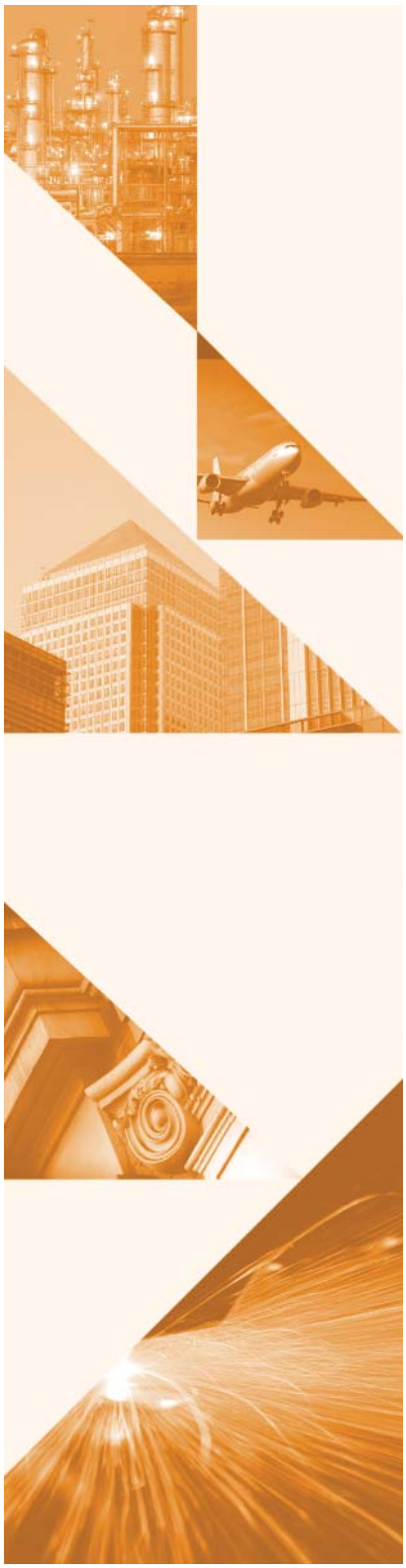
Fax and the Future:

A balanced overview of Fax over IP - where it delivers and where it doesn't.

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 that may be 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. Much of the activity surrounding Fax over IP is, however, driven by an industry keen to keep the market moving in that direction. For many companies with an effective fax server in place, the additional benefits of switching to Fax over IP can be fairly marginal and can be limited to the ability to virtualise the fax server, while the costs can be significant.

Whether it makes sense to upgrade is largely dictated by your existing communications infrastructure and the requirements of your business. What is clear, however, is that companies need to differentiate between the benefits they should expect from a fax server and those that are delivered specifically as a result of running fax over your IP network. In this White Paper we seek to provide a balanced view of what Fax over IP is, what it could deliver and what it is actually likely to given your current situation.

The future for fax

Perhaps the first question 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 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.

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 even though their existing fax server could do the job and could even track activity through all the company's MFPs and stand-alone fax machines to full compliance standards. 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 Public Switched Telephone Network (PSTN). 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 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.

Remote office locations present a significant issue for companies that are required to conform to regulatory compliance standards. A fax server can be configured on your WAN to allow 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.

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, and many network managers prefer to retain control of this business-critical element of their communications mix in-house.

Next phase in fax evolution

Where fax is managed within the business, the next logical progression would seem to be 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 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.

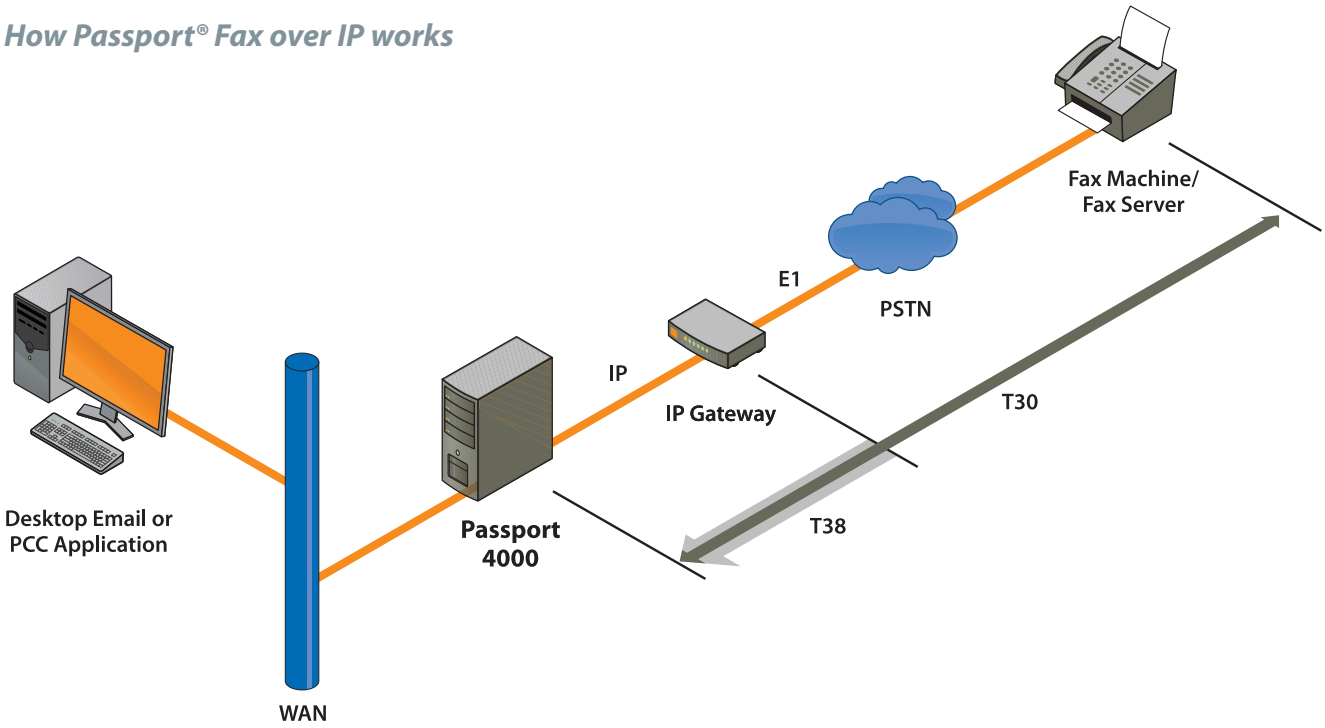
T.38 is designed specifically for the transmission of fax over IP. It provides facilities to eliminate the effects of packet loss through data redundancy and jitter buffering. A jitter buffer is a shared data area where packets can be collected, stored, and sent in evenly spaced intervals. Variations 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:

- **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 can be 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 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 center, using the gateways in remote offices to gain access to the PSTN. 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.
- **Lower risk of connection failure:** 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. This also allows the business to improve customer service by using local fax numbers in each country.
- **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.
- **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.

FoIP: Is it right for your organisation?

Although FoIP 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 your IP fax implementation.

Our message in this white paper is that you should carefully consider the potential benefits offered by FoIP in the context of your communications infrastructure. Clearly, every business will have a slightly different mix of requirements and legacy infrastructure so we have set out four different scenarios to demonstrate how your existing infrastructure could dictate the benefit you may derive from a FoIP installation.

As discussed above, a well set up fax server will deliver many very significant benefits to your business. We have, therefore, assumed for these examples that you already have an effective and efficient fax server set up so that we can concentrate just on the main incremental benefits that a FoIP installation could deliver in each case.

Scenario 1: An organisation with offices in several countries and a VoIP installation linking them all.

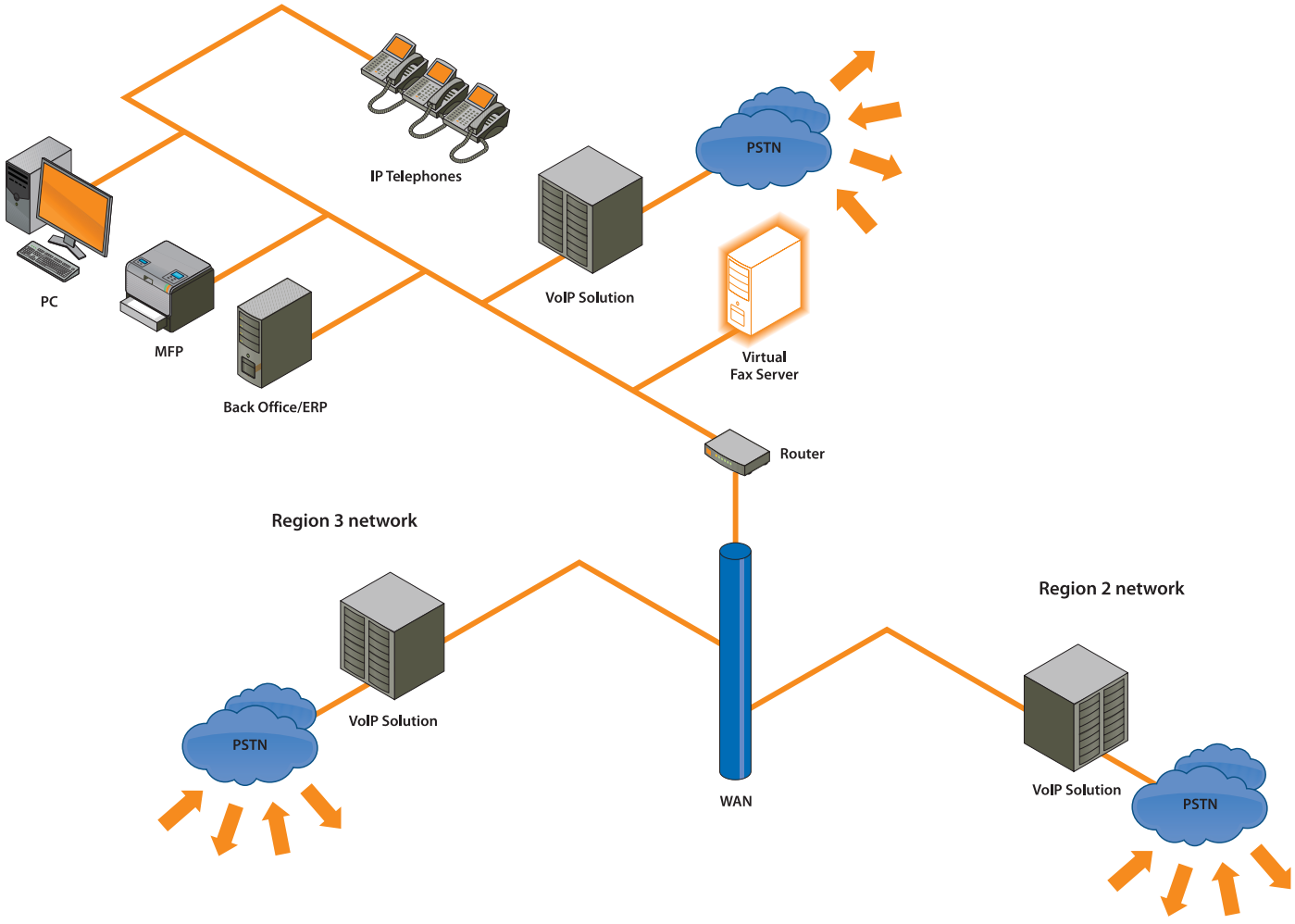
By running a Fax over IP system this organisation could converge voice, data and fax onto a single network which reduces complexity, management overheads and costs. Disaster readiness could be improved considerably and deployment of an integrated fax capability throughout the organisation would be much easier.

Outbound faxes from desktops, multi-function peripherals and ERP systems could benefit from least cost routing over your Voice network and be transmitted from PSTN breakout points in the regions nearest to the fax destination. This means that many faxes will only be charged at a local or national rate and long distance fax charges can be reduced enormously. A significant and often overlooked benefit is the improved customer satisfaction gained by providing local regional fax numbers rather than international numbers as may otherwise be the case.

Fax ports could be shared as required across the entire VoIP network so the fax server could be used to handle both inbound and outbound faxing much more efficiently. As a FoIP system does not require physical fax boards, the fax server could be virtualised saving money through a reduction in hardware costs, expensive data-centre server rack space and lower energy bills. And, as there are no fax boards, there's no need to purchase new boards due to obsolescence in the future.

Conclusions: In this situation, with multiple international offices and an existing Voice over IP system in place, there are many financial, operational and management benefits to running fax over the IP network.

This organisation has a VoIP solution in place linking its multiple international offices and has implemented FoIP with a virtualised fax server



Scenario 2: An organisation with offices in just one country that has an existing VoIP installation.

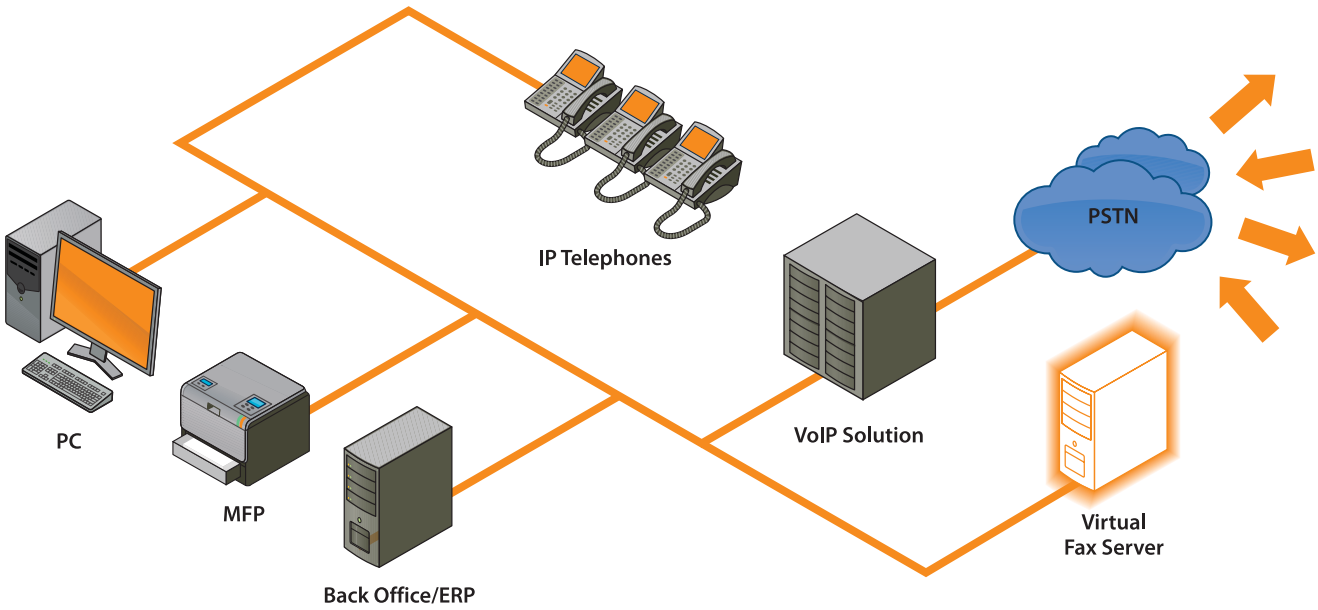
By running a Fax over IP system this organisation could converge voice, data and fax onto a single network which reduces complexity, management overheads and costs. As no international offices exist, however, there would be relatively few savings from least cost routing. Disaster readiness could be improved and deployment of an integrated fax capability throughout the organisation would be easier.

The primary benefit to this organisation is likely to be the opportunity to virtualise the fax server as a Fax over IP system does not require physical fax boards. This lowers costs through a reduction in hardware costs, expensive data-centre server rack space and lower energy bills. And, as there are no fax boards, there's no need to purchase new boards due to obsolescence in the future.

Conclusions: In this situation, with offices in one country and an existing VoIP system in place, there are some financial, operational and management benefits to running fax over the IP network, primarily from virtualisation of the fax server.

If, however, the fax server is set up correctly and runs efficiently then the costs of virtualisation may outweigh the benefits. If a requirement exists to upgrade the existing fax cards anyway, change the operating platform or even install a fax server for the first time then the organisation should consider implementing a system such as the Lane's Passport 4000 fax server incorporating Dialogic Fax over IP technology as much of the infrastructure required for Fax over IP could be put in place at that point.

This organisation has a VoIP solution in place and has virtualised its fax server.



Scenario 3: An organisation with offices in several countries but without a VoIP installation linking them.

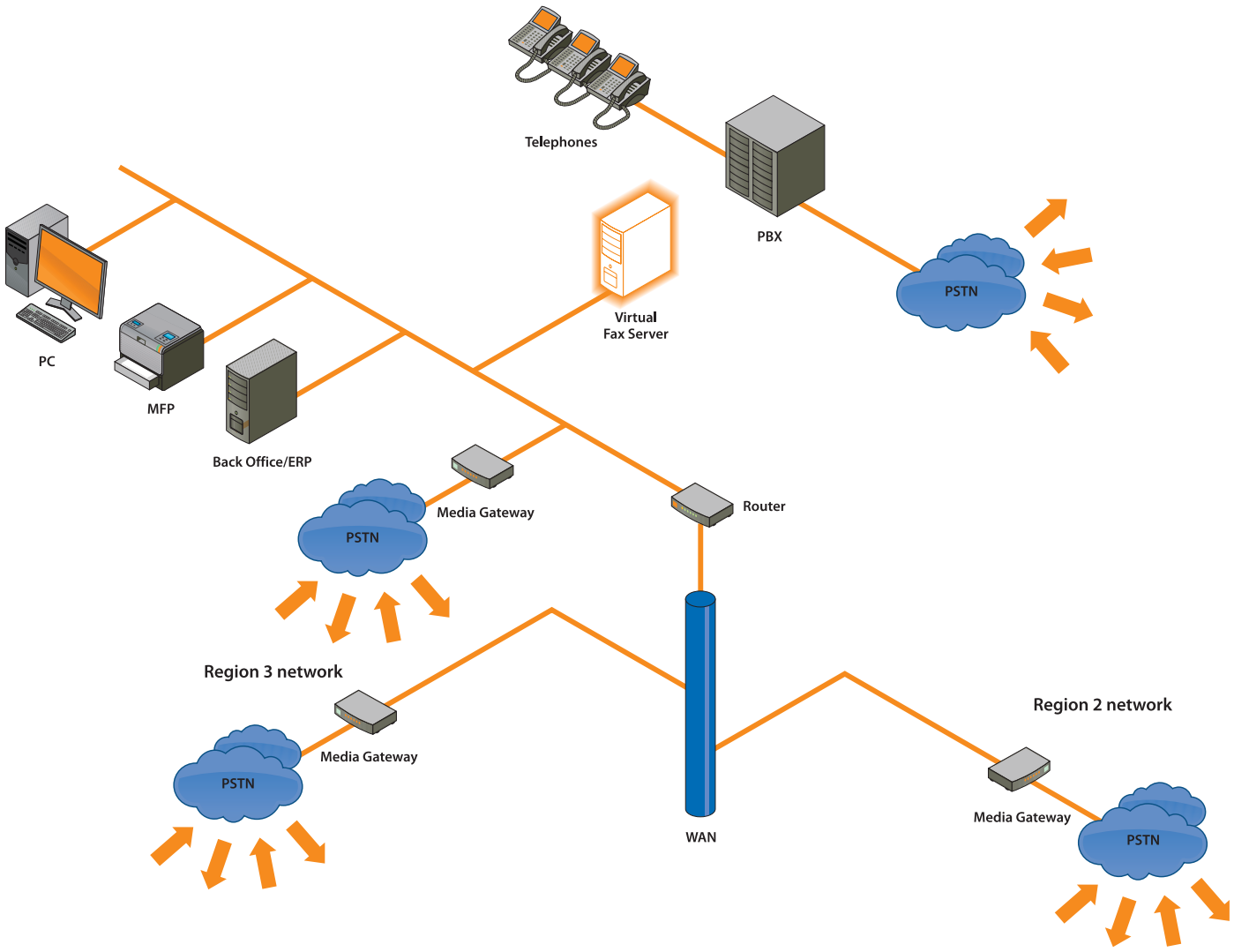
First of all, it isn't necessary to have a VoIP system in order to benefit from FoIP. For this business, Fax over IP could simply mean connecting the fax server to the PBX via IP in which case the fax server could be implemented without the need for any physical fax boards and so money can be saved by virtualising the Fax Server with the resulting reduction in hardware costs through consolidation, a saving in expensive data centre server rack space and lower energy costs.

The organisation could also implement a complete companywide FoIP infrastructure by utilising its fax server with strategically located media gateways. Outbound faxes could then be automatically routed over the FoIP network and transmitted from PSTN breakout points in the regions nearest the destination. This means that many faxes would only be charged at a local or national rate and long distance fax charges can be reduced enormously.

In addition, improved customer satisfaction could be gained by providing local regional fax numbers rather than international numbers as may otherwise be the case. Disaster readiness could be improved considerably and deployment of an integrated fax capability throughout the organisation would be much easier.

Conclusions: In this situation, with multiple international offices but without a VoIP system in place, there are financial, operational and management benefits to running fax over the IP network. This organisation should consider implementing a FoIP and/or a VoIP system but balance the potential cost savings and efficiency improvements against the implementation costs.

This organisation does not have a VoIP installation but has virtualised its fax server to manage faxing across all its locations.



Scenario 4: An organisation with offices in just one country without a VoIP installation.

As this organisation doesn't have a VoIP installation or multiple offices, the benefits of implementing FoIP are somewhat limited. If the fax server were to be connected to the PSTN via a media gateway then it could benefit from virtualisation as a FoIP system does not require physical fax boards. This would save money through a reduction in hardware costs, expensive data-centre server rack space and lower energy bills.

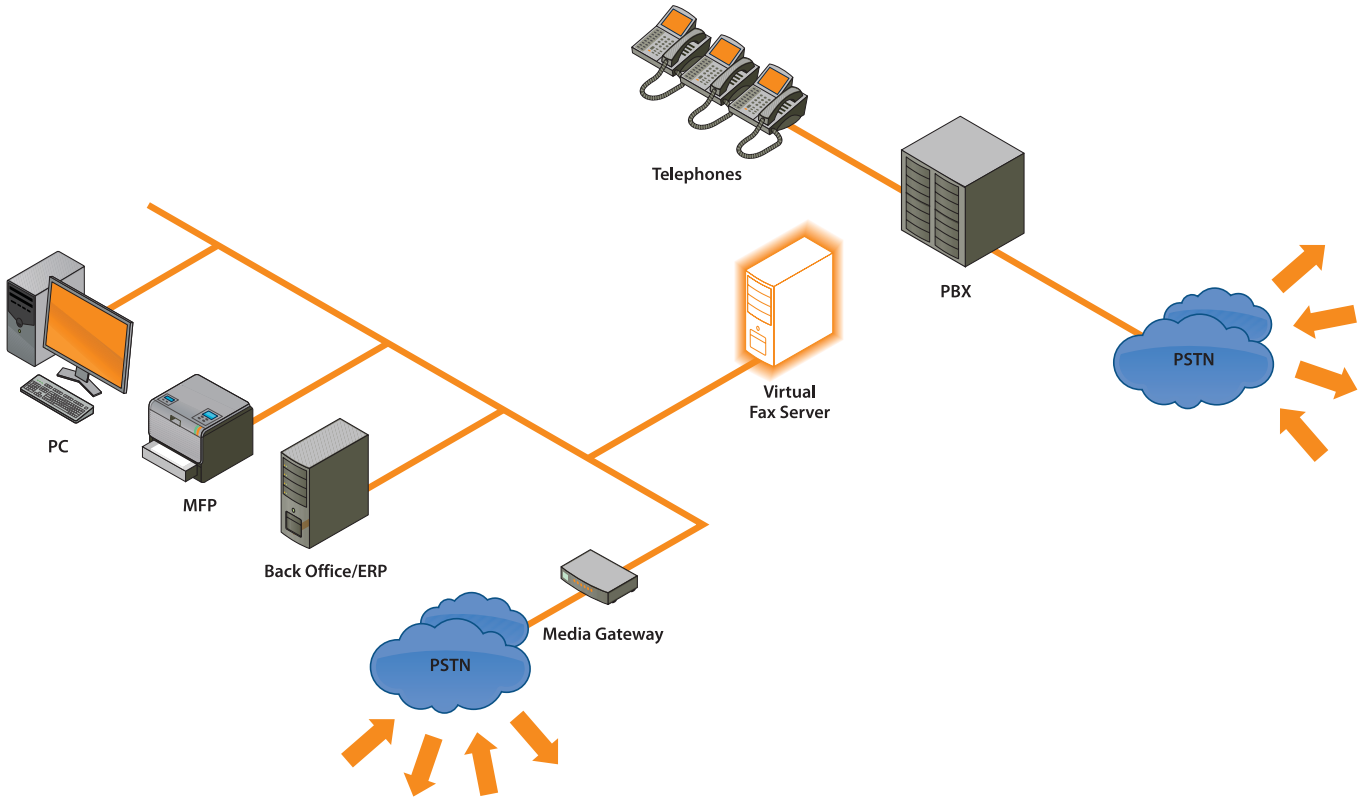
Disaster readiness could also be improved considerably and deployment of an integrated fax capability throughout the organisation would be much easier. And, as there are no fax boards, there's no need to purchase new boards due to obsolescence in the future.

Conclusions: In this situation, with offices in just one country and no existing Voice over IP system in place, there are some limited financial, operational and management benefits to running fax over your IP network, primarily from virtualisation of the fax server.

If, however, the organisation's fax server is set up correctly and runs efficiently then the costs of virtualisation may outweigh the benefits.

It is clear from these rather simplified examples that the benefits to be derived from FoIP will vary with the geographic extent of the business and the installed communications infrastructure. For many companies the best approach may well be to ensure that their fax server is delivering the benefits it should before considering converging voice, data and fax on their IP network. You should also be aware when considering a FoIP installation, particularly if you are running an older telephone system, that your existing system may not support T38 protocol which would incur additional costs if FoIP was implemented.

This organisation has implemented FoIP and virtualised its fax server.



Fax Card or Software Only solution?

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 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 Dialogic 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 FoIP 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 or completely separate FoIP 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 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 immediate challenge facing some organisations and a longer term one for others is when they should migrate to FoIP. If there is a business need to upgrade existing fax cards or the operating platform then now is clearly a good time for a review but for many companies the decision is based on a number of factors including whether greater benefit could be derived from improving the performance of their fax server.

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 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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