Protocol Deep Dive:
Voice over Internet Protocol (VoIP)

Introduction to VoIP

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Overview

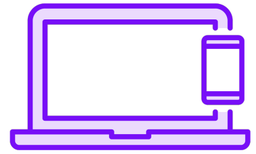
VoIP overview

- What is VoIP?
- How VoIP works?
- VoIP benefits and challenges

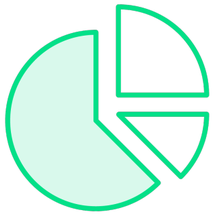
What Is VoIP?

Numerous calls every minute

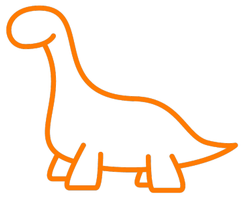
Local, long-distance and international



Different devices



Lots of VoIP calls



Without VoIP different world

Smart world incomplete without VoIP

Using an internet

Convenient

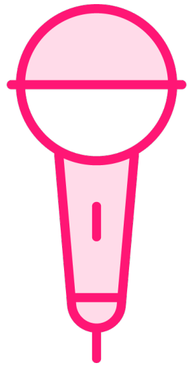
Less expensive

Calls from anywhere

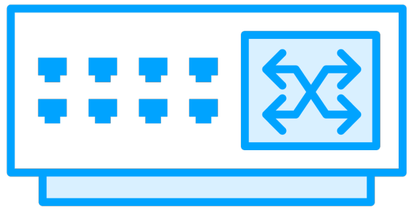
Traditional phone systems

Use dedicated phone lines to transmit calls

Definition



VoIP
Voice over Internet Protocol

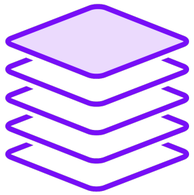


Transmission
Voice communications over the Internet

How Does a VoIP Call Work?

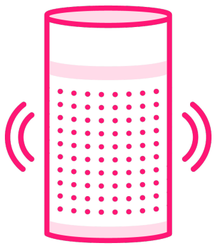
– Voice enters microphone as sound waves
– Converted into electrical signal
– Converted into digital data
– Analog-to-digital converter (ADC)
– Encoding
– Digital data is divided into small packets
– Sent over the internet

Regenerating Audio at Destination



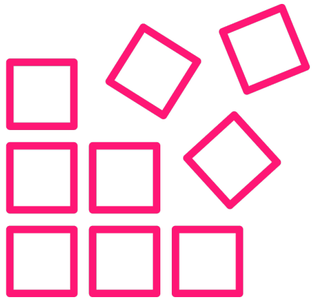
At destination phone data packets are reassembled

Digital data to electrical signal by digital-to-analog converter (DAC)

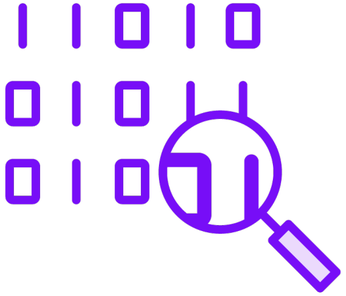


Electrical signal sent to speaker, speaker converts back to sound waves

Digital Data Packets



A small portion of the overall audio



Packet drop is missing part of conversation

Missing audio part makes meaning-less

Utilizing Existing Data Network

Transmitted over the Internet or other IP networks

Similar way to other types of data, such as email or web pages

Fast and reliable connections are very common and are accessible

Don’t need a separate infrastructure for calling

Traditional Phone System or Landline

From Traditional Phones to VoIP

Traditional phone system

Public switched telephone network (PSTN)

Dedicated

phone-lines

switches

other equipment

Plain old telephone system

(POTS)

How Do Traditional Phone Systems Work?

Dedicated phone lines to transmit calls

Phone sends an electrical signal over a phone line to local telephone exchange

Central switching center that routes call to their destination

Telephone exchange routes call to appropriate phone line

Advance Features

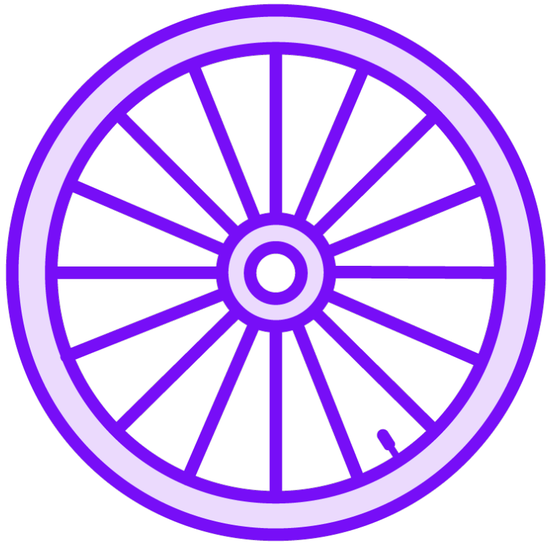
Voicemail

Call forwarding/waiting

Conference calls

Switches and other equipment

Limited features



- VoIP was developed in the late 1990s
- Improved internet connections
- Feasible to transmit voice data over internet
- Data network was not always occupied
- Transmit voice as a data packet to utilize network bandwidth
- VoIP became popular and widely used

Benefits and Purpose of VoIP

Benefits of VoIP

Comparison to traditional telephone system

What is the purpose of VoIP?

How is it different?

Cost Savings

Lower cost

compared to traditional phone calls

Especially

long-distance or international calls

Many organizations of all size

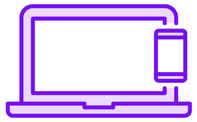
Strong connectivity

Flexibility

- Any device with internet
- Make and receive calls from anywhere
- Office or home
- No need to travel to office
- Location independent

Advance Features

All features of traditional telephone system



Softphones or applications

Voice-to-text transcription

Unified communication experience

VoIP for Business Communication

All sizes of organizations

cost-effective alternative

Implement a VoIP system to improve communication and collaboration

Companies working helping customers in different time zone

Traditional phone systems too expensive for international calls

VoIP for Personal Communication

No traditional phone service

VoIP-based applications

During travel in a different location

Challenges of Using VoIP

Dependency on Internet Connectivity

Stable internet connection

Calls not possible without internet

Power outage or server failure

Traditional phone lines still used as backup

Quality of Service (QoS)

VoIP calls quality can be affected by:

- Network congestion
- Packet loss
- Jitter

Network Congestion

More data traffic than network maximum capacity

Less bandwidth to handle

Slower connection affects VoIP calls

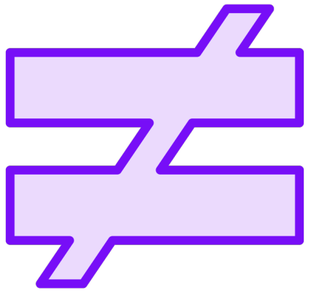
Packet Loss

Data packets not received at destination

Network congestion, interference, or other issues

Can result in poor call quality

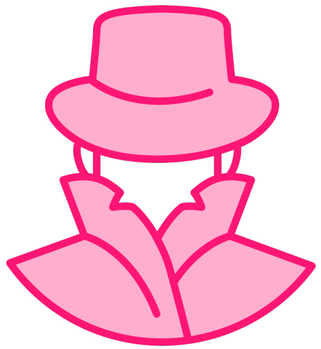
Poor user experience



Jitter:

- Variation in the time it takes for data packets to be transmitted
- Measured in milliseconds (ms)
- Packets out of order or delayed
- Choppy or distorted audio with frequent interruptions

Security



Hacking and spoofing

High-profile calls

Intruders barge-in

Demo

Different VoIP technologies and services

Summary

Summary

- VoIP emerged from data network
- Cost-effective, feature-rich, unified communication solution