Automotive Supply Chain Best Practice Recommendation

Comparison of File Transfer Alternatives

For B2B Data Exchanges

Version 1.0

Doc Ref No: OP06

Date: June 2011

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1. INTRODUCTION

In late 2009 the Odette Technology Committee created a Project Team to study the preferred standardised solutions for file transfer alternatives for future B2B data exchange within the European Automotive Industry.

There were a number of specific reasons why this initiative was undertaken:

- Due to continued globalisation of the industry there is a growing demand for data exchange solutions that are possible to use globally, including in emerging market countries.
- The Odette File Transfer Protocol (OFTP) can be used over any network. However, the current implementation base still relies heavily on the use of ISDN and/or X.25 for the transfer of logistics and CAD/EDI data. These services are either being closed down or redefined in many countries. To some extent such services are also considered as no longer meeting automotive requirements in terms of cost efficiency and bandwidth.
- Over the last decade, the Public Internet has become a widely accepted and viable platform for B2B data communication.
- A new version of the OFTP protocol specification, OFTP2, has been developed by an expert team based on the requirements specified by Automotive Industry stakeholders. The recommendation has been published by Odette and implemented by various software vendors. Besides others, one key feature is built-in support for secure data exchange over insecure networks, such as the Public Internet.

The main intention of this document is to compare various options for file transfer in B2B data exchanges.

Please note that in this document the words “file transfer” and “data exchange” are used mainly as synonyms. When referring to ‘OFTP’ it implies OFTP version 1.4 and ‘OFTP2’ implies version 2 of the OFTP protocol.

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1.1 CONTENT

1.2 SCOPE

The scope for the Project team was defined as follows:

- Review what combinations of network services and protocols are most commonly used today and what is known about future priorities among OEMs and large suppliers.
- Review and predict what kind of changes, outside of the control of Odette and the Automotive Industry, could be expected within the next 5 -10 years. For example: Closing down/redefining X.25/ISDN services.
- Identify the most likely combinations of network services and protocols that will be used for B2B Data Exchange within the Odette community, including data exchange with trading partners outside of Europe.
- Identify what parameters would be of interest when comparing alternatives (start-up and running costs, security, availability worldwide, suitability for various applications, etc).

1.3 PROJECT TEAM

The members of the Project Team who contributed to this work were:

Andrew Filby, Data Interchange
Bengt Andersson, Scania
Carl Marquardt, T-Systems
Dietmar Koch, Axway
Ewan Friend, Data Interchange
Jörg Walther, Odette International
Karsten Witzke, T-Systems
Sten Lindgren, Odette Sweden, *Leader of the group*
Torsten Schmied, Johnson Controls
Udo Thienelt, Hella

2. GENERAL OVERVIEW

In the context of this document the term "**network**" is used to describe wide area networks (WANs). A WAN is a computer network that covers a broad area (i.e., any network whose communications link across metropolitan, regional, or national boundaries. WANs are used to connect local area networks (LANs) and other types of networks together, so that users and computers in one location can communicate with users and computers in other locations.

A communications protocol is a formal description of message formats and the rules for exchanging those messages. Protocols may include signalling, authentication and error detection and correction capabilities. In its simplest form, a protocol can be defined as the rules governing the syntax, semantics and synchronisation of communication. Protocols are used on top of network services.

A virtual private network (**VPN**) is a network that uses a public or private telecommunication infrastructure, such as the Public Internet, to provide remote offices or individual users with secure access to their organisation's network. It aims to avoid an expensive system of owned or leased lines that can be used by only one organisation. The goal of a VPN is to provide the organisation with the same secure capabilities, but at a much lower cost.

Each data exchange solution consists of three main components:

- Network layer
- Protocol layer
- Application layer

The "application layer" is the purpose for the data exchange to take place. Examples of the application layer include the exchange of logistics information, technical drawings and financial information.

The "protocol layer" is the standardised method of exchanging data between two parties. There are many different communication protocols that are used around the world. The protocol layer sits on top of a "network layer". The network layer is the physical telecommunications connection method.

Neither layer can exist or function without the other as they are fundamentally different.

In addition, certain criteria have to be taken into account, and the optimal solution consists of an appropriate mix of the attributes.

Details of various layers and possible combinations are explained in this document.

3. NETWORKS

There are several network services that are in scope for evaluation as they are either currently the most prevalent in the Automotive Industry, or are the most obvious for future adoption:

- X.25
- ISDN
- Public Internet
- VPN
- Managed VPN (ANX, ENX, JNX, etc,)

3.1 X.25

X.25 is one of the oldest packet switched services. It was one of the most prevalent networks in the 1980s and '90s and had global coverage. As newer networks became available, the popularity of X.25 decreased due to its comparative slowness and cost. Starting in the early 1990s in North America, the use of X.25 networks began being replaced with Frame Relay. Many countries are now withdrawing X.25 offerings.

3.2 ISDN

ISDN was defined in 1988 and was used for the transmission of both voice calls and data. It became particularly popular as it was associated with being a secure network that was multipurpose with increased speed and lower costs in comparison to X.25.

3.3 PUBLIC INTERNET

The Public Internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide. Besides its role of offering information services like publishing information on the World Wide Web, the Public Internet has become an important tool for B2B information exchange.

3.4 VPN

A virtual private network (VPN) is a network that uses a public telecommunication infrastructure, such as the Public Internet, to provide security between two parties.

3.5 MANAGED VPN (ENX, ANX, JNX, ETC.)

Managed VPN services like ENX offer standardised VPN services through certified Service Providers.

4. GENERAL EVALUATION OF OPTIONS: NETWORK SERVICES

Network services	Comment
X.25[1]	Legacy service, only applicable if trading partner insists, and if there are services available for both parties.
X.31[2]	A service to use ISDN D-channel for X.25 communication; already phased out in many markets.
ISDN[3]	Widely used in Europe, easy to install, but limited bandwidth. Cost is a problem with larger bandwidth and ISDN services are being closed down in certain countries. Several OEMs are already dropping ISDN and if possible, ISDN should be avoided for new partner relations.
Public Internet	Globally available, cheap, used for multiple purposes, every company connected. Bandwidth scalable. No built in security. Not possible to apply SLA requirements end to end between partners. In practice there is a growing acceptance of Public Internet services for many automotive use-cases, with certain exceptions. Public Internet is available as a service from a large number of providers (ISPs).
VPN (partner solutions)	Individual solutions that can only be used in specific partner relations. Maintenance aspects big concern if multiple relations are handled. Such solutions are not dealt with in detail in this document due to the large number of different proprietary offerings.
Dedicated, centrally managed, automotive VPN services like ENX[4]	Built in network security, scalable service level and bandwidth, widespread and available. Widely used in the automotive community, with some exceptions. ENX is only available from certified service providers (CSPs).

To fairly assess the various network services, it is necessary to look at what is currently used by the Automotive Industry in Europe, along with the costs, availability and the future plans for the services.

[1] There are limitations that users should be aware of:

- Security is not based on encryption
- Unauthorised access to physical media is a threat
- There is also a risk in certain emerging markets where such services are monitored by governments

[2] Comments in footnote 1 also applies to X.31

[3] Comments in footnote 1 also applies to ISDN

[4] Similar services in other regions than Europe are ANX (North America) and JNX (Japan). ENX and ANX are connected

4.1 NETWORK SERVICES USAGE[5]

ODETTE surveyed a number of OEMs and Tier 1 suppliers about their current use of network services for file transfer in B2B data exchange. The results are given in Table 1 below.

	ISDN[6]	X.31	X.25[7]	Public Internet	ENX[8]	ANX[8]	JNX
AB Volvo	●		●	●			●
BMW	●			●	●		
Continental	●	●		●	●	●	
Daimler	●			●	●		
Ford	●		●	●	●	●	
Hella	●			●	●	●	
Johnson Controls	●			●	●	●	
PSA	●		●	●	●		
Renault	●		●	●	●	●	
Scania	●	●	●	●			
SKODA	●		●	●			
Valeo VMS	●			●	●	●	●
Volvo Cars	●	●	●	●			
VW	●			●	●		

Table 1: Usage of Network Services for B2B Data Exchange

[5] It should be noted that there is no indication of what applications are used over the network services.

[6] Since this survey was made several companies listed have decided to stop or reduce their usage of ISDN

[7] Since this survey was made several companies listed have decided to stop or reduce their usage of X25

[8] ENX and ANX networks are now connected

4.2 COMPARISON OF FEATURES

	Bandwidth	Cost	Administration and maintenance	Global/regional availability of service	Technical availability (Service level)
X.25	L	H	L	Global but decreasing	H
ISDN	L	H	L	Global but decreasing	H
Public Internet	H	L	L	Global	M
VPN for machine to machine (partner solutions)	H	H	M	Global	M
Dedicated automotive VPN services (ENX, ANX and JNX)	H	M	L	Global	M - H[9]

Table 2: Network services (except security features that are covered in a separate table)

Key:
H: High
M: Medium
L: Low
ENX: European Network Exchange
ANX: ANX eBusiness Corp. (US)
JNX: Japanese Automotive Network eXchange

IP Network services	Encryption	Partner verification	Denial of service protection
Public Internet	No	No	No
VPN (partner solutions)	Yes	Yes	Yes
Dedicated automotive VPN services like ENX, ANX and JNX	Yes	Yes	Yes

Table 3: IP network services security aspects

[9] If both ends are connected through dedicated ENX lines: H; if one of them or both connect via ENX over Internet (see "OFTP over ENX"): M

4.2.1 X.25

4.2.1.1 Availability

X.25 service is still in operation in most countries, but many have firm plans to withdraw the service within the next 5 years. Already some providers are no longer allowing new connections. Some providers are offering X.25 services on new technology platforms, which might influence pricing and availability.

From an operational perspective, many X.25 services are now being handled by secondary operators instead of the underlying carriers, sparking concern over the ability of such companies to support the service.

4.2.1.2 Costs

The costs of X.25 have increased significantly over the years as providers are left trying to support an ever decreasing user base. Such are the costs that X.25 is rarely used through choice for cross border connections.

4.2.1.3 Conclusion

X.25 has absolutely no future with the European Automotive Industry. The service is being withdrawn and users are already making plans to migrate to other network options, such as the Public Internet or a dedicated VPN service.

4.2.2 ISDN

4.2.2.1 Availability

ISDN has been available worldwide for decades. However, with the widespread adoption of ADSL it is decreasing in popularity. ISDN is often used simply because ADSL is not available in a given region. The number of ISDN subscribers is known to be decreasing in Japan, France, UK, Greece, Sweden and India.

4.2.2.2 Costs

- ISDN cost is comprised of fixed cost/month, connection cost and cost of self-managed equipment, including a user help desk.
- Due to its connection-oriented, channelled, dial-up link nature, set-up depends on the maximum number of concurrent connections and can be complex and expensive for dial-in sites.

- Connection cost depends on the number of connections, time and distance (by country, in some countries by region).
- Flat Rate plans exist, but can generally only be used for voice and possibly fax. Data is specifically excluded.

ISDN Germany[1]	Base/Month	Per Minute	1000 small EDI packets (<400 kB)	Per MB	1 GB
to Germany	30 €	0,029 €	29 €	0,063 €	64,87 €
to EU-W, US, China	30 €	0,035 €	35 €	0,076 €	78,29 €
to EU-E, Japan, Russia	30 €	0,059 €	59 €	0,129 €	131,98 €
to Mexico, Thailand, India, etc.	30 €	0,178 €	178 €	0,389 €	398,18 €
to Morocco, Tunisia, etc.	30 €	0,536 €	536 €	1,171 €	1.199,01 €
to Korea, Uruguay, etc.	30 €	1,012 €	1.012 €	2,211 €	2.263,81 €

ISDN Sweden[2]	Base/Month	Per Minute	1000 small EDI packets (<400 kB)	Per MB	1 GB
to Sweden	30 €	0.02 €	20 – 50 €	0.07 €	70 €
to EU-W, US, China	30 €	0.08 €	80 – 100 €	0.28 €	280 €
to Japan,	30 €	0.25 €	240 – 300 €	0.8 €	800 €
to Russia, Thailand	30 €	0.4 €	400 – 500 €	1.40 €	1400 €
to India	30 €	0.9 €	850 – 950 €	3 €	3000 €

Table 4: ISDN pricing examples

[1] Source: ENX Association, based on information from Deutsche Telekom, May 2010.

[2] Source: Odette Sweden based on information from TeliaSonera, May 2010. Prices based on ISDN BRI (2 x 64 kb), for ISDN PRI traffic rates are the same, but there is a fee of 220 €/month, includes 30 channels (but needs also additional investments in hardware).

4.2.2.3 Costs and availability – Conclusions

The tables above give some examples of the conditions where ISDN Services could be used.

ISDN is available in most countries, but penetration varies widely between different regions of the world; even use for business PBX lines is not ubiquitous. The conclusion is that ISDN services are not an option for the future; they are only an alternative for domestic small volume kinds of exchanges.

4.2.3 PUBLIC INTERNET

4.2.3.1 Availability

The Public Internet is a global system of interconnected computer networks. It is now estimated that there are close to 2 billion users of the Public Internet worldwide. During the 1990s the user base doubled year on year and consumers and businesses alike rushed to make use of the new technology.

4.2.3.2 Costs

The Public Internet was once the domain of only the technically minded, but as the number of suppliers has increased in line with the number of users, the pricing has decreased significantly, making the Public Internet open to even more users.

Not only has the Public Internet become more available, but it has also become an order of magnitude faster and more reliable.

4.2.4 ENX

ENX is an IP based Managed Security Service based on IPSec VPN. ENX is used for many other applications besides file transfer, which is the focus of this paper.

4.2.4.1 Availability

ENX based on private fixed lines is currently available in all European countries, North America, most of South America and Asia. ENX over Internet service is available worldwide.

In most countries, ENX access is available from more than one certified service provider. Access types vary between leased line, metro Ethernet, ADSL, SDSL and Public Internet.

In summer 2010 the ENX and ANX networks became connected as a result of a new agreement between ENX Association and ANX eBusiness Corp. For all communications between ENX and ANX customers, ENX technical and security standards are used.

4.2.4.2 Costs

Beside the core network cost ENX cost/per month generally includes:

- VPN Termination Router and maintenance
- Encryption Certificate
- End-to-End Management and Troubleshooting, setup of Additional Partner Connections/Tunnels

ENX access fee varies depending on location, CSP, bandwidth, Service Level etc., but is generally independent of trading partner connections (numbers/locations).

Due to the managed security and the specific network structure, ENX network access costs more than Public Internet access with comparable bandwidths.

5. GENERAL EVALUATION OF OPTIONS: PROTOCOL LAYER ALTERNATIVES

Protocol layer alternatives	
HTTPS	Used for web EDI (manual file upload/download) also transport layer for proprietary web services based exchanges. Only possible to use over IP based networks.
FTP	Easy to handle, widely spread. Provides basic functionality but no high level protocol functions or security features. Limited usage in automotive B2B relations, at least in Europe. Only possible to use over IP based networks.
SFTP/ FTPS	Same as above except that there is either socket layer or transport layer security. Only possible to use over IP based networks.
OFTP	Most used file transfer protocol in the Automotive Industry, at least in Europe. Network independent, runs over X.25, ISDN, and IP based networks. High level protocol features included like receipt acknowledgement, routing, restart etc., specifically designed for automated large volume data exchanges. Designed for usage over secure networks.
OFTP2	New version of the OFTP protocol developed with the intention to replace OFTP1.x. OFTP2 adds features for reliable and secure communications over IP based networks, including Public Internet, plus other extended functions required by stakeholders of the Automotive Industry (larger file size, signed end to end response and others).
X.400	Mainly a legacy message exchange protocol, used by some VAN Service providers in the Automotive Industry. Also used by governmental bodies in some countries.
AS2	Used by certain vehicle manufacturers in Asia, also in their European operations. Mainly used in retail and aftermarket. Does not have the same functionality as OFTP2, only usable over IP based networks. For details, see Table 6: Protocol layer alternatives from a file transfer point of view.

5.1 PROTOCOL USAGE AND FUTURE PLANS

ODETTE surveyed a number of OEMs and Tier 1 suppliers about their current and planned use of protocols for file transfer in B2B data exchanges. The results are given in Table 5 below.

	OFTP	OFTP2	AS2	SFTP	X.400	FTP	Web services
AB Volvo	●	●	●	●		●	●
BMW	●	●		●			
Continental	●	●	●	●	●	●	●
Daimler	●	❍					●
Ford	●	●				●	●
Hella	●	●	●	●	●	●	●
Johnson Controls	●	●	●			●	●
PSA	●	●[10]				●	●
Renault	●					●	●
Scania	●	●	❍	❍		●	
SKODA	●	●			●		●
Valeo VMS	●					●	
Volvo Cars	●	●		●		●	
VW	●	●					●

Table 5: Usage of Communications Protocols for B2B Data Exchange

Key:

- ● Implemented
- ❍ Planned

5.1.1 CONCLUSIONS

From Table 5, it is clear that the OFTP protocol family of OFTP and OFTP2 is the dominant protocol for data exchange in the European Automotive Industry.

[10] Exception: PSA – Engineering only

It is widely believed that the high usage of FTP is predominantly due to legacy connections and that the majority of these connections are using VPNs to provide a level of security.

5.2 EVALUATION OF SOLUTIONS

A group of experts representing OEMs, suppliers and IT Providers collaborated in producing this paper. The group held numerous discussions, to reach agreement on their views on available alternatives.

The group has done its best to produce a non-biased conclusion based on its collective knowledge and experience.

Aspects covered are:

- Costs
- Security
- Global Automotive Industry acceptance
- Ease of implementation
- Reliability, service level
- Bandwidth
- Backward compatibility to OFTP
- Fulfilment of specific Automotive technical requirements

5.3 PROTOCOL REQUIREMENTS

Users in the Automotive Industry have specific requirements for their B2B file transfers:

- Certain level of reliability and robustness
- Traceability for follow up, confirmation of receipt and non-repudiation
- Certain level of security
- Certain level of bandwidth
- Cross border B2B file transfer in use
- Availability 24/7
- To be achieved at the lowest possible cost, including initial investment in software, administration of the application and running costs for network services

Depending on size and intensity of communications, needs might vary among users such as:

- SME company with “occasional” data exchange
- Medium sized company with more demanding data exchange
- Large company with hundreds of trading partners running B2B exchange 24/7

5.4 COMPARISON OF PROTOCOL ALTERNATIVES

Protocol layer	Possible to use over IP based services?	Meets specific automotive requirements[11]	"Turnkey" application for Automotive Industry requirements available?
HTTP	Y	N	N
HTTPS	Y	N	N
FTP	Y	N	N
SFTP/FTPS	Y	N	N
OFTP	Y	Y	Y
OFTP2	Y	Y	Y
X.400	Y	N	N
AS2	Y	N	N

Table 6 Protocol layer alternatives from a file transfer point of view

5.4.1 WEB-SERVICES

Web Services are normally based on http/https (not to be seen as a communication protocol), but they depend on individual detailed technical agreements and are thus not standardised.

5.4.2 FTP

In the early days of computers nothing was "user-friendly". Anyone who wanted to use a computer had to learn to use a complicated set of commands that were specific to a system. It became clear that a set of standard commands was required to exchange files between systems and so in 1971 the FTP protocol was published, defining a standard protocol for exchanging files between remote systems.

The FTP protocol balanced a comparatively rich set of functionality with simplicity and ease of use and quickly became a globally accepted standard for data transfer.

Because of its global coverage and comparatively low setup costs, FTP has been adopted by a significant number of companies as a means of data exchange. However, as a protocol for exchanging business critical information there are a number of weaknesses:

[11] file names, file sizes, character sets, restart, technical acknowledgement, compression, reliability and robustness, traceability for follow up, confirmation of receipt and non-repudiation.

- The protocol does not support any form of session security. Consequently authentication details are transmitted in plain text.
- The protocol does not support any form of file encryption or digital signature.
- The FTP standard does not define any method of automatically acknowledging receipt of data.
- The implementation of the folder structures used in FTP is not defined as part of the standard. Consequently, each implementation typically has a bespoke configuration.

Although FTP is used by many of the companies in the survey to exchange non-business critical information and will continue to be used for the foreseeable future, for the reasons above it is not a suitable protocol for business critical data exchange.

5.4.3 SFTP/FTPS

Released in 2000, SFTP was designed by the Internet Engineering Task Force (IETF) as an extension of the Secure Shell protocol (SSH) to create a secure alternative to FTP.

SFTP has similar benefits and problems as FTP. It is globally recognised and used throughout the world and, unlike FTP, it has the benefit of session security. But, the protocol still lacks file acknowledgements and a standardised machine interface.

In the companies surveyed there has been limited adoption of the protocol and there is little impetus to implement it. For this reason it is unlikely to become a common protocol in the automotive sector.

5.4.4 THE ODETTE FILE TRANSFER PROTOCOL - OFTP

The Odette File Transfer Protocol provides a standard communications method for sending and receiving data files and EDI messages and has been adopted throughout the world. The OFTP protocol framework is common throughout the automotive sector and will continue to be so.

Whilst being designed with the Automotive Industry in mind, it has been used by a wealth of other sectors including retail, transport, white goods, manufacturing, financial institutions and governments.

Originally designed in 1986 to work over an X.25 network, the protocol has evolved to support X.25 over ISDN and TCP/IP. This support for a range of network protocols and functionality such as file acknowledgements, file restart and well defined machine to machine interfaces meant that the protocol became the de-facto standard for the European Automotive Industry and is used by all the companies surveyed.

With older network services becoming less appropriate due to availability, pricing and performance, many organisations are looking to use the benefits of IP based solutions (low cost, high speed) such as the Public Internet and ENX, or other VPN solutions.

5.4.5 OFTP2

The initial use of the OFTP protocol has been over ISDN networks that have been popular in Europe. To use higher bandwidth, several companies also facilitated data exchange with OFTP over ENX.

However, stakeholders of the Automotive Industry needed to extend the protocol. Amongst the requirements was the ability to use OFTP securely over Public Internet connections. Consequently, OFTP2 adds features for reliable and secure communications over IP based networks, including Public Internet and other extended functions required by automotive companies (larger file size, signed end to end response and others). OFTP2 enhances security via encryption methods and uses digital certificates.

OFTP2 is fully downwards compatible with earlier versions. This is important to enable a smooth migration path and to maintain relations to trading partners who still use the older version, OFTP.

Both OFTP and OFTP2 are also published as RFCs by the Internet Engineering Task Force (IETF). IETF develops and promotes Internet standards, cooperating closely with the W3C.

5.4.6 X.400

Of the companies surveyed, only 3 indicated that they use X.400. This is not surprising as X.400 has predominantly been used as a connection method between VAN services rather than between users. Many VANs have been migrating their inter VAN connections from X.400 to newer protocols, which are more widespread and consequently easier to support. Due to the lack of X.400 providers there is little future for X.400 in the Automotive Industry.

5.4.7 AS2

AS2 was developed in the U.S. by the Uniform Code Council (UCC) and is a secure, reliable Internet data transport standard. Security is achieved by using digital certificates and encryption. The AS2 standard supports EDI or any other data transmissions over the Public Internet using HTTP. The AS2 specification describes how to transport data, not how to validate or process data. Much of the success of AS2 has been seen in America, notably the retail sector.

A large influence behind the adoption of AS2 was in 2002 when retail giant Walmart mandated its 10,000+ suppliers to use AS2 to exchange EDI data with them directly.

AS2 supports a number of key features required by businesses to securely and reliably exchange data. Features include automatic message delivery notifications, which are used to confirm receipt of the data by the target system, file level encryption, digital signatures and session security. However, it also has some significant shortcomings as data can only be pushed by the originating system and can't be pro-actively picked up by the intended recipient (so both systems must always be able to communicate with each other). There is also no way of defining a file naming convention for data being exchanged.

Adoption of AS2 to-date in the companies surveyed has been limited and with few seeing it as a viable large scale solution it is unlikely to become a common protocol.

6. CONCLUSIONS (NETWORK SERVICES & PROTOCOLS)

It is clear that only OFTP, OFTP2 and AS2 are credible protocols for data exchange requirements of the Automotive Industry in Europe. Others may have similar security features, but their lack of adoption for production purposes means that they cannot be considered further as part of this review.

Similarly it is proposed that only Public Internet, VPN and managed VPN network services (ENX/ANX) are considered for review on the network services layer. ISDN and X.25 clearly have no future in the European Automotive Industry.

A total of nine combinations are left for critical review:

	OFTP	OFTP2	AS2
Public Internet	X	X	X
VPN	X	X	X
ENX	X	X	X

Each of these combinations needs to be reviewed with the criteria defined earlier.

7. DETAILED ANALYSIS OF COMBINATIONS

7.1 RATING MODEL

Criteria ratings in tables are not to be considered as exact science, but are rough estimates. Ratings given are only intended for the comparison of alternatives for typical B2B file transfer exchange in the Automotive Industry.

The following rating model has been selected:

7.1.1 RATING FACTORS

- Cost
- Security
- Reliability
- Implementation
- Applicability

7.1.2 RATING SCALE

From 1 to 5.

Key to colour coding:

1	Not meeting critical requirements - should not be used
2	Not meeting relevant requirements - not recommended
3	Not meeting some requirements - should be reviewed carefully before use
4	Meets most requirements – can be recommended
5	Meets all requirements listed in this document

7.2 OFTP OVER INTERNET

7.2.1 COST

This is the cheapest solution overall, on the assumption that the vast majority of automotive suppliers already have OFTP capable software and a Public Internet connection. It would typically require no additional investment other than the time to set up the connection.

7.2.2 SECURITY

The Public Internet is inherently insecure and sensitive business data must be exchanged in a secure fashion. OFTP has no inbuilt security features and so should not be used over the Public Internet as a communications method. Some OEMs have allowed this, but it should not be seen as a strategic method.

7.2.3 RELIABILITY

A lot of companies will not have leased line Internet connections due to cost and so historically it has been suggested that connections such as ADSL, are not reliable. This is no longer the case and it is now viable for companies to obtain business ADSL connections with guarantees and SLAs.

7.2.4 IMPLEMENTATION

A Public Internet connection is readily available in all modern businesses. Due to its lack of security, implementing an OFTP solution in conjunction with the Public Internet is actually incredibly easy.

7.2.5 GLOBAL APPLICABILITY

Both OFTP and the Public Internet are available worldwide. All of the major, global EDI providers support OFTP and there are many communities outside of automotive that also use it. Thus OFTP over the Internet is a globally applicable solution, although it is widely understood that OFTP is being superseded by OFTP2.

7.2.6 CONCLUSION

OFTP over Internet provides for the lowest possible cost, but it lacks security and it is not an option for the future. Due to a complete absence of security in a world where demand for secure data exchange is constantly growing, OFTP over Internet should not be adopted for data exchange.

Cost	1	2	3	4	5
Security	1				
Reliability	1	2	3	4	
Implementation	1	2	3	4	5
Applicability	1	2			

7.3 OFTP OVER VPN

7.3.1 COST

The initial implementation of this solution can be relatively cheap due to routers becoming more affordable. The disadvantage is the additional overhead of maintaining the VPNs. A lot of companies have to outsource this as they do not have expertise in house. Managing VPNs can be a costly exercise unless an infrastructure already exists to support them.

7.3.2 SECURITY

Securing an insecure Public Internet connection by using a VPN is a tried and tested solution that has been available for many years.

7.3.3 RELIABILITY

A lot of companies will not have leased line Public Internet connections due to cost and so historically it has been suggested that connections such as ADSL, are not reliable. This is no longer the case and it is now viable for companies to get business ADSL connections with guarantees and SLAs.

7.3.4 IMPLEMENTATION

VPN is always based on a bilateral agreement between the communication partners. Usually, VPNs are hub-spoke architecture around the private, internal network of one company. Therefore VPN solutions may fulfil the purpose for the partner in the hub position, but can hardly be recommended when the spoke users have to connect to several of their business partners. Also, it might be difficult to find staff with experience of running the service. It is not a solution for communications with hundreds of partners.

7.3.5 GLOBAL APPLICABILITY

See above.

7.3.6 CONCLUSION

Using OFTP over VPN is not a suitable solution for large scale B2B file transfer with many partners.

Cost	1	2			
Security	1	2	3	4	
Reliability	1	2	3	4	
Implementation	1	2	3		
Applicability	1	2	3		

7.4 OFTP OVER ENX

7.4.1 COST

One-time charge consists of cost for OFTP software and cost of setting up ENX access; monthly charges for OFTP software maintenance may apply and costs also apply for ENX access. ENX access costs vary depending on bandwidth and service level. They always include the router hardware, required encryption certificates and management of the router. ENX accesses can be used for other applications besides file transfer. For these reasons, the cost benefit ratio of ENX access depends on the specific requirements of the customer.

7.4.2 SECURITY

The OFTP protocol provides for authentication and basic data integrity checks. ENX connections always use end-to-end encryption. ENX provides for standardized management of network configuration by Certified Service Providers and therefore protects from typical customer configuration errors. It should also be noted that ENX security extends to all network protocols used over the managed VPN, so it is independent of the application.

7.4.3 RELIABILITY

ENX access has a variety of service levels, ranging from simple, non-redundant connections utilizing the Public Internet to high availability dedicated accesses using redundant router pairs setup in different locations. ENX Service Level Agreements can apply to end-to-end partner connections on the network, even in a multi-provider situation. OFTP file transfer has been proven to be a highly reliable application in this context.

7.4.4 IMPLEMENTATION

As ENX is a managed security service, ENX access and communication partner connections ("tunnels") are set up by the Certified Service Provider, providing for ease of implementation.

7.4.5 GLOBAL APPLICABILITY

ENX connects more than 1600 companies worldwide. With the ANX-ENX interconnect and the ENX-over-Internet access type, network access is available in all countries. For most OEMs, it is one of multiple recommended access solutions for their external partner communications, and in many cases it is preferred over proprietary VPN solutions when multiple partner links are involved. As such, it is highly applicable to automotive use-cases.

7.4.6 CONCLUSION

This is a good option for partners who are already connected to ENX through OFTP, if it satisfies their business requirement, or when migrating away from ISDN or X25 and no software upgrade is desired.

Cost	1	2	3		
Security	1	2	3	4[12]	
Reliability	1	2	3	4	5[13]
Implementation	1	2	3	4	
Applicability	1	2	3	4	

[12] As data are transmitted over a managed VPN, this option provides security on the network layer, i.e. door-to-door. However, the features of end-to-end security (e.g. file signing and file encryption) are not supported – see also Chapter 8 - Security Considerations.

[13] If both partners are connected over dedicated ENX lines.

7.5 OFTP2 OVER INTERNET

7.5.1 COST

For most existing OFTP users, there is an initial investment necessary to upgrade their software to OFTP2, which varies from vendor to vendor. For those companies, who start with EDI or CAD data exchange, these costs occur anyway, independent of the network used.

Recurring maintenance costs may apply for software and for the use of digital certificates.

Public Internet is available in all companies and therefore there is usually no extra cost for this.

7.5.2 SECURITY

The Public Internet itself is not a secure network, but OFTP2 adds all the necessary security features to operate a file transfer protocol in the Internet domain.

7.5.3 RELIABILITY

It is not possible to apply SLA requirements end to end between partners. In practice there is a growing acceptance of Public Internet services for most automotive use-cases, with certain exceptions. Public Internet is available as a service from a large number of providers (ISPs). It is used for many applications, so its network infrastructure can be considered reliable enough for B2B exchanges by the majority of the stakeholders in the Automotive Industry.

7.5.4 IMPLEMENTATION

All companies already have a Public Internet connection, so all that is needed is to combine an Internet service with the implementation of OFTP2. OFTP has proven to be an easy to configure protocol. OFTP2 requires some additional work to set up and configure its security features.

7.5.5 GLOBAL APPLICABILITY

Both OFTP2 and the Public Internet are available worldwide. All of the major, global EDI providers support OFTP2. Thus OFTP2 over the Internet is a globally applicable solution.

7.5.6 CONCLUSION

OFTP2 has been designed for exactly this option. The specific needs of an automotive file transfer protocol are combined with a secure use of Internet technology at the lowest possible cost.

Cost	1	2	3	4	
Security	1	2	3	4[14]	
Reliability	1	2	3	4	
Implementation	1	2	3	4	
Applicability	1	2	3	4	5

7.6 OFTP2 OVER VPN

The comments here refer to the protocol aspects of using VPN, for other aspects of this option; please see “OFTP over VPN”.

7.6.1 COST

For most existing OFTP users, there is an initial investment necessary to upgrade their software to OFTP2, which varies from vendor to vendor. For those companies, who start with EDI or CAD data exchange, these costs occur anyway, independent of whether Public Internet or ENX is used.

Recurring maintenance costs may apply for software and certificates.

The main cost comes with the overhead of managing the VPNs, including infrastructure maintenance and keeping knowledgeable staff. It is hard to quantify these costs.

[14] Although all required features for data security are provided by the OFTP2 protocol, there is a remaining risk exposure of the server/gateway to the internet (e.g. denial of service attacks) – see Chapter 8- Security Considerations.

7.6.2 SECURITY

There can be no doubt that a solution that involves a secure communications protocol and a secure network layer is an incredibly secure solution. However, it could be argued that this level of security is unnecessary, especially given the high levels of security built into the OFTP2 protocol. It should also be noted that OFTP2 has additional security features that specifically take into account the needs of the Automotive Industry, such as encryption and signing of files.

7.6.3 RELIABILITY

This mainly depends on the network level and there is no significant difference in using OFTP or OFTP2 over VPN.

7.6.4 IMPLEMENTATION

VPN solutions have a low level of standardisation; bilateral agreements with communication partners are always needed. In addition, setting of parameters and testing by both parties is also needed, and it might be difficult to find staff with experience of running the service. It is not a solution for communications with hundreds of partners. OFTP2 has proven to be an easy protocol to configure. This solution would require more networking alterations to be made and so would not be as quick to set up, especially between just two trading partners.

7.6.5 GLOBAL APPLICABILITY

See Implementation above.

7.6.6 CONCLUSION

Using OFTP2 over VPN is not a suitable solution for large scale B2B file transfers with many partners.

Cost	1	2	3		
Security	1	2	3	4	5
Reliability	1	2	3	4	
Implementation	1	2	3		
Applicability	1	2	3	4	

7.7 OFTP2 OVER ENX

7.7.1 COST

For most companies, there is the initial cost of upgrading their EDI software to obtain OFTP2 functionality, which varies from provider to provider. Another cost element comes from the ENX connection. This is a monthly cost that varies significantly depending upon the connection speed. Whilst the cost will probably not be a barrier to the majority, it could be seen as an unnecessary cost by some companies when running OFTP2.

7.7.2 SECURITY

"Door-to-door" Security comes from the ENX level; additional "desk-to-desk" security is provided by the protocol level.

7.7.3 RELIABILITY

See OFTP over ENX.

7.7.4 IMPLEMENTATION

See OFTP over ENX.

7.7.5 GLOBAL APPLICABILITY

See OFTP over ENX.

7.7.6 CONCLUSION

For use-cases where a digital signature is needed and where non-repudiation is required (such as product data exchange) we strongly recommend OFTP2 in relations where OFTP over ENX is used.

If a relationship already exists over ENX, or if a trading partner requires ENX, OFTP2 over ENX is a good solution.

Cost	1	2			
Security	1	2	3	4	5
Reliability	1	2	3	4	5
Implementation	1	2	3	4	
Applicability	1	2	3	4	

7.8 AS2 OVER INTERNET

7.8.1 COST

There are many different AS2 solutions in the marketplace aimed at companies of all sizes. The competition has been very fierce and due to the retail heritage of AS2, the prices of solutions have been driven down significantly.

7.8.2 SECURITY

AS2 was one of the first protocols to solve the inherent security problems of the Public Internet. It does not however go as far as the needs of the Automotive Industry to provide extended security rather than just application to application security.

7.8.3 RELIABILITY

A lot of companies will not have leased line Internet connections due to cost and so historically it has been suggested that connections such as ADSL, are not reliable. This is no longer the case and it is now viable for companies to get business ADSL connections with guarantees and SLAs.

7.8.4 IMPLEMENTATION

Implementation is not a big issue since there are many solutions in the market place.

7.8.5 GLOBAL APPLICABILITY

AS2 has been rolled out around the world and is now used in many different industries outside of retail. It does not yet have a significant following in the Automotive Industry and its adoption is limited.

7.8.6 CONCLUSION

AS2 supports a number of necessary key features, but it also has some significant shortcomings from an Automotive Industry point of view. For more information see the chapter “Evaluation of solutions”. Even if there is some limited use of AS2 over the Internet in the Automotive Industry this solution is not seen as one of the major options.

Cost	1	2	3	4	5
Security	1	2	3		
Reliability	1	2	3	4	
Implementation	1	2	3		
Applicability	1	2	3	4	

7.9 AS2 OVER VPN

7.9.1 COST

Due to fierce competition, AS2 solutions are often very affordable. However, the hardware cost of implementing a VPN may be relatively cheap, but it is the additional overhead of maintaining the VPNs that makes this solution less affordable.

7.9.2 SECURITY

With the security features of AS2, further securing the communication with a VPN is probably unnecessary, but is possible. This combination still does not give file level security.

7.9.3 RELIABILITY

A lot of companies will not have leased-line Internet connections due to cost and historically it was suggested that the more common place connections such as ADSL, are not reliable. This is no longer the case and it is now viable for companies to obtain business ADSL connections with guarantees and SLAs.

7.9.4 IMPLEMENTATION

By further complicating the environment with a VPN, an already difficult to setup solution becomes even harder.

7.9.5 GLOBAL APPLICABILITY

AS2 has been rolled out around the world and is now used in many different industries outside of retail. It does not yet have a significant following in the Automotive Industry and its adoption is limited. Furthermore, the use of AS2 over a VPN, whilst possible, is almost unheard of.

7.9.6 CONCLUSION

This combination becomes an unnecessarily complicated solution and offers no additional benefits beyond AS2 over the Internet. It should not be considered as a solution for the Automotive Industry.

Cost	1	2	3		
Security	1	2	3	4	
Reliability	1	2	3	4	
Implementation	1	2			
Applicability	1	2	3		

7.10 AS2 OVER ENX

7.10.1 COST

Due to fierce competition, AS2 solutions are often very affordable. However the additional ongoing costs of ENX reduce the affordability of this solution.

7.10.2 SECURITY

With the security features of AS2, further securing the communication over ENX, although probably unnecessary, provides a high level of security. This combination still does not give file level security.

7.10.3 RELIABILITY

ENX connections typically come with guarantees about service level and so provide a level of reliability. With it being a managed service there is a high degree of confidence in this solution.

7.10.4 IMPLEMENTATION

Implementing AS2 is known to be slightly complicated and combining this with co-ordinating an ENX implementation makes this solution more difficult to implement than AS2 over the Internet.

7.10.5 GLOBAL APPLICABILITY

AS2 is widely used around the world. AS2 and ENX are not a combination that has ever been seen in the industry.

7.10.6 CONCLUSION

This becomes an unnecessarily complicated solution and offers no additional benefits beyond AS2 over the Internet. It should not be considered as a solution for the Automotive Industry.

Cost	1	2	3		
Security	1	2	3	4	
Reliability	1	2	3	4	5
Implementation	1	2	3		
Applicability	1	2	3	4	

8. SECURITY CONSIDERATIONS

Security is a very complex matter and consists of various aspects such as technical or organisational considerations to ensure the security of a solution. There is probably no 100% guaranteed level of security. Security measures are taken to reduce risks. It is part of each company's security policy and risk management to decide what risks have to be considered and then what is an acceptable remaining risk.

Also, there are at least two areas of concern. The first is connected to the reliability of the service or function – for example, damage is caused because an attack slows down or completely blocks the ability to transmit data. However, the integrity or confidentiality of data is not affected. The second area is related to confidentiality where the attacker tries to get access to confidential data.

To use the Public Internet for data transmission exposes the system to risks of the first type. Many vehicle manufacturers and large suppliers consider the Public Internet as reliable enough for their data exchange and probably have taken counter measures to avoid the consequences of these attacks. Other companies do not accept this residual risk and require their suppliers to use a managed VPN network to further reduce this threat.

On the other hand, business and design information are so important and valuable today that various companies require specific means of protection such as file encryption to cover the confidentiality, not only in the public area, but also in their internal domains. In addition, if information is transmitted through a relaying system they want to control its security through the various stages of transmission. For them the use of a standardised protocol which also enables file encryption is a necessity and this cannot be fulfilled with VPN or managed VPN network layer.

9. OVERALL CONCLUSIONS FROM A USER'S PERSPECTIVE

For the European Automotive Industry the OFTP family is the preferred file transfer protocol. Companies must make sure that their EDI or CAD software supports OFTP and OFTP2 (downwards compatibility of OFTP2 is included in the protocol specification and can be assumed as implemented in OFTP2 compliant solutions).

The use of OFTP2 over Public Internet is widely accepted by the industry stakeholders as a reliable, secure and most efficient way of data communication using IP technology.

However, if a customer requires ENX, then the company has to comply with their wishes. They may also consider continuing to use OFTP over ENX if they are already connected to ENX. Even in this situation they may have to invest in the OFTP2 over Internet solution because some of their partners would not accept ENX connections.

The observations in this document are aimed as a guide to help companies take decisions on their own file transfer needs according to the specific context and partner requirements. Taking these considerations into account, the use of the Internet with OFTP2 and/or ENX with OFTP is seen as the most appropriate solutions for the future:

- **Recommendation to use Internet with OFTP2 if business partners require it**. The use of OFTP2 over Public Internet is accepted by some industry stakeholders as a sufficiently reliable, secure and efficient way of file transfer using IP technology. It is therefore recommended as a possible solution for new implementations of automotive file transfer.

- **Recommendation to use ENX with OFTP if business partners require it.** Companies should also consider using OFTP or OFTP2 over ENX if they are already connected to ENX and/or if they require a solution that supports additional applications besides file transfer and /or if they require premium end-to-end SLAs for their network connection.

10. APPENDIX 1: QUESTIONS & ANSWERS

Guidelines are given assuming that standardised automated data exchange between trading partners is an efficient means of communication (compared with manual or semi-automatic methods).

When deciding on future directions for file transfer data exchange we believe the following questions are very important:

1. **What are the mandatory requirements from your trading partners (TPs)?**

   If your TP requires you to use a specific network service or protocol, you must implement that solution. However TPs often support several solutions and you should determine what fits your business best.

2. **What kind of data are you planning to exchange? (logistics, product data, etc.)**

   This question is also related to the frequency and volume of transfers. It is assumed that for logistics the volume is rather low with a few exceptions, but the frequency could be high. For CAD data the volume is mostly high or very high and the frequency is usually lower than for commercial EDI. In the future we can expect even higher volumes and frequencies.

   For low volume occasional commercial EDI usage in certain regions of Europe, ISDN is still an option, but IP based network services are preferable. If you want to transmit CAD data the volume of data clearly indicates the use of IP based networks.

   There are also communications protocol aspects that must be respected. For large volume exchange in the Automotive Industry we recommend the use of OFTP2 as this protocol has been designed to meet current and future automotive requirements.

   Other solutions are used by some companies, see answer to question 1.

3. **Are you the driver of this or is it your customer?**

   If your customer has certain requirements, your freedom of choice is very limited (see answer to question 1).

4. **Do you have a plan to increase volume of traffic, messages, partners etc?**

   If you only intend to connect to one business partner, a proprietary VPN connection to that partner might be sufficient. If you plan to have more than one partner, you should select a standardized solution. Regarding volume and frequency matters, see answer to question 2.

5. **Do you already have a bandwidth bottleneck in your infrastructure?**

5.1 Do you only use ISDN or X.25?

Consider migrating to an IP based network.

5.2 Do you use ENX?

Consider increasing your bandwidth for your ENX service or consider extending your infrastructure for data exchange through the Public Internet.

6. **Are you intending or even forced to improve your level of security/IT governance/compliance?**

IT governance and other compliance requirements must be respected of course. We recommend using the secure OFTP2 protocol over Public Internet or over secure ENX connections.

7. **Are your actions directly related to the closing down / reshaping of network services (ISDN/X.25)?**

You must switch to new solutions recommended by your trading partner. See also considerations in question 6.

8. **What is the reason for reviewing your strategy and what are the pain points?**

8.1 Are you concerned with new customer requirements?

See answer to question 1.

8.2 Are you concerned with network cost issues?

If you are using ISDN or X.25 the most cost effective network alternative is the Public Internet. However, you have to invest in an OFTP2 solution to maintain the necessary security. An alternative is the secure ENX network. The recurring cost of the network are higher than Public Internet (same bandwidth assumed), which is due to the higher service level and built in security. If you have a business partner that requires you to use OFTP2 you will have to invest in that solution anyway.

8.3 Are you concerned with network availability?

There are different service level agreements applicable to the various networks.

Also the Public Internet access is available at various service levels; you should make sure that the service you use is in line with your business case.

Nowadays Public Internet services fulfil the requirements for most automotive use-cases. However, an end to end connectivity service level cannot be given (as for ISDN/X.25) due to the technical structure of the Public Internet. This might be only a theoretical problem for your business, but for specific business processes that demand even higher level of availability, like some JIS (Just in Sequence) communications, other services like dedicated lines or ENX are alternatives.

9. **Are you concerned with having to cope with many communication protocols and networks?**

   Unfortunately the situation in the Automotive Industry is rather complex. Migrating to OFTP2 and IP based network services does not add complexity. It gives you the chance to be prepared for future requirements and has the built in potential to reduce present complexity by applying widely accepted standards.

10. **Are you investigating what to do in emerging markets?**

    IP based technologies are the only option for global coverage.

11. **Will OFTP2 replace ENX?**

    This is a question that many users in the European Automotive Industry are asking.

    The answer is No.

    It must be underlined that network and protocol cannot be compared! The fact is that:

    - OFTP2 can be used with the Public Internet and / or ENX
    - ENX is used for other applications than file transfers, e.g. :
      - Video conferencing
      - Collaborative development
      - Secure portal applications

11. APPENDIX 2: EXAMPLE OF A USE-CASE

In this section we give an example of a use-case and the requirements that could come from it.

11.1 SCENARIO: LOGISTICS FORECASTING, INSTRUCTIONS, DESPATCH ADVICE.

This table can help you identify your future requirements when preparing decisions that take into consideration your current and future business needs.

	OEM	Large Supplier, Logistics Provider	Medium Supplier	Small Supplier
Message Number per month	X.000.000	X.000.000	X0.000	X.000
Message Size	5-50 kb[15]	5-50 kb	5-50 kb	5-50 kb
Message Frequency Daily	5 – X00 per partner	1 – X00 depending on partner type	0 – X0 depending on partner type	0 – X
Cross-Border Exchange	Yes	Yes	Yes	Partly
ERP Integration	100% automated	100% automated	95% automated	80% automated
Trading Partner Integration	99% of production partner	OEMs: 100% 2nd tiers: 70%	OEMs: 100% 1st tiers: 100% 2nd tiers: 10%	OEMs: 100% 1st tiers: 50% 2nd tiers: 5%
Reliability Availability	Very high	Very high	Very high – high	High – medium
Number of Trading Partners	X.000	X.000	X00	X0
Bandwidth requirements / Throughput	Very high to ensure overall throughput, SLA critical	Very high to ensure overall throughput, SLA critical	Medium: OEMs have to be ensured by 100%	Low requirements
Cost requirements for communications	Relevant dimension	Relevant dimension	Normal	Small, but relevant in comparison to volume
Security	Medium, but increasing	Medium, but increasing	Medium	Low

[15] In some relations between OEMs and large suppliers message/file size could be much bigger, > 100 MB

Table 7: Scenario example: Logistics Forecasting, Instructions, Despatch advice.

11.2 OTHER SCENARIOS

Based on this example you might want to develop your own matrix of requirements. There are many other use-cases in automotive which are not described here. Requirements for data exchange solutions vary according to the particular scenario e.g.:

- JIS: Time critical process with high connectivity requirements
- e-Invoicing: Where specific legal requirements must be taken into account
- CAD-exchange: Where the high data volume is an important parameter

12. APPENDIX 3: GLOSSARY OF TERMS

ADSL	Asymmetric Digital Subscriber Line, see "DSL".
ANX	An IP based private communications network that offers standardised VPN services through certified Service Providers. Run by the American ANX eBusiness Corp.
AS2	Applicability Statement 2. A specification on how to transport data securely and reliably over the Internet. Security is achieved by using digital certificates and encryption. (Also RFC standard 4130).
B2B	Business to Business.
CAD / CAx	Computer-aided design. CAx, Computer-aided technologies, is a broad term describing the use of computer technology to aid in the design, analysis, and manufacture of products.
Certificate	A digital file issued to an individual or company by a Certificate Authority that contains the individual's or company's public encryption key and verifies the individual's or company's identity. Rigorous management of certificates (CRL, PKI, secure transmission when exchange of certificates....) is a key element of security of the communication channel on Internet.
Communications Protocol	A communications protocol is a formal description of digital message formats and the rules for exchanging those messages in or between computing systems and in telecommunications.
CSP	Certified Service Provider.
DSL	Digital Subscriber Line. A generic term categorizing services provided over copper wire. DSL subscribers may receive high speed Internet service and other services bundled with the DSL package. When a service provider or ISP offers Asymmetric Digital Subscriber Line (ADSL), the customer will receive a service that is not guaranteed to be the same speed in both directions.
EDI	Electronic data interchange. The structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention.

ENX	European Network Exchange. An IP based private communications network that offer standardised VPN services through certified Service Providers. Run by the European ENX Association.
FTP	File Transfer Protocol. A standard network protocol used to copy a file from one host to another over a TCP/IP-based network, such as the Public Internet. FTP is built on a client-server architecture and utilizes separate control and data connections between the client and server.
FTPS	FTP Secure or FTP-SSL. An extension to the commonly used File Transfer Protocol (FTP) that adds support for the Transport Layer Security (TLS) and the Secure Sockets Layer (SSL) cryptographic protocols.
HTTP	Hypertext Transfer Protocol. A networking protocol for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web.
HTTPS	Hypertext Transfer Protocol Secure. A combination of the HTTP with the SSL/TLS protocol to provide encrypted communication and secure identification of a network web server.
IETF	The Internet Engineering Task Force. IETF is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.
IP	Internet Protocol. Responsible for routing packets across network boundaries, it is the primary protocol that establishes the Internet.
ISDN **ISDN BRI** **ISDN PRI**	Integrated Services Digital Network. A digital telephone service that provides data transmission over existing copper telephone wiring. Basic Rate Interface. An ISDN BRI connection supports two 64 kbps B-channels and one 16 kbps D-channel over a standard phone line. BRI is often called "2B+D" referring to its two B-channels and one D-channel. The D-channel on a BRI line can even support low-speed X.25 data. Primary Rate Interface. Used primarily by large organizations with intensive communications needs. An ISDN PRI connection supports 30 64 kbps B-channels and one 64 kbps D-channel.
ISP	Internet Service Provider. A company that collects a monthly or yearly fee in exchange for providing the subscriber with Internet access.

JIS	Just in Sequence. A development of the JIT (Just in Time) concept where each component reaches the customer at the right time, in the right sequence, and in the appropriate version.
JNX	Japanese Automotive Network eXchange. An IP based private communications network that offer standardised VPN services through certified Service Providers. Run by the Japanese JNX Center.
LANs	Local Area Networks.
OEM	Original Equipment Manufacturer. In the Automotive Industry an OEM is normally a vehicle manufacturer.
OFTP	Odette File Transfer Protocol. Defined in 1986 by Odette, to address the electronic data interchange (EDI) requirements of the European Automotive Industry. OFTP allows business applications to exchange files on a peer to-peer basis in a standardized, purely automatic manner and provides a defined acknowledgement process on successful receipt of a file. Today the term "OFTP" normally refers to OFTP version 1.4.
OFTP2	OFTP2 version 1.0 of the OFTP protocol, also known as IETF RFC 5024. See also "OFTP".
PBX	Private Branch Exchange. A telephone exchange that serves a particular business or office.
RFC	Request for Comments. "RFCs" are Standard specifications published by IETF.
SFTP	SSH File Transfer Protocol. Designed by IETF as an extension of the Secure Shell protocol (SSH) to create a secure alternative to FTP.
SLA	Service Level Agreement. Part of a service contract where the level of service is formally defined.
TCP/IP	A set of communications protocols used for the Internet and other similar networks, also known as the Internet Protocol Suite. Named from two of the most important protocols in it: the Transmission Control Protocol (TCP) and the Internet Protocol (IP).
TP	Trading Partner.
VAN	Value-added Network. A hosted service offering that acts as an intermediary between business partners sharing standards based or proprietary data via shared Business Processes.

WAN	Wide Area Networks.
Web EDI	Web EDI enables small to medium-sized businesses to receive, turn around, create and manage electronic documents using just a web browser.
Web services	An application programming interface (API) that is accessed via HTTP and executed on a remote system, hosting the requested service.
VPN	A virtual private network () is a network that uses a public or private telecommunication infrastructure, such as the Internet, to provide remote offices or individual users with secure access to their organisation's network.
X.25	An ITU-T standard protocol suite for packet switched wide area network communication.
X.31	An ITU-T Recommendation for X.25 packet-mode services over ISDN.
X.400	An ITU-T standard Message Handling Service Protocol (MHS) for e-mail and document exchange.