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Ludwigshafen

BW431
eBusiness Basics – Part 1

Bachelor Wirtschaftsinformatik

Winter Term 2019

Prof. Dr. Frank Thomé

Organisational Remarks

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- Course addresses students of Bachelor Wirtschaftsinformatik, 4th semester
- Course counts 2,5 credit points (75 h workload)
- Evaluation by:
  - Written examination (60 min.) with 30 points maximum achievable
- Script download:
  - Access via OLAT -> Katalog -> HS LU -> Fachbereich 3 -> Thomé, Frank Prof. Dr. -> BW431 E-Business Grundlagen -> Veranstaltungsunterlagen
  - Password: Ebus-W19

Educational Objectives

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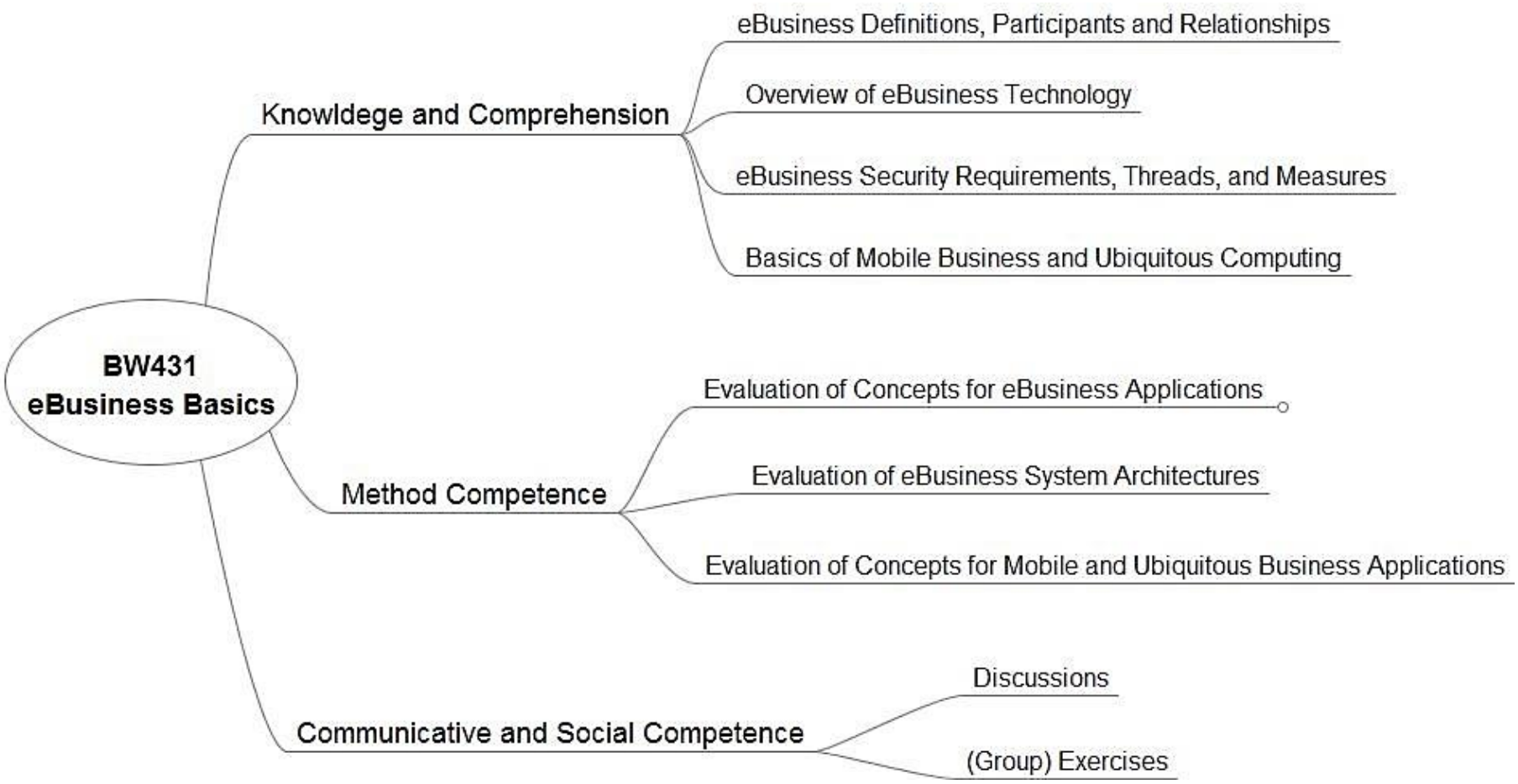

Literature (1)

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- Further Reading
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- Further Reading
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“Warm Up”

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- What do you understand by the term eBusiness? Which are in your opinion its main characteristics?

- “eBusiness was just a ‘millennium hype’ and is nowadays no longer relevant for companies and consumers”. So, why shall we consider such a topic at university?
  - Work together with 1 or 2 other students and try to refute this claim by collecting 10 eBusiness examples of today!

Today‘s „World of eBusiness“

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Internet Standards
WWW
TCP
XML
HTTPS
IP
FTP
SMTP
HTTP
DNS

Internet Security
Worm
Virus
Spoofing
Encryption
Certificates
Phishing
PKI
SSL

Business Activities and Applications
eProcurement
SCM
B2C
eCommerce
ePayment
Cloud Computing
ERP
eShop
CRM

Integration of Business Applications
SOA
B2B
Messaging
WSDL
EDIFACT
X12
SWIFT
ebXML
SOAP
EAI

Identification Technologies
GTIN
OCR
Barcode
GRAI
RFID
SSCC
GLN
EPC

Web 2.0
CSS
XSLT
HTML
UDP
Widgets
Blogs
Mashups
Social Networks
SaaS
RSS
VoIP
Podcasts

???

Mobile Business
Smartphones
iOS
LTE
Android
UMTS
PDA‘s
WLAN
GSM
LPWANs

Agenda

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1 Introduction to eBusiness
- 1.1 Definitions, Participants, and Relationships
- 1.2 eBusiness Concepts and Transactions

2 eBusiness Technology
- 2.1 Internet, World Wide Web, and Web 2.0
- 2.2 Software System Architectures for eBusiness
- 2.3 Design Principles for eBusiness Applications
- 2.4 Identification and Integration Technologies

3 eBusiness Security
- 3.1 Security Requirements and Security Threats
- 3.2 Security Measures

4 Mobile and Ubiquitous Business
- 4.1 Mobile Devices and Mobile Networks
- 4.2 Mobile Applications
- 4.3 Ubiquitous Computing / Internet of Things

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1 Introduction to eBusiness

1.1 Definitions, Participants, and Relationships

1.2 eBusiness Concepts and Transactions

Basic Definitions

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- Electronic Business
  - Initiation, (negotiation), agreement and transaction of electronic business processes
  - with the use of information technology and public or private communication networks (esp. the Internet)
  - in order to achieve added value
- eBusiness
  - Term was originally used by IBM in 1989
  - Characterized the use of information technology to support business processes within a company and across companies
- eCommerce
  - Use of information technology and public or private communication networks (esp. the Internet) to support commercial activities
  - Subset of eBusiness

Some More eBusiness Definitions…

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- A **secure, flexible and integrated approach** to delivering differentiated **business value** by **combining the systems and processes** that run core business operations with the simplicity and reach made possible by **Internet technology**. (IBM, 1997)

- Doing **business electronically**. […] Electronic Business encompasses the **execution of interactive, inter-business processes**. (Cunningham/Fröschl, 1999)

- … e-Business will be defined as the application of **information technologies** to facilitate **buying and selling of products, services, and information** over **public standards-based networks**. (Pricewaterhouse Coopers, 1999)

eBusiness Scope

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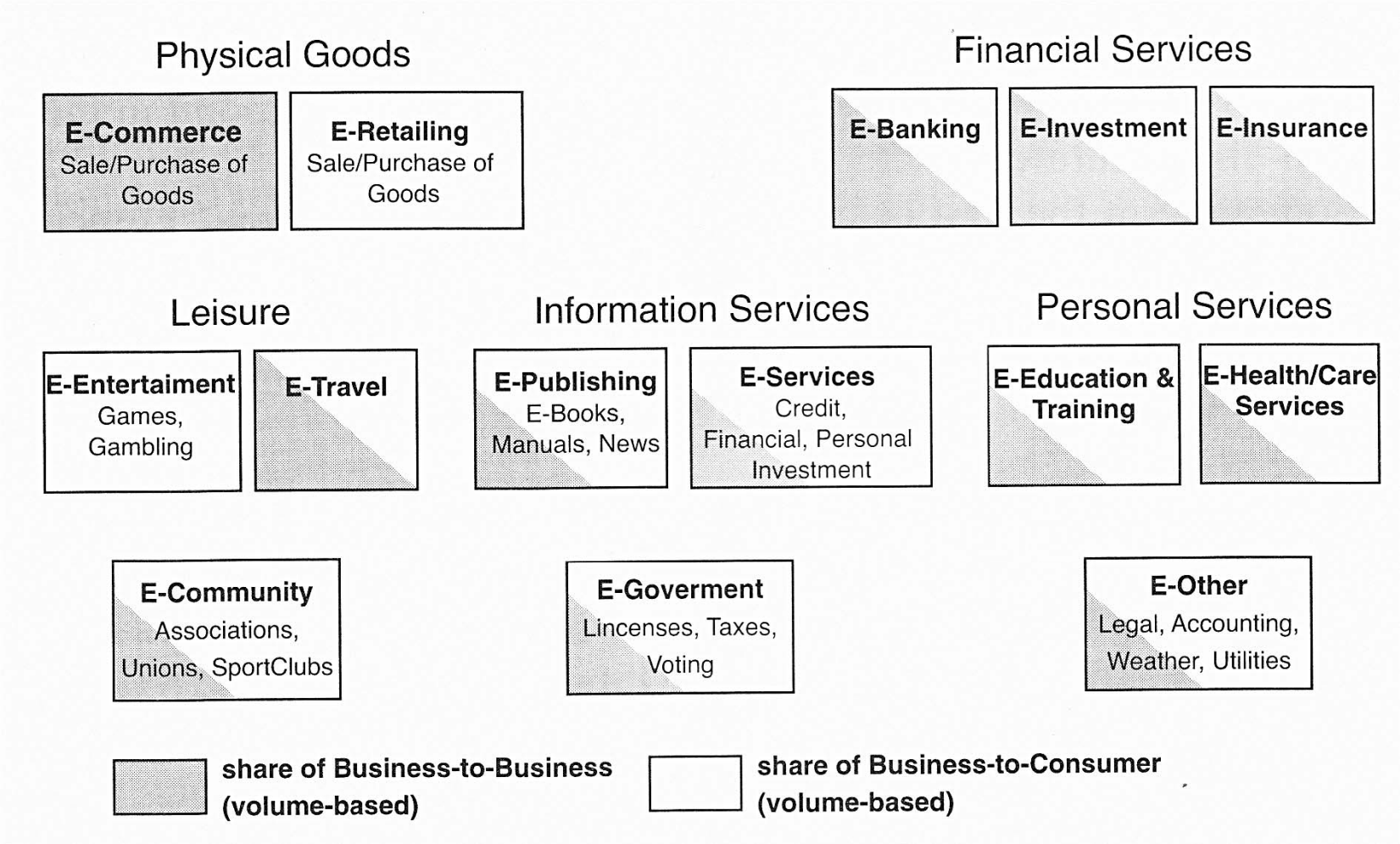

Source: Cunningham; Fröschl (1999), p. XVII.

eBusiness Participants and Relationships

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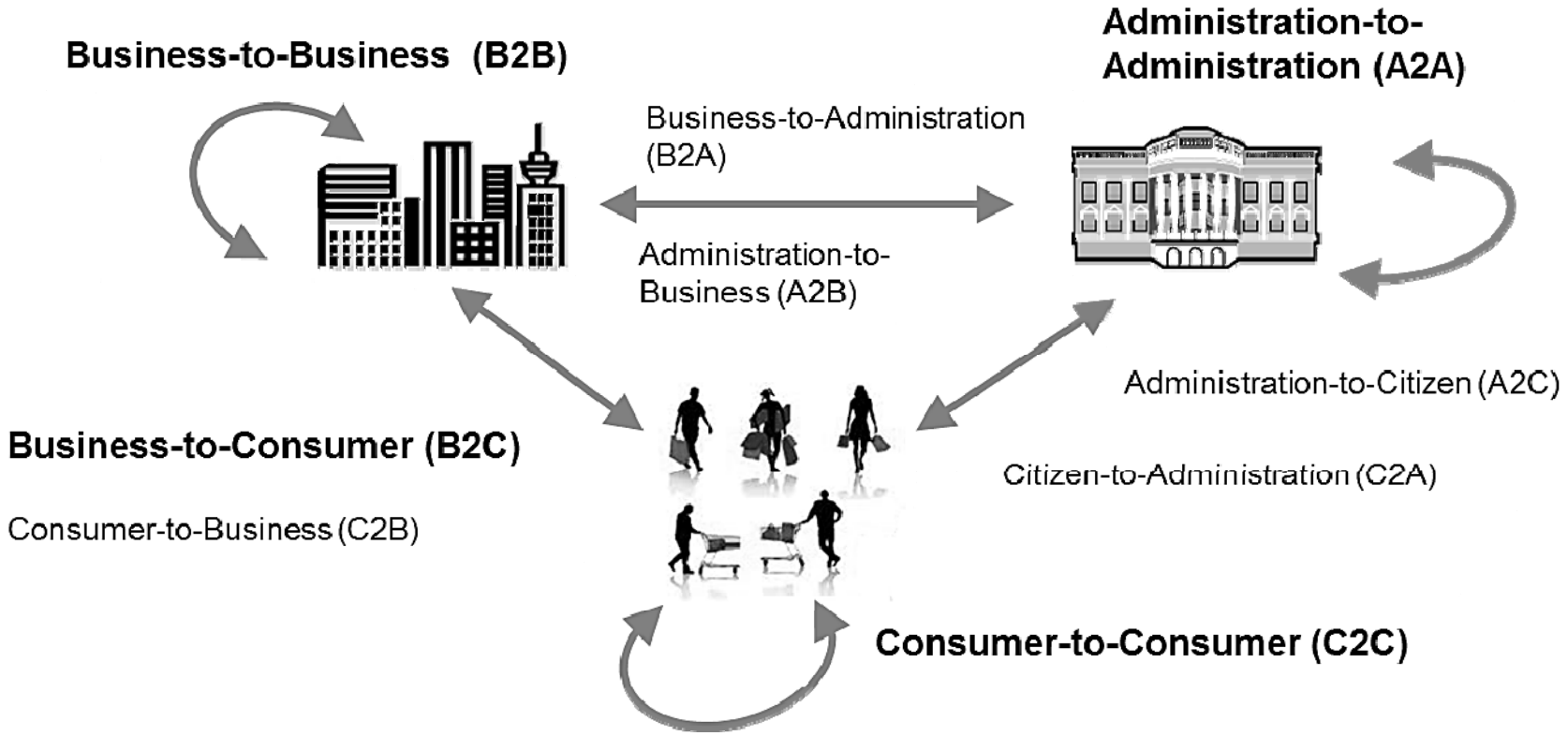
- Usually three major parties are used to characterize eBusiness relationships:
  - Companies (Business)
  - Public authorities (Administration / Government)
  - Private persons (Consumers / Citizens)



Examples of eBusiness Relationships

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		Service Consumer		
		Consumer	**Business**	**Administration**
Service Provider	**Consumer**	Consumer-to-Consumer (C2C)	Consumer-to-Business (C2B)	Consumer resp. Citizen-to-Administration (C2A)
	Business	Business-to-Consumer (B2C)	Business-to-Business (B2B)	Business-to-Administration (B2A)
	Administration	Administration-to-Consumer resp. Citizen (A2C)	Administration-to-Business (A2B)	Administration-to-Administration (A2A)

Based on Meier; Stormer (2008), p. 3.

Characteristics of B2B and B2C

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Characteristic	Manifestation B2B	Manifestation B2C
Structure of process	Complex business process across the value chain	Simple structured purchasing process
Duration of business relationship	Long-term	Short-term
Predictability	Rather predictable	Usually spontaneous
Value of transactions	High	Low
Number of transactions	Low to medium	Medium to high
Technology	Rather sophisticated hardware and software, high bandwidth	Often low-end hardware and software, lower bandwidths
Qualification of participants	Skilled employees, experts	Also people with lower education

B2B and B2C Scope

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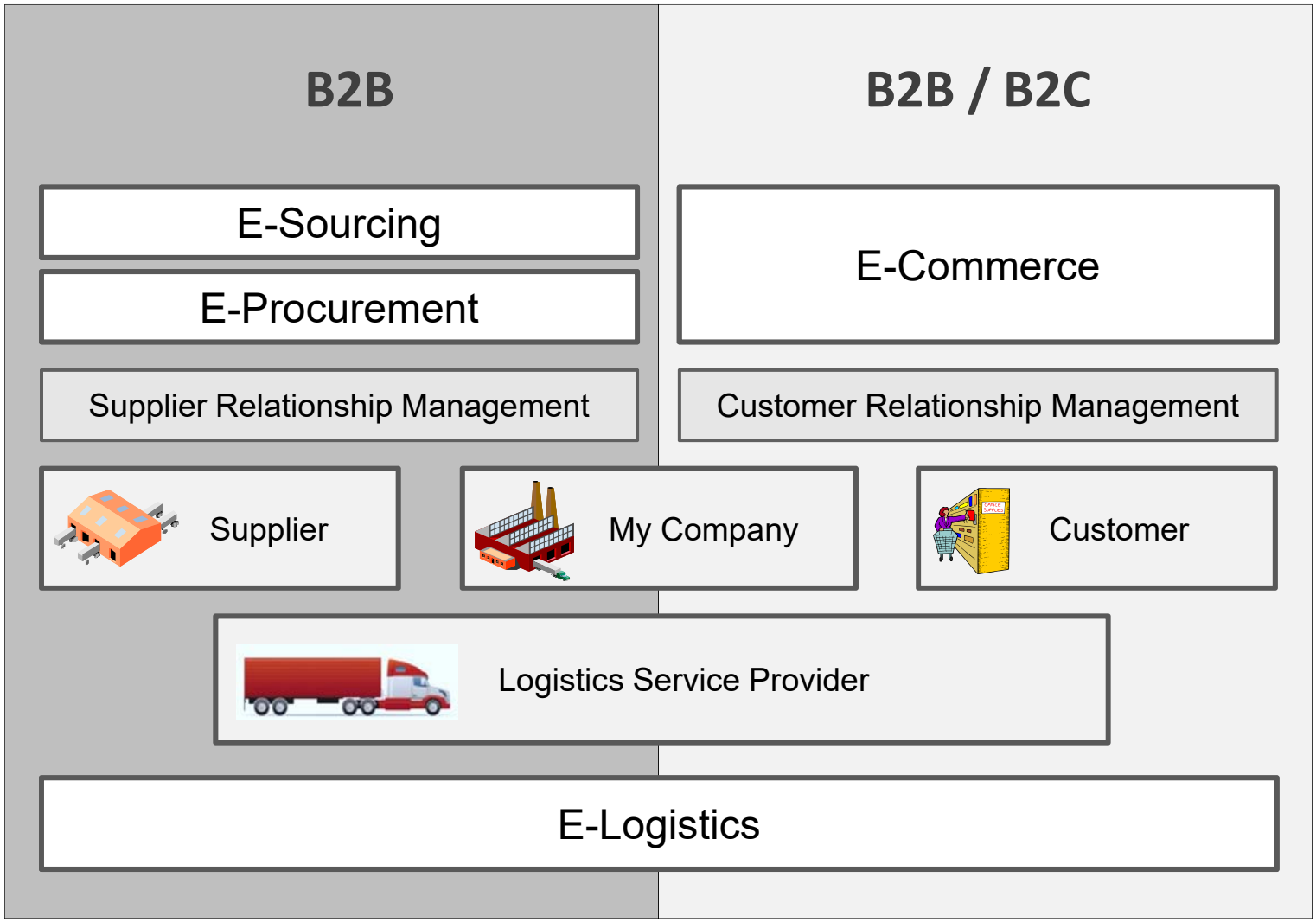

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eBusiness Value Creation

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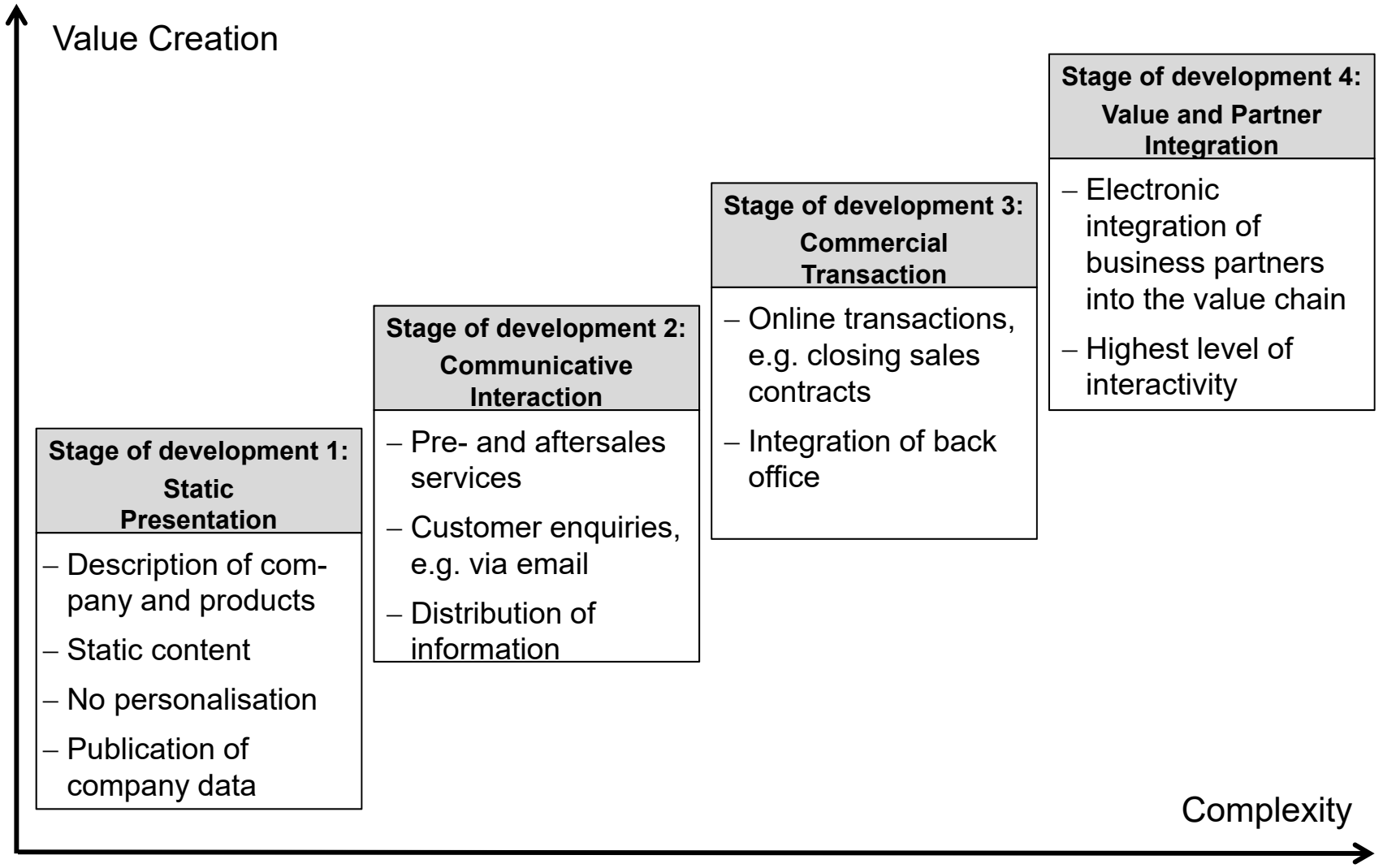

Based on Wirtz (2010), p. 21.

Electronic Business Concepts (1)

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- Content
  - Presentation and provision of buyer-oriented, personalised content across networks
  - Direct (premium content) and indirect (advertisement) revenue models
  - e.g. E-_____
- Commerce
  - Completion or substitution of traditional transaction phases across networks
  - Transaction dependent direct and indirect revenue models
  - e.g. E-_____
- Context
  - Reduction of complexity and provision of navigation and matching functions across networks
  - Direct (context specific content) and indirect (advertisement) revenue models
  - e.g. E-_____

Based on Kollmann (2011), p. 49.

Electronic Business Concepts (2)

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- Connection
  - Creation of technological or commercial relationships in networks
  - Direct (provision of content) and indirect (advertisement) revenue models
  - e.g. E-_____

- Communication
  - Creation of communicative relationships in networks
  - Direct (connection fees) and indirect (advertisement) revenue models
  - e.g. E-_____

Based on Kollmann (2011), p. 49.

Electronic Business Revenue Models (1)

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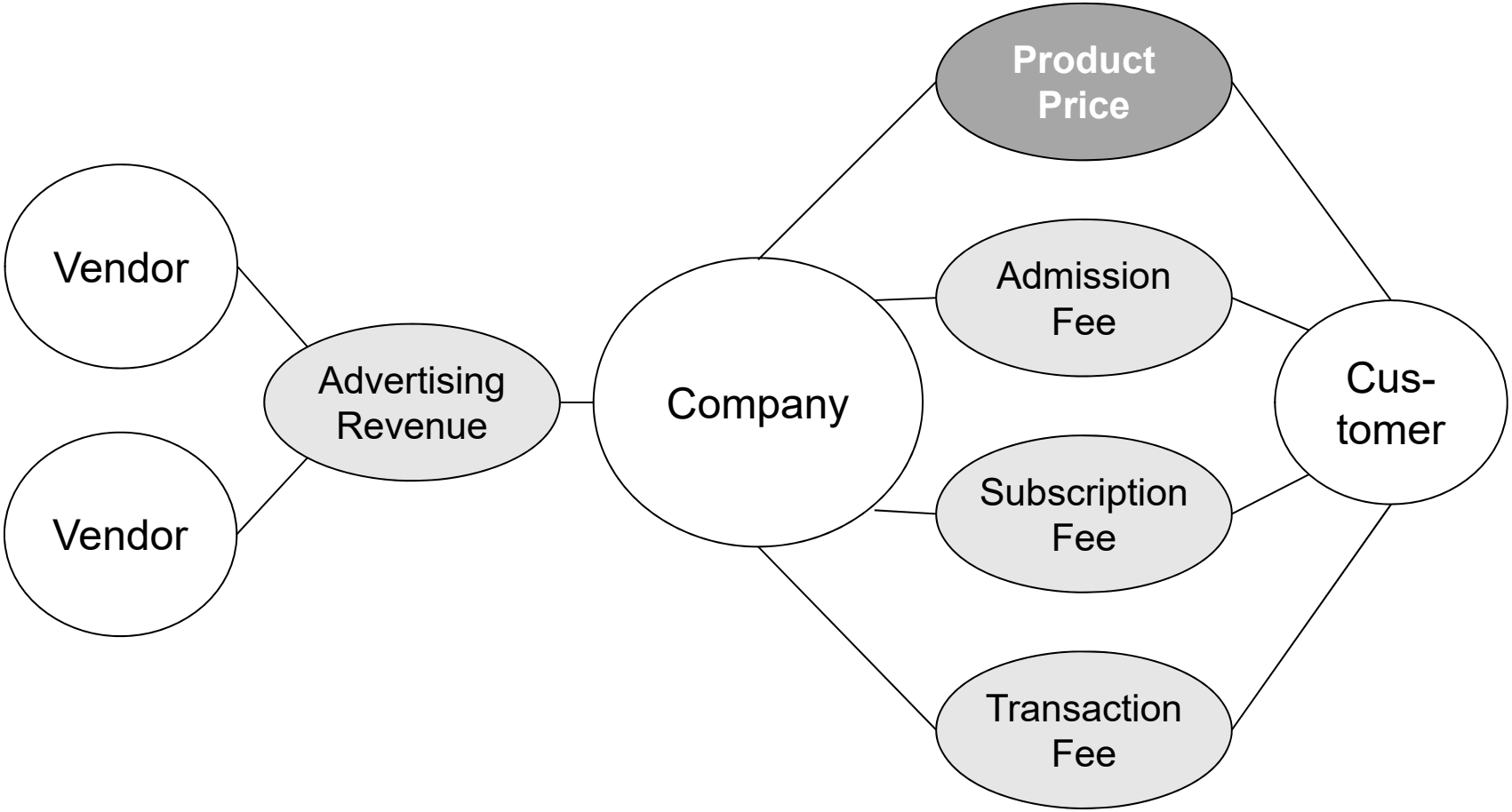

Based on Meier; Stormer (2008), p. 59.

Electronic Business Revenue Models (2)

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	Direct Revenue Models	Indirect Revenue Models
Transaction Dependent	➢ Transactions fees ➢ Connection fees ➢ User fees	➢ Provisions
Transaction Independent	➢ Installation fees ➢ Base rates	➢ Banner fees ➢ Data Mining revenues ➢ Sponsorship

Based on Wirtz (2010), p. 216.

Technology Platforms for eBusiness

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- E-Procurement Platforms
  - Allow companies to electronically purchase products and services
- E-Shops
  - Allow companies to electronically sell products and services
- E-Marketplaces
  - Offer commercial functionalities for companies and individuals to electronically purchase and sell products and services

Purchase, Sales, Trading

- E-Community Platforms
  - Allow companies and individuals to electronically establish contacts between each other
- E-Companies
  - Leverage electronic collaboration between companies to create “virtual enterprises”

Contact, Collaboration

Based on Kollmann (2011), p. 45f.

E-Shop (Sell-Side)

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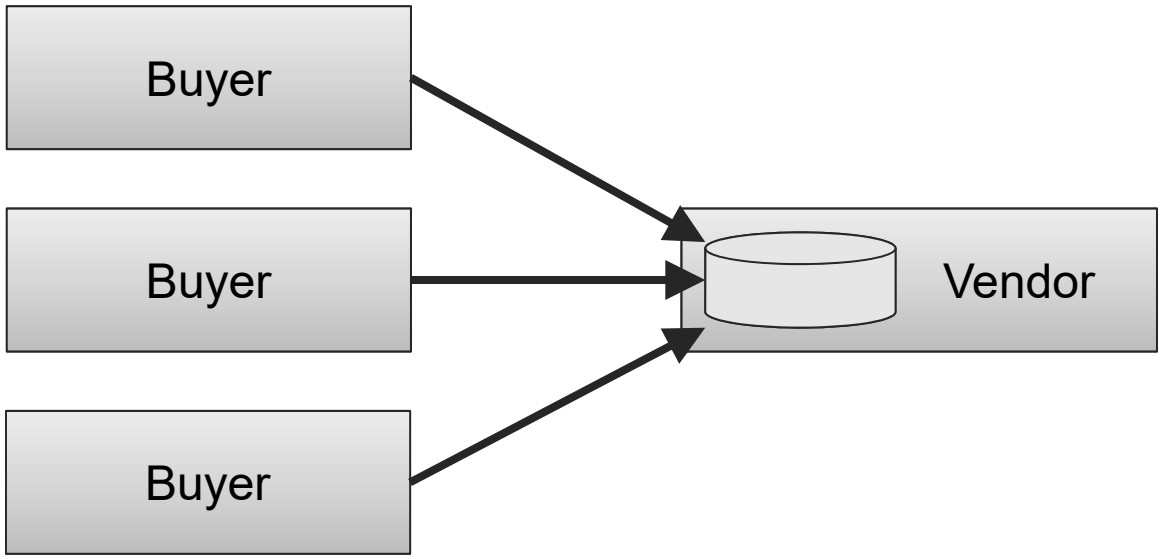

- Advantage:
  - Vendor (seller) organizes data management
- Disadvantage:
  - No price comparison across vendors
  - Different login and UI per vendor
  - No direct backend integration

E-Procurement Platform (Buy-Side)

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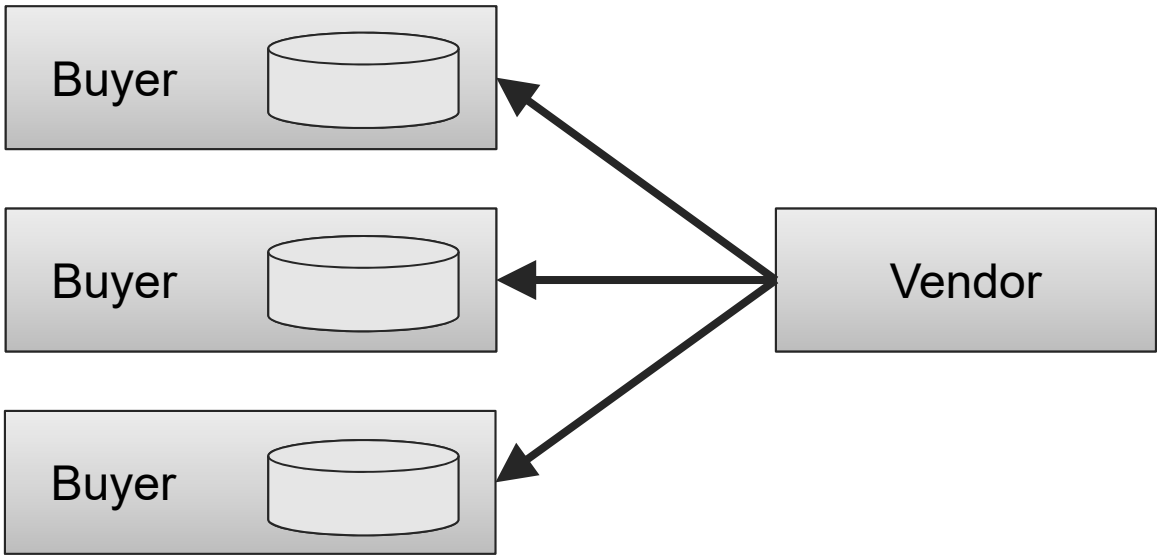

- Advantage:
  - Price comparison across vendors (if several suppliers have system acces)
  - Uniform login and UI (as each buyer has its own software solution)
  - Direct backend integration
  - Data transparency
- Disadvantage:
  - Each buyer has to organize data management on his own

E-Marketplace (Marketplace-Side)

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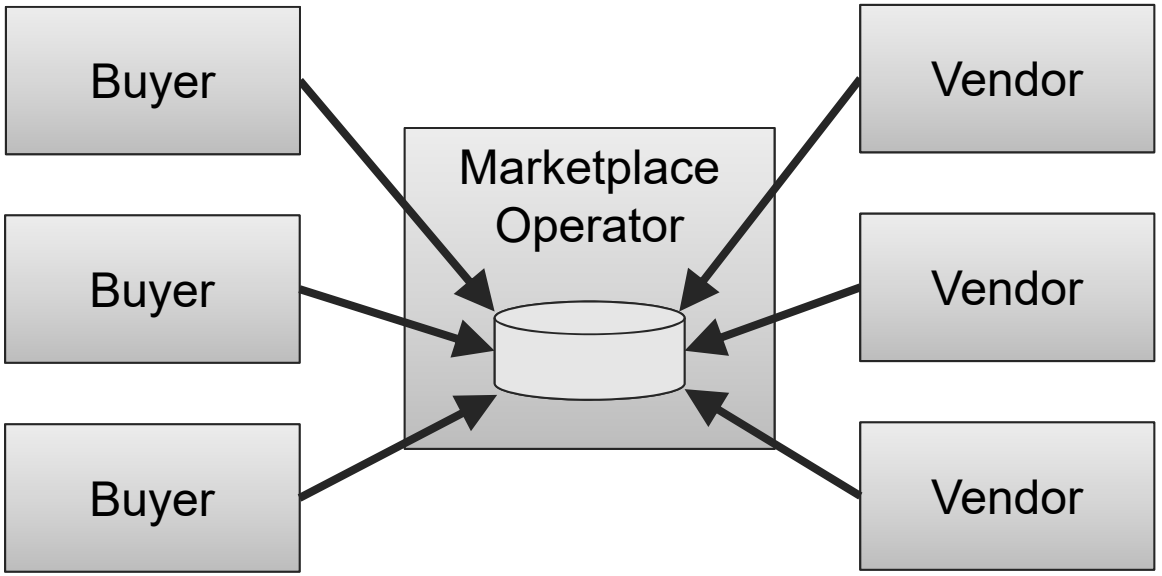

- Advantage:
  - Marketplace operator organizes data management for all parties
  - Uniform login and UI
  - Direct backend integration and data transparency
- Disadvantage:
  - Dependence on catalogue management of marketplace operator

Typical eBusiness Transactions

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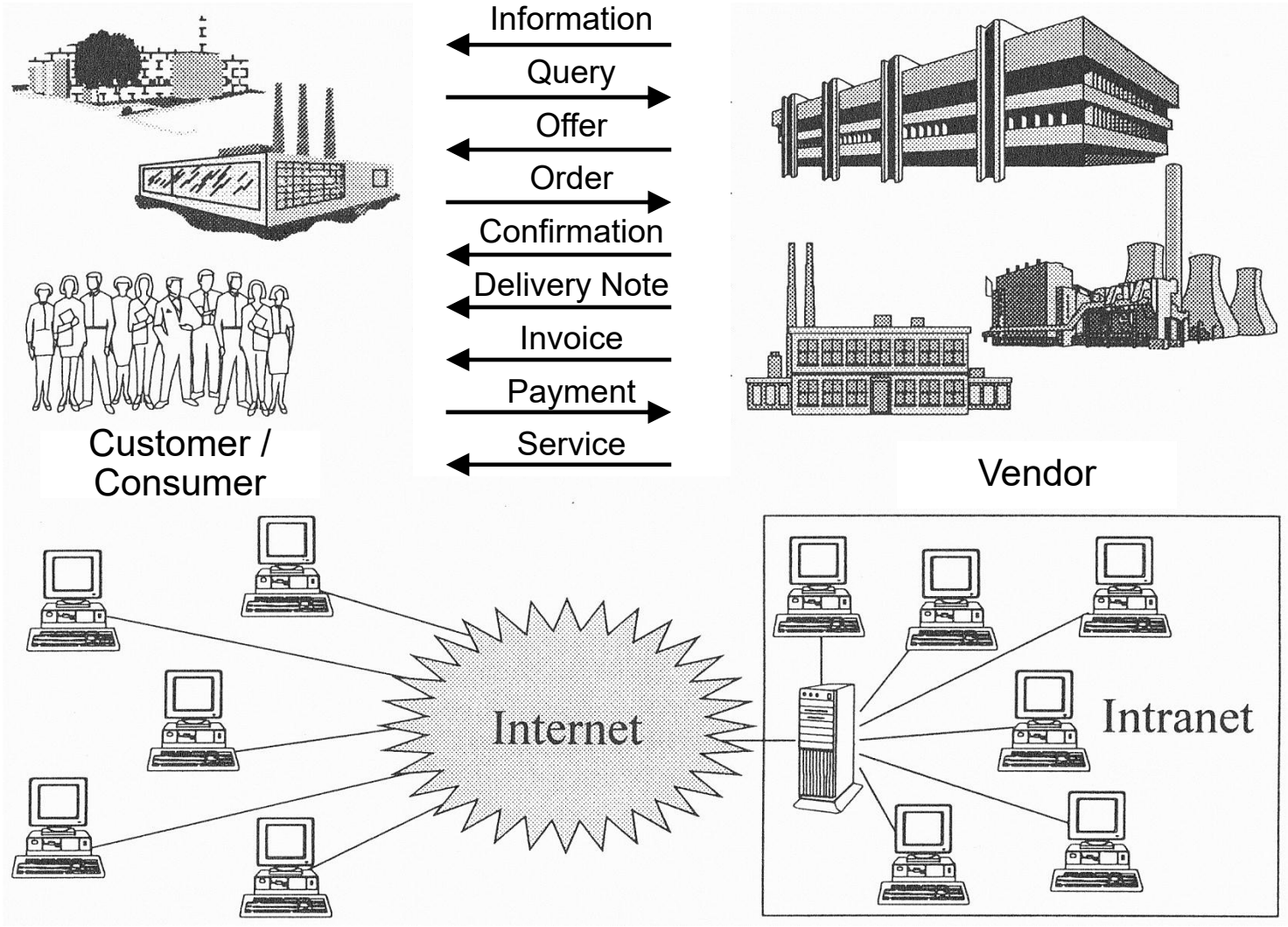

Based on Schwarze; Schwarze (2001), p. 22.

Direct Transactions between eBusiness Participants

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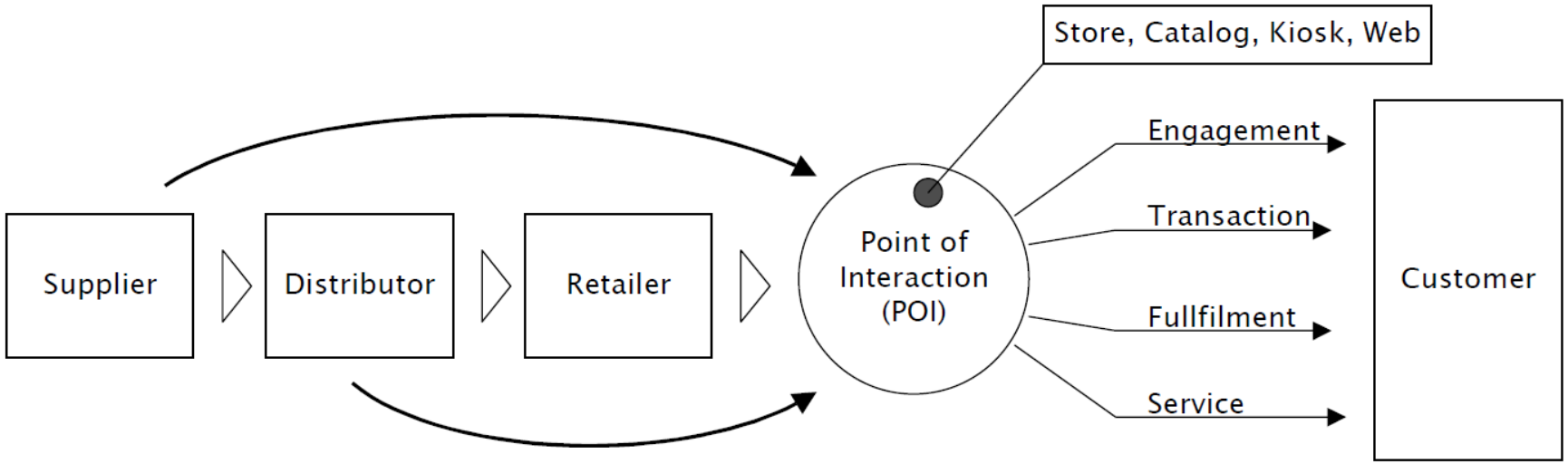
- Conducting transactions electronically and directly between business partners might lead to:
  - Bypassing traditional participants of the value chain
  - Disappearance of traditional mediators (disintermediation)
  - Appearance of new mediators (re-intermediation)



Source: Cunningham; Fröschl (1999), p. 159.

Advantages of Disintermediation for Manufacturers

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Disintermediation by Manufacturer

- Manufacturer takes over central trade functions
- Retail market in the value chain becomes partly superfluously

Two key advantages for manufacturer

Increasing Profit Margin

- Profit margins previously claimed by retailers no longer apply
- Additional expenditures of manufacturer will usually not consume those margins

Access to Customer Data

- Manufacturer gains direct access to customers
- Manufacturer can gain new stimuli for product development by systematically collecting customer data

Based on Wirtz (2010), p. 147.

Indirect Transactions via Electronic Marketplaces

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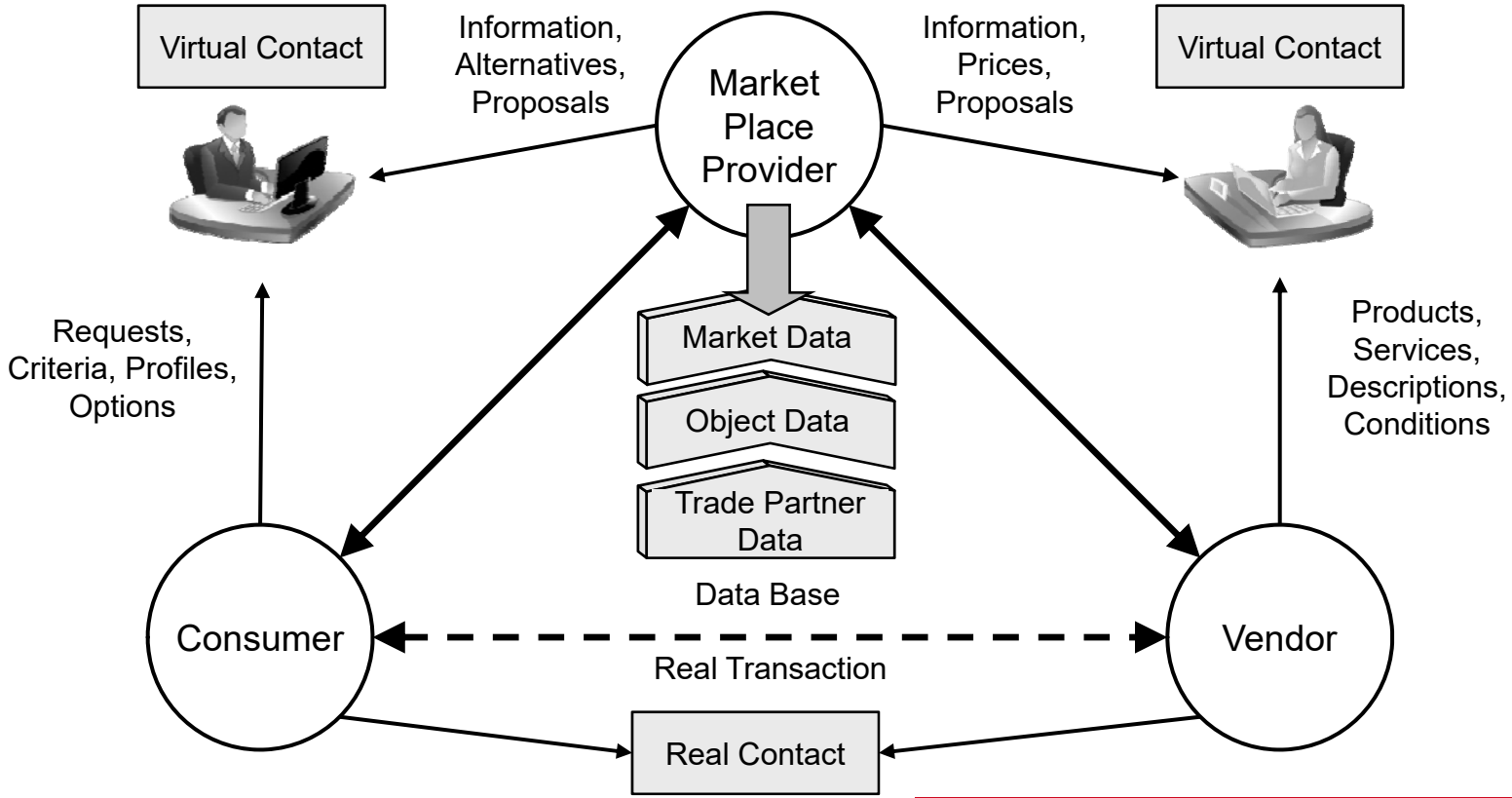
- Electronic Marketplace
  - IT platform usually hosted by a vendor or a third party provider
  - Brings one or several vendors and consumers together
  - Offers commercial functionalities (and sometimes additional services) for the market actors



Based on Kollmann (2011), p. 461.

Types of Electronic Marketplaces

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- Horizontal marketplaces
  - Intersectoral offers, no specialising in lines of business
  - Usually focussing on specific product groups, e.g. office equipment or computers
- Vertical marketplaces
  - Focussing on specific lines of business or industry sectors
  - Mainly offering trade-specific products and services
- Private marketplaces
  - IT platforms owned and often also hosted by larger enterprises
  - Open to their most important suppliers or customers
  - To ease, accelerate and cheapen business processes across the companies

Wiederholungsfragen zu Teil 1 / Repetition Part 1

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1. Definieren Sie den Begriff „Electronic Business“. / Define the term „Electronic Business“ (→ Folie / Slide 10)

2. Nennen Sie 5 Aktivitäts- bzw. Anwendungsbereiche des Electronic Business. Geben Sie jeweils ein praktisches Beispiel. / Give 5 examples of eBusiness activity and application areas. (→ Folie / Slide 12)

3. Erläutern Sie den Unterschied zwischen B2B und B2C anhand 4 typischer Merkmalsausprägungen. / Describe the difference between B2B and B2C by specifying 4 typical characteristic values. (→ Folie / Slide 15)

4. Sogenannte Technologieplattformen des Electronic Business lassen sich anhand ihrer primären Zielsetzungen „Einkauf“, „Verkauf“, „Handel“, „Kontakt“ und „Kooperation“ klassifizieren. Nennen Sie 3 konkrete Technologieplattformen und ordnen Sie ihnen jeweils die passende Zielsetzung zu. / So called technology platforms for eBusiness can be classified by their primary objectives purchase, sales, trading, contact, and collaboration. Specify 3 technology platforms and assign the correct objective. (→ Folie / Slide 23)

Wiederholungsfragen zu Teil 1 / Repetition Part 1

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5. Erläutern Sie den Begriff „Disintermediation“ anhand eines konkreten Beispiels. / Explain the term disintermediation with the help of a practical example. (→ Folie / Slide 28)

6. Erläutern Sie den Unterschied zwischen einem vertikalen und einem horizontalen elektronischen Marktplatz. Geben Sie je ein praktisches Beispiel. / Explain the difference between vertical and horizontal electronic marketplaces. (→ Folie / Slide 31)

Übung zu Teil 1

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- Erika und Max Mustermann betreiben ein kleines Einzelhandelsgeschäft, in dem es Waren des täglichen Bedarfs zu kaufen gibt. Ihre Kundschaft stammt überwiegend aus dem Stadtteil, in dem das Geschäft angesiedelt ist.

- Aufmerksam geworden auf das Thema E-Business entschließen sich Erika und Max dazu, eine Internetpräsenz für ihr Einzelhandelsgeschäft zu schaffen, um damit Umsatz und Gewinn zu steigern. Da Erika und Max bislang keine Erfahrung mit E-Business haben, suchen sie bei Ihnen um Rat.

- Bilden Sie 3er- oder 4er-Gruppen und unterstützen Sie Erika und Max, indem Sie zunächst ein einfaches „Geschäftsmodell“ für das geplante Vorhaben entwerfen
  - Berücksichtigen Sie hierbei insbesondere die in der Vorlesung vorgestellten Konzepte und Erlösmodelle des Electronic Business und konkretisieren Sie diese anhand einer auszuwählenden Technologieplattform in Verbindung mit den grundsätzlich erforderlichen Geschäftstransaktionen.

Exercise Part 1

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- Jane and John Doe run a small retail store with convenience goods. Their customer base mainly originates from the same urban district, in which the store is located.
- Attracted by the eBusiness topic Jane and John decide to create a web site for their retail store, in order to increase the sales and profit of their business. As Jane and John have not yet any experience with eBusiness solutions, they ask you for advice.
- Work together with 3 or 4 other students and help Jane and John to define a simple business model for their project.
  - Consider the electronic business concepts and the related revenue models as introduced in this lecture. Combine the relevant models and concepts with one or more technology platforms for eBusiness solutions, and specify the business transactions, which should be supported by the solution.

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BW431
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2 eBusiness Technology

2.1 Internet, World Wide Web, and Web 2.0

2.2 Software System Architectures for eBusiness

2.3 Design Principles for eBusiness Applications

2.4 Identification and Integration Technologies

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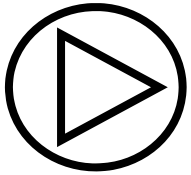
- The Internet
  - World-wide system of interconnected computer networks
  - Using common communication protocols, the so-called Internet Protocol Suite
  - No centralized governance in technological implementation as well as in policies for access and usage
  - Solely coordination of the Internet's naming system by the Internet Corporation for Assigned Names and Numbers (ICANN)

- The World Wide Web (WWW, W3, ‘the Web’)
  - World-wide network of interlinked ‘hypertext documents’ with references (hyperlinks) to other documents
  - Access via the Internet with web browsers using a client-server architecture
  - Most important technical components:
    - Uniform Resource Locators (URL) to specify an identified resource
    - Publishing language HyperText Markup Language (HTML)
    - Communication protocol Hypertext Transfer Protocol (HTTP)



TCP / IP Model: Overview

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- Reference model for Internet communication protocols
  - Resulted from research and development conducted by Defense Advanced Research Projects Agency (DARPA) in early 1970s
  - Named from 2 most important protocols in it, the Transmission Control Protocol (TCP) and the Internet Protocol (IP)
  - Basis for the Internet Protocol Suite
- Layered model for end-to-end connectivity
  - 4 abstraction layers to solve data transmission tasks, esp. addressing, routing and delivering (RFC 1122)
  - Each layer provides well-defined services to upper layer protocols based on using services from lower layers

TCP / IP Model: Abstraction Layers

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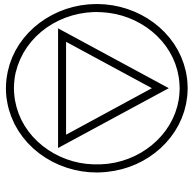
Abstraction Layers	Protocol Examples				Main Tasks
Application Layer	HTTP	FTP	SMTP	DNS	Provide services directly to application programs
Transport Layer	TCP		UDP		Provides reliable end-to-end communication services
Internet Layer	IP (IPv4, IPv6)				Connectionless inter-network service, provides packet delivery and routing
Link Layer	Ethernet	Token Ring	802.11 (WLAN)		Provides access to underlying communication networks



Domain Name System (DNS)

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- Distributed, hierarchical naming system for locating and addressing Internet resources
  - Originally specified in 1983 in RFC 882 and RFC 883
- Main Tasks:
  - Name resolution for translating domain names into IP address
    - e.g. www.hs-lu.de → 143.93.200.2
  - Reverse lookup for translating Internet resource identifiers into domain names
- Main components:
  - Domain Name Space
    - Tree structured name space with leave and nodes (labels)
    - Name resolution from rightmost label with top-level domain (e.g. com) to left (subdomains)
  - Name Servers
    - Software program for processing name space requests
  - Resolvers
    - Software program for name resolution queries (recursive and iterative queries)

Simple Mail Transfer Protocol (SMTP)

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- Internet standard for electronic mail transmission across IP networks
  - Originally specified 1982 in RFC 821
- Relatively simple, text-based protocol
  - Push protocol, cannot pull messages from a remote server
  - No inbuilt confirmation of message delivery
  - Error notification (standardised in SMTP extension)
- Message structure
  - Envelope with sender and recipient information for message routing
  - Content with:
    - Header: Sender and recipient address, message ID, subject etc.
    - Body: Message text

SMTP Communication Model

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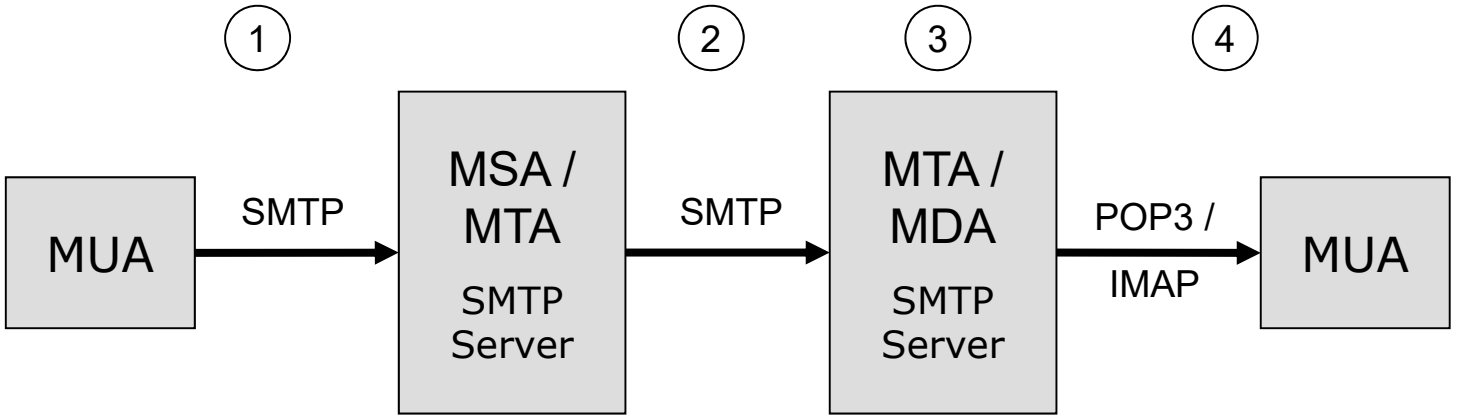

1. Initiating of mail transaction by sender's Mail User Agent (MUA) and connection to Mail Submission Agent (MSA)
2. Message transmission to recipient via Mail Transfer Agent (MTA)
3. Delivery of message to recipient's mail box by Mail Delivery Agent (MDA)
4. Message retrieval by recipient's MUA
   - Download with Post Office Protocol (POP)
   - Direct access with Internet Message Access Protocol (IMAP)

Selected SMTP Commands

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- HELLO (HELO) or Extended HELLO (EHLO)
  - Identifies sender-SMTP to receiver-SMTP
- MAIL (MAIL)
  - Initiates mail transaction
- RECIPIENT (RCPT)
  - Identifies individual recipient of the mail data
  - Multiple use in case of multiple recipients
- DATA (DATA)
  - Starts mail data from sender
  - End of data indicated by character sequence <CRLF>.<CRLF>
- RESET (RSET)
  - Aborts mail transaction
- QUIT (QUIT)
  - Closes transmission channel

Example: Mail Routing with SMTP and DNS

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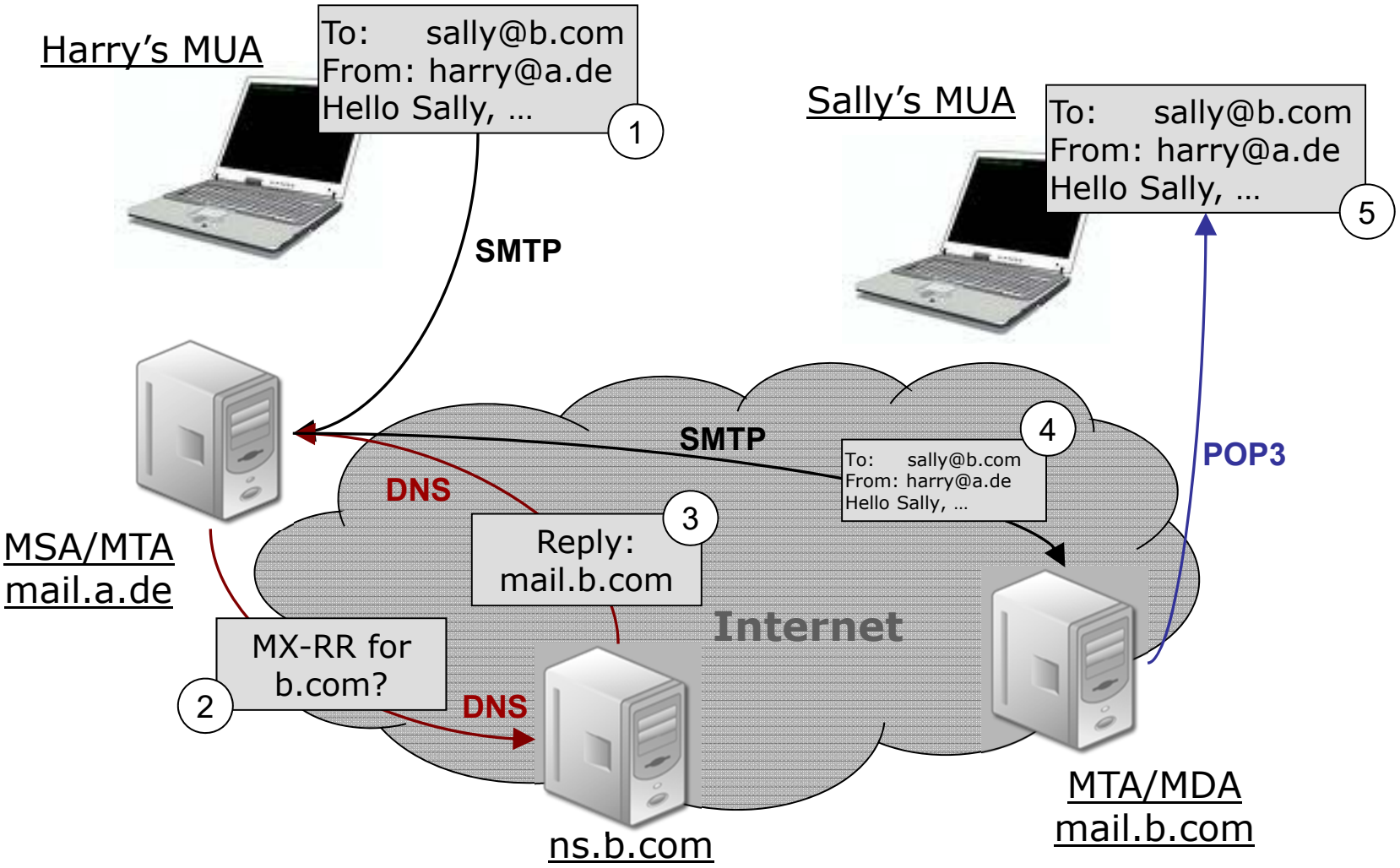

Hypertext Transfer Protocol (HTTP)

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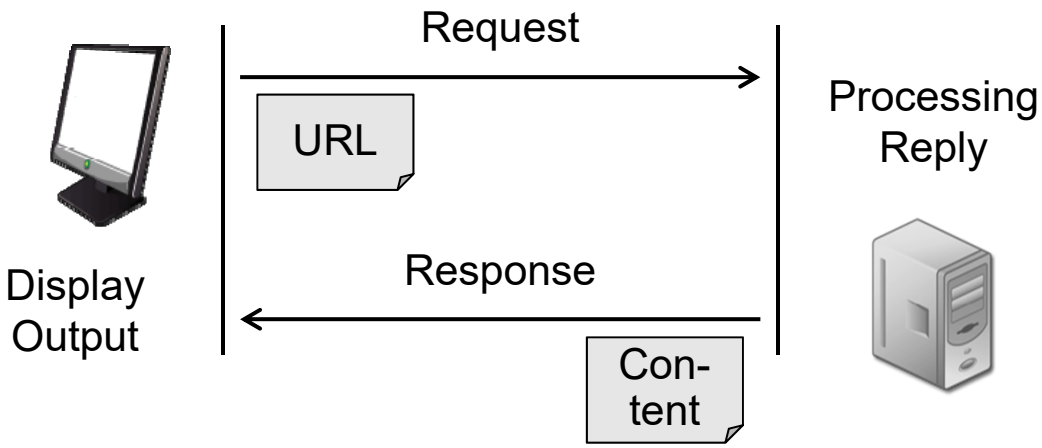
- Generic, stateless application-level protocol for distributed, collaborative, hypermedia information systems
  - Specified in RFC 2616 (HTTP/1.1):
- Request-response pattern in client-server computing model:
  - Web browser acts as client, application running on a computer and hosting a web site functions as server
  - Client submits HTTP request message to server
  - Server returns response message to client containing completion status information about the request and requested content



Hyper Text Markup Language (HTML)

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- Simple markup language used to create hypertext documents that are platform independent
  - Specified in RFC 1866 (HTML 2.0):
- HTML documents:
  - Structured by markup tags to denote semantics of text, e.g. headings, lists etc.
  - Contains hypertext links to navigate to other documents
  - Can embed script languages such as JavaScript to affect behavior of web page
  - Can include Cascading Style Sheets (CSS) to define appearance and layout of text and other material
- Example:

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD  HTML 4.0 Transitional//EN“>
<HTML>
    <HEAD>
        <TITLE>Hello World</TITLE>
    </HEAD>
    <BODY>
        <H1>Hello world again...</H1>
</BODY>
</HTML>
```

Extensible Markup Language (XML)

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- Universal format for structured documents and data first defined in the XML 1.0 Specification by the W3C:
  - Set of rules for encoding documents in machine as well as human readable form
  - Describe document's storage layout and logical structure

- XML documents
  - Textual representation with character data and markup
  - well-formed, i.e. conform to syntax rules provided in the specification
  - may be valid, i.e. contains reference to Document Type Definition (DTD) or XML Schema which declare usable elements and attributes as well as grammatical rules
  - Can be transformed with Extensible Stylesheet Language Transformation (XSLT) for the purposes of presentation or message interchange

Example: XML and XSLT

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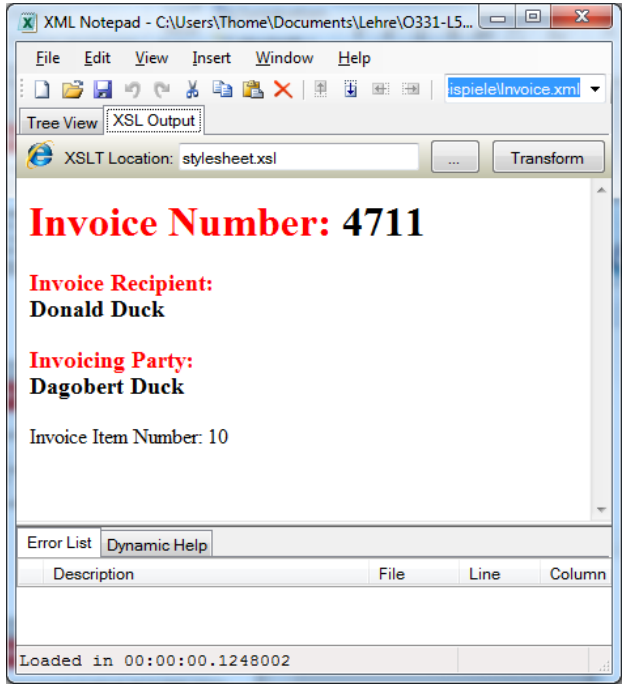
```
<?xml version="1.0" encoding="UTF-8" ?>
    <Invoice>
        <InvoiceID>4711</InvoiceID>
        <BuyerParty>Donald Duck</BuyerParty>
        <SellerParty>Dagobert Duck</SellerParty>
        <Item>
            <ItemID>10</ItemID>
            ...
        </Item>
            ...
    </Invoice>
```

XSLT



Web 2.0: Abstract

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- Term first used at the end of 2003 to refer to changes and new trends in web applications and offerings

- Refers to some new internet technologies, but mainly to new way of communicating and networking between users:
  - Leveraging the Internet as universal, standards-based platform
  - Interactive information sharing
  - Interoperability and collaboration
  - Active user participation

- “Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as a platform, and an attempt to understand the rules for success on that new platform.” [Tim O’Reilly]

Web 2.0 Application Types – Business Concepts and Revenue Models (1)

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- Software as a Service
  - Web as mobile, device independent service platform, replacing locally installed desktop applications
  - Business Concept: _____ / Revenue Model: _____

- Mashups
  - Web applications that combine several publicly available data sources to generate new services and realise added value
  - Data acquisition e.g. via Web Services, RSS feeds or widgets
  - Business Concept: _____ / Revenue Model: _____

- Blogs (Weblogs)
  - Personal diaries or journals with subjective information that manage content in a chronological manner
  - Also existent as Corporate Blogs to support communication needs within companies
  - Business Concept: _____ / Revenue Model: _____

Web 2.0 Application Types – Business Concepts and Revenue Models (2)

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- Social Software
  - Application software that allow users to interact, collaborate, and share (often private and/or business data)
  - User generated content
  - Business Concept: _____ / Revenue Model: _____

- Social Bookmarks
  - Hyperlinks to web pages that users want to share either publicly or with specific people or groups
  - Usually supplemented by descriptions to explain content of resources
  - Sometimes extra features such as ratings and comments on bookmarks, import and export features for browsers
  - Business Concept: _____ / Revenue Model: _____

Web 2.0 Application Types – Business Concepts and Revenue Models (3)

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- Wikis
  - Application software that allow easy creation and editing of interlinked web pages via web browser
  - Often used to create collaborative websites, for personal note taking, in corporate intranets, and in knowledge management systems
  - Business Concept: _____ / Revenue Model: _____

- Really Simple Syndication (RSS)
  - Web feed formats used to publish and distribute frequently updated information in a standardized format
  - Readers can subscribe to timely updates from favored websites and can aggregate feeds from many sites into one place
  - To be read using software called RSS ‘reader’ or ‘aggregator’
  - Business Concept: _____ / Revenue Model: _____

Wiederholungsfragen zu Teil 2.1 / Repetition Part 2.1

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1. Nennen Sie die vier Abstraktionsebenen des TCP/IP Modells und beschreiben Sie ihre wesentlichen Aufgaben. Nennen Sie jeweils ein konkretes Protokoll oder einen Standard pro Abstraktionsebene. / Specifiy the four abstraction layers of the TCP/IP model and describe their main tasks. Give an example of a protocol or standard for each abstraction layer. (→ Folie / Slide 39)

2. Nennen und beschreiben Sie in kurzen Stichworten die drei Komponenten, aus denen das Domain Name System (DNS) besteht. / Specify the three components of the Domain Name System (DNS) and briefly describe their purpose. (→ Folie / Slide 40)

3. Beschreiben Sie das grundlegende Kommunikationsmodell der E-Mail-Übertragung und nennen Sie die dabei zum Einsatz kommenden Protokolle. / Describe the basic model for email communication and specify the involved transfer protocols. (→ Folie / Slide 42)

Wiederholungsfragen zu Teil 2.1 / Repetition Part 2.1

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4. Nennen Sie vier Anwendungstypen, die das Web 2.0 kennzeichnen. Geben Sie jeweils ein praktisches Beispiel und nennen Sie das damit verbundene Geschäftskonzept und Erlösmodell. / Specify four Web 2.0 application types. Give a practical example for each application type and specify the related business concept and revenue model.
(→ Folien / Slides 50, 51, 52)

Übung zu Teil 2.1

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- Erika und Max Mustermann haben sich dazu entschieden, einen eShop zu realisieren. Hierdurch wollen Sie ihren Kunden die Möglichkeit geben, Waren aus ihrem Einzelhandelsgeschäft über das Internet zu bestellen und für einen selbstgewählten Abholtermin kommissionieren zu lassen.
- Die Bestellbestätigung an die Kunden soll per E-Mail, die Bezahlung der Waren bei Abholung an der Kasse des Einzelhandelsgeschäftes erfolgen. Dazu soll der eShop die Möglichkeit bieten, die Bestelldaten an das im Geschäft befindliche Kassensystem weiterzuleiten. Darüber hinaus soll das Kassensystem eine B2B-Schnittstelle erhalten, über die beim zentralen Lieferanten von Erikas und Max Einzelhandelsgeschäft automatisch Nachbestellungen erfolgen können.
- Bilden Sie 3er- oder 4er-Gruppen und unterstützen Sie Erika und Max, indem Sie ein einfaches Konzept für die erforderliche Informations- und Kommunikationsinfrastruktur des Gesamtsystems erstellen.
  - Berücksichtigen Sie hierbei, aufbauend auf den involvierten eBusiness Teilnehmern und den zuvor ermittelten Geschäftstransaktionen (→Übung zu Teil 1), insbesondere die in der Vorlesung vorgestellten Auszeichnungssprachen sowie ausgewählte Protokolle und Netzwerke aus dem TCP/IP Modell.

Exercise Part 2.1

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- Jane and John Doe have decided to realize an eShop. Their customers shall be able to order goods from their retail store via the Internet and specify a pick-up date and time. The ordered goods shall then be prepackaged in the store for the customers.

- The order confirmation shall be sent to the customers by email, the payment of the goods shall take place at the checkout counter in the retail store when picking up the goods. For this, the eShop shall offer the possibility to transfer the order data to the cash register in the retail store. Furthermore the cash register shall obtain a B2B interface for automatically sending replenishment orders to the main vendor of Jane's and John's retail store.

- Work together with 3 or 4 other students and help Jane and John to define a simple concept for the required communication infrastructure of their project.
  - Consider in particular, based on the participants and business transactions from the previous exercise (part 1), the markup languages which have been introduced in this lecture as well as relevant protocols and networks of the TCP/IP model.

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2 eBusiness Technology

Three-Tier Client / Server Architecture

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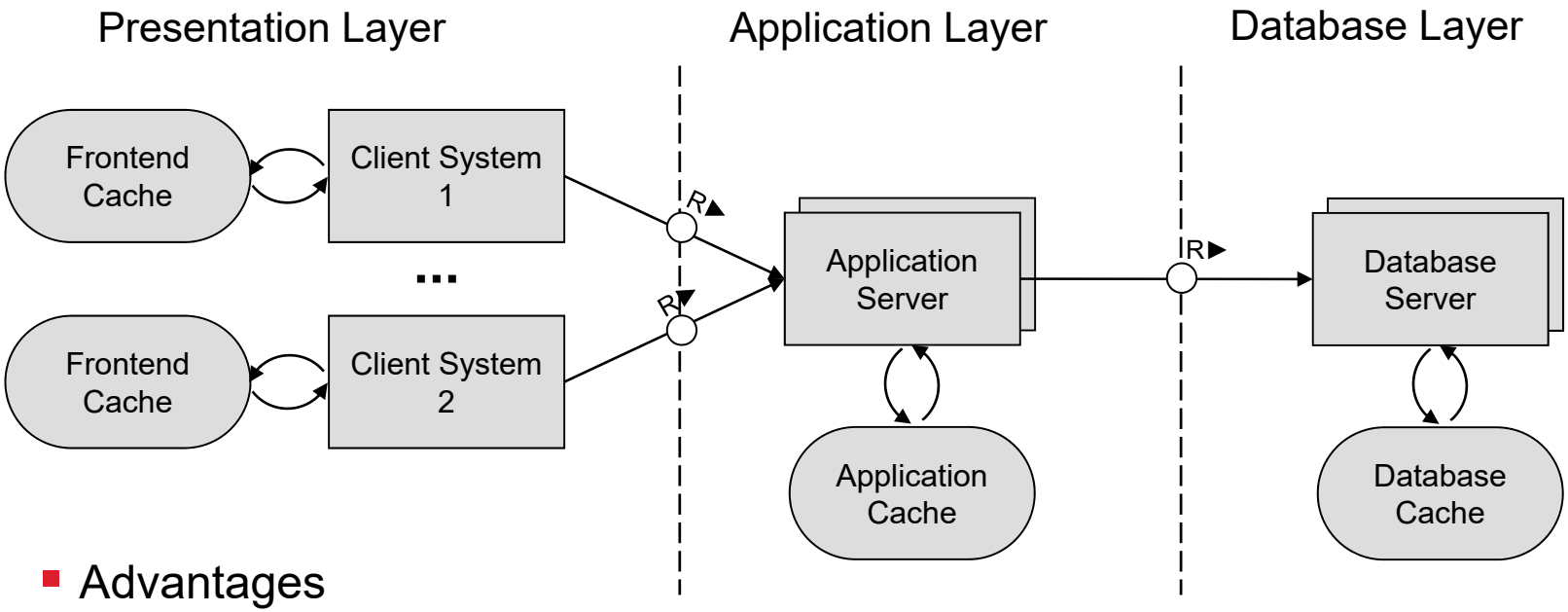

- Advantages
  - Load removal from database server by shifting tasks
  - High system scalability due to load-balancing with additional application servers
- Disadvantages
  - Strong requirements for system administration und maintenance
  - High complexity of application architecture und application logic

Four-Tier Client / Server Architecture of Web Applications

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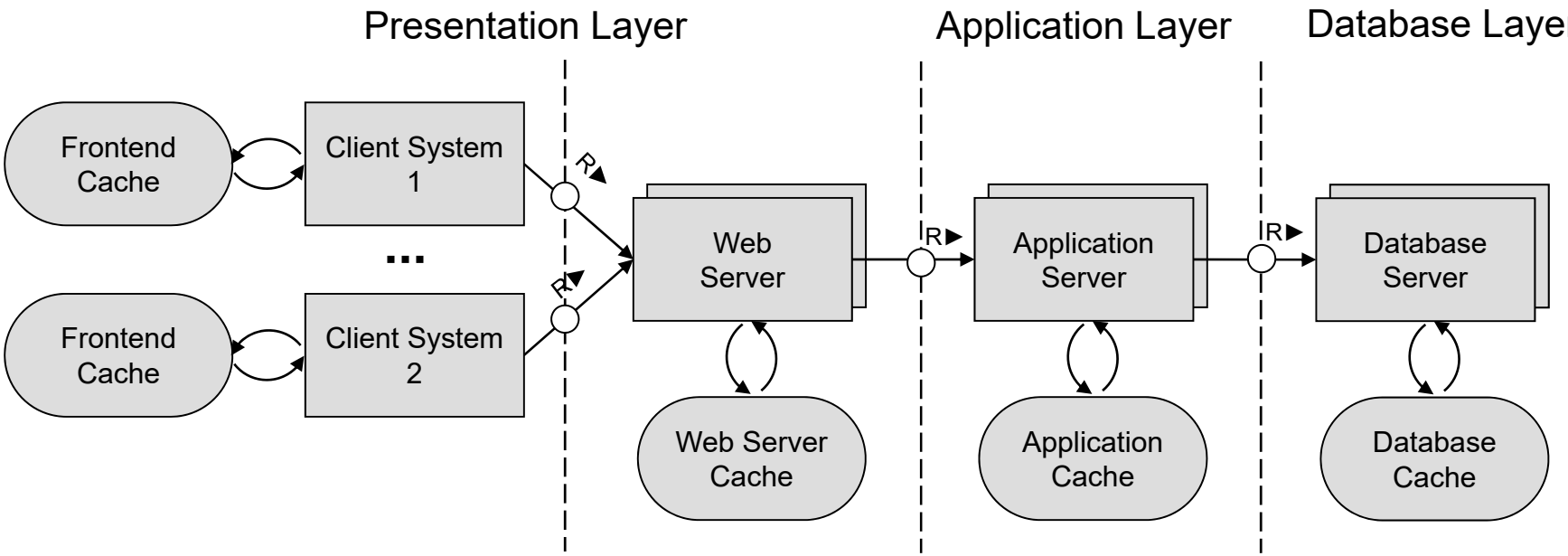

- Extension of the Three-Tier Architecture
- Usage for Web Applications with additional load-balancing mechanisms in Web Server layer

Example: Four-Tier Architecture of an Electronic Marketplace

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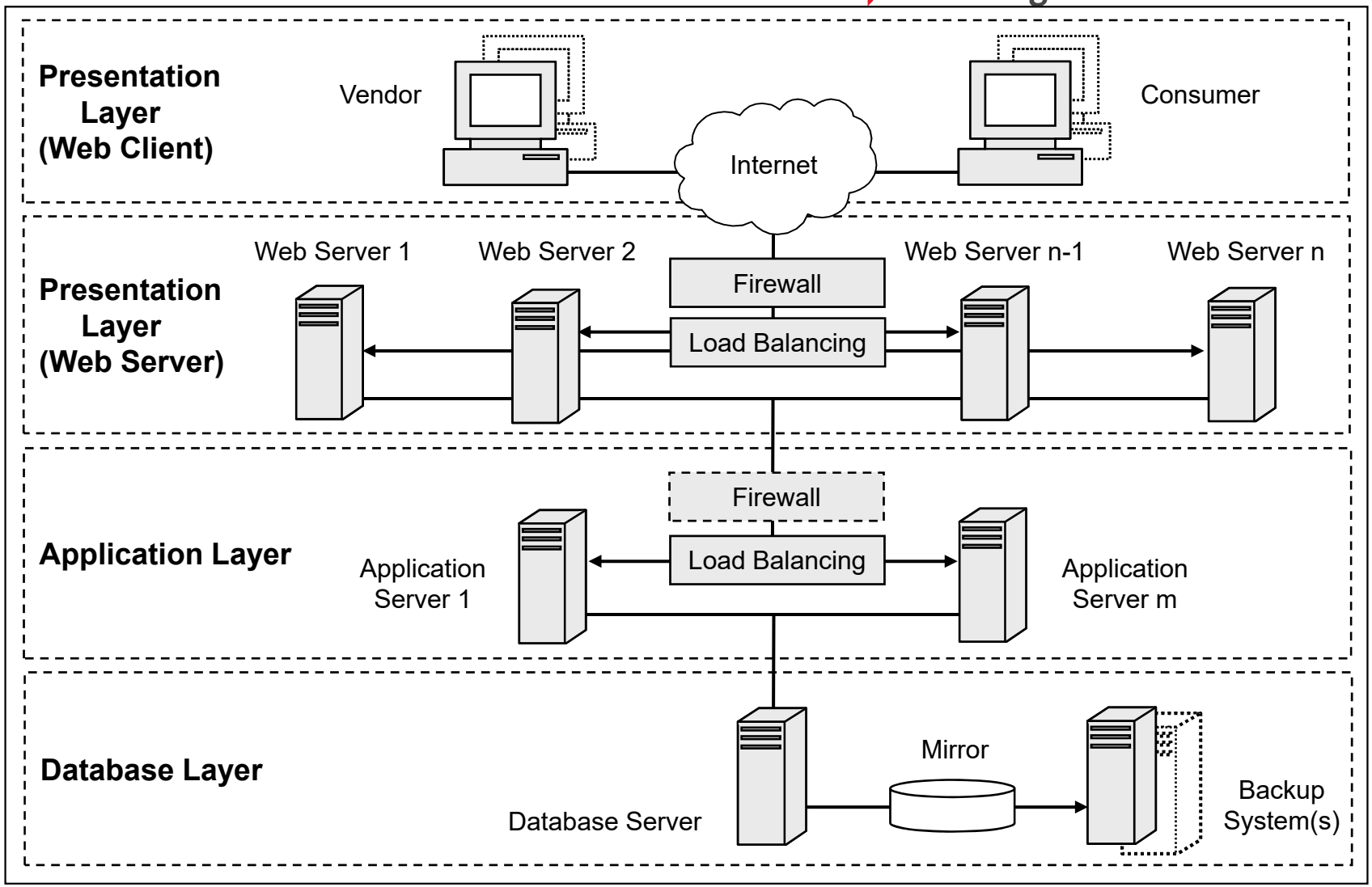

Peer-to-Peer Architectures

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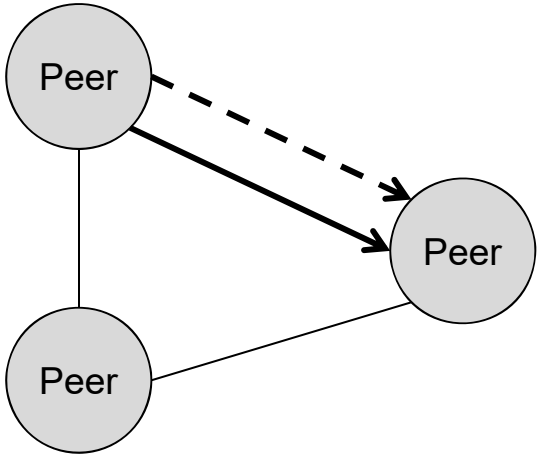
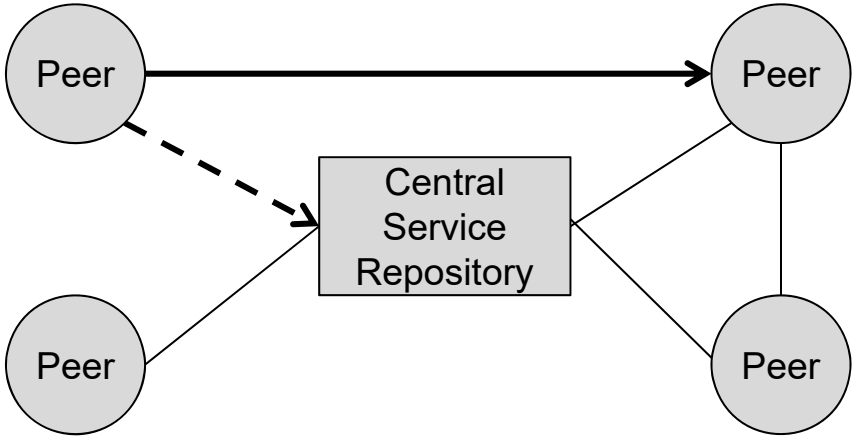
- Pure Peer-to-Peer Systems



- Hybrid Peer-to-Peer Systems



- - - -> Service Request ——> Service Consumption

Temple of Service Oriented Architecture

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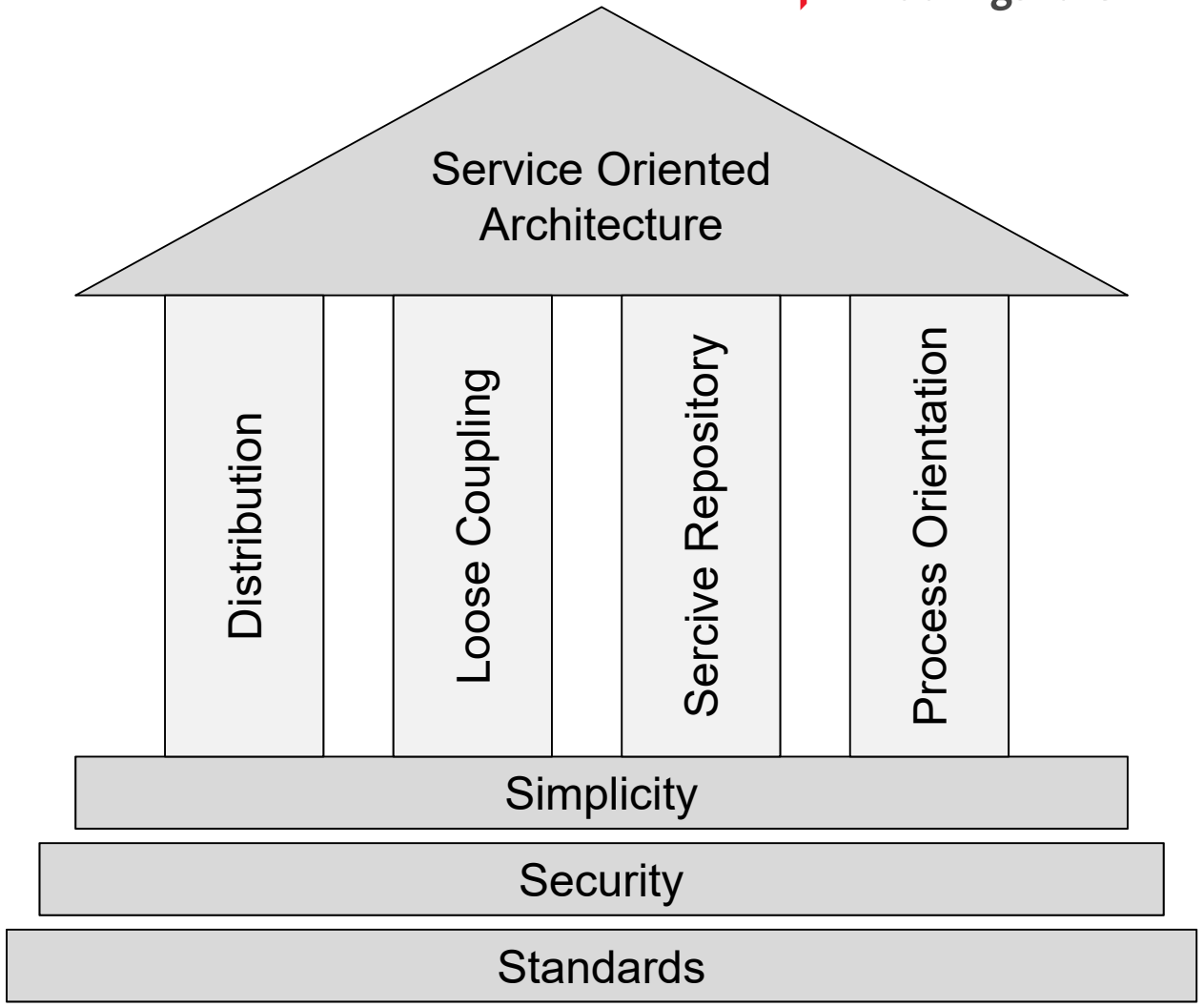

Based on Melzer (2008), p. 13.

Example: Enterprise Service Architecture

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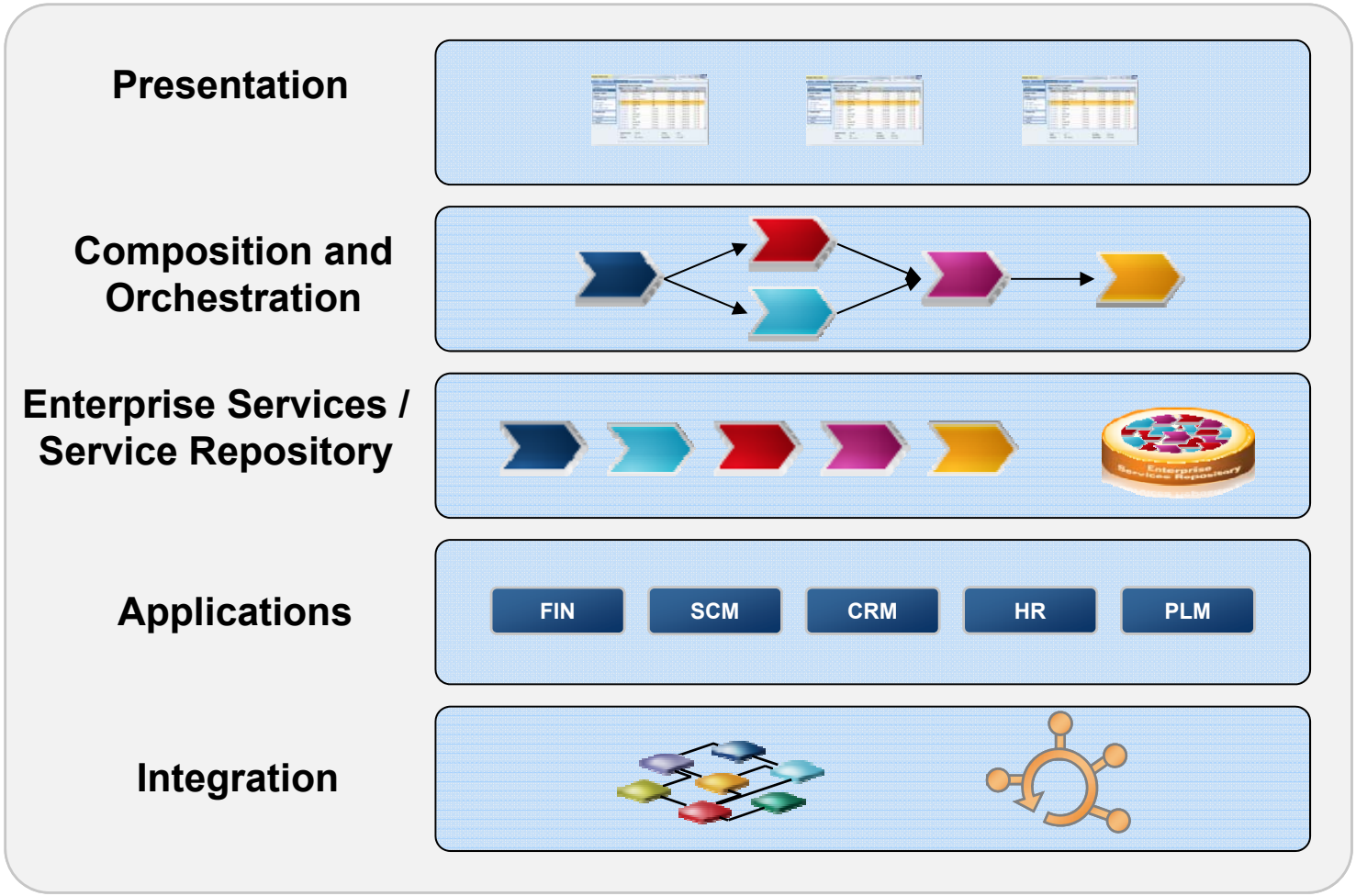

Web Service Standards

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- Simple Object Access Protocol (SOAP)
  - Specification for Web service based communication
    - Independent from transport protocol (e.g. HTTP, SMTP, FTP)
  - XML based message format with envelope, header and body
- Web Services Description Language (WSDL)
  - XML based language for description of Web service interfaces
    - → How to find and how to communicate with Web service
  - Abstract description on functional level
    - esp. interface with operations
  - Practical description on technical level
    - esp. binding and service
- Universal Description, Discovery and Integration (UDDI)
  - Directory service for publication and retrieval of Web services:
    - White Pages with company related information of service providers
    - Yellow Pages with industry sector related information of service providers
    - Green Pages and Service Type Registration with service related information

Roles and Actions in a Service Oriented Architecture

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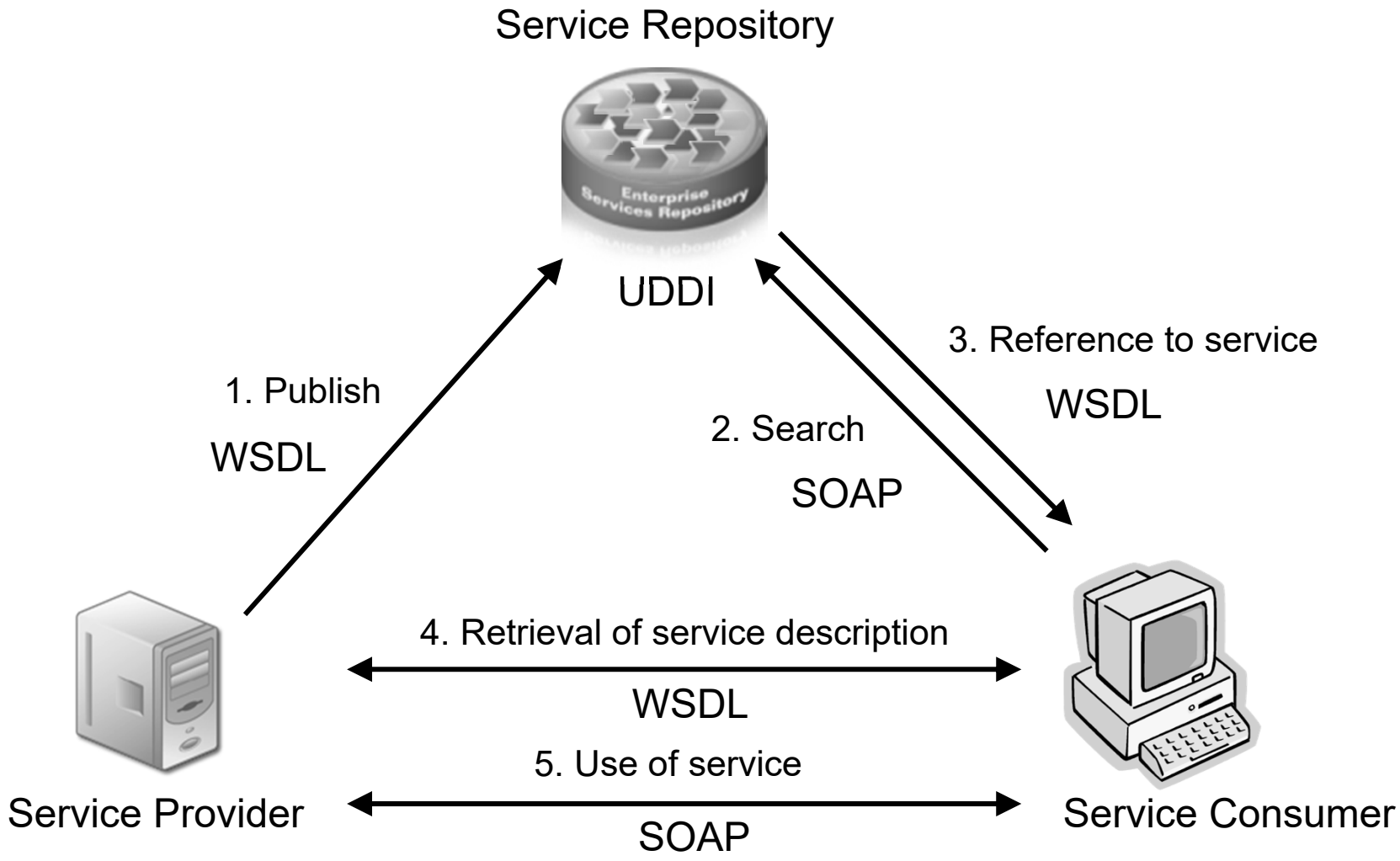
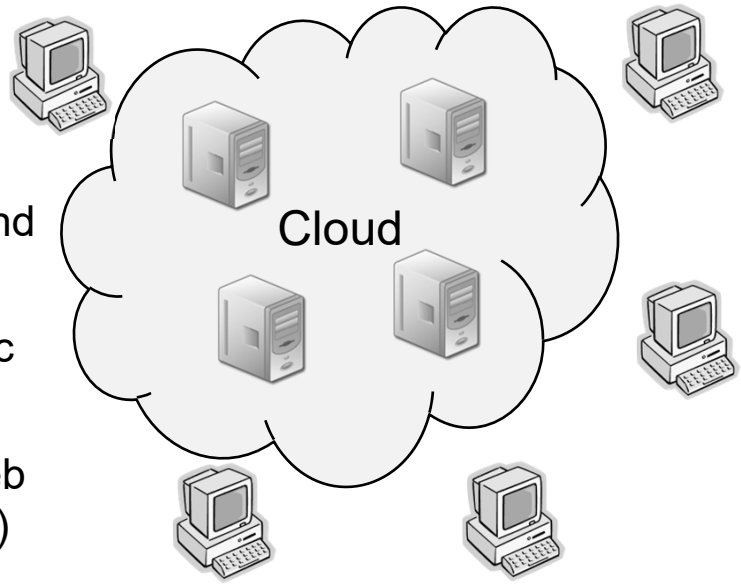


Based on Melzer (2008), p. 56.

- Development and operations model, enabling real-time delivery of software products, services and solutions over the Internet
  - e.g. data storage, email, and office products
  - but also complete business applications such as ERP, CRM, and SCM
- Usually based on pay-per-use business models when service is offered by independent provider or to external customers
- Technical realisation:
  - Provisioning of infrastructure resources (hardware, storage and system software) and applications in a service-oriented manner
  - Main features are virtualization and dynamic scalability on demand
  - Cloud services are consumed either via Web browser or via a defined API (Web services)



Common Layers of Cloud Computing

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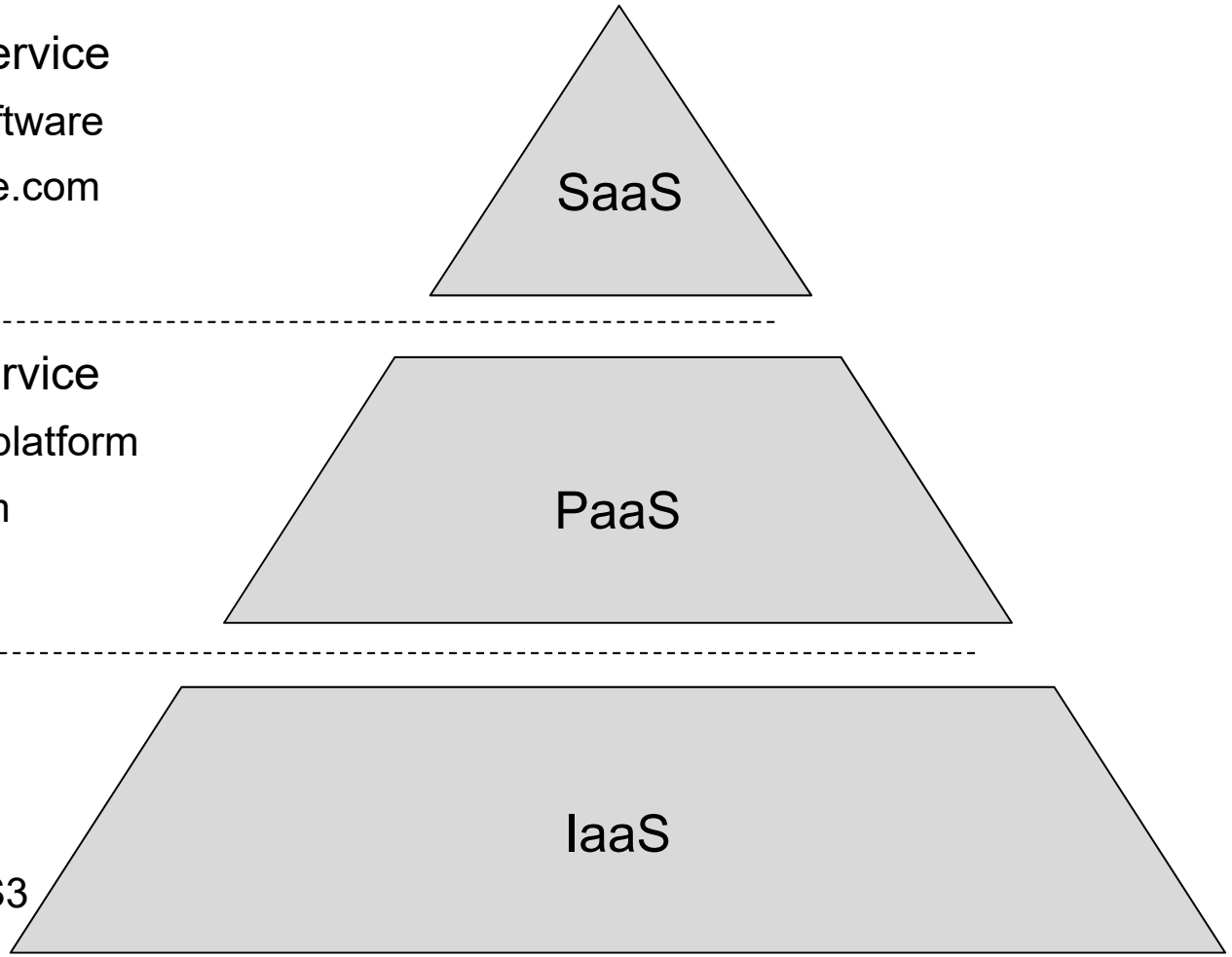
- Software as a Service
  - Application software
  - e.g. Salesforce.com
- Platform as a Service
  - Development platform
  - e.g. Force.com
- Infrastructure as a Service
  - Virtual Server
  - e.g. Amazon S3



Types of Cloud Computing

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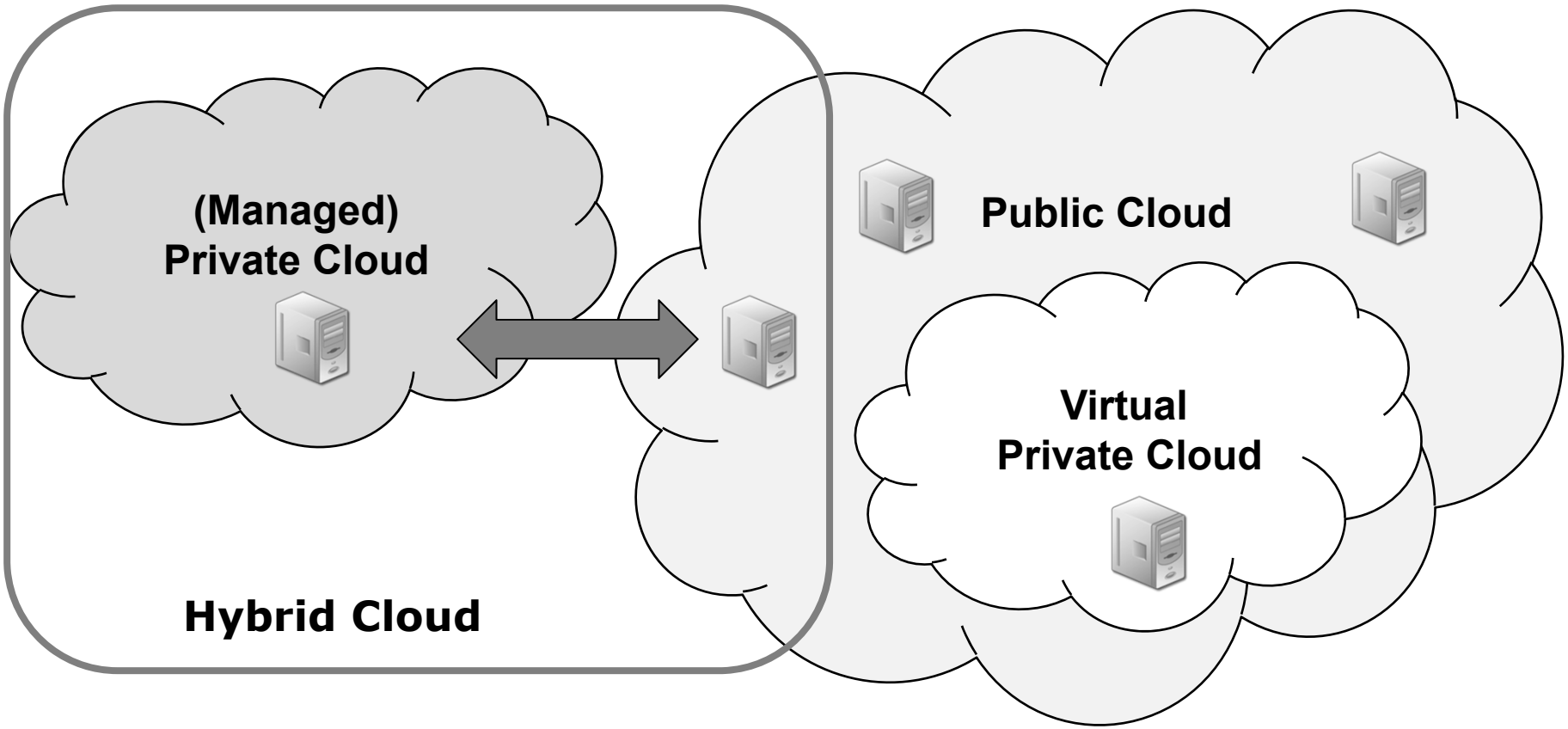

Typical eShop Architecture

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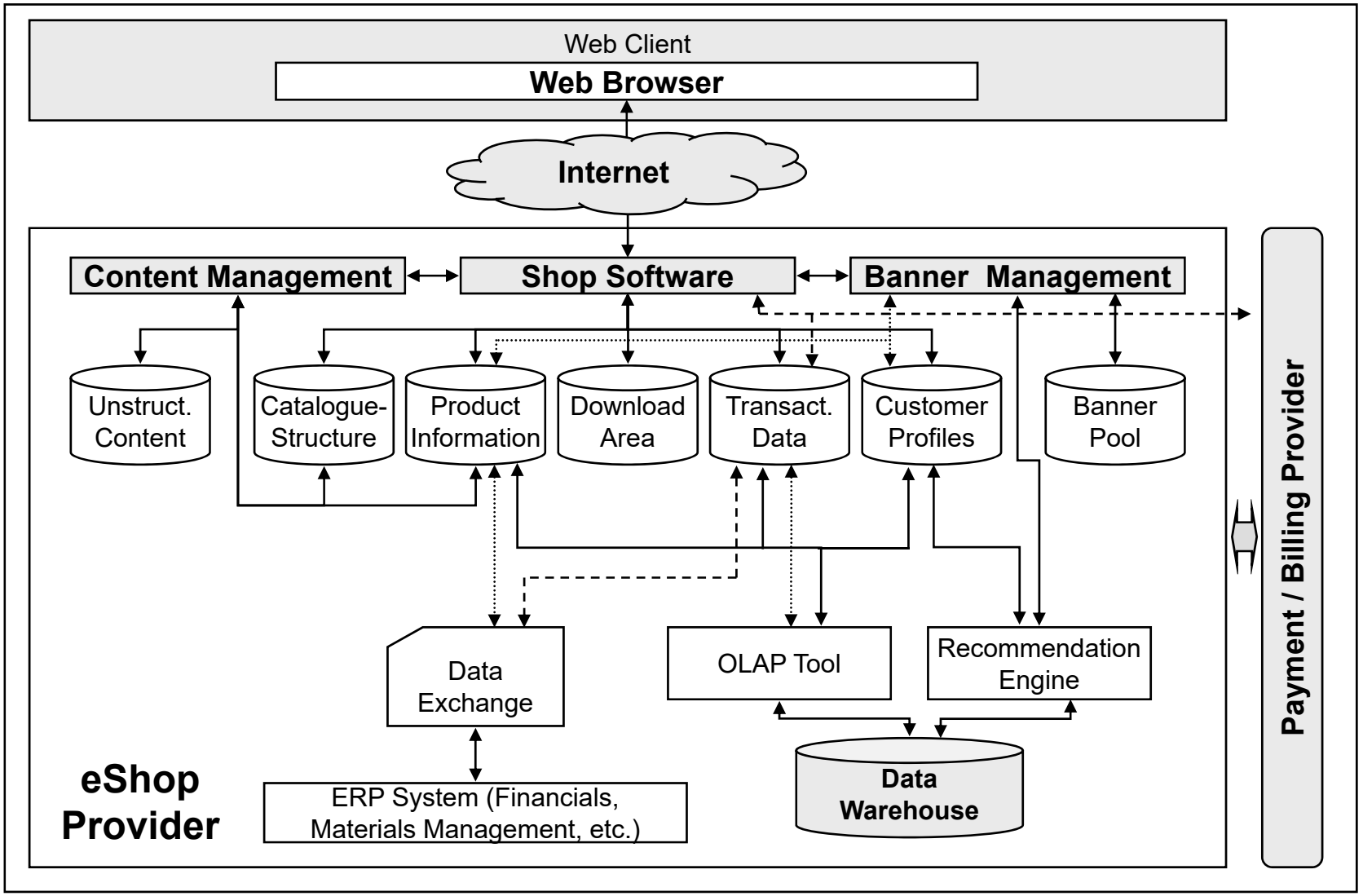

Based on Merz (2002), p.409.

Wiederholungsfragen zu Teil 2.2 / Repetition Part 2.2

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1. Nennen Sie die Schichten einer „3-Schichten Client / Server Architektur“ und beschreiben Sie kurz die wesentlichen Aufgaben dieser Schichten. / Specify the layers of a three-tier client / server architecture and briefly describe the main tasks of those layers. (→ Folie / Slide 58)

2. Nennen und beschreiben Sie 4 Merkmale, die eine Service-orientierte Architektur kennzeichnen. / Specify and describe 4 basic characteristics of a service-oriented architecture. (→ Folie / Slide 62)

3. Was versteht man unter Cloud Computing? Welche 3 technischen Ebenen des Cloud Computings werden i.d.R. unterschieden? / Explain the term Cloud Computing. Which 3 common layers of Cloud Computing can usually be distinguished? (→ Folien / Slides 66, 67)

Übung zu Teil 2.2

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- Auf Basis der Informations- und Kommunikationsinfrastruktur des eShops wollen Erika und Max Mustermann nun die Architektur für das benötigte Anwendungssoftware-System festlegen, um dieses von einem kleinen Softwareunternehmen aus der Nachbarschaft programmieren zu lassen.

- Da Erika und Max von dem aktuellen Trend des „Cloud Computing“ gehört haben, möchten Sie ihren eShop als „Software-as-a-Service“-Anwendung realisieren lassen, um keine zusätzliche Soft- und Hardware anschaffen zu müssen. Dabei sollen die Verbindungen zwischen eShop und lokalem Kassensystem sowie zwischen lokalem Kassensystem und zentralem Belieferer von Erikas und Max Einzelhandelsgeschäft mit Hilfe von „Enterprise Services“ erfolgen.

- Bilden Sie 3er- oder 4er-Gruppen und unterstützen Sie Erika und Max, indem Sie eine einfache Software System-Architektur für den eShop erstellen.
  - Berücksichtigen Sie hierbei insbesondere die in der Vorlesung vorgestellten Client/Server-Architekturen sowie die verschiedenen Architekturkonzepte und –beispiele für betriebliche Anwendungssysteme.

Exercise Part 2.2

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- Based on the eShop communication infrastructure Jane and John Doe plan to specify the architecture of the required application software, in order to be able to task a small software company from the neighborhood with the programming.
- Having heard of the current Cloud Computing trend, Jane and John would like to realize their eShop as „Software-as-a-Service“- application, in order to avoid purchasing additional soft- and hardware. In more details the connections between eShop and local cash register as well as between the cash register and Jane’s and John’s main supplier shall be realized by so called „Enterprise Services“.
- Work together with 3 or 4 other students and help Jane and John to define a simple software architecture for their eShop.
  - Consider in particular the Client/Server architectures as well as the different architectural concepts and examples of business application systems, as introduced in this lecture.

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2 eBusiness Technology

Excursus: The CAP Theorem

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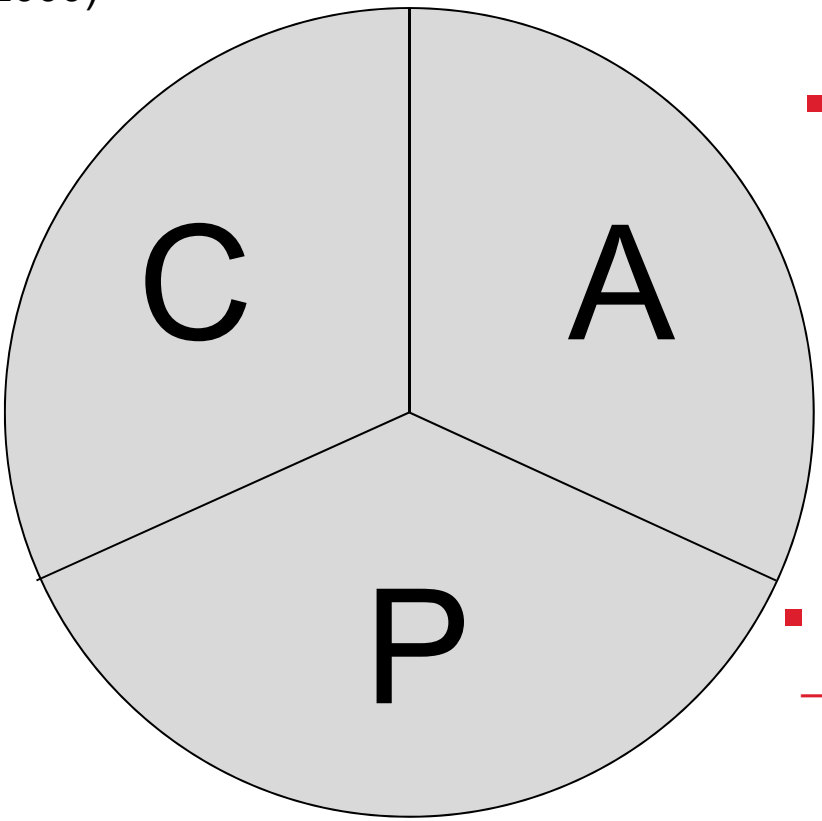
- In distributed systems only two of the following three characteristics can be realized simultaneously, not all three.
  (Eric A. Brewer, 2000)

- **C**onsistency
  - Consitency of the distributed data



- **A**vailability
  - System availability in terms of acceptable response times

- **P**artition Tolerance
  - Tolerance towards network partitioning in case of breakdown of network components

Example: Behavior of a Distributed Application System Without Network Partitioning

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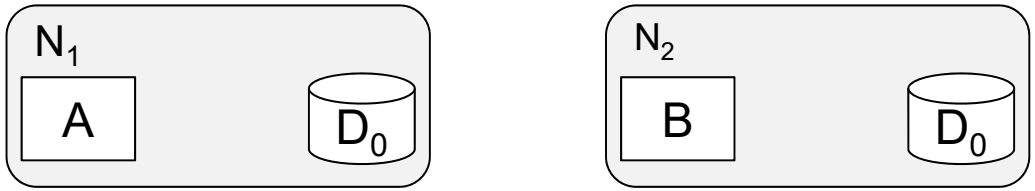
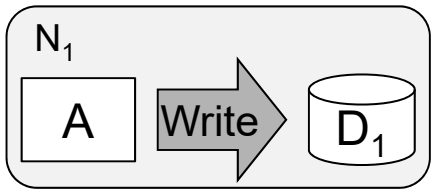
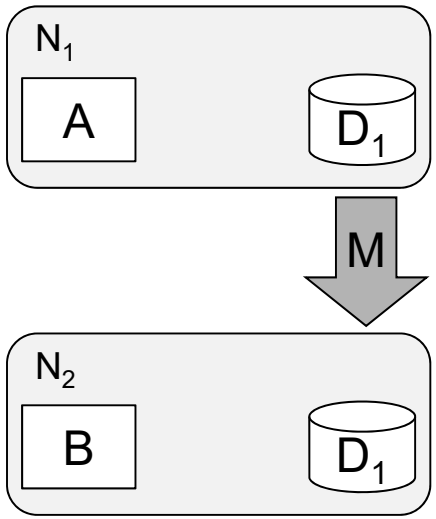
- Initial Situation



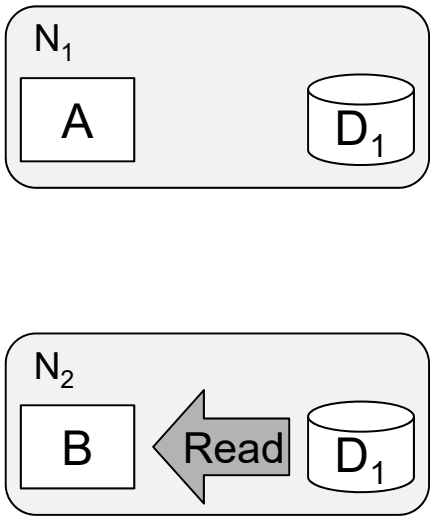
- Step 1



- Step 2



- Step 3



Legend: N_1, N_2: Networks; A, B: Applications, D_0, D_1: Data states, M: Message

Example: Behavior of a Distributed Application System With Network Partitioning

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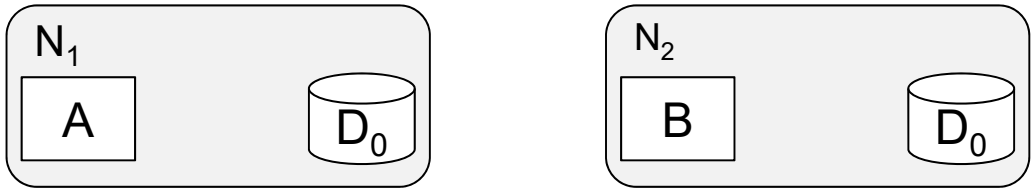
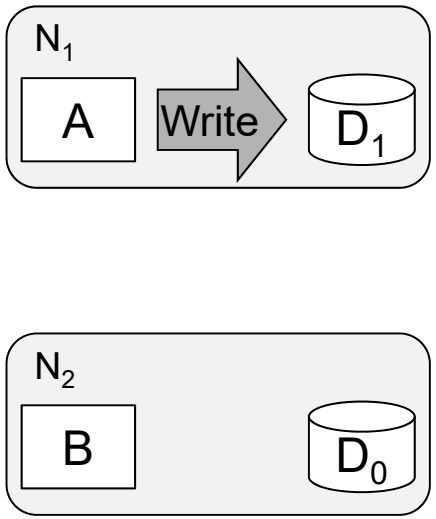
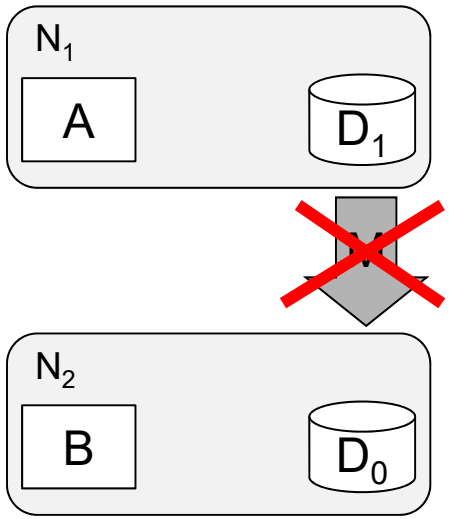
- Initial Situation



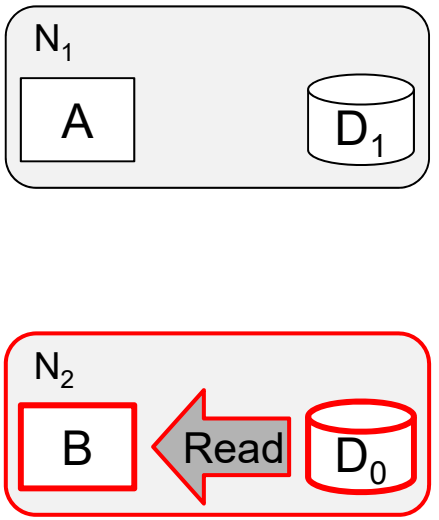
- Step 1



- Step 2



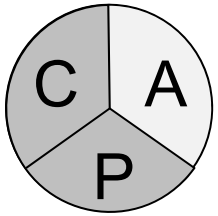
- Step 3



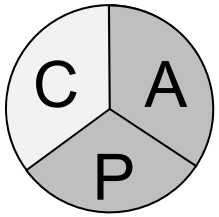
Legend: N_1, N_2: Networks; A, B: Applications, D_0, D_1: Data states, M: Message

Classification of Distributed Application Systems Considering the CAP Theorem

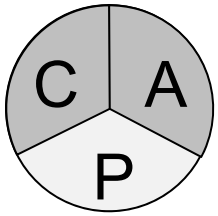
- CP Systems
  - Abandonment of permanent availability in case of network partitioning
    - Only that part of network, that can be held consistent, stays available
  - After network partitioning, first the consistency of previously not available network nodes and then their availability will be restored



- AP Systems
  - Abandonment of immediate consistency in case of network partitioning
    - All parts of network stay available, however replies of the different nodes are not necessarily consistent
  - After network partitioning, consistency of all network nodes will be restored



- CA Systems
  - Guarantee of availability and immediate consistency by exclusion of a network partitioning



Impact of the CAP Theorem on eBusiness Solutions

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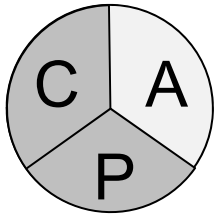
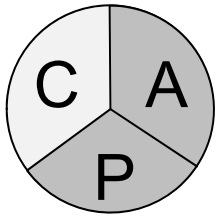
- Prevention of network partitioning (P) by avoiding a breakdown of network components

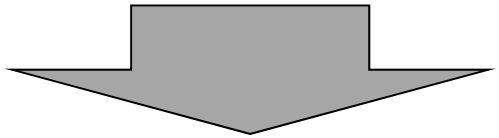
  → Not realistic for eBusiness solutions with distributed application systems

- Abandonment of permanent availability (A) of all network nodes in case of network partitioning



- Abandonment of immediate consistency (C) of all network nodes in case of network partitioning





Choice between C and A, in order to find ideal compromise for considered eBusiness solution

Example eCommerce: User Behavior

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- Google:
  - ½ a second extended response time for search results leads to reduction of data traffic of about 20%
- Amazon:
  - 100 milliseconds delayed response time leads to 1% loss in sales

- Results of further investigations:
  - About 50% of Internet users expect response times of below 2 seconds
  - Most visitors leave a website, if response time exceeds 3 seconds
  - 80% of internet user, who had problems with performance of a website, will avoid this website permanently

⇨ Availability (A) is more important than consistency (C)

Example Online Banking: Security Matters!

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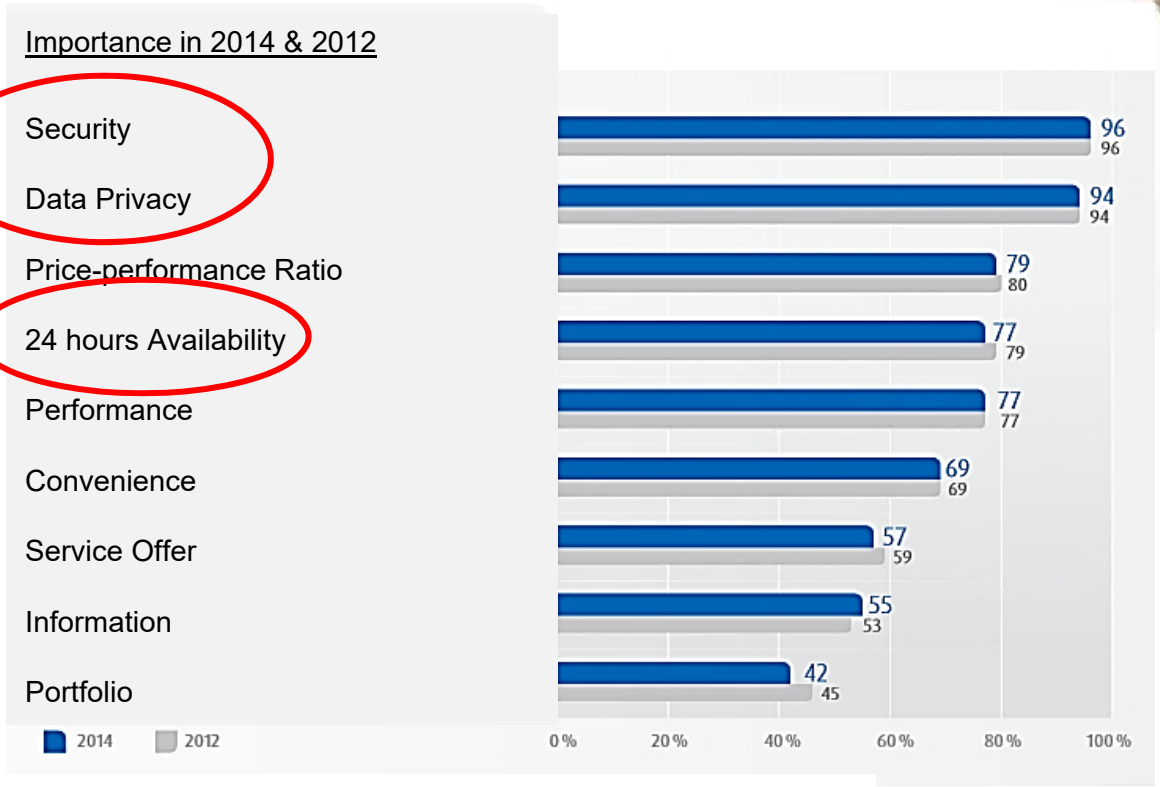
- Survey Online Banking 2014



Source: Initiative D21 e.V.; FIDUCIA IT AG (Ed.)

Consistency (C) is more important than availability (A)

Abandonment of Immediate Consistency: Realization of AP Systems

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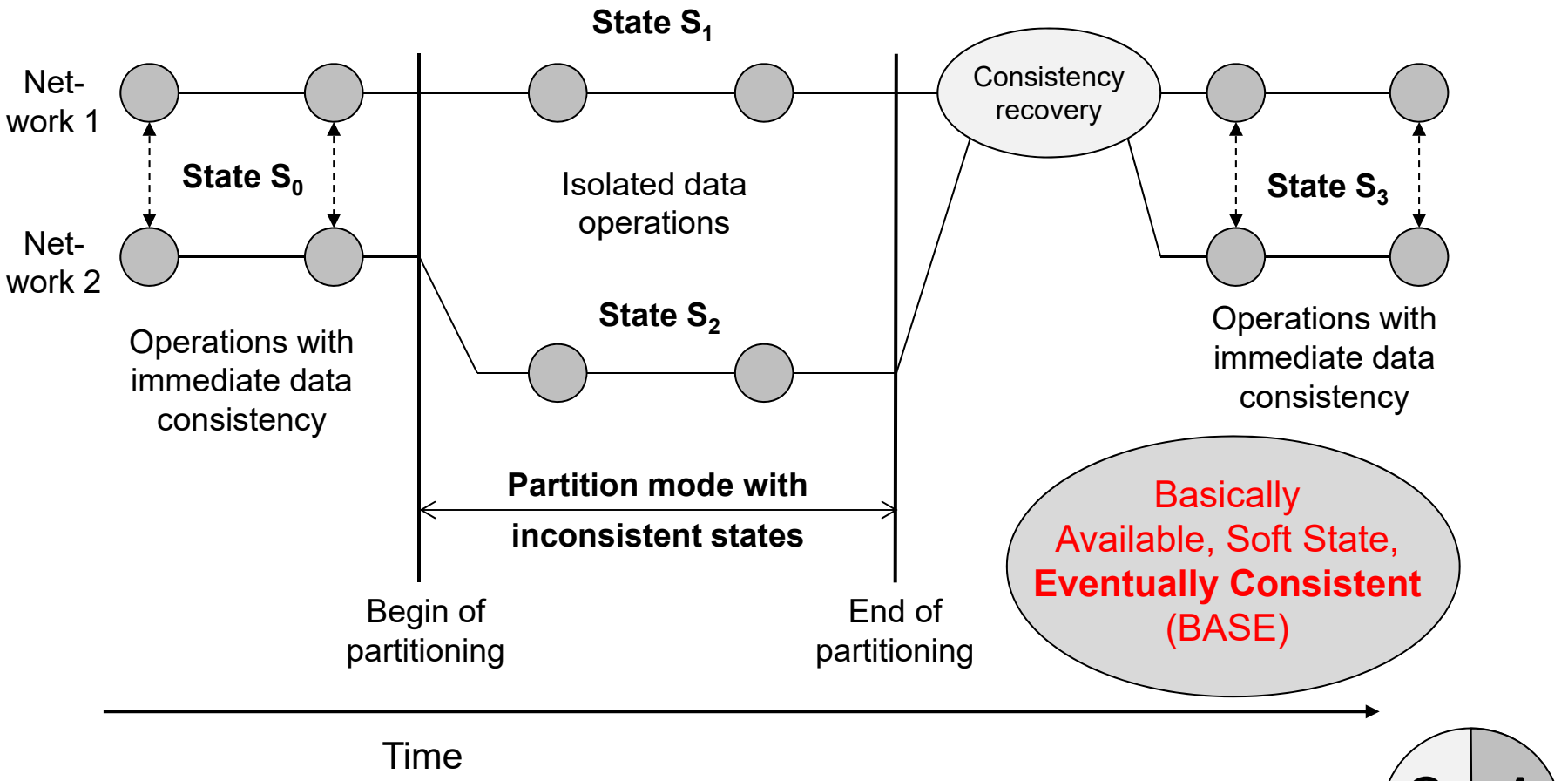

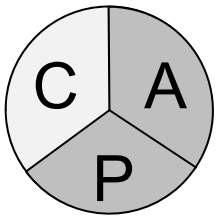

Example eCommerce: Amazon‘s Shopping Cart Service

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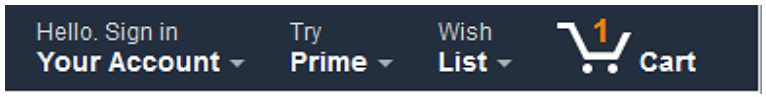
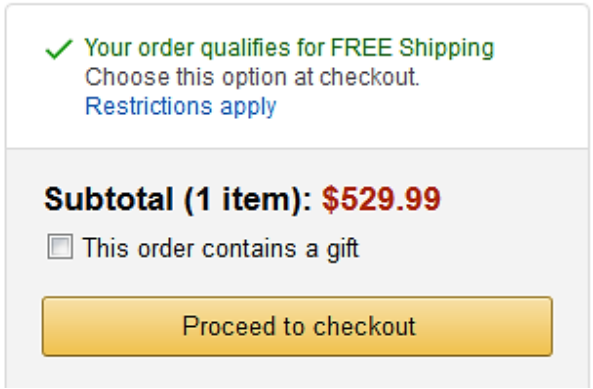
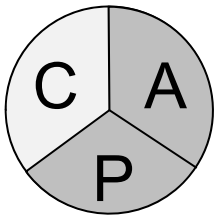
- Shopping cart can always be filled, even in case of network partitioning





- Conflict resolution, if several shopping carts of the same user have been filled with different content, e.g.:
  - Timestamp based → „Newest shopping cart is winning!“
  - Application based → Logic that merges the content of the shopping carts



Abandonment of Permanent Availability : Realization of CP Systems

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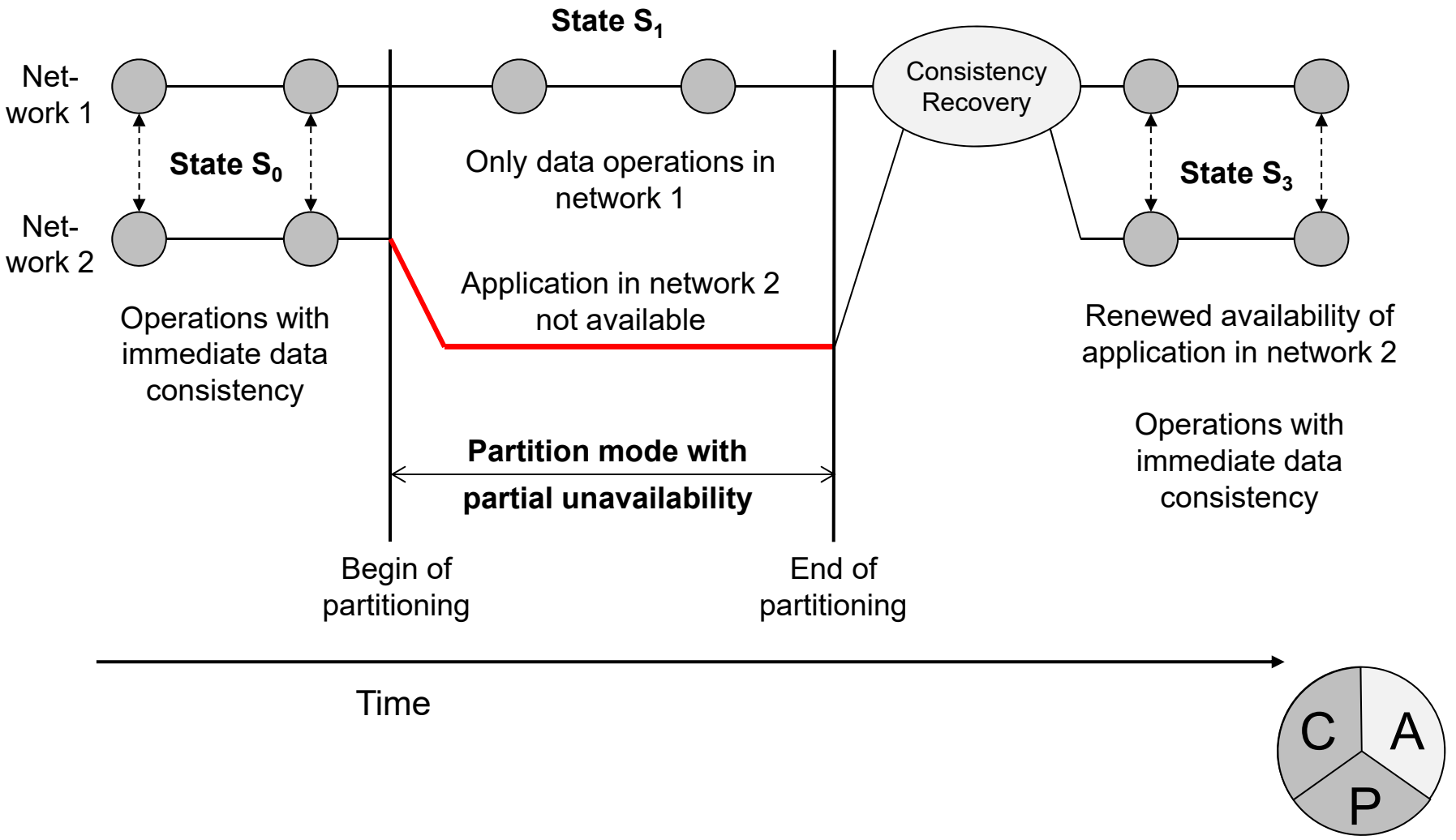

Example: Online Banking

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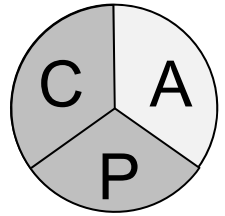
- Temporary unavailability of banking services

We are sorry …

Our online banking system is currently not available. We will offer this service again as soon as possible.

Thank you for your understanding!

Back



Wiederholungsfragen zu Teil 2.3 / Repetition Part 2.3

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1. Erläutern Sie das CAP-Theorem und zeigen Sie die Bedeutung für die Konzeption von E-Business Lösungen auf. / Describe the CAP theorem and explain its impact on the design of eBusiness solutions (→ Folie / Slide 74, 78)

2. Erläutern Sie das Grundkonzept eines sog. AP-Systems und geben Sie ein praktisches Einsatzbeispiel für ein solches System. / Explain the basic concept of a so called AP system and give a practical example for the usage of such a system. (→ Folie / Slide 81, 82)

3. Erläutern Sie das Grundkonzept eines sog. CP-Systems und geben Sie ein praktisches Einsatzbeispiel für ein solches System. / Explain the basic concept of a so called CP system and give a practical example for the usage of such a system. (→ Folie / Slide 83, 84)

Übung zu Teil 2.3

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- Die einzelnen Komponenten der in Übung 2.2 entworfenen Software-Architektur für den eShop von Erika und Max Mustermann sollen hinsichtlich ihrer Anforderungen an Verfügbarkeit, Konsistenz und Netzwerkpartitionierung analysiert werden.

- Bilden Sie 3er- oder 4er-Gruppen und helfen Sie Max und Erika für jede Komponente des verteilten Anwendungssystems die jeweils erforderliche Systemklassifizierung festzulegen.
  - Berücksichtigen Sie hierbei insbesondere die in der Vorlesung vorgestellte Klassifikation verteilter Anwendungssysteme unter Berücksichtigung des CAP-Theorems sowie deren Auswirkungen auf die Konzeption von eBusiness Lösungen.
  - Begründen Sie Ihre Entscheidung!

Exercise Part 2.3

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- The software architecture components of Jane and John Doe‘s eShop shall be analyzed with respect to their requirements concerning availability, consistency and network partitioning.

- Work together with 3 or 4 other students and help Jane and John to specify the required system classification for each component of the distributed application system.
  - Consider in particular the classification of distributed application systems with respect to the CAP theorem as well as their impact on the design of eBusiness solutions.
  - Give reasons for your decision!

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2 eBusiness Technology

Auto ID Technologies

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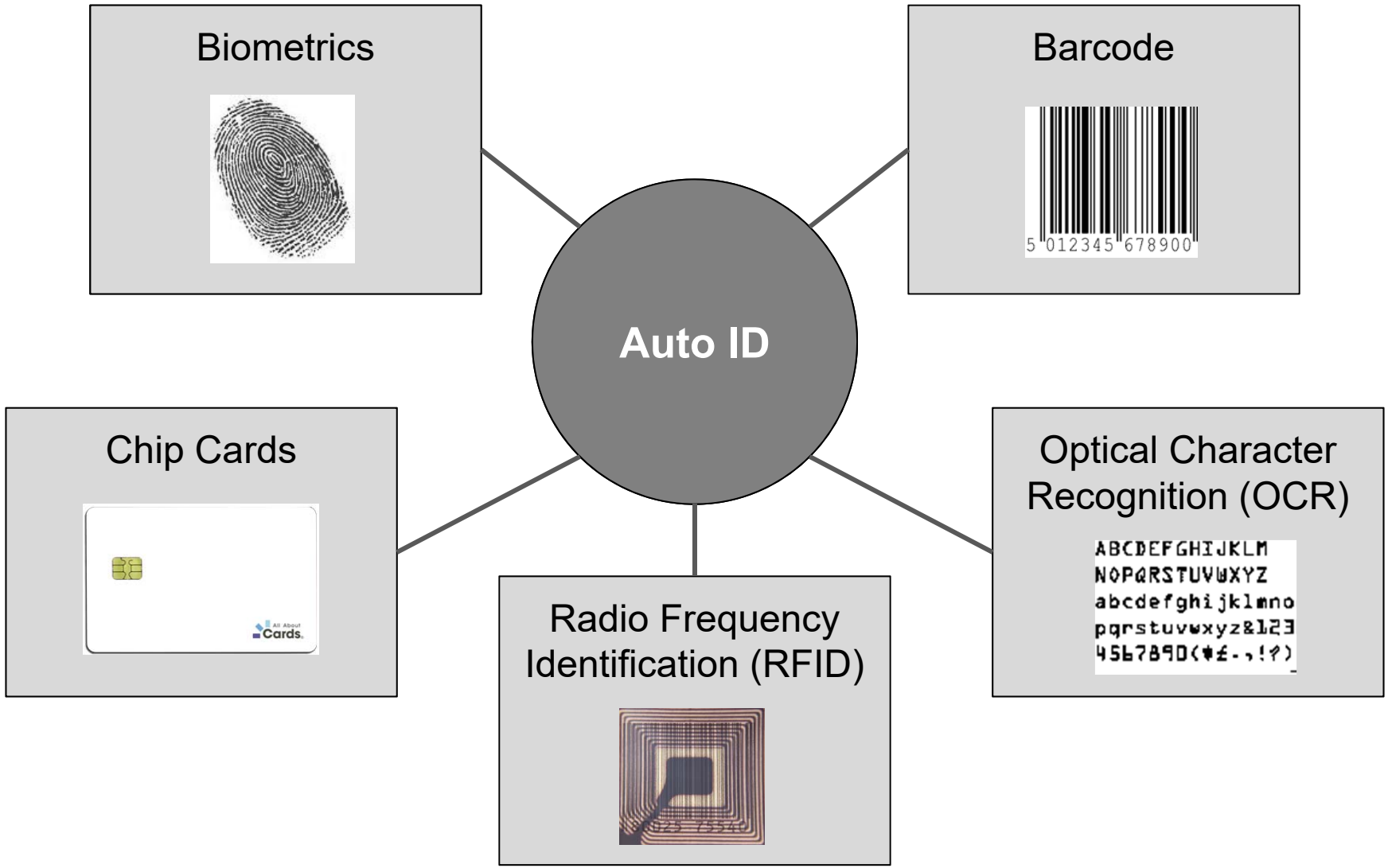

Examples of Barcode Types

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Linear Barcodes (GS1 EAN / UPC Family)

1 D

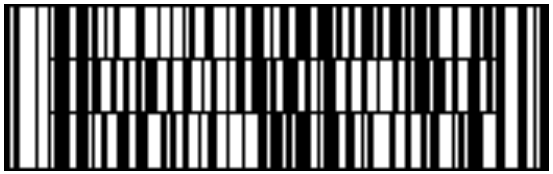
2 D

Matrix Codes

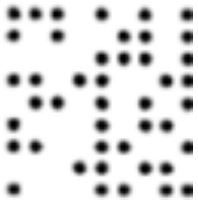
Composite Codes

3 D

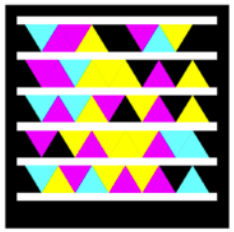
Staple Codes



Dot Codes



Color Barcodes



GTIN (Global Trade Item Number)

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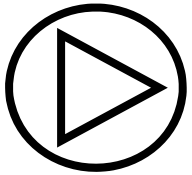
- Harmonization of EAN.UCC standards (UCC-12, EAN/UCC-8, EAN/UCC-13, and EAN/UCC-14) for unique identification of trade items
- Numerical data structure with fix length of 14 digits

Numbering Structures	Global Trade Item Number (GTIN)													
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}	T_{13}	T_{14}
GTIN-14	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}
GTIN-13	0	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}
GTIN-12	0	0	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}
GTIN-8	0	0	0	0	0	0	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8



Uniform Code Council (UCC): GTIN Implementation Guide (2002).

GLN (Global Location Number)

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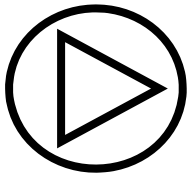
- Unique identification key for locations such as:
  - Functional entities
    - e.g. purchasing department, returns department
  - Physical entities
    - e.g. warehouse or gate
  - Legal entities or trading partners
    - e.g. buyers, sellers, freight forwarders
- Numerical data structure with fix length of 13 digits

GS1 Company Prefix >				< Location Reference								Check Digit
N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}



Uniform Code Council (UCC): GLN Implementation Guide (2002).

SSCC (Serialized Shipping Container Code)

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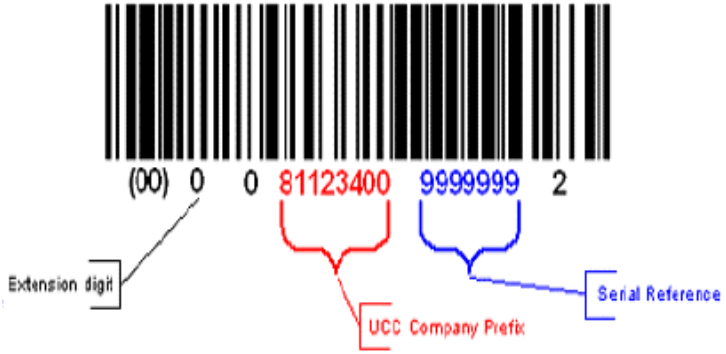
- GS1 standard for unique identification of loading units
- Numerical data structure with fix length of 18 digits



Example of an SSCC with an 8-digit UCC Company Prefix

Extension Digit	GS1 Company Prefix >							< Serial Reference								Check Digit
N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}	N_{15}	N_{16}	N_{17}	N_{18}

Uniform Code Council (UCC): SSCC Implementation Guide (2002).

GS1-128 (Formerly EAN128)

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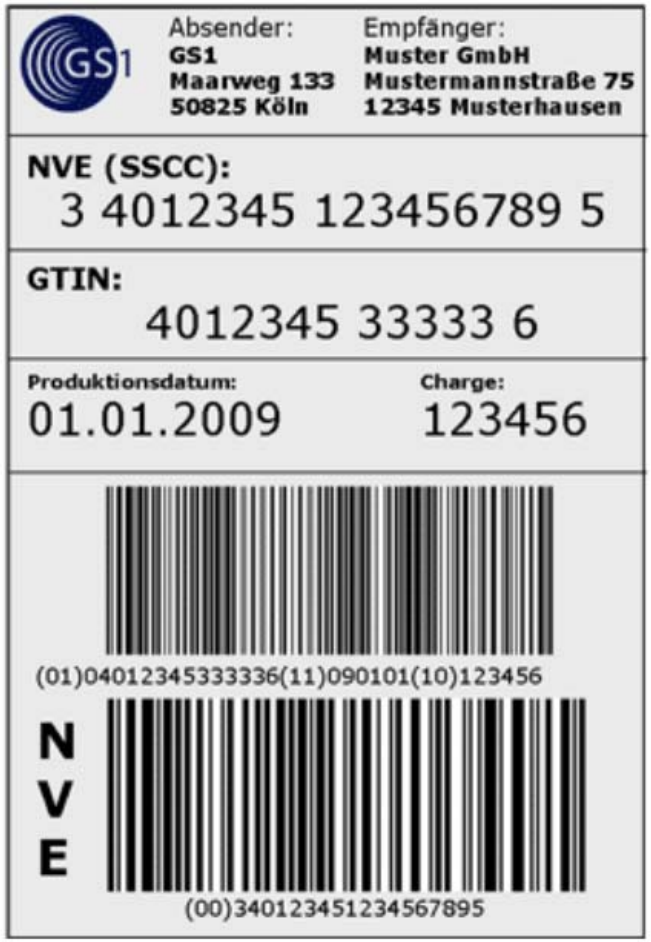
- GS1 standard that defines common syntax and semantic for barcode information:
  - Usage of application identifiers (2-4 digits) to determine semantic of carried data
  - Examples: GTIN, SSCC, best before dates, batch numbers, quantities, weights
- Alphanumeric data structure with maximum length of 48 characters



Quelle: GS1 Germany: GS1-Standards, Strichcode GS1-128.

Components of an RFID System

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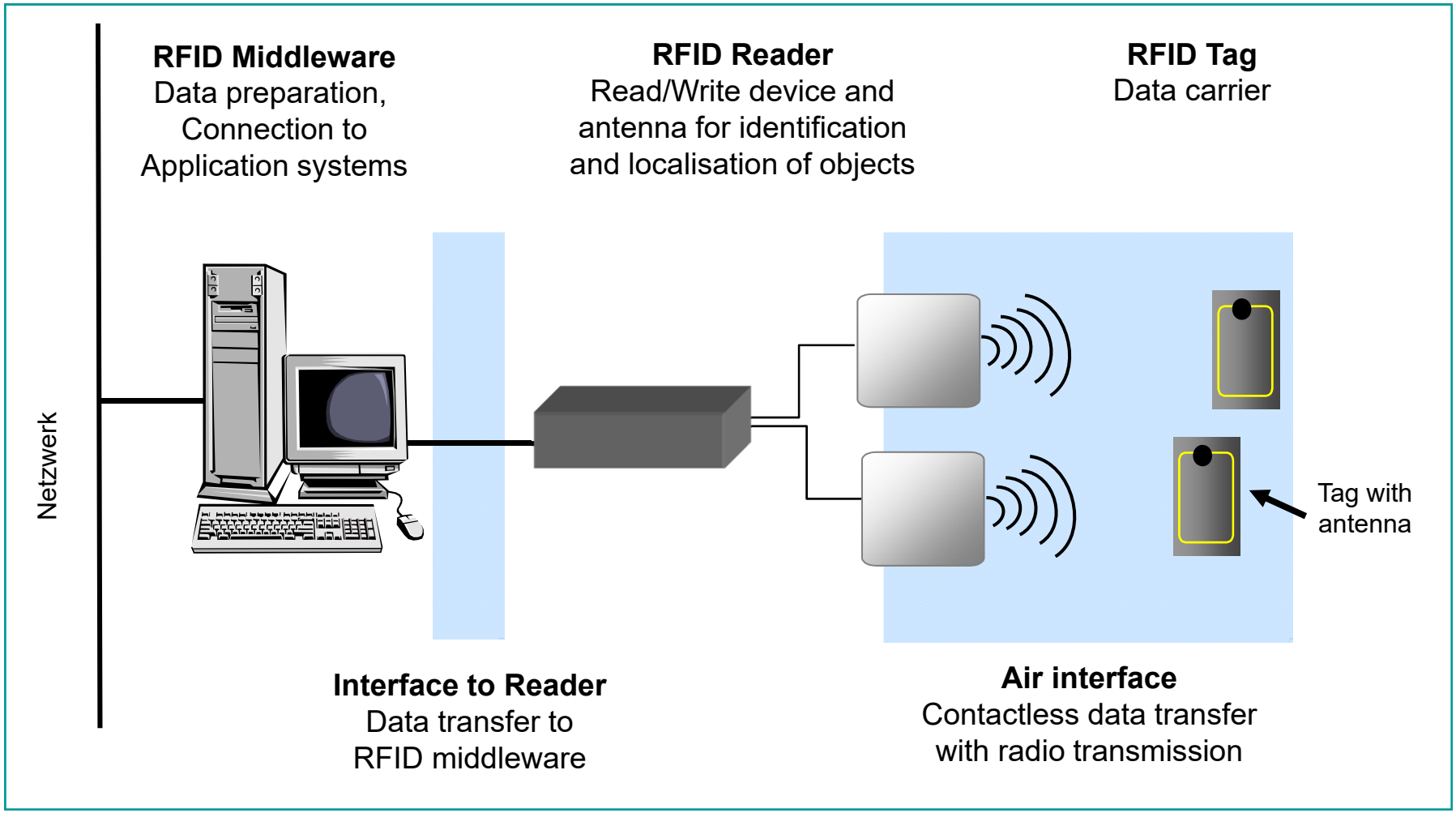
- RFID: Radio Frequency Identification



Example: Different Types of RFID Tags

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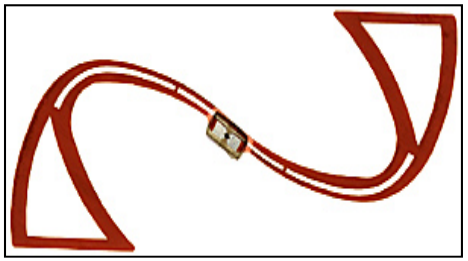
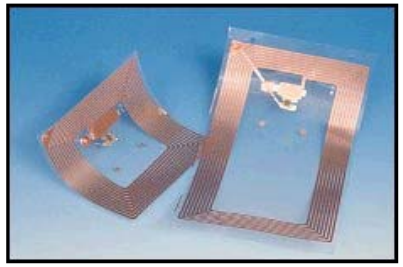
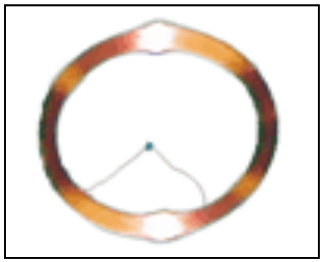
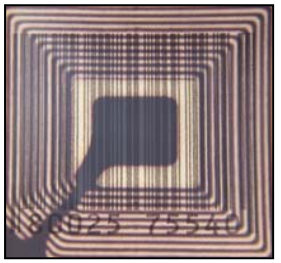
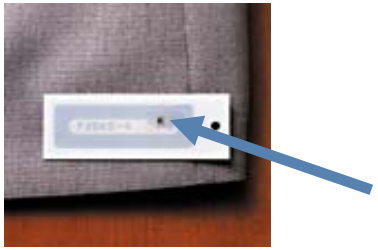
- Different Forms of RFID Antennas

- Different Tag Sizes and Materials





Example: Different Types of RFID Readers

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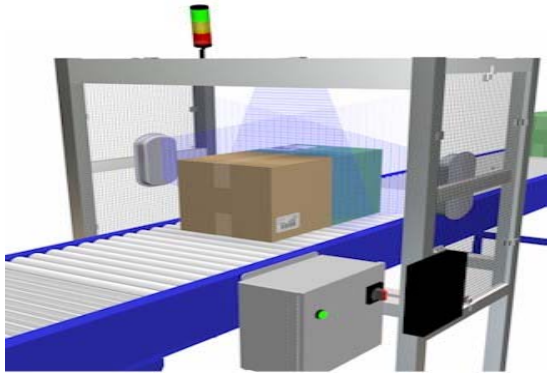
- Stationary RFID Readers



RFID Tunnel

RFID Gate Reader

- Mobile RFID Readers

Key Differentiators of RFID Systems

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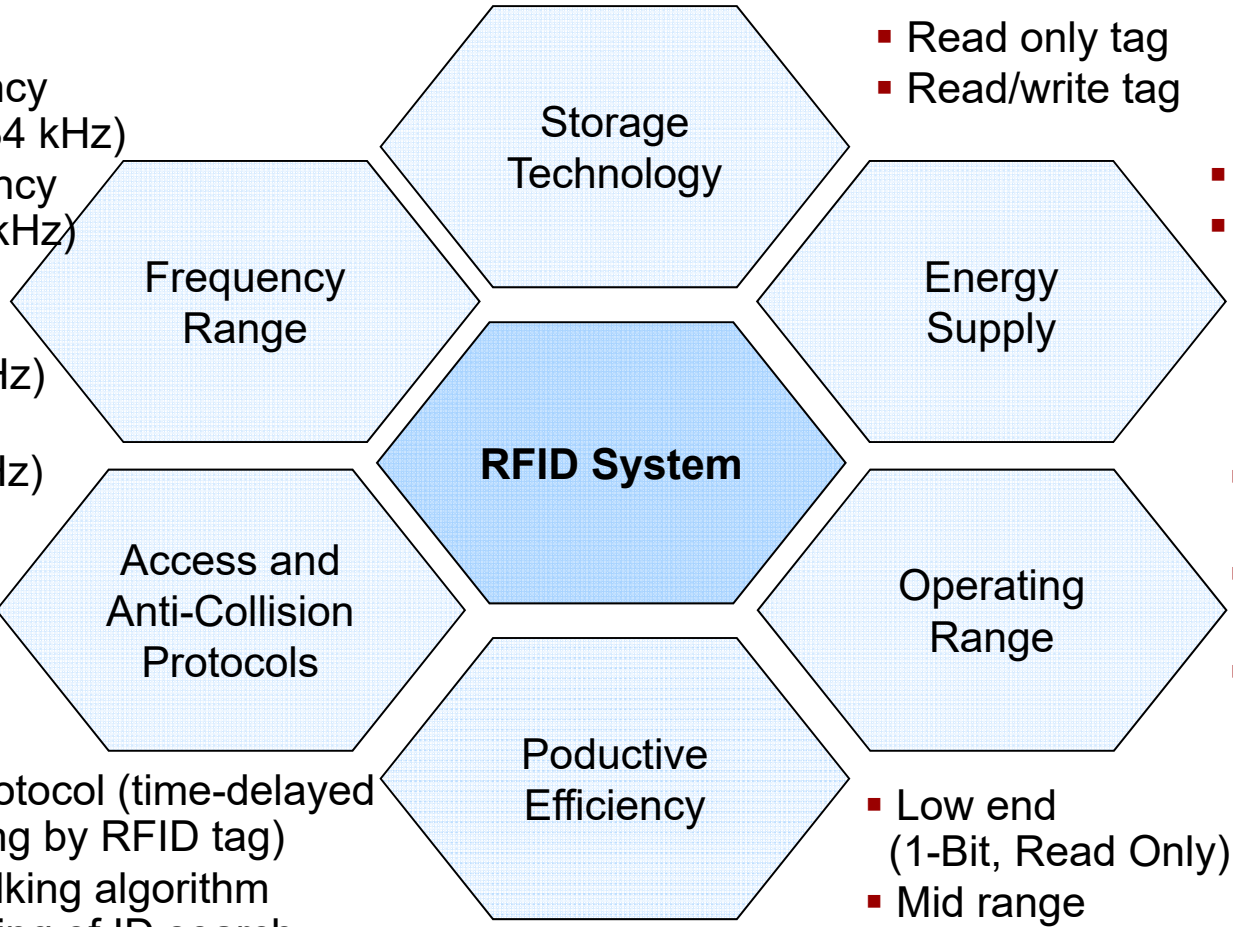

- Read only tag
- Read/write tag

- Low frequency (esp. 125-134 kHz)
- High frequency (esp. 13,56 kHz)
- Ultrahigh frequency (868/915 MHz)
- Micro wave (2,45/5,8 GHz)

- Aktive tag
- Passive tag

- Close coupling (until 1 cm)
- Remote coupling (until 1 m)
- Long range (1,5 to 10 m / 1 km)

- Aloha protocol (time-delayed ID sending by RFID tag)
- Tree Walking algorithm (downsizing of ID search domain by RFID reader)

- Low end (1-Bit, Read Only)
- Mid range (until 100 KByte, Read/write)
- High end

Based on BSI (2004).

Electronic Product Code (EPC)

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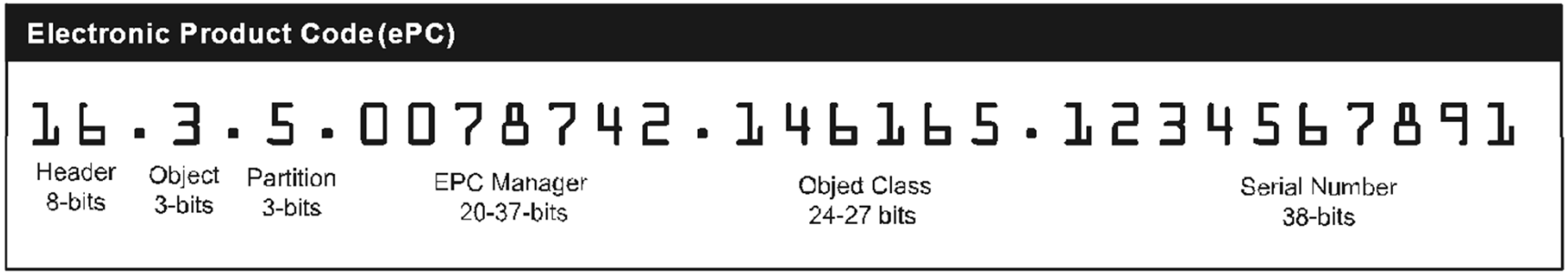
- Worldwide unique, non-overlapping digit sequence for product identification
  - Goal: Global acceptance and universal usage, not only for products but also for locations, logistic units, assets, and returnable packages
- Designed for storage of electronic identification data, mainly associated with RFID technology:
  - Sufficient length for incorporation of identification standards, which are currently available (e.g. EAN, UCC) or which are planned for the near future
  - Digit sequence with a length of 64 bit (EPC-64), 96 bit (EPC-96) or more (currently unti 204 bit)



RFID Benefits for B2B Processes

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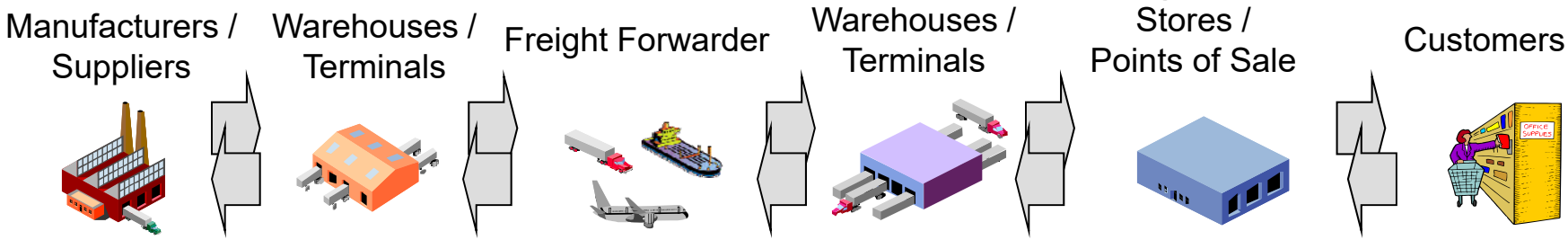

Monetary Benefits

- Efficient employment of labour / Efficient capacity utilisation
- Fully automated goods receipt and payment
- Less issues during shipment, transport, and receipt of goods
- Faster flow of goods / Increased punctuality with respect to shipment, transport, and receipt of goods
- Lower costs

Nonmonetary Benefits

- Increased transparency of transport processes and stock situation
- Increased data quality
- Automated real-time inventory
- Automated real-time inventory
- Increased data security
- Improved process knowledge

Customer satisfaction

Near Field Communication (NFC)

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- Wireless communication standard for contactless data transfer in distances of a few centimeters
  - Frequency range 13,56 MHz
  - Operating range at maximum 10 cm with transfer rate of 424 kBit/s

- Combines functionalities from RFID and smart card technology
  - Originally in 2002 specified by Sony and NXP Semiconductors (Philips)
  - Foundation of NFC forum in 2004 by Sony, NXP, and Nokia to promote standardization and integration of NFC, currently around 170 member companies

- 3 different operating modes:
  - Peer to peer mode: direct communication between 2 NFC devices
  - Reader / writer mode: interaction with passive RFID tags
  - Card emulation mode: interaction with RFID readers

Variants of B2B and B2C Integration

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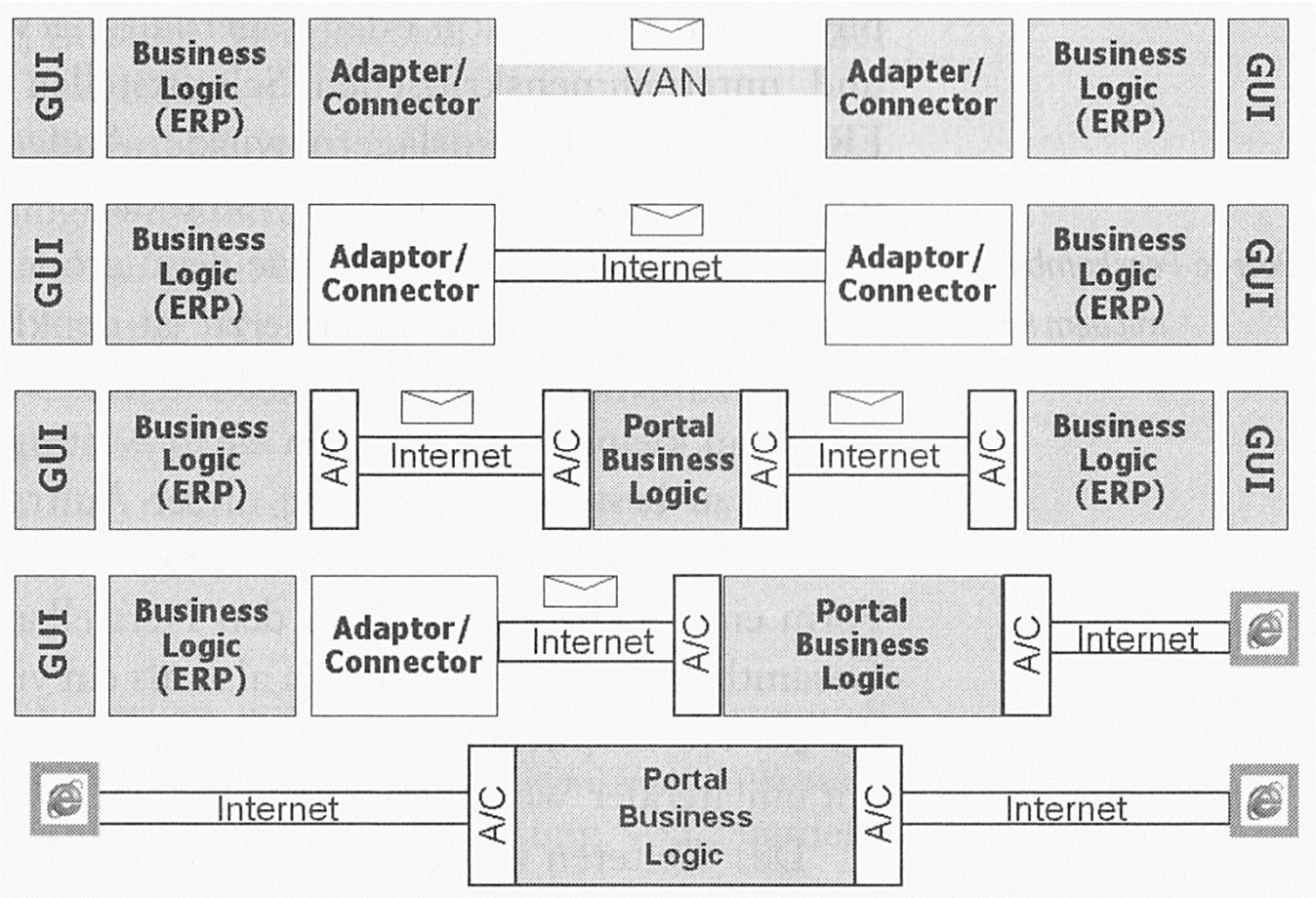
- Classical EDI
- XML based EDI
- Portal with marketplace
- Portal with unilateral web interface
- Portal with bilateral web interface



Based on Merz (2002), p.669.

Basic Components of B2B Integration

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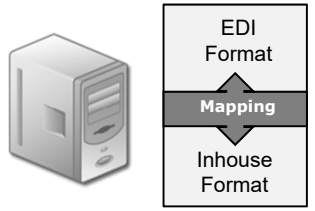
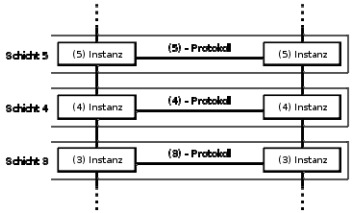
- Message Standards
  - Standardized data format, semantically oriented on business documents or business process steps

```
UNA:+.? '
UNB+UNOC:3+SID+RID+110625:0930+1234'
UNH+1+ORDERS:D:96A:UN'
BGM+220+B10001+9'
DTM+4:20110625:102'
NAD+BY+++Mustermann++Karlsruhe+++DE'
LIN+10++Musterprodukt:SA'
QTY+1:1000:ST'
UNS+S'
CNT+2:1'
UNT+9+1'
UNZ+1+1234567'
```

- Converter
  - Conversion of messages from internal format of a company into message standard and vice versa



- Communication Protocols
  - Agreements or rules, which are considered for the data transfer between two or more communication systems



- Communication Networks
  - Internet

B2B Message Standards

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- Usually either globally, nation-wide or industry-wide defined
- Goal is fully automated communication between application systems of business partners
  - Designed for asynchronous but also synchronous message exchange
- Examples of B2B standards:
  - UN/EDIFACT: United Nations Directories for Electronic Data Interchange for Administration, Commerce and Transport
    - international and intersectoral
  - ANSI ASC X12: American National Standards Institute, Accredited Standards Committee X12
    - national and intersectoral
  - SWIFT: Society for Worldwide Interbank Financial Telecommunication
    - international and sectoral
  - RosettaNet: Consortium of companies of the High-tech industry
    - international and sectoral

Example: 'Classical' B2B Integration with EDIFACT

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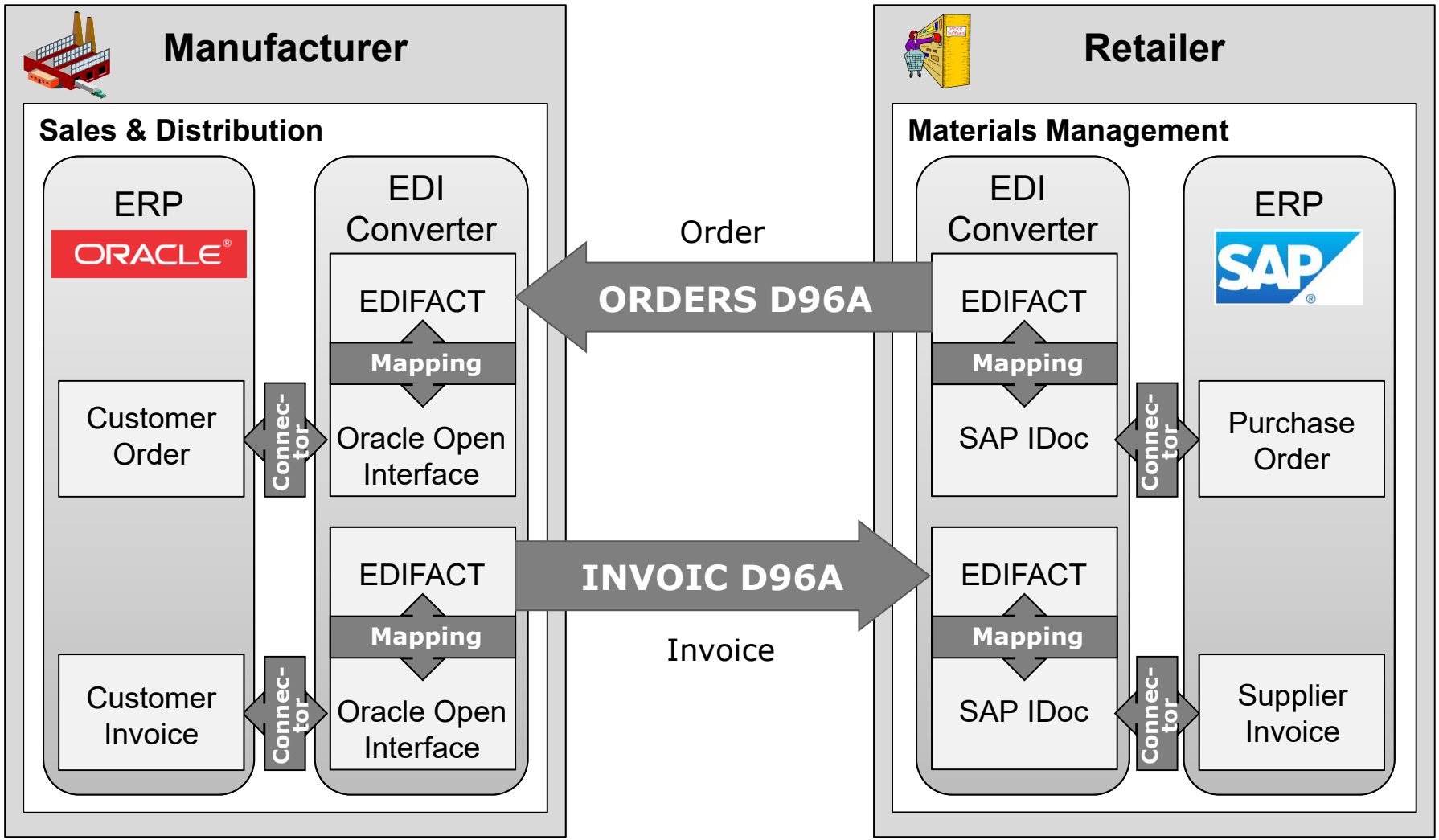

Example: EDIFACT Transmission Data with Orders Message

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UNA:+.? '

UNB+UNOC:3+SenderID+ReceiverID+110625:0930+1++1234567'

UNH+1+**ORDERS**:D:96A:UN'

BGM+220+B10001'

DTM+4:20110625:102'

NAD+BY+++Mustermann+Musterstrasse+Ludwigshafen++67059+DE'

LIN+10++Musterprodukt:SA'

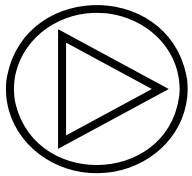
QTY+1:1000'

UNS+S'

CNT+2:1'

UNT+9+1'

UNZ+1+1234567'



Selected EDIFACT Subsets

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- CEFIC – Chemical Industry
- EANCOM – Consumer Goods Industry
- EDIBDB – Construction Materials Industry
- EDIFICE – Electronic and Computer Industry
- EDIFOR – Freight Forwarding Industry
- EDIFURN – Furniture Industry
- EDIGAS –Energy Industry (gas transmission)
- EDITEX – Textile Industry
- ODETTE – Automotive Industry
- RINET – Insurance Industry

Selected EDIFACT Message Types

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Message Type Abreviation	English Name	German Name
DELFOR	Delivery schedule	Lieferabruf / -plan
DESADV	Despatch advice	Liefermeldung
IFTSTA	Multimodal status report	Multimodaler Statusbericht
INVOIC	Invoice	Rechnung
INVRPT	Inventory report	Lagerbestandsbericht
ORDCHG	Purchase order change request	Bestelländerung
ORDERS	Purchase order	Bestellung
ORDRSP	Purchase order response	Bestellantwort
PAYORD	Payment order message	Zahlungsanweisung
RECADV	Receiving advice	Wareneingangsmeldung
REMADV	Remittance advice	Zahlungsavis

Wiederholungsfragen zu Teil 2.4 / Repetition Part 2.4

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1. Was bedeutet AutoID und welche Technologien werden darunter subsumiert? / Explain the term AutoID and specify the related technologies. (→ Folie / Slide 89)

2. Wofür steht die Abkürzung GTIN? Wie ist der Aufbau der Datenstruktur und welche Nummern können damit harmonisiert werden? / What does the abbreviation GTIN stand for? Explain the data structure and the numbers that can be harmonized. (→ Folie / Slide 91)

3. Nennen Sie die wesentlichen Komponenten, aus denen ein RFID System besteht und beschreiben Sie kurz deren Funktion. / Specify the main components of an RFID system and briefly explain their function. (→ Folie / Slide 95)

4. Nennen Sie 4 B2B Nachrichtenstandards und charakterisieren Sie diese Standards anhand der beiden Merkmale „Geltungsbereich“ und „Branchenbezug“. / Specify 4 B2B message standards and characterize those standards by differentiating between coverage and industrial sector relevance. (→ Folie / Slide 104)

Übung zu Teil 2.4

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- Zur Vereinfachung der Datenpflege wollen Erika und Max die Artikelnummern der im eShop angebotenen Waren und die Artikelnummern in ihrem Kassensystem vereinheitlichen. Hierzu sollen gängige Standards zur Produktidentifikation i.V.m. an EDIFACT orientierten XML-basierten Nachrichtentypen eingesetzt werden. Im Rahmen der Nachbestellung sollen diese Nachrichtentypen mit den harmonisierten Artikelnummern auch an den Lieferanten kommuniziert werden.
- Um nicht bei Abholung der Waren durch die Kunden alle Artikelnummern aus den bereit gestellten Warenkörben einlesen zu müssen, soll zusätzlich eine Identifikationsnummer für die jeweilige „Versandeinheit“ vergeben werden, die dann für die Bezahlung der Waren mit Hilfe eines Barcodescanners gelesen und mit der zugehörigen Bestellung verbunden werden soll.
- Bilden Sie 3er- oder 4er-Gruppen und unterstützen Sie Erika und Max, indem Sie, aufbauend auf der Software System-Architektur des eShops (→ Übung zu Teil 2.2), ein einfaches Konzept zur Einsetzung der erforderlichen Identifikations- und Nachrichtenstandards erstellen.
  - Berücksichtigen Sie hierbei insbesondere die in der Vorlesung vorgestellten Barcodetypen und Identifikationsstandards und wählen Sie zu den eShop Transaktionen passende EDIFACT Nachrichtentypen aus.

Exercise Part 2.4

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- In order to simplify data maintenance, Jane and John Doe plan to harmonize the product numbers of the eShop application and the cash register. For this, common standards for product identification with respect to EDIFACT oriented XML based message types shall be introduced. Within the scope of replenishment those message types as well as the harmonized product numbers shall be communicated to the supplier.

- To ease the pick up process in the store an additional identification number for each shipping unit shall be introduced. The identification numbers shall then be read by a barcode scanner and connected to the customer orders, so that entering all product numbers of the ordered and prepackaged goods into the cash register becomes superfluous.

- Work together with 3 or 4 other students and help Jane and John to define a simple concept for implementing the required identification and message standards, based on the software architecture of exercise part 2.2.
  - Consider in particular the barcode types and identification standards, as introduced in this lecture, and select EDIFACT message types, that fit to the eShop transactions.

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BW431
eBusiness Basics – Part 3

Bachelor Wirtschaftsinformatik

Winter Term 2019

Prof. Dr. Frank Thomé

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3 eBusiness Security

3.1 Security Requirements and Security Threats

3.2 Security Measures

Relevance of Security for eBusiness

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- eBusiness transactions require high degree of trustworthiness, confidentially, and security:
  - esp. payment transactions but also all other eBusiness transactions with exchange of private and confidential information
  - quite often prerequisite for electronic transactions to become legally binding
- Non-existence of security measures may/will lead to disuse and rejection of eBusiness offerings
- Coherent, consistent approach to security becomes crucial for all involved e-business participants:
  - “Keep the bad guys out!”
  - “Let the good guys in!“

- Major Task:
  - Ensure security and operability of eBusiness systems and applications
  - Detect potential and actual security risks and provide suitable counteractions

- Based on safety and security policy with appropriate objectives, strategy and measures, e.g.:
  - Definition of security requirements
  - Risk analysis
  - Mitigation strategy
  - Measures related to damage limitation
  - Financial precautions for damage events

Security Requirements for Electronic Data Exchange

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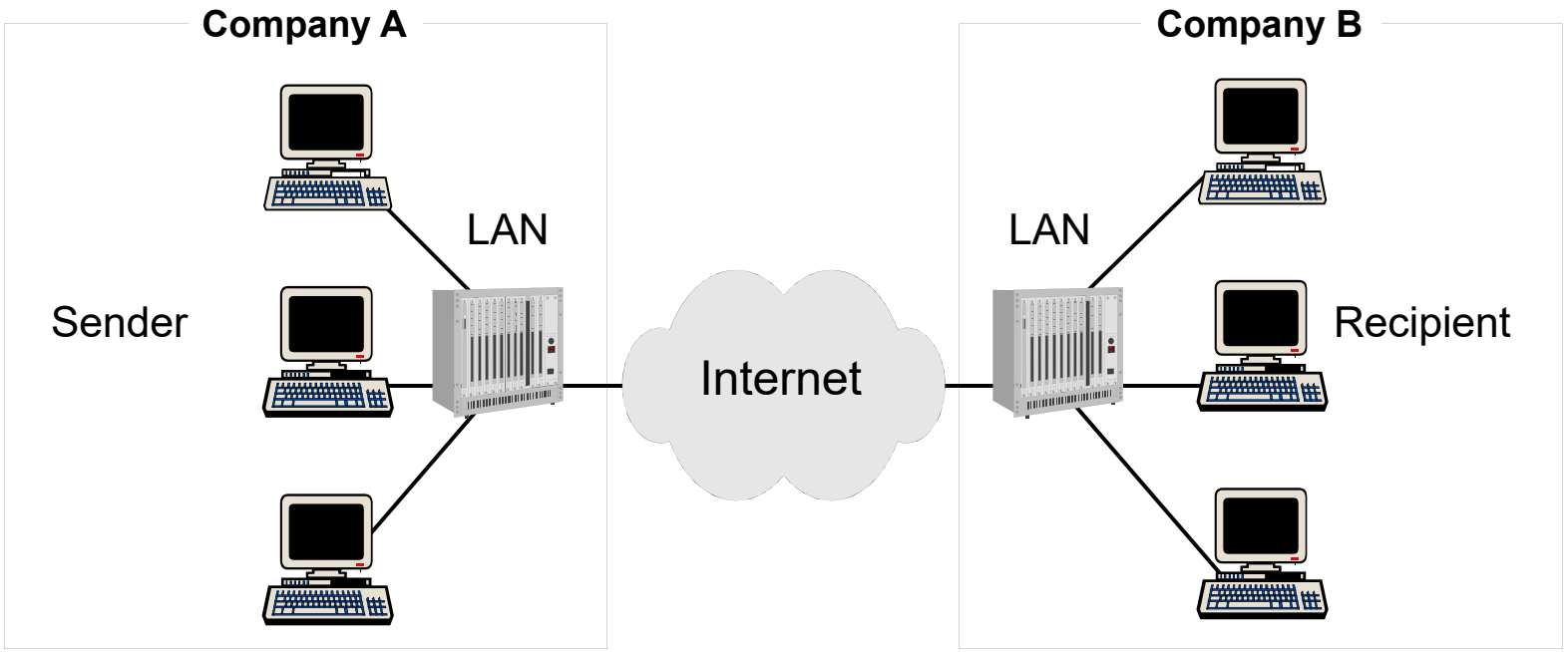

1. Identify and authenticate peer entity and origin of data
2. Ensure data confidentiality
3. Ensure data integrity
4. Non-repudiation of data transmission

Before data exchange — During data exchange — After data exchange

Based on the International Telegraph and Telephone Consultative Committee (CCITT) Recommendation X.800: Security Architecture for Open Systems Interconnection for CCITT Applications, Geneva 1991.

Security versus Safety Risks

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- Threats caused by attacks or violations of security with intended, destructive impacts, e.g.:
  - Viruses, worms, and Trojan horses (“Malware”)
  - Sniffing, spoofing, and man-in-the-middle attacks
  - Phishing and pharming
  - Denial-of-service attacks

Security Risks

- Accidental failures and interruptions during operations, e.g. :
  - Malfunctions of computer systems and networks
  - Software bugs
  - Hardware failures
  - Damage caused by environmental conditions or natural causes

Safety Risks

Malware Categories (1)

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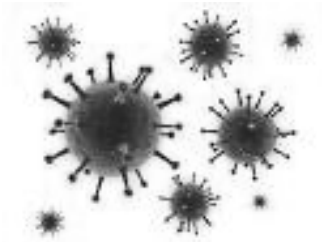
- Virus
  - Computer program that attacks computers and network systems through infected data files
  - Needs to attach itself to operating system or other programs, and automatically replicates itself to spread to other computers or network systems
  - Carried on removable mediums such as floppy disks, CDs, DVDs, USB sticks or sent over network systems or the Internet



- Worm
  - Self-replicating computer program that actively transmits itself over a network system to infect other computers
  - Unlike virus, it does not need to attach itself to existing programs
  - Can disrupt entire network systems by very fast replication over the connected computers
  - Usually gains entry into target computer through infected emails

Malware Categories (2)

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- Trojan Horse
  - Computer program that that appears to perform a legitimate and useful function, but also secretly performs destructive and illegal functions
  - May destroy stored data on target computer or allow outsiders to gain unauthorized access to the system (backdoor)

  - May illegally collect information about users without their knowledge, such as passwords, email addresses, software registration numbers (spyware)
  - Unlike virus or worm, it usually does not replicate itself within target computer or across network systems
  - Usually gains entry into target computer through software downloads, email attachments or Websites containing executable content

Spoofing and Man-in-the-Middle Attacks

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- Spoofing Attack
  - Situation in which one person or program successfully masquerades as another by falsifying data and therewith spoofing the communication partner
  - Often used to illegally acquire sensitive and confidential data from the deceived communication partner
  - Common types of spoofing: IP spoofing, Web Spoofing, DNS spoofing
- Man-in-the-Middle Attack
  - Situation in which attacker establishes independent connections with two or more communication partners and relays messages between them
  - Objective is to make partners believe that they are communicating directly to each other, when in fact the entire conversation is controlled and eavesdropped by the attacker
  - Can succeed only if attacker is able to intercept all messages that are exchanged between the communication partners and can inject new messages into the communication

Basic Principle: Man-in-the-Middle Attack

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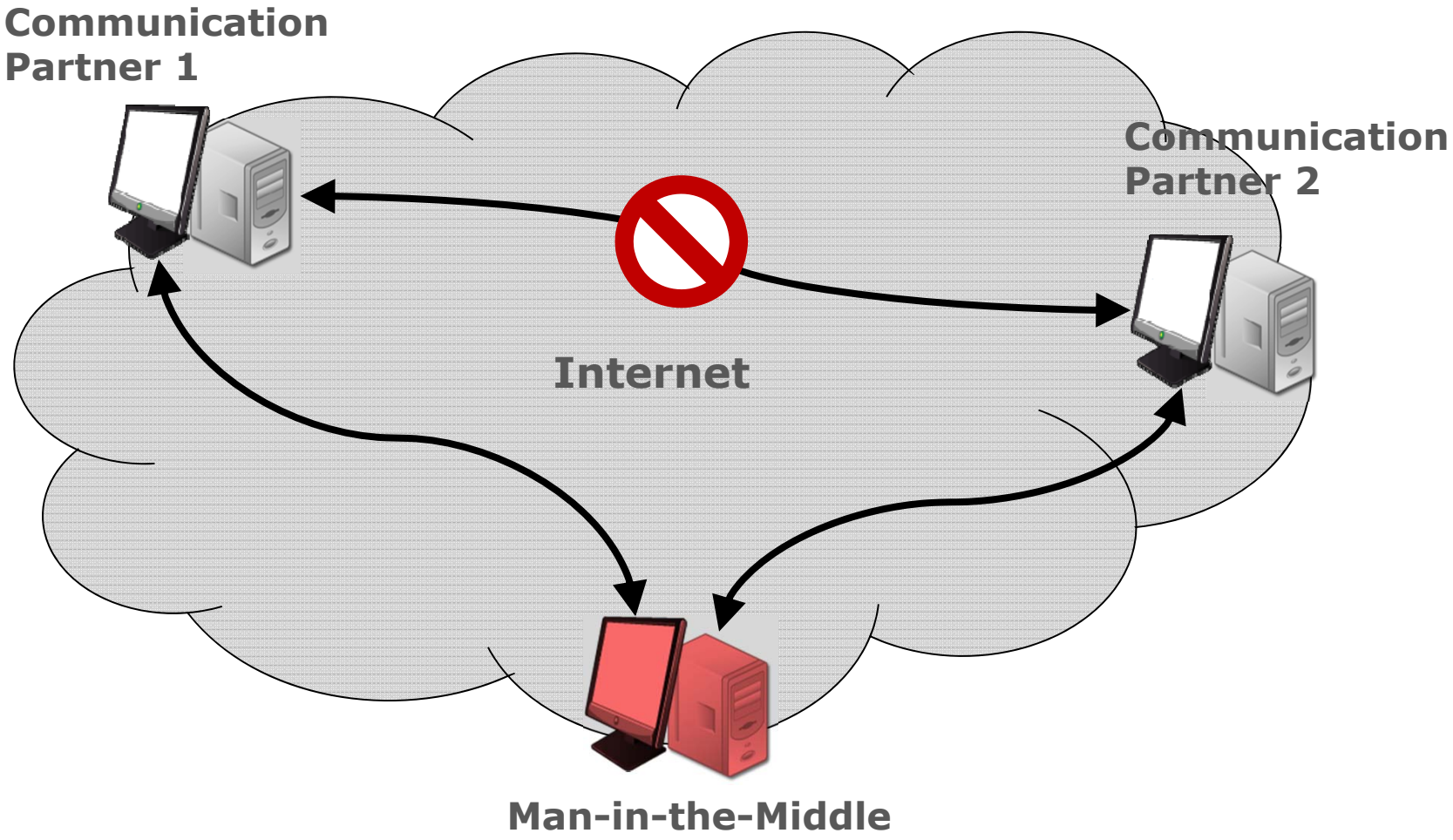

Phishing and Pharming

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- Phishing
  - Attempt to illegally collect sensitive and confidential data such as passwords, credit card numbers or access data for online banking by masquerading as a trustworthy entity in an electronic communication process
  - Conducted usually by sending emails or instant messages which request users to enter details at a fake website whose look and feel are almost identical to the legitimate one (→ Web spoofing)

- Pharming
  - Attempt to illegally redirect a website's traffic to another, bogus website
  - Conducted either by changing the hosts file on the target computer or by exploitation of a vulnerability in DNS server software (→ DNS spoofing)

Basic Principle: Pharming

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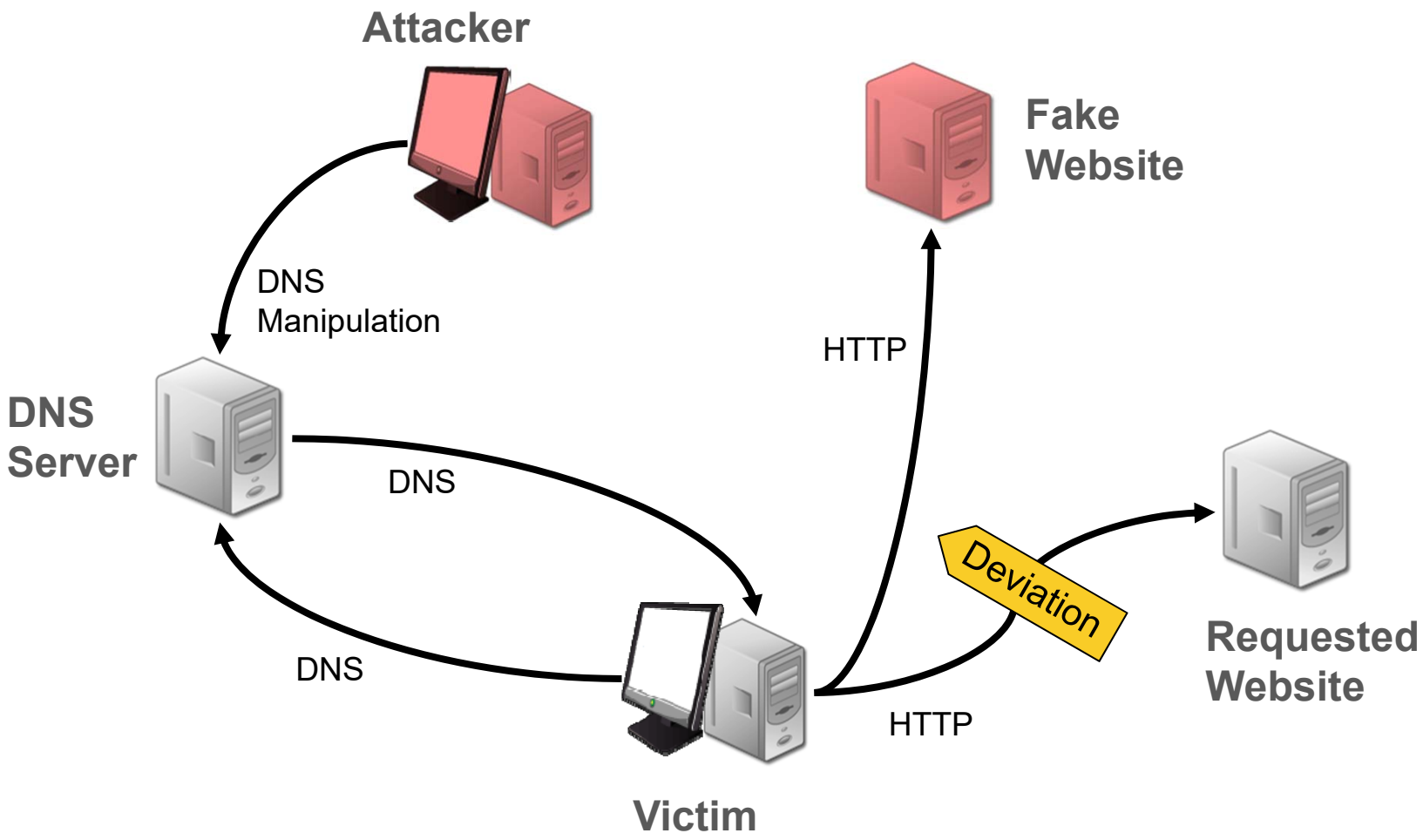

Denial-of-Service and Distributed Denial-of-Service Attacks

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- Denial-of-Service (DoS) Attack
  - Attempt by a malicious host to cause a computer, a Web site, or Internet node to deny service to its customers
  - Conducted usually by sending a multitude of communication requests that flood target system with useless load in order to exhaust its resources
  - Consequence is no or very slow response to legitimate traffic
- Distributed Denial-of-Service (DDoS) Attack
  - Coordination of many malicious hosts (army) to simultaneously flood target system
  - Typical army of attacker consists of master and slave zombie computers which are infected by malicious code
  - Attacker instructs master zombies to activate all attack processes on their machines and, through those processes, to send attack commands to slave zombies, which in turn begin to start flooding the victim's target system

Basic Principle: Distributed Denial-of-Service Attack

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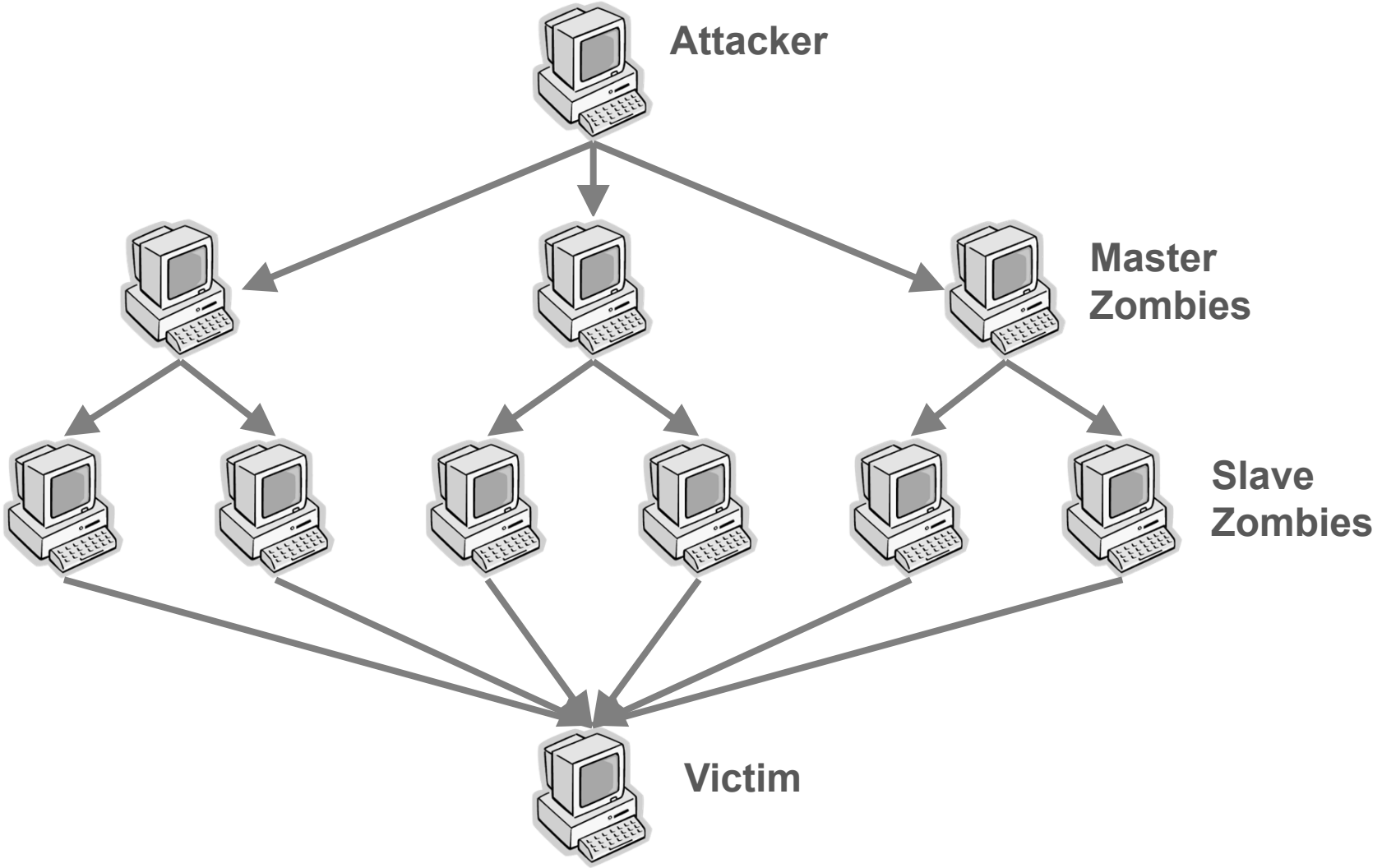

Example: IoT DDoS Attack in October 2016

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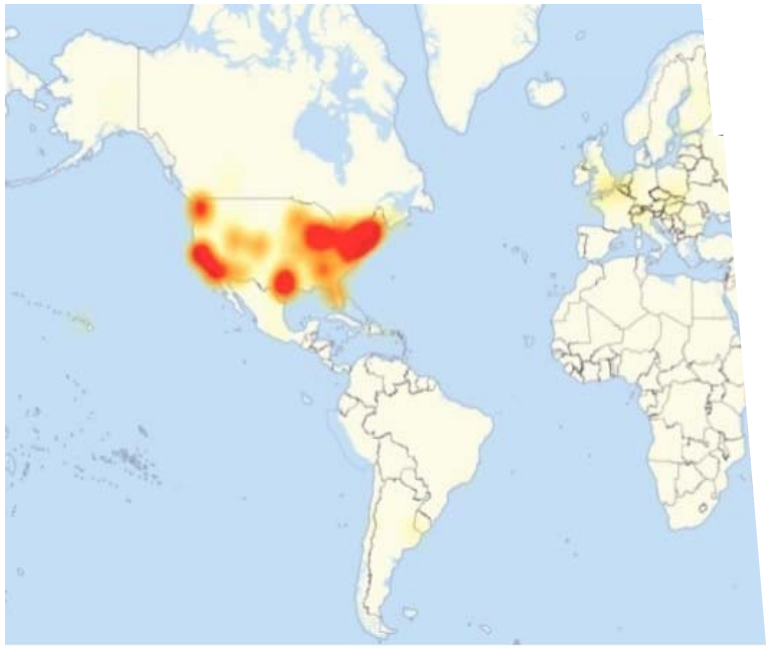
An IoT botnet is partly behind Friday's massive DDOS attack

DVRs and other devices compromised with the Mi



DDoS attack that disrupted internet was largest of its kind in history, experts say

The cyber-attack that brought down much of America's internet last week was caused by a new weapon called the Mirai botnet and was likely the largest of its kind in history, experts said.

The victim was the servers of Dyn, a company that controls much of the internet's domain name system (DNS) infrastructure. It was hit on 21 October and remained under sustained assault for most of the day, bringing down sites including Twitter, the Guardian, Netflix, Reddit, CNN and many others in Europe and the US.

The cause of the outage was a distributed denial of service (DDoS) attack, in which a network of computers infected with special malware, known as a "botnet", are coordinated into bombarding a server with traffic until it collapses under the strain.

What makes it interesting is that the attack was orchestrated using a weapon called the Mirai botnet. According to a blogpost by Dyn published on Wednesday, Mirai was the "primary source of malicious attack traffic".

Unlike other botnets, which are typically made up of computers, the Mirai botnet is largely made up of so-called "internet of things" (IoT) devices such as digital cameras and DVR players.

Because it has so many internet-connected devices to choose from, attacks from Mirai are much larger than what most DDoS attacks could previously achieve. Dyn estimated that the attack had involved "100,000 malicious endpoints", and the company, which is still investigating the attack, said there had been reports of an extraordinary attack strength of 1.2Tbps.

To put that into perspective, if those reports are true, that would make the 21 October attack roughly twice as powerful as any similar attack on record.

 Source: www.pcworld.com; www.theguardian.com

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3 eBusiness Security

3.1 Security Requirements and Security Threats

3.2 Security Measures

Cryptology

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- Cryptography
  - Branch of cryptology that deals with methods for coding (→ encryption) and decoding (→ decryption) information with respect to computer and network security
  - Basic technology for eBusiness security solutions
  - Objective is to transform confidential information in a way that makes it unreadable for non authorized access
  - Based on mathematical functions for the coding and decoding process
- Crypto Analysis (Cryptanalysis)
  - Branch of cryptology that deals with methods for obtaining the meaning of encrypted information, without access to decryption information (key)
  - Objective is to detect weaknesses in cryptographic methods
  - Effort required for decryption can be used to measure level of security
  - Example: Systematically testing all possible keys until the correct key is found (→ brute force attack or exhaustive key search)

Symmetric Encryption (1)

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- Basic principle:
  - One single key is used for encryption and decryption
- Advantage:
  - Simple and fast approach
- Disadvantage:
  - Key has to be exchanged between partners prior to communication
  - Key has to be kept secret in order to avoid decryption by non authorized parties
- Examples for algorithms:
  - DES (Data Encryption Standard)
    - Published by IBM in 1974; key size of 56 bit
  - IDEA (International Data Encryption Algorithm)
    - Developed 1990 by ETH Zurich and Ascom Systec AG; key size of 128 bit
  - AES (Advanced Encryption Standard)
    - Successor of DES; key sizes of 128, 192 and 256 bits, respectively

Symmetric Encryption (2)

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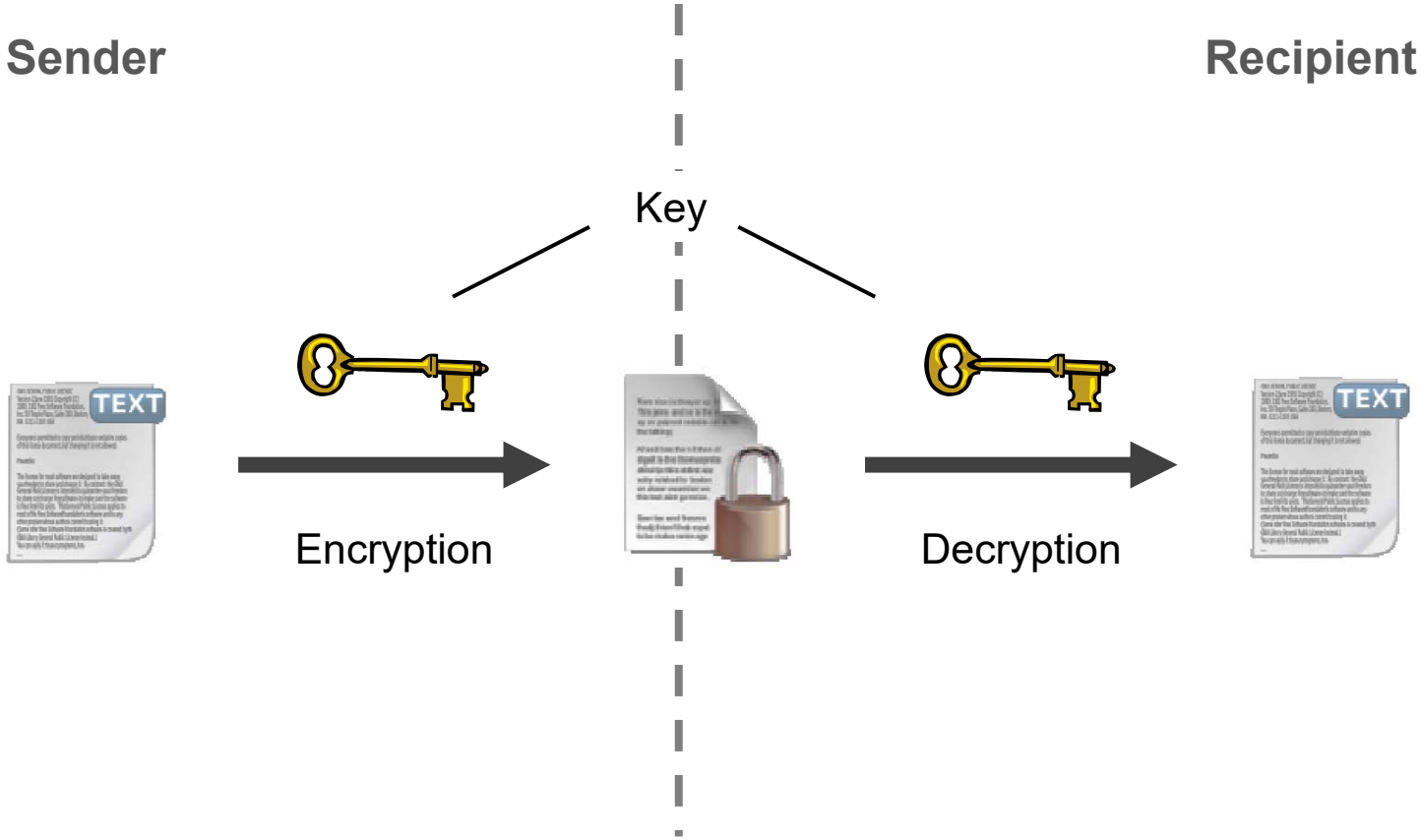

Asymmetric Encryption (1)

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- Basic Principle:
  - Two different keys are used for encryption and decryption
  - Both keys belong mathematically together
  - Also called public and private key method
- Advantage:
  - Higher degree of security than symmetric encryption
- Disadvantage:
  - More complex and therefore slower approach
- Examples for algorithms:
  - RSA (Rivest, Shamir, Adleman) algorithm
    - Developed 1977 by the cryptographers and computer scientists R. L. Rivest, A. Shamir and L. M. Adleman

Asymmetric Encryption (2)

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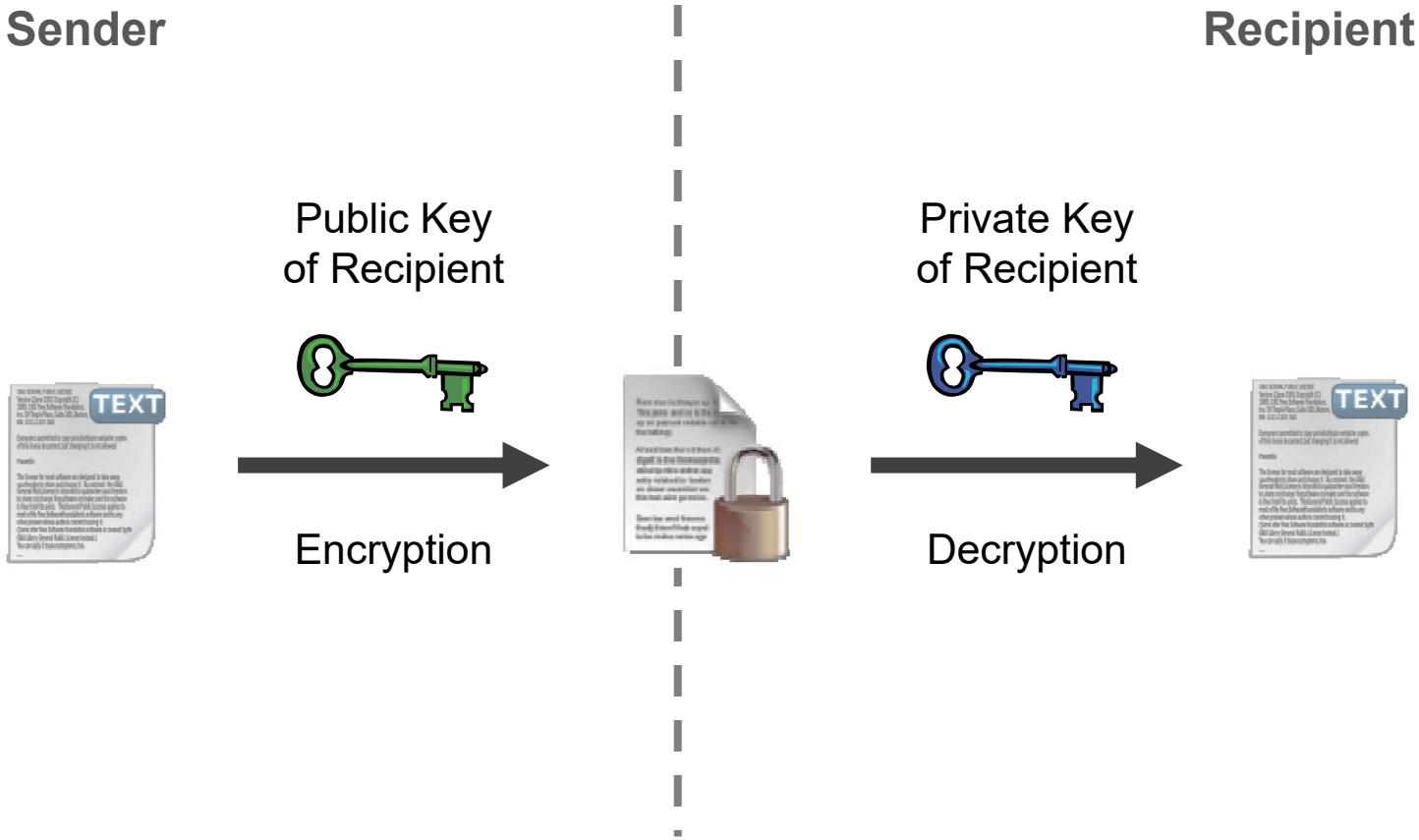

Hybrid Encryption (1)

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- Basic Principle:
  - Generation of random session key for each communication process
  - Symmetric encryption of communication data with session key
  - Asymmetric encryption of the session key with public key of recipient
- Advantage:
  - Combines advantages of symmetric and asymmetric encryption methods
  - Fast approach with high degree of security
- Examples for software tools and protocols:
  - PGP (Pretty good privacy)
    - Developed 1991 by P. Zimmermann for email communication
    - First versions were using IDEA algorithm for symmetric encryption
  - GnuPG (GNU Privacy Guard)
    - PGP alternative of the Free Software Foundation's GNU project
    - First version published in 1999, initially funded by the German Government (BMI)
  - SSL (Secure Socket Layer) / TLS (Transport Layer Security)
    - Encryption protocol for TCP/IP based communication (e.g. HTTPS)

Hybrid Encryption (2)

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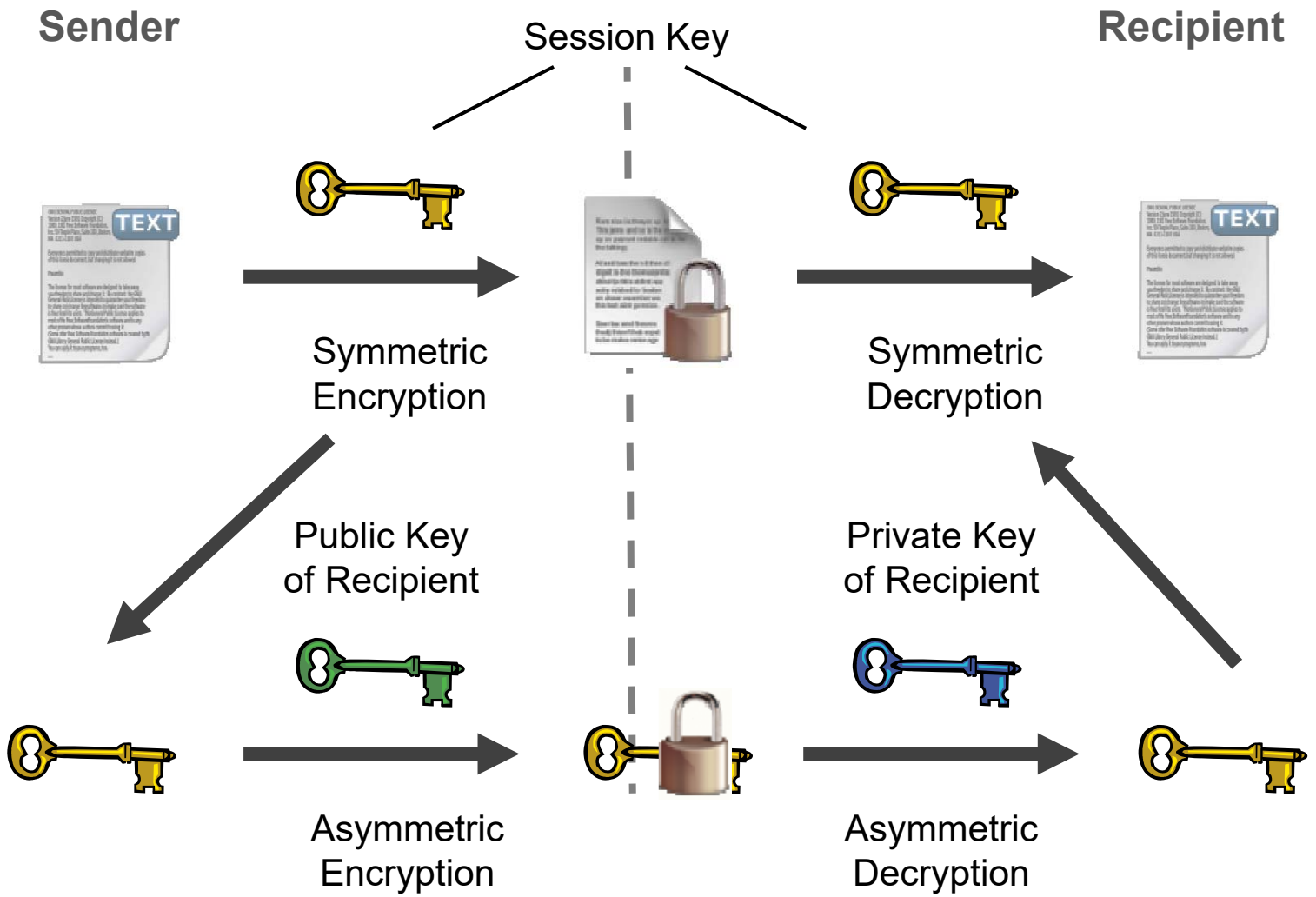

Digital Signature (1)

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- Checksum which together with an electronic document shows similar characteristics as a genuine signature
- Objective is to proof that document has not been changed by unauthorized person after being signed by initial author
- Basic signing principle:
  - Use of hash function to compute fixed-size checksum (hash value, message digest) out of the document
  - Inverse asymmetric encryption of hash value and attachment to document in order to obtain digitally signed data
- Basic verification principle:
  - Inverse asymmetric decryption of hash value attached to received document
  - Usually use of hash function to compute new checksum out of document and check for exact match with decrypted hash value

Digital Signature (2)

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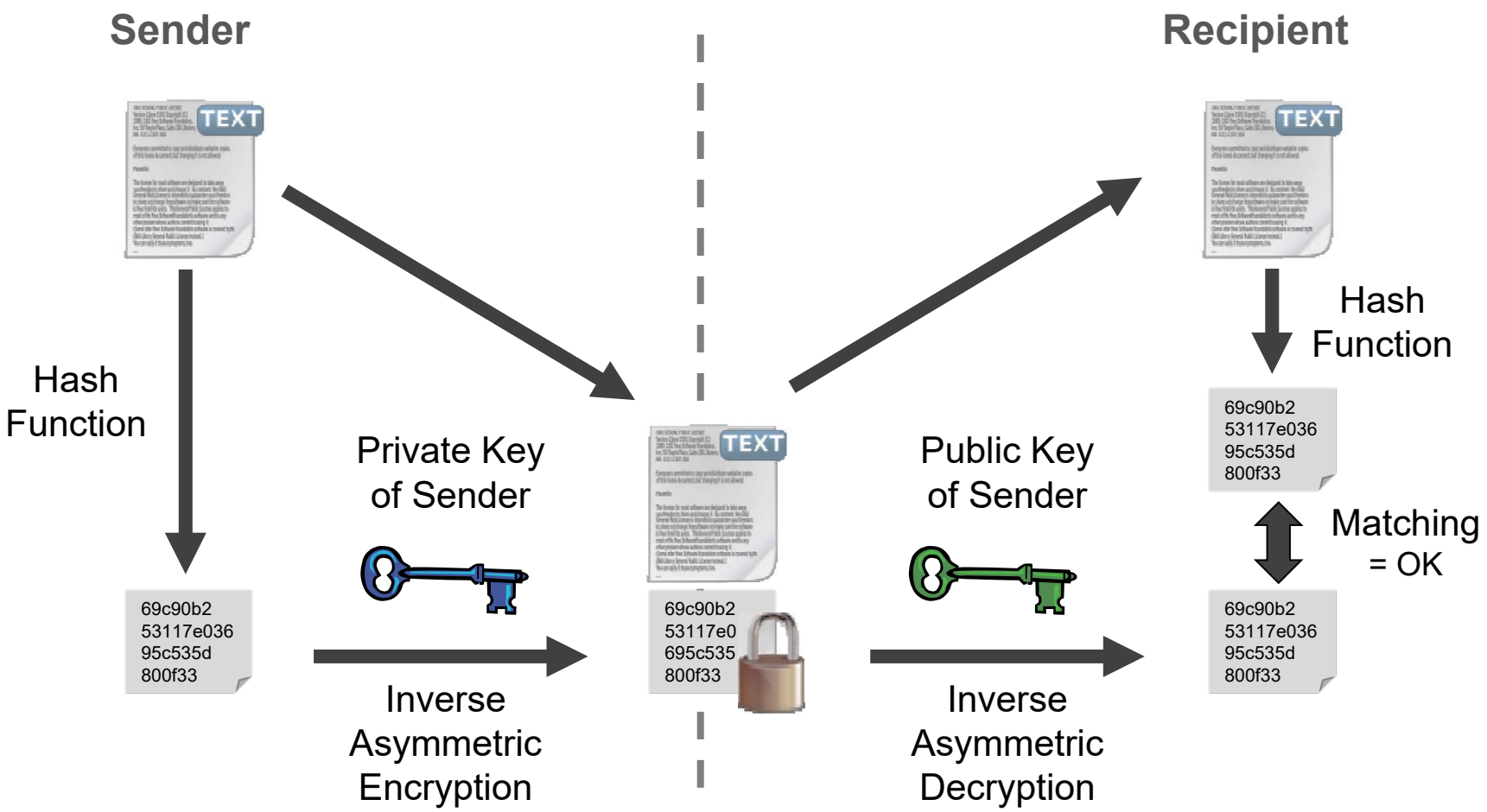

Digital Certificates

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- Electronic document which identifies and authenticates owner of a public key
- Uses digital signature to bind together public key with identity information such as name and address of person or organisation
- Direct trust
  - Identification and authentication by public key owner (self-signed certificate)
- Web of trust
  - Identification and authentication of public key owner by other users (endorsements)
- Public key infrastructure (PKI)
  - Infrastructure that is required to issue, distribute and validate digital certificates
  - Consists of certificate authority, registration authority, certificate repository, certificate revocation lists, and certificate policies

Basic Principle: Public Key Infrastructure

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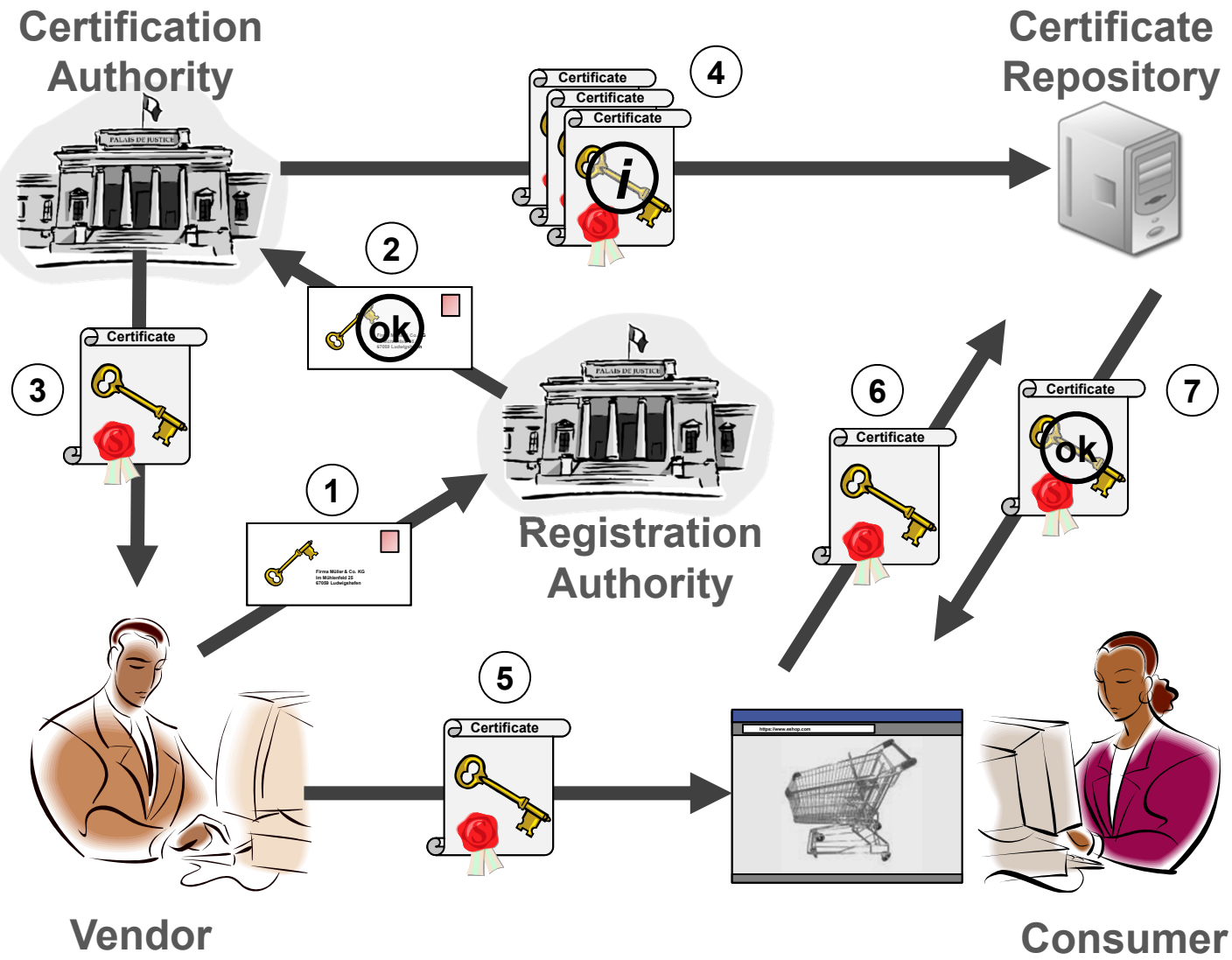

Blockchain

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- Originally created as technology for trading the digital currency Bitcoin

- Basic Principle
  - Reliable list of records (so called blocks) that act as distributed ledger in order to confirm transactions across a peer-to-peer network
  - Blocks are chronologically linked and secured through cryptography
    - i.e. they cannot be changed without destroying the entire chain of transactions
  - Chain is replicated and synchronized on every computer that uses the network
    - i.e. no central storage is required

- Benefits
  - Requires no third-party intermediaries such as banks, lawyers or brokers
  - High degree of security due to distributed and encrypted nature of blockchain
  - Allow realization of faster processes due to less participants and automation capabilities

Example: Blockchain @ SAP

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Blockchain as a service (BaaS)

Blockchain as a service lets companies experiment with distributed ledger technology in the cloud. By eliminating the need for a large upfront capital investment, BaaS is perhaps the easiest, lowest-risk gateway to enterprise blockchain adoption. You can use BaaS to:

- ✓ Experiment and play with the blockchain to see how it could benefit your business
- ✓ Use open standards to create consortia-based and private blockchain networks
- ✓ Prototype, test, and build customized blockchain applications and smart contracts

Source: https://www.sap.com/trends/blockchain.what-is-blockchain.html

Wiederholungsfragen zu Teil 3 / Repetition Part 3

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1. Nennen und erläutern Sie 4 wesentliche Sicherheitsanforderungen für den elektronischen Datenaustausch. / Specify and describe 4 fundamental security requirements for electronic data exchange. (→ Folie / Slide 115)

2. Was wird unter einer Spoofing Attacke verstanden und welche gängigen Spoofing Typen gibt es? / What is meant by a spoofing attack and which spoofing types can be distinguished? (→ Folie / Slide 119)

3. Erläutern Sie das Grundprinzip der hybriden Verschlüsselung und nennen Sie die wesentlichen Vorteile dieses Verfahrens. Welche Schlüssel kommen bei diesem Verfahren zum Einsatz? / Explain the basic principle of hybrid encryption and highlight the main advantages of this method. Which keys are used by this method? (→ Folien / Slides 132, 133)

4. Welche Zielsetzung hat eine digitale Signatur? Erläutern Sie das Grundprinzip und nennen Sie die zum Einsatz kommenden Schlüssel. / What is the objective of a digital signature? Explain the basic principle and specify the keys used by this method. (→ Folien / Slides 134, 135)

Übung zu Teil 3

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- Da die Sicherheitsthematik für eBusiness Anwendungen eine wichtige Rolle spielt, wollen Erika und Max Mustermann Ihren eShop gegen potentielle Gefährdungen und Angriffe über das Internet absichern.

- Bilden Sie 3er- oder 4er-Gruppen und unterstützen Sie Erika und Max, indem Sie sie bzgl. der informationstechnischen Sicherheitsmaßnahmen für ihren eShop beraten.
  - Definieren Sie dazu zunächst die wesentlichen Sicherheitsanforderungen für den eShop unter Berücksichtigung der bereits konzipierten Software System-Architektur (→ Übung zu Teil 2.2).
  - Identifizieren Sie anschließend mögliche Sicherheitsmaßnahmen mit denen der eShop ausgestaltet sein sollte, um eine Reduzierung bzw. Verhinderung aktueller Sicherheitsgefährdungen zu erzielen. Berücksichtigen Sie hierbei insbesondere die in der Vorlesung vorgestellten Sicherheitsmethoden und -konzepte.

Exercise Part 3

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- As security plays an important role for eBusiness applications, Jane and John Doe plan to protect their eShop against potential Internet threats and attacks.

- Work together with 3 or 4 other students and provide Jane and John advice with respect to IT-based security measures for their eShop.
  - Define first of all relevant security requirements for the eShop, based on the software architecture of exercise part 2.2.
  - Identify afterwards potential security methods that should be implemented within the eShop application, in order to reduce or avoid common security threats. Consider in particular the security methods and concepts, as introduced in the lecture.

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BW431
eBusiness Basics – Part 4

Bachelor Wirtschaftsinformatik

Winter Term 2019

Prof. Dr. Frank Thomé

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4 Mobile Business

4.1 Mobile Devices and Mobile Networks

4.2 Mobile Applications

4.3 Ubiquitous Computing / Internet of Things

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- Characteristics
  - Usage of mobile devices, infrastructure and applications
  - Location-independent communication and interaction
  - Support of business processes, business relationships or entire value chains

- Challenges
  - Requirement of complex and expensive operating infrastructure
  - Managing of technical limitations e.g.:
    - Insufficient bandwidth
    - Slow processors
    - Low main memory
    - Small screen size for user interaction
    - Energy consumption
    - Transmission interference

Number of Smartphone Users in Germany (1)

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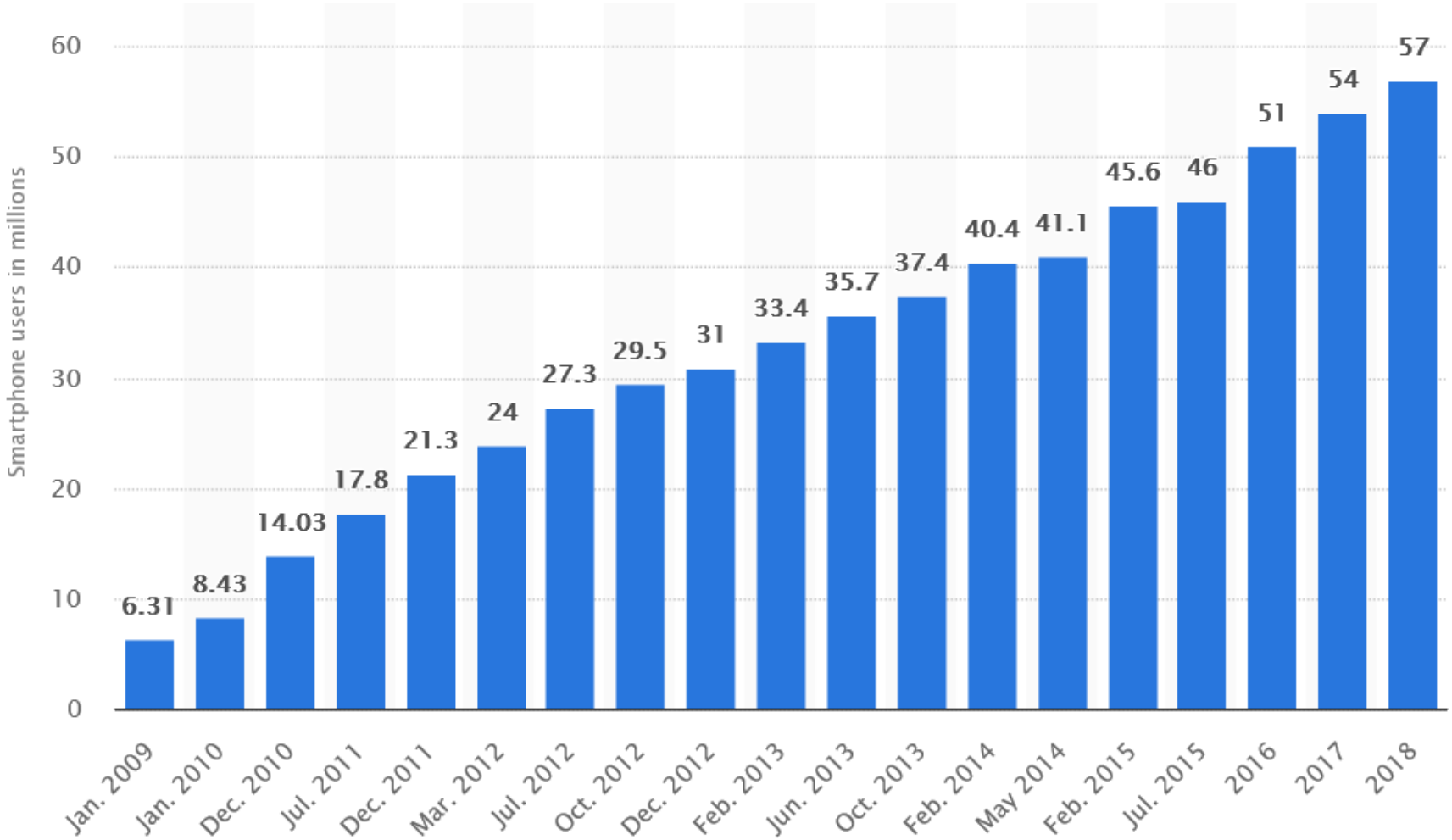

Source: Statista (2018).

Number of Smartphone Users in Germany (2)

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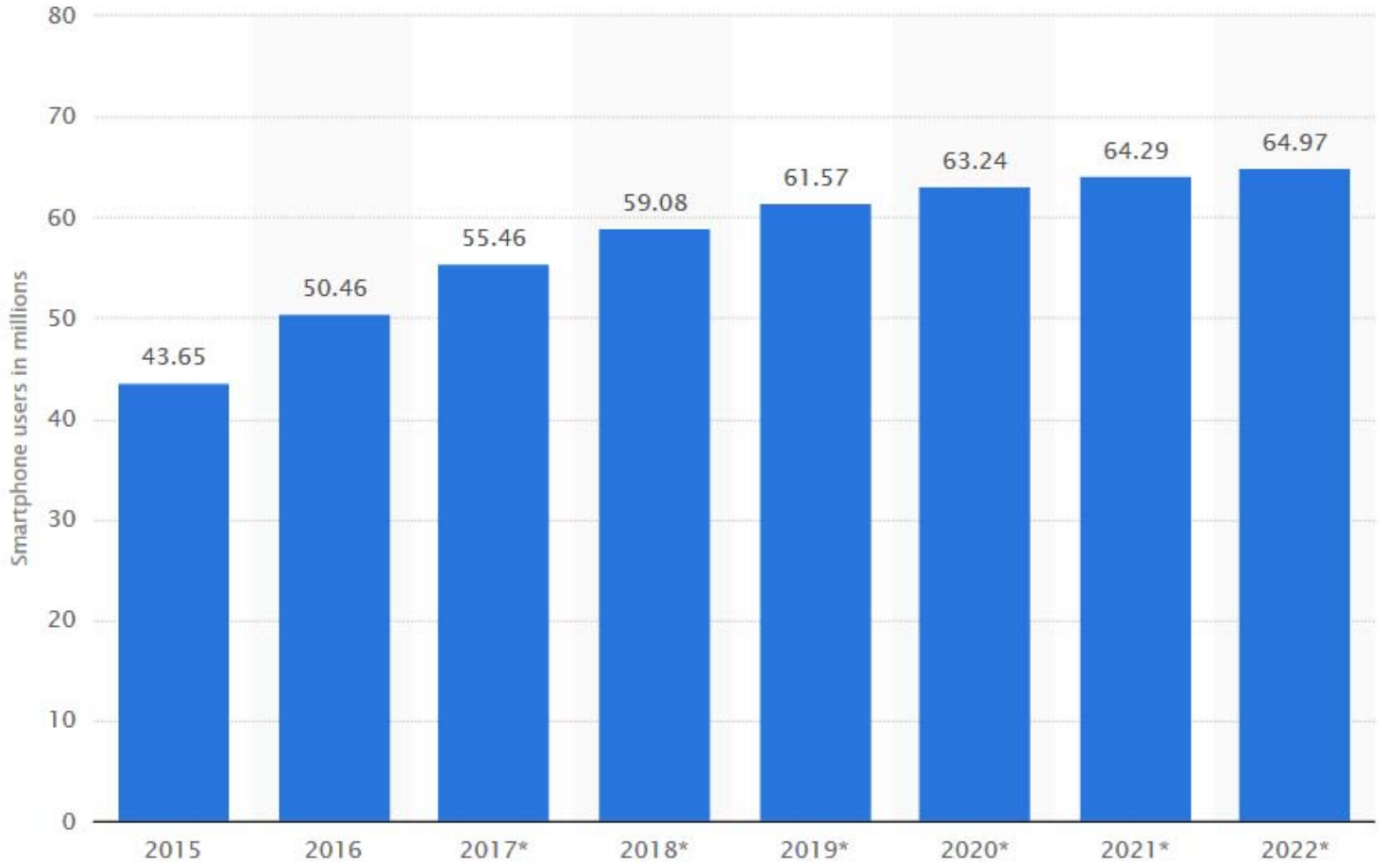

* Forecasts for 2017 until 2022.

Source: Statista (2017).

Worldwide Smartphone Sales to End Users by Vendor in 2018*

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* In thousands of units

Vendor	2018 Units	2018 Market Share (%)	2017 Units	2017 Market Share (%)
Samsung	295,043.7	19.0	321,263.3	20.9
Apple	209,048.4	13.4	214,924.4	14.0
Huawei	202,901.4	13.0	150,534.3	9.8
Xiaomi	122,387.0	7.9	88,926.8	5.8
OPPO	118,837.5	7.6	112,124.0	7.3
Others	607,049.0	39.0	648,762.7	42.2
Total	**1,555,267.0**	**100.0**	**1,536,535.5**	**100.0**

Source: Gartner (February 2019).

Worldwide Smartphone Sales to End Users by Operating System in 2017*

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* In thousands of units

Operating System	2017 Units	2017 Market Share (%)	2016 Units	2016 Market Share (%)
Android	1,320,118.1	85.9	1,268,562.7	84.8
iOS	214,924.4	14.0	216,064.0	14.4
Other OS	1,493.0	0.1	11,332.2	0.8
Total	**1,536,535.5**	**100.0**	**1,495,959.0**	**100.0**

Source: Gartner (February 2018).

Basic Architecture of a Mobile Cellular Network

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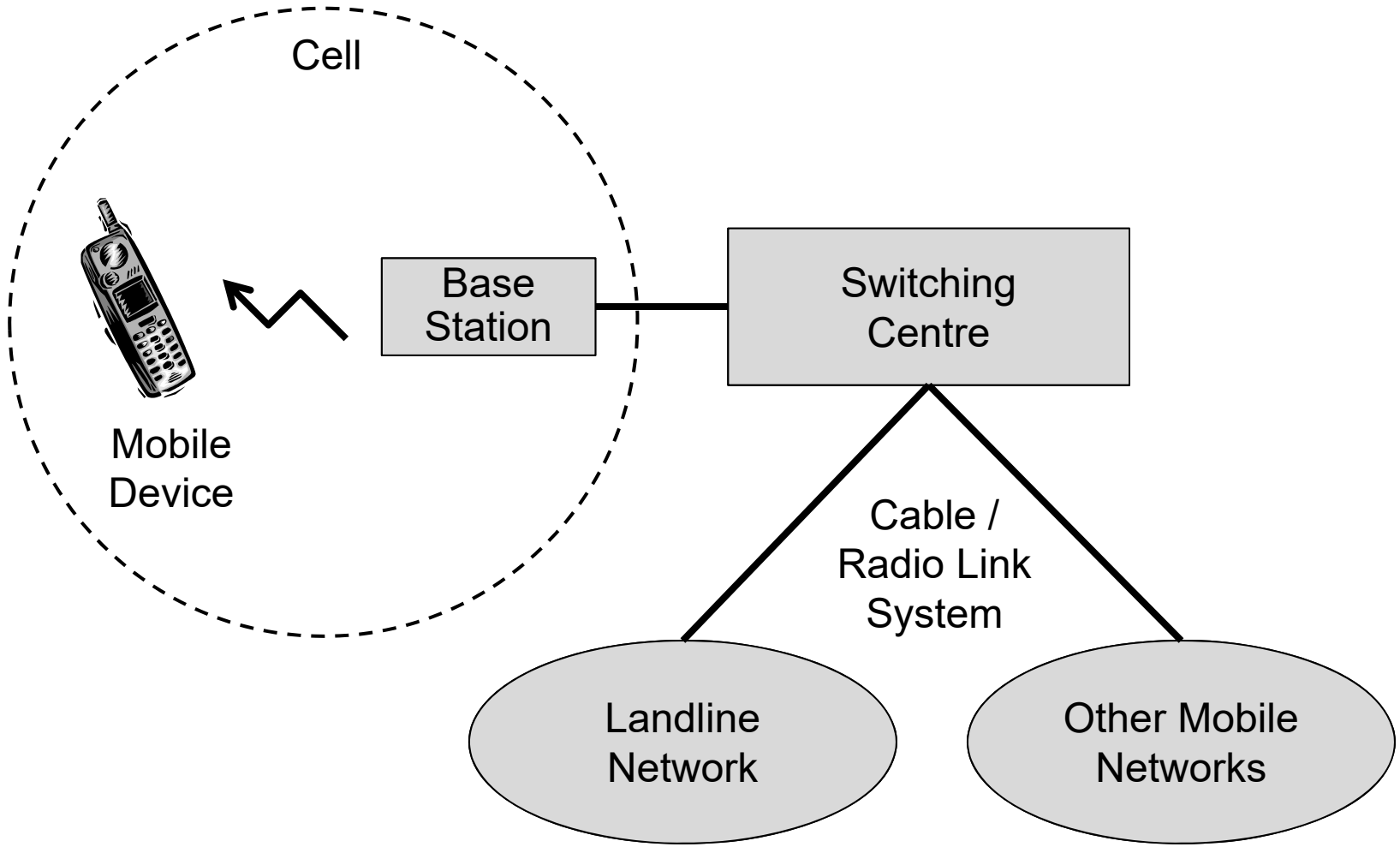

Selected Characteristics of Cell Based Communication

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- Robustness
  - Failure of one base station does not affect the complete infrastructure
- High availability
  - Dependent on development of infrastructure
- High capacity
  - Possibility to share transmission frequencies by combining communication signals or data streams of several mobile devices (→ multiplexing)
- Reduced power usage for mobile devices
  - Small cell requires only limited amount of transmission power, compared to a distant base station
- Complex infrastructure and system operation
  - Complex infrastructure with variety of network components (e.g. antennas, switches, repeater)
  - Complex handover mechanisms to allow real-time change of cells during communication process

Evolution of Mobile Networks (1)

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- 1st Generation
  - Analogue networks
  - in Germany: A-Net (1958-1977), B-Net (1972-1994), C-Net (1985-2000)

- 2nd Generation
  - GSM (Global System for Mobile Communications)
    - Started in 1982 in order to create Europe-wide, digital network standard for mobile communication (meanwhile more than 200 countries)
  - Main frequency bands are 850, 900, 1800 and 1900 MHz (→ Quad band)
  - Data services with download data rates from 9.6 up to 270 kbit/s:
    - CSD (Circuit Switched Data)
    - GPRS (General Packet Radio Service)
    - EDGE (Enhanced Data Rates for GSM Evolution)
  - In Germany technical basis of D-Nets (since 1992) and E-Nets (since 1994/1997)

Evolution of Mobile Networks (2)

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- 3rd Generation
  - UMTS (Universal Mobile Telecommunications System)
    - Objective to overcome incompatibility of 2nd generation networks around the world
    - Full packet driven architecture for voice and data transmissions
    - Download data rates up to 384 kbit/s
  - HSPA (High Speed Packet Access) / HSPA+ (Evolved HSPA)
    - UMTS enhancements with theoretical download data rates up to 168 Mbit/s
- 4th Generation
  - LTE (Long Term Evolution)
    - 3,9G standard based on UMTS infrastructure with theoretical download data rates up to 300 Mbit/s
  - LTE Advanced
    - Enhancement of LTE standard completely fulfilling the 4G requirements set by International Telecommunications Union (ITU)
    - Downward compatible to LTE in order to allow current LTE devices to continue using the LTE Advanced networks
    - Theoretical download data rates up to 1 Gbit/s

Evolution of Mobile Networks (3)

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- 5th Generation
  - Newest standard for digital cellular networks, based on LTE technology
    - Theoretical download data rates up to 10 or 20 Gbit/s
    - Air latency target is 1 ms (currently around 10 ms)
    - Use of higher frequency bands (in Europe 3,4 – 3,8 GHz, 24,25 – 27,5 GHZ, and 31,8 – 33,4 GHz) with smaller cell sizes
    - Additionally use of lower frequency bands possible
  - Available in Germany since July 2019 (Vodafone), other providers will follow in 2020
  - Usage scenarios
    - Enhanced Mobile Broadband: Mobile communications with faster connections, higher throughput, and higher capacity
    - Ultra-Reliable Low-Latency Communications: Mission critical applications that requires uninterrupted and robust data exchange
    - Massive Machine-Type Communications: Connecting large amount of low power, low cost devices, which have high scalability and increased battery lifetime

Wireless LAN (WLAN)

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- Wireless communication standard based on radio as transport medium
  - Possible extension to a wire based LAN
- Radio cell based architecture
  - One cell serves a circular area in which desktop computer, notebooks, smart phones, and other devices can be connected and move freely around
- Bandwidth depends on distance between client and access point, construction and quantity of walls and chosen IEEE 802.11 standard, e.g.:
  - 802.11 (2 Mbit/s at 2,4 GHz)
  - 802.11g (54 Mbit/s at 2,4 GHz)
  - 802.11n (up to 600 Mbit/s at 2,4 and 5 GHz)
  - 802.11ac (Gigabit WLAN at 5 GHz, around 900 Mbit/s up to theoretically 7 Gbit/s)
  - 802.11ad (Multiple Gigabit Wireless up to 7 Gbit/s at 60 GHz, short range of few meters)

WLAN Components and Networks

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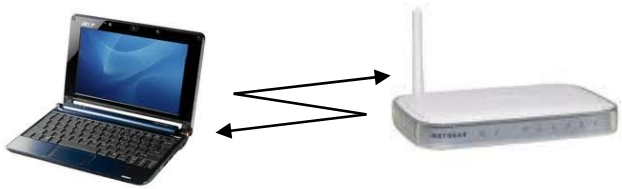
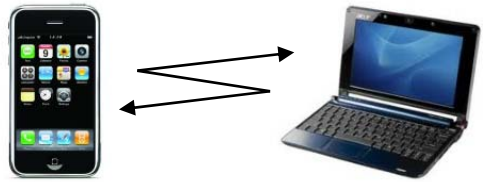
- Access Point
  - Sender and receiver station that allows connecting of multiple client stations

- Client Station
  - (Mobile) device that establish wireless connection with access point

- Infrastructure Networks
  - Infrastructure similar to cellular networks for mobile phones
  - Access points coordinates communication with client stations



- Ad Hoc Networks
  - Connection between two or more devices without access point
  - Direct, peer-to-peer communication between devices when they are in range



Bluetooth

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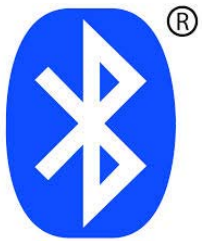

- Wireless communication standard IEEE 802.15.1 for exchanging data and voice over short distances
  - Originally specified by Ericsson in 1994
  - managed by the Bluetooth Special Interest Group (SIG) with more than 20,000 member companies
- Operates in the unlicensed 2.402–2.480 GHz frequency band with so called frequency-hopping
  - transmitted data are divided into packets and transmitted on one of the 79 designated Bluetooth channels with 1 MHz each
  - performs 1600 frequency hops per second in order to improve connection quality
- Transfer technology and data rates:
  - Synchronous Connection Oriented (SCO) for voice
  - Asynchronous Connectionless Link (ACL) for data
  - Asymmetric connection with original download data rates up to 723,2 kBit/s in
  - Symmetric connection with original data rates up to 432,6 kBit/s in each direction
  - Enhanced Data Rates with up to 2 MBit/s possible

Low Power Wide Area Network (LPWAN)

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- Wireless wide area network technologies that allow long range communication at low bit rate and with low energy consumption
  - Mainly created for connecting objects operated outdoors and indoors by battery
- Currently several competing technologies and related platforms, e.g.:
  - LoRaWAN
    - Based on chirp spread spectrum modulation technology
    - Uses different frequencies of the radio spectrum, e.g. 433 MHz and 868 MHz (in Europe), 915 MHz (in USA)
    - Operating distance from 2 to 40 km
  - NarrowBand IoT (NB IoT)
    - Based on Long Term Evolution (LTE) technology
    - Uses different frequencies of the radio spectrum in the 800 and 900 MHz range
    - Operating distance of more than 10 km
  - Wi-Fi HaLow (IEE 802.11ah)
    - Based on WLAN standard
    - Uses different frequencies of the radio spectrum, mainly in the 900 MHz range
    - Operating distance range about twice that of today's Wi-Fi

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4 Mobile Business

4.1 Mobile Devices and Mobile Networks

4.2 Mobile Applications

4.3 Ubiquitous Computing / Internet of Things

Mobile Applications

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- Rapidly developing segment of global market for mobile communication
- Application specific software that runs on a mobile device and performs certain tasks for the user of the device
  - Pre-installation on mobile device
  - After-sale provisioning, usually by downloading applications
    - via operating system dependent Internet marketplaces for mobile applications
- Different development types for mobile applications, e.g.:
  - Native apps, depending on the operating system of mobile device
    - e.g. Android, iOS, Windows
  - Web apps, running in the mobile Web browser
    - e.g. Chrome, Safari
  - Hybrid applications, using development frameworks to ease cross platform app development
    - e.g. PhoneGap

Total Number of Apps offered in Leading App Stores (as of Q3 2018)

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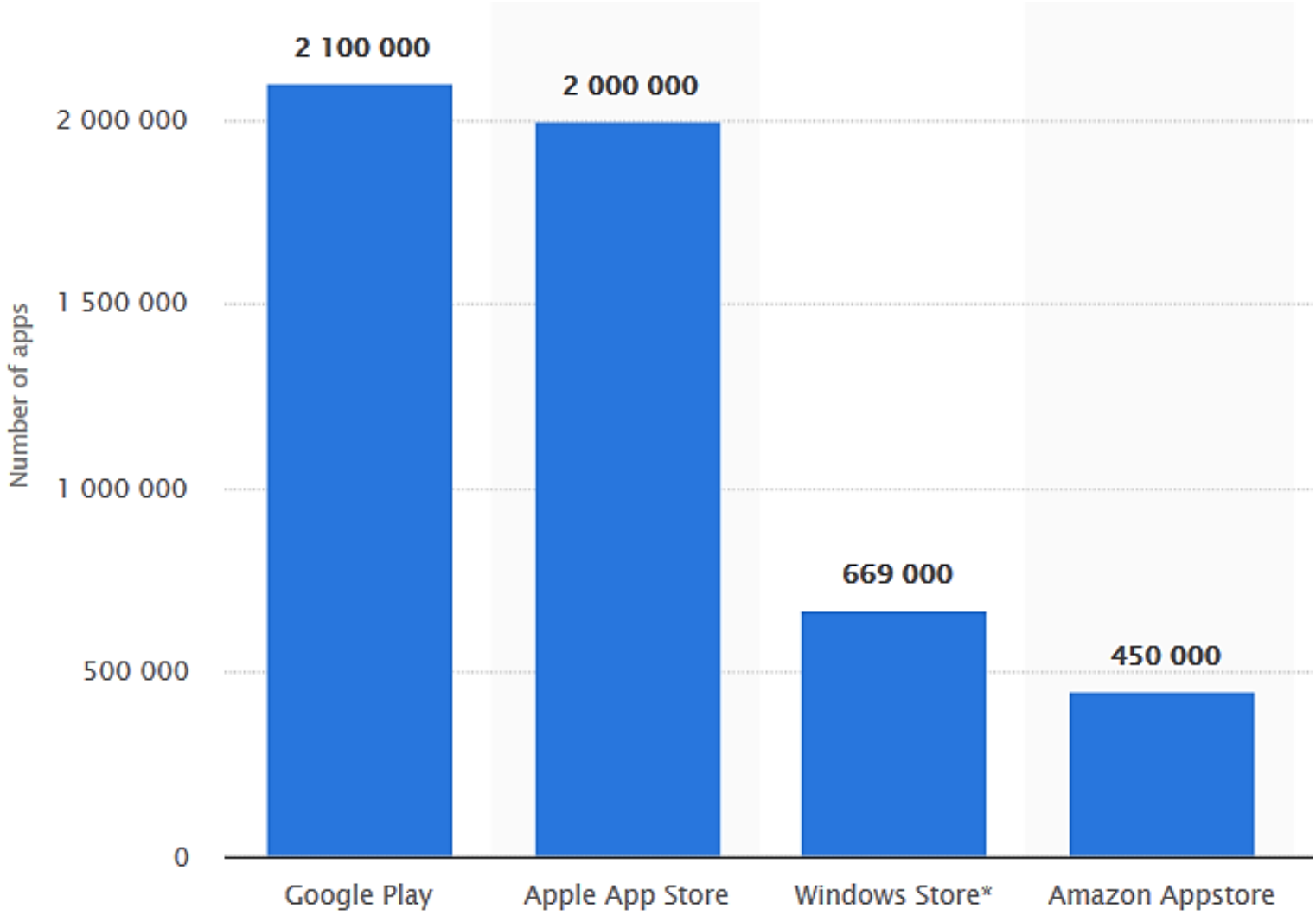

* Windows Phone Store figures as of March 2016.

Source: Statista (2019).

Mobile Application Categories (1)

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- Information and communication applications
  - Web browsers
  - Email clients
  - News clients

- Multimedia applications
  - Image viewers
  - Video players
  - Audio players, e.g. MP3

- Office applications
  - Address books
  - Calendars
  - Calculators
  - Currency converters

Mobile Application Categories (2)

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- Travel and navigation applications
  - Maps & Positioning tools
  - Flight booking
  - Hotel booking
  - Weather forecasts

- Banking / finance applications
  - Online banking
  - Mobile Payment
  - Stock trading

- Ticketing applications
  - Purchase of train or bus tickets
  - Purchase of admission tickets for cultural events
  - Purchase of parking tickets

Mobile Application Categories (3)

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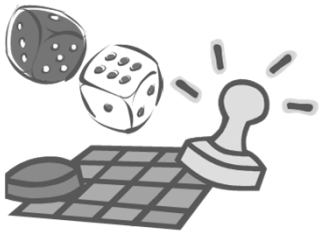
- Games
  - Strategy games
  - Card & casino games
  - Action & adventure games
  - Sport games



- Utilities and system applications
  - Screen savers
  - Task managers
  - File managers

Current Mobile Payment Solutions

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- Mobile transaction number (mTAN)
  - Sending of SMS with TAN to registered mobile phone number
  - Input of TAN in order to confirm payment
  - Mainly used for online banking and online shopping

- Near field communication (NFC)
  - Implementation of NFC functionality on debit or credit cards or within smartphones, e.g. Samsung‘s Galaxy, Google‘s Nexus, Sony‘s Xperia
  - Mainly used for shopping in retail stores

- Barcode scanning
  - e.g. GO4Q with QR codes

- Bluetooth low energy (BLE) technology
  - esp. iBeacon from Apple

Example: VR-SecureGo App

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Example: Mobile Ticketing Solution

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- Mobile ticketing solution for car parking in Austria
  - Customer registers for Wien or other Austrian cities with his mobile phone number and license plate number
  - Purchase of parking ticket via SMS with indication of required parking time
  - Billing via mobile payment solution paybox austria or prepaid with credit card or direct debit

Source: http://www.handyparken.at

Example: VRNnextbike

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Source: http://www.vrnnextbike.de.

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4 Mobile Business

4.1 Mobile Devices and Mobile Networks

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4.3 Ubiquitous Computing / Internet of Things

Integration of Information Technology into Everyday Life

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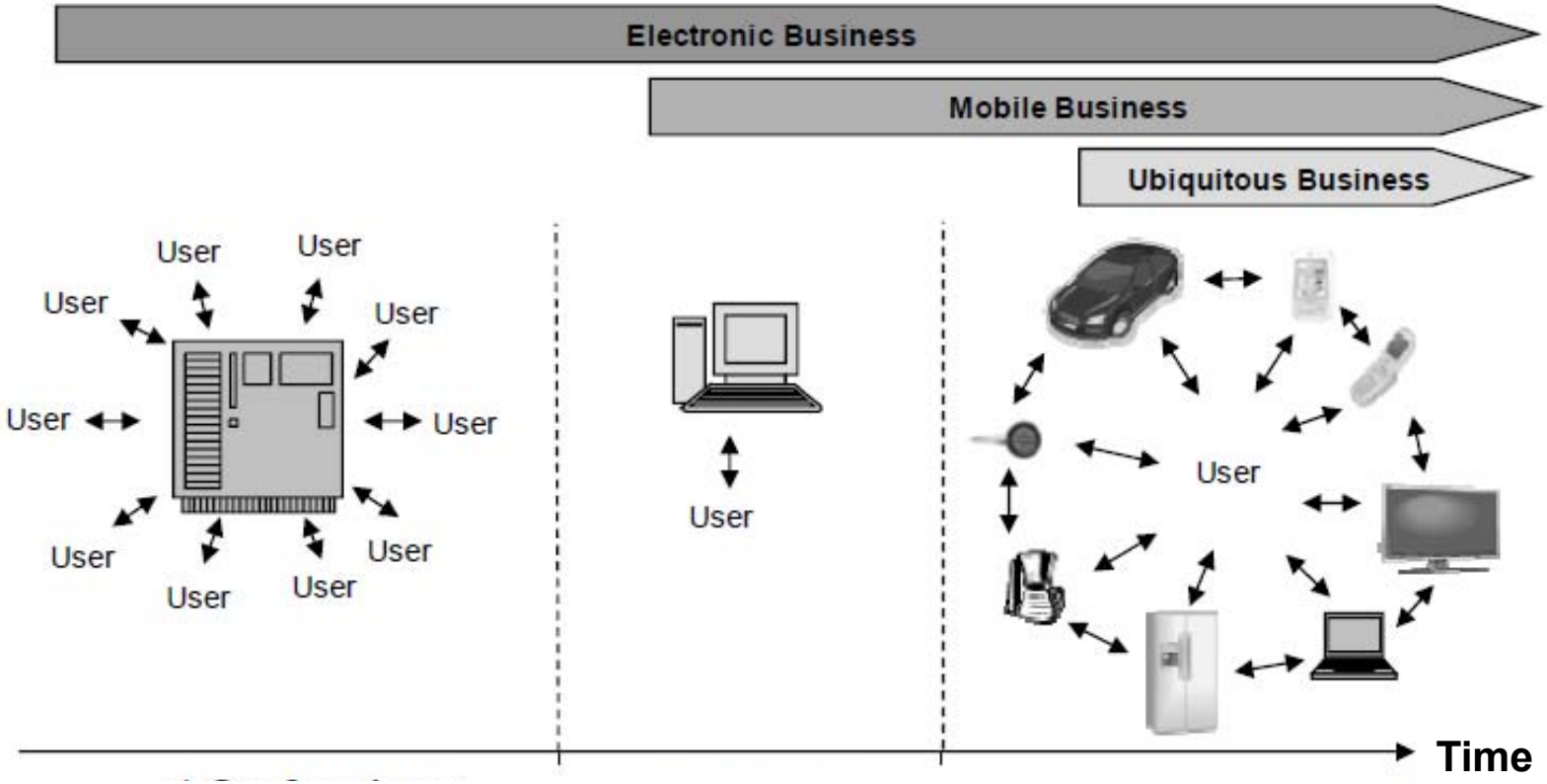

One mainframe computer for many users

One (mobile) computer for every user

Many (embetted) computers for every user

Based on Wirtz (2010), p. 92.

Ubiquitous (Pervasive) Computing *

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- Ubiquity / Pervasiveness
  - High amount of computing devices
  - Often mobile or imbedded in environment (e.g. in appliances, in equipment in homes, workplaces and factories, and in clothing)
- Invisibility
  - Often interface between the user and device disappears and device becomes invisible
  - If applicable, access and control by other devices such as smartphones or by voice control
- Connectedness
  - Devices are networked to other devices and information
  - Using wireless and wired network technologies
- Context-awareness
  - System is aware of context of users and provides intelligent bridge between computational environment and real world
  - Using sensor and identification technologies (e.g. RFID, GPS)

* Based on National Institute of Standards and Technology (NIST) definition of ubiquitous computing.

Subject Areas of Ubiquitous Computing

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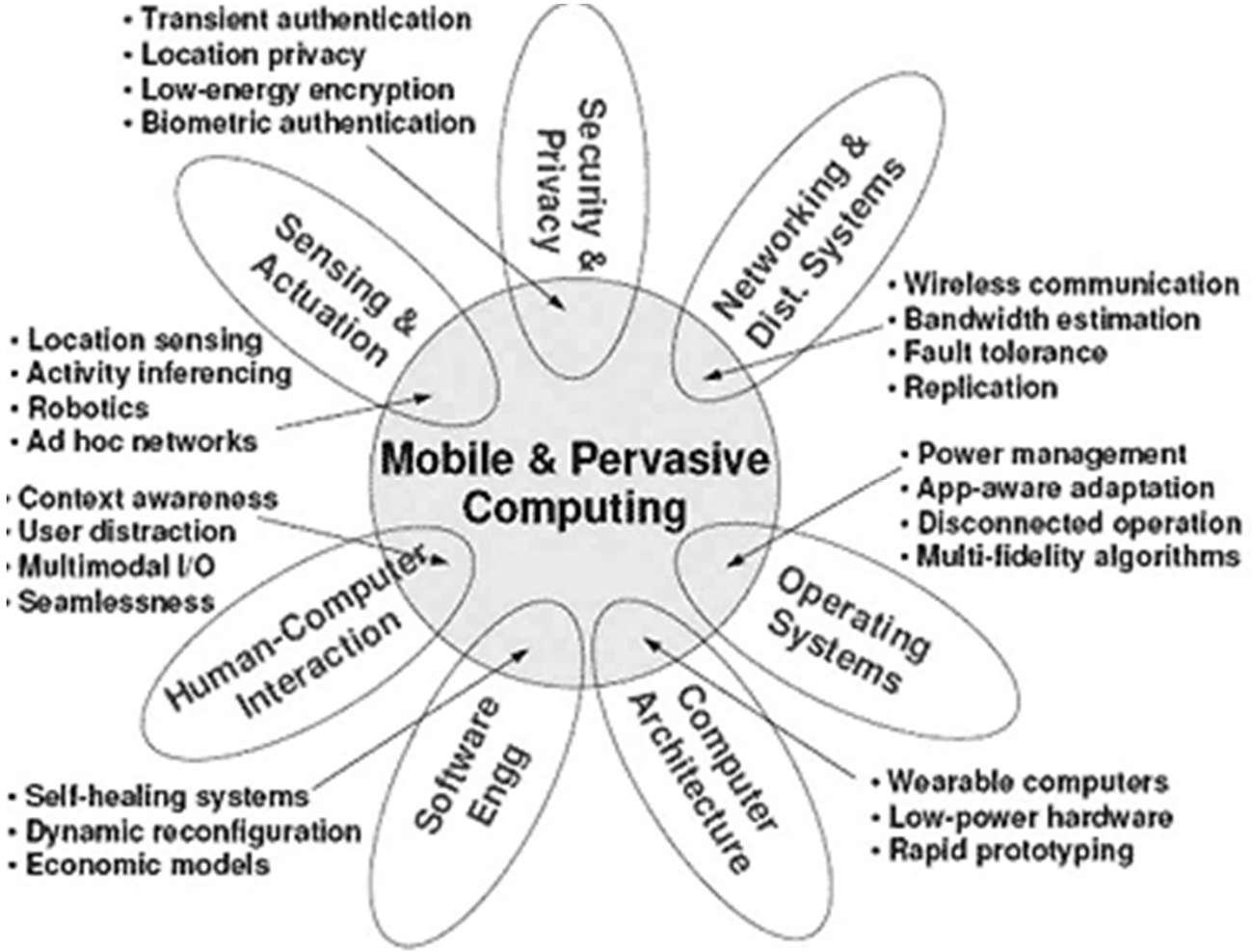

Source: Mobile and Pervasive Computing Research in the Computer Science Department at Carnegie Mellon University.

Internet of Things (IoT)

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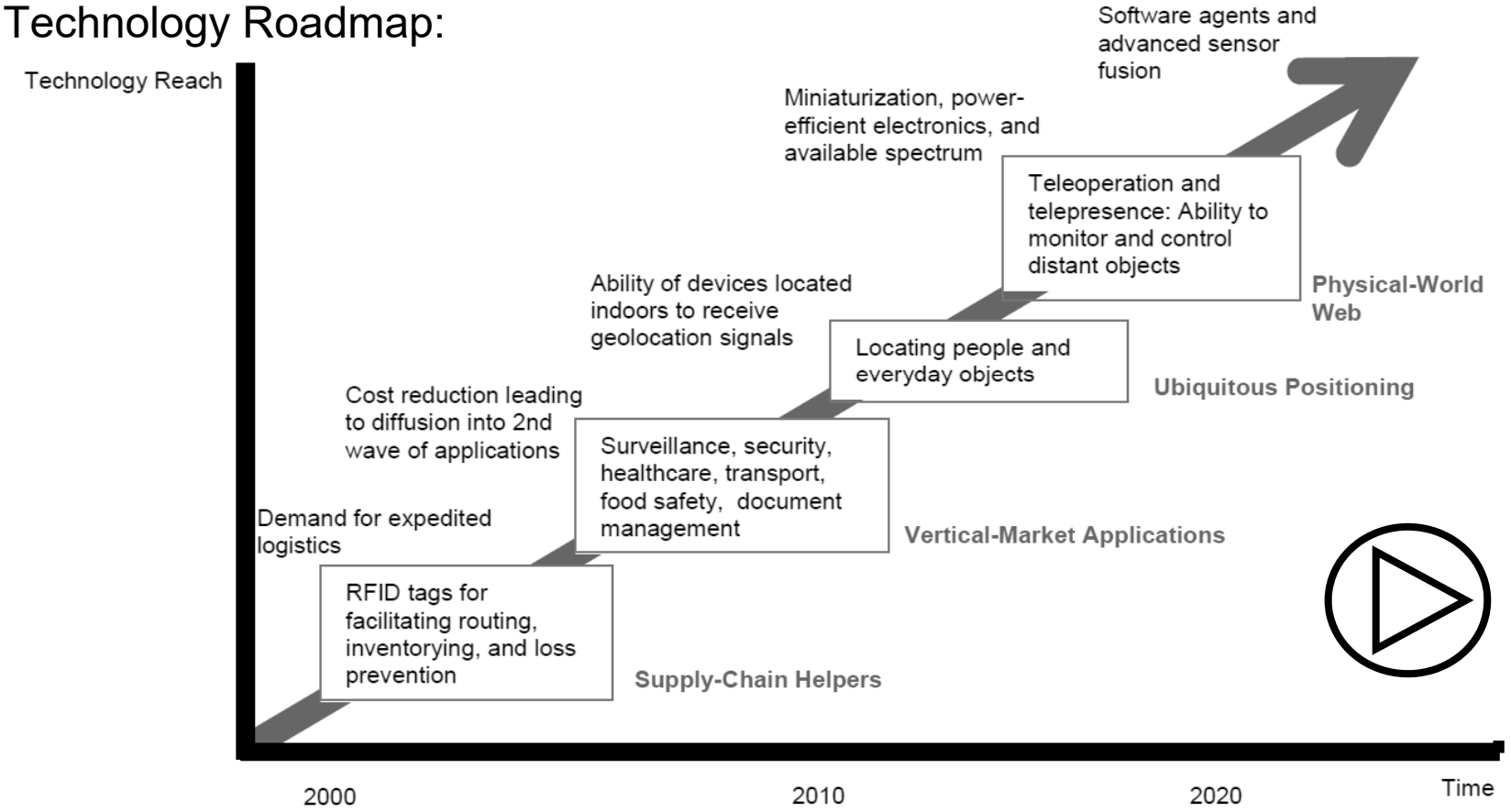
- Term refers to general idea of things, especially everyday objects, that are readable, recognizable, locatable, addressable, and/or controllable via the Internet
- Technology Roadmap:



Source: SRI Consulting Business Intelligence.

IoT Value Added Potential

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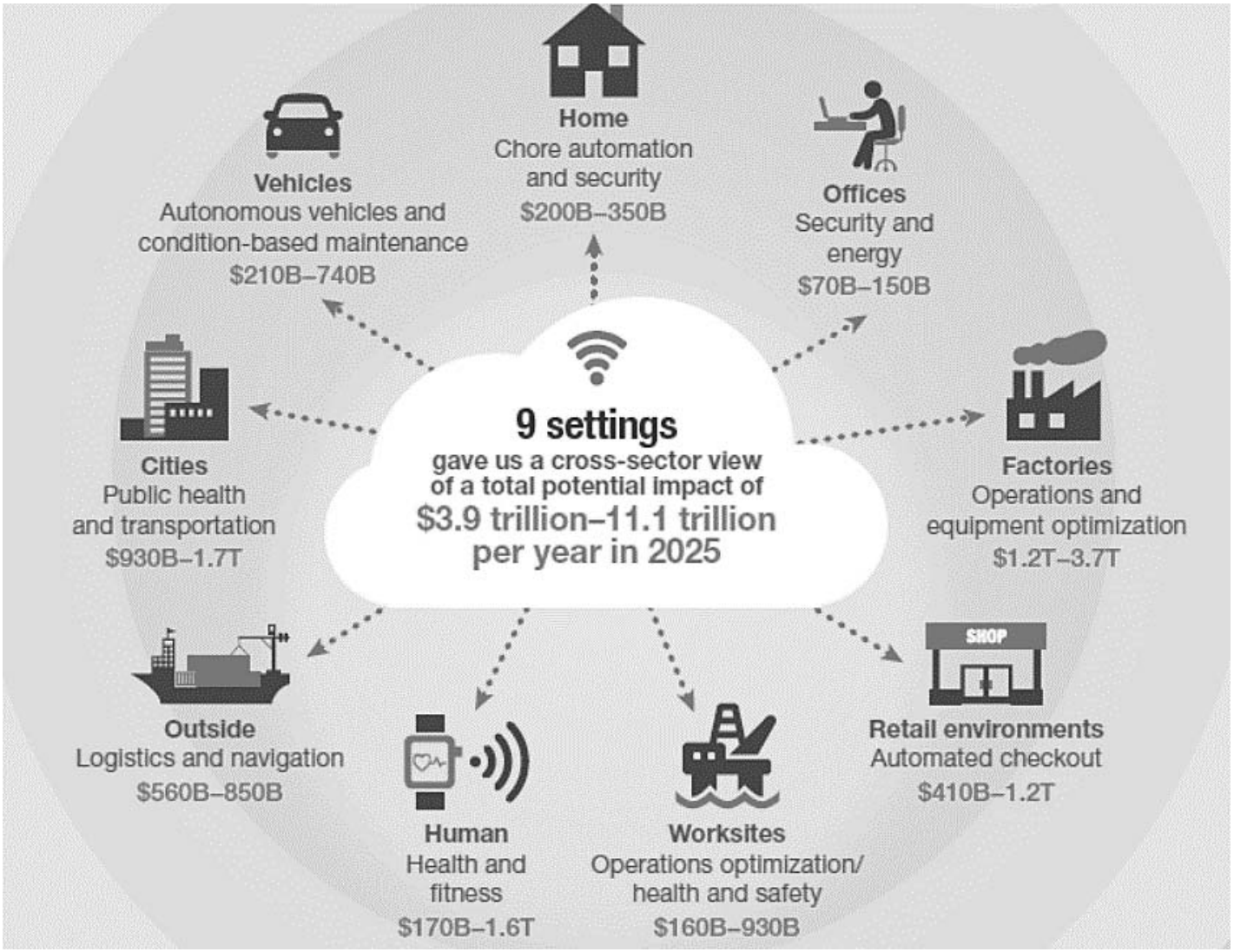

Source: McKinsey Global Institute: The Internet of Things: Mapping the value beyond the hype,(2015), p. vii.

IoT Areas of Growth (1)

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Setting		Description	Examples
	Human	Devices attached to or inside the human body	Devices (wearables and ingestibles) to monitor and maintain human health and wellness; disease management, increased fitness, higher productivity
	Home	Buildings where people live	Home controllers and security systems
	Retail environments	Spaces where consumers engage in commerce	Stores, banks, restaurants, arenas—anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
	Offices	Spaces where knowledge workers work	Energy management and security in office buildings; improved productivity, including for mobile employees
	Factories	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory

Source: McKinsey Global Institute: The Internet of Things – Mapping the Value Beyond the Hype (2015), p. 3.

IoT Areas of Growth (2)

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Setting		Description	Examples
	Worksites	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
	Vehicles	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircraft, and trains; condition-based maintenance, usage-based design, pre-sales analytics
	Cities	Urban environments	Public spaces and infrastructure in urban settings; adaptive traffic control, smart meters, environmental monitoring, resource management
	Outside	Between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations), and flight navigation; real-time routing, connected navigation, shipment tracking

Source: McKinsey Global Institute: The Internet of Things – Mapping the Value Beyond the Hype (2015), p. 3.

IoT Fields of Application

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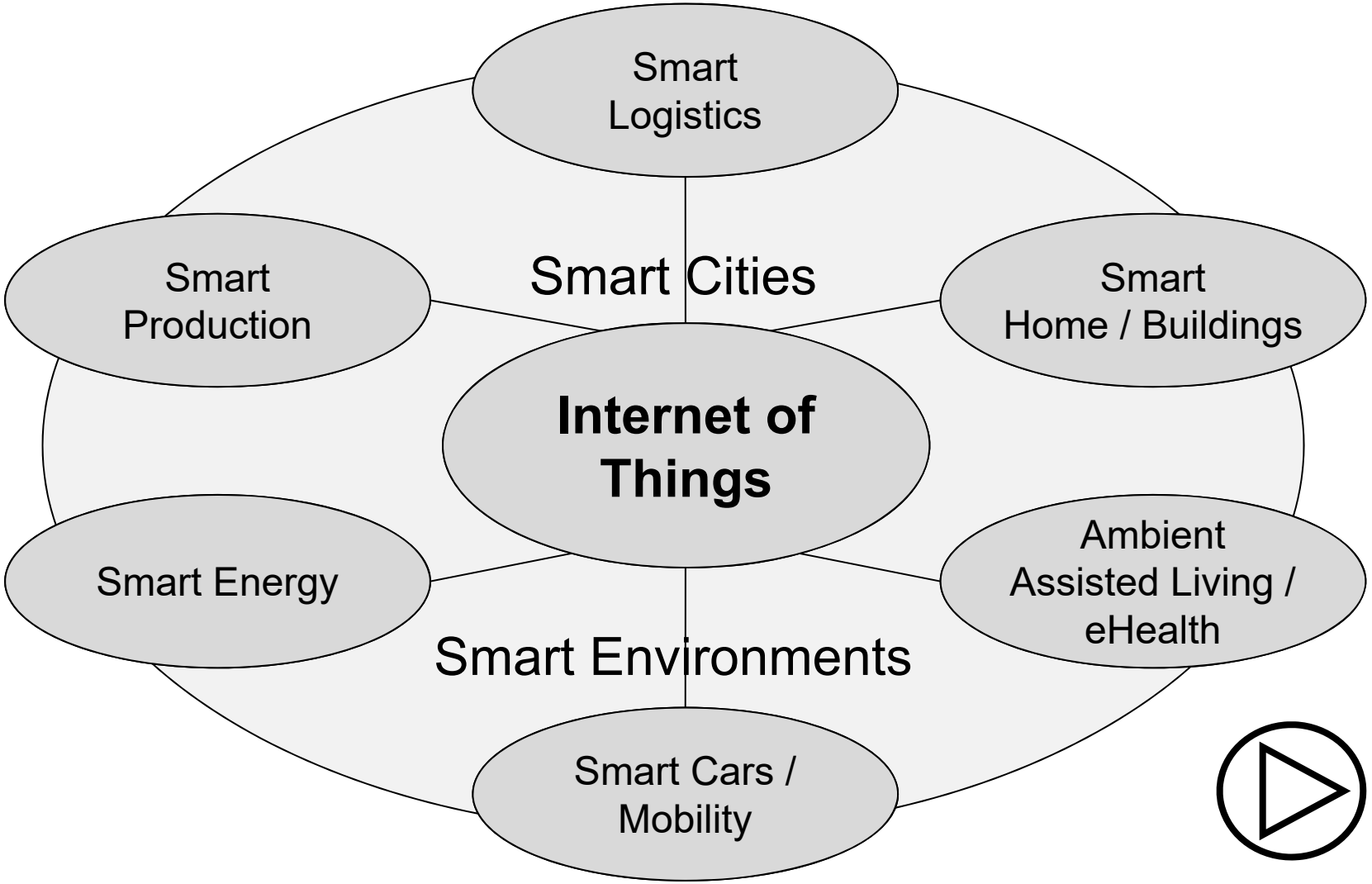

Example: Smart Office @ HS-LU – Using openHAB and MQTT (E35)

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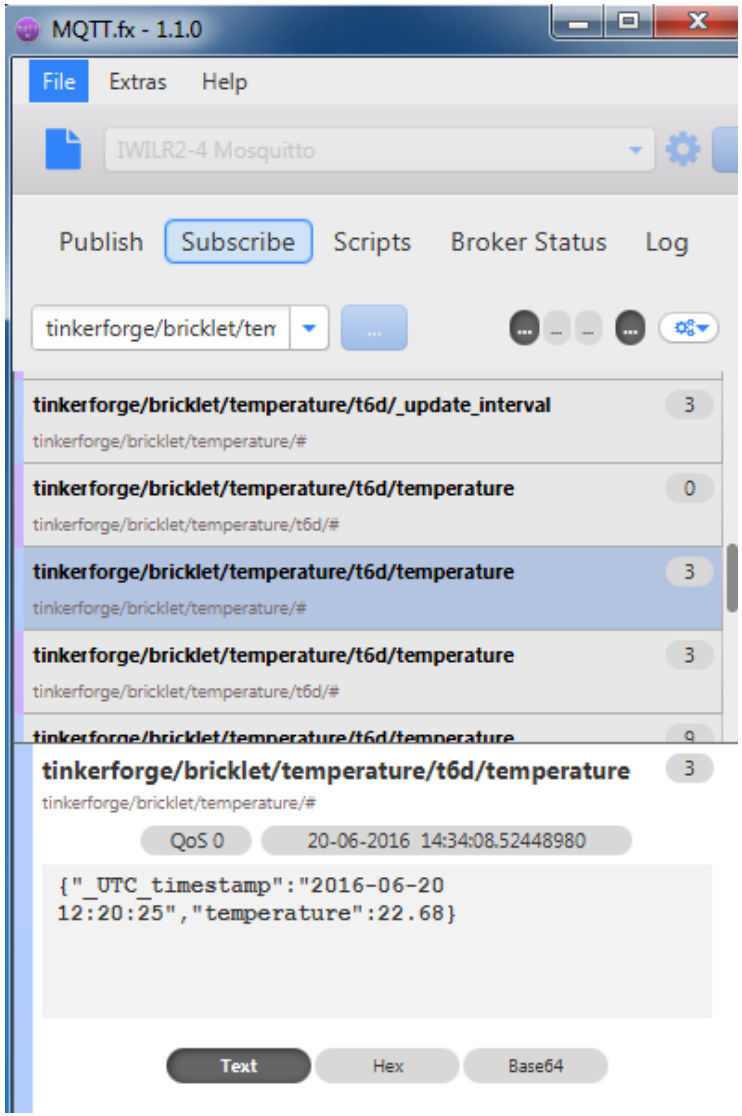

Wiederholungsfragen zu Teil 4 / Repetition Part 4

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1. Nennen Sie 5 Herausforderungen bzw. technische Beschränkungen, mit denen Mobile Business derzeit konfrontiert ist. / Specify 5 challenges or technical restrictions respectively Mobile Business currently is confronted with. (→ Folie / Slide 144)
2. Wie viele Generationen von Mobilfunknetzen werden bislang unterschieden? Nennen Sie pro Generation ein konkretes Mobilfunknetz oder einen damit verbundenen Mobilfunkstandard. / How many generations of mobile networks can be distinguished so far? Specify for each generation one mobile network or one related standard. (→ Folien / Slides 151, 152, 153)
3. Nennen Sie 5 Kategorien mobiler Anwendungen und geben Sie jeweils ein Beispiel. / Specify 5 mobile application categories and give an example for each category. (→ Folien / Slides 161, 162, 163)
4. Nennen und erläutern Sie die vier wesentlichen Charakteristika, die das sogenannte Ubiquitous Computing auszeichnen. / Specify and describe the 4 main characteristics of the so called Ubiquitous Computing. (→ Folie / Slide 170)

Übung zu Teil 4

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- Da das Internet der Dinge eine zunehmend wichtige Rolle für eBusiness Anwendungen spielt, wollen Erika und Max Mustermann ausgewählte Waren, die in Ihrem Einzelhandelsgeschäft verkauft werden, mit RFID Transpondern bestücken, um dadurch in Echtzeit den aktuellen Warenbestand ermitteln zu können. Diese Information soll dann zeitnah auf den Webseiten des eShops angezeigt werden.

- Bilden Sie 3er- oder 4er-Gruppen und unterstützen Sie Erika und Max, indem Sie sie bzgl. der informationstechnischen Umsetzung beraten.
  - Legen Sie dazu zunächst fest, wie das im Einzelhandelsgeschäft zu installierende RFID-Lesegerät in die bereits bestehende Software System-Architektur (→ Übung zu Teil 2.2) eingebunden werden soll. Diskutieren Sie hierbei auch die Implementierung einer evtl. zur Berechnung des Warenbestands benötigten Anwendung mit Datenhaltung.
  - Definieren Sie anschließend, welche Informationen mindestens an den eShop übertragen werden müssen, um dort den aktuellen Warenbestand auf der Webseite anzeigen zu können.

Exercise Part 4

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für Wirtschaft und Gesellschaft
Ludwigshafen

- As the Internet of Things increasingly plays an important role for eBusiness applications, Jane and John Doe plan to implement RFID tags into selected goods of their retail store, in order to be able to calculate the inventory in real time. This information shall be shown directly on the website of the eShop.

- Work together with 3 or 4 other students and provide Jane and John advice with respect to an IT-based realisation.
  - Specify first, how the RFID reader which has to be installed in the retail store shall be integrated into the existing software architecture (→ exercise part 2.2). Discuss hereby a potential implementation of an additional application with data storage for calculating the inventory.
  - Define afterwards which minimum information has to be transferred to the eShop, in order to be able to display the current inventory level on the website.