Data Traffic Costs and Mobile Browsing User Experience

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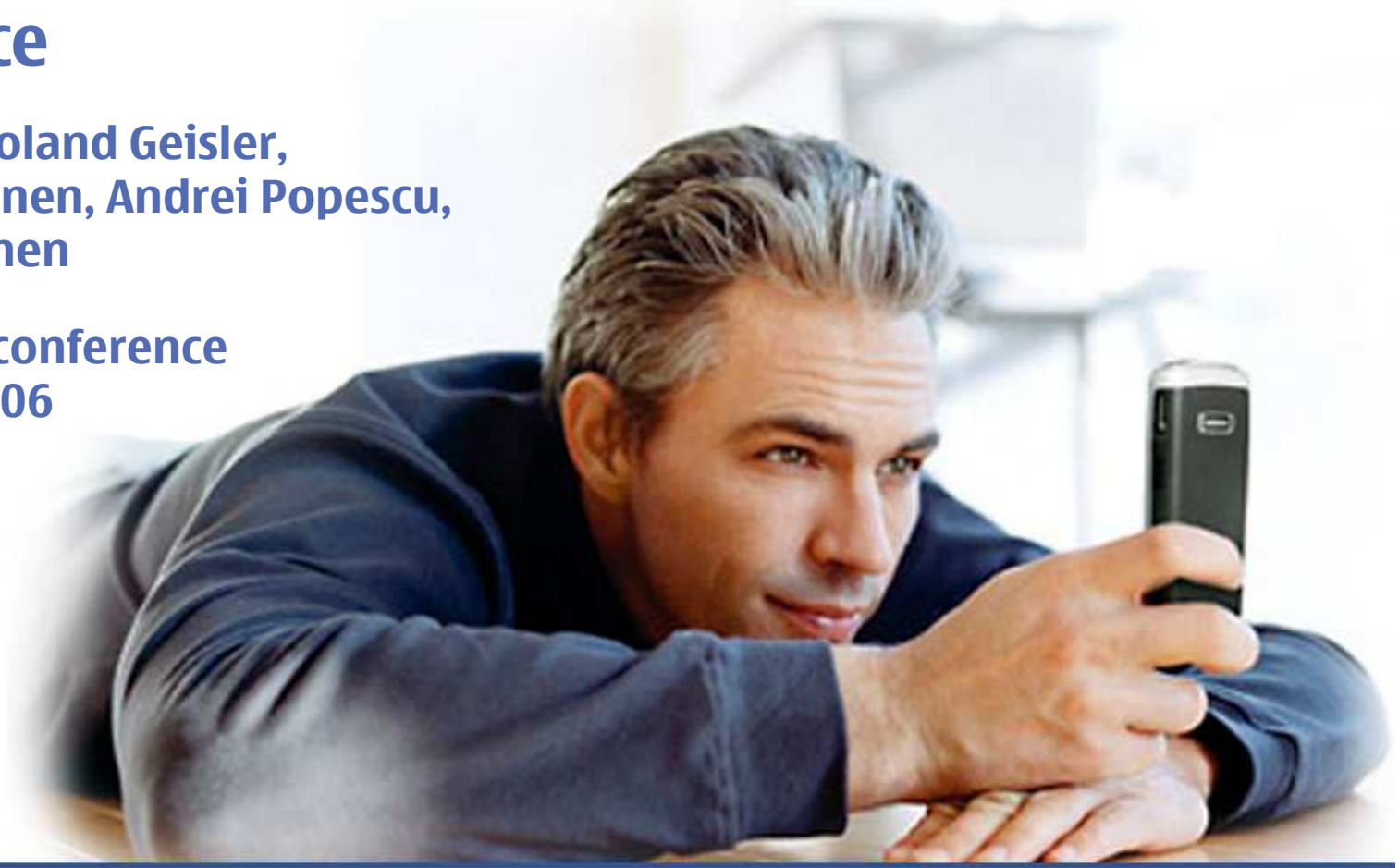

Why is cost an important topic for mobile browsing?

- Cost is a showstopper for mobile services and Web
  - Still increasing number of carrier revenues comes from data traffic
- Never mentioned in the User Experience literature
- Research question: how to allow the end-user to *understand*, *follow*, and *control* the expenses?
  - By letting the services and sites stay unchangeable
- Our focus was in Internet browsing
  - Also applies to other data traffic

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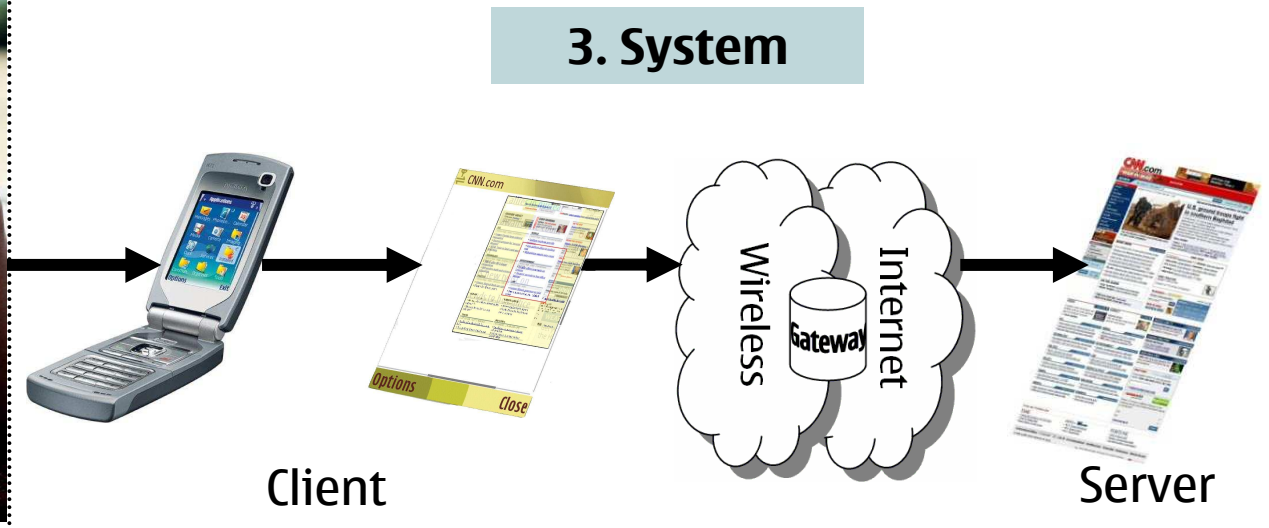
Mobile browsing user experience – building blocks



1. User	2. Context	Mobile device	Browser	Connection	Site
Need	Physical context	Appeal	Usability	Availability	Value
Motivation	Social context	Connectivity	Content support	Speed	Usability
Experiences	Temporal context	Usability	Functionality	Cost	Appeal
Expectations	Task context	Memory space		Trust	Trust
Mood		Battery lifetime		**Gateway**	
Resources		Performance		(Page optimizations)	
				(Access restrictions)	

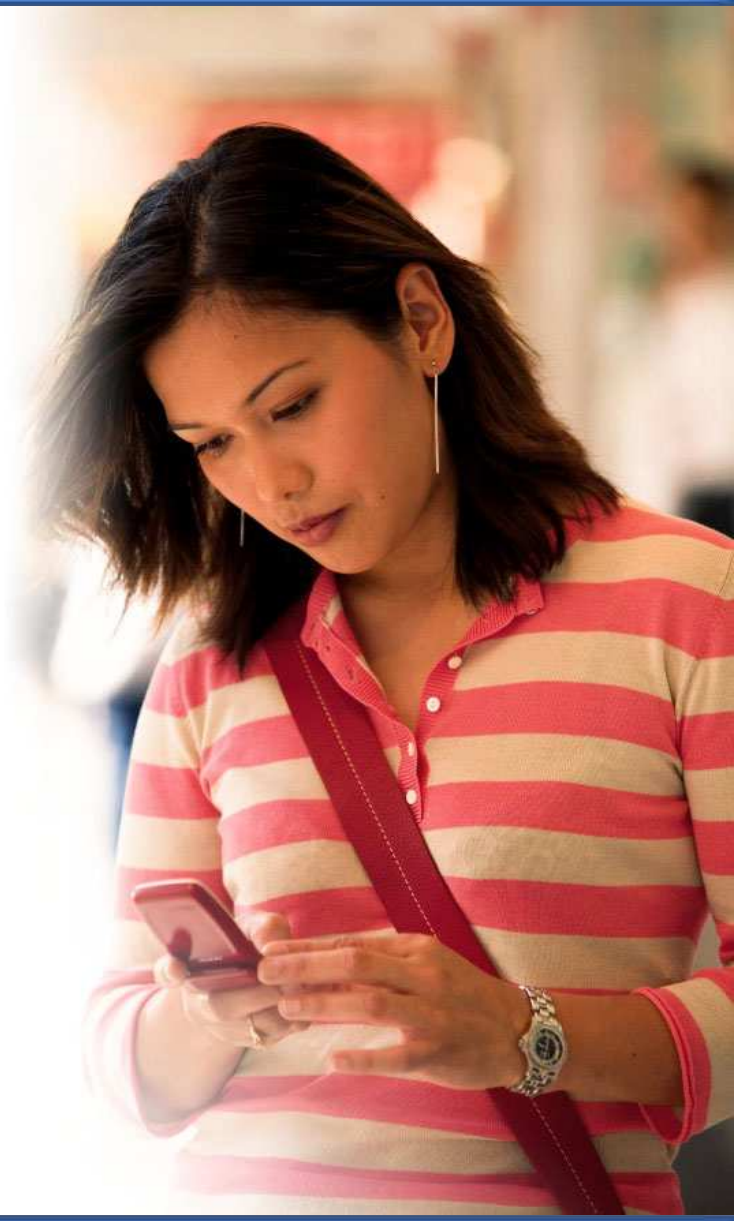
Billing models

Billing models are fairly complex and vary from carrier to carrier

Wireless data traffic is typically separated from wireless voice

The criteria for data traffic billing:

- Duration of connection
- Amount of data downloaded and uploaded
- Connection speed
- Number of downloads
- Combination of these



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Billing based on duration of connection (2G)

Pros:

- Relatively easy to understand for the users

Cons:

- Users have to pay for:
  - Waiting time
  - Correction of errors
  - Text entry time
  - Text reading time
- Users perform tasks as quickly as possible to minimize the connection time

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Billing based on transferred data (2.5G, 3G)

Pros:

- Users can have connection always on without extra cost

Cons:

- Costs are hard to control
  - Some data pieces can be transferred without fee (e.g. in carrier' portals)
- Users have to pay for correction of errors

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Billing based on flat fee subscription

Users pay a fixed fee for unlimited amount of online data

Pros:

- Simple and predictable for both users and carriers
- No need to think about session expenses

Cons concerning users:

- Occasional users have to subsidize the traffic generated by the heavy users
- Users in developing countries cannot afford paying an average fee
- Roaming may generate extra costs

Cons concerning carriers:

- Congested network because of mobile data traffic (VoIP, music, movies)

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Fixed data block

Carriers' solutions:

- Set an upper limit for the amount of data

But these introduce problems for the user:

- Hard to estimate the amount of data
- Not informed about exceeding the data limit
- No simple way to purchase extra data block
- In the worst case, a huge bill as without the fixed data block

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Billing based on prepaid

A way for users to pay the bill beforehand

Pros:

- Convenience of purchasing
- Ability to keep the phone costs within a budget

Cons:

- Does not make it any easier to estimate how much one consumes for data traffic
  - Users are surprised by how quickly the prepaid sum is spent

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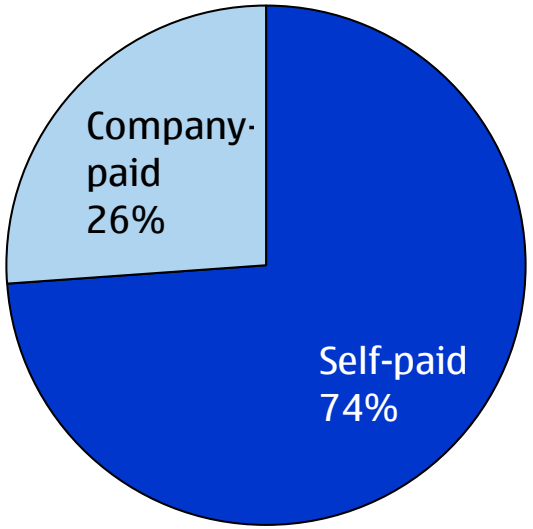
Bill paid by company

Company users are less reluctant to data traffic costs if it does not affect one's own financial situation

However:

- The smaller the company, the more business users do care about how much their browsing costs for their company



Our user studies on mobile web browsing

35 in-depth interviews in different parts of the world

Based on contextual inquiry method

Several interviewees had cut down the amount of mobile browsing after once received a huge phone bill

	Location	Interviewees	Time	Scope
1.	Helsinki, Finland	6	2/2004	Phone browser
2.	Boston, U.S.A.	9	10/2004	WLAN
3.	Helsinki, Finland	6	3/2005	WLAN
4.	Tokyo, Japan	7	5/2005	Phone browser
5.	London, UK	7	11/2005	Phone, WLAN

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PERCEIVED BILLING MODEL

Most carriers do not clearly communicate how data traffic is billed

User make assumptions based on

- Prior knowledge
- System feedback
- Phone bill

-> *Perceived billing model*

- Affects online usage patterns

Perceived billing model that is misconceived is an unfortunate situation for all parties

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Current solutions for controlling costs

- Minimizing connection time
  - Cutting the connection after a Web page is downloaded
  - Saving Web forms for offline text entry and for later usage
- Data traffic indicators:
  - Blinking icon
  - Counters
- Cost control service available from the carrier
- Downloading only textual content
  - Technical users can do this trick

Providing control for end-users

1. On carrier side
2. On gateway
3. On mobile device

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1. Carrier discloses cost information

- The carrier is in a key position
- Seeing the costs all the time does not drive increased usage?
  - Knowing the current balance could **increase** browsing usage
- Data counter in a phone is not an optimal solution
  - The user must remember to reset the counter
  - Not all data traffic is charged in a consistent way
  - Roaming in a foreign network
- Complicated and quickly changing pricing complex to manage

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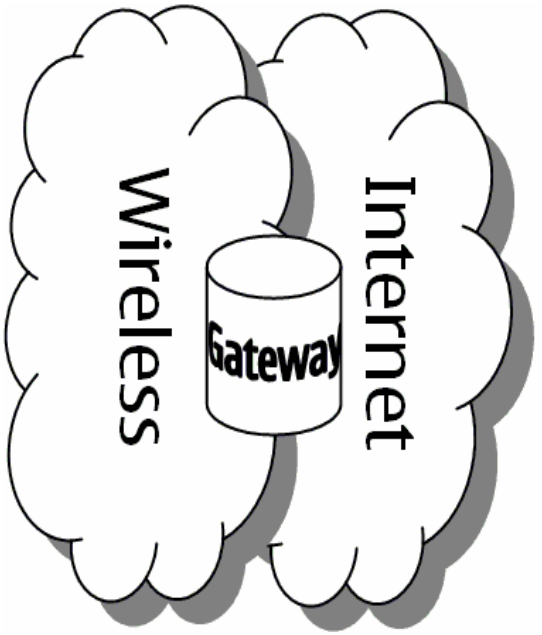
2. Gateway provides end-user control

Methods:

- Splitting the page into pieces
- Removing irrelevant content
- Transforming content to a lighter format

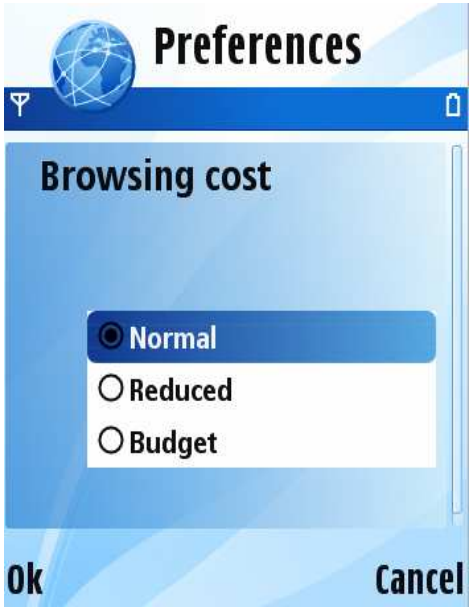
Problems:

- Scalability
- Privacy
- Copyright issues
- Identification and preferences of users
- Pages look different
- Inconsistency between gateway and browser optimizations

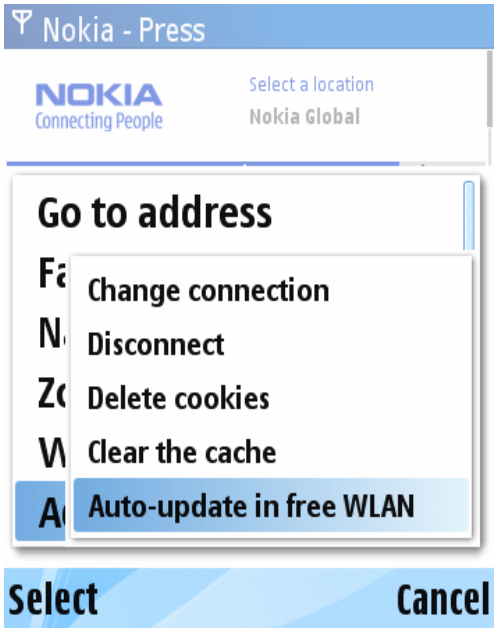


3. Client provides end-user control

Simple setting where user can adjust browsing costs, whatever the means for cost saving are



Automatically fetch as much relevant data from online sources as possible for offline usage later on



Conclusions

Cost is a major influencer in mobile browsing user experience

- Hard to know how costs cumulate
- Hard to follow cost accumulation
- Hard to control costs

Users create perceived billing model

- Affects their mobile browsing usage patterns

If the carrier does not provide a flat fee, it should provide information on cost accumulation

After better information on data cost accumulation is provided to users, the number of mobile data users will increase

-> Cost control for mobile browsing is an important topic for future research

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Thank you!

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