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Employing Attribute-Based Encryption in Systems with Resource Constrained Devices in an Information-Centric Networking Context

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SEVENTH FRAMEWORK PROGRAMME

ICN2020

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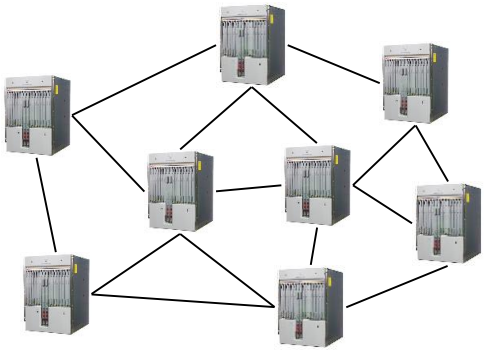
Outline

- ICN overview
- ABE overview
- Scenario & Testbed
- Results & Conclusions

Evolution of networking

Today's Internet
Focuses on
Conversations between Hosts
Host-centric abstraction
Who to communicate with



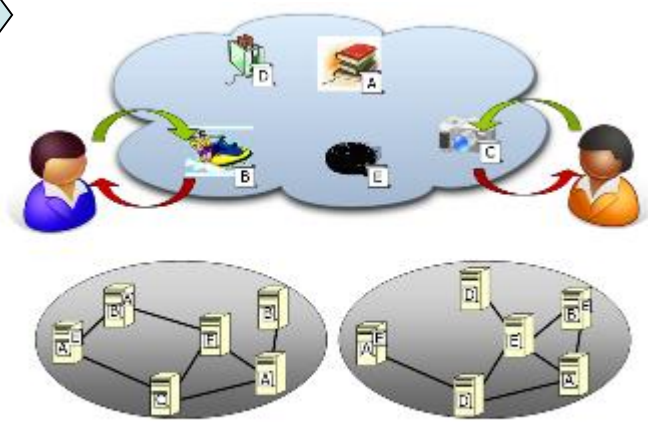
Evolution

Web

CDN

P2P

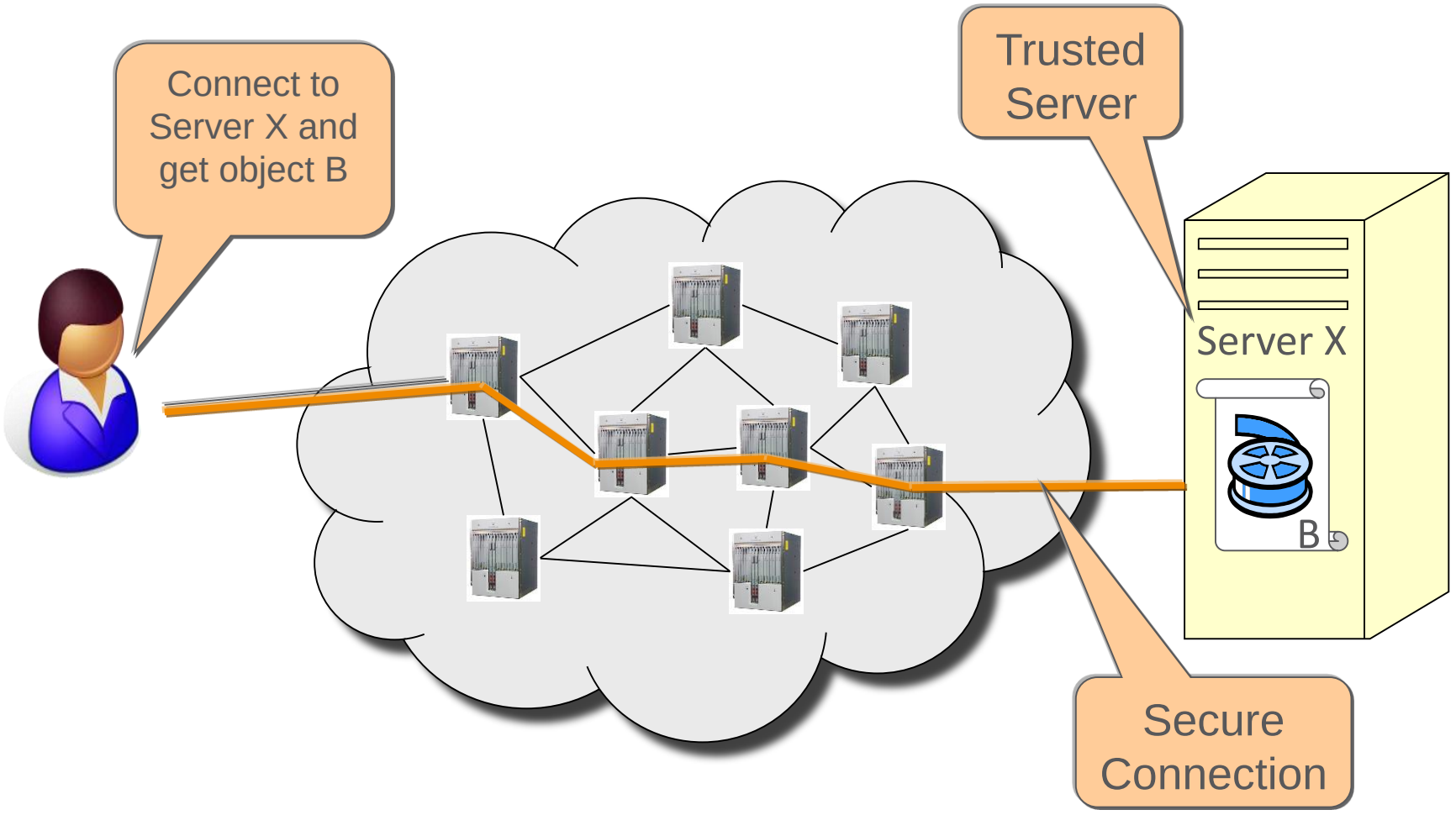
Information-centric network (ICN)
Focuses on
Dissemination of Information objects
Information-centric abstraction



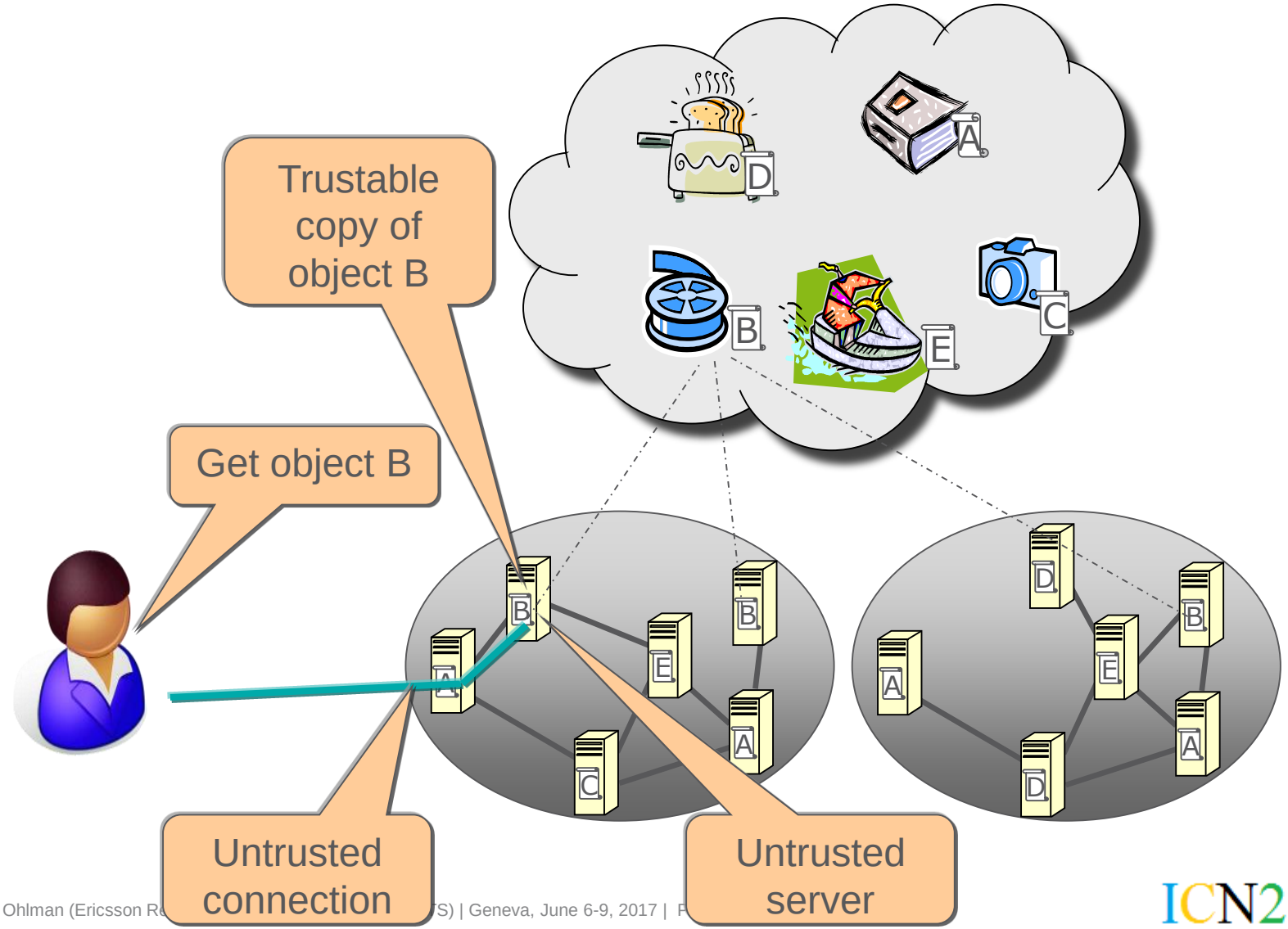
Major ICN approaches

- Content Centric Networking (CCN) / Named Data Networking (NDN)
- Network of Information (NetInf)
- Publish/Subscribe Networking (PSIRP / PURSUIT)

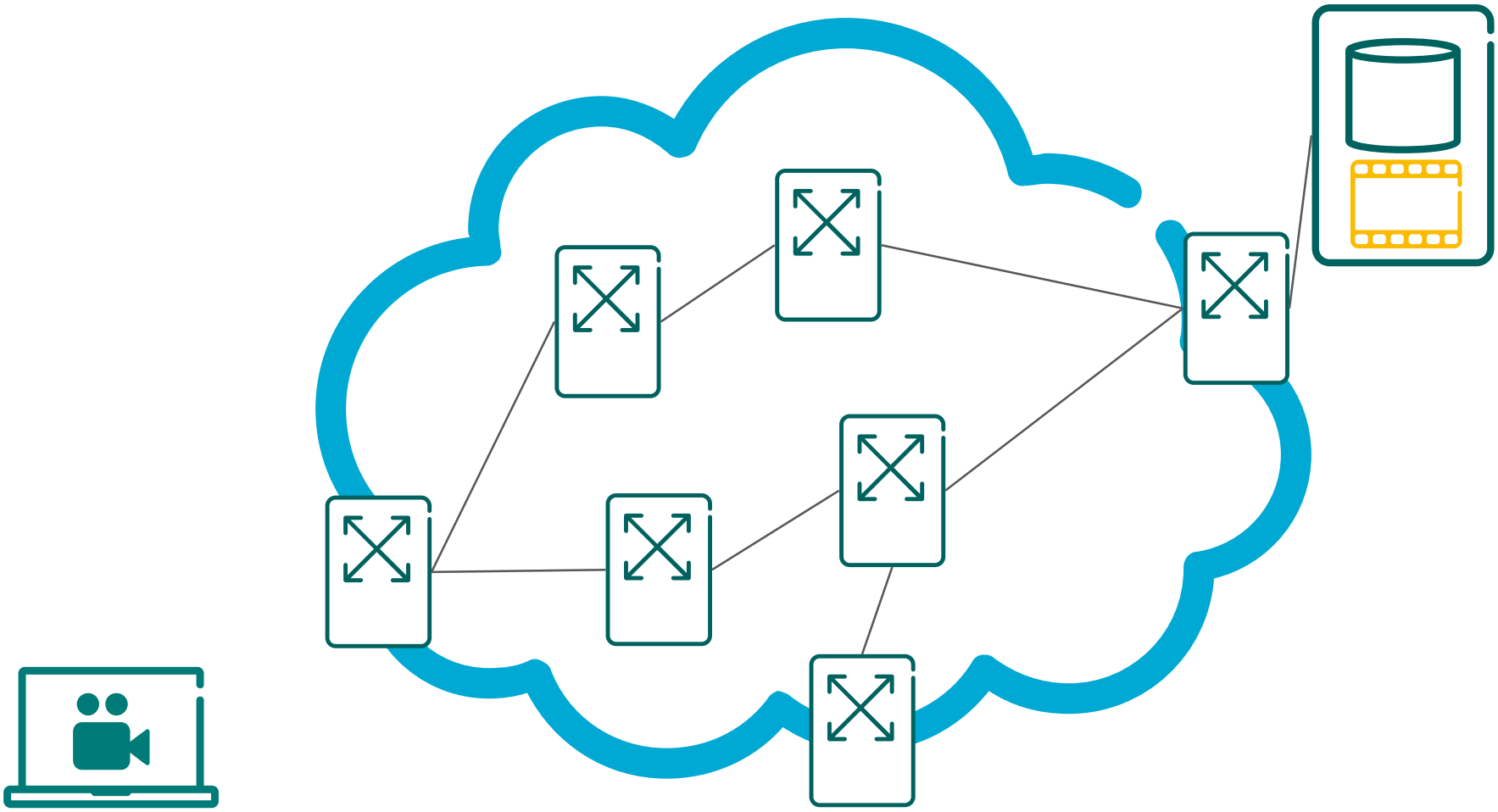
Security model in traditional node-centric networking



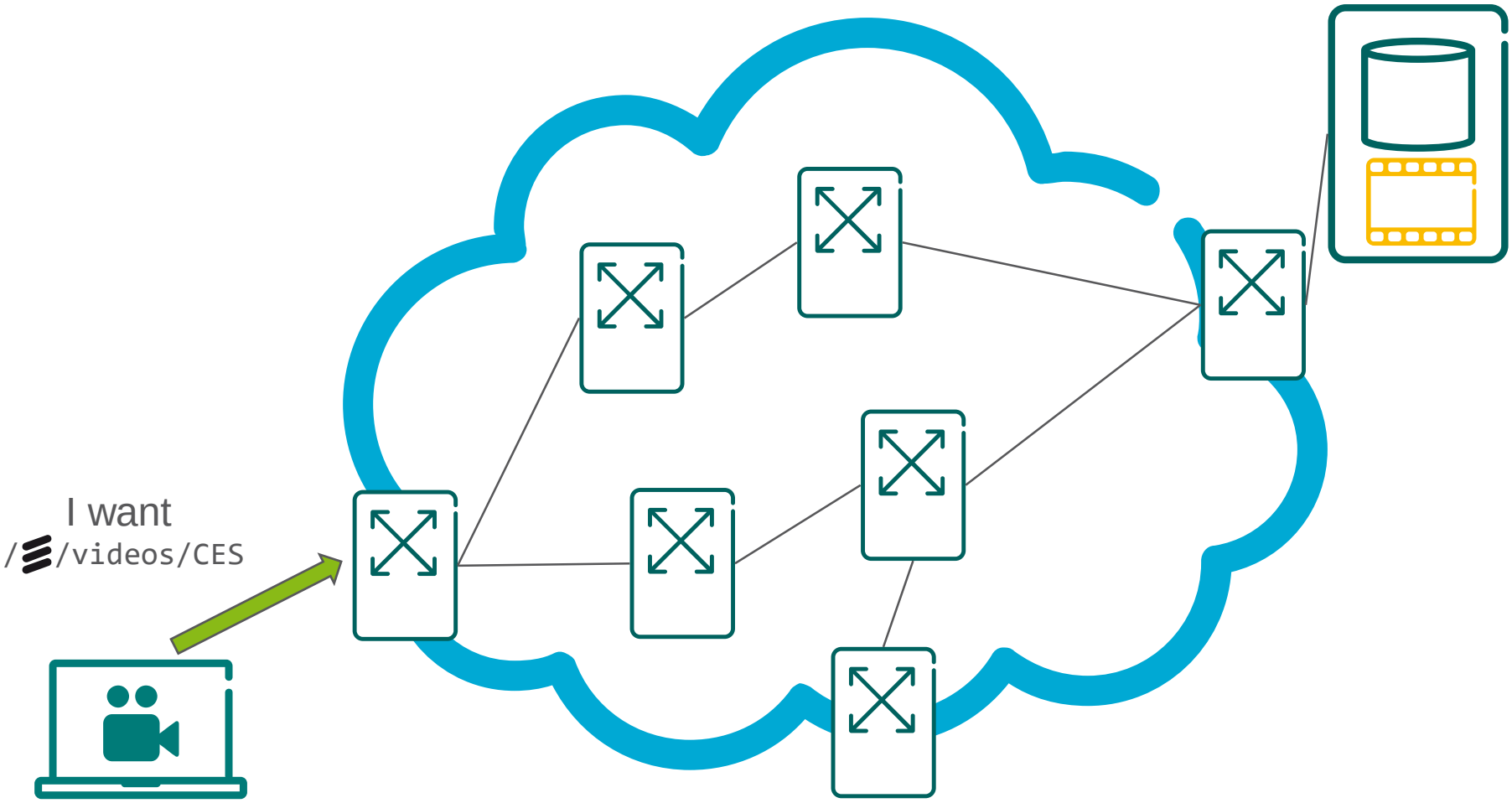
Security model in Information-centric Networking (ICN)



Content Centric Networking (CCN)

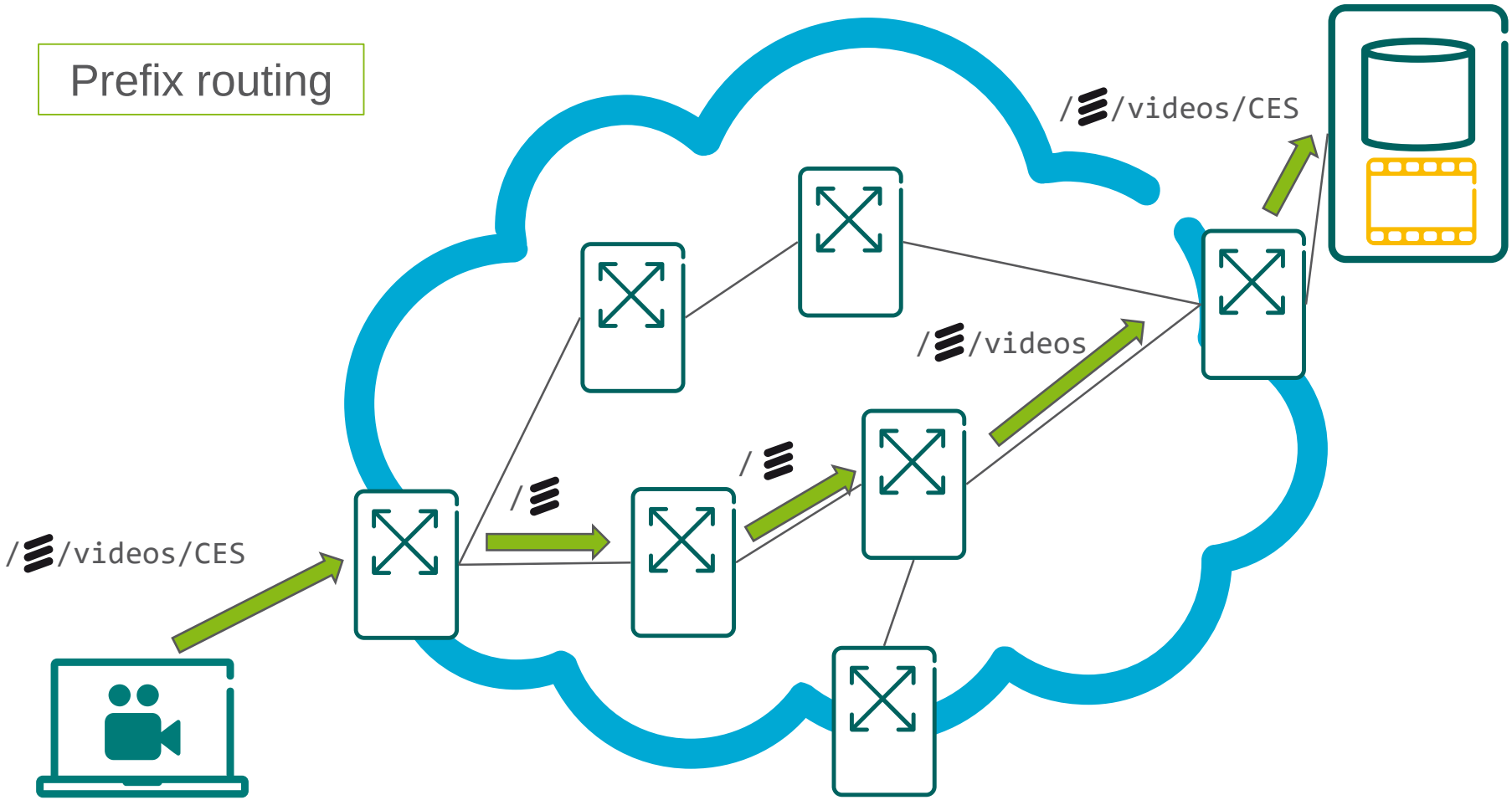


CCN



CCN

Prefix routing



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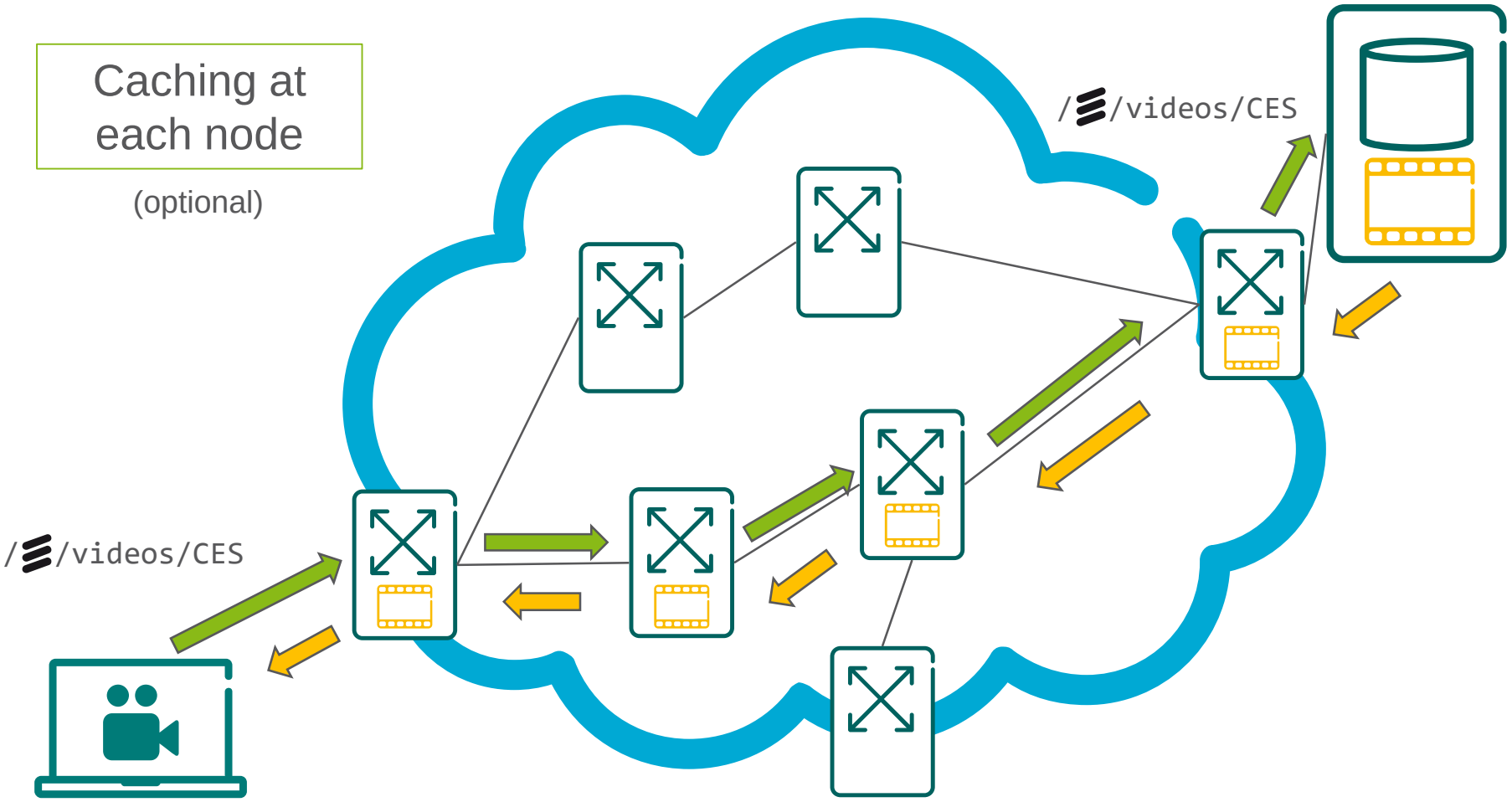
CCN

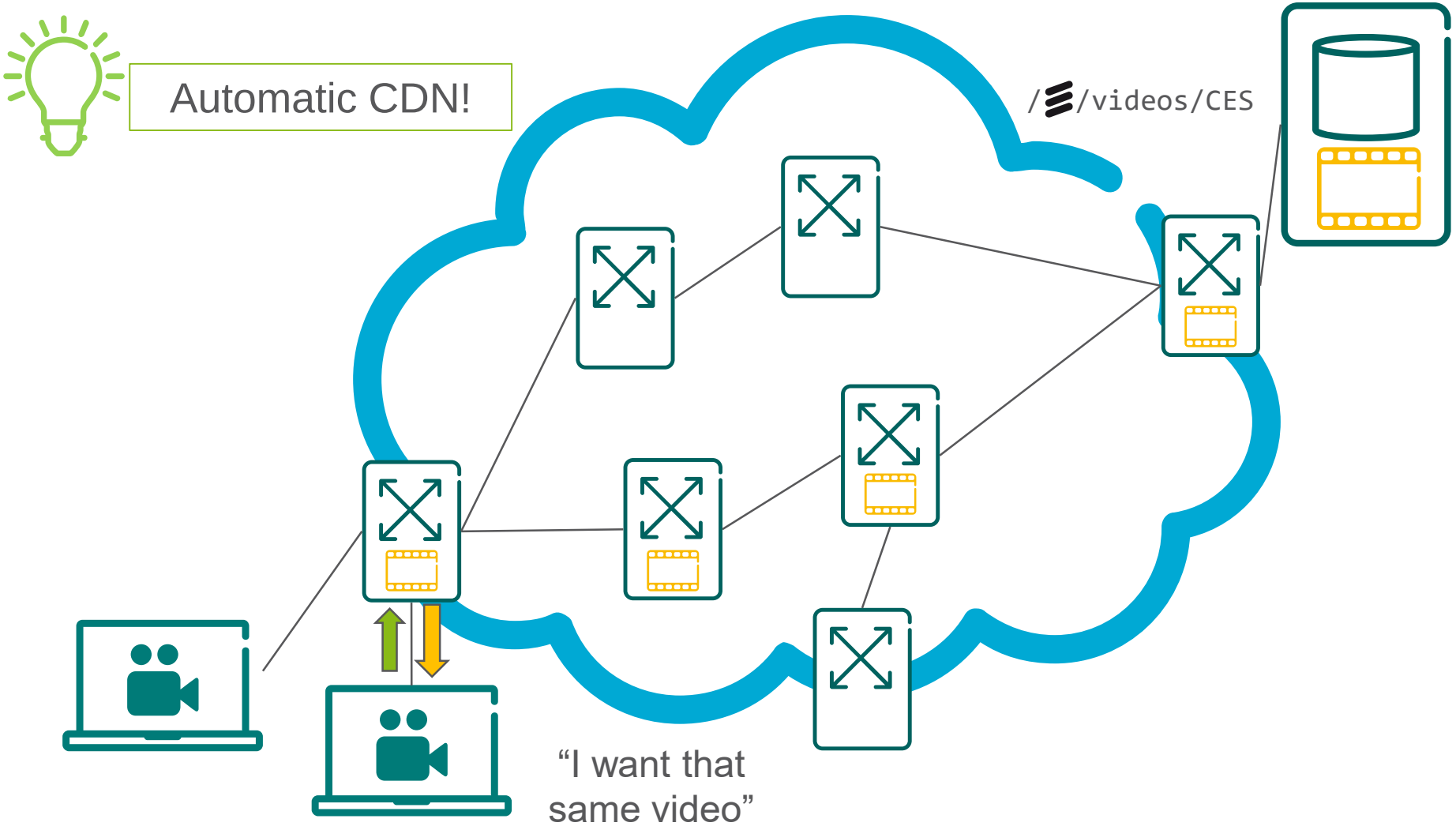
Caching at each node

(optional)



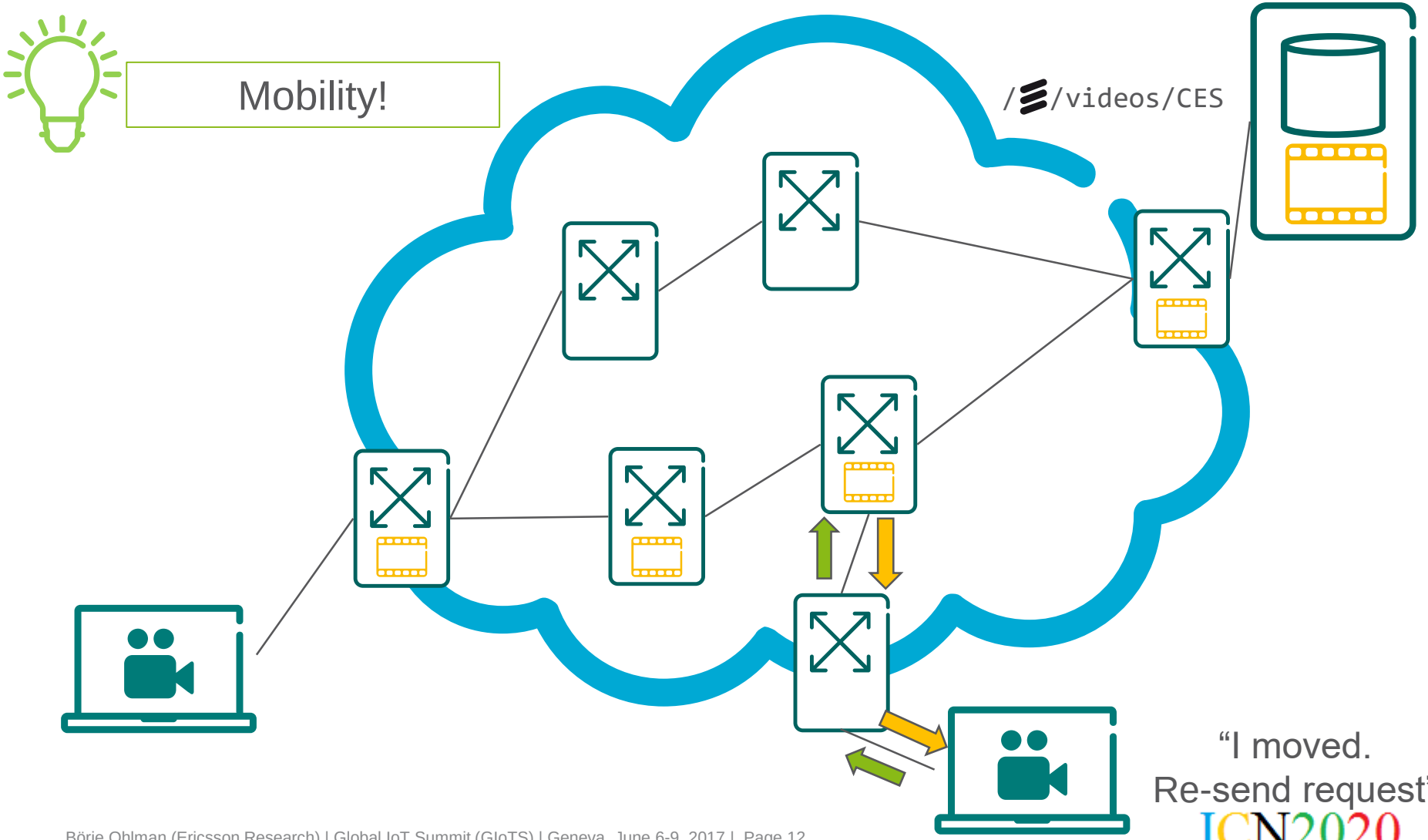
ICN2020

CCN

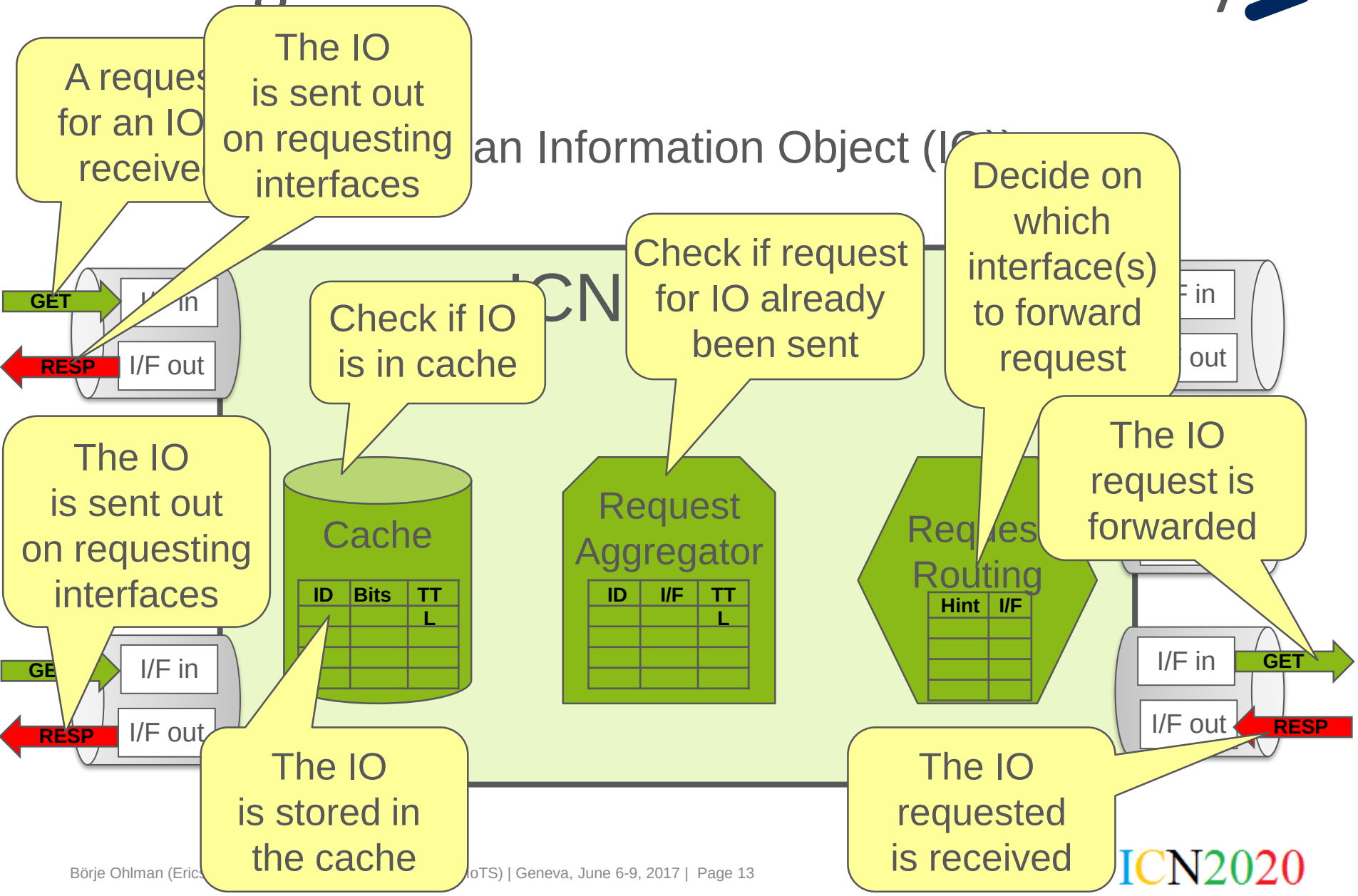


ICN2020

CCN



Basic generic ICN Router functionality



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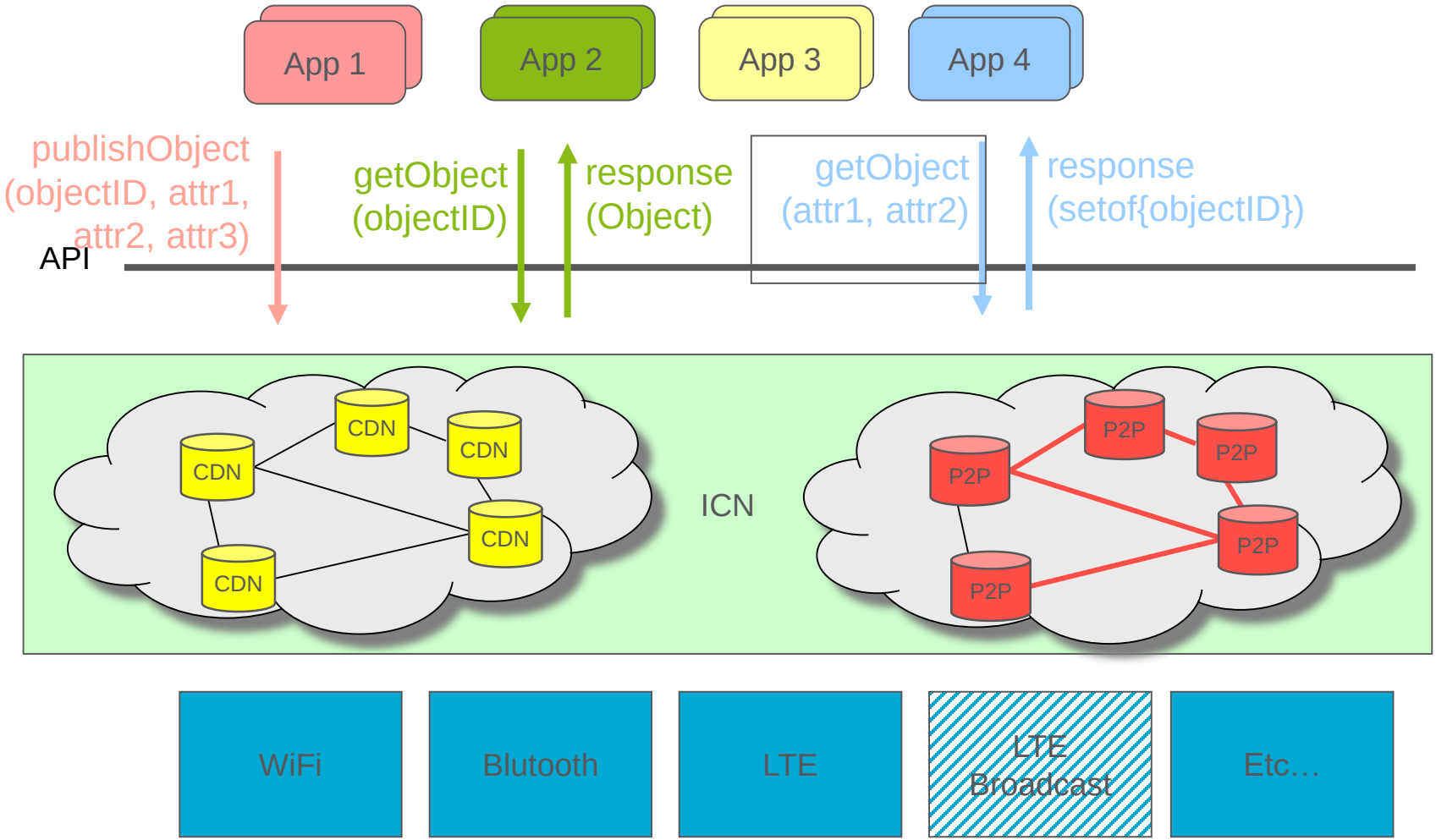
Providing cdn & p2p as an application independent Service for Secured Objects



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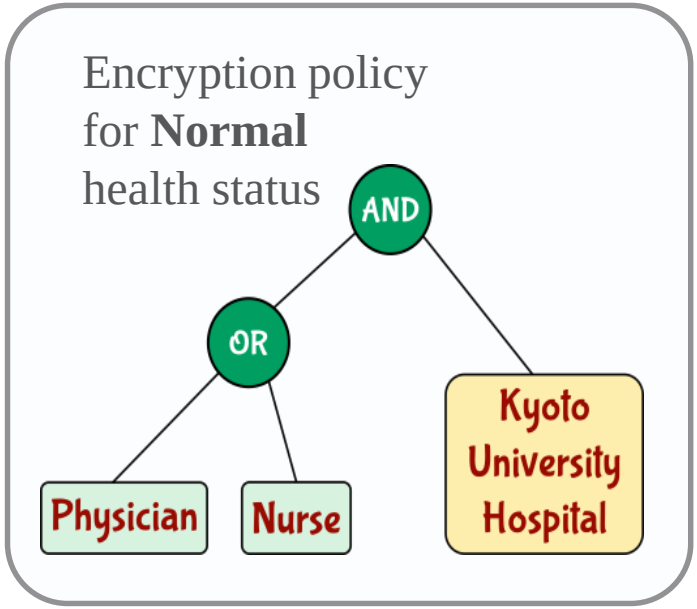
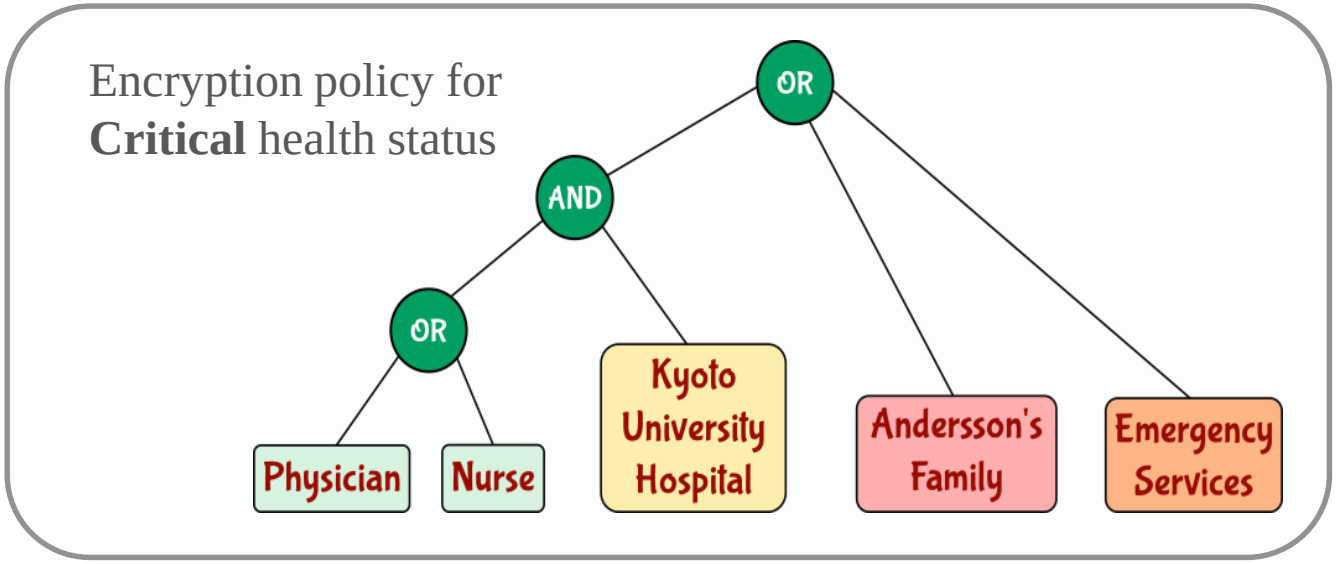
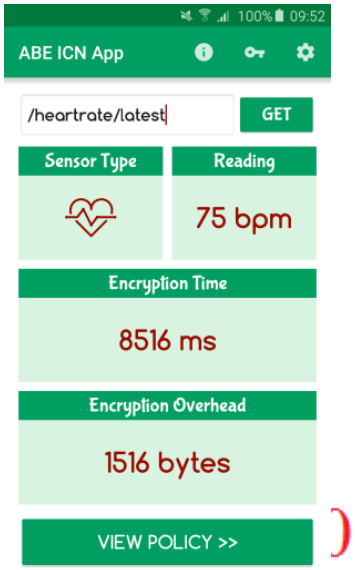
ICN & ABE Scenario

- A person has a personal sensor device that monitors body temperature and heart rate
- Data is privacy protected under ABE encryption policies
- Different encryption policies are used depending on the health status







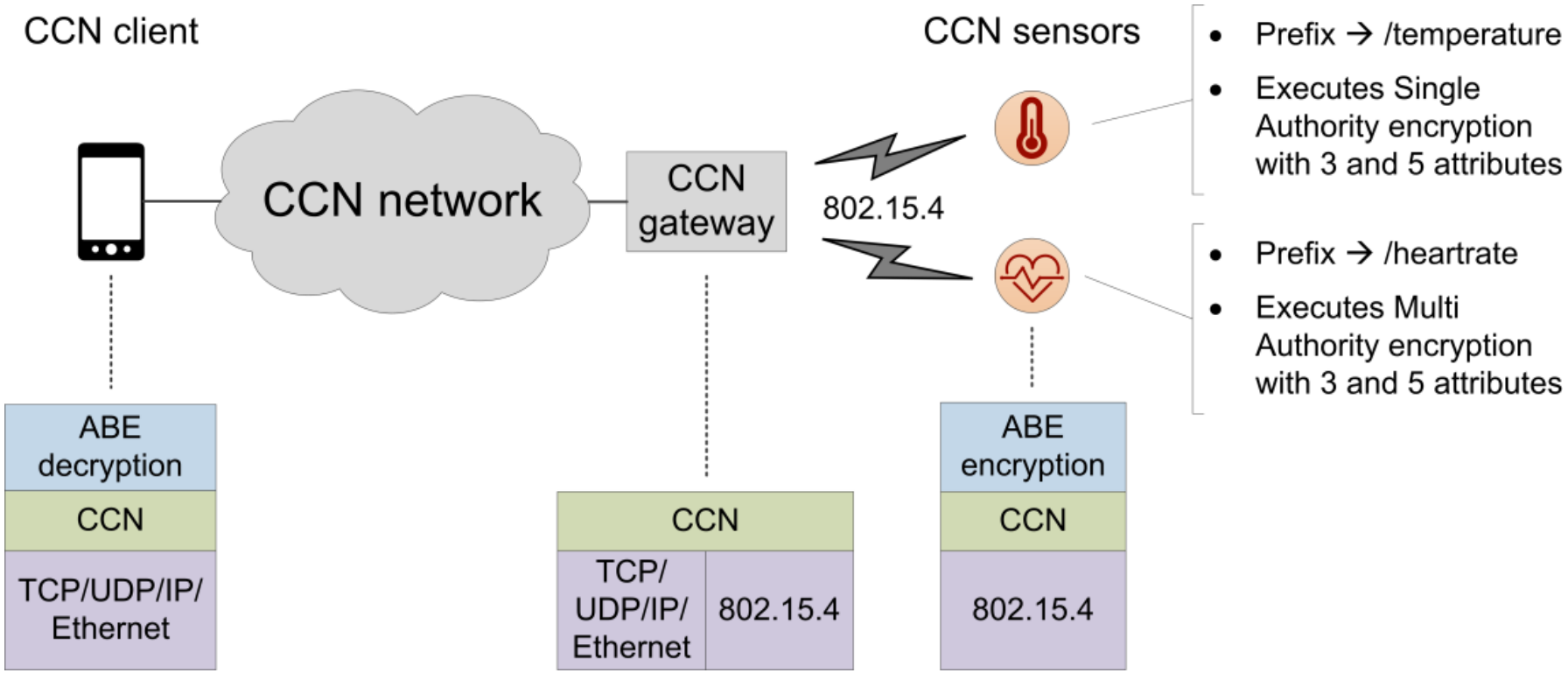
ABE & ICN

- ABE provides object security
- ABE is inline with ICN as both focus on information objects
- ABE allows for complex access policies for objects while maintaining one encrypted version of the object

Attribute-Based Encryption (ABE)

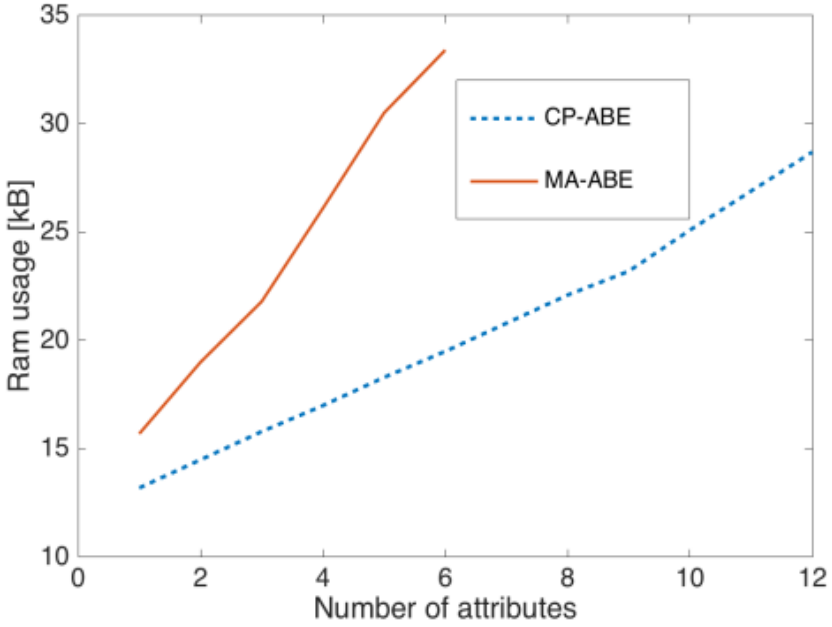
- Pros:
  - Object security that secures the object at the source, no need to trust gateways in the network
  - Successful decryption can be achieved with multiple different keys
  - Does not require online communication with the key management server
  - Can provide good privacy by use of decentralized attribute authorities
- Cons:
  - Computationally heavy
  - No easy solution to revoking attributes/keys

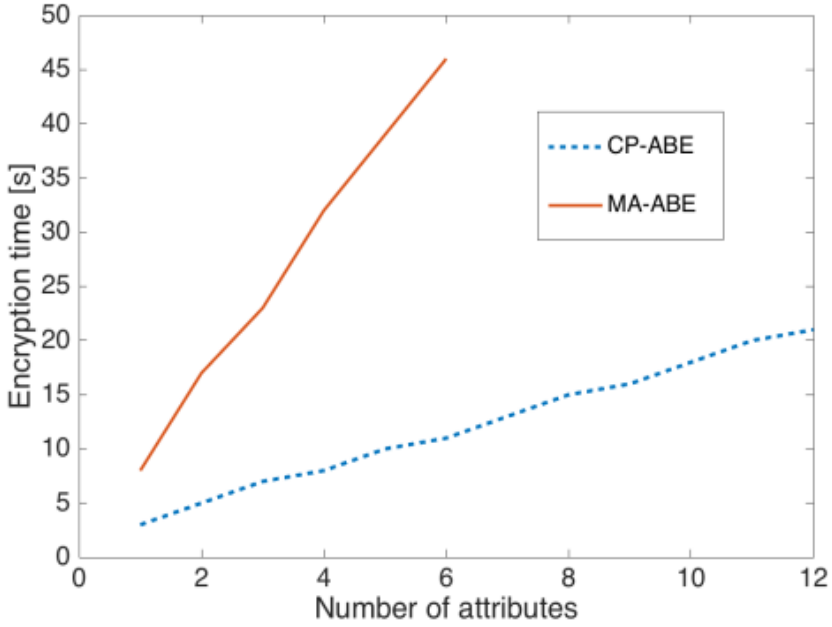
Testbed



- CCN relay implemented in CCN-lite on top of RIOT OS
- Android ICN ABE app developed
- Sensor hardware platform used STM32F4DISCOVERY
  - ARM Cortex-M4 32-bitcore, 1 MB Flash memory and 192 kB RAM

results & Conclusions





- Performing ABE on sensors is feasible
- RAM is the bottle-neck, not processing power

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