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IPv6 Community Wifi

Unique IPv6 Prefix per Host

IPv6 Enhanced Subscriber Access for WLAN Access

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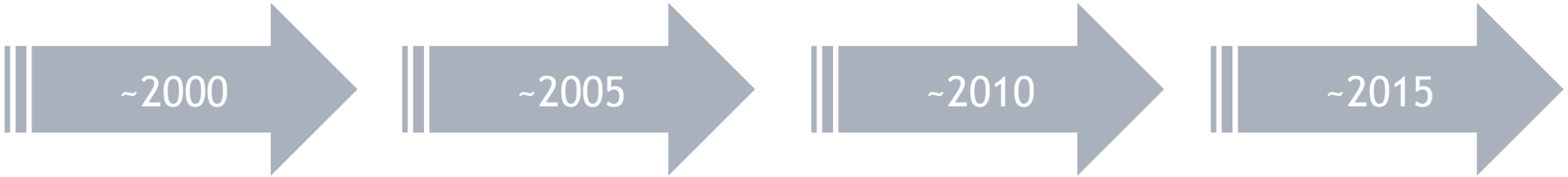
- 19-04-2016

IPv6 timeline

4 waves… as noticed by ALU IP Division



IPv6 INIT
- IPv6 native routing

IPv6 infrastructure
- Interconnecting IPv6 clouds (6PE/ 6VPE)

IPv6 for services
- Residential (BNG)
- Business VPN

IPv6 for Mobile access (3GPP)
- **IPv6 for Carrier Wi-Fi**

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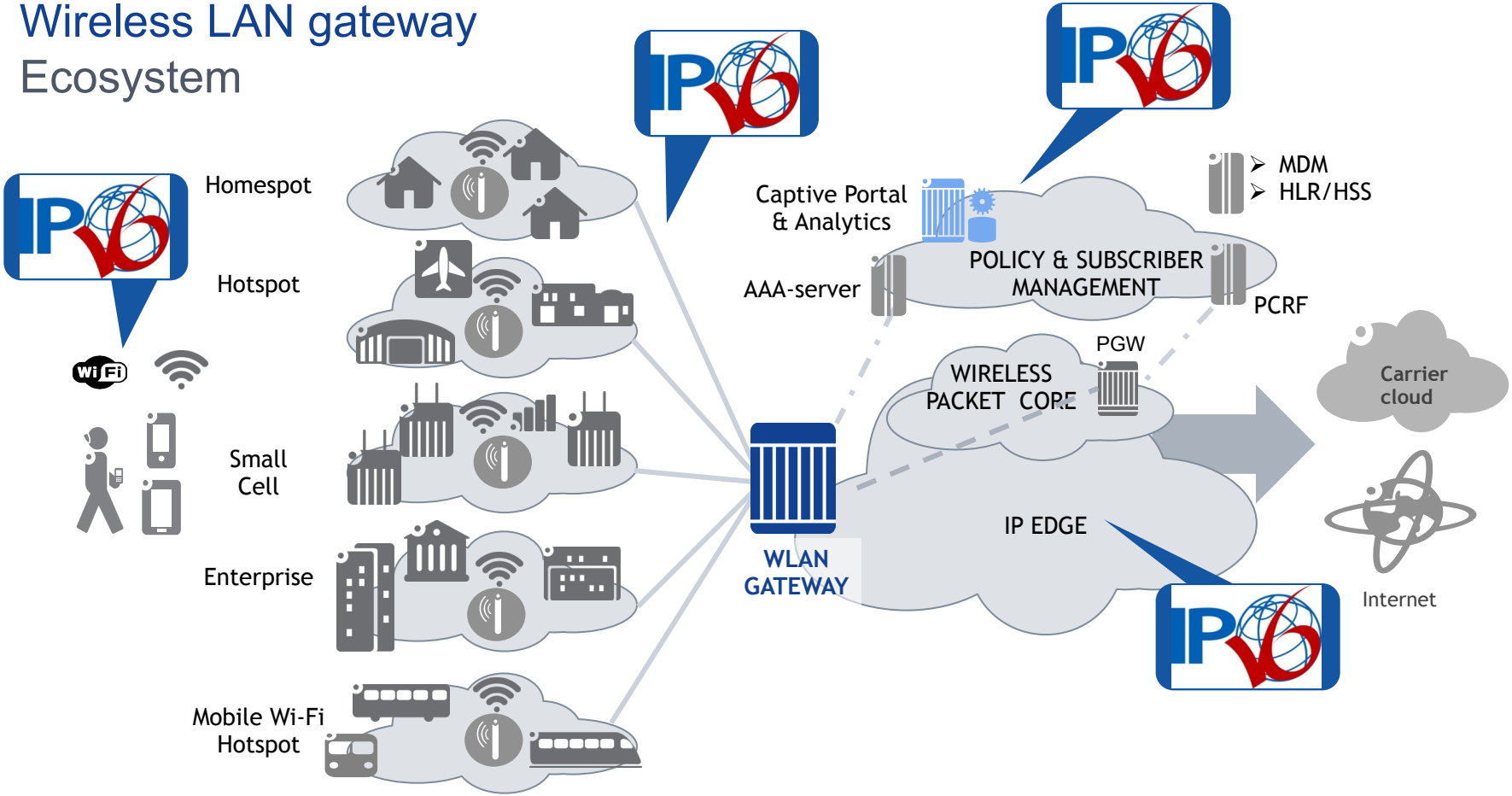
Carrier wi-fi
Who? What? How?

- Who?

- What?
  - Community Wi-Fi (residential Wi-Fi, like Fon/Wifree/…)
  - Hotspot aggregation (venues, stadiums, airports, …)
  - Mobile off-load (connect to mobile network over Wi-Fi)
- How?
  - Offering seamless (and secured) connectivity over Wi-Fi
  - Tunneling traffic from access points towards centralized gateway *(next slide)*

Wireless LAN gateway
Ecosystem



WLAN Gateway
Push towards IPv6

What are the IPv6 enablers for carrier Wi-Fi?

1. Dynamic behavior of sessions, consuming more IP-addresses
   - Each session, being redirect, active or passive will consume IP address
   - NAT44 only option for IPv4, with clear disadvantages (next slide)
2. Huge variety of IPv6 enabled, host-OS's (IOS, Android, windows…)
   - Note that for Wi-Fi (in opposite to mobile) not only SIM-based devices are present. Regular PC's/laptops/gaming consoles may connect as well.

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Wlan gateway
IPv4 addressing challenges

1. IPv4 inefficient address usage
   - Open SSID: no detection mechanism when UE disappears
   - Closed SSID (PMK caching): UE will return in Wi-Fi range and will request/re-use the previous IPv4 address
2. IPv4 NAT44 characteristics
   - Only few hundred ports per UE required
   - Data retention and lawful intercept (NAT logging)
   - Focus on fragmentation/reassembly over tunnels

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Wlan gateway
IPv6 only?

IPv6 only the best way forward for Wi-Fi?

- Long term… yes
- Today… technically yes

<u>But today…</u>

- Still NAT required: NAT64 (DNS64)
- Most Wi-Fi devices are dual stack (initial start with IPv4), and still some Wi-Fi devices are IPv4-only
- In contrast to mobile/cellular, where a UE (Smartphone) is a controlled device, this is not the case for Wi-Fi. IPv4 will remain for a while…

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WLAN gateway
dual stack approach

Why dual stack?

- Most of the Wi-Fi devices support dual stack
- Even some “legacy” IPv4-only devices
- Hitless introduction

Three dual-stack IPv4/v6 models are envisaged:

- DHCPv4 + SLAAC/64
- DHCPv4 + SLAAC/64 with DHCPv4 linking
- DHCPv4 + DHCPv6/128 IA_NA

… most of the devices start with SLAAC and may enable DHCPv6

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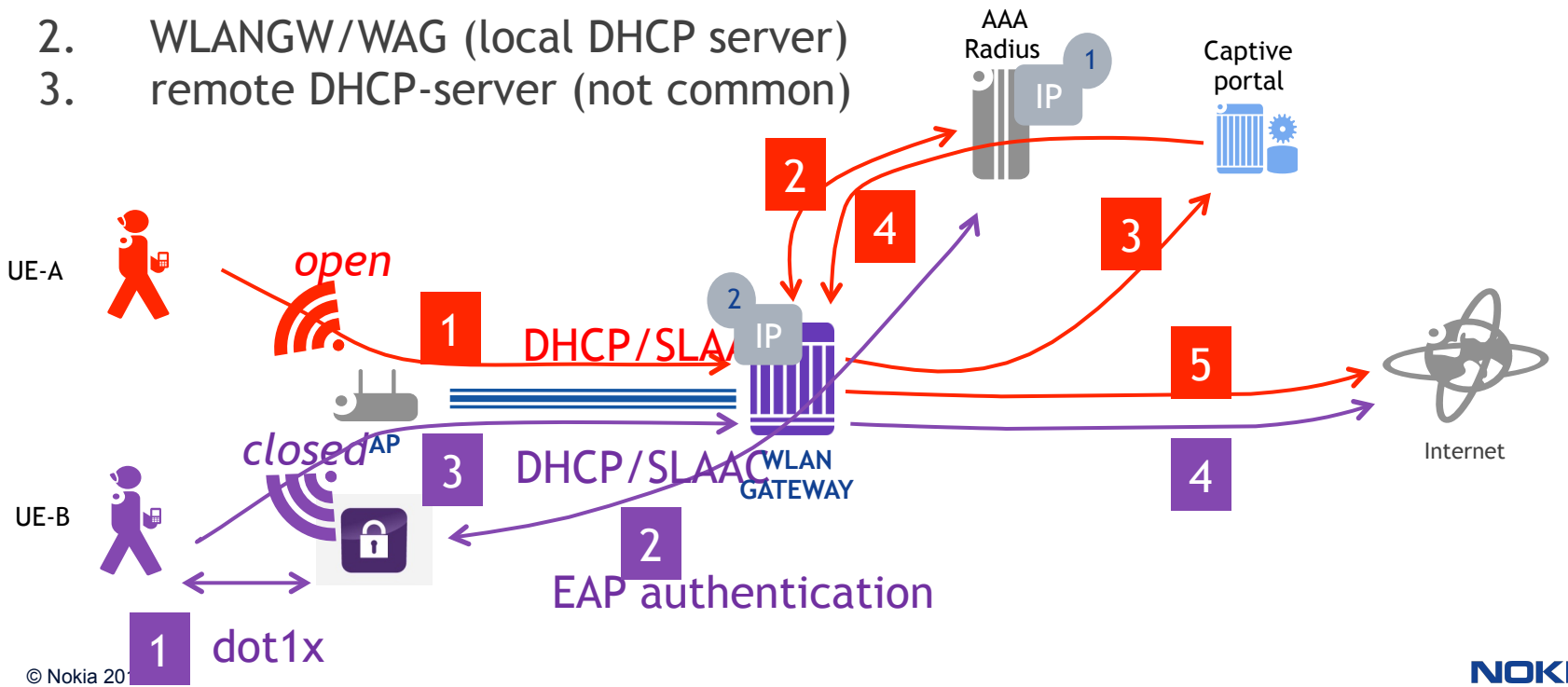
WLAN gateway

IP address assignment

Following network elements can assign the IPv4 and/or IPv6 address:

1. AAA/Radius server
2. WLANGW/WAG (local DHCP server)
3. remote DHCP-server (not common)



IETF DRAFT - Unique IPv6 Prefix Per Host
(draft-ietf-v6ops-unique-ipv6-prefix-per-host-00)

- Draft is currently mainly focused around Comcast community Wi-Fi deployment use-case, under leadership of John Brzozowski
- The current draft explains the high level architecture and provides some technological details regarding IPv6 address assignment related aspects for community Wi-Fi access
- The implementation provides each Subscriber with a unique /64 address, allowing flexibility per subscriber on addressing technology used to derive /128 IPv6 addresses
- The architecture allows IPv6 support for UE's with minimal address management capabilities
- The draft provides insight in a real deployment considerations regarding address assignments (other aspects were explained
- The documented use-case deploys a captive portal for subscriber identification

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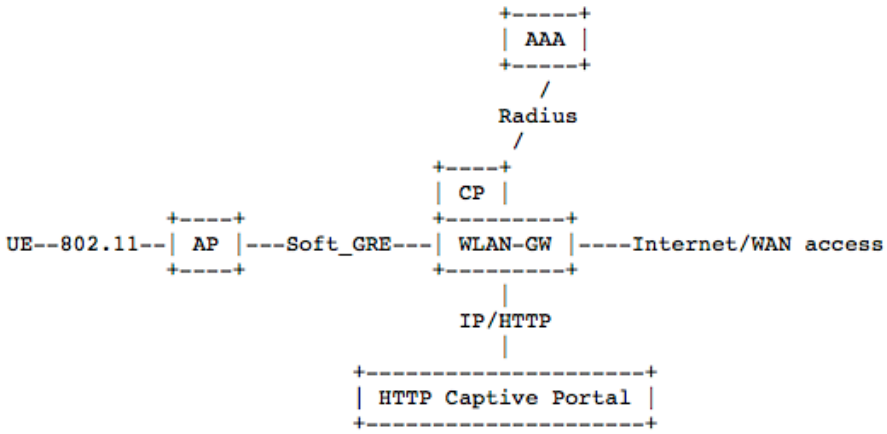
Details

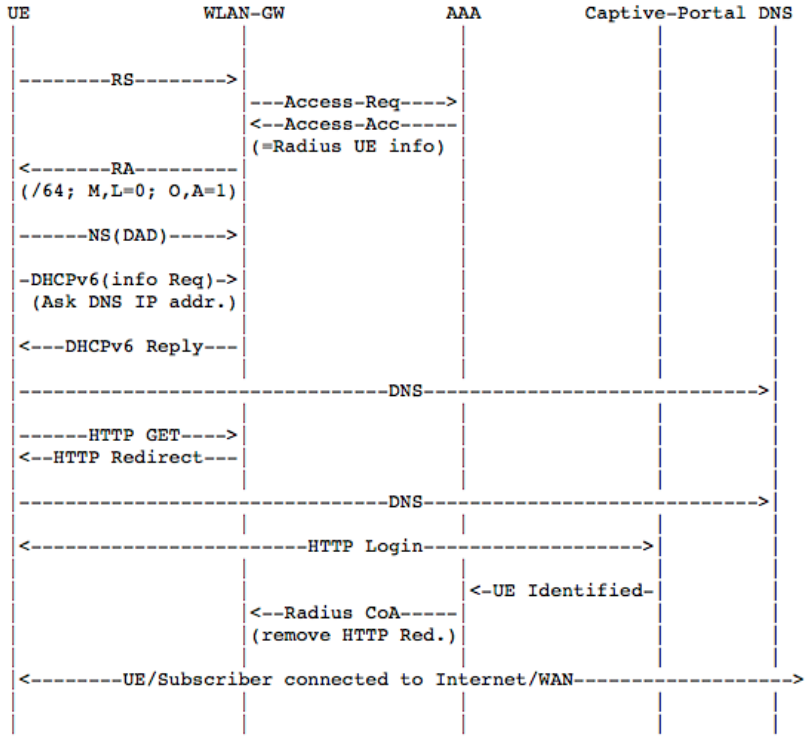
Generalized Community WIFI Topology



- UE: User Equipment.
- 802.11: Wireless Network
- AP: Access Point.
- Soft-GRE: Stateless GRE tunnel
- WLAN-GW: Wireless LAN Gateway
- CP: Control Plane component of the WLAN-GW (uses DHCP, ARP, DHCPv6, ICMPv6 (RS/RA/ NS/NA), Radius, Diameter, etc.)
- AAA: Accounting, Authorization and Authentication
- HTTP Captive Portal: Captive portal used to redirect traffic towards during subscriber onboarding process

Details

IPv6 Wi-Fi Subscriber Onboarding Procedures (1)



- When UE connects it sends a RS to learn
  - IPv6 Gateway, Prefix information, DNS, remaining info for global routing
  - RS send from UE via the AP-bridge onto the Soft-GRE the WLAN-GW
  - Due to split-horizon for BUM traffic the RS is not seen by other UE's connected to the same AP
- First time UE connects it is not Authorized and WLAN-GW queries AAA server
- AAA server checks policy DB and returns /64 together with http-redirect to Captive portal via Radius-acknowledge message

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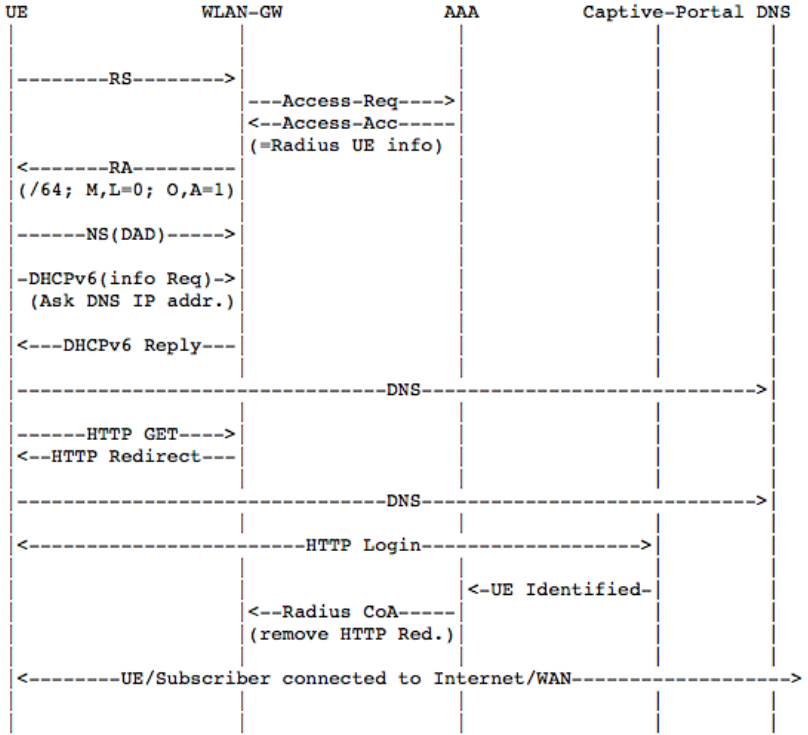
Details

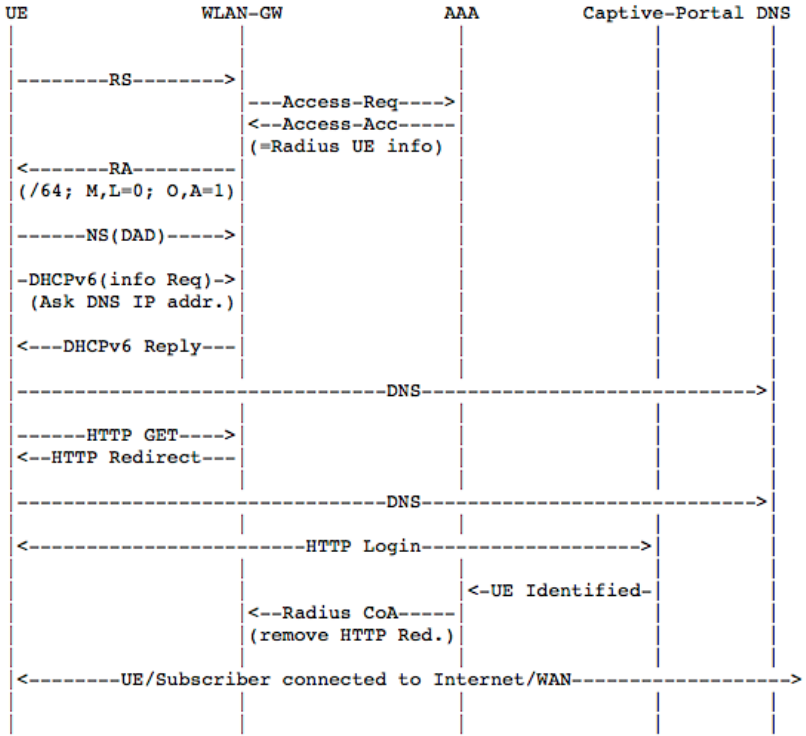
IPv6 Wi-Fi Subscriber Onboarding Procedures (2)



- WLAN-GW uses received Radius info to compose the “RA” response to the UE originated “RS” message
- RA contains few important bits of information
  - A IPv6 /64 prefix
  - Some flags
- (1) IPv6 /64 prefix
  - Locally managed pool on WLAN-GW
  - Pool signaled through Radius
- (2) Some flags
  - Indicate to use SLAAC and/or DHCPv6
  - Prefix is on/off-link
  - Is there need to request ‘Other’ information (e.g DNS)?

Details

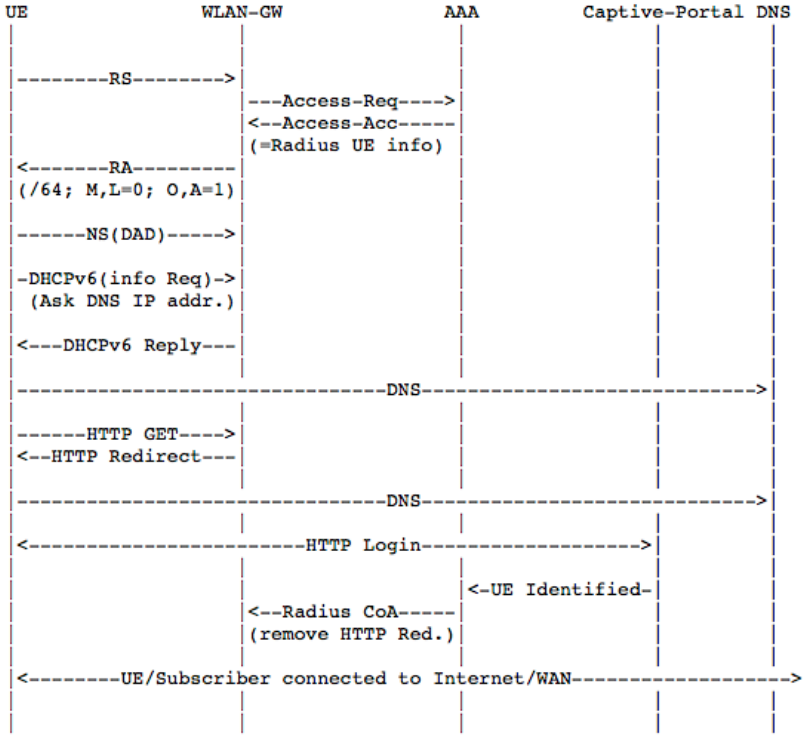
IPv6 Wi-Fi Subscriber Onboarding Procedures (3)



- IPv6 RA flags for best common practice
  - **M-flag = 0** (UE/subscriber address is not managed through DHCPv6), this flag may be set to 1 in the future if/when DHCPv6 prefix delegation support over Wi-Fi is desired)
  - **O-flag = 1** (DHCPv6 is used to request configuration information i.e. DNS, NTP information, not for IPv6 addressing)
  - **A-flag = 1** (The UE/subscriber can configure itself using SLAAC)
  - **L-flag = 0** (The UE/subscriber is off-link, which means that the UE/subscriber will send packets ALWAYS to his default gateway, even if the destination is within the range of the /64 prefix)

Details

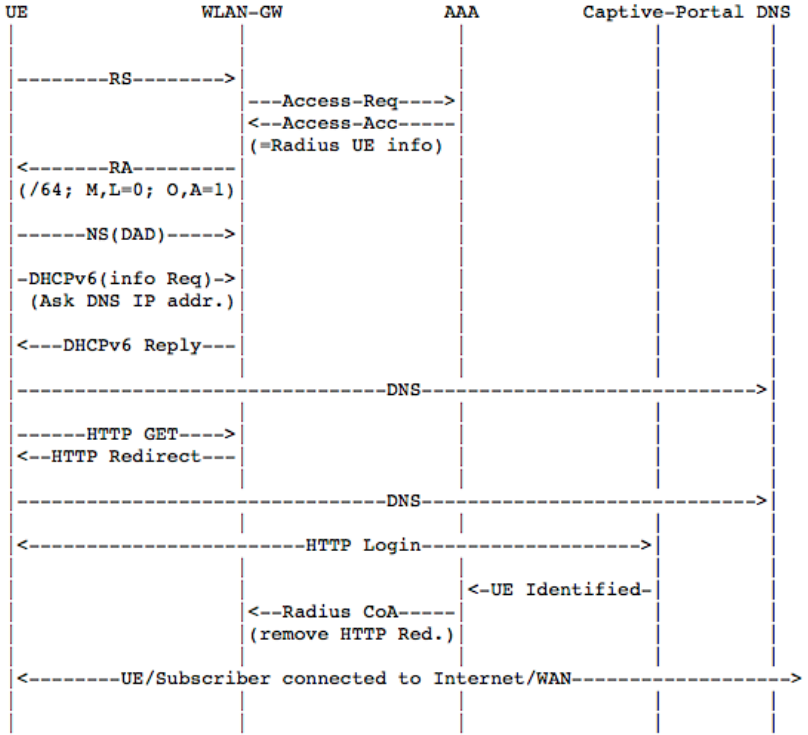
IPv6 Wi-Fi Subscriber Onboarding Procedures (4)



- Deploying a unique IPv6 per UE/subscriber
  - Each UE belongs to unique /64 subnet, hence through natural network behavior all traffic will be directed to the default gateway (=WLAN-GW)
  - Due to the flags set hosts can keep using privacy addresses within the /64 prefix
  - Accounting per UE can be done per /64 instead of per /128 IPv6 address
- UE Learning about DNS
  - Most common Stateless DHCPv6 is used by UE/subscribers
  - RA extensions for RNDSS RFC6106 can be used also, albeit less supported on UE devices
  - Both technologies can be used simultaneous and are non-mutual exclusive (however the address must be identical)
- Captive portal used to identify the subscriber (other means could potentially be used also)

Details

IPv6 Wi-Fi Subscriber Onboarding Procedures (5)



- IPv6 ND Timers
  - IPv6 Router Advertisement Interval = 300s
  - IPv6 Router LifeTime = 3600s
  - Reachable time = 30s
  - IPv6 Valid Lifetime = 3600s
  - IPv6 Preferred Lifetime = 1800s
  - Retransmit timer = 0s
- Geo-localization for UE
  - When DHCPv6 is used AP can insert interface-id in DHCP solicit message
  - When using SLAAC alternate information can be used. E.g. NSoGRE to harvest the AP MAC address

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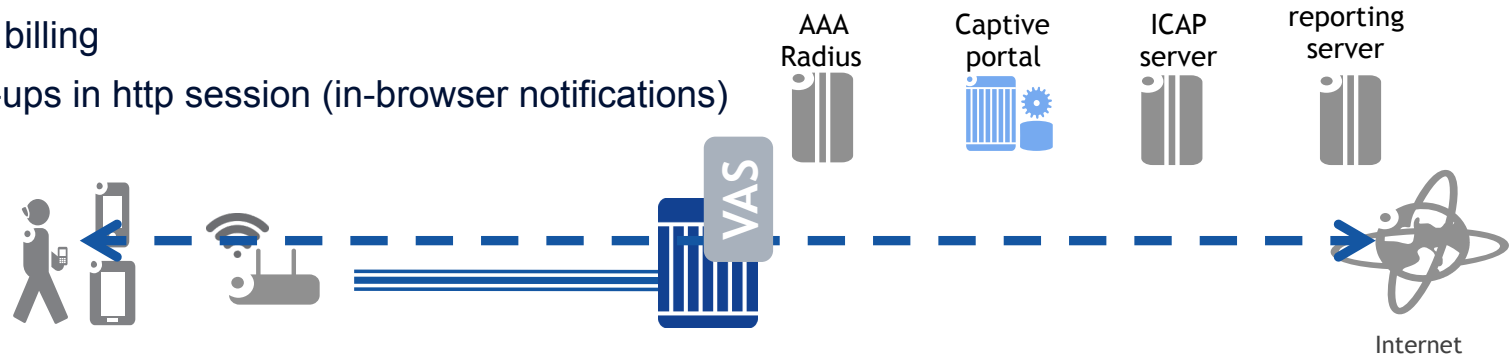
Wi-Fi specific features:
Value-added-services (IPv6 aware)

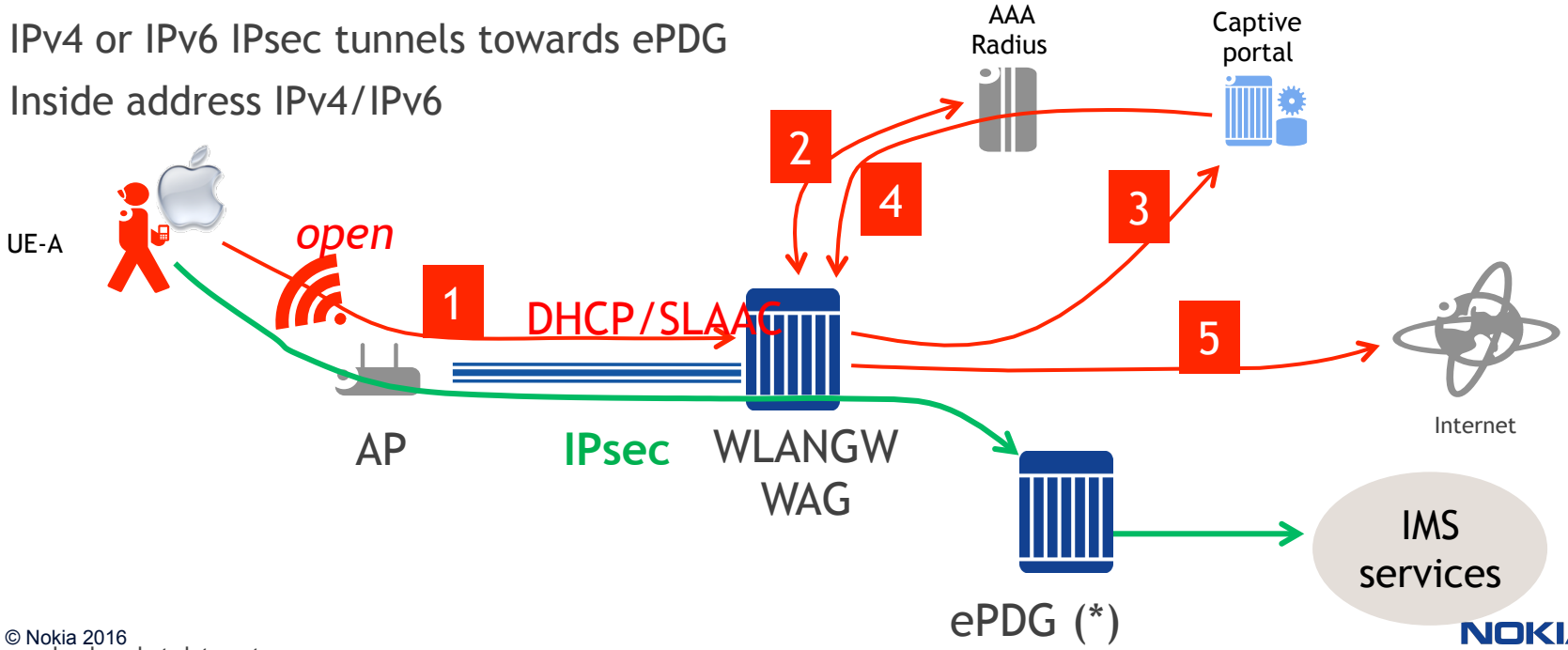
- Carrier Wi-Fi mandates VAS in order to monetize Wi-Fi as a service. Only offering connectivity (bit-pipe) is not a future-save business case.
- Few examples:
  - HTTP(s) redirects are influencing QoE heavily. Soft-redirect recommended (white listing), with success verification
  - Parental control based on ICAP (blacklist filtering)
  - Usage based billing
  - Inserting pop-ups in http session (in-browser notifications)



Value-added-services supported over IPv6 !

Wi-Fi specific features:
Voice over wifi (apple wifi calling)

- Delivering Voice over Wi-Fi in a secured way, over an “untrusted” connection
- Encryption/authentication from Smartphone, with dedicated encrypted tunnel
- IPv4 or IPv6 IPsec tunnels towards ePDG
- Inside address IPv4/IPv6



(*) ePDG: evolved packet data gateway

SUMMARY

What does IPv6 bring to carrier Wi-Fi?

- More available IP addresses
- Avoiding NAT44 means:
  - less logging/processing/resources
  - No fragmentation/reassembly issues
- Easy integration
  - Offering IPv6 over IPv4 infrastructure is possible
  - Hitless introduction of IPv6 Wi-Fi devices (single or dual stack)
  - Wi-Fi specific features are operational in IPv6 environment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