FreeSurf: Application-centric Wireless Access*

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* Sigcomm 2015 Poster, and IEEE HPSR 2016

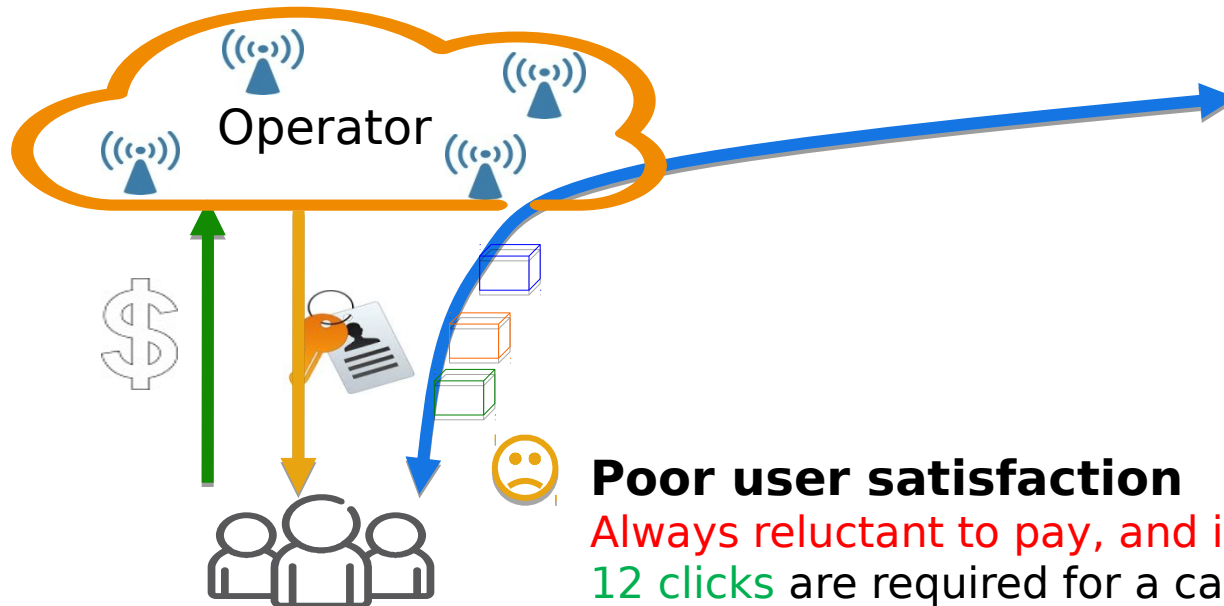# Costly WiFi and Free Apps

Public Wi-Fi with a Traditional setup

Network highly underutilized
Only ONE connection per user per month*
10% active customers

No way to provide ubiquitous connectivity for customers

Operator

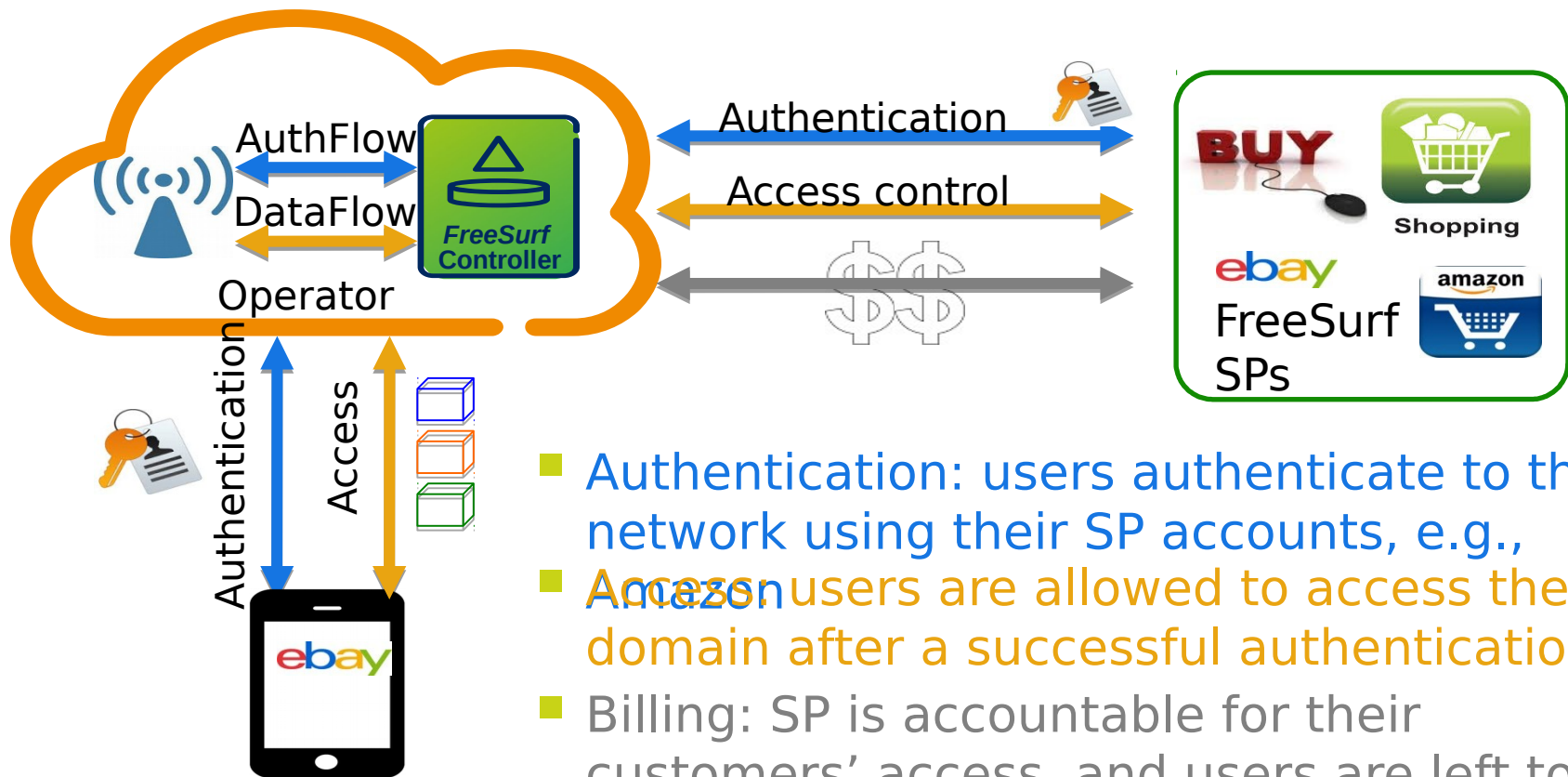Service Providers

Poor user satisfaction
Always reluctant to pay, and impatient
12 clicks are required for a captive portal authentication
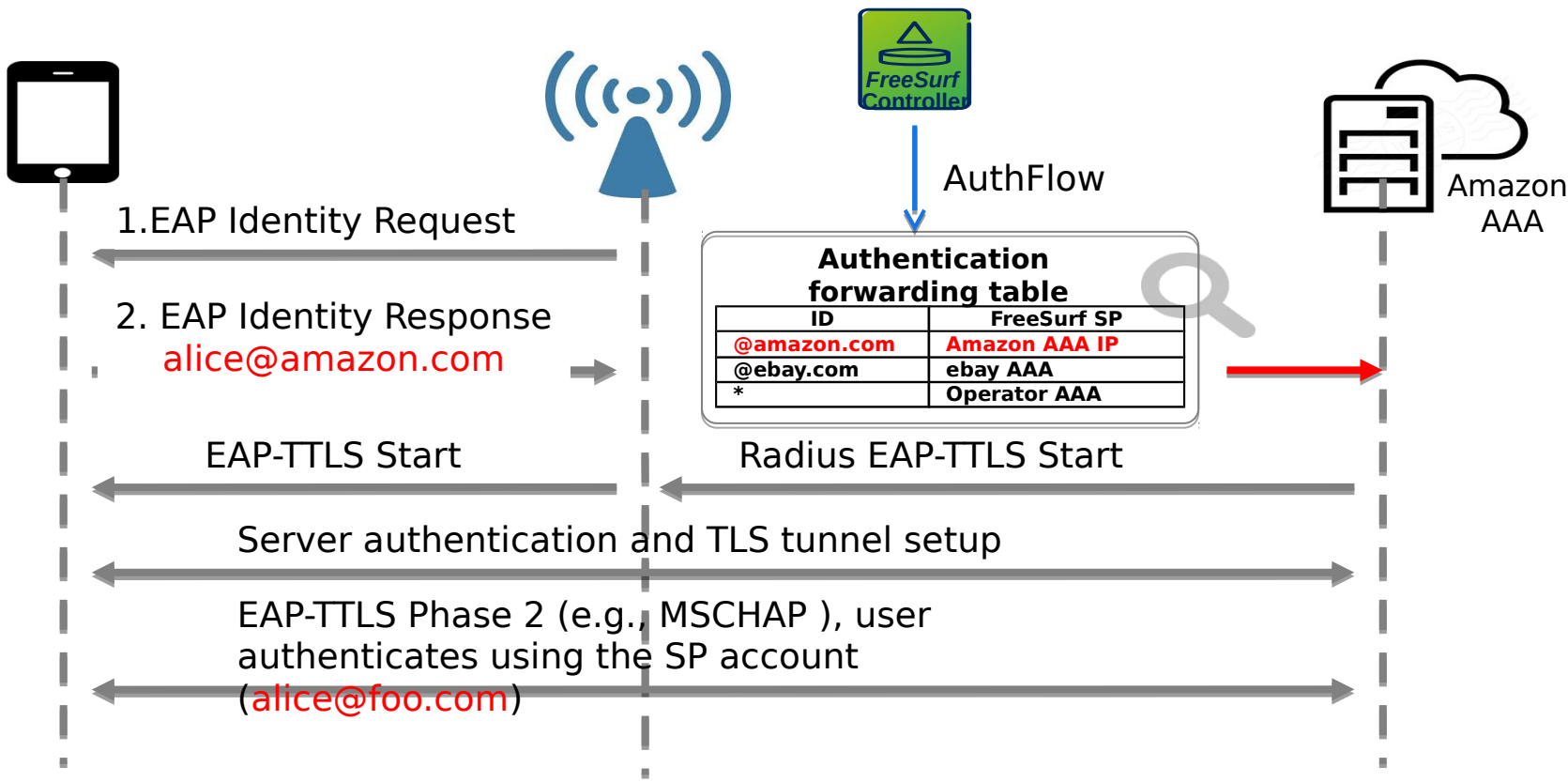25% of users abandon access after 4 seconds #
50% of users abandon access after 10 seconds
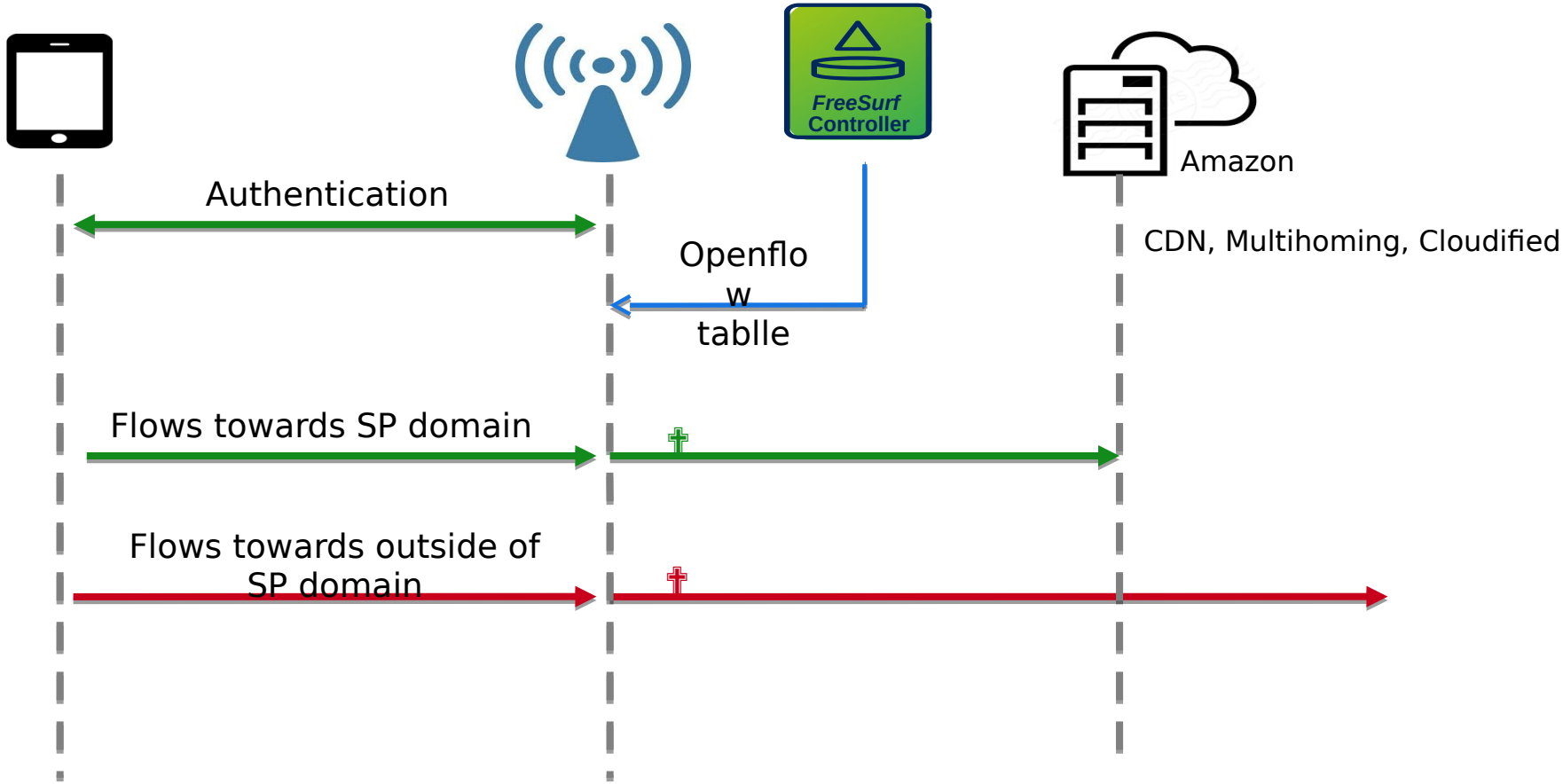
Application-centric Wireless Access

- Authentication: users authenticate to the network using their SP accounts, e.g., Amazon
- Access: users are allowed to access the SP domain after a successful authentication
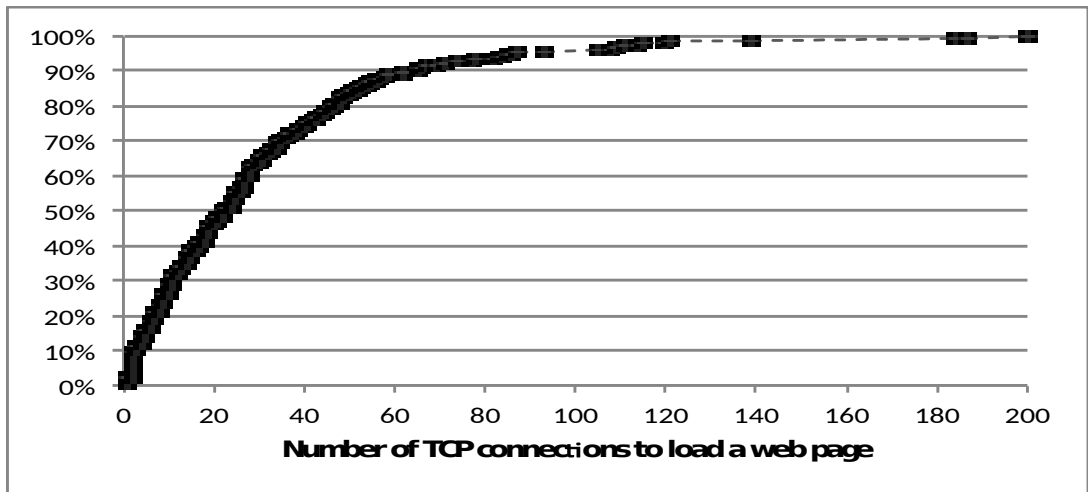- Billing: SP is accountable for their customers' access, and users are left to **FreeSurf**

FreeSurf Authentication

AuthFlow

Amazon AAA

1.EAP Identity Request

2. EAP Identity Response
alice@amazon.com

Authentication forwarding table

ID	FreeSurf SP
@amazon.com	Amazon AAA IP
@ebay.com	ebay AAA
*	Operator AAA

EAP-TTLS Start

Radius EAP-TTLS Start

Server authentication and TLS tunnel setup

EAP-TTLS Phase 2 (e.g., MSCHAP), user authenticates using the SP account
(alice@foo.com)

FreeSurf Access Control

Authentication

Openflow tablle

Amazon

CDN, Multihoming, Cloudified

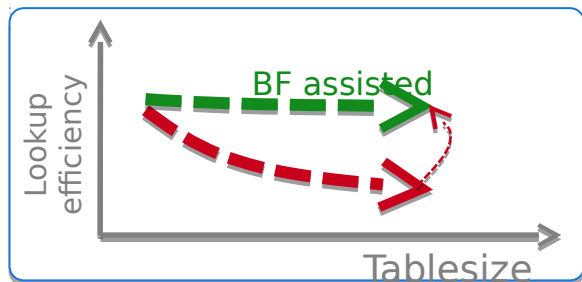Flows towards SP domain
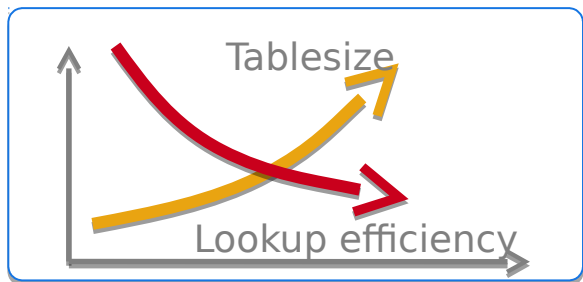
Flows towards outside of SP domain

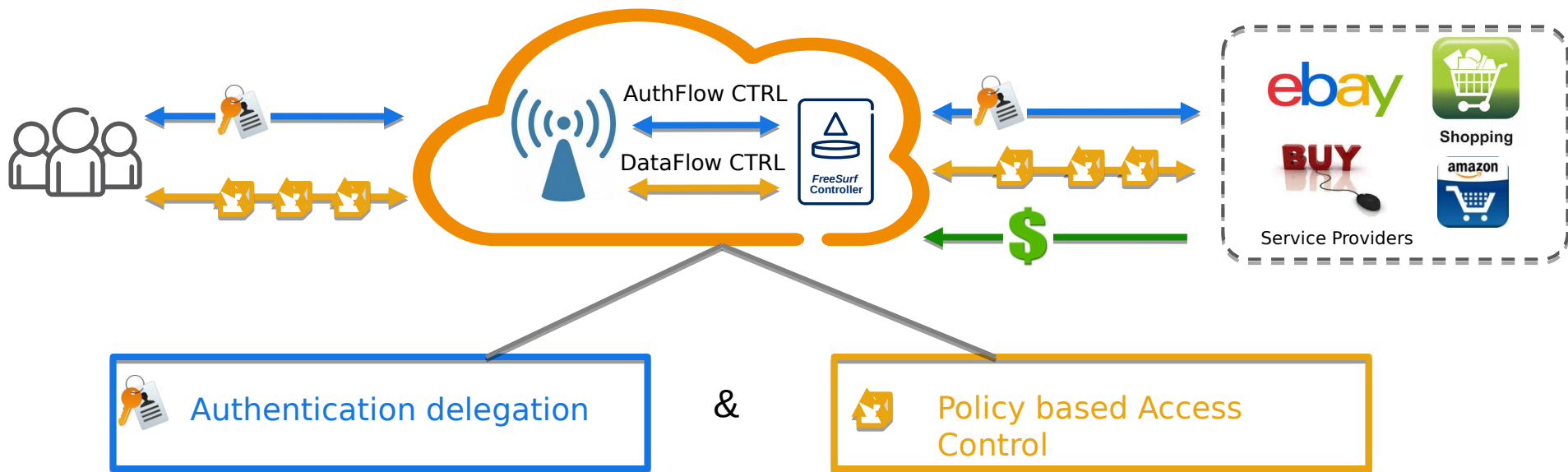# Understanding SP's Networks

CDF of the number of TCP connections per web page; ~30% of them need more than 40 TCP connections

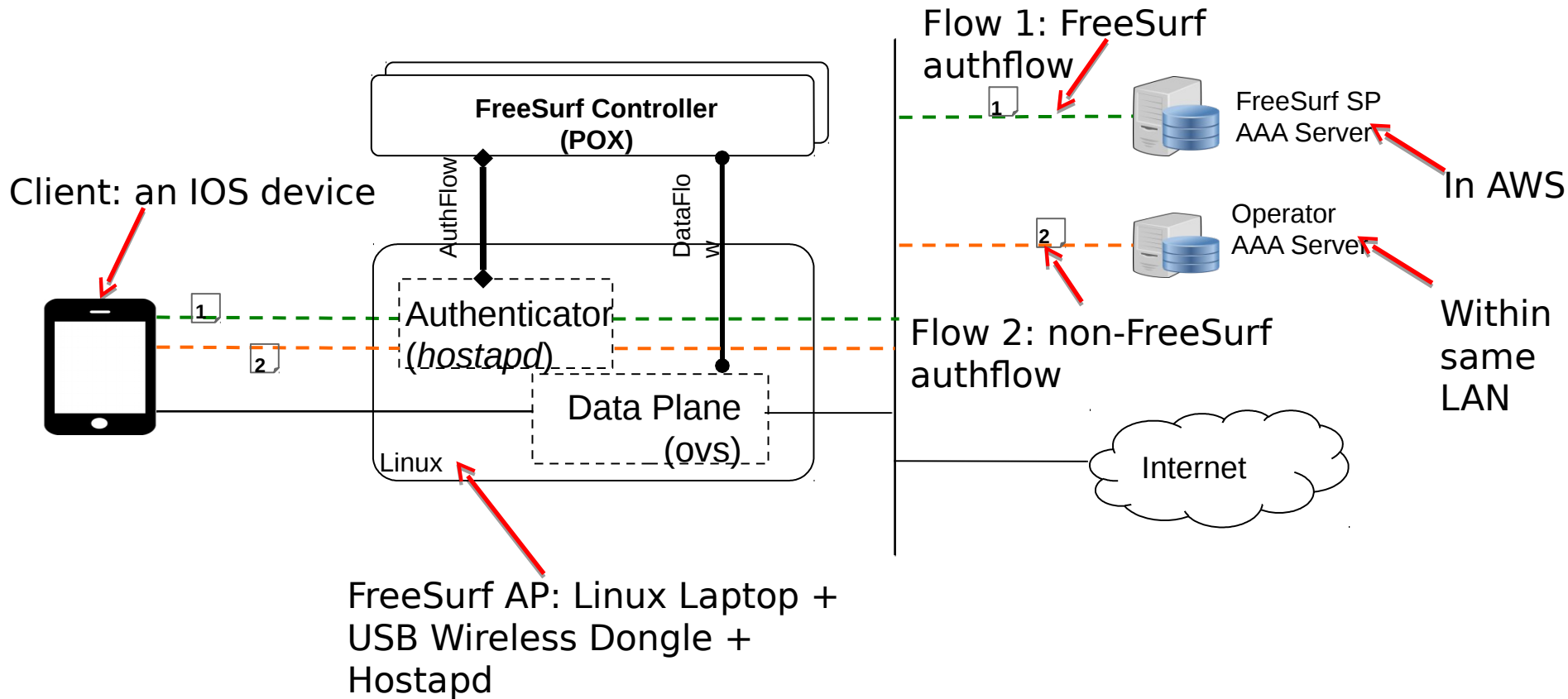Consequences with the increase of number of SPs and users

FreeSurf Architecture (recap)

AuthFlow CTRL

DataFlow CTRL

FreeSurf Controller

Service Providers

Authentication delegation

&

Policy based Access Control

- Support both direct mode and broke mode

FreeSurf Prototype

Client: an IOS device

FreeSurf Controller (POX)

AuthFlow

DataFlow

Authenticator (*hostapd*)

Data Plane (ovs)

Linux

Flow 1: FreeSurf authflow

FreeSurf SP AAA Server

In AWS

Operator AAA Server

Within same LAN

Flow 2: non-FreeSurf authflow
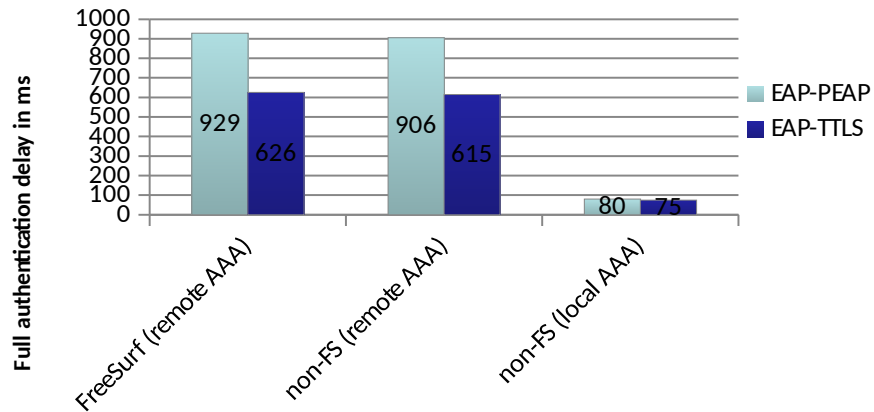
Internet

FreeSurf AP: Linux Laptop + USB Wireless Dongle + Hostapd
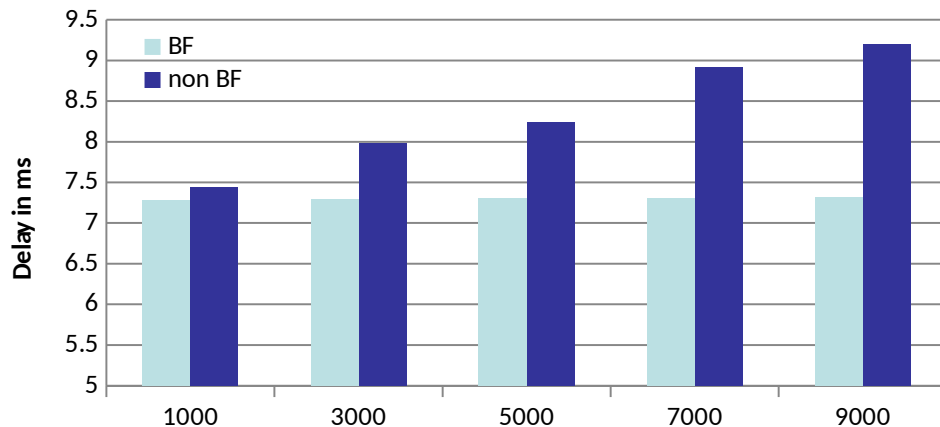
FreeSurf Evaluation

- **Minimal increase in authentication delay with FreeSurf**
  - 1.7% additional delay with EAP-TTLS
  - 2.4% additional delay with EAP-PEAP

- **BF promotes lookup efficiency**
  - The larger the flow table is , the more BF helps
  - Lookup with the BF is constant irrespective of flow table size

Related Work

	Target users	Authentication	Approach	Third-party Friendly?
FON	Fon members	Web portal with user intervention	Member participation	NO
Facebook WiFi	Facebook users	Web portal with user intervention	Facebook initiated participatory program	NO
Facebook Zero	Cellular users	Need operator SIM	Special URL and offline negotiation	NO
OpenWiFi	Guest WiFi	Portal based with user intervention	SDN	YES
Eduroam	Academic	EAP compatible /Radius Routing	Agreement pre-setup	NO
FreeSurf	Public WiFi and SP customers	EAP compatible and automatic	SDN	YES

Takeaway

- FreeSurf supports SP sponsored data access :
  - Authentication delegation via AuthFlow
  - Policy based access control

- More challenges ahead:
  - Authentication resumption in case of mobility and roaming
  - Access control policy update

THANK YOU

For more information, checkout our paper and codes here **https://github.com/freesurf**