

Quality of experience metrics for cloud services: A systematic mapping

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APPENDIX 1. CLASSIFICATION OF QOE METRICS FOUND IN THE SYSTEMATIC MAPPING

Legend	
Data Extraction criteria	Possible Answer of each data extraction criteria
QoE characteristic	EF FE=Effectiveness, EFFI=Efficiency, SATI=Satisfaction, FREE=Freedom from risk, COCO=Context coverage
Metric	Name of the metric
Lifecycle phase	Req. = Requirements, Acq. =Acquisition, Dev. = Development, Int = Integration, Ope. = Operation, Ret = Retirement
Artifact evaluated	Spe. = Specification of cloud service, Arc. = Architecture of cloud service, Ser. = Cloud Service
Type of service	SaaS= Software as a service, PaaS = Platform as a service, IaaS= Infrastructure as a service
Stakeholder viewpoint	CSP = Cloud Service Provider, CSC = Cloud Service Consumer, CSB = Cloud Service Broker, CSD = Cloud Service Developer, USE= End-user
Validation procedure	A.A. = Axiomatic approach, A.T.M = Approach based on the Theory of Measurement, C.S. = Case study, SU. = Survey, C.E = Controlled Experiment, N.V.= Not validate, P.C. = Proof of concept

QoE characteristic	Sub-characteristic	Metric	Lifecycle phase					Artifact evaluated			Type of service			Stakeholder viewpoint					Validation procedure						Ref. Paper																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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																				A.A	A.T.M.	C.E.	C.S.	SU.	N.V.	P.C.		
EFFE		QoE RAS System (Sel)	X				X				X	X		X	X		X	X							X		S23	
EFFE		QoE RAS User (Ins Upd Del)	X				X				X	X		X	X		X	X							X		S23	
EFFE		QoE RAS User (Sel)	X				X				X	X		X	X		X	X							X		S23	
EFFE		QoE System R&Q (Ins Upd Del Sel)	X				X				X	X		X	X		X	X							X		S23	
EFFE		QoE System Total (Ins Upd Del Sel)	X				X				X	X		X	X		X	X							X		S23	
EFFE		QoE User R&Q (Ins Upd Del Sel)	X				X				X	X		X	X		X	X							X		S23	
EFFE		QoE User Total (Ins Upd Del Sel)	X				X				X	X		X	X		X	X							X		S23	
EFFE		StateCost					X				X			X	X											X	S15	
EFFE		Successful service outcomes					X				X	X		X	X		X	X							X		S23	
EFFE		TransCost					X				X			X	X											X	S15	
EFFI		Workload delay					X				X			X	X				X				X			X	S24	
SATI	Acceptability	Flow-Short-Scale (FSS) [17] or the Flow State Scale					X				X	X			X		X		X						X		S18	
SATI	Acceptability	Game Engagement Questionnaire (GEngQ) or Immersive Experience Questionnaire (IEQ)					X				X	X			X		X		X			X			X		S18	

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																				A.A	A.T.M.	C.E.	C.S.	SU.	N.V.	P.C.		
SATI	Acceptability	Game Experience Questionnaire (GEQ) or in-game version (iGEQ)					X				X	X			X		X		X						X		S18	
SATI	Acceptability	Igroup Presence Questionnaire (IPQ)					X				X	X			X		X		X						X		S18	
SATI	Acceptability	Player Experience of Satisfaction (PENS)					X				X	X			X		X		X						X		S18	
SATI	Acceptability	Presence Questionnaire (PQ)					X				X	X			X		X		X						X		S18	
SATI	Acceptability	Self-Assessment Manikin (SAM)					X				X	X			X		X		X						X		S18	
SATI	Courtesy	Degrees of formalization of the employee's language and attitude (DoF-ATT)	X						X			X	X	X					X							X	S33	
SATI	Courtesy	Free trial		X		X	X				X	X	X	X	X	X	X								X		S03	
SATI	Pleasure	API		X	X	X	X		X		X	X	X	X	X	X	X								X		S03	
SATI	Pleasure	Client interface		X	X	X	X		X		X	X	X	X	X	X	X								X		S03	
SATI	Pleasure	Use Intention		X			X				X			X	X	X	X						X				S10	
SATI	Pleasure	User Experience Level	X	X			X				X	X	X	X	X	X	X								X		S03	
SATI	Pleasure	User patient					X				X			X	X				X						X		S07	
SATI	Responsiveness	Delay Score					X				X	X			X		X								X		S04	
SATI	Responsiveness	Game delay (GD)					X				X	X							X						X		S06	

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																				A.A	A.T.M.	C.E.	C.S.	SU.	N.V.	P.C.		
SATI	Responsiveness	Network (ND)	delay				X				X	X								X						X	S06	
SATI	Responsiveness	Playout delay (OD)					X				X	X								X						X	S06	
SATI	Responsiveness	Processing (PD)	delay				X				X	X								X						X	S06	
SATI	Responsiveness	Response (RD)	Delay				X				X	X								X						X	S06	
SATI	Responsiveness	Responsiveness (RESP)					X				X	X	X							X						X	S32	
SATI	Responsiveness	Responsiveness (RESP-CQ)					X				X	X	X	X						X						X	S31	
SATI	Responsiveness	Responsiveness(R)			X	X					X			X						X	X					X	S05	
SATI	Trust	Cloud Confidence	Customer Level				X				X	X			X											X	S21	
SATI	Trust	Monitoring			X	X		X		X		X	X	X	X	X	X								X		S03	
SATI	Trust	Monitoring			X	X					X			X			X	X							X		S02	
SATI	Trust	Number of Clients				X					X	X								X					X		S01	
SATI	Trust	Perceived fluidity of gameplay (ACR scale)					X				X	X								X						X	S22	
SATI	Trust	Perceived graphics quality (ACR scale)					X				X	X								X						X	S22	
SATI	Trust	Reliability (Rel)					X				X			X	X			X							X		S28	
SATI	Trust	Reputation			X	X		X			X	X	X	X	X	X	X								X		S03	
SATI	Trust	Reputation					X				X			X	X					X					X		S29	

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																				A.A	A.T.M.	C.E.	C.S.	SU.	N.V.	P.C.		
SATI	Trust	Reputation of service provider	X	X							X			X		X	X		X							X		S02
SATI	Trust	Reputation (Repws)						X			X	X							X							X		S09
SATI	Trust	Security (Sec)						X			X			X	X		X									X		S28
SATI	Trust	Transparency		X							X			X			X		X							X		S11
SATI	Trust	Trust						X			X	X	X	X						X						X		S25
SATI	Trust	Trustworthiness of service		X							X	X								X							X	S17
SATI	Trust	Trustworthiness of virtual resources and services						X			X	X	X	X						X						X		S30
SATI	Trust	Utility of trust for request (Ti)						X			X			X	X		X		X							X		S28
SATI	Trust	Video Quality Score Squality						X			X	X			X		X		X								X	S04
SATI	Utility	API	X	X							X			X		X	X		X							X		S02
SATI	Utility	Customer support	X	X	X	X	X		X		X	X	X	X	X	X	X									X		S03
SATI		Game Mean Opinion Score (GMOS)						X			X	X								X							X	S26
SATI		Mean opinion score (MOS)						X			X	X								X							X	S27
SATI		Mean opinion score (MOS)						X			X	X								X							X	S27
SATI		Mean opinion score (MOS)						X			X	X								X							X	S27

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																				A.A	A.T.M.	C.E.	C.S.	SU.	N.V.	P.C.		
SATI		Mean opinion score (MOS)		X			X				X			X	X	X	X							X				S10
SATI		Mean opinion score (MOS)					X				X	X								X						X		S20
SATI		Satisfaction degree		X			X				X	X	X	X	X			X						X				S16
SATI		satisfaction rate					X				X				X			X						X				S14
SATI		Service Visibility					X				X	X			X					X						X		S21
SATI		User Experience	X	X							X			X		X	X			X					X			S02
SATI		User rating					X				X	X	X	X						X					X			S25
SATI		User rating					X				X	X	X	X						X					X			S25
FREE	Environmental risk	Carbon Cost (CFP)		X							X	X			X			X							X			S12
FREE	Environmental risk	Data Center Infrastructure Efficiency (DCIE)		X							X			X				X							X			S11
FREE	Environmental risk	Data Center Performance per Energy (DPPE)		X							X			X				X							X			S11
FREE	Environmental risk	Efficiency of the physical infrastructure (PUE)		X							X			X				X							X			S11
FREE	Environmental risk	IT equipment energy efficiency (ITEE)		X							X			X				X							X			S11
FREE	Environmental risk	IT equipment utilization (ITEU)		X							X			X				X							X			S11

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																				A.A	A.T.M.	C.E.	C.S.	SU.	N.V.	P.C.	
FREE	Environmental risk	Penetration of renewable (green) energy into the system (GEC)		X							X			X			X								X		S11
FREE	Environmental risk	Power Usage Efficiency (PUE)		X							X			X			X								X		S11
FREE	Environmental risk	Service Sustainability(E)		X							X	X			X		X								X		S12
COCO	Flexibility	Flexible Capacity (C)					X				X		X		X										X		S21
COCO	Flexibility	Flexible Degree					X				X		X		X										X		S21
COCO	Flexibility	Flexible Distance (Si)					X				X		X		X										X		S21
COCO	Flexibility	Flexible Force (Fi)					X				X		X		X										X		S21
COCO	Flexibility	Flexible Point (FXPi)					X				X		X		X										X		S21
COCO	Flexibility	Payment flexibility					X				X	X	X	X						X					X		S25
COCO		User Experience Level					X				X	X			X		X								X		S13