IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834, p- ISSN: 2278-8735.Volume 20, Issue 5, Ser. I (Sept - Oct2025), PP 01-05
www.iosrjournals.org

A Survey Of Messaging Systems Used In The Wireless And Network Domain

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Abstract
In this paper, we present an overview of messaging systems that have been adopted in the times past and this present moment. We highlight the application specific areas including multi-criteria decision making messaging systems, location-aware intelligent messaging, importance messaging, search and retrieval messaging, web-based, SMS and WSN based messaging systems. . We discuss other messaging methods that herald the use of WLANs for enhancing the messaging process. We further highlight the strength and weakness of these messaging systems with a focus on the messaging network platform modes such as AdHoc and Infrastructure-based solutions including such factors as data throughput, message QoS, network delays and access point power consumption.

Keywords: *Access point, messaging, networking, Wireless, WLAN*

Date of Submission: 12-08-2025 Date of Acceptance: 22-08-2025

I. Introduction

Messaging is an essential part of society that may come in different forms and flavors. It is as old as man himself and has been communicated through voice, imaging (or visual signs) and through a variety of other physical media by wired or wireless means. The business of messaging in pre-historic times revolved around the use of some earlier forms of communication such as with floaters using the waterways to pass a message from one end of a place to another and by using a town crier within a locality. The invention and development of the Personal Computer (PC) and telecommunications field has resulted in tremendous improvements in the traditional or manual methods of messaging leading to more modern and advanced forms of message parsing across a variety of digital media and/or platforms.

Some of these innovations include the development of the e-mail for peer-to-peer and peer-to-all messaging, web server sensor messaging and the short-messaging-service (SMS) for mobile messaging between clients and between clients and the operators (Othman & Shazali, 2012). Some of these systems are applied to various sectors such as in real-time data gathering from remote fields in smart agricultural systems (Hussain & Saikia, 2021).

However, due to the development of the Internet, the existence of messaging systems that affect and play a major role to the realization and success of the internet has been somewhat obscured. For instance, it has been identified the challenge of enabling seamless messaging in the absence of good interconnectivity using alternate connections such as Bluetooth and Wi-Fi (Pirani et al., 2018).

In this survey, we expound on several existing and emerging wireless network domain leveraging on their underlying technologies and application use cases. In particular, the notable features of these systems including their strengths and weaknesses (bordering on compatibility and heterogeneous operation) and offer possible suggestions that may enhance and make them more proactive.

II. Application-Specific Messaging Systems

Multi-Criteria Decision Making Messaging

Isaksson and Fiedler (2007) described a Multi-Criteria Decision Making (MCDM) defined by an analytic hierarchy process (AHP) for streaming and messaging services. Specifically, this approach employed the fuzzy-sets thresh-holding criteria for multi-point scaling to describe a ranking function for evaluating which communication medium is more connection-appropriate i.e. “Always Best Connected”. Thus, depending on the ranking for a messaging service, WLAN, UMTS, or GPRS may be selected as transmission backbone. In the following sub-sections, some application-specific messaging systems are described.

Location Aware Intelligent Messaging

This is one attempt to address the context-specific nature of intelligent messaging. In the messaging system, location embedded mobile devices are used augment the message parsing options of a subscriber. Users can intelligently parse messages based on location via an inquiry approach (Iachello et al, 2005).

Importance Messaging Systems

General messengers are used for public transfer from one person to another. This may refer to internet or web based messaging which may be on-line or off-line, instant messengers used in social web apps, and conventional means of message transport via regular post mail services, SMS etc.

Messaging for Search and Retrieval

Messaging for search and retrieval are centered primarily on search engines and social network information boxes. Often times this process is automated to facilitate data access in a timely fashion. Key examples of some popular search engines include www.bing.com, www.google.com, and www.yahoo.com.

Web-based Messaging

Web-based messaging or mails are an online/offline internet based approach to message communication. Such mails have been responsible for the major breakthrough in modern day communications bridging the digital divide among continents. Web-based mails are more common online over the internet and uses the basic internet mail protocols such as POP3/IMAP though some may additional use a tunneling HTTP protocol/SMS gateway for communication over the web server. Web-based mails are prone to censoring and unsolicited mailing or messaging. Examples of web-mails include www.gmail.com, www.edutxtmail.com, and www.yahoomail.com.

Short-Messaging Systems

Popular among cell phone users, this type of messaging is generally referred to as the short message service. It is operator-controlled and is also prone to censoring and unsolicited messaging. Some examples include LORA – a low cost SMS one-to-one messaging app for WiFi enabled devices and with support for unlicensed bands (Cardenas et al., 2020), Hybrid LORA (Davoli et al., 2021), LORA-WAN (Haxhibeqiri et al., 2018) and GOEmbed using the Quectel GSM/ ArduinoUNO module (Osegi & Enyindah, 2015).

Sensor-based Messaging

This type of messaging is more common in industrial environments, automation factories and specialized laboratories where seamless communication among machines is desired. This is possible using such technologies as Zig-Bee Protocols (Gupta & Singh, 2021), PZ-TENG nano-fiber communication messaging links with 3-digit code binary signaling mechanized activities (Pandey et al., 2023), drone-enabled secured data communication systems for internet of vehicles (SDCD-IoV) such as in (Qureshi et al., 2022) and the JAVA embedded infrastructure. Such systems may employ some wireless communication technology to form Wireless Sensor Networks (WSNs) (Kandris et al., 2020; Keerthikaa & Shanmugapriyam, 2021). The aspect of censoring is not applicable though is equally likely in web-based environments.

Some examples include Flexcrypt for mobile clustering (Khashan et al., 2021), wild fire emergency alerts using the IPAWS generic model (Kuligowski et al., 2023), 6G IoE models for controlled software defined WSN messaging (Lv & Kumar, 2020), Ethanol (Moura et al., 2020), SPatT/MAP V2V messaging for transportation sector (Wagner et al., 2023), and underground wireless sensor monitoring and messaging for mining operations (Moridi et al., 2018).

Wireless Local Area Networks (WLANs)

Local area networks play a primary role in many modern-day business enterprise and institutions providing a secure and seamless communication structure for data exchange. Depending on communication technology, data transmission may be through cables (wired), wireless links or a combination of both. One specific technology used in wireless local area networks. WLANs use different approach to message transmission and reception - the original intent of WLANs is to communicate over a cable-less system since most message systems prior to the invention of WLANs all used some form of cable or wire. A WLAN refer to Wireless local area specifically aimed at transmitting messages through a radio frequency channel within a few kilometers (Al Naamany et al., 2006). Its evolution in mobility services is predominantly occurring in 4-G and 5-G networks (Salih et al., 2020).

The IEEE 802.11 standard is one container infrastructure that is very popular and widely used among mobile gadgets and PCs in many countries.

The most broadly actualized wireless LAN innovations depend on the IEEE 802.11 standard and its alterations. The first 802.11 standard was distributed in June 1997 as IEEE Std. 802.11-1997, and it is regularly alluded to as 802.11 prime since it was the principal WLAN standard. The standard was reexamined in 1999, reaffirmed in 2003, and distributed as IEEE Std. 802.11-1999 (R2003).

Wireless LAN offers a speedy and compelling expansion of a wired system or standard LAN. Introducing a wireless LAN is simple and kills the need to pull wired links through dividers and roofs.
A wireless LAN can be configured in either ad-hoc mode (Figure 1) or infrastructure mode (Figure 2).

Figure 1: Wireless configuration in adhoc-mode (Source: Al Naamany et al., 2006)

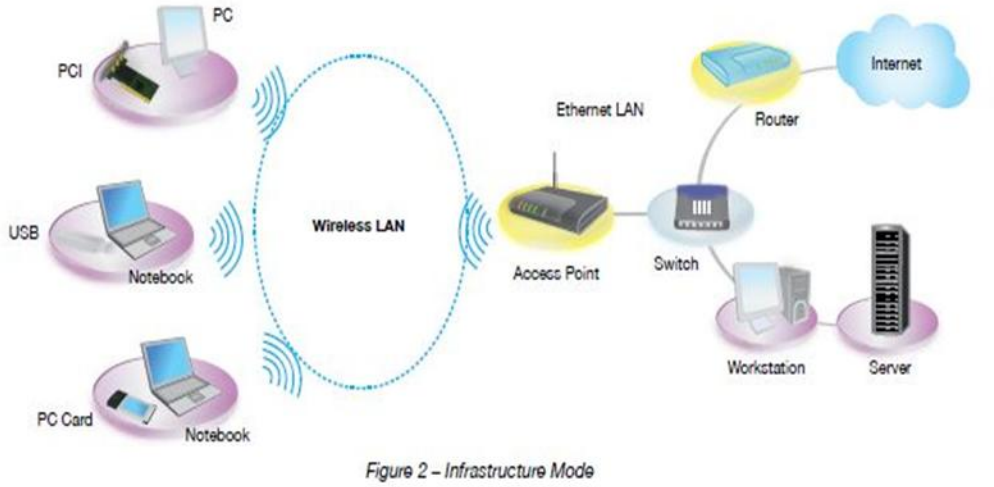

Figure 2: Wireless configuration in infrastructure-mode (Source: Al Naamany et al., 2006)

An **ad-hoc wireless LAN** mode enables wireless customers to associate straightforwardly to each other to share records or assets. This mode does not require a wireless access point; consequently, the wireless customers interface and impart straightforwardly to each other (inside a specific range) by means of a wireless customer gadget (e.g. wireless USB, PCI, PCMCIA, PC card connectors, and inherent wireless chips). This mode is built up by a few wireless customers, which have the same SSID and radio channel for a peer-to-peer (P2P) correspondence mode. Some emerging applications have been identified in (Yadav & Verma, 2021) with some examples including nature-inspired solutions such as BeeAdHoc (Saleem et al., 2008) and AntAdHoc (Maistrenko et al., 2016) to enhance resilience. However, due to their unstable and somewhat decentralized nature they may lead to lower Quality of Service (QoS) (Reddy et al., 2006).

Infrastructure mode must contain at least one wireless access point that connects wireless clients to wireless LANs or other networks such as the Internet or intranet. The wireless access point establishes an infrastructure mode for networking between all wireless clients and wired network resources (i.e. servers, printers). In other to enhance power reliability, sleep modes are typically enforced in the radio interface when in transmit mode. However, operating in this mode may still lead to sub-optimality such as identified during power saving operations in the stations bearing the wireless access points – station access points (STAPs) in the network (IEEE, 2012; Dogar et al., 2010; Malekshan & Zhuang, 2013). Hence, High Efficiency WLANs

(HEWLANs) are proposed by the adjustments in the separation of delay-operations (both sensitive and tolerant) in traffic so as to enhance power efficiency and hence extend STAPs sleep times (Dogar et al., 2010), service prioritization by virtue of reducing waiting times (Rozner et al., 2010).

III. Strengths And Limitations

Every beneficial system or product is not without its own set of shortcomings. In this section, the core benefits and some identifiable weaknesses are highlighted with respect to the surveyed research studies.

In the particular area of WLANs, the summary of Table 1 describes the key limitations and strengths of WLAN AdHoc and WLAN infrastructure-based solutions.

Table.1. Comparative Overview of the studied WLAN schemes

Criteria	Strengths and Weaknesses	
	WLAN AdHoc	**WLAN infrastructure-based**
Data throughput	Adaptive with high throughput and scalability (Lenov, 2017)	Requires configuration/ reconfiguration operations
Power Consumption	Adaptive	Requires configuration/ reconfiguration operations
Delay	Low to moderate	Lowest values achievable
Message QoS	Moderate to High (Reddy et al., 2006)	High

IV. Conclusions

As can be seen from the reviewed works, wireless messaging can be effectively administered using a variety of techniques including but not limited to web-based, SMS and WSN networking systems. With some modifications, these schemes or systems have particular applications in the WLAN setting where it may be more suitable to adopt a less costly option.

Furthermore, by employing AdHoc or Infrastructure modes, the WLAN messaging process can be made more adaptive and equally very power friendly. This can be viewed from the intersecting protocols such as Bluetooth, and Wi-Fi where intelligent operations in the AdHoc mode may be needed to counteract the effects of centralized control in the Infrastructure mode.

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