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| Network Discovery and Selection |
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Abstract

This document proposes initial draft text for the Network Discovery and Selection chapter of P802.1CF.

# Access Network Discovery and Selection

## Introduction

Access network discovery and selection describes the process of exploring the surrounding environment for available access networks, retrieving information of each of the access network and evaluating the collected information in order to determine the most appropriate Point of Attachment to connect to.

The procedures are usually executed when a terminal is powered on and performs an initial network entry, or when a terminal lost or is in the process to lose connectivity and prepares for re-entry, or when a terminal transitions across access network coverage areas and reestablishes connectivity to always the most reliability.

## Acronyms

* TE Terminal
* AN Access Network
* ANI Access Network Identifier
* PoA Point of Attachment (e.g. AP)
* NAI Network Access Identifier
* SS Subscription Service
* SSI Subscription Service Identifier
* CNS Core Network Service
* CNSI Core Network Service Identifier
* EUI48 48-bit Extended Unique Identifier

## Use Cases

### Initial AN access

* Session establishment
* AN access without any prior experience
* No cached information at all

### AN re-entry

* Session establishment
* AN access with prior experience
* Some cached information about AN capabilities

### PoA transition

* Session continuation
* Association with another PoA of the same AN

### AN transition

* Session continuation
* Association with a PoA of another AN

## Functional requirements

The NDS procedures SHOULD support the following requirements

* Support for multiple access technologies
* Support for multiple different access networks supporting the same or different subscription services
* Support for multiple subscriptions on the same access technologies. Different access technologies may have the same set of subscriptions.
* Extensibility to support specific service requirements
* No requirement to establish a-priori knowledge within the TE about offered services of the existing ANs

## Roles and identifiers

* User
The user represents the unique identity of a subscription. A user may have subscriptions with one or more subscription services. Unique subscription identifiers are created by an user name amended by the identity of the subscription service.
ID of User: Subscription Identifier {NAI} + Subscription Name {String}
* Terminal
The terminal represents the physical device communicating with the core network service making use of an access network to establish the link. An unique identifiers is assigned to each of the terminals.
ID of Terminal: {EUI48} or {EUI64}
* Point of Attachment
The point of attachment is the physical device at the edge of the access network creating the communication link to the terminal. Different PoAs may have different capabilities.
ID of Point of Attachment: {EUI48} or {EUI64}
* Access Network
Access network denotes the infrastructure consisting of one or more Points of Attachment and the related backhaul for establishment of links between the points of attachment and corresponding interfaces to connected core network services.
ID of Access Network: ANI {EUI-48} + AN Name {String}
* Subscription Service
The subscription service is the entity establishing and maintaining user specific configuration and usage data. For security reasons the subscriptions service performs authentication of the corresponding terminal to ensure that usage and modification of user specific information is really caused by that user. Subscription service is commonly known as termination point of AAA.
ID of Subscription Service: SSI {FQDN} + SS Name {String}
* Core Network Service
Core network service denotes the termination point of the user plane of a terminals. Multiple terminals may connect to the same core network service, but there may be several core network services available by an access network. Selection of the corresponding core network service may happen through authorization by the subscription service eventually amended by signaling from the terminal.
ID of Core Network Service: CNS Identifier {???} + CNS Name {String}

## Supportive information

Each of the involved identities is related with additional information elements, which are helpful or required when processing the NDS procedures. The following list provides examples of related information elements:

* Access Network
	+ Supported Subscription Service Providers
	+ Supported Core Network Services
	+ AN certificate
	+ Access Network Capabilities
		- Link Layer capabilities
			* E.g. MTU, encryption, shared/ptp-link
		- Link Layer performance
			* E.g. supported service classes (Throughput up/down, delay, jitter)
* Subscription Service Provider
	+ List of supported Core Network Services
	+ SP certificate
* Core Network Service
	+ Network Layer Capabilities
		- E.g. IP version, configuration, multi-protocol support, service discovery support
	+ Network Interface performance
		- E.g. supported service classes (throughput up/down, delay, jitter)
	+ Offered application services
		- E.g. Internet, Voice, Printer, File service,

## NDS basic functions

### PoA Discovery

PoA discovery is the process initiated by the terminal to retrieve the list of points of attachments, which can be reached via the physical medium.

* + Active scanning
	+ Passive scanning

### AN Detection

AN detection is the process to retrieve the identity of the access network to which a discovered point of attachment belongs.

* + Advertisement information retrieval
	+ Local data base query
	+ Remote data base query

### SS Detection

SS detection is the process to retrieve the list of subscription services, which are available by the detected access networks. The process establishes a list of all available subscription services as well as a matrix, which of the subscription services is available by which access network.

* + Advertisement information retrieval
	+ Local data base query
	+ Remote data base query

### CNS Detection

CNS detection is the process to retrieve the list of core network services, which are available by the detected access networks. The process establishes a list of all available core network services as well as a matrix, which of the core network services is available by which access network

* + Advertisement information retrieval
	+ Local data base query
	+ Remote data base query

### SS and CNS Selection

SS and CNS selection is a multi-dimensional selection process in the terminal making the best choice among the detected subscription services and core network services. The selection process may perform a weighted evaluation of all available information down to interface parameters of the physical link to the point of attachment.

* + Applying pre-configured priorities
	+ Applying dynamically provided policies (e.g. ANDSF)

## Detailed procedures

### First-time use of TE without subscription

1. TE detects one or more available ANs.
2. TE discovers available SSs associated with one or more ANs.
3. TE selects an AN and a SS based on some preference criteria.
4. TE performs a special connection procedure with the selected AN for establishment of a subscription.
5. TE creates a trust relationship enabling network access authentication and authorization by the selected SS
6. TE acquires and stores the configuration information of the selected SS

### Initial AN access

1. TE detects, using the stored configuration information, one or more available ANs.
2. TE discovers available control entities associated with one or more ANs.
3. TE identifies all accessible control entities and, using the stored configuration information, selects or allows a subscriber to select an control entity based on some preference criteria.
4. TE performs an initial network entry procedure with a AN that is supported by selected control entity.

### PoA transition

* Session continuation
* Association with another PoA of the same AN

In the case of failure, TE reverts to initial AN access.

### AN re-entry

* Session establishment
* AN access with prior knowledge

AN re-entry leverages previously retrieved information about the AN, but does not resume the previously established session.

In case of failure, TE reverts to initial AN access.

### Transitions across multiple AN coverage area

1. TE has previously completed network entry and is in normal operation with its SS on an AN.
2. TE discovers, using the stored configuration information, one or more available neighboring ANs.
3. TE discovers that the neighboring ANs have direct or indirect relationships with the same SS, by which it is currently authenticated and authorized.
4. Due to user movement or other reason, the TE decides to transition to another AN.
5. TE performs an network re-entry procedure with a neighbor AN that has a relationship to the currently used SS enabling access by the same SS. This network re-entry will involve a full authentication cycle to re-establish a complete session context with the new AN.

In case of failure, TE reverts to initial AN entry.

## Mapping to IEEE 802 technologies

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 802.3 | 802.11 | 802.15 | 802.16 | 802.22 |
| Identifiers | STA | EUI-48 | EUI-48 | EUI-64 | EUI-48 | EUI-48 |
| PoA | EUI-48 | EUI-48 | EUI-64 | EUI-48 | EUI-48 |
| ANI | ??? | EUI-48 | ??? | EUI-48 | EUI-48 |
| AN-name | 256 Char | 30 Char | ??? |  |  |
| Subscription Type | NAI | NAI/PSK | ???/PSK | NAI | NAI |
| Multiple SSPs | Info | ANQP | - | ? | - |
| Discovery process | manual | passive, active | passive, active | passive | passive |

## Additional capabilities in IEEE 802 technologies

### IEEE 802.3

For further study.

### IEEE 802.11

IEEE 802.11 provides a number of functional enhancements to support more complex deployments:

* Access Network Query Protocol
* Pre-Association Discovery Protocol
* Network triggered NDS
E.g. Directed PoA transition
* Online subscription establishment
E.g. Hotspot 2.0 ‘Online Sign Up’

### IEEE 802.15

For further study.

### IEEE 802.16

For further study

### IEEE 802.22

For further study