

Innovative Queue Management Mechanism for Congestion Control in Wireless Cloud Computing Environment

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Abstract--- As the demand on the cloud services increases, networks in the wireless cloud environment would not be able to handle the big amount of data traffic without some procedures that control the arriving traffic from outside the cloud and manage the connections inside the cloud. Thus, for efficient traffic monitoring and control, it is essential to have some measures that would improve the cloud performance. Since congestion phenomenon can negatively affect the utilization of the cloud resources and reduce the performance experienced by the end-users, it is highly necessary to diminish congestion phenomena in order to optimize the cloud service utilization and provide end-users with appropriate level of performance that meets their requirements. The paper aiming at improving the performance in wireless cloud computing environment in frame of delay, packet loss, throughput, and utilization.

Keywords--- Cloud model, Hoff's model, Wireless cloud, Congestion Cloud.

I. Introduction

Cloud computing all the technical, electronic and information achievements in various fields, the world is turning to advanced technology cloud computing, which relies upon the exchange of preparing and storage room of the PC to the purported Cloud, a server is gotten to through the Internet, IT programs from items to administrations. So everything that is used and what happens from the processes and programs to access files and data stored on computers over remote networks. For such big amount of data, the difficulty of management on the one hand storage and processing being large data through a small set of computers (Kadhim, Mahdi, et al. 2018). Computer networks support almost every aspect of modern business. In the area of competent management is critical to the success of the company and experts who can perform this role has expanded after too. Network management is a rapid development specialty that needs leadership, problem solving, organizational, as well as technical ability in data management and analysis service provided in computing and protection (Buyya et al. 2008). Cloud computing may refer to a collection of infrastructure equipment and frameworks programming in server farms that gives pay-examine parallel administrations to many applications in different areas such as physics, biology, chemistry, finance, and information retrieval, to name few (Hoffa et al. 2008). Define cloud computing is a group of virtual servers that networked over Internet and dynamically managed, monitored and maintained by the cloud provider. Services in cloud computing are characterized into three main categories (Kadhim, Yusof & Selamat 2018). Programming as a Service (SaaS), Platform as a Service (PaaS), and Cloud Software Infrastructure that is made out of three layers to be specific; computational assets or Infrastructure as a Service (IaaS), Data-Storage as a Service (DaaS), and Communication as a Service (CaaS). Figure 1 presents the cloud computing classification model (Chhabra & Dixit 2015). SaaS is browser-based applications (such as Google Docs and Google SpreadSheets) with predetermined functionality and scope. It reduces the requirements of hardware (and other related matters such as the maintenance of the hardware) on the end user's side, as it allows developers to frequently upgrade and fixe their applications at the data center offered by the provider. With PaaS, application-programming interfaces (APIs) are provided to developers to build, test, and deploy applications on the cloud. For IaaS, datacenters supply flexible infrastructure resources for several services such as computing, storing, and communication.

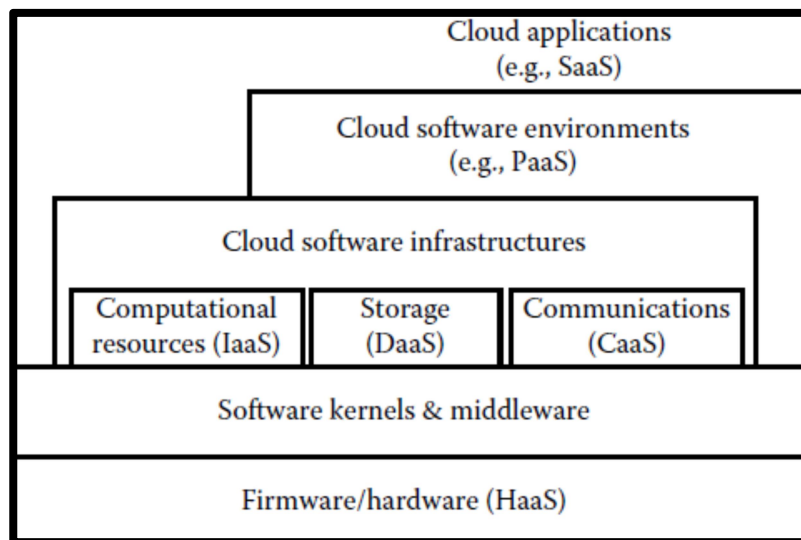


Figure 1. Cloud Computing Classification Model (Elena & Johnson 2015)

Christopher Hoff (Grobauer et al. 2011) suggested more detailed and abstracted cloud ontology (shown in Figure 2) that dissects the three main categories to several other components according to their objectives.

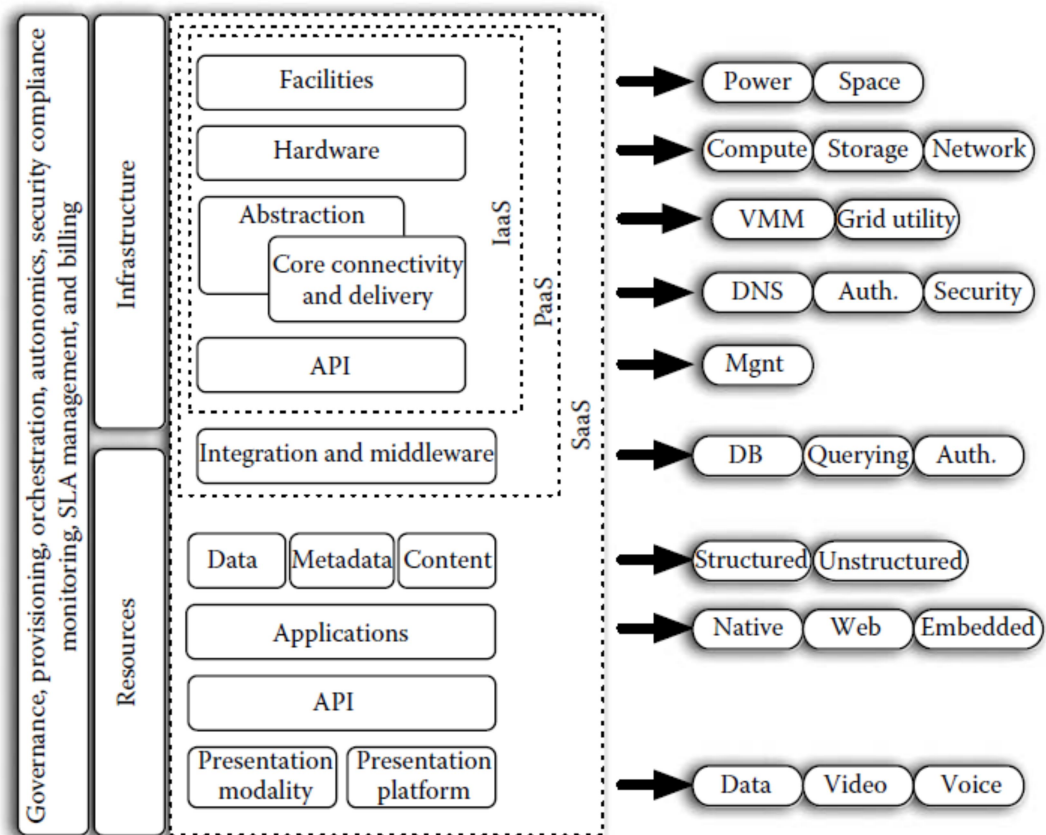


Figure 2. Hoff's model for cloud computing (Grobauer et al. 2011)

II. Wireless and Mobile Cloud

The ubiquitous communications and low-cost portable wireless devices have increased the demand for utilizing a cloud for processing data, which in turn drove several IT companies future outlook cloud computing Wireless, such as gold mine (Ren & Van Der Schaar 2014). As commercial cloud services are increasing more and more, cloud large-scale data processing is extensive architecture for portable wireless devices is emerging rapidly due to the high speed of wireless broadband and the availability of mobile devices (portable) (Dong et al. 2015). This is called “wireless cloud” or “mobile cloud” that is depicted in Figure 3 below. Numerous wireless cloud-based applications have been developed such as education (distance learning)(Ye et al. 2010), healthcare (medical diagnoses and surgical operations).(Hoang & Chen 2010), and multimedia (seminars and conferences)(Dinh et al. 2013).

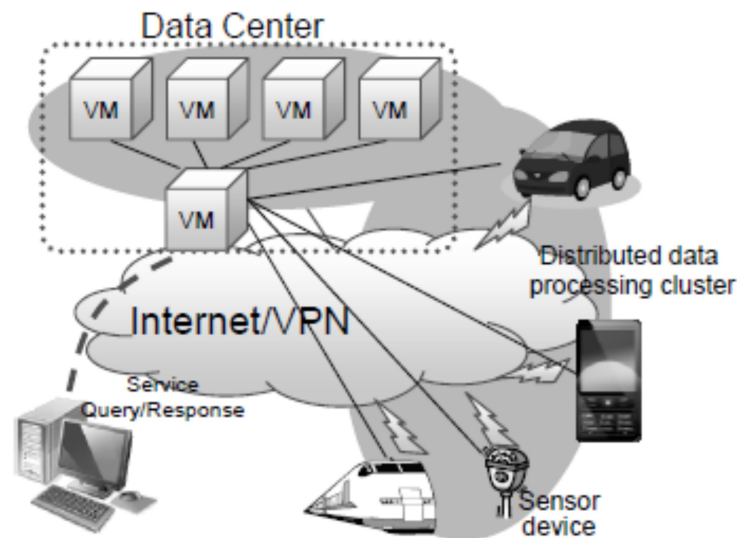


Figure 3. Wireless and mobile cloud (Oguchi & Abe 2011)

Wireless cloud extends resources to varying static, mobile, or nomadic wireless devices with different capabilities; including cars, trains, airplanes, sensors, mobile phones, and laptops (Brooks et al. 2012). The independence a wireless device allows accessing the cloud resources regardless of the location or the type of the cloud's wireless device. Wireless cloud enables the information exchange and interaction among heterogeneous wireless devices. Mobile computing with networked information systems presented by wireless cloud may improve the operational efficiency and productivity. However, high network load or insufficient bandwidth can affect the system performance noticeably. Figure 4 identifies the conceptual model of wireless cloud computing environment. In such model, wireless devices may function as both end users and virtual machines.

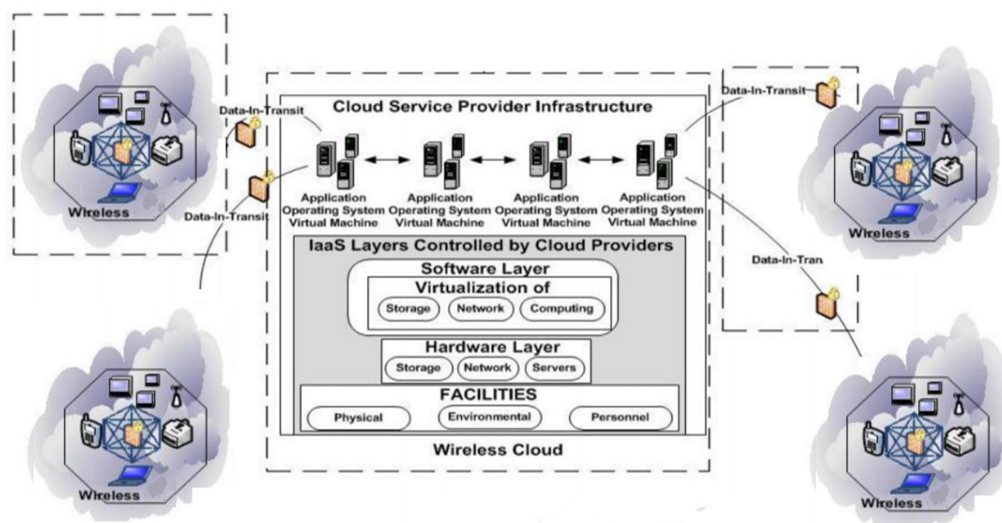


Figure 4. Wireless cloud computing environment ((Lim et al. 2009) and (Brooks et al. 2012))

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III. Communication and Congestion Issues in Cloud Computing

Network connectivity for cloud computing is required, Quality of Service (QoS) which must be available in the network infrastructure for cloud computing, a requirement for cloud computing to provide a connection and a range of processing power and to provide a service of high quality across dynamic layers providing a bandwidth for network monitoring. Instant messaging, audio and video conferencing, in addition Voice over IP (VoIP) telephone systems are the common cloud applications that are concerned in CaaS layer. Challenges and obstacles facing the quality of service provided by the distribution of wireless networks in the cloud-computing environment of the limitation of wireless devices power, bandwidth, and mobility effects. As connections in cloud computing environment uses Transmission Control Protocol (TCP) as underlying transport protocol for end-users sessions (shown in Figure 5), in terms of Web traffic, Constant change in network construction and wireless because of the effects end-to-end the movement of virtual devices in the cloud. Furthermore, in wireless cloud computing environment, large-scale of data need to be transferred over a wide area. The protocol TCP connections over low quality wireless connections are the Protocol is unable to provide unsatisfactory productivity (Silva et al. 2013)(Kadhim, Yusof & Mahdi 2018). Also, devices with large communication delay degrade the overall performance of the cloud (Sharma & Wang 2017). Therefore, it is important to optimize TCP communications in wireless cloud computing.

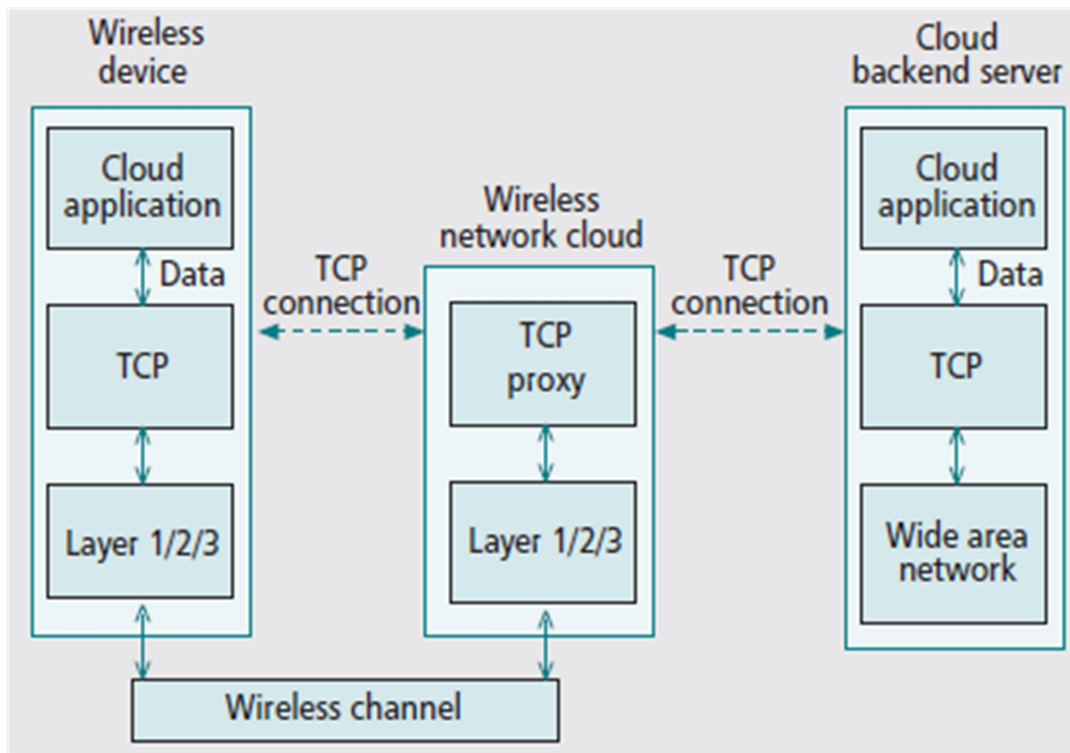


Figure 5. Logical connection of wireless devices, wireless cloud, and cloud backend servers(Cai et al. 2014)

The measurement of congestion issues in wireless network in cloud computing is the quality of service provided by hand queuing and quality application in terms of productivity performance. The congestion results from loss of data in packets due to delay and the amount of temporary storage more than scheduled to drop data in traffic in wireless cloud computing. Also the carrier medium of the service provided by the wireless cloud computing through the Internet to connect between remote areas and the delivery and delivery service is the point of effective speed Internet power in the data transmission provided cloud service (Mahdi et al. 2018). The more cloud computing services are offered over the Internet, it results in a queue waiting to pass packets and as more packets cause loss between transmission and receiving see Figure 6. This result in traffic congestion in the wireless network using the TCP protocol in general in the wireless networks and the loss of the data in the protocol TCP and the speed of the transmission of the transmission suffers waiting in the long queue. These reasons affect the quality of service provided by cloud computing.

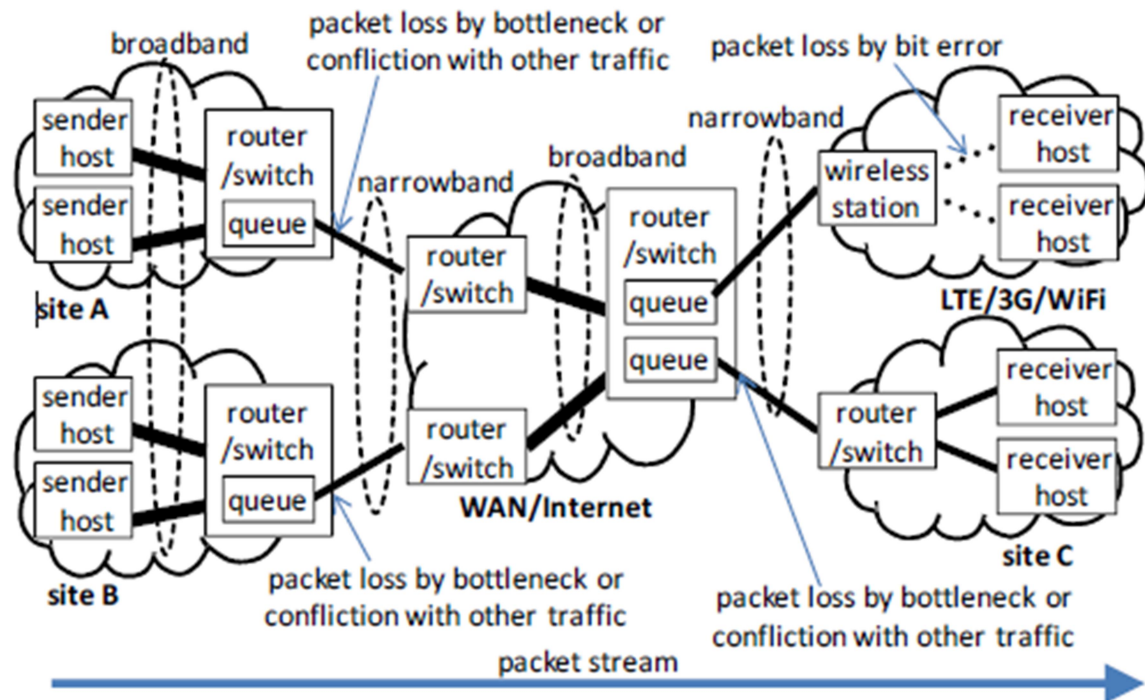


Figure 6. Packet loss from in wireless cloud (Mahdi et al. 2018)

It is possible to avoid traffic congestion at the gates being closer to the recipient. And to control the increase in traffic load at the gates to maintain the size of the queue to be smaller to provide temporary storage increase in pregnancy to spite traffic data and avoids the loss of inventory flood (Boudi & Loudini 2018). The end-user devices in wireless cloud computing and the Internet has to control gates to reduce congestion (Ahmad et al. 2018). The mechanisms of congestion in data packets and loss and work portals when the issue of congestion in the wireless cloud computing. The responsibility for controlling the queue waiting time, the packet connection to the end user, and the detection when the wireless cloud control management (Ibanez et al. 2017).

IV. Congestion Detection

Congestion in wireless cloud might be avoided if end-user devices are able to perceive the happening of congestion and take proper reaction by reducing their sending rate, which would help mitigate the congestion. The congested gateway in the wireless cloud (or in Internet that connects the cloud) conveys congestion information to the end-user devices in either implicit or explicit way. The congested gateway may purposely drops data packets to inform (alert) the corresponding end-user devices about congestion; this is an implicit congestion feedback. The end-user devices in turn deduces the occurrence of congestion in the cloud when perceiving packet drops whether from the receiving of the duplicate acknowledgements (ACKs) or from the timeout of retransmission timer of the transmitted packets. Nevertheless, with implicit feedback, end-user devices might not be able to differentiate between congestion condition and other network issues; for instance hardware failure. On the other hand, in the explicit feedback way, the gateway may explicitly sends the congestion information in the headers of data packet (or control packets) to notify the incidence of congestion at that gateway. However, in wireless could environment, explicit congestion feedback adds an additional burden on the wireless network since the network in this case is required to transfer more traffic. This would cause inefficiency in the cloud if the feedback overhead were not managed appropriately.

As most of connections of end-user devices in wireless cloud are based on TCP/IP protocol stack, packet loss is commonly inferred as a sign of congestion in the cloud gateways. Upon the sense of congestion, TCP end-user devices control their data transmission rate by reducing the size of their packet transmission rate is determined by the congestion window (cwnd). The size of cwnd depends on the rate of incoming (arriving) acknowledgments (ACKs) for the sent packets(Kadhim et al. 2017), which is affected by the presence or absence of the congestion phenomenon in the gateways on the route between end-user devices and the cloud servers.

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V. Conclusion and Recommendation

This paper points out the need for an efficient queue management mechanism that is able to control data traffic in the wireless clouds efficiently and enhance the performance of cloud computing environment. Thus, innovative queue management mechanism for congestion control, which is based on wireless architecture, will be proposed for wireless cloud computing environment. The proposed mechanism is supposed to present quick sensing and reaction to the congestion, timely distribution of congestion notification, and direct managing of the queue size according to congestion condition (which would reduce the queue size fluctuation). , the researcher has the following recommendations:

- i. Survey on the common existing congestion management mechanisms to define the key issues.
- ii. Empirical performance analysis of the current congestion management mechanisms to identify their advantages and disadvantages.
- iii. Define the specifications and requirements of an effective congestion management mechanism.
- iv. Plan the parts of the proposed clog administration system.
- v. Develop of the proposed clog administration system in simulated wireless cloud environment.
- vi. Performance evaluation of the proposed clog administration component to study its impact on the cloud traffic regarding delay, packet loss, throughput, and utilization.

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