SMS: COLLABORATIVE STREAMING IN MOBILE SOCIAL NETWORKS

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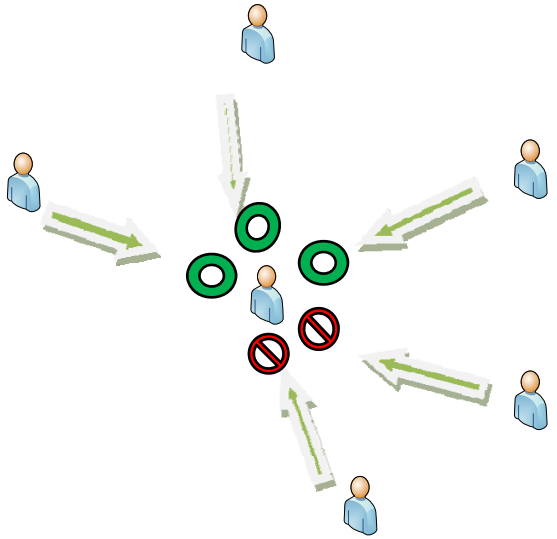
Outline

- Introduction
- System Architecture
- Detailed Design and Protocols
- Evaluation and Results
- Conclusion

Introduction

- Users' preferences are important during communication
  - Allow a part of other users to communicate with them
  - Refuse others
- Commonly, users are divided according to social closeness

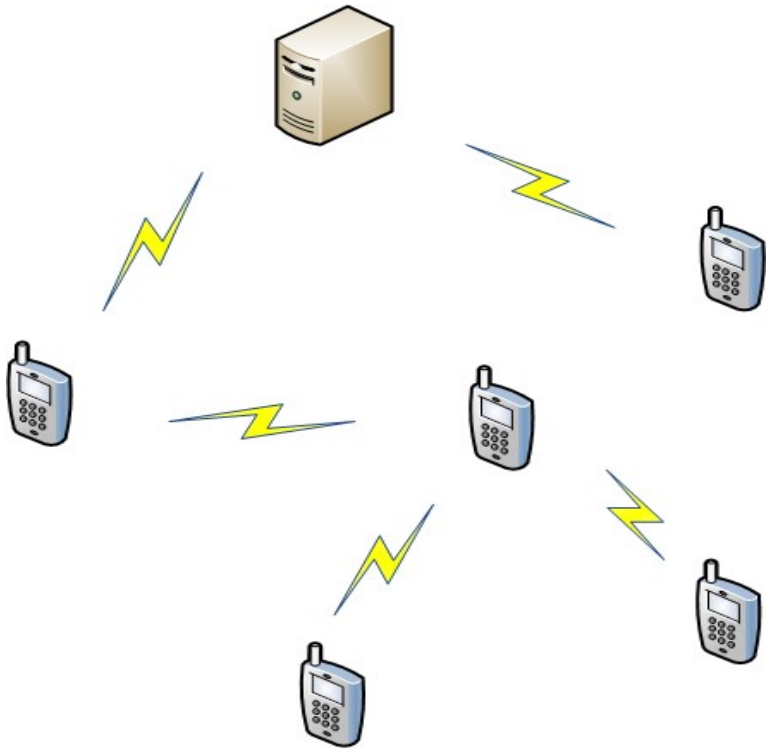


Introduction

- Exploiting the functions of users' preferences is necessary in various communication scenarios
  - Bring better user experience
  - Increase users' incentive to collaborate
  - Keep users away from unwanted disturbance

Introduction

- SMS: collaborative streaming in mobile social network



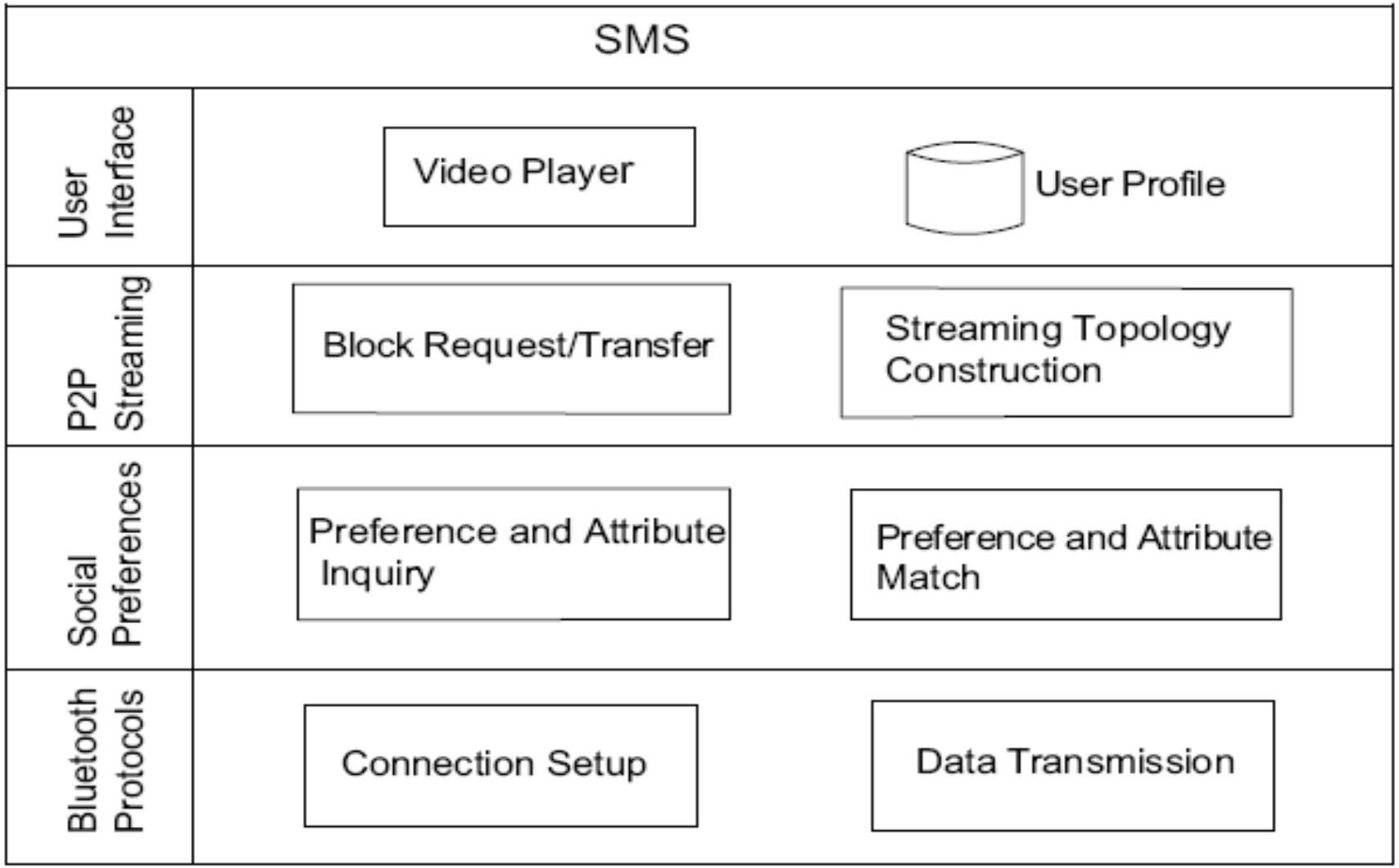
Introduction

- Challenges in SMS
  - Motivate users to participate
  - Guarantee streaming transmission rate in low bandwidth network
  - Efficient VOD fashion of Streaming

Contribution

- Exploit a novel social network model
  - Three different levels of social connection qualities based on
    - User' social relationships
    - Users' preferences
- Construct streaming overlays by combining
  - Social network model
  - Video segment availability
  - Bluetooth infrastructure
- Design detailed protocols to implement SMS

System Architecture

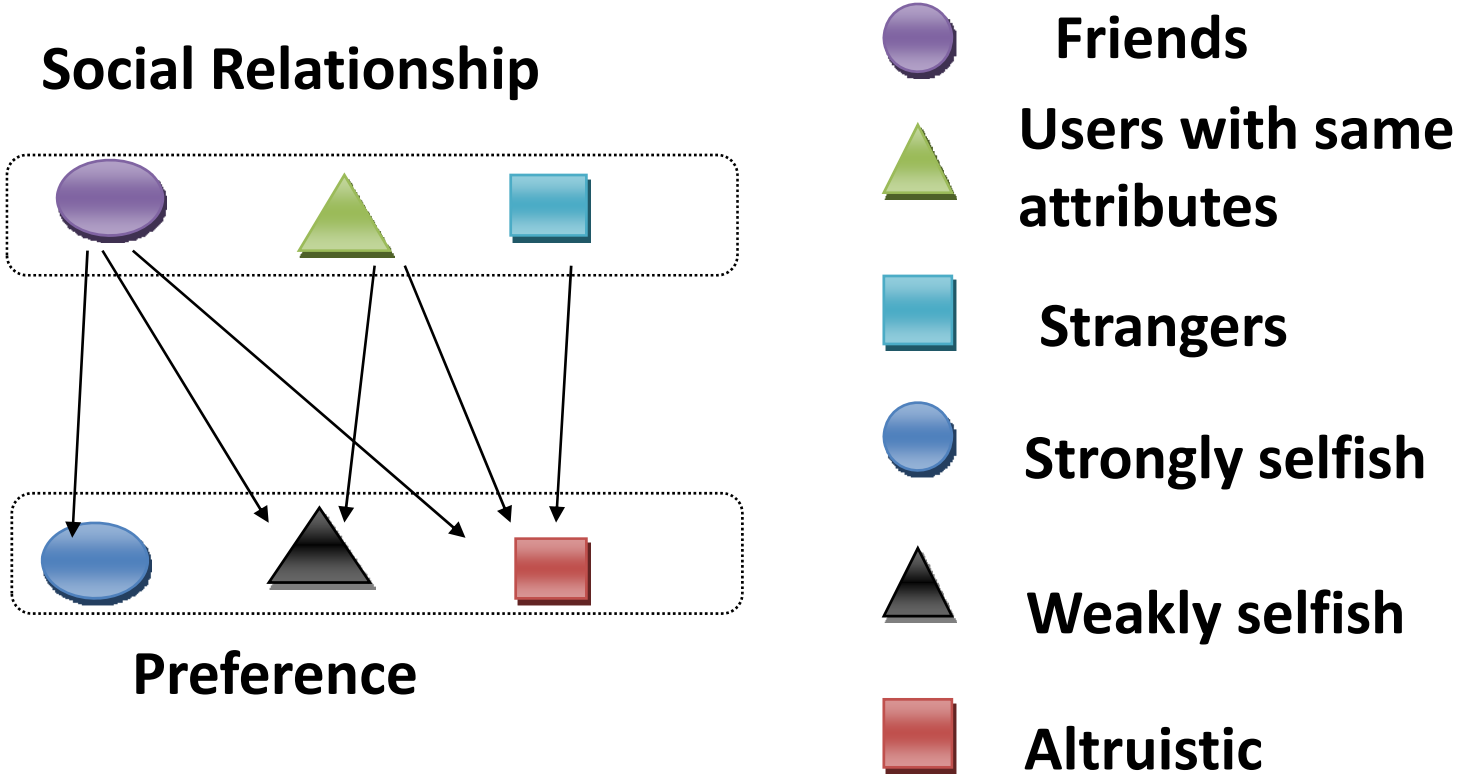


Detailed Design and Protocols

- Social preference and user matching
  - Users' social relationships:
    - Friends
    - Users with same attributes
    - Strangers
  - Users' preferences:
    - To friends only: strongly socially selfish
    - To friends and users with same attributes: weakly socially selfish
    - To all users: altruistic

Detailed Design and Protocols

- Social preference and user matching



Detailed Design and Protocols

- Social preference and user matching
  - W(x,y) denotes the level of preference for x to provide service to y

$$W(x,y)=\begin{cases} a & : \quad friends \\ b & : \quad attributes-matching \\ c & : \quad strangers \\ 0 & : \quad otherwise \end{cases}$$

a+b+c=1; a>b>c

Detailed Design and Protocols

- Segment availability
  - $S_x = (s_x^1, s_x^2, ..., s_x^n)$: bitmap indicating which video segments user x has

$$s_x^i = \begin{cases} 1 & : \quad X \text{ holds video segment i} \\ 0 & : \quad \text{otherwise} \end{cases}, \quad i = 1, \ldots, n.$$

  - $R_y = (r_y^1, r_y^2, ..., r_y^n)$: the segment request list at user y

$$r_y^i = \begin{cases} \rho^{i-p} & : \quad i \geq p \\ 0 & : \quad \text{otherwise} \end{cases}, \quad i = 1, \ldots, n,$$

ρ<1, p indicating the index of the segment user y is currently playing

Detailed Design and Protocols

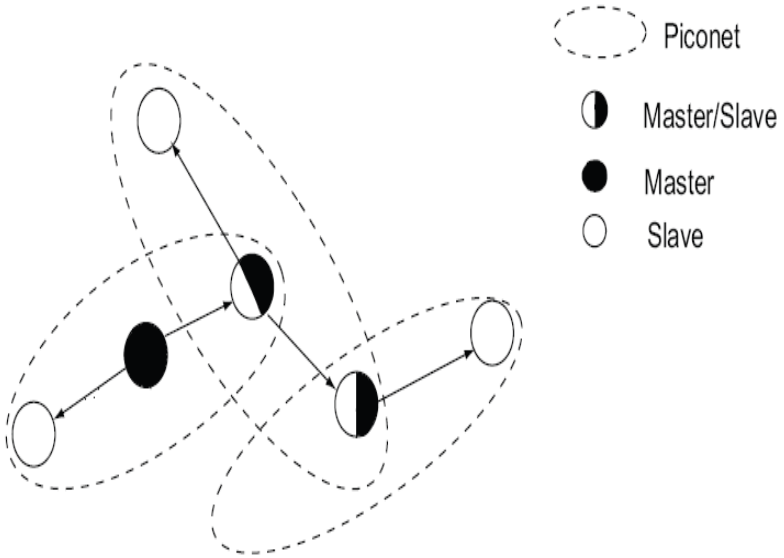
- Segment availability
  - Suitability for user y to stream from user x

$$F(x,y) = \sum_{i=1}^{n} r_y^i \times s_x^i.$$

  - Download preference: the priority for user y to require to connect to user x

$$P(x,y) = W(x,y) \cdot F(x,y).$$

Detailed Design and Protocols

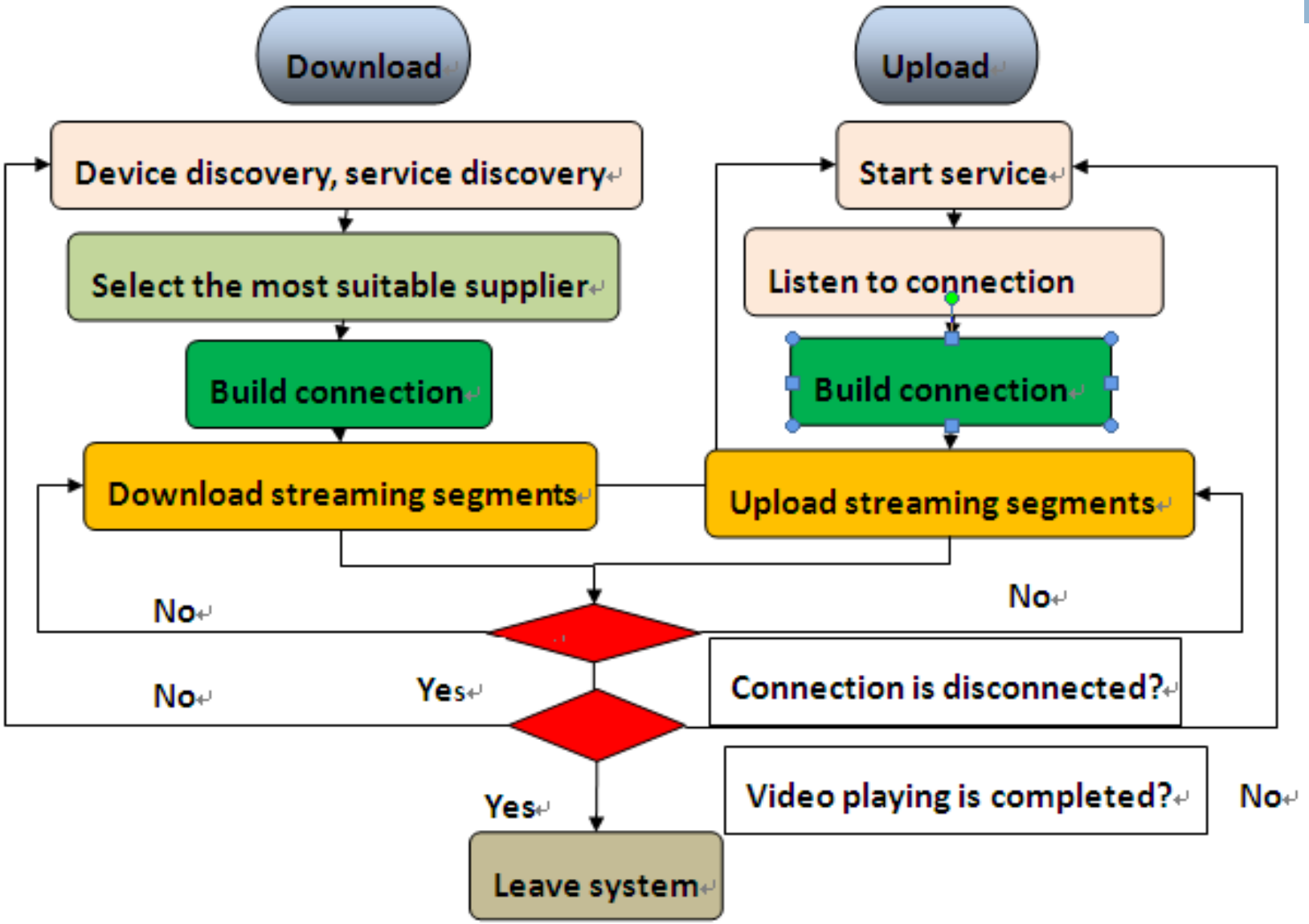


- Bluetooth transmission efficiency
  - Piconet and scatternet
    - Data transmission is executed in piconet
    - Each piconet has unique FHS
    - Multi piconets form scatternet
  - Different types of nodes
    - Master
    - Master/Slave
    - Slave

Detailed Design and Protocols

- Each mobile user maintains only one download connection
  - Higher quality of service
  - Higher transmission rate
- Users with similar segment requests are maximally arranged into the same piconets
- Broadcast is available if device and platform support

Practical protocols



Practical Protocols

- Joining the system
  - Device discovery, service discovery: to find out available users
  - Attributes in service records: to obtain the social network and video segment information
  - Users choose the suitable users and request to join their piconets

Practical Protocols

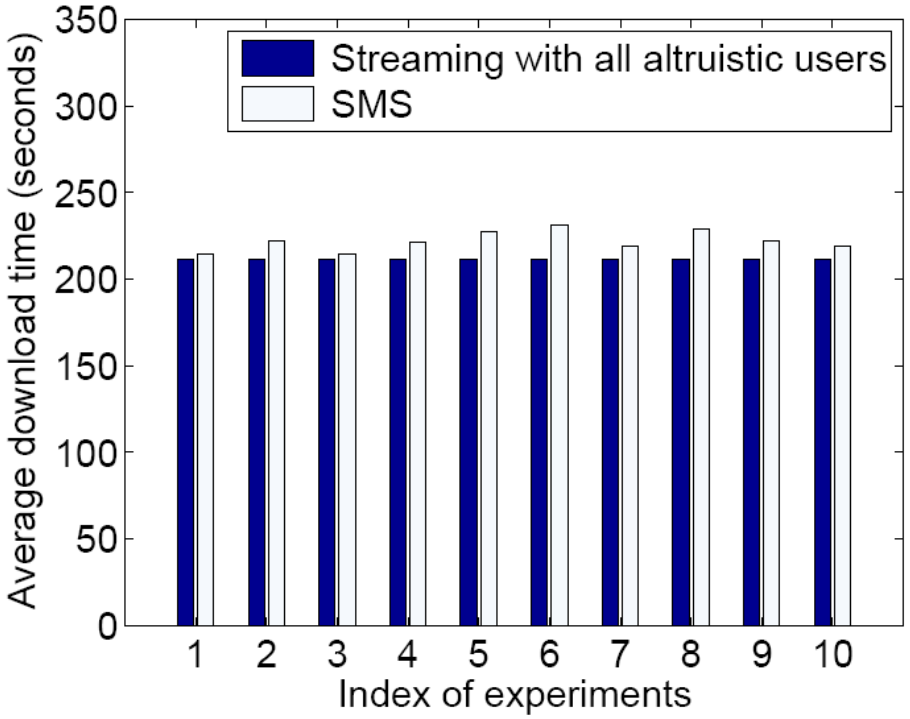
- Mobility
  - Connection may break due to various reasons:
    - Uploading users leave the system
    - Downloading users perform VCR operations
    - All available segments are downloaded
  - Tearing down connection and starting up the joining procedure to build a new connection

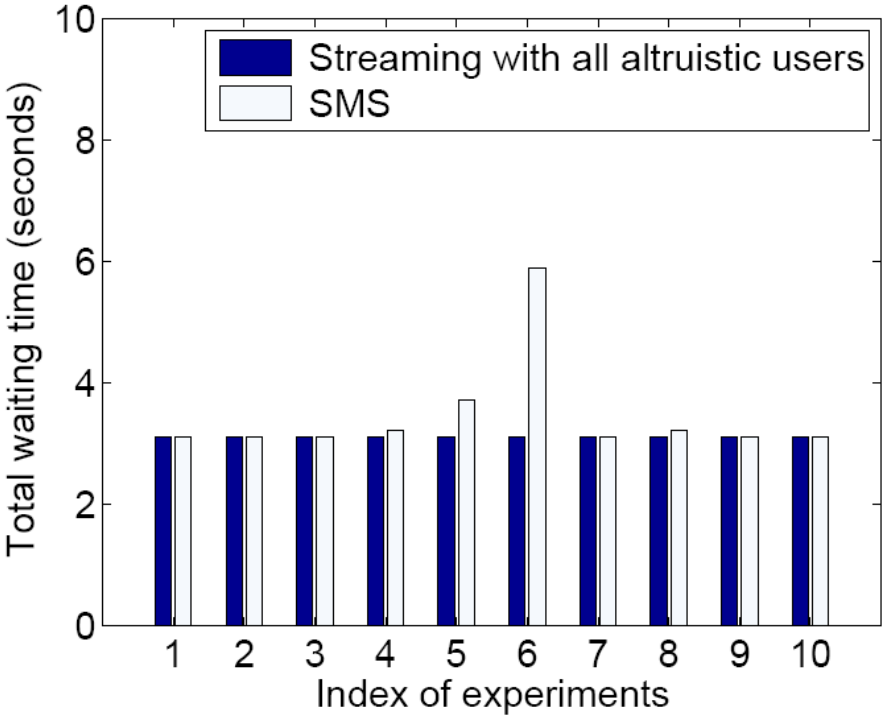
Performance Evaluation

- Experiment setting
  - 6 HTC Wildfire mobile phones
  - Android 2.1 platform
  - A video with size of 15MB, playback time of 320 seconds
  - Mobile devices join the system one by one
  - Social relationship and preference of each user are randomly chosen

Performance Evaluation

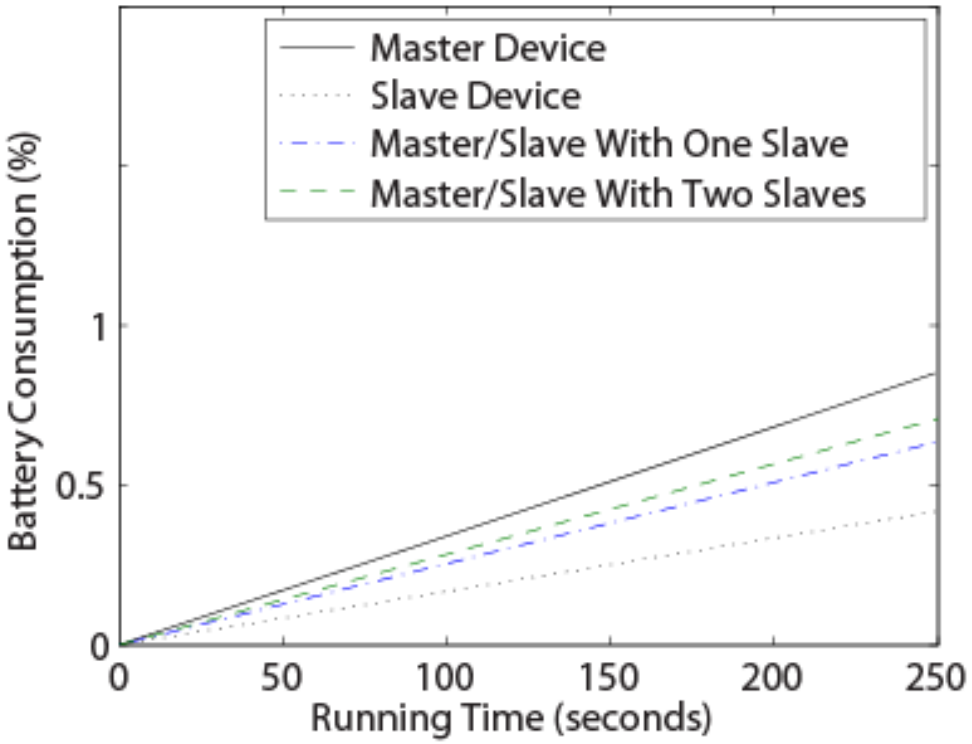
- Streaming Performance

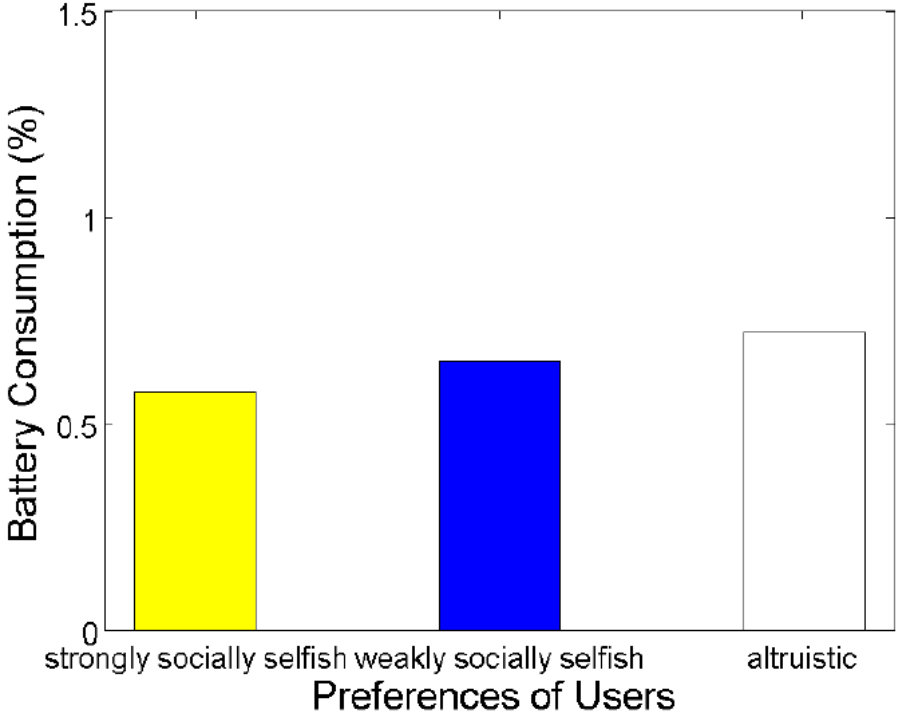




Performance Evaluation

- Battery Consumption





Conclusion

- A novel collaborative streaming system in mobile social network: SMS
  - Exploit novel social network model based on social relationships and users' preferences
  - Construct streaming overlay by combining social network, video segment availability and Bluetooth infrastructure
  - Implement system with designed protocols
- Future work: large-scale system implementation

Thanks!

Q&A