

# Assignment Strategy Mechanism for Heterogeneous Types of Mobile Users and Access Points

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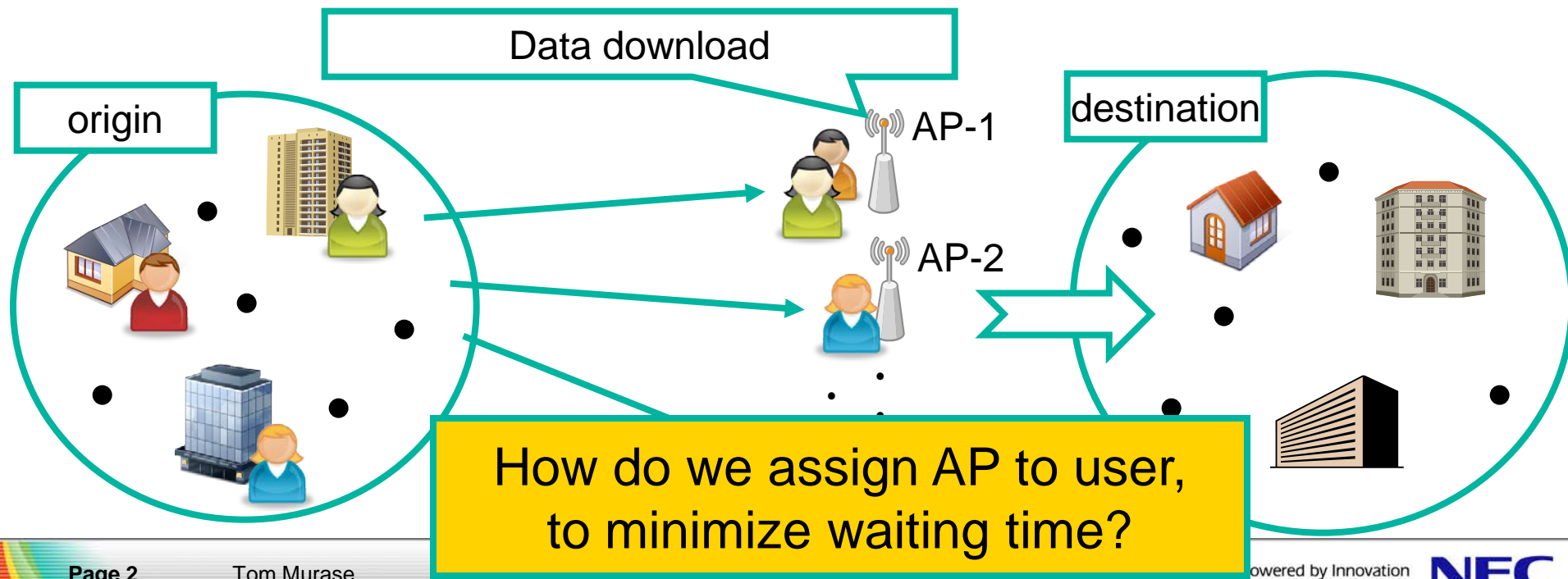
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# Background

- Mobile users want to use Internet even in moving.
- Usage of WiFi AP (Access Point) draws big attentions.
  - High speed data communication is attractive for users
  - Data off loading is becoming important for service providers.
- There are multiple WiFi APs on the ways but in different locations.
- Many users share the APs.



Mobile user can use only the AP that meet user's type.

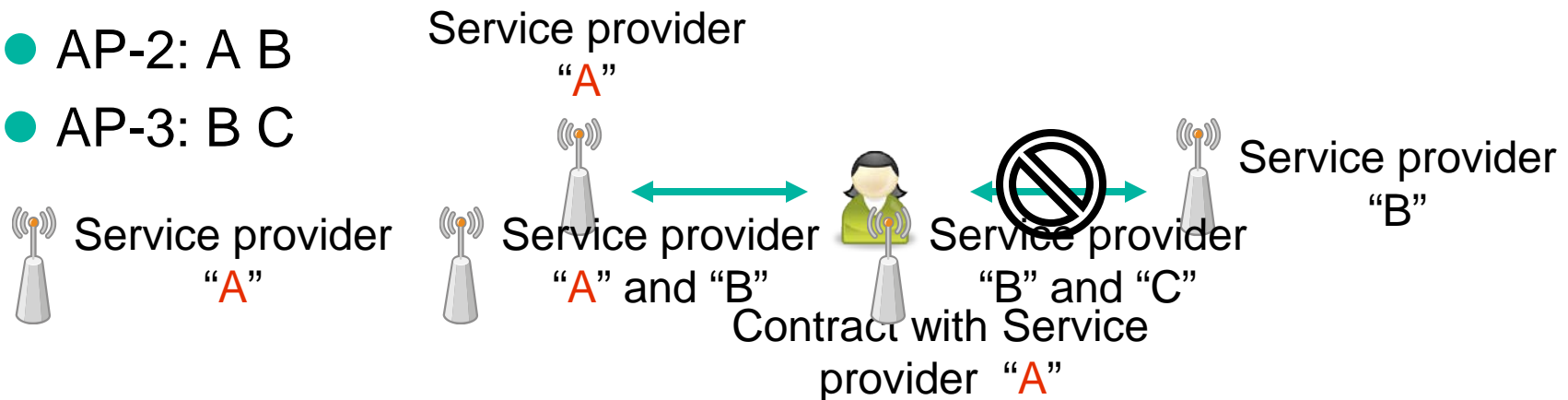
- APs have types, and users have types.
- User can use AP if AP has the same type as the user's types

This condition comes from such example;

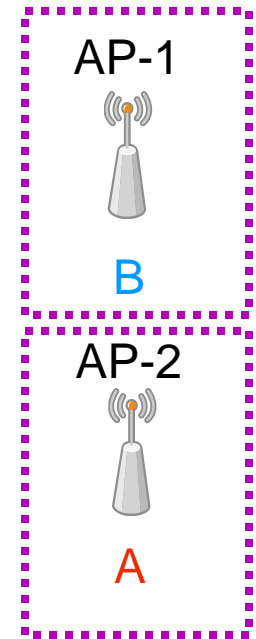
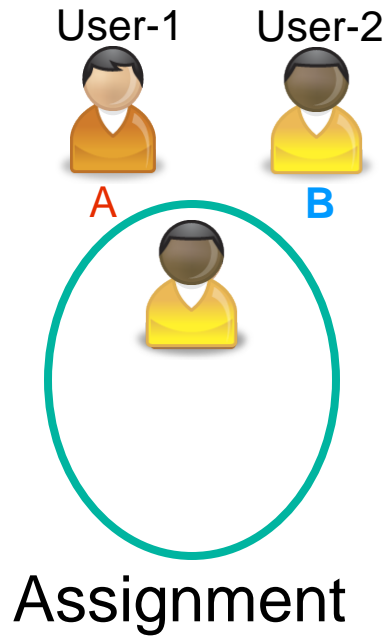
- An AP is shared by single or multiple service providers
- An mobile user use a single service provider

Example; Service providers; A, B and C

- AP-1: A
- AP-2: A B
- AP-3: B C

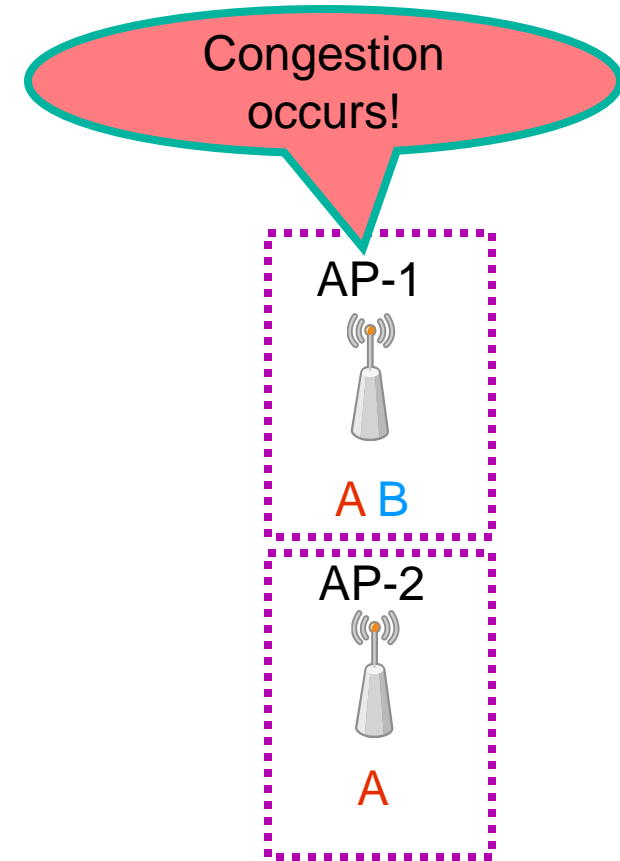
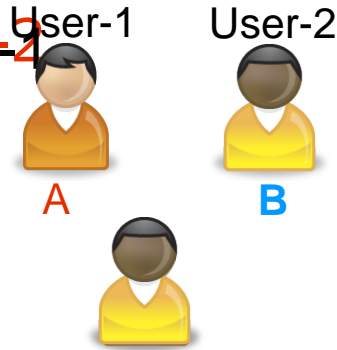


## Types of services: A and B



# Sample assignments

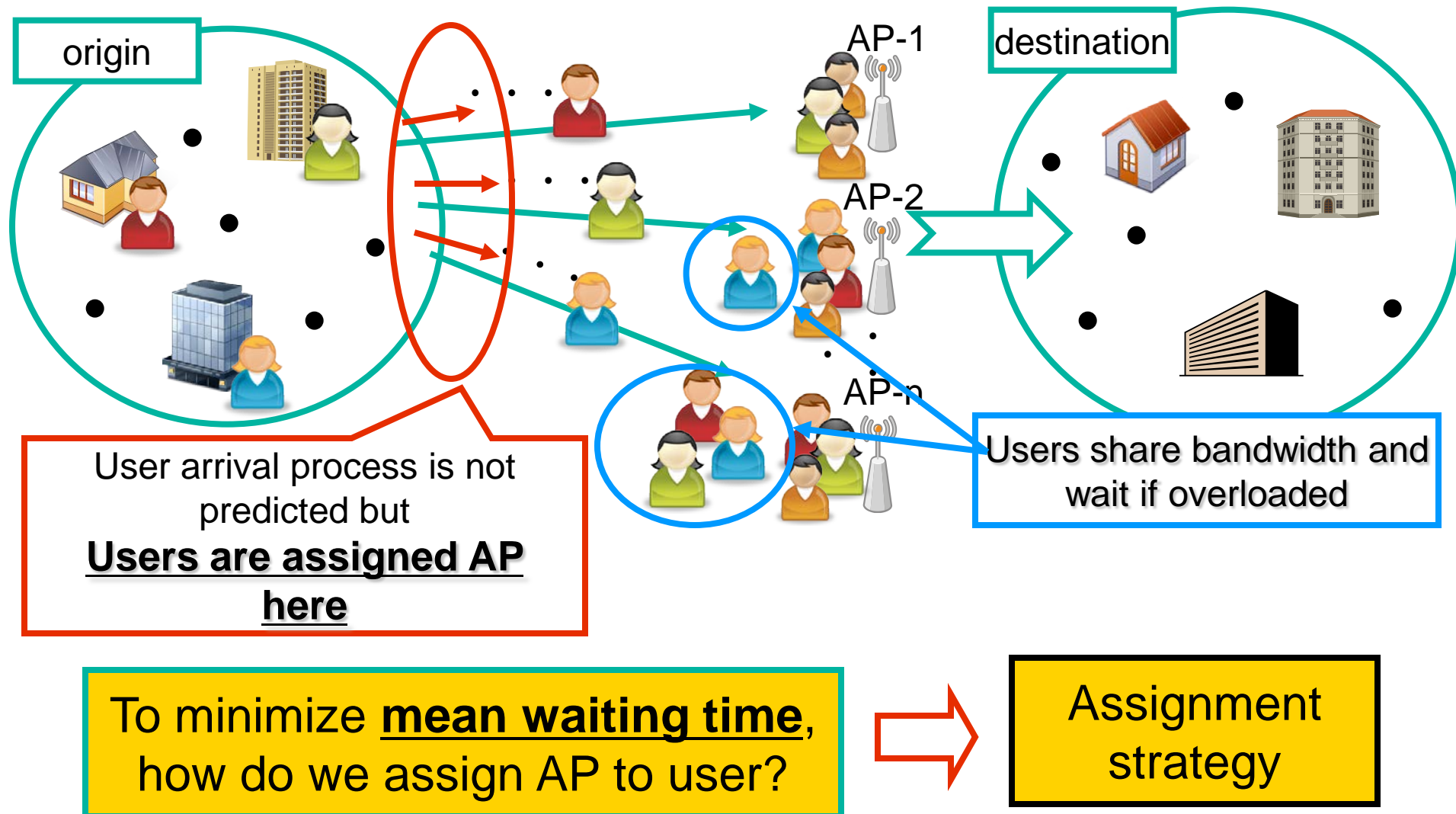
- Two sample assignments
- Types of services: A and B
- AP assignment-2



- Assignment-1 : AP-1 is congested and waiting time becomes longer.
- Assignment method decides waiting time

# General model and problem

Assignment Strategy Mechanism for  
Heterogeneous Types  
of Mobile Users and Access Points



■ Random assignment may result in poor performance.

■ We propose;

Exclusive-use Grouping and Fair-Use (EGFU) assignment

- Each AP is grouped into a
  - Service group  $i$  is
  - It is important how many
- These try to make  
each AP utilization the same
- group  $i$

# Exclusive-use Grouping and Fair-Use (EGFU)

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## EGFU assignment

Service : A, B

User



A

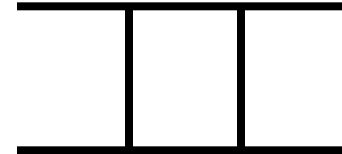
User



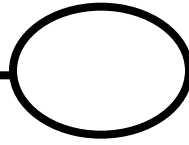
B



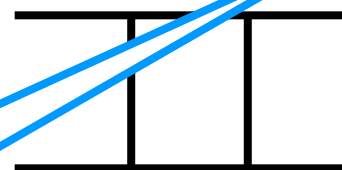
Group-A



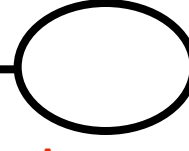
AP-1



A B



AP-2

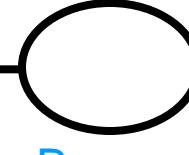


A

Group-B



AP-3



B

This AP can serve  
service B, but is not  
assigned to user B.

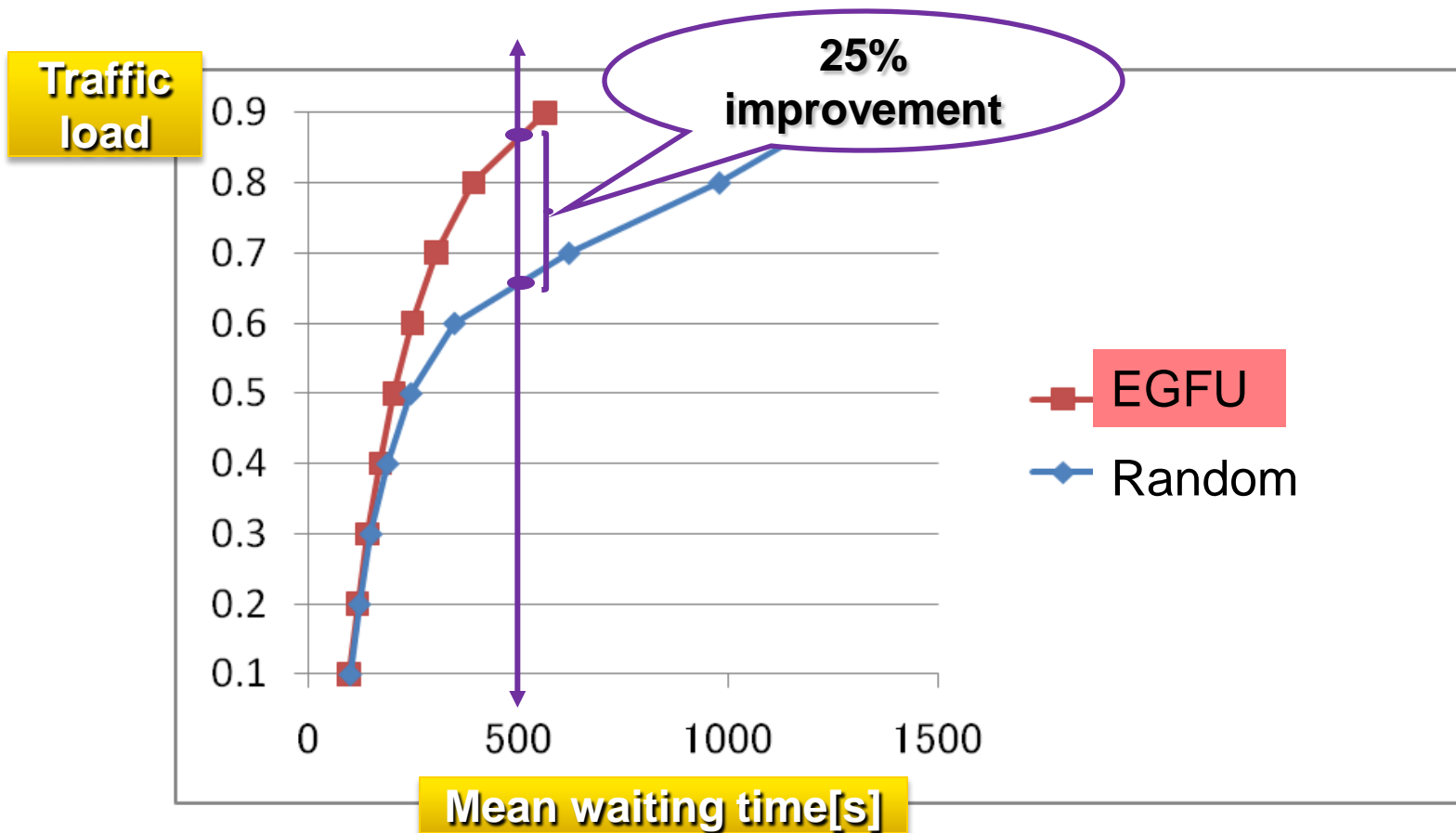
➤ This type of Queueing model is new and hard to be analyzed → simulation



- No dynamic information on each AP such as number of users is known
- No arrival process is predicted
  - Static information is given such as link capacity
  - Static arrival information is given such as fractions of user's type A, B, C, ...
    - Ex. Numbers of users of AT&T, Verizon, Sprint are known.
- Within a group, an AP is randomly selected to be evenly utilized
- User can not change APs, once assigned
- User must download a specific amount of data in the assigned AP before go to destination

- 5 types of services, A, B, C, D and E
- Random arrival of mobile users
- 31 APs which has different combination of service types
  - A, B, ..., AB, AC, ... ABC, ABD, ..., ..., ..., ABCDE
  - $5C_1 + 5C_2 + \dots + 5C_5 = 31$
- Fraction of user requirement for A, B, C, D and E is given;
  - A:B:C:D:E = 5:4:3:2:1
- AP capacity: 54Mbps
- Amount of downloaded data: 10MB exponentially distributed
- Maximum number of users served in each AP: 5

# Simulation result



- EGFU can accept 25% more load than random assignment for 500s mean waiting time requirement

# Summary

## Mobility and Internet usage

- Mobile users use WiFi broadband Internet during moving.

## Heterogeneity

- Users and WiFi APs have different service types.

## New queueing model

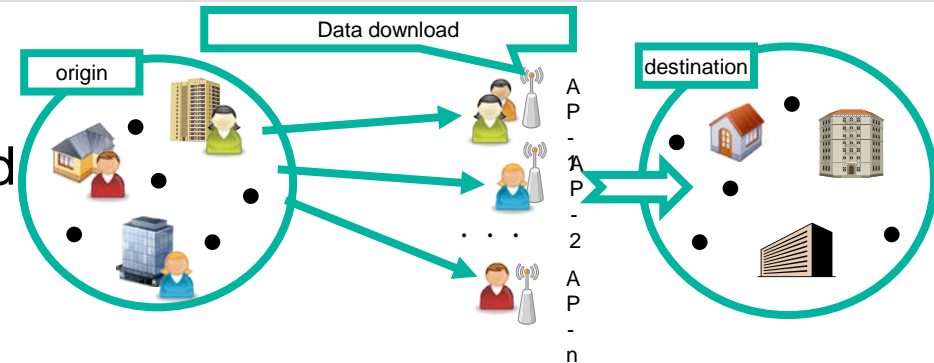
- Transactions are treated only in matched servers

## Assignment strategy (Dispatch method)

- Assignment of users to APs plays an important role to optimize QoS performance such as mean waiting time

## Performance

- Proposed “Exclusive-use Grouping and Fair-Use (EGFU) assignment” show 25% improvement to random assignment.



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