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Voice Over WI-FI Communication

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Abstract: *Nowadays everyone is on the edge of wireless connectivity where everybody prefers to be connected online without any wired medium. Schools, Colleges, Corporate offices, cafes, malls provide Wi-fi facilities in order to provide internet connection. The purpose of this project, Voice Over Wi-Fi, is to make use of available resources in order to provide a facility of making free voice calls, SMS/MMS services over Wi-Fi without using a service provider. Wi-Fi (i.e. Wireless Fidelity) service is mostly used as a medium to access the internet. This project improvised the use of WLAN, as a medium for voice & data transmission offered by the Wi-Fi network. Wi-Fi allows the smartphone devices which can be connected to the router and can communicate with each other using a wireless network (i.e. Wi-fi). Wi-Fi is also being deployed in public places to create hotspots, where Wi-Fi accessing users can obtain seamless internet access. The use of Wi-Fi calling over the network is the most cost-effective technology. This technology will help us in terms of free calling & transfer data and thus ultimately helps to us for reducing bills over communication.*

Keywords: *Voice over, WiFi, Wireless Communication*

1. INTRODUCTION

Communication is one of the important parts of our day to day life. Technology has improved a lot and hence everyone seeks a convenient and efficient way to communicate. Organizations like colleges, corporate offices, communication channels among all employees play a very vital role. Many organizations such as schools, Colleges, cafes, etc are providing Wi-Fi facilities in order to provide internet connectivity. One can connect to the network using devices like laptops, tablets, or cell phones to the Wi-Fi router and get access to internet connectivity. It is an application that allows us to place a call over a Wi-Fi network. VoWi-Fi is the standard industrial approach for mobile service providers seeking to deliver voice and SMS/MMS services over Wi-Fi.Voice over Wi-Fi (VoWi-Fi) allows users to make calls over a wireless internet connection as opposed to using a cellular network.

VoWi-Fi allows mobile subscribers to receive a seamless voice and messaging experience as they move between the macro cellular network and existing Wi-Fi networks. VoWi-Fi provides a less cost-effective solution as users can send and receive phone calls as if they were on their home network when connected to any Wi-Fi network anywhere around the world. Voice over Wi-Fi is a kind of technology that is most often used for representing telephonic services using VO-IP technology for mobile devices connected across the Wi-Fi network. VoWi-Fi counters to alternatives, Voice over LTE (VoLTE), in which a mobile network operator's licensed spectrum (i.e. 4G LTE). The Voice over Wi-Fi (VoWi-Fi) service, also called Wi-Fi Calling, which enables subscribers to use martphones/cell phones that support VoWi-Fi to dial numbers to initiate voice or video calls when a

Wi-Fi connection is available. Voice over Wi-Fi is technology is currently working only with Android devices. In today's world more than hundred-millions mobile devices are using the Android platform in more than 190 countries around the world. Every day more than 1 million new Android devices are getting activated worldwide. 1.5 billion Android apps are being downloaded in a single month.

Today we have various technologies that support communication over a network like chatting, video calling, and calling from one device to another. These systems are based on a protocol called VoIP (Voice over Internet Protocol) commonly known as a communication protocol.

2. TECHNOLOGIES

1. ***Title: Voice Over Internet Protocol (VoIP)***
    - Provides facility for connecting two remote clients devices via voice over the internet protocol.
    - IP applications can provide interfaces between telephonic signals and IP networks.
    - IP phones are of the fixed type they communicate over the data networks such as LAN.
    - VoIP phones need an internet service provider
2. ***Title: Voice Transmission over LAN***
    - Two cell phones devices, connected via Bluetooth, can exchange data and media files.
    - Bluetooth covers a limited geographical area. The area covered by Bluetooth's range is very small, resulting in limitations over the user's mobility.
    - Bluetooth enabled devices such as laptops and desktops, using which we can obtain wireless communication.
3. ***Title: Voice Calls Over Wi-Fi***
    - It explains how the use of Wi-Fi enabled phones i.e. IP phones and their communication happens within local wireless LAN.
    - It also states that every mobile device connected to the WLAN router updates its routing table.
    - In case if a call is placed by the user than the packet is sent to the router which further tries to reach its destination.
4. ***Title: Messenger***
    - There are various applications that are used for video calling over LAN.
    - Nowadays conference calls & video calls are all possible using such software.
    - Software automatically recognizes nodes connected in LAN.
5. ***Title: Call over Bluetooth of Laptop***
    - Call initiated from the cell phone, connected to the laptop via Bluetooth is charged by service provider cell phone companies.
    - It is mandatory for customers that they must talk through the microphone of the laptop only.
    - The entire communication takes place through the laptop.

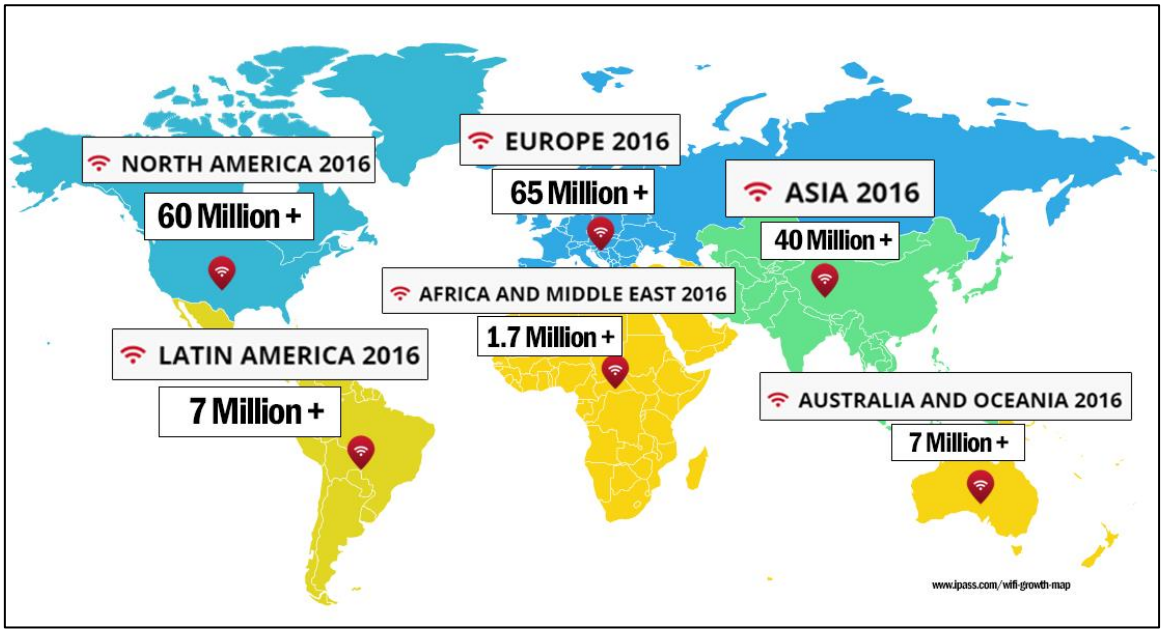
3. VOWI-FI FUNDAMENTALS

There are 3 primary components within a VoWi-Fi communications framework i.e. the Wi-Fi network, the Wi-Fi enabled device.

Wi-Fi Networks

Wi-Fi networks are getting expanded day after day through public access points such as cafes, hotels, trains, planes, etc. & home which helps to build a large coverage around the world. Wi-fi hotspots & home spots are helping to access the Wi-Fi network.

The homeowner's network located on a separate SSID within the same Wi-Fi router device. According to Wi-Fi network access provider, IPass2 worldwide hotspots are approaching 200 million with growth expected to reach 340 million Wi-Fi hotspots by 2018.



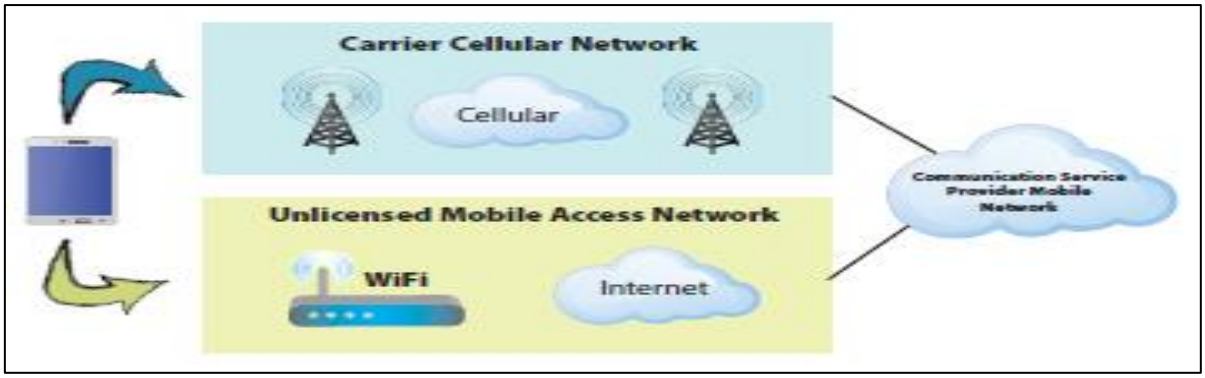
Wi-Fi Alliance and the Wireless Broadband Association provide public access to the Wi-Fi network. They are designed to enable & provide seamless and automatic network selection over a secure Wi-Fi connection network.

Components: WPA, EAP & 802.11u

Smartphone manufacturing companies are adding these parts or all of these standards to their devices so that to make it easier to connect to a Wi-Fi network without any failure.

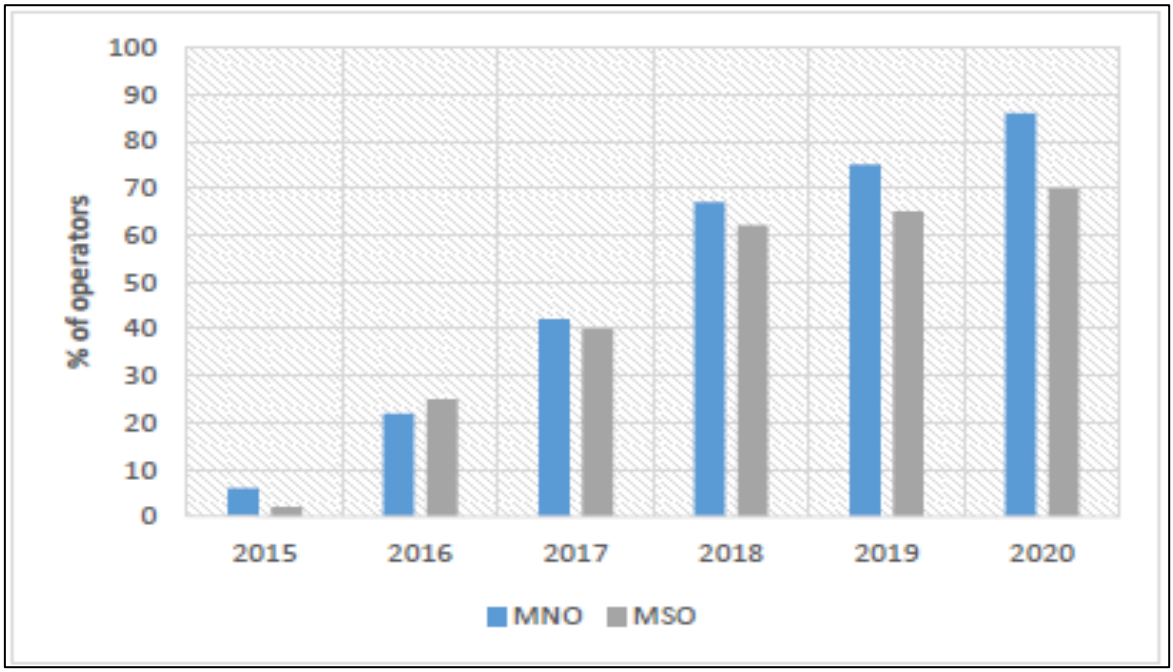
Wi-Fi Enabled Devices

A study had predicted in 2017 there were 7 billion Wi-Fi enabled devices that were used around the world. Wi-Fi enabled devices such as cell phones and tablets comprise over half of the total. IoT (Internet of Things) devices such as cameras, wireless speakers, and household appliances are also using Wi-Fi. Mobile phones are rapidly being delivered to the customer with a Wi-Fi facility directly "out of the box". Research has indicated that more than 90% of smartphones are Wi-Fi enabled which include chipsets and firmware supporting relevant protocols such as 802.11u or 802.11n which helps to discover and connect to a Wi-Fi network. In the absence of a Wi-Fi signal the telephonic channel will use GSM (Global System for Mobile) or CDMA (Code Division Multiple Access) phones, and Wi-Fi when IP connected.



Service Provider Infrastructure

Wi-Fi enabled phones are associated with telecommunications carrier which is capable of supporting Wi-Fi calling feature. Service providers that only support LTE it is relatively easy as LTE and Wi-Fi are packet-switched technologies. 3G and earlier technologies were more challenging as circuit and packet-switched technologies need to be integrated. Service Providers around the world are adding or evaluating voice over Wi-Fi service. Wireless Broadband Alliance details the percentage of MNOs (Mobile Network Operators) and MSOs (Multiple System Operators) deploying IMS-based VoWi-Fi applications between 2015 and 2020 around the world.



By 2020, despite near-ubiquitous LTE and VoLTE population coverage in some developed markets, almost 90% of mobile operators will be offering Wi-Fi Calling too.

4. FEATURES OF WI-FI CALLING

Wi-Fi calling can only be enabled if the user device, the access and packet core networks, and the service core (IMS) support it. Although any Wi-Fi network can be used.
There are various ways to deploy and support Wi-Fi Calling, which will influence the effectiveness of the roll-out and how well it supports the operator's business case.

- Security and privacy.

- Ability to differentiate services.
- Flexibility to support new services.
- Scalability.

a) Security and privacy

Security is the most prominent concern among operators adopting IP-based LTE in general and Wi-Fi Calling in particular. It significantly improves the operator's defenses against the rising tide of malware and hacking of IP systems.

b) Ability to differentiate services

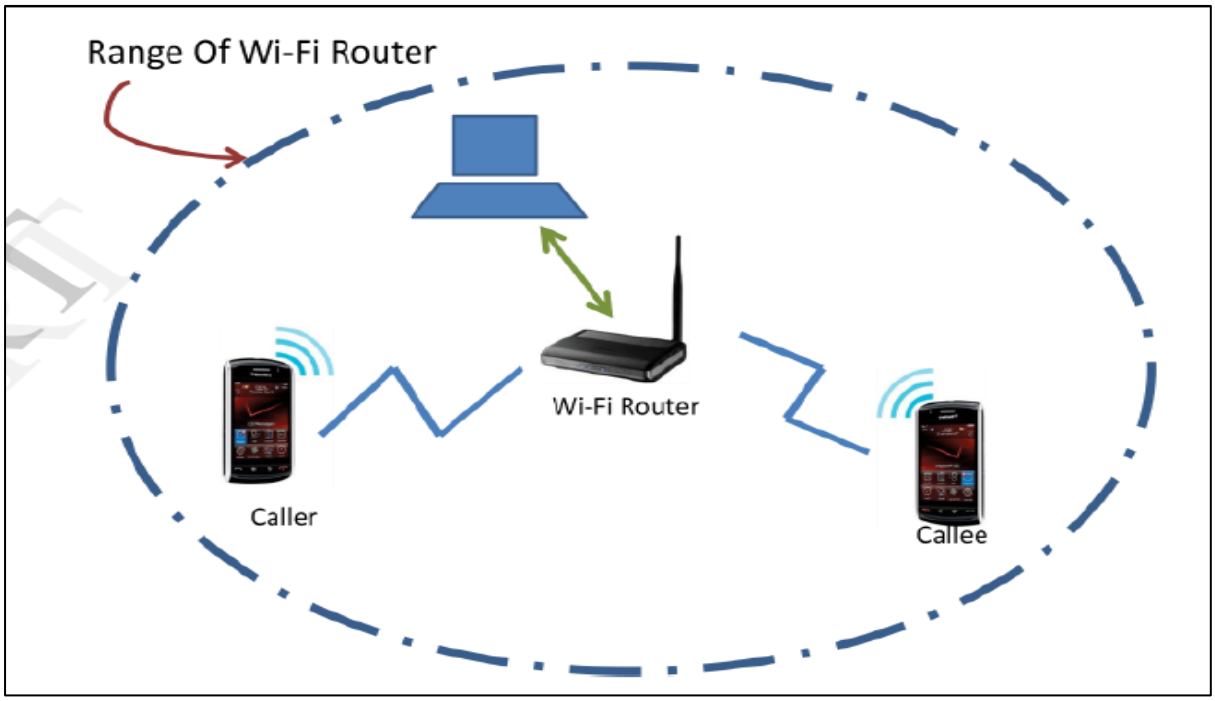
Wi-Fi Calling helps in terms of business purpose, needs to be clear in order to achieve flawless experience in terms of consistent experience with the mobile network, dropped call rates, and so on. A dedicated system can offer higher-level functionality and performance when managing authentication, connection choice or handover.

c) Flexibility to support new services

Mobile IP services are in their early state and the needs of the operator and the subscriber are changing rapidly. Mobile operators should have a competitive edge and should have its ability to respond to changes rapidly and cost-effectively, in order to keep its user experience strong and updated, without making any major network change.

d) Scalability

Operators are handling millions of subscribers, making billions of calls every month, and so their gateway and core platforms need to scale up to huge levels of usage. They are designed specifically to handle and secure subscribers.



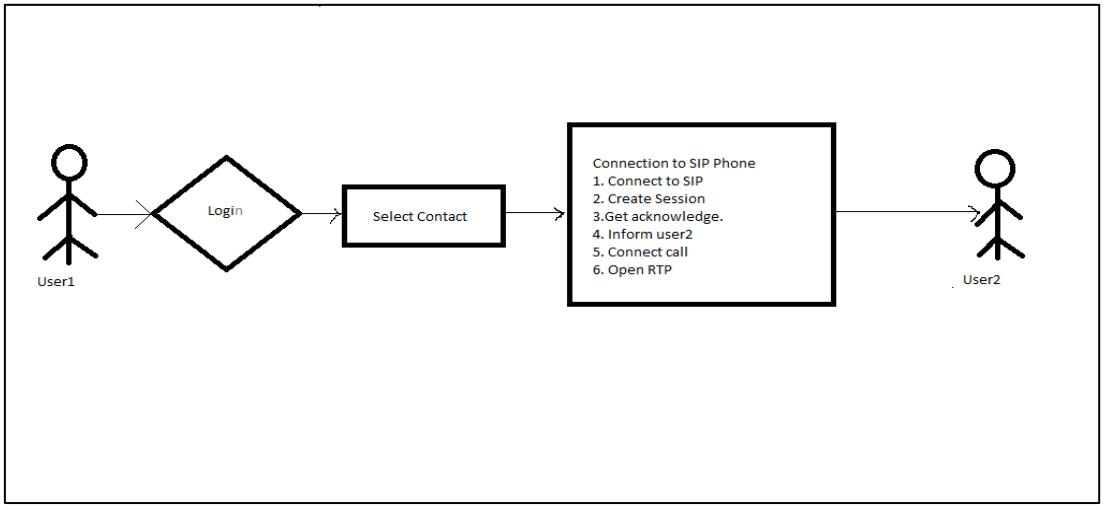
5. VOWI-FI CHALLENGES

VoWi-Fi service is not fully secured it has few risks. There are some issues that should be considered while deploying.

- ***Quality of Service*** **–** The Service providers have access to whole access to the internet but has zero control over the quality of a Wi-Fi network. Service providers will be facing challenges such as troubleshoot Wi-Fi issues and could be unfairly blamed for poor service. This issue can be overcome by using an app that will help to monitor the Wi-Fi network quality.
- ***Capacity Planning*** **-** Unloading cellular traffic to Wi-Fi will now free up the spectrum bandwidth. However, additional devices will now become part of voice and roaming will be enabled. This means planning for Wi-Fi to cellular integration and more complexity when planning infrastructure upgrades.
- ***Security*** **–** Secure communications must be managed with the help of the IP component of VoWi-Fi. Authentication and encryption, are frequently utilizing IPSec must be implemented and managed properly.
- ***Emergency Calls*** **-** A Wi-Fi network is a challenge as a Wi-Fi access point MAC address doesn't provide any location. Service Providers may need to find alternate solutions while using an app that provides VoWi-Fi service the operator may find this issue by forcing an emergency call out over the mobile network instead of the Wi-Fi network.

6. APPLICATION FLOW

Many companies and organizations make use of traditional intercom system for internal communication within their organization. These intercom systems require various resources such as telephones, cables, central connection board, etc., for which the organization requires and have to invest a considerable amount of money. The maintenance and running of these intercom systems also require an addition to the cost of investment. This application will effectively & efficiently reduce the cost of maintaining resources of the intercom system. Places like malls, airports, college campuses, hospitals, corporate offices have Wi-Fi facilities in order to access the internet free of cost. Such a network can be used for multiple purpose & voice communication for which users need not have to pay for accessing the network. Voice call done by this application using these networks does not depend on service provider therefore they do not cost any charges.



Use case diagram for connecting user1 to user2

In this use case, user1 is trying to call user2 using an application. When user1 wants to connect to user2, then the first user2 has to login to the application. On second stage user1 will now select the contact whom to call and then application move further to stage three. A session is been established for calls between the two users. After the acknowledgment is received that user2 is also available then a call takes place and the RTP channel is open up between two users and users can further contact each other over VoIP using the Wi-Fi network. In such cases, if we need we can also store information of whom user1 called and for what duration. We can also save this information in the SQL Database.

7. CONCLUSION

In this research, we have presented the design and implementation details of an application based on Wi-Fi technology for Wi-Fi enabled devices such as mobiles, laptops, PC's, tablets, etc which support calling mechanism, also provides secured Wi-Fi network, based on open technologies such as android programming, MySQL database, etc. Our main goal was to create an easy to use of cell phones flexibly and extensible system for calling using free resources. Multiple systems use Wi-Fi router as a medium to have voice communication. Which provides communication without any service provider i.e. free of cost to the user, which eliminates various issues like range coverage, cost of calls, call drops, etc. Wi-Fi is established for accessing the internet and we are extending its use to make the system is cost-efficient and more effective.

Communications Service Providers key takeaway is

- ***Subscribers need VoWi-Fi*** - User expectations for quality, convenience, and cost savings.
- ***Do not delay*** – With the entrance of Google Fit and other, the competition is building.
- ***Get started without an IMS*** - There is an alternate option that allows the Service Providers to deploy before an IMS core is in place with Krypton solution.

8. FUTURE SCOPE

- In order to allow the user with greater mobility this application can be further extended to perform a call handoff.
- This application can also be used to perform a broadcasting voice message, voice calls to multiple users at the same time.

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