



Information-Centric Connectivity (ICCON)

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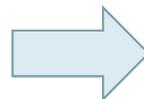
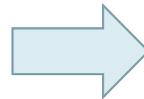
Information-centrism

- 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 deployments
 - Multiple visible SSIDs at several locations
 - Mostly urban environments

- Device-2-device opportunities
 - Crowded events
 - *E.g.*, football games, concerts, demonstrations



Information availability

- In-network caches
 - *E.g.*, on the AP, middleboxes
- In-network services/apps
 - *Fog computing*
 - *E.g.*, augmented reality, touristic guide

- 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

Handling rich connectivity today...

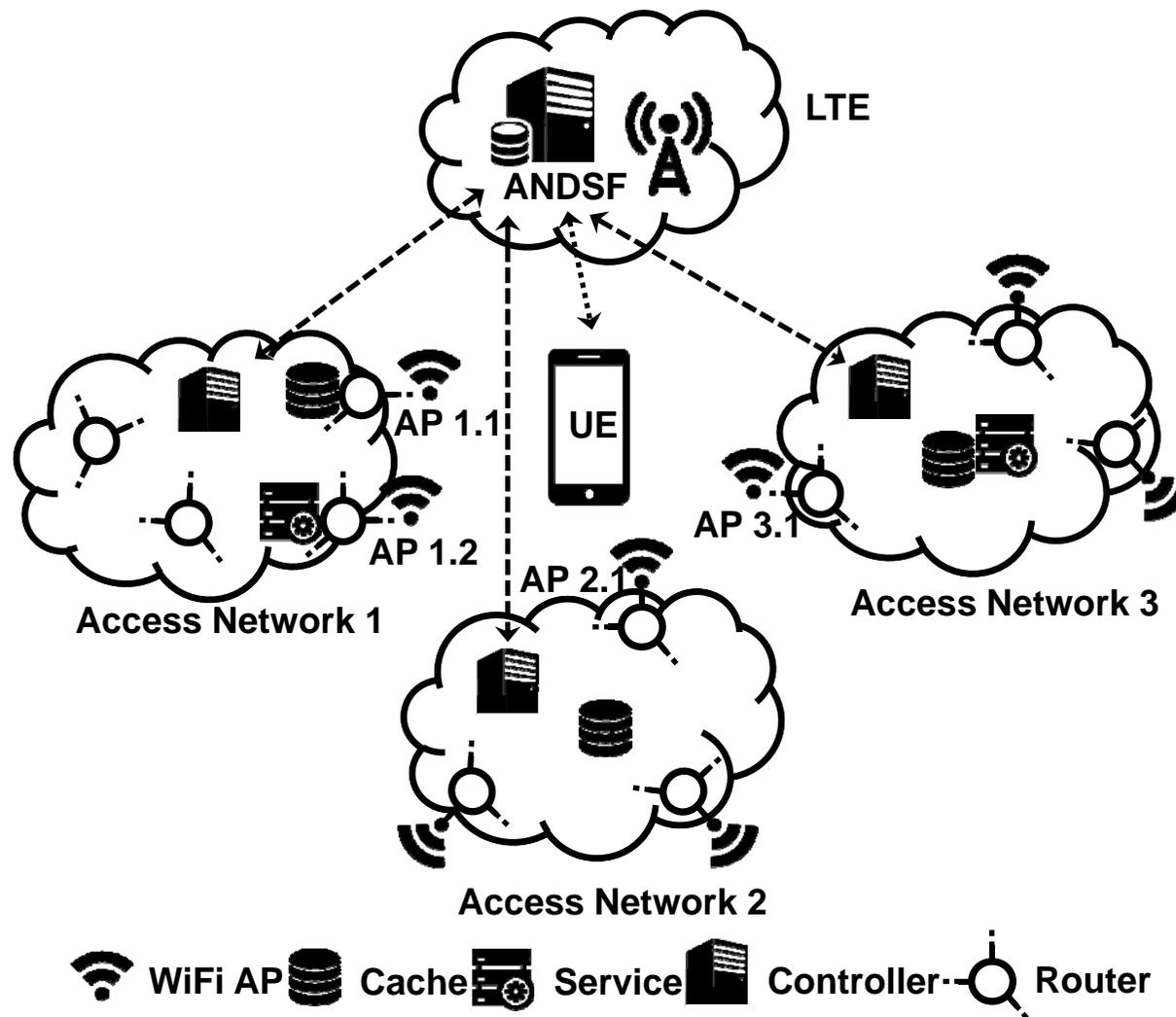
Information-availability not taken into account

- 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.

Use case 1: cellular offloading



Taking a connectivity decision

1. Identifying and representing
 - Desired information
 - Available/expected information
2. Bringing representations together
3. Comparing representations
4. Selecting *best* connectivity option

Identifying and representing information

- **Cached content**
 - Following cache naming scheme
 - *E.g.*, CCN/NDN names, URLs
 - *Available information*: cache index(es)
 - *Desired information*: “*user profiles*”
 - *E.g.*, LFU index of 10K requested CCN/NDN names

Identifying and representing information

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

Bringing representations together

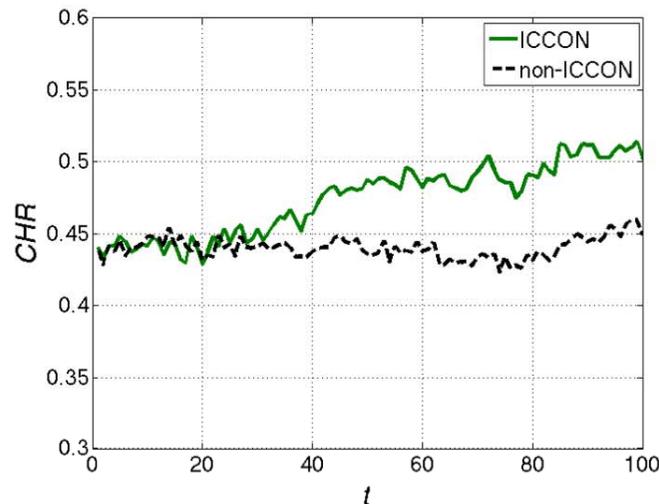
- LTE offloading
 - Access Network Discovery and Selection Function (ANDSF)
- Autonomous WiFi management
 - IEEE 802.11u
 - Generic Advertisement Service (GAS)
 - Access Network Query Protocol (ANQP)
 - WiFi-Aware (WiFi-Alliance)
 - Neighbour Awareness Networking (NAN) protocol
 - SSIDs

Comparing and Selecting

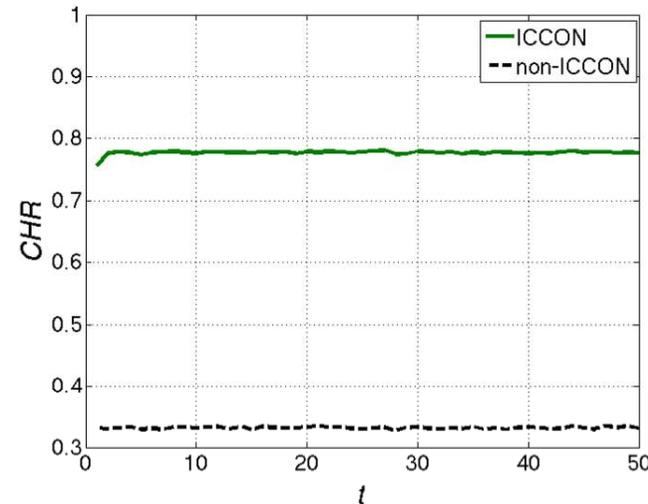
- Best *or* exact match *e.g.*,
 - Best matching against cached content
 - Exact against service identifier
- Decision temporal granularity
 - Per *session*
 - Per content request

Use case 1: cellular offloading

Preliminary results



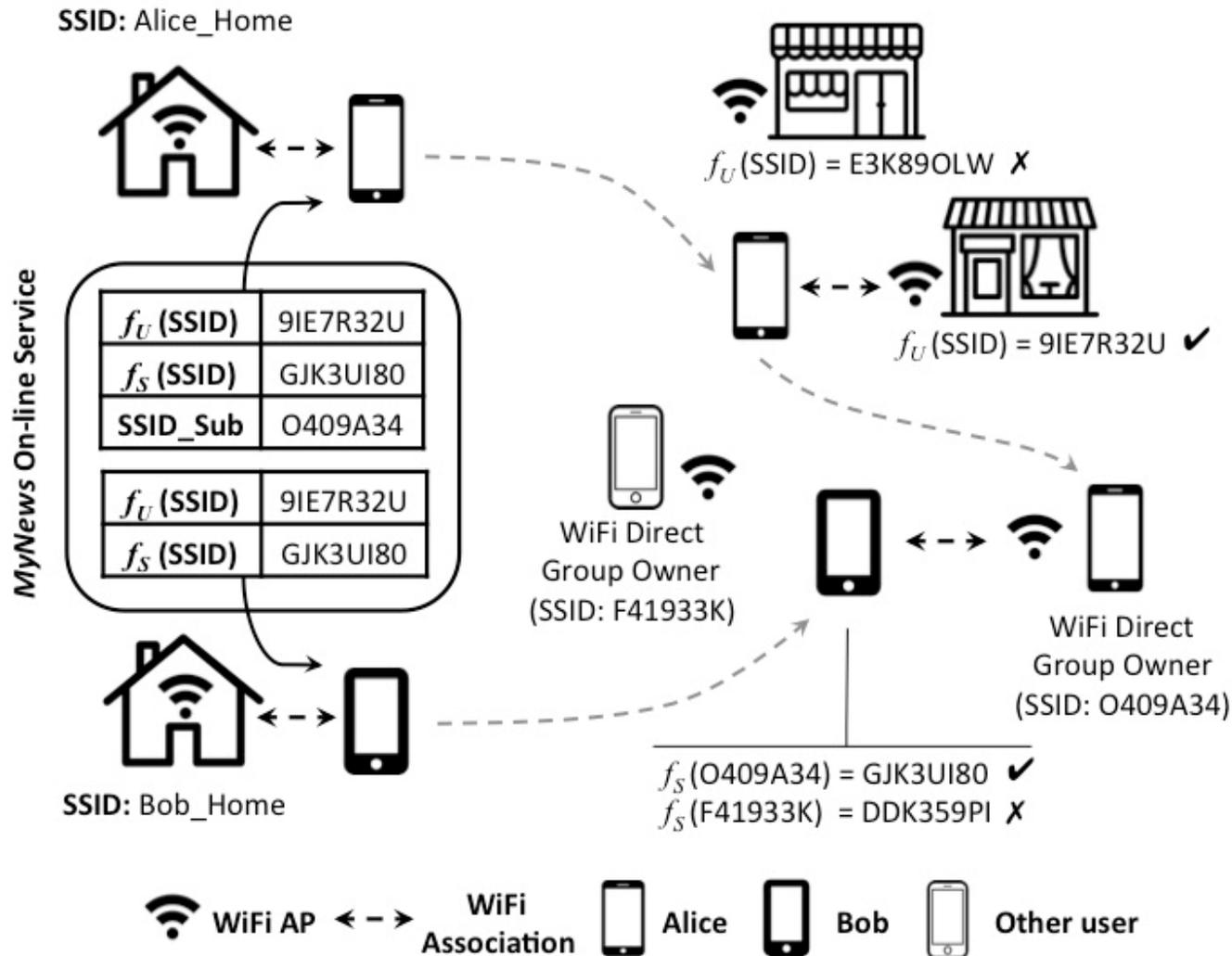
(a) AP selection remains the same across all UE content requests.



(b) AP selection is enabled per content request.

Impact of ICCON supported AP selection on CHR [$N=150$, $M=10$, $C=10^4$, $c=5\%C$, $s=0.8$, $\lambda_c=0.01$ req/sec, $\lambda_v=0.003$ 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?