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Videoconference system for E-learning platform based on WebRTC protocol

UNIVERSITAT BIELEFELD · Universidad de Jaén · UNIVERSITY of NICOSIA · ÖREBRO UNIVERSITET · OSTRAVSKA UNIVERZITA · UNIVERSITÀ DEGLI STUDI DI SALERNO · USU · Universitatea Ştefan cel Mare Suceava · université de TOURS · ŠIAULIŲ VALSTYBINĖ KOLEGIJA

About presentation

- WebRTC – Definition and usage
- System architecture
- Centralization of media streams

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WebRTC: Definition

WebRTC (Web Real Time Communication) is an open source techonogy and set of protocols that enables real-time communication – including audio, video and arbitrary data directly between browsers and devices using peer-to-peer (P2P) connections

WebRTC

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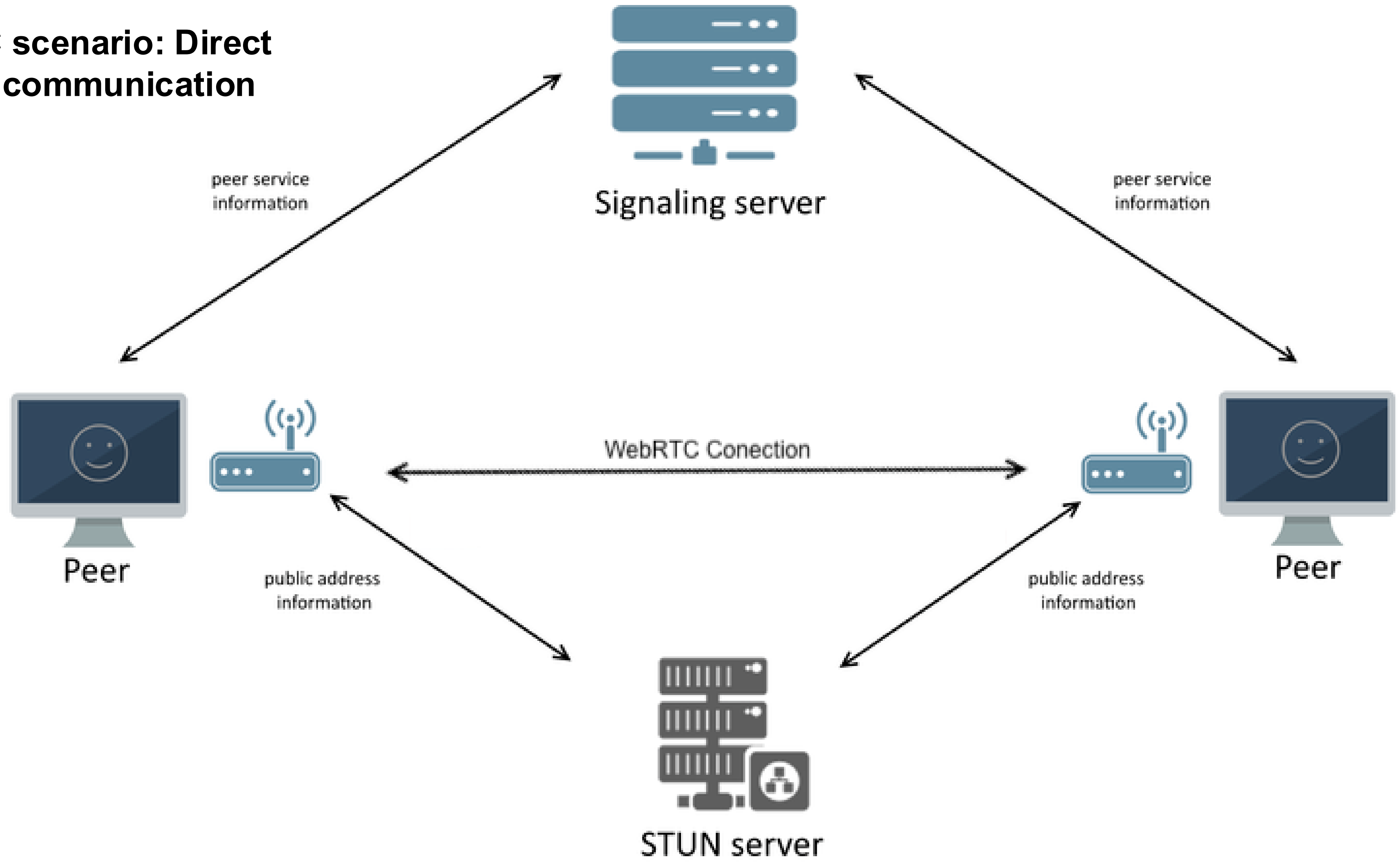
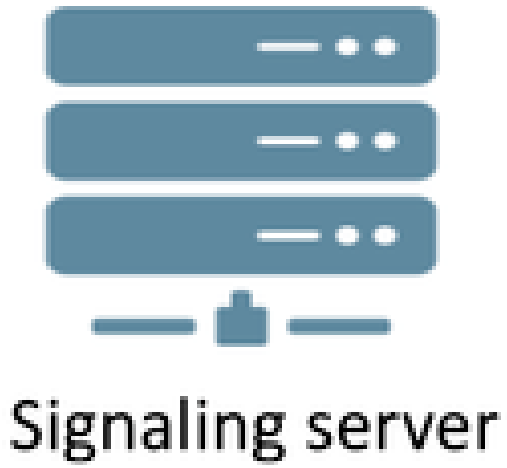
Ideal WebRTC scenario: Direct Peer-to-Peer communication



Signaling Server

- It's purpose is to exchange connection-related information between 2 peers
- It is commonly built on top of WebSocket technology to enable low-latency communication
- The exchanged connection data includes: the SDP offer/answer and ICE candidates



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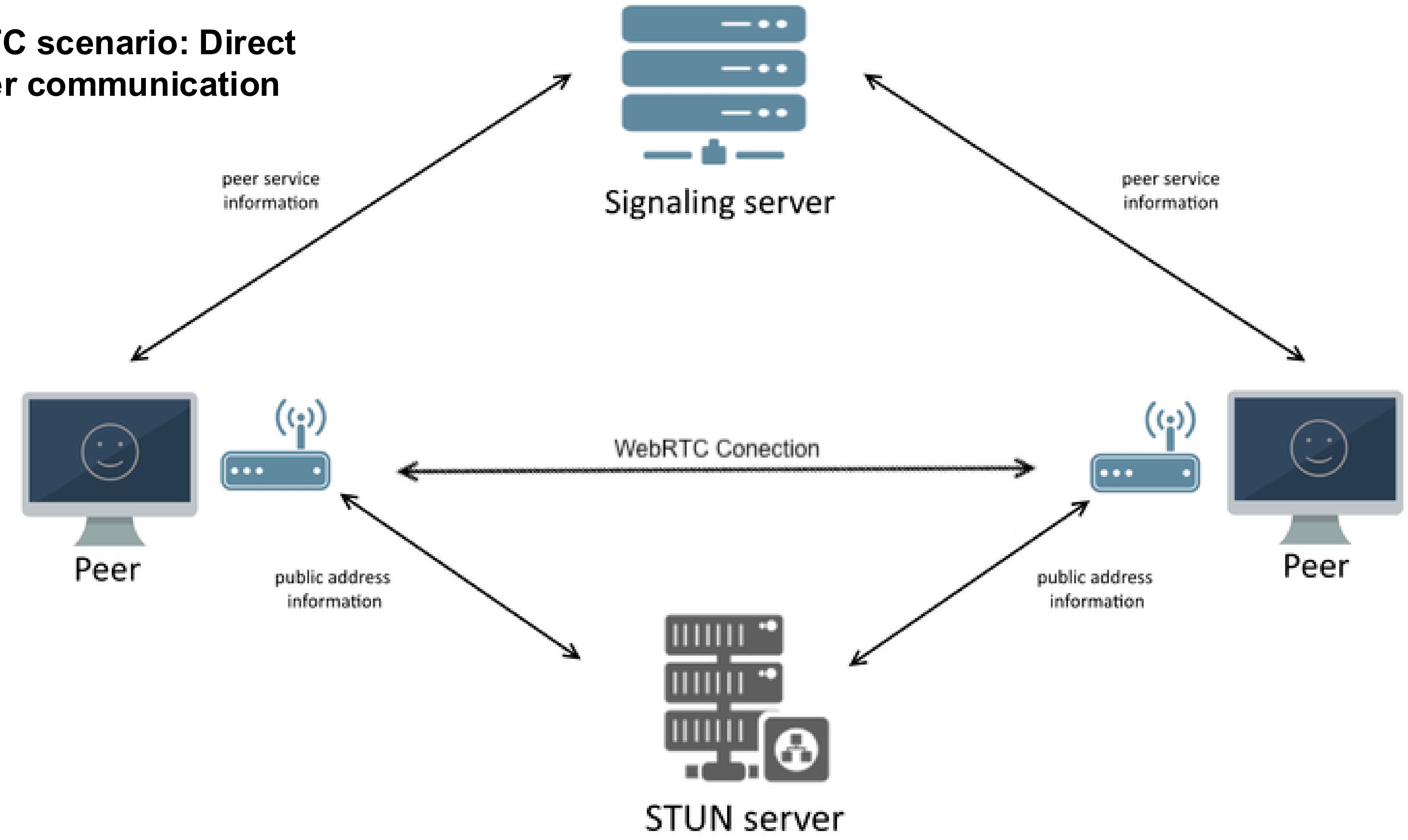

STUN: Session Traversal Utilities for Nat

- It’s purpose is to determine the public IP adresses of the peers involved in the communication
- The server is required only during the initial connection setup between peers
- Beside public IP, it also delivers information about the type of NAT configuration the device is behind

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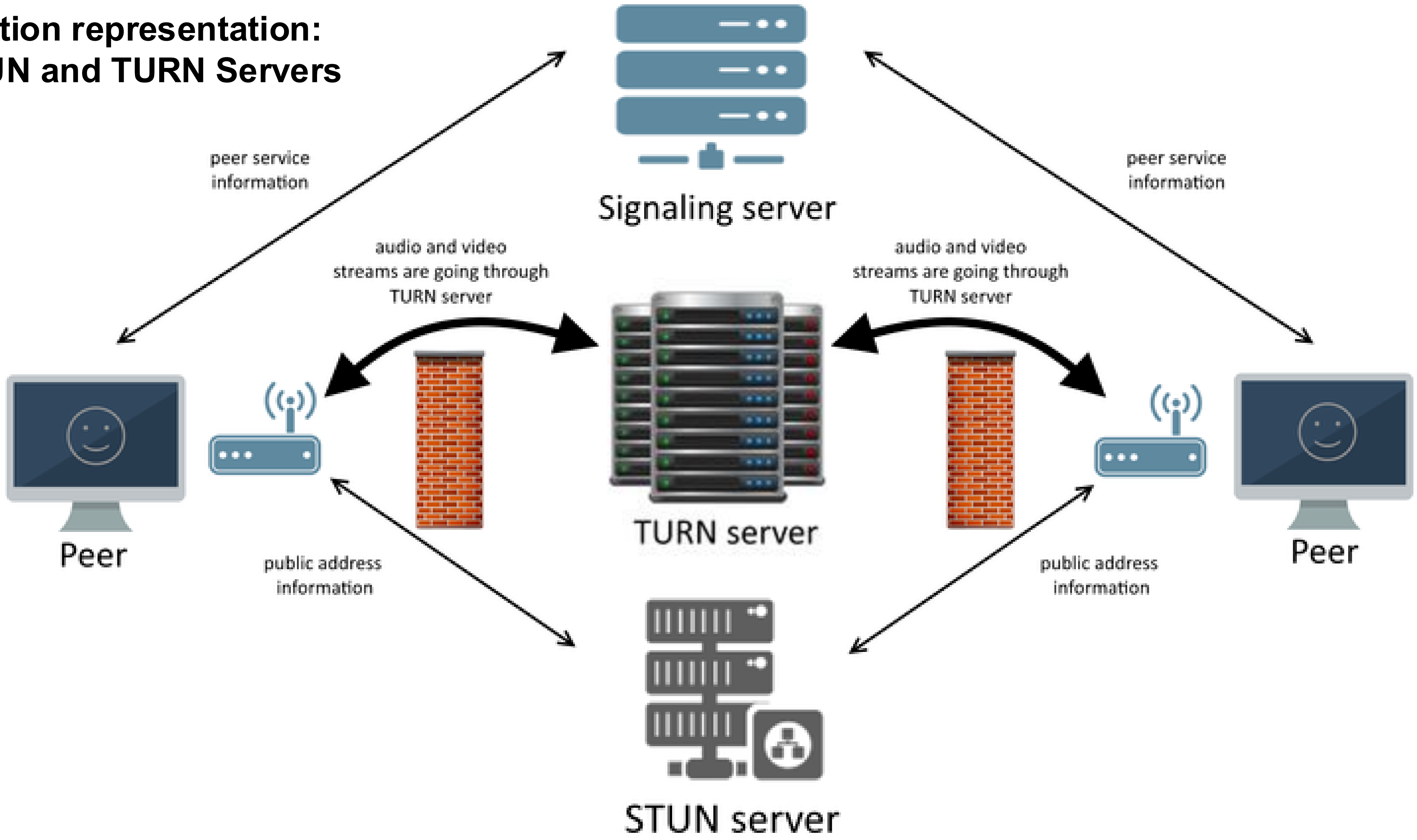
WebRTC connection representation: Scenario with STUN and TURN Servers



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TURN: Traversal Using Relays around NAT

- The TURN server’s role is to facilitate and intermediate data relaying between participants
- TURN is used as a fallback mechanism when direct P2P connection is impossible
- Built to handle various network conditions, it enables adaptive media streaming over both TCP/IP and UDP, ensuring flexibility and reliability

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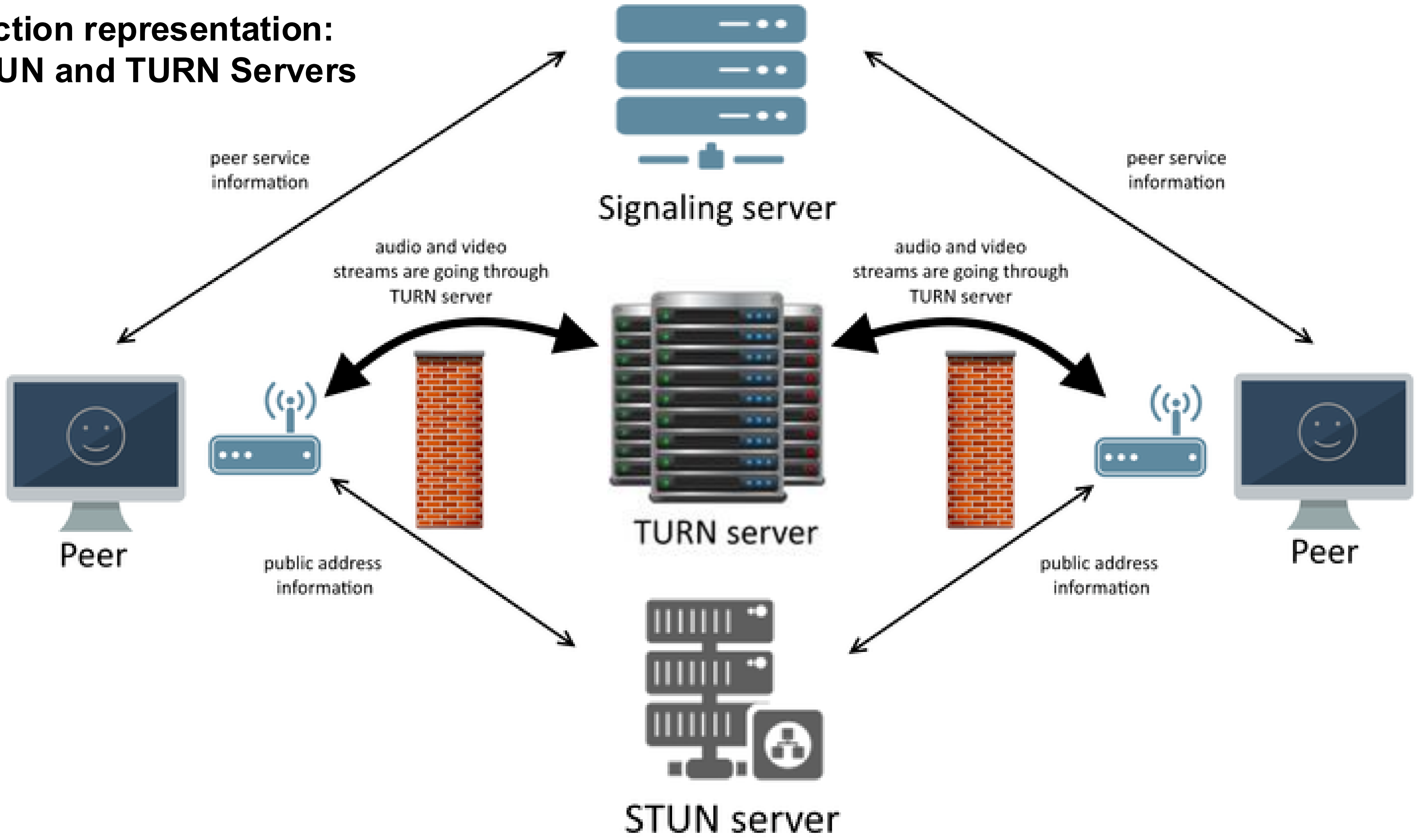
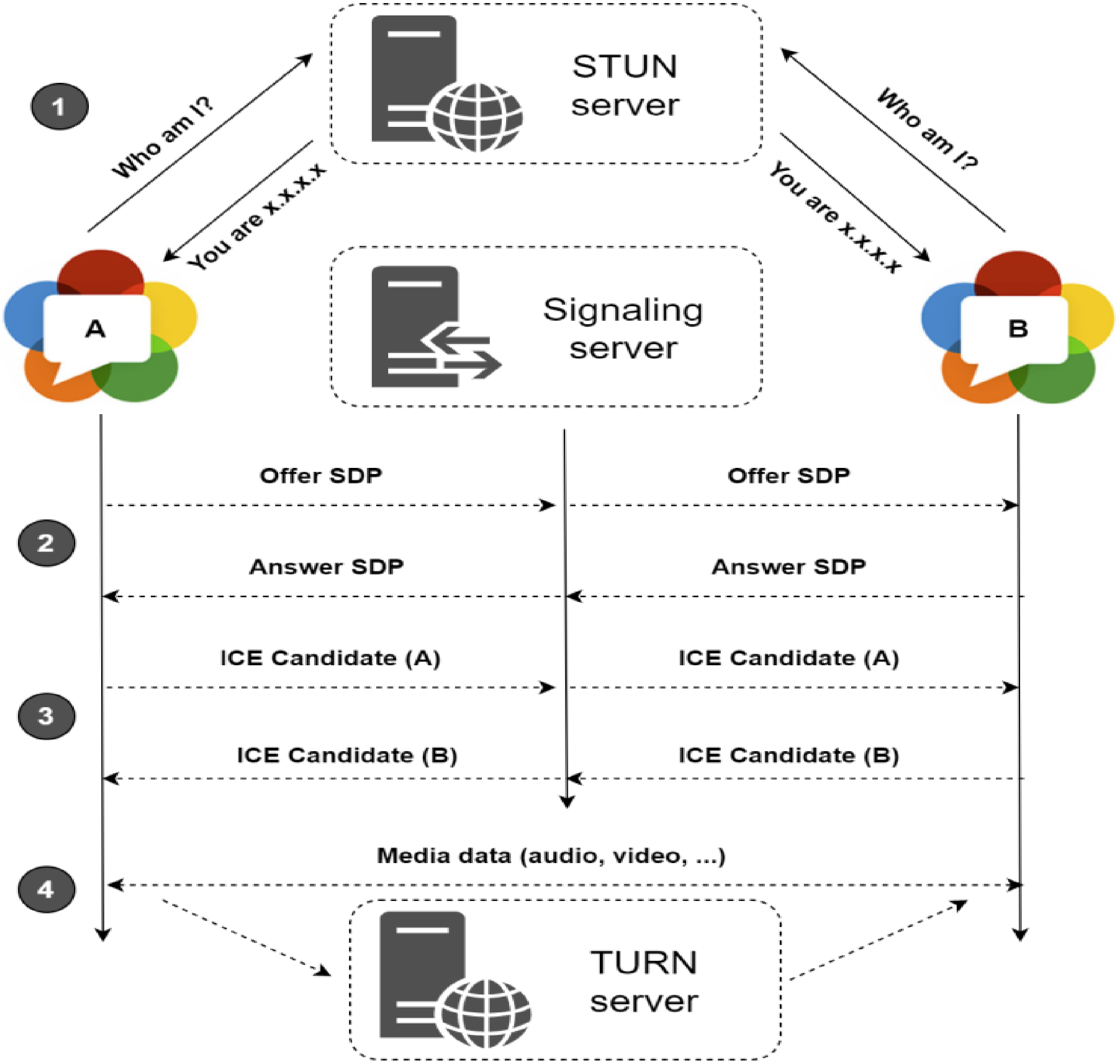
WebRTC connection representation: Scenario with STUN and TURN Servers



Connection setup Diagram: Step-by-step WebRTC Flow



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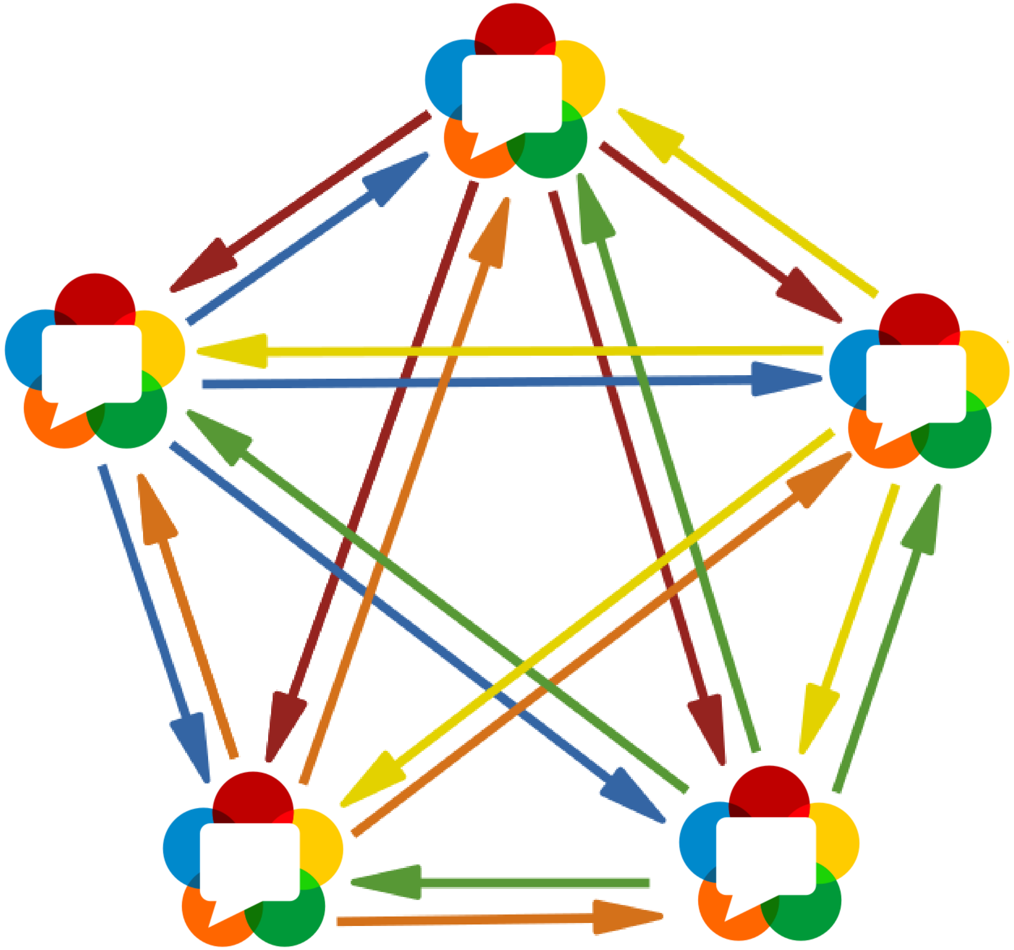
Centralisation of Media streams

- The implementation of E-Learning video conferencing system can rely on three main methods of media centralization and distribution

Centralisation of Media streams

Mesh Topology

This model assumes a decentralized system where streams are transmitted directly between participants. It is used for conferences with a small number of users (approximately 3-5)



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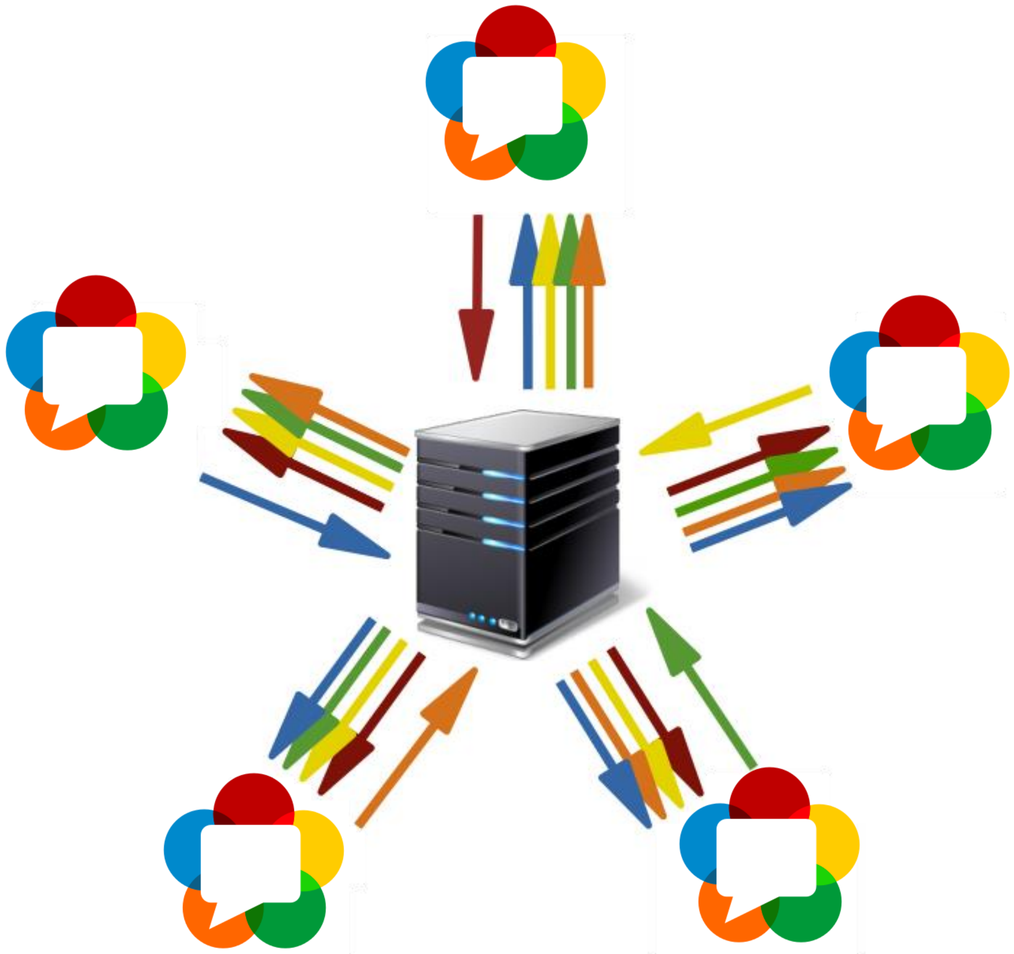
Centralisation of Media streams

SFU – Selective Forvarding Unit

This model centralizes the streams, but not in the most efficient way. It allows connecting multiple participants, but yet it is not well suited for E-Learning platform



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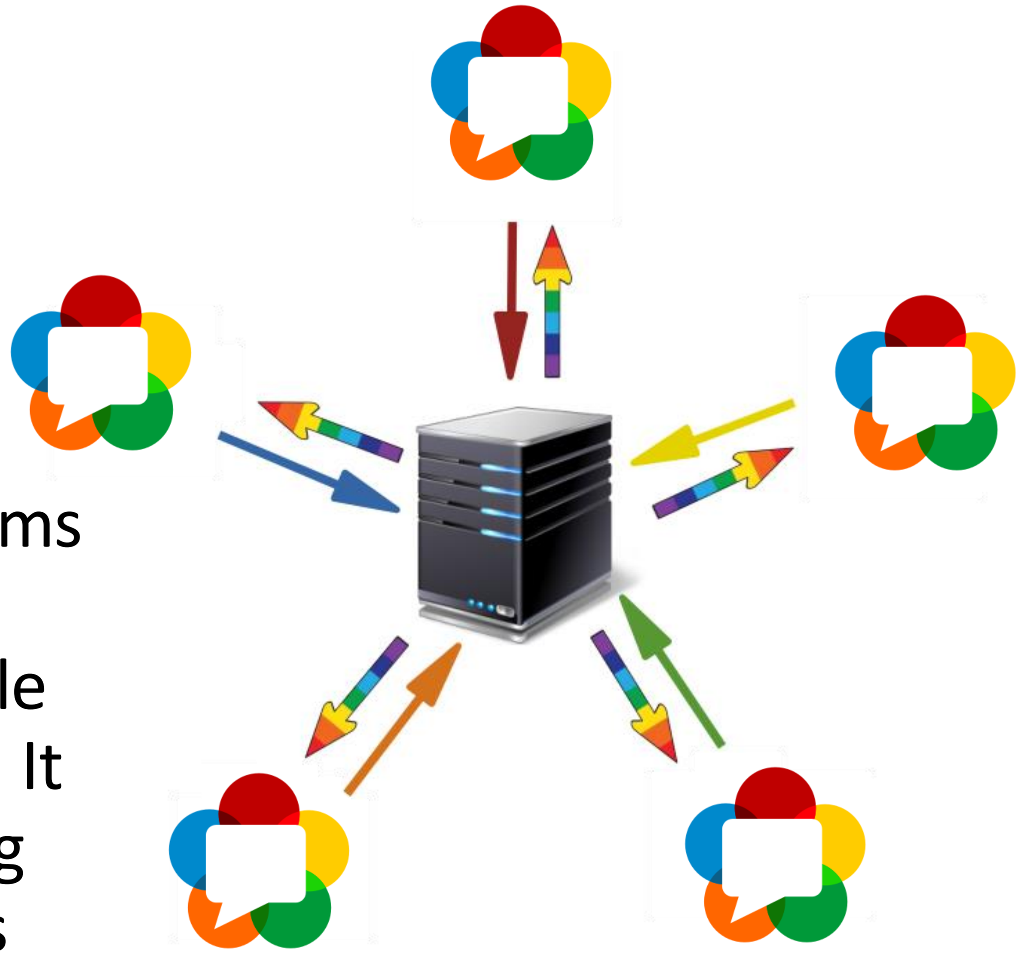
Centralisation of Media streams

MCU – Multipoint Central Unit



This model not only centralizes the streams but also optimizes their distribution by compositing multiple streams into a single one and retransmitting it to participants. It is optimal solution for video conferencing with a large number of users, which suits our needs perfectly

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Authors:

Universitatea Ştefan cel Mare Suceava

Student:
Topala Ivan

Professor:
Tiberiu Socaciu