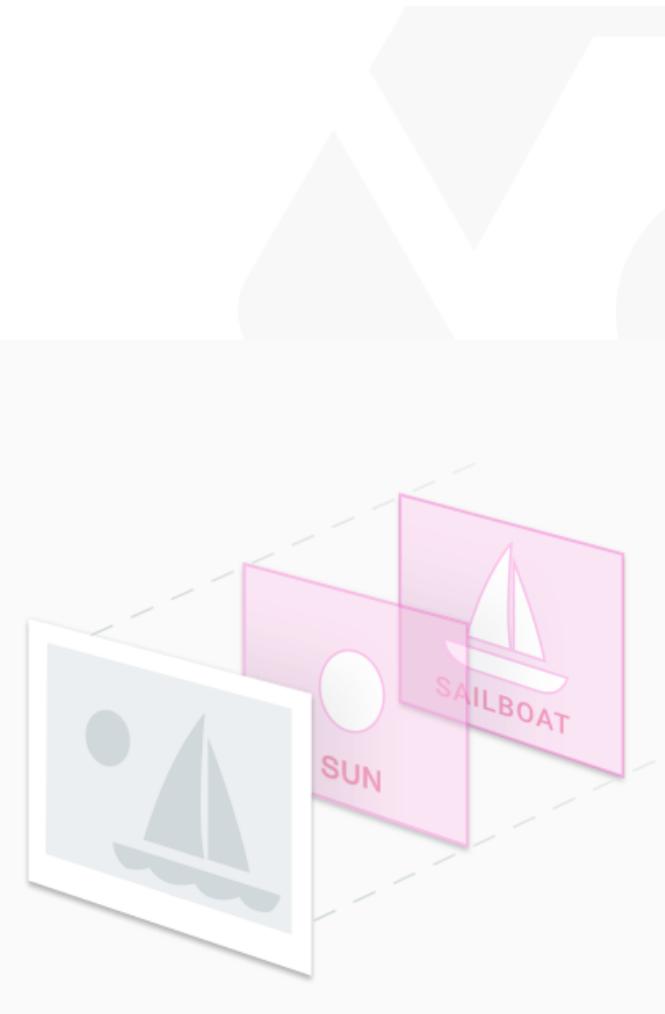
Derive insight from images with our powerful Cloud Vision API

 TRY IT FREE

VIEW DOCUMENTATION

Powerful Image Analysis

Google Cloud Vision API enables developers to **understand the content of an image** by encapsulating **powerful machine learning models** in an easy to use REST API. It quickly **classifies images** into thousands of categories (e.g., "sailboat", "lion", "Eiffel Tower"), **detects individual objects and faces within images**, and finds and reads printed words contained within images. You can build metadata on your image catalog, moderate offensive content, or enable new marketing scenarios through image sentiment analysis. **Analyze images uploaded in the request** or integrate with your image storage on Google Cloud Storage.



<https://cloud.google.com/vision/>



Visual Recognition

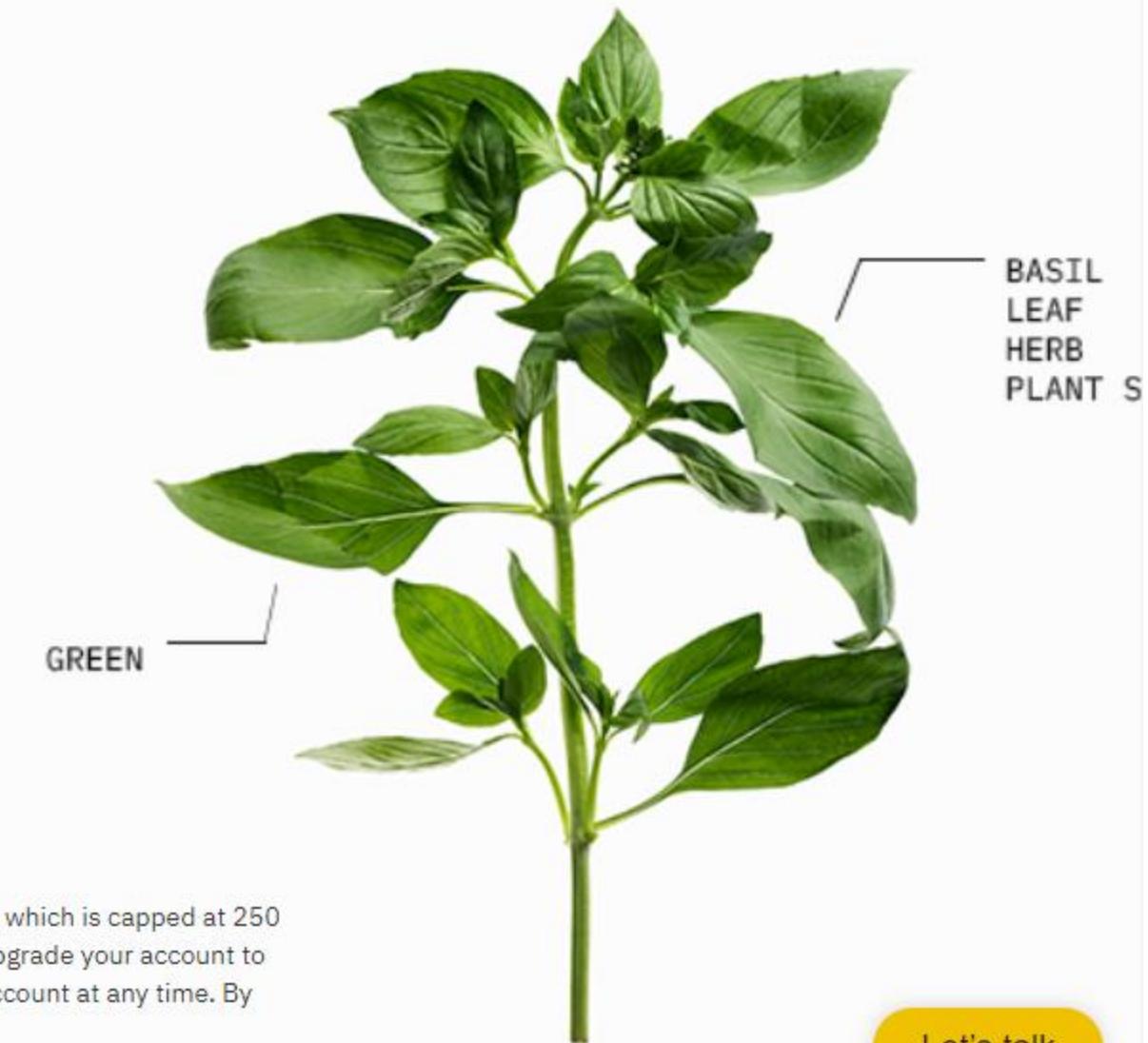
Quickly and accurately tag, classify and train visual content using machine learning.

Get started free

Already using Visual Recognition? [Log in](#)

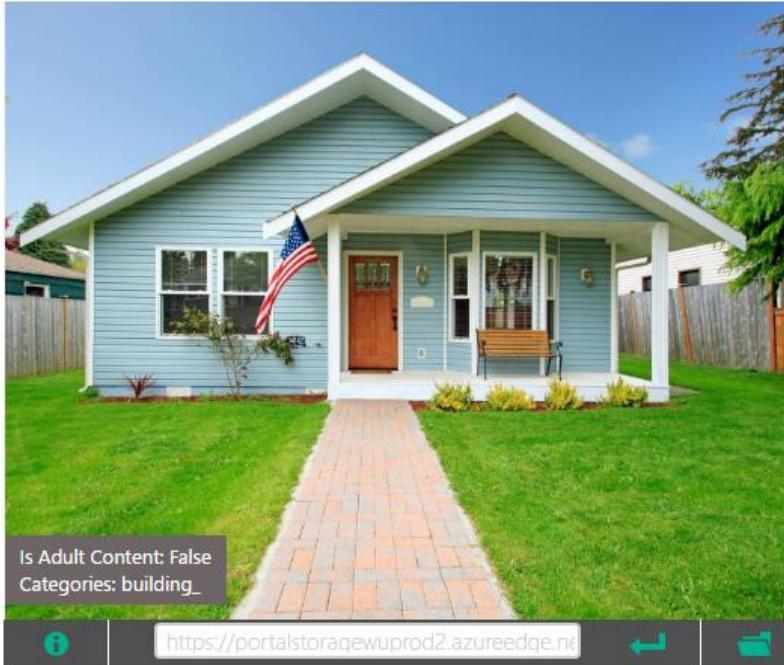
To get started, you will create a [Lite Plan](#) (no charge) instance of the Visual Recognition service, which is capped at 250 Events per day. Your Lite plan instance will be deleted after 30 days of inactivity if you do not upgrade your account to a subscription plan. Details of subscription options are available [here](#). You may upgrade your account at any time. By continuing, you agree to the [Terms](#).

<https://www.ibm.com/watson/services/visual-recognition/>



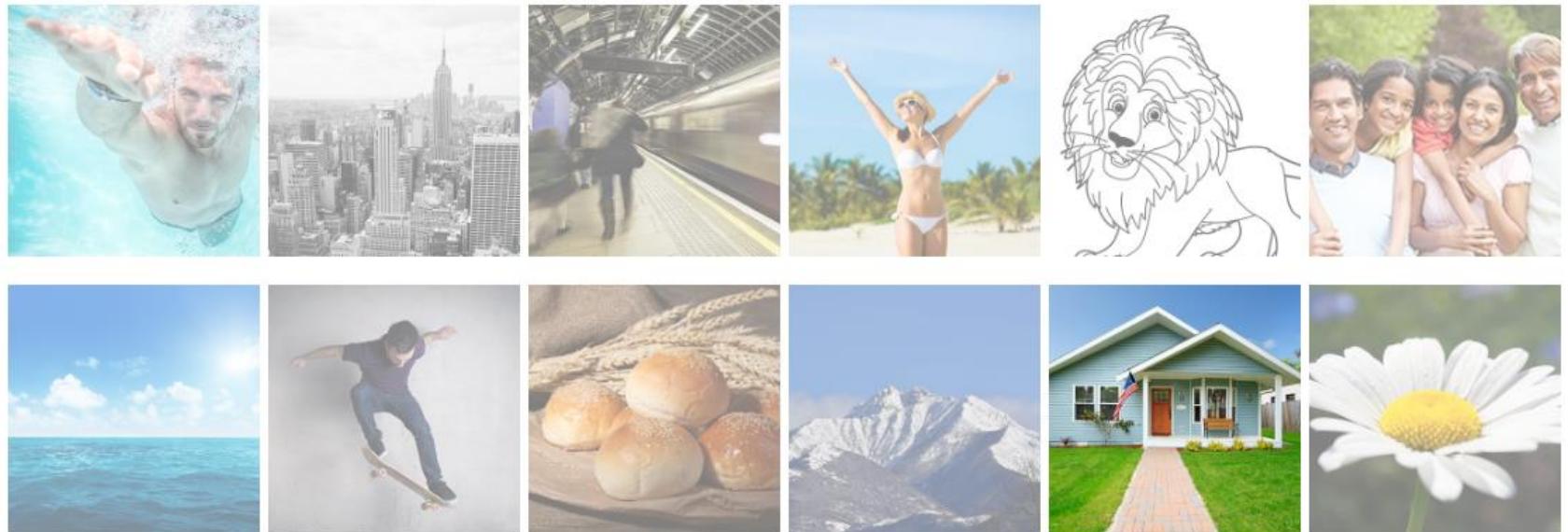
Let's talk

<https://www.microsoft.com/cognitive-services/en-us/computer-vision-api>



Features:

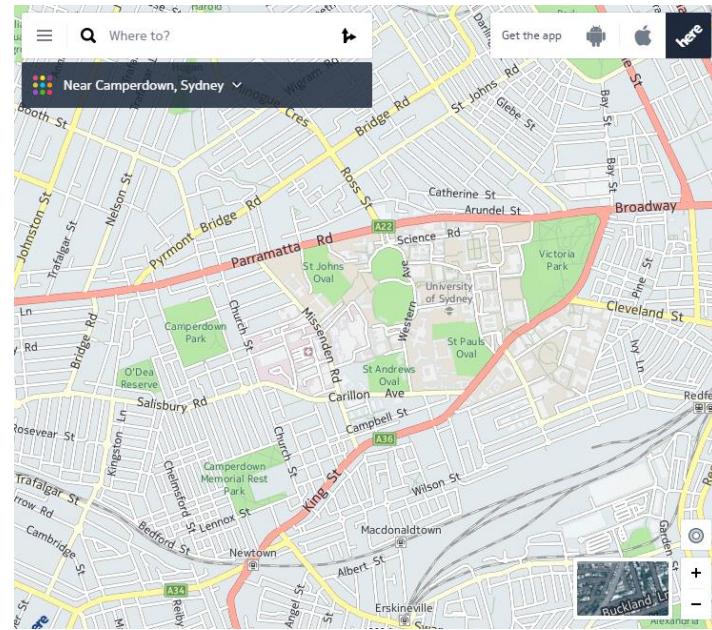
Feature Name	Value
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Image Format	Jpeg
Image Dimensions	1500 x 1155
Clip Art Type	0 Non-clipart





Past Semesters.... Innovative use of Technologies?

- Augmented Reality – Prac Lab 1
- Google Earth / Maps – Prac Lab 2
- Electronic Payment – Prac Lab 3



Tutorial 4 – Cognitive IT Services and its Value Chain

Tutorial Questions

- Can you describe the underlying technology, the idea/invention, and how it is used to provide the above cognitive services?
- Can you identify how existing companies that are using the technology? There are many cognitive service companies with some example in <https://www.microsoft.com/cognitive-services/en-us/applications>
- Can you think of a new business model using the cognitive service (technology)? Does it have the attributes to be a disruptive innovation? Answer this in terms of
 - Does it gain a foothold in a low-end market that has been ignored in favour of more profitable customers?
 - Does it create an entirely new market, turning non-customers into customers?
 - Does it begin with low-quality offerings, then eventually captures the mainstream market by improving quality?
 - Consider the features and usability of the APIs. Where are APIs typically involved in a value chain?
 - Do you think MS cognitive services will be easy to use the service and innovate with it for a new business? Is it creating a new value network?
- [Optional / Homework] There are other competing services, including IBM Watson (<https://www.ibm.com/watson/>), Google upcoming deep mind (<https://deepmind.com/>), etc. Referring back to the innovation concepts we discussed last week, do you think there is an agreed ‘Product Category’, and an emergence of a dominant design? Note here that dominant design does not necessarily mean only one product has to win, e.g., Apple and Android.

Quiz Review

Contents from Week 1 to 5

Assessments

- **2 MCQs 5% each for a total of 10% (Week 5 and Week 9)**
 - Multiple choice questions
- **Innovation Report (Group + Individual) – 15% (Week 9)**
 - Critical report on a topic with IT innovation, with multiple case studies
- **Presentation (Group) : – IT Innovation Case Studies – 10% (Week 10+)**
 - Presentation of Innovation case studies and pitching a new idea!
- **Peer-Review Assessment of Presentations – 5% (Week 13)**
 - Attendance and participation in group presentations
- **Final Exam 60% (Exam Period)**
 - Final exam covering all material covered in lectures, guest lectures, assigned reading and class discussion

Multiple Choice Qs

- The MCQ is to give you practice in understanding this unit of study
- All lecture and tutorial contents from weeks 1 to 4, and possibly 5.
- Feedback will be provided indicating what students are generally doing well and what they are not doing so well. This feedback will be posted in Canvas to help all students in preparation for the exam.

Mid-Sem Quiz

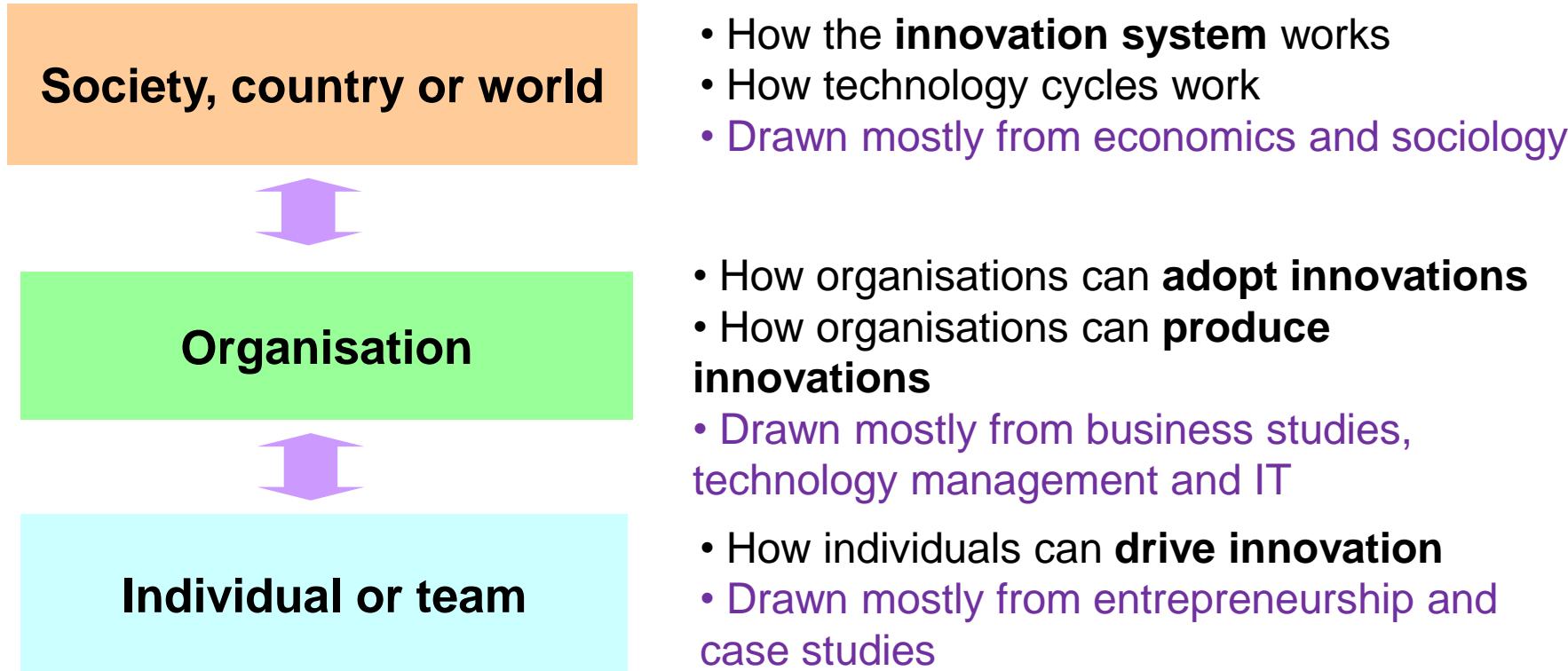
- 30 minutes
- In your Lab using Canvas
- Make sure you attend your Lab – you may use your laptop etc.
- Your tutor will be present to assist

Sample Qs

- Utterback and Abernathy introduced the concept of "design dominance" (or dominant design) in an industry.
 - Explain this concept.
 - Give an example of a recent IT-related architecture that has become a dominant design for an industry. Identify factors that led to that architecture becoming dominant over other possible architectures and explain how each of those factors contributed to this dominance.
- In the tutorial we discussed MOOCS use of innovative technologies. Does MOOCS fit into the description of 'Disruptive Innovation'?

Week 1: IT Innovations – Introduction

Levels of Involvement



Introduction to technological innovation

- Definition of innovation:
 - Innovation involves idea + application of that idea (“ideas successfully applied”)
 - Innovation as creative destruction (Schumpeter)

Innovation vs Invention



Joseph Schumpeter,
Economist and political scientist
(1883 – 1950)

- Innovation involves (1) a new idea that is (2) applied commercially – Schumpeter (1930s).
- “Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice.”
 - Jan Fagerberg, Oxford Handbook of Innovation, 2004

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Definition of innovation



“Innovation is not simply invention; it is invention put to use. Invention without innovation is a pastime.”
(Photo by Dian Dry)

Sir Harold Evans, journalist and writer on the history of innovation

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Definition of innovation



“Ideas successfully applied.”



Mark Dodgson, academic/author on innovation, Uni of QLD

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Introduction to technological innovation

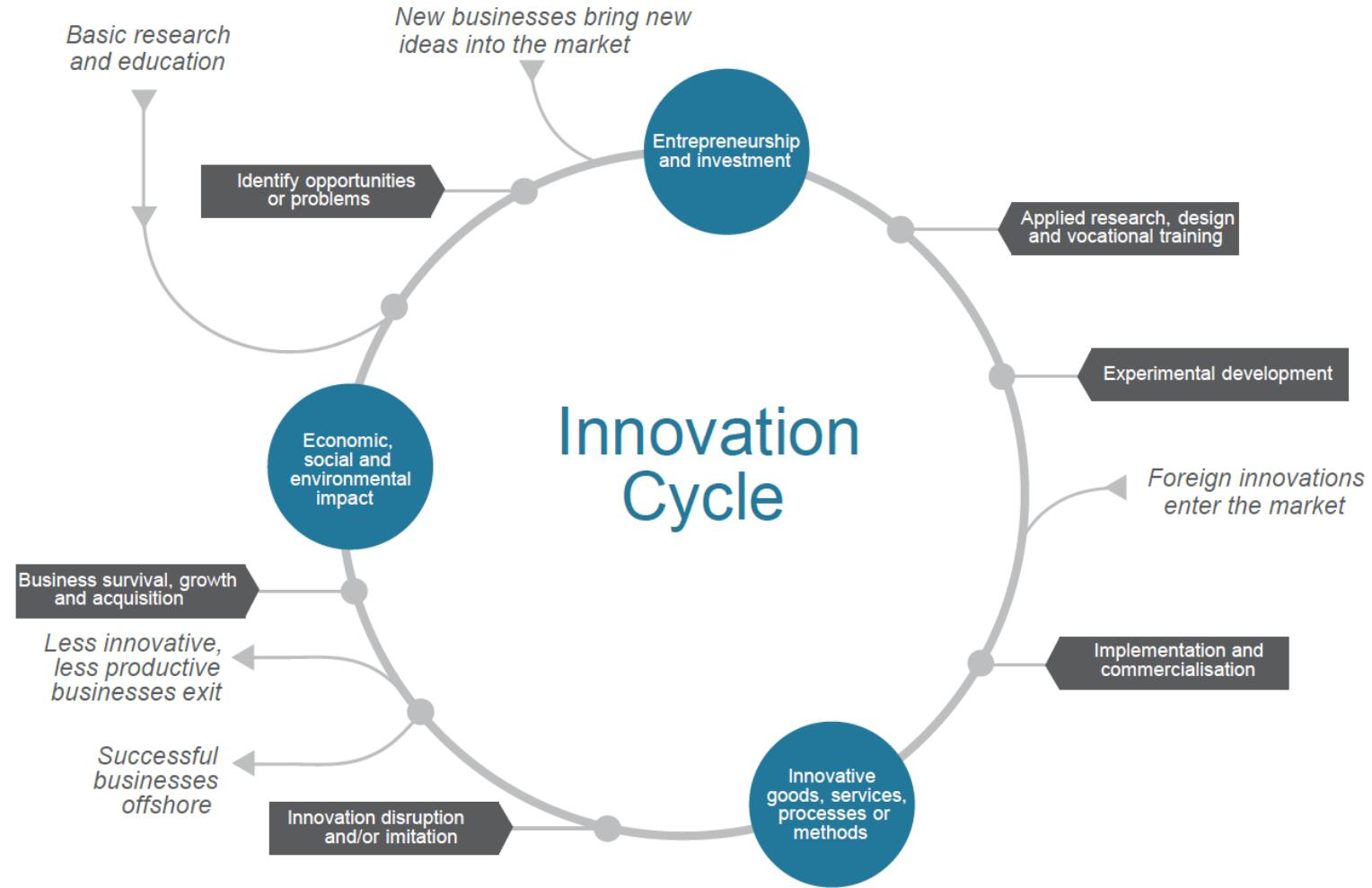
- The importance of innovation:
 - The importance of innovation to a country:
 - Innovation is a driver of productivity, growth, improvement in living conditions (health, education, reducing pollution etc.)
 - The importance of innovation to a company:
 - Innovative companies usually have greater productivity, revenue, growth and social contributions
- Innovation as “creative destruction”
- The importance of IT innovation:
 - IT as “general purpose technology”
 - IT as enabler of innovation in other fields (e.g. bio-informatics, logistics, automotive, ...)
 - IT innovation as creative destruction
 - Why “software is eating the world”

Case Study: Importance of innovation to a Country

- Technological innovation:
 - Is often the most important competitive driver in many industries
 - Leads to improvements in productivity
 - Is strongly linked with improvements in Gross Domestic Product (GDP)
 - Is linked to improvements in standard of living including:
 - Job creation
 - Improved enjoyment of life
 - Health improvements
 - Education improvements
 - Addressing national or global issues
 - High growth firms – what do they differ?



Innovation Cycle



Source: Department of Industry, Innovation and Science (2016)

Tutorial1: Importance of Innovation to a Country – Roles of the Government

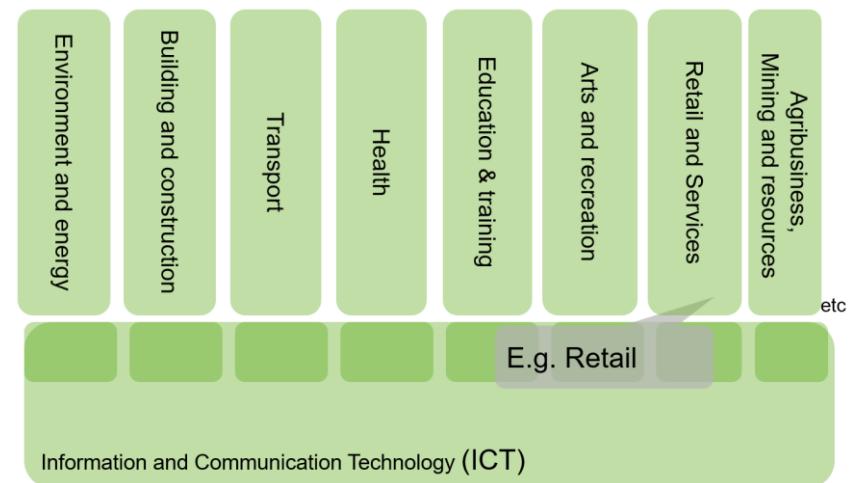
- Read Section 5.8 of the 2016 report [1], pages 82 – 85. It is important to note the roles of the Government in a Country's innovation cycle. Study the cycle and look at the different roles of the Government. What are some of the ways that the Government can support innovation?
- ‘Historically, publicly-funded research has been essential to a range of significant innovations that turned out to have large economic returns. Notable examples include aviation, nuclear energy, the internet, pharmaceuticals, GPS navigation, biotechnology, artificial intelligence and robotics’ [1]. It is important to note that many of the given examples are technology (IT) innovations, e.g., Internet, GPS, AI and Robotics, and likely the others are enabled by these IT innovations. Why do you think these examples were publicly funded and not privately funded?
- [Optional / Homework] Read the ‘Feature Article’ of the 2017 report [2], pages 59-62. It presents findings on the “new tech means greater returns”. What is the outcome of this study and what does it say about the use of technologies as in ‘digital footprints’ and its impact on employment growths?

Week 2: Introduction to Technological Innovation

IT as enabling technology

- IT is a “General Purpose Technology” (GPT)
- Like electricity – it enables other technologies
- GPTs differ from other technologies and:
 - Are pervasive – spreading to most sectors
 - Continually improve in usefulness and lower in cost
 - Spawn innovation in other areas – making it easier to invent and produce new products or processes

Source: ITU, *Measuring ICT for Social and Economic Development*, 2006.
(based on Bresnahan and Trajtenberg, “General purpose technologies”, 1995)



IT Innovation as Creative Destruction

- Examples:
 - Largest bookseller in world is a software company
 - (Amazon – while Borders went bankrupt)
 - Largest video service is a software company
 - (Netflix – while Blockbuster went bankrupt)
 - Dominant music companies are software companies
 - (Apple, Spotify, Pandora – traditional record companies exist to provide them with content)
 - Fastest growing game company is a software company
 - (Zynga who make Farmville)
 - Largest direct marketing company is a software company
 - (Google)



Types of Innovation

- Types of innovation according to different dimensions:
 1. What type of thing is being innovated?
Product/service innovation vs process innovation vs business model innovation
 2. How different is it from what's already available?
Radical vs incremental innovation
 3. What impact will it have on the consumer?
Life-changing vs incidental innovation
 4. What impact will it have on the market or industry?
Disruptive vs sustaining
 5. What scope of the product/service/process does it affect?
Architectural vs component innovation
 6. What impact will the innovation have on the producers?
Competence-enhancing vs competence-destroying innovation

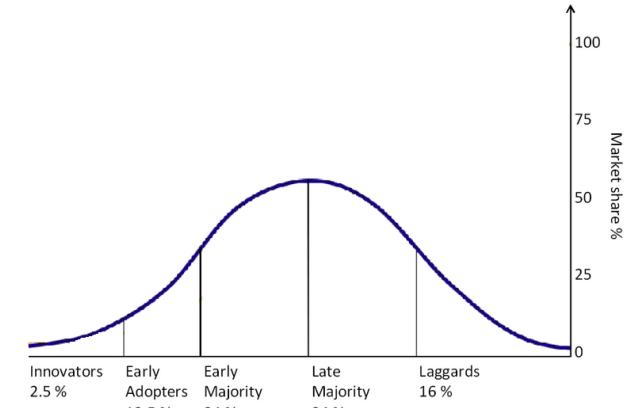
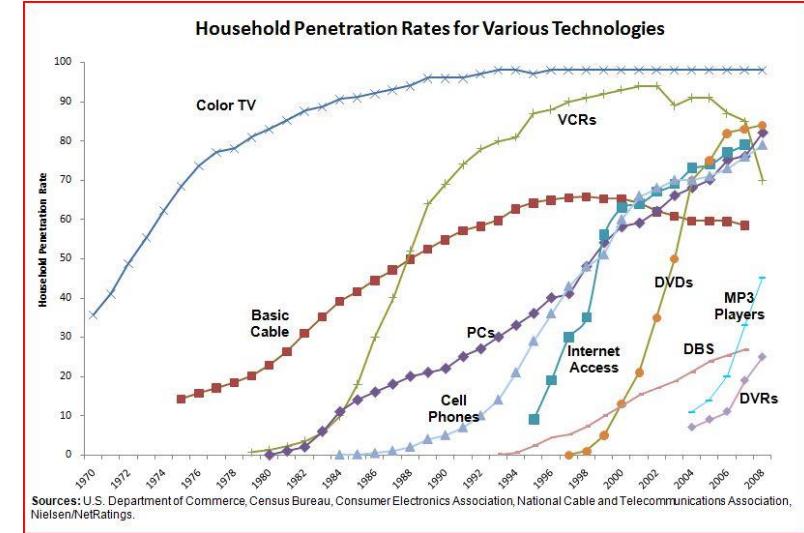
Tutorial2: Importance of IT innovations in the Education sector

- Identify the key enabling IT solutions, common across all the articles, (software, hardware, etc) that are used in the education and the training sector.
- Discuss the evolution of the education industry due to the introduction of MOOCS. You may apply ‘Innovation System’ concept, where you consider all the stakeholders involved in an innovation, into your discussion.
- Following from b., Micromasters is a new program three-way arrangement between educator, student and employer. What is the innovation in this new program, and how does it differentiate itself? Why is such a model only available via MOOCS?
- Peer-assessment for MOOCS is an area which needs further development – what are its challenges and emerging / existing solutions?
- [Optional/Homework] Now look at the PLP. Similarly, identify the key enabling IT innovations for PLP, and how the technologies are used to enable a different style of learning.

Week 3: Industry dynamics of Technological Innovation

Industry dynamics of innovation

- Diffusion and adoption of innovations:
 - A model for the diffusion of innovations (Rogers)
 - Categories of adopters (Rogers)
 - The “chasm” - between early adopters and the early majority (Moore)
 - The process of innovation adoption by individuals and organisations (Rogers)
 - Factors influencing speed of adoption (Rogers)
 - Technology adoption S-curves
 - Factors leading to lack of adoption

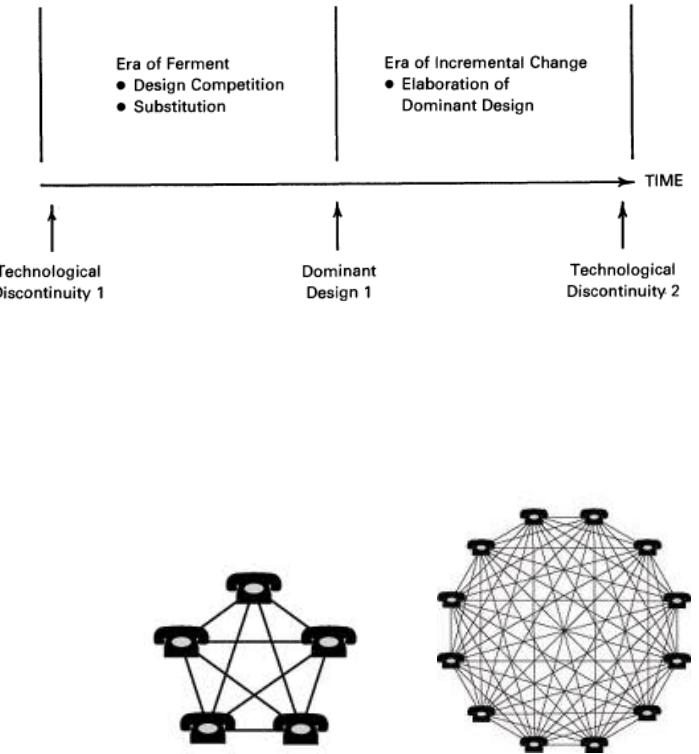


Product Category

- “A product category is all the products offering the same general functionality.”
- A socially constructed partition of products that are perceived to be similar and in which firms choose to position their products
 - based roughly on an excerpt from the reading: “Perfect timing? Dominant category, dominant design, and the window of opportunity for firm entry”
 - <http://onlinelibrary.wiley.com/doi/10.1002/smj.2225/full>

Industry dynamics of innovation

- Design Dominance:
 - The concept of DD (Utterback & Abernathy)
 - The process by which DD happens (Utterback & Abernathy)
 - Phases of DD and technology cycles (Anderson & Tushman)
 - Standards for dominant designs
- Why dominant designs get selected in markets:
 - Learning effects
 - Network effects and its 4 types
 - Government regulations
- Frameworks for modelling design dominance
- First, Second, and Fast Second
 - waiting for the dominant design to begin to emerge and the moving to be part of it (that is, helping to create it)



Tutorial3: Dominant Design in the Smartphone Market

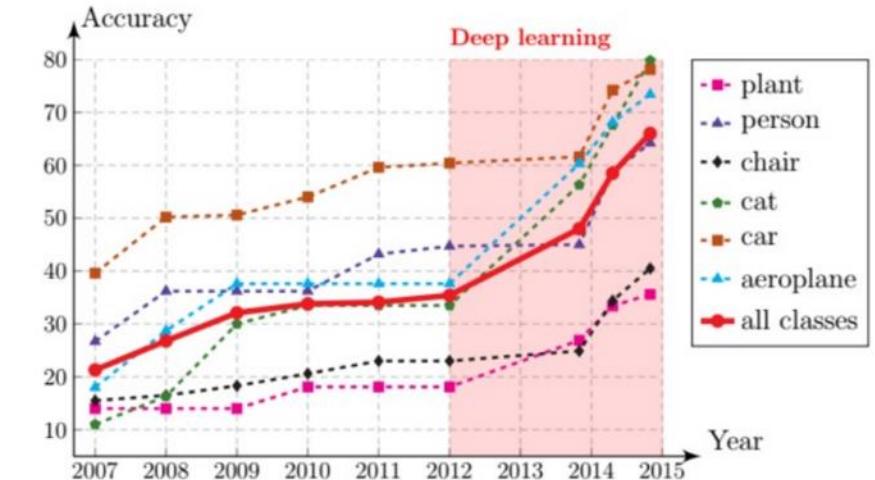
- Q1. Android OS architecture is appearing to be the dominant design in the smartphone OS market. What are the main reasons that led to this?
- Q2. In the short article, Android's strategy for the VR is following similar principles to what made Android the dominant design for the smartphone OS. Do you think this strategy will become the dominant design in the VR space? You may think about this in the context of concepts learned in the class including 'architecture', 'standards', 'network effect' and 'self-reinforcing cycle'.
- Q3. Apple recently launched their AR strategy – as with other Apple products, it is a closed system, e.g., a part of the Apple ecosystem. Apple has a massive user base, and the AR technology is strong. Do you think they can become the dominant design of 'Reality' technology for smartphones? It's interesting to note that Apple is not getting into VR and instead focusing on AR. AR with smartphones is been around for a long time.
- Q4. Do you need to be a smartphone OS to dominate in VR? Facebook is a massive social platform and they have many of the services that smartphone OS has e.g, Apps, network effect, and architecture. With Oculus GO becoming 'standalone' device, and therefore a mobile device, could they become the dominant design?
- Q5. In the short article on Windows 10, the author suggests “Windows 10’s Smartphone Failure Is Microsoft’s Greatest Opportunity”. Do you agree with this comment? Can you answer in terms of the dominant design concepts, in regards to Android and iOS platforms?

Week 4: Disruptive innovation

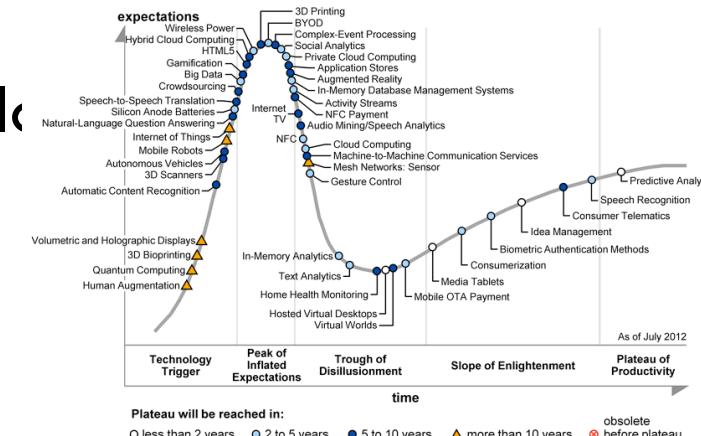
Industry dynamics of innovation

- Improvements in technological performance:

- Technology performance S-curve

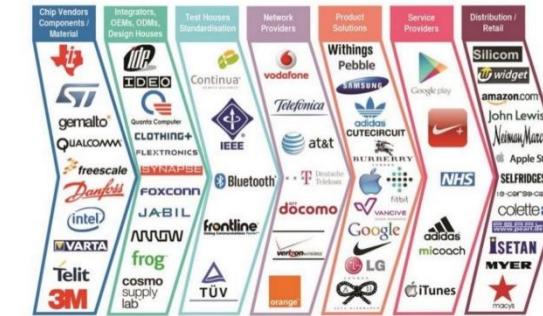


- Relationships between technology adoption and technology performance improvement
- Modelling maturity and adoption of technology
 - The Gartner “Hype-cycle”



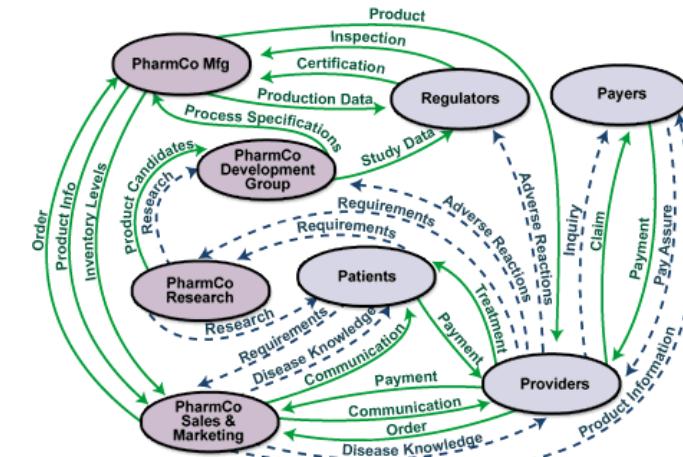
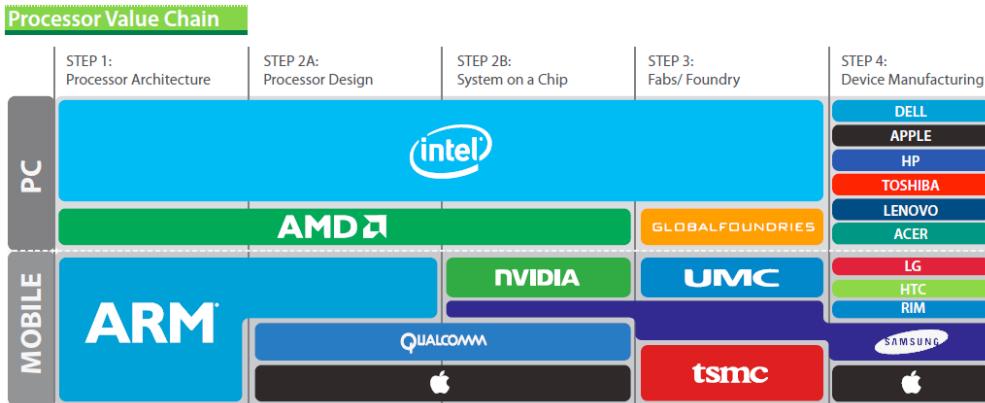
Disruptive innovation

- create new markets or change the **value network** in an existing market
- Industry value chains and value networks
 - What are they?
 - Analysing a value network
- Disrupting value networks
 - disintermediation, reintermediation, ignoring
- The relevance of disruptive innovation to established companies and to startups
- Typical results of the disruption of a market (eg changing the value network, types of companies, etc)



Use of Value Chains/Networks

- Analysing value chains/systems/networks is useful for:
 - Understanding an industry (including relationships between companies)
 - Understanding your company's position within the market
 - Deciding where your company wants to be within that market
 - Looking for opportunities for disruptive innovations

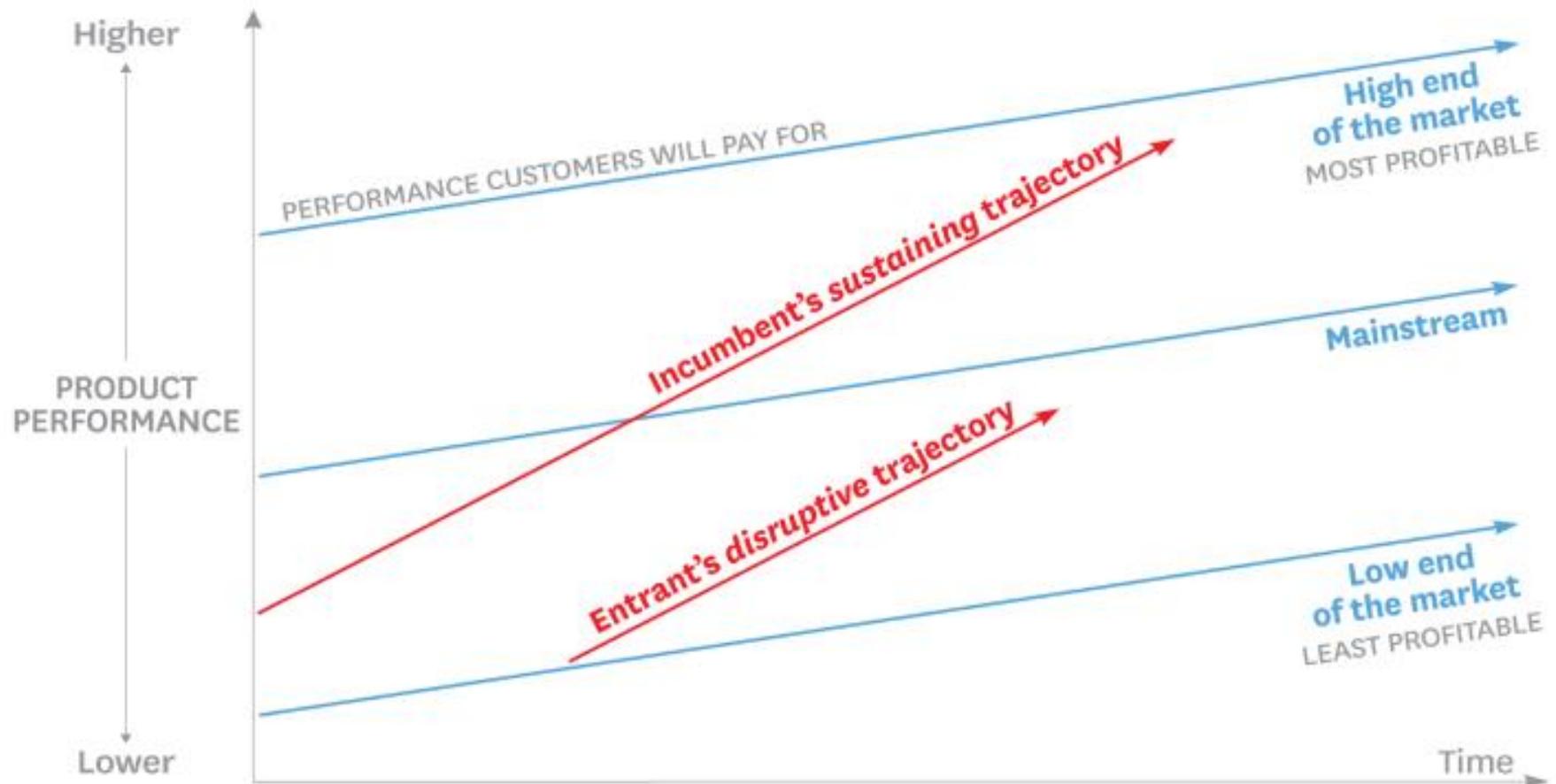


Source of figure: Verna Allee

Disruptive innovation

- Disruptive innovations create new markets or change the value systems within existing markets
- “The innovator’s dilemma” (Christensen)
- Sustaining innovation vs disruptive innovation
- Low-end disruption and new-market disruption
- Other types of disruptive innovation
- Examples of disruptive innovation

The disruptive innovation model



SOURCE CLAYTON M. CHRISTENSEN, MICHAEL RAYNOR, AND RORY MCDONALD
FROM "WHAT IS DISRUPTIVE INNOVATION?" DECEMBER 2015

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Disruptive innovation?



coursera

Tencent 腾讯

UBER



NETFLIX

- Bitcoin bypasses traditional banks and clearinghouses with **blockchain** technology.
- Coursera and edX, among others, threaten business schools with **massive open online courses** (MOOCs).
- Tencent outcompetes in Internet services through microtransactions.
- Uber sidesteps the license system that protects taxicab franchises in cities around the world.
- AirBNB is also redefining the industry as it sidesteps regulatory system of the hotel industry and introduce social aspect of consumerism.
- Netflix destroyed the movie rental industry by providing new distribution business model to customers

Tutorial 4: Cognitive Services and its Value Chain

- Can you describe the underlying technology, the idea/invention, and how it is used to provide the above cognitive services?
- Can you identify how existing companies that are using the technology? There are many cognitive service companies with some example in <https://www.microsoft.com/cognitive-services/en-us/applications>
- Can you think of a new business model using the cognitive service (technology)? Does it have the attributes to be a disruptive innovation? Answer this in terms of
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