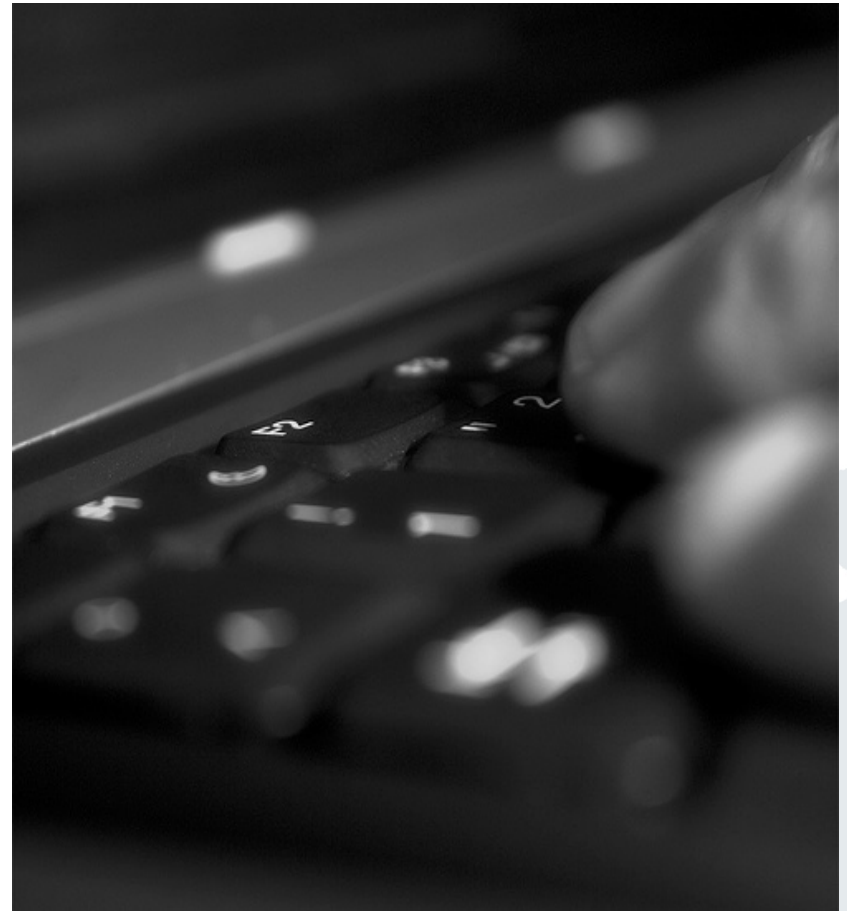mobile business

Lecture 14
Mobile Business 1

FAQ

WS 2014/15

Prof. Dr. Kai Rannenberg
www.m-chair.de

Jenser (Flickr.com)

Focus and content of Final Written Exam

- ## Focus of Final Written Exam
  - Content covered in Exercises and Mentorium

- ## Exam questions are in English and German
  - You can answer in German or English. But please do not mixed languages in one sentence!

- ## Balance between Knowledge and Transfer
  - Majority of questions is transfer related

- ## Lectures to be excluded from Final Written Exam
  - Lecture 1 (Introduction & Course Organisation)

(Value Creation) Was unterscheidet die Klassische Wertschöpfungskette (Porter) von der modifizierten Wertschöpfungskette für „Intermediary Service Production"?
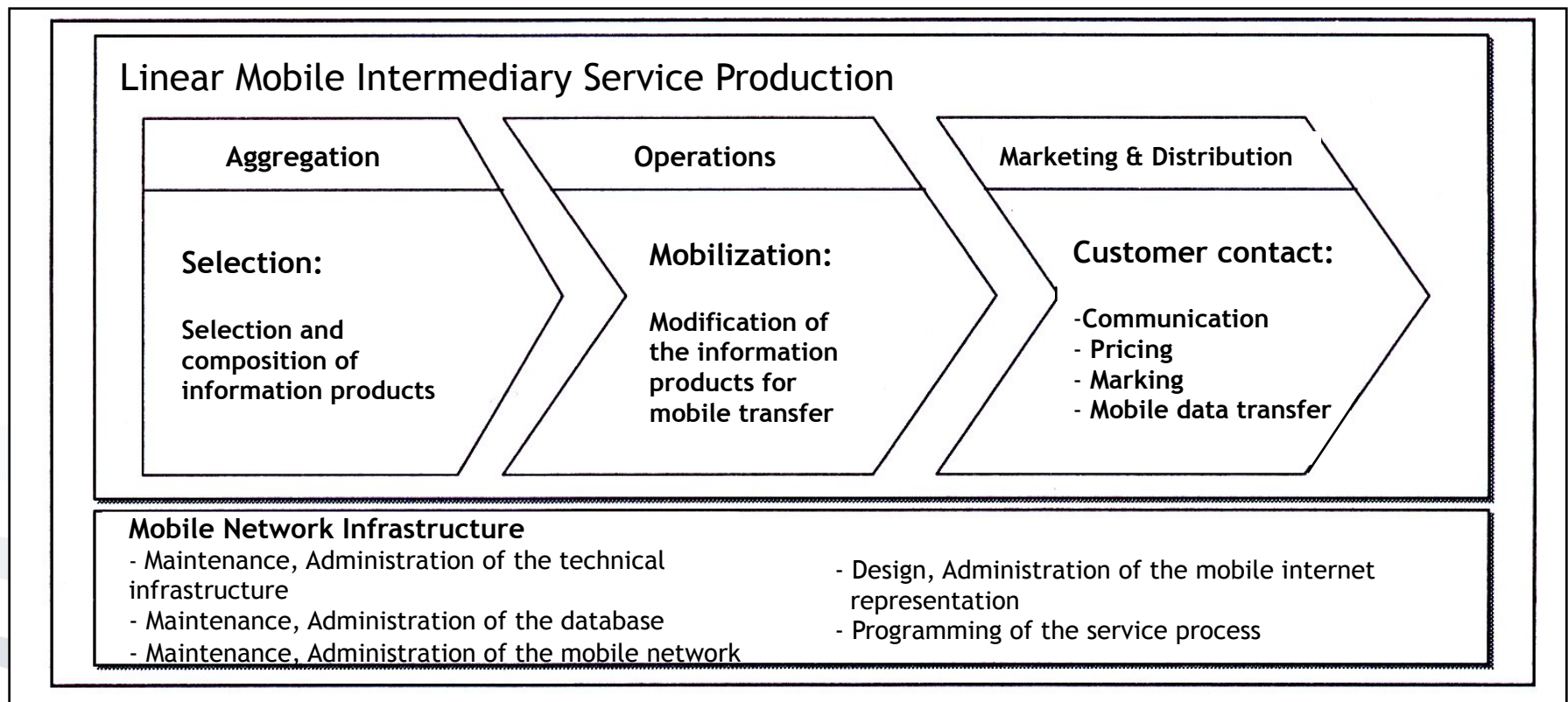
- Classical value chain (Porter 1985)
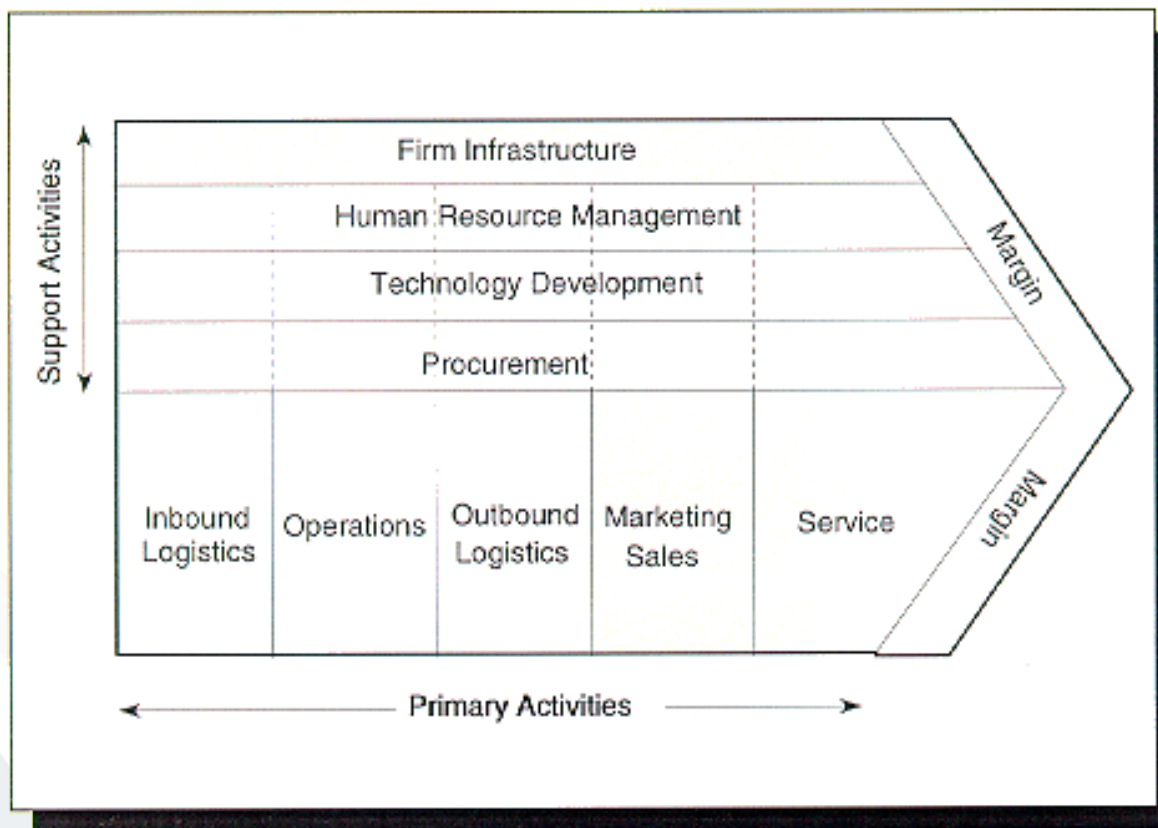
[Porter1985]

- Suitable for illustrating value-adding activities

- Input-output-orientation of the different value chain elements

- Applicable to services? (criticism)

- Mobile segment: Only for linear mobile services (procurement, preparation, sales)

➲ Modification of the value chain

[ReicMeieFrem2002]

Modified value chain

Linear Mobile Intermediary Service Production

Aggregation	Operations	Marketing & Distribution
Selection: Selection and composition of information products	**Mobilization:** Modification of the information products for mobile transfer	**Customer contact:** -Communication - Pricing - Marking - Mobile data transfer

Mobile Network Infrastructure
- Maintenance, Administration of the technical infrastructure
- Maintenance, Administration of the database
- Maintenance, Administration of the mobile network
- Design, Administration of the mobile internet representation
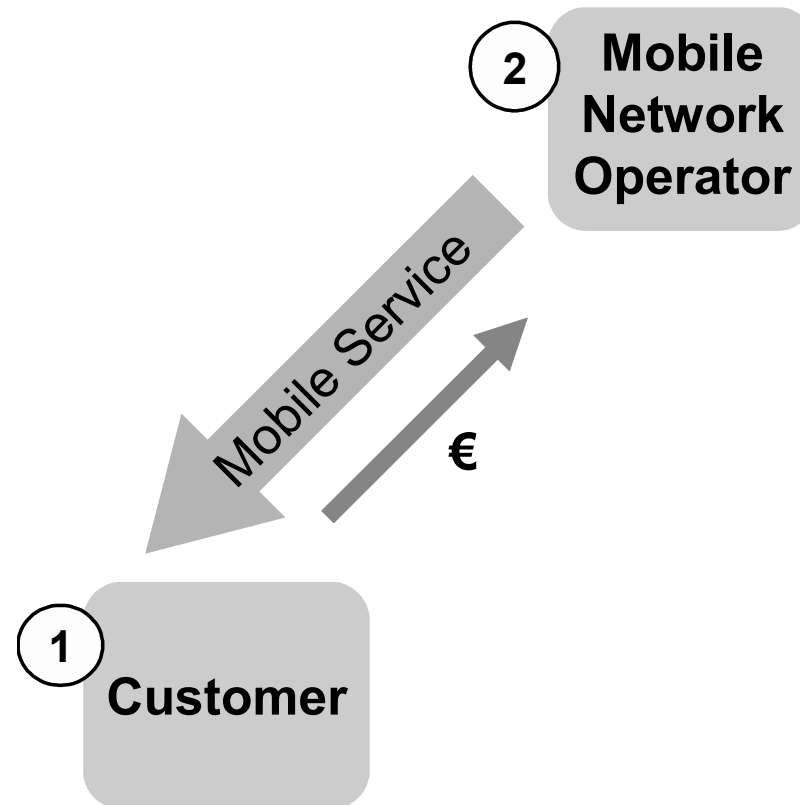- Programming of the service process

[ReicMeieFrem2002]

- Suitable for illustrating *linear mobile services.*
- Example:

Sind CBM 1 und CBM 2 beides klassische Geschäftsmodelle oder nur eins davon?
Was die weitere Frage aufwirft: Was wäre in dem Zusammenhang dann das „New Business model"?

- Classical business model (CBM) I:

② **Mobile Network Operator**

Mobile Service

€

① **Customer**

- ## Classical business model I:

  - Two parties: Customer, mobile network operator

  - Operator provides communication services and possibly contents to the customer.

  - Possibly the operator manufactures these contents himself. Providing contents is not his core competence.

- ## Classical business model II:
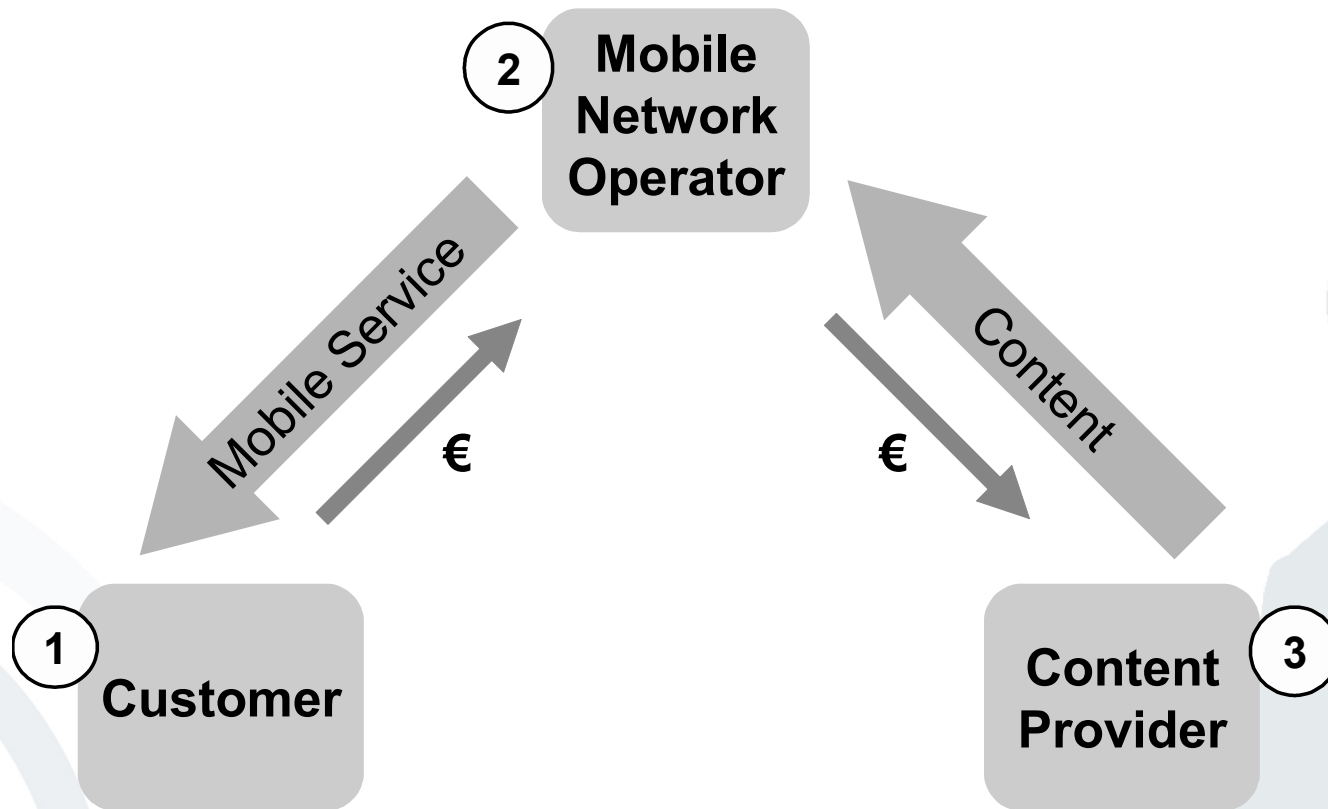
- Classical business model II:

    - Three parties: Customer, mobile network operator, content provider.

    - Operator purchases content (from the content provider) and passes it on to the customer.

    - Content Provision is not the core competence of the network operator.

- **New business model**

    - "Reverse" approach: Instead of charging the customer, the service provider contacts the customer and offers free access.

    - ➲ Sponsoring of interesting (profitable) customers by advertising service providers
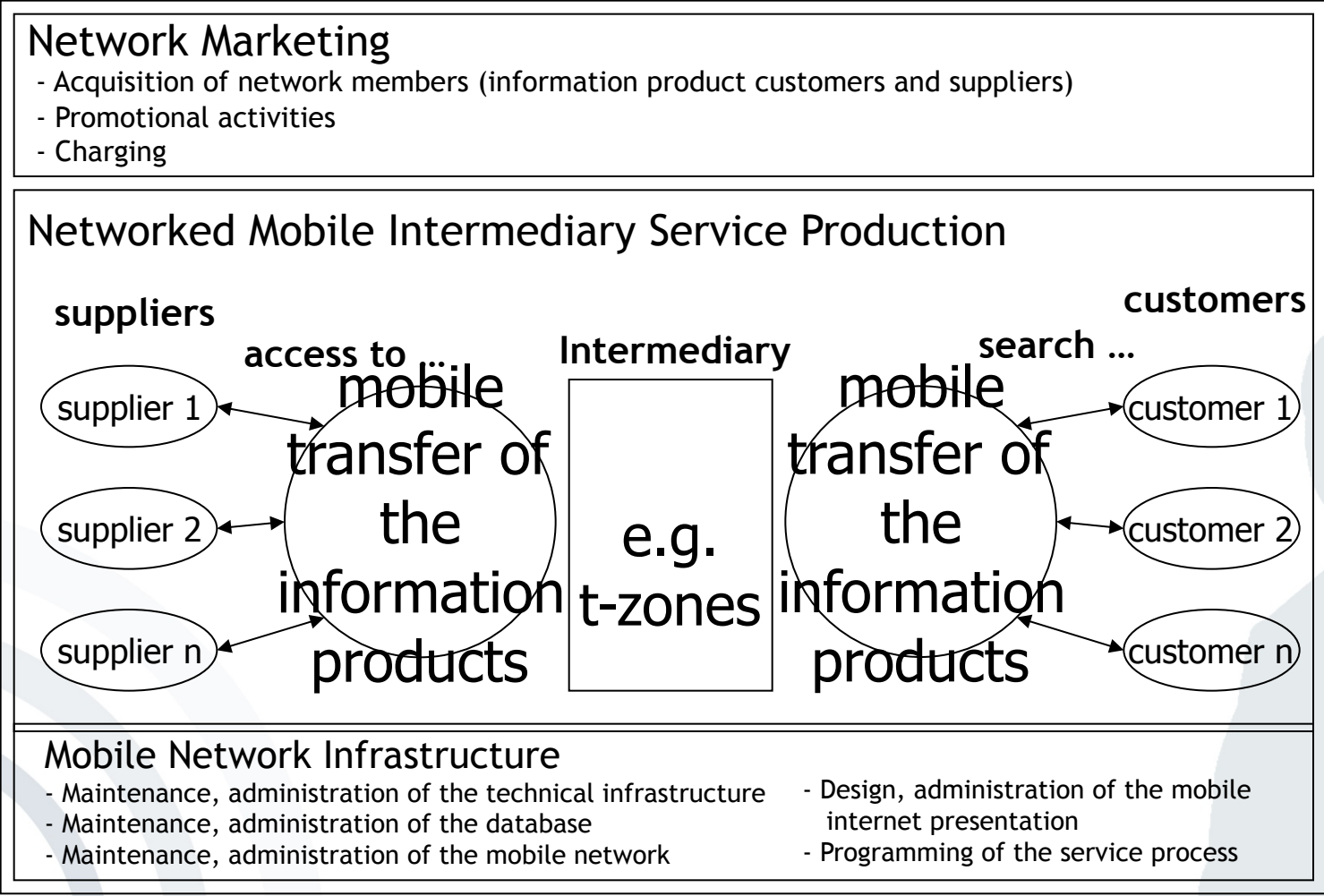
- ## New business model:
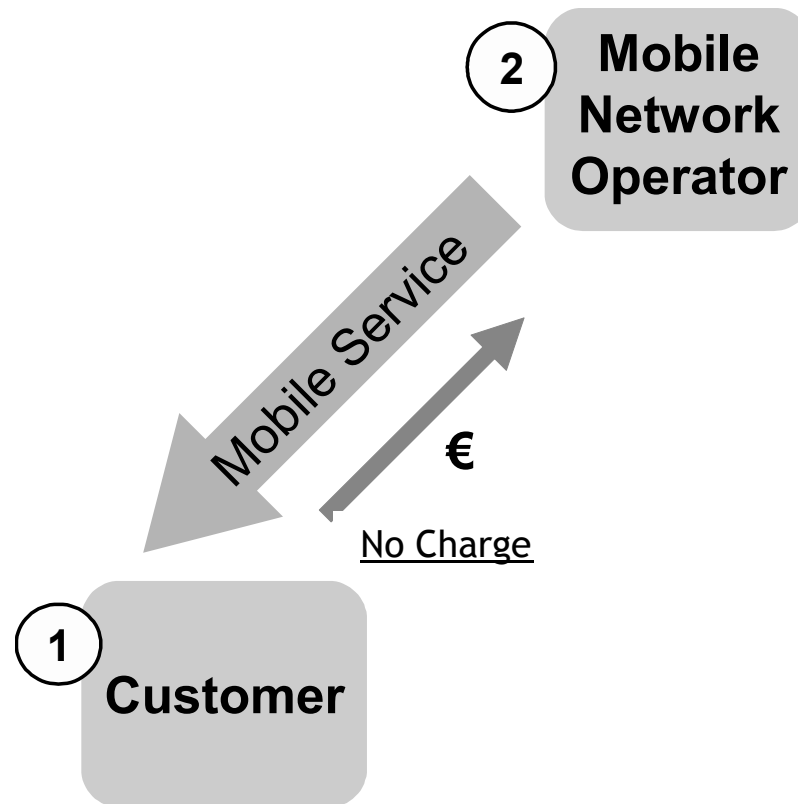
Könntet ihr das Value Network nochmal kurz erklären? Und welche Rolle spielen dabei Value added shop und M-value chain? (Vorlesung 6)

- However, it is not applicable to networked intermediary service settings

⮑ "Value creation network" or "value network"

[ReicMeieFrem2002]

- Value network [ReicMeieFrem2002]

Network Marketing
- Acquisition of network members (information product customers and suppliers)
- Promotional activities
- Charging

Networked Mobile Intermediary Service Production

suppliers

customers

access to ...

Intermediary

search ...

supplier 1

mobile transfer of the information products

e.g. t-zones

mobile transfer of the information products

customer 1

supplier 2

customer 2

supplier n

customer n

Mobile Network Infrastructure
- Maintenance, administration of the technical infrastructure
- Maintenance, administration of the database
- Maintenance, administration of the mobile network
- Design, administration of the mobile internet presentation
- Programming of the service process

17

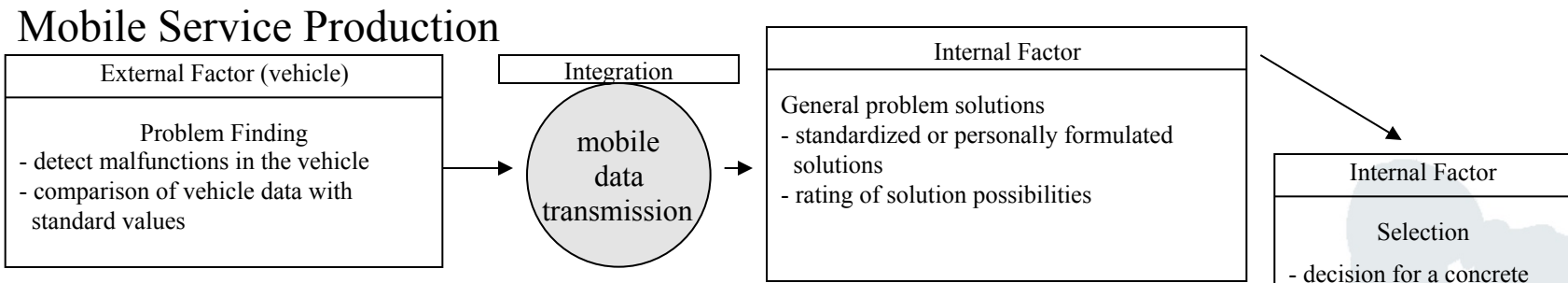# mobile business

■ Example: Community-approaches, dating, …

■ One of the unique benefits of taking Match.com's dating services mobile **is the ability to match members based on their physical location.** Initially, matches will be made based on the user profile zip code but in coming months, the service will be enhanced with location-based technology. This means match.com users can locate their matches within an approximate geographical location automatically **using their mobile device.**
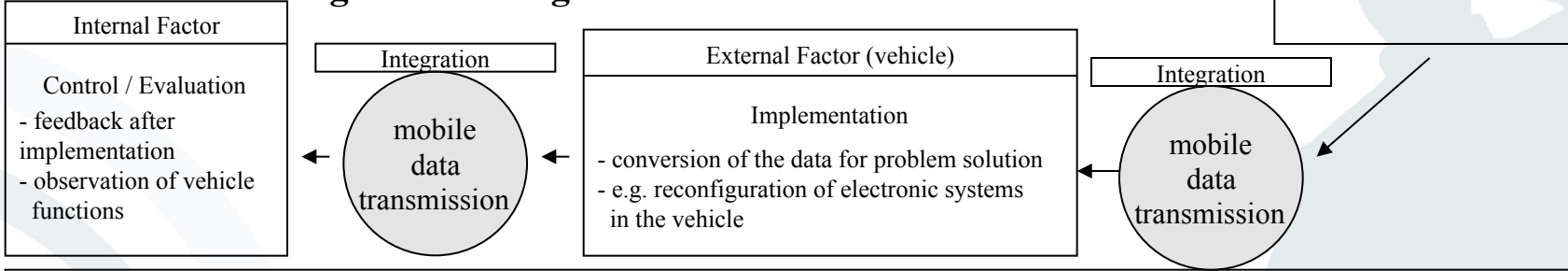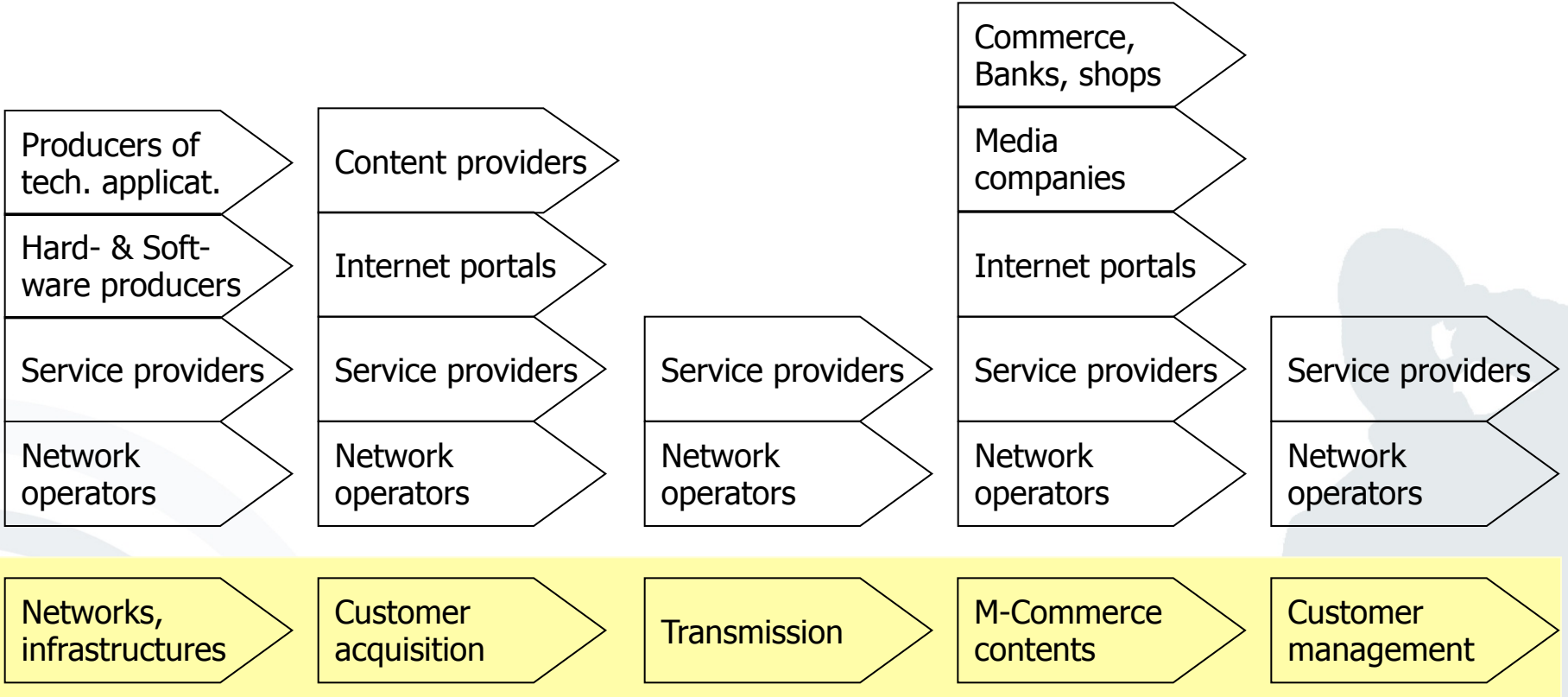
18

- ## Value added shop   [ReicMeieFrem2002]

Network Marketing
- Acquisition of network members (information product customers and suppliers)
- Promotional activities
- Charging

Mobile Service Production

External Factor (vehicle)

Problem Finding
- detect malfunctions in the vehicle
- comparison of vehicle data with standard values

Integration

mobile data transmission

Internal Factor

General problem solutions
- standardized or personally formulated solutions
- rating of solution possibilities

Internal Factor

Selection

- decision for a concrete solution method

e.g. remote diagnostics of vehicles

Internal Factor

Control / Evaluation
- feedback after implementation
- observation of vehicle functions

Integration

mobile data transmission

External Factor (vehicle)

Implementation

- conversion of the data for problem solution
- e.g. reconfiguration of electronic systems in the vehicle

Integration

mobile data transmission

Mobile Network Infrastructure
- Maintenance, administration of the technical infrastructure
- Maintenance, administration of the database
- Maintenance, administration of the mobile network
- Design, administration of the mobile internet appearance
- Programming of the service process

19

- The presented classification is just **one possibility**

- Further example:

  Mobile value chain [PicotNeuburg2002]

M-value chain

			Commerce, Banks, shops	
Producers of tech. applicat.	Content providers		Media companies	
Hard- & Software producers	Internet portals		Internet portals	
Service providers	Service providers	Service providers	Service providers	Service providers
Network operators	Network operators	Network operators	Network operators	Network operators

Networks, infrastructures	Customer acquisition	Transmission	M-Commerce contents	Customer management

[PicotNeuburg2002]

-V6/F.32= wie kommen geringere "service costs" für MVNOs in einem wettbewerblichen Markt zustande? Werden sie auf mehrere Anbieter verteilt?
-V7/F.45= was ist mit "Disintegration of existing provider constellations…" gemeint?

- # Price effect:
  - ## Increasing number of sellers (i.e. network operators, MVNOs) in an oligopolistic market ➲ causes tendency towards competitive market:
    - The price converges to the marginal costs.
    - The output converges to the economically efficient level.
    - Lower MVNO prices due to lower service costs of MVNOs

[Mankiw1999]

- ## New approach

  - ### Disintegration of existing provider constellations through revenue-sharing and sponsoring

[FigSchMunRan2002]

- **New business model**

  - "Reverse" approach: Instead of charging the customer, the service provider contacts the customer and offers free access.

  - ➲ Sponsoring of interesting (profitable) customers by advertising service providers

- ## New business model:
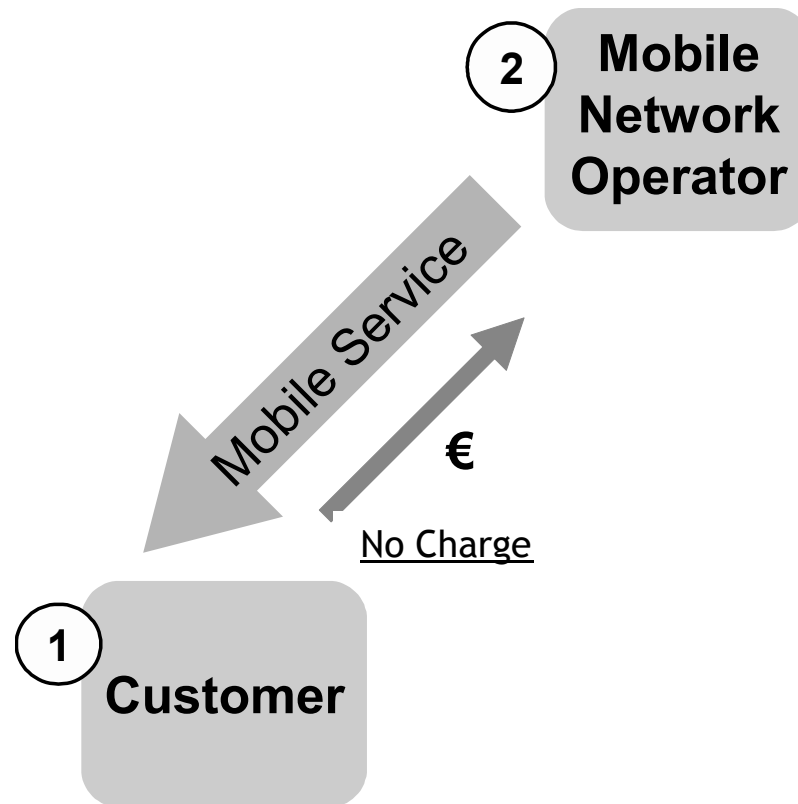
- Packet-oriented vs. circuit-switch networks: Welche speziell werden in der GSM-Welt wie angewandt? Werden alle Daten als Pakete verschickt?

Mobile Data Services

- **Modem** (modulator-demodulator) in analogue mobile networks (300 – 2400 bit/s)
- *CSD* (Circuit Switched Data) in GSM networks (9.6 Kbit/s)
- *HSCSD* (High-Speed Circuit Switched Data) in GSM networks (57.6 Kbit/s max.)
- *GPRS* (General Packet Radio Service)
- *EDGE* (Enhanced Data Rates for Global Evolution)

Evolution of Mobile Data

2G – GSM CSD/HSCSD	2.5G – GSM GPRS	3G – UMTS	3.5G – HSPA/HSPA+	3.9G/4G – LTE

1G - Modem   **2.75G - EDGE**   **4G – LTE Advanced**

28
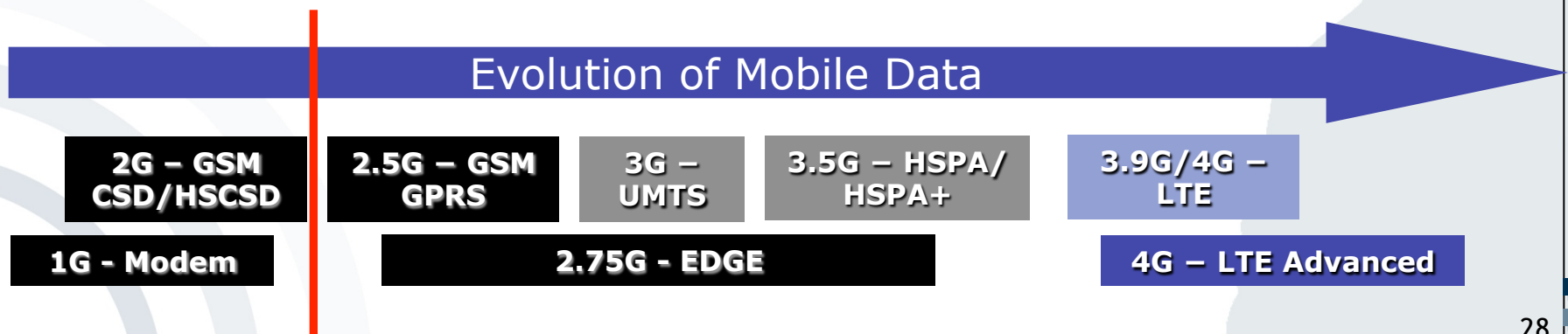
-Ü1/F.18 "QoS and reservation of resources help to avoid network congestion-related issues" => was ist mit diesem Satz gemeint?

- Order of packets is not guaranteed (routing!)
- Possibly wide variation in the delay of packets

- **Quality of service (QoS)** and the **reservation of resources** help to avoid network congestion-related issues
  - QoS defined by ITU in 1994: Requirements on all the aspects of a connection

2

-V2/F.59 was heißt in diesem Zusammenhang "user administration"?

- No existing standard for "roaming" between:
  - Access points (AP)
  - Different providers of APs

- Change of AP leads to
  - Connection interrupt
  - New connection/authentication

- Non-uniform accounting / user administration

→ Some of the reasons why WLAN will not replace mobile communication networks

-V2/F.59 ("no existing standard for roaming between AP") vs. V3/F.24 ("since 2008 a standard for roaming between WLAN AP is available: 802.11r"): ist das nicht ein Widerspruch oder liegt der Fokus hier auf dem Wort "existing„ (z.B. 2013: keine Intel-Geräte unterstützen 802.11r)?

- **No existing standard for "roaming" between:**
  - Access points (AP)
  - Different providers of APs

- **Change of AP leads to**
  - Connection interrupt
  - New connection/authentication

- **Non-uniform accounting / user administration**

- → Some of the reasons why WLAN will not replace mobile communication networks

-V3/F.34 gilt das mögliche Update im DNS als Lösung für die Probleme des Binding Updates (F.33) oder ist nur als Zusatzinfo gedacht?

-Frage zu GSM-Authentifizierung/Encryption:

Authentifizierung V2/F.35 vs. INKO V11/F.29 => in der Abfolge der Schritte werden zu Schritt 3 und 4 alternative Begrifflichkeiten verwendet: Bei INKO wird z.B. SRES* an NSS, bei MB1 an VLR gesendet. Ist dies nur eine genauere Formulierung? (da: VLR Teil von NSS)

- Challenge response protocol

Mobile network

AuC

K_i rand

128 bit   128 bit

A3

SRes* (32 bit), rand

AuC/ NSS

SRes* =? SRes

SIM

rand K_i

128 bit   128 bit

A3

rand

SRes 32 bit

SRes (32 bit)
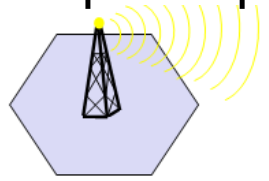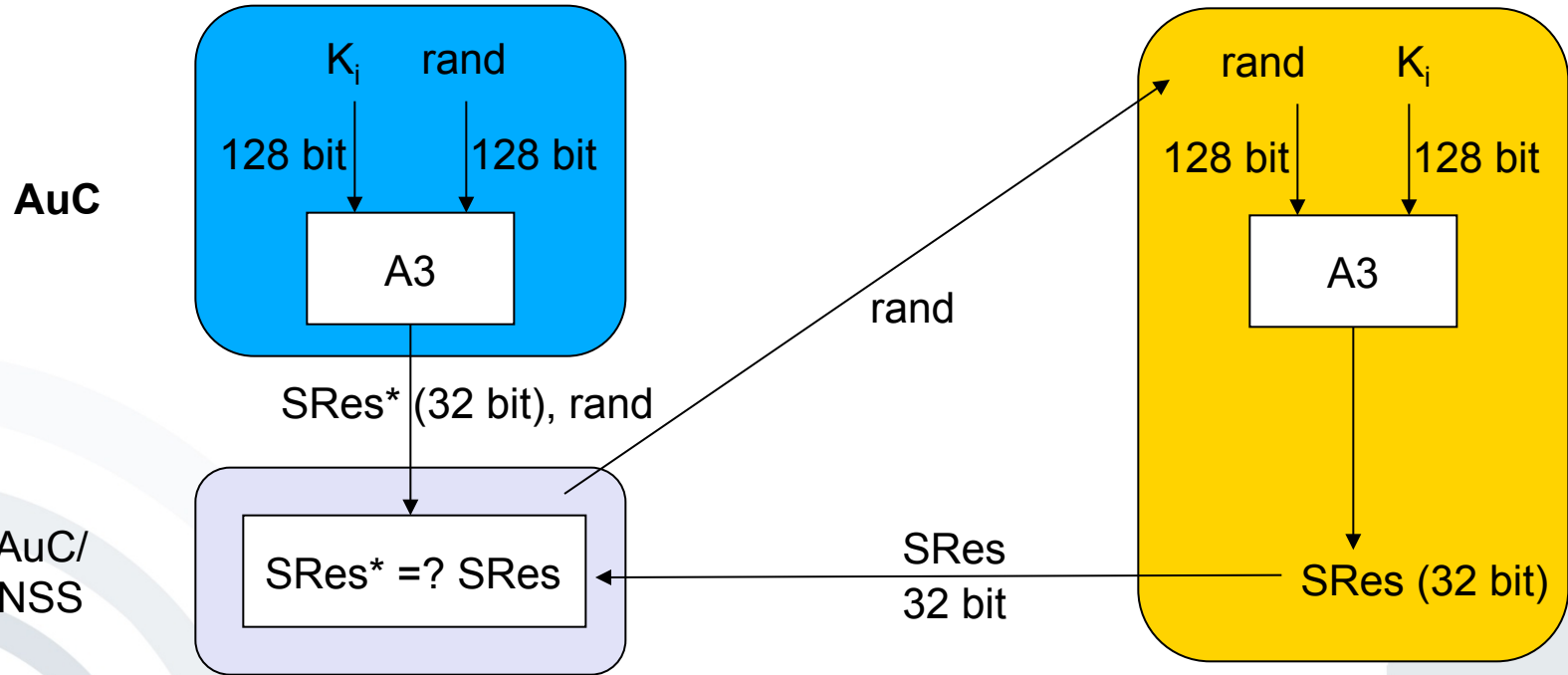
K_i: individual subscriber authentication key

A3: („secret") authentication algorithm

SRes: signed response

[Schiller2003]

- Challenge-Response-Procedure (Subscriber Authentication)
  Authentication is based on the individual key K_i, the subscriber identification IMSI and a secret algorithm A3.

- K_i and A3 are stored on the SIM and deposited in the AuC.

1. AuC creates random number *rand*.
2. AuC encrypts rand and K_i via A3 (->SRes*).
3. AuC transfers rand and SRes* to VLR.
4. VLR transfers exclusively *rand* to SIM.
5. SIM computes with "own" K_i and A3 Signed Response SRes.
6. The SRES computed by the SIM is transmitted to the VLR and is compared with SRES*.
7. If SRES* and SRES are equal the subscriber is authenticated successfully.

-Frage zu GSM-Authentifizierung/Encryption:

Encryption V2/F.37 vs. INKO V11/F.33 => bei Schritt 3: "VLR sendet..." vs. "AuC sendet.." = was ist hier die Logik?

mobile radio network

MS with SIM

rand

AuC

K_i — 128 bit
rand — 128 bit

rand — 128 bit
K_i — 128 bit

SIM

A8

A8

A8 for key computation ("secret")

K_c 64 bit

K_c 64 bit

BTS

data block

coded data blocks

data block

MS

A5

A5

A5 for encryption
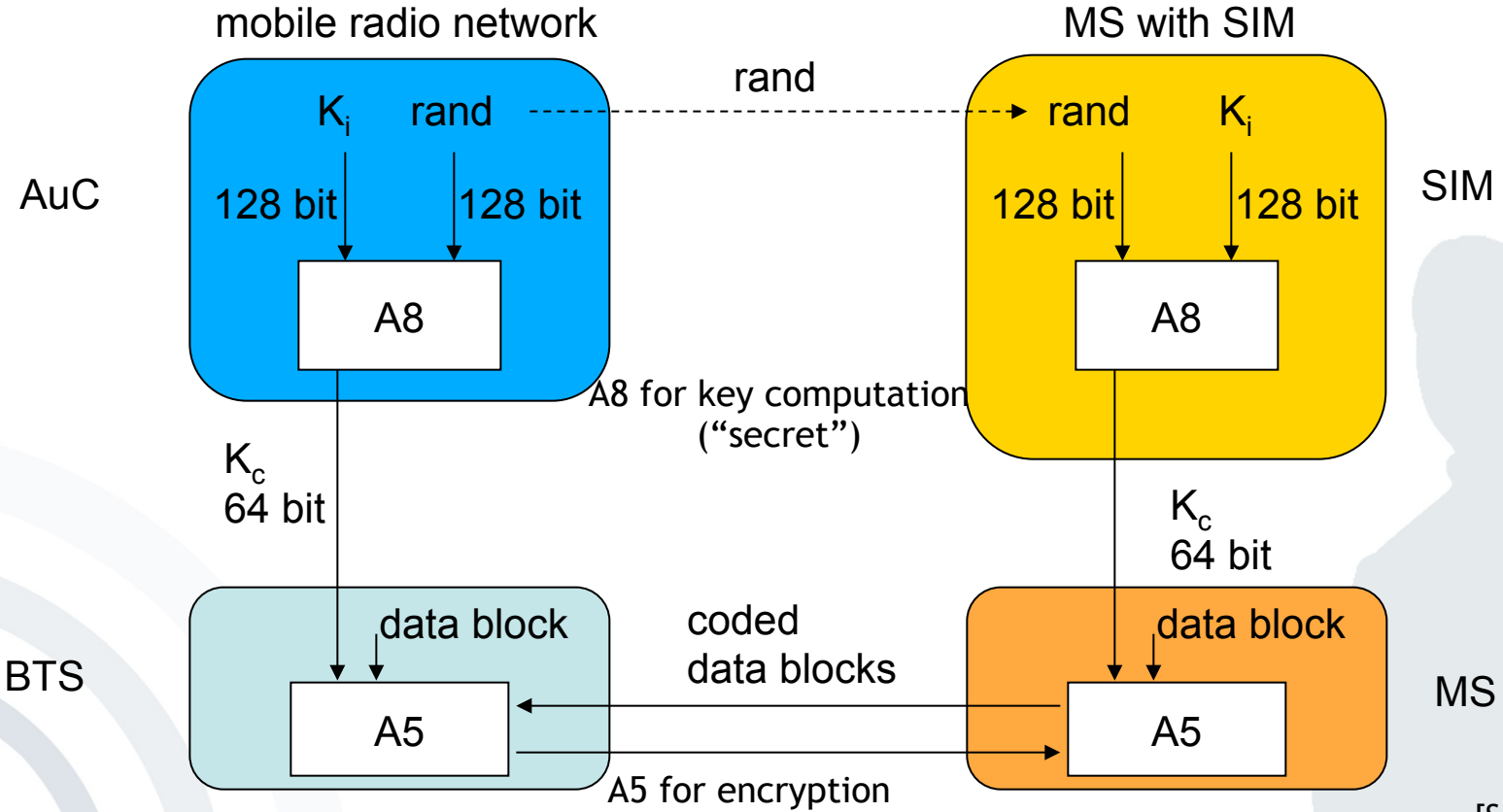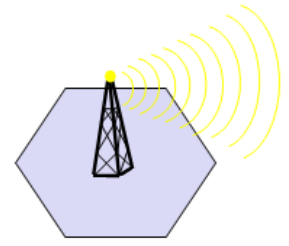
[Schiller2003]

- **GSM provides encryption of voice and data transferred via the air interface:**

1. AuC creates random number rand.

2. AuC generates the key K_c for the encryption of the transferred data via rand, K_i and A8.

3. VLR transfers only rand to SIM.

4. SIM computes the key K_c using A8, the rand received and the local K_i

5. Mobile station and mobile radio network use generated K_c and algorithm A5 for encryption and decryption of sent and received data.

-Klausur SS02/Aufgabe 1d = die Challenge soll im HLR und nicht im VLR generiert werden. Diese Aussage steht für mich im Widerspruch zu den oben genannten Folien oder besteht hier ein "Denkfehler"?

-V3/F.38 Verständnisproblem mit IP RAN

UMTS (3G) System Architecture

- *UTRAN*: **UMTS Terrestrial Radio Access Network**

- *RNS:* Radio Network Subsystem

- *RNC:* Radio Network Controller (controls the Node Bs)

- *Node B:* UMTS base stations (equivalent to base transceiver stations (BTS) in GSM)
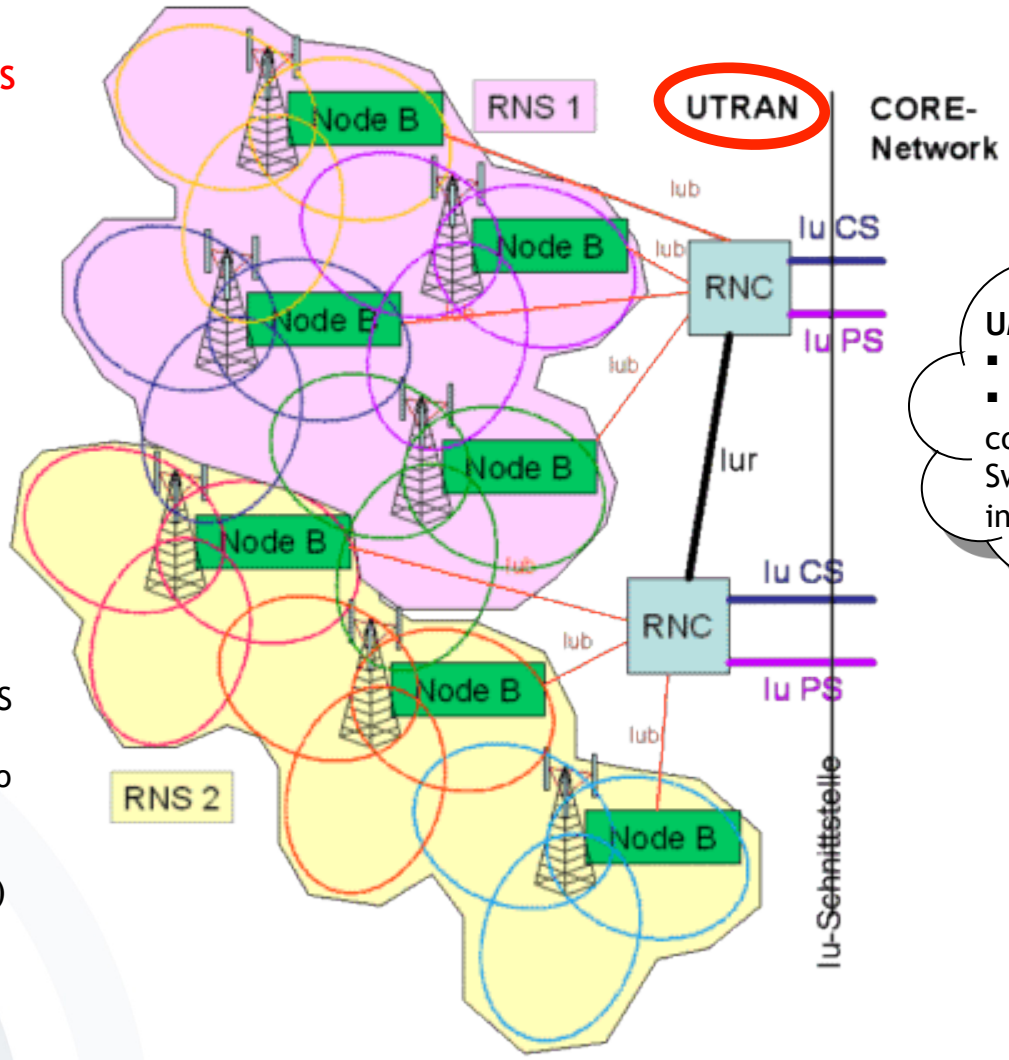
UMTS Core network
- is not shown here in detail
- UMTS Core network corresponds to Network- & Switching Subsystem (NSS) in GSM

Source: UMTSlink.at (2011)

Radio Access Networks (RAN)

- Part of a mobile telecommunication system

- Provides connection between device (phone, computer, or machine) and core network

- Implements certain radio access technologies, e.g. GSM or 3G

- Examples of radio access network types are:

  - **GRAN:** GSM radio access network

  - **GERAN:** essentially the same as GRAN but specifying the inclusion of EDGE packet radio services

  - **UTRAN:** UMTS radio access network

  - **E-UTRAN:** Long Term Evolution (LTE) high speed, low latency radio access network

- Some handsets have capability to be simultaneously connected to multiple RANs (dual-mode handsets).

[Wiki 2014]

IP-based Radio Access Networks (IP RAN)

- All different backhaul technologies may be collapsed onto a single IP/MPLS network (MPLS = Multiprotocol Label Switching) → End-to-end IP approach
- Support for legacy services and reduced cost per bit
- 2G, 3G, and 4G radio technologies transparently supported
- Cost savings possible due to alternative transport media (such as Ethernet and DSL)
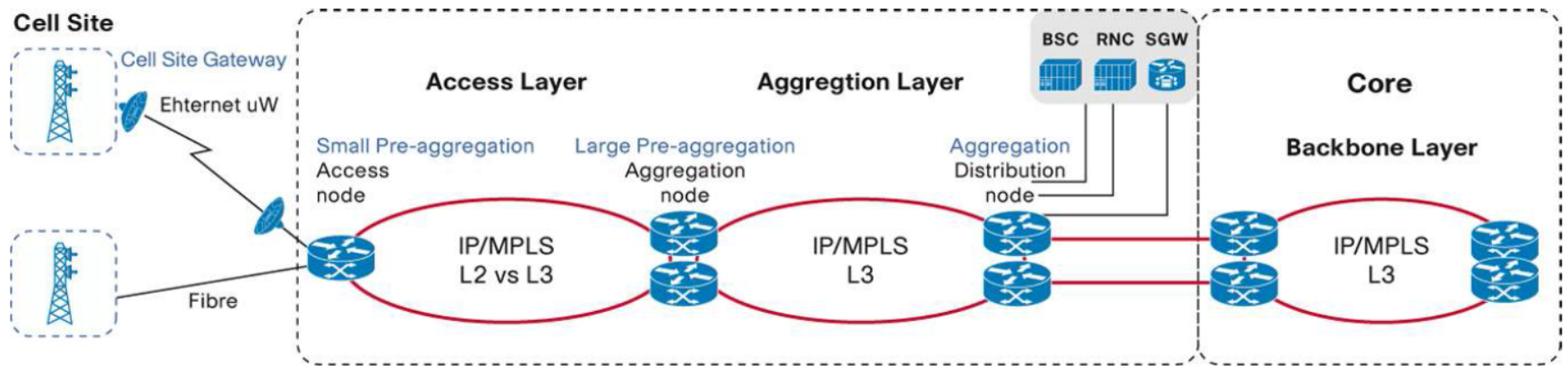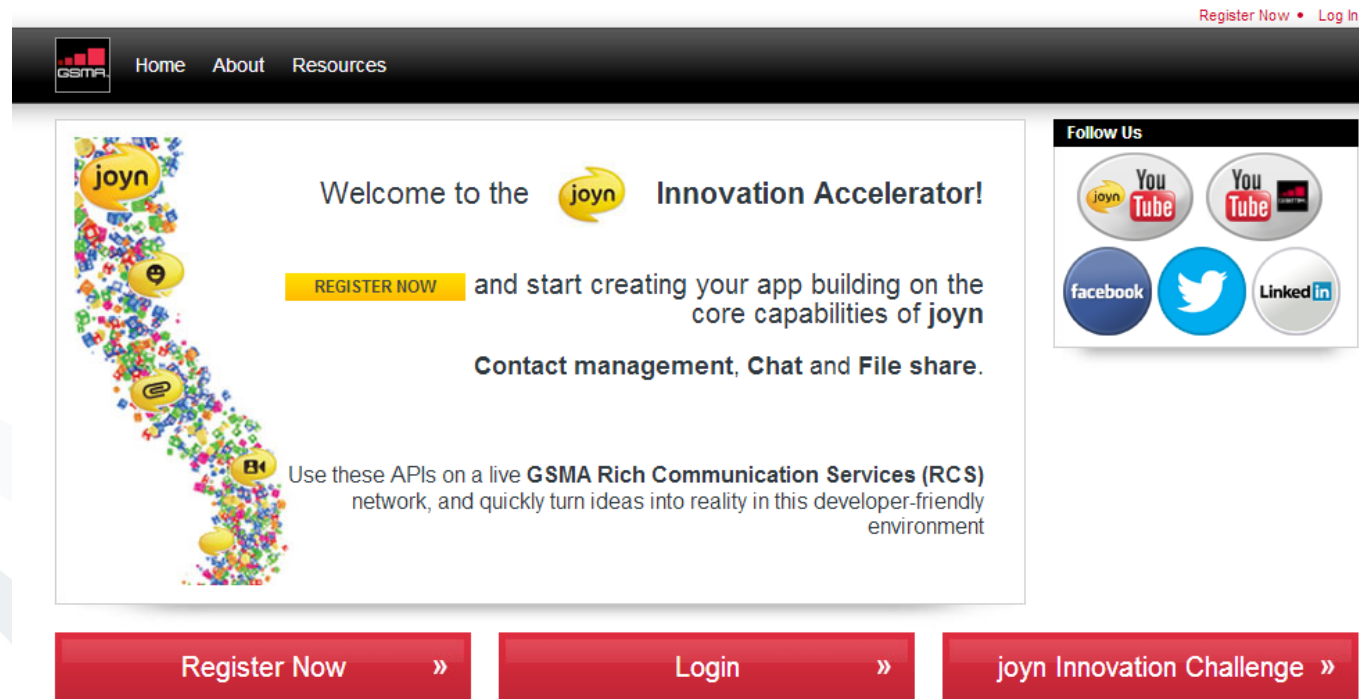
[Cisco 2011] [Cisco 2014]

-V4/F.44 was ist mit "cross-carrier ecosystem" gemeint?

Rich Communication Suite – enhanced (RCS-e)

- Cross-carrier ecosystem developed in a **global initiative by the GSMA**
- GSMA supports mobile network operators in their effort to market the service using **brand name** joyn to application developers and end users.

joyn Innovation Accelerator website,
http://rcs.oneapi-gw.gsma.com, accessed on 2013-10-11.

-V8/F.15 ist mit "Living Standard" gemeint, dass das SAT grundlegend in heutigen Mobilgeräten implementiert ist, um Mehrwertdienste nutzen zu können?

- Provides an interface for **Value Added Services** implemented on **programmable SIMs** for interacting with mobile devices

- **Standardised** 1996 as ETSI GSM 11.14, extended 1999 [GSM2006]

- **Controls** I/O, Telephony, Download

- Allows for **security functionality**

- „Living standard"
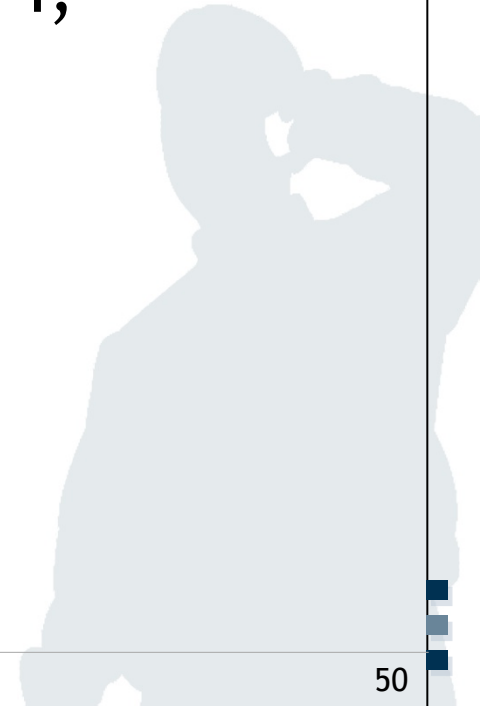
-1. Once it was stated that we should focus on the exercises for exam preparation. As we haven't had an exercise session dealing with lecture 12 yet, does it mean we can exclude this lecture?

- No

- Name of the lecture: Mobile Trusted Devices

-2. Are the appendix of lecture 4 and the case study of lecture 13 (both dealing with WAP and imode) relevant for the exam? I.e., do I have to memorize facts abouth both technologies?

Reasons for the Failure of WAP Services

- Usage of the term "mobile Internet" for marketing WAP confused customers and nourished wrong expectations towards this technology. Compared with those expectations WAP had:
    - High costs for the content
    - Complex billing system
    - Low speed
    - Low usability
    - …

- When WAP was rolled out, only a limited amount of devices with WAP-capabilities was available.

- Internet-based providers offering mobile content for free also lowered the demand for WAP services

[BüllingStamm2004]

Conclusion: WAP vs. i-mode

- It is unlikely that i-mode's success in Japan can be transferred to other markets, due to the unique market situation in Japan.

- But key lessons learned from i-mode's success story in Japan include:
  - Importance of a **trusted**, branded, useful, easy-to-use, holistic package of services
  - The value of investment and leveraging of technological infrastructure such as networks and handsets

[HungKuChang2003]
[BarnesHuff2003]

-Übung 3, Thema UISM, UICC

a) What is a USIM?

3

- **Standardised** in 3GPP TS 21.111 and 3GPP TS 31.102 [GSM2006]

- **Successor** of SIM in 3G networks (but 3G networks are downward compatible to many SIMs)

- Supports different „**virtual**" **USIMs** and **SIMs** on one cards – i.e. multifunctional smartcard

- Specified as „**UMTS-SIM**", to support authentication, authorisation and computation of future services
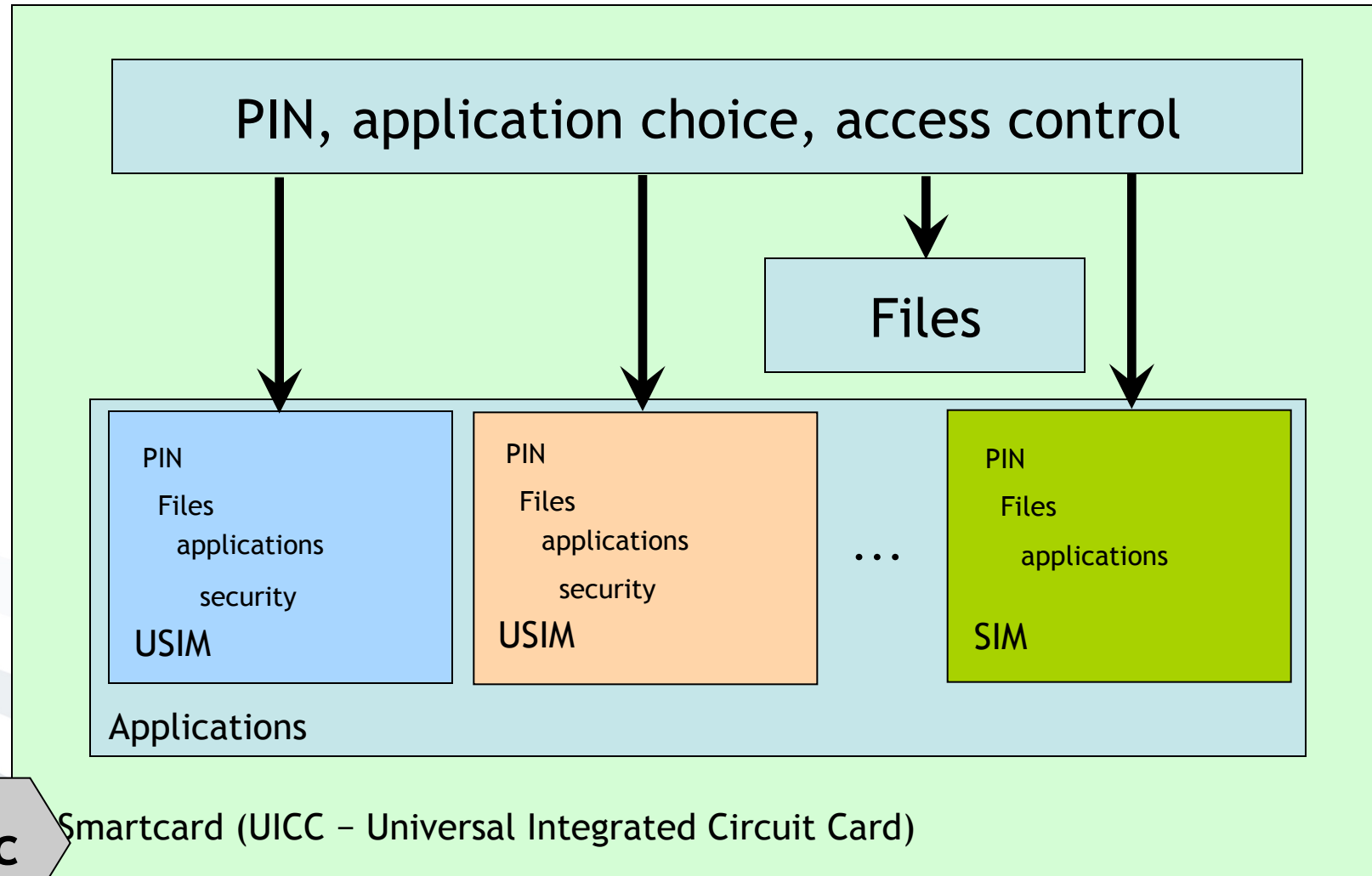
3a

b) Name the innovations introduced with the USIM.

3

- **Support for multiple applications**
- **End-to-end security** from the USIM to the application
- **Authentication of the network** towards the USIM via cryptography
  ➲ **Multilateral Security** is possible!
- **Downward compatible** to SIM
- **Extended phone book** on card:
  - Email addresses
  - Multiple names & numbers for each entry
  - More memory
  - Standardised entries

3b

c) What is a UICC and how do USIMs relate to a UICC?

3

PIN, application choice, access control

Files

USIM
PIN
Files
applications
security

USIM
PIN
Files
applications
security

...

SIM
PIN
Files
applications

Applications

Smartcard (UICC – Universal Integrated Circuit Card)

3c

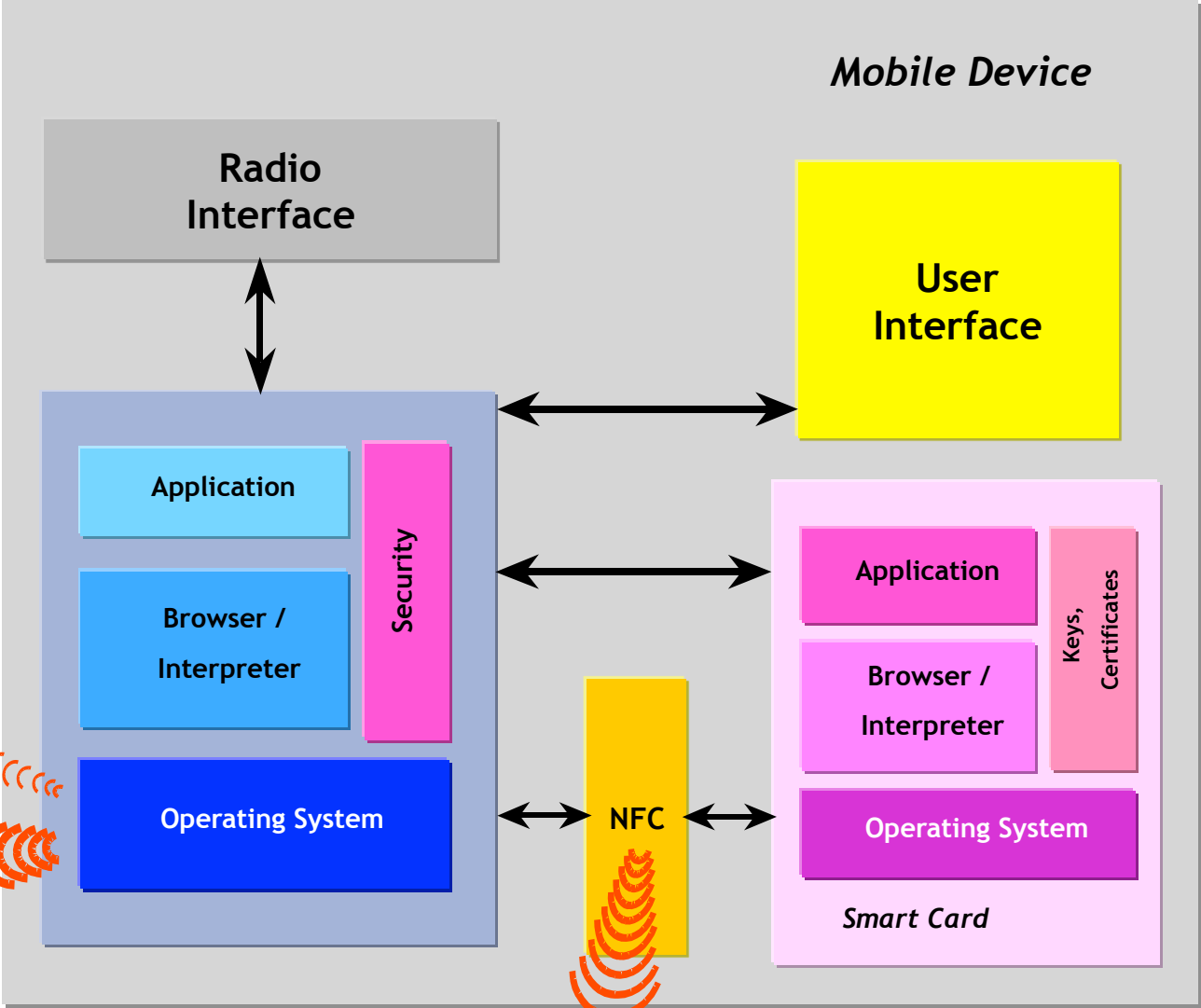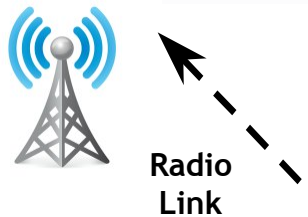d) Describe market opportunities and effects of competing USIMs.

3

- **Market entry** of USIM „disguised" **as SIM**
  ➲ UMTS activated by operator

- **Multiple USIMs** – possibly **from competing providers** – can technically coexist on one card. Selection via menu on mobile device
  ➲ Reduction of operator switching cost

- Switching to anonymous prepaid USIM as a privacy option when using privacy sensitive services?

3d

-V9 F.24 Könntet ihr bitte nochmals auf die Wechselbeziehungen der einzelnen OS Bestandteile eingehen?

OS – Functional Architecture

Mobile Device

- Radio Link
- Radio Interface
- User Interface
- Application
- Browser / Interpreter
- Security
- Operating System
- Global Positioning System (GPS)
- PAN: Bluetooth, Infrared, …
- NFC
- Application
- Browser / Interpreter
- Keys, Certificates
- Operating System
- Smart Card
- Near Field Communication (NFC)

-Could you explain Packet Collision and the solution for the problem?

Wie löst sich das Packet Collision Problem anhand des RTS – CTS Mechanismus?

Was genau ist das Hidden Station Problem und wie kommt es zustande?

- **Description of problem and solution for Packet Collision**
  RTS-CTS (Request to send – Clear to send)
  - Wireless LAN uses "Air" as medium
  - There is no CSMA/CD (Carrier Sense Multiple Access / Collision Detection) available for Wireless LAN.
  - CSMA/CA (Carrier Sense Multiple Access / Collision Avoidance) is possible.
  - The following figure shows typical problems in air transmission systems.
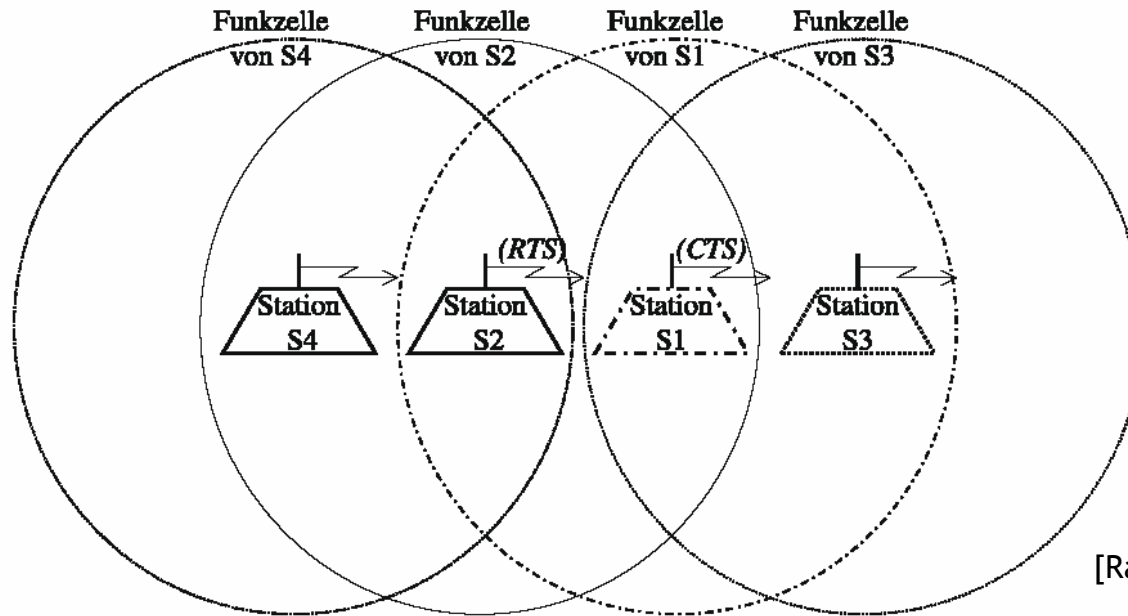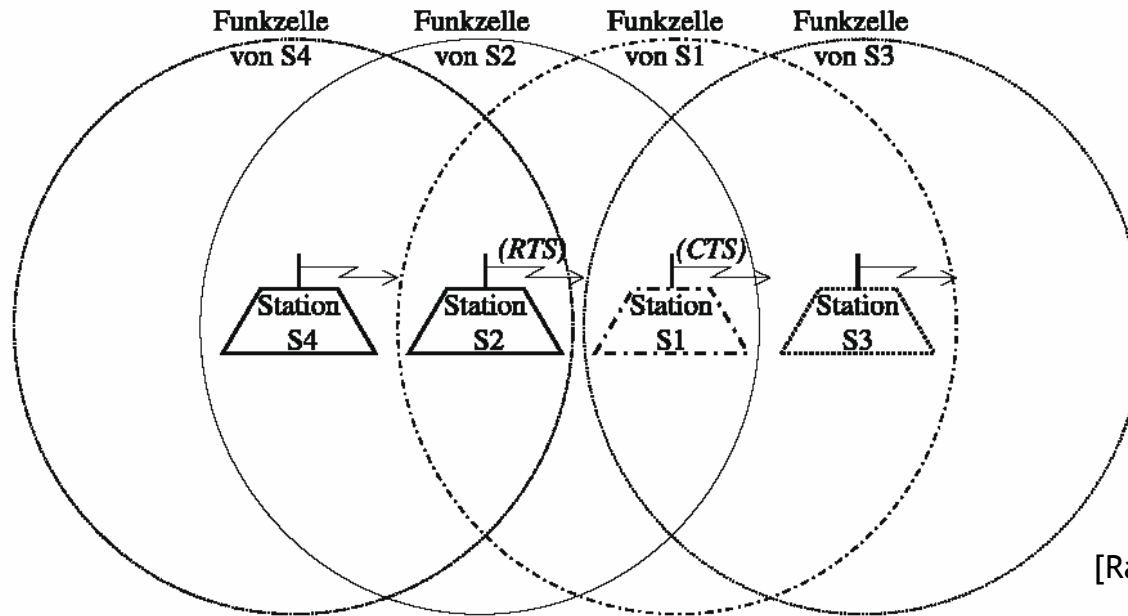
[Radmacher 2004]

- Hidden station problem (S2 and S3)
- S2 can't "hear" S3 and the other way round.
- Starting a communication by both of them leads to a collision at S1.
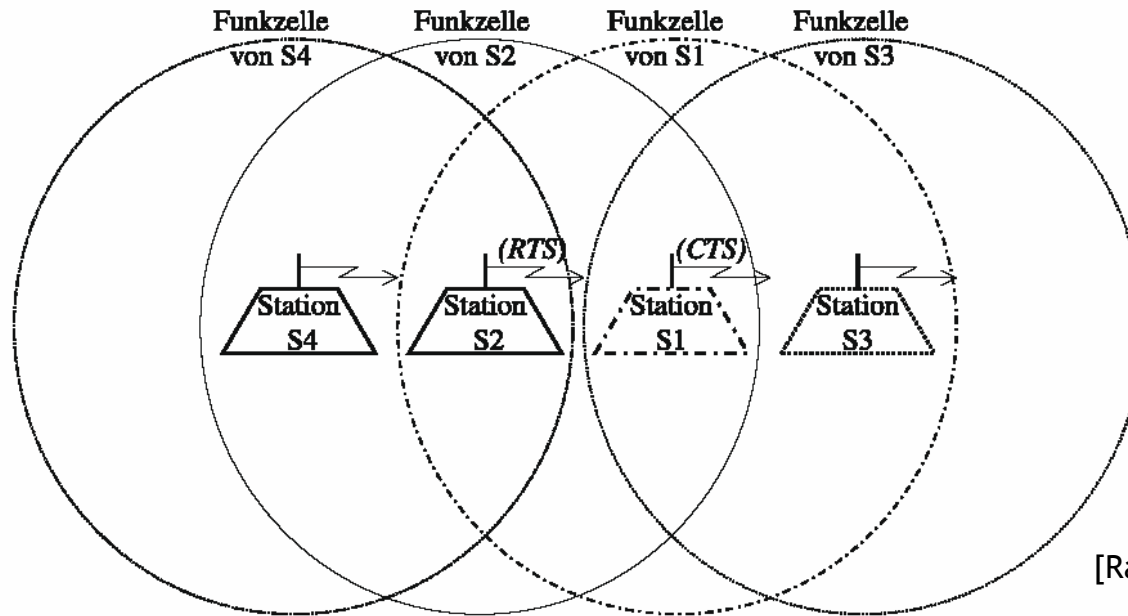
[Radmacher 2004]

- *Solution:* before communication, S2 sends an RTS-frame to S1
  - If there is no other communication a CTS-frame is the response and the communication starts.
  - If there is a communication, no CTS-frame is sent, S2 follows a back-up strategy.

Funkzelle von S4   Funkzelle von S2   Funkzelle von S1   Funkzelle von S3

(RTS)   (CTS)

Station S4   Station S2   Station S1   Station S3

[Radmacher 2004]

- After some time, based on the back-up strategy, S2 starts again sending a new RTS-frame.

- Without a CTS-frame there is no beginning of a communication.

- **Back-up strategy**
  - Communication attempt failed
  - After a time-interval based on a special algorithm the sender tries again to send a RTS-frame.

-(Subscriber Identity Module) In der Übung 3 Aufgabe 2b steht: Welche Inhalte sind geschützt und welche nicht. Bezieht sich das „nichtgeschützt" auf die Dynamischen Daten? Weil sonst werden ja keine weiteren genannt.

b) What does the Subscriber Identity Module contain? Which of these contents are protected, which are not and why?

2

- **Protected data:**
  - IMSI, PIN, PUK
  - A3, A8 crypto algorithms
  - List of subscribed services
  - Language used by the subscriber

- **Dynamic data:**
  - Cell information
  - Frequency information
  - Dynamically generated (session) keys
  - Attributes of GSM login
  - User data (address book, telephone list, SMS memory)

2b

-Was genau ist „Near Field Communication"? Nur ein Oberbegriff für Infrarot und Bluetooth, oder etwas völlig Eigenständiges? Wäre nett wenn ihr ein Beispiel bringen könntet.

- Enables radio communication between
  - two NFC devices,
  - an NFC device and an (unpowered) tag.

- NFC based on existing radio-frequency identification (RFID) standards

- Range: 10 cm or less

- Transfer rates between 106 kbit/s and 424 kbit/s

- Three major modes of NFC
  - Reader/Writer Mode
  - Card Emulation Mode (referred to as "Digital Wallet")
  - Peer-to-Peer Mode

-V10 Unterschied zwischen Mapping, Paging und Segmentation erklären. Das ist in der Vorlesung ein wenig zu kurz gekommen... auch das Windows-Beispiel am Ende ist mir nicht ganz klar geworden.

V10 ...viele Dinge zu abstrakt...

V10 ...ob und in welchem Umfang diese Vorlesung relevant ist...

-V10 F.28–38 Könntet ihr bitte auf die Unterschiede von Mapping, Paging und Segmentation eingehen? Was versteht man unter einer physischen, logischen und symbolischen Adresse?
Hierbei wäre es mir lieb, wenn ihr so „untechnisch" wie möglich vorgehen könntet.

-I had some problems understanding the topic Memory Management, which was dealt with in lecture 10. In particular, I struggled with the examples (pp. 40-52). Could you please explain those again in the Q&A session if they are of any relevance for the exam?