
PDL ISG - PoC Proposal Template

1 PoC Project Details

1.1 PoC Project

PoC Number (assigned by ETSI): PoC#04

PoC Project Name: IoT-based access control system using NFT ticket to prevent scalping

PoC Project Host: Sejong University

Short Description: Traditional access authentication systems face multiple security vulnerabilities, including forgery, tampering, and server hacking. For example, issues with scalpers who steal identities to buy and illegally transfer bulk tickets for cultural performances highlight the need for a system that ensures access only with legitimately issued tickets. This PoC introduces a new ticket issuance and anti-counterfeiting solution using blockchain's Non-Fungible Tokens (NFTs) to combat scalping and counterfeit tickets. Integrated with an IoT access control system, it allows entry solely to individuals holding validly issued tickets. Utilizing a decentralized distributed ledger enhances security by preventing unauthorized access from forged passes or compromised servers. The system employs blockchain standard PDL and IoT standard oneM2M technologies, enhancing interoperability and facilitating future expansion with other IoT devices.

1.2 PoC Team Members

Table A.1

	Organization name	ISG PDL participant (yes/no)	Contact (Email)	PoC Point of Contact (see note 1)	Role (see note 2)	PoC Components
1	Sejong University (SJU)	Yes	jssong@sejong.ac.kr	X	Application /infrastructure provider	Blockchain development, oneM2M development
2	Guarantable	No	kyle@guarantable.com		Application /infrastructure provider	Blockchain development
3	ETRI	No	pjs@etri.re.kr		Application provider	Blockchain development
...						
NOTE 1: Identify the PoC Point of Contact with an X.						
NOTE 2: The Role will be network operator/service provider, infrastructure provider, application provider or other as given in the Definitions of ETSI Classes of membership.						

All the PoC Team members listed above declare that the information in this proposal is conformant to their plans at this date and commit to inform ETSI timely in case of changes in the PoC Team, scope or timeline.

1.3 PoC Project Scope

1.3.1 PoC Goals

The PoC will demonstrate:

- Utilization of PDLs in oneM2M using standardized and interoperable interfaces, related to ETSI GR PDL 028 (Study on Utilizing PDLs to Standardized IoT Service Layer Platform oneM2M)
- Developing a secure, verifiable, and immutable ticket system using smart contracts, related to ETSI GS PDL 004 (Smart Contracts System Architecture and Functional Specification)

1.3.2 PoC Topics

PoC Topics identified in this clause need to be taken for the PoC Topic List identified by ISG ENI and publicly available, i.e. the three topics identified in clause 4.5 of the ENI PoC Framework. PoC Teams addressing these topics commit to submit the expected contributions in a timely manner.

Table A.2

PoC Topic Description (see note)	Related WI	Expected Contribution	Target Date
Utilization of PDLs in oneM2M using standardized and interoperable interfaces	related to ETSI GR PDL 028 (Study on Utilising PDLs to Standardized IoT Service Layer Platform oneM2M)	Validation of PDL utilization in oneM2M	2024-06
Developing a secure, verifiable, and immutable ticket system using smart contracts	related to ETSI GS PDL 004 (Smart Contracts System Architecture and Functional Specification)	Smart contract application and validation	2024-06
Integrating the PDL-based ticket system with oneM2M access control system	related to ETSI GR PDL 028 (Study on Utilising PDLs to Standardized IoT Service Layer Platform oneM2M)	Interworking between oneM2M and PDL	2024-10
NOTE: This column should be filled according to the contents of table 1.			

1.3.3 Other topics in scope

List here any additional topic for which the PoC plans to provide input/feedback to the ISG ENI.

Table A.3

PoC Topic Description	Related WI	Expected Contribution	Target Date
Validate use cases that utilize PDL in oneM2M	related to ETSI GR PDL 028 (Study on Utilising PDLs to Standardized IoT Service Layer Platform oneM2M)	Demonstration to validate PDL utilization in oneM2M	2024-06

1.4 PoC Project Stages/Milestones

Table A.4

PoC Milestone	Stages/Milestone description	Target Date	Additional Info
P.S	PoC Project Start	2024-05	
P.D1	PoC Demo 1	2024-06	PDL#18, F2F Develop an NFT-based ticket system to prevent ticket scalping
P.D2	PoC Demo 2	2024-10	Develop an NFT-based ticket system and gate access control system using PDL and oneM2M
P.C1	PoC Expected Contribution	2024-06	PDL features to support NFT-based ticket system – New Work - Item
P.C2	PoC Expected Contribution 2	2024-10	oneM2M interworking proxy application – Revision of the System architecture
P.R	PoC Report	2024-11	
P.E	PoC Project End	2024-12	

2 PoC Technical Details

2.1 PoC Overview

A oneM2M access authentication system based on a Permissioned Distributed Ledger (PDL) can address many vulnerabilities by leveraging the security and immutability features of blockchain technology. IoT platforms that utilize a PDL and NFT to prevent scalping—using macros to buy tickets in bulk and resell them at a profit—and to prevent ticket tampering can provide enhanced access control policies. Additionally, implementing two-factor authentication (2FA) through the PDL and the oneM2M standard can effectively prevent scalping and ticket tampering, ensuring that access control systems operate securely and reliably.

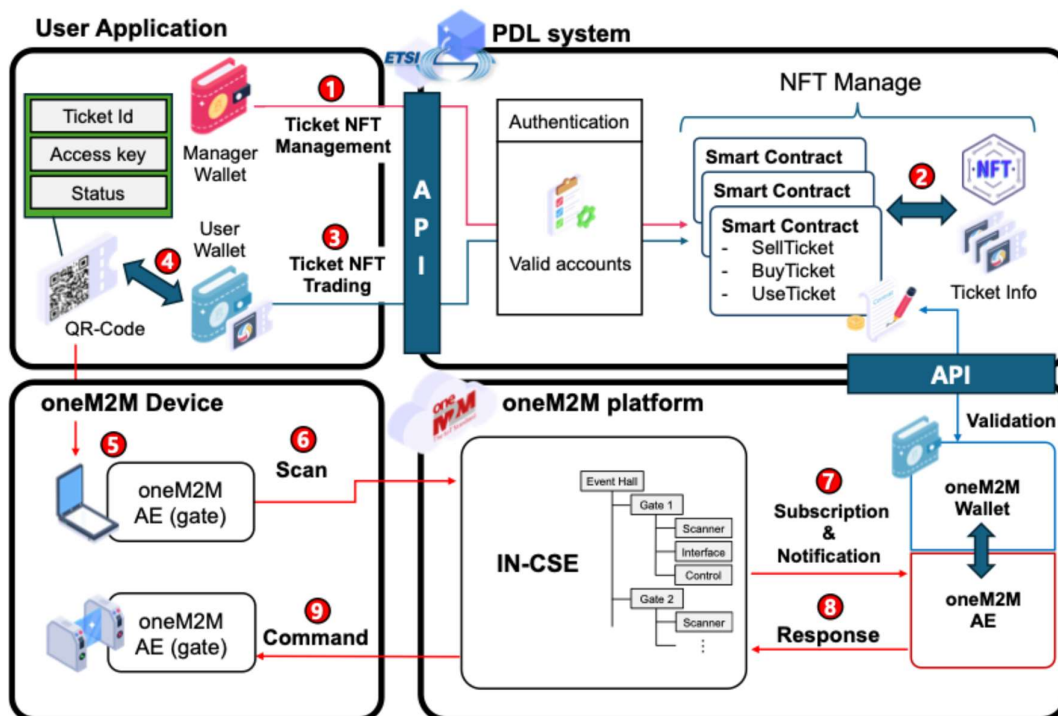


Figure 1. PDL-based oneM2M access authentication system overview

Minting: mint a new ticket as NFT. This process involves generating a unique token on a PDL system that represents the ticket.

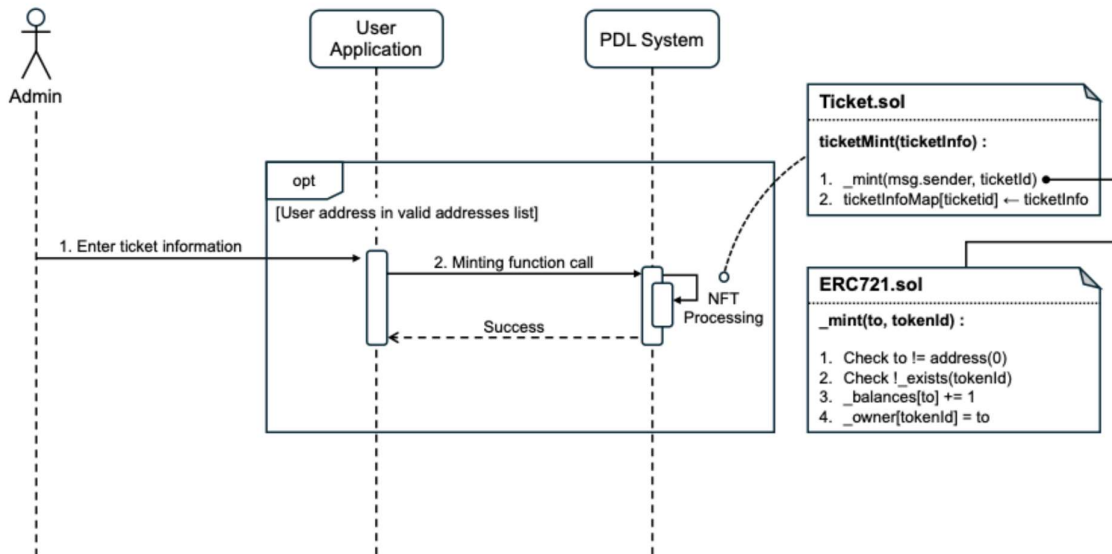


Figure 2. Ticket minting sequence diagram

Figure 2 shows the ticket NFT minting sequence diagram in the proposed system. The process involves generating a unique token on a PDL system that represents the ticket. After the minting process, validate tickets can be created with NFTs through the PDL system to access.

Listing and sales: List the NFT for sale on a marketplace that supports NFT transactions, allowing buyers to purchase or bid on the ticket.

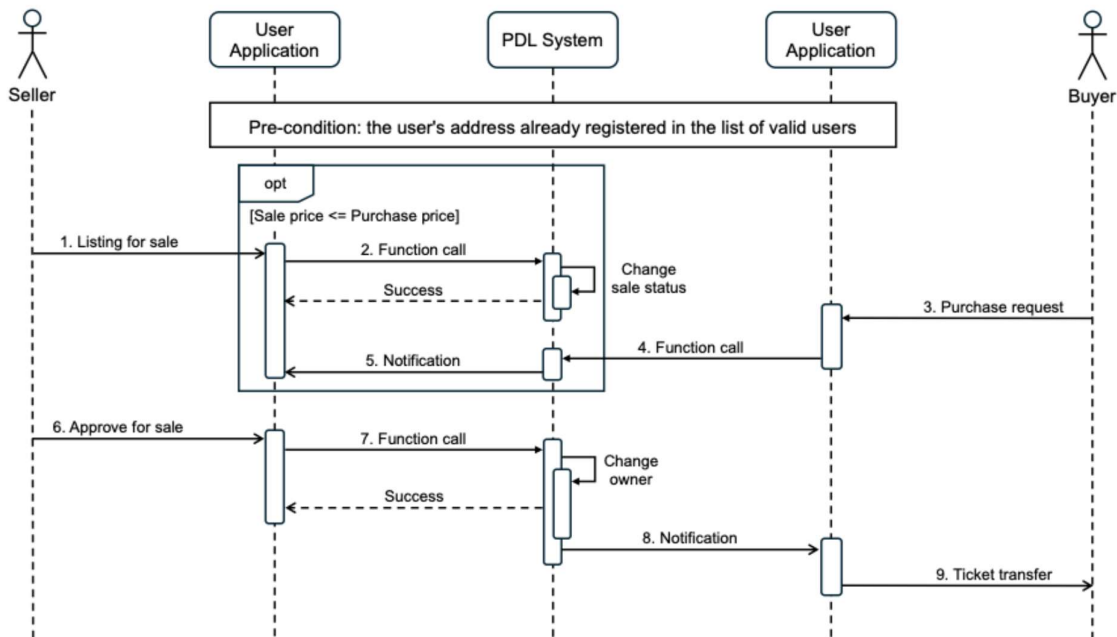


Figure 3. Ticket listing and sales sequence diagram to prevent scalping

Figure 3 shows a sequence diagram of the ticket listing and sales function. The procedure describes how to list the created NFTs for sale on a marketplace or ticket applications that support NFT transactions, allowing buyers

to purchase or bid on the ticket. To prevent ticket scalping, the system does not allow NFT tickets to be set higher than the purchase price when reselling them.

Validation and Verification: Provide mechanisms for ticket verification at the event entrance, ensuring that the ticket holder is the legitimate owner of the NFT.

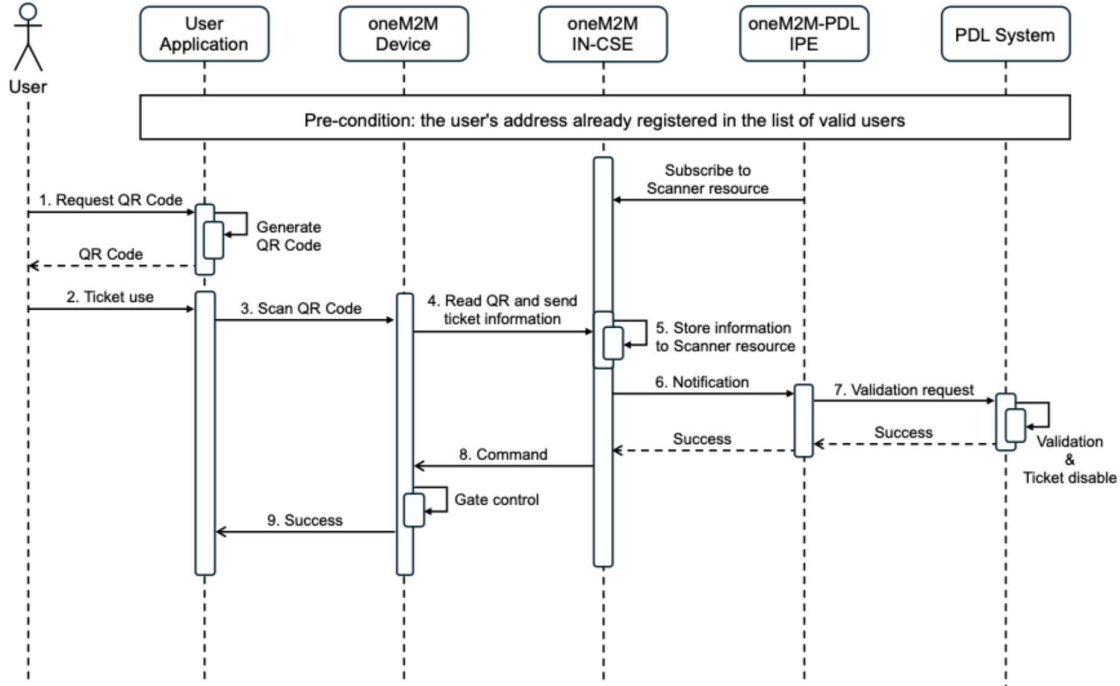


Figure 4. Ticket validation and verification sequence diagram for PDL-based oneM2M access authentication

Figure 4 shows a sequence diagram of the PDL-based access authentication scheme in oneM2M. oneM2M can verify the validation of a ticket through PDL.

2.2 PoC Architecture

The detailed PDL-based access authentication system PoC architecture is shown below.

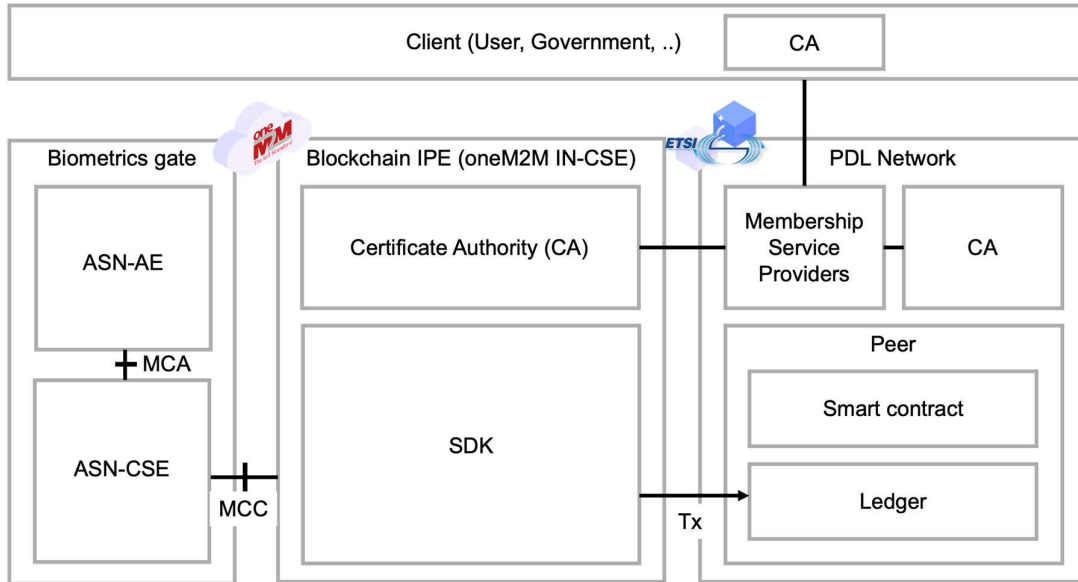


Figure 5. PDL-based access authentication system architecture

2.3 PoC Success Criteria

The success of the PoC is demonstrated by the verification of the interaction between oneM2M-PDL through the demonstration. It does not include non-functional requirements such as performance or availability goals. Consequently, validation of the functional use case via a demo is sufficient.

2.4 Additional information

No additional information