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**Group Report**

Smart Contracts in Telco Permissioned Distributed Ledgers — System Architecture and Functional Specification

Reference

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# Foreword

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# Modal verbs terminology

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# Executive summary

This present document specifies a high-level functional abstraction of PDL Smart Contract System Architecture. In particular, basic building blocks for designing, coding and testing Smart Contracts for the PDLs. This includes describing how different classes of systems interact with Smart Contracts. Processes, models, and detailed information are beyond the scope of the present document.

# Introduction

The present document defines a high-level functional abstraction of policies to design and code Smart Contract components. Smart Contracts are mere codes, and if not well planned, designed, coded and tested; can leave the system vulnerable to external attacks and internal errors.

# 1 Scope

**Scope of work to be undertaken:** The present document specifies the functional components of Smart Contracts, their planning, coding and testing. This includes:

a) reference architecture of the technology enabling Smart Contracts – the planning, designing and programming frameworks

b) specify how to engage using this architecture – the methods and frameworks the Smart Contracts building blocks possibly communicate

c) point out possible threats and limitations

# 2 References

## 2.1 Normative references

## 2.2 Informative references

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

## 3.2 Symbols

## 3.3 Abbreviations

AML: Anti-Money Laundering

API: Application Program Interface

SC: Smart Contract

CEN-CENELEC: European Committee for Standardization and European Committee for Electrotechnical Standardization.

DLT. Distributed Ledger Technology

EBP: European Blockchain Partnership

EBSI: European Blockchain Service Infrastructure.

EC: European Commission

EFTA: European Free Trade Association

eIDAS: Electronic Identification, Authentication and Trust Services.

EIRA: European Interoperability Reference Architecture

ESSIF: European Self Sovereign Identity Framework

ETSI: European Telecommunication Standards Institute

EU. European Union

FIG: International Federation of Surveyors

GDPR: General Data Protection Regulation

ICO: Initial Coin Offering

ICT: Information and Communications Technology

ISO: International Standards Organization

ITU: International Telecommunication Unit

KYC: Know Your Customer

OECD: Organization for Economic Co-operation and Development

PDL: Permissioned Distributed Ledger.

SG: Study Group.

SLA: Service Level Agreement

SME: Small and Medium Enterprise.

STO: Security Token Offering.

TOOP: The Once-only Principle

TSAG: Telecommunication Standardization Advisory Group.

UN/CEFACT: United Nations Centre for Trade Facilitation and Electronic Business.

UNCITRAL: United Nations Commission on International Trade Law.

UNE: Spanish Association for Standardization.

# 4 Smart Contracts

## 4.1 Definition

Smart Contracts are software codes, installed on distributed machines and govern the manifesto of the PDLs. They are installed or deployed once and can be executed many times.

## 4.2 Properties

SCs possess properties of auto-execution, immutability and transparency.

### Auto-Execution

SCs are auto-executable, self-governing code. Once installed and they will be executed when the specified condition becomes true.

### Immutability

SCs cannot be amended by any party, however their all executions are recorded as transactions.

### Transparency

SCs should be transparent to both the parties; both the parties should be able to view and audit their contracts.

### Reusability

SCs are coded once and executed multiple times. To ensure reusability, the contracts are advised to be generalised; this will enable the standardisation of contracts for industries. For example, the SC for cellular service is standardised with required field for QoS metrics such as latency; all the operators in this case will be required to specify the latency they will provide.

## 4.3 Components

# 5 Smart Contracts – Planning, coding and Testing

## 5.1 Planning phase

## 5.2 Coding Phase

## 5.3 Testing Phase

# 6 Architectural requirements for Smart Contracts

## 6.1 Reference Architecture

## 6.2 Interaction between PDLs

It can be foreseen as that most of the major organisations will be adopting PDLs to maintain their company records. For example, a telecom company can be using a PDL to maintain its billing records, an automobile company for their vehicle specifications, and an aviation authority to log their flight records. The next step would be these ledgers should have access, to some extent, to other ledgers. For example, a tractor should be able to records its start and end of a trip to the logistic company ledger but should not be able to change any record. However, this tractor can have full access to its own company’s PDL where it can record and access its maintenance information such as service history.

Hence, multiple PDL must be able to inter-connected by a secure Access Control (AC) mechanism and should allow permissioned access to only certain sections with appropriate AC credentials. PDLs should be able to access each other’s ‘related and concerned only’ records only such as GP Surgery should be able to access person’s health records but don’t have access to their financial transactions.

If a PDL wishes to access an object from other PDL, in this case, we consider examples of ORG1 – PDL is the PDL wishes to access the information(the ‘Subject)’, the data it wants to access from other PDL(i.e. ORG2 - PDL) is called as ‘object’. The components are explained in detail below:

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Figure 1: Overall two PDLs with respective MSP

### Membership Service Provider (MSP)

The term MSP is adopted from Hyperledger Fabric and its function here is similar (to some extent) to HLF’s MSP. Every PDL has one ‘Membership Service Provider’(MSP) – and is responsible to maintain node IDs, their access rights and roles. All MSPs keep their own ledgers for identity management, to which access can be granted to other PDL-MSPs for verification. The common records (i.e. access of MSP2 from MSP1) should be recorded, and accessible by both.

### Smart Contracts (SC)

MSP will install three different Smart Contracts (SC) in MSP ledger; one to ensure the dynamic up of public keys, one to amend access rights of the nodes (which is accessible only by the MSP itself or nodes with higher authority) and other to grant access to other PDLs.

When a node/peer wishes to update its public key, it will locally generate Public Key/Private Key pair and invoke the smart contract to update this credentials at MSP end. A peer on its own cannot amend, its role and access rights; this is still managed and controlled by the MSP or the authorised node.

### Node Identity

The node identities and access rights are kept by MSP, in a separate ledger; when the access rights or ID of the node is changed, a smart contract is executed by the authorised node and the state changed is recorded in MSP ledger.

### Inter-PDL communication

Two PDLs should be able to connect through MSPs only and as MSP has no access to ledger data, this access should ask by a designated node (Admin node (AN)). When a PDL (i.e. ORG1-PDL) wishes to access data from other PDL (i.e. ORG2-PDL), the AN must ask permit from its local MSP(i.e.MSP1). The MSP, then contacts the other MSP (i.e. MSP 2 in this example) by sending Access Request (AR). AR must define metrics of access (i.e. PDL ID, roles, duration and PKs of the nodes).

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Figure 2: MSP1 sends AR to MSP2

MSP2 grants access to its PDL by invoking SC; and recording the request and access grant to its ledger and sending the Transaction ID to MSP 1.

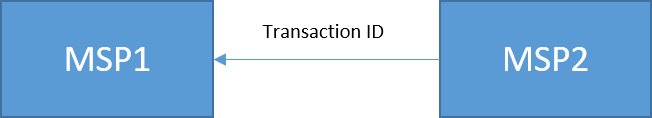


Figure 3: MSP confirms the access with Transaction ID

MSP2 will subsequently record the keys of MSP1 and assign role (such as visiting peers with read only access). As soon as the duration elapsed, the access is revoked, and all the ledgers are updated.

# 7 Smart Contracts – Applications, solutions and Needs

## 7.1 Regulatory Aspects

# 8 Limitations of Smart Contracts

## 8.1 Inter and Intra system threats

## 8.2 Limitations

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