Technical Brief

Successful Faxing with SIP Trunks

Why to Do It and How to Do It

Scott Riley

Faxing with SIP Trunks Requires Special Attention

SIP trunks are increasingly displacing traditional telecom strategies as carriers and PBX manufacturers abandon aging infrastructures in favor of IP telephony (IPT) and Voice over IP (VoIP).

The good news is that the IPT industry is rapidly maturing due to infrastructure investments, design improvements and standards cooperation. But the disruptive entry of SIP trunks is not without growing pains, such as interoperability, service quality, support and administration. And companies need to be aware that the specific requirements for successfully implementing Fax over IP (FoIP) and cloud fax with SIP trunks are much different from the needs of VoIP.

This technical brief will help you understand the benefits of faxing over SIP trunks, the characteristics of a fax-friendly SIP trunk carrier, and appropriate fax server technologies and deployment strategies. I will not dive into the engineering details or differences of IP telephony, voice and fax. (We do have other papers on these deep technical details; email me if you are interested.)

First, let's agree on four underlying principles.

Principle #1

SIP trunk providers, especially in the fax world, are not created equal.

A big name telecom carrier may claim to support faxing with their SIP trunks, or be "certified" (likely in a controlled environment), or have a few success stories. But these do not necessarily translate into "fax-friendly" SIP trunks or high completion rates for all customers. In reality, a true commitment to reliable Fax over IP has been a low priority for many carriers. Never, ever accept a carrier at their word just because they say they support fax. The carrier is not necessarily making an intentional misrepresentation, just displaying ignorance and avoidance. "After all," they think, "isn't a fax call the same as a voice call?" The answer is Principle #2:

Principle #2

Fax is not analog voice. Fax is digital data transmitted over suitable transmission media.

Virtually all VoIP sessions, even with lossless G.711, are not suitable for fax. This might seem counterintuitive because traditional fax data is typically sent over the same networks that deliver phone calls. The similarity between voice and fax ends there, first because fax communication exists as binary data, and second because of the fundamental differences

between IP communications and the Public Switched Telephone Network (PSTN, analog phone lines or T1-PRI circuits).

When the decades-old T.30 faxing protocol was established, it was designed to carry digital information over an analog path (such as a telephone network) using digital-to-analog modulation and demodulation techniques (a.k.a. the modem). The V.17 and V.34 modem-related protocols that characterize the fax transmission process certainly did not anticipate digital options such as Internet Protocol (IP), nor did they anticipate IP network issues such as burst packet loss, jitter and latency.

Attempting to "pass through" IP packets that carry fax data encoded as audio (such as G.711) creates further issues due to Principle #3:

Principle #3

Fax is a synchronized, two-way data communication "protocol" that, when interfaced to PSTN end points, can be adversely affected by data loss and timing thresholds introduced by IP environments

Voice is essentially "good enough quality sound" pushed from one location to another, unassembled and reassembled in the VoIP world. Voice codecs allow for inaudible (or at least tolerable) compression losses and network impediments, whereas such problems are not tolerable for fax and modem data using audio pass-through techniques.

The mismatch created when a fax call originates or terminates as an analog signal while passing through an IP network as audio is on average detrimental to transmissions. This becomes exponentially serious with multi-page faxes. Fortunately, fax technology standards for IP networks have been modernized and adopted by industry leaders, leading us to Principle #4:

Principle #4

Faxing in real-world IP environments should leverage a well-established standard specifically designed for Fax over IP. That standard is T.38.

The most widely used and accepted industry standard that addresses real-time transmission of faxes over IP networks is T.38 fax relay. T.38 fax is inherently digital data and it encapsulates the T.30 information in digital form, resulting in the digital transport of digital media. Residual benefits include sustained communications with PSTN-terminated T.30 devices in the midst of unfavorable network conditions. T.38 provides data redundancy and corrects for packet loss and delays. Finally, T.38 provides up to a 10X reduction in bandwidth requirements over G.711. Simply put, G.711 faxing is an equation for failure.

Now that we have these supporting principles in place, let's look at the benefits of faxing over SIP trunks.

Understanding the Value of SIP Trunks for Fax over IP

By exploiting virtualization, FoIP helps eliminate the traditional need for dedicated physical servers and fax boards. However, FoIP still depends on a telephony interface, which can be traditional telecom (T1's and analog lines) or can follow the next evolutionary path: SIP trunk or cloud fax interfaces.

SIP trunks have three distinct advantages for faxing:

Benefit #1

SIP trunks reduce hardware dependency and increase virtualization.

Traditional telecom lines create physical and geographic limitations that require localized phone services in the form of T1 lines or analog trunks that support local area codes and rate centers. This includes termination equipment and infrastructure, and the associated "copper" services pre-sized based on carrier offerings.

In contrast, virtualization combined with the flexibility permitted by IP communications allows a pure software implementation to be consolidated, distributed, replicated, scaled and moved at the will of an organization.

Benefit #2

SIP trunks provide geographic abstraction.

SIP trunks virtualize your telecom and data environments, thus extending your infrastructure beyond physical locations and into your carrier's cloud environment. Your phone service is now accessed via one or more IP addresses. This means you can receive faxes for multiple locations and branches through a single fax server at a single data center or hosting location, using local phone numbers around the world: Imagine having a local fax number in the UK for a fax server in California.

Furthermore, disaster recovery (DR) servers can exist at remote locations and receive the same SIP traffic, or you can load balance traffic across these servers, all with the same direct inward dialing (DID) fax numbers. You can even support multiple carriers for redundancy, with primary and secondary IP addressing behavior through applications, load balancers and dialing rules. And you can create hybrid environments with traditional PSTN and SIP trunks.

Benefit #3

SIP trunks provide rapid provisioning, sizing and administrative control.

Have you ever waited 2-4 weeks for regular phone lines and T1's, associated demarcation equipment and other hardware terminations? Because SIP trunks are like software, they remove many physical dependencies such as these, fulfilling business needs with more flexibility and agility.

With some exceptions, it is possible to have services established in hours, dynamically sized according to need, and delivered to your fax servers of choice on the fly. Many complexities and delays can be avoided, and businesses can react more fluidly to changing requirements or emergencies.

Top 10 Requirements Related to Fax-Friendly SIP Trunk Carriers

The following are my top 10 preferred requirements related to a fax-friendly SIP trunk carrier, known as an Internet Telephony Service Provider (ITSP). These should be your initial guidelines as you pursue business-critical faxing through any SIP trunk & FoIP solution:

1. The carrier should fully support and test T.38 across the network.
2. The carrier should own their T.38 network.
3. The carrier should have fax-centric technical support expertise.
4. The carrier should offer Internet fax service with T.38.
5. The carrier should tag faxes for optimized routing with T.38.
6. The carrier should offer flexible pricing and provisioning without extended terms.
7. The carrier should provide NAT traversal and secure registration.
8. Your vendor should test and validate SIP and FoIP environments before production.
9. You should subscribe to the manufacturers' FoIP-specific technical support and unit exchange programs.
10. You should choose a well-rounded fax server vendor who is familiar with multiple technology requirements.

These top 10 preferred requirements are detailed below.

Requirement #1

True T.38 is fully supported and tested across the network

More and more ITSPs are offering SIP trunking, but for some of them, the same network that supports SIP trunking will not support T.38, or not support it well. Other methodologies oriented to voice are poorly positioned for fax, except in pristine environments.

Beware of G.711 fax implementations, which rob you of bandwidth and do not cope well with network impediments. In addition, beware of carriers that appear to deliver T.38 to your network edge but actually switch back to G.711 on their network. Also, be skeptical of "fax certified" or "fax interoperability approved" carriers, as these do not imply success in real-world environments or that your fax calls will be routed on supported networks in a majority of markets.

Finally, keep in mind that for many enterprises, fax makes up 5-10% of the calling traffic, which may be neglected by certain ITSPs hungry for a larger billable slice of voice and data traffic. Sadly, some major carriers may refuse to make changes dynamically to support improved fax traffic delivery, as other dominant traffic could be negatively impacted. When your fax traffic does not meet service level agreements, this 5-10% of calling traffic can generate 50-80% of your support calls. No support department wants this type of ratio, and certainly no business wants this impact to revenue-generating transactions.

Requirement #2

Carrier owns their T.38 network

For proper, high-quality T.38 results, make sure the carrier you choose "owns their network" and is not a regional player. This means that all the hardware in the network is owned by the carrier, up to and including a connection to their Internet backbone. Owning all the network hardware allows the carrier to diagnose issues and make changes to the network in a timely manner. Carriers that represent other networks can add additional layers of customer support, and thus increase the amount of time to resolution, or even impede resolution.

Requirement #3

Carrier has fax-centric technical support expertise

It is imperative that you select an ITSP with dedicated, fax-centric customer support. Select a service provider that has in-house expertise specifically with T.38 fax. Technical support should be able to trace, analyze and resolve T.38 fax cases. Too many times, the T.38 expertise resides

with the carrier's hardware vendor or elsewhere, adding layers upon layers of time and complexity to resolve issues, sometimes with unacceptable results.

Requirement #4

Internet fax service offering with T.38

An ITSP that supports T.38 over the Internet not only is nice to have in terms of cost and flexibility, but also is a sign of the carrier's confidence and maturity as it relates to fax. The value increases with distributed or smaller environments. The Internet is normally the highest trafficked network in an enterprise, so it makes sense that adding additional T.38 traffic should not cost any more than the service itself. Some carriers make you purchase a dedicated IP connection in addition to the T.38 service costs. Using the Internet for T.38 faxing saves you money and gives you the flexibility to select, manage and change your Internet provider on the basis of your specific requirements.

Requirement #5

Fax tagged for optimized routing with T.38

Fax-optimized routing is a fundamental differentiator of an ITSP. A good ITSP will actually tag and segment SIP sessions to be specifically T.38 fax plus voice, or just optimized for voice. Strong T.38 carriers have complex routing tables that segment and direct T.38 traffic across networks that have the best termination. Experienced carriers also have a knowledge base of troublesome fax destinations, so that they find different routes to terminate your T.38 fax.

For inbound traffic, which is frequently governed by the source of DID fax numbers and porting options, a good carrier will reduce the footprint of DID selection for better results. For outbound traffic, a rich backend of routing tables, exclusions and reroutes is crucial to success. A good ITSP will also set thresholds and be alerted of low success routes and poor line quality to enable quick changes. And in rare cases, an ITSP will still support a fallback to G.711 in the event a certain PBX does not support T.38.

Requirement #6

Flexible pricing and provisioning without extended terms

You probably hate "use it or lose it" rate plans for cell phones that force you to over-purchase usage and also charge punitive rates for exceeding your plan. Businesses deal with the same kind of issue with Internet service and traditional telephony. It's easy to buy more bandwidth or T1 lines, but try reducing that bandwidth inside a multi-year agreement.

What is the point of buying into the flexibility of a SIP trunk if the business relationship does not leverage the desired flexibility? I would seek a carrier that provides a month-to-month service agreement as a standard offering, while also allowing you to provision up or down as business needs dictate.

Requirement #7

Carrier-provided NAT traversal and secure registration

Your carrier should provide Network Address Translation (NAT) traversal, and secure registration with credentials, allowing you to keep the IP address of your fax equipment private, and your equipment protected behind your firewall. It is important to hide your topology to inhibit sudden hacking of your SIP sessions. In some cases, organizations may add a session border controller (SBC) to support extended features, as well as leverage secure VPN options using IPsec.

Requirement #8

Test and validate your SIP and FoIP environment

Typically at One Touch we do an initial assessment of our customer's requirements and the ability of their environment to support FoIP and SIP trunks as applicable. We have the ability, even on a virtual machine, to run test traffic as a means of establishing requirements, and ultimately, prior to cutover, perform live testing that attempts to replicate the production environment. It is critical in any deployment to have a process for testing and validating traffic — most importantly from remote fax locations — and varying the sample set of senders and peak usage times.

Requirement #9

Subscribe to FoIP-specific technical support & unit exchange programs

Obtaining support directly from senior technicians employed by manufacturers of FoIP host drivers, gateways and SBCs is invaluable. Combined with your dedicated fax server vendor who can communicate and troubleshoot issues with the proper tools, you can quickly deal with abstract issues in the IP telephony world and associated network impediments. A proper team with years of day-to-day expertise enables low-level testing, root cause analysis, interoperability configurations, system tuning, and IP communications analysis across several components.

Requirement #10

Select an experienced fax vendor to smoothly incorporate multiple technologies

Although companies handle hundreds of millions of business-critical fax pages, the hiring pool is limited for top fax integrators, particularly those with more than ten years of dedicated fax technology experience. Any organization where fax touches critical revenue generation should avoid vendors who sell fax solutions as a “me too” offering.

There is substantial credibility that comes with implementation experience, especially involving disparate technologies beyond the core fax software:

- Application integration and line-of-business workflow interfacing to other software systems and databases.
- Network components such as Active Directory, mail servers, security, SANs, SQL servers, routers, load balancers and firewalls.
- Telecom interfaces such as VoIP and traditional PBXs, gateways, T1 circuits, FoIP, cloud fax, session border controllers and SIP trunks.
- Disaster recovery options.
- Ongoing support availability with enough technical aptitude to encourage best practices (this is crucial).

Simple Steps for Moving to Fax over IP and other Cloud Solutions

To find out if Fax over IP (FoIP), fax-friendly SIP trunks or other cloud fax solutions (such as https document transfer services or email2fax) are right for you — regardless of your current fax strategy —engage a Novaris Communications technical solutions analyst by contacting our technical support engagement team at support@novaris.com, or call (866) 885-5606.

Learn more at www.novaris.com.

About the Contributors

About the Author

Scott Riley was educated as an electrical and computer engineer in the 1980's, and served as a U.S. Naval Officer on active duty and the reserves through 1996. In 1990 he created One Touch Global Technologies with a focus on fax, document automation and integration technologies. In 2010 Scott and his management team also created www.AllAboutFoIP.com, the original worldwide industry voice for Fax over IP, cloud faxing, and emerging forms of document delivery. In 2014 Scott separated the cloud services division of One Touch by creating Novaris Communications, Inc. With almost 30 years of experience in developing integrated fax server solutions, and working with products like RightFax, TargetFax, OTIS, FaxCore, Dialogic Brooktrout, and many others, Scott is part of a short list of respected veterans with focused expertise in business-critical fax delivery, automation and line of business integration, and subsequent advancements away from legacy technologies.

Today, Scott's role with Novaris Communications and One Touch Global Technologies leverage a portfolio of solution options, including requirements assessments, design, deployment, third-party integration and enterprise support. These include new technologies that enhance or replace traditional fax solutions with secure document delivery and transfer services in many markets including healthcare, financial, insurance and government operations.

About Novaris Communications, Inc.

Novaris Communications was originally conceived as a line of business within One Touch Global Technologies. With the emergence of cloud infrastructure technologies, changes geared to IP telecom, and advancements in secure document exchange, Novaris Communications, Inc. was created in 2014 with a focus on contracting, consulting, and facilitating the delivery of cloud-based solutions.

Novaris' primary focus is a commitment to delivering your business faxes and documents with faster speed, exceptional security, and improved compliance. In addition, as part of the cloud infrastructure portfolio, Novaris also focuses on enterprise video security solutions that eliminate the need for cumbersome premise-based hardware solutions by delegating video access, storage, analytics and monitoring to the cloud, easily supporting small businesses and distributed enterprises at a lower TCO.

Novaris Communications, Inc.
901 Dove Street, Suite 210
Newport Beach, CA 92660

866-885-5606 (General)
support@novaris.com