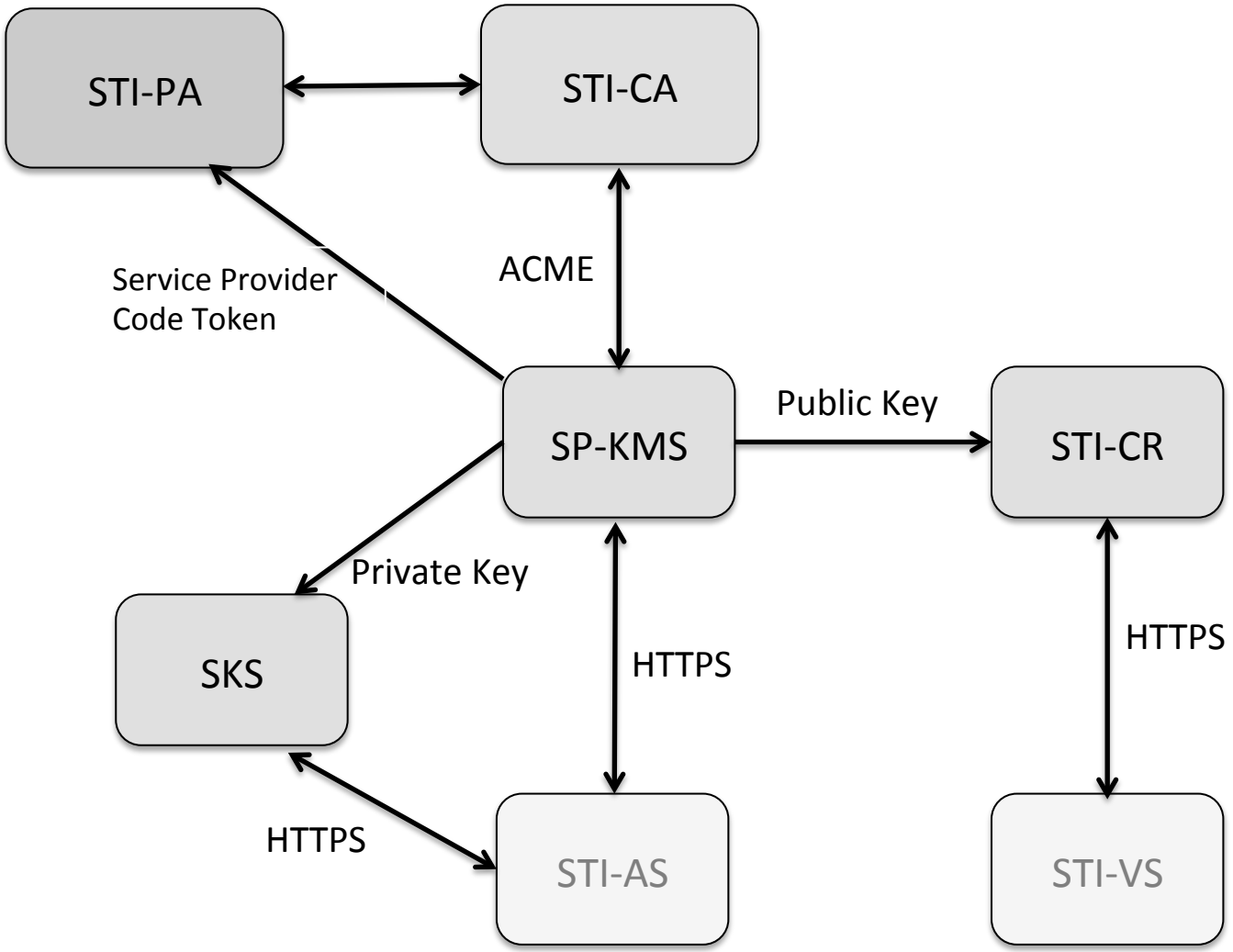
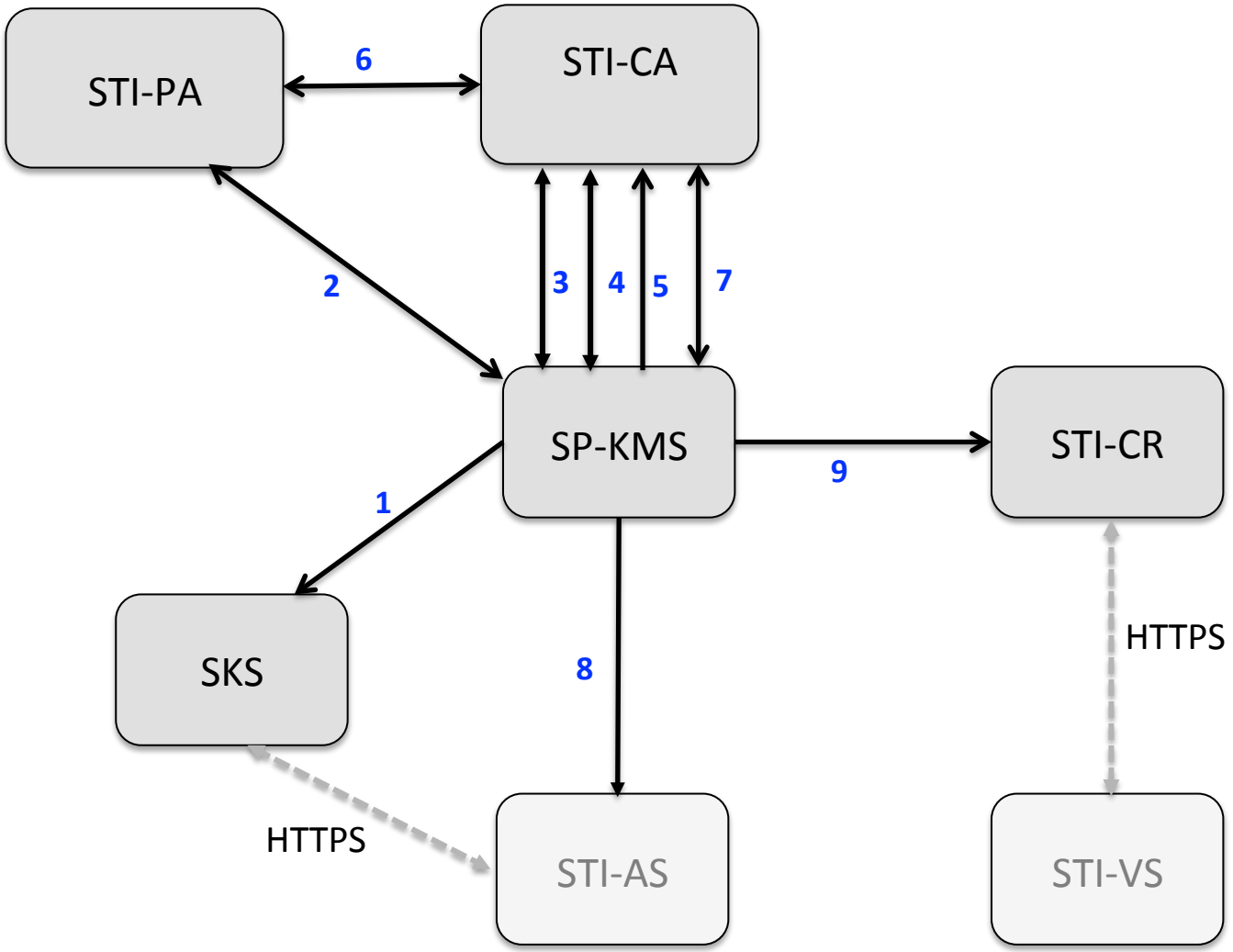
SHAKEN Governance Model and Certificate Management Overview

ATIS-1000080


STI-PA
STI-CA
Service Provider
Code Token
ACME
SP-KMS
Public Key
STI-CR
Private Key
SKS
HTTPS
HTTPS
HTTPS
STI-AS
STI-VS


STI-PA
6
STI-CA
2
3
4
5
7
SP-KMS
9
STI-CR
1
SKS
8
HTTPS
HTTPS
STI-AS
STI-VS
Interface used during Session Setup

High level call/data flow for CM

1. The **SP-KMS** generates a STI public/private key pair for the service provider, for use by the **STI-AS** in signing the PASSporT. The **SP-KMS** securely distributes the SP STI private key to the **SKS**.
2. The **SP-KMS** sends a request for a token to the **STI-PA.** The token will be used for service provider validation during the process of acquiring a certificate.
3. The **SP-KMS** selects an **STI-CA**. If it has not already done so, the **ACME** client on the **SP-KMS** registers with the **STI-CA** using the **ACME** credentials.
4. The **ACME** client on the **SP-KMS** then establishes request for a new certificate to the **ACME** server hosted on the **STI-CA**. The response to the request includes a URL with the authorization challenge.
5. The SP that is requesting the certificate responds to that challenge by providing the current valid token acquired from the **STI-PA**.
6. If not already cached, the **STI-CA** sends a request for a public key certificate to the **STI-PA** in order to validate that the signature of the token has been signed by the **STI-PA**. Once the **STI-CA** receives the indication that the service provider is authorized, the **STI-CA** can issue the certificate.
7. In parallel with step 5, the **ACME** client starts polling for the status to determine if the service provider has been authorized to get a certificate and whether a certificate is available. Once the certificate has been issued, the **ACME** client downloads the certificate for use by the **SP-KMS**.
8. The **SP-KMS** notifies the **STI-AS** that the public key certificate is available through implementation specific means (e.g., SIP MESSAGE or WEBPUSH).
9. The **SP-KMS** puts the public key certificate in the **STI-CR**.

Service Provider Code Token (JWT)

JWT Header:

- alg: Defines the algorithm used in the signature of the token. For Service Provider Code tokens, the algorithm MUST be "ES256".
- typ: Set to standard "JWT" value.
- x5u: Defines the URL of the certificate of the STI-PA validating the Service Provider Code.

JWT Payload:

- sub (*): Service Provider Code value being validated in the form of a JSON array of ASCII strings.
- iat: DateTime value of the time and date the token was issued.
- nbf: DateTime value of the starting time and date that the token is valid.
- exp: DateTime value of the ending time and date that the token expires.
- fingerprint: : (Certificate) key fingerprint of the ACME credentials the Service Provider used to create an account with the CA.

- "fingerprint" is of the form:
  - base64url(JWK_Thumbprint(accountKey))
  - * For ATIS-1000080, only a single Service Provider Code is required in the "sub" field.

Certificate format

- X.509 v3 certificate (RFC 5280) syntax with STIR extensions (draft-ietf-stir-certificates):

```
Certificate  ::=  SEQUENCE  {
     tbsCertificate      TBSCertificate,
     signatureAlgorithm   AlgorithmIdentifier,
     signatureValue      BIT STRING  }
  TBSCertificate  ::=  SEQUENCE
     version              Version
     serialNumber         CertificateSerialNumber,
     signature            AlgorithmIdentifier,
     issuer               Name,
     validity             Validity,
     subject              Name,
     subjectPublicKeyInfo SubjectPublicKeyInfo,
     issuerUniqueID  [1]  IMPLICIT UniqueIdentifier OPTIONAL,
                          -- If present, version MUST be v2 or v3
     subjectUniqueID [2]  IMPLICIT UniqueIdentifier OPTIONAL,
                          -- If present, version MUST be v2 or v3
     extensions      [3]  EXPLICIT Extensions OPTIONAL
                          -- If present, version MUST be v3
  }
```

Distinguished Name optional fields:

- countryName (C=) (e.g. US)
- organizationName (O=) (e.g company name)
- organizationalUnitName (OU=) (e.g, Residential Voice or Wholesale Services)
- stateOrProvinceName (ST=) (e.g. PA)
- localityName (L=) (e.g. Philadelphia)
- commonName (CN=)

Note: If any of these attributes are filled out, generally they SHOULD be validated as claims in the token provided by STI-PA as valid contact and address strings.

Certificate format (continued)

Version ::= INTEGER { v1(0), v2(1), **v3(2)** }
CertificateSerialNumber ::= INTEGER
Validity ::= SEQUENCE {
    notBefore
    notAfter
Time ::= CHOICE {
    utcTime
generalTime
Time, Time }
UTCTime,
GeneralizedTime }
UniqueIdentifier ::= BIT STRING
SubjectPublicKeyInfo ::= SEQUENCE {
    algorithm AlgorithmIdentifier,
    subjectPublicKey BIT STRING }
Extensions ::= SEQUENCE SIZE (1..MAX) OF Extension

Certificate format – STIR specific Extensions

```
TNAuthorizationList ::= SEQUENCE SIZE (1..MAX) OF TNAuthorization
    TNAuthorization ::= SEQUENCE SIZE (1..MAX) OF TNEntry
    TNEntry ::= CHOICE {
      spc     [0] ServiceProviderICodeList,
      range [1] TelephoneNumberRange,
      one       E164Number }
    ServiceProviderCodeList ::= SEQUENCE SIZE (1..3) OF
                                OCTET STRING
    -- When all three are present: Service Provider Code, Alt Service Provider Code, and Last Alt Service
Provider Code
    TelephoneNumberRange ::= SEQUENCE {
      start E164Number,
      count INTEGER }
    E164Number ::= IA5String (SIZE (1..15)) (FROM ("0123456789"))
```

Note: OID for TNAuthorization List is 26

Certificate Example

Data:
Version: 3 (0x2)
Serial Number: 6734468596164949790 (0x5d75a381e96f771e)
Signature Algorithm: sha256WithRSAEncryption
Issuer: CN=CallAuthnCA, O=STI-CA-xyz IOT Lab, C=US
Validity
Not Before: May 10 20:19:22 2017 GMT
Not After : May 10 20:19:22 2019 GMT
Subject: CN=SHAKEN, OU=VOIP, O=AcmeTelecom, Inc.,
L=Bridgewater, ST=NJ, C=US
Subject Public Key Info:
Public Key Algorithm: id-ecPublicKey
Public-Key: (256 bit)
pub:
04:77:c6:b0:d6:df:fd:1f:0a:23:dc:40:24:a4:ea:
93:ca:d7:3f:9e:b7:8e:c7:70:6b:e2:d2:0e:8e:79:
0c:5a:38:b8:a5:fd:52:5d:db:43:bf:00:b1:cd:df:
d4:cf:cb:69:35:13:d1:52:9a:e3:10:fe:1b:51:5b:
74:c2:96:9c:22
ASN1 OID: prime256v1
X509v3 extensions:
1.3.6.1.5.5.7.1.26:
0.....1234
X509v3 Subject Key Identifier:
ED:87:91:08:DA:FC:82:A8:8A:CD:56:F5:A1:D6:7A:
91:43:70:C5:C6
X509v3 Basic Constraints: critical
CA:FALSE
X509v3 Authority Key Identifier:
keyid:03:93:A5:3B:9B:2E:8B:14:D6:C4:CF:58:CF:46:DB:
83:31:54:D0:C8