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Parental Control with Edge Computing and 5G Networks

➢ ***Parental control*** methods are a popular tool to keep children safe in the digital world.

➢ A problem in the existing methods: Child has **no privacy.**

Goal: Design a privacy-preserving AI-based parental control system in the 5G networks with edge computing.

Private Set Operation (PSO): a cryptographic protocol for two or more parties that have an input set of elements. The goal is to compute the outcome of one or more set operations of these input sets, without revealing anything about the elements that are not in the outcome. We use a variant of PSO, where the outcome of the protocol is revealed only to one special party [1].

Our Contribution:

- Privacy for **children**
- Privacy for **Parents**
- Protection for **all** children
- **Smart** responses

There are seven components involved in our **Parental Control System** : A Child, the Parent, the Kid-client, the Parent-client, the Edge Server, the Service Provider, and the Network Provider.

Edge Computing handles the data at the edge of a network, where part of the data is generated. It reduces latency and transmission costs.

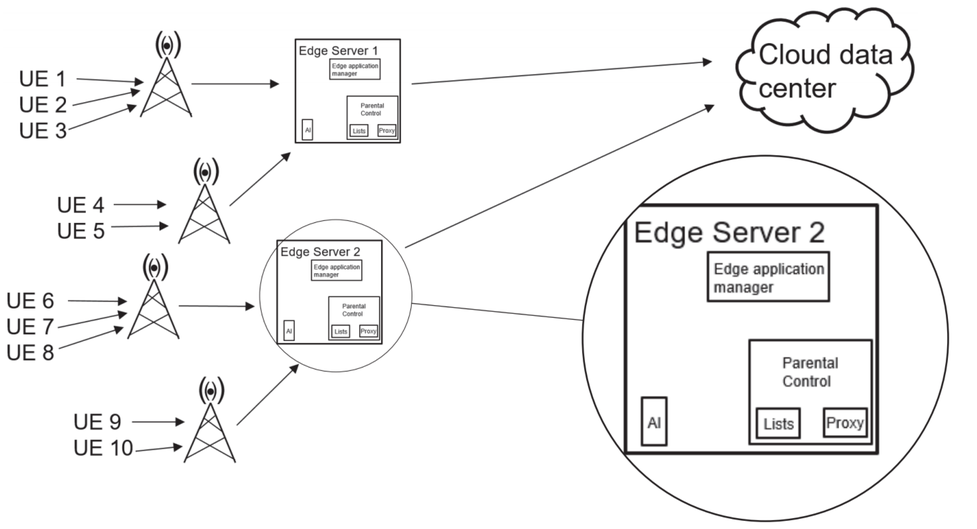
Parental Control System [2]:

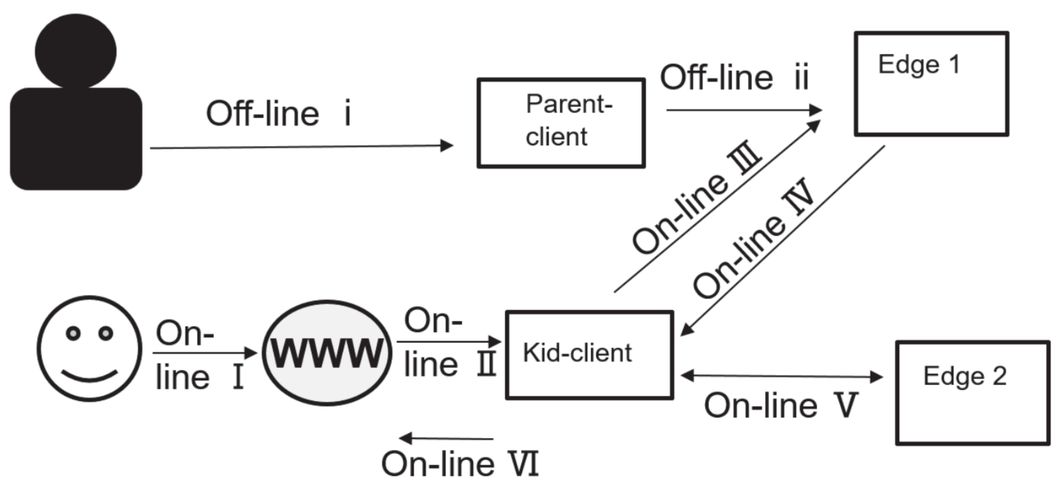
- A parent has a **list**, which contains **attributes** of such content that their child should not be exposed to. This list should remain **private** from the child and the network.
- The child may want to access Internet **without disclosing** all their on-line activities to their parent, and neither to the network.
- The network wants to provide a safe on-line environment for **all children.**
  - also when there is no input from parents.
- **AI classifiers** are applied in the edge servers.

Kid-client is an application that is installed on the child's device and acts as the middle man between web/messaging applications, and the network.

Parent-client is an application that is installed on the parent's device.

Smart Response is used whenever a child wants to access a potentially harmful content. It is an AI based technique to respond to child's on-line request in a positive way.





➢ **Performance:** If 20 attributes need to be checked for a website, and the modulus N^2 for Paillier cryptosystem is 4096 bits, then the parent-client and Edge server each encrypt their list in 2.8 seconds. In the online phase of the protocol, the edge server needs 0.14 seconds to perform computations. The kid-client decrypts the result of PSI protocol in less than 3.4 seconds.

[1]: Ramezanian, S., Meskanen, T., & Niemi, V. Multi-party Private Set Operations with an External Decider. In DBSec' 21. *https://arxiv.org/pdf/2103.08514.pdf*
[2]: Ramezanian, S., Meskanen, T., & Niemi, V. Parental Control with Edge Computing and 5G Networks. In 29th FRUCT Conference (pp. 290-300). IEEE.

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