MulteFire End-to-End Architecture and Neutral Host

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Agenda

- Introduction to MulteFire End-to-End Architecture
- Architecture for Public Land Mobile Network (PLMN) Access Mode
- Architecture for Neutral Host Network Access Mode
- Summary

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Introduction to E2E architecture

Starting Points

Interworking with 3GPP PLMNs

- MulteFire networks should be able to:
  - Co-exist with legacy and future 3GPP networks
  - Interwork with legacy 3GPP networks
  - Support similar features as 3GPP LTE

- Legacy 3GPP interface could be used between MulteFire and 3GPP networks
  - Only optional extensions are defined to enable MulteFire specific features

- Baseline specification is 3GPP Release 13

General Concepts

Implementation

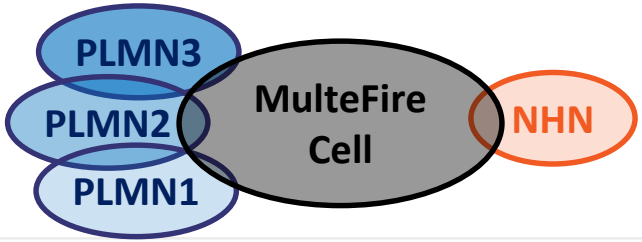
- No restrictions in the implementation of the MulteFire network
  - MulteFire network elements can be implemented as separate entities
  - MulteFire network elements can be combined, e.g. a full network can be implemented in a single box

- Multi-vendor deployments are supported
  - Interfaces between the MulteFire RAN and the MulteFire Core Network are standardized

Architecture Solutions

Two solutions are defined

- PLMN access mode:
  - The MulteFire cell is connected to 3GPP EPC in a similar manner as E-UTRAN is connected to the EPC
- Neutral Host Network access mode:
  - The MulteFire cell is connected to a Neutral Host Network
    - The Neutral Host Network is a self-contained “standalone” deployment, providing IP services
- A MulteFire cell may support simultaneously:
  - PLMN access mode for specific PLMNs
  - Neutral Host Network access mode for a specific Neutral Host Network



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Architecture for PLMN Access Mode

PLMN Access Mode Overview

MulteFire as new RAN connected to the EPC

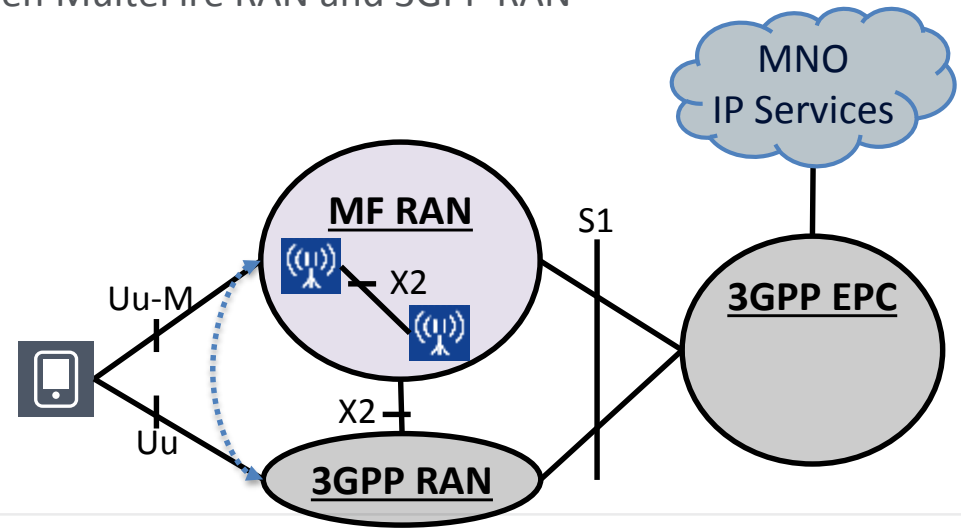
- This is a solution…
  - When MulteFire is used as an additional RAN
  - For standalone deployment when there is dedicated EPC for MulteFire

- The same procedures and identifiers are used as in LTE
  - Same bearer and QoS models are supported

- Some optional LTE features (e.g. Multimedia Broadcast Multicast Services (MBMS)) will not be supported in Release 1
  - These features may be added later

PLMN Access Mode Architecture

- MulteFire-APs are connected to a 3GPP EPC via S1 (S1-U and S1-MME)
  - MulteFire-AP provides similar functionality as an LTE eNodeB
- MulteFire-AP is an eNodeB from the EPC point of view
  - Tracking Area Codes can be used to differentiate MulteFire RAN from LTE
- Seamless mobility is supported between MulteFire RAN and 3GPP RAN
  - There are some limitations



Mobility in PLMN Access Mode

- Mobility between MulteFire cells is fully supported
  - Both in Radio Resource Control (RRC) connected mode and in idle mode
- Mobility from a MulteFire cell to a 3GPP cell fully is supported
  - Both in RRC connected mode and in idle mode
- Limitations of mobility from a 3GPP cell to a MulteFire cell
  - This type of mobility requires MulteFire support in 3GPP RAN
  - Mobility can be supported as a UE functionality without RAN support

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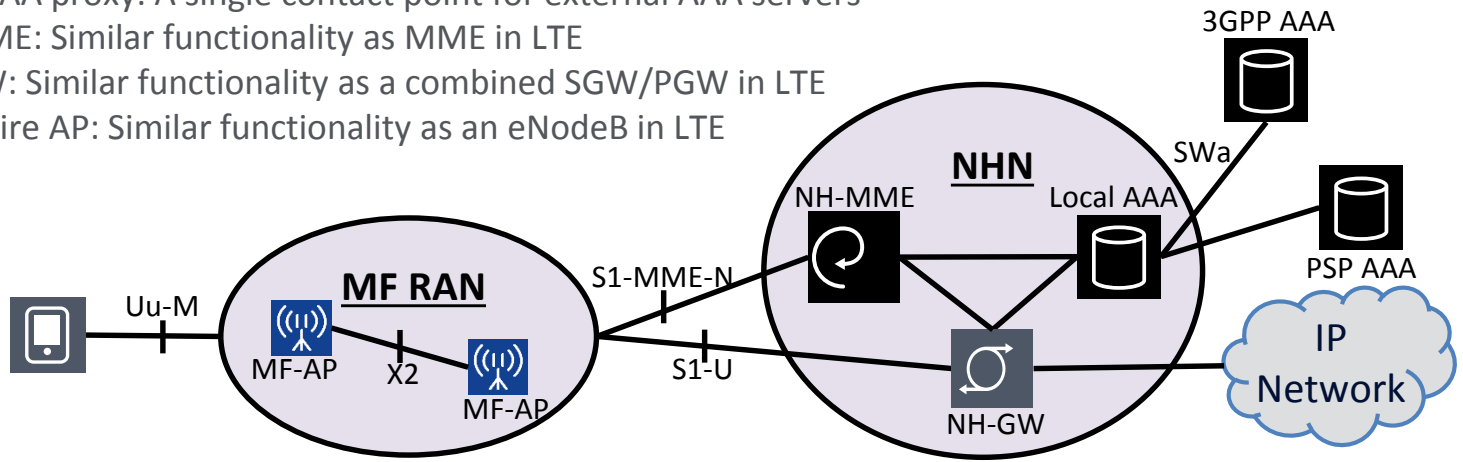
Architecture for
Neutral Host Network Access Mode

Neutral Host Network (NHN) Access Mode Architecture

Architecture addresses standalone deployment scenarios

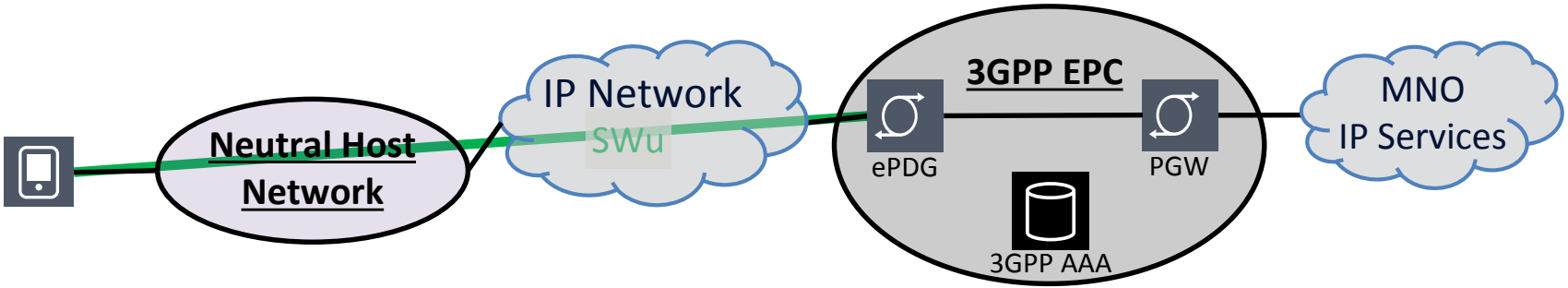
- MulteFire cell is connected to an NHN
- NHN is a self-contained network providing IP access
- Participating Service Providers provide subscriptions (e.g. credentials and billing) for users
  - A 3GPP PLMN can also be a PSP using USIM-based access authentication (via 3GPP SWa)
- New network elements
  - Local AAA proxy: A single contact point for external AAA servers
  - NH-MME: Similar functionality as MME in LTE
  - NH-GW: Similar functionality as a combined SGW/PGW in LTE
  - MulteFire AP: Similar functionality as an eNodeB in LTE



Neutral Host Network (NHN) Access Mode as Untrusted Non-3GPP Access Network

Interworking with 3GPP network

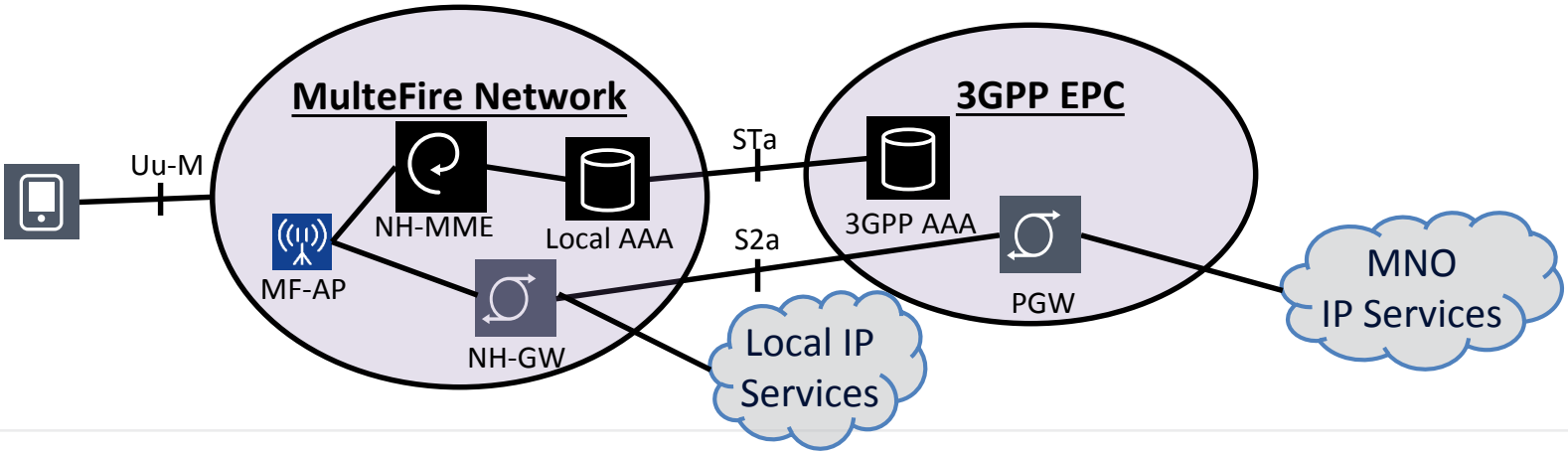
- Neutral Host Network can also be a Trusted non-3GPP access network
  - 3GPP specifications (e.g. TS 23.402) are applicable
- UE can use ePDG (via SWu) to gain access to MNO's IP services
  - Transparent to NHN
  - An extension of SWu to support QoS will be specified to benefit from MulteFire QoS



Neutral Host Network (NHN) Access Mode as Trusted Non-3GPP Access Network

Interworking with 3GPP network

- Neutral Host Network can also be a Trusted non-3GPP access network (Acting as a Trusted WLAN)
  - 3GPP specifications (e.g. TS 23.402) are applicable
- Local AAA performs Trusted WLAN AAA Proxy (TWAP) functionality
- NH-GW acts as Trusted WLAN Access GW (TWAG) for PLMN routed traffic
  - For offloaded traffic the NH-GW performs the SGW/PGW functionality in NHN



NHN and Participating Service Providers Selection

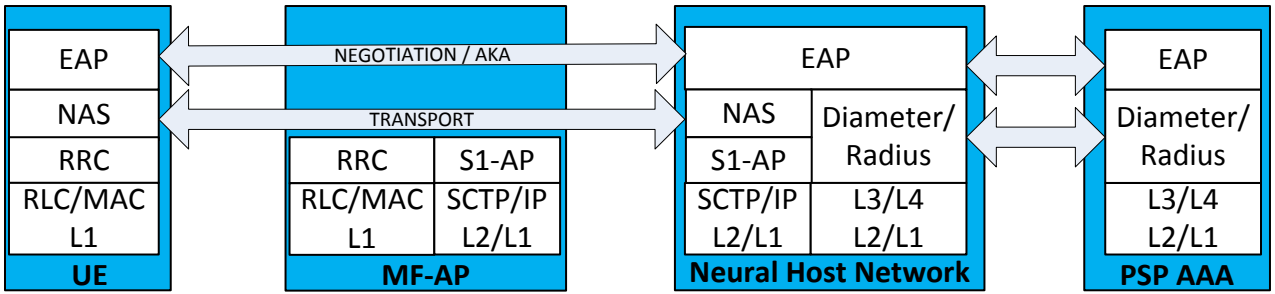
This is new procedure

- NHN and PSP selection is totally different from normal LTE cell and PLMN selection
- NHNs advertise their unique identifier: NHN-ID
  - NHNs have no PLMN-ID
- NHNs advertise identifiers of supported Participating Service Providers (PSP): PSP-ID
  - Subscribers can have multiple subscriptions with different PSPs
- Main steps of the procedure
  - Step 1: UE discovers which PSPs are supported by the available NHNs
  - Step 2: UE selects a NHN based on the supported PSPs (highest priority PSP)
- It is up to the user which subscription is the preferred one
  (e.g. USIM or a non-SIM based subscription)
- The subscription data can include preferred PSPs
  - Similar to the preferred roaming partner list

Authentication in NHN Access Mode

EAP based access authentication

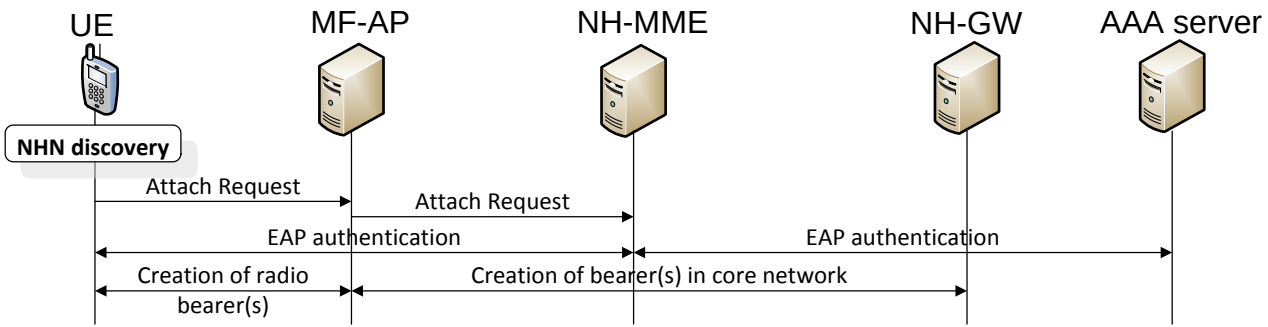
- Similar level of security can be achieved as in LTE
- UEs shall perform access authentication using Extensible Authentication Protocol (EAP) to get access to MulteFire network
  - EAP-AKA' for USIM or Certificate based EAP mechanism can be used
  - EAP messages are transferred over NAS (no change at Radio level is needed)
  - EAP authentication delivers a Master Session Key (MSK) from which K_{asme} is derived
- Online Sign Up will also be possible



Overview of Attach Procedure

Attach is similar to LTE attach

- Key difference from LTE:
  - Different authentication procedure
  - There is no Home Subscriber Server (HSS) in the system
  - UE should store contexts per NHN and PSP
  - A global value is used as PLMN-ID as NHN has no PLMN-ID
    - NHN-ID is used to identify Neutral Host Network when needed



Other Special Issues with NHN Access Mode

- Mobility is only provided within a NHN
  - MulteFire-APs of a NHN advertise the same NHN-ID
  - Similar procedures to LTE

- To access MNO's IP services Trusted and Untrusted Non-3GPP InterWorking model defined in 3GPP can be used
  - Mobility between MulteFire and 3GPP RAN can be provided by the 3GPP EPC (no radio level mobility)

- Some of the LTE features (e.g. interworking with 2G/3G) are not relevant

- Some optional LTE features (e.g. MBMS) will not be supported in Release 1.0
  - These features may be added later

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E2E Architecture Summary

E2E Architecture Summary

Two MulteFire architecture solutions

- In PLMN access mode, the MulteFire RAN is connected to the 3GPP EPC
  - MulteFire is an additional LTE “sub-type”
  - Solution can be used by 3GPP PLMNs to extend their capacity or coverage

- In NHN access mode, the MulteFire RAN is connected to a Neutral Host Network
  - Neutral Host Network is a self-contained “standalone” deployment providing IP services
  - IP services can be provided to UEs associated with different Participating Service Providers
  - A 3GPP PLMN can also be a Participating Service Provider
  - Services of 3GPP PLMNs can be accessed using 3GPP defined Non-3GPP IW models

- These architecture solutions can address different types of deployments

Thank You

For more information,
visit us at www.multefire.org