Abstract

The JSON Web Encryption JSON Serialization (JWE-JS) is a means of representing encrypted content using JavaScript Object Notation (JSON) data structures. This specification describes a means of representing secured content as a JSON data object (as opposed to the JWE specification, which uses a compact serialization with a URL-safe representation). It enables the same content to be encrypted to multiple parties (unlike JWE). Cryptographic algorithms and identifiers used with this specification are described in the separate JSON Web Algorithms (JWA) specification. The JSON Serialization for related digital signature and HMAC functionality is described in the separate JSON Web Signature JSON Serialization (JWS-JS) specification.

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1. Introduction

The JSON Web Encryption JSON Serialization (JWE-JS) is a format for representing encrypted content as a JavaScript Object Notation (JSON) [RFC4627] object. It enables the same content to be encrypted to multiple parties (unlike JWE [JWE].) The encryption mechanisms are independent of the type of content being encrypted. Cryptographic algorithms and identifiers used with this specification are described in the separate JSON Web Algorithms (JWA) [JWA] specification. The JSON Serialization for related digital signature and HMAC functionality is described in the separate JSON Web Signature JSON Serialization (JWS-JS) [JWS-JS] specification.

1.1. Notational Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in Key words for use in RFCs to Indicate Requirement Levels [RFC2119].

2. Terminology

This specification uses the same terminology as the JSON Web Encryption (JWE) [JWE] specification.

3. JSON Serialization

The JSON Serialization represents encrypted content as a JSON object with members for each of four constituent parts: a headers member whose value is a non-empty array of Encoded JWE Header values, an encrypted_keys member whose value is a non-empty array of Encoded JWE Encrypted Key values, a ciphertext member whose value is an Encoded JWE Ciphertext value, and an integrity_values member whose value is a non-empty array of Encoded JWE Integrity Value values. The number of elements in each of the arrays MUST be the same.

Unlike the compact serialization used by JWEs, content using the JSON Serialization MAY be encrypted to more than one recipient. Each recipient requires:

- a JWE Header value specifying the cryptographic parameters used to encrypt the JWE Encrypted Key to that recipient and the parameters used to encrypt the plaintext to produce the JWE Ciphertext; these values are represented as Encoded JWE Header values that are elements of the non-empty array contained in the headers member.
- a JWE Encrypted Key value; these values are represented as Encoded JWE Encrypted Key values that are corresponding elements of the non-empty array contained in the encrypted_keys member.
- a JWE Integrity Value that ensures the integrity of the Ciphertext and the parameters used to create it; these values are represented as Encoded JWE Integrity Value values that are corresponding elements of the non-empty array contained in the integrity_values member.

Therefore, the syntax is:
The contents of the Encoded JWE Header, Encoded JWE Encrypted Key, Encoded JWE Ciphertext, and Encoded JWE Integrity Value values are exactly as specified in JSON Web Encryption (JWE) [JWE]. They are interpreted and validated in the same manner, with each corresponding headers, encrypted_keys, and integrity_values value being created or validated together. The arrays MUST have the same number of elements.

The i'th JWE Encrypted Key value and the i'th JWE Integrity Value are computed using the parameters of i'th JWE Header value in the same manner described in the JWE specification. This has the desirable result that each Encoded JWE Encrypted Key value in the encrypted_keys array and each Encoded JWE Integrity Value in the integrity_values array are identical to the values that would have been computed for the same header and payload in a JWE, as is the JWE Ciphertext value.

All recipients use the same JWE Ciphertext value, resulting in potentially significant space savings if the message is large. Therefore, all header parameters that specify the treatment of the JWE Ciphertext value MUST be the same for all recipients. In particular, this means that the enc (encryption method) header parameter value in the JWE Header for each recipient MUST be the same, as MUST be the iv (initialization vector) value (when required for the algorithm).

4. Example JWE-JS

This section contains an example using the JWE JSON Serialization. This example demonstrates the capability for encrypting the same plaintext to multiple recipients.

Two recipients are present in this example: the first using the RSAES-PKCS1-V1_5 algorithm to encrypt the Content Master Key (CMK) and the second using the AES Key Wrap algorithm to encrypt the CMK. The Plaintext is encrypted using the AES CBC algorithm to produce the JWE Ciphertext. The two Decoded JWE Header Segments used are:

```json
{"headers": [
  "eyJhbGciOiJSU0ExXzUiLA0KICJlbmMiOiJBMjU2Q0JDIiwNCiAiaW50IjoiSFMyNTYiLA0KICJpdiI6IlJ6LW1XXzRKSgZnIlwNCiAieDV0IjoiN25vT1BxLWhKM9qQ52Vg2SWWzSTJ30VEwIn0",
  "eyJhbGciOiJFQ0RILUVTIiwNCiAiZW5jIjoiUi9ST0lNQkcyCii0vVxU0hQ0ZgIn0",
],
"encrypted_keys": ["<key 1 contents>"],
"ciphertext": "<ciphertext contents>",
"integrity_values": ["<value 1 contents>"],
"alg": "RSA1_5",
"x5t": "7noOPq-hJ1_hCnvWh6IeY1w9Q0",
"enc": "A128CBC",
"iv": "79_Pv6-fj39vX08_Lx8A",
"int": "HS256"}
```

and:

```json
{"headers": [
  "eyJhbGciOiJSU0ExXzUiLA0KICJlbmMiOiJBMjU2Q0JDIiwNCiAiaW50IjoiSFMyNTYiLA0KICJpdiI6IlJ6LW1XXzRKSgZnIlwNCiAieDV0IjoiN25vT1BxLWhKM9qQ52Vg2SWWzSTJ30VEwIn0",
  "eyJhbGciOiJFQ0RILUVTIiwNCiAiZW5jIjoiQi9ST0lNQkcyCii0vVxU0hQ0ZgIn0",
],
"encrypted_keys": ["<key 2 contents>"],
"ciphertext": "<ciphertext contents>",
"integrity_values": ["<value 2 contents>"],
"alg": "A128KW",
"enc": "A128CBC",
"iv": "79_Pv6-fj39vX08_Lx8A",
"int": "HS256"}
```

The complete JSON Web Encryption JSON Serialization (JWE-JS) for these values is as follows (with line breaks for display purposes only):

```json
{"headers": [
  "eyJhbGciOiJSU0ExXzUiLA0KICJlbmMiOiJBMjU2Q0JDIiwNCiAiaW50IjoiSFMyNTYiLA0KICJpdiI6IlJ6LW1XXzRKSgZnIlwNCiAieDV0IjoiN25vT1BxLWhKM9qQ52Vg2SWWzSTJ30VEwIn0",
  "eyJhbGciOiJFQ0RILUVTIiwNCiAiZW5jIjoiQi9ST0lNQkcyCii0vVxU0hQ0ZgIn0",
  "eyJhbGciOiJSU0ExXzUiLA0KICJlbmMiOiJBMjU2Q0JDIiwNCiAiaW50IjoiSFMyNTYiLA0KICJpdiI6IlJ6LW1XXzRKSgZnIlwNCiAieDV0IjoiN25vT1BxLWhKM9qQ52Vg2SWWzSTJ30VEwIn0",
  "eyJhbGciOiJFQ0RILUVTIiwNCiAiZW5jIjoiQi9ST0lNQkcyCii0vVxU0hQ0ZgIn0",
],
"encrypted_keys": ["<key 1 contents>", "<key 2 contents>"],
"ciphertext": "<ciphertext contents>",
"integrity_values": ["<value 1 contents>", "<value 2 contents>"],
"alg": "RSA1_5", "A128KW",
"x5t": "7noOPq-hJ1_hCnvWh6IeY1w9Q0", "79_Pv6-fj39vX08_Lx8A",
"enc": "A128CBC", "A128CBC",
"iv": "79_Pv6-fj39vX08_Lx8A", "79_Pv6-fj39vX08_Lx8A",
"int": "HS256", "HS256"
```
5. IANA Considerations

This specification makes no requests of IANA.

6. Security Considerations

The security considerations for this specification are the same as those for the JSON Web Encryption (JWE) [JWE] specification.

7. Open Issues

[[ to be removed by the RFC editor before publication as an RFC ]]

The following items remain to be considered or done in this draft:

- Complete the example.
- Track changes that occur in the JWE spec.

8. References

8.1. Normative References


8.2. Informative References


Appendix A. Acknowledgements

JSON serializations for encrypted content were previously explored by JSON Simple Encryption [JSE] and JavaScript Message Security Format [I-D.rescorla-jsms].

Appendix B. Document History

[[ to be removed by the RFC editor before publication as an RFC ]]

-00

- Renamed draft-jones-json-web-encryption-json-serialization to draft-jones-jose-jwe-json-serialization to have "jose" be in the document name so it can be included in the Related Documents list at http://datatracker.ietf.org/wg/jose/. No normative changes.

draft-jones-json-web-encryption-json-serialization-02

- Updated examples to track updated algorithm properties in the JWA spec.
- Tracked editorial changes made to the JWE spec.

draft-jones-json-web-encryption-json-serialization-01

- Tracked changes between JOSE JWE draft -00 and -01, which added an integrity check for non-AEAD algorithms.

draft-jones-json-web-encryption-json-serialization-00

- Created the initial version incorporating JOSE working group input and drawing from the JSON Serialization previously proposed in draft-jones-json-web-token-01.

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