# Collaborative Video streaming for Mobile Devices

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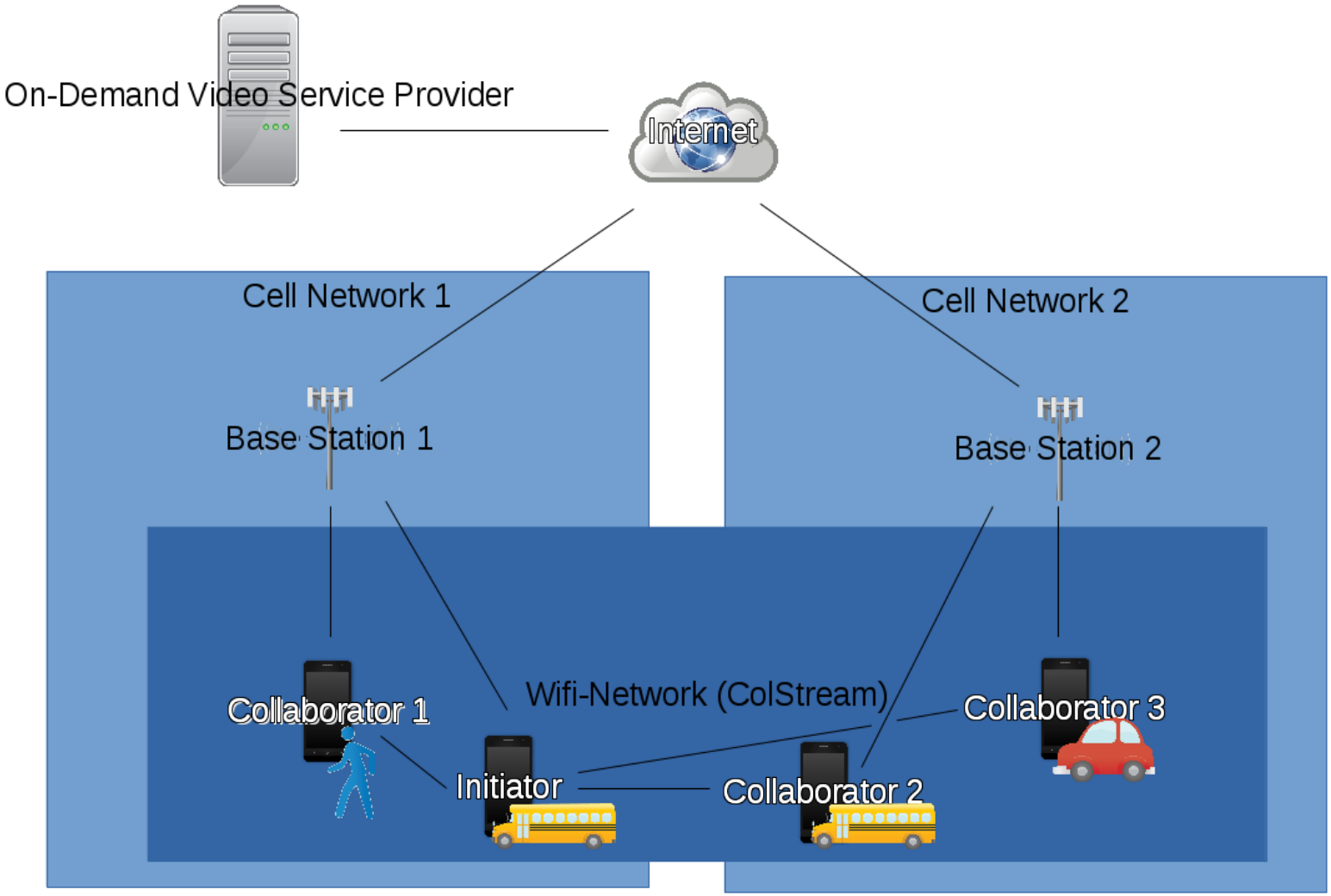
# Motivation/Problem

- Growing demand for mobile Video Streaming
  - Mobile video more than 50% of data traffic
  - Increasing device capabilities leading to higher data rates (e.g. 4k displays)
- A user can not use the entire bandwidth of the cell even if he is alone [1]
- Signal coverage fluctuation [2]
  - Changing distance to base station
  - External interference
  - Multi-path propagation

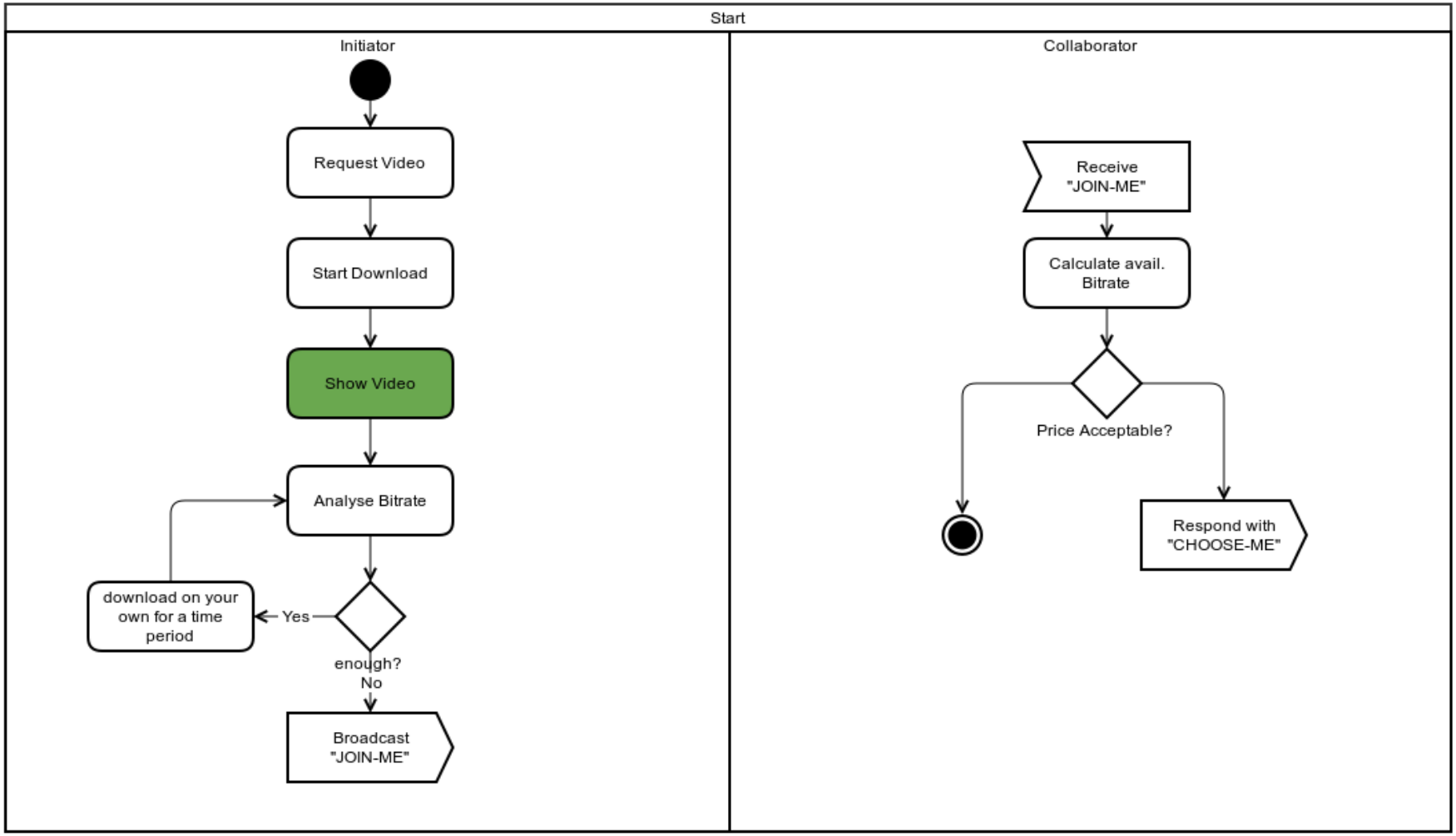
# What is ColStream

- **Col**laborative **Stream**ing
- Working prototype
- Authors: Mingyang Zhong, Peizhao Hu, Jadwiga Indulska, Mohar J Kumar
- Still in development
- Focus on mobile scenario

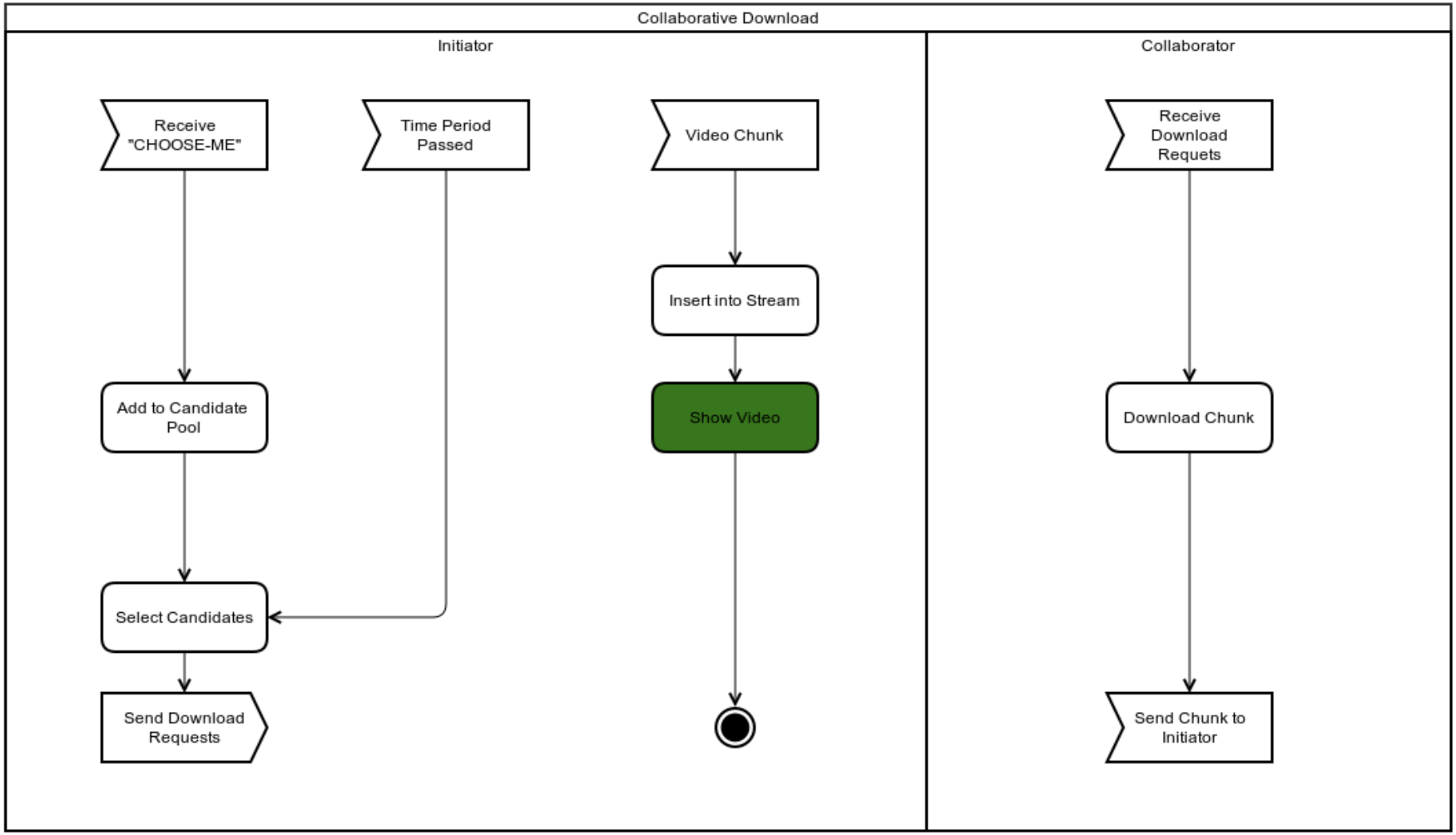
# Technical Detail



# Collaborative Download



# Collaborative Download Cont.



# Group Formation

- Streaming begin initially
- Background service check for bandwidth
- *JOIN-ME* message sent to nearby devices
  - with contact information, purchase price, & public key
- Interested devices reply with *CHOOSE-ME* message
  - With estimated throughput of the connection and the selling price.
- Collaborators pool is formed.

# Collaborators Selection

Bandwidth estimation

- Collaborator periodically measured signal and achieved throughput
- Those results are smoothed to avoid fluctuation
  - $signal = \alpha * signal_{new} + (1 - \alpha) * signal_{old}$
  - $tp = \alpha * tp_{new} + (1 - \alpha) * tp_{old}$
- Those measures are used to asses the signal history of a collaborator.

# Collaborators Selection Cont.

- User Specify it's own price per data unit
- Price takes into account data usage and battery usage
- The paper doesn't specify what is the price or how it get paid

**Choosing collaborator:**

- Multi-objective optimization problem is formulated

# Dynamic Work Distribution

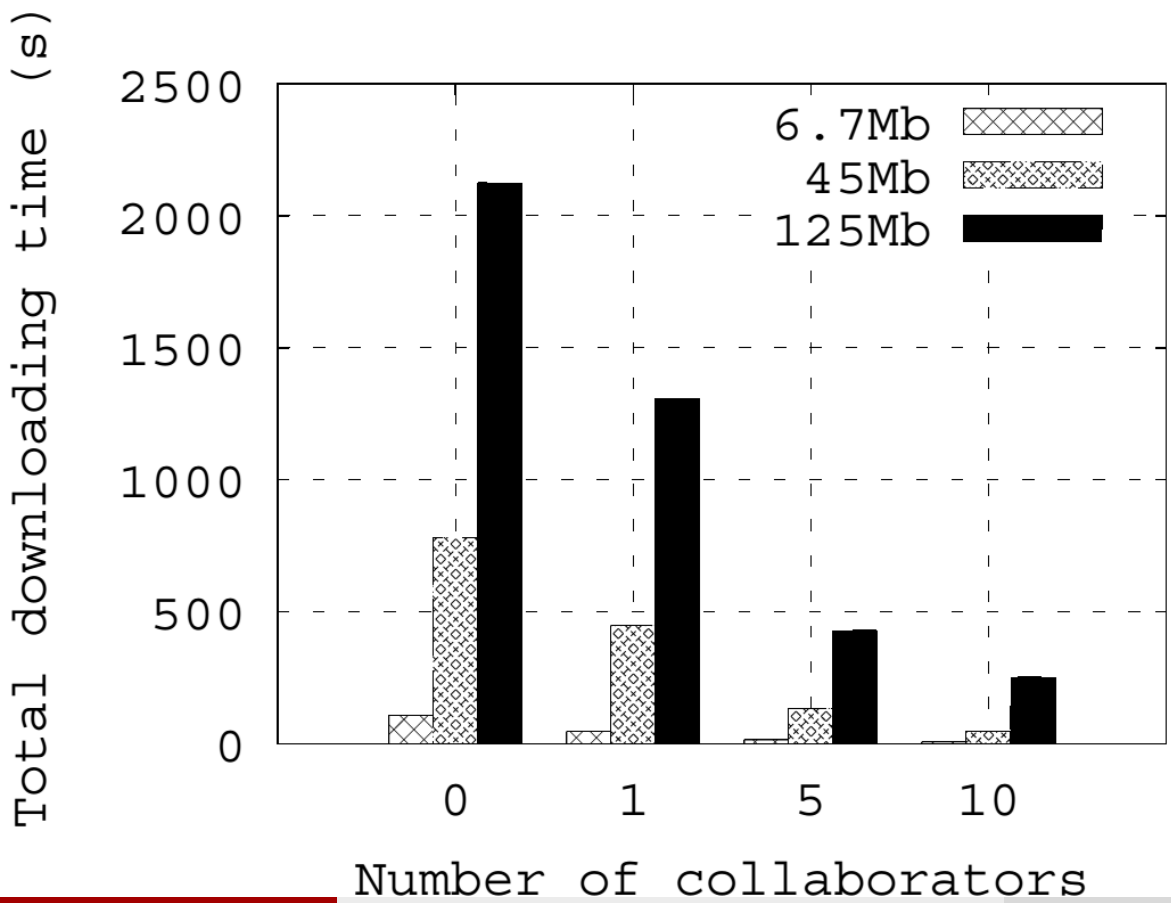
- Each collaborator assigned a chunk of the video to download
- Chunk size is not fixed , it depends on the estimated throughput
  - $ChunkSize_i = \frac{MAXCHUNKSIZE * tp_i}{tp_{max}}$
- Avoids over committing collaborators , and leads to less delay
- Collaborator periodically sends *I-AM-ALIVE* messages
- Missing 3 consecutive messages means collaborator disconnected
- In case of disconnection another collaborator from the pool is assigned the same chunk

# Simulation Setup

- Android emulators
- 1 initiator and 10 collaborators
- Laptop with Intel Core i5-3210M processor and 6 GB of RAM
- Download throughput fluctuation simulated
- 3 different videos (6.7 MB2, 45 MB3 and 125 MB)
- 4 collaborators configurations (0, 1, 5 and 10)

# Results

Figure: Performance when different numbers of collaborator are used [1]



# Discussion

- Content Filtering (Copy righted materials)
  - Onion routing
- Privacy
  - Can I see what the initiator watch
  - What usage information the initiator will have about collaborators.
- Security
  - Built in man in the middle???
  - Handling unknown data for anonymous person !!!!

# Questions?

# References


1. ColStream: Collaborative Streaming of On-Demand Videos for Mobile Devices
   - Mingyang Zhong, Peizhao Hu, Jadwiga Indulska, Mohan J Kumar
2. MobilNetze, dienstintegrierte Netze und Echtzeitkommunikation. Chapter 1
   - Prof. Dr. rer. nat. Bernd E. Wolfinger
3. Cisco visual networking index: Global mobile data traffic forecast update, 20122017, Cisco white paper, Feb 2013.