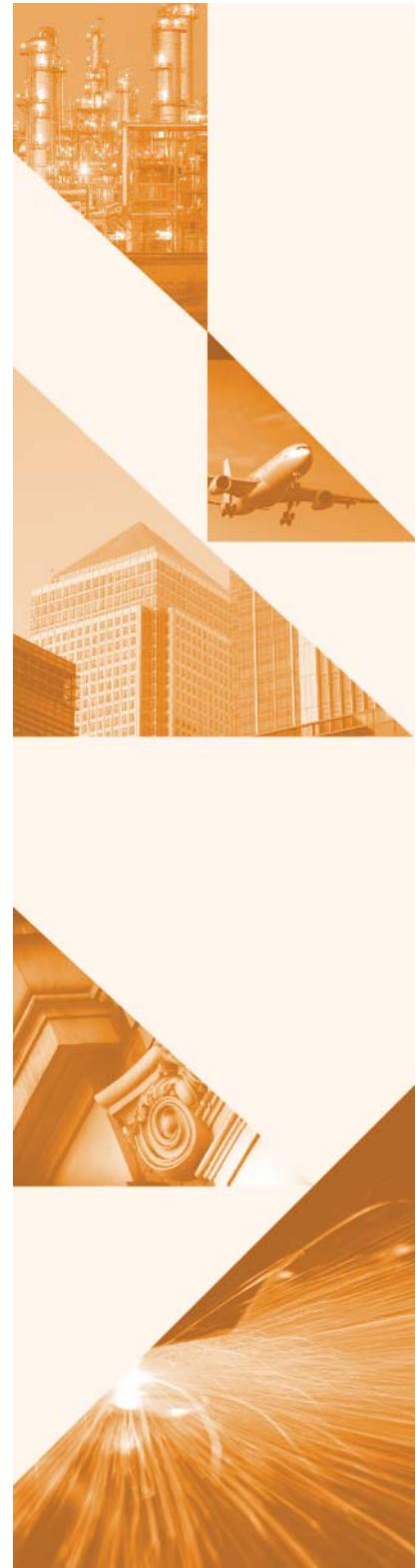


Fax over IP: Fax takes its place on the IP network

A Lane Telecommunications White Paper



Executive Summary

The fax market is changing significantly though not in the way predicted by many. Far from an inevitable decline brought about by the emergence of e-mail, the demand for fax, particularly from larger companies, is actually growing. The way that fax is managed within the business is also undergoing a significant period of transition. Just as most medium to large businesses made the shift from stand-alone fax machines to fax servers some time ago, many are now looking at the next phase in the evolution of integrated business communications and considering moving fax onto their IP networks.

Demand for ever greater convergence of data and communications networks is fuelled primarily by the cost savings achievable through more efficient communications management and lower infrastructure overheads. There is also a greater need to improve corporate governance in order to comply with legislation requiring better record keeping and greater data security.

Convergence in the voice market has gathered pace over recent years as standards have become well established and vendors have integrated IP capabilities into their equipment which has made migration a relatively straightforward process. Voice over IP will achieve market penetration of over 50% by 2010 and now accounts for a large majority of all new voice systems being installed today.

In the rush to integrate voice communications into IP networks fax has been somewhat overlooked but this is now changing and organisations are becoming aware of the role that fax servers can play in fully integrating communications and seamlessly exchanging documents throughout the business. Among other things, legacy back-office systems can be linked in to allow production fax runs over IP networks and inbound faxes can be routed to appropriate workflows via various data capture technologies within the fax server. The fax server becomes the central document exchange hub in the enterprise; linking remote locations and allowing the business to achieve compliance goals across the whole organisation.

In this White Paper we seek to place fax into its true context with regard to future developments and then look at the trends in an industry that is increasingly moving towards integration of fax into the IP environment. We show how Fax over IP can deliver significant business advantage through a migration strategy that takes account of installed network resources and future business demands. Finally, we look at the options and explore some of the considerations that are not always apparent to the unwary.

The future for fax

Perhaps the first questions that should be asked by companies considering the options open to them regarding the further integration of their fax facilities into their broader communications infrastructure relates to the future of fax itself as a core means of communication within the business environment. Only when satisfied that further investment is warranted will organisations consider the options available to them.

So what is the future for fax?

The answer to this question lies in an understanding of the way that fax is used within organisations throughout the world and in the attributes it has in comparison to the alternatives available. Lane is well placed to comment on the evolution within the communications market having been involved as a vendor of messaging and document management systems for over 30 years.

The business has seen the strategic role of Telex and other wire services wane as fax became prevalent throughout the world providing cheap, secure and legally recognised communications to virtually every business, irrespective of size or location. Lane's hardware based system, which was predominantly based on Telex and leased lines, gave way to the first release of their Passport Fax Server, then based on OS/2, which could manage both burgeoning fax traffic and integrate with e-mail as it became more widespread. Today, of course, Lane's Passport Fax Server has evolved significantly and is now the most powerful Windows-based fax server on the market.

The flexibility of e-mail as a communications medium appeared to signal the end of fax in the same way the fax had ended the Telex era. Indeed, to the casual observer fax usage has declined as stand alone fax machines have been discarded and e-mail has seemingly taken over our lives. This perception is, however, some way wide of the mark. Sales of stand-alone fax machines have declined sharply in recent years but this is primarily the result of a shift away from stand-alone fax machines to Multi-Function Peripherals (MFPs), fax servers and outsourced fax services. The reality is that fax usage is actually increasing year on year and is forecast to continue to do so.

Why does fax survive given the ubiquitous nature of e-mail today?

Quite simply, fax is used to securely transmit business-critical documents today and will continue to do so for many years to come. Although e-mail has undoubtedly become the dominant form of communication between businesses it does have certain limitations in areas where fax has significant strengths:

- Fax has a massive installed base across the entire world. Even the smallest businesses are likely to have telephones, and a phone line makes fax available with minimal additional investment. E-mail, although inexpensive to operate, requires more initial investment.



- Fax is inherently secure. As the fax is simply an image passed down a phone line it is not subject to the threats that e-mail is vulnerable to. Faxes cannot propagate viruses and cannot be altered in transit. For this reason fax has long been accepted for legal documents and is used to transmit sensitive and business-critical information from point to point - e-mail by contrast is open and relatively insecure.
- Faxes are sent and delivered in real time with verification of delivery. Advances in routing and delivery to any location in virtually any form have overcome the delivery limitations and inefficiencies that fax originally suffered from.
- As a fax is simply an image of the document it does not rely on the receiver to have any fonts, language or character sets installed and there are never any file format issues.
- Fax costs are falling all the time as a result of advanced fax servers utilising least-cost routing, outsourced fax options and lower long-distance call charges which are reducing variable telecoms costs considerably.
- Compliance with industry-specific and data protection legislation has become an increasing issue for all organisations that hold and transmit sensitive or personal information. Fax servers provide a fully compliant way of tracking recording and recovering information and of restricting access to it.

It is clear, therefore, that fax as a communications technology has an important role to play in the foreseeable future. The main area of transition within the fax market in recent years has been in the way the fax traffic is handled within the business.

Evolution of fax in the enterprise

Stand-alone fax machines still persist mainly for 'convenience' fax reasons. This allows individuals or departments access to a fax machine for ad hoc use but this is an expensive and inefficient option when hardware, additional telephone lines and consumables are taken into account. As MFP devices which integrate printing, copying, scanning and fax capabilities into one machine have become more prevalent individual fax machines have started to disappear. Although MFPs are a more efficient approach, they still require a dedicated telephone line or they need to be integrated into the network in order to handle fax traffic; many companies simply don't do this. The result is that many of the benefits of operating MFPs are lost. For more information on getting the most out of MFPs see the Lane White Paper "Realising the full benefits of MFP integration with network fax".

A bigger concern for most medium to large businesses has been the need to fully integrate production fax into their communications network. Production fax covers business-critical fax traffic to and from back-office systems and business workflows. For most companies a fax server such as Lane's Passport Fax Server, has been the preferred option.

In its simplest form, the fax server manages the flow of fax traffic in and out of the business. Outbound messages are received by the fax server from a variety of application servers or desktop clients. It then converts the various file formats into the standard fax format before distributing them over the telephone network. Inbound faxes are received by the fax server and distributed over the internal network according to a set of rules.

More capable fax servers, such as Lane's Passport Fax Server, are able to interact with virtually all legacy systems as well as MFPs and to integrate with ERP systems and business workflows in a way that makes the fax server the central document exchange hub for the business. Data can be captured from inbound faxes to automate certain business processes and route documents to the appropriate point on the network. All this activity is logged to full compliance standards and management of the entire communications system is simplified considerably.

As an alternative to maintaining a fax server capability in house, hosted fax services have appeared in recent years which allow convenience fax to be handled more efficiently and for certain high volume production fax tasks to be outsourced. These services can be used as an alternative to operating a fax server where traffic is relatively low or can be used in conjunction with a fax server to handle peak loads more efficiently. Hosted services vary greatly in sophistication and cost.

Next phase in fax evolution

Where fax is managed within the business, the next logical progression is to move fax communications fully onto the IP network through the introduction of Fax over IP (FoIP). Many companies have already implemented Voice over IP telephony systems and the large majority of new telephone system sales are for VoIP enabled systems. The adoption of VoIP systems is being fuelled by the lower costs and greater flexibility afforded by routing calls over the internet rather than through the traditional Public Switched Telephone Network (PSTN).

Although initially overlooked by many companies deploying VoIP systems, FoIP offers significant benefits and now that standards have been set the migration of fax onto integrated data networks is gathering pace.

What is FoIP

FoIP (Fax over Internet Protocol) is also called IP faxing and is a method of sending faxes over the Internet or your wide area network. FoIP changes the transmission method of faxing in much the same way that VoIP (Voice over Internet Protocol) changes the transmission method of a phone call. In both FoIP and VoIP, data travels most of the distance between sending and receiving devices on a packet-switched network, often avoiding the long-distance phone lines of the telephone network. This reduces the cost of transmission and can be a more efficient setup for a business that already has access to

Internet bandwidth or a wide area network. It is a common misconception that all of the fax transmission from end to end is conducted over IP. Unless you are sending messages within the organisation this will not generally be the case; you will need to switch out through your PSTN gateways to deliver to the destination fax machine.

There are two main FoIP protocols T.37 (store and forward) and T.38 (real-time). The difference between the two relates primarily to the delivery method and the way the receipt is confirmed by the receiving fax machine. T.38 is the preferred protocol as it is designed to preserve the familiar fax experience that standard T.30 based fax machines deliver when communicating via the PSTN. The sending and receiving devices establish a session, send and verify transmission and then terminate the session using active confirmations.

T.38 is designed specifically for the transmission of fax over IP. It provides facilities to eliminate the effects of packet loss through data redundancy and jitter buffering. A jitter buffer is a shared data area where packets can be collected, stored, and sent in evenly spaced intervals. Variations in packet arrival time, called jitter, can occur because of network congestion, timing drift, or route changes. The jitter buffer, which is located at the receiving end of the connection, intentionally delays the arriving packets

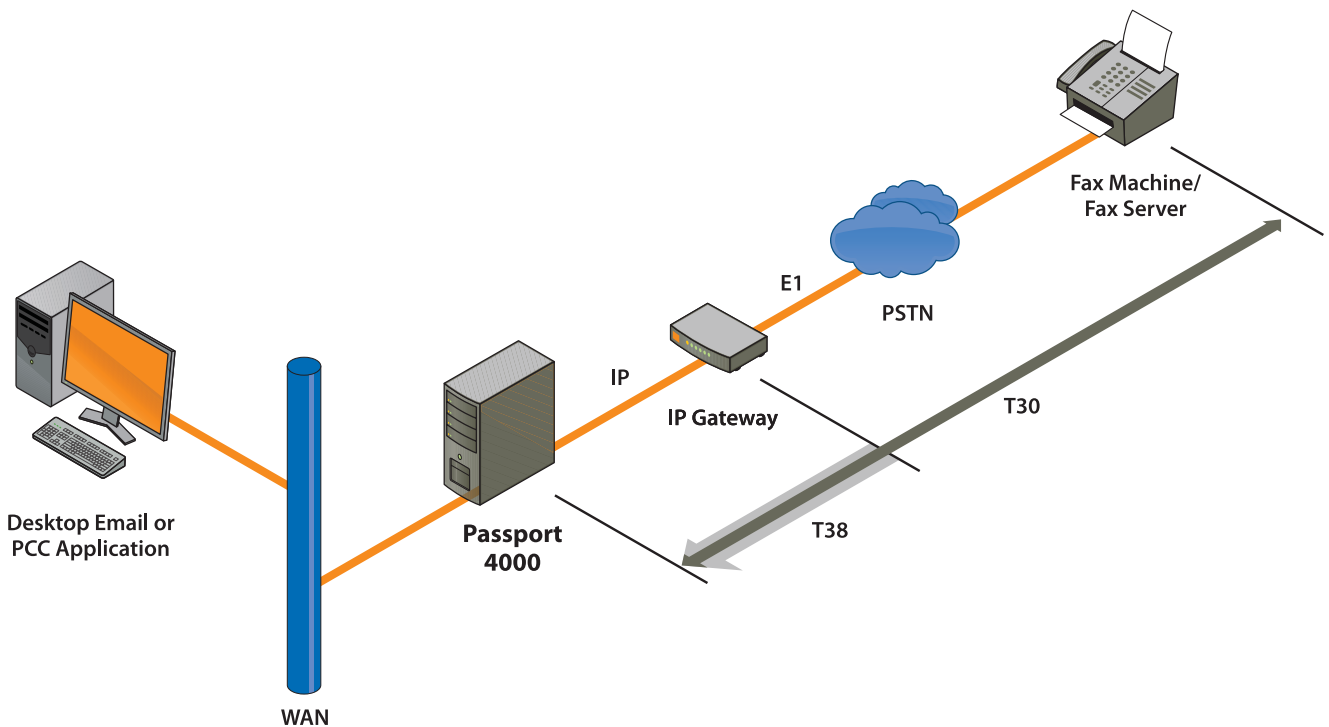
so that the end user experiences a clear connection with very little or no image distortion.

Communication could be entirely over an IP network in which case the session uses T.38 throughout or it could be routed via the PSTN, as mentioned above, in which case the IP switch must convert the 'packets' to T.30 for the PSTN part of the link. T.38 is widely supported and is incorporated into virtually all IP routers, IP-PBXs and media gateways.

How does FoIP differ from traditional fax?

In any fax session, timing is crucial and traditional telephone lines are really good in this regard because they provide constant timing for each phase of the fax session; making the connection, exchanging signals, sending and confirming receipt of page data, sending and confirming multipage alerts, and terminating the call. At each step along the way, the machines are exchanging information with each other to make sure everything is going according to plan. A real-time FoIP session includes all of these phases and confirmations; FoIP uses the same method of compressing and interpreting image data as traditional fax (G3) does, but it uses the T.38 protocol for transmitting that data.

HOW PASSPORT® FAX OVER IP WORKS

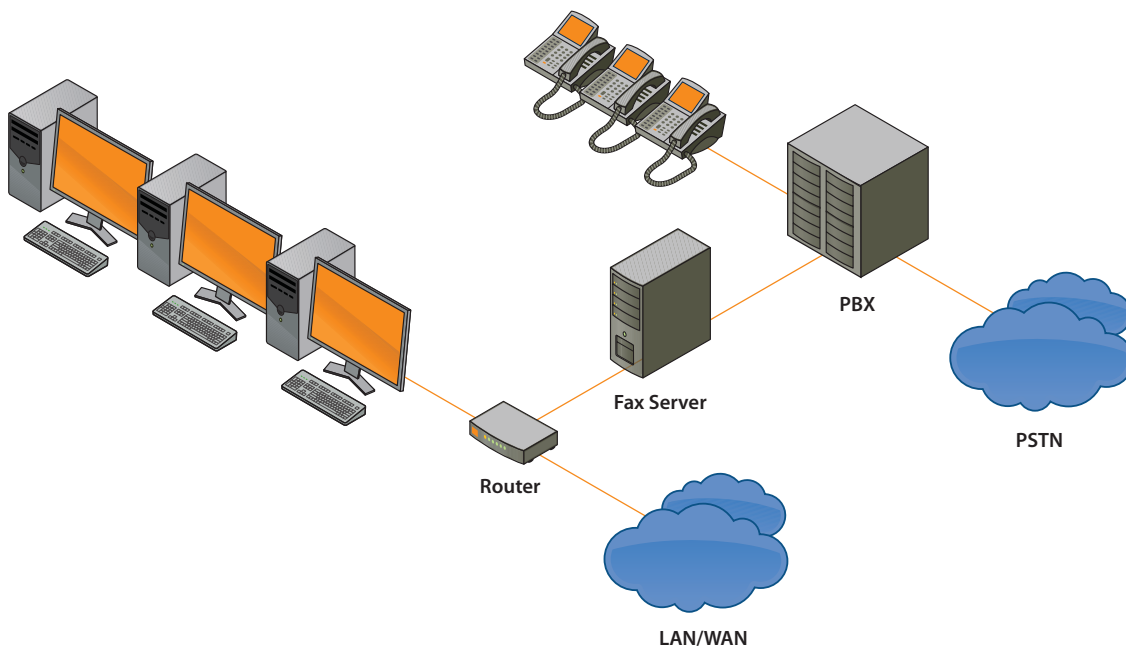


Benefits of FoIP

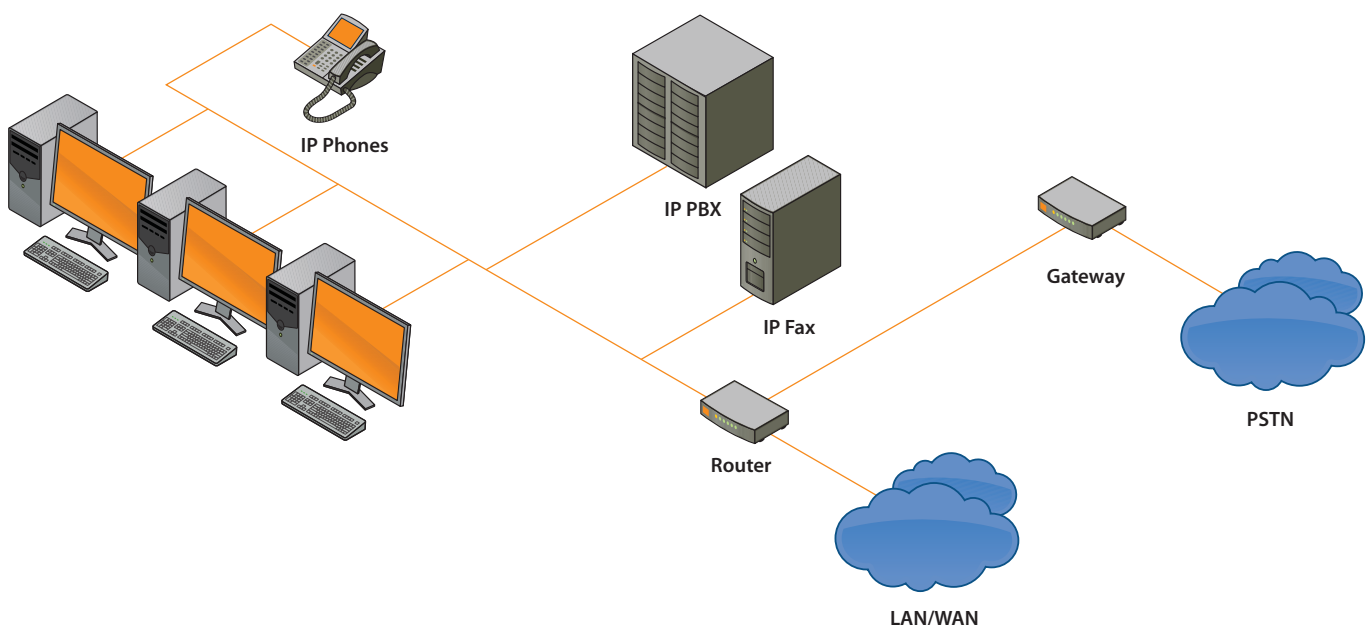
Installing an IP fax server delivers wide ranging benefits due to its centralised and fault tolerant nature. The primary advantages are:

- **Reduced long-distance phone charges:** Faxes sent via the IP network avoid the PSTN and therefore avoid large long distance call charges.
- **Much lower maintenance costs:** With an IP fax solution fax traffic enters the IP environment via a gateway rather than through the PBX. As the maintenance costs of routers are significantly less than those for a PBX regular maintenance contract costs are greatly reduced.
- **Lower operating costs:** Complex network infrastructures made up of disparate technologies are common in medium to large enterprises. Complexity is forced on the company as it expands and having to operate separate data and telephone networks adds to this issue. Integration of data, voice and fax communications over the IP network eliminates the need for a telephone network and allows support resources and personnel to be focused on the data network.
- **Easier deployment and maintenance:** In a VoIP/FoIP environment the location of the IP fax server is independent of the PSTN network access point as gateways provide the connection to the PSTN. The fax processing resources simply

TRADITIONAL FAX SERVER PBX INTEGRATION



IP FAX SERVER - IP PBX INTEGRATION



need access to a data network, Local Area Network (LAN) or Wide Area Network (WAN), where the gateway resides.

The various application servers on the enterprise WAN can now deliver services to all locations from one central data centre, using the gateways in remote offices to gain access to the public telephone network. This arrangement reduces the number of parts that are remotely managed, consolidating maintenance and lowering costs. This also simplifies deployment to remote locations, enables greater consolidation of fax services, lowers disaster preparedness costs, and enables least cost routing via the WAN.

Traditionally, provisioning fax services to employees in remote locations required installing an on-site fax server in those remote locations, which usually required a large user base to cost-justify. However, with an IP fax server, employees can access the fax image and signal processing capability that resides in a remote data centre. The gateway that resides in the field offices provides the ramp onto the PSTN. Thus, with IP fax services, adding remote employees to an IP fax server is now done entirely through software, e.g., purchasing a seat license for the fax server, and no additional equipment is needed in remote locations. With IP Fax, a remote employee in Paris can use the company's fax server in London just as easily as if it were located in their local office.

- **Better disaster readiness:** With a FoIP solution in place, the location of the fax server is independent of the user. Fax server deployment can, therefore, be reduced to one or two strategically located data centres. The number of sites requiring rapid response is significantly reduced and the fax servers can be located in the most secure and stable environments.
- **Much lower risk of connection failure:** Apart from being more inherently stable and fault tolerant than traditional circuit switched architecture, FoIP networks provide the flexibility to route traffic via fully functional nodes even if part of the network is down. A single fax server, or multiple load balanced redundant servers can be installed on multiple network nodes effectively eliminating the risk that the fax server will be without access to the network. This is critical where fax is the method of delivery for vital health or natural disaster alerts.
- **Least cost routing:** Using the gateways installed at remote locations as part of the FoIP network, companies can route calls and faxes across their WAN so avoiding any long distance call charges even if the fax is sent across the world.
- **Enhanced business productivity:** Fax server technology sits at the heart of the communications infrastructure and can be used to enhance a company's ability to streamline business process automation and improve document

management. Investment in FoIP solutions provides an opportunity to integrate communications and document management more fully into corporate workflows.

- **Compliance:** Remote office locations present a significant issue for companies that are required to conform to regulatory compliance standards. Implementation of a FoIP network architecture allows remote workers to be brought onto the fax server system quickly and easily from where all authentication, management control, archiving and retrieval to compliance standards can take place centrally.
- **MFP integration:** MFPs combine copying, printing, faxing and scanning into one networked device. They have the potential to deliver many business benefits but they do not come equipped with IP fax support. Fax servers, such as Lane's Passport Fax Server, allow MFPs to be fully integrated into the IP network environment enabling users to send and receive faxes as they would from a stand-alone fax machine. All fax traffic from the MFP then goes through the central fax server ensuring that compliance obligations are met. For more information on getting the most out of MFPs see the Lane White Paper "Realising the full benefits of MFP integration with network fax".
- **Virtualisation:** New virtualisation software technologies are becoming increasingly popular as organizations seek to improve efficiency and consolidate hardware resources. Software only FoIP solutions that are compliant with leading manufacturers of virtualisation software, such as Lane's Passport Fax Server, can co-exist in a virtualised environment.

Fax over IP options

Although Fax over IP has the potential to deliver many benefits it is not always the appropriate solution for every network and care must be taken in choosing whether to deploy a traditional PSTN fax platform or an IP solution.

The starting point for an evaluation must be to consider the topology of the existing network to determine those parts, if any, that may already be equipped to support an IP fax environment. Having mapped out the existing network it must then be decided what other equipment must be deployed in the enterprise, in addition to the fax server, to complete the IP fax implementation.

Until relatively recently it was necessary to install hardware cards to integrate fax into the communications infrastructure. With the ever increasing power available from a single platform it is now possible to move to a software only solution for the fax interface. Below we explain the differences:

Fax Card or Software Only solution?

Fax Cards

A solution incorporating Fax Cards is an infrastructure in which the fax server software as well as associated hardware is installed into a new or existing network server. The fax software application may be one among many other applications on the server or may be installed as a stand-alone application for the sole purpose of handling fax transmission and reception. This architecture is comprised of dedicated analogue fax lines as well as specialized fax boards, maintenance and supplies

The hardware card includes onboard chips to perform digital signalling processing (DSP's); this does not provide an overhead on the platform CPU as all processing is carried out by the hardware card. This does, however, provide an issue in sourcing hardware as it is becoming more and more difficult to source hardware with the required number and size of slots.

If considering purely cost, however, the later Brooktrout hardware cards support both T.30 (traditional fax) and T.38 (FoIP) and as such may be redeployed into a FoIP environment, thus saving the costs of moving to a software only solution.

Software Only

In a software based solution, the fax data packets are processed by the platform's CPU and require no additional hardware. In this way the fax software may be deployed anywhere on the organisation's network, including virtual servers. Software solutions are marginally cheaper than purchasing hardware cards. The elimination of fax boards within this architecture also leads to lower energy usage.

Considerations

It cannot be assumed that moving to a software driven IP Fax solution will inevitably result in an overall reduction in the hardware required to process fax messages as they pass through the enterprise. There will obviously be no requirement for fax cards but additional steps may have to be added to allow faxes to reach their final destination as they pass through IP switches, routers and gateways on their way to the PSTN.

The question of reliability should also be considered. FoIP is reliable over an organisation's wide area network where a guaranteed level of service exists, however, FoIP over the internet has some way to go before it's as reliable as traditional phone-line faxing. FoIP may still be a very attractive option for any organisation that sends a lot of long-distance faxes. In most cases, the cost savings and network integration of FoIP far outweigh the downside of having to occasionally resend a fax that doesn't go through.

Faxing speeds

Hardware based fax boards support transmission speeds of up to 33.6 kilobits per second whereas at this time most of the industry currently transmits fax traffic over T.38 at a maximum of 14.4 kbps.

There are exceptions, however, such as Lane's Passport fax server which uses the latest Dialogic® products including the Brooktrout® SR140 and the DMG3000 & DMG4000 Media Gateway Series which enable enterprises to deploy fax server solutions into existing VoIP installations, while leveraging their existing IP infrastructure. The addition of V.34 T.38 allows these products to transmit fax data at 33.6 kbps.

Voice integrated solutions

FoIP does not, at this time, support voice integrated features such as DTMF (dual tone multi frequency). If you require this feature you should select a fax card and PSTN solution for your fax server.

Capacity and Bandwidth

A T.38 (IP Fax) session is open for the entire duration of a fax transmission and therefore requires a dedicated channel between the IP network and the fax server for the duration of the call. In this way the channel capacity for the IP Fax server is no different were it to be an IP solution or a PSTN solution. In addition, unlike IP voice, most IP fax needs a consistent signal quality and cannot operate with latency in the network.

Lane has developed a remote service for processing the T.38 anywhere on the enterprise, allowing the T.38 service to be deployed adjacent to any gateway, thus reducing the network overhead and removing the problems associated with network latency.

Which option is right for a business will depend on a number of factors which we are happy to discuss with you, just go to the Lane website at www.lanetelecom.com and follow the link to our Free FoIP Consultation.

Conclusion

Over recent years the fax market has undergone a period of transition and this is far from complete. New technologies have emerged, business processes have evolved and the legal framework within which organisations must operate has changed. Fax as a communications technology is coming through this period stronger and with a more clearly defined role. It is clear now that the future of fax in most medium to large companies will be in the IP environment and even smaller companies will follow this route through outsourced or hosted fax services.

The challenge facing organisations is when they should migrate to FoIP and how they can take full advantage of the wide ranging business benefits that this can bring. IP Fax servers are often cost-justified in terms of their ability to perform a particular function; perhaps handling production fax requirements or fully integrating MFPs, but then their full potential is recognised and they become a business-critical hub for business messaging, communications integration and document exchange.

It will take some time until equilibrium is restored in the market and the transition of fax fully into the IP environment is complete. For many businesses this will not be a simple transition as they will have a complex set of issues to resolve. Existing IP and analogue infrastructure, legacy back-office systems, business process and management systems all need to be considered and the costs balanced against the potential benefits that IP fax servers can bring to the organisation as a whole. Before embarking on this transition it is advisable to consult industry experts such as Lane who are able to provide an objective overview of the costs, implications, benefits and technical considerations relating to a FoIP deployment in your particular organisation.



About Lane Telecommunications

Since its formation in 1976 Lane has been at the forefront of messaging communications and is now recognised internationally as a leader in fax integration, across the financial, healthcare, manufacturing and transport industries. Based in the UK, US and Singapore, Lane has implemented systems across 50 countries and provided professional services in all time zones. Lane offers the very best solutions for integrating fax servers as a part of wider communications networks. As specialists in messaging solutions for over 30 years, Lane delivers seamlessly integrated fax and messaging systems across entire organisations and into consolidated data networks, across one site, many sites or across borders.



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