Information-Centric Connectivity (ICCON)

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Information-centrism

- Expressed by users
  - Increasingly through mobile devices

- Reflected by ICN on the network architecture
  - Network layer and above
    i.e., routing, forwarding, transport, etc.

Rich connectivity

- Dense WiFi network deployments (hotspots)
  - Multiple visible SSIDs at several locations
  - Mostly in urban environments

- Multitude of co-located mobile devices in several social events
  - *E.g.,* football games, concerts, demonstrations
  - Opportunities for device-2-device (D2D) connectivity

Rich connectivity & Information-availability

- WiFi hotspots
  - In-network caches

    e.g., on the AP, middleboxes
  - In-network services/applications (*fog* computing)

    e.g., augmented reality, touristic guide

- D2D
  - Previously downloaded content
  - User generated content (UGC)

Handling rich connectivity today…

- WiFi hotspots
  - Random selection
  - Affiliation/plan based
  - Load metrics (offloading) *e.g.*, number of users, rates, *etc.*

- D2D: selecting a device or WiFi Direct group
  - Not-wide spread
  - Random/opportunistic selection
  - Out-of-band user coordination

Handling rich connectivity today…

Information-availability not taken into account

- Missed opportunities

  - **Enhancing** content delivery efficiency *e.g.,* cache hits

  - **Enabling** information discovery and retrieval *e.g.,* UGC-D2D

Information-Centric Connectivity

In the presence of multiple connectivity options…

…make a connectivity decision (*i.e.*, select)…

…taking into account information availability within each option.

Taking a connectivity decision

- Identifying and representing
  - Desired information
  - Available/expected information
- Bringing representations together
- Comparing representations
- Selecting *best* connectivity option

Identifying and representing information

- Cached content
  - Available information: Cache index
  - Desired information: *user profile*
    - Following Cache naming scheme
      - E.g., URLs, Interest names, etc.
    e.g., LFU index of 10K requested URLs

Identifying and representing information

- Services/applications
  - *Wrapping* content
    - Avoiding content item granularity
      - May not justify a connectivity decision
      - May result in (signaling) overheads
  - Fitting application-centric mobile computing
    - Service/application driven semantic scoping of information
    - Facilitating access control, reputation and incentives schemes
  - Topics within services/applications
    - Increasing granularity
    - *Channel* mode
   - *e.g.*, connect to SSID providing concert photos

Bringing representations together

- LTE offloading
  - Access Network Discovery and Selection Function (ANDSF)

- Autonomous WiFi management
  - IEEE 802.11u
    - Generic Advertisement Service (GAS)
    - Access Network Query Protocol (ANQP)
  - WiF-Aware (WiFi-Alliance)
    - Neighbour Awareness Networking (NAN) protocol
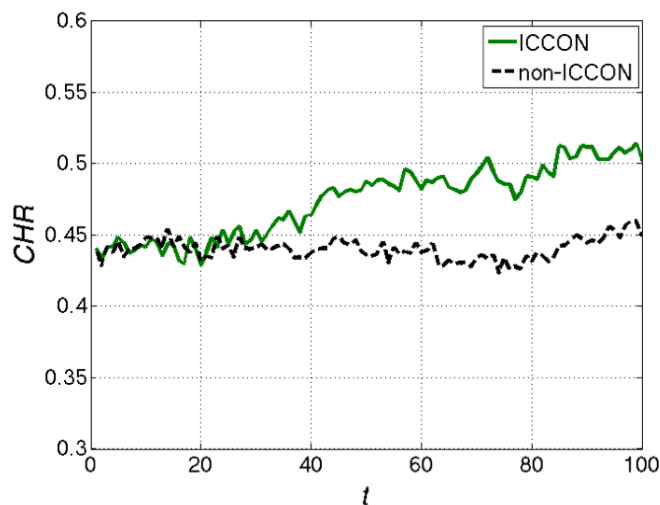 - SSIDs

Comparing and Selecting

- Best *or* exact match *e.g.*,
  - Best matching against cached content
  - Exact against service identifier

- Decision temporal granularity
  - Per *session*
  - Per content request
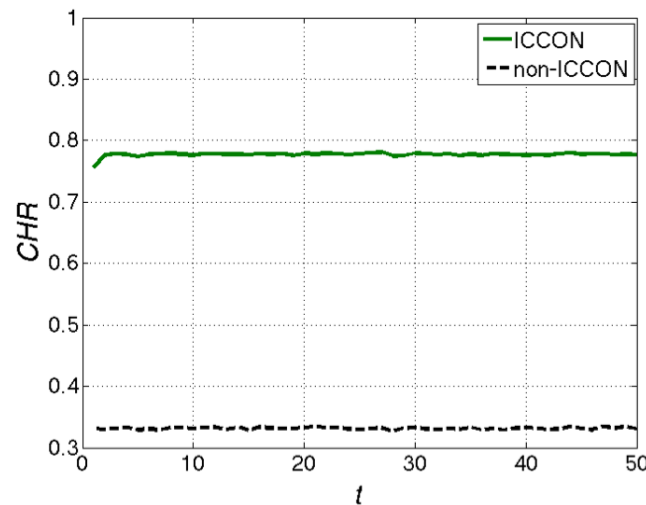
Use case 1: cellular offloading
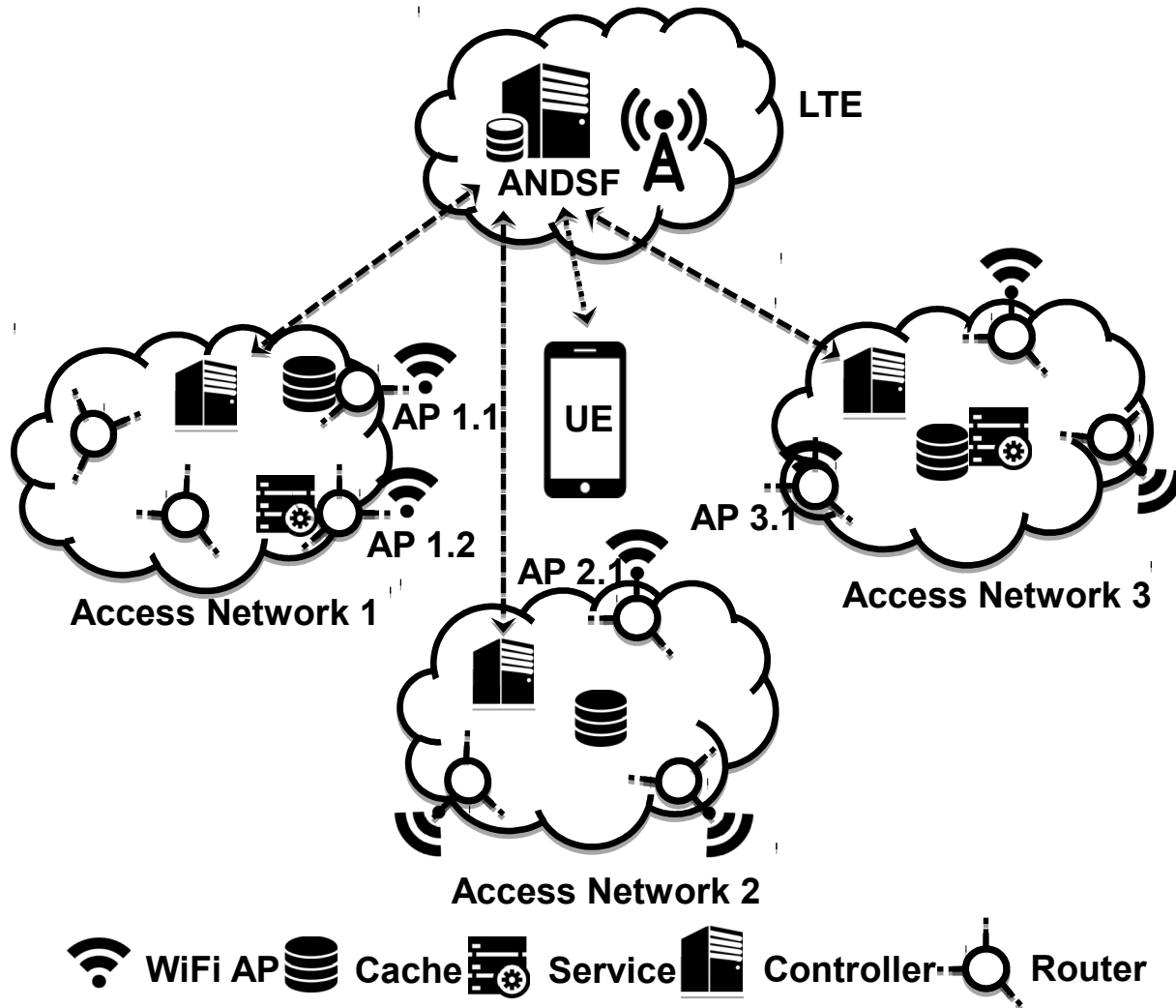
Use case 1: cellular offloading
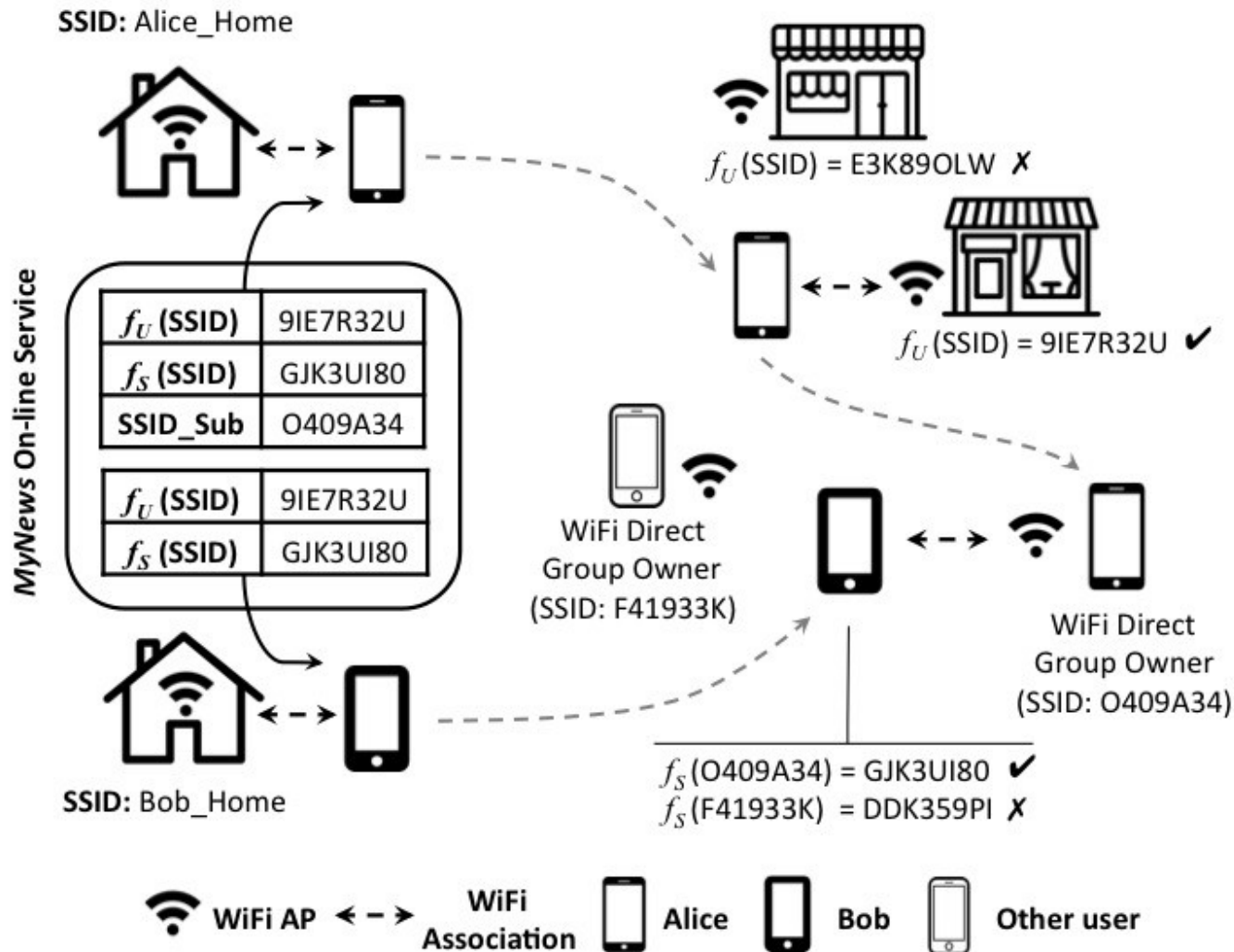## Preliminary results

(a) AP selection remains the same across all UE content requests.

(b) AP selection is enabled per content request.

Impact of ICCON supported AP selection on CHR [N=150, M=10, C=10^4, c=5%C, s= 0.8, λ_c =0.01 req/sec, λ_v=0.003 users/sec, U=50, u=10%C, w=0.65]. Time is measured in total number of arrival/departures.

Use case 2: autonomous WiFi

Challenges

- Profiling
  - Network/cache scope, privacy, *etc.*

- Holistic connectivity management
  - Weight of information availability

- Security and Incentives
  - DoS attacks, D2D incentives & the role of applications, *etc.*

- Information placement
  - Sensing information popularity…

- Naming granularity and spectrum sharing
  - SSID management

- …

Summary & Conclusions

- Rich connectivity environments

- Rich and diverse information available

- ICCON: ICN to the link layer

- Various use cases, various mechanisms

- Multiple research challenges

Thank you.
Questions?

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