Layering in the concept of quality

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Where we are now

Internet became the crucial part of modern life. A lot of social activities, governmental works and business processes depend on this global network.

At the same time, the concept of the quality in the Internet was not properly conceived.

- “Best Effort” is the question, not the answer

1 year ago, on WSIS 2015, we started discussing the quality in the Internet.

Traditional (“naïve”) approach

- Quality is the combination of the basic parameters of the network path between the resource and it’s client: **bandwidth, delay, jitter, packet loss**.

- Parameters of network path could be derived from the corresponding parameters of the separate segments, forming this path.

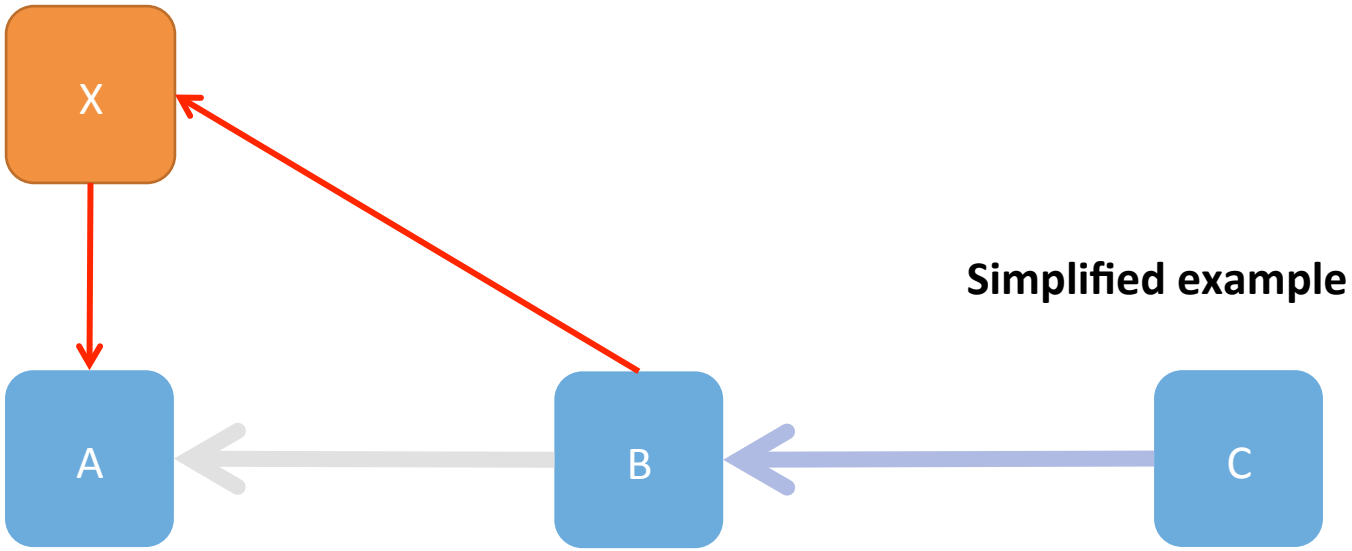
Total delay = Σ (delay for segment$_i$)

Bandwidth of the path = min (bandwidth of segment$_i$)

Naïve approach is incomplete

- The root cause: Internet has horizontal structure managed by distributed mechanisms.
- We illustrate that studying the phenomenon of “route leaks”
  - 1% of all IP prefixes in Internet every single moment
  - 5% of all IP prefixes during each 2 weeks
- There are other distributed mechanism with the similar impact
  - DNS

Route leak phenomenon



Here X abnormally gets traffic sent to A. Then X might send it to A or might drop it.
The result:

- delays always increases
- bandwidth usually decreases
- jitter can deteriorate dramatically

And there no operator X in naïve approach at all.

Strict definitions: IETF draft-dickson-sidr-route-leak-def

How to augment this approach then?

- Obviously, the quality is the derivative of judgmental aspects
  - “Is it convenient?”
  - “Is it durable?”
  - “Is it personable?”
  - “Is it safe?”
  - <*your question here*>
- Thus our task is:
  - to classify those aspects,
  - to propose some quantitative parameters for each class,
  - and to reveal the ways of proper measurements.

Our approach

We introduce three hierarchical classes (layers):

- Instant user's impression from the service: right now, right here:

Quality of Perception

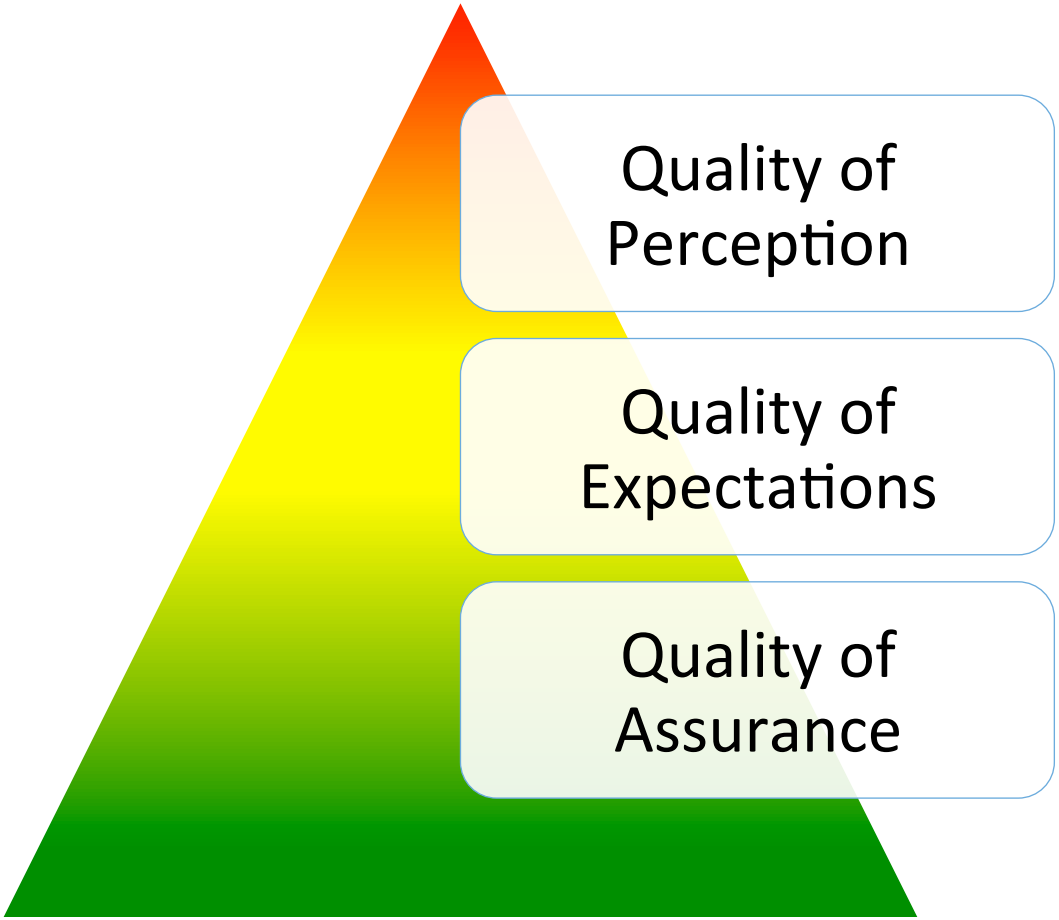
- Further user's expectations: whether he is going to have the same impression from this service tomorrow; in 1 week; in 6 month:

Quality of Expectations

- User's implication that service do not perform concealed actions, do not cause harm etc:

Quality of Assurance

Proposed layering diagram



Quality of Perceptions

- Includes those parameters of naïve approach
  - There are large projects providing useful instruments – but not enough
    - RIPE Atlas, CAIDA Atlas
  - The task is huge
    - About 700000 IP-prefixes in Internet =>
    - About 70000 infrastructural units =>
    - Over 2 billions of values simultaneously
- Considers not only service under the consideration but whole IT-infrastructure
  - Remember DNS?
- Evaluates also current routing scheme at the moment and another infrastructural entities
  - At least: optimal/suboptimal, normal/abnormal
  - Fundamentally different type of analysis!

Quality of Expectations

- Basically we describe the availability of the resource in quantitate manner
- There are large set of parameters to be included here:
  - Evaluation of service topology (Anycast? CDN?)
  - Indexes of connectivity
  - Stability of the principal components
    - Network: Renesys, Radar//Qrator, RIPE etc
    - Datacenters: Uptime Institute
    - IT services: different methodologies
  - Data from capacity management

Quality of Assurance

- Security is a part of the quality concept
- There are different mature methodologies here, their metrics have to be involved
  - PCI DSS, COBIT SOX, HIPAA…
- Here we face the possible intentional activity against the user
  - Investigations should be involved
  - CERT/SoC

Conclusions

- We provide the panoptic approach to the problem
- It is very flexible and can be easily expanded
  - Horizontally: more parameters on each layer
  - Vertically: more layers?
- Total picture is really huge, and there are many parameters of different nature.
  - It cannot be handled by the entity “inside”, it is necessary to be “above”

We are open for the communication. Any comments and propositions are definitely welcome.