Perception of Quality in Cloud Computing Based Services

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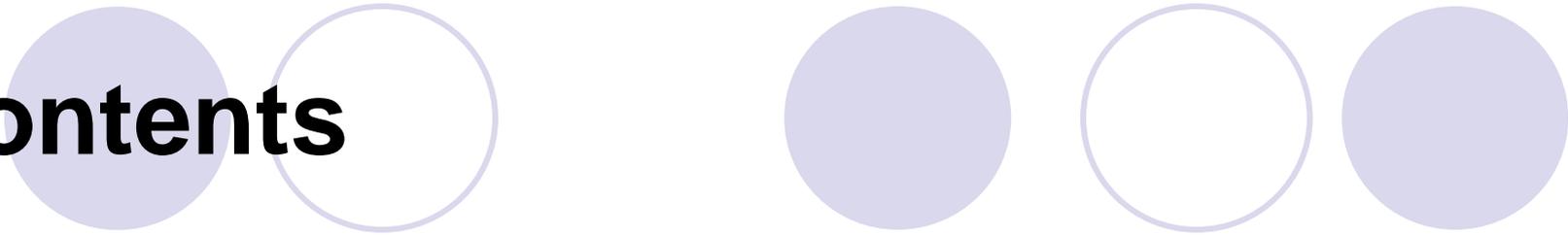- Faculty of Computer Science and Engineering
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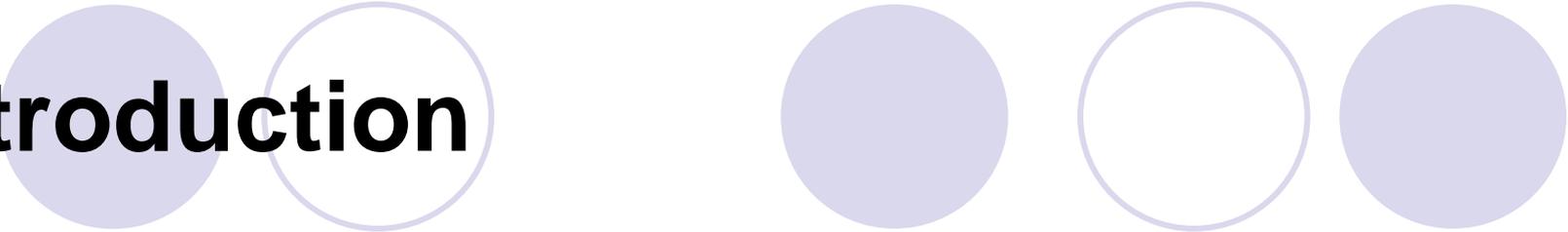**02.2016**

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Introduction

- Cloud computing aims to provide stable, reliable and encapsulated dynamic information and communication environment.

- The end users are able to simultaneously access shared resources that are available anywhere and at any time.

- The perception of quality is different from the perception of quality in traditional applications, it mainly depends on the quality of parameters that are specific for cloud computing.

Motivation
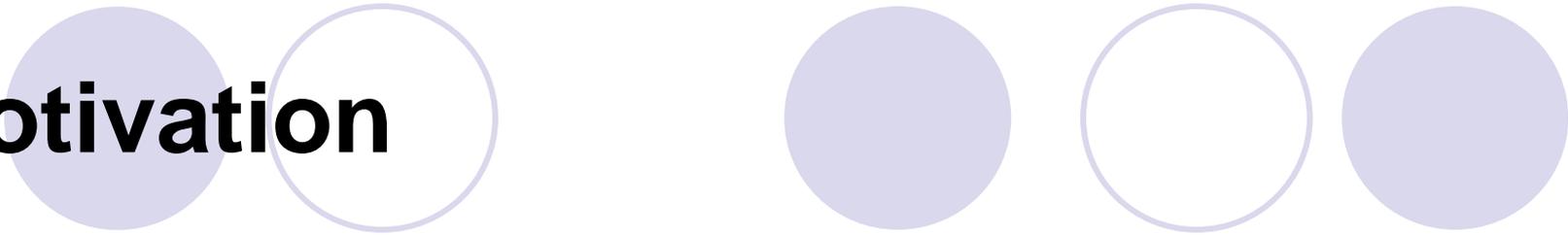
- The cloud applications are intended for distributed usage, which contributes to a greater degree of complexity of the system.

- It is a computing paradigm that provides an abstraction of the mobile network management.

- It enables mobile applications to provide end users with personalized, context-aware delivery of multimedia content.

Motivation

- The accurate assessment on the quality for services and applications in the "cloud" provides greater control over the quality of the delivered multimedia content.

- Research challenge is to define an appropriate *perception of quality for cloud computing based services* offered to end users.

- Given that there is no direct way to measure the perception of quality of the cloud-based services offered, the challenge is to design appropriate models that will ensure transparent quality measurements.

Main contribution of research

- The major benefit of cloud computing is used to improve the perception of quality for the client requests.

- The main contribution of this research is to propose a classification of cloud-based services based on objective and subjective characteristics for perception of quality.

- We have done assessment of QoE level for cloud-based services considering the level of interactivity, service complexity, usage domain, and multimedia–intensity.

Related work
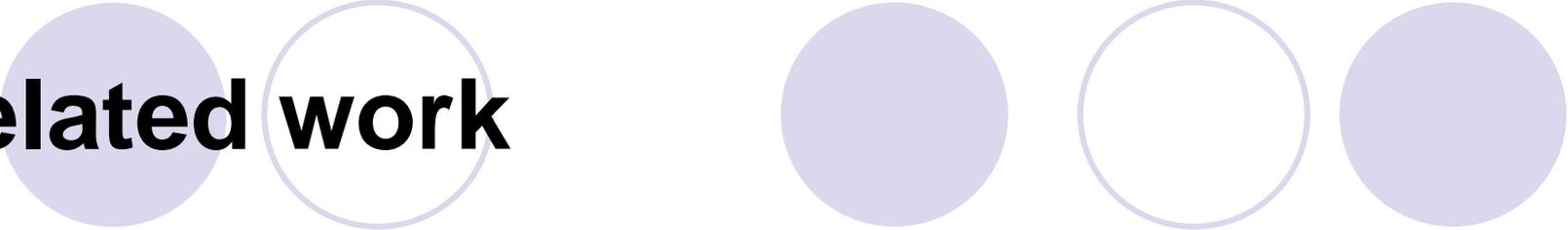
- The online live streaming services are using innovative approach for online QoE prediction.

- Models are developed for QoE prediction, where machine learning technique is used for online estimation of real-time user feedback [10].

- The Back propagation neural network is used to reflect the mapping relations of the QoS parameters and QoE are used to build a three-layer QoE model for HTTP video streaming [11].

- Statistical nonlinear regression analysis has been used to build the models with a group of influencing factors as independent predictors [12].

Perception of quality
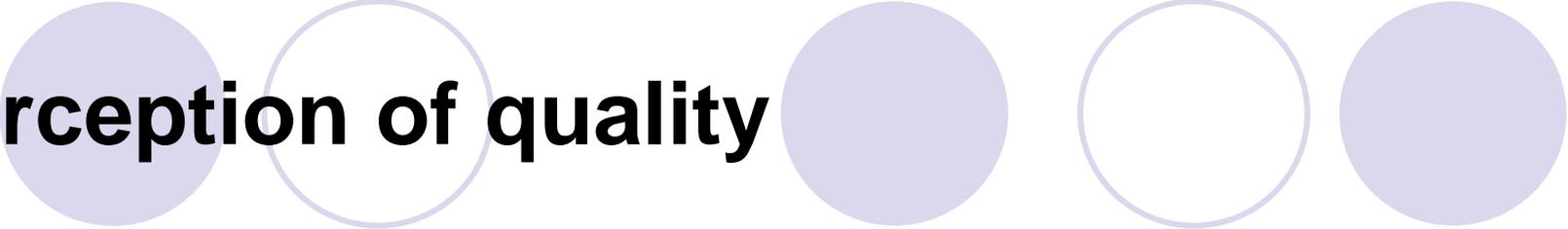
- The QoE is defined as "the degree of delight or annoyance of the user of an application or service. It results from the fulfillment of his or her expectations with respect to the utility and/or enjoyment of the application or service in the light of the user's personality and current state"[3].

- Primarily the factors that influence the perception of quality can be roughly grouped into three categories, namely *human, system, and context-dependent* influence factors

Perception of quality for cloud-based services

- Considering the analysis of all the factors and parameters that affect QoE, we noted various subjective factors affecting the user's environment for cloud computing.

- Depending on the cloud service type, we have proposed QoE-based classification of different cloud services, with regard to level of interactivity, service complexity, usage domain, and multimedia–intensity.

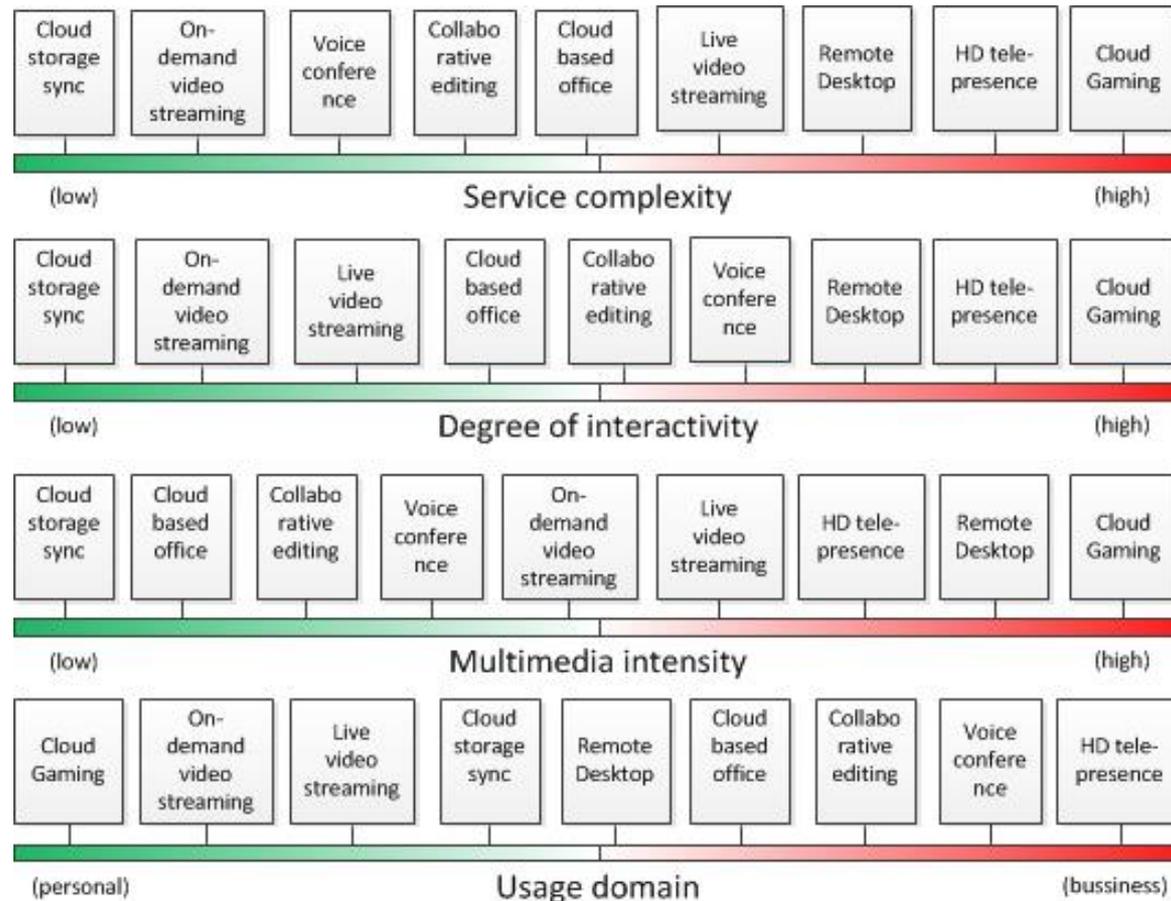# Perception of quality for cloud-based services

Figure 1. QoE-based classification of different cloud service types

Perception of quality for cloud-based services

- Bayesian modeling allows analysis of both linear and non-linear relationships between variables.

- It works with probabilities and therefore it is expected to produce discrete data containing nominal and ordinal attributes [13].

- The *cloud storage synchronization* service has low multimedia intensity (MI), low level of interactivity (DI), also low service complexity (SC) and the service is more intended for personal usage (UD), as observed in Figure 1.

Bayesian model for evaluation of quality for cloud-based services

- The model is comprised of the four predetermined factors that influence the perception of quality.

- The benefit of using Bayesian models to build QoE model for interactive services [13], has been used as a reference to develop our own prototype for cloud-based services QoE assessment using the GeNIe 2.0 platform [18], see Figure 2.

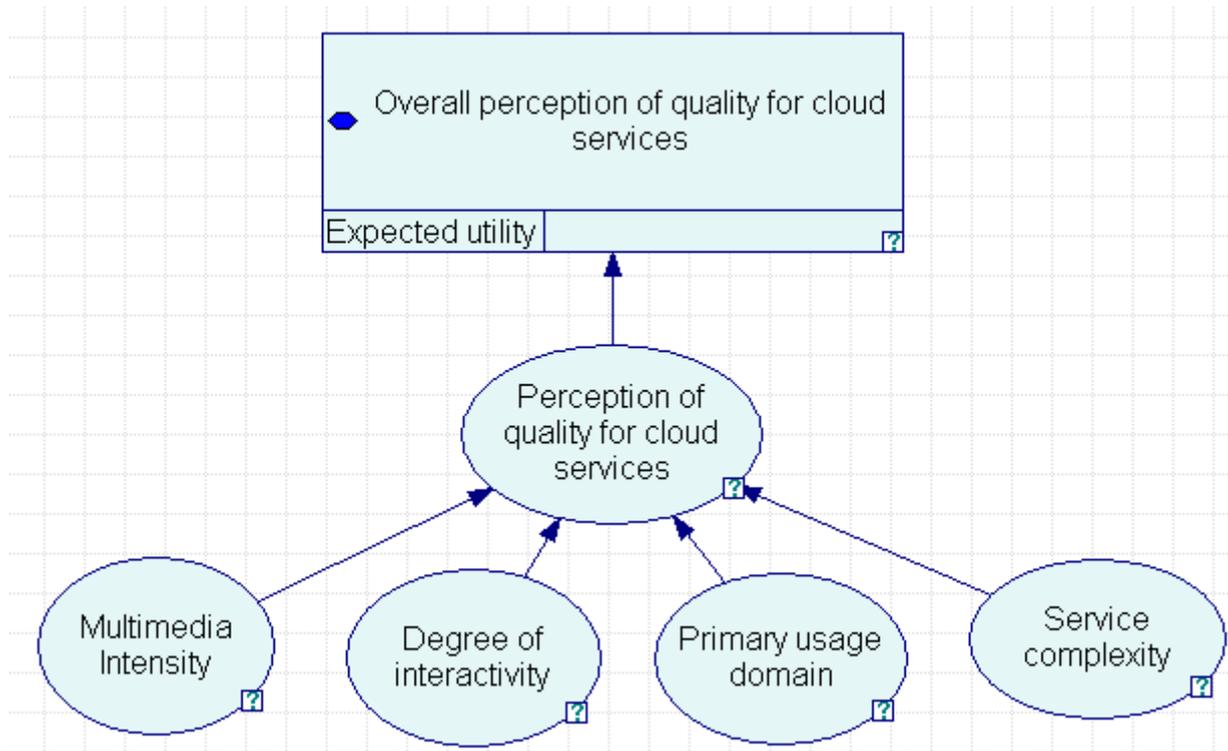# Bayesian model for evaluation of quality for *cloud storage synchronization* service

Figure 2. Bayesian network model

Bayesian model for evaluation of quality for cloud-based services
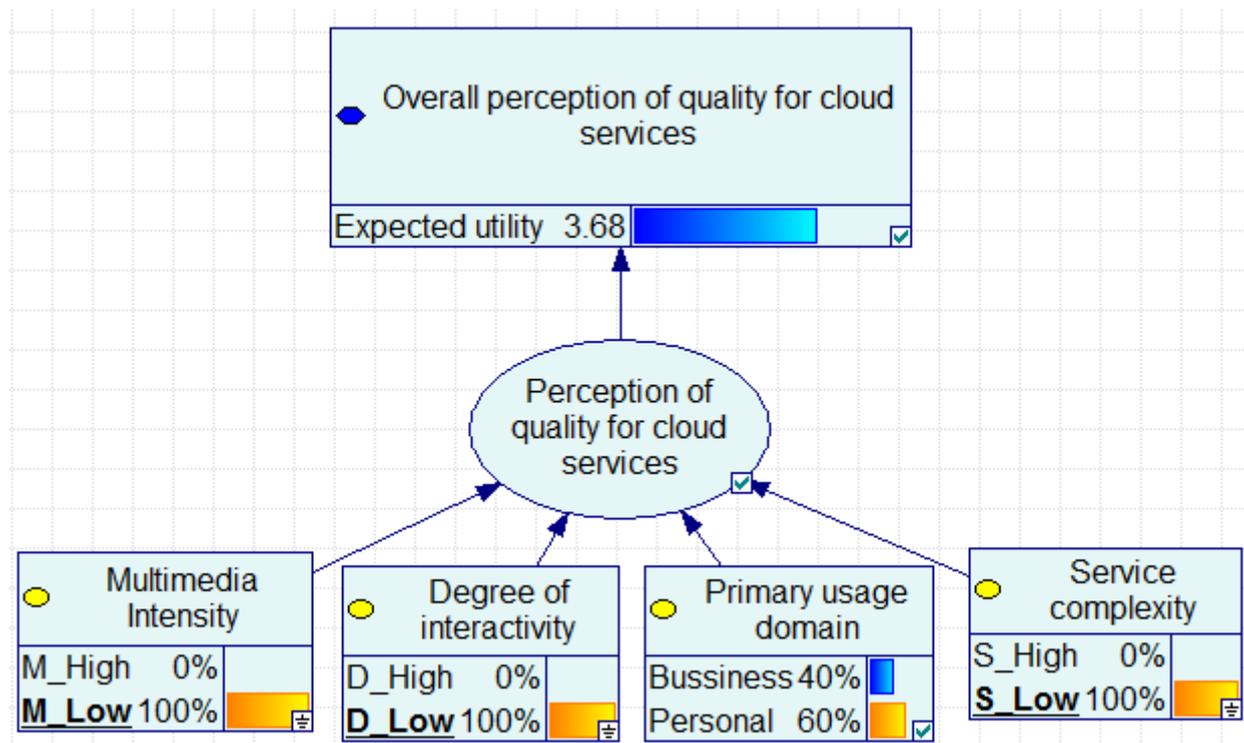

Figure 3. Bayesian model for perception of quality for cloud storage synchronization service

Established classification of cloud-based services and using the conventional Bayesian model has allowed to measure the overall perception of quality, in the Table 1.

Cloud service type	Overall perception of quality	Influencing factors			
		Multimedia intensity	Degree of interactivity	Primary usage domain	Service complexity
Cloud storage sync	good (3.68)	low (1)	low (1)	bussines (0.4), personal (0.6)	low (1)
On-demand video	good (3.8325)	high (0.45), low (0.55)	low (1)	personal (1)	low (1)
Voice conference	very good (4.334)	high (0.3), low (0.7)	high (0.6), low (0.4)	bussines (1)	low (1)
Collaborative editing	very good (4.07192)	high (0.3), low (0.7)	high (0.6), low (0.4)	bussines (0.4), personal (0.6)	high (0.3), low (0.7)
Cloud based office	good (3.7488)	low (1)	high (0.6), low (0.4)	bussines (0.6), personal (0.4)	high (0.6), low (0.4)
Live video streaming	good (3.64146)	high (0.55), low (0.45)	high (0.4), low (0.6)	bussines (0.4), personal (0.6)	high (0.6), low (0.4)
Remote Desktop	very good (4.134)	high (1)	high (0.6), low (0.4)	bussines (0.4), personal (0.6)	high (0.6), low (0.4)
HD telepre-sence	very good (4.368)	high (0.55), low (0.45)	high (1)	bussines (0.4), personal (0.6)	high (1)
Cloud gaming	excellent (4.65)	high (1)	high (1)	personal (1)	high (1)

Bayesian model for evaluation of quality for cloud-based services

- The expected utility function values, for the overall perception of quality of cloud services, are conveyed on 5-point MOS scale, in Table 1.

- The perception of the quality for *cloud storage synchronization* service has "good" perception (3.68) that is calculated as overall perception of quality for cloud services, in the established Bayesian network.

- This assessment has provided the *realistic estimation for the different intensity of usage on cloud-based services* based on the proposed classification.
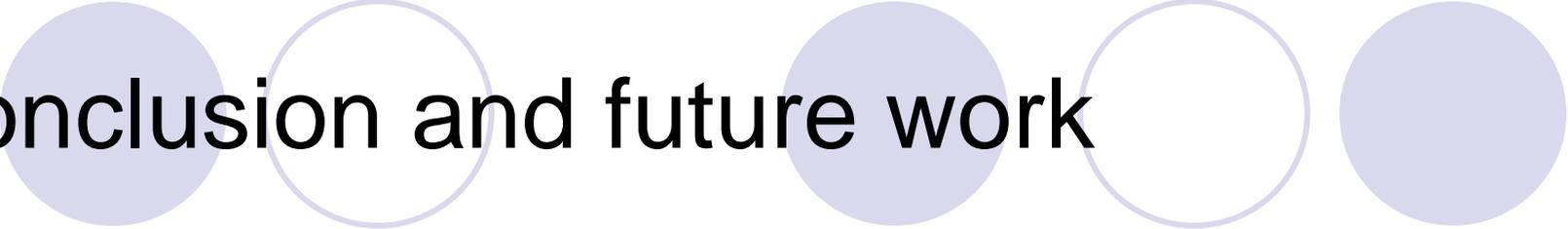
Conclusion and future work

- This research has provided new insight to what it is of particular importance for users of cloud computing in order to assess the quality of services offered.

- This research contributed to the creation of models for end user perception of quality that are based on the technology of cloud computing.

- It has been developed a QoE metrics that could be used for estimating the quality by effectively measuring cloud-based services with consideration of the influencing factors: level of interactivity, service complexity, usage domain, and multimedia–intensity that are affecting the user perception.

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