

DID-based Auth Protocols

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Nelerden bahsedecegiz

DID Core

- ▶ w3c DID Spec
- ▶ DID-common-java

DID Auth

- ▶ DID TLS (Agust 2017) *unresolved*
- ▶ RWOT 2018 DID Auth (March 2018)
- ▶ indt_auth
- ▶ did-auth-jose (October 2018, ietf, dif) *archived sept 22*
 - ▶ Javascript Object Signing and Encryption (jwt, jws, jwe, jwa)
- ▶ DID SIOP *identity.foundation/did-siop*
 - ▶ Javascript Object Signing and Encryption (jwt, jws, jwe, jwa)
 - ▶ Current Focus

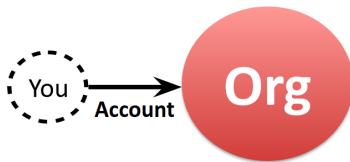
Nelerden bahsedecegiz

Current Auth Protocols & DID Auth

- ▶ web auth kısa
- ▶ single sign on
- ▶ single sign on ile basic auth farki
- ▶ Hali Hazirdaki Protokoller Yapilar
 - ▶ SAML
 - ▶ CAS
 - ▶ OpenID Connect
- ▶ karsilasitirilmalari
- ▶ Self-Issued OpenID Connect Provider DID Profile (did-siop, DIF)
- ▶ DID SAML ?
- ▶ DID CAS ?
- ▶ DID Authentication in PAM ?

Centralised ID

#1: Siloed (Centralized) Identity



Standards:



<https://>



SSIMeetup.org

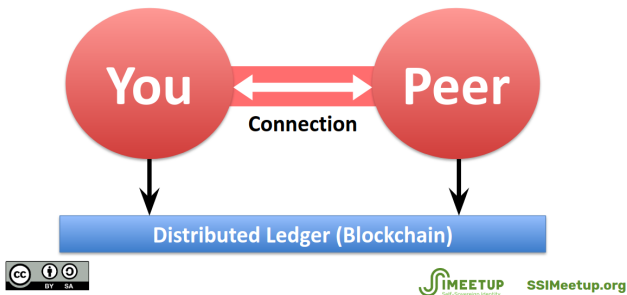
#2: Third-Party IDP (Federated) Identity



Standards:



#3: Self-Sovereign Identity (SSI)



!!! DID Core giris slayti !!! bu spec hakkında genel bilgiler

1. A permanent (persistent) identifier

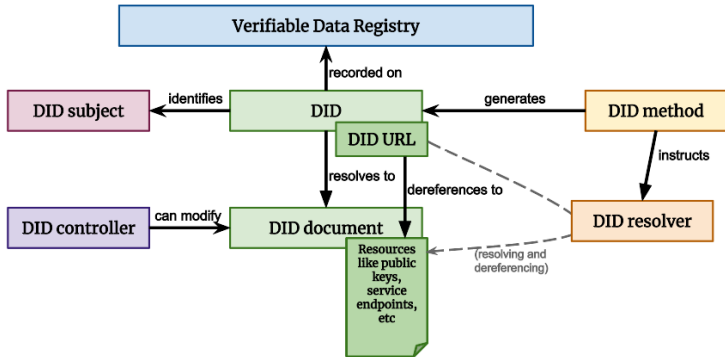
2. A resolvable identifier

3. A cryptographically-verifiable identifier

4. A decentralized identifier



!!! not: bu neyi cozuyor, strongly biding ... detay ekle, strongly binding identifier and allows key rotation



!!! not: query ye detayli deginecegiz

A DID, or Decentralized Identifier, is a URI composed of three parts: **the scheme** “did:”, a **method identifier**, and a unique, **method-specific identifier** generated by the DID method.

DIDs are resolvable to DID documents. A DID URL extends the syntax of a basic DID to incorporate other standard URI components (path, query, fragment) in order to locate a particular resource.

did:sov:3k9dg356wdcj5gf2k9bw8kfg7a



The subject of a DID is, by definition, the entity identified by the DID. The DID subject may also be the DID controller. Anything can be the subject of a DID: person, group, organization, physical thing, logical thing, etc.

Architecture Overview

!!! gorsel ekle ?

The controller of a DID is the entity (person, organization, or autonomous software) that has the capability—as defined by a DID method—to make changes to a DID document. This capability is typically asserted by the control of a set of cryptographic keys used by software acting on behalf of the controller, though it may also be asserted via other mechanisms. Note that a DID may have more than one controller, and the DID subject can be the DID controller, or one of them.

Architecture Overview

!!! örnekler ekle

In order to be resolvable to DID documents, DIDs are typically recorded on an underlying system or network of some kind. Regardless of the specific technology used, any such system that supports recording DIDs and returning data necessary to produce DID documents is called a verifiable data registry. Examples include distributed ledgers, decentralized file systems, databases of any kind, peer-to-peer networks, and other forms of trusted data storage.

DID documents

Architecture Overview

DID documents contain metadata associated with a DID. They typically express verification methods (such as public keys) and services relevant to interactions with the DID subject.

[illegible]

DID resolvers and DID resolution

Architecture Overview

!!! not: detayli spec linkte, burda did res. in detayina girmeyecegiz

A DID resolver is a software and/or hardware component that takes a DID (and associated input metadata) as input and produces a conforming DID document (and associated metadata) as output. This process is called DID resolution.

detailed spec w3c-ccg.github.io/did-resolution/

```
{
  "@context": "https://www.w3.org/ns/did/v1",
  "id": "did:example:123456789abcdefghi#keys-1",
  "type": "RsaVerificationKey2018",
  "publicKeyPem": "-----BEGIN PUB...0101010..END PUB -----\r\n"
}
```



Identifier

!!! identifier giris slayti !!! ceviri

did ve did urllerinin syntaxini inceleyecegiz, generic terimi burda tanimlanan syntaxin diger did methodlarinda tanimlanabilecek syntaxlardan ayirtild edilmek amaciyla kullanildi

This section describes the formal syntax for DIDs and DID URLs. The term “generic” is used to differentiate the syntax defined here from syntax defined by specific DID methods in their respective specifications.

- ▶ The generic DID scheme is a URI scheme conformant with [RFC3988].
- ▶ The DID scheme and method name **MUST** be an ASCII lowercase string.

did:ethr:0xb9c5714089478a327f09197987f16f9e5d936e8a

A DID is expected to be persistent and immutable. That is, a DID is bound exclusively and permanently to its one and only subject. Even after a DID is deactivated, it is intended that it never be repurposed.

DID

```
did-url = did path-abempty [ "?" query ] [ "#" fragment ]
```




DID Parameters

DID URL Syntax

The DID URL syntax supports a simple format for parameters based on the query component. Adding a DID parameter to a DID URL means that the parameter becomes part of the identifier for a resource.

DID URL Syntax

Relative Reference

A relative URI reference according to RFC3986 Section 4.2 that identifies a resource at a service endpoint, which is selected from a DID document by using the service parameter. Support for this parameter is **REQUIRED**

```
{
  "@context": "https://www.w3.org/ns/did/v1",
  "id": "did:example:1234",
  "verificationMethod": [{
    "id": "did:example:1234#key-1",
    "type": "Ed25519VerificationKey2018",
    "controller": "did:example:1234",
    "publicKeyBase58": "H3C2AVvLMv6gmMnam3uVAjZpfkcJCwDwn..."
  }, ...],
  "authentication": [
    // relative DID URL to `did:example:1234#key-1`
    "#key-1"
  ]
}
```

DID Parameters

DID URL Syntax

service parameter

Identifies a service from the DID document by service ID. Support for this parameter is **REQUIRED**

`did:foo:21tDAKCERh95uGgKbJNHYP?service=agent`



DID Parameters

DID URL Syntax

version-id parameter

Identifies a specific version of a DID document to be resolved (the version ID could be sequential, or a UUID, or method-specific). Support for this parameter is **OPTIONAL**

DID URL Syntax

version-time parameter

Identifies a certain version timestamp of a DID document to be resolved.

Support for this parameter is **OPTIONAL**

did:foo:21tDKJNHyp?version-time=2002-10-10T17:00:00Z

DID Parameters

DID URL Syntax

!!! not: iyi bir ozellik ama mekanizmasini tam olarak anlayamadim

hl parameter

A resource hash of the DID document to add integrity protection, as specified in Hashlink RFC. This parameter is *non-normative*

url encoded hash link

hl:zm9YZpCjPLPJ4Epc:z3TSgXTuaHxY2ts...7DYuQ9QTPQyLHy



DID URL Syntax

Path

A DID path is identical to a generic URI path

`did:example:123456/path`

Query

A DID query is derived from a generic URI query and **MUST** conform to DID URL Syntax rules.

If a DID query is present, it **MUST** be used with DID Parameters.

`did:example:123456?query=true`

DID URL Syntax

Fragment

A DID fragment is used as method-independent reference into a DID document or external resource. DID fragment syntax and semantics are identical to a generic URI fragment and **MUST** conform to RFC 3986

did:example:123#agent # service endpoint

did:example:123#public-key-0 # verification method

Relative DID URLs

!!! buraya biraz daha bak !!! ornegine deginmistik

A relative DID URL is any URL value in a DID document that does not start with did:<method-name>:<method-specific-id>.

```
// ... relative DID URL to `did:example:1234#key-1`  
"authentication": [ "#key-1" ]  
// ...
```

Example DID URLs

!!! gecis !!! not: did url ye degin

A DID URL with a 'service' DID parameter

did:foo:21tDAKCERh95uGgKbJNHYP?service=agent

A DID URL with a 'version-time' DID parameter

did:foo:21tD...gKbJNHYP?version-time=2002-10-10T17:00:00Z

did:example:1234/

did:example:1234#keys-1

did:example:1234;version-id=4#keys-1

did:example:1234/my/path?query#fragment

did:example:1234;service=hub/my/path?query#fragment

Core Properties

!!! core prop giris slayti !!! hepsini anlatmaya gerek yok

- ▶ id
- ▶ authentication
- ▶ controller
- ▶ service
- ▶ verificationMethod
- ▶ assertionMethod
- ▶ keyAgreement
- ▶ capabilityDelegation
- ▶ capabilityInvocation

id Property

DID Subject

The DID subject is denoted with the ***id*** property at the top level of a DID document.

- ▶ The DID subject is the entity that the DID document is about
- ▶ DID documents **MUST** include the id property at the top level.

```
{  
  "id": "did:example:21tDAKCERh95uGgKbJNHYP"  
}
```

alsoKnownAs

- ▶ A DID subject can have *multiple identifiers* for different purposes, or at different times.
- ▶ The assertion that two or more DIDs (or other types of URI) identify the same DID subject can be made using the ***alsoKnownAs*** property.

Control

!!! not: did doc may have controller, illa controller olacak diye birsey yok
!!! not: no longer has access to their keys, or key compromise, where the DID controller's trusted third parties need to override malicious activity by an attacker. bunu anla

Authorization is the mechanism used to state how operations are performed on **behalf** of the DID subject. **A DID controller is authorized** to make changes to the respective DID document.

Note: Authorization vs Authentication !

DID Document With a Controller Property

```
{  
  "@context": "https://www.w3.org/ns/did/v1",  
  "id": "did:example:123456789abcdefghi",  
  "controller": "did:example:bcehfew7h32f32h7af3",  
  "service": [{  
  
    "type": "VerifiableCredentialService",  
    "serviceEndpoint": "https://example.com/vc/"  
  }]  
}
```

Verification Methods

!!! not: did controller vs verification method anla not al !!! not: A DID document MAY include a verificationMethod property. !!! not: çok detaylı, her detaya gerek yok

A DID document can express verification methods, such as cryptographic keys, which can be used to authenticate or authorize interactions with the DID subject or associated parties. A DID document MAY include a verificationMethod property.

- ▶ The information expressed often includes globally unambiguous identifiers and public key material, which can be used to verify digital signatures.
- ▶ Verification methods might take many parameters. An example of this is a set of five cryptographic keys from which any three are required to contribute to a threshold signature.
- ▶ In order to maximize interoperability, support for public keys as verification methods is restricted.

verificationMethod Property

Verification Methods

!!! not: çok detaylı, her detaya gerek olmayabilir !!! not: notu not al,

- ▶ The properties **MUST** include the ***id, type, controller, and specific verification method properties*** , and MAY include additional properties.
- ▶ The value of the ***id*** property for a verification method **MUST be a URI**.

Note: Verification method controller(s) and DID controller(s)

As well as the ***verificationMethod*** property, verification methods can be embedded in or referenced from properties associated with various verification relationships

Embedding and referencing verification methods

```
{ ... "authentication": [
  // this key is referenced
  it may be used with more than one verification relationship
  "did:example:123456789abcdefghi#keys-1",
  // this key is embedded
  and may *only* be used for authentication
  {
    "id": "did:example:123456789abcdefghi#keys-2",
    "type": "Ed25519VerificationKey2018",
    "controller": "did:example:123456789abcdefghi",
    "publicKeyBase58": "H3C2AV...z3wXmqPV"
  }
], ... }
```

Key types and formats

Verification Methods

!!! not: burada bircok issue var onlari not al

Key Type (type value)	Support
RSA (RsaVerificationKey2018)	RSA public key values <i>MUST</i> be encoded as a JWK [RFC7517] using the publicKeyJwk property.
ed25519 (Ed25519VerificationKey2018)	Ed25519 public key values <i>MUST</i> either be encoded as a JWK [RFC7517] using the publicKeyJwk or be encoded as the raw 32-byte public key value in Base58 Bitcoin format [BASE58] using the publicKeyBase58 property.
secp256k1	Secp256k1 public key values <i>MUST</i> either be encoded as a JWK [RFC7517] using the publicKeyJwk or be encoded as the raw 33-byte public key value in Base58 Bitcoin format [BASE58] using the publicKeyBase58 property.
Curve25519 (X25519KeyAgreementKey2019)	Curve25519 (also known as X25519) public key values <i>MUST</i> either be encoded as a JWK [RFC7517] using the publicKeyJwk or be encoded as the raw 32-byte public key value in Base58 Bitcoin format [BASE58] using the publicKeyBase58 property.
JWK (JsonWebKey2020)	Key types listed in JOSE , represented using [RFC7517] using the publicKeyJwk property.

Verification Relationships

Authentication

!!! not: note u al, alt basliklarin detaylarini not al

The **authentication** verification relationship is used to specify how the DID subject is expected to be authenticated, such as for the purposes of logging into a website

Assertion

The **assertionMethod** verification relationship is used to specify how the DID subject is expected to express claims, such as for the purposes of issuing a Verifiable Credential

Key Agreement

The **keyAgreement** verification relationship is used to specify how to encrypt information to the DID subject, such as for the purposes of establishing a secure communication channel with the recipient

Verification Relationships

Capacity Invocation

The ***capabilityInvocation*** verification relationship is used to specify a mechanism that might be used by the DID subject to invoke a cryptographic capability, such as the authorization to access an HTTP API

Capacity Delegation

The ***capabilityDelegation*** verification relationship is used to specify a mechanism that might be used by the DID subject to delegate a cryptographic capability to another party, such as delegating the authority to access a specific HTTP API to a subordinate

Service Endpoints

!!! not: detaylari not al

Service endpoints are used in DID documents to express ways of communicating with the DID subject or associated entities. Services listed in the DID document can contain information about privacy preserving messaging services, or more public information, such as social media accounts, personal websites, and email addresses although this is discouraged

One of the primary purposes of a DID document is to enable discovery of service endpoints. A service endpoint can be any type of service the DID subject wants to advertise, including decentralized identity management services for further discovery, authentication, authorization, or interaction

Various service endpoints

```
{ // ...
  "service": [{
    "id": "did:example:123456789abcdefghi#openid",
    "type": "OpenIdConnectVersion1.0Service",
    "serviceEndpoint": "https://openid.example.com/"
  }, {
    "id": "did:example:123456789abcdefghi#vcr",
    "type": "CredentialRepositoryService",
    "serviceEndpoint": "https://repository.example.com/service/8"
  }, {
    "id": "did:example:123456789abcdefghi#xdi",
    "type": "XdiService",
    "serviceEndpoint": "https://xdi.example.com/8377464"
  }]
// ... }
```

Core Representations

!!! kısa gec

!!! yeniden duzenle

All concrete representations of a DID document are serialized using a deterministic mapping that is able to be unambiguously parsed into the data model defined in this specification

Producers **MUST** indicate which representation of a document has been used via a media type in the document's metadata. Consumers **MUST** determine the representation of a DID document via the content-type DID resolver metadata field (see § 8.1 DID Resolution), not through the content of the DID document alone.

- ▶ JSON
- ▶ JSON-LD
- ▶ Concise Binary Object Representation (CBOR)

Methods

!!! not: Because there is no central authority for allocating or approving DID method names, there is no way to know for certain if a specific DID method name is unique

!!! not: The authors of a new DID method specification **SHOULD** use a method name that is unique among all DID method names known to them at the time of publication.

DID methods provide the means to implement did core specification on different *verifiable data registries*.

- ▶ The DID method specification **MUST** specify how to generate the *method-specific-id* component of a DID.
- ▶ The *method-specific-id* value **MUST** be able to be generated without the use of a centralized registry service.
- ▶ Each DID method **MUST** define how authorization is implemented, including any necessary cryptographic operations.

Method Operations

!!! not: not al

Create

The DID method specification **MUST** specify how a DID controller creates a DID and its associated DID document on the verifiable data registry, including all cryptographic operations necessary to establish proof of control.

Read/Verify

The DID method specification **MUST** specify how a DID resolver uses a DID to request a DID document from the verifiable data registry, including how the DID resolver can verify the authenticity of the response.

Method Operations

!!! not: not al

Update

The DID method specification **MUST** specify how a DID controller can update a DID document on the verifiable data registry, including all cryptographic operations necessary to establish proof of control, or state that updates are not possible

Deactivate

The DID method specification **MUST** specify how a DID controller can deactivate a DID on the verifiable data registry, including all cryptographic operations necessary to establish proof of deactivation, or state that deactivation is not possible.

Note: Check Out Method Security & Privacy Requirements

Resolution

!!! giris !!! not: kesin implementasyon did core specinin disnda bundan
dolayi cok detaya girmeyecegim !!! gorsel ekle

DID URL Dereferencing

!!! not: detaylari not al

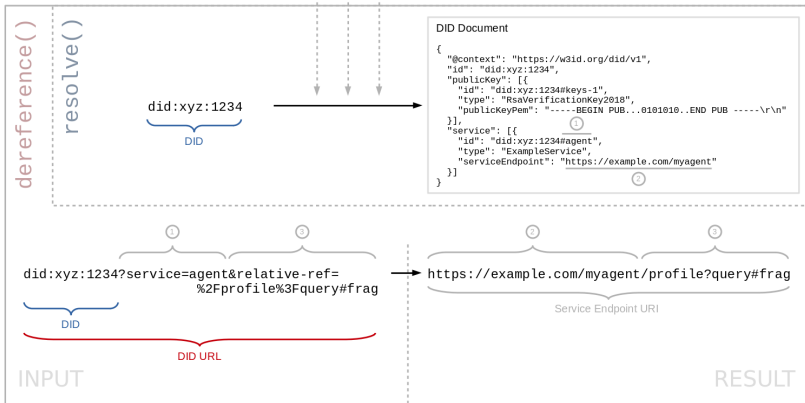
The DID URL dereferencing function dereferences a DID URL into a resource with contents depending on the DID URL's components, including the DID method, method-specific identifier, path, query, and fragment

```
dereference ( did-url, did-url-dereferencing-input-metadata )  
  -> ( did-url-dereferencing-metadata,  
        content-stream, content-metadata )
```



DID URL Dereferencing

Decentralized Identifier Registry



- ▶ dif/did-common-java
- ▶ w3c/did-use-cases
- ▶ peacekeeper/blockchain-identity
- ▶ peacekeeper/did-imp-guide **initial phase**