GS1 Newcomers to AS2

Implementation Guide

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Table of Contents

1.   Introduction

1.1.   Purpose

AS2 (Applicability Statement 2) is a standard that describes how to move data securely and reliably over the Internet. GS1 recommends the AS2 protocol to its member community for secure exchange of GS1 XML messages and EDI transactions. AS2 provides a direct point-to-point message exchange between trading partners, compared with using an intermediate value added network (VAN) or service provider. AS2 is a rich and powerful protocol created to serve the needs of modern electronic commerce using the public internet.

This guide is designed to be an informative source to GS1 community members and their trading partners who are new to AS2 based communications. The guide will assist the reader to successfully implement AS2 within their enterprise network. It is not intended to be a tutorial on the AS2 protocol itself.

Many large enterprises have on-boarding programmes for their trading partners to help them setup AS2 connections. Additionally, they may have dedicated Technical Support services and channel partners to help trading partners with the AS2 setup process. This guide captures learning's from such industry leaders to share knowledge of AS2 communications setup and implementation to the benefit of newcomers to AS2.

Typically small and medium enterprises (SME's) do not have the necessary IT infrastructure, resources or budget to engage in a detailed AS2 programme with their trading partners. Quite often, they are mandated by the larger trading partner in the relationship to implement AS2 based communications within a short period of time. AS2 readiness is key to such SME's when doing business with most global multi-national corporations. This guide is designed to help such SME's establish successful connections with their AS2 ready trading partners.

1.2.   Audience

The intended audience of this guide is IT managers, Network Infrastructure managers and Application Support specialists who are trying to setup AS2 communications within their organizations. Additionally this guide will also help GS1 community members understand the basics of getting started with AS2.

2.   Overview of AS2

AS2 is a standard for Secure Business Data Exchange. It uses the Web's Hypertext Transfer Protocol (HTTP). AS2 is an extension of AS1 which was developed earlier. Both standards were created by the EDIINT work group of the Internet Engineering Task Force (IETF) which develops secure and reliable business communications standards.

Note that the AS2 standard only defines how to securely deliver data from one company (or end point) to another. AS2 does *NOT* include the translation or "mapping" of the data content (EDI, XML, etc.) from one format to another. Although the AS2 standard was originally focused on EDI data, any data content type such as XML, "flat files", or binary files is supported. While some AS2 products may include EDI translation, this functionality is completely separate from the AS2 standard.

The AS2 standard uses HTTP to transmit data over the public Internet. AS1 uses a slower protocol, SMTP (Simple Mail Transfer Protocol). The use of HTTP allows communication in real time rather than through e-mail delivery. Security, authentication, message integrity, and privacy are assured by the

use of encryption and digital signatures. Another important feature, non-repudiation, makes it difficult under normal circumstances for the intended recipient of a message to deny having received it.

The AS2 standard allows businesses to use a common, single communications solution. This eliminates the complications and costs involved when different businesses in a network use different transfer protocols. A Web server, an AS2 transfer engine, and digital certificates are required for data exchange using AS2. Almost any type of data can be transmitted.

An implementation of AS2 involves two machines, a client and a server, communicating with each other over the public Internet. At the operating system level, the AS2 client may be a server as well, offering its communication services to application software.

The client sends data to the server (e.g. a trading partner); on receipt of the message, the receiving application sends an acknowledgment or MDN (Message Disposition Notification) back to the sender.

2.1.   Advantages of AS2

The following are the direct benefits of using AS2:

- Allows event driven, real time delivery of data to the supply chain
- 24 x 7 availability
- Designed to push data securely and reliably over the public Internet
- Fast and reliable connectivity
- Encryption ensures that only the sender and receiver can view the data
- Digital signatures ensure authentication; only messages from authorized senders are accepted
- The use of a hash algorithm ensures data integrity by detecting whether the data was altered during transmission
- Provides non-repudiation, ensuring that the intended party did receive the data (receipt Non-Repudiation)
- Decreases turn-around time for business processes by real-time data transfer
- Reduces high phone bills by eliminating slower bi-sync connections
- Replaces out-of-date hardware and slow bisynchronous modems
- Elimination or reduction of Value-added network (VAN) costs
- Certification supports a level of confidence for the interoperability of the disparate software tools available for AS2 connectivity.

Additionally other business benefits are achieved as a result of engaging in automated data transfer using a robust communications protocol like AS2. As an example:

- **Buyer Benefits**
  - **Lower Inventory Levels**: Reductions in order-processing time can result in shorter delivery cycles.
  - **Quick Order Acknowledgment**: If a supplier cannot provide the product desired, the buyer can quickly seek an alternate supplier.
  - **Efficient Invoice Processing**: Time spent matching invoices to purchase orders and re-keying invoices into an accounts-payable system is reduced.
- **Supplier Benefits**

□ **Elimination of Problems and Delays Caused by Order-Entry Errors**: Manual order entry can result in errors in as many as 50% of all documents. Errors in order entry mean missed ship dates, shipment of wrong items or quantity and lower customer satisfaction.

□ **Personnel Reductions**: There are estimates that as much as 70% of all computer output becomes computer input. With electronic order processing, the supplier is relieved of the process of re-keying and verification of orders.

□ **Inventory Reductions**: Production schedules can be tuned more closely to customer demand, thereby reducing supplier inventory.

□ **Improved Cash Flow**: Time taken out of the invoicing/payment cycle improves the supplier's cash flow.

□ **Improved Customer Service**: Automated order processing benefits participants on both sides of the sales equation.

□ **Improved Sales Tracking**: Because orders are already in the system, analysis can take place in real time.

□ **Cost Savings**: One survey estimated that the cost of a manually prepared and transferred document to be about $40 and the cost of an electronic document to be only $2.10

2.2. Elements of an AS2 Data Transmission

■ **Store** - the repository where data (i.e. a document) resides

■ **Document Digest (Hash)** – the hashing algorithm creates the document's digest

■ **Signing** - the document digest is encrypted with the sender's private key to create a digital signature which is attached to the data

■ **Encryption** - both the signature and the data are encrypted for secure transport

■ **Sending** - the data is pushed to the intended recipient. (For example, if a retailer generates a purchase order, it is immediately pushed to the supplier, as opposed to mail boxing the data and waiting for the supplier to dial in and pick up the data.)

■ **Decryption** - the data and the digital signature are decrypted to create the unencrypted document and the sender's original hash

■ **Signature Verification** – the digital signature is verified to ensure it was sent from the expected sender

■ **Integrity Validation** – the unencrypted received data is hashed by the receiver and compared with the sender's hash to ensure that there were no alterations

■ **Signed Receipt** – the receiver's hash is encrypted with the receiver's private key to create a signed receipt which is attached to the successful (or unsuccessful) notification information.

■ **Return of MDN** - An MDN (Message Disposition Notification) is created from the signed receipt and notification and returned to the sender, acknowledging successful (or unsuccessful) receipt of the data by the receiver

■ **File Storage** - the decrypted file is delivered to the recipient's back end system for processing

■ **Verification of MDN Signature** - the MDN signature is verified by the original sender to ensure the initial recipient received the data

■ **MDN Processing** - the MDN is processed and verified indicating that the transmission was successful (or unsuccessful)

3. Getting Ready for AS2 Communications

3.1. Requirements for AS2 Communications

In order to get started with AS2 communications the following requirements will need to be met;

- An interoperable-tested AS2 software solution is required in order to upgrade to AS2 communications.

- AS2 software must be installed and configured to run with a web server. (Some EDIINT software solutions have a web server bundled with the software).

- An Internet connection with 24 x 7 availability

- A static IP address and dedicated firewall port(s)

- Business software solution that can communicate with the AS2 software used. Depending on the product chosen the business software solution (e.g.: GS1 XML, EDI) may have the AS2 communications software bundled together.

- Digital Certificates and Security considerations. This will be based on your company's policies and trading partner relationships. Most AS2 software solutions allow your company to create self-signed digital certificates.

- All necessary hardware. Hardware required for the AS2 communications will depend on combination of factors like; AS2 software requirements, IT Security and Network policies of your company, etc…

- Contingency plan for outages. It is very important to plan for outages and have procedures in place for backup internet connection, backup servers and 24 x 7 tech support services either from within your company or via service providers.

3.2. Choosing an AS2 Software Client

You may choose any AS2 solution which meets your business needs. Each of the products and ranges of functionality offered have their respective costs. GS1 strongly recommends that you use software that is interoperable certified by a third party certification authority. From time to time GS1 supports/sponsors certification programs for interoperable AS2 software. Check with your local GS1 Member Organization for a list of interoperable certified AS2 software or the AS2 certification authority.

The use of an AS2 software solution that supports the automated exchange of digital certificates is strongly recommended. This minimizes potential interruptions in exchanging data with your trading partners when a digital certificate expires (see sections 3.3, 3.7, and [CEM]).

Make sure that implementation assistance will be provided as part of the contract with your chosen AS2 software provider.

Once the appropriate AS2 software has been procured follow the installation and configuration options as explained in the product documentation.

3.3. Digital Certificates

A digital certificate is the electronic equivalent of an ID card such as a driver's license. Digital certificates use a technology called public key cryptography based on a matched pair of encryption and decryption keys called a public key and a private key. The certificate contains the public key and information such as the name of a person or an organization, their address, and so forth. The certificate is shared with AS2 trading partners, and the private key is kept securely by the certificate owner. AS2 requires the use of digital certificates so that trading partners can ensure that their AS2

communications have no eavesdroppers and that the each trading partner is "genuine" and not an impostor.

One aspect of digital certificates is that they expire, and a replacement certificate must be sent to your trading partner prior to the expiration date. Typically a digital certificate used for production data expires one to two years from the date it was created or issued. The reason for this is to greatly reduce the possibility that a malicious individual could derive a certificate's private key from its public key. While this scenario is extremely unlikely due to the vast number of combinations that would need to be calculated for the large keys used by AS2, it is still theoretically possible. No such case of deriving a private key used in AS2 has been discovered.

Since certificates need to be replaced, the use of AS2 software that supports the automated certificate exchange [CEM] standard is important to prevent potential outages and minimize manual effort in exchanging certificates with numbers of trading partners.

Digital certificates may either be purchased from trusted commercial certifying authorities or may be self-signed if bilaterally agreed between the sender and receiver. The type of digital certificate to be used will depend on your company's security policies and the trading partner relationships. It is very common to require the use of multiple and different types of digital certificates due to individual trading partner agreements and business relationships. The sources in the reference section provide additional in-depth detail on digital certificates, their usage and related security considerations.

3.4. Security

The AS2 communication can be secured at various levels in the transmission.

1. **Transport protocol layer** – The AS2 transmission can be secured via the use of HTTPS using SSL or similar security protocol

2. **Message Body** – The AS2 payload can be made secured further via the use of S/MIME security and encryption on the message body of the AS2 communication

3. **Business Payload** – Business processes may further dictate the used of digital signatures and encryption on specific parts of the business payload.

Depending on the security policies and mutual agreements the security algorithms, keys and digital certificates can be either the same or different for all the 3 options. These options must be assessed and agreed upon between the trading partners prior to engaging in AS2 communications.

The use of HTTPS adds more complexity to the AS2 setup process and results in additional barriers to implementation. HTTPS also requires additional resources for processing and may reduce AS2 server throughput times. It is recommended to weigh the costs vs. benefits before implementing HTTPS for AS2. However, if the AS2 Header fields (i.e. AS2-To and AS2-From fields, etc.) contain sensitive information; or it's desired to implement HTTP Basic Authentication, it is strongly recommended that HTTPS be used to prevent sensitive information from being sent in the open.

Also, if possible it is strongly recommended that you receive data on the ports commonly used for AS2:

▪ HTTP: port 4080

▪ HTTPS : port 5443

The use of these recommended ports over random/specific ports will simplify network configuration management and IT security policies. This will also improve your network security by reducing the number of open ports in your firewall. The use of random ports is one of the common problems in new AS2 implementations and as such should be avoided.

3.5. Testing

Once the AS2 software is installed, testing can begin. There are two basic methods to test your AS2 connections.

1. **Loopback Test** – with this method, your AS2 software performs both roles of the sending and receiving communications agent. In this method you configure your AS2 software to loopback the test message in a send and receive scenario. Some AS2 software will allow you to perform this form of basic testing. This method will allow you to properly test your AS2 configuration settings. The drawback of this method is that it will most likely not put your external communications and firewall settings to test as the test messages will never leave your enterprise network.

2. **Network Test** – with this method, you need to configure your AS2 software to connect to an outside receiving AS2 communications agent and an internal business application software. The test should simulate a real world business transaction using real business data from the business application. The test should both send and receive messages while interfacing with the business application software. This method will test the all aspects of your AS2 software installation in addition to the configuration settings. Most importantly it will test;

   □ The routing of the messages over the public internet

   □ Internal routing of messages to business applications

   □ Interoperability with other AS2 software

   □ Trading partner connections including send, receive and processing of digital certificates

   □ Network, security and firewall configuration

Loopback testing as described above has limited value because it will not test your network configuration for settings like DMZ, NAT, proxy, relay, etc. Also it will not test your data exchange end points. Additionally, AS2 software vendors will usually provide utilities that check your server for configuration correctness and also check your AS2 connection automatically reducing the need for a loopback test. However, it is strongly recommended that Network testing should be performed thoroughly and that the Loopback test should be performed only if required. The test can be performed either with a trusted partner, third party testing centres or your AS2 software provider. Most large corporations are likely to have test programmes in place. Check with your trading partner for any specifics required for testing including but not limited to configuration settings like IP Address, Identifiers, Digital Certificate type, etc …

It is important to differentiate between the testing of the AS2 connection and the testing of the Message structure (e.g. EDI/XML) or content. In addition to the AS2 communications, the content and the structure of the message should also be tested and approved by the appropriate business unit within the enterprise. (E.g. if implementing EANCOM, the INVOIC message should be tested and approved by the financial department and not only by the EDI department.)

Additionally, [X12] provides in-depth details on the following AS2 network tests;

- General Interoperability Testing
- Secure Message Testing
- Error Testing

3.6. Checking Readiness for Testing AS2 Communications

You are ready to test AS2 communications if you can check off all of the items listed below:

- Capability to accept and translate business application data (EDI, XML, etc …)
- AS2 software installed and configured to run with a web server (Web server, separate or bundled, also installed)
- An internet connection with 24 x 7 availability and a static IP address
- Successfully tested AS2 software with software provider
- Firewall rules in place to allow communications with testing partner

■ Exchanged digital certificates with your testing partner

3.7. Automated Certificate Exchange

Because AS2 uses digital certificates which expire, and replacement certificates must be exchanged between trading partners, a standard-based certificate exchange process is important. A number of AS2 software solutions have implemented functionality to automatically exchange replacement certificates prior to an existing certificate's expiration. A draft IETF standard called "Certificate Exchange Messaging for EDIINT" [CEM] defines that functionality.

CEM allows a company to automatically share a replacement certificate with their trading partners. The replacement certificate is encrypted and the exchange process builds on the existing certificate's secure trust relationship. The recipient partner's software may install a received certificate for immediate use. The recipient partner may however, choose to store the certificate in a "pending" status based on their individual security policies, and install the certificate at a later date.

AS2 software solutions which implement the CEM automatically detect whether a trading partner's AS2 software also supports the CEM. This approach allows data exchange with all AS2 software used by various trading partners.

3.8. AS2 Reliability

Because AS2 uses HTTP as a transport protocol, it generally provides an excellent quality of network reliability, but experience indicates that infrequently transient conditions can impact AS2 reliability. Some more recent versions of AS2 software have implemented functionality to help ensure that the AS2 protocol succeeds in exchanging business data payloads exactly once, using a draft IETF standard called "Operational Reliability for EDIINT AS2" [REL], The goals for AS2 Reliability are, first, that errors associated with HTTP server operation do not prevent delivering AS2 messages and, second, that retry or resending operations made to compensate for these errors do not result in the same message payloads being submitted for further processing more than once.

3.9. Going Live with AS2

Prior to connecting with Trading Partners, several activities typically take place. Some of the typical configuration parameters and activities are presented in the checklist below. The checklist will certainly not cover everyone's specific environment, security, topology, and software requirements, so partners are encouraged to communicate individual requirements as soon as possible.

#	Parameter	Options	Examples
1	**AS2 Server** Either IP address & port number or URL	Inbound IP address	192.168.1.1
		Inbound Port number	5443, 4080
		Outbound IP address	192.168.1.1
		Outbound port number	typically assigned dynamically
		Inbound URL	http://test.gs1.org:5443/as2
		Outbound URL	http://test.gs1.org:4080/as2
2	**AS2 Header** The version of AS2 being used and the mutually agreed upon identifiers to be used with the fields in the AS2 Header. As an	AS2-Version	1.1
		AS2-To	GS1-AS2-Test-Instance-1, MB10000006583 0012463794567

#	Parameter	Options	Examples
	example, the names may represent particular Mailbox or Queue in the system, file name or GLN, depending on your trading partner relationship or business process.	AS2-From	GS1-AS2-Test-Instance-2, MB10000004172 00470038774890
3	**Digital Certificates** Information about the digital certificates used in the AS2 communications. The digital certificate contains information regarding the public/private keys used in for securing the AS2 transmission Trading partner may also communicate the method used to exchange the digital certificates. Currently, the draft "Certificate Exchange Message (CEM) for EDIINT' for automated exchange of digital certificates is recommended. *Note: The key lengths depend on the algorithm selected.*	Certificate type	X.509
		Self-signed / Trusted 3rd party	Self-signed
		Root CA (Certificate Authority)	VeriSign, Thawte, Entrust, Comodo, GoDaddy
		Certificate Class	Class 1 - 5
		Signature hash algorithm	SHA1
		Signature key length	1024 , 2048
		Encryption algorithm	3-DES, RC-2, AES
		Public/Private Encryption key length	1024 , 2048
		Certificate validity period	Minimum 1 yrs and maximum 5 yrs
		Certificate Exchange Method	CEM for EDIINT, automatically bi-lateral
4	**Symmetric Key** The one-time session symmetric key encryption and lengths	Key length	168 bits , 192 bits, 256 bits
		Encryption method	RC-2, 3-DES, AES

#	Parameter	Options	Examples
5	**HTTPS security** Parameters to secure HTTP transmission	HTTPS	SSL 2.0 128-bit
		HTTP Basic Authentication (Username / Password) [rarely used]	GS1 / ********
6	**Message disposition notification** MDN options	MDN required (Yes /No)	Yes
		Signed (Yes/No)	Yes
		Synchronous / Asynchronous	Asynchronous
7	**Technical contact details** Contact details for operational backup	Name	John Doe
		Email	john.doe@gs1.org
		Telephone Number	+1 (609) 620-0200
8	**Business payload** The syntax format of the actual business payload being exchanged	EDI	EANCOM 2002 INVOIC D01B ASC X12 EDI 850 & 810 version 003040
		XML	GS1 BMS Catalogue Item Synchronization v2.2 GS1 BMS Invoice v2.3

Once all the required information has been exchanged the following activities may be performed;

- Establish firewall rules for inbound and outbound HTTP to and from AS2 servers
- Register partner certificates in stores used by AS2 server
- Configure partner profiles in AS2 server
- Configure partner profiles in back-office applications

A sample form requesting such information from a trading partner has been provided for illustration purposes in Appendix A.

4.   References

In addition to this guide for newcomers to AS2, the documents referenced below provide excellent detailed guidelines on AS2 implementation. These user guides provide in-depth technical details on the following aspects of AS2;

- Usage of AS2 protocol – concepts and configuration
- Architectures for implementing AS2
- Guidelines for use of AS2 with GS1 XML standards and supported EDI standards
- AS2 security considerations and usage of digital certificates
- Recommendations from GS1 Europe EDIINT forum for AS2 implementations in Europe

1. "EDIINT AS1 and AS2 Transport Communication Guidelines - Issue 1, Feb-2006" by John Duker and Jin Chun

This document defines the EDIINT AS1 and AS2 Transport Communication Guidelines used by companies participating in e-Commerce using the GS1 published XML, EANCOM, I/C, UCS, and VICS data format standards.

http://www.gs1.org/docs/gsmp/EDIINT_AS1_AS2_Transport_Comm_Guide_i1.pdf

2. "EDIINT AS1 and AS2 User Guide – Version 1.1, 2006-08-01" by the GS1 Europe EDIINT Forum, a network of Western European Member Organizations of GS1

This document aims to provide both a functional overview and a technical framework for the implementation of the EDIINT protocols.

http://www.gs1.eu/?page=&tudasbazis=60&lister=8

3. [X12] "Guideline on Implementing EDIINT for Secure and Reliable Internet Transport of Messages" by X12C, the Communications and Controls Subcommittee of ANSI ASC X12

ANSI ASC X12 Guideline on Implementing EDIINT for Secure and Reliable Internet Transport of Messages. Provides a comprehensive "cross-industry" guide to recommended parameters and settings in software compliant to the IETF standards of EDIINT AS1, AS2, and AS3.

The guideline is available by ordering online via www.x12.org, click on Publication & X12 Standards under Quick Links and click on the EC/EDI Publications tab.

4. [CEM] "Certificate Exchange Messaging for EDIINT"

This draft IETF standard defines how to automatically exchange replacement digital certificates with other AS2 trading partners. This can remove the potential for interruptions in data exchange due to expired certificates, and eliminate the manual effort needed to coordinate the installation of replacement certificates.

The draft standard is available at:
https://datatracker.ietf.org/public/idindex.cgi?command=id_detail&id=12703

5. [REL] "Operational Reliability for EDIINT AS2"

This draft IETF standard aims to improve AS2 reliability by defining approaches to achieve a "once and only once" delivery of messages. The draft standard describes some ways to compensate for exceptions and enhance the reliability of AS2 protocol operation.

The draft standard is available at:
https://datatracker.ietf.org/public/idindex.cgi?command=id_detail&id=13578

Also, the actual AS2 standard itself can be found at;

- "MIME-Based Secure Peer-to-Peer Business Data Interchange Using HTTP, Applicability Statement 2 (AS2)", RFC 4130

http://www.ietf.org/rfc/rfc4130.txt

For AS2 implementation in RosettaNet, the following guide may be referenced;

- "Multiple Messaging Services (MMS) Profile for AS2"

This document defines the RosettaNet Multiple Messaging Services profile for AS2. The Profile provides guidance and best practices about how to use the AS2 message system to transport RosettaNet PIP business messages between trading partners.

http://rosettanet.org/cms/export/sites/default/RosettaNet/Downloads/MMS/MMS_AS2_Profile_R01_00_00A.pdf

Appendix A

Using a form like the one illustrated below, trading partners engaging in AS2 communications can exchange vital AS2 server configuration information.

AS2 - Trading Partner Implementation

Trading Partner Customer Details

Customer Name:

Customer Address:

Contact Details

Technical contacts

Name		Name	
Telephone		Telephone	
e-mail		e-mail	
Office Hours Telephone		Office Hours e-mail	
After Hours Telephone		After Hours e-mail	

Trading Partner AS2 Software

AS2 Compliant Software Vendor

Is Software Drummond Certified   Yes   No

Test AS2 Specifications (if applicable)
Test AS2 Identifier

Test Interchange ID

Test URL Destination

Test IP address you send from

If no MDN received from company, TP will

Production AS2 Specifications
Production AS2 Identifier

Production Interchange ID

Production URL Destination

Production IP address you send from

If no MDN received from company, TP will