

**Fax solutions**

**Application note**

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## Introduction

Some might say that fax technology should be as extinct as the Martinique Parrot by now; only it doesn't know it. However, it wasn't so long ago that it was cutting-edge communication technology. Despite its invention as far back as 1843, by the Scottish technician and clockmaker, Alexander Bain, and the first telephone-based fax machine, which was completed by AT&T in 1924, facsimile machines didn't become popular until the mid-1980s.

This upsurge in the use of fax technology was in part fuelled by the adoption, in 1983, of the CCITT Group 3 standard protocol for sending faxes at rates of 9600 bits/s, which allowed interoperability between devices. The ITU-T T.30 fax transmission protocol, which has been around in its present form for nearly 30 years, was designed to operate over the PSTN. In that time, an installed base of over 100 million fax machines has come into existence and most of those machines are used daily.

Now commonplace around the world in offices of all sizes, fax continues to be a cornerstone of original document transferral. It has also remained surprisingly resistant to the encroachments of email and other newer technologies.

Apart from its ease of use and real-time nature, the attractions of fax are well known. It provides an inexpensive, fast and reliable method for transmitting correspondence, contracts, résumés, handwritten notes, and illustrations. Furthermore, it leaves a paper trail and that trail is considered to be legal proof of document delivery as well as an acceptable form of document archiving. And of course, with fax, you get a confirmation of delivery.

Combine all of this with the lack of any requirement for computer literacy, and it's no surprise that corporations are even now using substantial document management systems based on fax transmission. Whether they are installing in-house systems or using a hosted platform from a business communications solutions provider, it is clear the demand for integrated voice and fax solutions is still growing.

## Target applications

Faxing remains a powerful and widely-used tool that retains a firm foothold in the workflow of many corporations and is used today in many diverse applications. These range from its use in fax bureaux and contact centres to unified communications (UC) solutions and hosted, IP-centric services. It can also feature in IMS architectures; in an IMS compliant media resource function (MRF) or an IMS compliant media gateway (MGW). In addition, customer service, marketing programs, purchasing, invoicing and application processing are just a few of the business processes that rely on this hard copy delivery method.

Even with the mass adoption of Internet and wireless communications, many companies still choose fax when they need to get information into the hands of key stakeholders, quickly and easily. Indeed, fax broadcast is used very effectively for a range of legitimate business purposes. These can involve business units such as sales and marketing, finance and securities, healthcare, and the travel industry. In all of these, fax is still an important medium and, in fact [*sic*], there are few businesses where it is not used.

It is undoubtedly true that many companies still use standalone fax machines. Others have deployed fax servers, which are centralised, network-based platforms that extend fax machine abilities to the desktop or enable the faxing of batch-oriented documents generated from back-office applications. Whilst these fax servers promised easier administration and cheaper faxing, they have fallen out of favour with volume users, largely because of unforeseen, ongoing costs and unpredictable capacity needs, notwithstanding the large capital investment.

To reduce costs and minimise support issues, many corporations are turning to hosted or outsourced document management and information broadcast service providers. A hosted model means large companies don't have to purchase costly hardware or maintain an aging system. Solutions are highly scalable, accommodating seasonal demands without additional capital investments, and a significant benefit for customers is that they only need pay for what they use.

Unsurprisingly, this is an area where there is significant growth potential for fax.

## Application examples

Aculab's fax enabling technology is used by many hosted service providers offering solutions that automate, simplify and improve communication-centric business processes. These applications, delivered on demand, are hosted on a network of platforms, comprised of server centres and network operations centres, and located worldwide. Inside these platforms, you will find Aculab's Prosody X – a scalable, distributable, high density, DSP-based media processing board that inarguably offers industry leading fax handling capabilities.

Key customers are delivering millions of mission critical communications per day to the global target audiences of their end users, including some of the world's leading corporations and a majority of the Fortune 500. Together with its market leading partners, Aculab is helping to increase business efficiency levels and improve customer communications across the enterprise.

## How it works

Frequently, the same document must be delivered to multiple recipients, which can be a tedious process on many fax machines. Hosted platforms enable end users to transmit thousands of faxes, each one individually addressed, literally within a few minutes to any destination in the world. Traffic is forwarded through a fax service provider's high speed, high volume global network with total transparency to end users i.e., the receiver perceives the fax as coming directly from the sender.

In order to initiate a fax delivery or broadcast, the sender is typically provided with a secure web interface to online administration tools. Note that it is not necessary for the user to install any additional hardware or software as the service works with existing desktop and enterprise platforms for access to the Internet. In this way, the user has complete control of registration and account profiles, and is able to edit and customise settings and options such as for coversheet design, distribution lists, billing and delivery status reports, and the tracking of inbound and outbound faxes.

Users can send, receive, save, view, print, forward and track electronic faxes from their desktops. Confidentiality is improved as documents no longer sit on the fax machine for everyone to see and users are isolated from the frustration of missing another important document because the fax number is busy. Beneficially, for the enterprise, work is accomplished faster, with total reliability and added security, while billing is usually based on the actual time it takes to send the fax, rather than costly 'per page' fees.

### Financial services

Imagine a hypothetical international financial management company that needs to exchange thousands of confidential, time-sensitive business faxes daily. With a bank of fax servers, it will need its internal IT team available 24x7 to address any issues arising. There will be a fixed monthly cost, including maintenance, to have the system in place, regardless of usage, and capacity will be fixed. Over time, scaling up will require additional investment in hardware, whereas, if volumes decline, the ratio of fixed costs vs. usage will swing negatively.

Conversely, with an outsourced fax solution from an Aculab developer, the company can route all fax messages to a hosted platform. This will result in reduced operating costs, enhanced productivity for a no doubt already stretched IT staff, and provide a scaleable solution without the pain of capital investment. In addition, costs will be proportional to usage and the company is protected from 'highs and lows' as volumes fluctuate.

### Healthcare

Innovative Aculab customers have taken the hosted solution a step further by integrating fax capability within specialised business process solutions. A good example of this is in healthcare, where next generation electronic medical record (EMR) and practice management (PM) solutions are used to manage patient flow, access patient records, electronically communicate with referring physicians and securely send prescriptions, consult notes and other clinical data.

Such systems incorporate an embedded messaging service that enables clinical practices to send faxes, in batches or singularly, to colleagues, partners and patients for all aspects of care. These might include prescriptions, appointment reminders, lab results, information on medications or allergies, diagnostic imaging and statements.

It is clear that a huge volume of fax traffic is still generated in the healthcare industry and, of course, this communication is all done to help speciality practices and primary care physicians give the best possible medical care. Providers are able to better manage care for patients, promote patient safety while reducing costs, and improve overall patient health, because of better continuity and coordination of patient care information.

#### **eClinicalWorks endorses Aculab's fax capability:**

"Aculab's Prosody X technology has been recognized for being a leading platform in the communications industry for its advanced capabilities, reliability and price performance."

"The flexible, IP-centric architecture of Prosody X allows eClinicalWorks to utilize its outstanding fax functionality and to deploy voice applications on the same platform."

Girish Kumar Navani, CEO and co-founder of eClinicalWorks, a leader in the ambulatory clinical systems market.

## Aculab's technology

Fax boards have come a long way since the early days of GammaFax and Rhetorex. Now, with the flexibility of a fax option on intelligent, media processing resource boards like Prosody X, dedicated fax boards have indeed gone the way of the Martinique Parrot. The use of proprietary hardware solutions is no longer a fixed expectation and this is important for developers and integrators when the benefits of learning and coding through a coherent and consistent API are also considered.

Aculab's fax software allows the transmission and reception of faxes within ITU-T T.30 (up to V.34 speeds) and T.38 specifications on the Prosody family of media processing platforms, including its Prosody S host media processing (HMP) variant. Using Aculab's software, with call progress monitoring, a system can discriminate between incoming fax and voice calls, allowing an application to route a call to a fax or speech resource as needed, which is ideal for UC solutions.

Prosody X is 'host independent' approved for use in many countries around the world and supports, as standard, a comprehensive portfolio of signalling protocols, including SS7. Consequently, it offers an established, deployment proven platform with vital PSTN connectivity and interoperability, plus a powerful, ready made migration option for IP.

With VoIP being accepted as the future of communications, IP-based solutions will replace switched circuit connections. Needless to say, they must replicate legacy capabilities, and that requires compatibility with fax transmissions. With fax software available to download from Aculab's website under a cost free licence, users get unmatched value per channel for both fax over IP (FoIP) and Group 3 fax solutions.

## Class leading interoperability

Even with all its benefits, fax remains a challenge. The T.30 fax protocol is a recommendation rather than a standard and it is generally accepted that much of it is commonly violated when implemented in fax terminals. Exacerbating this, the persistent use of fax worldwide has left 10, 15 and even 20 year old terminals in widespread use. Therefore, interoperability with the installed base is a real issue.

For any benchmark figure to be meaningful, a common method has to be used to produce results. With fax, there are many legitimate reasons for a transmission failing and these should be factored out when comparisons are sought. The most significant factor is the time of day as many fax machines are switched off outside business hours and, at certain times, as little as 20 percent of faxes can make it through. Also, an obvious problem is that the published number no longer exists or has changed use and is answered by a person. Additionally, network line issues, such as signal-to-noise ratio, echo cancellation and attenuation, affect the success or otherwise of any fax transmission.

And, of course, there is fax machine compatibility. It is practically impossible to achieve interoperability with every conceivable machine. Indeed, industry experts suggest that a figure exceeding 80 percent is commendable. Profitably for developers and service providers, Aculab's fax capability is second to none. In any like-for-like scenario, where compatibility is the sole issue, a fax transmission success rate of 95 percent is the interoperability challenge for competing products.

### V.34 performance

The V.34 fax standard was established by the ITU as the standard for full duplex modems at up to 33.6 kbits/s. Compared to V.17, V.34 reduces call set-up and session management time by one third, which contributes to faster transmission time per page. It also provides greater adaptability to varying line conditions, and a consequent reduction in the number of fax resends. These improvements result in cost savings through a reduction in long distance phone charges that can be significant for a company sending millions of faxes daily. For a hosted service sending out say 100 000 V.34 faxes a day (at an average of 4 pages per fax) on a long distance rate of \$0.05 per minute, the savings compared to V.17 are in excess of \$1M per year.

Impressively, Aculab's V.34 fax channel count gives a massive total of 160 transmit channels on a Prosody X PCI board, outperforming the competition fivefold and fundamentally satisfying the most demanding user's needs.

### Conclusion

Now commonplace in businesses of all sizes, fax continues to be a cornerstone of document processing and it has also remained surprisingly resistant to the encroachments of email and other, newer technologies. Apart from its ease of use and real-time nature, the attractions of fax are well known. Particularly, that it leaves a paper trail, which is deemed to be legal proof of delivery as well as an acceptable form of archiving. Whether corporations are installing in-house systems or using a hosted platform from a business communications solutions provider, it is clear the demand for integrated voice and fax solutions is still growing.

Fax servers have fallen out of favour with volume users in favour of hosted or outsourced service provision. A hosted model provides both CAPEX and OPEX benefits with solutions being highly scalable and readily able to accommodate seasonal demands.

Aculab's fax enabling technology is used by many hosted service providers offering solutions that automate, simplify and improve communication-centric business processes. Aculab's Prosody X – a scalable, distributable, high density, DSP-based media processing board that inarguably offers industry leading fax handling capabilities – is found in many of these platforms.

Beneficially, whilst interoperability with the installed base remains a real issue, Aculab's fax capability is second to none and provides real benefits for developers and service providers alike. With Aculab's fax software readily available to download from its website, users get unmatched value per channel for both fax over IP (FoIP) and Group 3 fax solutions.

Aculab's dedication to fine tuning its R&D sets it apart as a key supplier of specialist, DSP- and host-based media processing and signalling products. With the flexibility of a fax option on intelligent media processing resource boards like Prosody X, single function fax boards from specialist vendors are a thing of the past. In an increasingly complex business environment, strong partnerships are important and Aculab stands ready to invest in developing products that will add value and allow its fax customers to trust their critical documents to Aculab.

### Features summary

- T.30 fax termination/relay protocol up to V.34 speeds
- T.38 real-time fax over IP (FoIP) with T.30-to-T.38 gateway function
- Call progress monitoring (incoming and outgoing)
- Automatic detection of fax calls
- Dynamic switching between fax and voice within a call
- Powerful and comprehensive API
- Group 3 TIFF image file manipulation library
- Supports multiple page formats and properties
- Supports single documents with multiple image formats
- Application control of individual pages
- Supports unlimited page length and header/footer formatting
- Supports fax on demand – polled mode fax

### Group 3 fax and image compression conformance

Aculab's Group 3 fax conforms to the following ITU-T and IETF specifications:

V.21	300 bits/s for T.30 fax negotiation
V.17	7200; 9600; 12 000; and 14 400 bits/s
V.27ter	2400; and 4800 bits/s
V.29	7200; and 9600 bits/s
V.34	33 600 bits/s
ECM	Error correction mode – transmission and reception supported
RFC2306	Group 3 TIFF

ITU-T data modems are also available to developers for use independently, using the TiNG architecture and the data communications API for the Prosody family.

Images can be received or transmitted in TIFF format using the following compression algorithms according to ITU-T recommendations:

MH (1D)	Modified Huffman data compression (ITU-T T.4)
MR (2-D)	Modified Read data compression (ITU-T T.4)
MMR	Modified Modified Read data compression (ITU-T T.6); ECM only

## Supported products and typical performance

		Product				
		Prosody X PCIe, PCI and cPCI boards				Prosody S HMP
Feature	Feature detail	Maximum channels per DSP	Maximum channels per PCIe board	Maximum channels per PCI board	Maximum channels per cPCI board	Maximum channels per host platform
Group 3 fax transmit	V.27ter, V.29	120	240	480	960	
	V.17	120	240	480	960	
	V.34	40	80	160	320	
Group 3 fax receive	V.27ter	90	180	360	720	
	V.29	64	128	256	512	
	V.17	35	70	140	280	
	V.34	20	40	80	160	
FoIP <sup>1</sup>	T.38	200 <sup>2</sup>	400 <sup>2</sup>	800 <sup>3</sup>	1600 <sup>3</sup>	400 <sup>4</sup>

### Notes:

1. For fax termination (non-gateway mode); simultaneous transmit or receive using V.17 emulation.
2. Quoted figure is based on a Prosody X board using 2 DSPs in a 3.192GHz server fitted with 1Gb of RAM.
3. Above 2 DSPs, the number of simultaneous fax channels per board is dependant on the host system performance.
4. For Prosody S, the number of simultaneous fax channels is dependant on the host system performance.

## About Aculab

Aculab is an innovative, market leading company that provides world class IP and media processing boards and software to the global communications market. With many years of experience in helping to drive our customers' success, our enabling technology provides the essential components required to deliver multimodal voice, data, fax and video solutions for use within IP, PSTN and mobile networks – with performance levels that are second to none.

Aculab serves the evolving needs of developers, integrators, service providers and equipment manufacturers with cost-effective, deployment proven, high performance products. Companies worldwide have adopted our technology for a wide variety of business critical services and solutions.

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