

The Software Industry

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Agenda

1. Definition (software)
2. The software industry
3. A (very) short history
4. The main players
5. Software products
6. Software platforms
7. Software ecosystems

1. What is Software?

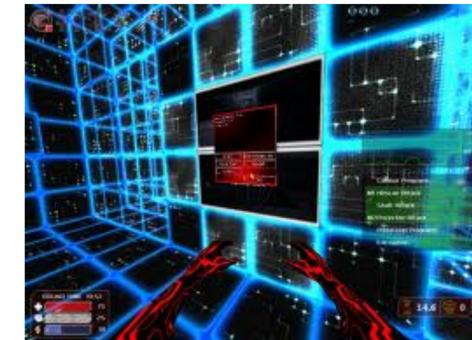
Software Definition

- **Software** (technical definition)
 - Is a set of instructions to make computers perform work
 - Can come in several equivalent forms (source, binary)
 - Is formed into components and programs
 - Programs can be built from components
- **Software** (economic definition)
 - Is a **digital good** that **can be sold**



A screenshot of a software application's dashboard. At the top, it says "Recent AdWords Statistics". Below that is a table of lead conversion data:

The homepage of the Facebook website. The top navigation bar has the word "facebook" in white. Below it, a large blue header contains the text "Facebook helps you connect and share with the people in your life." A world map at the bottom shows user connections across the globe.



Software as a Product

- A **product**
 - Is a **man-made artifact sold to customers in a market**
 - Has a life-cycle
 - Is born,
 - Grows and matures,
 - Eventually dies
- A **software product** is a product that
 - Is intellectual property
 - Is non-physical, does not rot
 - Has near-zero copying costs
 - Is extremely malleable

2. The Software Industry

The Software Industry

- The software industry
 - Is the set of business that provide
 - Software products and
 - Software services such as
 - Operating services
 - Consulting services
 - Development services
 - Implementation services
 - to other industries as well as itself
- The software industry
 - Is highly concentrated
 - Is highly internationalized
 - Has strong network effects
 - Has a high speed of innovation
 - Is rapidly expanding into new domains

Global Information Technology (IT) Spending [1] in US\$bn

	2019 Spending	2019 Growth (%)	2020 Spending	2020 Growth (%)	2021 Spending	2021 Growth (%)
Data Center Systems	205	-2.7	208	1.9	212	1.5
Enterprise Software	456	8.5	503	10.5	556	10.5
Devices	682	-4.3	688	0.8	685	-0.3
IT Services	1,03	3.6	1,081	5.0	1,14	5.5
Comm. Services	1,364	-1.1	1,384	1.5	1,413	2.1
Overall IT	3,737	0.5	3,865	3.4	4,007	3.7

[1] From <https://www.gartner.com/en/newsroom/press-releases/2020-01-15-gartner-says-global-it-spending-to-reach-3point9-trillion-in-2020>

“Software is eating the world”

Wall Street Journal

2011-08-20



The CEO Interview

“Industrial companies are in the information business whether they want to be or not.”

—Jeff Immelt



Change and Innovation at the Speed of Software

- Products increasingly include software components
 - Hardware components traditionally have long innovation cycles
 - Software has a significantly faster innovation cycle
 - Innovation speed is continuously increasing
- Products are being adapted to take advantage of software
 - Products can be reconfigured at speed of software
 - Products evolve at speed of software innovation
- Examples increased innovation speed
 - Cars are fully delivered with features switched off
 - Cars evolve at speed of over-the-air update
- Software is eating established industries and products

[1] See <https://dirkriehle.com/2019/12/09/the-first-derivative-of-software-is-eating-the-world/>

Societal Significance of Software and Software Systems

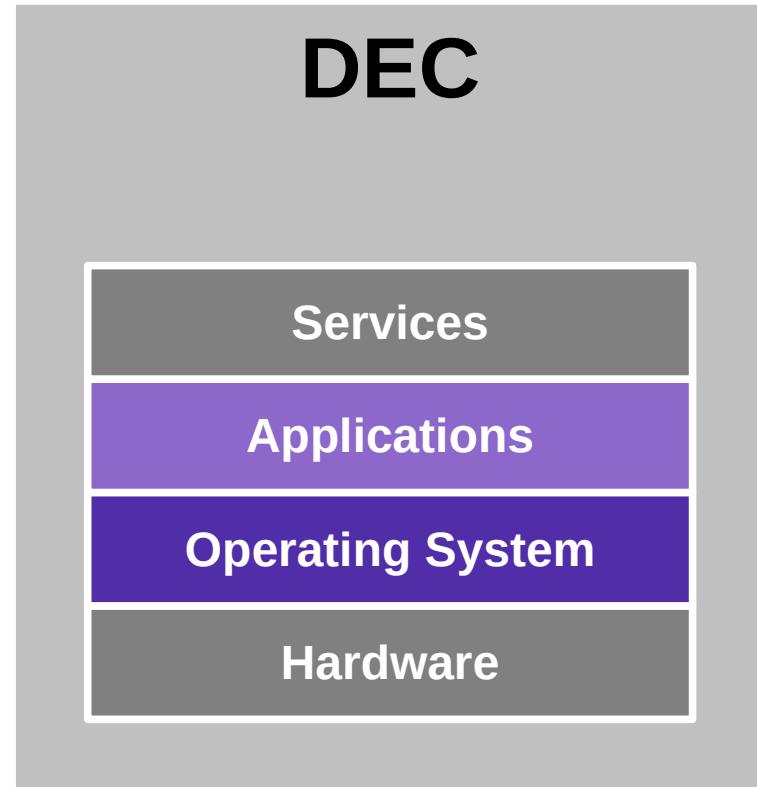
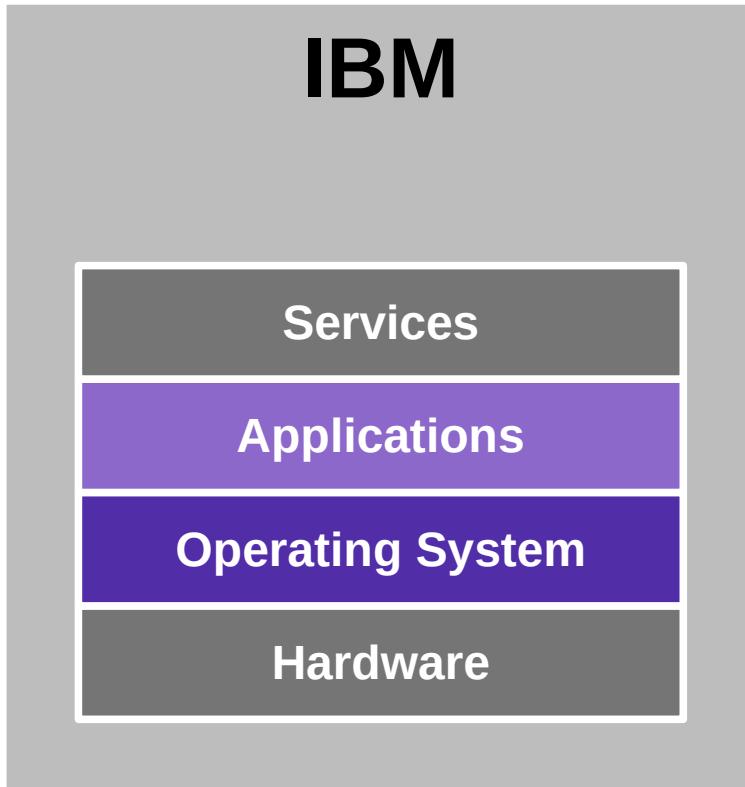
- Software and software systems are changing society
 - Empowerment vs. stratification
 - Enlightenment vs. misinformation
 - Sociability vs. isolation
- Internet and email have become basic utilities

3. A (Very) Short History

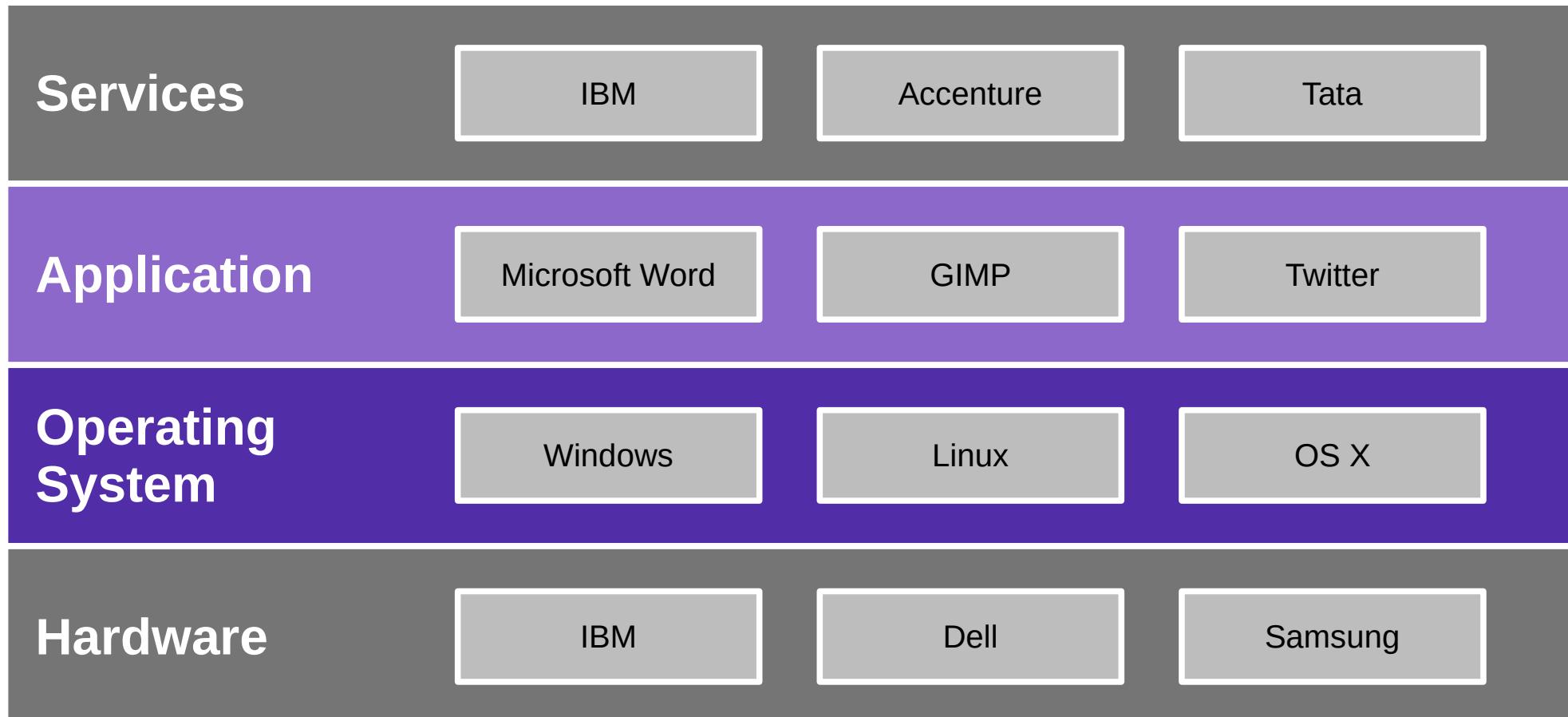
Short History of the Software Industry

- 1959
 - First mentioning of term “software”
- 1969
 - US Dept. of Justice separates hardware from software in landmark decision
- 1980ties
 - From vertical to horizontal integration; growth of platforms and ecosystems
- 1990ties
 - Centralization, dominance of Windows
- 2000ties
 - Diversification, multiple platforms; growth of open source software
- 2010ties
 - Back to vertical integration in the form of cloud computing

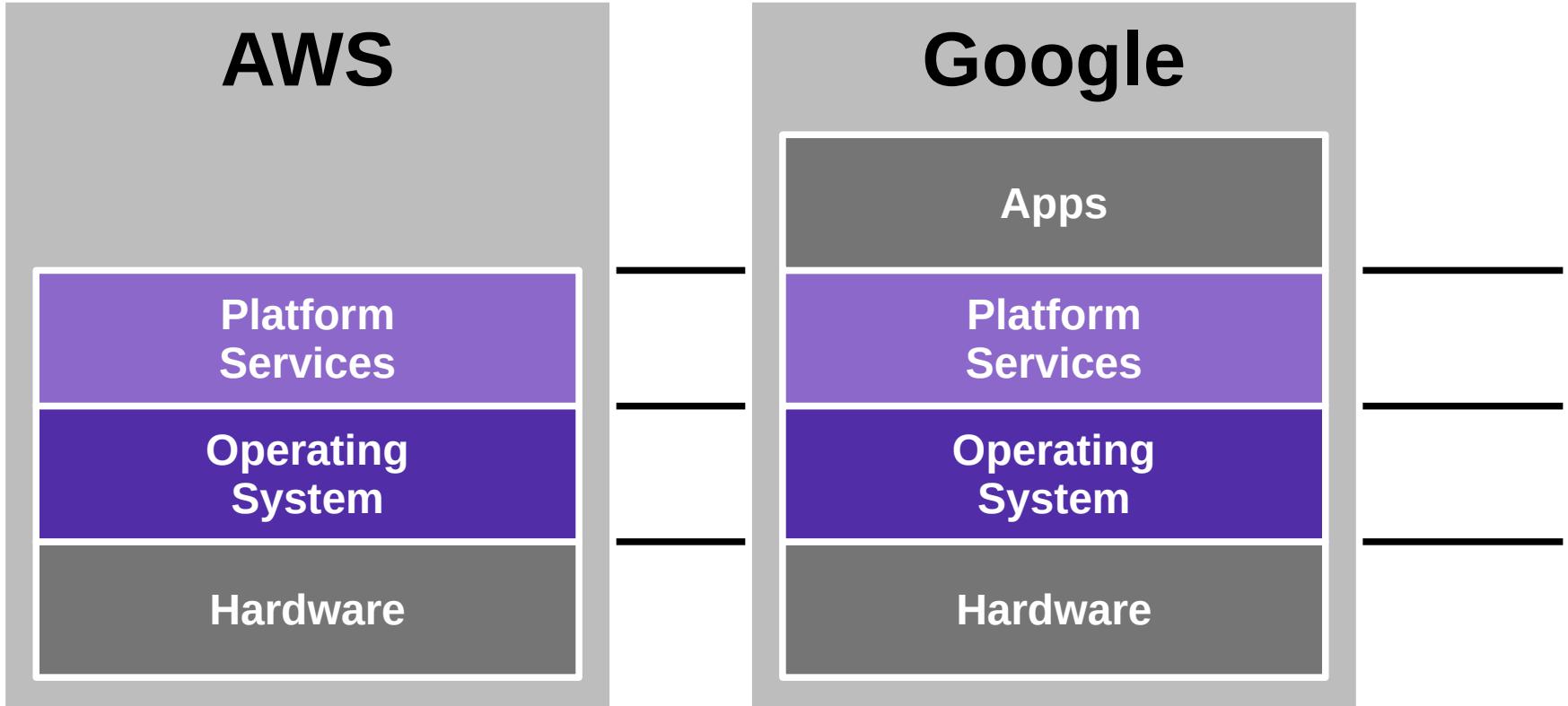
Vertical Integration (Until 1980ties)

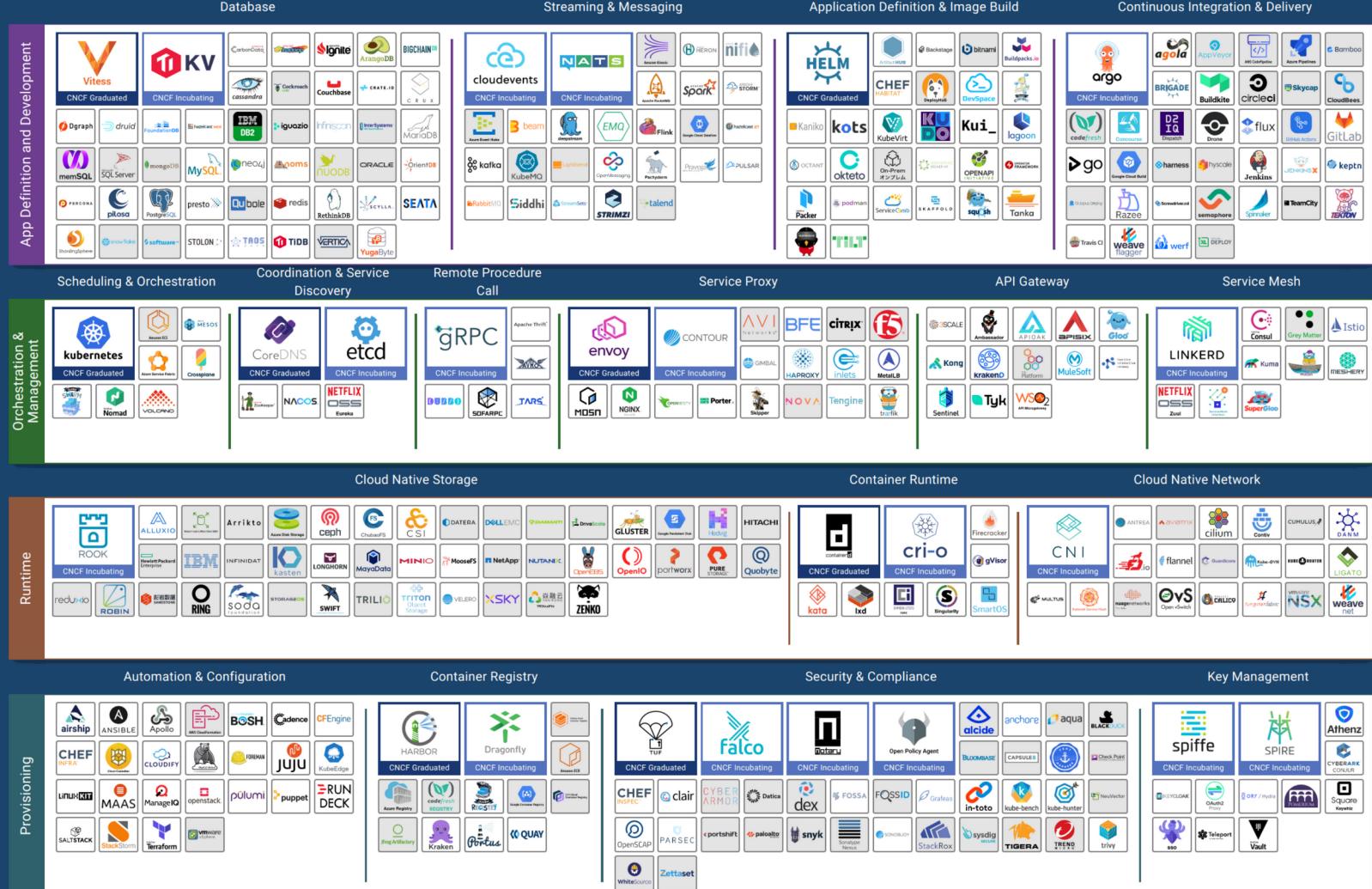


Horizontal Integration (Since 1990ties)



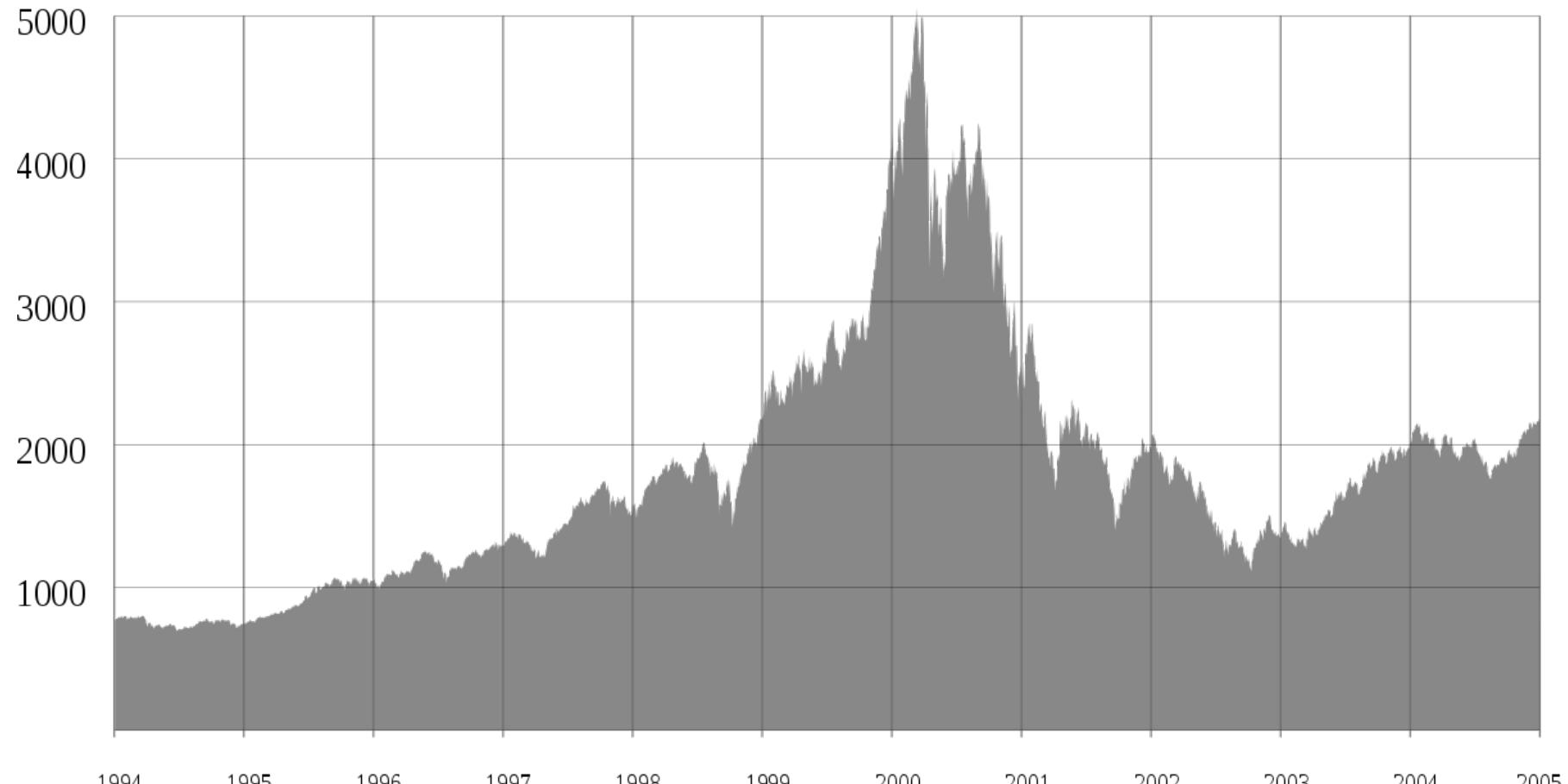
Cloud Computing (Since 2000ties)





[1] <https://landscape.cncf.io/>

The “Dot-Com” Bubble and Burst (1995-2000)



[1] See https://en.wikipedia.org/wiki/File:Nasdaq_Composite_dot-com_bubble.svg

The NASDAQ Composite Index 1971-2021 [1]



[1] By Seriesofsines, own work, CC0, [Wikimedia Commons](#)

Commercial Open Source Startups
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4. The Main Players

The Main Types of Industry Players

- Standard product providers
 - (Independent) software vendors (ISVs)
 - Produce software products (“standard software” or “commercial off-the-shelf software”)
 - Cloud service providers (e.g. “Internet companies”)
 - Operate any form of software (and hardware)
- Software consulting firms
 - Development services firms
 - Produce custom software
 - Implementation services firms
 - Configure software products for use by customers
- Non-profit organizations
 - Standards organizations
 - Regulatory bodies
 - Certification agencies

Top 10 Independent Software Vendors (ISVs) in 2019 [1]

Rank	Organization	Sales (B\$)	FY	Market cap (B\$)	Headquarters
1	Microsoft	118.2	2019	946.5	Redmond, WA, US
2	Oracle	39.6	2019	186.3	Redwood City, CA, US
3	SAP	29.1	2019	134.9	Walldorf, Germany
4	Adobe Inc.	9.5	2019	132	San Jose, CA, US
5	Salesforce	13.3	2019	120.9	San Francisco, CA, US
6	VMware	9.0	2019	77.2	Palo Alto, CA, US
7	Intuit	6.4	2019	66.8	Palo Alto, CA, US
8	ServiceNow	2.6	2019	42.9	Santa Clara, CA, US
9	Workday	2.8	2019	41.7	Pleasanton, CA, US
10	Dassault Systèmes	4.1	2019	39.2	Vélizy-Villacoublay, France

[1] Forbes Global 2020, see https://en.wikipedia.org/wiki/List_of_the_largest_software_companies

Software Vendors vs. “Internet Companies” [1]

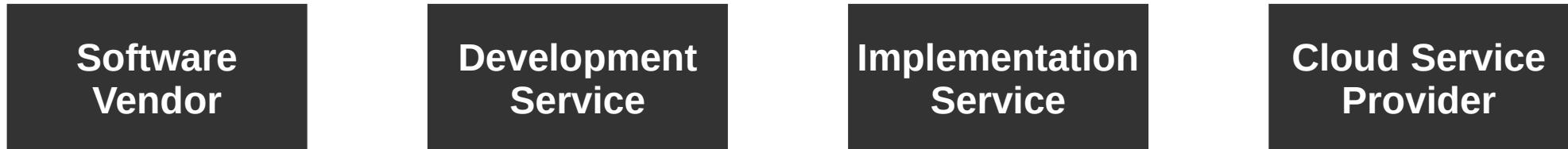


[1] See https://en.wikipedia.org/wiki/List_of_largest_Internet_companies

Software Vendors vs. Service Provider / Operator

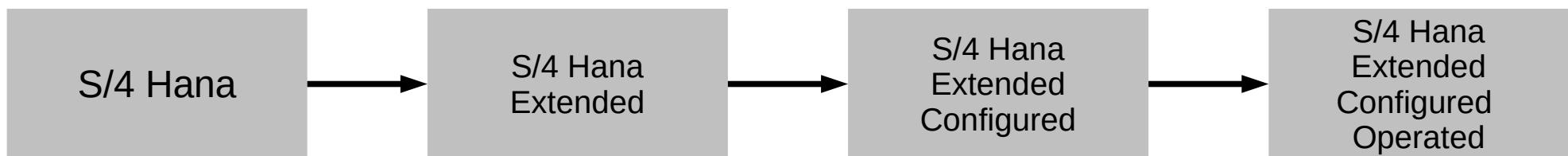
- Software vendor
 - Product is a licensed-out artifact
- Examples (before cloud offering)
 - Microsoft
 - Oracle
 - SAP
 - Adobe
- Service provider / operator
 - Product is a standardized service
- Examples
 - Amazon Web Services (if it was broken out)
 - Various Google services
 - Salesforce
 - Facebook

Software Vendors, Consulting Firms, and Service Providers



accenture >

T·Systems



Standards Organizations

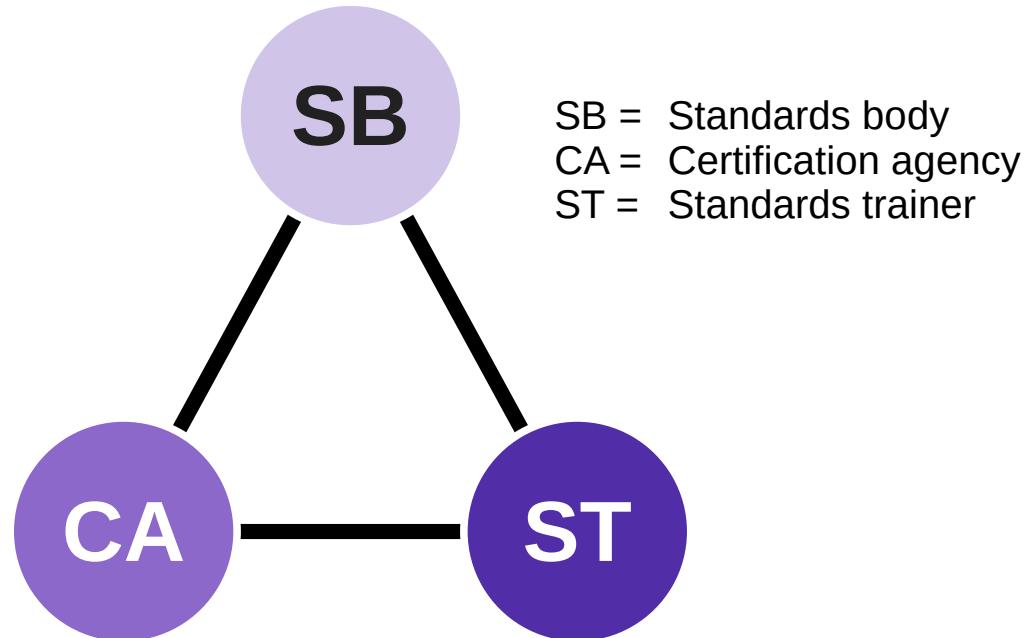
- A standards organization
 - Is a public (often non-governmental) organization financed by industry
 - That serves as meeting point and platform to define industry standards
 - Conformance to which may be required before admission to market
 - Is one player (of three) in standards and certification processes
- Examples
 - ISO (“International Standards Organization”)
 - VDE (“Verband der Elektrotechnik”)
 - VDA (“Verband der Automobilindustrie”)

Regulatory Bodies (Regulators)

- A regulatory body
 - Is a public organization or government agency (state-level, federal-level, union-level)
 - Which by way of laws and directives regulates industries and industry player behavior
 - To protect the public by preventing undesired behavior and enforcing desired one
- Examples
 - European Union
 - European commission → Data protection (GDPR) → Enforcement by Information Commissioner's Office (ICO)
 - U.S.A.
 - Federal and state governments → Antitrust law → Enforcement by Federal Trade Commission (FTC), DoJ

Certification Agencies

- A certification agency
 - Is a non-profit organization that provides certification services for given standards



SB = Standards body

CA = Certification agency

ST = Standards trainer

5. Software Products

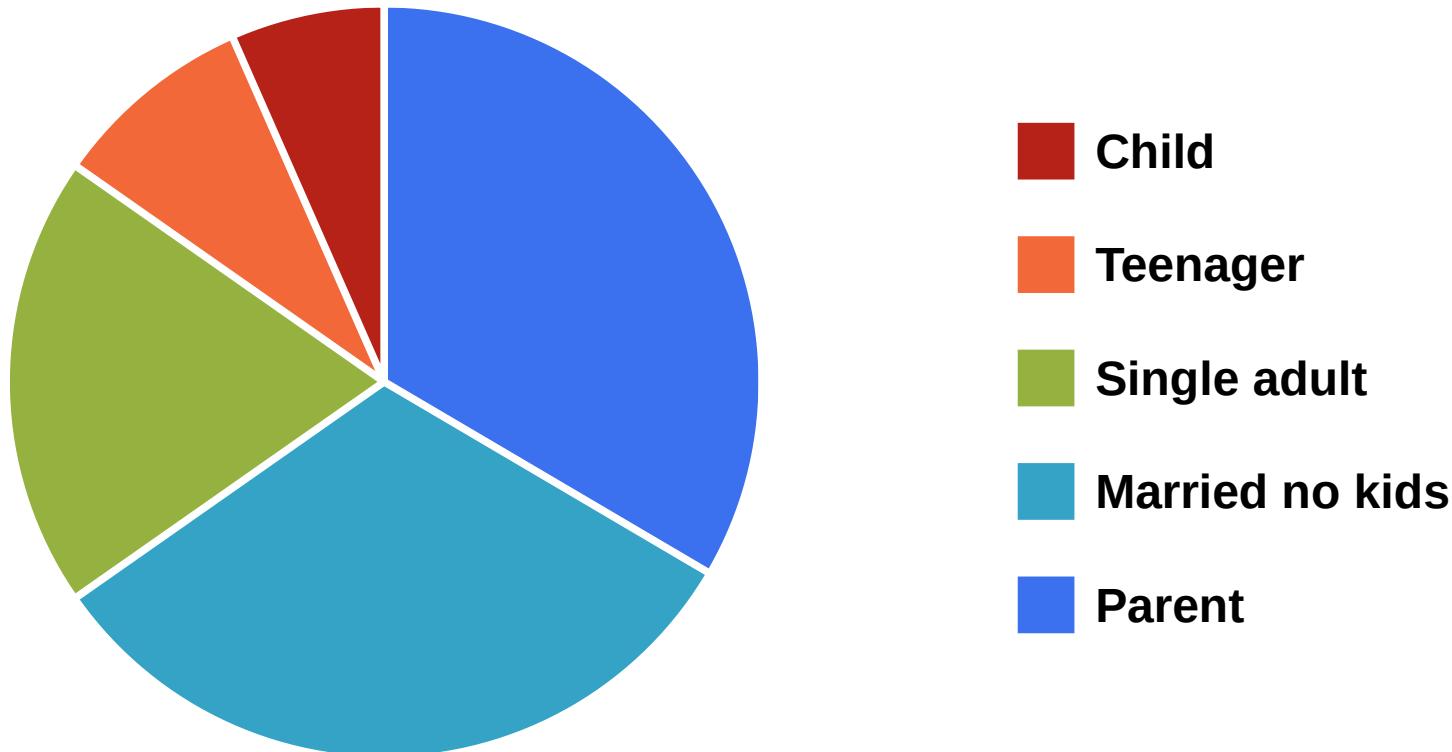
Consumer vs. Enterprise Customers

- Retail customers (B2C)
 - Are willing to trade time for money
- Enterprise customers (B2B)
 - Are willing to trade money for time

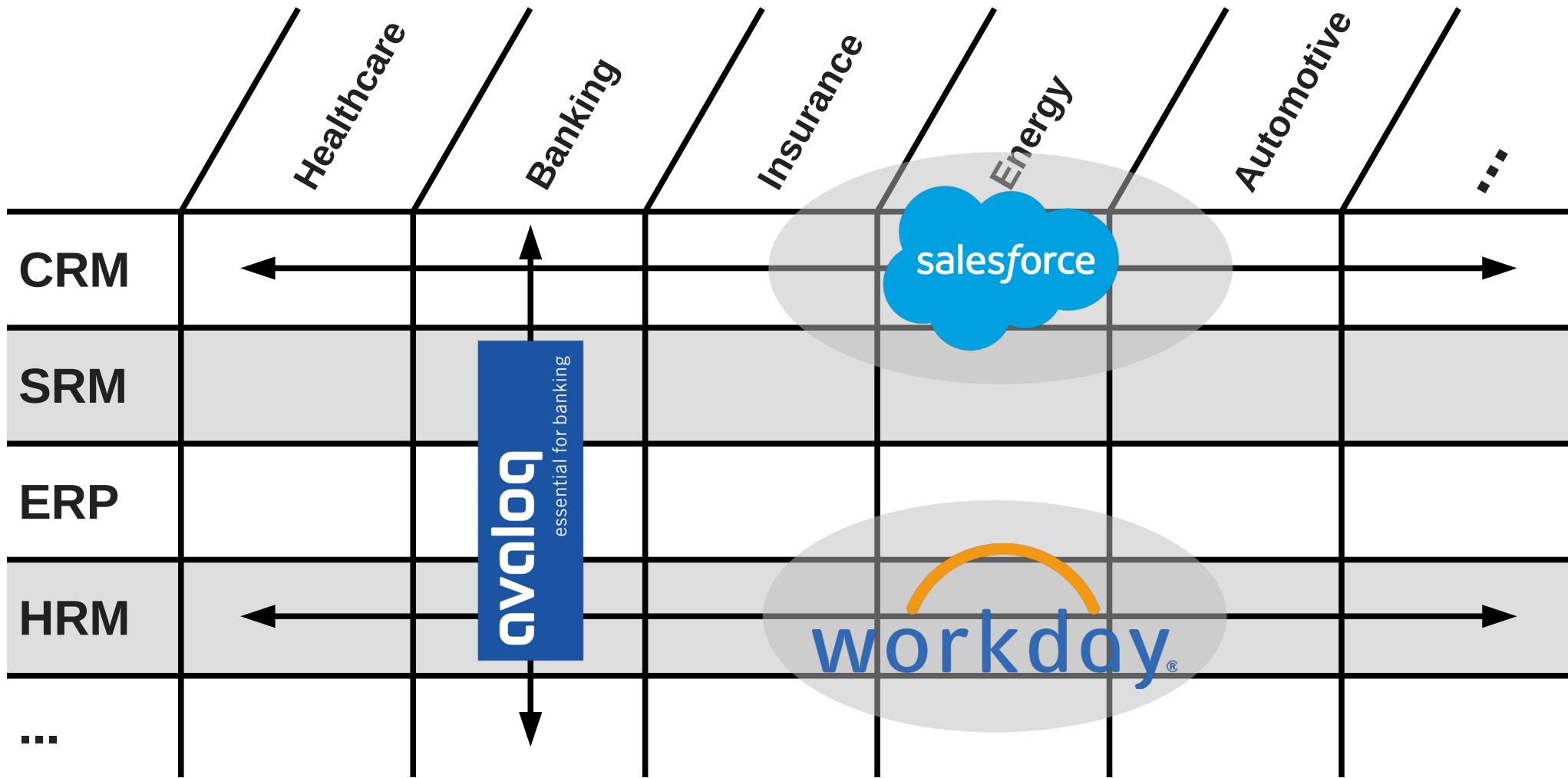
Consumer vs. Enterprise Software Products (and Markets)

- Consumer (retail) products
 - Pricing
 - Comparatively cheap
 - Often free, then subsidized
 - Segmentation
 - Usually by demographics, e.g.
 - By age group
 - By gender
 - Adoption
 - Out of the box
- Enterprise software products
 - Pricing
 - Into million Euros
 - Often the real product behind consumer software
 - Segmentation
 - Horizontal vs. vertical, e.g.
 - By business function
 - By industry
 - Adoption
 - May require implementation project

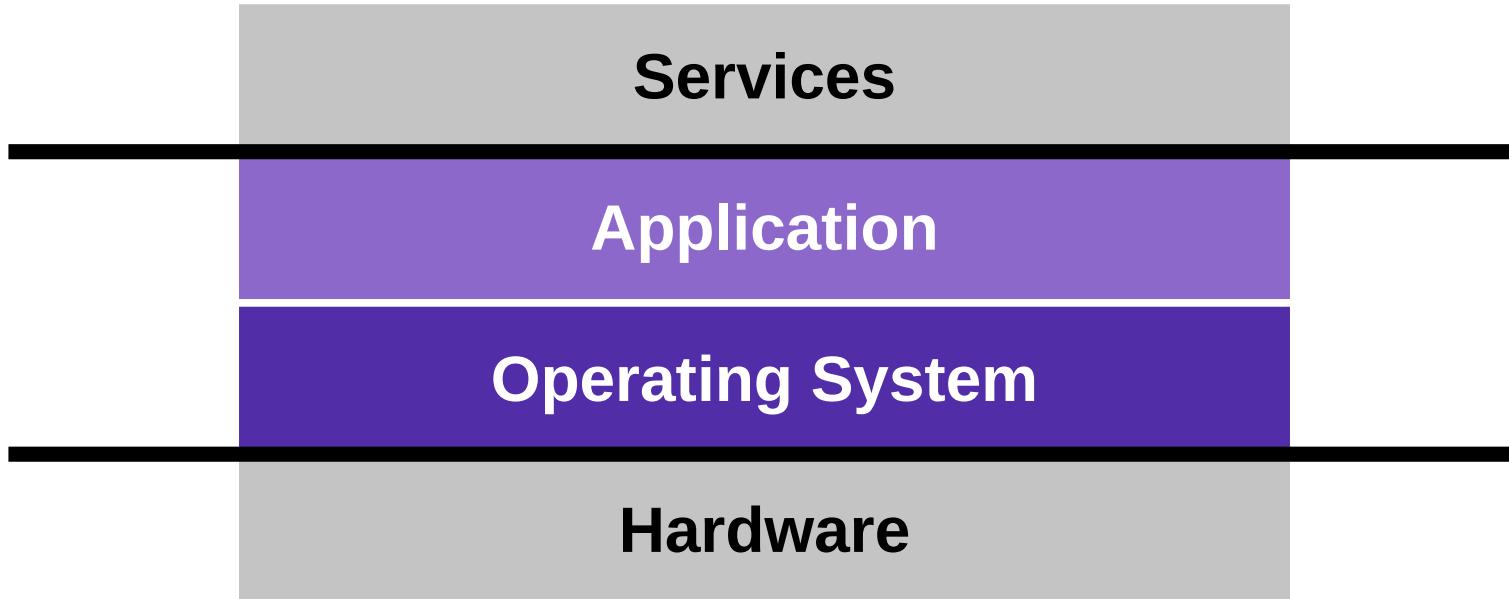
Consumer Market Segmentation



Enterprise Software Market Segmentation



Customers Want to Buy a “Solution”

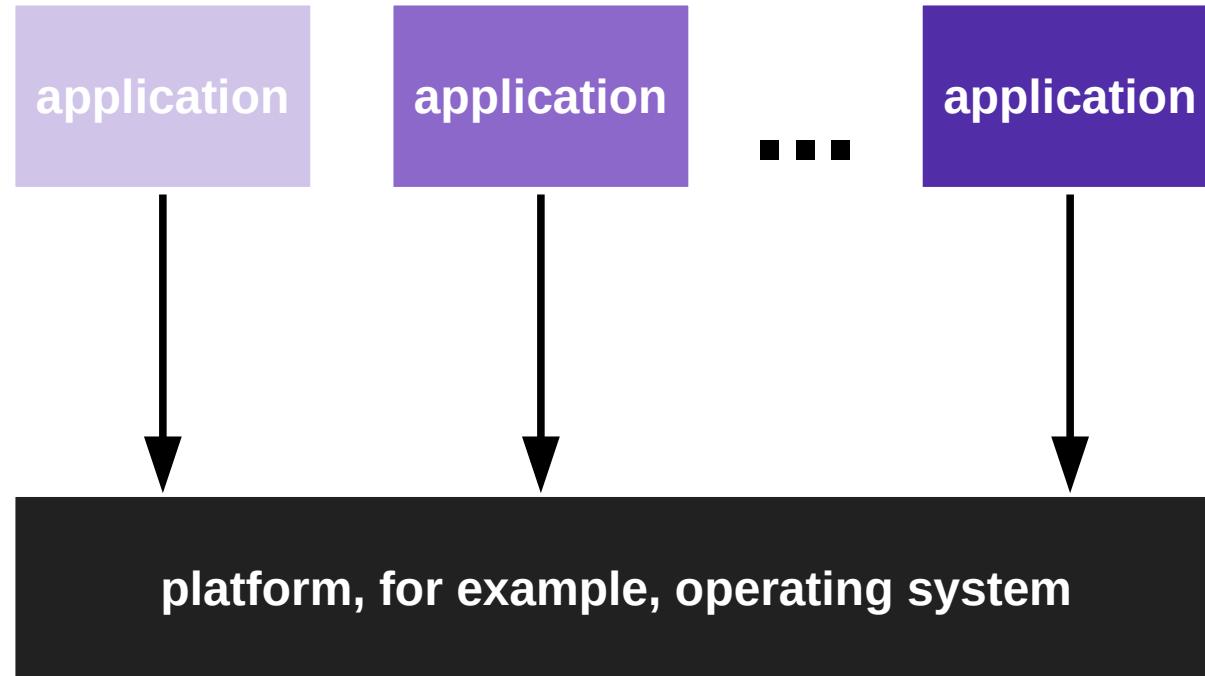


6. Software Platforms

Categories of Software Products

- **Applications**
 - Software that is not built upon
 - Software that delivers immediate business value
 - Top-layer of the solution stack
- **Platforms**
 - Software that is built upon
 - Software that supports other software in delivering business value
 - Everything that is not the top layer
- **Why does everyone want to be a platform?**

Software Platform 1 / 2



Software Platform 2 / 2

- Software platform
 - Is an environment for the development and deployment of applications
 - Implies split between applications on top of the platform
 - Provides a full set of application-independent life-cycle functions for applications
 - Among many components, the largest collection (i.e. not just a library)
- Customer (user) value of software platforms
 - By definition, a platform in itself is useless
 - Customer value is only created by applications

Software Platforms as a Product

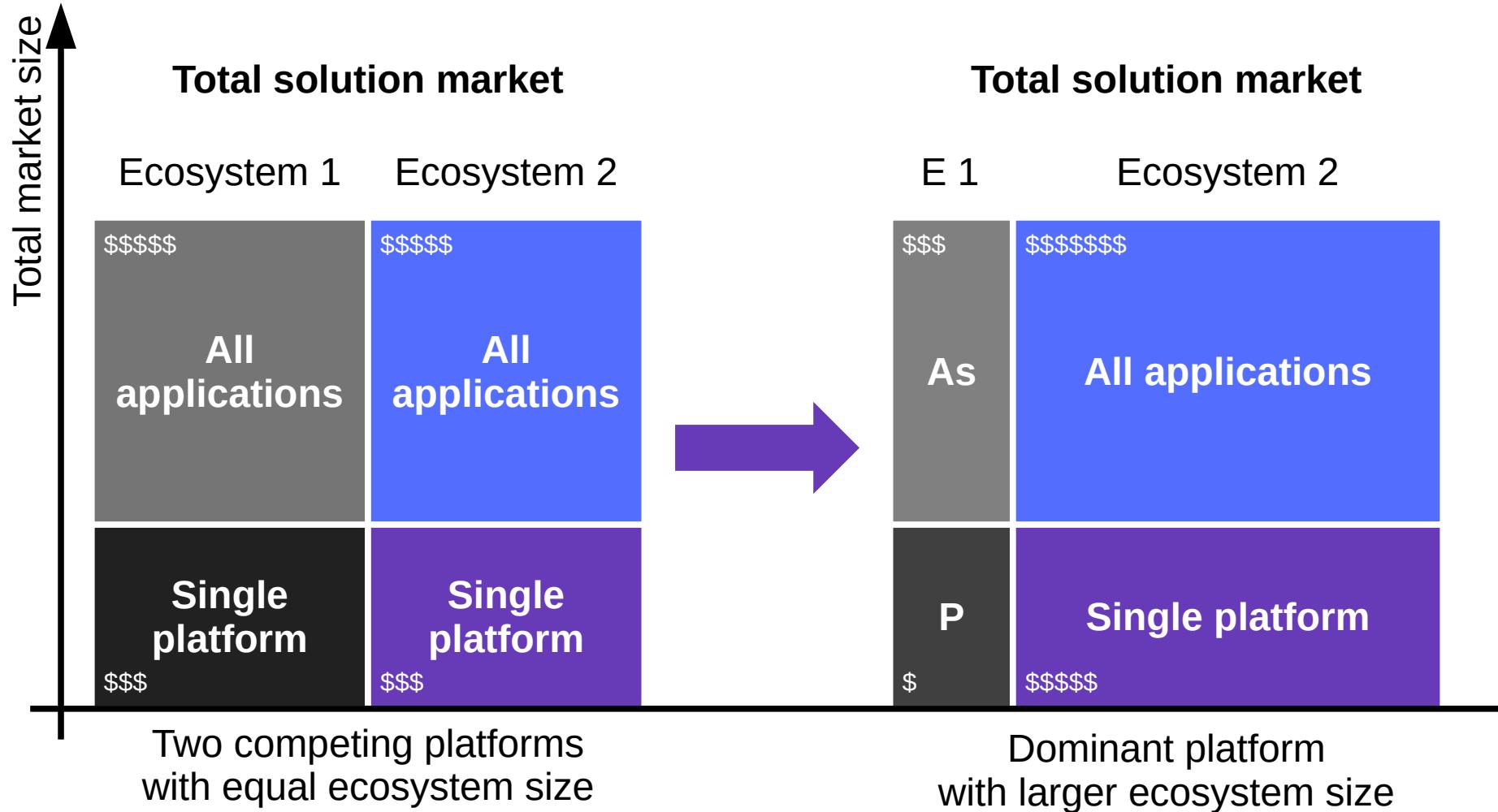
- Platforms are valuable
 - Platforms are needed by the applications running on top of it
 - Platforms can simplify IT department operations costs
- An application license sale implies a platform sale

7. Software Ecosystems

Software Ecosystem

- **A software ecosystem**
 - Is the totality of actors (businesses and individuals),
 - Software applications and components, and
 - Their relationships and goals
 - On and around a software platform

The Software Ecosystem Wars



Summary

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Thank you! Questions?

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