

# The Software Industry

**Prof. Dr. Dirk Riehle**

**Friedrich-Alexander University Erlangen-Nürnberg**

**FOSS C01**

Licensed under CC BY 4.0 International



# The Software Industry

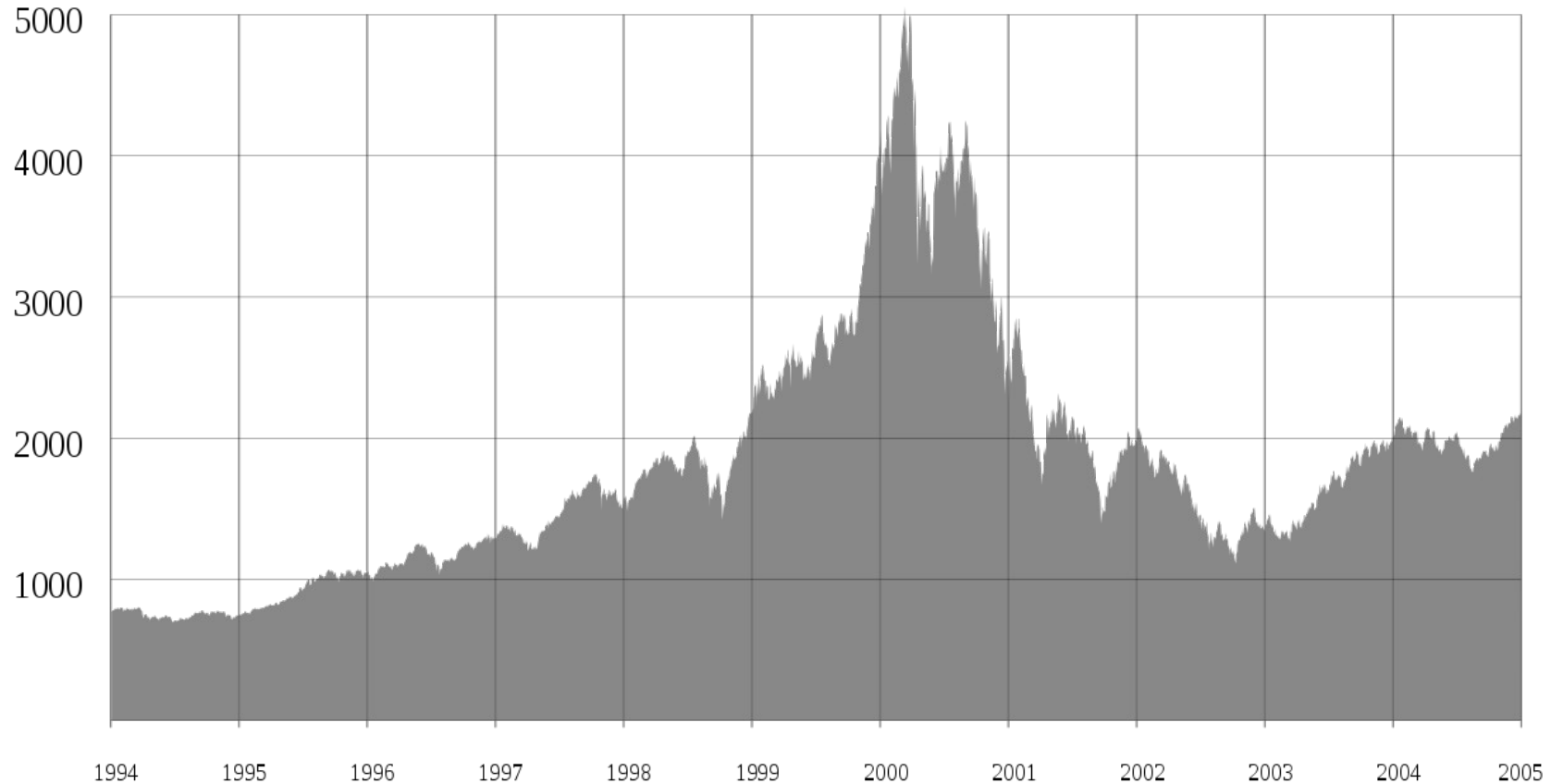
- The software industry
  - Is the set of business that provide
    - Software products and
    - Software services such as
      - Operating services
      - Consulting services
        - Development services
        - Implementation services
  - to other industries as well as itself
- The software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

# The Software Industry in 2016 [1]

market capitalization	total	\$1.298 trillion
	median	\$744.2 million
	highest	\$415.4 billion (Microsoft)
	lowest	\$177700 (Innovaro Inc.)
earnings per share	median	\$0.20
	highest	\$13.23 per year (IBM)
	lowest	– \$3.40 per year (Wave)
dividend yield	mean	8.913%
	highest	170.3% (Aware)
	lowest	0.07106% (FICO)

[1] <https://www.wolframalpha.com/input/?i=how+big+is+the+software+industry>

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



# Software is eating the world

WSJ, 2011-08-20





# Venture Capital and Open Source (Recap)

## Increasing Open Source Investment Pace

	<5 YEARS	5-10 YRS	>10 YEARS	AGGREGATE
OSS COMPANIES FOUNDED (1ST INST. INV.)	31	19	8	58
VC INVESTMENT BY FOUNDING VINTAGE (\$M)	\$1,802	\$2,847	\$255	\$4,904
VC INVESTMENT BY YEAR BUCKET (\$M)	\$4,237	\$506	\$161	\$4,904
VALUATION BY FOUNDING VINTAGE (\$M)	\$8,174	\$12,719	\$16,992	\$37,886
EXCL. RED HAT			\$1,938	\$22,832

**“It is actually open source software that’s eating the world.” [V15]**

## The CEO Interview

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

—Jeff Immelt

McKinsey&Company





# Short History of the Software Industry

- **1959**
  - First mentioning of term “software”
- **1969**
  - US DoJ separates hard- from software
- **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, cloud computing

# Main Industry Players

- **Software vendors**
  - Produce products
    - A.k.a. “standard software” or “commercial off-the-shelf software” (COTS)
- **Operating services firms**
  - Operate any form of software (and hardware)
- **Development services firms**
  - Produce custom software
- **Implementation services firms**
  - Adjust software products for use by customers
- **Regulatory bodies**

# Software is a Digital Good

- **Digital good**
  - A digital artifact satisfying a human need
  - Without further intervention
    - No or low reproduction costs
    - Perfect reproduction possible
- **Software** as a digital good
  - Typically high cost to first copy
  - Typically high switching costs
- Examples
  - Consumer software (Games, social media, etc.)
  - Enterprise software (SAP Business Suite, Oracle RDBMS, etc.)

# Software as a Product

- **Product**
  - A man-made good sold to customers in a market
- **Software** as a product
  - A product sold to either enterprise or retail customers
  - What is sold is a license, a usage right, plus services
- **Characteristics**
  - Has an open-ended life-cycle: Is born, may live forever
  - Typically requires upfront capital investment (development)

# Core, Basic, and Whole Product

- **Core product** =
  - Core software
- **Basic product** = bundle of
  - Software + complementary materials + self-help services
  - Guarantees about fitness for use + indemnification
  - Support services
- **Whole product** = basic product +
  - Training
  - Consulting
  - Operations
- For more, see our **Product Management** course



Whole product

Basic product

Usage rights

Software (core product)

- Core software
- Additional software (extensions + plug-ins, tools and utilities, integrations)

Complementary materials

- Documentation
- Training materials

Self-help services

- Forums, mailing lists
- Help and chat agents
- On-line tutorials

Pricing of usage rights

- Quantity: User, machine, time, ...
- Duration: Perpetual, time-limited, ...
- Structured: Initial license fee, regular maintenance fee

Guarantees (“insurance”)

- Fitness for use, certification
- Indemnification

Pricing of guarantees

- By damage: Loss of business, fines received
- Structured: Levels / bands, formula

Support services

- Hot-line support
- On-site servicing

Pricing of support services (SLAs)

- By availability: Incident-based, 9x5, 24x7
- By quality: First-level, second-level, third-level

Training

- In-house training
- Off-site training

Pricing of training

- Fixed fee
- Per participating person

Consulting

- Technical implementation services
- Strategic solution consulting

Pricing of consulting

- Fixed fee
- Time and materials

Operations

- Provision of SaaS (managed service)

Pricing of operations

- Quantity: Users, resources, ...
- Duration: Always time-limited
- Structured: Set-up, subscription

# Commercial Open Source Products [WR13]

	Web Store	Direct Sales	
Open Source Community	DOC INC UTIL		DOC Documentation INC Incident-based support UTIL Utilities
Enterprise Customers		LIC UPD UTIL DOC TRN 24x7	LIC Commercial license UPD Update service TRN Training ... 24x7 24x7 hot-line
ISV/OEM		LIC UTIL DOC TRN 24x7	

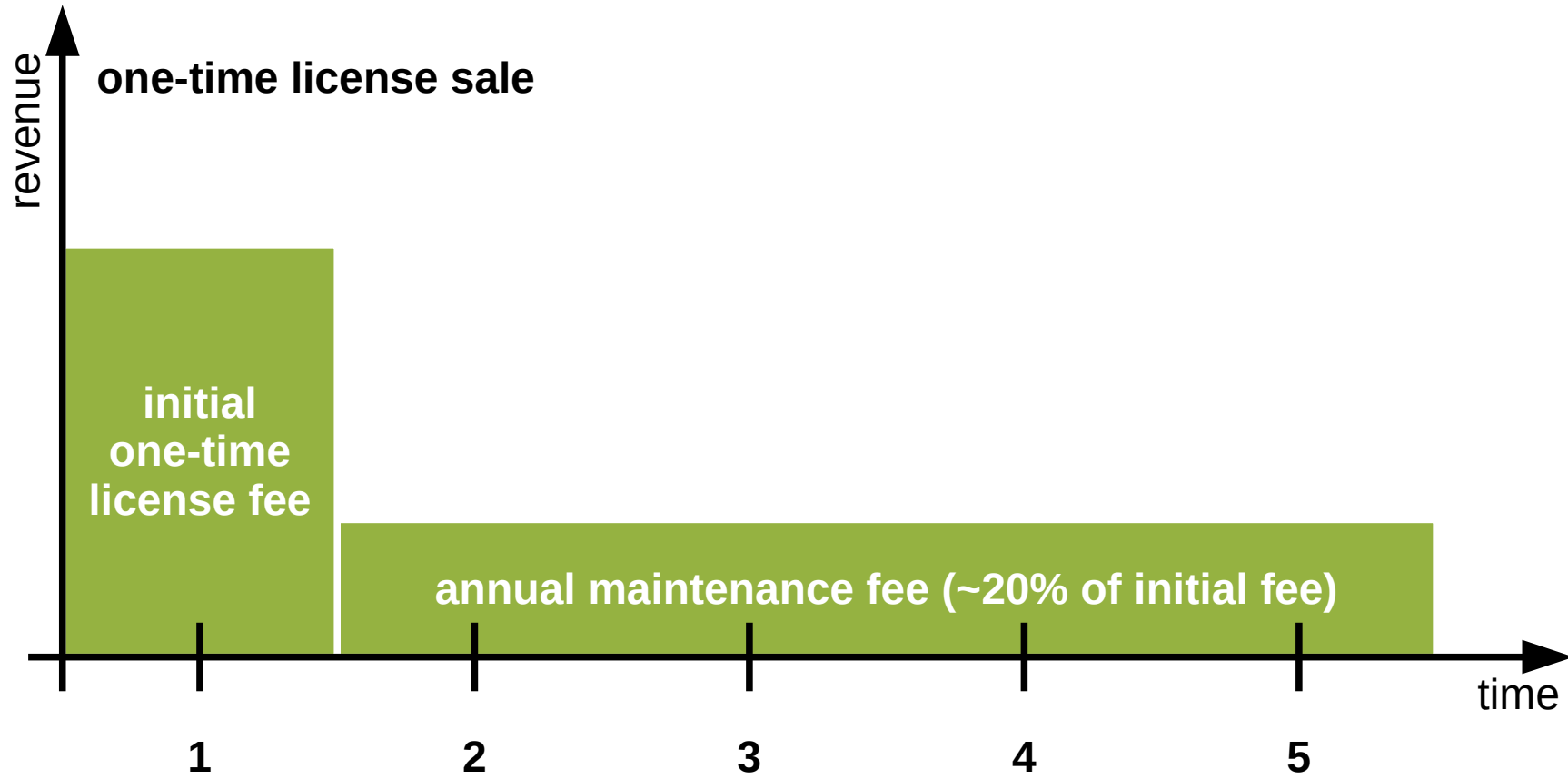
# Enterprise Customers vs. Private Users

- Enterprise customers
  - Are willing to trade money for time
- Private users
  - Are willing to trade time for money

# Products, Projects, and Services

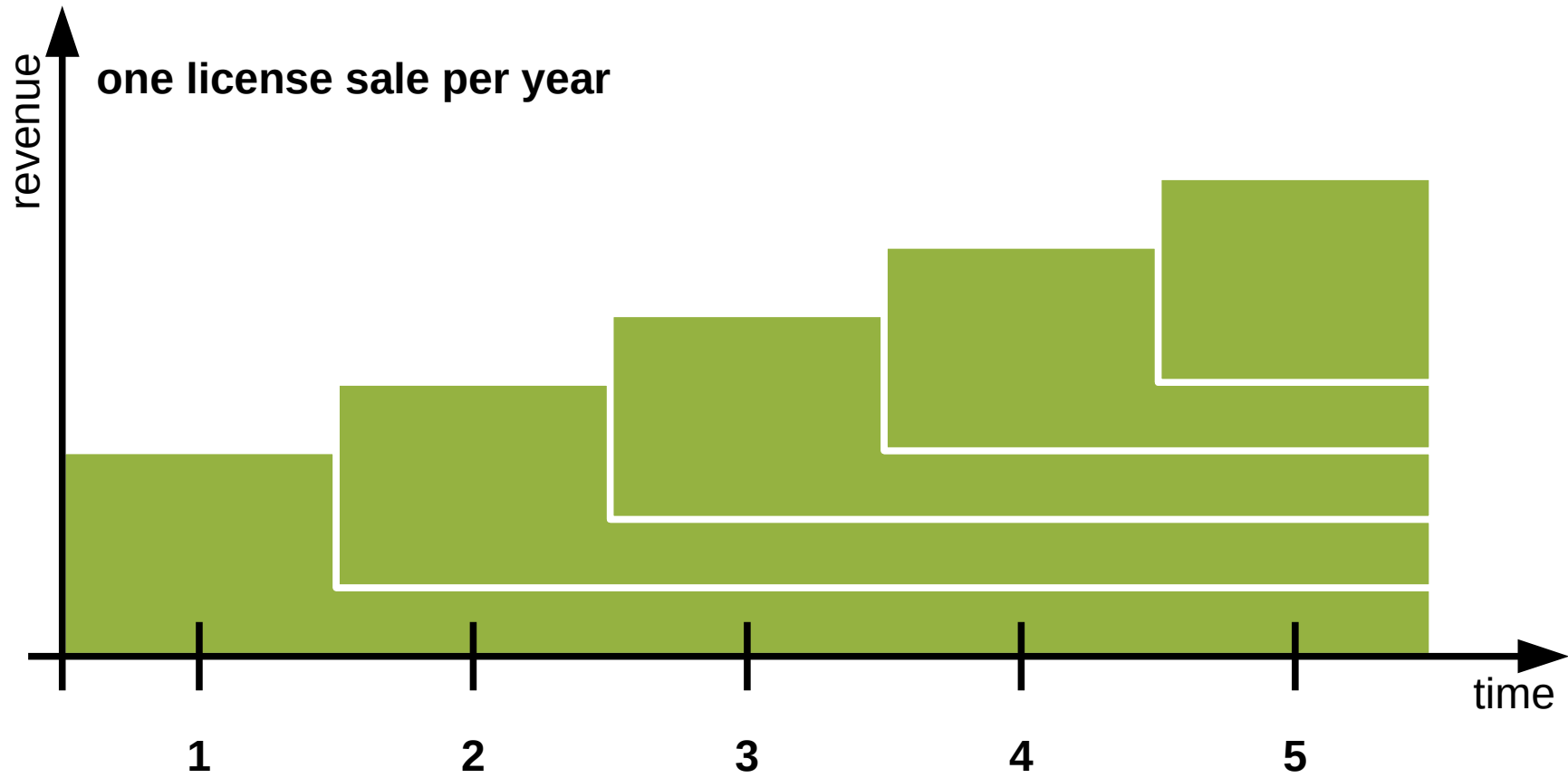
- Products are provided by a software vendor
  - “Standardsoftware”, (commercial) off-the-shelf software (COTS)
- Products can be operated by service providers
  - Service providers specialize in specific products
- Projects are performed by consulting firms
  - “Individualsoftware”, custom software
- Many companies do all of the above

# Single Product Sale Revenue





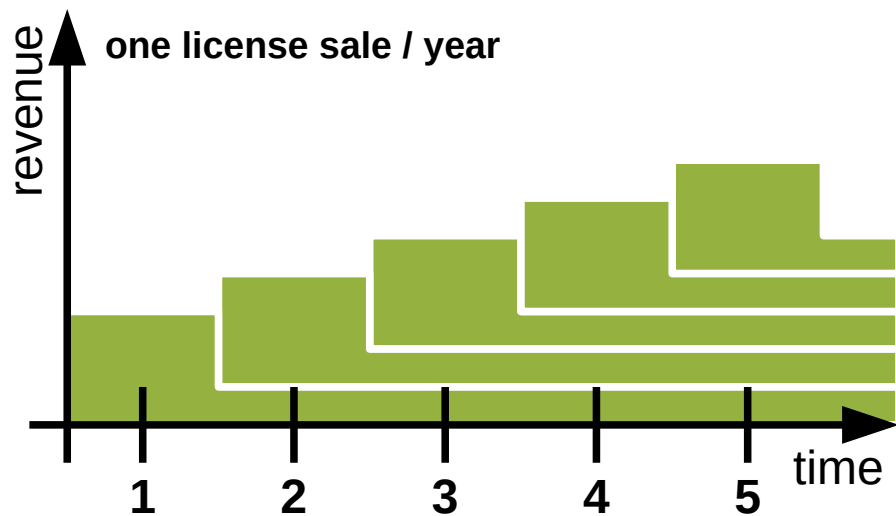
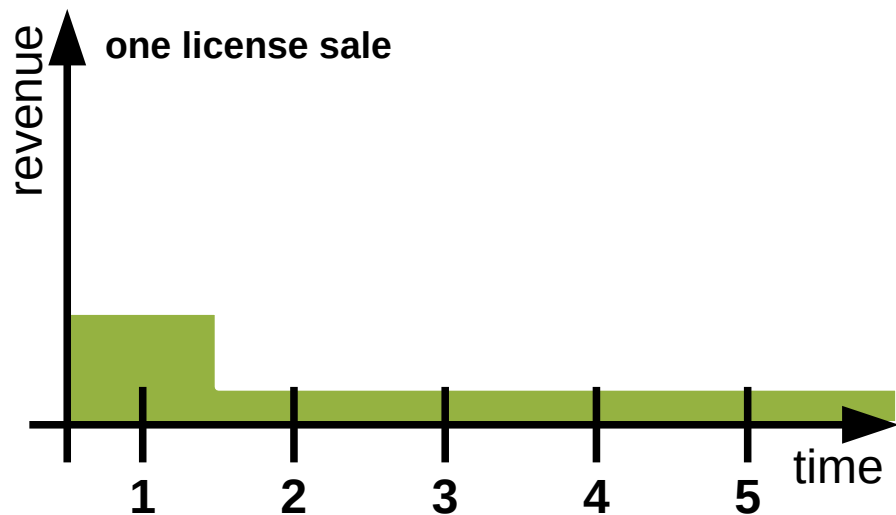
# Accumulating Product Revenues (SaaS) [1]



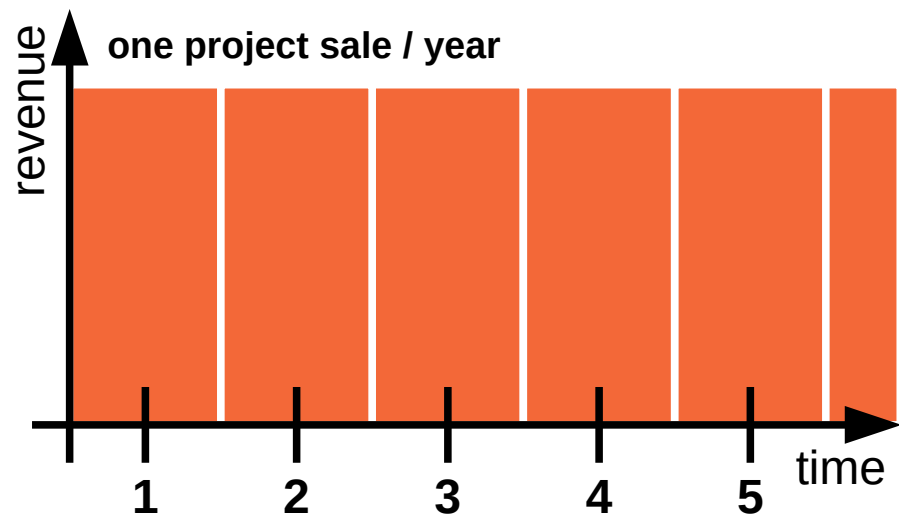
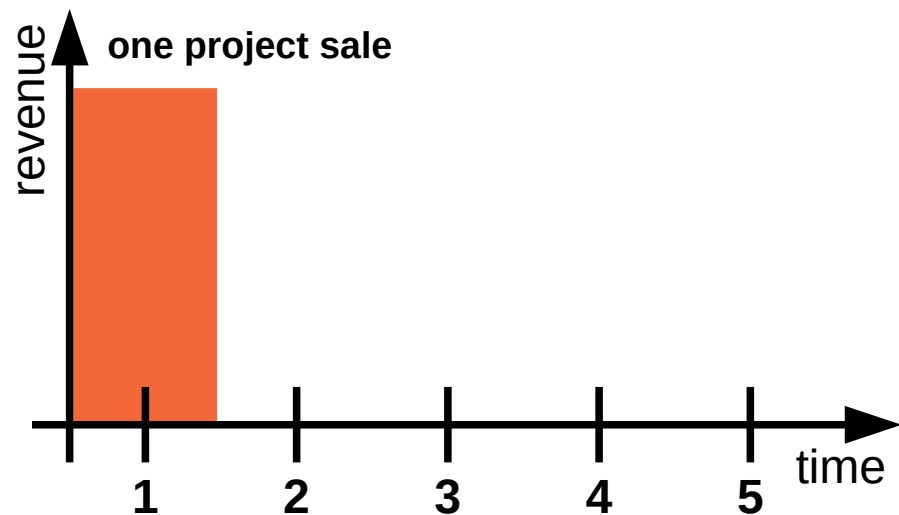
# Software Projects

- Projects
  - A process with a defined start and a defined end
- Software projects
  - Revenues correlate with performed labor
    - Fixed price vs. actual labor
  - Accounted for as revenue and expenses
- Examples
  - Bachelor and Master theses
  - Customizing SAP for a customer

## Product Revenue



## Project Revenue



# (Software) Products and (Implementation) Projects

Software  
Vendor

Product

Consulting  
Firm

Project



Widget Corp.  
BI Impl. 2008



German SME  
Sugar 2010



Continental  
Stages 2010

**Microsoft®**

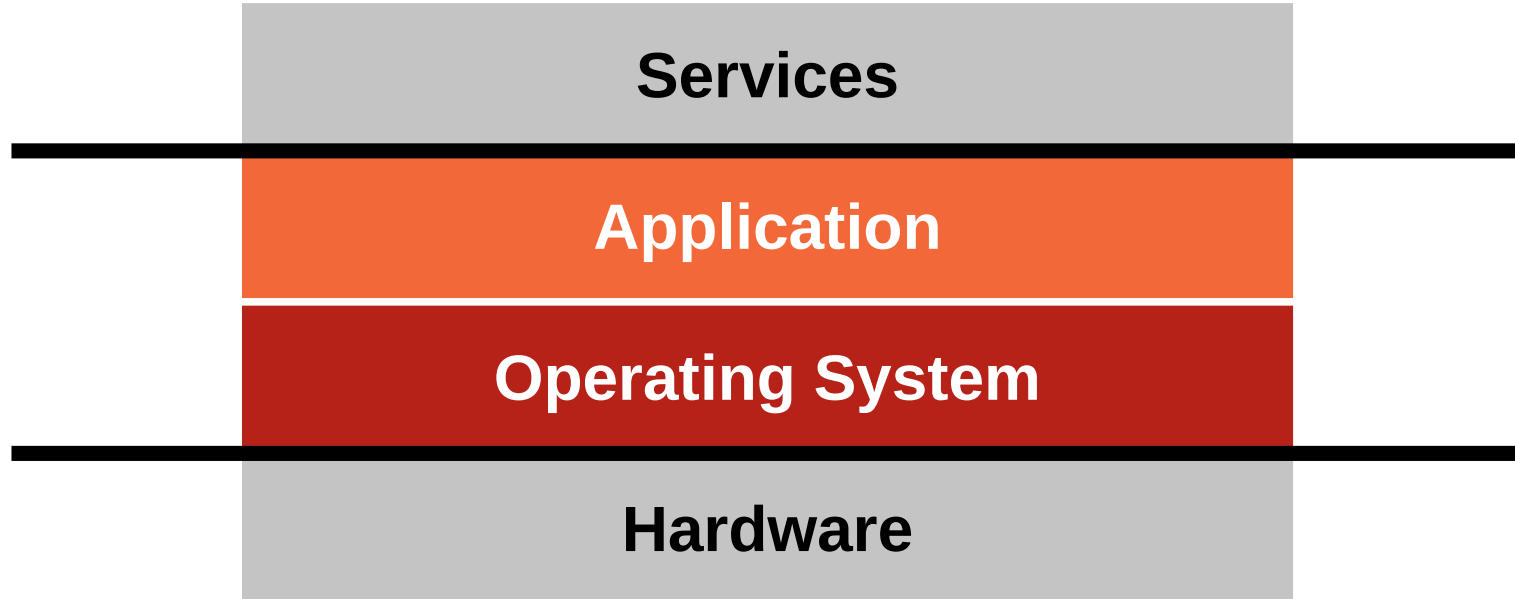


# Software Product vs. Project Companies

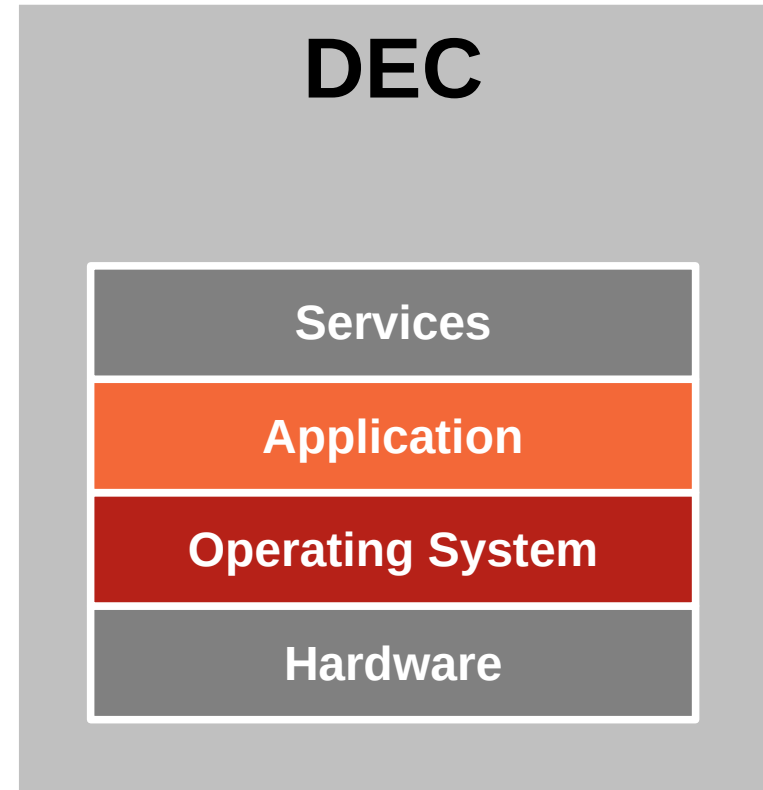
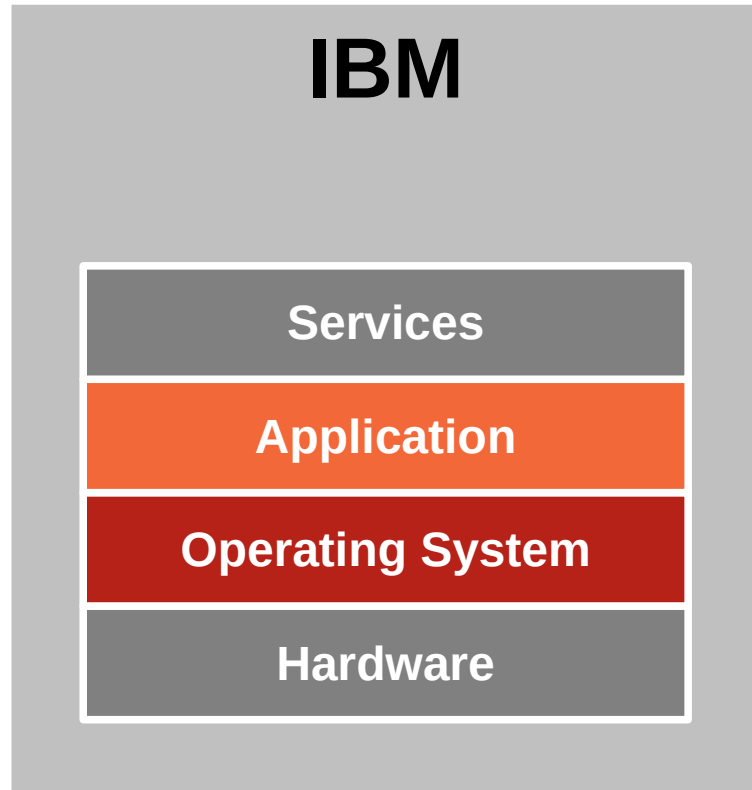
	Consulting Firms (Custom Development)	Software Vendors (COTS Development)
Advantages	<ul style="list-style-type: none"><li>• Not capital intensive</li><li>• Can be started easily</li></ul>	<ul style="list-style-type: none"><li>• Stable maintenance revenue</li><li>• High market capitalization</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>• Somewhat fragile revenue</li><li>• Little long-term stability</li><li>• High business volatility</li><li>• Limited scalability</li></ul>	<ul style="list-style-type: none"><li>• Hard to get started</li><li>• Requires upfront investment</li><li>• May be slow to react</li><li>• Most fail, few survive</li></ul>



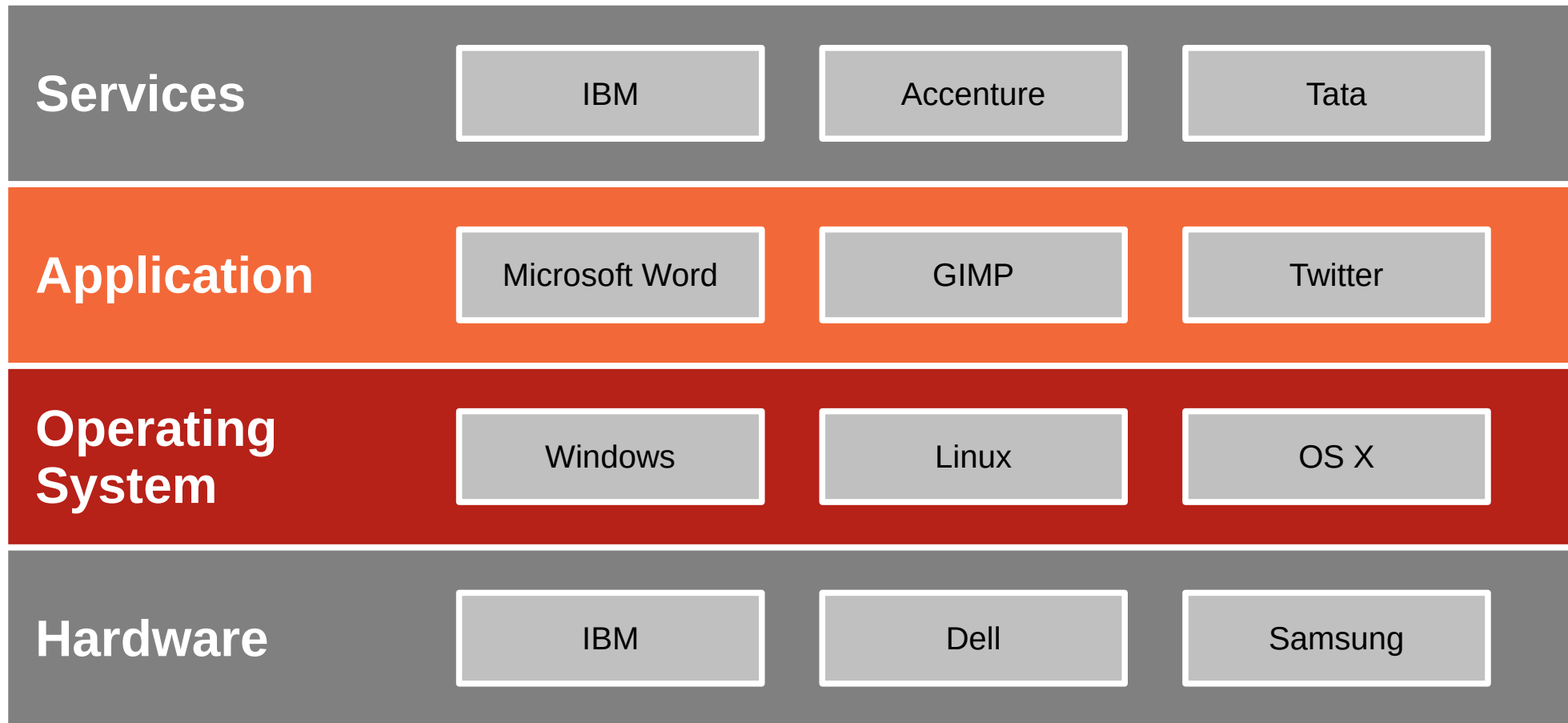
# Customers Buy a “Solution”



# Vertical Integration (Until 1980ties)

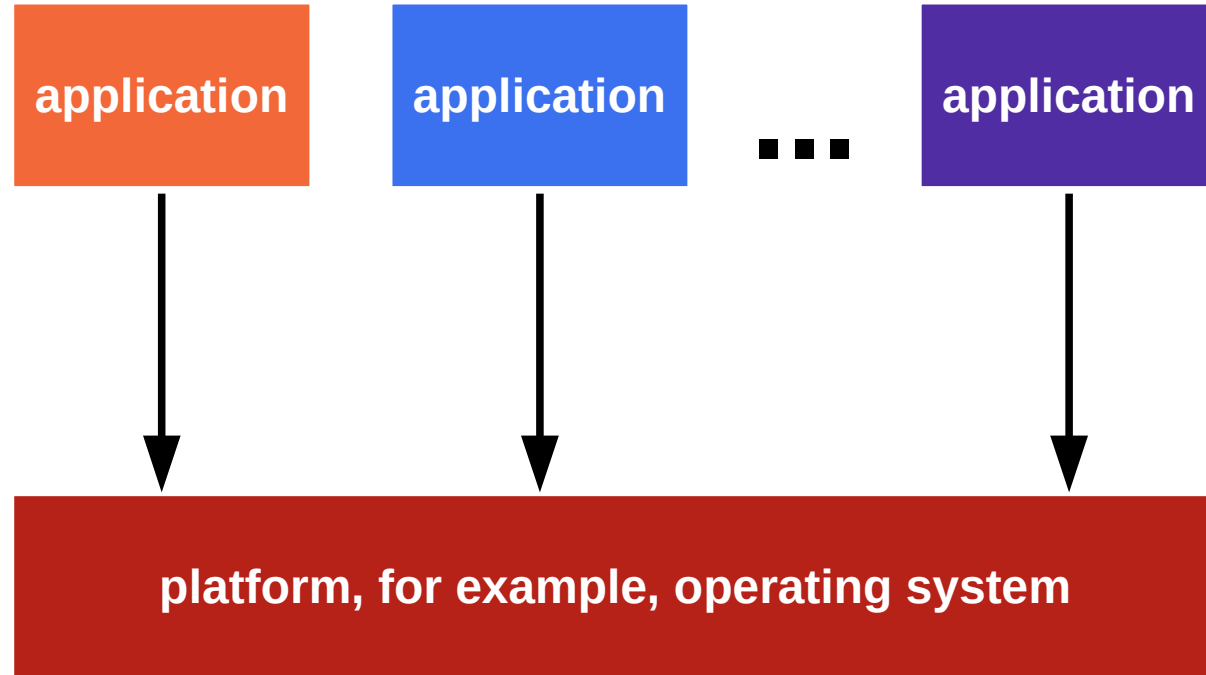


# Horizontal Integration (Since 1990ties)



# Categories of Software Products

- **Applications**
  - Software that is not built upon
  - Top-layer of the solution stack
- **Platforms**
  - Software that is built upon
  - Everything that is not the top layer
- **Why does everyone want to be a platform?**



- Software platform
  - Is an environment for the development and deployment of applications
    - Implies split between applications on top of the platform
  - Is 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

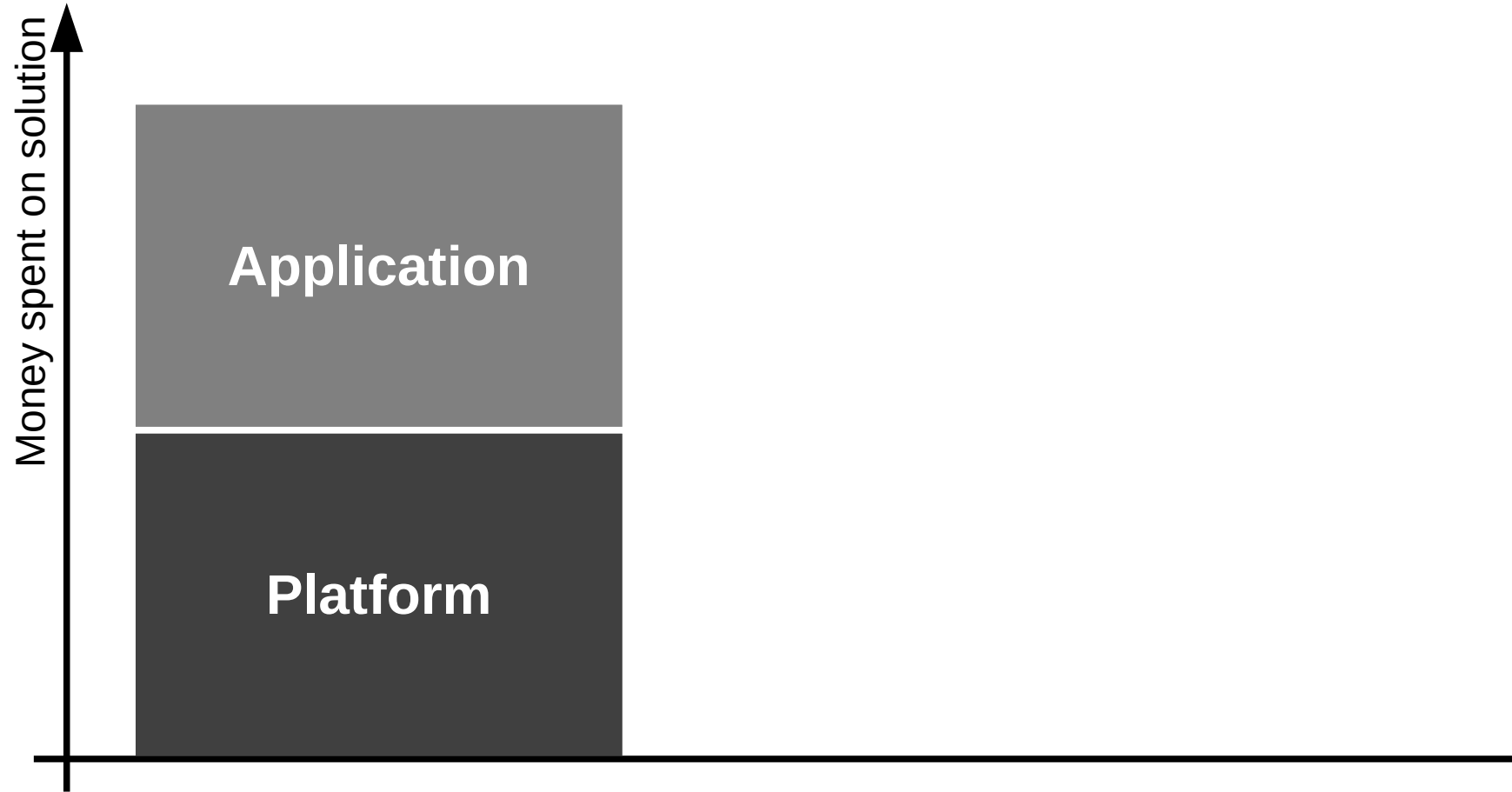
- Platforms are valuable
  - Platforms are needed by the applications running on top of it
  - Platforms can simplify IT department operations costs
- An application license sale implies a platform sale

# Software Ecosystem

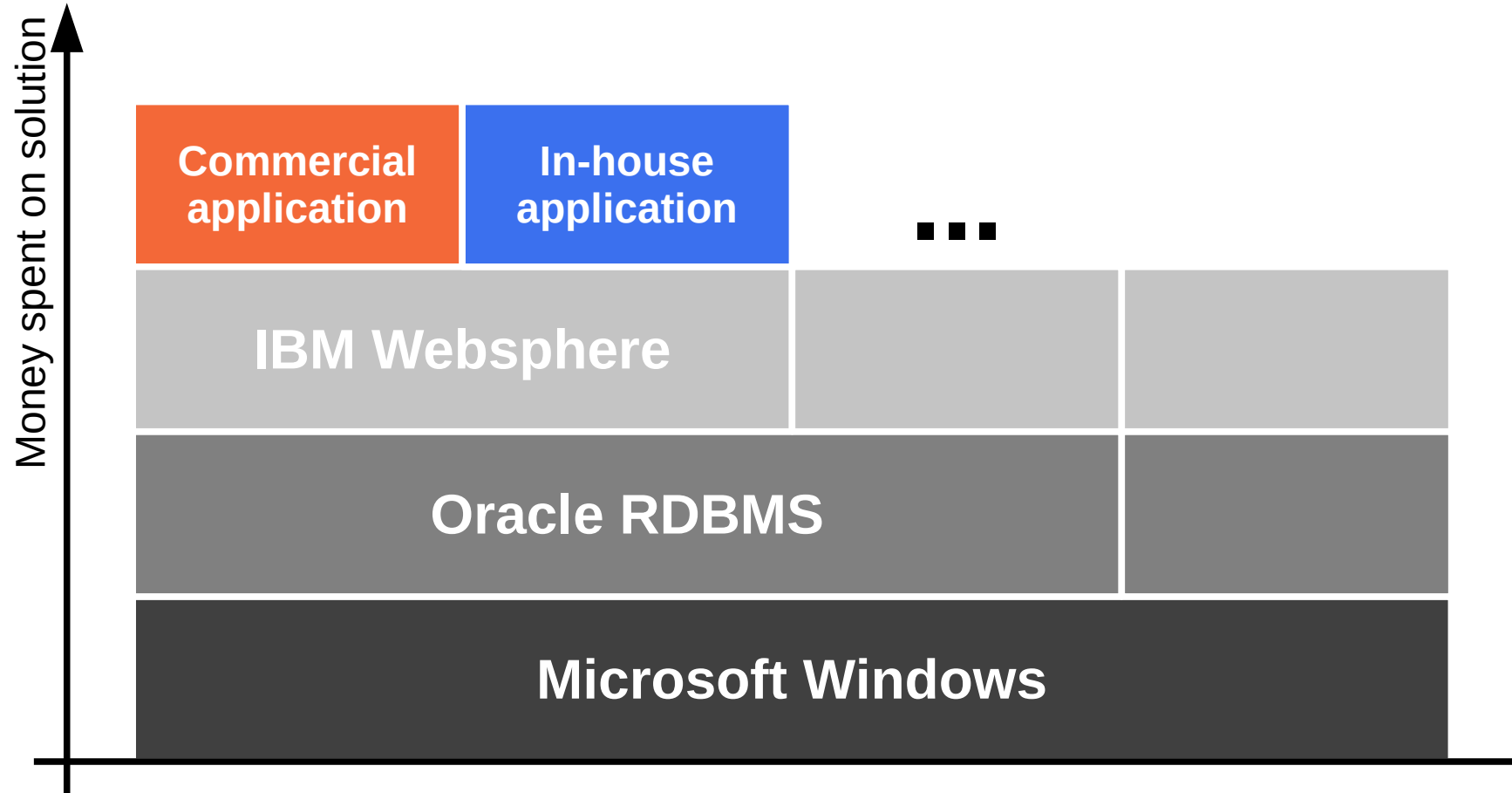
- Software ecosystem
  - The totality of actors (businesses and individuals),
  - software applications and components,
  - their relationships and goals
  - around a software platform
- Includes but is not limited to a community



# Pricing Power 1 / 2

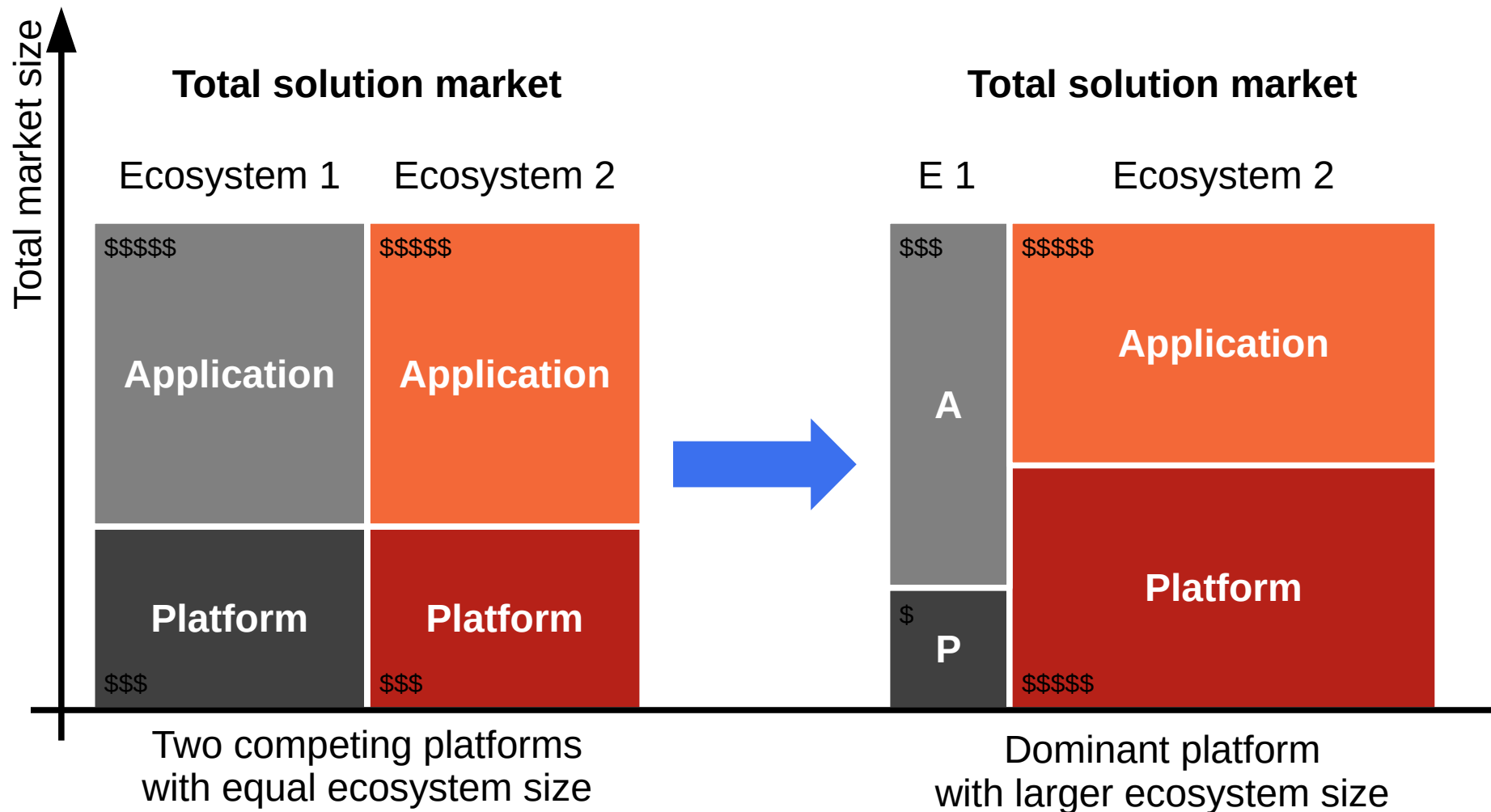


# Pricing Power 2 / 2

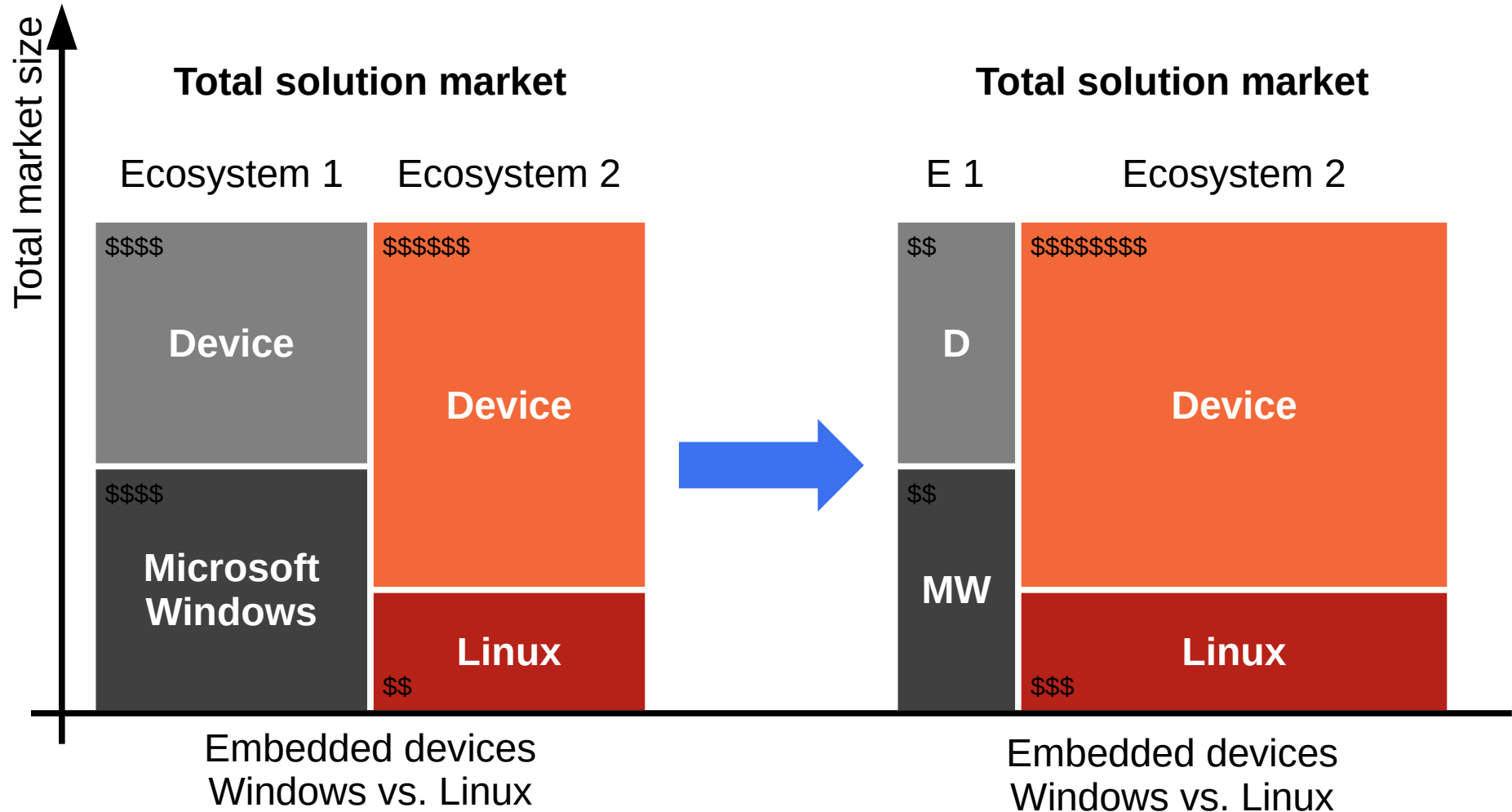


- **Software ecosystem**
  - The totality of actors (businesses and individuals),
  - software applications and components,
  - their relationships and goals
  - for a software platform

# The Software Ecosystem Wars



# Open Source in the Ecosystem Wars



- **A business model**
  - Is a summary description (model) of how a business' elements and their relationships interact to help the business achieve its strategic goals
  - Example elements are products, partners, people, positions, etc. and example relationships are the processes that govern their interaction
- But “open source is not a business model” [A08]
  - But open source can be a key enabler of a business model
  - So much so that the business model is called “open source”

**Key Partners**

**Key Re-  
sources**

**Key  
Activities**

**Value  
Proposition**

**Channels**

**Customer  
Relationships**

**Customer Segments**

**Cost Structure**

**Revenue Streams**

	2011 (\$m)	Percentage
<b>Revenues</b>	\$1.657	100%
Subscription and Support	\$1.551	94%
Professional Services etc.	\$106	6%
<b>Cost of Revenues</b>	\$324	20%
Subscription and Support	\$208	13%
Professional Services etc.	\$116	7%
<b>Gross Profit (and Gross Margin)</b>	\$1.333	80%
<b>Operating Expenses</b>		
Research and Development	\$188	11%
Sales and Marketing	\$792	48%
General and Administrative	\$256	15%
<b>Total Operating Costs</b>	\$1.236	74%
<b>Operating Profit (and Operating Margin)</b>	\$97	6%

Source: Michael A. Cusumano. Reflecting on the Facebook IPO. CACM 10, 2012.



# Open Source “Business Models”

- Non-profit open source
  - **Community projects** without foundation
  - Open source **developer foundations**
  - Open source **user foundations**
- For-profit open source
  - **Service and support firms**
  - Open source **distributor firms**
  - **Single-vendor** open source **firms**

# Open Source and Business Models

- Open source may not be a business model, but it may be ...
  - A go-to-market strategy
  - An innovation model
  - A collaboration model
  - A sourcing strategy
  - And many other things
- More on this in later lectures on open source business models

# Review / Summary of Session

- The software industry
- Software platforms
- Software ecosystems
- Business models

# Thank you! Questions?

**[dirk.riehle@fau.de](mailto:dirk.riehle@fau.de) – <http://osr.cs.fau.de>**

**[dirk@riehle.org](mailto:dirk@riehle.org) – <http://dirkriehle.com> – [@dirkriehle](#)**

# Credits and License

- Original version
  - © 2012-2019 Dirk Riehle, some rights reserved
  - Licensed under [Creative Commons Attribution 4.0 International License](#)
- Contributions
  - ...

# The Software Industry

**Prof. Dr. Dirk Riehle**

**Friedrich-Alexander University Erlangen-Nürnberg**

**FOSS C01**

Licensed under CC BY 4.0 International

It is Friedrich-Alexander University Erlangen-Nürnberg – FAU, in short.  
Corporate identity wants us to say “Friedrich-Alexander University”.



# 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

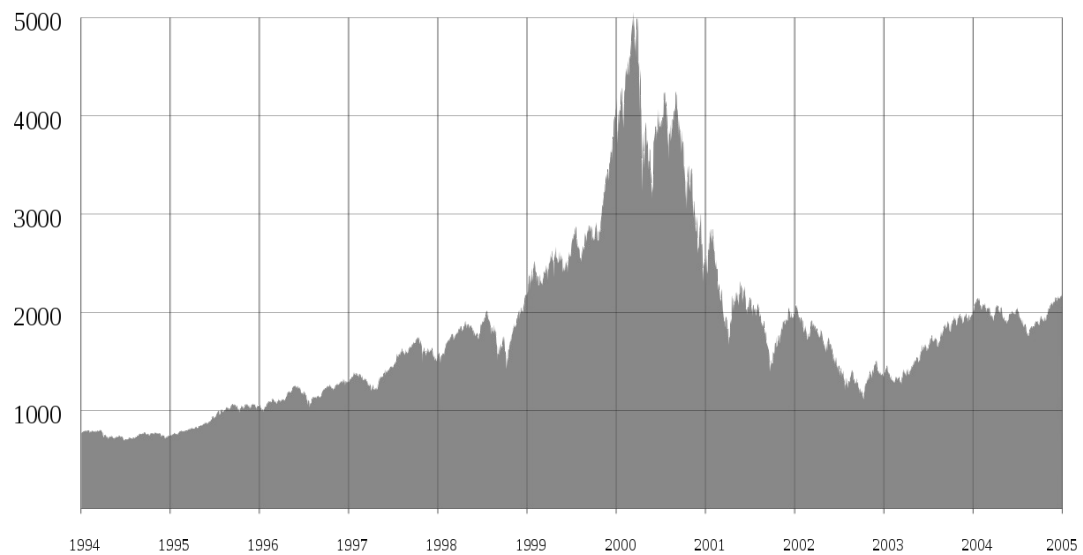


## The Software Industry in 2016 [1]

market capitalization	total	\$1.298 trillion
	median	\$744.2 million
	highest	\$415.4 billion (Microsoft)
	lowest	\$177 700 (Innovaro Inc.)
earnings per share	median	\$0.20
	highest	\$13.23 per year (IBM)
	lowest	– \$3.40 per year (Wave)
dividend yield	mean	8.913%
	highest	170.3% (Aware)
	lowest	0.07106% (FICO)

[1] <https://www.wolframalpha.com/input/?i=how+big+is+the+software+industry>

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



Free / Libre and Open Source Software  
© 2019 Dirk Riehle - Some Rights Reserved

# Software is eating the world

WSJ, 2011-08-20



## Venture Capital and Open Source (Recap)

### Increasing Open Source **Investment Pace**

	<5 YEARS	5-10 YRS	>10 YEARS	AGGREGATE
OSS COMPANIES FOUNDED (1ST INST. INV.)	31	19	8	58
VC INVESTMENT BY FOUNDING VINTAGE (\$M)	\$1,802	\$2,847	\$255	\$4,904
VC INVESTMENT BY YEAR BUCKET (\$M)	\$4,237	\$506	\$161	\$4,904
VALUATION BY FOUNDING VINTAGE (\$M)	\$8,174	\$12,719	\$16,992	\$37,886
EXCL. RED HAT			\$1,938	\$22,832

**“It is actually open source software  
that’s eating the world.” [V15]**

## The CEO Interview

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

—Jeff Immelt

McKinsey&Company



## Short History of the Software Industry

- **1959**
  - First mentioning of term “software”
- **1969**
  - US DoJ separates hard- from software
- **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, cloud computing

## Main Industry Players

- **Software vendors**
  - Produce products
    - A.k.a. “standard software” or “commercial off-the-shelf software” (COTS)
- **Operating services firms**
  - Operate any form of software (and hardware)
- **Development services firms**
  - Produce custom software
- **Implementation services firms**
  - Adjust software products for use by customers
- **Regulatory bodies**

## Software is a Digital Good

- **Digital good**
  - A digital artifact satisfying a human need
  - Without further intervention
    - No or low reproduction costs
    - Perfect reproduction possible
- **Software as a digital good**
  - Typically high cost to first copy
  - Typically high switching costs
- **Examples**
  - Consumer software (Games, social media, etc.)
  - Enterprise software (SAP Business Suite, Oracle RDBMS, etc.)



## Software as a Product

- **Product**
  - A man-made good sold to customers in a market
- **Software** as a product
  - A product sold to either enterprise or retail customers
  - What is sold is a license, a usage right, plus services
- **Characteristics**
  - Has an open-ended life-cycle: Is born, may live forever
  - Typically requires upfront capital investment (development)

## Core, Basic, and Whole Product

- **Core product** =
  - Core software
- **Basic product** = bundle of
  - Software + complementary materials + self-help services
  - Guarantees about fitness for use + indemnification
  - Support services
- **Whole product** = basic product +
  - Training
  - Consulting
  - Operations
- For more, see our [Product Management](#) course

## Whole product

### Basic product

#### Usage rights

##### Software (core product)

- Core software
- Additional software (extensions + plug-ins, tools and utilities, integrations)

##### Complementary materials

- Documentation
- Training materials

##### Self-help services

- Forums, mailing lists
- Help and chat agents
- On-line tutorials

##### Pricing of usage rights

- Quantity: User, machine, time, ...
- Duration: Perpetual, time-limited, ...
- Structured: Initial license fee, regular maintenance fee

#### Guarantees ("insurance")

- Fitness for use, certification
- Indemnification

##### Pricing of guarantees

- By damage: Loss of business, fines received
- Structured: Levels / bands, formula

#### Support services

- Hot-line support
- On-site servicing

##### Pricing of support services (SLAs)

- By availability: Incident-based, 9x5, 24x7
- By quality: First-level, second-level, third-level

#### Training

- In-house training
- Off-site training

##### Pricing of training

- Fixed fee
- Per participating person

#### Consulting

- Technical implementation services
- Strategic solution consulting

##### Pricing of consulting

- Fixed fee
- Time and materials

#### Operations

- Provision of SaaS (managed service)

##### Pricing of operations

- Quantity: Users, resources, ...
- Duration: Always time-limited
- Structured: Set-up, subscription

## Commercial Open Source Products [WR13]

	Web Store	Direct Sales	
Open Source Community	DOC INC UTIL		<b>DOC</b> Documentation <b>INC</b> Incident-based support <b>UTIL</b> Utilities
Enterprise Customers		LIC UPD UTIL DOC TRN 24x7	<b>LIC</b> Commercial license <b>UPD</b> Update service <b>TRN</b> Training ... <b>24x7</b> 24x7 hot-line
ISV/OEM		LIC UTIL DOC TRN 24x7	

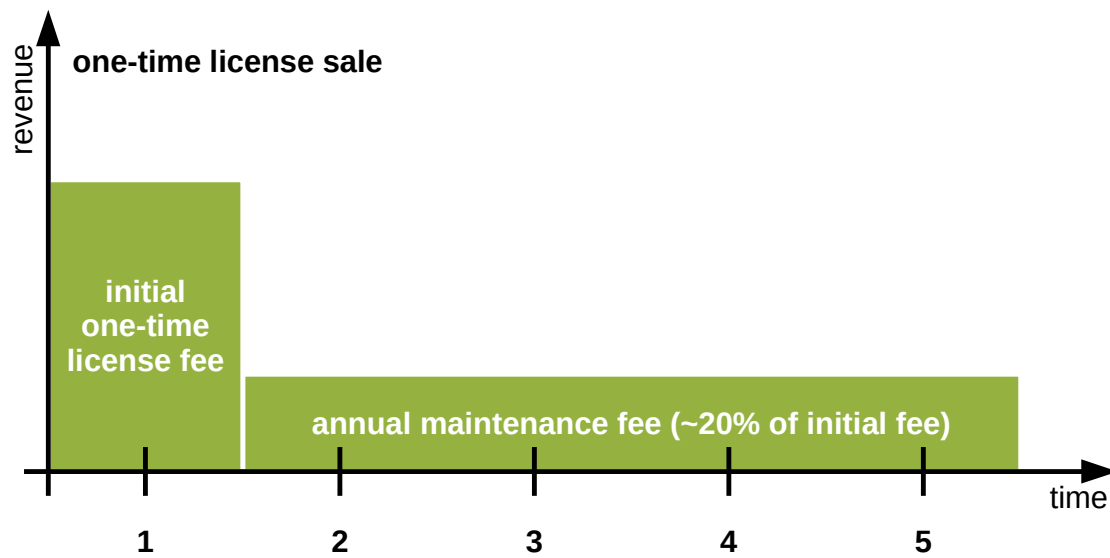
## Enterprise Customers vs. Private Users

- Enterprise customers
  - Are willing to trade money for time
- Private users
  - Are willing to trade time for money

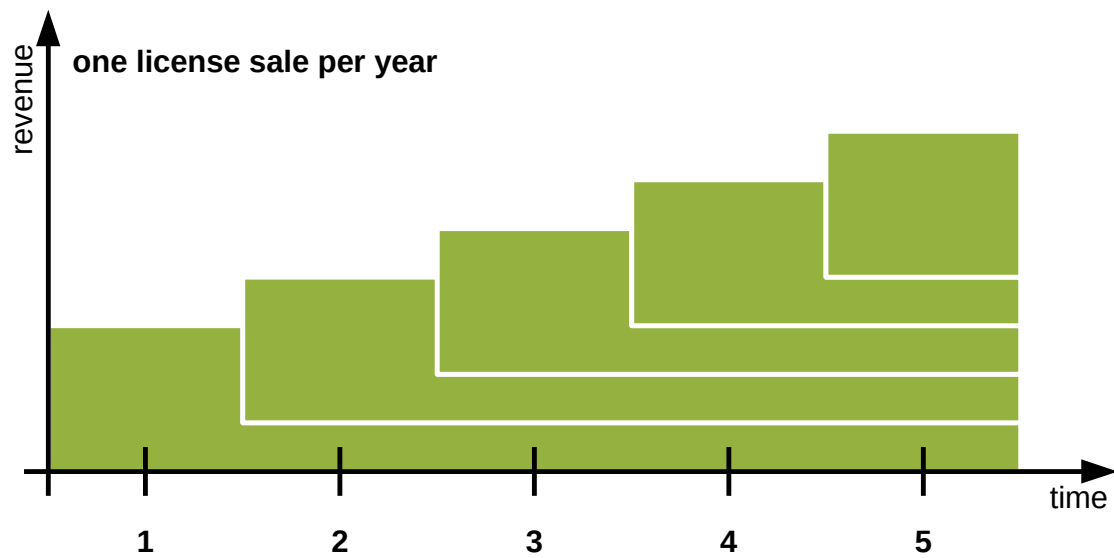
## Products, Projects, and Services

- Products are provided by a software vendor
  - “Standardsoftware”, (commercial) off-the-shelf software (COTS)
- Products can be operated by service providers
  - Service providers specialize in specific products
- Projects are performed by consulting firms
  - “Individualsoftware”, custom software
- Many companies do all of the above

## Single Product Sale Revenue



## Accumulating Product Revenues (SaaS) [1]

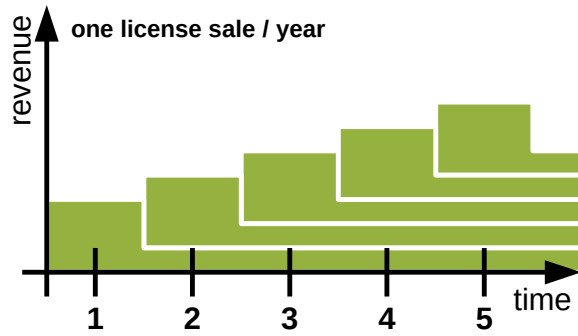
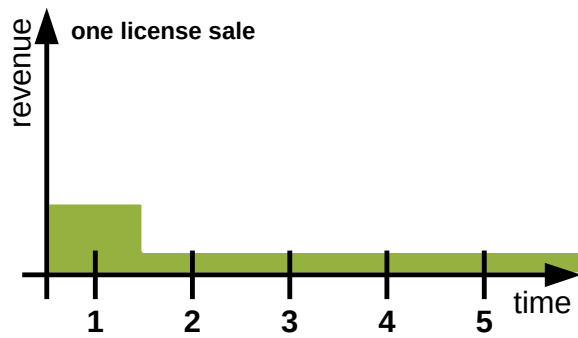




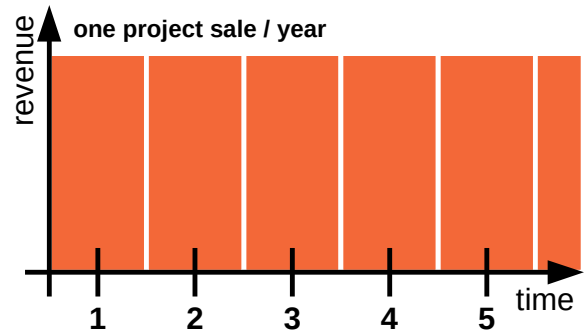
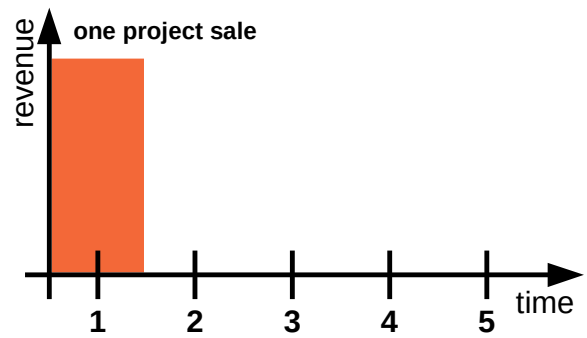
# Software Projects

- Projects
  - A process with a defined start and a defined end
- Software projects
  - Revenues correlate with performed labor
    - Fixed price vs. actual labor
  - Accounted for as revenue and expenses
- Examples
  - Bachelor and Master theses
  - Customizing SAP for a customer

## Product Revenue



## Project Revenue



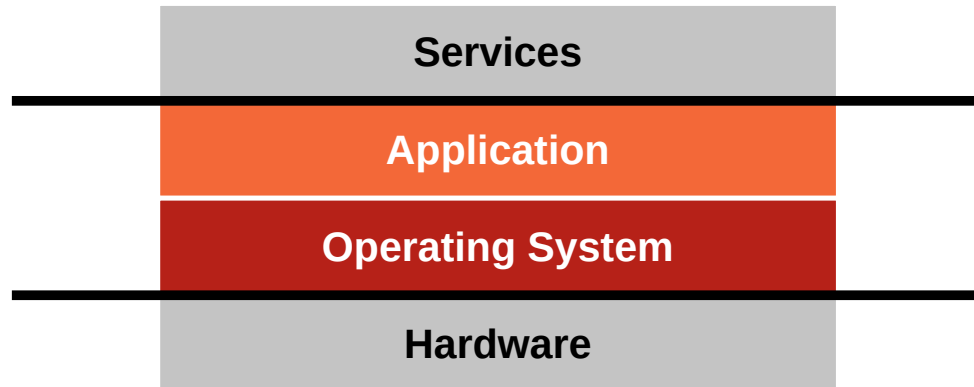
## (Software) Products and (Implementation) Projects

Software Vendor	Product	Consulting Firm	Project
		 <i>High performance. Delivered.</i>	Widget Corp. BI Impl. 2008
		 Open-minded Business Solutions	German SME Sugar 2010
			Continental Stages 2010
			

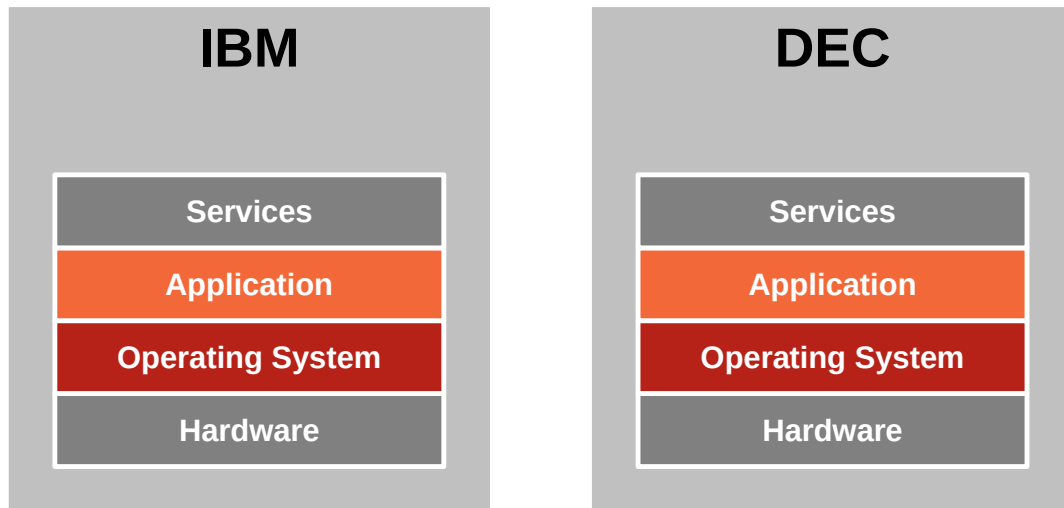
## Software Product vs. Project Companies

	Consulting Firms (Custom Development)	Software Vendors (COTS Development)
Advantages	<ul style="list-style-type: none"><li>• Not capital intensive</li><li>• Can be started easily</li></ul>	<ul style="list-style-type: none"><li>• Stable maintenance revenue</li><li>• High market capitalization</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>• Somewhat fragile revenue</li><li>• Little long-term stability</li><li>• High business volatility</li><li>• Limited scalability</li></ul>	<ul style="list-style-type: none"><li>• Hard to get started</li><li>• Requires upfront investment</li><li>• May be slow to react</li><li>• Most fail, few survive</li></ul>

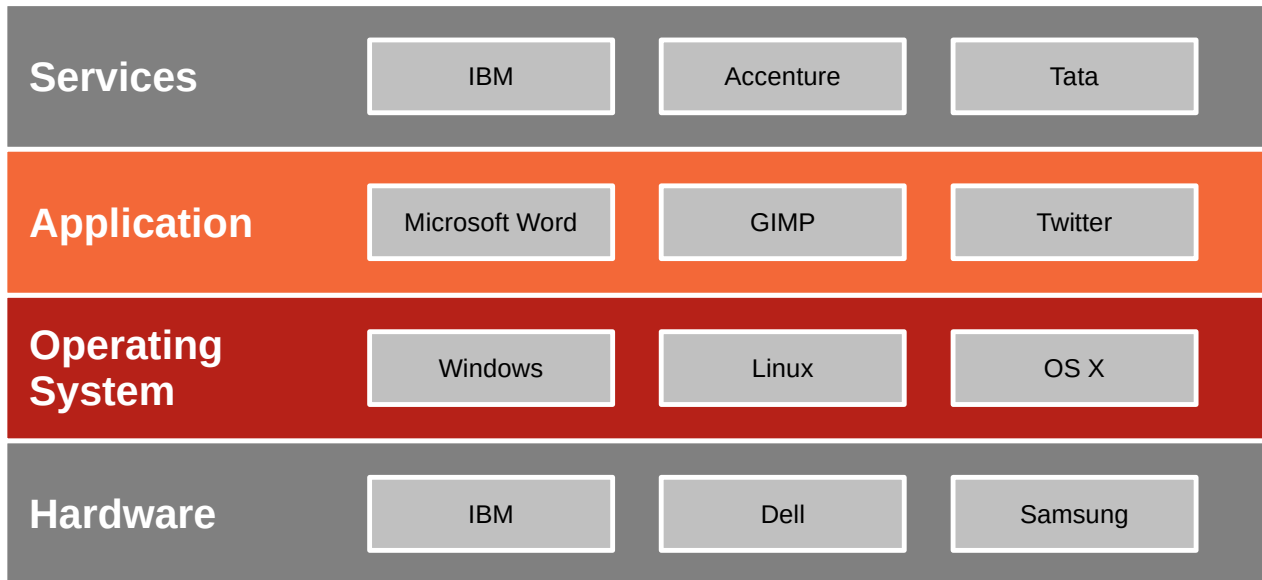
## Customers Buy a “Solution”



## Vertical Integration (Until 1980ties)



## Horizontal Integration (Since 1990ties)



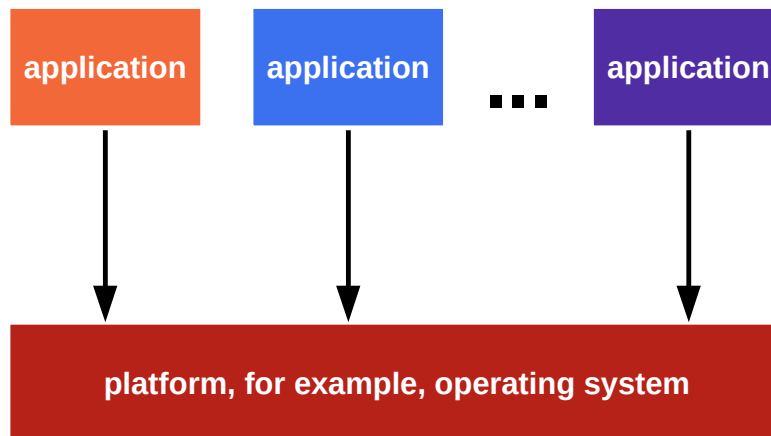
Free / Libre and Open Source Software  
© 2019 Dirk Riehle - Some Rights Reserved

## Categories of Software Products

- **Applications**
  - Software that is not built upon
  - Top-layer of the solution stack
- **Platforms**
  - Software that is built upon
  - 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
  - Is 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

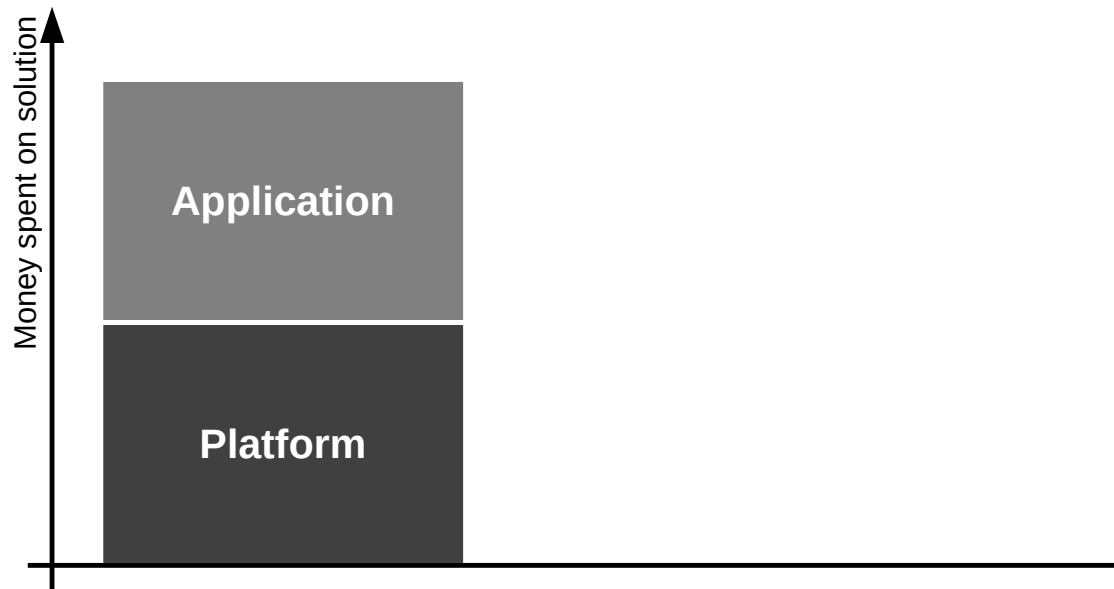
## Software Platforms as a Product

- 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

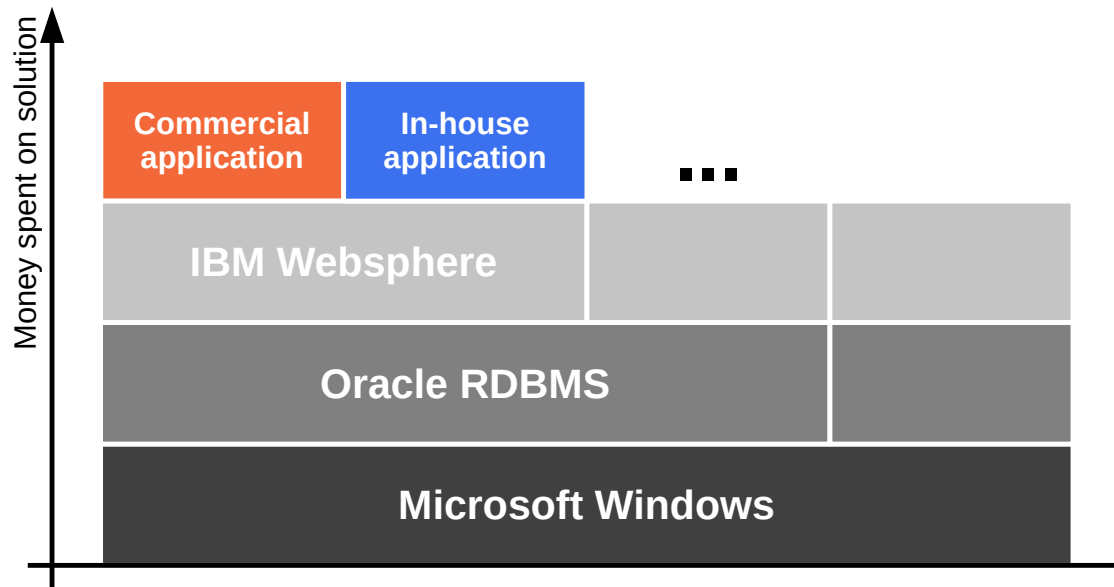
## Software Ecosystem

- Software ecosystem
  - The totality of actors (businesses and individuals),
  - software applications and components,
  - their relationships and goals
  - around a software platform
- Includes but is not limited to a community

## Pricing Power 1 / 2



## Pricing Power 2 / 2

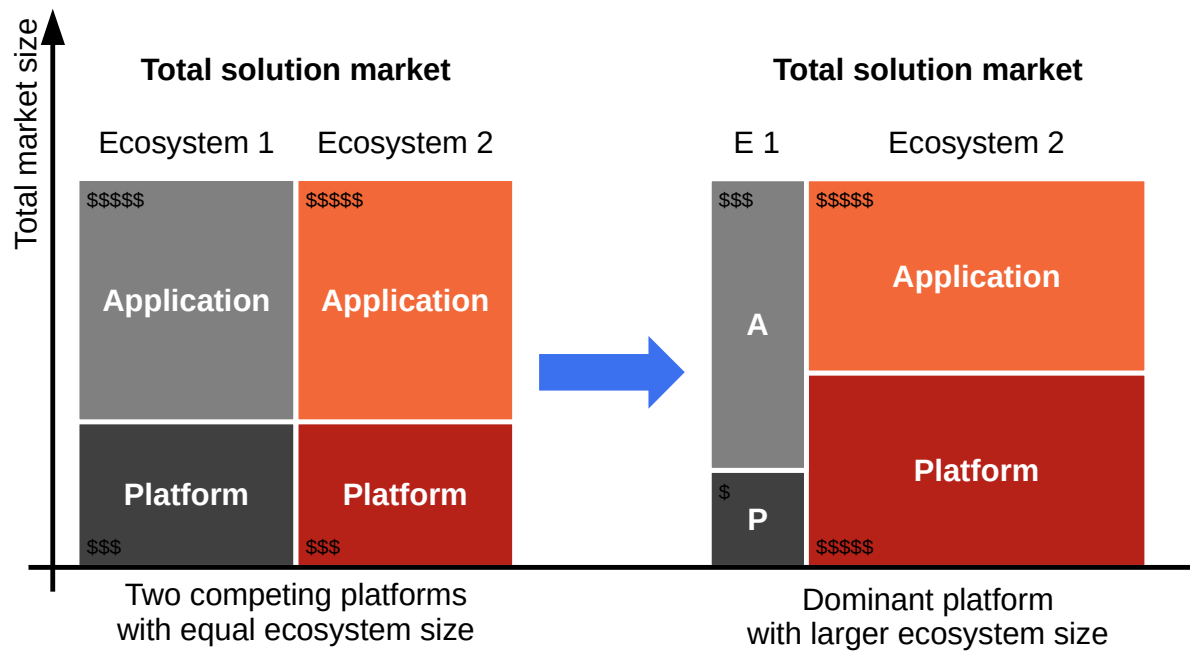


Free / Libre and Open Source Software  
© 2019 Dirk Riehle - Some Rights Reserved

## Software Ecosystem

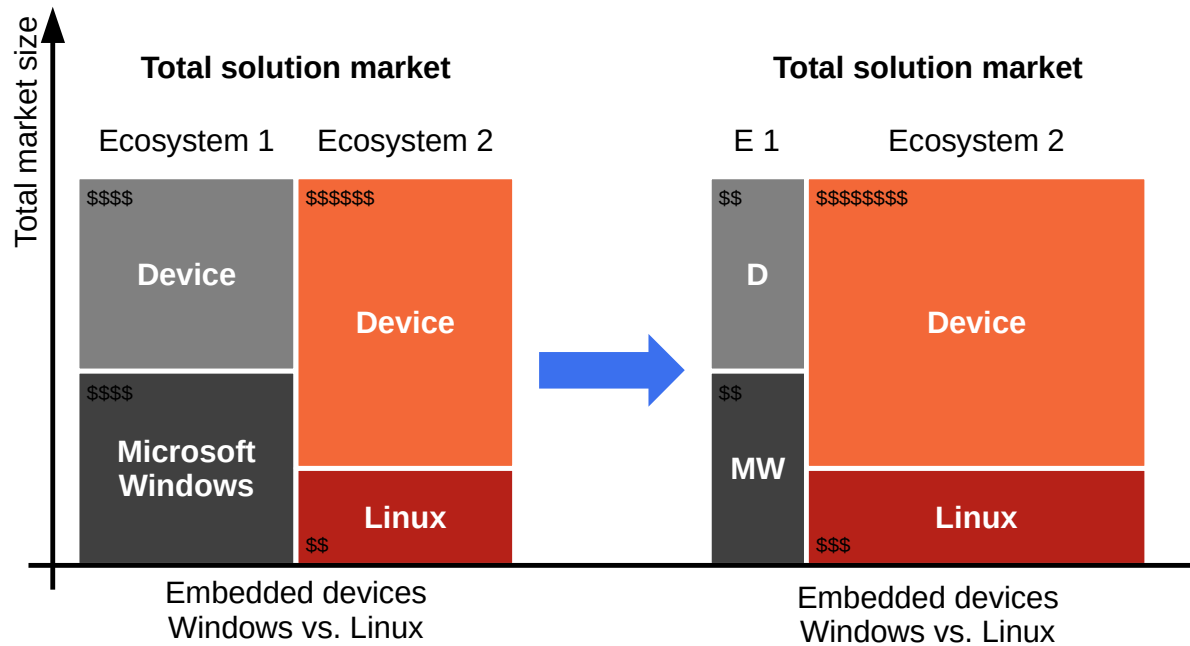
- **Software ecosystem**
  - The totality of actors (businesses and individuals),
  - software applications and components,
  - their relationships and goals
  - for a software platform

## The Software Ecosystem Wars



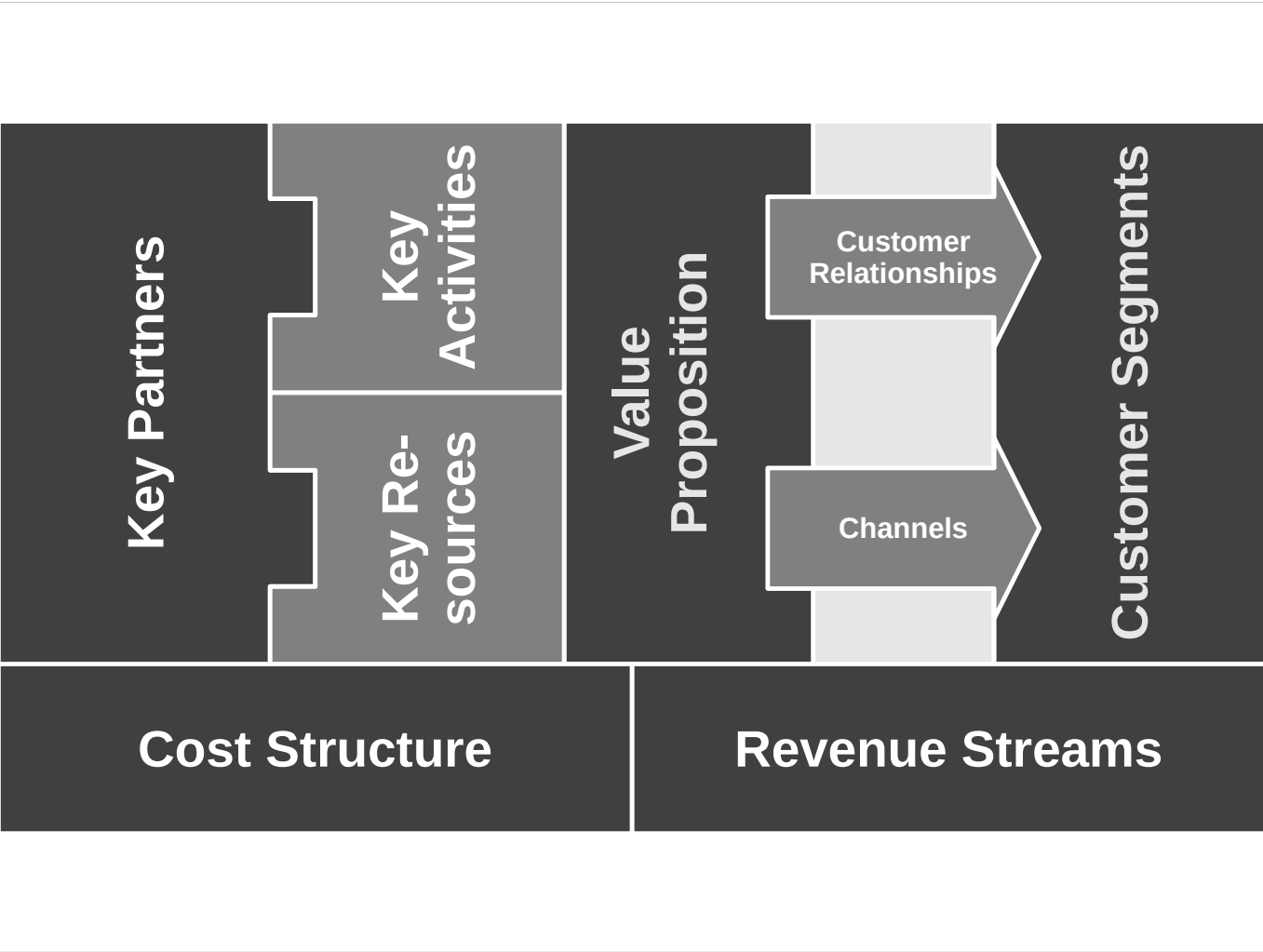


## Open Source in the Ecosystem Wars



## Business Model

- **A business model**
  - Is a summary description (model) of how a business' elements and their relationships interact to help the business achieve its strategic goals
  - Example elements are products, partners, people, positions, etc. and example relationships are the processes that govern their interaction
- But “open source is not a business model” [A08]
  - But open source can be a key enabler of a business model
  - So much so that the business model is called “open source”



	2011 (\$m)	Percentage
<b>Revenues</b>	\$1.657	100%
Subscription and Support	\$1.551	94%
Professional Services etc.	\$106	6%
<b>Cost of Revenues</b>	\$324	20%
Subscription and Support	\$208	13%
Professional Services etc.	\$116	7%
<b>Gross Profit (and Gross Margin)</b>	\$1.333	80%
<b>Operating Expenses</b>		
Research and Development	\$188	11%
Sales and Marketing	\$792	48%
General and Administrative	\$256	15%
<b>Total Operating Costs</b>	\$1.236	74%
<b>Operating Profit (and Operating Margin)</b>	\$97	6%

Source: Michael A. Cusumano. Reflecting on the Facebook IPO. CACM 10, 2012.

## Open Source “Business Models”

- Non-profit open source
  - **Community projects** without foundation
  - Open source **developer foundations**
  - Open source **user foundations**
- For-profit open source
  - **Service and support firms**
  - Open source **distributor firms**
  - **Single-vendor** open source **firms**

## Open Source and Business Models

- Open source may not be a business model, but it may be ...
  - A go-to-market strategy
  - An innovation model
  - A collaboration model
  - A sourcing strategy
  - And many other things
- More on this in later lectures on open source business models

## Review / Summary of Session

- The software industry
- Software platforms
- Software ecosystems
- Business models

# Thank you! Questions?

**[dirk.riehle@fau.de](mailto:dirk.riehle@fau.de) – <http://osr.cs.fau.de>**

**[dirk@riehle.org](mailto:dirk@riehle.org) – <http://dirkriehle.com> – [@dirkriehle](#)**

DR



## Credits and License

- Original version
  - © 2012-2019 Dirk Riehle, some rights reserved
  - Licensed under [Creative Commons Attribution 4.0 International License](#)
- Contributions
  - ...