JOHANNES KEPLER UNIVERSITY LINZ

Keynote

Digital Authentication in the Real World without Sacrificing Privacy

Computing Conference 2020, 2020-07-16 16:30 (BST/UTC+1), London/virtual

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(Full disclosure: also affiliated with Android security, but not speaking for Google today)

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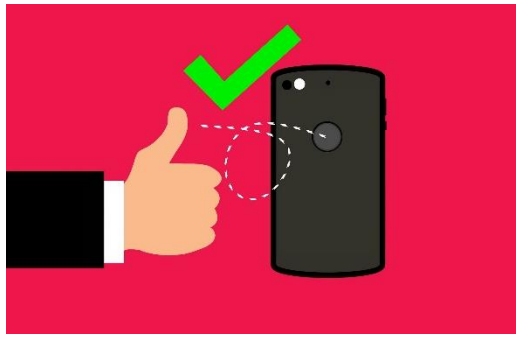
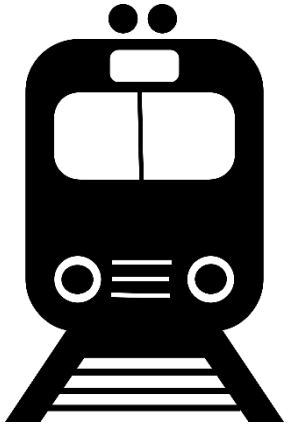
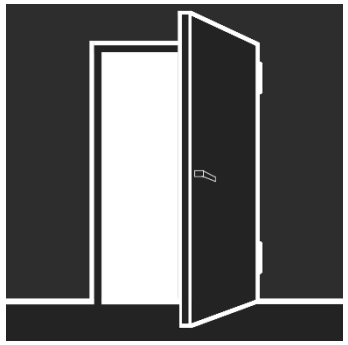
Digital Authentication – Identity and Attributes







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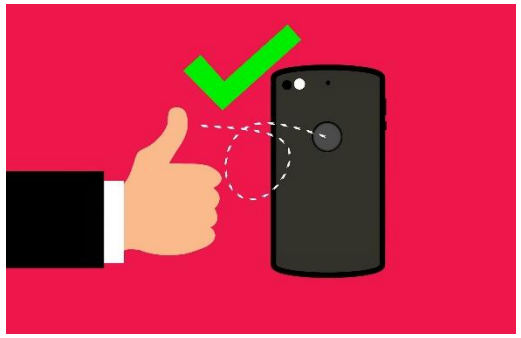
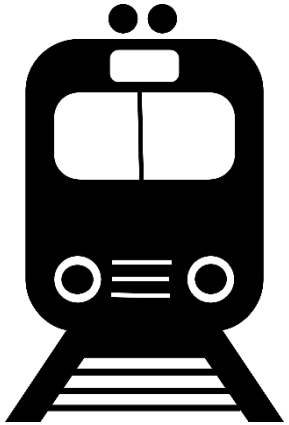
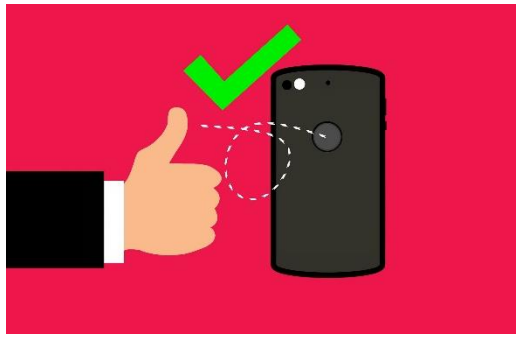
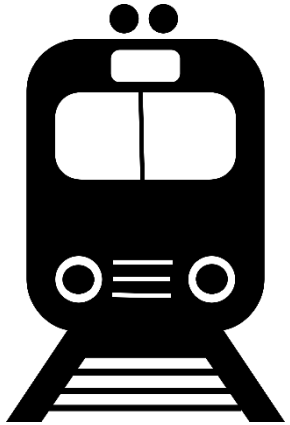
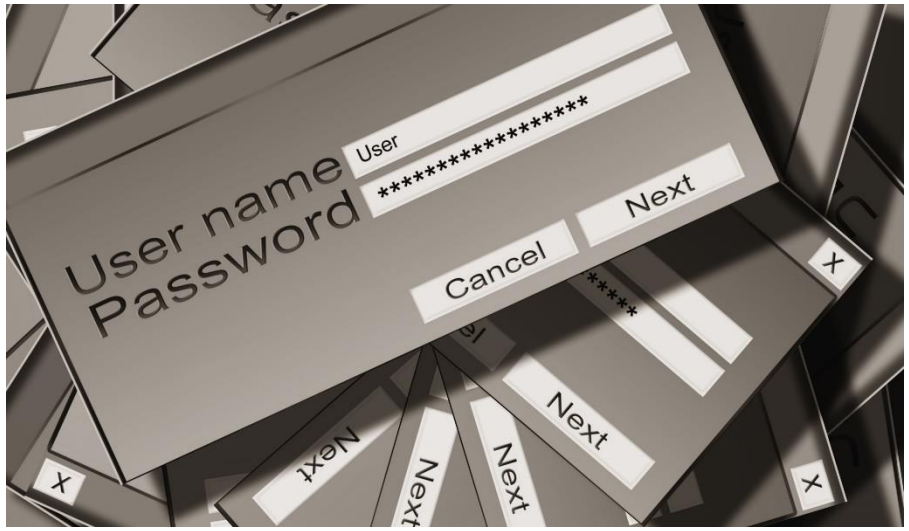




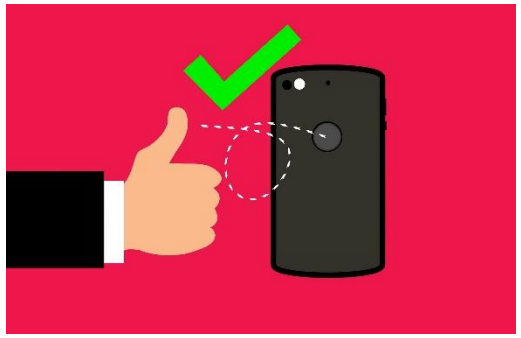
Digital Authentication – “State of the Art”

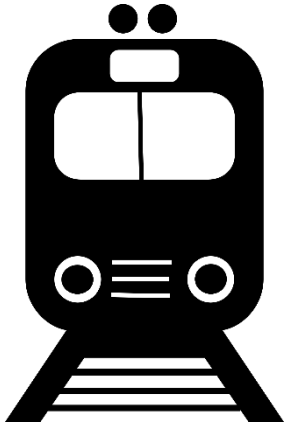




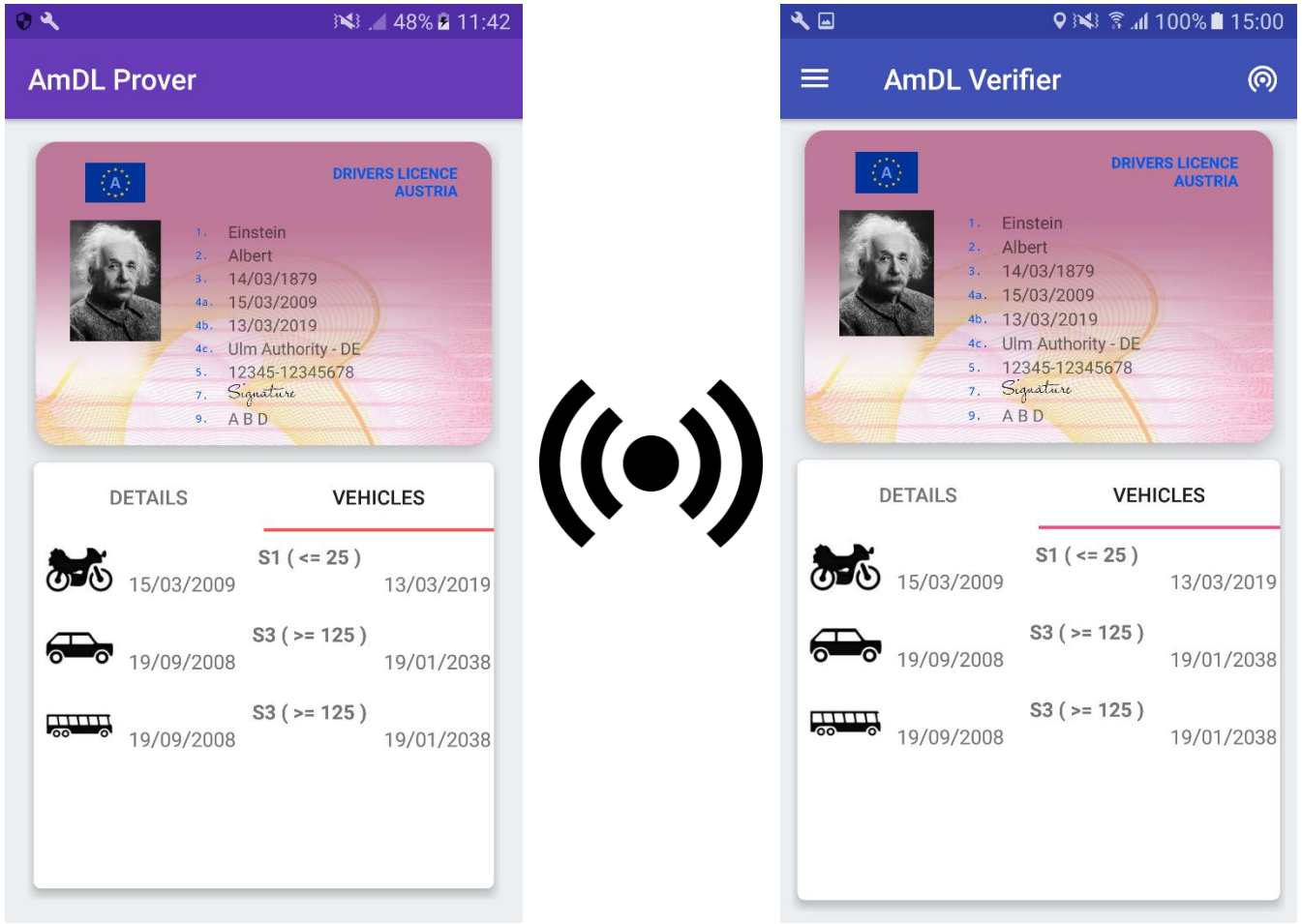


Digital Authentication – Identity on Smartphones





Scenario 1: Traffic Check

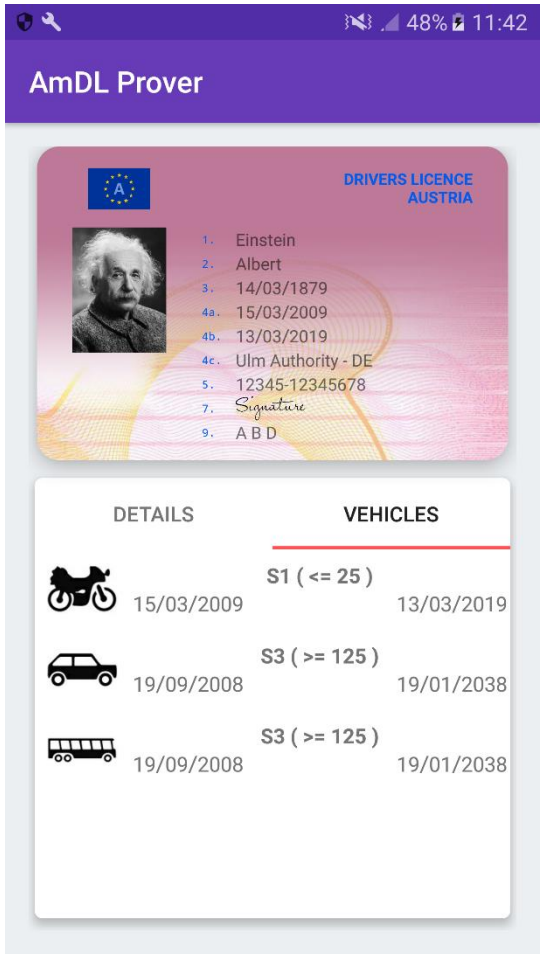


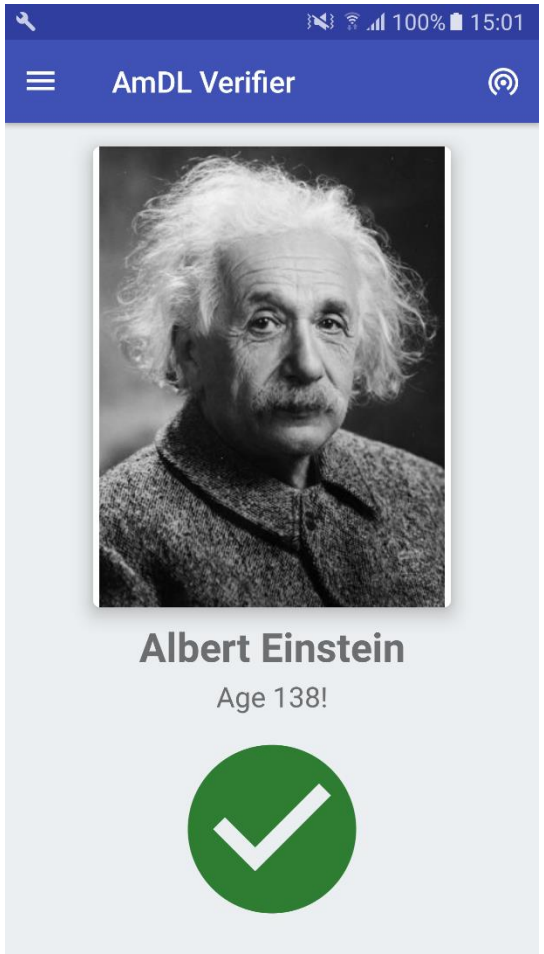
All attributes are transferred

- Name
- Date of birth
- Face picture in full resolution
- (optional) Place of residence
- (optional) Biometric features
- Vehicle classes, potential restrictions, …

Also needs to work offline!

Scenario 2: Proof of Age





Only relevant attributes

- Face picture
- Age

Scenario 3: Public Transport

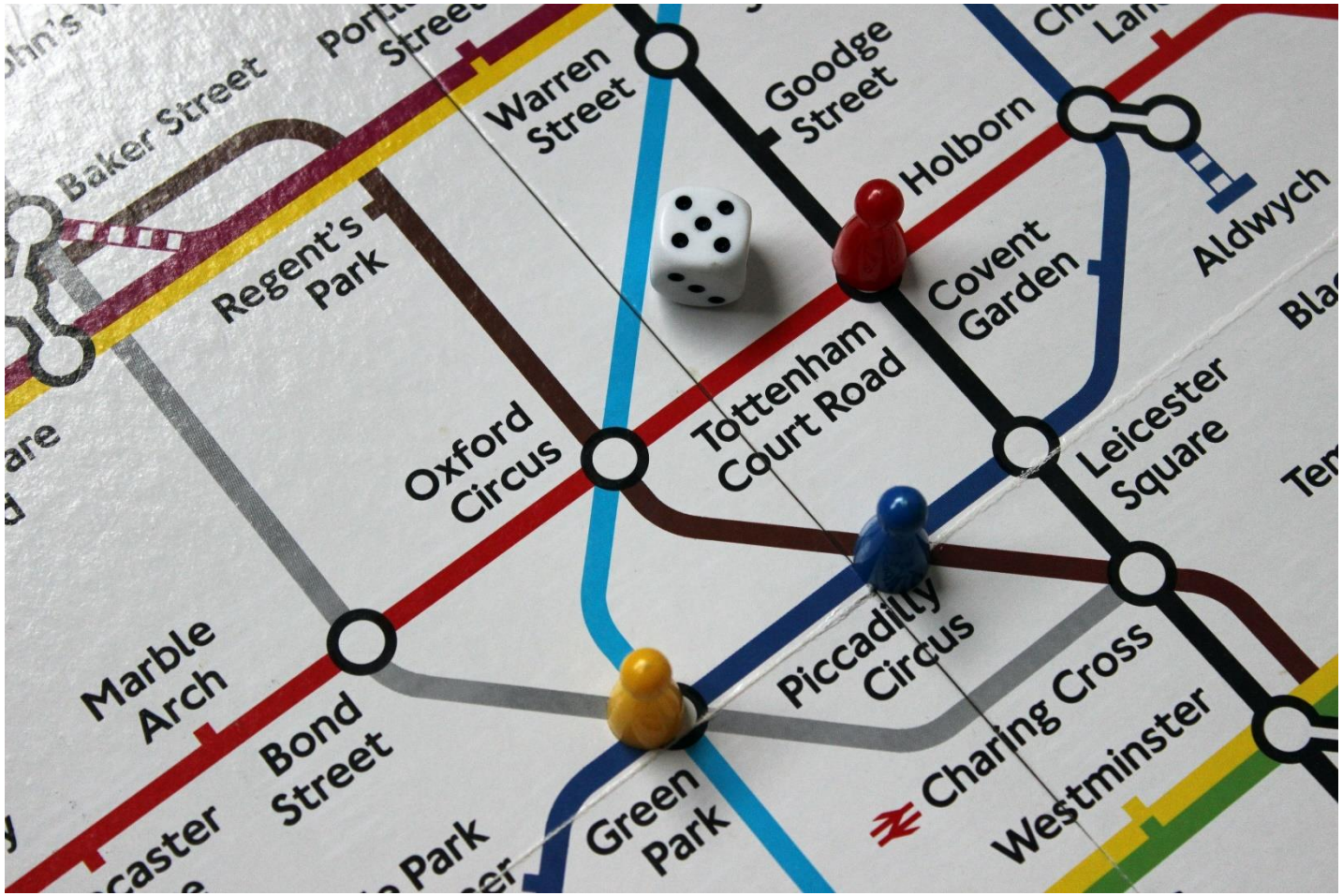


Image credit: https://pixabay.com/photos/underground-tube-map-stations-2725336/

Location traces constitute highly sensitive data

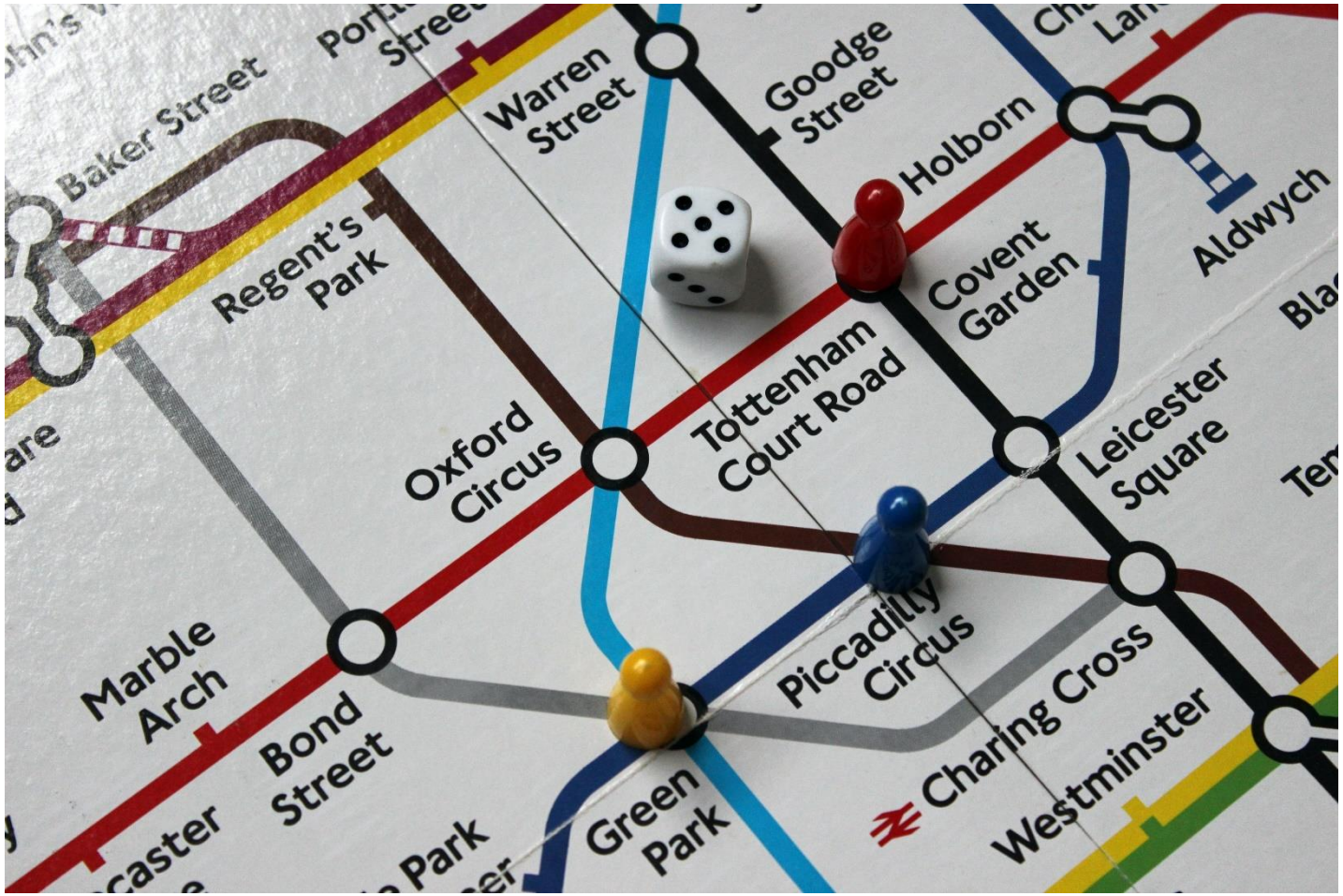
- Place of residence / work
- Religious beliefs
- Illnesses
- Hobbies, particular preferences

Only relevant attributes

- Place of entry / exit **or**
- Possession of time based ticket

But no unique identifier!

Scenario 4: Contact Tracing



Location traces constitute highly sensitive data

- Place of residence / work
- Religious beliefs
- Illnesses
- Hobbies, particular preferences

Only relevant attributes

- Contact with (pseudonym) person X for Y minutes on day Z

But no unique identifier!

Requirements for Digital ID

Functional

- Real-world identification
- One-to-many
- Revocation

Mobility

- Offline
- Power-off
- Scalability

Security

- Key confidentiality
- Unforgeability
- Communication protection
- (future) State-of-the-art cryptography

Privacy

- Anonymity
- (forward/backward) Unlinkability
- User control
- Privacy-preserving attribute queries

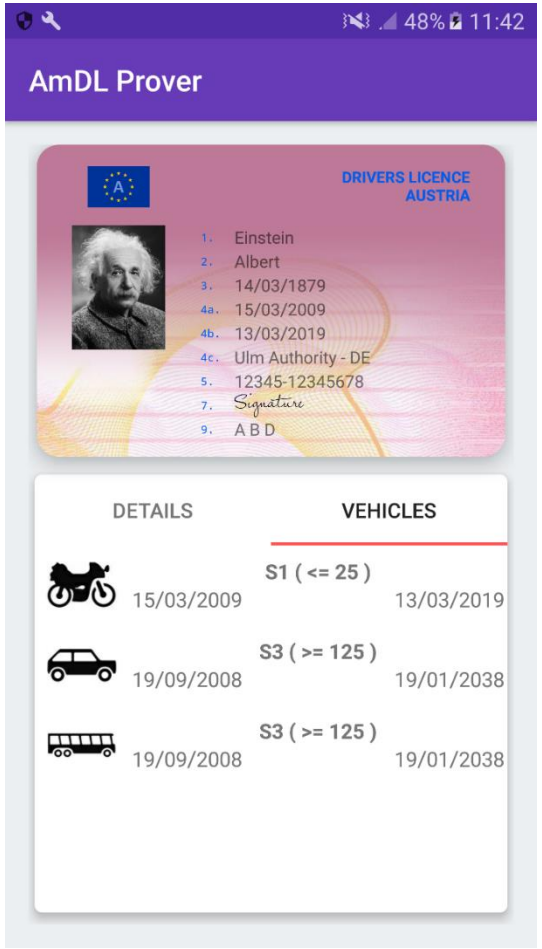
Michael Hölzl, Michael Roland, and René Mayrhofer. “Real-World Identification: Towards a Privacy-Aware Mobile eID for Physical and Offline Verification”. In *Proceedings of the 14th International Conference on Advances in Mobile Computing and Multi Media* (MoMM '16), ACM Press, November 2016

Security and Privacy for draft mDL standard (ISO 18013-5)

- **Security** properties:
  - **Anti-forgery**: Identity Credential data is signed by the Issuing Authority
  - **Anti-cloning**: Secure Hardware produces MAC during provisioning using a key derived from a private key specific to the credential and an ephemeral public key from the reader. Public key corresponding to credential private key is signed by the Issuing Authority
  - **Anti-eavesdropping**: Communications between Reader/Verifier and Secure Hardware are encrypted and authenticated
- **Privacy** properties:
  - **Data minimization**: Reader/Verifier only receives data consented to by the holder. Backend infrastructure does not receive information about use
  - **Unlinkability**: Application may provision single-use keys
  - **Auditability**: Every transaction and its data is logged and available only to the Holder (not the application performing the transaction)

Question:
Strictly require secure (certified) hardware?

The Android implementation



Android Standard

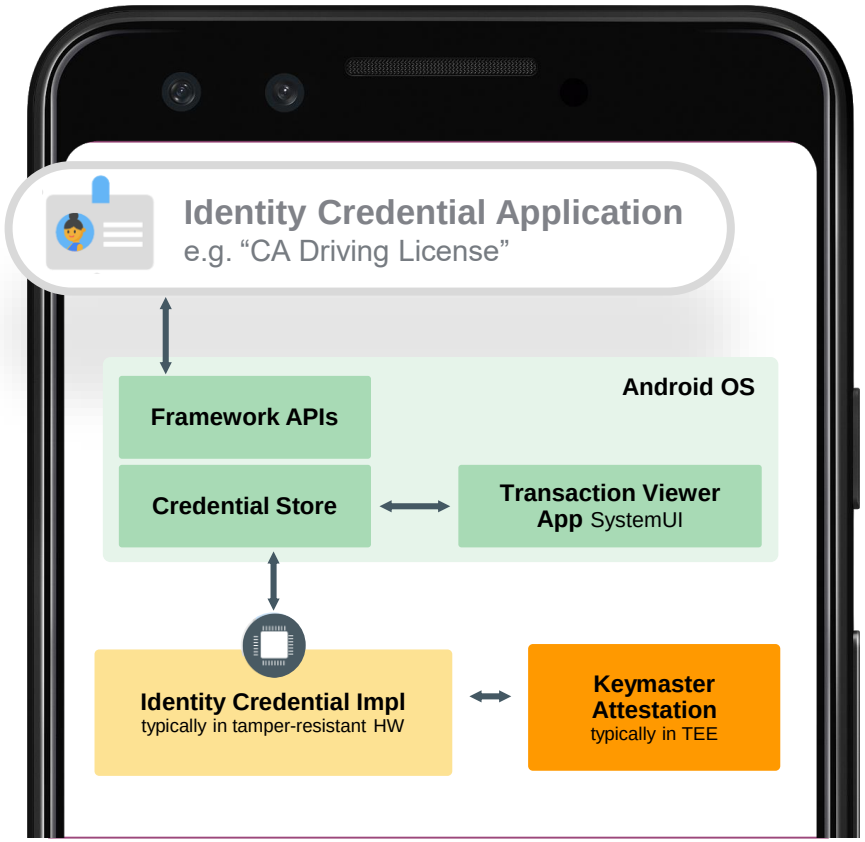


Image credit: Google

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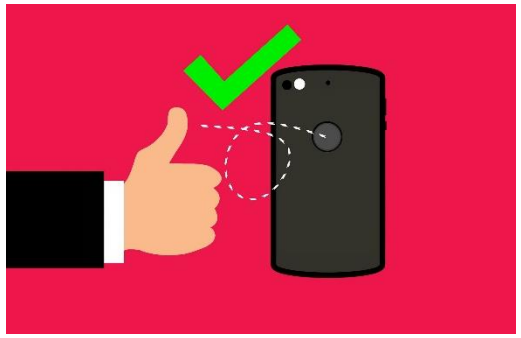
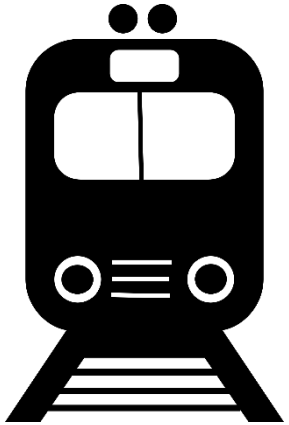
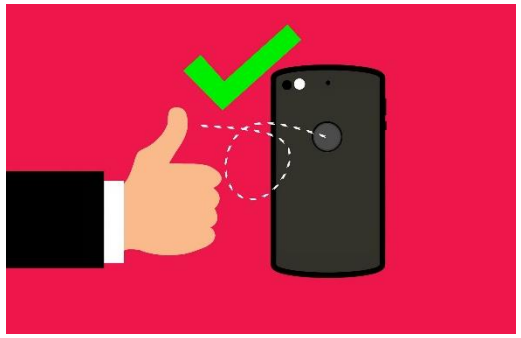
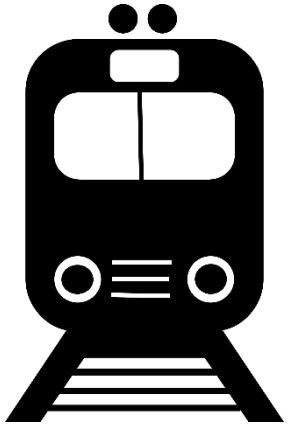




Digital Authentication – Vision





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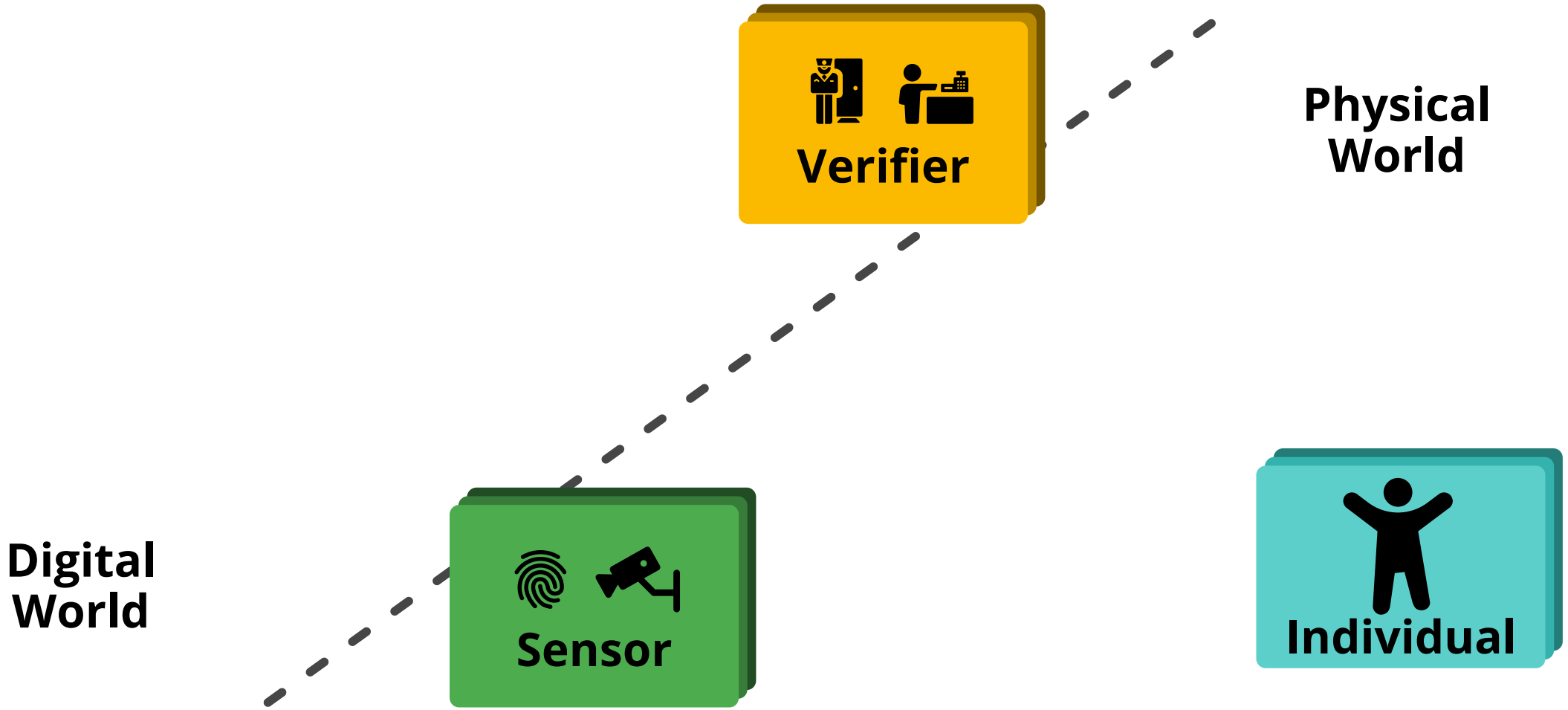
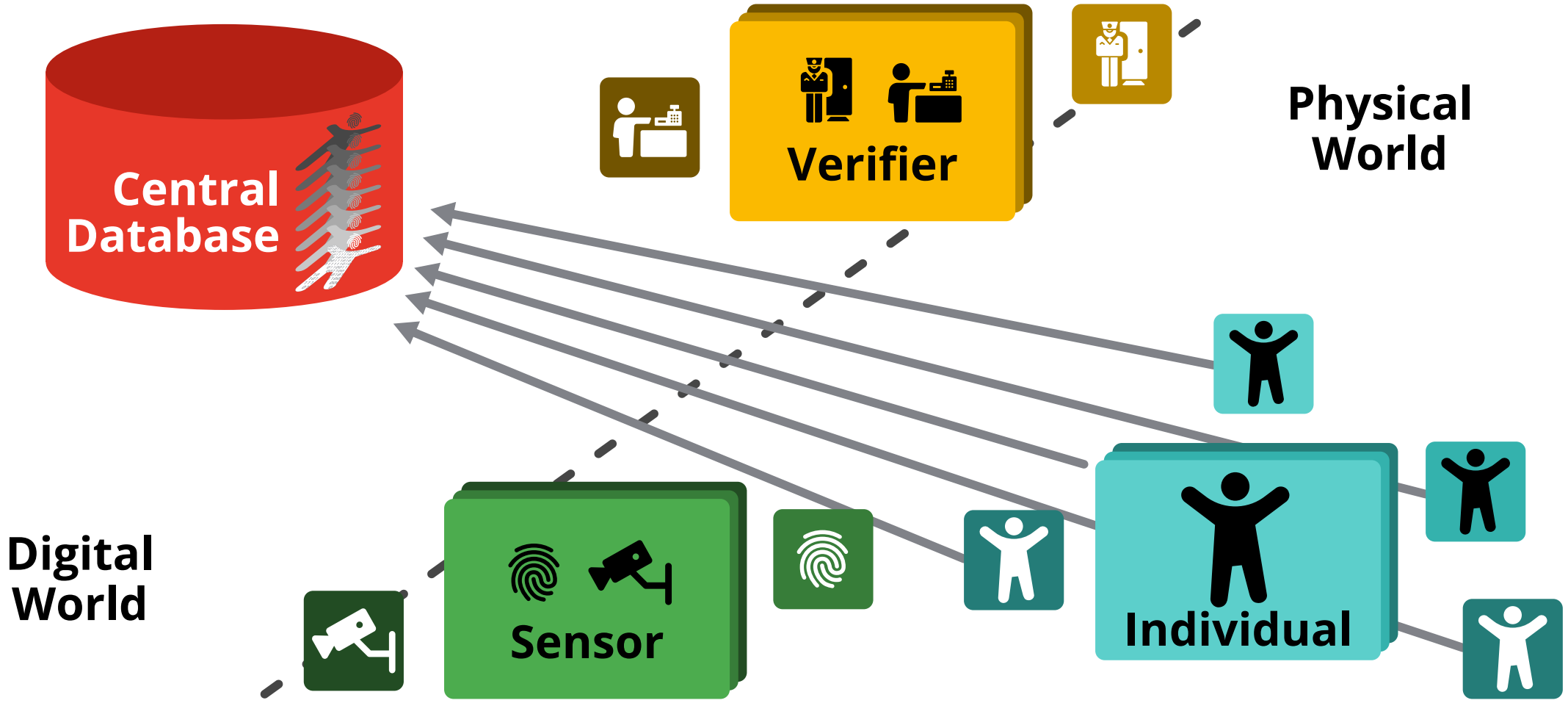
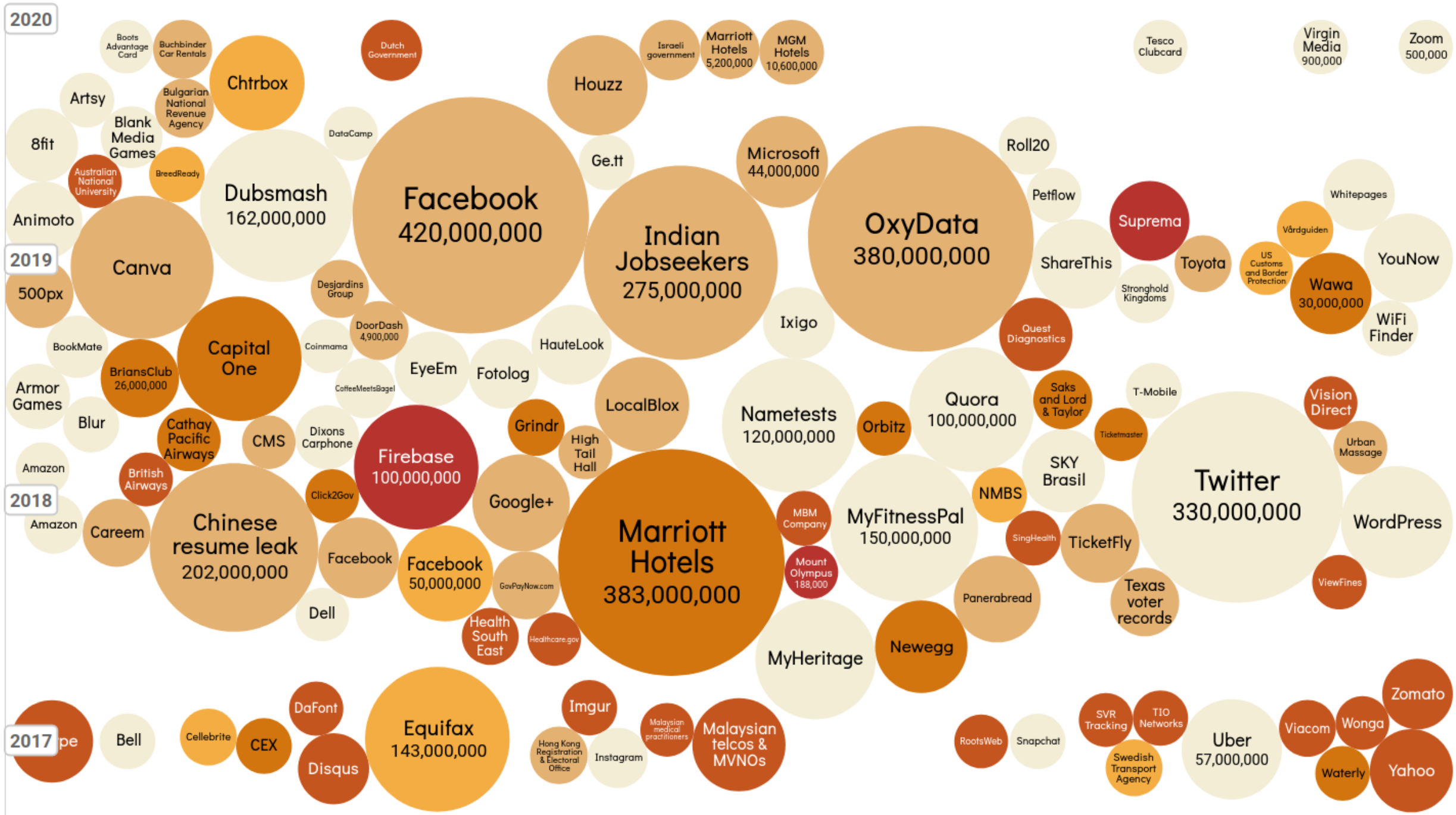


Digital Authentication – Centralized Approach




2020
2019
2018
2017
Boots Advantage Card
Buchbinder Car Rentals
Chtrbox
Dutch Government
Houzz
Israeli government
Marriott Hotels 5,200,000
MGM Hotels 10,600,000
Tesco Clubcard
Virgin Media 900,000
Zoom 500,000
Artsy
Bulgarian National Revenue Agency
Blank Media Games
8fit
DataCamp
Australian National University
BreedReady
Dubsmash 162,000,000
Facebook 420,000,000
Ge.tt
Microsoft 44,000,000
Indian Jobseekers 275,000,000
OxyData 380,000,000
Roll20
Petflow
Animoto
Canva
Desjardins Group
DoorDash 4,900,000
Coinmama
Ixigo
Suprema
ShareThis
Toyota
Stronghold Kingdoms
Whitepages
Vårdguiden
US Customs and Border Protection
Wawa 30,000,000
YouNow
WiFi Finder
500px
BookMate
Capital One
HauteLook
Quest Diagnostics
BriansClub 26,000,000
CoffeeMeetsBagel
EyeEm
Fotolog
LocalBlox
Armor Games
Blur
Cathay Pacific Airways
CMS
Dixons Carphone
Grindr
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MyHeritage
Newegg
Bell
Cellebrite
CEX
DaFont
Disqus
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Imgur
Hong Kong Registration & Electoral Office
Instagram
Malaysian medical practitioners
Malaysian telcos & MVNOs
RootsWeb
Snapchat
SVR Tracking
TIO Networks
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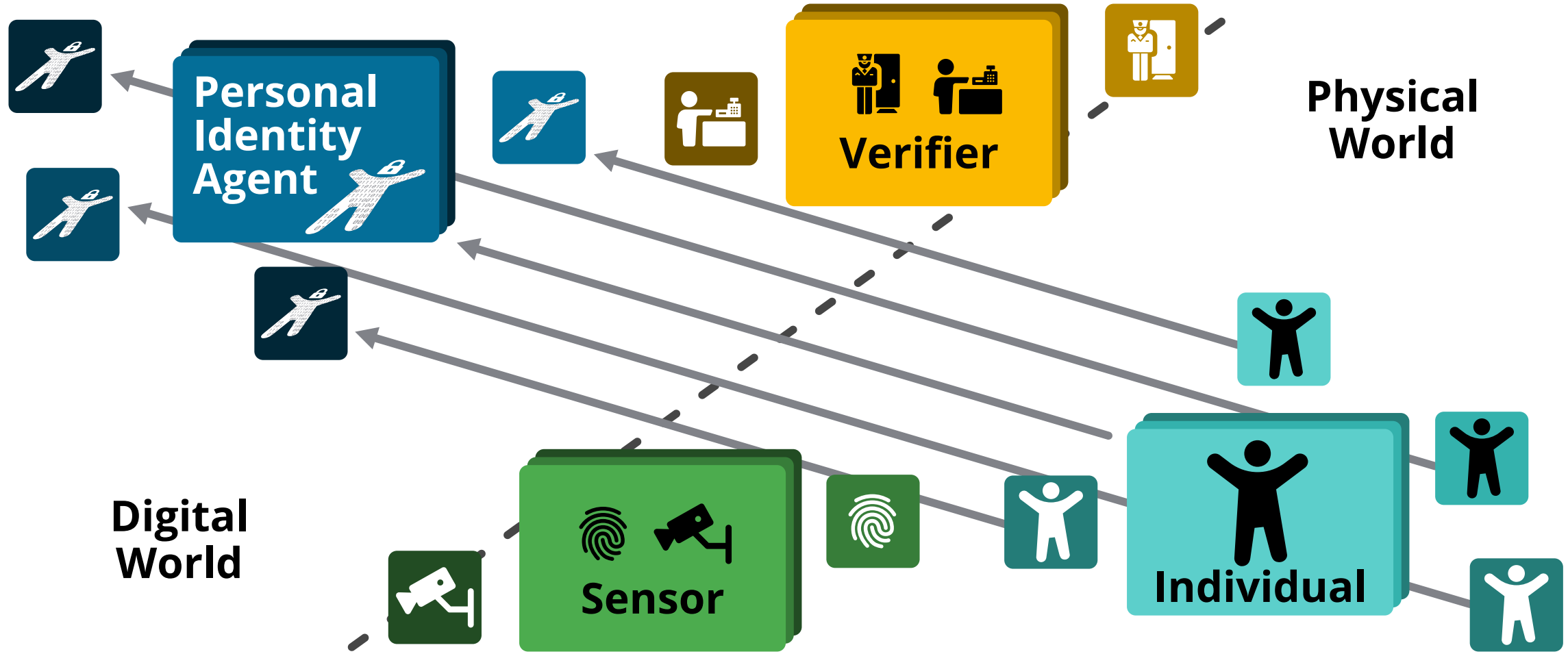
Uber 57,000,000
Viacom
Wonga
Zomato
Waterly
Yahoo

Digital Authentication – Decentralized Approach



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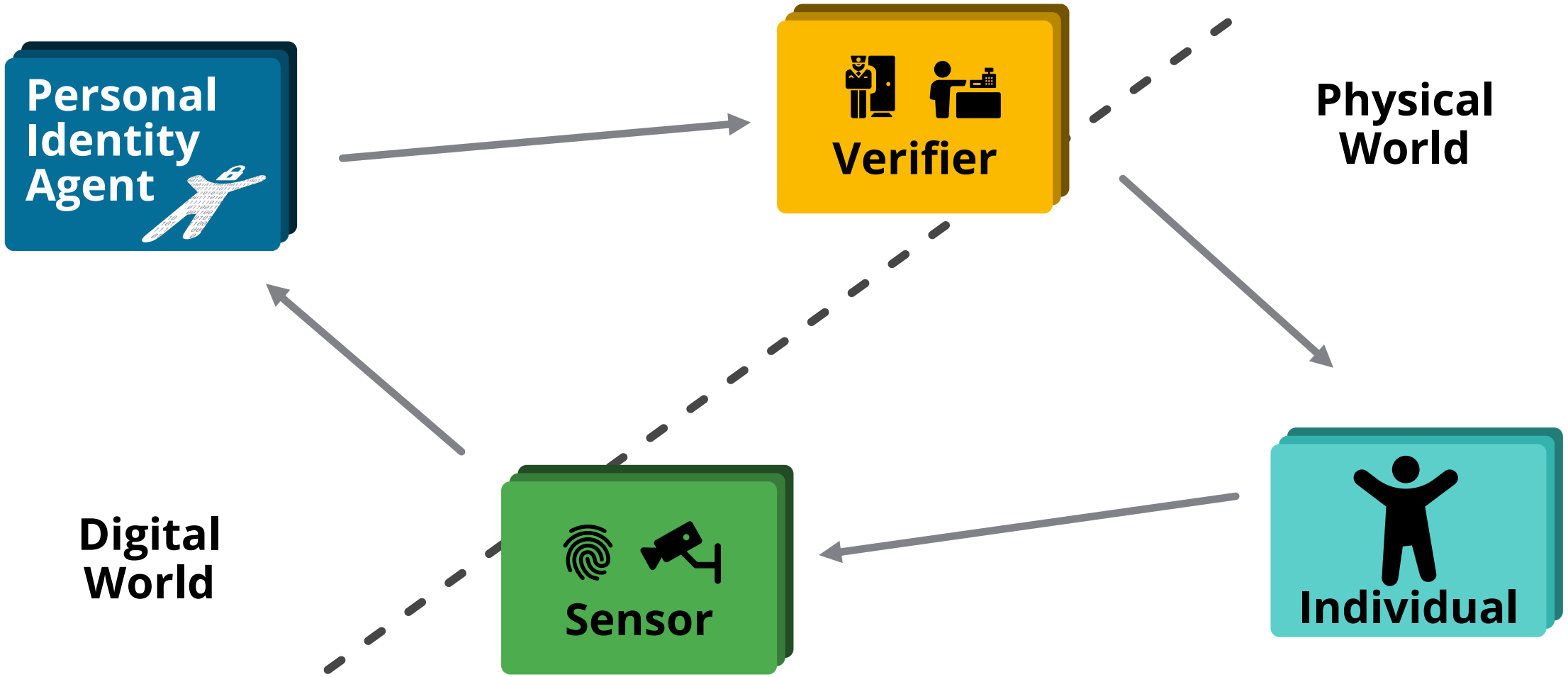
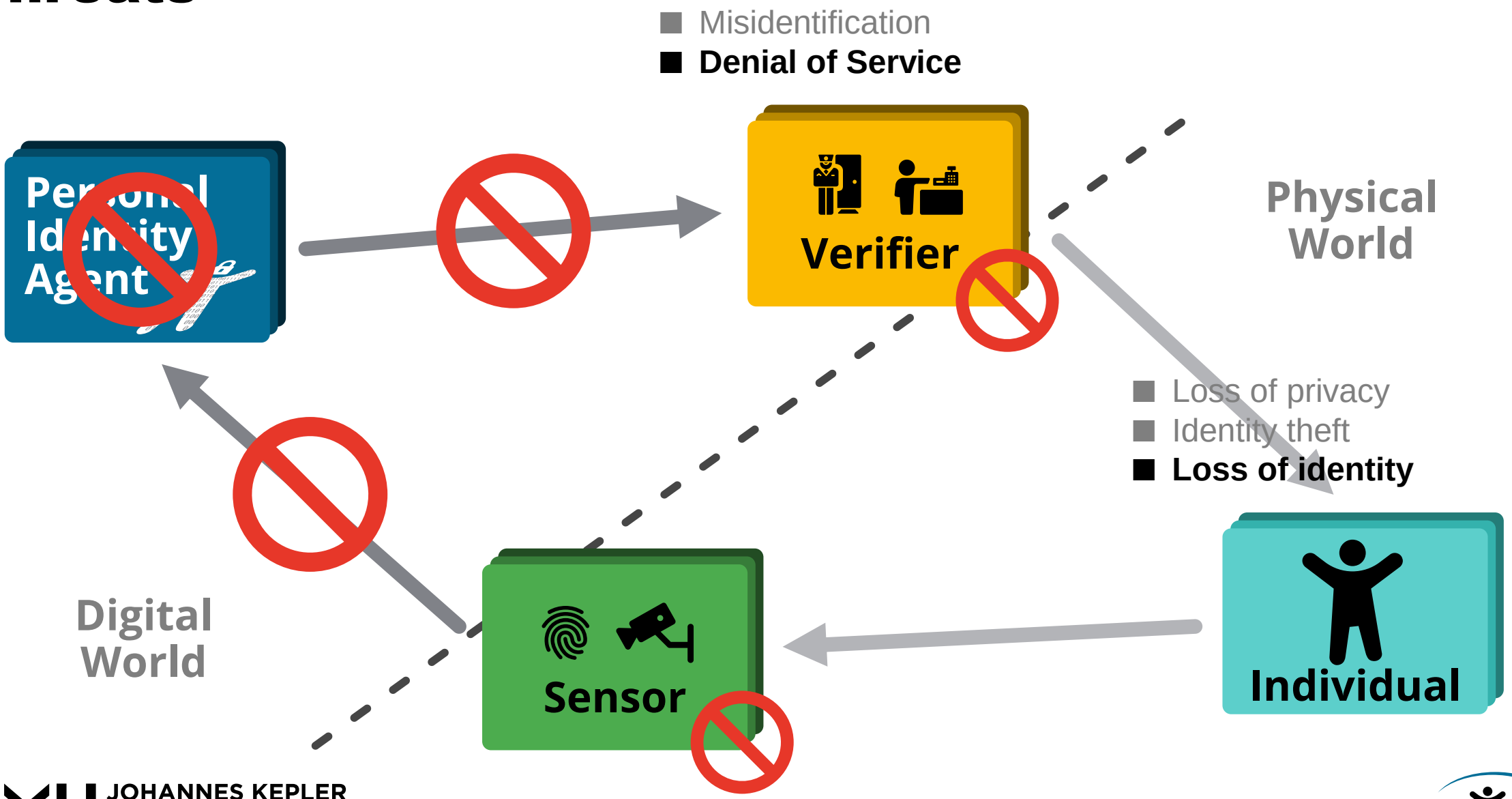
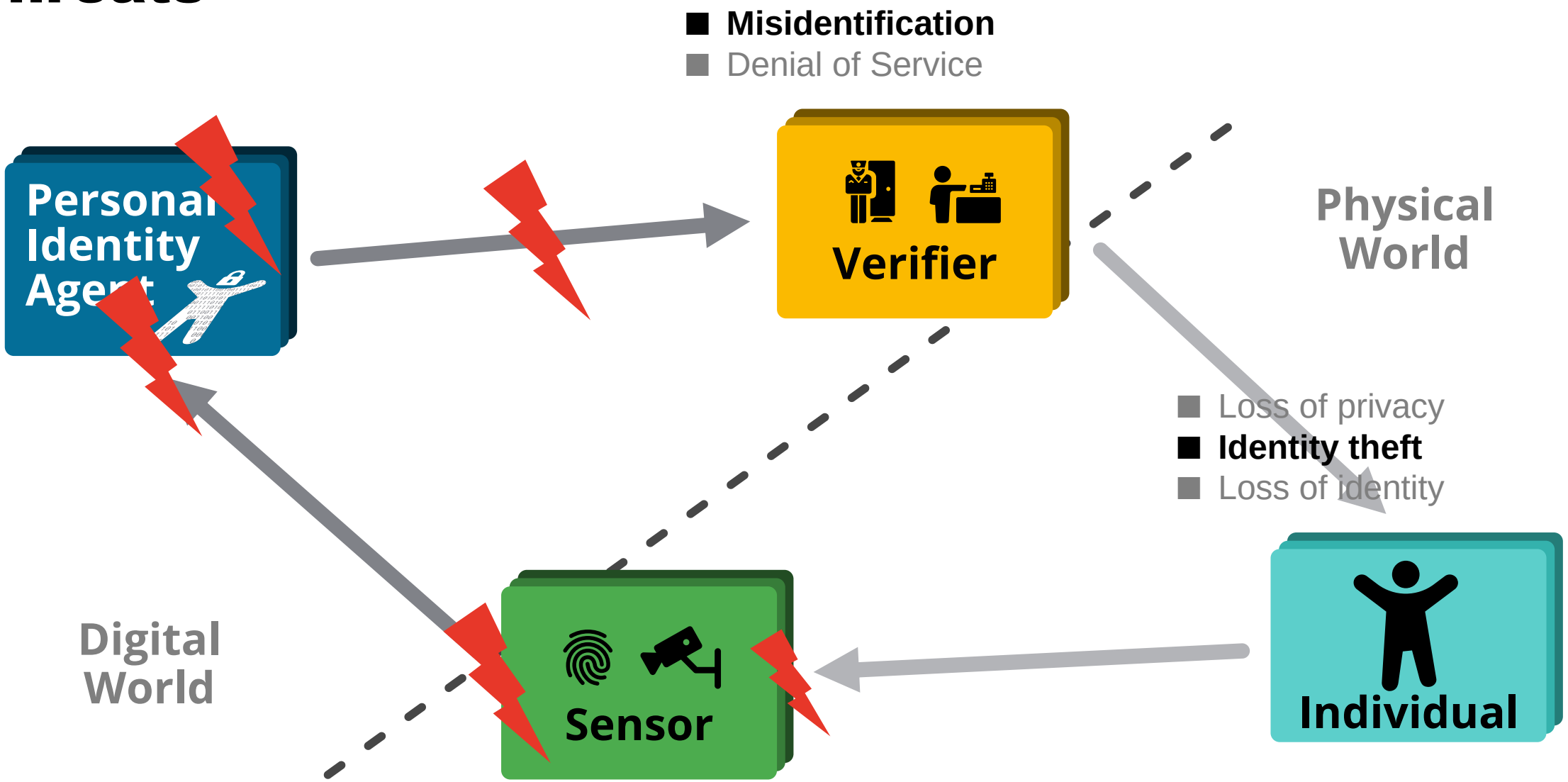


Threats


Misidentification
Denial of Service
Personal Identity Agent
Verifier
Physical World
Loss of privacy
Identity theft
Loss of identity
Digital World
Sensor
Individual

Threats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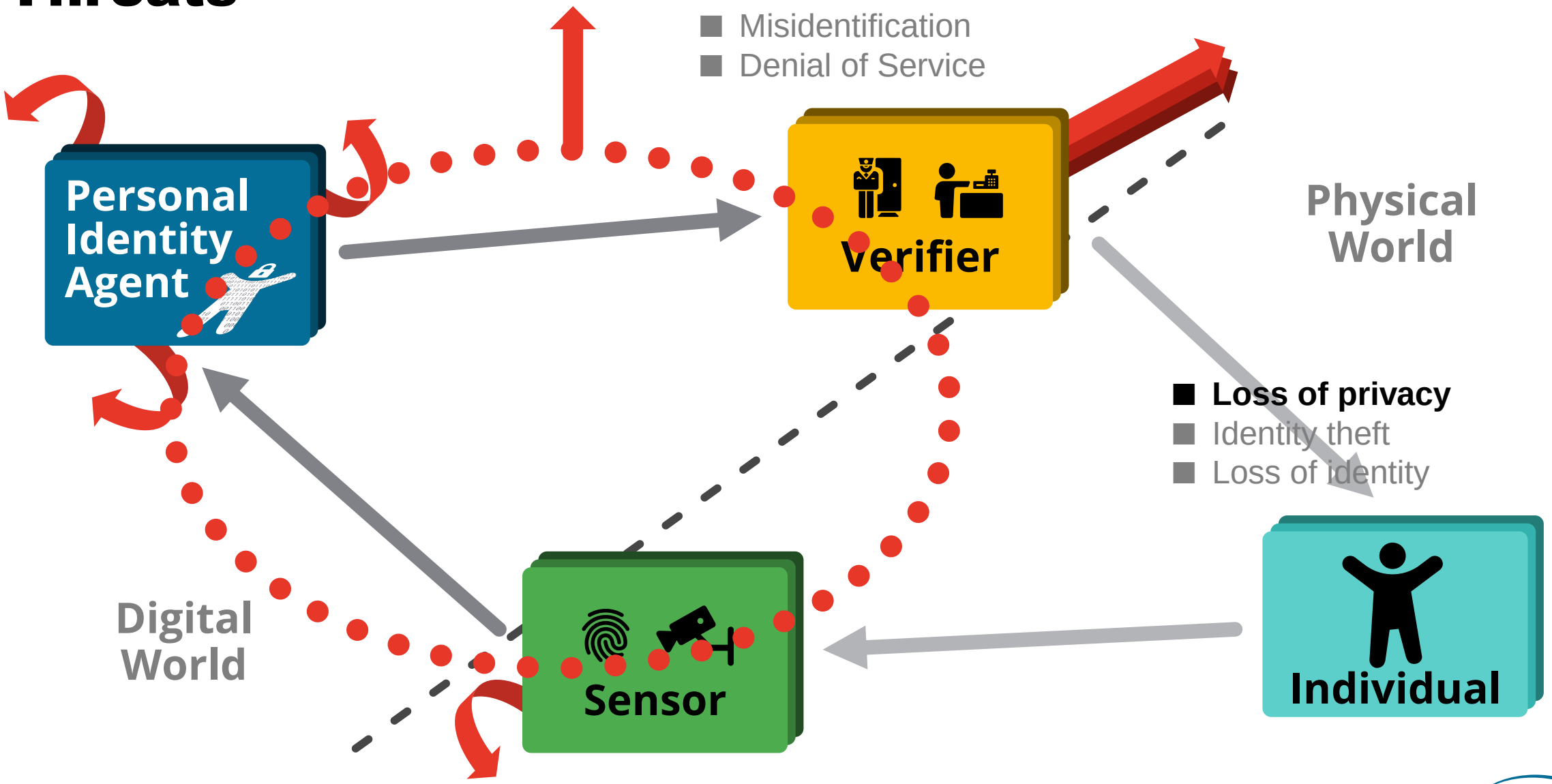
Misidentification
Denial of Service
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Physical World
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Identity theft
Loss of identity
Digital World
Sensor
Individual

Digital Authentication in the Physical World

Image credit: https://pixabay.com/photos/private-privacy-green-secret-1647769/

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Questions?

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DIGiDOW

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