JSON Web Proofs
Initial Drafts

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Overview

JSON Web Proofs

What it is

- A new container format, in the family of JOSE containers (JWS, JWE, **JWP**)
- Aims to support newer algorithms and cryptographic techniques for new privacy-preserving applications such as "anonymous credentials" use cases
- Establish the role of a *holder*, which has limited capabilities to derive new restricted messages from an original issued message
- Enables messages that can still be cryptographically verified but not correlated when presented to different verifiers

JSON Web Proofs

What it is

Examples of capabilities an algorithm *may* support include:

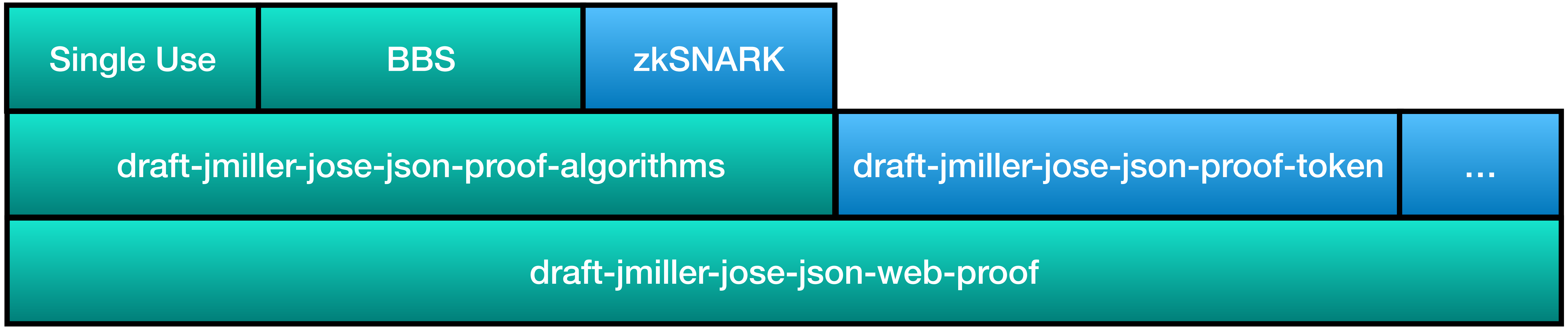
- Selectively disclose a subset of information to the verifier
- Multiple uses of a proof without correlation from underlying cryptography
- Answer a predicate without disclosing the data used for evaluation
- Proof of possession

JSON Web Proofs

History

- Early 2021 - Initial ideas circulated in the OpenID Connect SIOP community by Jeremie Miller and David Waite
- Mid 2021 - Decided the effort needed incubation before any standards org, was adopted as a DIF work item in their Applied Crypto WG
- Late 2021 / Early 2022 - Regular meetings and many discussions resulting in the initial -00 drafts with much guidance and input from Mike Jones
- Mid 2022 - Recognition that the work constituted a notable advancement of the JOSE family to support Zero-Knowledge Proofs and related privacy structures

JSON Web Proof Specifications


Single Use
BBS
zkSNARK
draft-jmiller-jose-json-proof-algorithms
draft-jmiller-jose-json-proof-token
…
draft-jmiller-jose-json-web-proof

JWP Design Factors

Adopt W3C Verifiable Credentials Terminology

Issuer, Holder, and Verifier

- Large community with a common understanding of the three roles
- Makes it easier to talk about the privacy primitives based on each role

Issuer - Signs the message

Holder - Holds and presents the message

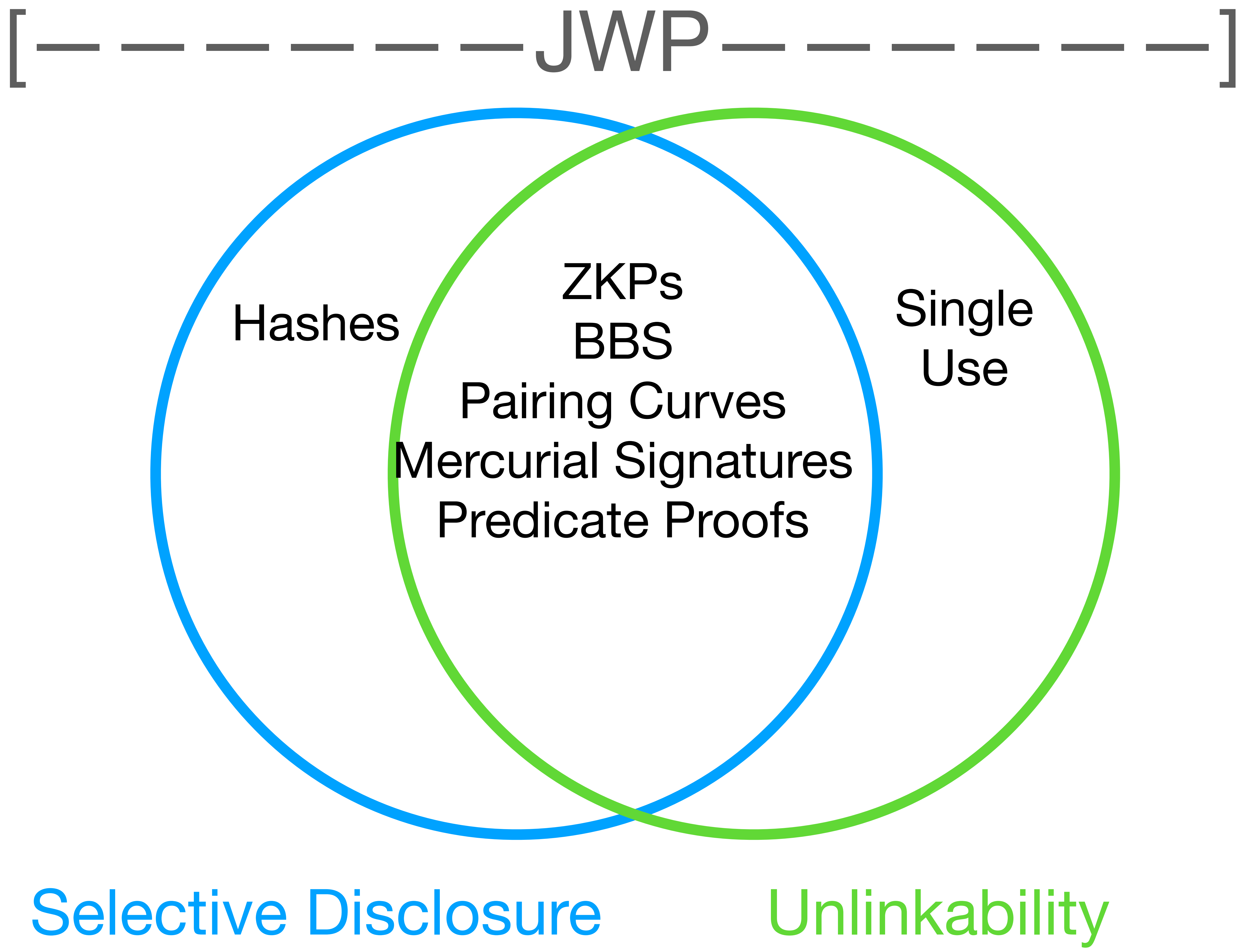
Verifier - Verifies the message

Two Interrelated Privacy Features

Selective Disclosure & Unlinkability

- **Selective Disclosure** - capability for the holder of a message to reveal only a subset of that message while maintaining its verifiability
  - The issuer divides the message into disclosable subsets
  - The holder creates a presentation that is the selected subset
- **Unlinkability** - ensuring nothing inherently links one presented message with another
  - Easy - the issuer can generate single-use messages with different signatures
  - Hard - the holder can present a single message multiple times by generating a unique proof for each verifier

Relationship



KISS

Advanced crypto is already hard enough

- Strove to adhere to the principle “*What would JOSE do?*”
- Core JWP draft is minimal container formatting only
- Support techniques adoptable today (Single-Use, Hashes)
- Support new signature types with necessary capabilities (BBS)
- Remain flexible to support more advanced crypto as it evolves (DL-PoK, ZKPs, Mercurial, predicates, verifiable compute, etc)

Comparison of JWP and JWS

Classic JSON Web Signature

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.
eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM.
SflKxwRJSMeKKF2QT4fwpMeJf36POk6yJV_adQssw5c

Classic JSON Web Signature

eyJhbGciOiJIUz

Protected Header

cCI6IkpXVCJ9.

eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZ

Payload

SI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM.

SflKxwRJSMeKKF2QT4fwpMeJf36POk6

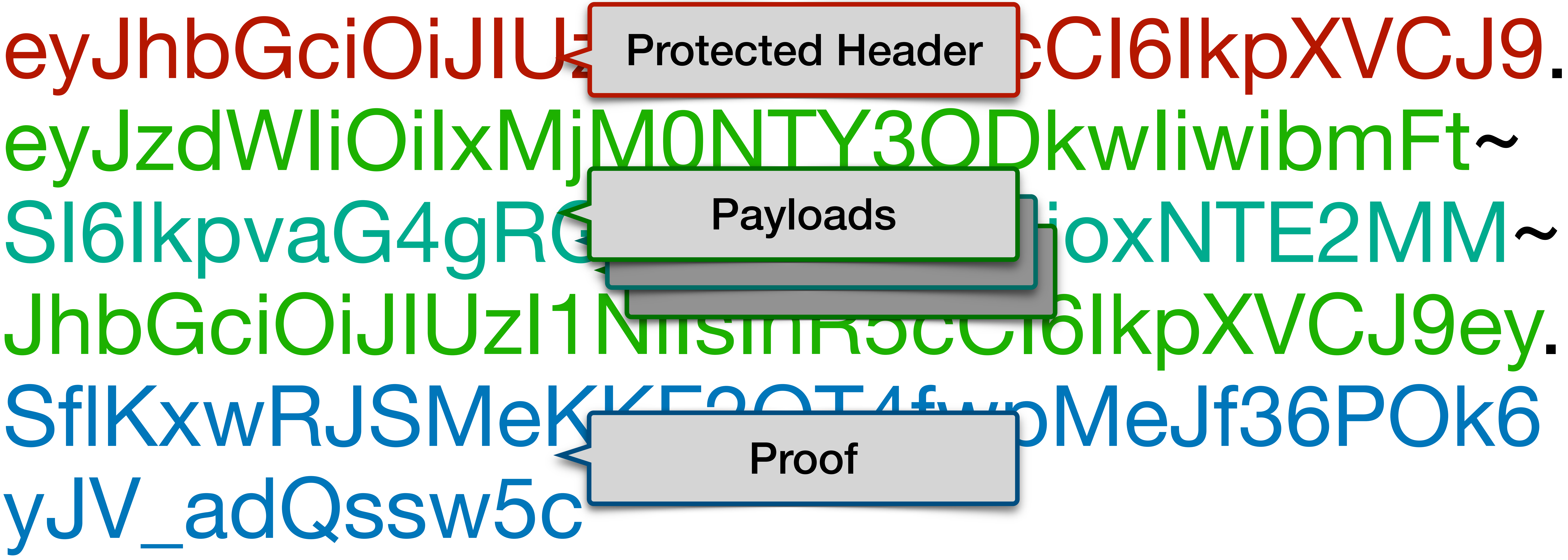
Signature

yJV_adQssw5c

JSON Web Proof

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.
eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFt~
SI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MM~
JhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9ey.
SflKxwRJSMeKKF2QT4fwpMeJf36POk6
yJV_adQssw5c

JSON Web Proof



eyJhbGciOiJIUz cCI6IkpXVCJ9.
eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFt~
SI6IkpvaG4gRG ioxNTE2MM~
JhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9ey.
SflKxwRJSMeKKF2QT4fwpMeJf36POk6
yJV_adQssw5c

JSON Web Proof

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.
eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZ
~~.SflKxwRJSMeKKF2QT4fwpMeJf36P
Ok6yJV_adQssw5c

Two Omitted Payloads

Links

https://www.ietf.org/archive/id/draft-jmiller-jose-json-web-proof-00.html

https://www.ietf.org/archive/id/draft-jmiller-jose-json-proof-algorithms-00.html

https://www.ietf.org/archive/id/draft-jmiller-jose-json-proof-token-00.html