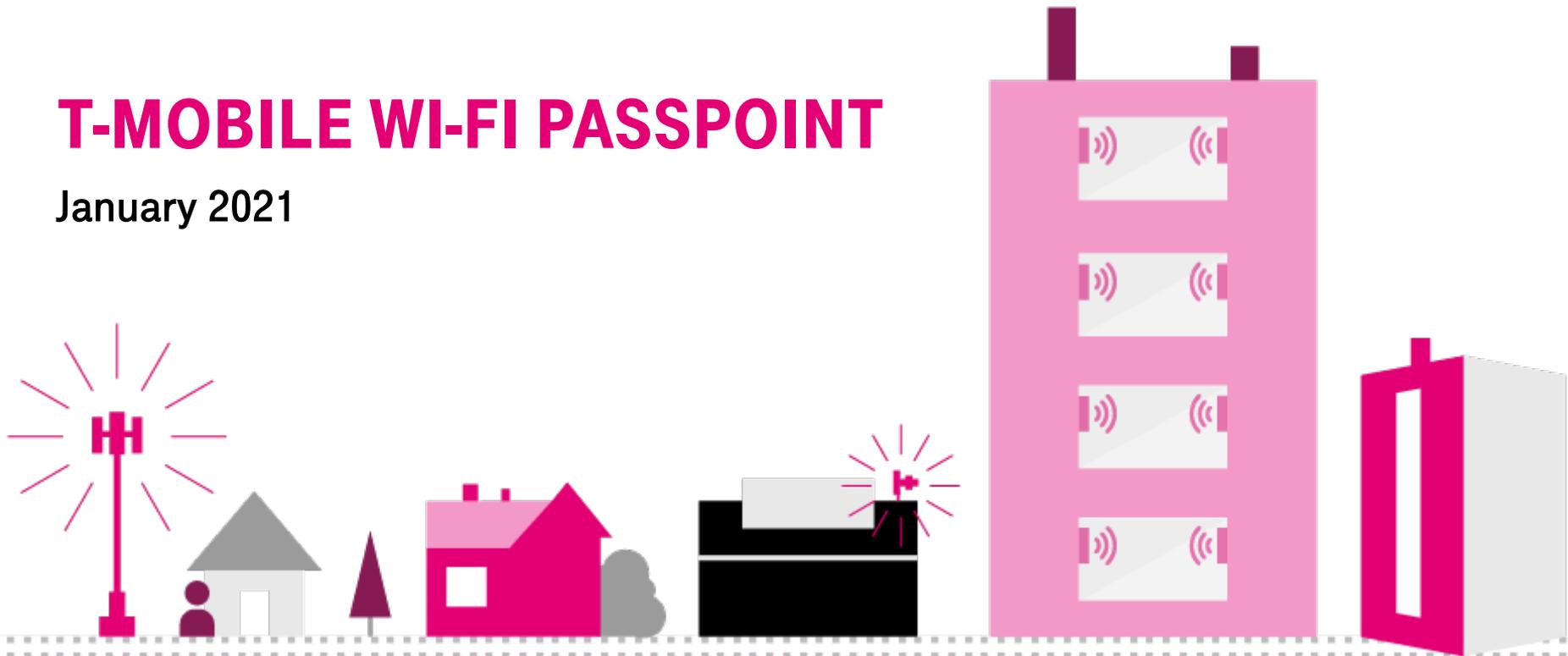


T-MOBILE WI-FI PASSPOINT

January 2021



WHY DEPLOY PASSPOINT?

- Achieve the best & seamless customer experience for your buildings' employees and guests
- Secured Access to Wi-Fi networks using WPA2/WPA3 Encryption
- A reliable, low cost, and easy to enable solution that leverages your Wi-Fi network to improve cellular coverage in your building.
- Standardized solution for Wi-Fi connectivity supported by most equipment providers and T-Mobile.

Wi-Fi Challenges Today



Confusion & frustration



Security issues

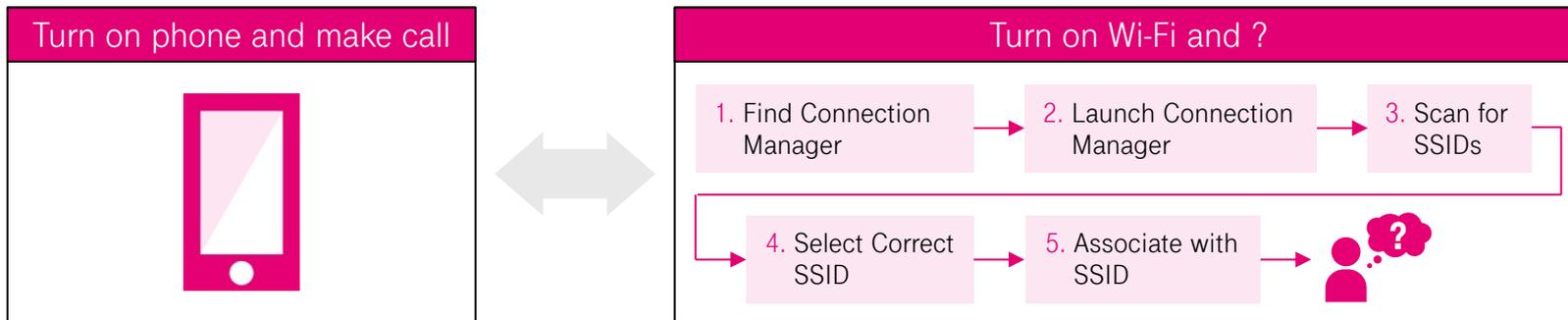


Unreliable connections



Multiple & different access methods

USER EXPERIENCE TODAY

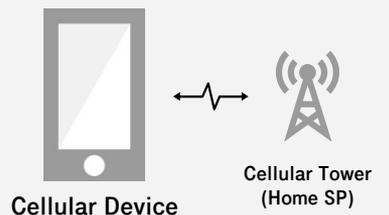


1. Wi-Fi is not easy to use (manual intervention required) and confusing
 - Web page redirection creates ease of use problems
2. Absence of a standardized mechanism for connection establishment
3. Hotspot network connectivity \neq Internet access
 - User may have WLAN and IP connectivity but stuck until they launch their browser to login for internet access.
4. Inconsistent and limited security
5. No indication that a session has expired – network access is suddenly lost

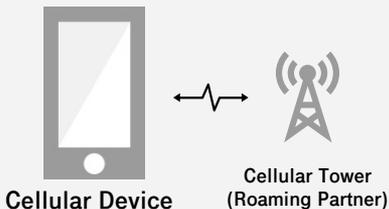
PASSPOINT CREATES A CELLULAR LIKE EXPERIENCE FOR EMPLOYEES AND GUESTS

Cellular

1. SP subscriber turns on their phone
2. Gets cellular service automatically
3. Secure connection



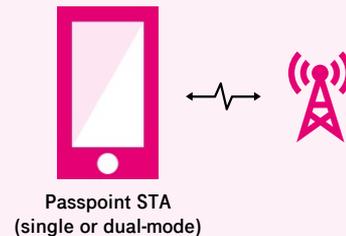
1. SP subscriber comes to roaming partner
2. Gets service automatically
3. Secure connection



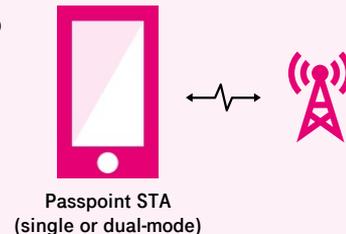
Automatic and Secure

Passpoint

1. Wi-Fi subscriber comes to AP of Home SP
2. Gets Wi-Fi service automatically
3. Secure connection



1. Wi-Fi subscriber comes to AP of Roaming Partner
2. Gets Wi-Fi service automatically
3. Secure connection



Automatic and Secure

Automatic and Secure Easy Connectivity for Wi-Fi Subscribers

PASSPOINT CORE FEATURES



SEAMLESS ACCESS

- Eliminates the need for users to find and authenticate to Wi-Fi networks



OPERATOR POLICY

- Owners and operators can decide who has access to the network and can limit types of activity like video streaming



NETWORK DISCOVERY

- Automatic network discovery
- Network selection
- Roaming across operators
- New information elements in beacons
- New GAS/ANQP protocol
- New information fields provide information about a hotspot's operator, venue and configuration:

```

# Frame 2: 334 bytes on wire (2672 bits); 334 bytes captured (2672 bits)
# RadioTap, IEEE 802.11, Length: 334
# IEEE 802.11 Beacon Frame, Flags: [..]..C
# IEEE 802.11 Wireless LAN Management Frame
# Fixed parameters (12 bytes)
# Tagged parameters (208 bytes)
# Tag: SSID parameter set: Hotspot2_0
# Tag: Supported Rates: 10, 20, 55, 110, (Mbit/sec)
# Tag: TX Power: 0dBm: Current Channel: 1
# Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
# Tag: TIM Information
# Tag: Extended Supported Rates: 6, 9, 12, 18, 24, 36, 48, 54, (Mbit/sec)
# Tag: Vendor Specific: Huawei's vendor's Parameter Element
# Tag: QoS Load Element: 802.11e QoS Version
# Tag: Vendor Specific: Fragment of Capabilities: 802.11n-01-1a)
# Tag: HT Capabilities: 802.11n-01-1a)
# Tag: Vendor Specific: Fragment of Advertisement
# Tag: HT Information: 802.11n-01-1a)
# Tag: Interworking
# Tag: Advertisement Protocol
# Tag: Roaming Consortium
# Tag: Extended Capabilities
# Tag: Vendor Specific: WPA2/WPA3
# Tag: Vendor Information
# Tag: Vendor Specific: WPA2/WPA3
  
```

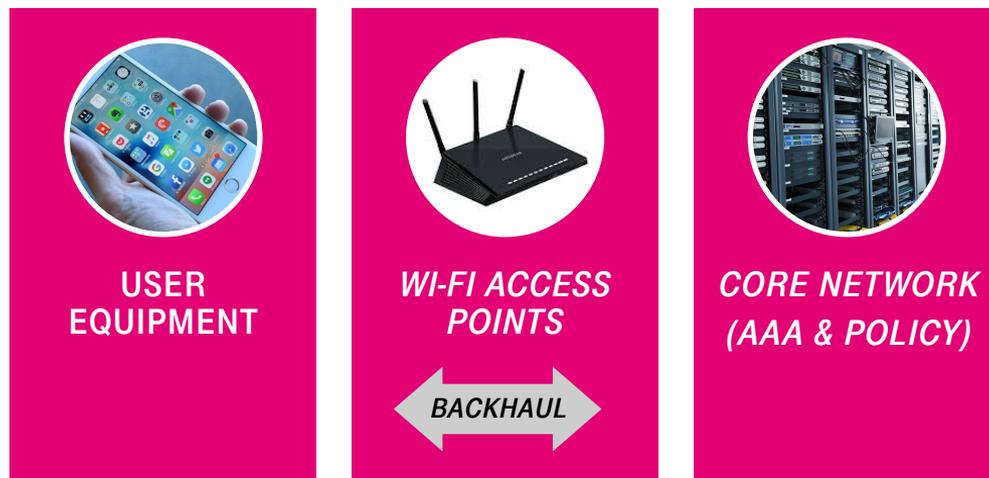


SECURED CONNECTION

- Secured access to Wi-Fi networks using WPA2/WPA3 encryption

PASSPOINT DEPENDENCIES (COMPONENTS)

- Device: Chipset and FW components (2012 and later) required to support Passpoint parameters
 - Users must enable Wi-Fi calling to access network
- Wi-Fi APs: 802.11u or above support required
- EPC: AAA access for user authentication
- Policy Server: required for provisioning, authentication type, and network selection

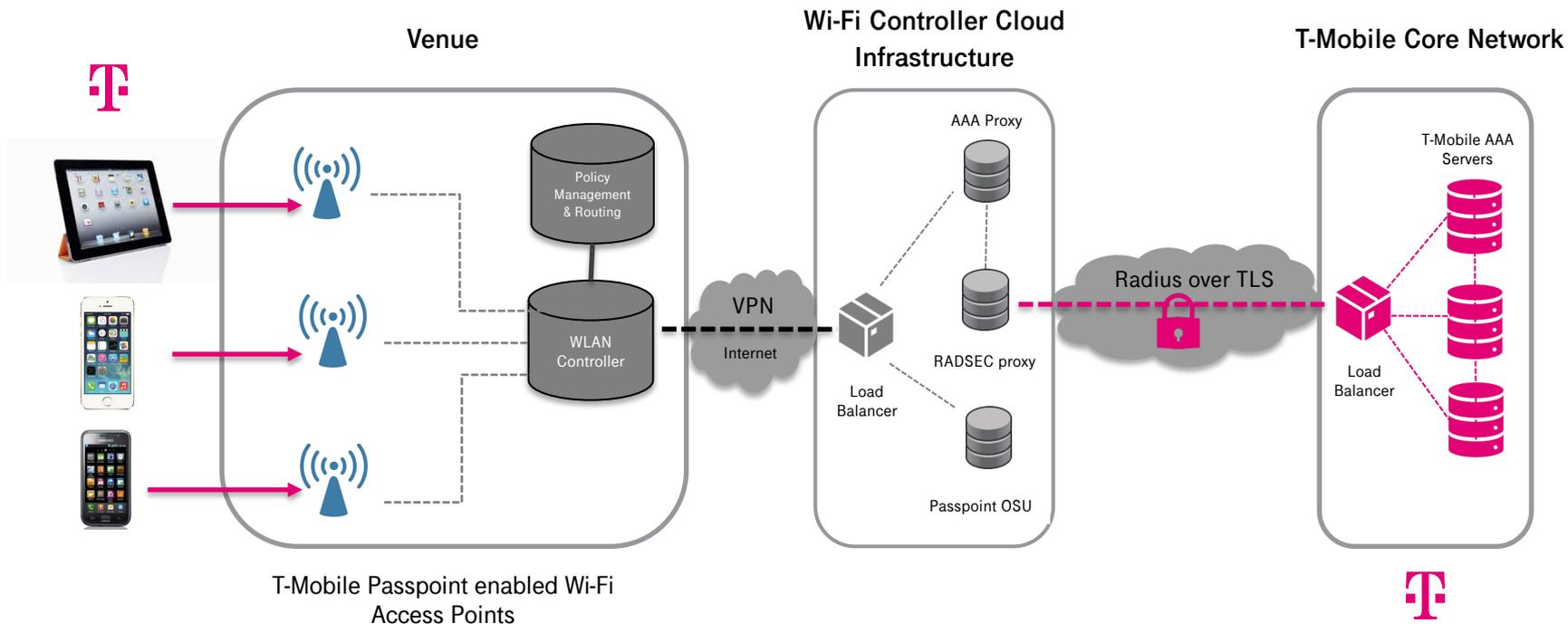


KEY:

Support Required

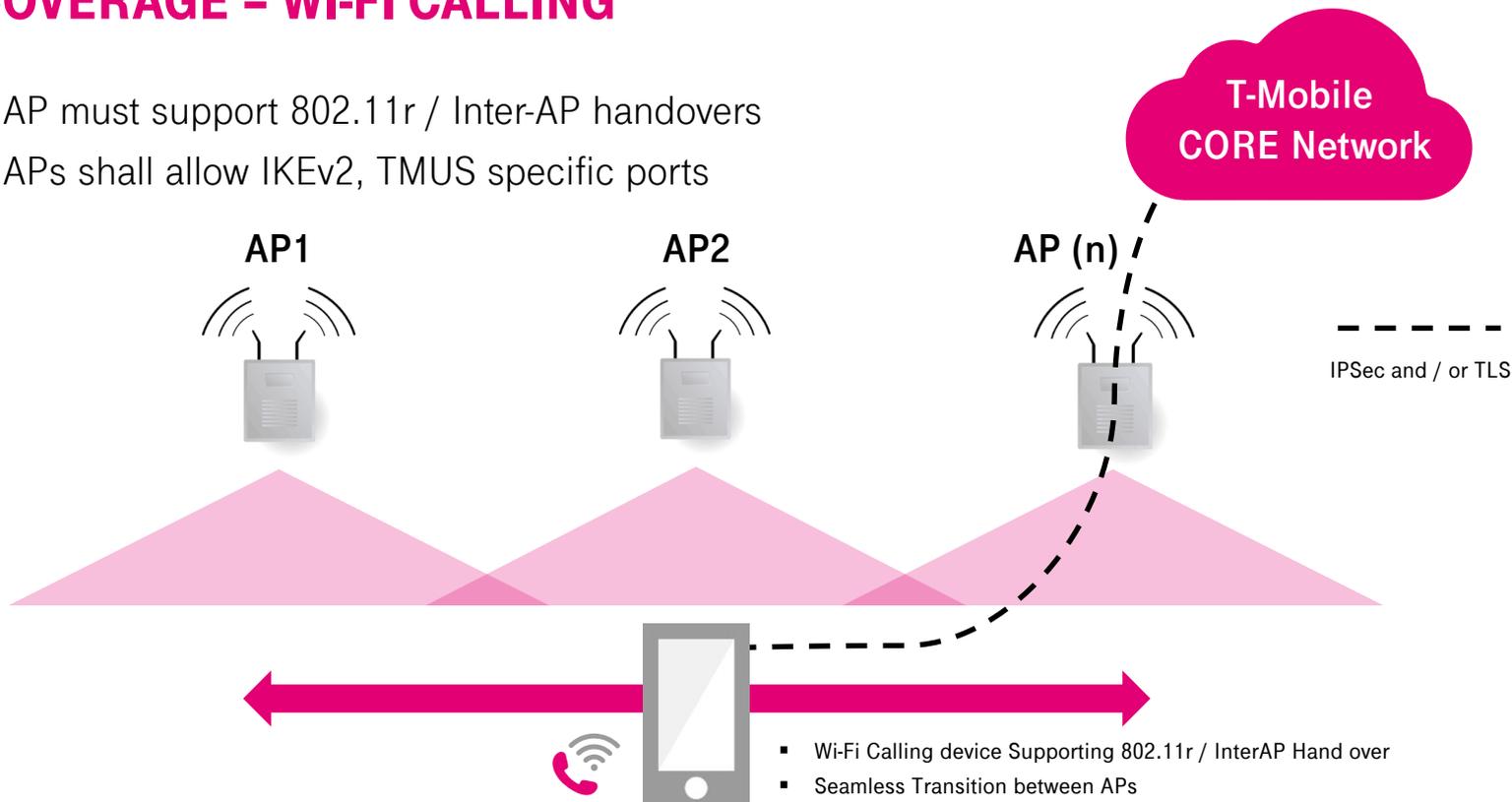
No dependencies

T-MOBILE PASSPOINT ARCHITECTURE



COVERAGE - WI-FI CALLING

- AP must support 802.11r / Inter-AP handovers
- APs shall allow IKEv2, TMUS specific ports



BENEFITS AND SUMMARY

T-Mobile Benefits

- Coverage
- Data offload
- Roaming agreements
- Subscriber loyalty
- Service provider policy
- Savings from deploying DAS solutions
- Faster in-building deployments
- Lower cost alternative to DAS implementation or replacement

Customers

- Consistent streamlined connection
- One set of account credentials for multiple hotpots
- WPA2/WPA3 security
- Easy deployment
- Solves problem going from DAS to DAS

Equipment Vendors

- A single solution for many operator vendors
- Reduced development costs
- Fewer support calls to network IT teams

Q&A

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