

The Role of Quality Feedback for Perceived Service Dependability

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1

My Own Background (1)

Moved from the network towards the user ☺

- Working with Grade of Service/Quality of Service issues since 1992
 - Admission control, dimensioning
- Got interested in end-user throughput perception in 2000
 - "Kilroy"-Indicator 2002 co-developed with Kurt Tutschku, University of Würzburg
- E-Government project 2002—2004
 - Implications of IT problems
- Preparation of the NoE EuroNGI 2003



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2

EuroNGI-Related Activities



- Leader of
 - Joint Research Activity JRA.6 “Socio-Economic Aspects of Next Generation Internet”
 - Work Package WP.JRA.6.1 “Quality of Service from the users’ perspective and feedback mechanisms for quality control”
 - Work Package WP.JRA.6.3 “Creation of trust by advanced security concepts”
- EuroNGI-sponsored AutoMon project (2005)
 - Improved discovery of end-to-end problems
 - Improved quality feedback facilities



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3

My Own Background (2)

- Projects within Intelligent Transport Systems and Services since 2003
 - Timely delivery is crucial (dependability, safety)
 - Network Selection Box (GPRS/UMTS/WLAN)
 - How to match technical parameters and user perception?
- Surprised that rather little attention has been paid to user-related issues by “our” scientific community



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4

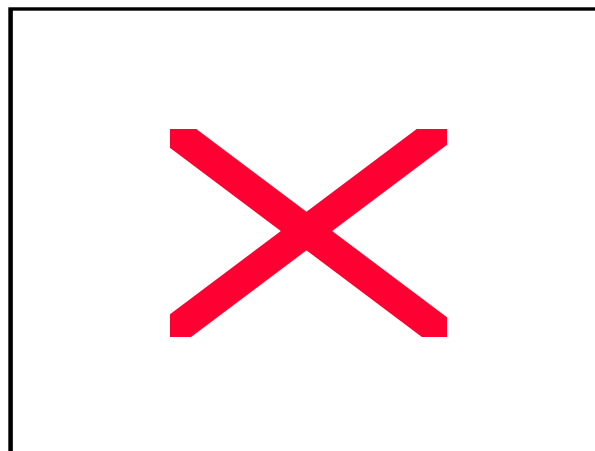
Thesis 1:
Users do have – sometimes unconscious – expectations regarding ICT performance



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5

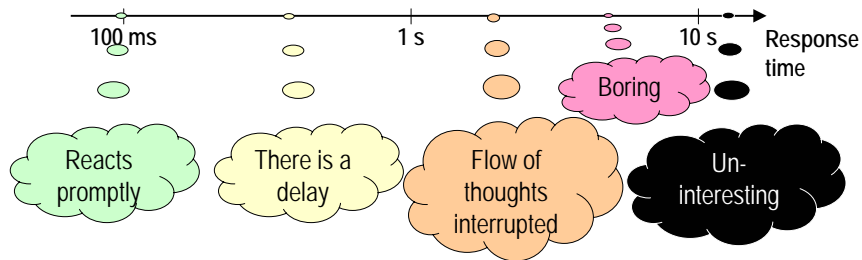
Quality Problems?!?



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6

Perception of Response Times



- Most users do not care about "technical" parameters such as Round Trip Time (RTT), one-way delay, losses, throughput variations, ...



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7

Some User Reactions (1)

- Study by HP (2000) [1]
- Test customers were exposed to varying latencies when composing a computer in a web shop and had to rate the service quality
- Some of their comments are found below:
 - *Understanding that there's a lot of people coming together on the process makes us more tolerant*
 - *This is the way the consumer sees the company...it should look good, it should be fast*



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8

Some User Reactions (2)

- *If it's slow I won't give my credit card number*
- *As long as you see things coming up it's not nearly as bad as just sitting there waiting and again you don't know whether you're stuck*
- *I think it's great...saying we are unusually busy, there may be some delays, you might want to visit later. You've told me now. It I decide to go ahead, that's my choice.*
- *You get a bit spoiled. I guess once you're used to the quickness, then you want it all the time*



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9

Consequences?

Shortcomings in perceived dependability are likely to cause churn!

[2] summarises:

- *82% of customer defections are due to frustration over the product or service and the inability of the provider/operator to deal with this effectively*
- *on average, one frustrated customer will tell 13 other people about their bad experiences*
- *For every person who calls with a problem, there are 29 others who will never call.*
- *About 90% of customers will not complain before defecting – they will simply leave once they become unsatisfied.*



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10

Quality of Experience (QoE)

- Rather new concept, even more user-oriented than QoS: "how a user perceives the usability of a service when in use – how satisfied he or she is with a service" [2].
- Includes
 - End-to-end network QoS
 - Factors such as network coverage, service offers, level of support, etc.
 - Subjective factors such as user expectations, requirements, particular experience
- Economic background: Dissatisfied user may leave and take others with him/her.



Quality of Experience (QoE)

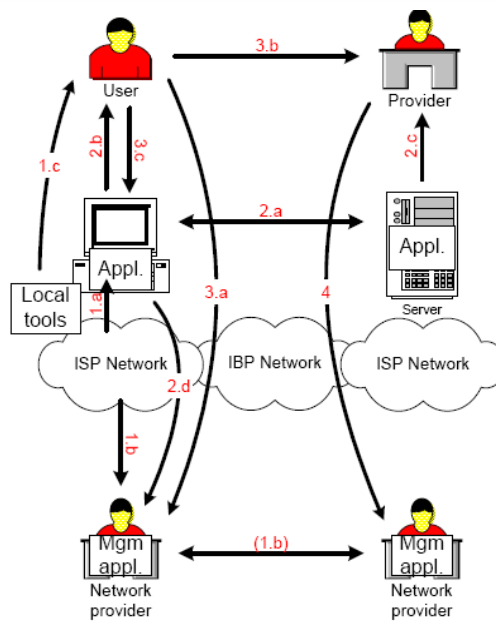
- Key Performance Indicators (KPI)
 - Reliability (service quality of accessibility and retainability)
 - Service availability
 - Service accessibility
 - Service access time
 - Continuity of service
 - Comfort (service quality of integrity KPIs)
 - Quality of session
 - Ease of use
 - Level of support
- Need to be measured as realistically as possible



Thesis 2:
There is a need for more explicit feedback
to make the user feel more confident



Typical Feedbacks



Cf. [3]
 Section 2.4



Types of Feedback

- Explicit feedback
 - Positive/negative acknowledgements
 - E.g. TCP
 - Asynchronous notifications
 - E.g. SNMP traps
- Implicit feedback
 - Can be obtained through observing whether/how a process is happening
 - Dominating Internet as of today



1. Feedback From the Network

- a. Network → Application
 - Implicit: No or late packet delivery
- b. Network → Network Provider
 - Classical Network Management/monitoring
- c. Network → User
 - Implicit: "Nothing happens"
 - Rudimentary tools available
 - Operating system issues warnings

Within the network stack: control packets



2. Feedback From the Application

- a. Application → Application
 - Some applications measure the performance of the packet transfer and adapt themselves (e.g. Skype, videoconferencing)
- b. Application → User
 - Implicit by not working as supposed
 - Explicit by notifying the user or adapting itself
- c. Application → Service Provider
 - Active measurements of service performance
- d. Application → Network Provider
 - Monitoring of control PDUs



3. Feedback From the User

Implicit: give up / churn

Explicit:

- a. User → network operator
 - Blame the closest ISP
 - Not uncommon ISP attitudes:
 - The problem is somewhere else
 - The user is an idiot
- b. User → service provider
 - Online quality surveys
- c. User → application
 - Change settings



Feedback Provided by Bandwidth Auctions

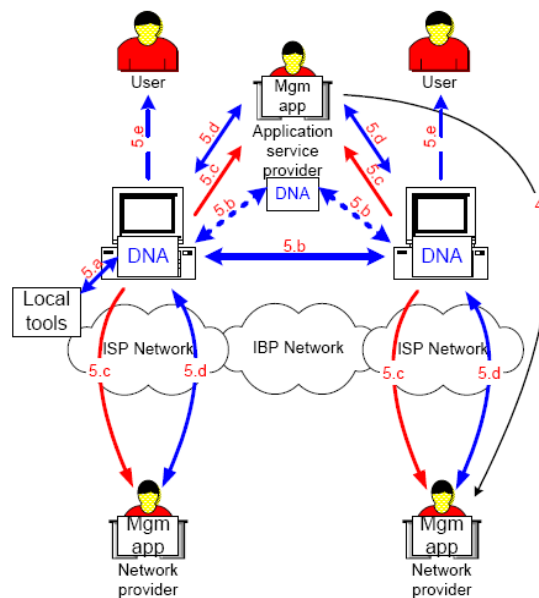
- a. Bidding for resources on behalf of the user
- b. Signaling of success or failure
- c. Results communicated towards the user
 - Successful transfer at resonable QoS
 - Unsuccessful transfer at low cost
- d. Results communicated to network (and perhaps even service) provider
 - Dimensioning
 - SLA



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21

The AutoMon Approach



Cf. [4]
Chapter 6



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22

AutoMon Feedback

- DNA (Distributed Network Agent) = main element in a self-organising monitoring overlay
 - a. Local tests using locally available tools
 - b. Remote tests and inter-DNA communication
 - Comparison of measurement results
 - c. Alarms towards {network|service} provider(s) in case of perceived problems
 - E.g. using SNMP traps
 - d. Lookup facilities for providers
 - E.g. saving critical observations in a local MIB
 - e. Notification facilities towards users
 - Not mandatory, but maybe helpful



Thesis 3:
The user needs to be relieved from decisions based on incomplete feedback



Status

Internet usage still implies a high degree of self-service

- Some kind of Internet paradigm (just provide connectivity, the rest is left to the user)
- The "Anything-over IP-over-anything" principle provides both opportunities and nightmares
- Mastered differently by different applications (better by some, worse by others)
- A lot of "decision making" is left to the user – does (s)he really know about the implications?
- Recent trend towards IMS (Internet Multimedia System): might help, but will the Internet community accept that?



Status

**Solving these issues
increases dependability
perception and thus trust**

Issues:

- How do subjective QoE and objective QoS parameters match each other?
 - Solved for some applications
- How can I be sure that
 - "my" task is performed and completed
 - "my" problems are detected and worked on in time?
- Which network can be used for a particular task?
 - Rough indications available
- "Money back" policies?
 - cf. airlines and (some) train companies



Wishlist

- No additional complexity for the user!
 - Application of self-organisation principles
- Preventive feedback:
 - Clear guidelines and indications regarding (im-)possibilities
 - Optional cross-layer interfaces required
- Reactive feedback:
 - Signalling of success or failure
 - Again a matter of cross-layer interfaces
 - Action on behalf of the user
 - Notifications
 - Selections (e.g. a particular network)



References

1. A. Bouch, A. Kuchinsky, and N. Bhatti. *Quality is in the eye of the beholder: Meeting user's requirements for Internet quality of service*. Technical Report HPL-2000-4, HP Laboratories Palo Alto, January 2000.
2. Nokia White Paper: *Quality of Experience (QoE) of mobile services: Can it be measured and improved?* http://www.nokia.com/NOKIA_COM_1/Operators/Downloads/Nokia_Services/whitepaper_qoe_net.pdf
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4. M. Fiedler, ed.: EuroNGI Deliverable D.WP.JRA.6.1.3. *Studies of quality feed-back mechanisms within EuroNGI*. May 2005. <http://eurongi.enst.fr/archive/127/JRA613.pdf>



Thank you for your interest ☺

Q & A

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