

LANDLINES & VOICE OVER IP (VoIP) - MYTH vs. FACT

Landlines are better for emergencies than VoIP.

Mostly true. VoIP can provide 911 dispatchers with location information (using E911), but this needs to be set up properly. However, this isn't always done.

Landlines pretty much guarantee that 911 will have your exact location. That said, you should still do a test call at some point to your local PSAP to confirm they have it. The phone company still must submit your address for Automatic Location Identification (ALI) - much the same way it needs to be done with VoIP. If they forget to do this (it has happened before), 911 won't get any location information at all if you call.

E911 has also changed the dynamics. Kari's Law and Ray Baum's Act¹ have actually put landlines out of favor for being used for 911. E911 allows location to be sent at the time of a call with VoIP, which can't be done with POTS. This is going to be very common with multiline phone systems in the future, due to new regulations.

Bottom line: for individual consumers, landlines still shine in emergencies, but recent changes to 911 have prioritized VoIP for business phone systems. And, whether you have a landline or VoIP system, always test to ensure that 911 can get your location.

Landlines work in power outages, and VoIP doesn't.

Mostly true. "Traditional" analog copper landlines (POTS) have been common battery since the early 20th century, meaning the central office powers all the analog phone lines it serves. (Copper has been used because it conducts electricity well). Wherever the line is digitized is where it gets powered. Historically, this has been the central office. With VoIP, an adapter is typically installed at the customer premises, which is why they "don't work" in a power outage. You're responsible for powering it, not the phone company.

Longer answer: it's complicated. Obviously, fiber conducts light, not electricity, so common battery over fiber is impossible. However, it's not that simple. Technologies like T1/PRI can be delivered over copper, but also require customer premises power, and these are also considered "legacy" technologies that telecoms want to phase out. Most importantly, POTS lines are no longer guaranteed to work in an outage, because many POTS lines no longer terminate at the CO but at SLCs (Subscriber Line Concentrators), which multiplex many POTS lines together back to the CO². In these cases, the SLC is responsible for powering phone lines, and SLCs rarely have the massive battery backups that COs do. Landlines, if powered from the CO, will last a long time - perhaps indefinitely in a power outage - but if your line doesn't go all the way to the CO, there's no guarantee it will be any more resilient in a power outage than any other alternative, including VoIP.

Landlines are more reliable than VoIP.

Mostly true. Landlines are incredibly robust, resilient, and robust (at least historically, see qualifier above). 99.999% ("five 9s" reliability) is typical. Reliability - a guarantee that service will not be impaired - is the primary advantage of POTS.

¹ <https://www.fcc.gov/mlts-911-requirements>

² https://en.wikipedia.org/wiki/Subscriber_loop_carrier

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Landlines are more secure than VoIP.

Mostly false. “Vanilla” VoIP offerings are generally not encrypted, and it’s true that such VoIP communications are sent in the clear and easy to intercept. However, VoIP can be encrypted – most commonly using TLS and SRTP – much like browsing the web securely using https.

Secondly, PSTN calls are not secure, period. Thanks to CALEA³, law enforcement has a right to remotely tap into any PSTN communications, landline or VoIP. Law enforcement can remotely monitor your POTS line, without any physical arrangements at the CO. Once upon a time, interception required physical access, but all phone calls on the PSTN today are digital and can be intercepted.

Done right, encrypted VoIP that doesn’t traverse the PSTN is much more secure than a landline phone call (e.g. peer-to-peer between two IP phone systems). Caller ID also can’t be spoofed or set on POTS lines, so anyone you call potentially has your real phone number, even if you use *67 to “block” Caller ID (“blocking” is a misnomer. Caller ID can’t be blocked. *67 sets a presentation flag that *requests* that the phone number not be displayed to subscribers). In short, landlines don’t offer particularly meaningful security or privacy. Landlines are more secure than unencrypted VoIP but less secure than encrypted VoIP calls.

Landlines have better call quality than VoIP.

Mostly false. In the heyday of VoIP, compressed codecs were often used because bandwidth was scarce. These days are long past. The gold standard codec in telephony is G.711 μ law or alaw (64 kbps). This is what TDM uses to digitize POTS calls. The same codec is also quite ubiquitous in VoIP⁴. Any half-decent VoIP provider or setup will be using G.711. Thus, on a perfect day, the call quality of VoIP and POTS are identical.

Note the qualifier. If there are Internet issues, call quality can and will suffer. However, this isn’t due to a compressed codec, but to jitter, latency, and packet loss. These don’t happen with POTS because it’s circuit-switched. This is a problem inherent to VoIP because it’s packet-switched. Put another way, the quality is identical, but POTS is guaranteed to be consistent, and without the proper QoS assurances, VoIP comes with no such guarantees.

It’s also worth mentioning that some non-traditional landlines, such as from an ISP (e.g., “cable landlines”), may not suffer from quality issues since there is dedicated bandwidth and QoS for them to operate. This traffic doesn’t go over the Internet, but through the company’s private network so they can provide a service that emulates circuit-switched consistency.

VoIP is more expensive than a landline.

False. The main advantage of VoIP is that it’s cheap, typically no more than a penny or two per minute, and a couple dollars per number per month or less. However, unlimited flat-rate packages are not as common with VoIP providers. For high-volume scenarios, a flat-rate long-distance package could be more economical, but with high charges for landlines today, landlines will almost always be more expensive. POTS is almost always the mostly costly basic

³ <https://www.fcc.gov/public-safety-and-homeland-security/policy-and-licensing-division/general/communications-assistance>

⁴ <https://www.nextiva.com/blog/voip-codecs.html>

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phone offering by telcos today. However, POTS is generally available in a wide variety of plans - from basic measured-rate ones to all-encompassing ones with calling features and long-distance. Unregulated offerings tend to offer a complete package but with less flexibility.

If my service isn't over copper, it's VoIP.

False. This may be true, but not necessarily. While VoIP technically refers to any packet-switching voice schemes using IP technology, including over private networks, it's also commonly used to refer to packet-switched calls that traverse public data networks, like the Internet. Many telcos that provide VoIP services to their customer may use a private, dedicated backbone for this, so voice traffic is never mixed with data traffic.

Additionally, VoIP often implies an unregulated offering that is not generally considered to be "basic service". For example, Verizon offers "POTS over fiber" to customers over fiber, which is not the same thing as FiOS Digital Voice, the latter of which is categorized as VoIP but the former of which is not. POTS over fiber lines have much the same calling functionality as a traditional landline, such as Equal Access; VoIP services virtually never provide any of these capabilities. While POTS over fiber may use packet switching as a transit mechanism, most of the disadvantages of VoIP do not apply here.

All non-copper services will need local power and local battery backup. Additionally, these services may or may not be regulated. In many areas where copper has been decommissioned, it is still possible to get regulated service over fiber, particularly in Verizon territory.

If I can't order copper service, I'm stuck with VoIP.

False. This is an extension of the previous question. In most areas where copper has been decommissioned, regulated phone service can still be ordered and is often called "POTS over fiber" by companies such as Verizon and AT&T. In many cases, they are legally obligated to provide this service and must sell it to you if you ask them for it (Verizon makes it easy; AT&T will try to upsell its unregulated offerings, but this is still an option). This service functions almost identically to traditional copper-based POTS service. However, it is delivered over fiber and requires a local battery backup. The backend telephone switches used are also typically newer packet switches that may not support all the niche functionality of a traditional telephone switch from the 1970s, like a 5ESS or DMS100.

Landlines are "analog", so they sound better.

False. Double false, because the conclusion doesn't follow from the premises, and the premises are false. It is true that the local loop is analog - a copper wire that conducts analog sound waves. However, this is true with any phone line, VoIP included. In both cases, the analog signal is eventually digitized. With VoIP, it gets digitized almost immediately - maybe a few feet away. With a POTS line, digitization might happen a few hundred feet away (at a SLC) or a few miles away (at the CO). Key point: all phone calls today are digitized. You can't make an end-to-end analog phone call over the PSTN anymore. Digitization started long before VoIP; the Bell System began using T-carrier for long-distance multiplexing starting in

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the 1960s, and digitization was well underway by the 1970s and 1980s. The network was virtually fully digital by the 1990s – years before VoIP was even a feasible technology.

Secondly, a major reason for digitization has been improving call quality, not reducing it. Digitization preserves a relatively faithful replica of an analog signal perfectly. Analog signals themselves degrade over time and with distance. So, if anything, POTS lines might sound slightly worse than VoIP. After all, wet or noisy phone lines are only an issue with long (and neglected) local loops.

In summary: POTS lines remain very useful, and despite the many advantages of VoIP, serve a critical purpose. However, it is important to have an accurate understanding of what their strengths are and are not. Their main advantages today are reliability and disaster/emergency/power outage preparedness. Concerns about cost, security, privacy, or quality are based not in fact but historical myths. Landlines have changed a lot in the past fifty years, and it's important to be aware of how their utility has changed as a result.

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TELCO ACRONYMS

Legal and Logical Concepts

PSTN – Public Switched Telephone Network. The worldwide public telephone network, sometimes but rarely referred to as the MTS (Message Toll System). Private calls between PBXs or COs using leased or dedicated lines may not necessarily traverse the PSTN, but the vast majority of calls (such as to regular 10-digit numbers in North America) are calls to and from the PSTN. The alternative to routing calls through the hierarchical and insecure PSTN is to route them over dedicated lines or the Internet. Calls may also traverse both the PSTN and the Internet.

LEC – Local Exchange Carrier. A local phone company that provides local phone service (and potentially other services, such as long-distance service, but not necessarily).

ILEC – Incumbent Local Exchange Carrier. The monopoly telephone provider serving a particular area. There is only ever one of these in a particular area and they are the entity that actually owns the outside plant.

RBOC – Regional Bell Operating Company. Any ILEC that was formerly part of the Bell System. Today, these are generally just AT&T, Verizon, and CenturyLink.

COLR – Carrier of Last Resort. Companies that are obligated to provide basic service to anyone in its service territory. Many states no longer have COLR obligations; California's COLR obligations do not dictate a particular kind of service (e.g. POTS, VoIP) or physical medium (e.g. copper, fiber).

CLEC – Competitive Local Exchange Carrier. Secondary phone companies that can provide service to customers using an ILEC's outside plant and facilities. Mike Sandman characterized CLECs as "fake phone companies that compete with the real phone company" (the ILEC). CLECs did not exist prior to 1996 Telecommunications Act. The FCC's UNE forbearance order recently freed ILECs from obligations to provide certain unbundled network elements to CLECs on a wholesale basis, which may signal the beginning of the end for many CLECs.

UNE – Unbundled Network Element. Physical plant elements such as the copper that ILECs, since 1996, were required to allow CLECs to use at wholesale rates. The FCC's recent *UNE forbearance* order freed ILECs of some of these requirements.

Equal Access – The ability to use the intrastate/interstate long-distance provider of your choose, typically using Feature Group D codes (i.e. 101XXXX, often advertised in the 80s and 90s as 10-10-XXX codes). Only traditional, regulated voice services (copper or fiber) have Equal Access capability; unregulated voice services do not.

Technical Concepts

VoIP – Voice over IP (Internet Protocol). Refers to the transmission of voice/video phone calls using IP (packet-switched) data networks as opposed to using traditional circuit-switched networks.

POTS – Plain Old Telephone Service. Refers to traditional landline service that is fully analog at the customer premises, with a dedicated line running to a SLC or the CO. Considered "legacy" today in favor of "digital landlines", VoIP, etc.

"POTS over fiber" – Some RBOCs, particularly Verizon, have recently begun referring to providing regulated service over fiber as "POTS over fiber". This is not "Digital Voice" service; it is priced the same as copper service with similar feature capabilities. However, it is not physically a copper circuit.

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CO - Central Office. This is where all the phone lines in a particular area are switched. These can serve tens to hundreds of thousands of phone lines.

ONT - Optical Network Terminal. Essentially a "fiber modem". It serves as the telco demarc for fiber-based phone service, with fiber running to the telco and analog ports for the customer. Can also be used for Internet service over fiber (e.g. FiOS).

ATA - Analog Telephone Adapter. A small embedded device that is VoIP-enabled, allowing analog phones to be plugged into it and interface to a VoIP system, typically using SIP (Session Initiation Protocol). Often provided by non-telco VoIP providers to their customers for VoIP "landline replacement" voice services.

SLC - Subscriber Line Carrier. This is a landline technology that multiplexes phone lines closer to the customer premises, often in suburban or residential neighborhoods. Analog pairs terminate here and are multiplexed back to the central office, traditionally using T1 circuits. Generally SLCs lack the extensive backup power that central offices have.

TDM - Time Division Multiplexing. Refers to the sampling of audio with a bandwidth of 8,000 Hz for a 64 kbps datastream. TDM has been around since the mid-20th century and is the technology used in all modern landline telephony to digitize phone calls. Considered "legacy" today in favor of packet-switching.

T1 - a digital TDM circuit that has 24 64kbps channels for a total of 1.544 Mbps, usable for voice and/or bandwidth. PRIs (Primary Rate Interface) are a common voice service using T1s for voice.

G.711 - The standard (consisting of the ulaw/alaw codecs) for voice transmission with TDM, also very common with most VoIP providers today. G.711 codecs are designed for good-quality audio transmission of the human voice. This codec remains widely used in both landline telephony and VoIP and is considered the "gold standard" for voice telephony.

GSM - A voice codec originally widely used by cell phones that uses compression but is poorer quality. While many wireless technologies still use GSM, it is no longer as universal as it used to be, particularly as 4G has enabled wireless calls to use higher-quality codecs.

G.722 - A standard codec used for HD voice, considered to be technically superior to G.711. Often supported by enterprise IP phones and some mobile phones.

PBX - Private Branch Exchange. A business phone system that, at its essence, switches calls between internal extensions and outside trunks.

PSAP - Public Service Answering Point. This is the call center where 911 calls are handled.

E911 - Enhanced 911. A collection of efforts to furnish location information to PSAPs and make 911 information more accurate for wireless and VoIP services.

CALEA - Commission on Accreditation for Law Enforcement Agencies. Specifically, "CALEA compliance" refers to compliance with U.S. regulations require that PSTN phone calls can be remotely surveilled by law enforcement.

TLS - Transport Security Layer. The successor to SSL (Secure Sockets Layer), encrypts Internet traffic, such as https webpages. In VoIP, refers to encryption of call signaling.

SRTP - Secure Real-Time Transport Protocol. In VoIP, refers to encryption of call media.

SLA - Sealed Lead Acid battery. Older Verizon battery backup units used rechargeable 12V SLA batteries. Most of the newer ones are designed to take 48V D-Cell batteries instead. The 12V SLA

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battery backup units are generally considered superior, as lead-acid battery technology is standard in the telco industry for backup power.