Airborne Network – Architecture, Applications, Research Trends

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Abstract— An expanding area in wireless networks is airborne networks. Between aircraft and the ground, they can offer a connected digital data network. It may alter how aircraft are observed and tracked by the air traffic control system, as well as how they communicate with and exchange data with other aircraft. The distance between aircraft as well as crucial data like weather, noise, and landing circumstances can be transmitted. In this essay, we discussed the architecture of the airborne internet, how it functions, its benefits, and its applications.
We are currently living in a world where people have started exchanging or downloading enormous amounts of data via the internet. To connect internet from ISPs (Internet Service Providers) to users computers or to business centers, numerous wires are being set underground by workers and numerous wires are being connected across electric poles.
In this essay, we'll talk about a cutting-edge innovation called "airborne internet" that brings broadband into the air. The goal is to establish a high-speed network that facilitates communication between aeroplanes and the ground as well. The primary goal of airborne internet is to deliver internet signals to locations where there are no other options.

Index Terms: Airborne Internet, performance, Aerial network architecture and Applications.

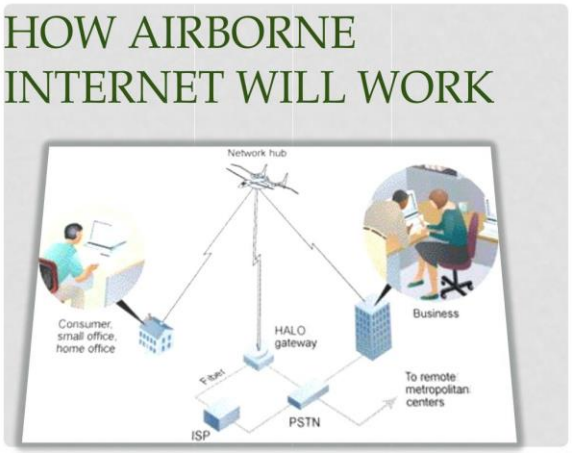
I. INTRODUCTION

The "airborne Internet" is a peer-to-peer network for aircraft communications that same similar to commercial Internet technology, yet it is private, secure, and reliable. It is an implementation that creates a link between an aeroplane and a node of the Internet that is located on the ground and allows for the transfer of data over this link. It provides aerial access to a variety of internet tools and information. It is practical and helpful for a number of tasks, such as booking tickets and arranging travel arrangements. It assists with weather information transmission in addition to being useful for aircraft-to-aircraft conversations [4]. Land-based connections are physically limited in the amount of data they can transfer by the diameter of the cable. Such a physical limitation does not exist for adding capacity to the aerial Internet. One of the components required to install airborne is the external antenna.

2. An Internet hub is built into an aeroplane. The security applications include flight tracking or departure monitoring, in-flight video monitoring, and voice or video recording of the pilot.
All nodes would be found in aircraft in a network known as the Airborne Internet. Industries, individual Internet users, government organizations—particularly the military—and aviation communications, navigation, and monitoring (CNS) would all benefit from the network. For example, an aerial network would make it possible for military aircraft to operate during conflicts without the requirement for a communications network on the ground. Commercial aeroplanes might be able to continuously track one another's positions and flight paths via a similar network [5].
The aerial Internet will have certain electrical components. For any airborne Internet network, ground-based components are a need [6]. For the purpose of receiving signals from the network hubs above, customers need to set up an antenna on their residence or place of business. In addition, the networks will partner with renowned Internet Service Providers (ISPs), who will give them access to their high-capacity terminals. These ISPs are in charge of providing the fiber-optic infrastructure that is already in place and the optical fibre point of presence. In locations without broadband cables and wires, the airborne Internet will offer a structure for connecting.
Shown in Figure 1.

II. WORKING

In today's world, almost all Internet users describe their connection as "broadband." Today, we send and receive enormous amounts of data, including video, audio, and photo files, which is overloading our fragile networks. To enhance their capacity, a large number of Internet users are migrating to cable modems and digital subscriber lines (DSLs). Additionally, a whole new service that will put broadband in the air is in the works. Figure 2 shows.



A rapid wireless Internet connection is made possible by HALO Network, as shown in Figure 2. By flying in pre-determined patterns over thousands of cities, several companies aspire to offer high-speed wireless Internet access. In order to send data to businesses more quickly than a T1 connection, small planes would fly overhead as part of the High Altitude Long Operation (HALO) airborne Internet network from Angel Technologies. A connection similar to DSL would be felt by customers. In addition, Sky Station International is getting ready to launch a project similar to the HALO network using Blimps rather than aeroplanes, while NASA and Aero Environment are collaborating to construct an autonomous, solar-powered aircraft that would operate similarly to the HALO network. The networks that are being constructed now, aeroplanes, and upcoming consumer applications

III. AIRBORNE INTERNET ARCHITECTURE

A MANET (mathematical networks) infrastructure known as the Airborne Network offers communication services through at least one node that is located on a platform with flight capabilities. Airborne networks are communication systems made up of both airborne and ground components. They can be viewed as a specific type of wireless network because of their minimal reliance on existing infrastructure; they can also be ordered referred to as "opportunistic networks"[2]. The network is useful for corporations, government agencies, and the military in particular, as well as for aeronautics Communications, Navigation, and Surveillance (CNS). There are at least three alternative suggestions for how to arrange communication nodes. Three different methods are available: manned aircraft, unmanned aircraft, and blimps. Surface-to-air, air-to-air, and surface-to-surface communications may be offered by the nodes. The blimps or flying nodes can cover areas with a 64 km radius while hovering at an altitude of roughly 16 km. Airborne networks have a tendency to be highly variable. For instance, fighter and defender aircraft are very adaptable, and aircraft motions may result in contacts rapidly terminating due to antenna.

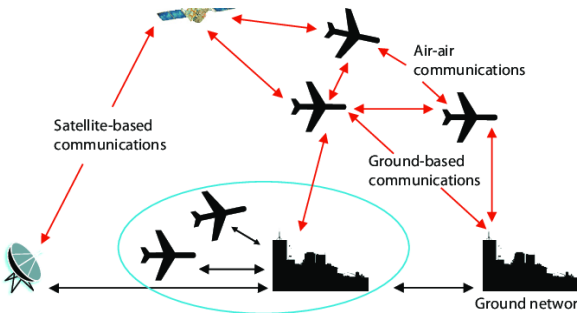


Figure 3: Airborne Network Architecture

Such intermittent connections are frequently used to classify airborne networks. Such aeroplanes in the network will cause rapid topological changes and temporary connection failures. Unmanned aerial vehicles (UAVs) and helicopters, which have substantially lower speeds, can hover over a specific area. The mobility of handheld radios employed as ground assets is reduced, and their battery life is limited. Traditional ad hoc routing methods are designed for mobile nodes, however due to high-speed motion and frequent connection breaks, they may not be suited for airborne nodes [2]. Airborne networks require routing
protocols that can adapt to high motion, dynamic topology, and a variety of routing capabilities.

IV. APPLICATIONS

The need for high speed and capacity in aeroplane communications is constant in both commercial and military aviation. To be more precise, the military transmits and receives data, voice, and other types of media using a variety of dismounted, airborne, marine, and flexibility force components assets. The need for better performance overrides the goal for large band-width, increasing data rate in the process.

Financial Service Organization (FSO) has various applications such as,

a. Privacy management: It can be used as a last-mile access point that provides a high data rate without any intervention because it is untraceable and does not require a license.

b. Enterprise connectivity**:** FSO can be used to link two buildings together or between buildings utilizing LANs and SANs because they are simply upgradeable. As a result, it can be used to link buildings, ships, and aircraft to ground stations.

c. Defense: These can be used in military operations, whether it is for communication or rescue missions, as they are easier to deploy and more reliable [3].

d. Disaster recovery: When a natural disaster strikes, all of the existing links break. At this point, FSO or a hybrid FSO/RF can be employed as a backup, allowing for the continuation of operations.

e. Mobile backup connectivity: can be utilized to expand the network of mobile devices, send data back to a specific channel, or quickly deliver it to any base station.

V. ADVANTAGES

i) Encourage productivity and economic growth: Increased connection will enable higher aircraft capacity and the efficient use of traveller's otherwise inactive time.
ii) Lower cost: In addition to saving weight and space, the aircraft's flight deck operations will be united, which will result in less radius requirements.
iii) Increase dependability, scalability, and security.
iv) Reduce risk.
v) Enhance flexibility and creativity
vi) The antennas that are mounted to the building's roof are lighter antennas.

VI. IMPLEMENTATION SYSTEM

• By flying in fixed patterns over hundreds of cities, three companies intend to offer airborne internet.

- Angel Technologies' Proteus Plane.
- Aero Vironment using NASA-Helios plane.
- Sky Station International-Blimps.

VII. FUTURE WORK

In this essay, we've seen how airborne internet technology may bring the internet to regular locations, distant locations, and emergency situations. It seems evident that airborne internet technology will function with current technology rather than replacing it. We have seen how various researchers and academics have presented their concepts for using this technology in diverse contexts and environments. Through this, a region of the world that currently lacks access to the internet may eventually gain access. With the help of this technology, passengers travelling by plane can get the much-needed internet access. so giving them a chance to effectively manage

their time. We can now see that as a result of the advancement of the airborne internet.

VIII. CONCLUSION

The primary characteristic of airborne internet is that it is a service that can be found everywhere, or what is known as an omnipresent service.

Governments and commercial organizations must transition to airborne internet in order to use internet services as a wireless communication as technology continues to progress. Data traffic and time delays won't occur during data transmission due to the airborne internet.

Although a satellite's bandwidth and an airborne internet's bandwidth are practically equal, a satellite's orbit places it several miles above the ground, therefore an airborne internet's data arrival is generally quicker than that of a satellite.

To small and medium-sized businesses at a competitive price, the HALO network would like to suggest this most recent technology.

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