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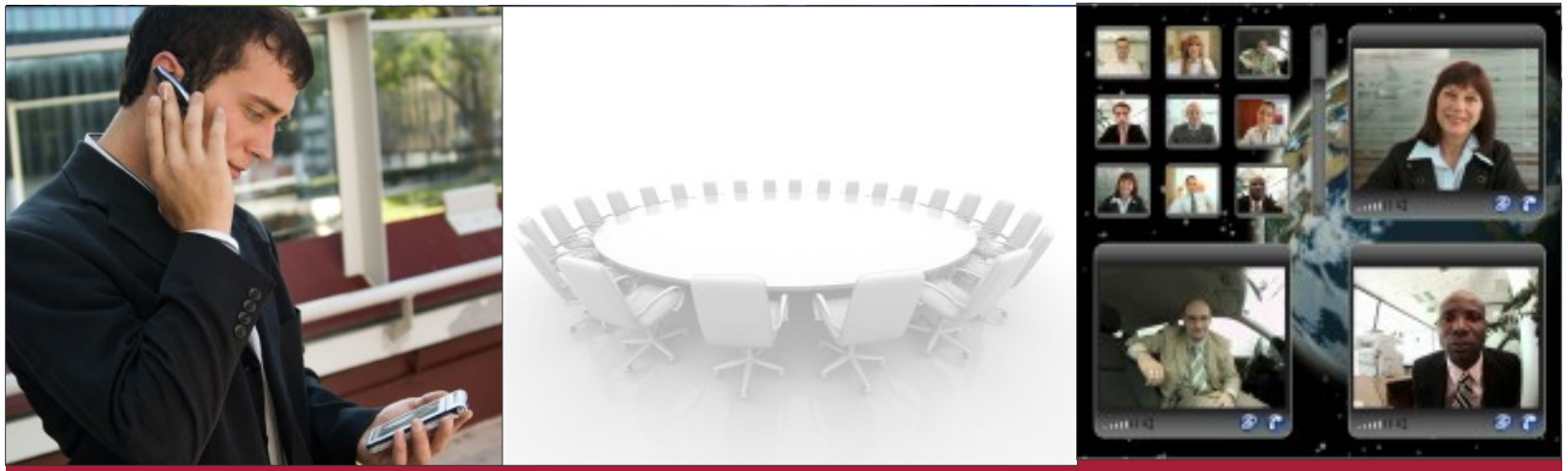
**Spin-Off: Sonicon GbR**



# Improving the Usability of Charging Systems

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- Introduction: Sonicon
- High Quality Telephony, Adaptive VoIP, and Resource Consumption
- Adding the human factor
- Contract of Sales
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- Summary

# Spin-Off Sonicon GbR

- Sonicon provides technologies and services to allow

**High Quality Telephony**

**Spatial Audio Teleconferencing**

- Won the bwcon Award „Best Business Idea“ (Heidelberger Innovationsforum, 12. April 2011)

- Financed by the BMWi within the EXIST Technology Transfer Prg.

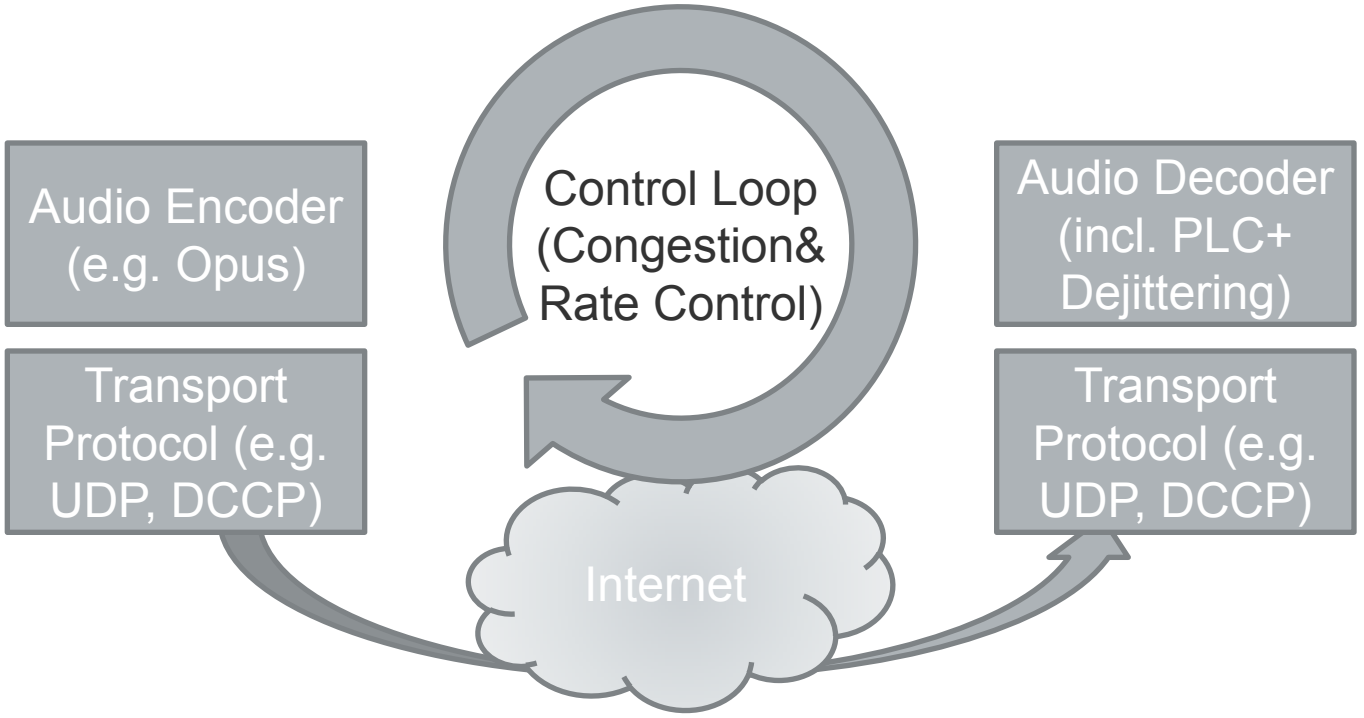
# High Quality Telephony


- Delay Tolerant Telephony
  - Delay ranging from a few ms to days (Push-To-Talk like conversations)
  - no minimal bandwidth (if bandwidth is low, pauses get longer)
- PSTN has narrow-band quality
  - 150-400 ms mouth-to-ear delay
  - coding rate 8 kbps, frame sizes 20-160 ms
- Telepresence
  - 150-400ms at CD quality
  - 32-128 kbps with IETF Opus codec (soon to be standardized)
- Distributed Ensemble Performance
  - up to 25ms instrument-to-instrument delay, CD quality, multiple channels
  - 128-256 kbps coding rate with Opus, 2.5 ms frame size

# Adaptive Telephony

- Goal: maximize quality (QoE) for a given transmission path

1. Get bandwidth estimate from transport protocol
2. Set encoding parameters (including FEC)



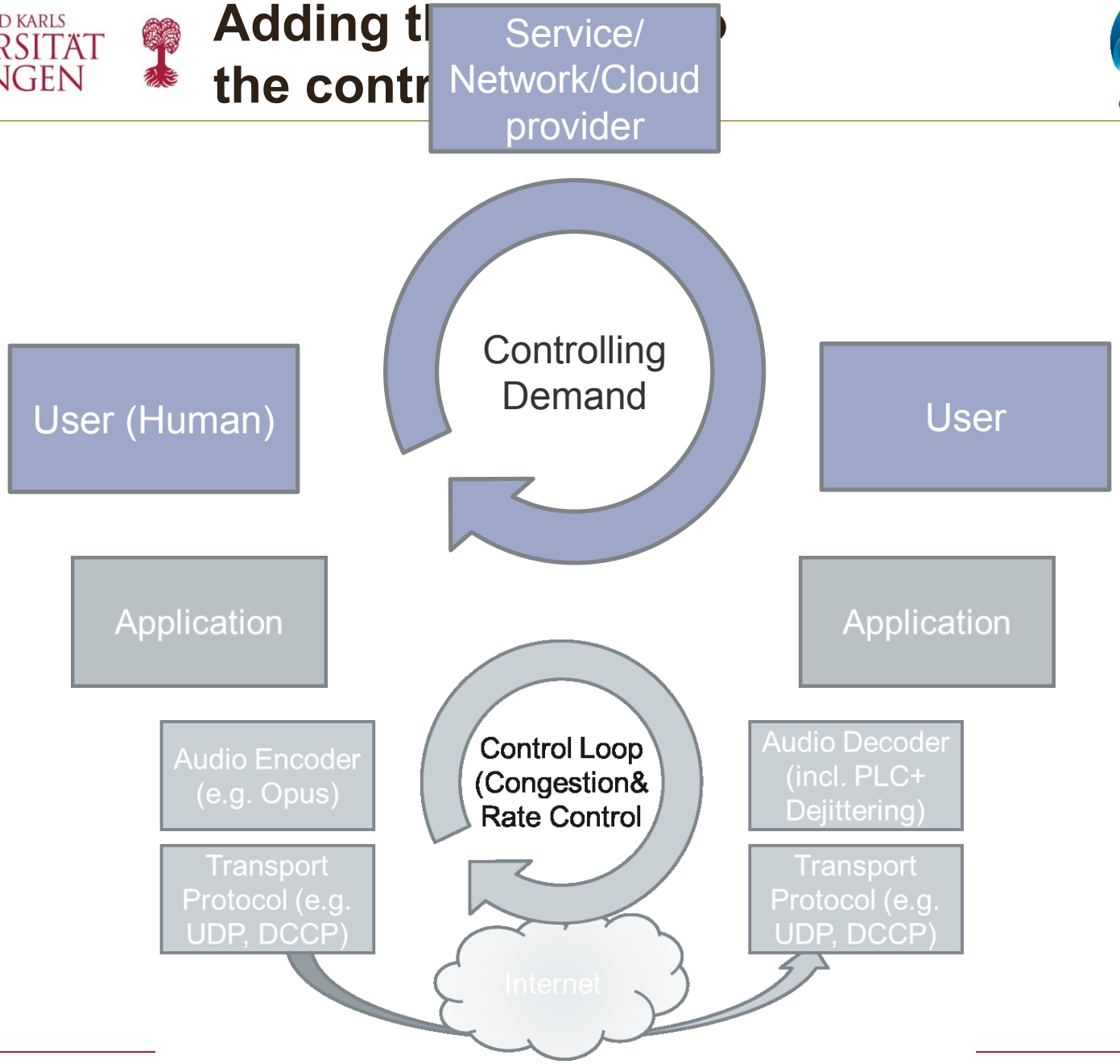
# Resource Consumption

- High quality telephony requires much more bandwidth as traditional VoIP.
  - Because of adaptation, available bandwidth will be used.
- Similarly, spatial audio teleconferencing also requires transmission bandwidth and – in addition – computational resources.
  - Similar to capacity sharing, we also need to share computational resources.

**Summary:**

- Future VoIP will require a lot more resources: bandwidth, computations, energy, costs…
- How to share those resources fairly?

# Adding t… the contr…



# Challenge: How to efficiently control the demand?

## Starting points

- Costs (e.g. €) are a proper metric to control the demand
  - Well proven solutions for such problems
  - But exchanging service against money requires a contract and a transaction
- User behaves rational (Homo oeconomicus)
  - Modeling assumption
  - Tries to minimize cost per service
  - Feelings play a minor role
- The price has to be changed frequently to control capacity
  - because constant prices do not change demand
  - Is it possible to change the price/quality per teleconference/per call?

# Different price? New contract!

**Legal Requirement:**

- If price of a service is changing in a non-agreed way, a new contract is required!

**Contract of Sale**

- is a legal contract about the exchange of goods, services or property between a seller and a buyer for an agreed upon value in money paid or the promise to pay same.

# Contract of Sales: §145 BGB

- **Request for tender** (lat. invitatio ad offerendum)
  to ask for an offer.

- The seller writes an **offer** to show his willingness to sell goods at given conditions and to settle a trading contract
  - Offer is binding for some limited period of time.

- Offer is the basis for the **contract**,
  - which contains the most important facts (lat. essentialia negotii)
  - If both parties agree on the same essentialia negotii, the deal is settled and a contract is agreed upon.
  - Can be accepted with an unqualified expression.
  - Content of the deal can – but is not required to- be recorded in a written contract.

- If the offer is accepted and the rules are followed by both sides, then the deal is fulfilled.

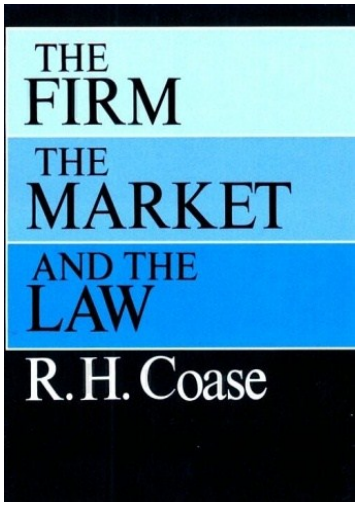
# Definition: Transaction

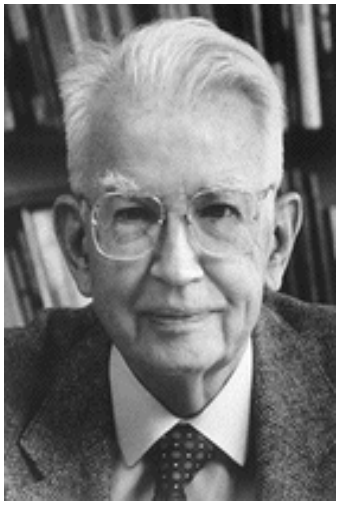
*A transaction is an agreement, communication, or movement carried out between separate entities or objects, often involving the exchange of items of value, such as information, goods, services, and money*

[wikipedia]

# Every Transaction has Costs

**Transaction costs** (TC)
are "(a) costs of undertaking a transaction, including search and information costs, bargaining costs and monitoring, enforcement costs of implementing a transaction; and (b) the opportunity costs of non-fulfillment of an efficient transaction."



# Transaction Costs

**Search and information costs (pre service provisioning )**

- marketing goods
- determining where to buy the goods
- Who has the lowest price?

**Bargaining costs (pre)**

- negotiating and forming a contract

**Goods exchange (service provisioning)**

**Policing and enforcement costs (post)**

- ensure that the contractual agreements are followed

# Sharing of Transaction Costs

- The transaction costs are split between the seller, the buyer, and external parties and are expressed as

$$c_t = c_{t.b} + c_{t.s} + c_{t.e}$$

with $c_{t.b}$, $c_{t.s}$, and $c_{t.e}$ referring to the transaction costs of buyers, sellers, and externalities respectively.

- For the seller to be profitable, the price $p$ of a product should be larger than the seller's transaction costs.

$$p \geq c_{t.s}$$

- The buyer's costs are:

$$p + c_{t.b}$$

- The society has the following costs:

$$c_{t.e}$$

# Homo oeconomicus

- Homo oeconomicus will take the best offer in order to save costs.
- Assuming, *n* offers are available, he takes the offer *i* that fulfills the following condition:

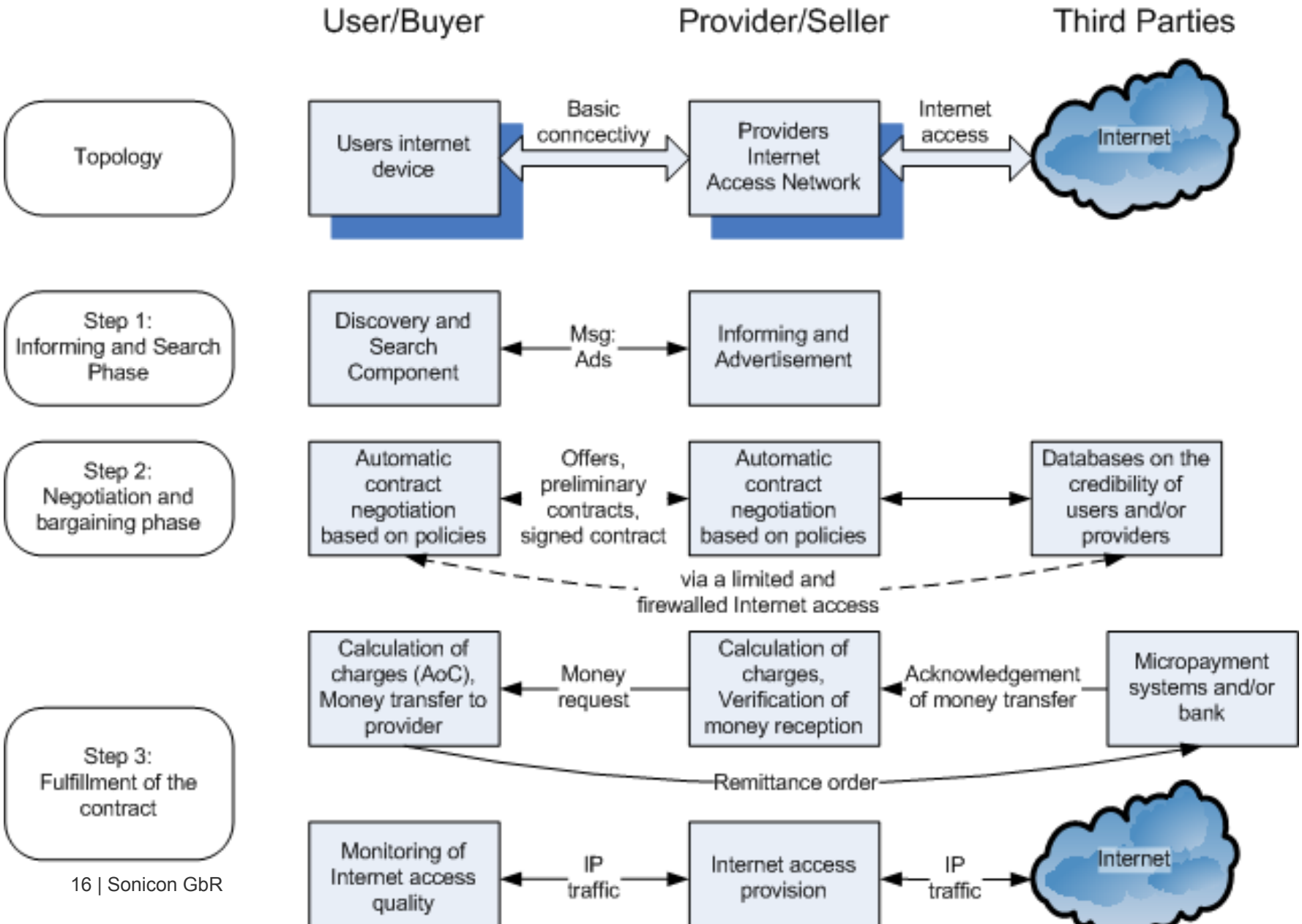
$$\exists i : \forall j \in \{1...n\} : p^i + {}^{i}_{c_{t.b}} \leq p^j + {}^{j}_{c_{t.b}}$$

- Homo oeconomicus does not go for the cheapest price!

**Consequence**

- Price of a service is not the primary selection criteria – the user's transaction costs are also important!
- How to design a charging system that reduces the user's transaction costs?

# Charging Solution with Low TC Example Internet Access



# Conclusion

- Money allows you to share capacity and resources fairly.
- But how to make transactions efficient?
- Transaction costs is performance metrics for charging solutions.

- Existing cellular charging solutions have very high transactions!
- More research is needed to improve the usability of charging.
- Can we convince providers to change their charging system?

- Good news for Sonicon:
  If you lower the buyer's TC, prices can be kept high.

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# Thank you.

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