

Control by design, the new frontier of audit?

The case for a blockchain solution

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How difficult is to falsify a digital document?

Modifying content and metadata, such as creation date and author, without IT skills



Starting point



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Audit preview
Information on an upcoming audit



**EU action to fight
antimicrobial
resistance**

February 2019

Document Properties

Description Security Fonts Custom Advanced

Description

File: AP_Anti-Microbial resistance.pdf

Title: Audit Preview - EU action to fight antimicrobial resistance

Author: European Court of Auditors

Subject:

Keywords:

Created: 25/02/2019 11:21:15

Modified: 25/02/2019 17:01:04

Application: Acrobat PDFMaker 15 for Word



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Looking for help

how to modify the creation date of a pdf



About 2,020,000,000 results (0.67 seconds)

Many options in terms of desktop application and even free online tools



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Using a dedicated online tool

 **Edit PDF metadata**
Change PDF metadata: author, title, creation date, etc.

[+ Add file\(s\)](#)  

or drag & drop

Author:

Title:

Subject:

Keywords:

Created on:

Modified on:

[Apply changes](#)

[Download file](#)  

< 1 minute !



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Result

Document Properties

Description	Security	Fonts	Custom	Advanced
Description				
File:	Alarming Findings_Anti-Microbial resistance.pdf			
Title:	Alarming findings - EU action to fight antimicrobial resistance			
Author:	European Court of Auditors			
Subject:				
Keywords:				
Created:	13/04/2017 11:21:15			
Modified:	14/04/2017 17:01:04			
Application:				



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Alarming Findings
From a recent audit



**EU action to fight
antimicrobial
resistance**

April 2017



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How difficult is to falsify a digital document?



And yet, the majority of our supporting documents and audit evidence come in **digital (unsigned) format**.

Is there a solution to mitigate this issue?

In the “physical world”, we would ask a notary to timestamp and seal our paper document.

The notary himself would provide the needed trust.



Can we build an equivalent for the digital world?

Objectives

To design a solution whereby documents produced by **different stakeholders** are systematically **notarised**, are easily verifiable and create a common, reliable audit trail that every stakeholder can trust.



“Control by design”

The case for a blockchain-based solution

The ECA Registry

Part 1 - Introduction

How to build a notarisation service on blockchain

History of ledgers



A few centuries old

Physical and centralised



A few decades old

Digital and centralised



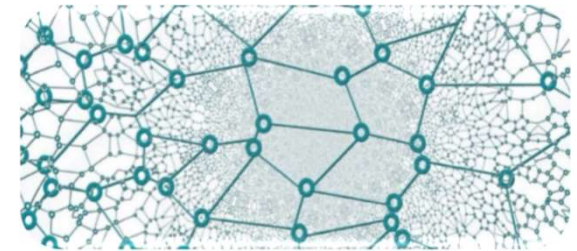
10 years old

Natively digital and decentralised

What is blockchain in one slide

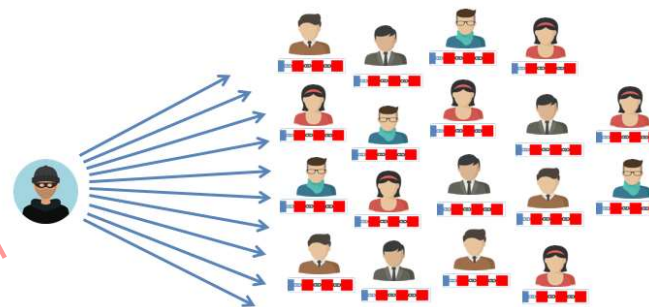
A blockchain is a **distributed** digital ledger (database) that can record economic transactions between two parties in a **verifiable**, **permanent** and **secure** way, without the need for **trusted** authorities (intermediaries).

Many copies of the database (nodes) are spread around the globe and synchronised through a **consensus mechanism**.



Once added to the blockchain, transactions **can't be deleted nor modified**.

The past is written in stone: the ledger is an **immutable, ever-growing** list.

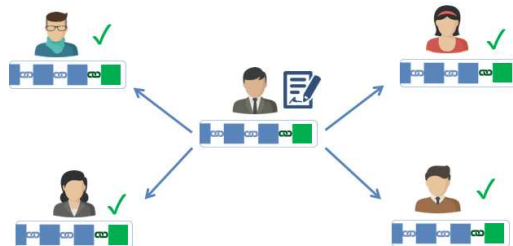


In a centralised system, an attacker would have only **one target**.

With blockchain, he would need to overpower **every other node of the network**, or gain control of at least 51% of the copies of the database.

Each transaction is **digitally signed** by the initiator, and **must be accepted** (validated) by the **majority** of the other nodes.

The ledger is **transparent**: All actors can see all the transactions.



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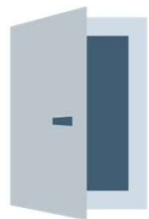
Main variables



Public

vs

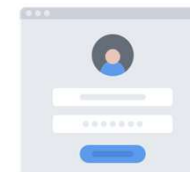
Private



Permissionless

vs

Permissioned

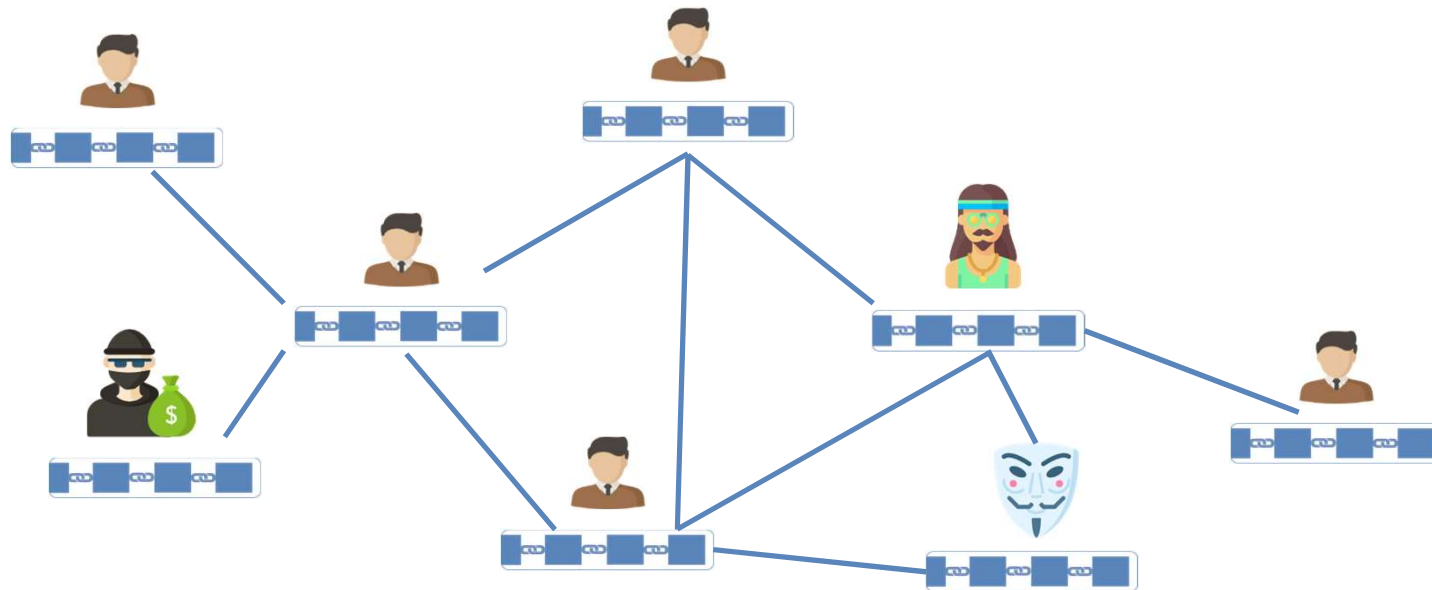


Consensus algorithm



In other words

- Blockchain **builds trust in the data among different stakeholders.**
- This is true **even in presence of untrusted actors**, as long as the majority of the nodes behaves ethically



In other words

- It provides a **common state (truth)** every actor can agree upon and everyone can verify
- It keeps a **permanent** history of all records

... but it is **less efficient** than a centralised database and can store **very little data**.



Some applications



Cryptocurrencies



Smart Contracts



Notarisation services



Notarisation = recording imprints of documents

Imprints = unique digital footprints (hash) generated from the content of a document.

Document = any digital asset (text, message, photo, step in process etc.)

Notes:

- **Any change in the content completely alters the imprint**
→ mechanism to verify the integrity of a document.
- **An imprint on blockchain is “written in stone”**
→ it serves as a future reference to prove that a document has not been altered since its registration.
- **Only the imprint is saved on the blockchain.**
→ the source data (documents, metadata etc.) are kept “off-chain” and can be kept private, as required.



Minutes of the EU Ebola Task Force meeting of 07/05/2015

Main points:

1. **Ebola co-ordination: interplay between UNMEER, OCHA, RC/HC and WHO**
(information by David Nabarro, Special Envoy on Ebola): As of today, the lowest number of cases has been reported since the beginning of the outbreak, 9 in Guinea, 9 in Sierra Leone and no new cases in Liberia for 40 days. However, a substantive risk linked to the virus subsists and WHO expects it will need to continue to work in full operational mode until at least September/October, to have the epidemic completely under control. The handover between UNMEER and WHO, providing the technical guidance, epidemiology and field coordination, WFP for logistics, air travel and communications, OCHA to be responsible for support to the RC in communication and information management, and other partners has been on track since February. The division of tasks are being summarised, with specific attention being paid to clarifying accountability of the different parts of the implementation. Special Envoy Nabarro will focus on sustaining adequate funding to ensure the continuation of operations. In terms of planning, in Sierra Leone the handover is expected to take place at the end of June and in Guinea at the end of July, 2015.

2. **LRBD: The PREPARE project (presentation by France)**: France presented the PREPARE project, aimed at strengthening the preparation, prevention and response to epidemics in Guinea by setting up early warning and rapid response teams at a regional district level. The project has been designed in coordination with the main stakeholders, the Guinean Ebola Coordination Cell and Ministry of Health, the French civil protection, the Bioforce Institute and Expertise France. The project is funded by the European Commission (4.6 million euros) and France (1 million euros).

3. **Update from the field (ECHO Offices in Liberia, Guinea)**: In Sierra Leone, two different districts have active cases of Ebola, with 0 cases reported by WHO. One district is in a large slum area of Freetown, where authorities have established a cordoned sanitare and the second district is in Kambia, where cross border information and communication remains the largest issue. Liberia will mark 42 days since the last case of Ebola was reported. A very cautious celebration will be staged, highlighting the fact that the transmission continues in neighbouring countries. ECHO Liberia stressed the need for clarification of the division of labour post-UNMEER. The decision made by the Liberian authorities to guarantee hazard pay to all health workers remains a large challenge to financing of the health system, in the short and medium term.

1. **Ebola co-ordination: interplay between UNMEER, OCHA, RC/HC and WHO**
(information by David Nabarro, Special Envoy on Ebola, Bruce Aylward, WHO and Peter Craaff, UNMEER)

WHO's Assistant Director-General, Bruce Aylward provided the TF with an epidemiological overview of the current situation in the region. As of today, the lowest number of cases has been reported since the beginning of the outbreak, 9 in Guinea, 9 in Sierra Leone and no new cases in Liberia for 40 days. However, WHO highlighted that a substantive risk linked to the virus subsists and the low number of new cases should not trigger an end to the

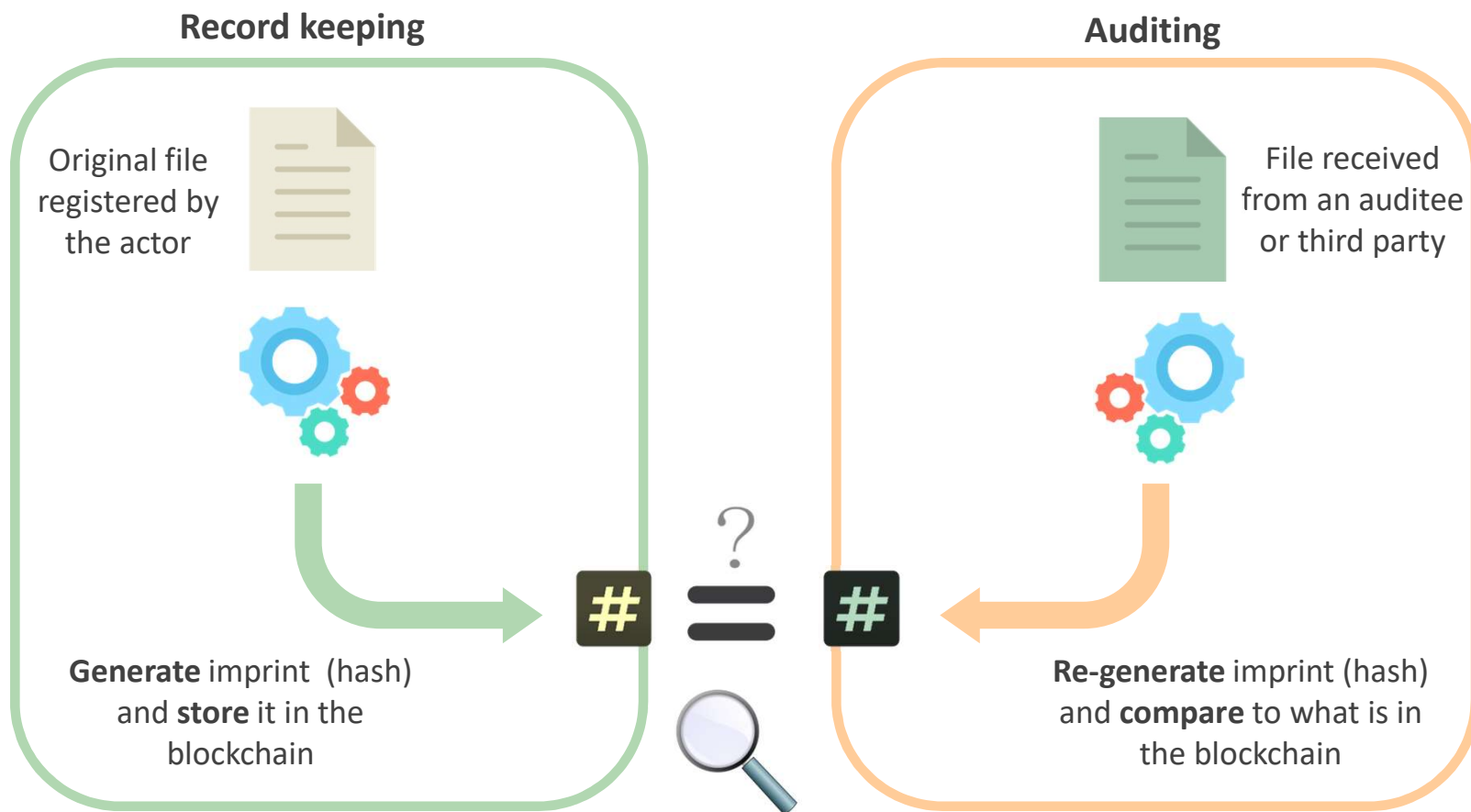


0086 46BB FB7D CBE2 823C
ACC7 6CD1 90B1 EE6E 3ABC



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Verifying a document's integrity / authenticity



Part 2 - The beginning

The ECA Registry PoC

The ECA Registry

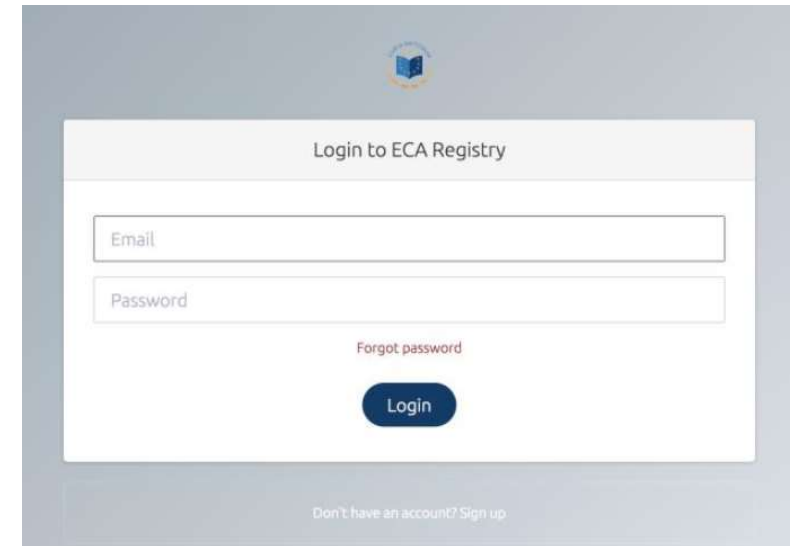
A Proof of Concept (Mar-Jun 2018) developed together with a private company.

It acts as a **notarisation service** that allows users to:

- register on **public blockchain(s)** digital documents
- verify their authenticity
- create a **secure, timestamped audit trail**.

Moreover the ECA registry:

- allows to **record** and **link together** *imprints* of files and their metadata
- allows for bi-directional exchange of information with third parties in a **GDPR compliant** way
- **naturally interfacing** with existing systems (API)



The screenshot shows the 'Login to ECA Registry' interface. At the top is the ECA logo. Below it, the title 'Login to ECA Registry' is centered. There are two input fields: 'Email' and 'Password'. Below the password field is a link that says 'Forgot password'. A blue 'Login' button is positioned below the password field. At the bottom of the form, there is a link that says 'Don't have an account? Sign up'.



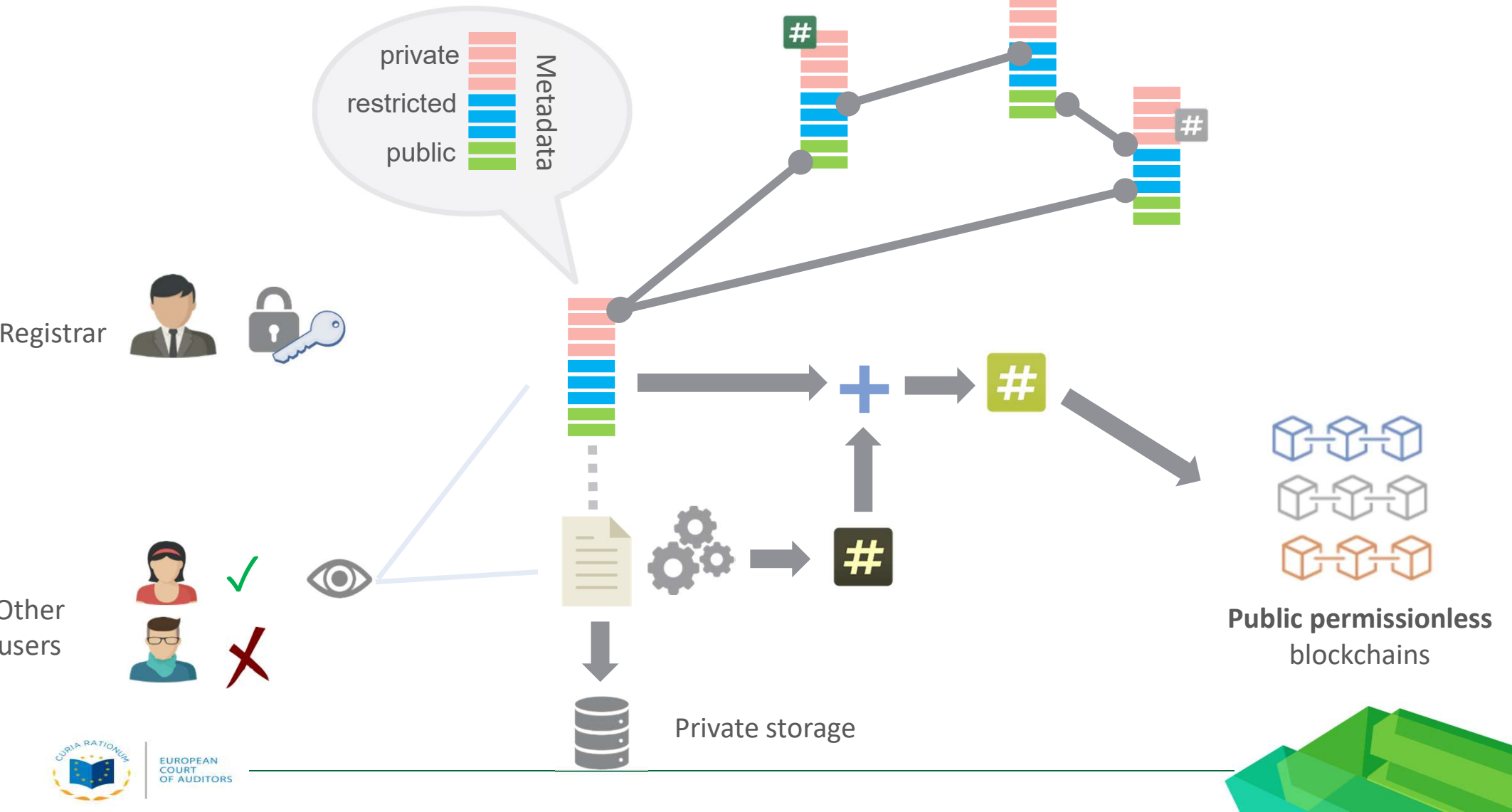
Existence+integrity | Permanent | Time-stamped | Verifiable | Interlinked



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How does it work?



Our main use case: audit documentation

Scenario

Commission services, managing authorities and beneficiaries of EU funds **notarise systematically and in decentralised way** files which may be relevant for an audit (e.g. contracts, invoices and other supporting documents).

Original document (private storage)



Registration (linked to public blockchains)

Title	Type	Created at	
Venue change - materiality	Notification	17 Oct 2018 - 20:35:49	View
Presence list	Proof of delivery	17 Oct 2018 - 20:38:44	View
Participants list	Proof of delivery	17 Oct 2018 - 21:58:56	View
Training material	Deliverable	17 Oct 2018 - 22:01:25	View
Expenses Jun. 15 - Feb. 16	Expenses report	17 Oct 2018 - 22:06:31	View
Expenses approval	Authorization	17 Oct 2018 - 22:08:56	View

Enter imprint... [Check imprint](#)

Proof of delivery registration reg_5bc79dd34c9b6 Registered

</> Imprint
61F073D2A7872A849435400060EBCA6C7
13C2A716F5D5E336321D286054C640B

Description
No Info Available

Registrar
ECA Registry
European Court of Auditors (ECA)

Registration time
2018-10-17 20:38:43.547088 (UTC)

Ethereum Transaction **Bitcoin Transaction**

Additional Information about this registration

Relations

Registered on the blockchain using the Compello Registry



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Our main use case: audit documentation

They explicitly authorise the ECA to access their registrations (GDPR compliant process). The ECA is a Certified Registrar and as such can also register documents on behalf of an auditee, when authorised. The registered documents become visible as well **in the auditee's account**.



Unauthorise registrar

Registrar details
• Certified registrar
👤 Authorized registrar
📍 Based in Luxembourg

ECA Registry

[Visit registrar's website](#)

European Court of Auditors (ECA)

The Court of Auditors (European Court of Auditors, ECA) (French: Cour des comptes européenne) is the fifth institution of the European Union (EU). It was established in 1975 in Luxembourg.

The primary role of the court is to externally check if the budget of the European Union has been implemented correctly, in that EU funds have been spent legally and with sound management. In doing so, the court checks the paperwork of all persons handling any income or expenditure of the Union and carries out spot checks. The court is bound to report any problems in the Court's reports for the attention of other states and institutions, these reports include its general annual report as well as specific and special reports on certain bodies and issues. The Court's decision is the basis for the European Commission decisions; for example, when the Court found problems in the management of EU funds in the regions of England, the Commission suspended funds to those regions and prepared to fine those who did not come back up to acceptable standards.



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Three layers

User interface

	Title	Type	Created at	
☐	promotion event india	Proof of delivery	28 Sep 2018 - 10:08:42	View
☐	promotion event russia	Proof of delivery	28 Sep 2018 - 10:13:01	View
☐	roadshows declarations	Proof of delivery	28 Sep 2018 - 10:14:26	View
☐	Invoice - Platon 052	Invoice	28 Sep 2018 - 10:22:21	View

Registry database

\$ Invoice registration reg_5bae00dd11fee

</> Imprint

D646FF3FB81436E0ABB7234B79236D9F6BA8890
EF30DF516FDC6DA8096C00CC1

Description

No Info Available

Registration time

2018-09-28 10:22:21.266890 (UTC)

Ethereum Transaction

Additional Information about this registration

date	31 July 2017
amount	8565,92
currency	EUR
invoice_number	052

Blockchain explorer

Etherscan

Rinkeby Testnet Network

All Filters Search by Address / Txn ID Home Blockchain

Transaction Details

Overview

[This is a Rinkeby Testnet Transaction Only]

Transaction Hash:

0x64279ec9b172ca7ab69c61c877370e3999445df1687bec0056fdb69b78f4bf0b

Status:

Success

Block:

3078450 1624109 Block Confirmations

Timestamp:

281 days 23 hrs ago (Sep-30-2018 10:36:25 AM +UTC)

From:

0x7c3d5b476dbe5592dc71533e31cf635740e72394

To:

0x7c3d5b476dbe5592dc71533e31cf635740e72394

Value:

0 Ether (\$0.00)

Transaction Fee:

0.000023448 Ether (\$0.00)

Gas Limit:

23,500

Use case: audit documentation

Potential benefits



Integrity of the supporting documents provided is guaranteed



It is possible to prove that **time-sensitive documents** were produced before a given deadline



Audit trail of **interlinked documents** (logical chain)



Decentralised and **GDPR compliant** process



Reduced administrative burden for auditees – “Once only” principle



In case of widespread adoption, **faster and fully digital audits** would be possible



Other potential uses

Public Procurement

- Call for tender, offers and other documents are notarised as soon as they are produced. This leads to:
 - ✓ A **fully digital**, notarised and **verifiable procedure, with a lightweight tool**
 - ✓ More **transparency** on the process vis à vis citizens

ECA publications

- **All the ECA publications are notarised** through the Registry as **part of the publication process**. This guarantees:
 - ✓ Protection of content integrity (e.g. in case of outsourced publication).
 - ✓ Possibility to verify a document (by any stakeholders, including citizens)
 - ✓ In the context of open data/creative commons, certification of original content (imprint + timestamp)



Other potential use cases

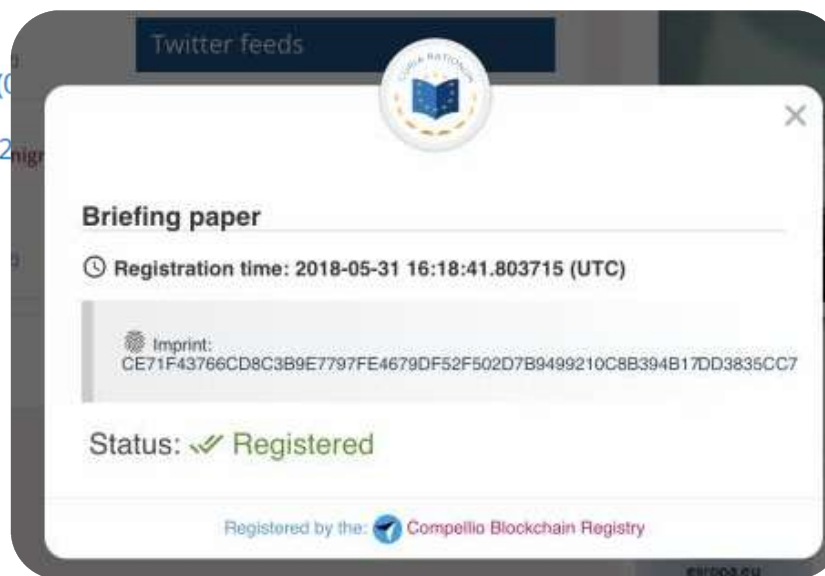
ECA Publications

Recently published

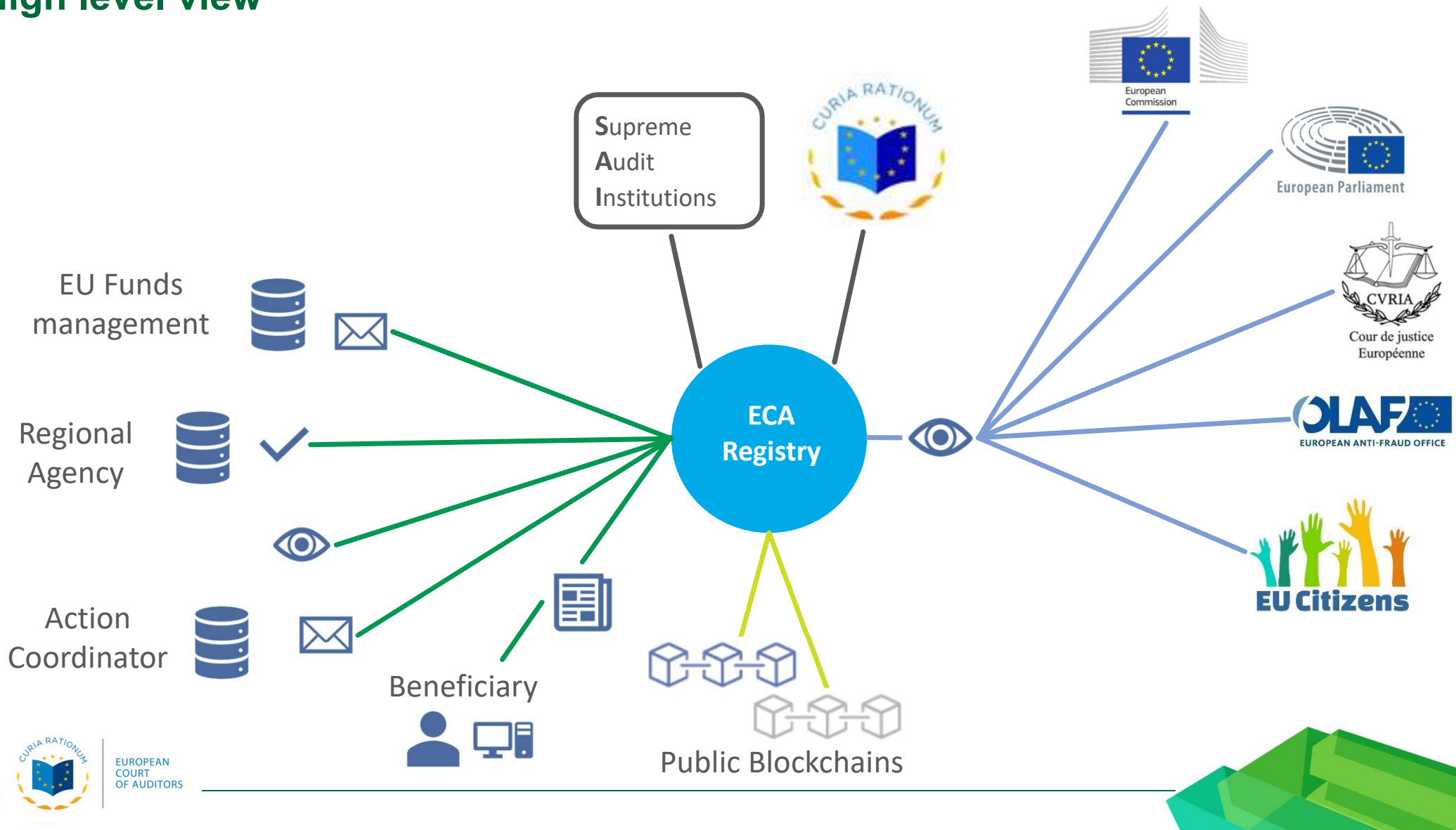
28/05/2018

**Briefing Paper: Simplification in post-2020
delivery of Cohesion Policy**

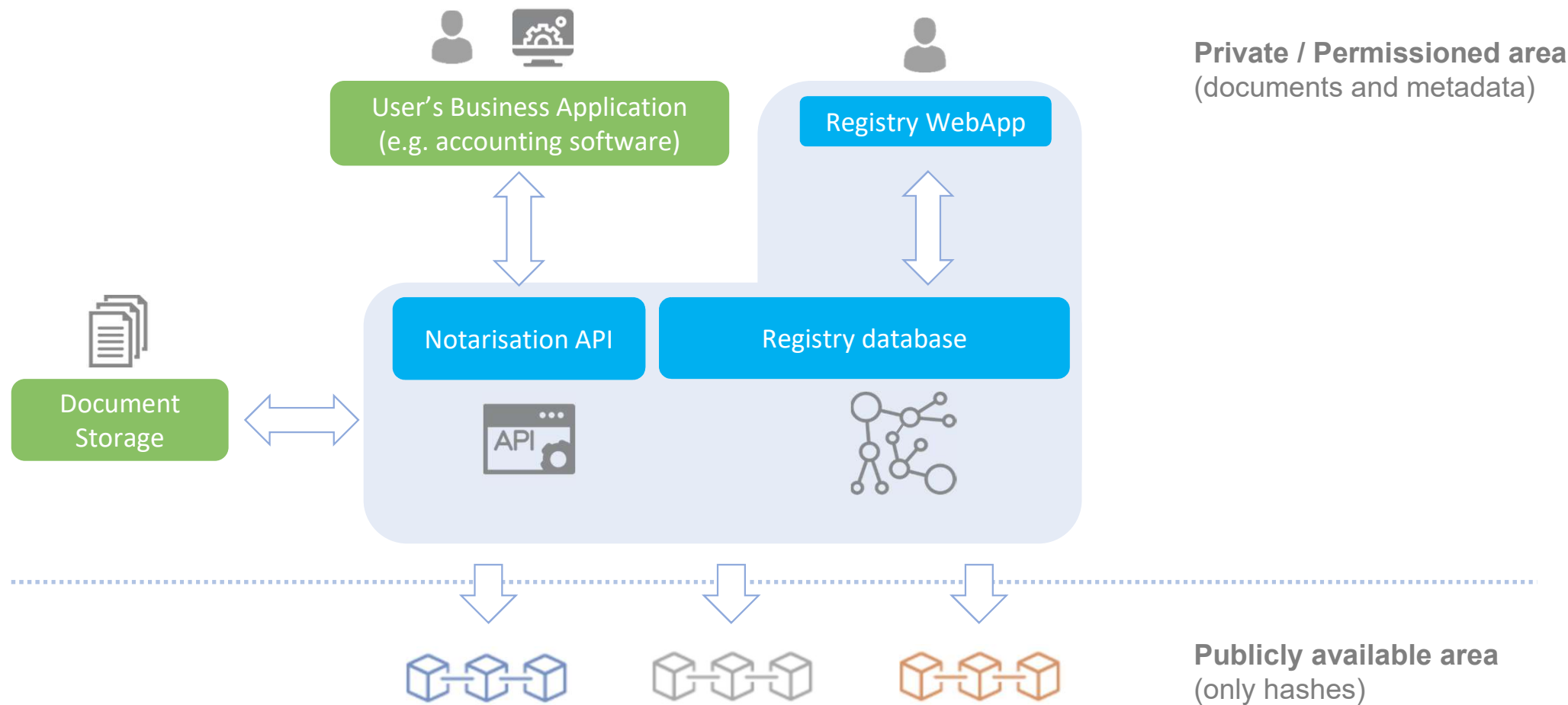
EN 2 MB | Other Languages (0)
Press release | Other Languages (22)



High level view



Simplified conceptual architecture



Part 3 – The present and future

The European Blockchain Services Infrastructure

European Blockchain Partnership

26 EU Member States
plus Norway and
Liechtenstein



- Recognise potential of blockchain to transform digital services in Europe
- Signatories and EU institutions to work together to make Europe the leader
- Build a **European Blockchain Services Infrastructure (EBSI)**:
 - ✓ Started in 2018 – **First services in 2020**

Implementation
in cooperation with
EU Member States



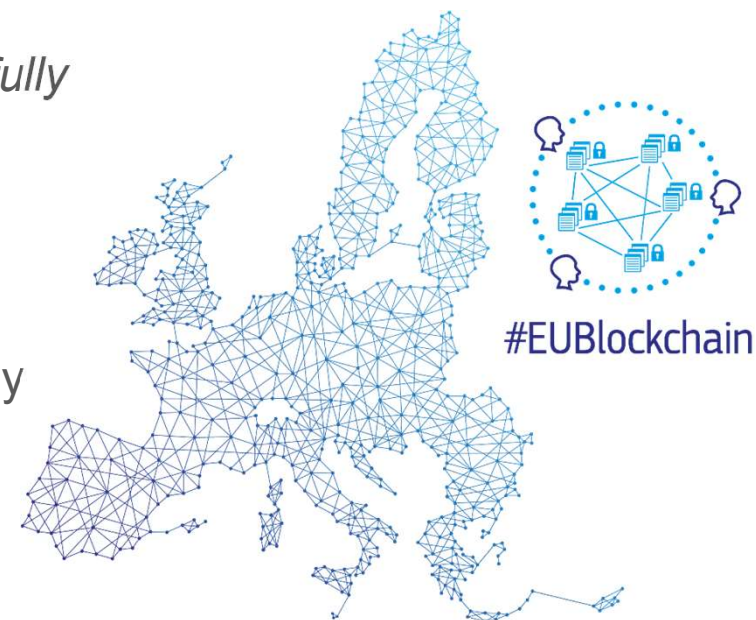
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European blockchain Services Infrastructure (EBSI)

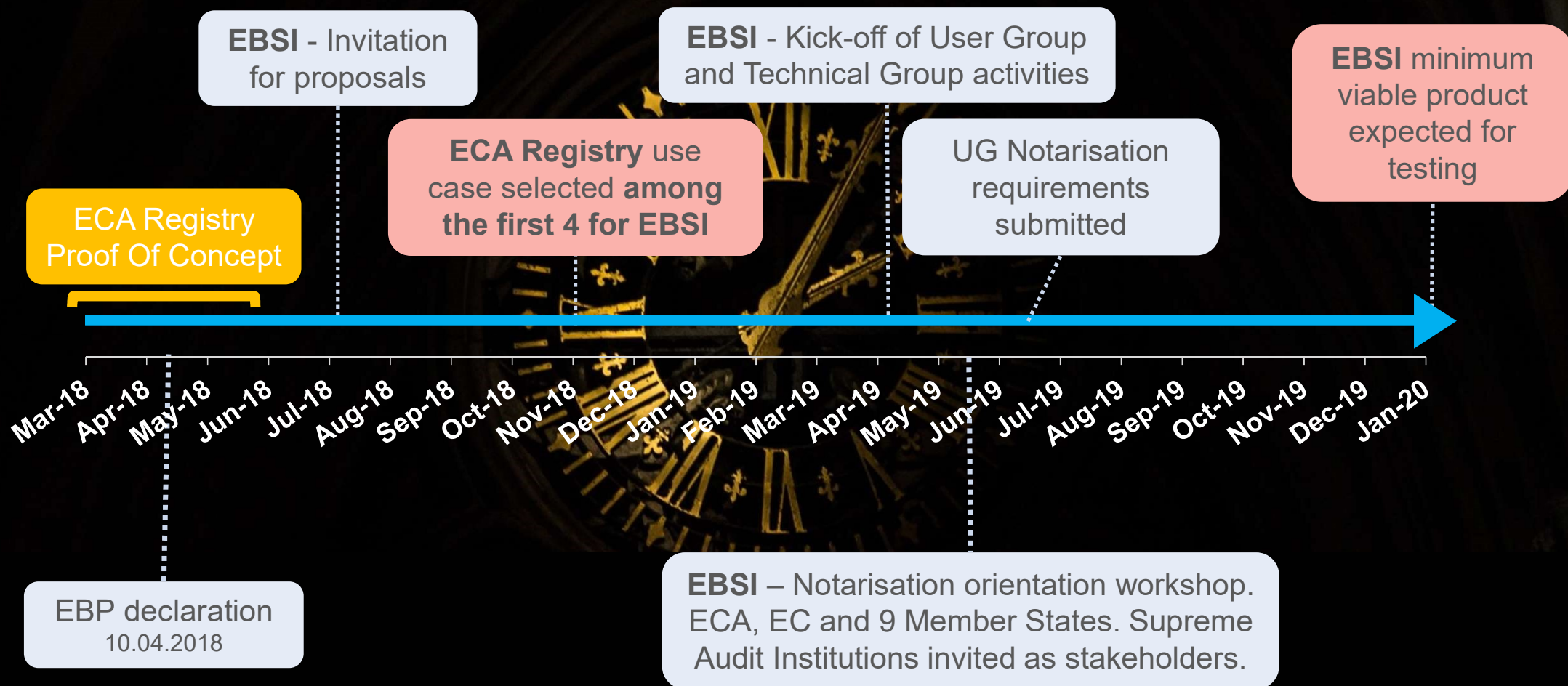
Ambition: put in place the EBSI as a **"gold" standard** in terms of *Cybersecurity, Energy efficiency, Scalability, Performance, Service continuity, integrating EU standards, fully compliant with EU regulations (e.g. GDPR)*

Practical implementation via use cases agreed upon by European Blockchain Partnership:

- First focus on **cross border public services** substantially enhanced through the use of blockchain
- Enable private services through effective public-private partnership
- EC funding through Connecting Europe Facility (2019-20) and then Digital Europe Programme proposal (as of 2021)



ECA Registry and EBSI - Timeline



The next steps – Not just a technical matter

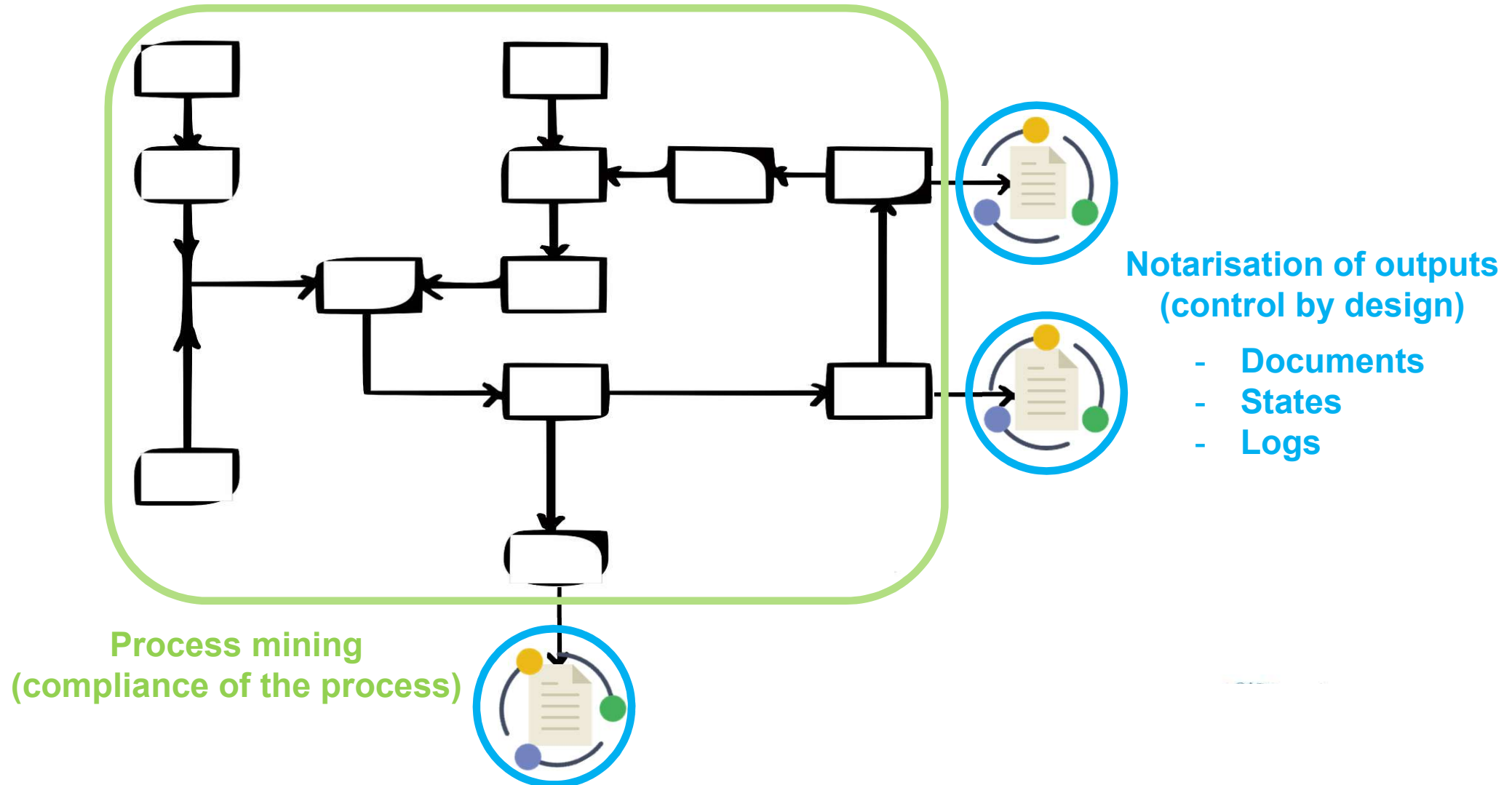
The technology has been tested in the PoC and will be soon (re)developed as a pan-European service. Some technical details still to be defined in such a broader context (e.g. identity standard(s)).

The main choices to be made are now **business related** (e.g. metadata sets)

But above all, we will have to **update our rules/processes accordingly**. For example, the notarisation of documents by the beneficiaries could become a mandatory requirement for the disbursement of EU funds.



Complementarity with process mining



Conclusion

A blockchain-based registry

provides a solution whereby outputs produced by **different stakeholders / processes** can be systematically **notarised**, are easily verifiable and create a common, reliable audit trail that every stakeholder can trust.



“Control by design”

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