INFO5992 Understanding IT Innovation

Week 04: Open Innovation & Distributed Innovation I

Semester 1, 2025

THE UNIVERSITY OF SYDNEY

Acknowledgement of Country

I would like to acknowledge the Traditional Owners of Australia and recognise their continuing connection to land, water and culture. I pay my respects to the first nations people and their Elders, past, present and emerging.

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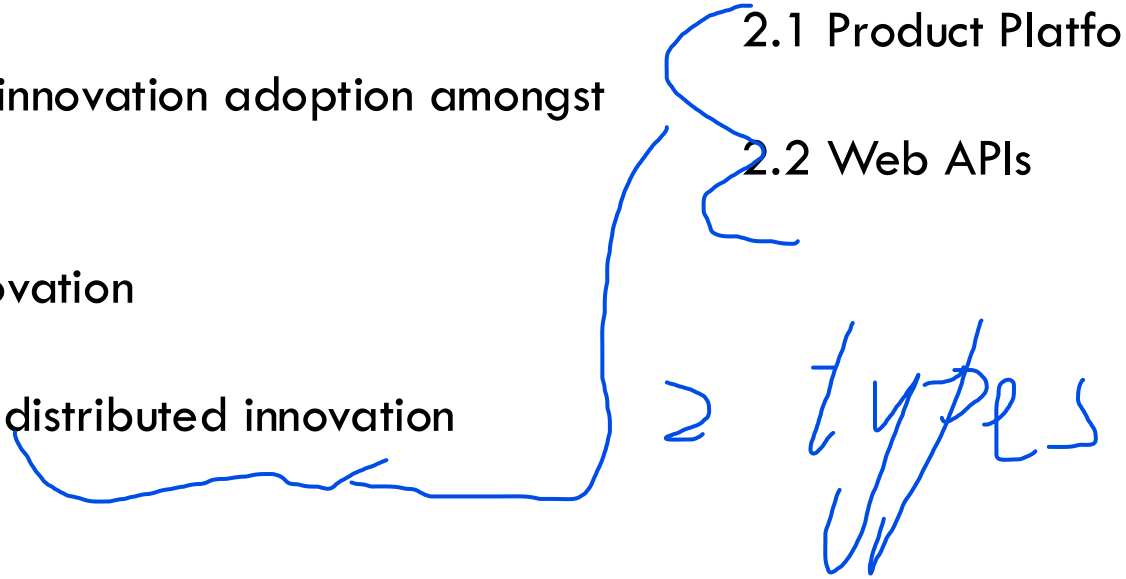
UoS Semester Outline

Week	Learning Outcomes	Lectures
Module 1: Innovation Framework		
Week 01	L01, LO2, LO3	Unit of Study Introduction, Administrivia, Definition of IT Innovation, Importance of Innovation to a Country, General Purpose Technologies, Overview of Emerging Technologies
Week 02	LO4, LO5	Innovation Frameworks I: Dynamics of IT Innovation, Dominant Design
Week 03	LO6	Innovation Frameworks II: Disruptive Innovation, Innovator's Dilemma, Value Chain & Value Network
Module 2: Development of Key Intellectual Property in the Modern Age		
Week 04		Introduction to Open Innovation and Closed Innovation Distributed Innovation I: Product Platforms, Web APIs
Week 05	LO7	Distributed Innovation II: Crowdsourcing, Free and Open- Source Software, Open Data
Week 06		Distributed Innovation III: Platform Ecosystems, User Innovation
Module 3: Commercialisation Process and Business Strategies for Emerging Technologies		
Week 07	LO8	Commercialisation I: Startup vs Traditional Companies, Lean Startup Methodology and Agile Development
Week 08		Commercialisation II: Customer Development Process, Value Proposition Canvas
Mid semester break		
Week 09	LO8, LO9	Commercialisation III: Innovation Management, Business Model Canvas Commercialisation IV: Capital & Fundraising for IT Innovation
Week 10	LO11, LO12	Organisational Cultures and Structures Supporting Innovation, Judging IT Innovation
Module 4: Innovation At-Scale		
Week 11	LO10	Innovation Ecosystem: Silicon Valley and Australia
Week 12	N/A	Course Review | Innovation Pitch Presentation
Week 13	N/A	Innovation Pitch Presentation
Final Exam		

Agenda – Week 04

Section One (1st Half)	Section Two (2nd Half)
Open Innovation & Distributed Innovation	**Detailed Discussion: Product Platforms & Web APIs**
1.1 Evolution of Innovation	2.1 Product Platforms
1.2 Tutorial: Open innovation adoption amongst companies	2.2 Web APIs
1.3 Distributed innovation	
1.4 Approaches to distributed innovation	



Open Innovation

Section 1

Evolution of Innovation

Sub-section 1.1

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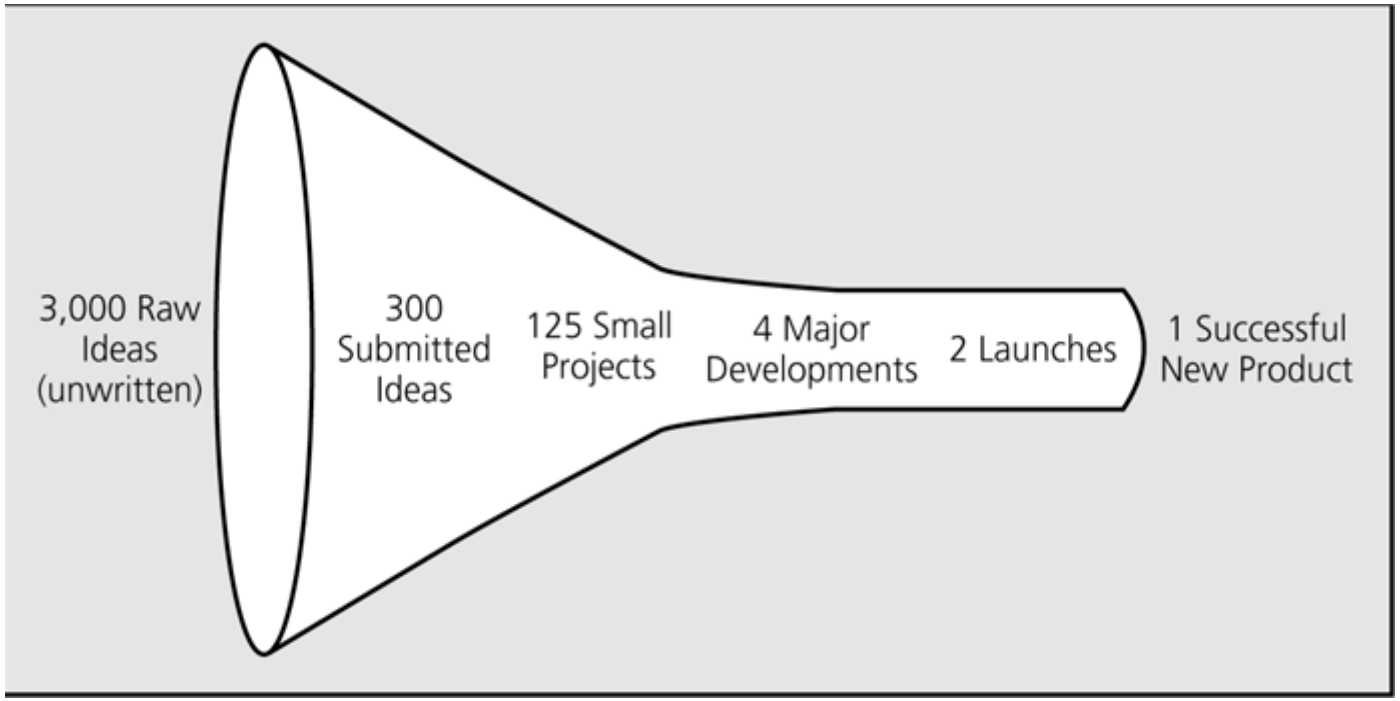
Evolution of innovation by companies: Traditional model

- Most R&D and other innovation done in-house
- Was used for most of the 20th century
- Some spreading of innovation through “spillovers”

Evolution of innovation by companies: Traditional model

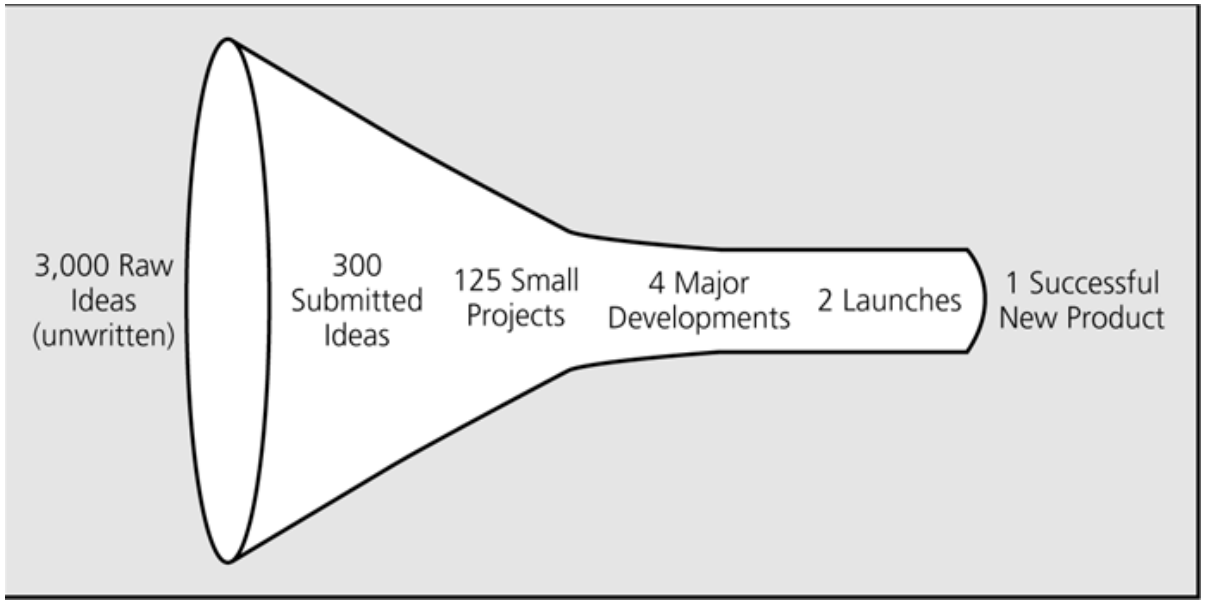
- Example of a traditional innovation funnel



Source – Schilling, 2013

Evolution of innovation by companies: Traditional model

- This is a simplistic model assuming:
  - Simple one-way flow – left to right (it's not usually this simple)
  - All activities inside a single company (no in-flows, no out-flows)



Source – Schilling, 2013

Evolution of innovation by companies: Some trends in the late 20th century

- More mobility of workers between companies
- More outsourcing of work
- Globalisation (more working across countries)
- Better information and communication technologies (e.g., email, web)
- Availability of **venture capital funding** allowing small companies to grow quickly (even without revenue)
- Easier to create and build new technology companies

- So more opportunities for collaborative innovation

"Joy's Law"

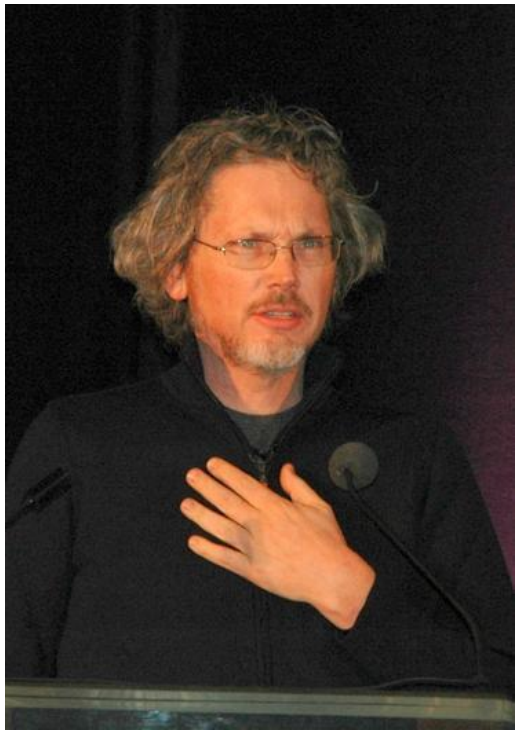


Photo: Martin LaMonica/CNET Networks

Bill Joy
Co-founder of Sun Microsystems
Computer Scientist

- "Most of the bright people don't work for you -- no matter who you are. [So] you need a strategy that allows for innovation occurring elsewhere."

- In 1990 speech - quoted by Surowiecki (1997)

“Open Innovation”

- Many companies have changed from purely internal R&D activities to being open to outside ideas and innovations.
- Cooperation and collaboration with external parties to increase innovation and reduce time to market.

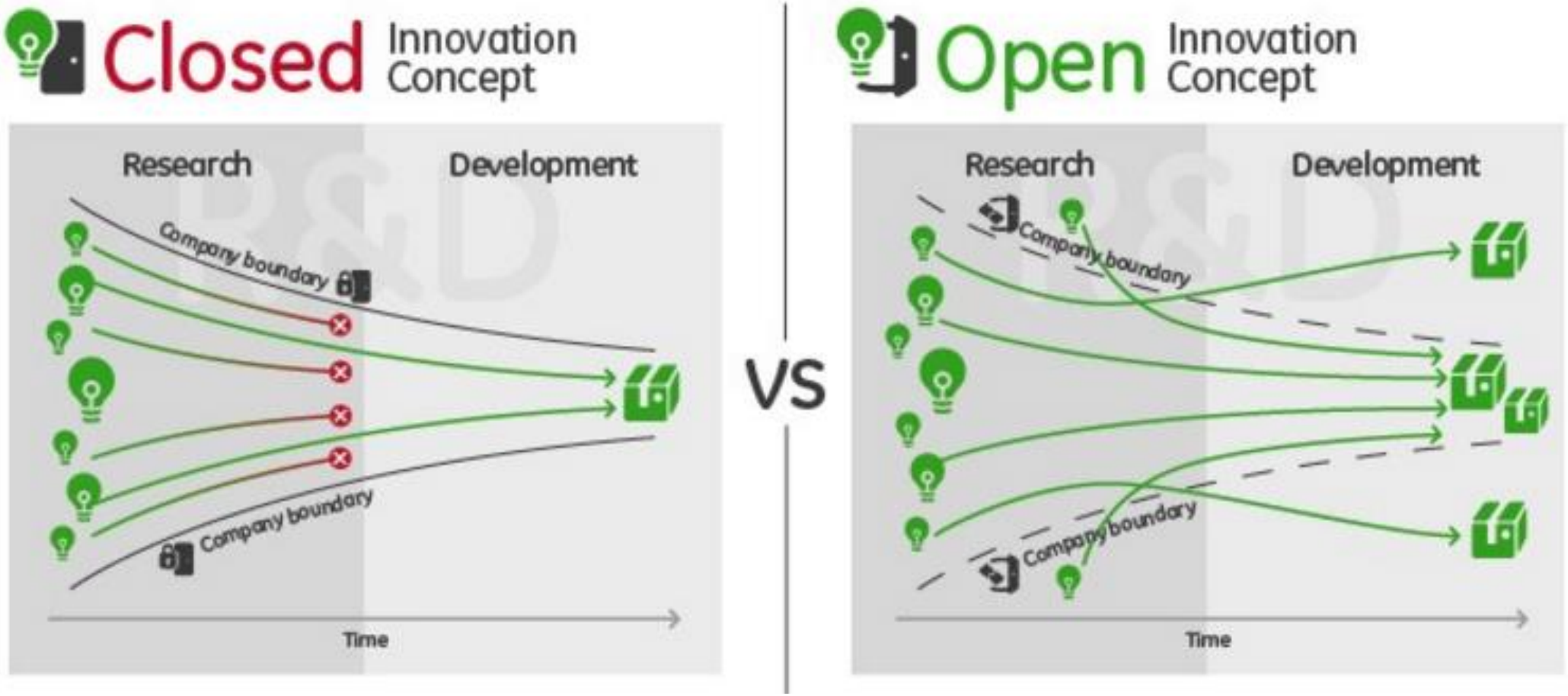
Henry Chesbrough, Economist, Business Administration
University of California, Berkeley.
Started and promotes term “open innovation”

Definition of "Open Innovation"

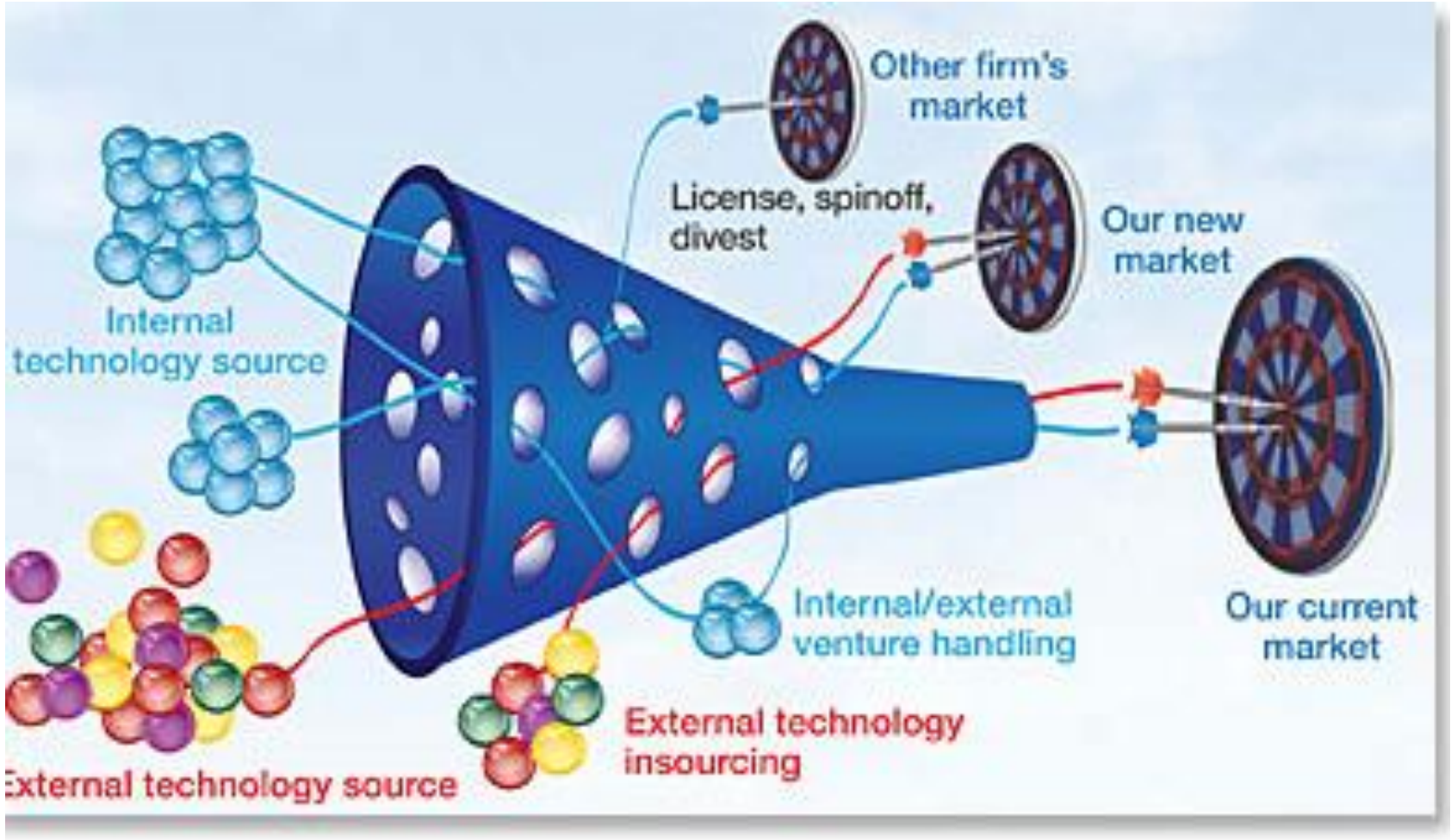
- "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation" (Chesbrough, 2006)

- Revised definition: "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model" (Chesbrough and Bogers, 2014)

The classic innovation funnel: "Closed innovation"



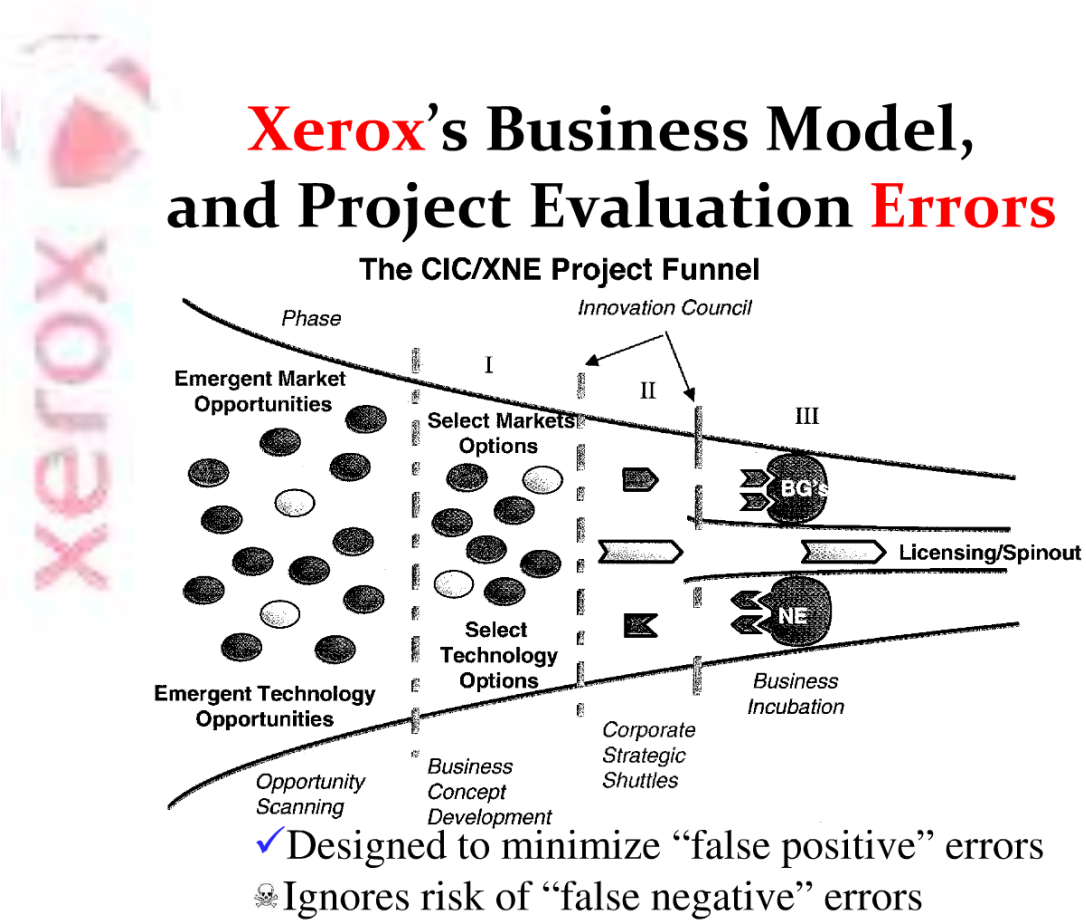
Open innovation



Open Innovation (spie.org) (Mar'25)

Example of closed innovation: Innovation at Xerox PARC

- Chesbrough studied Xerox Palo Alto Research Center (PARC) for R&D



IBM Open Innovation Community: https://www.ibm.com/opensource/innovation/ (Mar'25)

Parker, G., Petropoulos, G., Van Alstyne, M. W., & West, J. (2024). Driving Open Innovation Through Open Platforms.

Chesbrough, H. (2024). Open Innovation in Large Companies.

https://scholar.google.com/citations?user=1-kDZb0AAAAJ&hl=en&oi=sra

Source: Chesbrough (2009) - http://www.slideshare.net/Allagi/open-innovation-seminar-2009-brazil-henry-chesbrough (Mar'25)

Types of open innovation

1. Outside-in process:
   - "Enriching the company's own knowledge base through the integration of suppliers, customers, and external knowledge sourcing". E.g., Microsoft acqutred GitHub
2. Inside-out process:
   - "Earning profits by bringing ideas to market, selling IP, and multiplying technology by transferring ideas to the outside environment.", E.g., Qualcomm's Licensing Model
3. Coupled process:
   - "co-creation with (mainly) complementary partners through alliances, cooperation, and joint ventures during which give and take are crucial for success.". E.g., BMW, Intel, and Mobileye Collaboration

Source: Enkel, Gassmann and Chesbrough (2009)

Some benefits of open innovation

- ☺ Larger base of ideas to draw from for innovation
  - "Not all of the smart people work for us" (Bill Joy from Sun Microsystems)
- ☺ Existing third-party technology can be used, reducing risk and cost of development
- ☺ Identification of new business opportunities with collaborators
- ☺ Share risks and pool resources with other companies
- ☺ Can be lower cost than large R&D departments

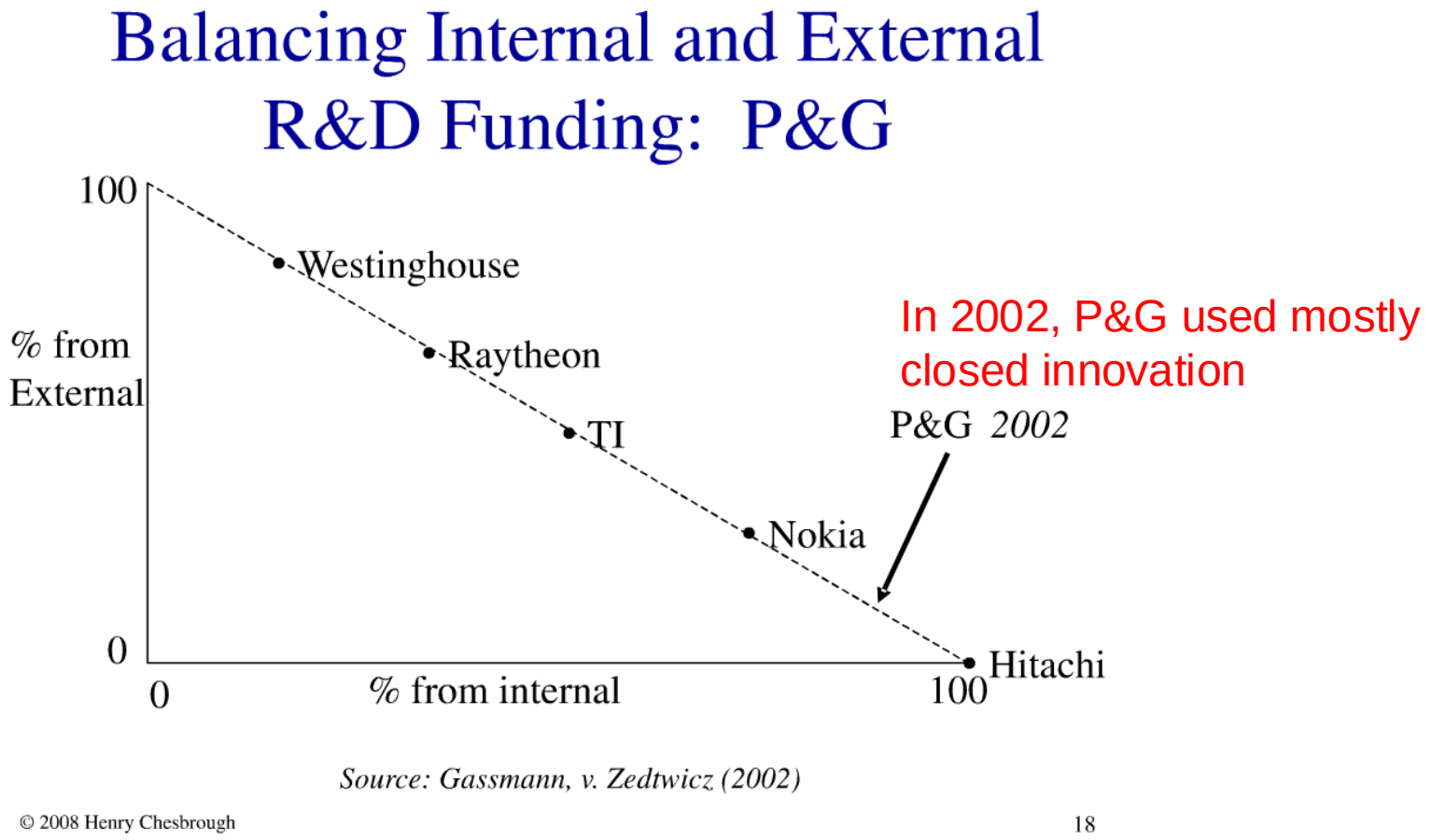
Risks of open innovation (compared to closed innovation)

- ☹ Lack of control
  - Will usually not have as tight control of external resources as internal ones
- ☹ Higher complexity of managing innovation
  - Need to manage external relationship, intellectual property, confidentiality etc
- ☹ Higher coordination costs
  - May cost to coordinate external resources
- ☹ Possible loss of own capability over time
  - If are not using and building a capability but relying on others
- ☹ Possible loss of competitive advantage compared to others
  - If allow others to build skills in area important to your business, they can sell their expertise to your competitors (contracts can help address the risk)

Balancing Open and Closed Innovation?

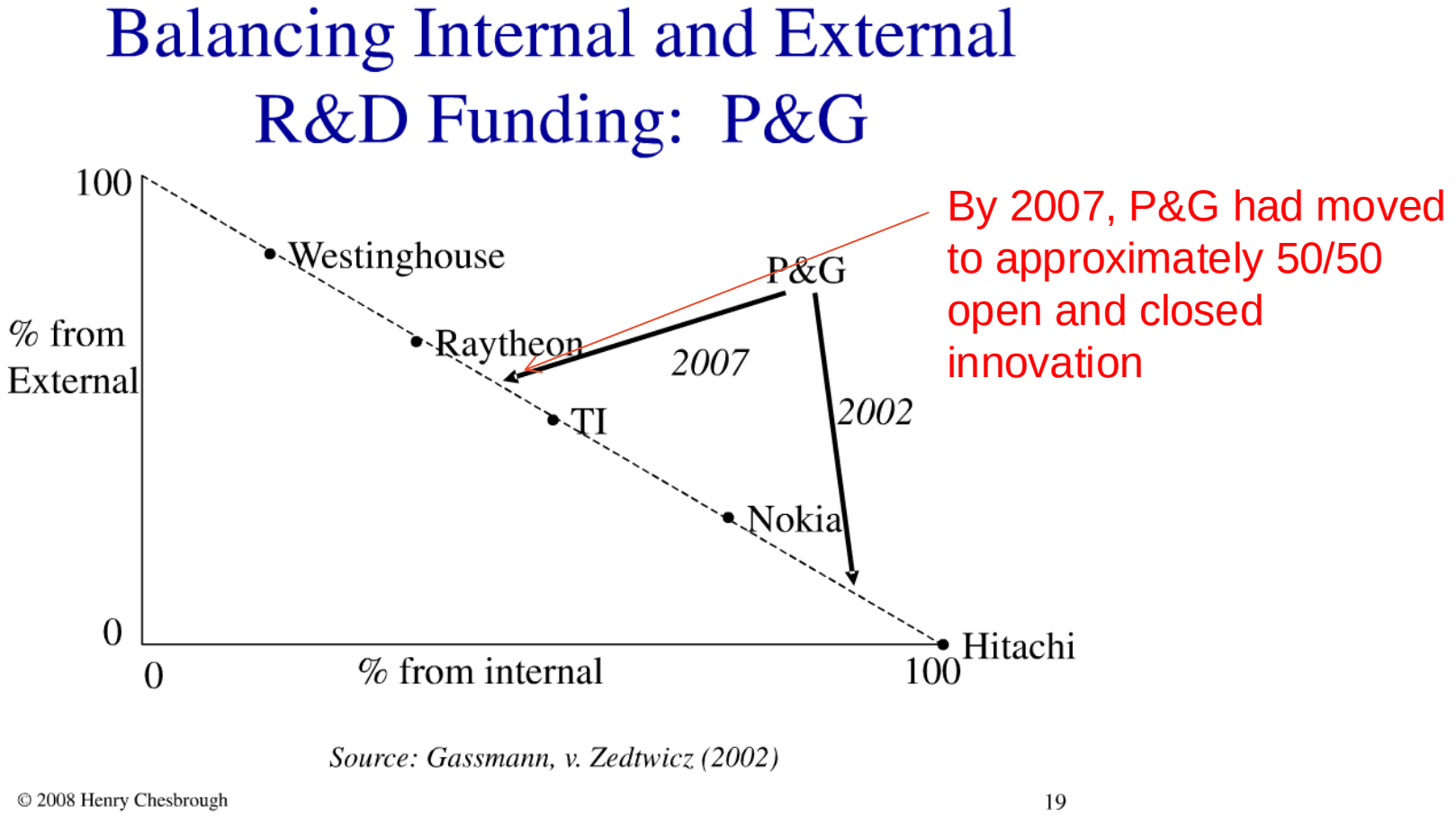
- Both traditional ("closed") innovation and open innovation have benefits
- Many companies do both and balance them

Balancing internal and external spending on innovation



Source: Chesbrough (2009) - http://www.slideshare.net/Allagi/open-innovation-seminar-2009-brazil-henry-chesbrough (Mar'25)

Balancing internal and external spending on innovation



By 2007, P&G had moved to approximately 50/50 open and closed innovation

Source: Chesbrough (2009) - http://www.slideshare.net/Allagi/open-innovation-seminar-2009-brazil-henry-chesbrough (Mar'25)

Open Innovation Adoption amongst companies

Sub-section 1.2

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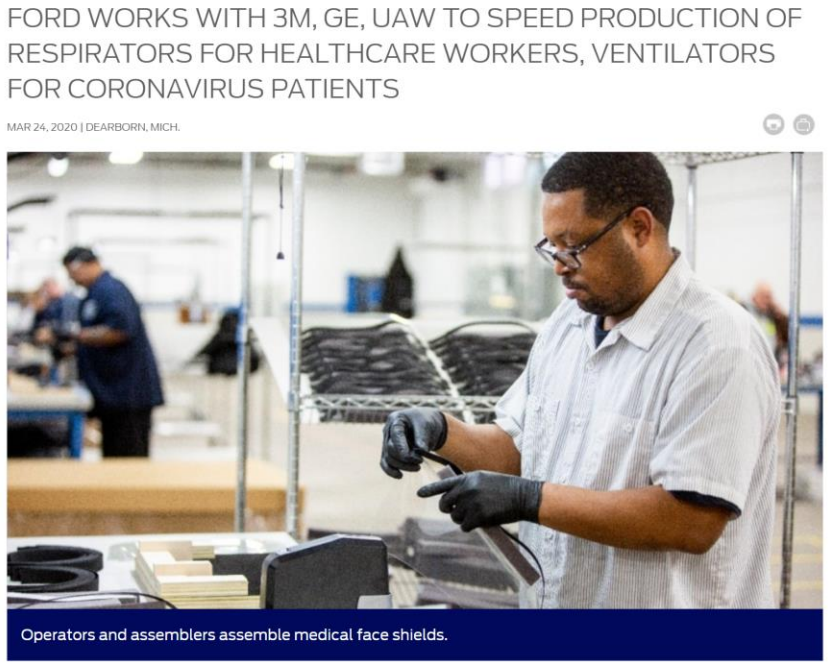
Top companies following open innovation in 2023

https://www.openstartups.net/site/ranking-global/index.html (Mar'25)

Open Innovation Examples (during the COVID-19 Pandemic)

- Amidst the gloom and doom of the early months of the Covid-19 crisis, something surprisingly uplifting started to happen: Companies began to come together to work openly at an unprecedented level, putting the ability to create value before the opportunity to make a buck.
  - The German multinational Siemens, for instance, opened up its Additive Manufacturing Network to anyone who needs help in medical device design.
  - Heavy truck maker Scania and the Karolinska University Hospital have partnered, too: Scania is not only converting trailers into mobile testing stations, but also directed some 20 highly skilled purchasing and logistics experts to locate, acquire, and deliver personal protective equipment to health care workers.
  - Similarly, Ford is working together with the United Auto Workers, GE Healthcare, and 3M to build ventilators in Michigan using F-150 seat fans, portable battery packs, and 3D printed parts.



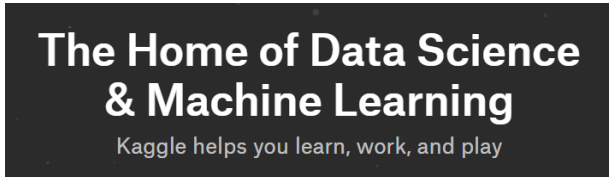
Why Now Is the Time for "Open Innovation" (hbr.org)

Companies Tap into Open Innovation by…

- Top coder by Nasa, ebay

- https://www.topcoder.com/
- http://www.designorate.com/successful-open-innovation-examples/

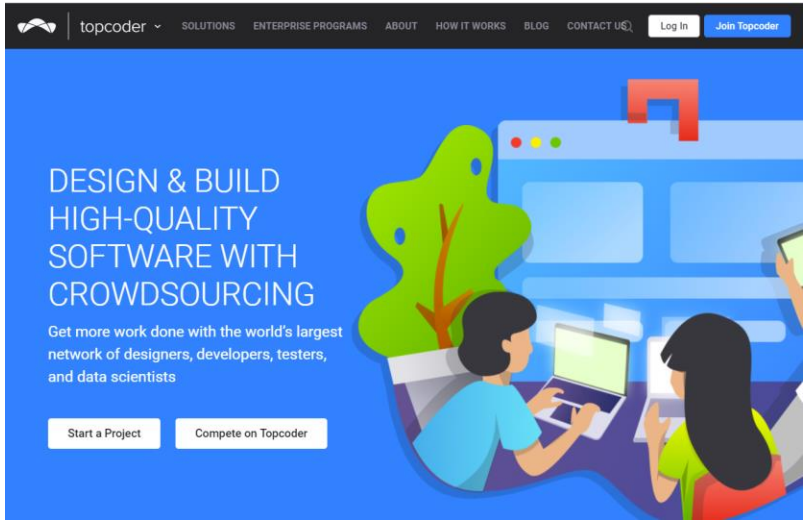
- Kaggle



- https://www.kaggle.com/
- https://www.kaggle.com/c/intel-mobileodt-cervical-cancer-screening

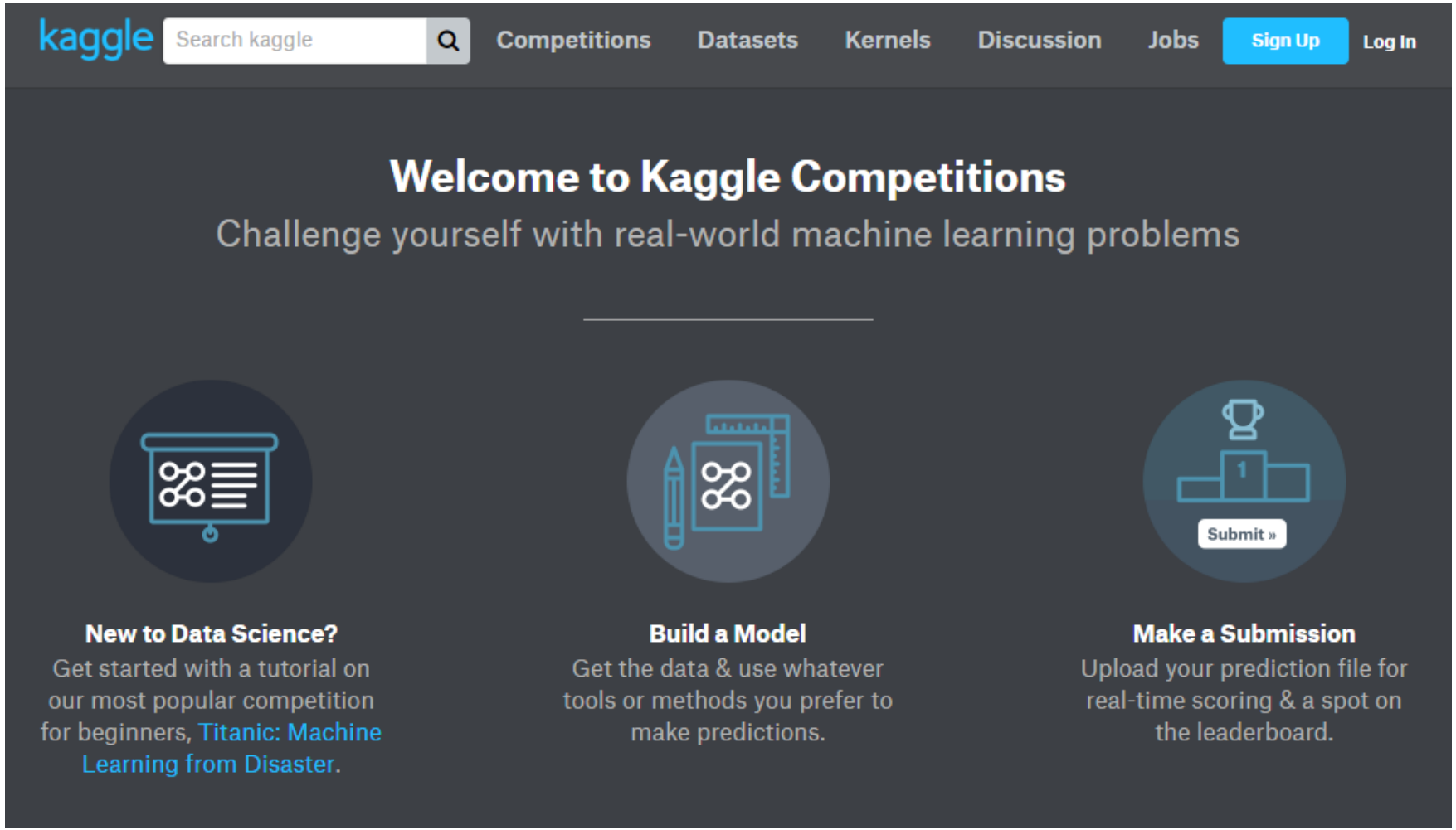
Example: Topcoder

- **Create a Project** - Choose the project type that best matches your requirements, and use the interactive guide to tell us about your vision and requirements.
- **Get Expert Assistance** - A project manager is assigned to you to handle all logistics—from launching crowdsourcing competitions to delivering your feedback on deliverables.
- **Review Submissions** - You can review and provide feedback on all deliverables—and often have multiple options to consider. We keep you abreast of progress the whole way.
- **Pay for Results** - We sell outcomes, not contracts for services. With Topcoder you pay only for the solution that meets your requirements, not the hours to create it.



https://www.topcoder.com/

Case Study – Kaggle – Big data competitions

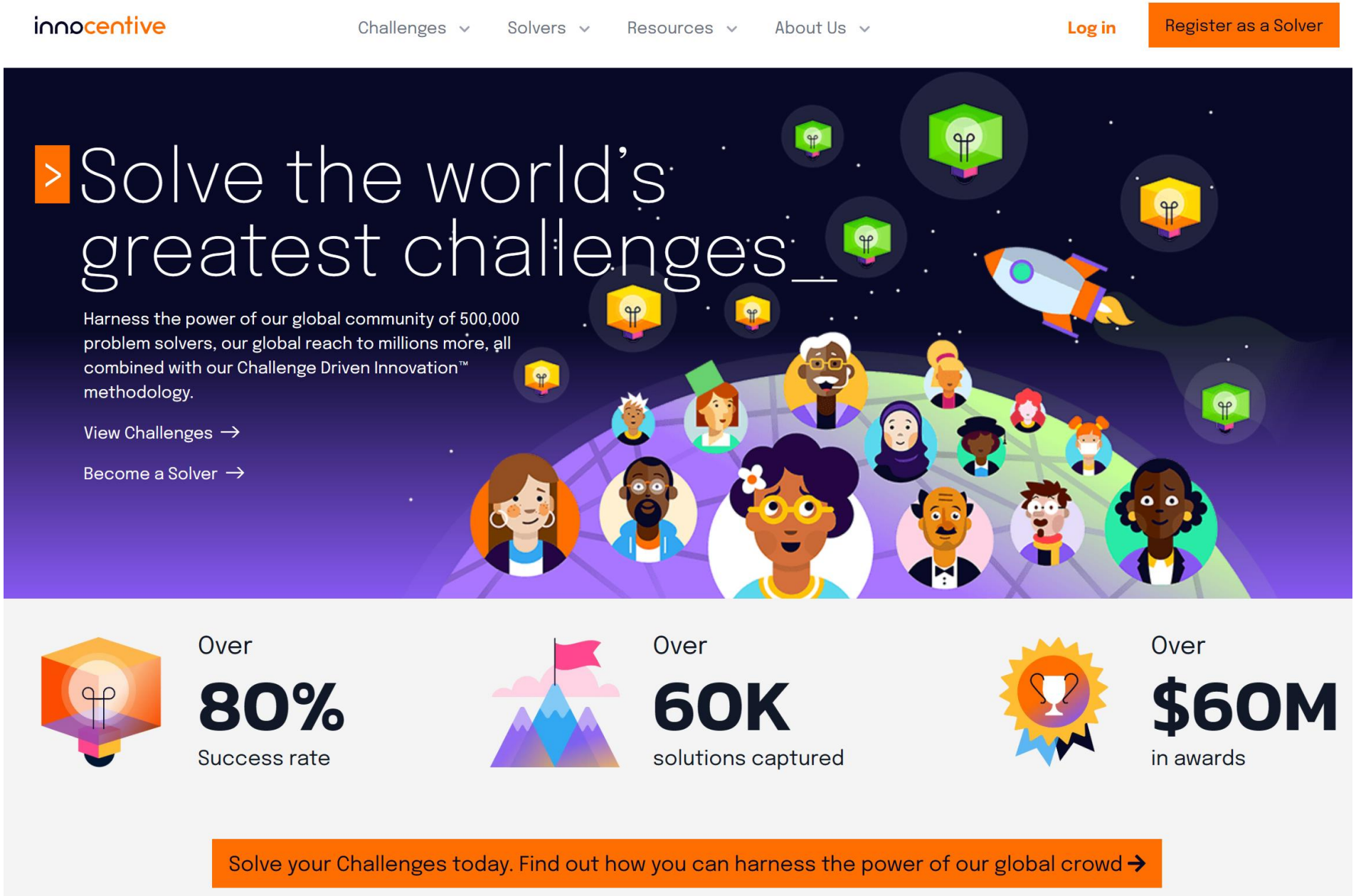


https://www.kaggle.com/competitions

Kaggle story

- In 2010, **Kaggle** was founded as a platform for predictive modelling and analytics competitions on which companies and researchers post their data and statisticians and data miners from all over the world compete to produce the best models. **This crowdsourcing approach** relies on the fact that there are countless strategies that can be applied to any predictive modelling task and it is impossible to know at the outset which technique or analyst will be most effective. Kaggle also hosts recruiting competitions in which data scientists compete for a chance to interview at leading data science companies like Facebook, Winton Capital, and Walmart.
- In April 2015, Kaggle released the first version of their **Scripts product onto their platform**. Scripts allows users to write, run, and publicly share their code on Kaggle.
- In January 2016, Kaggle released their **Datasets product**, making a selection of public datasets available on Kaggle. Each datasets has Scripts enabled, as well as a dedicated forum, allowing for conversation and collaboration between data scientists and the work they are doing on each dataset.
- On 8 March 2017, Google announced that they were acquiring Kaggle.[2] They will join the Google Cloud team and continue to be a distinct brand.[3]

https://en.wikipedia.org/wiki/Kaggle
http://www.afr.com/technology/google-buys-australias-kaggle-20170308-gutzx3



https://www.innocentive.com/ (Mar'25)

History lesson…. Open Innovation Examples from Companies

NOKIA Bell Labs

Walmart Labs

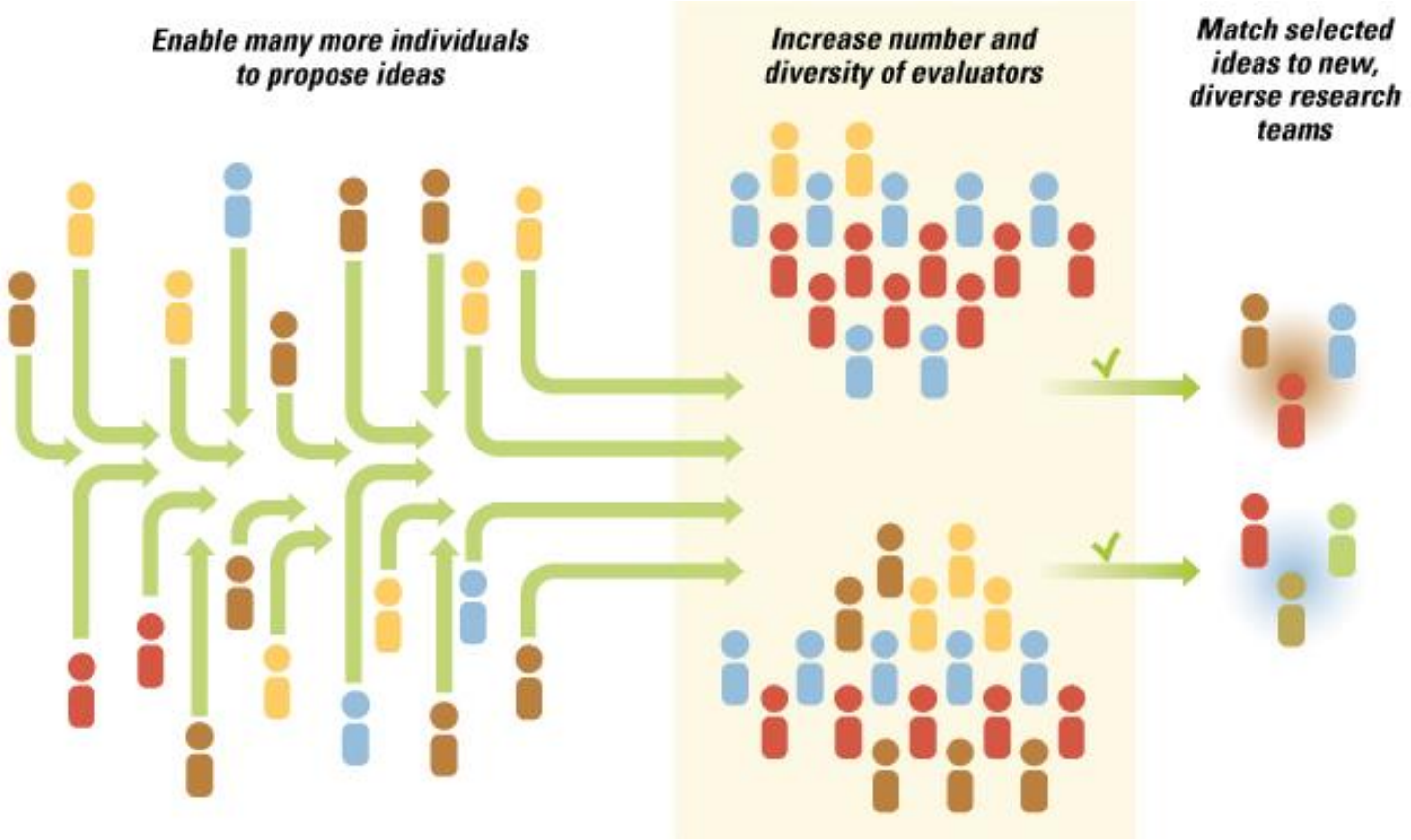
https://www.nokia.com/about-us/events/calendar/open-innovation-challenge/
https://www.lockheedmartin.com/en-us/capabilities/artificial-intelligence-machine-learning.html
https://www.lockheedmartin.com/en-us/news/events/ai-innovation-challenge.html
https://www.walmartlabs.com/

Distributed Innovation: Modularity

Sub-section 1.3

Distributed innovation

- "a system in which innovation emanates not only from the manufacturer of a product but from many sources including users and rivals"
- Eric von Hippel (1988) paraphrased by Carliss Baldwin (2012)



http://sloanreview.mit.edu/article/experiments-in-open-innovation-at-harvard-medical-school/ (Mar'25)

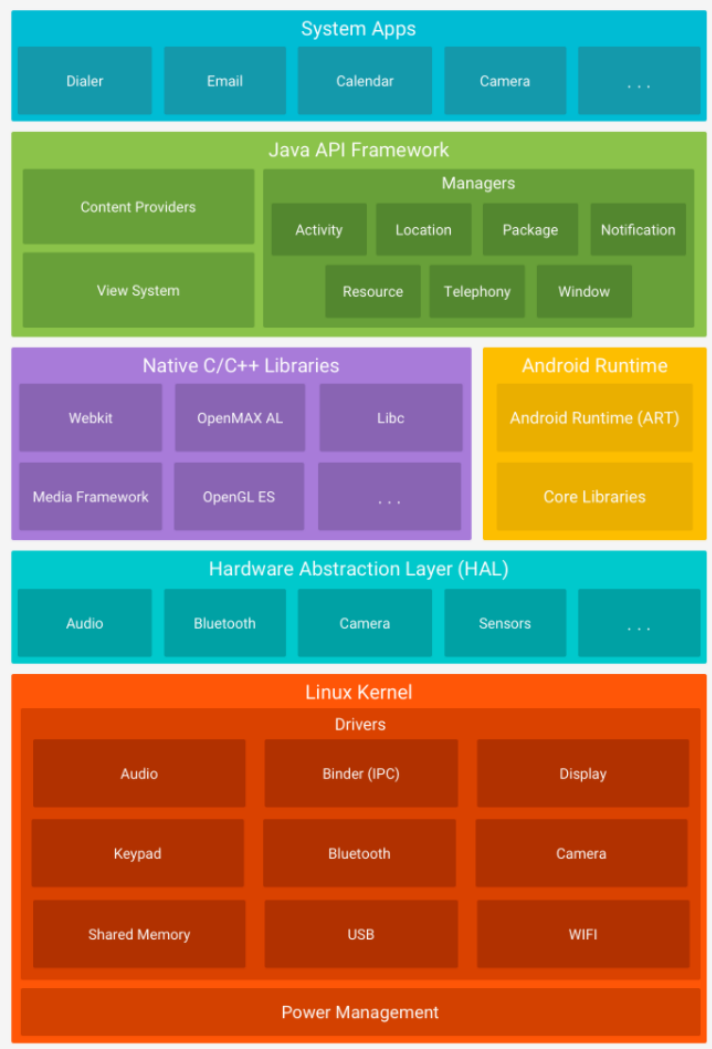
Enabling distributed innovation: Modularity

- In software engineering, modularity refers to how much a software/Web application may be **divided into smaller modules**. Software modularity indicates that the number of application modules can serve a specified business domain.

https://www.techopedia.com/definition/24772/modularity

Enabling distributed innovation: Modularity

- A standard interface enables components to be combined easily (e.g. by user, within company, between companies)
- Modularity can enable many different configurations to be achieved from a given set of components.



https://developer.android.com/guide/platform/index.html (Mar'25)

Enabling distributed innovation: Modularity

- Products may be modular at:
  - **User level** e.g. Firefox add-ons, Microsoft Office plug-ins, Smartphone Apps
  - **Producer (company) level** e.g. Software products based on a company's platforms
  - **Industry level** e.g. Each component of a PC made by different company

Approaches to distributed innovation

Sub-section 1.4

Some approaches to distributed innovation

– These are some approaches companies use to get external companies/individuals involved in their innovation:

A. Product platforms
B. Web APIs
C. Crowdsourcing innovation / Crowdfunding Innovation
D. Releasing data sets “Open data”
E. Free and Open Source Software
F. User innovation
G. Platform ecosystems
H. Accelerators, investment and others

Detailed Discussion:
Product Platforms & Web APIs

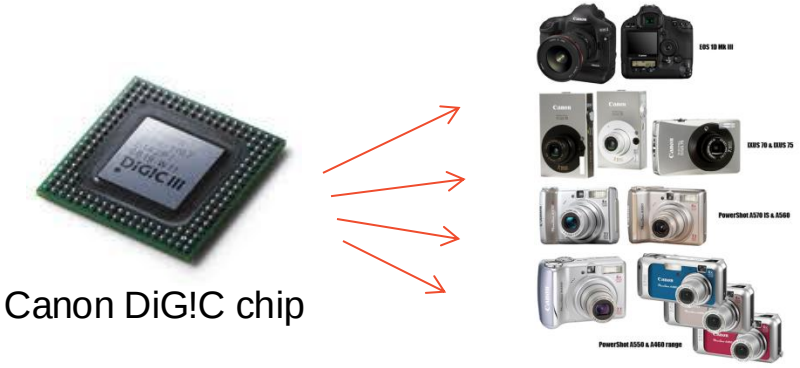
Section 2

Product Platforms: In Detail

Sub-section 2.1

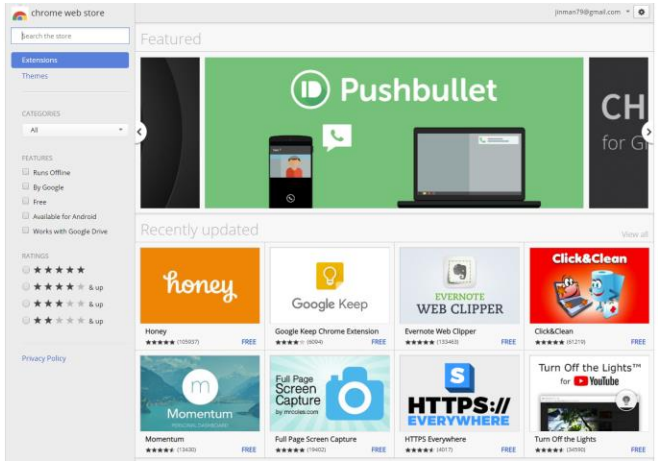
Product Platforms

- Concept became popular in the 90s – used for reusable components/design frameworks
- Foundation of components around which a company builds related products
- Also known as "product family engineering"
- Platforms make it possible for companies to:
  - Have a rich line-up of different products with the same core functions
    - At different price-points
    - For different customer types
  - To do so efficiently through re-use of a common platform



Canon DiG!C chip

http://www.reghardware.com/

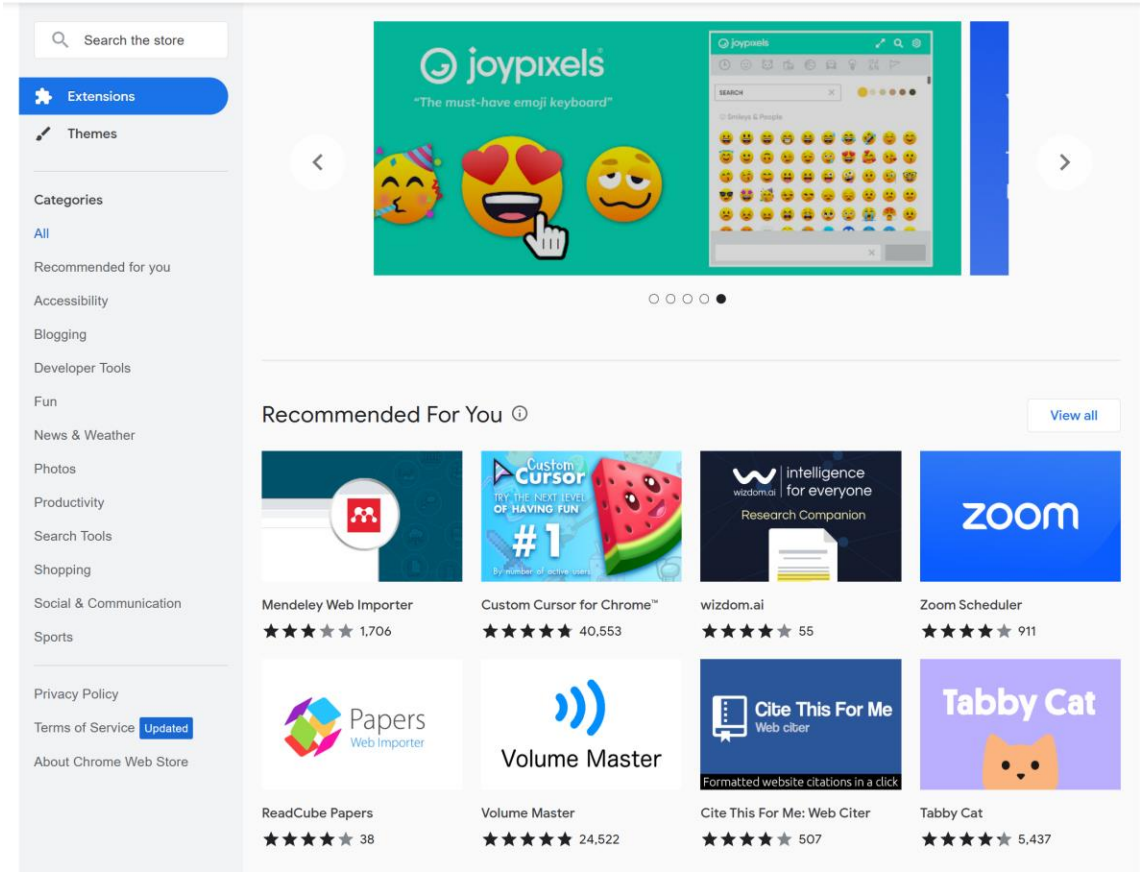


Some ways in which companies provide IT product platforms

- Make source code available:
  - Allows external innovators to modify the software for their own needs
  - E.g., Core Java platform
- Provide toolkit (software and documentation):
  - Allows external innovators to write software based on the toolkit
  - E.g., SAP XML Toolkit for Java
- Provide plug-in/add-on support in software:
  - Allows external innovators to customise software without access to source code
  - E.g., Google Extensions
- Provide a complete product platform for external innovation
  - Allows external innovators to write rich and varied applications on the platform
  - E.g., Android and iPhone app architectures
- Provide live data/functionality via an application programming interface (API)
  - Allows external innovators to build new services using the data
  - E.g., Facebook API

Example of a Product Platforms – Google Extensions

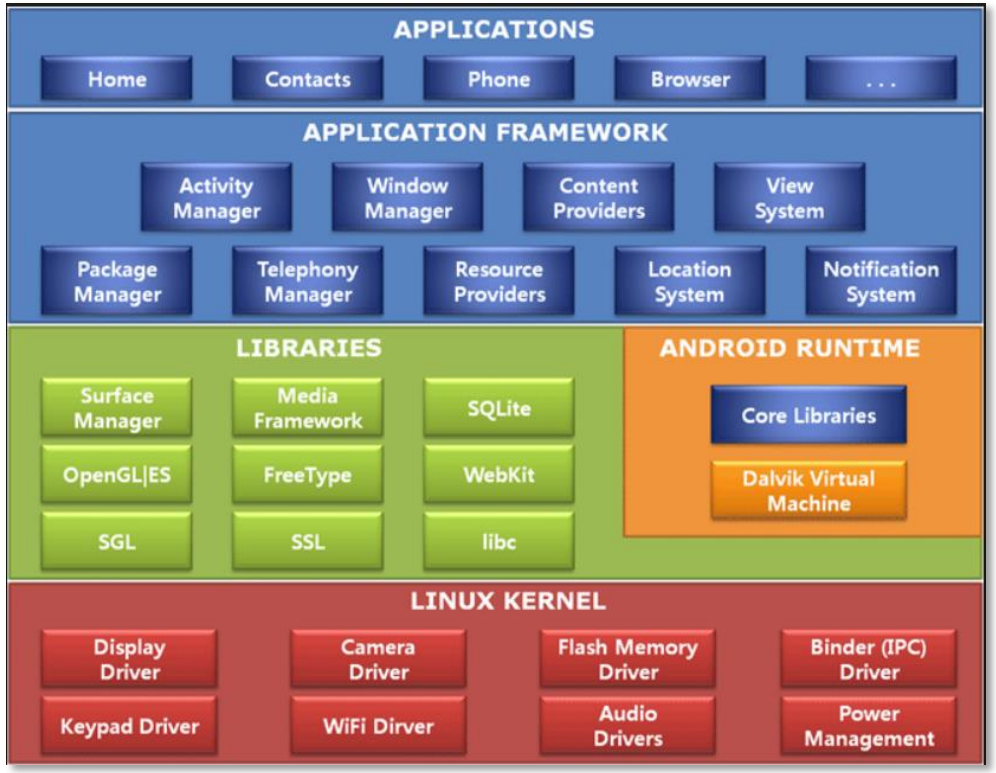
- Extensions are small software programs that customise the browsing experience. They enable users to tailor Chrome functionality and behavior to individual needs or preferences.
- They are built on web technologies such as HTML, JavaScript, and CSS.



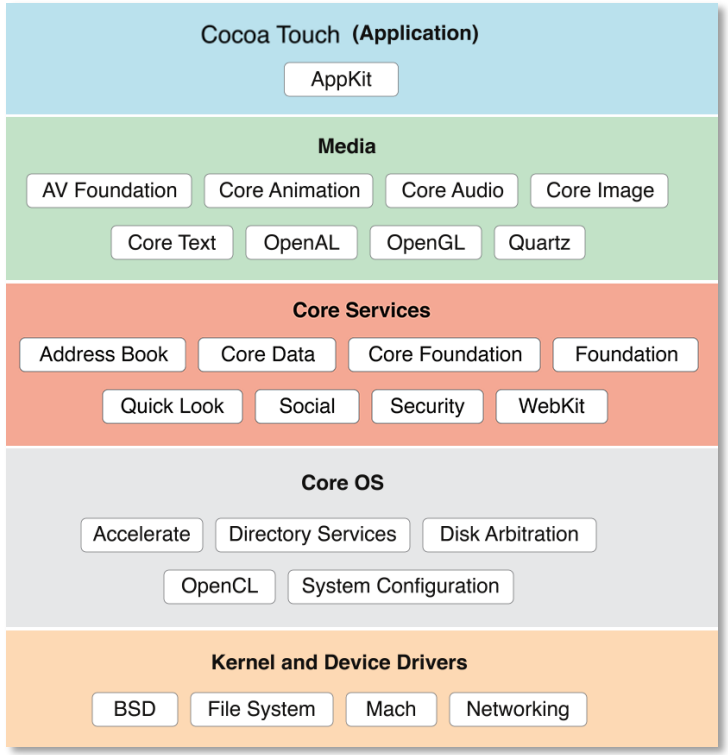
Chrome Web Store - Extensions (google.com) (Mar'25)

Dominant Design Is an Architecture (Recall…)

Android example



Cocoa Touch is a UI framework for building software programs to run on iOS for the iPhone



Note: Dominant designs are not specific products, they are architectures.

Product Platforms: Benefits

- For external product platform:
  - Can be made available externally, leading to new businesses, and new business models
- For internal product platform:
  - Reuse technology component in multiple products leading to:
  - ☺ Faster development time so gets to market sooner
  - ☺ Lower effective cost (as spread over multiple products)
  - ☺ Higher adaptability and 'evolve-ability'
  - ☺ Innovative aspects of the platform can benefit a range of products
  - ☺ Application development on platform can focus on innovative value-add

Web APIs: In Detail

Sub-section 2.2

Web APIs

- Interfaces for web-based services to interact (usually RESTful APIs)
- Enable modularity on the web
- Used e.g.:
  - Maps
  - Payment
  - Messaging
- Becoming the underlying infrastructure for a lot of automation

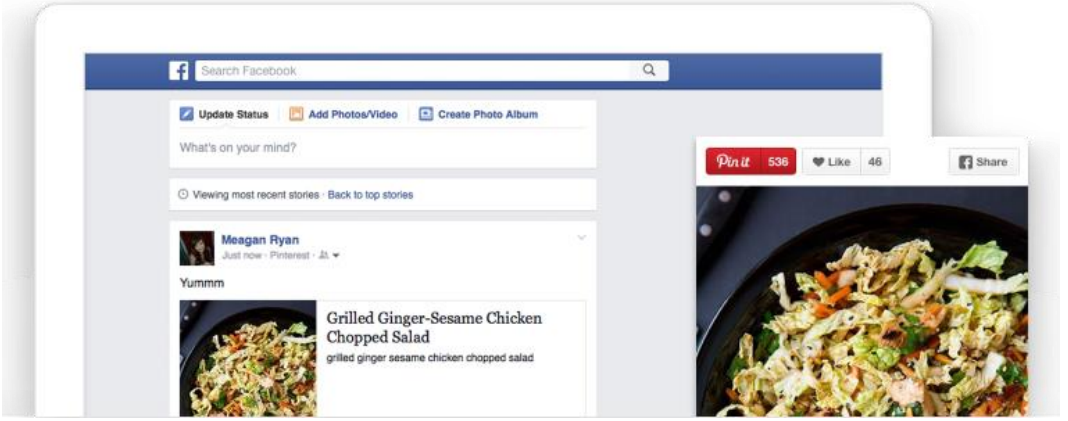


Image: developer.google.com

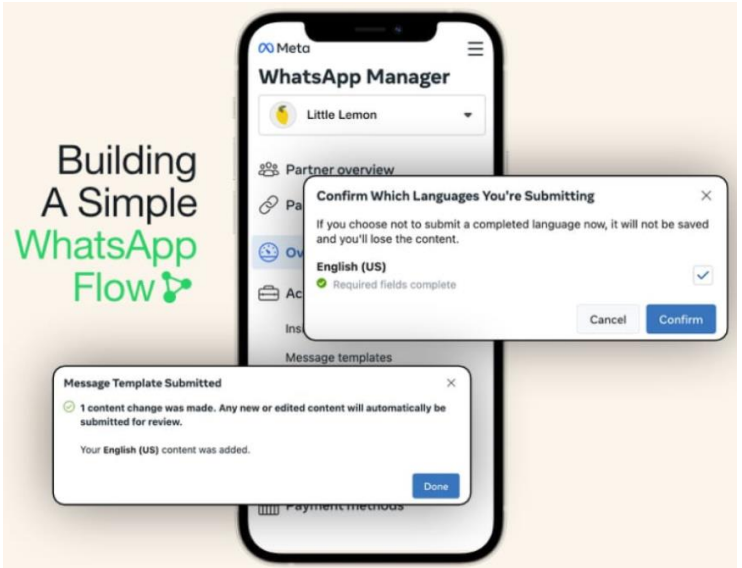
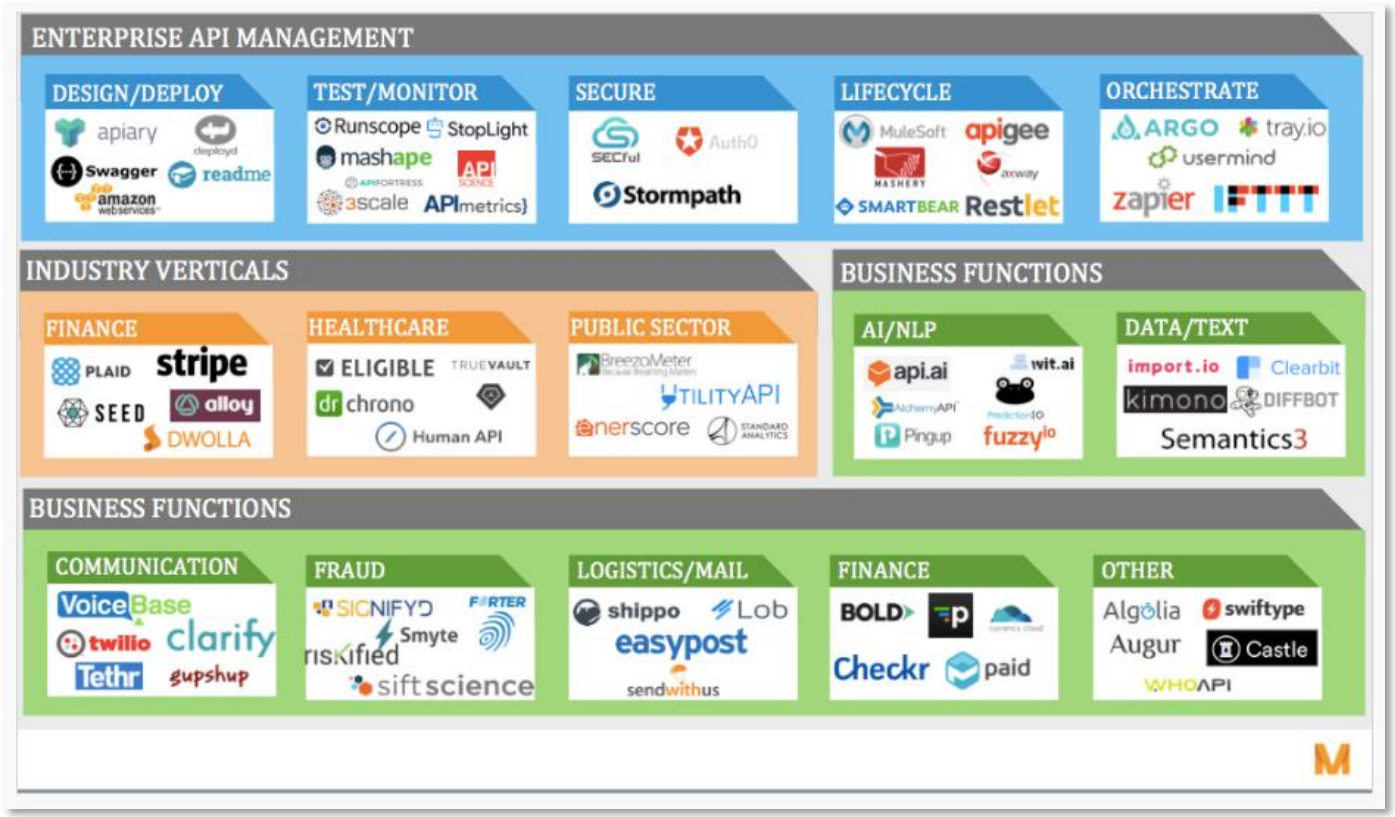


Image: facebook.com/developer

The Rise of APIs

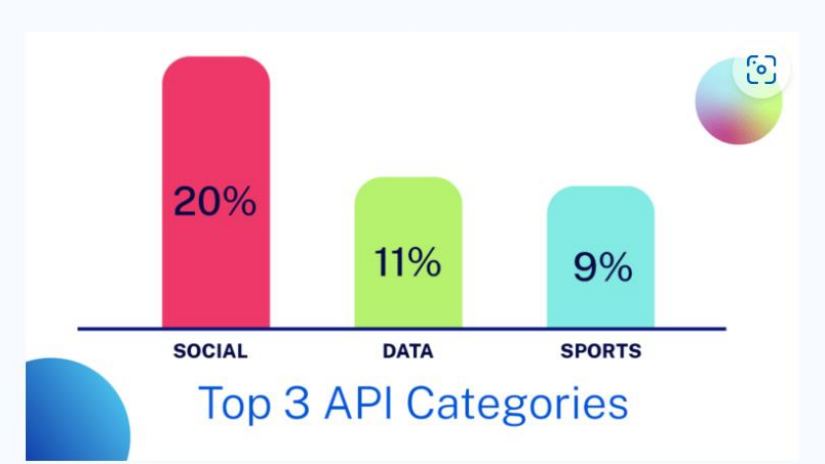
- Faster, cheaper, smarter
- A new breed of software companies
- Rethinking the value chain

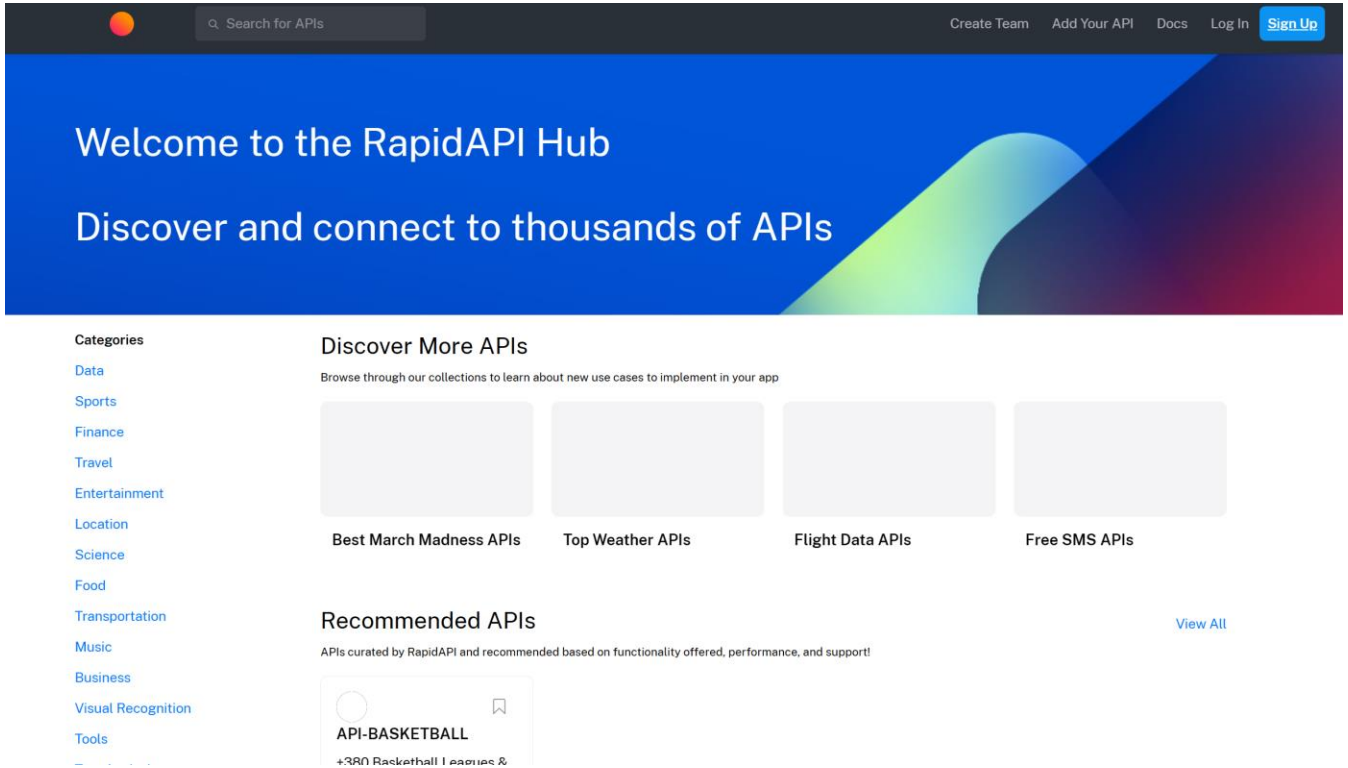
https://www.verifiedmarketresearch.com/product/open-api-market/
(Mar'25)



The Rise of APIs | TechCrunch (Mar'25)

Web APIs





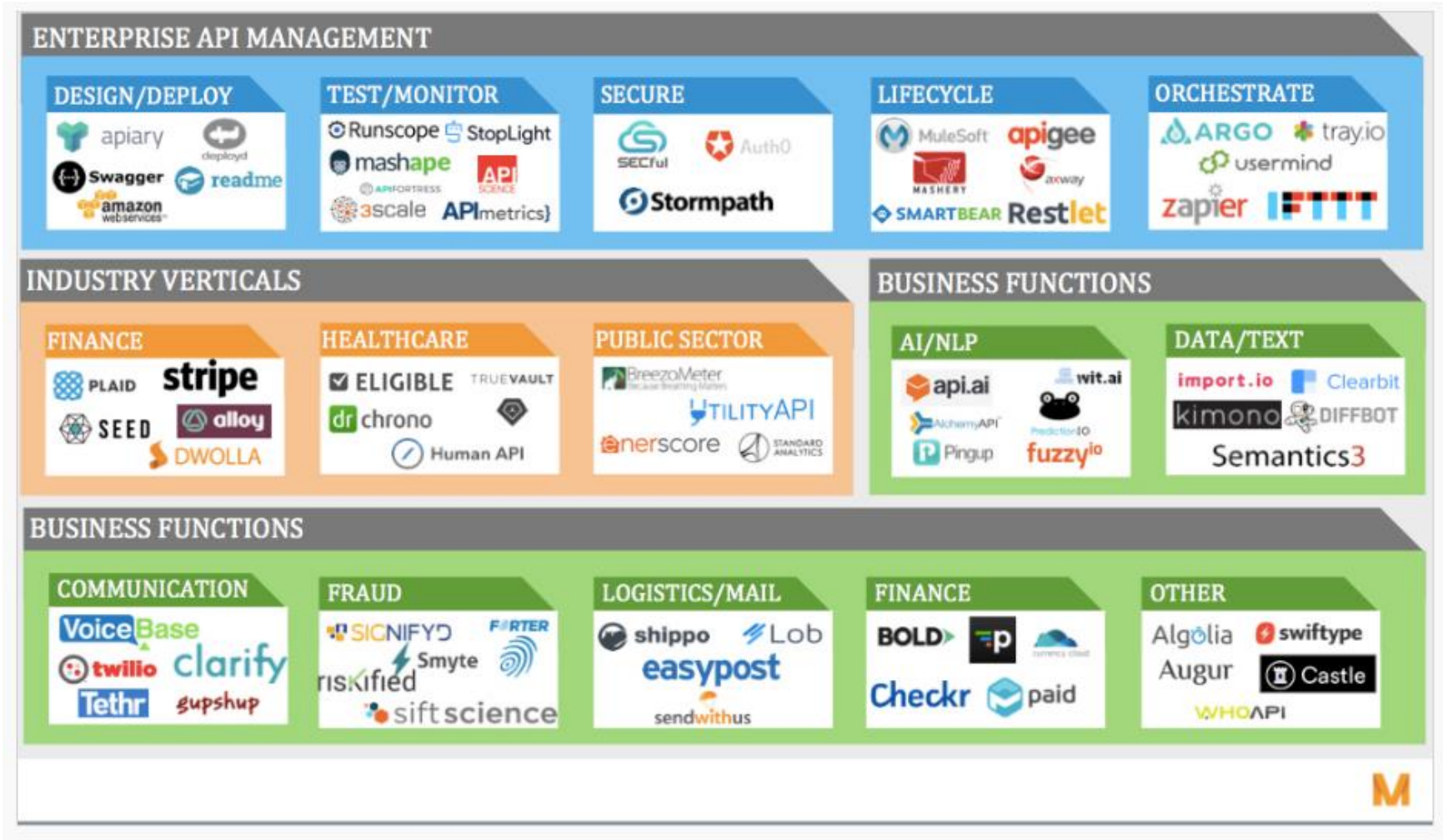
Top 50 Most Popular APIs (Updated for 2023) | Rapid Blog (rapidapi.com) (Mar'25)

What Makes a Great Open API? (Mar'25)

The API Billionaires Club is about to welcome Trillionaire members. But how should you deal with it? (Mar'25)

The rise of APIs – Techcrunch

- Faster, cheaper, smarter
- A new breed of software companies
- Rethinking the value chain



https://techcrunch.com/2016/05/21/the-rise-of-apis/ (Mar'25)

"In the past, the biggest companies were those closest to the data (e.g., a system of record), able to impose a tax, or lock-in to their platform. In the API economy, the biggest companies may be the ones that aggregate the most data smartly and open it up to others."

https://techcrunch.com/2016/05/21/the-rise-of-apis/ (Mar'25)

API Business models

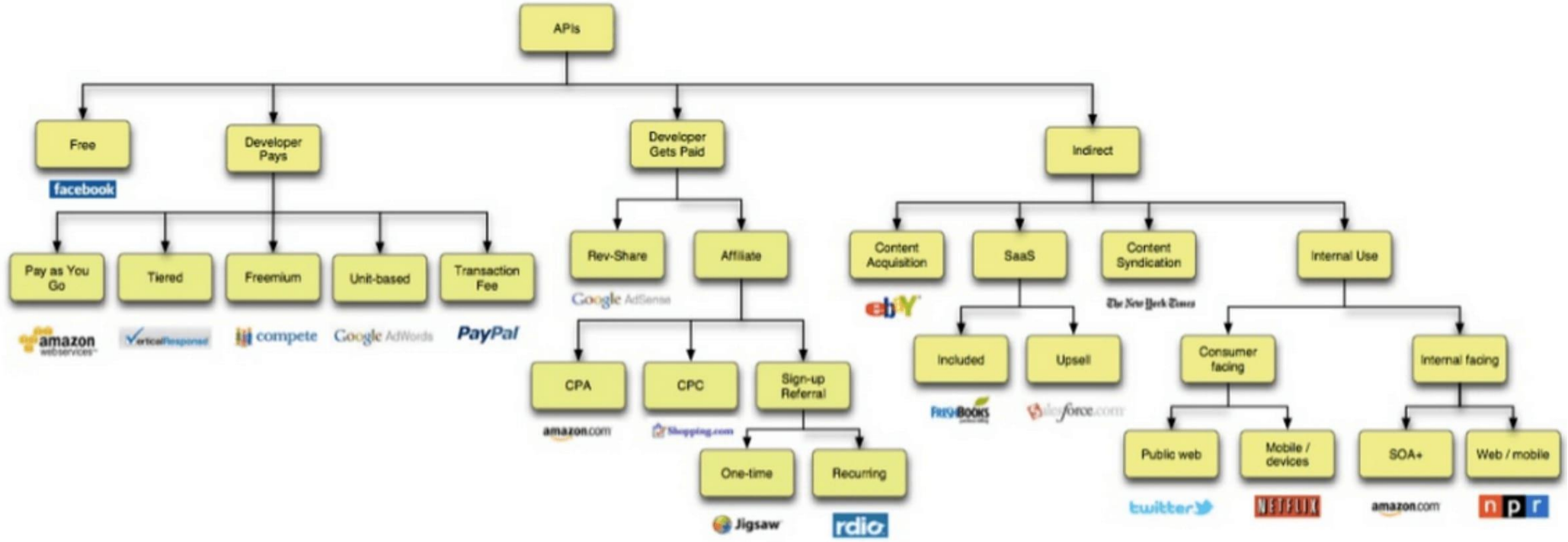
- Models can be: Free /Developer Pay / Developer Gets Payed / Indirect

- ***API as a product***: This category implies that the API has a specific money-making goal or serves as a significant or single source of income for the company. By definition, APIs in this category must provide value that is easy to monetize, and is highly competitive or unique
- ***API enhancing existing product***: A majority of monetized APIs fall into this category. With the main money-making **responsibility** assigned to another part of the business, API providers have a greater set of business model options, ranging from direct pay-to-play to indirect, commission-based compensation
- ***API promoting existing product***: Designed to solidify the market position, APIs in this category are often offered for free, and work to attract interest and traffic to the API provider.

https://www.epam.com/insights (Mar'25)

A Quick Guide to Business Models for APIs (Mar'25)

API Business Models, 2013

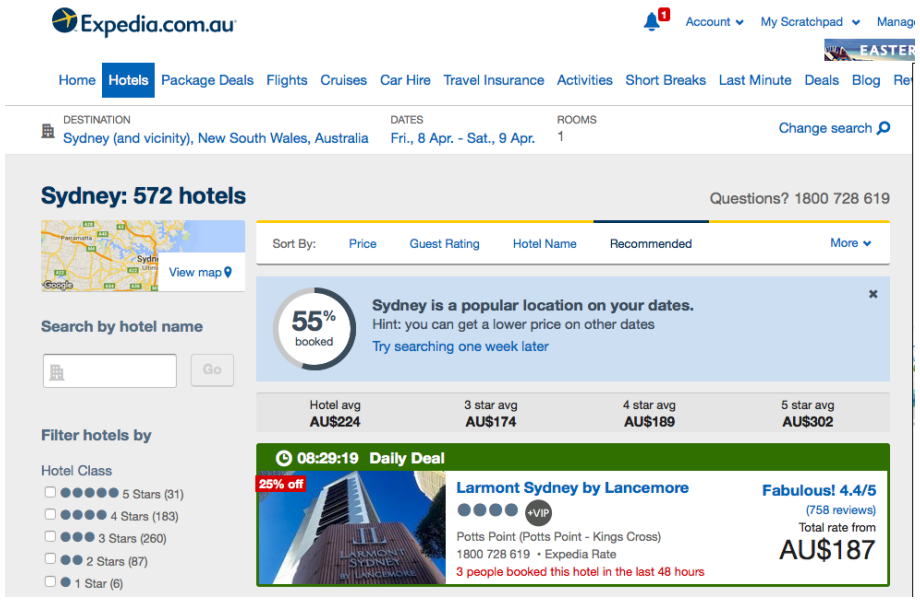


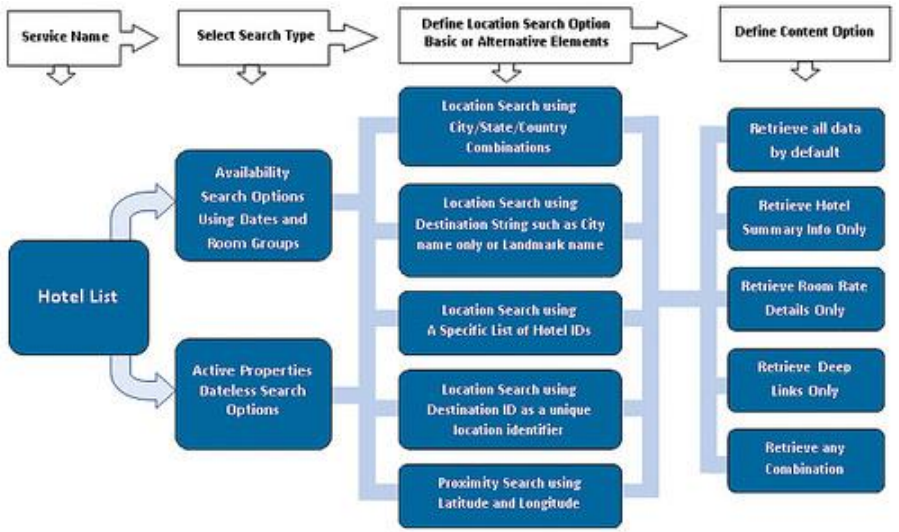
How To Pick the Best Business Models for Your APIs (Mar'25)

Examples: Using APIs for business

- Salesforce.com generates 50% of its revenue through APIs
- Expedia generates 90%
- eBay generates 60%

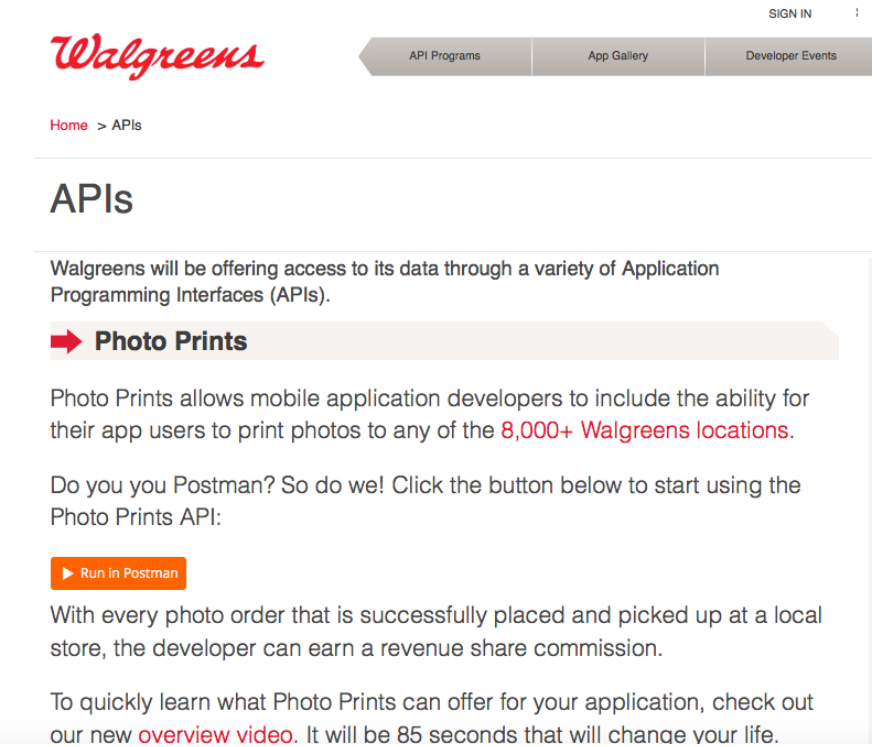
Source: https://hbr.org/2015/01/the-strategic-value-of-apis



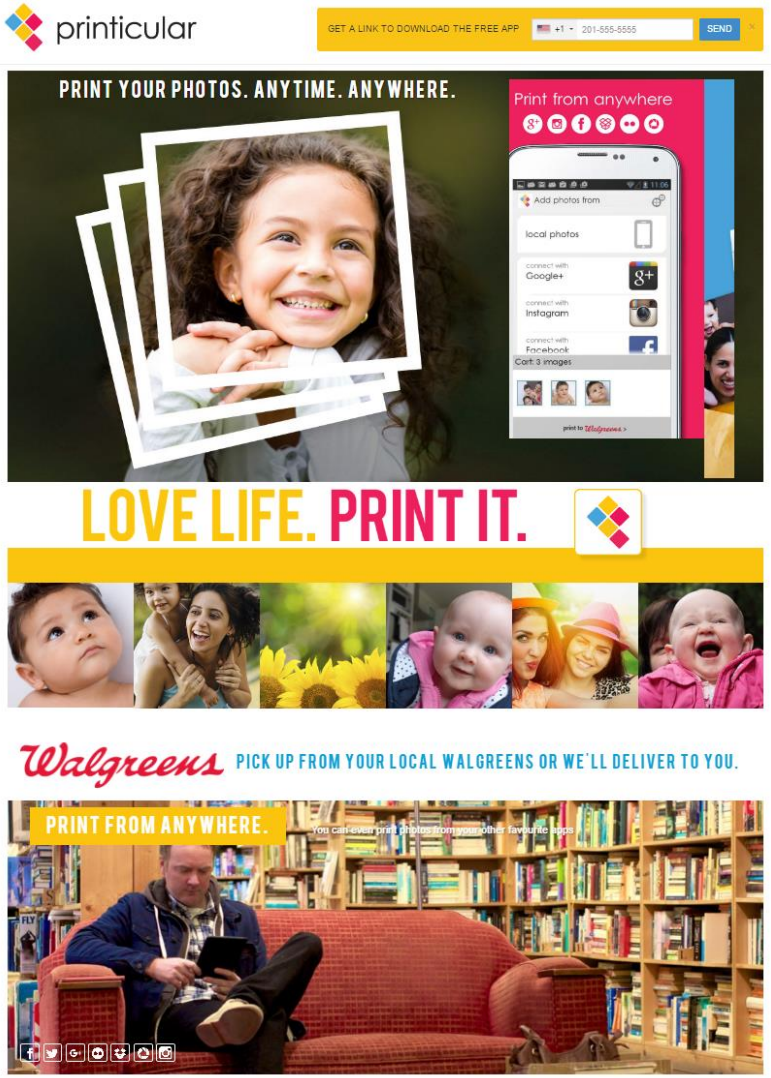


Expedia Affiliation Network – typical pathways http://developer.ean.com/docs/getting-started

Examples: Not just the usual web companies…



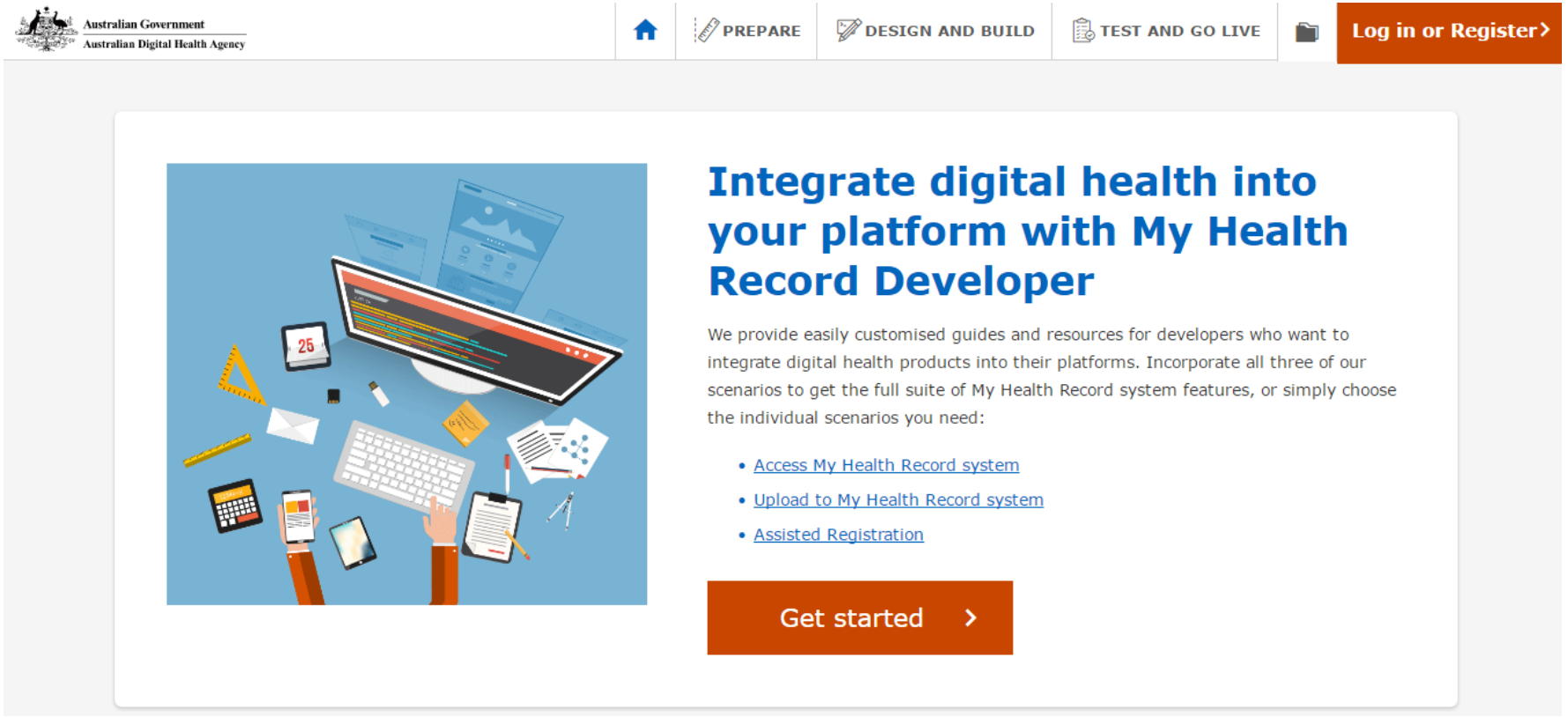
https://developer.walgreens.com/apis (Mar'25)



https://www.printicular.com/

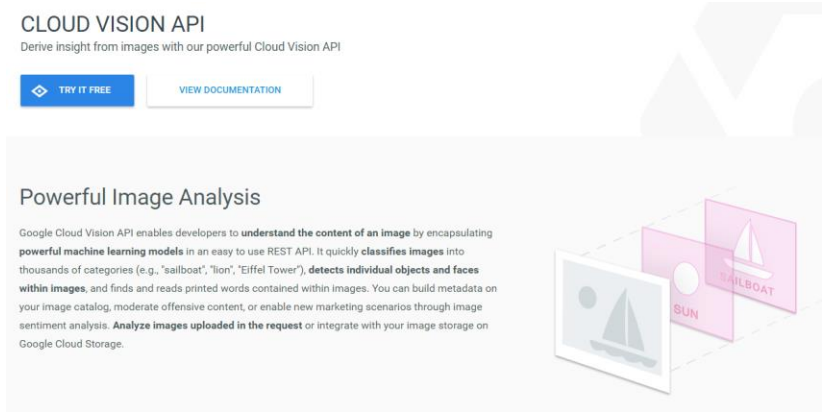
Example: Personal health record in Australia

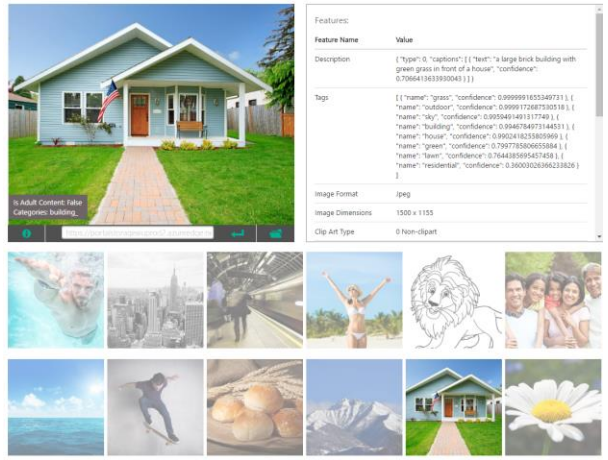
- Government wants to increase the acceptance of personal health records
- API for developers

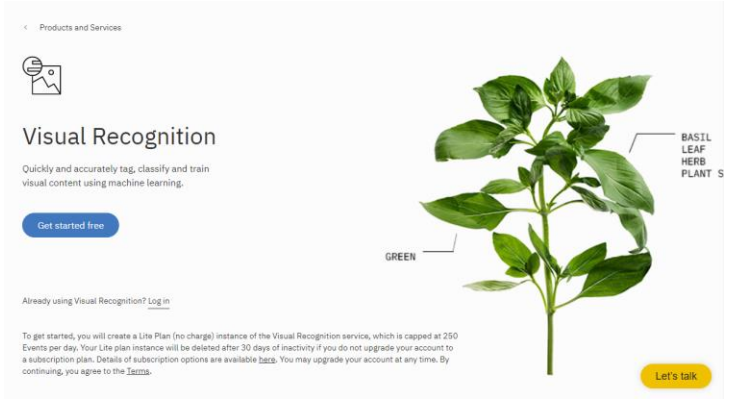


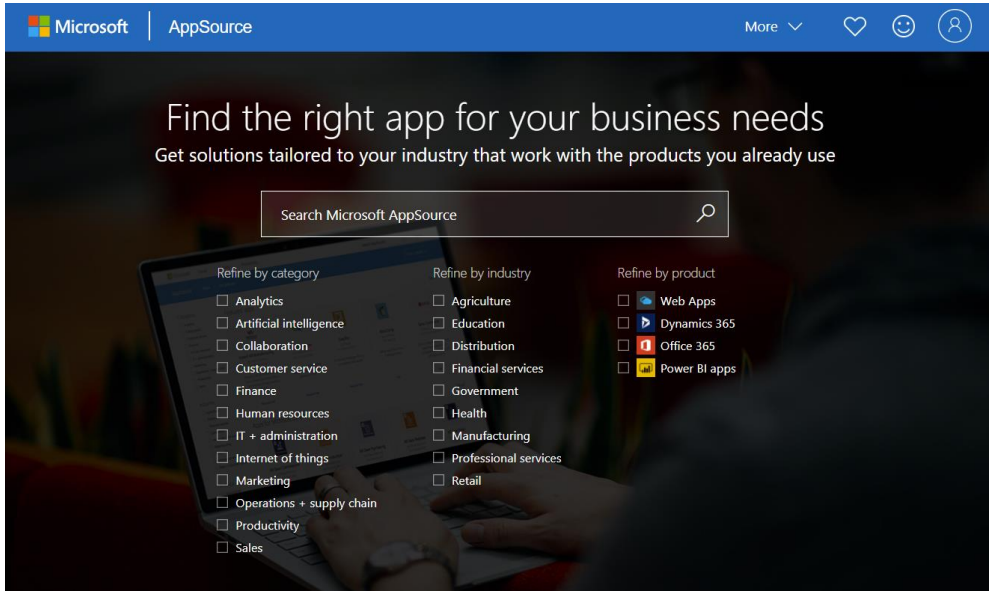
https://myhealthrecorddeveloper.digitalhealth.gov.au/ (Mar'25)

Example: Cognitive computing / Services









https://appsource.microsoft.com/en-GB/

http://customers.microsoft.com/en-us/search?sq=%22Microsoft%20Cognitive%20Services%22&ff=&p=0&so=story_publish_date%20desc

Example - Chatgpt - API

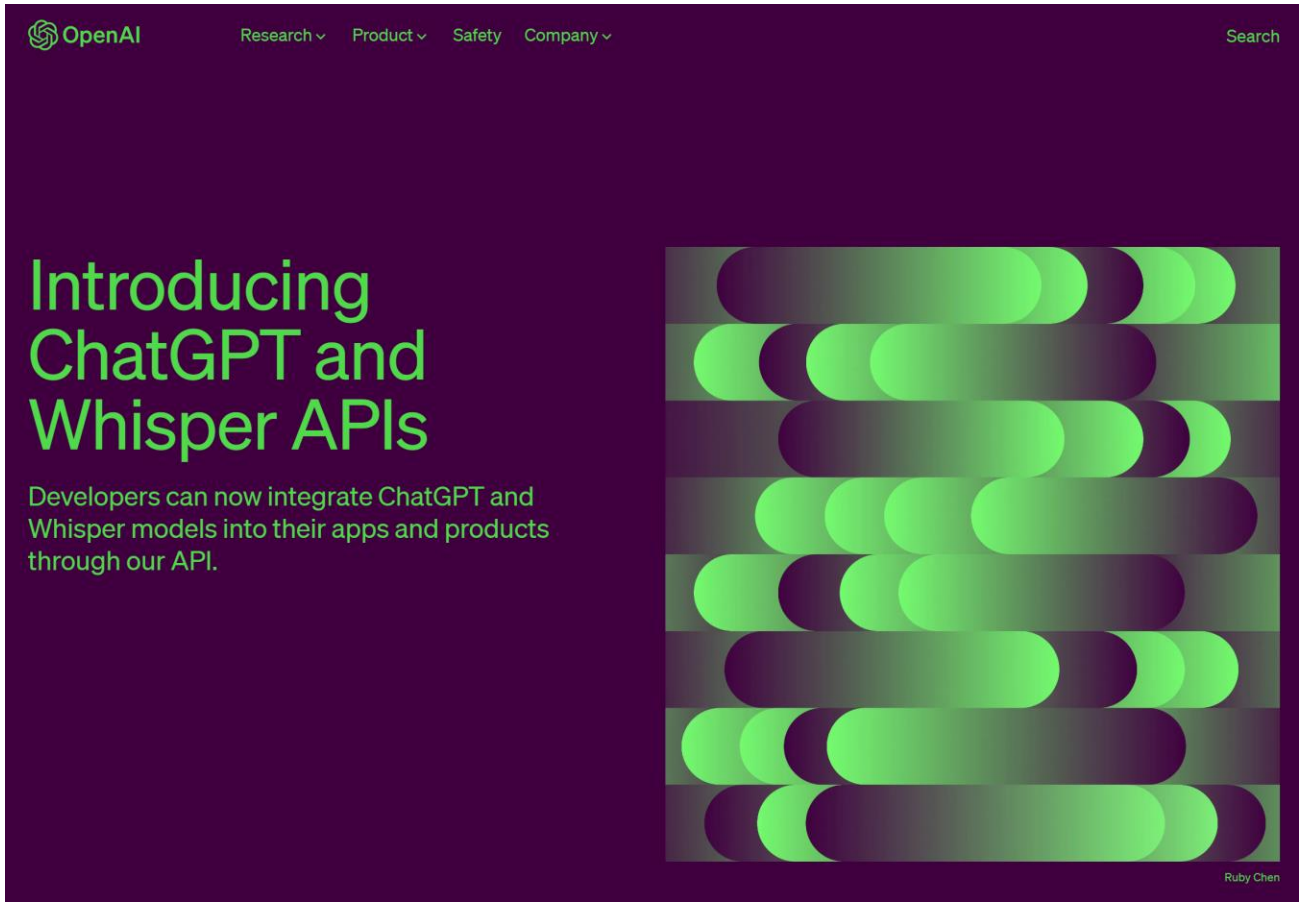


Image generation Beta

Learn how to generate or manipulate images with our DALL·E models

Introduction

The Images API provides three methods for interacting with images:

1. Creating images from scratch based on a text prompt
2. Creating edits of an existing image based on a new text prompt
3. Creating variations of an existing image

This guide covers the basics of using these three API endpoints with useful code samples. To see them in action, check out our DALL·E preview app.

The Images API is in beta. During this time the API and models will evolve based on your feedback. To ensure all users can prototype comfortably, the default rate limit is 50 images per minute. If you would like to increase your rate limit, please review this help center article. We will increase the default rate limit as we learn more about usage and capacity requirements.

Usage

DALL·E 2 (openai.com)

Introducing ChatGPT and Whisper APIs (openai.com)
Image generation - OpenAI API

What is the next API??

- DALL.E?