

A FRAMEWORK OF ADAPTIVE INTERACTION SUPPORT IN CLOUD-BASED INTERNET OF THINGS (IOT) ENVIRONMENT

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Abstract

- This paper discusses the **Internet of Things (IoT)** within the **cloud** computing concepts and architectures.
 - We review different frameworks of **combined IoT architecture with cloud** being in the center and
 - We **investigate adaptive interaction support** concept.
 - We propose a novel framework that incorporates and supports adaptive interaction of the user with the IoT cloud architecture

INTRODUCTION

IoT Cloud Architecture

- The IoT uses the cloud to leverage its processing powers due to its need to greater processing than that provided by the miniature sensors and things.



IoT Cloud Architecture

- Some challenges to the IoT cloud
 - Interoperability
 - Communication Errors
 - Security Threats
 - Adaptive Interaction with the IoT cloud architecture.
- Many studies have presented frameworks and architectures that combine the internet of things with the cloud.
- But little has been done to support the user interaction with such smart environments

Adaptive Interaction Support in IoT Cloud Environment

- Our main goal is to design the architecture of the adaptive interaction support in IoT cloud environment.
- There are some adaptive interaction support architectures provided, but not specifically designed for, the IoT cloud environment.
- The IoT cloud framework has its own architectures, framework and limitations that need to be addressed specifically when designing adaptive interaction support.

Adaptive Interaction Need

- In reality our lives don't follow precise schedules
- Moreover these things are not always accurate and error free
- That's why we need these smart things to **adapt their communication** with the users especially if they are not able to get the accurate status.



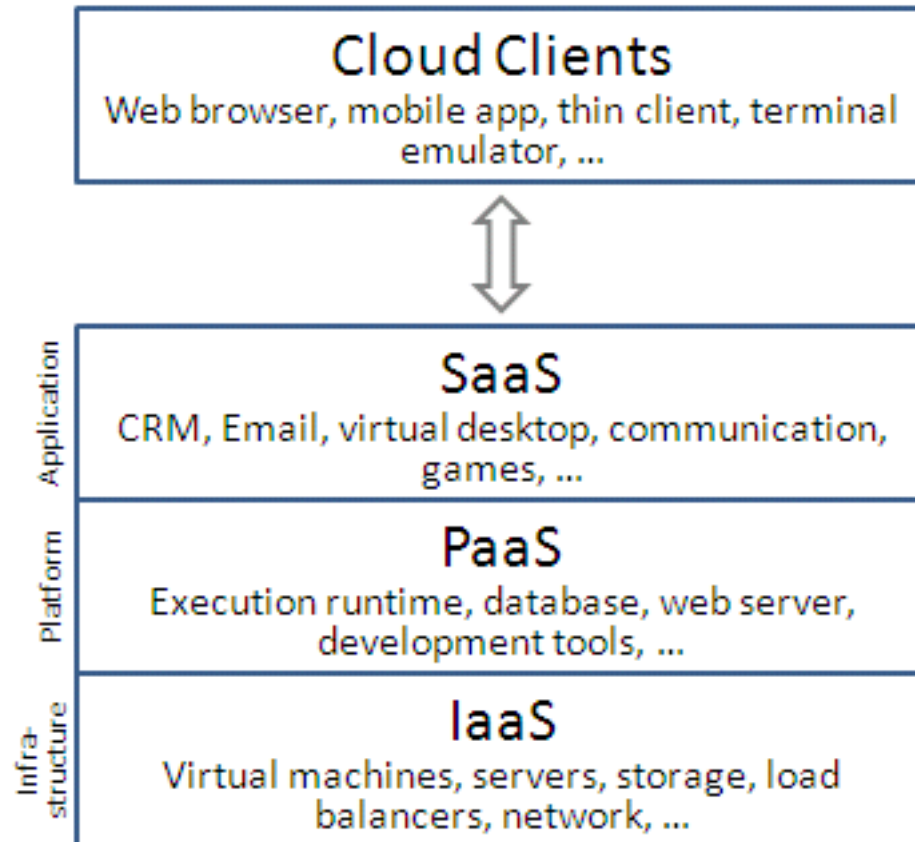
Adaptive Interaction Support in IoT Cloud Environment

- In our proposed approach, the interaction is adapted based on the **quality of context** and **quality of services** provided to the user.
- This dynamic adaptation gives the user more control at times of less quality of information communicated which reduces irrelevant or annoying actions taken by the system.



LITERATURE REVIEW

Cloud Computing

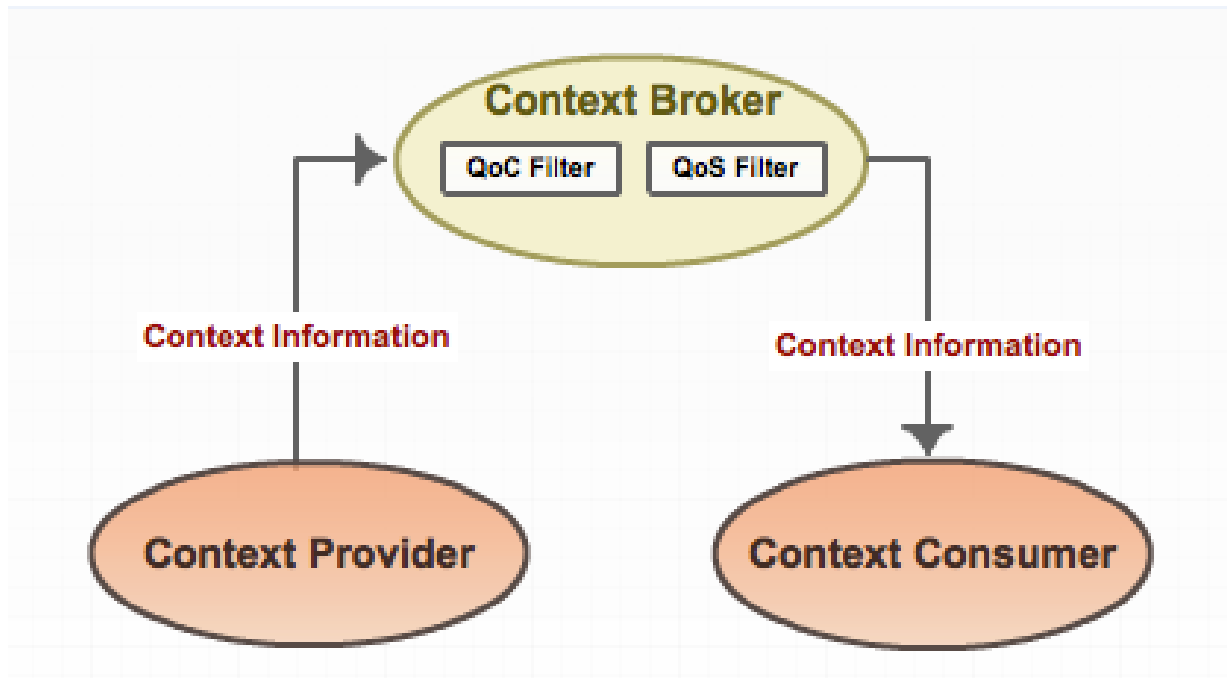


Internet of Things (IoT)

- One proposed framework had the internet at the center, but the internet was substituted with the cloud and presented cloud centric internet of things framework.
- The benefits from such frameworks are the scalability and cost effectiveness.
- The cloud will offer its services to all connected parties where they can benefit and utilize them as needed.



Interaction Support



Interaction Classification

Interaction between the system and the user is classified into:

- **Explicit interaction mode** - where the user initiates the interaction.
- **Implicit interaction mode** - where actions are performed automatically by the environment, based on the knowledge of the user's situation or the context.
- **Mixed-initiative interaction** - which combines explicit interaction with implicit interaction to facilitate joint interaction between user and environment.

Interaction Modes

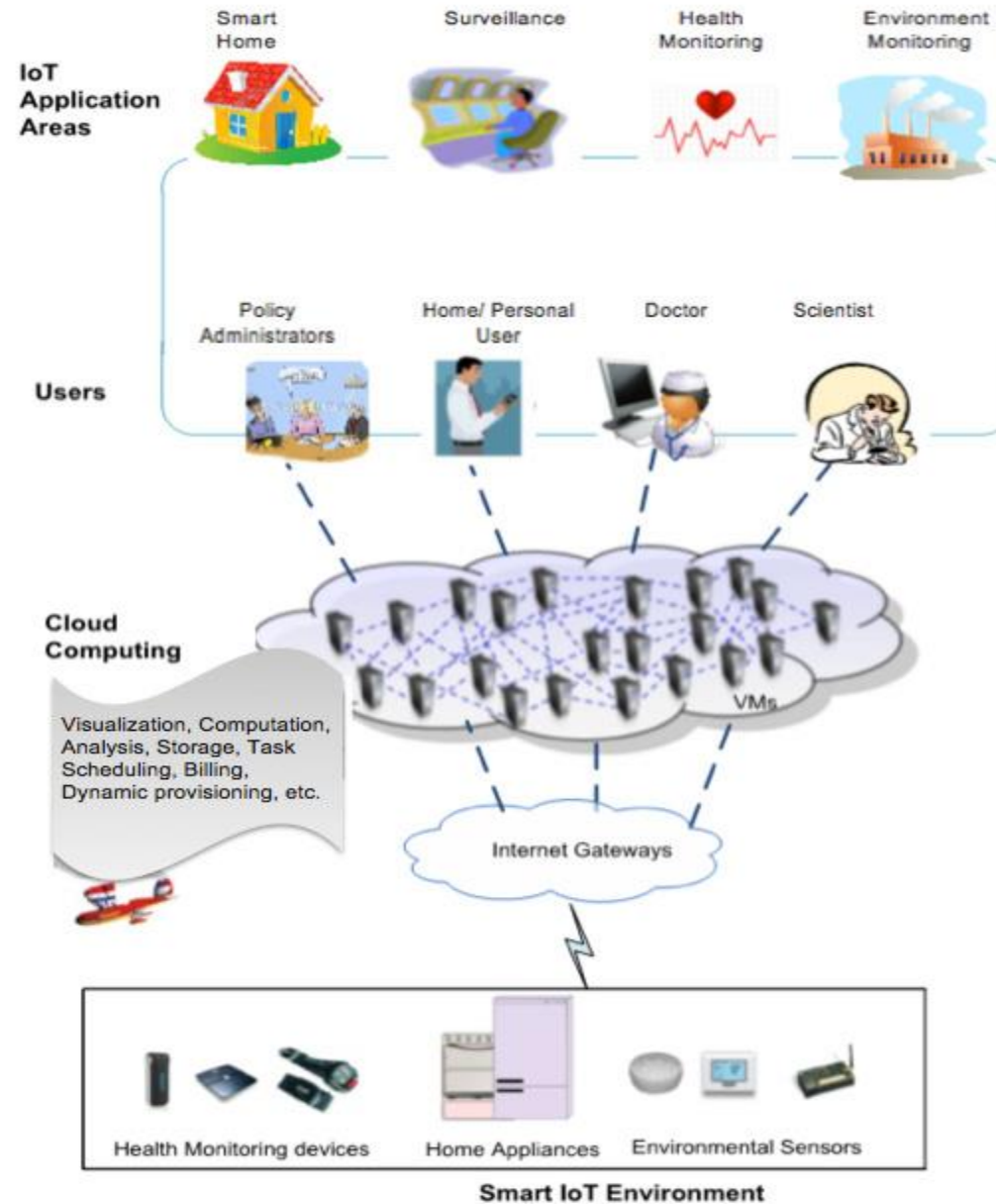
- Different modes of interaction are suggested based on the quality of information (QoI) of the context.
- The suggested modes are
 - full automation
 - action suggestion
 - simple notification
 - null action.
- More automation is selected with higher (QoI) and more user control is provided as the (QoI) decreases.

PROPOSED INTERACTION SUPPORT FRAMEWORK

Proposed Interaction Support Framework

- The framework of cloud centric IoT has been proposed and used as a base in many central papers.
- Then again adaptive interaction in context aware systems has been discussed in the literature.
- Our proposal **incorporates both concepts into one framework** and uses the quality of context and quality of service levels to base the adaptive interaction mode with the user.

IoT cloud Centric Architecture



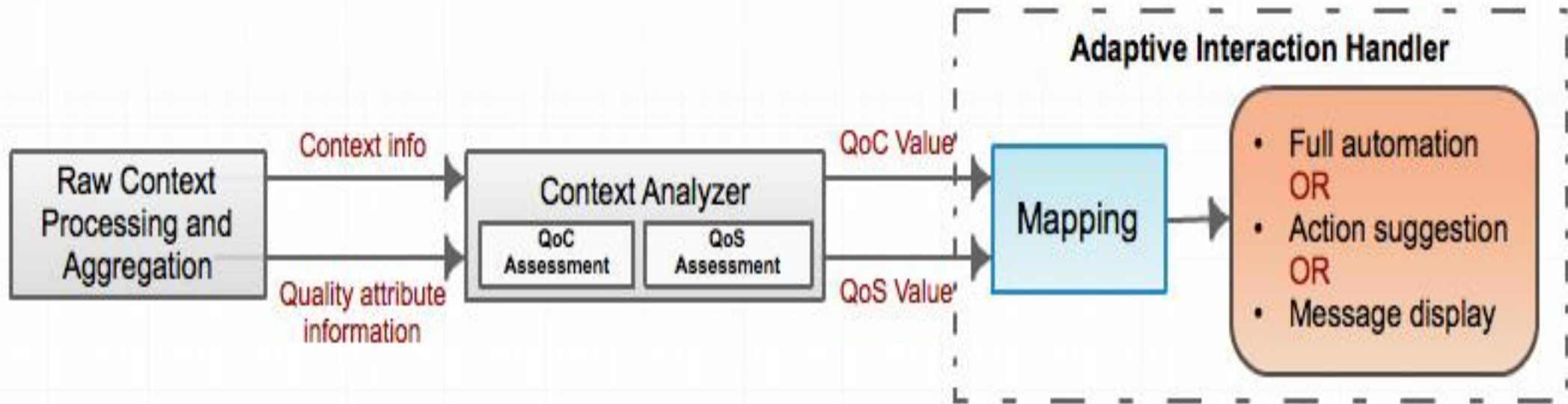
Quality of Context Information and Services

- IoT cloud centric environment context or users' situation **uncertainty** is unavoidable.
- Therefore our proposal supports the adaptive interaction of the user with the IoT cloud centric environment depending on the Quality of Context (**QoC**) and Quality of Services (**QoS**) provided.

QoC Vs. QoS

- QoC refers to quality of **information** and neither to the process nor the hardware component that possibly provide the information.
 - Examples of QoC attributes are precision, probability of correctness, trust-worthiness, resolution, and up to date information
- QoS refers to the quality of a service. QoS is defined by the nonfunctional characteristics of a system, affecting the perceived quality of the results.
 - Examples of QoS attributes are timeliness, reliability, and perceived quality

Context Interaction in the IoT cloud Centric Environment

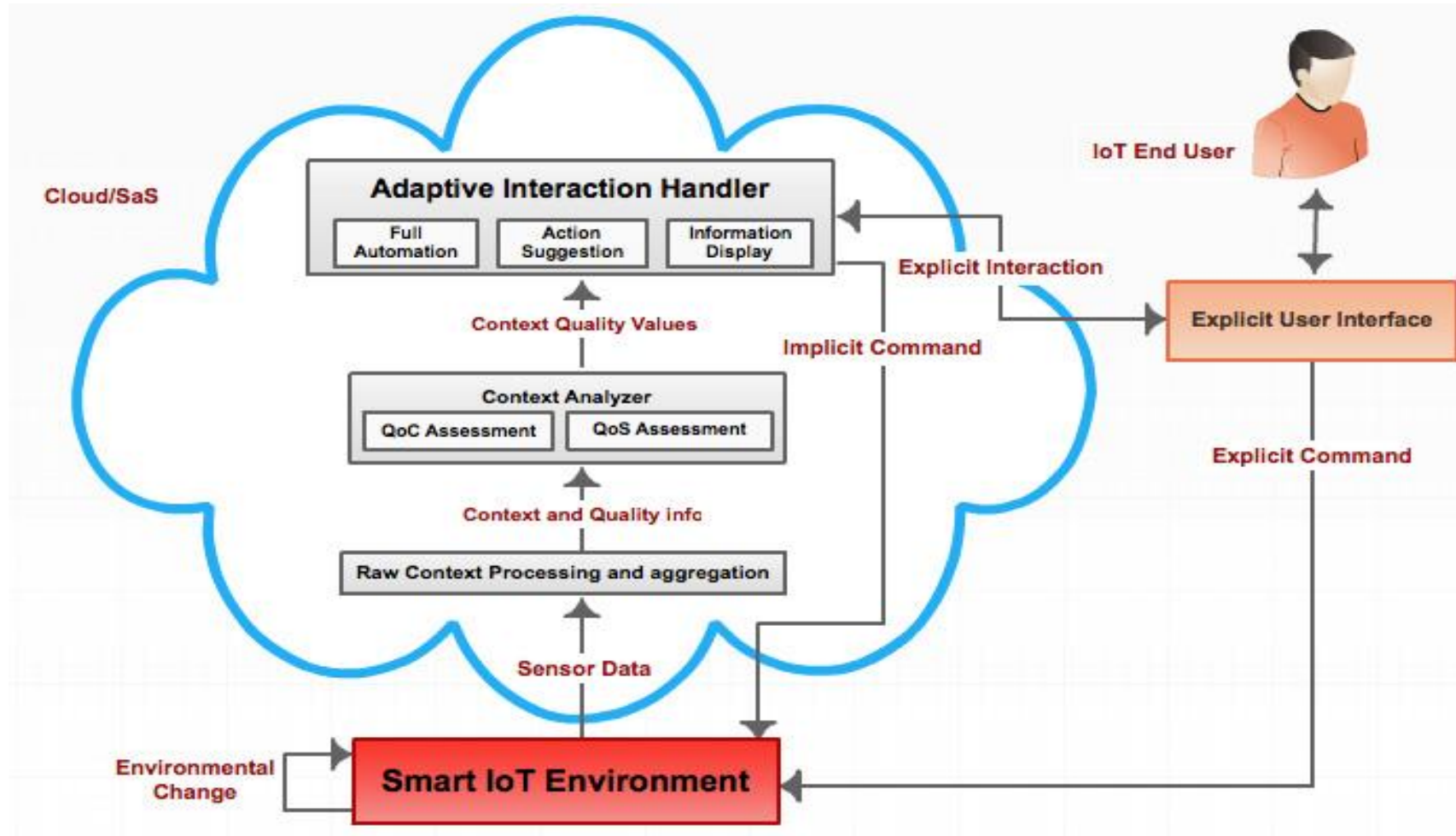


Motivation for Interaction Support

- Adaptive interaction enables more automation with better quality of context information and services provided and more user control with decreased quality levels.
- This reduces the annoyance with wrong automation
- Adaptive interaction mode take into consideration the unavoidable uncertainty

PROPOSED INTERACTION SUPPORT FRAMEWORK

Adaptive Interaction Support in IoT cloud Centric Environment



Process of choosing a particular interaction mode

Algorithm Adaptive Interaction

Input: {Context Information C_x , $QoC(C_x)$, $QoS(C_x)$ }

BEGIN

1: Identify context C_x

2: Determine quality attributes $QoC(C_x)$ and $QoS(C_x)$

3: Assign values LQ_c and LQ_s for each $QoC(C_x)$ and $QoS(C_x)$

4: Map C_x , $QoC(C_x)$, $QoS(C_x)$ and their respective LQ_c and LQ_s to the appropriate automation level {full automation, action suggestion, message display}

5: Invoke the actions (A_i) for a given context C_x based on the selected automation level

END

Limitations of the Proposed Framework

- Identifying **exact actions** to be performed with certain quality levels; The choice of specific action or action mode criteria is left to the system designer.
- **More or less number of attributes** and acceptable levels to each attribute can be modified according to different systems' requirements.
- The degree of confidence in QoS or QoC are not decided in our framework, it is left to each system designer to adjust it to the specific **level of quality requirements**

Conclusion

- The purpose of the proposed framework is to include adaptive interaction support to the IoT cloud framework
- An important benefit to this study is to give the user more control when context information is unreliable - which will decrease the level of annoyance with the smart environment.

THANK YOU
