



The Standards People



# Permissioned Distributed Ledgers

## Smart Contracts

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For: **ICT Verticals and Horizontals for Blockchain  
Standardisation – Smart Contract  
Roundtable**

# Agenda

- ✔ Introduction to ETSI ISG PDL(Permissioned Distributed Ledgers)
- ✔ Smart contracts: An introduction, properties and challenges
- ✔ Requirements for Smart Contracts' standardisation
- ✔ Smart Contracts' standardisation ISG PDL
- ✔ Smart Contracts' performance and ledger-type
- ✔ Conclusion



# ISG - PDL

# The ISG PDL Goals and Scope

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- ✓ Provide the foundations for the operation of permissioned distributed ledgers
  - ✓ Create an open ecosystem of industrial solutions
  - ✓ Deployable by different sectors
- ✓ Foster the application of the technology
  - ✓ Start from already available experiences
  - ✓ Coordinate with existing initiatives
- ✓ Define a set of well-known open operational mechanisms
  - ✓ Support their demonstration
  - ✓ Facilitate interoperability assessment
- ✓ More than thirty members from industry (telco and not telco), public sector and academia

# The Work Programme (I)

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- ✓ PDL-001 - Landscape of Standards and Technologies
  - ✓ Identify relevant activities in standardization and research.
- ✓ PDL-002 - Applicability and Compliance to Data Processing Requirements
  - ✓ Analyse the essential data processing requirements
- ✓ PDL-003 – Application Scenarios
  - ✓ Potential application scenarios for the operation of PDLs and governance aspects
- ✓ PDL-004 – Smart Contracts PDL System Architecture and Functional Specification
  - ✓ Planning, designing and programming frameworks
- ✓ PDL-005 – PoC Framework
  - ✓ Build commercial awareness and confidence and encourage development of an open ecosystem

## The Work Programme (II)

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- ✓ PDL-006 – Inter-Ledger Interoperability
  - ✓ Key elements for the exchange and use of the information available across DLs
- ✓ PDL-007 – Research Landscape
  - ✓ Facilitate exchange of information on PDL related research projects
- ✓ PDL-008 – PDL Research and Innovation Landscape
  - ✓ Document research and innovation projects relevant for BDLT standardisation
- ✓ PDL-009 – PDL for federated Data Management
  - ✓ Architecture and key functional mechanisms leveraging PDL for federated data management
- ✓ PDL-010 – PDL Operations in Offline Mode
  - ✓ Challenges related to data storage and ledger operations when the PDL nodes are offline

## The Work Programme (III)

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- ✓ PDL-011 – Specification of Requirements for Smart Contracts' architecture and security
  - ✓ Specifications for Smart Contracts' Architecture and Security



The background of the slide features a close-up of a person's hand holding a transparent, flexible digital display. The display shows a glowing blue globe with a white map of the world, centered on the Atlantic Ocean. The globe is surrounded by a grid of white dots and lines, suggesting a digital or networked environment. The hand is positioned on the left side of the frame, with the thumb and index finger visible, holding the edges of the transparent screen. The overall color palette is dominated by blues and whites, with a soft, futuristic aesthetic.

# Smart Contracts – Introduction, Properties and Challenges



# Smart Contracts: An Introduction

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Software codes installed on Permissioned Distributed Ledgers (PDLs)

PDLs : Distributed Immutable data structures where all the participants keep a copy of the ledger

## Properties

- ✓ Immutable
  - ✓ Once recorded cannot be changed or amended
- ✓ Auto-executable
  - ✓ Triggered by software condition
- ✓ Transparent
  - ✓ Because they are installed on PDLs – all the participants of the ledger keep the same copy



# Challenges

# Immutable

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Smart contracts are immutable – because they are installed on a PDL, cannot be changed or amended:

- ✔ Smart contract can not be removed - old and dormant contracts if not secure can be dangerous
- ✔ If a smart contracts has some errors in a code it can leave back doors open- means they may be callable by unauthorized contracts



# Auto-executable

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Smart contracts are self-executable – Pre-programmed conditions trigger these contracts.

- ❖ Erroneous code can trigger unwanted functions of the code which may cause monetary losses such as unwanted payments

# Transparency

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Because PDLs are transparent, smart contracts and all their respective transactions are visible to all the parties of the contract.

- ✔ Contracts are visible in a PDL, if a visibility domain is not specified, can cause contracts to be visible to unintended parties within the PDL.







# Requirements for Smart Contracts' Standardisation



# Requirements to Design Smart Contracts

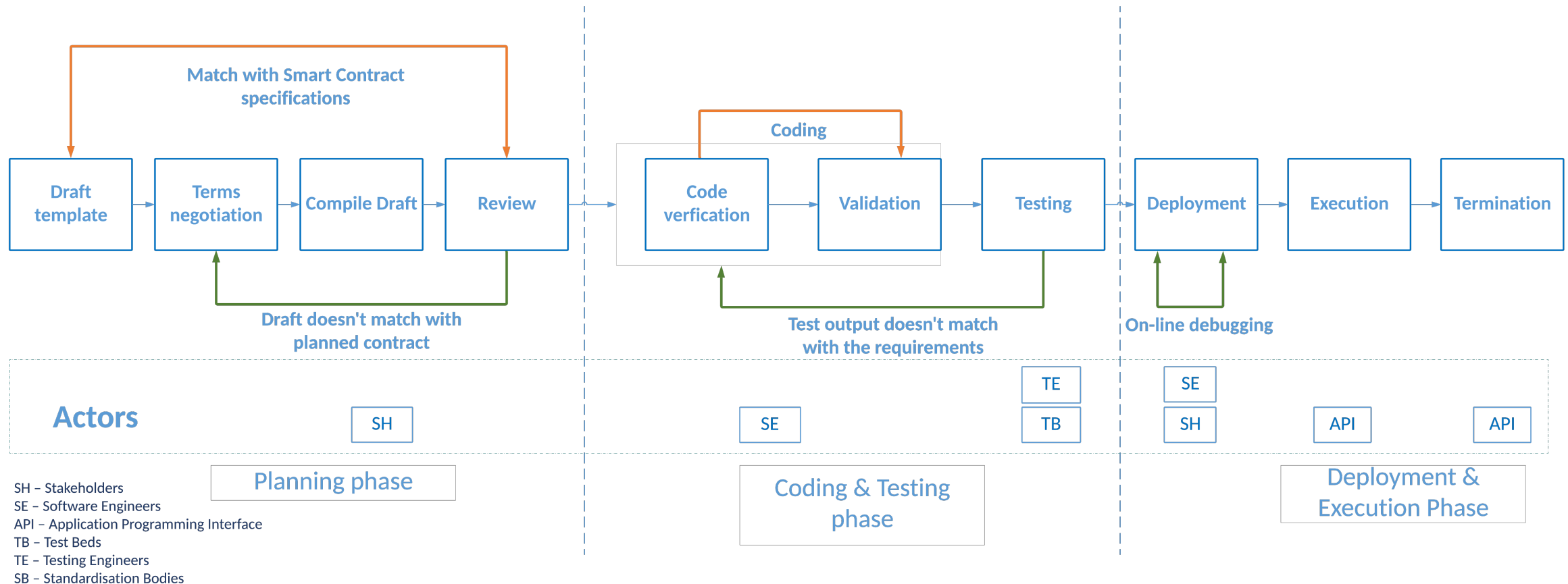
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- I. **Water-tight Security** – only authorised users can access smart contracts and selected functions only.
- II. **Terminatable** – ensure that smart contracts are terminated after certain time to avoid eternal contracts.
- III. **Auditable** – the stakeholders should always be able to audit smart contracts' code and the libraries used to develop. E.g., should use open-source libraries.
- IV. **Upgradable** – can be upgradable but precise versioning must be followed and older contracts must be deactivated safely.
- V. **Reusability** – must be reusable, to cope with scalability

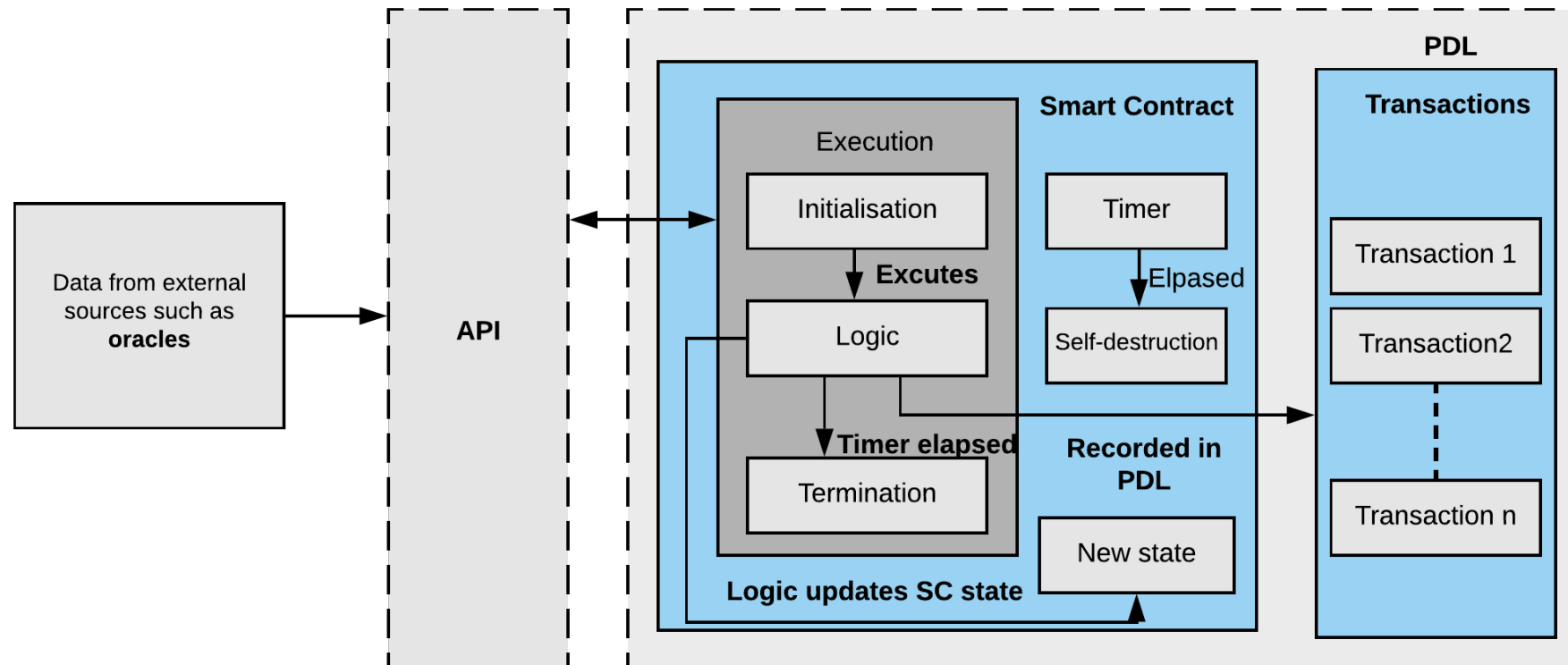
A photograph of two men sitting on a row of light blue stadium seats. The man on the left has dreadlocks, wears glasses, a denim vest over a plaid shirt, and has red headphones around his neck. The man on the right wears a grey beanie, sunglasses, and a brown jacket. They are both smiling and looking at a white smartphone held by the man on the right. The background shows many rows of empty stadium seats receding into the distance.

# ISG – PDL – Smart Contract Standardisation

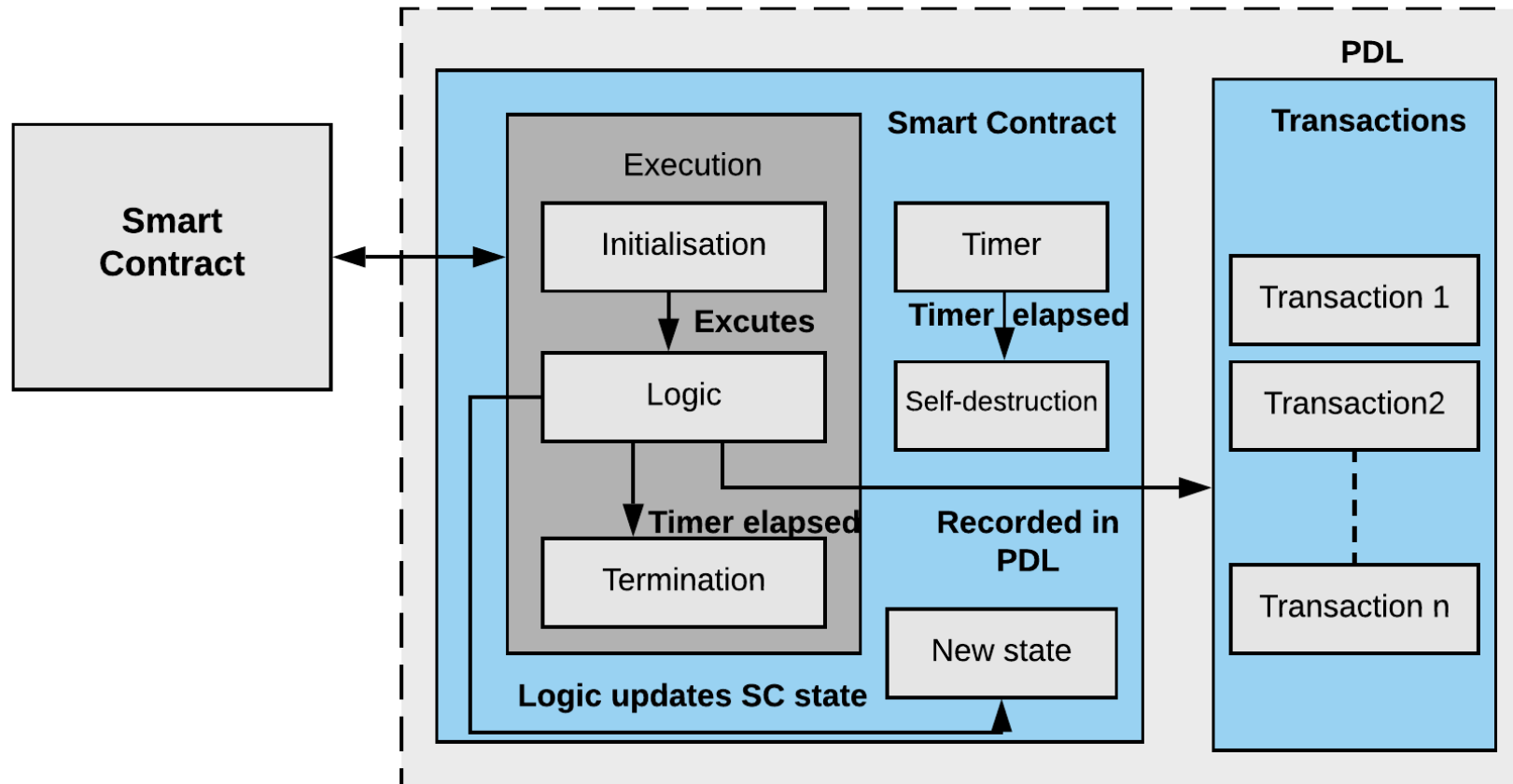
# Smart Contract Life-Cycle (PDL-004)




# Smart Contract Reference Architecture (PDL-004, PDL-011)



# Smart Contract Reference Architecture (Contract Chaining) (PDL-004, PDL-011)



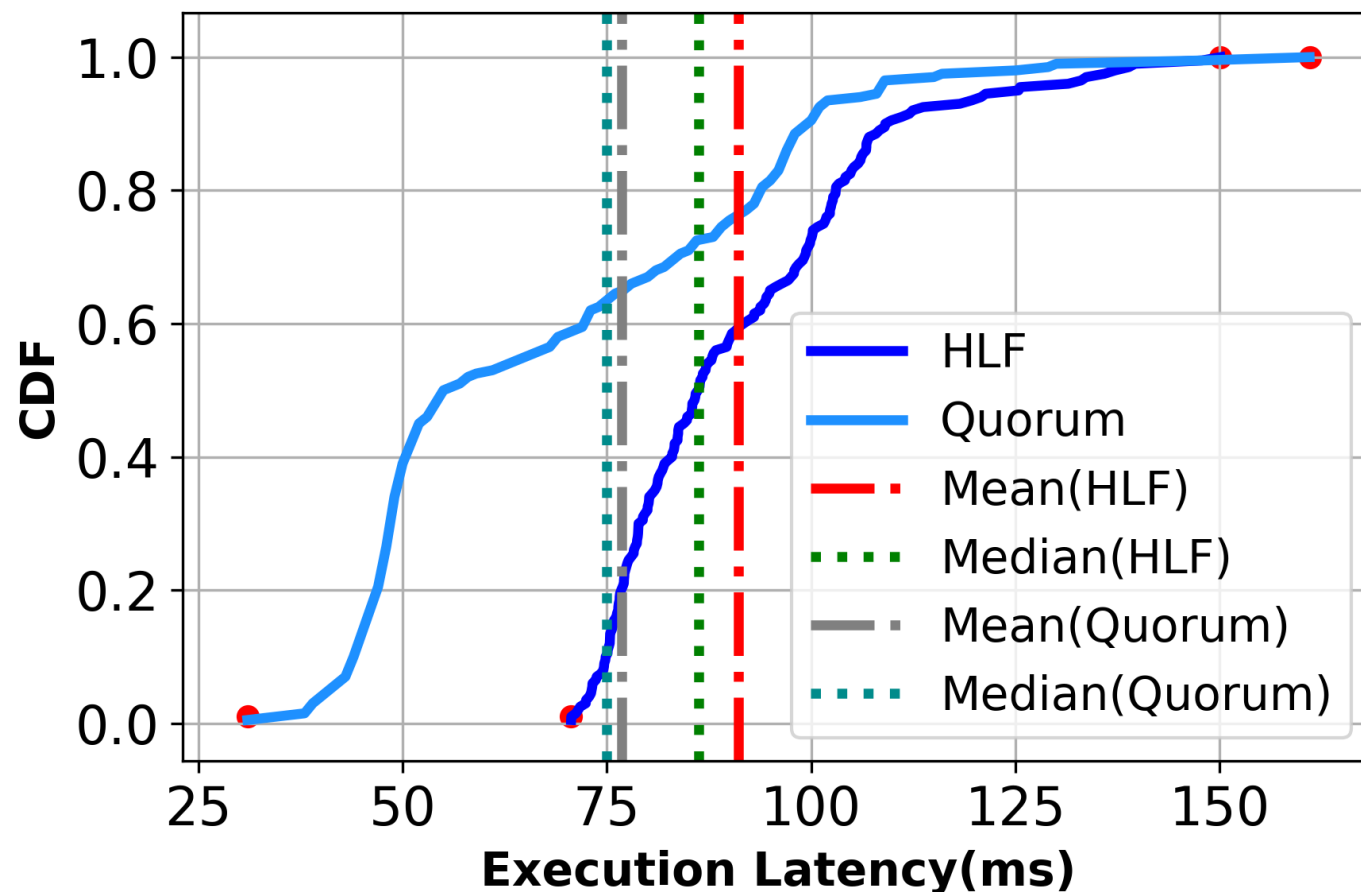


A photograph of two men sitting on a large number of empty, light blue stadium seats. The man on the left is wearing a denim vest over a plaid shirt, glasses, and has red headphones around his neck. The man on the right is wearing a brown jacket, a grey beanie, and sunglasses, and is holding a white smartphone. They are both smiling and looking at the phone. The background shows rows of empty seats stretching into the distance under bright, natural light.

# Smart Contracts' Performance and Ledger-type



# Smart Contracts' execution is dependent on the ledger-type



Mean Execution Time:  
Hyperledger Fabric **~91 ms**  
Quorum **~68 ms**

\* Faisal, T et al. Work to be published in ICBC '2021

# Conclusion

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Smart contract standardisation is important because:

- ✔ Smart contracts are inherently immutable, means care must be taken before their installation.
- ✔ Smart contracts are a potential solution for future transparent and autonomous contracting mechanism and it is only viable with standardised smart contracts.
- ✔ They provide a method to create traceable audit mechanism.
- ✔ Smart Contracts' execution times depends on the ledger type and consensus protocol used.

## For Further Reference

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### ✓ ETSI ISG PDL

- ✓ PDL Terms of Reference, ETSI ISG PDL Portal : <https://portal.etsi.org/TB-SiteMap/PDL>
- ✓ Work Programme: <https://portal.etsi.org/tb.aspx?tbid=873&SubTB=873#lt-50611-work-programme>
- ✓ PDL Community: <https://portal.etsi.org/TB-SiteMap/PDL/List-of-PDL-Members-and-Participants>

### ✓ PDL Proofs of Concept (PoCs)

- ✓ PDL Wiki and PoC Proposal How-To: <https://pdlwiki.etsi.org/>

### ✓ Research and Standardisation

- ✓ Research Projects interested in collaborating with PDL refer to: [PDL Work Programme](#), [PDL Membership List](#), [PDL Member Agreement](#)/[PDL Participant Agreement](#)
- ✓ ETSI Research and Standards Website, ETSI Research Strategy, ETSI Tools for Researchers, FAQs on Research and Innovation: <https://www.etsi.org/research>