Cityroam, Providing Secure Public Wireless LAN Services with International Roaming

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Security threats in the current Public Wi-Fi

- No doubt, open Wi-Fi is *unsecure*!
  - Vulnerable to Eavesdropping, MITM attacks.
  - Anyone can set up *Evil Twin Access Points.* (Even with WPA-PSK)
  - Malicious scripts may be screwed in by the Captive Portal and/or AP itself.
  - No means to check if the AP is genuine or not.
- Who is the actual user?

Hey, use dot1X or Passpoint!

Genuine AP
SSID: XXopen
Internet

user

Fake AP
SSID: XXopen

attacker

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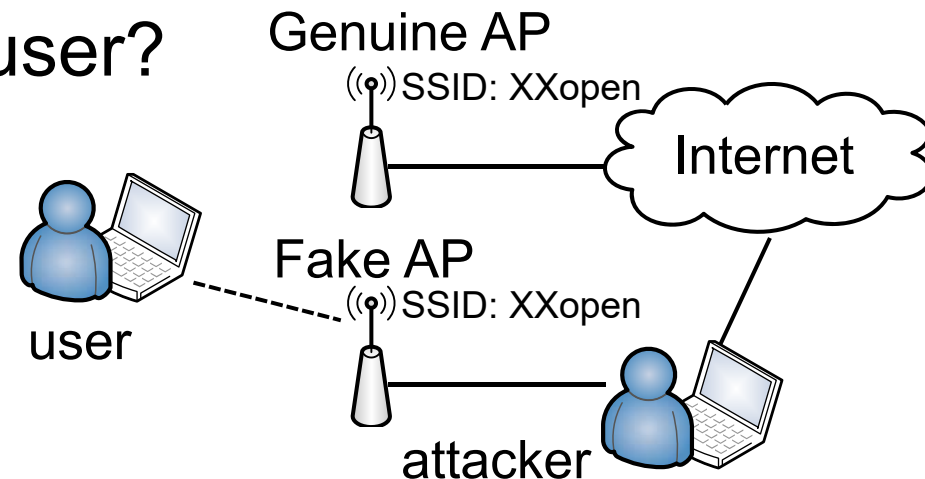
# Next Gen Public Wi-Fi with Passpoint (Hotspot 2.0)

- **Some operators provide secure Wi-Fi option:**
  - San Francisco & San Jose Wi-Fi (2014)
  - Orange Romania (2014)
  - LinkNYC (2016), InLinkUK (2017)
  - Boingo provides Passpoint Secure at 27+ airports in US, Brazil, Portugal
  - US phones come with built-in Passpoint, enabling automatic connection to Wi-Fi
  - ...

Wi-Fi Alliance and Wireless Broadband Alliance (WBA) are promoting Passpoint/NGH.

Look!

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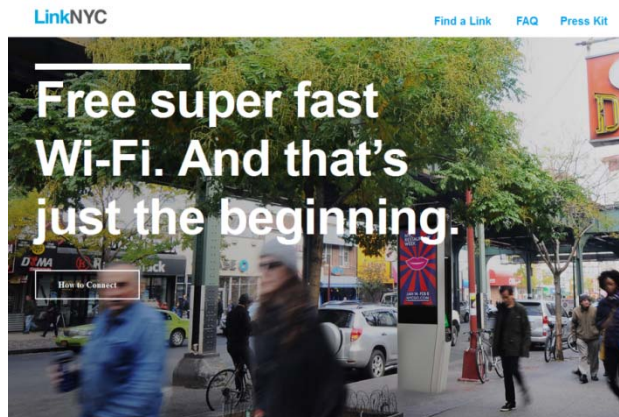
What is eduroam?

*eduroam (**edu**cation **roam**ing) is the secure, world-wide roaming access service developed for the international research and education community.*

eduroam allows students, researchers and staff from participating institutions to obtain Internet connectivity across campus and when visiting other participating institutions by simply opening their laptop.

https://www.eduroam.org/

Inst. A

students / staff

Home inst.

Inst. B

Internet
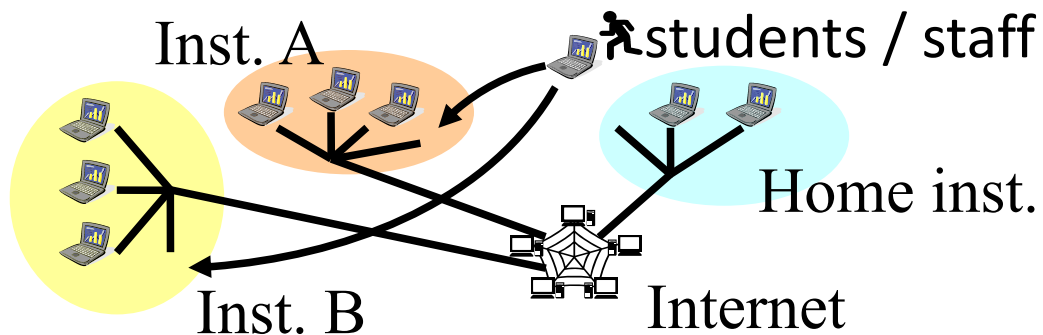
The world becomes a virtual campus!

- 130+ eduroam hotspots at rental meeting rooms, cafes, etc. in the central area of Tokyo since 2011
- eduroam at airports, train stations, etc. in Sweden
- eduroam on HotCity (municipal Wi-Fi) in Luxemburg
- eduroam at 19 airports in Norway
- eduroam in downtowns of York, Munich, Porto, etc.
- 132 hospitals in the UK (as of 2017)
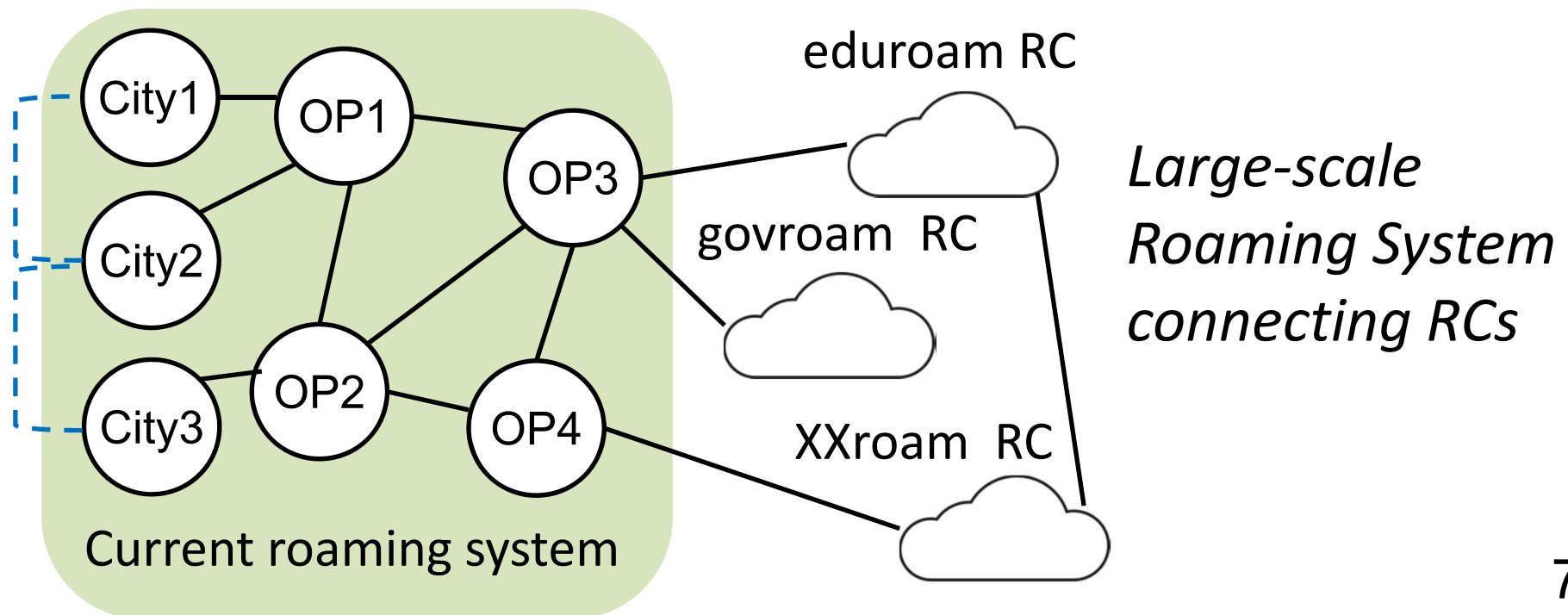

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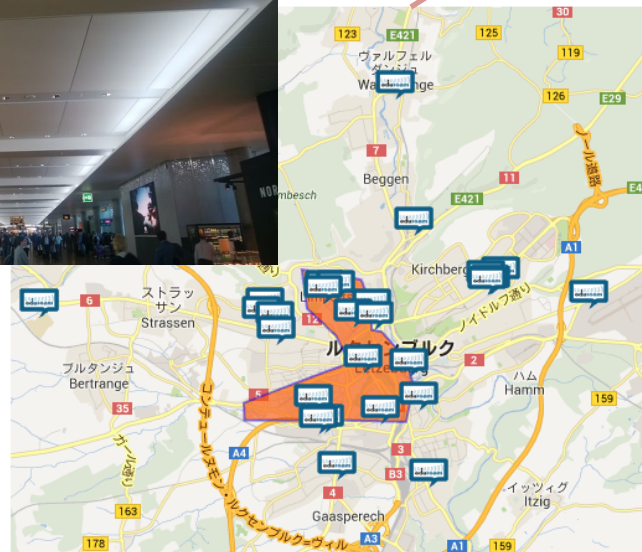
Why City/Free Wi-Fi & off-campus eduroam?

- Tourism
- Smart Cities
- Provide citizens with access means for various electronic services.
- Wi-Fi for all. (WiFi4EU by European Commission) (resolving digital divide)
- Community supports for Research & Education.

What do we need?

- ✓ Secure connection means with high usability
- ✓ Roaming
- ✓ User's identity verification and traceability
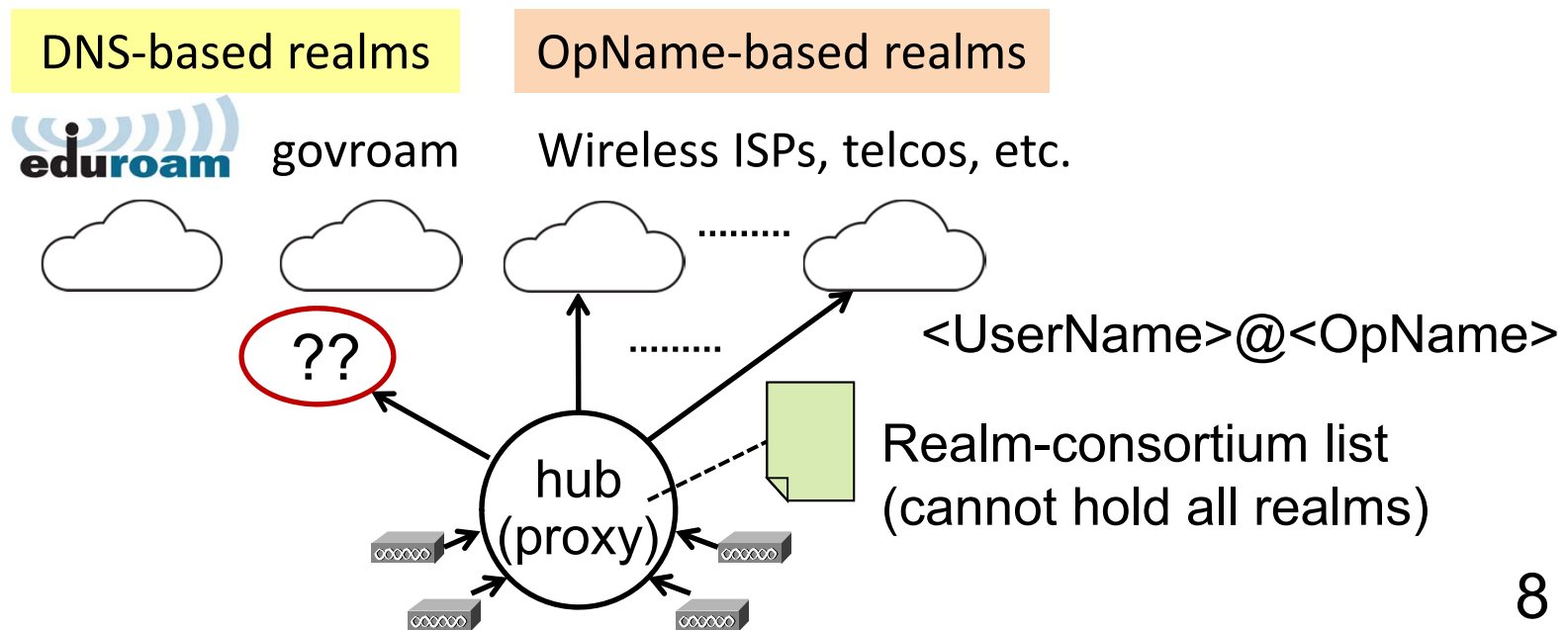 (for security, trust between operators, and compliance)

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Roaming System for City/Free Wi-Fi

- Conventional roaming systems are not scalable as they are often based on bilateral agreements.
- No large-scale roaming system for City/Free Wi-Fi yet.
- eduroam is the largest, but only for R&E use.

eduroam RC

govroam RC

XXroam RC

City1 OP1 OP3 OP2 City2 City3 OP4

Current roaming system

Large-scale Roaming System connecting RCs

Routing problem in DNS-based realms

- Service Providers (SPs) cannot find which *Roaming Consortium* to send the authn request by looking at the realm only.
  - eduroam/govroam use realms like:
    <UserName>@<InstName>.ac.jp
    <UserName>@<InstName>.jp
    <UserName>@<InstName>.org

DNS-based realms

OpName-based realms

eduroam   govroam   Wireless ISPs, telcos, etc.

....

??   ....

<UserName>@<OpName>

hub
(proxy)

Realm-consortium list
(cannot hold all realms)

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NGH Special Interest Group (NGHSIG)   Since Jan. 2017

- Push forward dot1X adoption and Hotspot 2.0 deployment to make Public Wi-Fi secure.

- Exchange and accumulate technical info. about RADIUS, roaming, and HS2.0.

- Provide NGH testbed for development and pilot service (now as Cityroam).

- Develop an inter-roaming architecture, "eduroam/govroam on NGH"

- Survey on legal aspects and compile rules.

https://nghsig.jp/en/

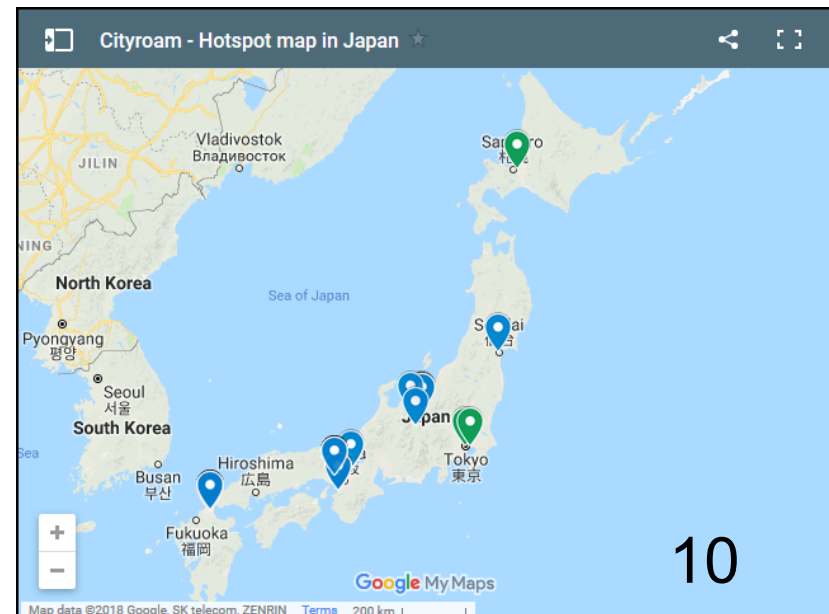# Cityroam, the secure roaming system for Public Wi-Fi

- Passpoint/NGH as well as dot1X
- Affordable roaming platform for various RCs and operators including small ones and cities.
  - IdP: eduroam, ANYROAM, NGHSIG Cloud IdP, etc. (planned: telcos/ISPs and cities via NGH hub)
  - SP: Free Wi-Fi operators supporting 1X/Passpoint
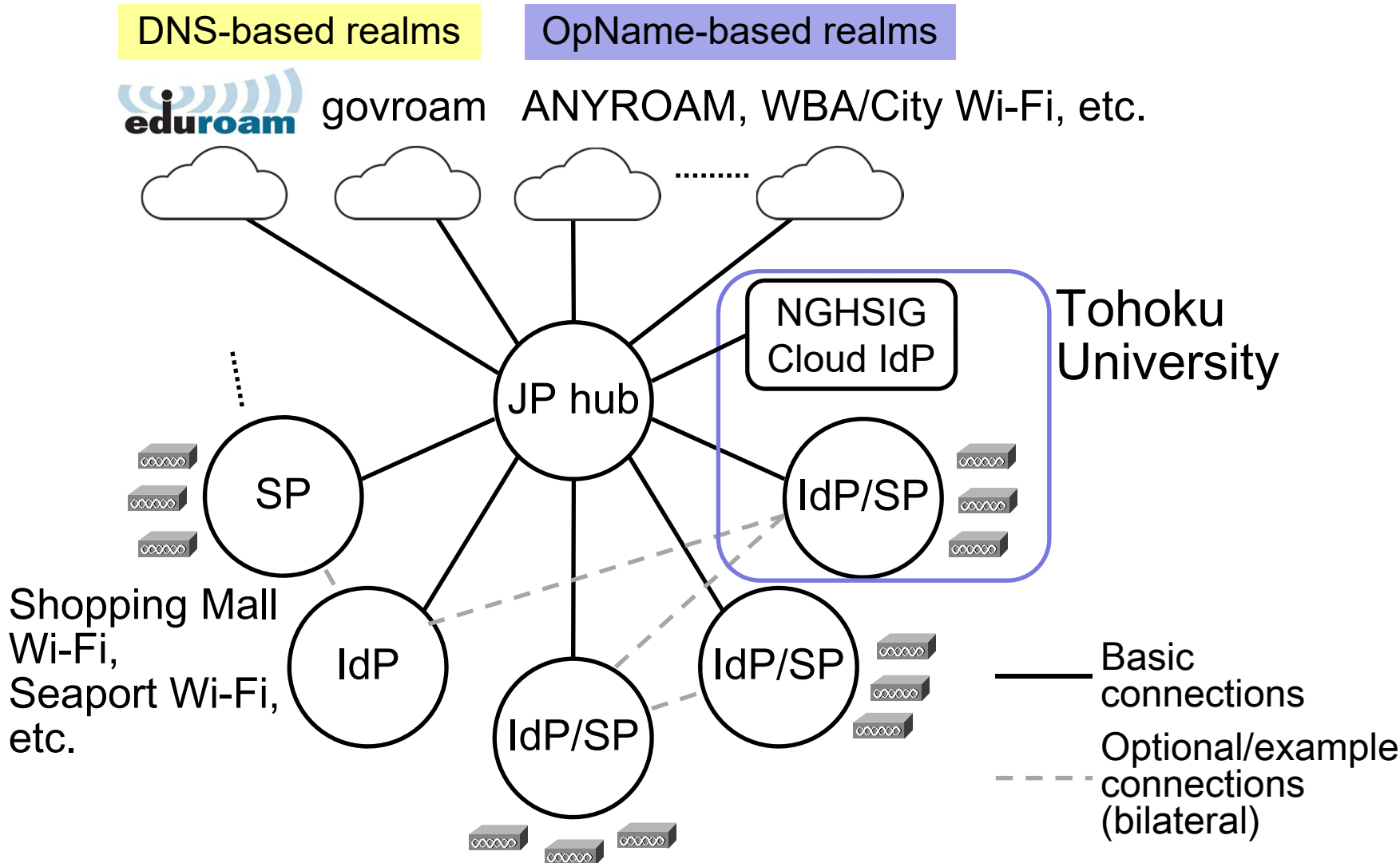- Strategies:

No roaming fee settlement.
(Each City/Free Wi-Fi has its own local ecosystem.)

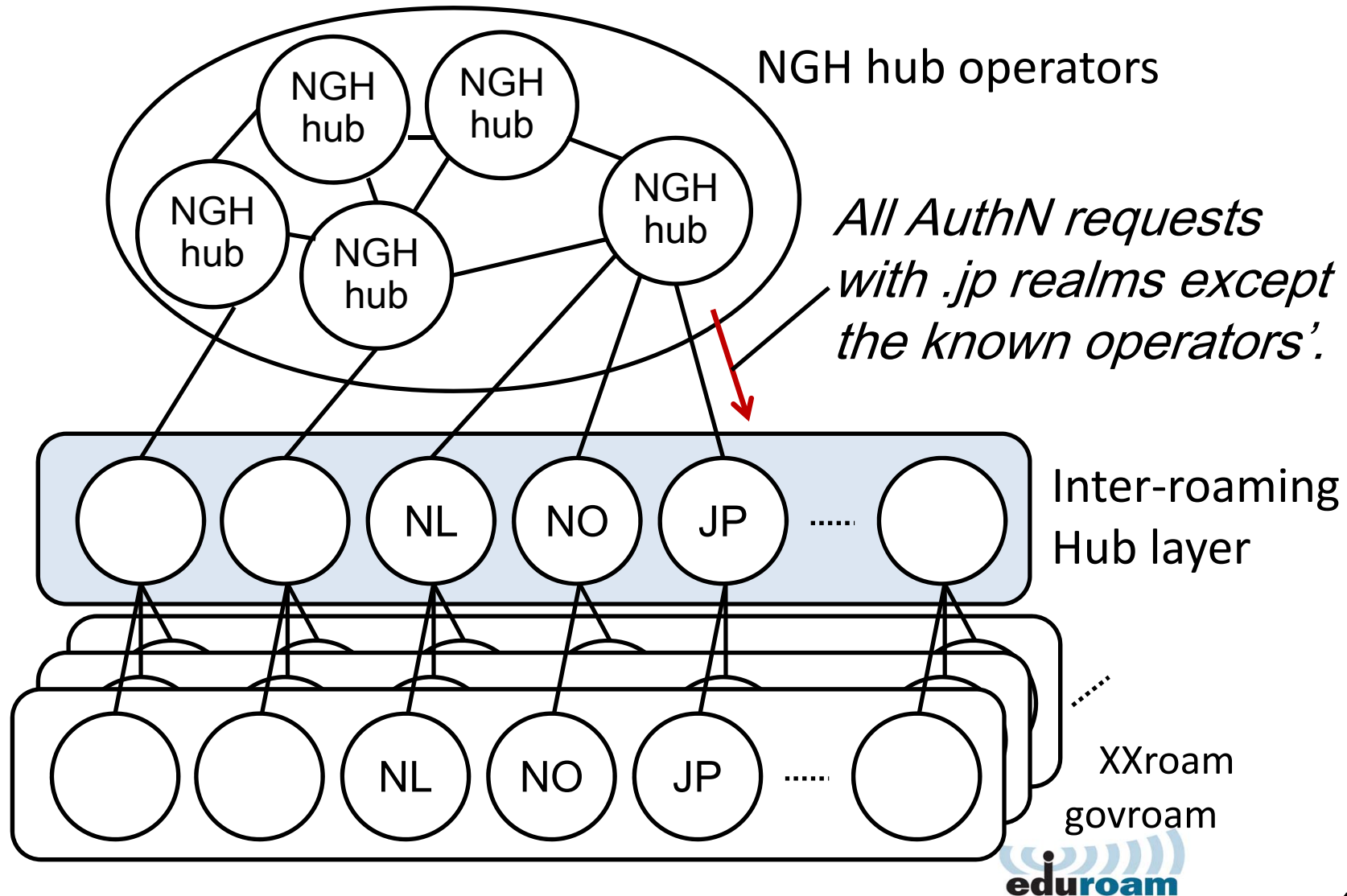*Utilize existing accounts as much as possible.*
(roaming with operators)

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NGH testbed system in Japan

DNS-based realms

OpName-based realms

eduroam   govroam   ANYROAM, WBA/City Wi-Fi, etc.

....

JP hub

NGHSIG Cloud IdP

Tohoku University

IdP/SP

SP

Shopping Mall Wi-Fi, Seaport Wi-Fi, etc.

IdP

IdP/SP

IdP/SP

Basic connections

Optional/example connections (bilateral)

Inter-roaming Hub layer for connecting Roaming Consortia

NGH hub operators

All AuthN requests with .jp realms except the known operators'.
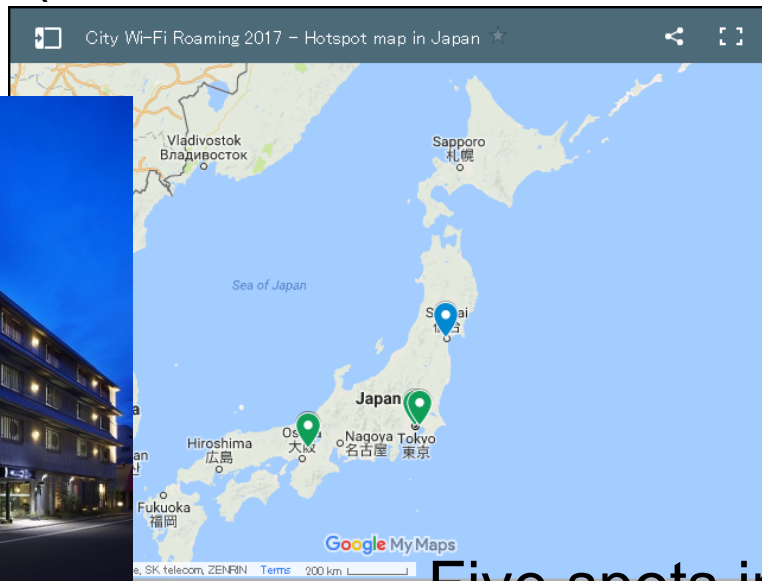
Inter-roaming Hub layer

XXroam
govroam

City Wi-Fi Roaming 2017

- **NGH trial program by WBA**
  - Period: World Wi-Fi Day (June 20) – Aug. 20
  - 40 carriers, some Wireless ISPs, and about 20 cities
  - Tohoku University became the first academic institution participating in the trial.
    (NGHSIG as the first NGH operator in Japan)
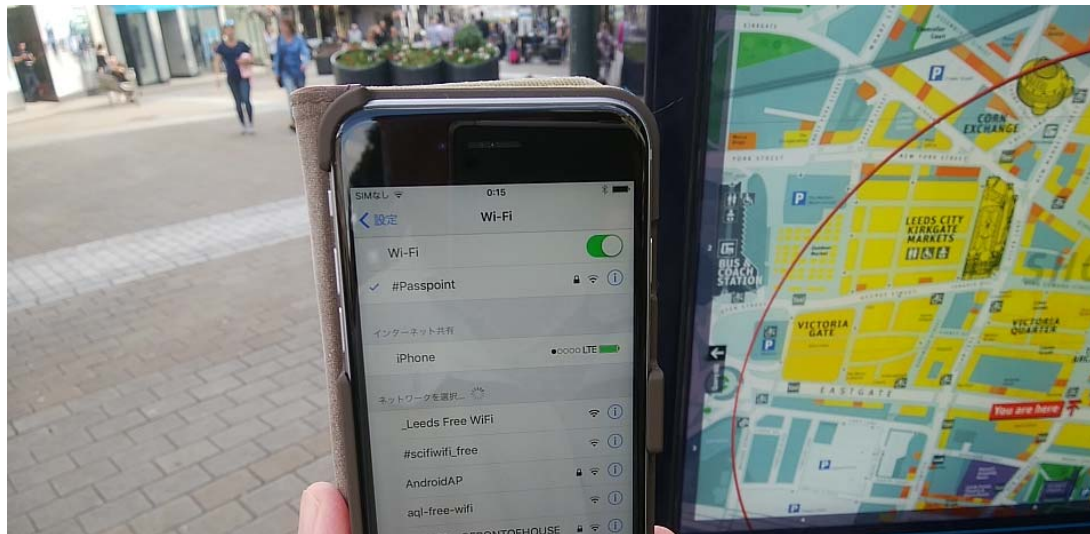

eduroam/NGH-ready hotel in Kyoto.

Five spots in the country.

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eduroam on NGH

- **Roaming tests during the City Wi-FI Roaming trial, enabling eduroam service on City Wi-Fi.**
  - Connected the eduroam JP proxy to the NGH infrastructure.
  - RADIUS test from ER Telecom in Russia.
  - Connection tests in Birmingham and Leeds in the UK.

It works!

☺ ☺ ☺

Successful connection using eduroam credentials on the Briggate Street, Leeds.

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Conclusions

- Established the NGH Special Interest Group.

- Developed an inter-roaming architecture for large-scale roaming and an NGH testbed,

- Started a pilot service "Cityroam", combined with eduroam.

~~Future~~ Current development work

- Passpoint Onboarding System for guests.

- World-wide roaming system for secured Public Wi-Fi.