# Refactored AC Lib

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# Refactored AC library Overview (1/2)

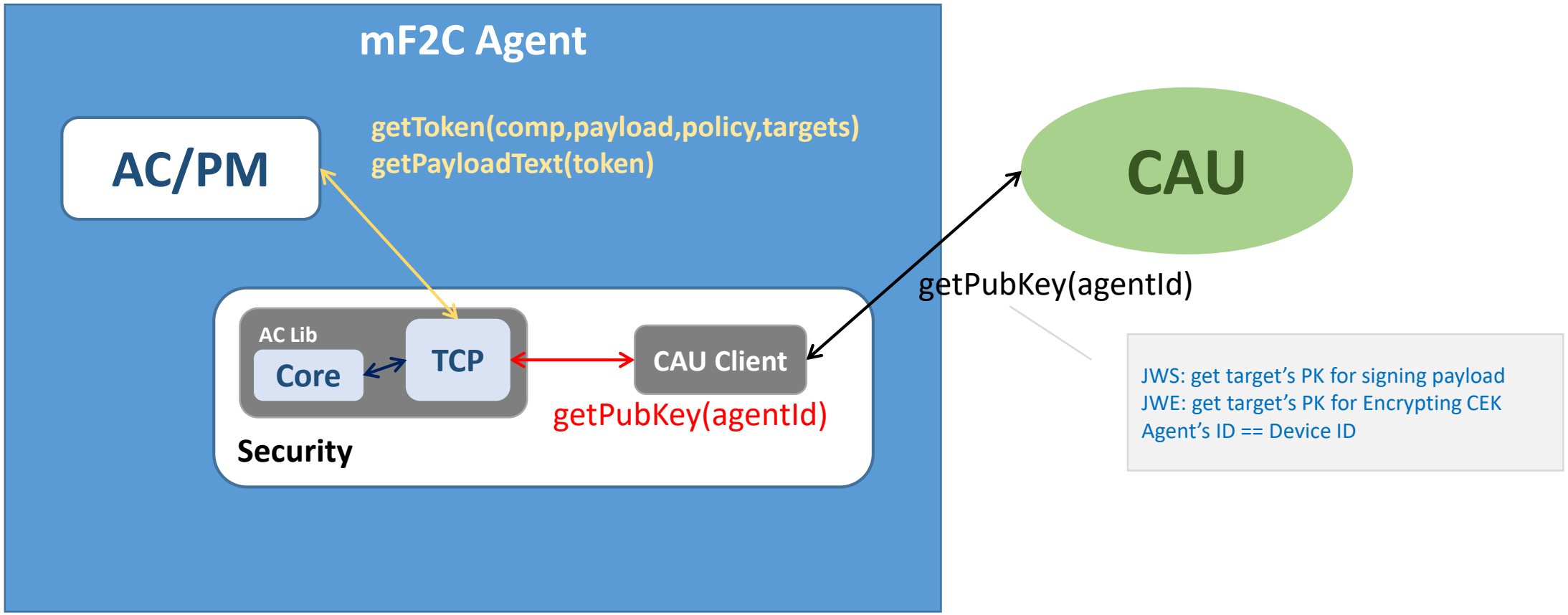
**Key features**

- Light-weight JAVA implementation, dependent on JRE native security and JOSE4J (NO bouncycastle)
- Leverage mF2C PKI and CAU security middleware
- Communication with AC Lib is via existing private Docker's network

**Objective**

- Implement mF2C security policy for message protection (D2.5):
  - public - for data not requiring protection
  - Protected - for data which needs to be integrity protected but is not confidential
  - Private - for data which needs both integrity and confidentiality protection

# Refactored AC library Overview (2/2)



# Input/Output to/from the AC Lib (1/2)

## GetToken : Input An UTF8 encoded Json String

“sec”:”pub”,
“comp”:”t”,
“recs”:{“rec1”,”rec2”,”rec3”},
“payload”:”payload plaintext”

security policy : public, protected, private
plaintext payload compression flag : true, false
*recipient/s : (comma-separated list of Agent IDs)
payload : plaintext payload

“\n”

!!! Important!!! Terminate input by sending EOF signal

* Only required for Private messages.

UTF8({/”sec/”, /”pri/”, /”comp/”:/”f/”, /”recs/”:{[/”rec1/”, /”rec2/”]}, /”payload/”: /”plaintext/”})

## GetToken : Output a Base64Url encoded String representation of the Token

eyJhbGciOiJub25lIiwidHlwIjoiSk9TRSIsIm1mMmMtc2VjIjoicHVibGljIiwibWYyYy10bXNwIjoiMTU1MzYwMzgyODcyNCIsIm1mMmMtc2VuZGVyIjoiMGY4NDhkOGZiNzhjYmU1NjE1NTA3ZWY1YTE5OGY2NjBhYzg5YTNhZTAzYjk1ZTc5ZDRlYmZiMzQ2NmMyMGQ1NGU5YTVkOWI5YzQxZjg4Yzc4MmQxZjY3YjMyMjMxZDMxYjRmYWRhOGQyZjlkZDMxYTRkODg0NjgxYjc4NGVjNWEiLCJtZjJjLWFjbGliIjoiMS4wIn0.V2VsbCwgYXMgb2YgdGhpcyBtb21lbnQsIHRoZXkncmUgb24gRE9VQkxFIFNFQ1JFVCBQUk9CQVRJT04hICtEbyB5b3UgcmVhbGx5IGNhcmU_ICBJIGRvbid0LiBUaGUgc2lsdmVyIGZveCBxdWlja2x5IGp1bXB0ZWQgb3ZlciB0aGUgZmVuY2UuICBBcyBsb25nIGFzIGl0IGRvZXNuJ3QgZWF0IG15IGNoaWNrZW5zLi4uLkl0IGNhbiBnbyBhcyBpdCBpdCBwbGVhc2VzLiA6RA
.

**(See slides on token specifications )**

# Input/Output to/from the AC Lib (2/2)

## GetPayLoadText : Input the Token String (see token specifications)

eyJhbGciOiJub25lIiwidHlwIjoiSk9TRSIsIm1mMmMtc2VjIjoicHVibGljIiwibWYyYy10bXNwIjoiMTU1MzYwMzgyODcyNCIsIm1mMmMtc2VuZGVyIjoiMGY4NDhkOGZiNzhjYmU1NjE1NTA3ZWY1YTE5OGY2NjBhYzg5YTNhZTAzYjk1ZTc5ZDRlYmZiMzQ2NmMyMGQ1NGU5YTVkOWI5YzQxZjg4Yzc4MmQxZjY3YjMyMjMxZDMxYjRmYWRhOGQyZjlkZDMxYTRkODg0NjgxYjc4NGVjNWEiLCJtZjJjLWFjbGliIjoiMS4wIn0.V2VsbCwgYXMgb2YgdGhpcyBtb21lbnQsIHRoZXkncmUgb24gRE9VQkxFIFNFQ1JFVCBQUk9CQVRJT04hICtEbyB5b3UgcmVhbGx5IGNhcmU_ICBJIGRvbid0LiBUaGUgc2lsdmVyIGZveCBxdWlja2x5IGp1bXB0ZWQgb3ZlciB0aGUgZmVuY2UuICBBcyBsb25nIGFzIGl0IGRvZXNuJ3QgZWF0IG15IGNoaWNrZW5zLi4uLkl0IGNhbiBnbyBhcyBpdCBwbGVhc2VzLiA6RA
.

“\n” !!! Important!!! Terminate input by sending EOF signal

## GetPayLoadText : Output the payload plaintext (on success)

"Well, as of this moment, they're on DOUBLE SECRET PROBATION!  Do you really care?  I don't.  The silver fox quickly jumpted over the fence.  As long as it doesn't eat my chickens.... It can go as it pleases. :D"

## GetPayLoadText : Output error code

“err1” : integrity error for JWE and signed JWS
“err2” : credential error for JWE
“err3” : other errors

# Token specifications:

Both are formatted as a 3-part JWS Compact Serialization (RFC7515) String

## Public Message (Unsigned JWS)

BASE64URL(UTF8(JWS Protected Header)) || ‘.’ ||
BASE64URL(JWS Payload) || ‘.’ ||

eyJhbGciOiJub25lIiwidHlwIjoiSk9TRSIsIm1mMmMtc2VjIjoicHVibGljIiwibWYyYy10bXNwIjoiMTU1MzYwMzgyODcyNCIsIm1mMmMtc2VuZGVyIjoiMGY4NDhkOGZiNzhjYmU1NjE1NTA3ZWY1YTE5OGY2NjBhYzg5YTNhZTAzYjk1ZTc5ZDRlYmZiMzQ2NmMyMGQ1NGU5YTVkOWI5YzQxZjg4Yzc4MmQxZjY3YjMyMjMxZDMxYjRmYWRhOGQyZjlkZDMxYTRkODg0NjgxYjc4NGVjNWEiLCJtZjJjLWFjbGliIjoiMS4wIn0
.
V2VsbCwgYXMgb2YgdGhpcyBtb21lbnQsIHRoZXkncmUgb24gRE9VQkxFIFNFQ1JFVCBQUk9CQVRJT04hICtEbyB5b3UgcmVhbGx5IGNhcmU_ICBJIGRvbid0LiBUaGUgc2lsdmVyIGZveCBxdWlja2x5IGp1bXB0ZWQgb3ZlciB0aGUgZmVuY2UuICBBcyBsb25nIGFzIGl0IGRvZXNuJ3QgZWF0IG15IGNoaWNrZW5zLi4uLkl0IGNhbiBnbyBhcyBpdCBpdCBwbGVhc2VzLiA6RA
.
dMg8-IZuk3Fo5R0nC1cOznWdRnapL63opAT-DKmJKixE_Yi_c0aA9JnggZ2o2g5O1sFO1-SlhOsbDD1oMaf2xuthSSm0ASmORxtNkFerGxCzdpbVWQejZnfJtO-vSYsXpoBtMSZlwN0pnUdJ3yJMa7xpGGS8Y4N15OLn-oz2Gs5ZBr0VqkR_Fg0LnrOcK1EY4nEkJtYNEzwpeJx2DsMC3h_KsQqxzFZHu0es3rFsr-e9nMAuN65sNKaTsLN_I_-CbPIB2Q3JYda0cT1QpkhLeW9MCC_E_aJ-vrNRcLk2iO035lNcITFLOkWTng2fNbdKVlYMjPUD8ikr12No7KCmhA.

## Protected Message (signed JWS)

BASE64URL(UTF8(JWS Protected Header)) || ‘.’ ||
BASE64URL(JWS Payload) || ‘.’ ||
BASE64URL(JWS Signature)

eyJhbGciOiJSUzI1NiIsImtpZCI6IjFjNTE2NDY2LTRiZjAtNDRiNC04NDcwLWYzOGYxZjNkZmM3ZiIsInR5cCI6IkpPU0UiLCJtZjJjLXNlYyI6InByb3RlY3RlZCIsIm1mMmMtdG1zcCI6IjE1NTM2MDQyOTUyNDQiLCJtZjJjLXNlbmRlciI6IjBmODQ4ZDhmYjc4Y2JlNTYxNTUwN2VmNWExOThmNjYwYWM4OWEzYWUwM2I5NWU3OWQ0ZWJmYjM0NjZjMjBkNTRlOWE1ZDliOWM0MWY4OGM3ODJkMWY2N2IzMjIzMWQzMWI0ZmFkYThkMmY5ZGQzMWE0ZDg4NDY4MWI3ODRlYzVhIiwibWYyYy1hY2xpYiI6IjEuMCJ9
.
V2VsbCwgYXMgb2YgdGhpcyBtb21lbnQsIHRoZXkncmUgb24gRE9VQkxFIFNFQ1JFVCBQUk9CQVRJT04hICtEbyB5b3UgcmVhbGx5IGNhcmU_ICBJIGRvbid0LiBUaGUgc2lsdmVyIGZveCBxdWlja2x5IGp1bXB0ZWQgb3ZlciB0aGUgZmVuY2UuICBBcyBsb25nIGFzIGl0IGRvZXNuJ3QgZWF0IG15IGNoaWNrZW5zLi4uLkl0IGNhbiBnbyBhcyBpdCBpdCBwbGVhc2VzLiA6RA
.
dMg8-IZuk3Fo5R0nC1cOznWdRnapL63opAT-DKmJKixE_Yi_c0aA9JnggZ2o2g5O1sFO1-SlhOsbDD1oMaf2xuthSSm0ASmORxtNkFerGxCzdpbVWQejZnfJtO-vSYsXpoBtMSZlwN0pnUdJ3yJMa7xpGGS8Y4N15OLn-oz2Gs5ZBr0VqkR_Fg0LnrOcK1EY4nEkJtYNEzwpeJx2DsMC3h_KsQqxzFZHu0es3rFsr-e9nMAuN65sNKaTsLN_I_-CbPIB2Q3JYda0cT1QpkhLeW9MCC_E_aJ-vrNRcLk2iO035lNcITFLOkWTng2fNbdKVlYMjPUD8ikr12No7KCmhA.

- Unsigned JWS with empty signature part

Example Protected Headers (with compression element set and additional metadata [in blue] set by AC Lib) :

{"zip":"DEF","alg":"none","typ":"JOSE","mf2c-sec":"public","mf2c-tmsp":"1553603681877","mf2c-sender":"0f848d8fb78cbe5615507ef5a198f660ac89a3ae03b95e79d4ebfb3466c20d54e9a5d9b9c41f88c782d1f67b32231d31b4fada8d2f9dd31a4d884681b784ec5a","mf2c-aclib":"1.0"}

# Token specifications:

Single recipient JWE is formatted as a 5-part JWE Compact Serialization (RFC7516) String

Multi-recipient JWE are formatted as a general Json serialization (RFC7516) String

## JWE (Compact)

BASE64URL(UTF8(JWE Protected Header)) || ‘.’ ||
BASE64URL(JWE Encrypted key) || ‘.’ ||
BASE64URL(JWE Initialization Vector) || ‘.’ ||
BASE64URL(JWE Ciphertext) || ‘.’ ||
BASE64URL(JWE Authentication tag)


eyJhbGciOiJSU0ExXzUiLCJlbmMiOiJBMTI4Q0JDLUhTMjU2Iiwia2lkIjoiNGYwNTBlNTQtZmI3Zi00MDNjLTgwNzItNmQzMWEzN2ZhMWFiIiwidHlwIjoiSk9TRSIsIm1mMmMtc2VjIjoicHJpdmF0ZSIsIm1mMmMtdG1zcCI6IjE1NTM2MTEzOTI2MzQiLCJtZjJjLXNlbmRlciI6IjBmODQ4ZDhmYjc4Y2JlNTYxNTUwN2VmNWExOThmNjYwYWM4OWEzYWUwM2I5NWU3OWQ0ZWJmYjM0NjZjMjBkNTRlOWE1ZDliOWM0MWY4OGM3ODJkMWY2N2IzMjIzMWQzMWI0ZmFkYThkMmY5ZGQzMWE0ZDg4NDY4MWI3ODRlYzVhIiwibWYyYy1hY2xpYiI6IjEuMCJ9
.
SNRdIlgBgYmm90uRLf-vxIyJGfGfhAtgIsCJS4oQfAZAEom56pO3rPQWg1zFpAbwSZluq5G4Fqyr-POUKnC1o24aRYAgRPD1xxqtHiOaxkQz-HDI9MuFfBXo74LCstYt2hC1CWRO-rloZR7ionpcQFDgDSwsaUHNl9Lzro28uhqoHPACfyHXRc84lpEZMRPLiVfchA4jJfzsNKrLzx3VLzQZ4GduPJIbrfs9a1eclYp8NLBZ2q06Bd1tYRLydoEz1nzFXxxf8ukvXR8TE2bO1-5c7LCvNARO9u3yKUsykuGccxRQ0FS9YDHdh-ATSDWEB1GhhZYWzQV-rNBtRmaj1A
.
zC93BaSlY1kp02TY2yTg4g
.
cOydbXGdiJDff2t5vldDxhfiXE7qrP3KlW3OonwIhL0GtZr1_E-c3hot7mfxhsCdZxYpkGqUFUR8fTxsVXSkrPYC3Fatl3W1ll85mjt58nYmX4cwX0e5Hj7oK_svruGiE8-wUBXka89bh9Y4-0LWTQMq00R6lhi6qDiEkY1f8GfhLehlUa8aZnvfwDLaJGA0Y8YbkiyNt1saXNhU4VqgkNlTsKtDUBVIxsf_WprBWYN7IODsJBOYuudqw-t8EgHG7nrmUxmNk8zOJuWT2C05J9pLV_ATAqmRpkDeD2V69cM
.
FILX3vcNLaZSKclXApCt7w


## Json JWE (General)


{"protected":"eyJtZjJjLWFjbGliIjoiMS4wIiwiYWxnIjoiUlNBMV81IiwiZW5jIjoiQTEyOENCQy1IUzI1NiIsInR5cCI6Impzb24iLCJtZjJjLXNlYyI6InByaXZhdGUiLCJtZjJjLXRtc3AiOiIxNTUzNjA5NjYxMTM2IiwibWYyYy1zZW5kZXIiOiIwZjg0OGQ4ZmI3OGNiZTU2MTU1MDdlZjVhMTk4ZjY2MGFjODlhM2FlMDNiOTVlNzlkNGViZmIzNDY2YzIwZDU0ZTlhNWQ5YjljNDFmODhjNzgyZDFmNjdiMzIyMzFkMzFiNGZhZGE4ZDJmOWRkMzFhNGQ4ODQ2ODFiNzg0ZWM1YSJ9“,
"recipients":[{"header":{"alg":"RSA1_5","kid":"2b82208a-d3ba-49c9-b46a-d99dc0ebb121"},"encrypted_key":"CDARNQMIC0Oq0EdP2BsBQTyjNS5ZtFSVnor-Q6EejWy0Ax6cgaF4cEiQrTa3DJx3nzbkW5GCcAXVRMOBKfianjdrcJ2zMlj-0hREPeOZRtePsdBafGQtcc4ZlfG7O_u8LaFzM78lZMP6eGeDbwRdb-G4fiXKc7oGHYL6ibAnyemHWBipQEf44CwoDWV582gMrGgJTvhzzPt6hJ7gKywjMcFPnhZYmNjLKubZN8kKvG9kqX4f6O2zUL3ijQr5jbbNR0vjam6cGFHI_tSbA0eCVMWOPBS6j6HgPfFej-c0fK0igCvuw8pNnjeOgRrh-aodry-yMMDEkC23p1555eoEoQ"},{"header":{"alg":"RSA1_5","kid":"4cacae66-5357-4d81-b108-de0e17aa7a72"},"encrypted_key":"RH2VyFsQtP2A2LxqB7kLAH4NMfqYOxibXE5maBWUXoRE08nBAjLKsZCH56WnTOg9JY8tkve5w2A1DhQmMQIcSxJCAau2P_O2Hcg8wLXqvb1MuiV5oQVQq5h3yBoMwp5SlvO2xFMi__63XK4BuiftbCpUy7OdujutRnUlO7h7PyeXauDNQ-JAe-R9FMd1E2P31m-qXStdhk2Lm2fGaQ5PLYTzzxbV_m2NblBQ2OHbaufQJ81-Zh1KEHCO7TJTHHHgBcWq_n6kId6Ux11al6oXmwwcXnGc8RsRcF8RlXNRdvU5hdW7-GvlgnTzo4z61ejd_WhU0yLgKFWk7ANiEuoGfg"},{"header":{"alg":"RSA1_5","kid":"885626b6-0bdf-4931-957c-7392abfa4a9f"},"encrypted_key":"UdUmedv1L63tUMfsh-BVVU6n3vYt4AxkPBHAzx5Tal_kDUDHkwJuab053igy7BlVn7qjcwFLcXbVrZGo4u1UdGIxYqY0DieiXLlxWgC9T9Xx6nSsYaj2KsvQIg7IFAenXU23FSQPg_9u8cJLGE6wGHAWLOdWp5awT3djYtU7GAHlpH-vIpNjTKxKiReIi2kbgyWqvh4PGtvnG8Oe5jwXikHR35Q0J8LunszE2nn1iRs_LenzlX4sBDpCDRqWIQuGa3tv7v1JkDM5z3WJ64j3c-XB0gal6qOkoLwqoKmK611TF0tHiuurydBpNudkKbQAfGGk8Y3hBqYb8kpFY0tz8A"}],
"iv":"v2cIQg64zYDdupk8WNpVrQ",
"ciphertext":"FqMiaDCwW0YDS5-y_7RFxVjJLlfJQwwNZ5Etqj1km5p1aE53SbgATw_nhvK2iggKpWLKhNF5QeJMyNbvtpWkEP94BU0lzF1glhrr5TydBHr41_JLbY5QQ8BuvGWGhf2-9gKfWDyCMjTIuTYqIR1WvKGMKO-QnhZ8RKd2yQTgOVNrSgjkvwiHMC9LspkHVuwnmVB--88Rz1LIM_PFnrnRnhvQF92eXxbOAWVtMrK9aQUFY3MarILMW8RgEHWGns9Oig5p7cP2Yg1wAiBavg3jklMEVsvKaN3Dq-ewqYx3cV8",
"tag":"pcytqfh3UcwLSOQZjco79Q"}


**26March2019 – AC lib**

# Supported Algorithms:



RSA Json Web Key (2048 bits) :

RSA keypair associated with the Agent’s X509 certificate

Plaintext payload de-/compression :

RFC 1951 DEFLATE

Protected messages :

Signature* : SHA256 with RSA

Private messages :

Key management : RSA with PKCS1Padding

Payload content encryption : AES CBC mode (EtM~)

Integrity protection^ : HMAC SHA2

* Over Protected Headers and Payload parts

^ Over Protected Headers (as AAD), Ciphertext, IV, Tag

~ Encrypt-then-MAC