

Sept. 13, 2023

Technical 4 – JANOG session, APNIC56, Kyoto

Next-generation secure public Wi-Fi supporting the digital society

– eduroam/OpenRoaming combined deployment in Cityroam –

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A part of this work was supported by the Beyond 5G R&D Promotion program at National Institute of Information and Communications Technology (NICT) in Japan.

Public Wi-Fi as an infrastructure

■ WiFi4EU's case

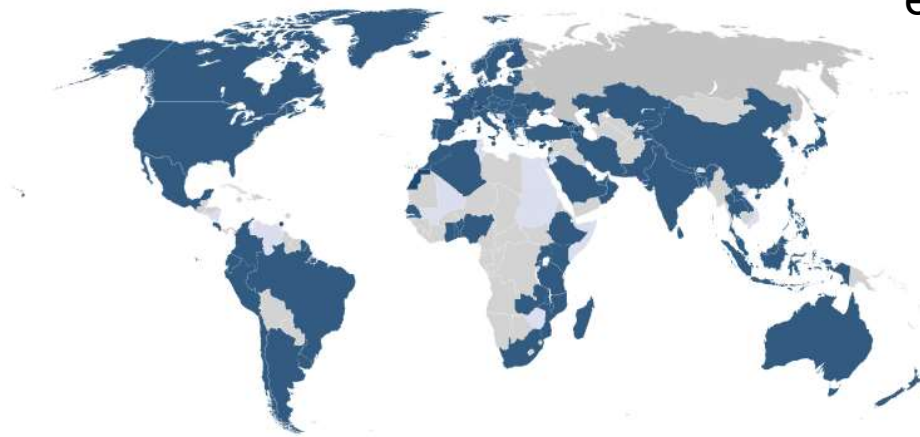
- Project for EU-wide Free Wi-Fi deployment
- Public Wi-Fi is a society infrastructure like water and electricity.
- Provide network access means to everyone including those who cannot have a DSL at home.
- Access to digital government services is crucial.

"Everyone benefiting from connectivity means that it should not matter where you live or how much you earn. So we propose today to equip every European village and every city with free wireless internet access around the main centres of public life by 2020.

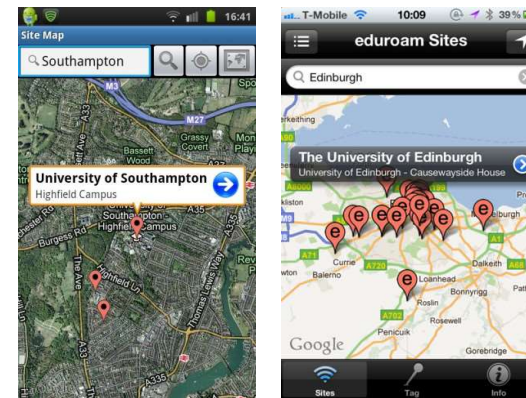
Jean-Claude Juncker - State of the Union speech, September 2016"

eduroam (RFC 7593)

- Secure Wi-Fi Roaming system for Research & Education institutions.
 - Started as a pilot at TERENA (now GÉANT).
 - 104 countries/territories worldwide (as of 2023)
 - De facto standard of campus Wi-Fi in the world.
 - Mutual benefit system.
 - High security and usability based on 802.1X.



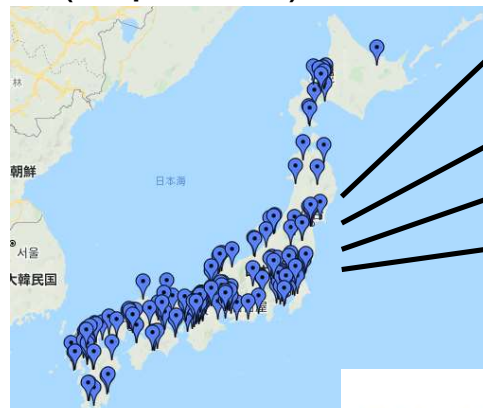
eduroam Companion (Android, iOS)



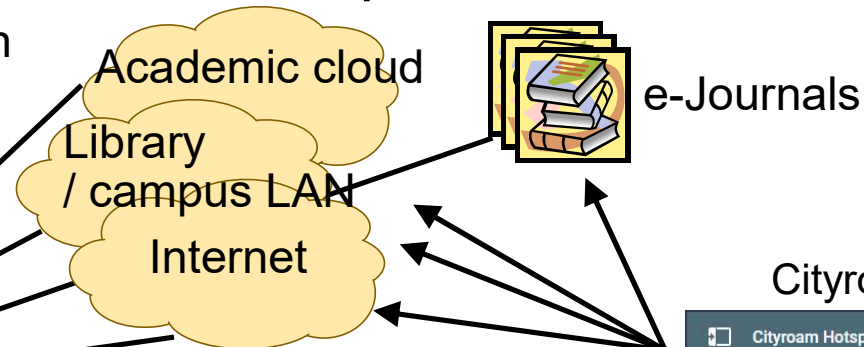
Collaboration with Public WLAN services

■ Virtual expansion of campus networks.

401 institutions in Japan
(Sep. 2023)



104 countries worldwide



Federation

NW accesses using
universities accounts

e-Journals

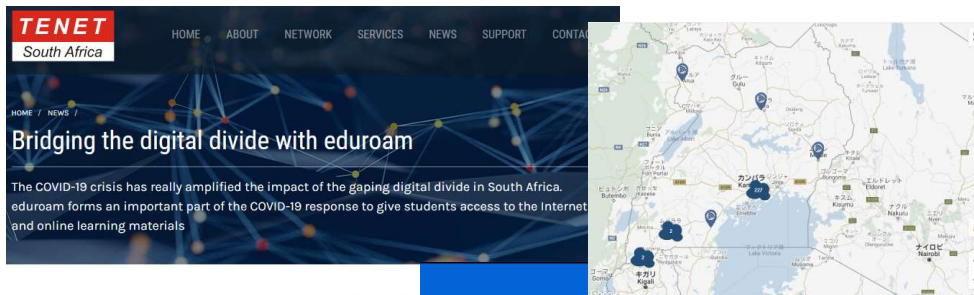
Cityroam since 2018



130+ in-door APs at cafes, conference sites, large
shops in and around Tokyo (2011-2020)

Off-campus eduroam as digital infrastructure

South Africa:
eduroam at most universities, addressing digital divides and COVID-19 (July 2020)



Today a University of Cape Town student living in Khayelitsha can access eduroam, the high-speed Internet offered by nearly all South African universities and an additional 105 countries around the world, at their local library. A University of Witwatersrand (Wits) student living in Sebokeng needs only to travel 30 minutes to North-West University's Vaal Triangle Campus to download their course content and videos quickly and for free on the eduroam network, while a University of South Africa (UNISA) student anywhere can check the [eduroam interactive map](#) to see where their closest internet access point is.



RENU in Uganda:
Town-wide eduroam
to help students
learning under COVID-19 (Oct. 2020)



“Extended virtual campuses”
in Ireland (Jan. 2021)
<http://www.universitytimes.ie/2021/01/heanet-to-extend-wifi-initiative-for-students-to-90-new-locations/>

Off-campus eduroam as digital infrastructure



HEAnet
@HEAnet

Did you know that there are more than 160 eduroam Wi-Fi hotspots across Ireland? Click here to view a map of all live eduroam locations: heanet.ie/services/conne...
#eduroam #eduroameverywhere

ツイートを翻訳



LIR HEAnet
@LIRHEAnet

"On the buses" from today a very visual message about @eduroam on Dublin Bus. Looks great! @HEAnet

ツイートを翻訳



HEAnet, Ireland: 160 locations + "eduroam on Dublin Buses" (Mar. 2021)

Off-campus eduroam as digital infrastructure

Jisc News > Call for local authorities to support students with free wifi in public ...

News

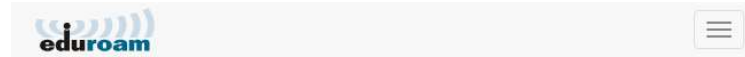
Call for local authorities to support students with free wifi in public spaces

19 May 2021

Building on efforts to tackle digital poverty, Jisc has written to the Local Government Association, urging authorities to provide free internet access to students in public spaces via our eduroam connectivity service.



Jisc, UK (May, 2021)



eduroam in Libraries, transport hubs, hospitals, and beyond.

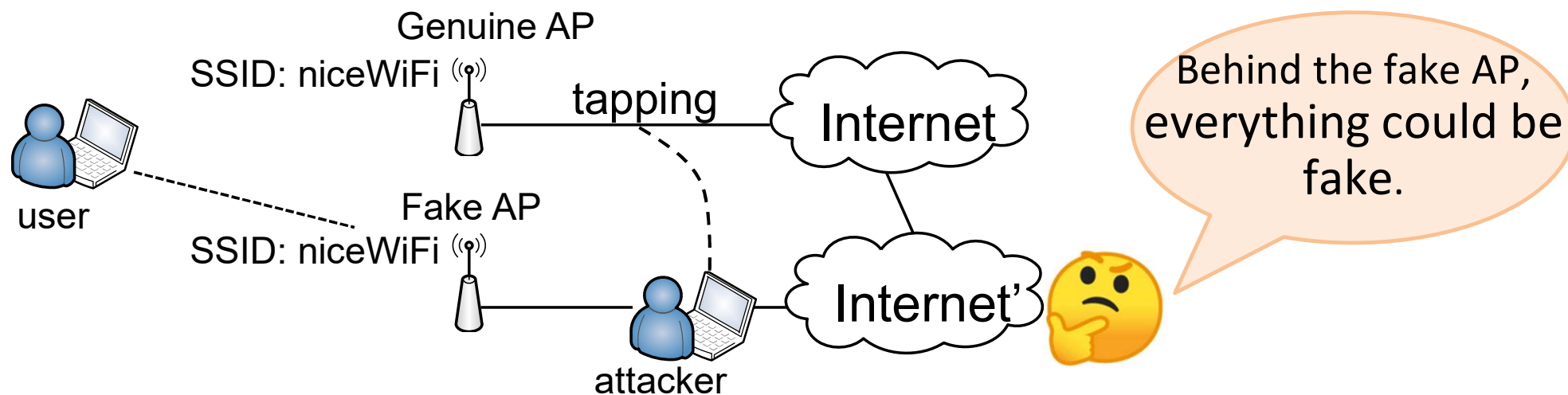
The original eduroam use case was for a researcher at one institution to easily be able to collaborate with researchers at another institution without having to jump through bureaucratic hoops to get Internet access. This is relevant in South Africa too, because we have a great deal of inter-institution collaboration, but a more important use-case, when you bring eduroam to Africa, is the potential it has to play in bridging the digital divide.



TENET, South Africa (July, 2021)

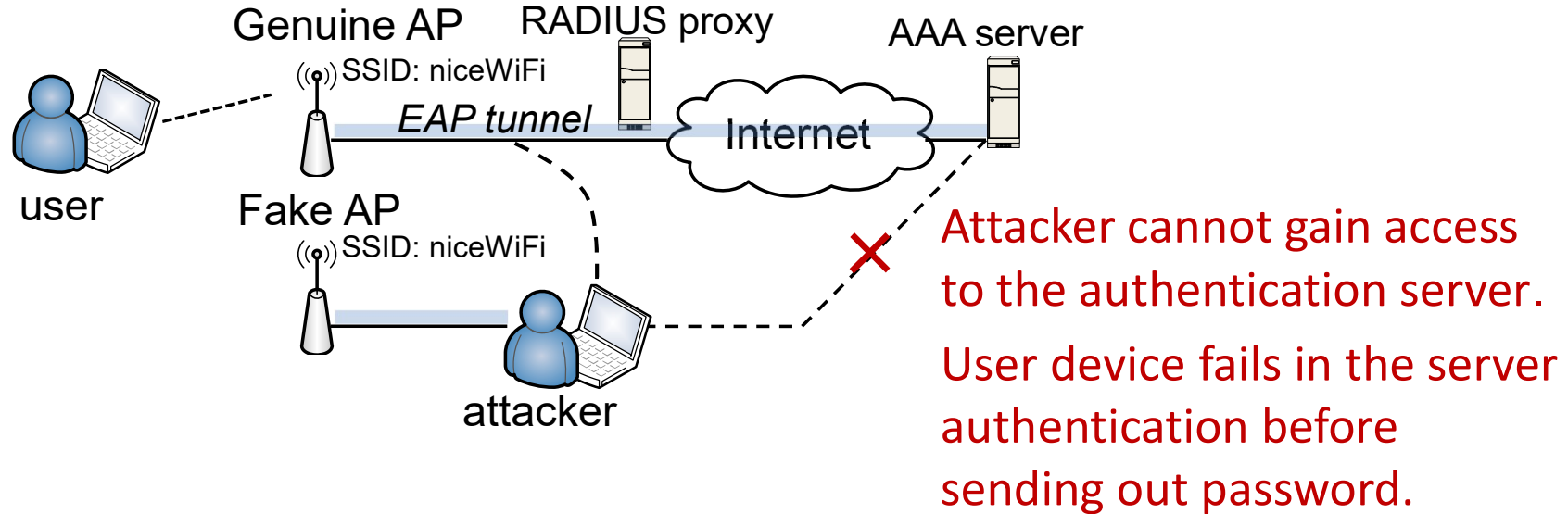
Are you connected to the right network?

- If *Open Wi-Fi* is used, there's no security or privacy. Anyone can plant an Evil Twin AP.
- If many people are using *WPA Personal*, sharing a *Pre-Shared Key* (PSK), the network is also unsecure.
- If you have joined a fake network, many attacks become possible. E.g., MITM, eavesdropping, malware insertion, and active attacks.



Secure Public Wi-Fi Using WPA2/WPA3 Enterprise

- Users should check whether the AP is a genuine one provided by an authorized operator.
Server authentication in 802.1X makes it possible.
- Password protection as well as privacy protection is needed.
EAP (Extensible Authentication Protocol) can provide protection.



Other aspects of security

- Security for Wi-Fi operators:
 - Make clear the responsible bodies.
 - Keep user traceability in case of network abuse or crime.
User Verification at the service sign-up is important.
- Security for the society:
 - Suppress crimes such as fraud.
 - Suppress organized crimes and terrorisms.
 - Disaster prevention and mitigation utilizing user activity analysis.
 - Smart City design through data analysis.
 - Securing people's communication means under disasters.

WBA OpenRoaming



- **eduroam-like, seamless connection experience for everyone**, not limited to R&E community.
- Inter-connect telcos, ISPs, City Wi-Fi, **eduroam**, etc.
- Based on Passpoint and Wireless Roaming Intermediary eXchange (WRIX) framework.
- PKI and RadSec + Dynamic Peer Discovery
 - Similar to the eduroam architecture, but in larger scale.
- Two policies using different RCOIs
 - Settled: Accounting and intermediary are required.
 - Settlement-free: No roaming fee. Easier onboarding. 👍

OpenRoaming deployment status



Nationwide Cityroam deployment in Japan

- **Cityroam is a roaming federation** providing secure roaming system for Public Wi-Fi since 2018.
- All venues provide both **eduroam and OpenRoaming** (2020-).
- Multi-operator, multi-vendor
- **Unique venues** across the nation.
(90+ spots)



cityroam (as of Sep. 2023)

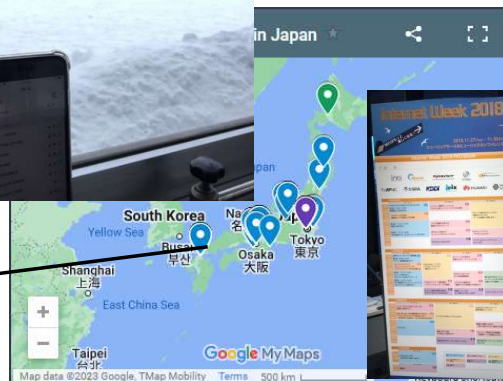
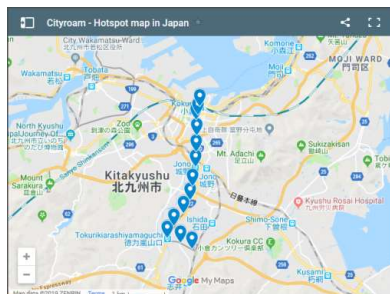


Cityroam venues

- Cafes, hotels, shopping malls, etc.
- Sapporo Gakuin University (for better services for residents)
- Ski resorts (Hakuba47)
- Kita-Kyushu Monorail stations
- Conference venues (temporary deployment)
Internet Week 2018 & 2019, AXIES 2018, 2021, 2022,
Comic Market 95th-97th, 99th-102nd, etc.

New direction:
Univ.&Schools
should provide
Public Wi-Fi, too.

Cityroam supports quick
deployment of eduroam
+ Public Wi-Fi.



Mobile eduroam
/OpenRoaming AP
(over 4G & VPN)

Cityroam venues



Co-working space in Morioka
(OpenRoaming was added
in 2020)



Conference Center in Nagano
(May 2021)



Hot Spring facility in Nagano
(May 2021)

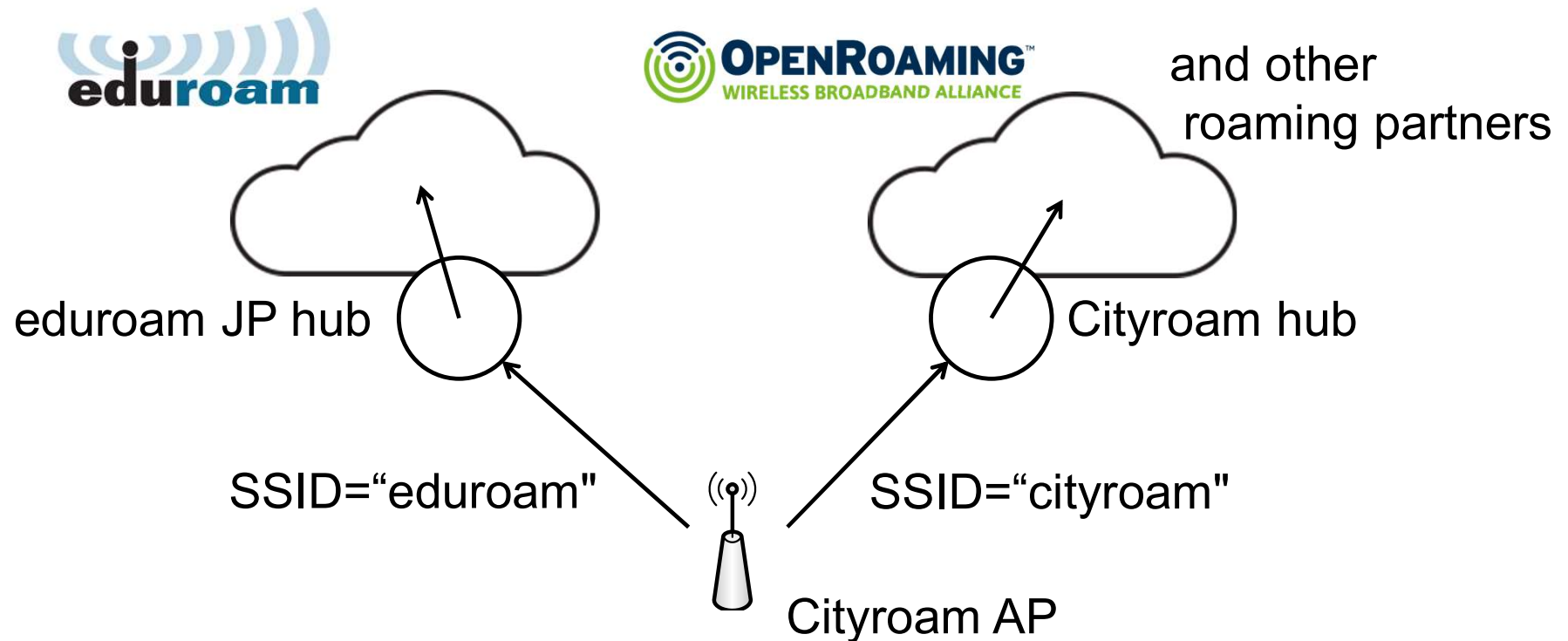


Resort Hotel & Complex in Ise
(Feb. 2022)



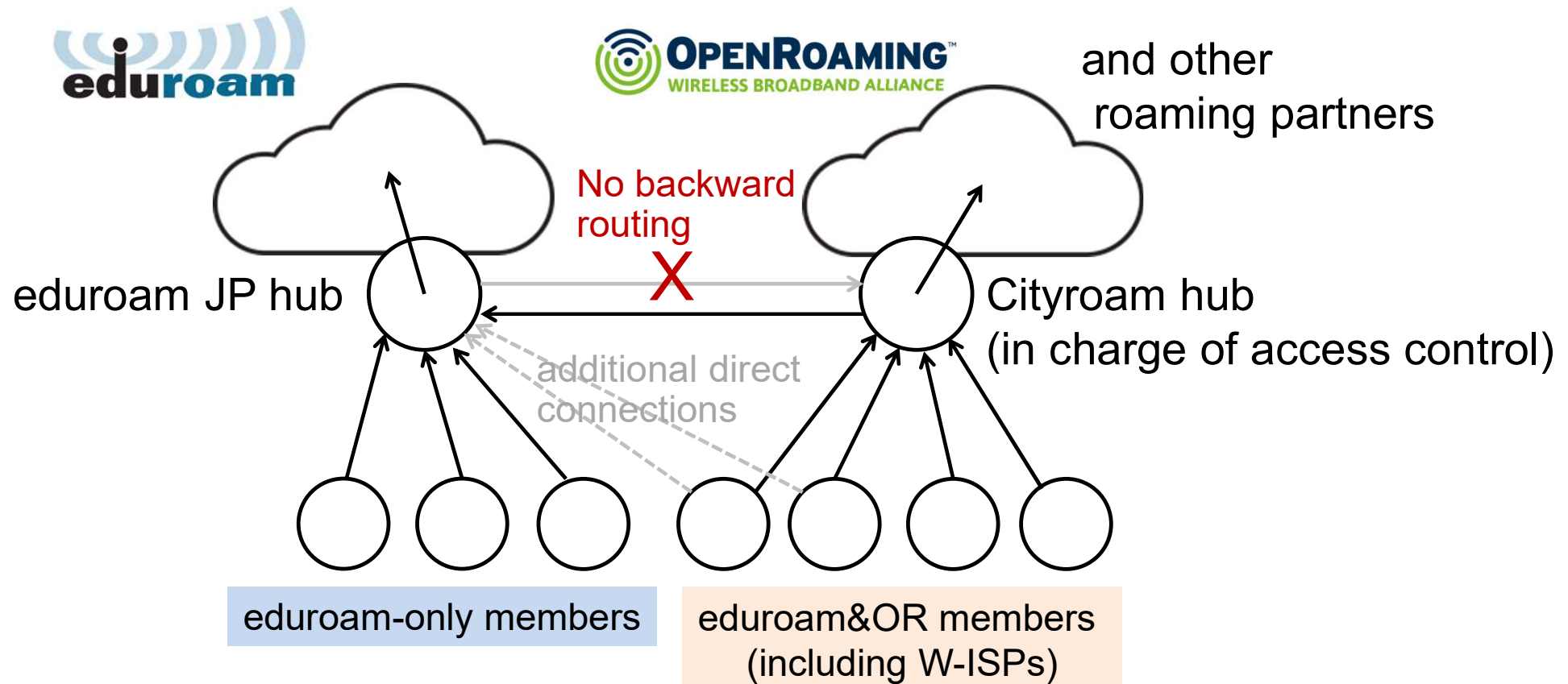
Vending machines in
Kyoto City Parks
(May 2020)

eduroam traffic separation – basic (but complex) implementation



- Require multiple RADIUS connections
- Complex AP configuration

Access request routing in eduroam/OpenRoaming combined architecture



Forward to eduroam if (" $\%{\text{Called-Station-Id}}$ " = ~ /:eduroam/)

Renewed “TOKYO FREE Wi-Fi” supports OpenRoaming

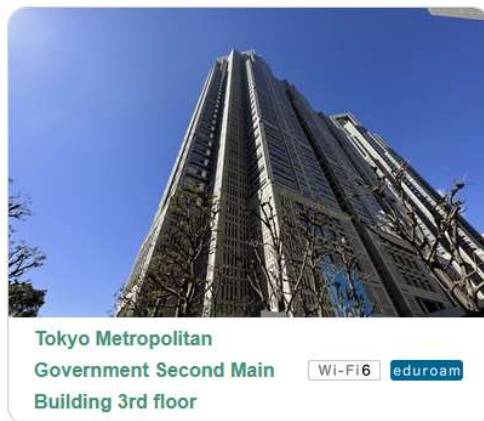
- Released on Mar. 31, 2023
- Tokyo Metropolitan Government + KDDI / Wire & Wireless (Wi2)
- Enhanced security, safety, and usability. 😊



<https://wi-fi.metro.tokyo.lg.jp/en/>

OpenRoaming hotspots provided by the Tokyo Met. Govt.

- 4 new sites in Apr. 2023
- 600+ sites planned in 2023



Smart Poles and Digital Signages
in Nishi-Shinjuku Area (2021-2022)



Access analysis in the eduroam/OpenRoaming combined deployment

- **eduroam accesses account for 55%** (as of 2023)
- SIM-based authentication is the second popular.
 - The authentication is quite stable, with few errors.
- Samsung's built-in OSU produces high access counts.
- Google Pixel's built-in OSU is easy to use.
- Cisco OpenRoaming app is popular, but the percentage is not so high.
- TOKYO FREE Wi-Fi profiles are becoming popular.

Embedded profiles win!

It is quite important to lower onboarding hurdles.

Summary

- Public Wi-Fi is a necessary infrastructure in the digital era.
- Security and usability are quite important.
OpenRoaming can fulfill the demands.
- Cityroam in Japan developed eduroam/OpenRoaming combined architecture. Nation-wide deployment is ongoing.
- Tokyo has adopted OpenRoaming, and some more municipalities are about to follow.
Many municipalities take eduroam as a valuable application.
- High access number from the beginning thanks to the eduroam users (although eduroam is not actually OpenRoaming).
- Existing profiles (eduroam, SIM) and built-in OSU work quite well.