ASSESSMENT SUMMARY v1.0.0

Advanced Message Queuing Protocol (AMQP)[1]

Organization for the Advancement of Structured Information Standards (OASIS)[2]

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[1] AMQP Specification: http://docs.oasis-open.org/amqp/core/v1.0/amqp-core-complete-v1.0.pdf

[2] OASIS: https://www.oasis-open.org/

Change Control

Modification	Details
Version 1.0.0	
Initial version	

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1. INTRODUCTION

The present document is a summary of the assessment of the **AMQP** carried out by CAMSS using the CAMSS Assessment EIF scenario[3]. The purpose of this scenario is to assess the compliance of a standard or specification with the European Interoperability Framework (EIF)[4].

2. ASSESSMENT SUMMARY

Advanced Message Queuing Protocol (AMQP) is an open standard application layer protocol for message-oriented middleware. The defining features of AMQP are message orientation, queuing, routing (including point-to-point and publish-and-subscribe), reliability and security.

AMQP ensures that messaging providers and clients from different vendors are interoperable, like SMTP, HTTP, and FTP. Unlike earlier middleware standardisations focused on programmer interaction (e.g., JMS), AMQP aims at interoperability between multiple implementations, such as Microsoft Azure Bus, RabbitMQ and among others.

In a European context, AMQP is used in the Data Management Working Group's DERA 2.0[5] module to enable communication between system components, ensuring they can exchange information and coordinate actions. This communication layer is essential for keeping an open and standardised protocol and format. A data connector can establish communication within the data space ecosystem, ensuring interconnectivity across different domains and sectors.

AMQP originated in 2003 by John O'Hara at JPMorgan Chase in London. It was designed collaboratively from mid-2004 to mid-2006, leading to the formation of a working group with various firms, including Cisco Systems and Red Hat. The group expanded to twenty-three companies, such as Bank of America and Goldman Sachs. It became an ISO and IEC International Standard[6] in April 2014. AMQP is widely applicable beyond financial services to various middleware problems.

2.1. EIF Interoperability Principles

***The specification supports the principles setting context for EU actions on interoperability*:**

- **Subsidiarity and proportionality**
  Advanced Message Queuing Protocol is only included in the Catalogue of the Member State of France. The *Référentiel général d'interopérabilité*[7] (RGI) currently has AMQP "under observation",

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[3] CAMSS Assessment EIF Scenario: https://ec.europa.eu/eusurvey/runner/CAMSSAssessmentEIFScenario6

[4] Isa2 programme web site : https://ec.europa.eu/isa2/eif_en

[5] European (energy) data exchange reference architecture 3.1: https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/working-groups/data-management

[6] IEC International Standard (ISO/IEC 19464) : https://www.iso.org/standard/64955.html

[7] Référentiel général d'interopérabilité[7] (RGI) :

https://www.numerique.gouv.fr/uploads/Referentiel_General_Interoperabilite_V2.pdf

meaning that if the experiments prove conclusive, it will be included in a later version of the "General Interoperability Framework Status Explanation" as "recommended". The specification has been included within the catalogue of a Member State with a middle-lower performance than said in the Digital Public Administration NIFO[8] factsheets.

The specification supports the principles setting context for EU actions on interoperability:

- **Openness**
  AMQP is a binary protocol for reliable business message exchange. The OASIS AMQP Technical Committee (TC)[9] oversees its development, welcoming stakeholder input and feedback. The AMQP License Agreement grants developers a broad set of rights to encourage widespread distribution and implementation of AMQP. This license holds specific provisions to give companies the unambiguous right to implement and licenses to any necessary patents held by AMQP Working Group firms.

  AMQP 1.0 is used in applications like Azure Service Bus[10] and Red Hat AMQ[11] for reliable data delivery and real-time integration, including IoT. Furthermore, the standard is supported by the OASIS AMQP TC and is an ISO and IEC International Standard (ISO/IEC 19464).

- **Transparency**
  AMQP does not enable or scope the visibility of administrative procedures, rules data, and services. However, it defines a standard message format with properties and sections for structuring data, which supports interoperability when exchanging information with public administration services. This format enables public administration services to structure and exchange information in a clear and organized manner, which is an important prerequisite for building transparent systems and easing the open sharing of data. The sections and properties within AMQP messages allow for the inclusion of metadata and content that can contribute to the understanding, traceability, and integrity of exchanged information, thereby supporting transparency at the data exchange level.

- **Reusability**
  AMQP specification is designed to be implemented and used across various business domains, easing the reliable exchange of messages between parties. Its versatility comes from

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[8] National Interoperability Framework Observatory Factsheets:

https://interoperable-europe.ec.europa.eu/collection/nifo-national-interoperability-framework-observatory/digital-public-administration-factsheets-2024

[9] OASIS AMQP TC: https://www.oasis-open.org/committees/amqp/charter.php

[10] Microsoft Azure Service Bus: https://azure.microsoft.com/en-us/products/service-bus

[11] Red. Hat AMQ: https://www.redhat.com/en/technologies/jboss-middleware/amq

characteristics like its symmetric protocol, interoperable data representation, and flexible messaging layer.

- **Technological neutrality and data portability**
  The AMQP specification is technology-agnostic and platform-agnostic, ensuring reliable information exchange between diverse systems. It allows for partial implementations, enabling adaptation to specific use cases. A notable implementation is RabbitMQ[12], which supports various operating systems and platforms and provides messaging through multiple protocols.

  AMQP offers customisation of messages and connections, including custom data types, filtering, and capabilities negotiation. The type of system ensures consistent data exchange across different systems, promoting flexibility and interoperability.

The specification supports the principles related to generic user needs and expectations:

- **User-centricity**
  Assuming data is kept, the AMQP specification promotes information reuse through filter sets to efficiently reuse relevant information. Filter sets in AMQP offer a mechanism for granular and targeted information retrieval. This capability becomes a powerful tool for information reuse, allowing multiple consumers with diverse needs to efficiently access specific subsets of the data without redundant transmission of irrelevant information.

- **Inclusion and accessibility**
  The purpose of AMQP does not enable the e-accessibility. Therefore, this criterion is not applicable to this specification.

- **Privacy**
  AMQP establishes authenticated and encrypted transport using security layers like TLS[13] and SASL[14], which can be tunnelled together for both functions. The specification also restricts access to data through security layers such as filters and hostname verification (e.g., SASL Init for client authentication). The level of data access is determined by the specification's implementer. However, there is no evidence that AMQP addresses privacy aspects in any initiative.

- **Security**
  The AMQP specification enables secure data exchange and processing using TLS and SASL for authenticated and encrypted transport. While it does not guarantee authenticity or protection against unauthorised changes, it offers mechanisms like Hostname Verification and SASL Init for

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[12] RabbitMQ: https://www.rabbitmq.com/

[13] Transport Layer Security: https://www.rfc-editor.org/rfc/rfc8446.html

[14] Simple Authentication and Security Layer (SASL): https://www.rfc-editor.org/rfc/rfc4422.html

authentication. The specification also does not ensure data processing accuracy. However, SASL authentication helps find client access levels.

- **Multilingualism**
AMQP specification can be used in a multilingual context. AMQP uses IETF[15] language tags. These tags are used to specify the language of informational text, including connection, session, and link error descriptions but implementations should understand at least the en-US language tag.

The specification partially supports the foundation principles for cooperation among public administrations:

- **Administrative Simplification**
AMQP participates in European data spaces and digital transformation initiatives, easing data sharing, interoperability, and efficient transport. It provides a secure, reliable internet protocol for high-speed transactional messaging and is approved as ISO/IEC 19464:2014.

  Furthermore, the integration of AMQP into a major cloud platform's IoT hub, such as Microsoft Azure Service Bus[16]. shows the protocol's practical value in enabling reliable, secure, and interoperable communication within complex IoT deployments.

- **Preservation of information**
AMQP specification allows systems to send and receive messages securely and efficiently. Once a message is successfully delivered and acknowledged, AMQP can remove it from the queue. This means that the data does not linger indefinitely, which helps in managing resources efficiently.

- **Assessment of effectiveness and efficiency**
AMQP specification includes mechanisms for assessing its efficiency and effectiveness, proved through various assessments, such as Choice of Effective Messaging Protocols for IoT Systems: MQTT, CoAP, AMQP and HTTP by Nitin Naik[17], real-world scenarios, and products. Numerous sectors, such as telecommunications, defence, manufacturing, internet, and cloud computing, use AMQP. Notable examples include Deutsche Börse, VMware, and Mozilla. Additionally, AMQP is employed in products like Microsoft's Azure Service Bus and IBM's MQlight, highlighting its widespread adoption.

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[15] Internet Engineering Task Force: https://www.ietf.org

[16] Microsoft Azure Service Bus: https://learn.microsoft.com/en-us/azure/service-bus-messaging/service-bus-amqp-overview

[17] Choice of Effective Messaging Protocols for IoT Systems: MQTT, CoAP, AMQP and HTTP:
https://pure.port.ac.uk/ws/portalfiles/portal/12197128/IoT_Messaging_Protocols_Naik.pdf

2.2. EIF Interoperability Layers

The interoperability model which is applicable to all digital public services includes:
- Four layers of interoperability: legal, organisational, semantic and technical;
- A cross-cutting component of the four layers, 'integrated public service governance';
- A background layer, 'interoperability governance'.

The Specification supports the implementation of digital public services complying with the EIF interoperability model:

- **Interoperability governance**

  AMQP can be found in the EIRA Library of Interoperability Specifications (ELIS) under the "Data Exchange" ABB in the Technical Application View. Solace provides an AMQP Protocol Conformance Validation Tool to validate AMQP implementations. AMQP is recommended by France, though it is currently "under observation" in the *Référentiel général d'interopérabilité* (RGI).

  AMQP is highly involved in the Harmonised Turbulence project, delivering turbulence forecast information for air traffic in Europe. The message consists of a binary GRIB2 file retrieved via AMQP 1.0 subscription. Additionally, AMQP is used in the Data Management Working Group project within the DERA 2.0 Communication Layer module, providing a secure and reliable exchange protocol.

  AMQP is included in the StandICT[18] European catalogue of standards and is recommended by France.

- **Legal Interoperability**

  AMQP specification is not a European Standard. However, the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC) recognized the importance of this protocol and its wide application in the industry, leading to its designation as an International Standard (ISO/IEC 19464:2014) in 2014.

- **Organisational interoperability**

  AMQP allows different organisations to interconnect their systems seamlessly, enabling reliable and efficient message exchange between disparate systems, regardless of the underlying technology or platform. AMQP can also be integrated into a larger Business Process Management (BPM) system, enabling asynchronous communication and message queuing to orchestrate and automate business processes more efficiently.

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[18] AMQP StandICT Reference: https://standict.eu/standards-repository/information-technology-advanced-message-queuing-protocol-amqp-v10

- **Semantic Interoperability**

  AMQP enables different organisations to interconnect their systems seamlessly, by ensuring that messages can be exchanged reliably and efficiently between disparate systems, regardless of the underlying technology or platform used by each organisation.

3. ASSESSMENT RESULTS

This section presents an overview of the results of the CAMSS assessments for **AMQP**. The CAMSS "Strength" indicator measures the reliability of the assessment by calculating the number of answered (applicable) criteria. On the other hand, the number of favourable answers and the number of unfavourable ones is used to calculate the "Automated Score" per category and an "Overall Score".

Category	Automated Score	Assessment Strength	Compliance Level
EIF Principle setting the context for EU actions on interoperability	60/100 (60%)	100%	Essential
Core interoperability principles	1580/1700 (93%)	100%	Seamless
Principles related to generic user needs and expectations	1140/1200 (95%)	100%	Seamless
Foundation principles for cooperation among public administrations	420/500 (84%)	100%	Seamless
Interoperability layers*	920/1000 (92%)	100%	Seamless
Overall Score	3520/3900 (90%)[19]	100%	

The technical interoperability layer is covered by the criteria corresponding to the core interoperability principle ''Openness''.

With an 100% of assessment strength, this assessment can be considered representative of the specification compliance with the EIF principles and recommendations.

The Overall Automated Score of 90% (3520/3900) demonstrates that the specification supports the European Interoperability Framework in the domains where it applies.

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[19] See the "results interpretation" section of the CAMSS Assessment EIF Scenario Quick User Guide:

https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/solution/camss-assessment-eif-scenario/results-visualisation-and-interpretation