E-ID in India

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21 Mar 2023

Table of contents

What is Aadhaar?

- 12 digit unique biometric ID system established in 2009
- ID linked to photo, 10 fingerprints and 2 iris scans
- Voluntary; available for all citizens and non-citizens with residence in India for at least 6 months
- World’s largest biometric ID system - 1.35 billion IDs
- Managed by a dedicated government department - Unique Identification Authority of India (UIDAI)

Why Aadhaar?

- Many specific purpose ID documents - but not guaranteed to be unique per person
  - Ration card for food security
  - Voter ID card to exercise voting rights in elections
  - Passport
  - PAN card for income tax compliance
  - Driving license
- Aadhaar is unique ID by design; linking of the different IDs to Aadhaar improve reliability (e.g. Voter IDs)

Benefits - Poverty Alleviation

- Rajeev Gandhi, Indian prime minister (1980s): “*For every 1 rupee target towards poverty alleviation, only 15 paise (0.15 rupee) reached the intended beneficiary*”
  - High leakages due to very high levels of corruption and administration expenses
  - Fake or duplicate ration cards created by organised crime syndicate

- Aadhaar based Direct Benefit Transfer - subsidies are directly transferred to bank accounts of the beneficiary
- Aadhaar linked ration cards reduced duplication, and resulted in savings

Benefits - eKYC

- Previously: no consensus among financial institutions on list of ID documents that are acceptable for KYC
- Getting loans for marginalised group was complex due to need for multiple documents for KYC compliance

- Aadhaar card with mobile OTP based authentication - possible over internet (e.g video + UIDAI signed KYC XML)
- Aadhaar simplified Know Your Customer (KYC) process, reducing hassle of loan application processes

Benefits - Ease of Living

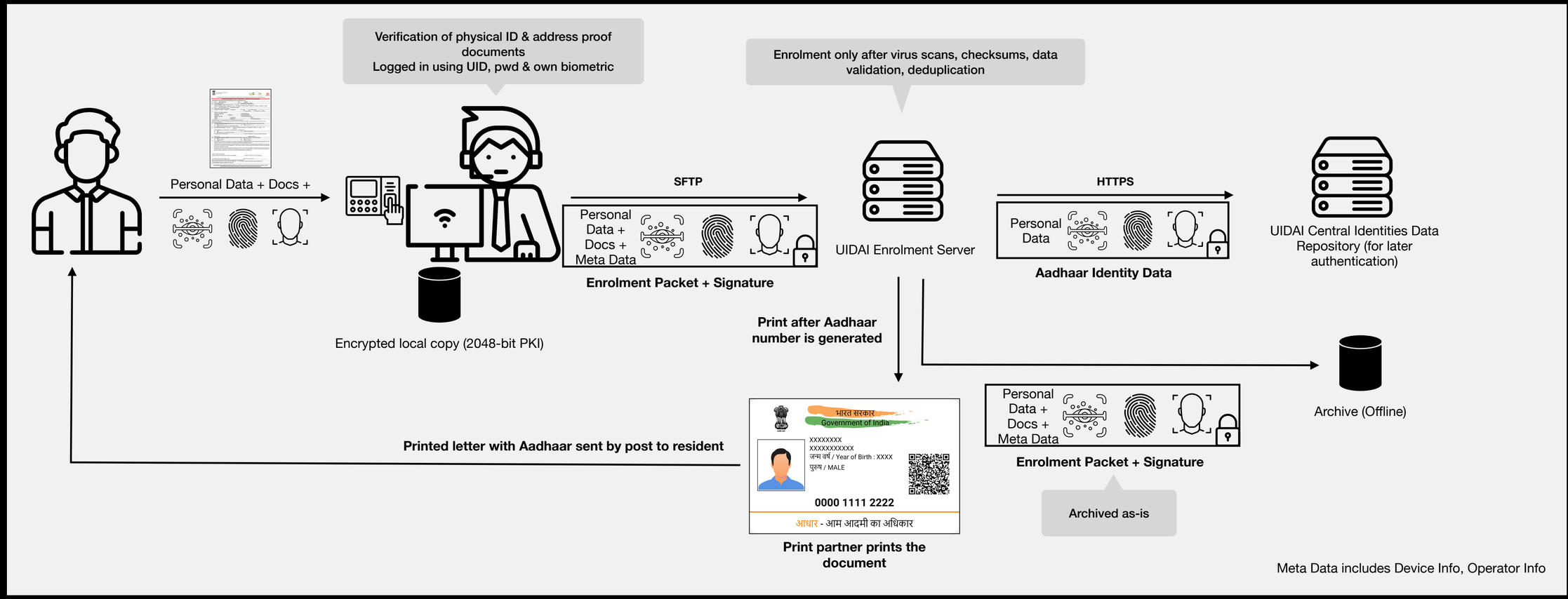
- Ration Card - not portable; need to go through complex process of de-registration and re-registration
- Multiple documents had to be shared manually with different government departments

- One Nation One Card - Aadhaar linked ration card; instrumental in supporting migrant workers during Covid
- DigiLocker - A free of cost Aadhaar enabled digital vault for documents and certificates for Indian residents; supports e-signature, auto updates

Challenges

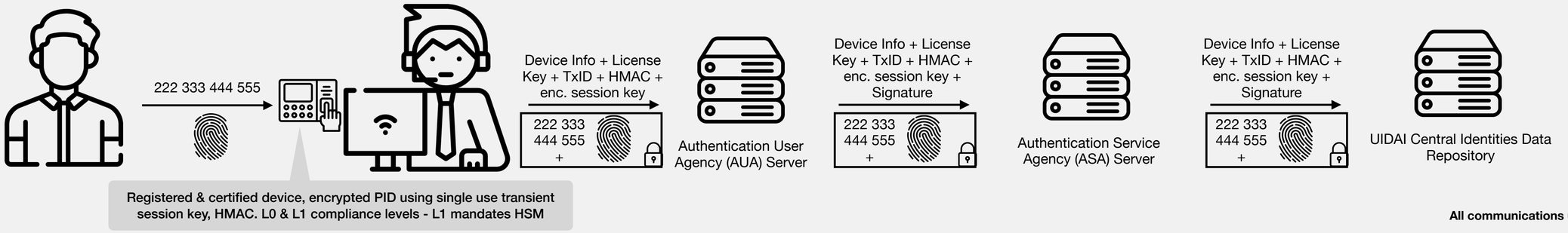
- Bedridden residents get scanning kits at home for enrolment
- Physically challenged residents have exemption process where only one biometric input is taken in addition to photograph (1% of enrolment)
- With population of 1.4 billion, there are still high amount of edge cases not thought of before
- Potential to become tool of mass surveillance - needs vigilance by citizens
    - Though UIDAI itself does not have the linked documents/information

Enrolment process



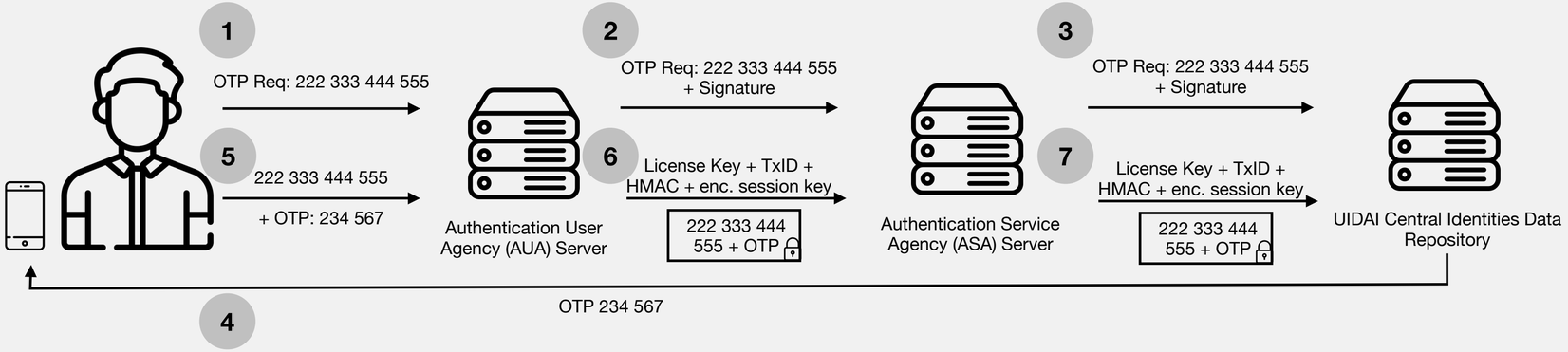
Authentication process

In-person authentication



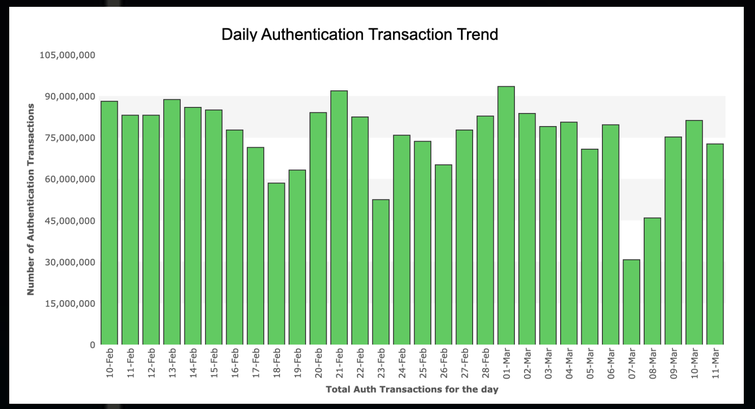
All communications using HTTPS

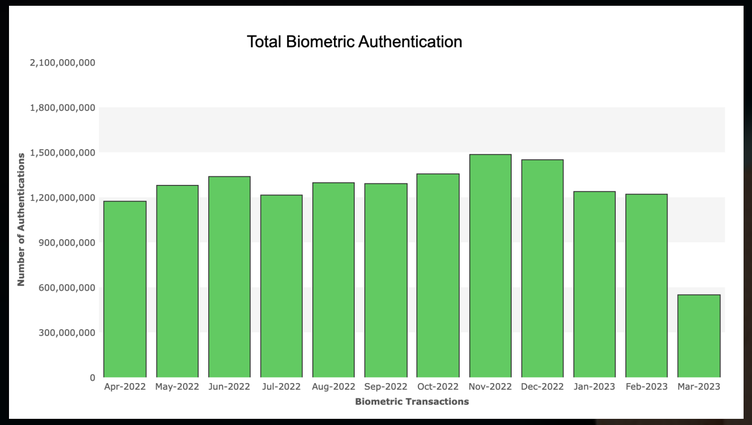
Self-service authentication

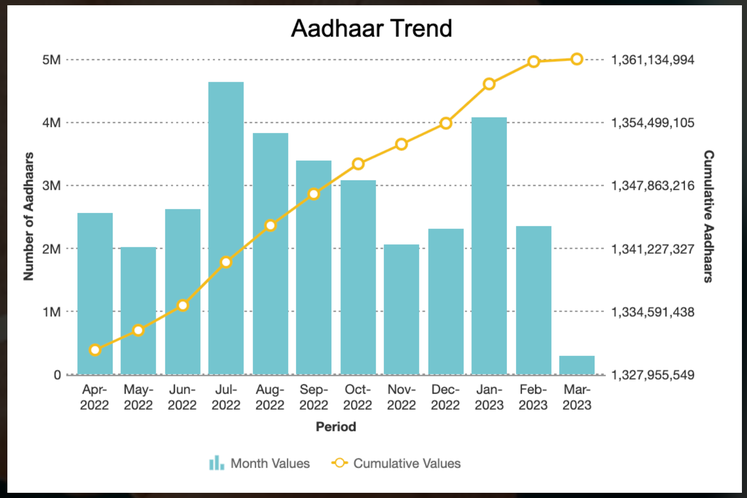


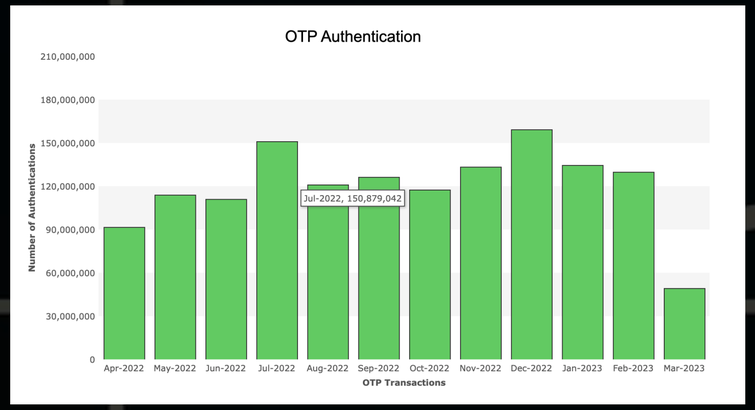
All communications using HTTPS

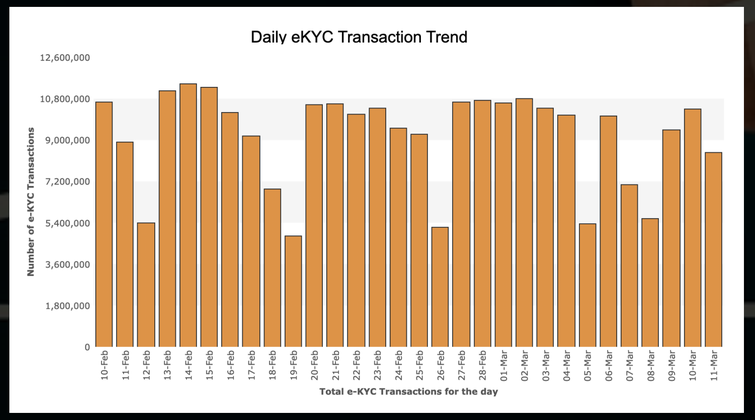
Statistics from Aadhaar Dashboard











Technical Architecture

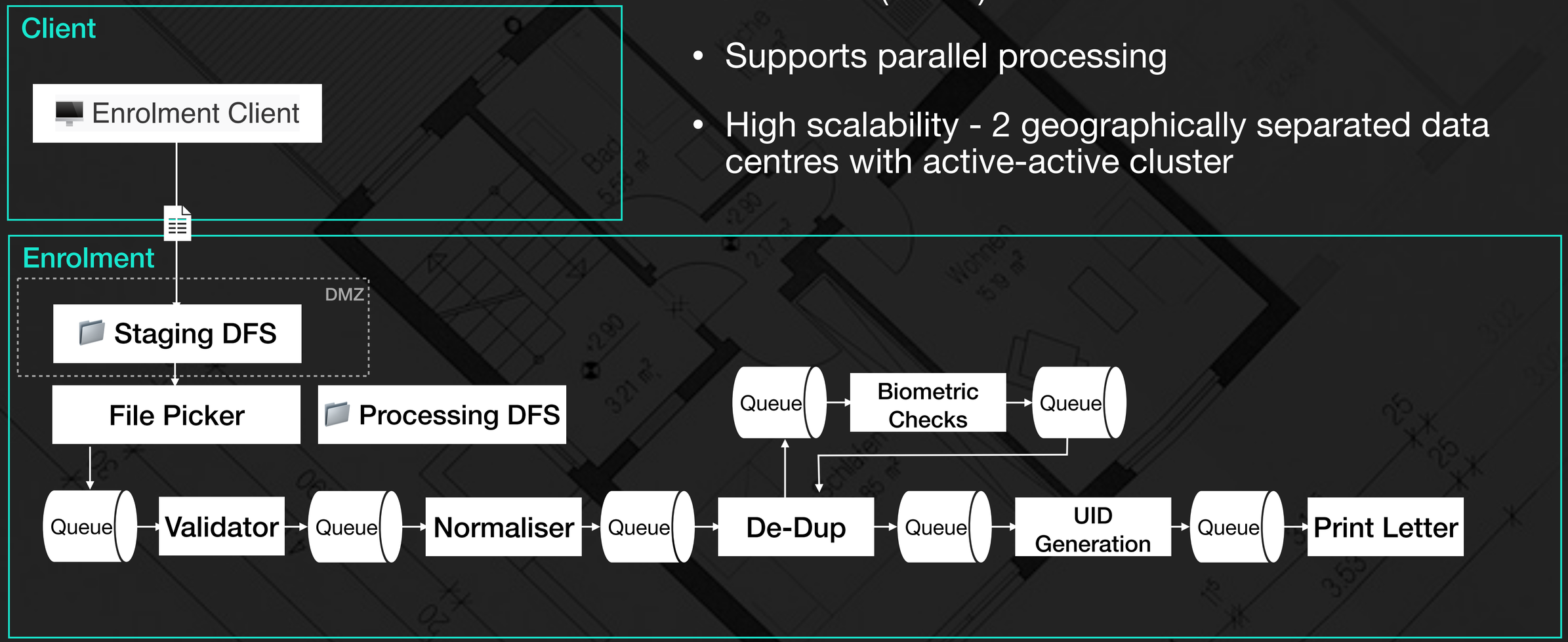
Technology

- Open & vendor neutral
  - Standards, Open Source, APIs, commodity hardware
- Tech Stack
  - Linux, Java+Spring, MySQL, MongoDB, Mule ESB, Apache Tomcat, HDFS, RabbitMQ, XML, JSON, AMQP, HTTP
- Security
  - PKI 2048, Hardware Security Module, physical, & network security, access controls, audits & monitoring, encryption in transit & at rest

Technical Architecture

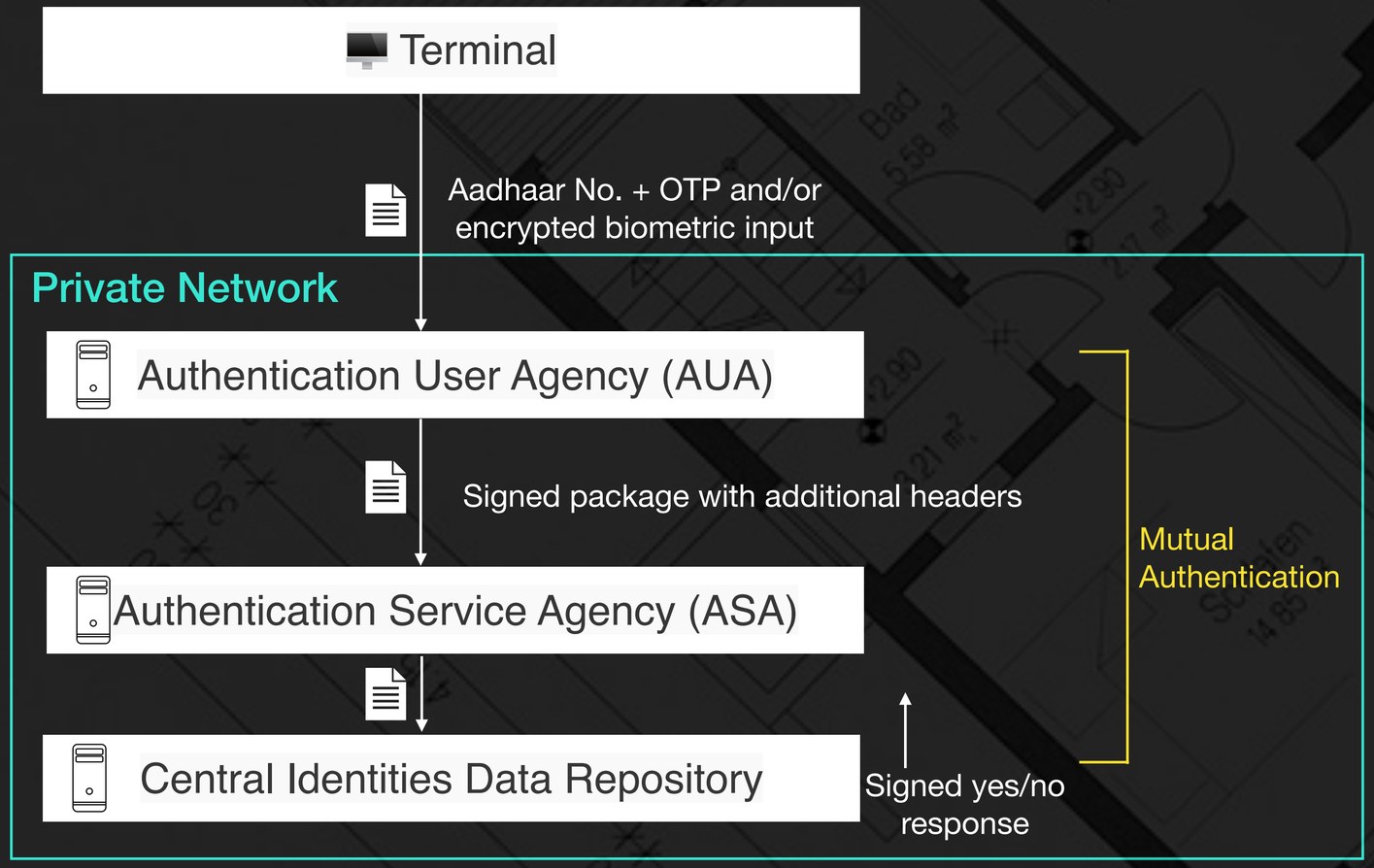
Enrolment Architecture

- Defined as per principles of Staged Event Driven Architecture (SEDA)
  - Supports parallel processing
  - High scalability - 2 geographically separated data centres with active-active cluster



Technical Architecture

Authentication Architecture

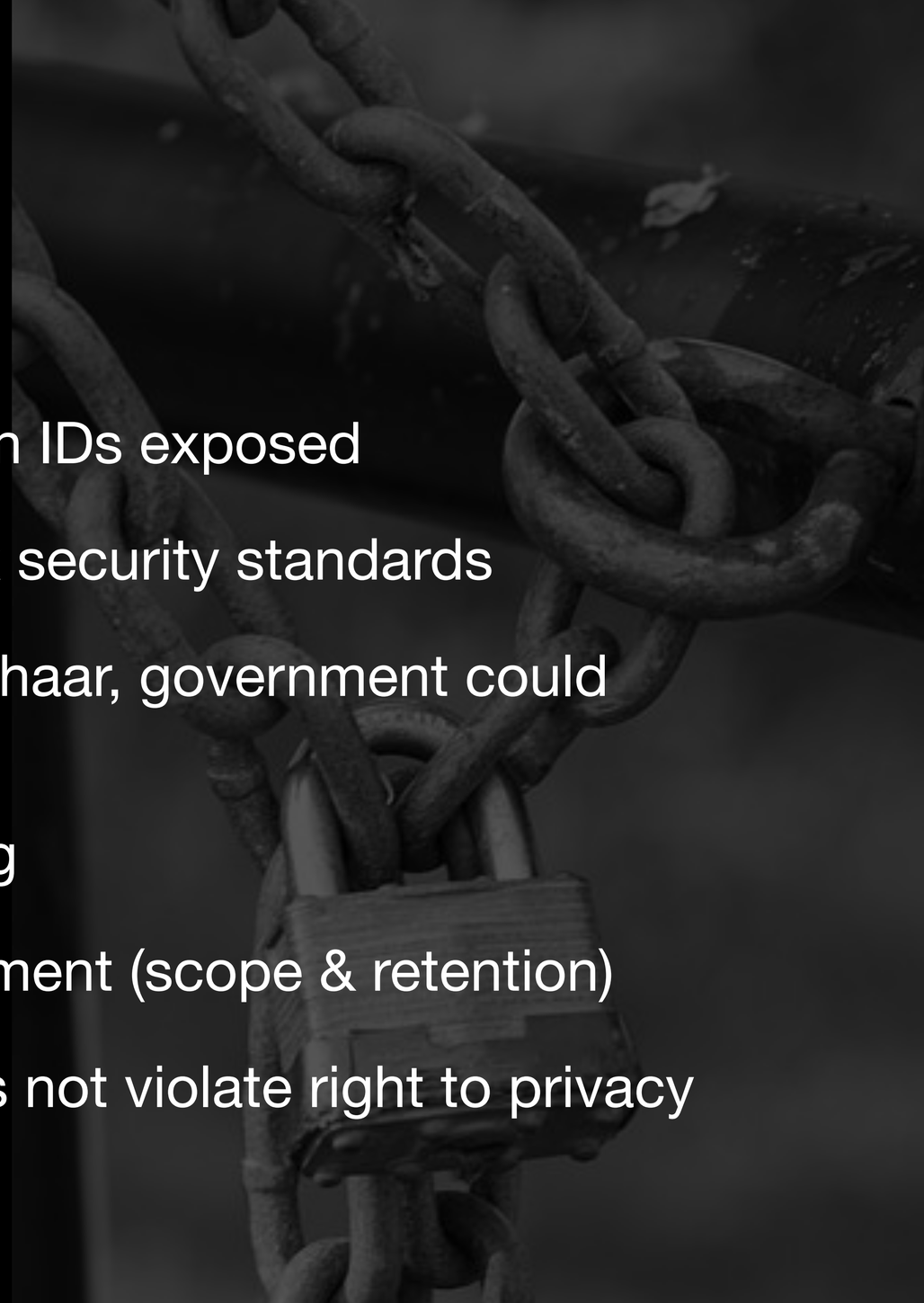


- REST APIs with XML payload over an encrypted channel
- Production servers are within a secure private network and are mutually authenticated
- The input payload is encrypted
- Response is only a “yes/no”

Security & Privacy (1/3)

- Aadhaar captures: Biometrics, Photograph, Name, Gender, DoB, Address, and optionally Mobile & E-Mail
  - No other data is stored or linked within the Aadhaar database itself
- Authentication using OTPs (6digits, 10m) with registered mobile number
- Consent/Authorisation checks before the Aadhaar data is shared with 3rd parties
  - However, 3rd parties may use the data for purposes other than the consent
- One-time use Virtual Aadhaar IDs to avoid sharing of actual Aadhaar IDs
- By legislation Aadhaar is voluntary - but practically a necessity

Security & Privacy (2/3)



- Security breaches in the past - up to 150 million IDs exposed
- Many authorised private organisations have lax security standards
- As more and more services are linked with Aadhaar, government could potentially conduct mass surveillance
- Strong data protection legislation is still missing
  - Currently under consideration by the government (scope & retention)
- Supreme Court judgement 2018: Aadhaar does not violate right to privacy

Security Issues (3/3)

- Replay attacks - previously allowed devices that stored unencrypted biometric data (now fixed with mandatory use of registered devices with transient encrypted biometric data - 2018)
- Biometrics is not a secret - can be forged/spoofed - 440 people defrauded recently (UIDAI now introducing liveness checks)
- SMS is not secure - messages can be intercepted and SMS is prone to SIM card scams
- UIDAI is reactive - many security features added only after occurrences of real world frauds

DigiLocker

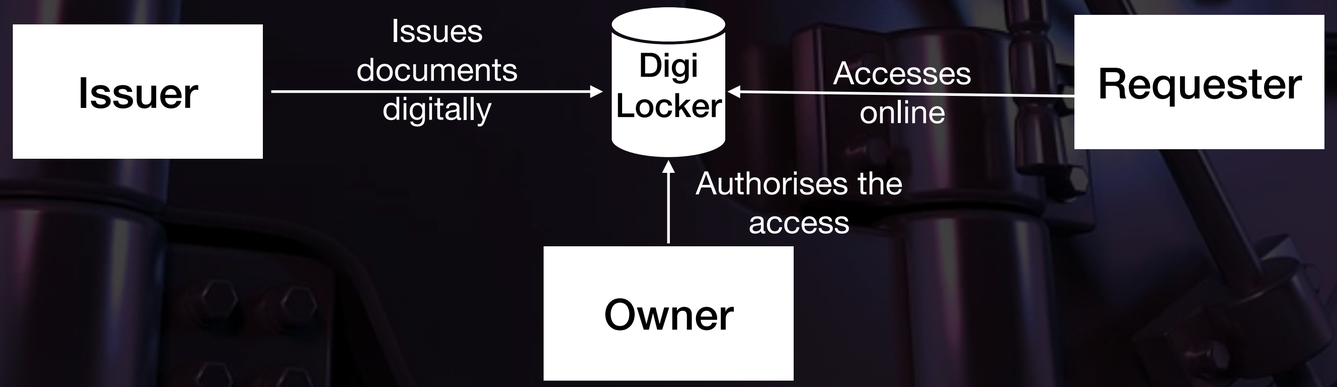
Vision

- Provide shareable private space on a public cloud
- Digitise all documents and records of the citizens and make them available on a real-time basis
- Facilitate process reengineering through paperless processes
- With due authentication, consent, audits, and other security best practices

DigiLocker

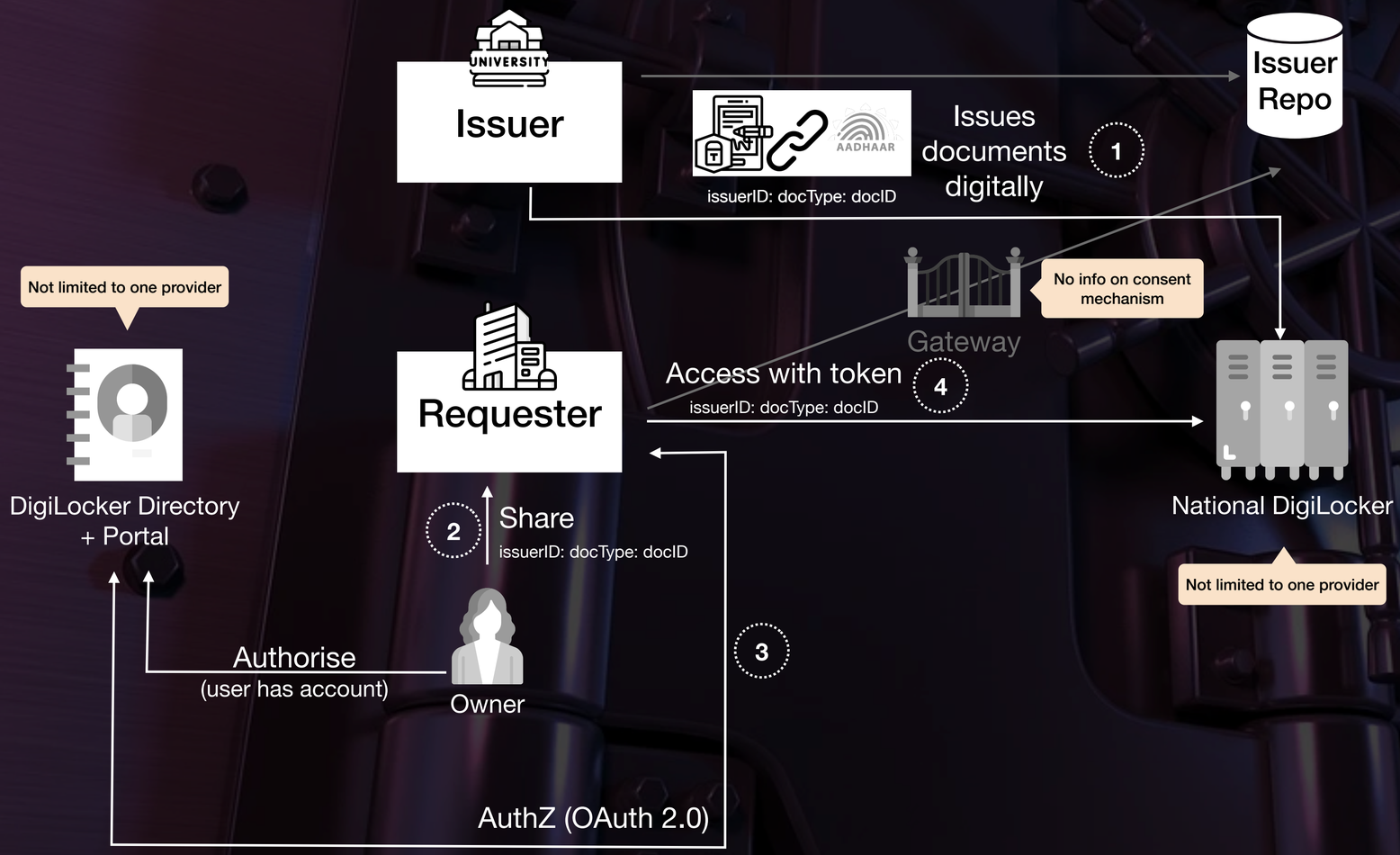
What it provides

- Open and interoperable architecture for creating a multi-provider ecosystem providing choice to the issuers, requesters, and individuals
  - Federated architecture: No centralised single document repository
- E-Sign capability
- Secure access to various government issued documents



DigiLocker

How it works (simplified)



- REST APIs (HTTPS)
- APIs accessed with API Key + Signature
- E-Document (XML)
  - Two references: Machine Readable (e.g. XML) and/or Printable (e.g. PDF)
  - Digitally Signed
  - Owner consent required for documents classified as private/ secure
  - Unique document URI (IssuerID::DocType::DocID)

Appendix

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