

Alcatel-Lucent - FCC Strategies to Implement Nationwide Roaming and Interoperability



November 8, 2010

Nationwide Roaming

- To support nationwide roaming we recommend using PLMN ids to govern the roaming, including settling of roaming charges
 - Consistent with commercial network strategy

- We recommend use of PLMN id at state/regional level, with possibly a separate PLMN id for a few major metropolitan areas and a few 3rd party hosting providers
 - Statewide/regional management of LTE core will provide better operational scale for smaller PS entities, and facilitate roaming agreements
 - Each UE will be assigned a specific Home PLMN id (H-PLMN)

- In addition to H-PLMN id, ALU proposes to use an umbrella Public Safety PLMN id that is used nationwide to create a virtual nationwide network
 - There may or may not be any subscribers that have the nationwide PLMN id as their H-PLMN
 - UE will first look for H-PLMN, then for nationwide PLMN, and finally for commercial PLMNs with which jurisdiction has roaming agreement

Geographic Overlap

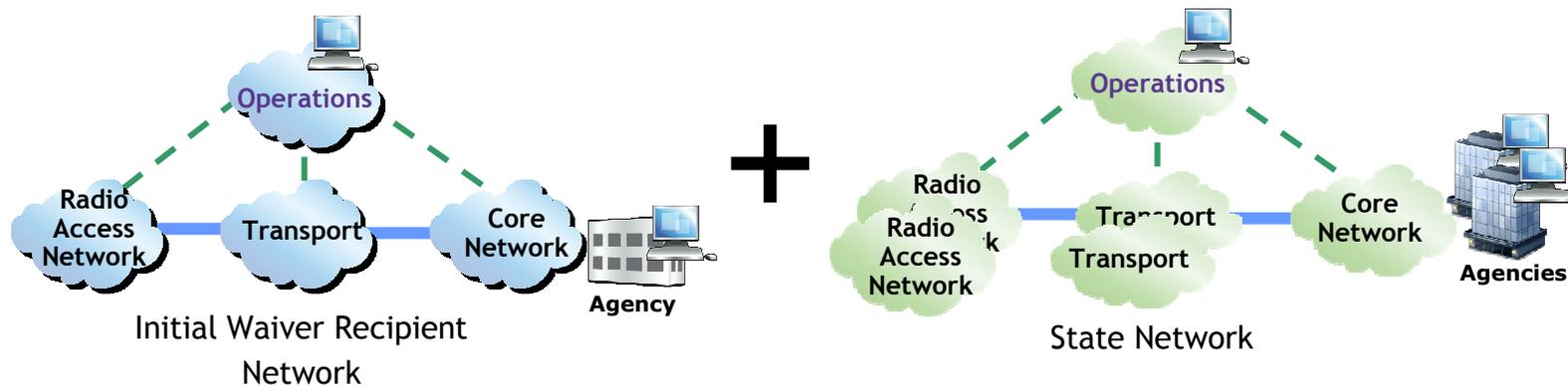
- As observed by FCC (DA-10-1748A1) several recent waiver submissions either overlap geographically with each other, or with previously granted waivers

- Alcatel-Lucent evaluated four scenarios:
 1. Initial waiver recipient maintains own core long-term
 2. Initial waiver recipient moves from own core to state core
 3. Initial waiver recipient's core evolves to state core
 4. Initial waiver recipient partners with 3rd party for core
 - a) Waiver recipient evolves from hosted core to state core
 - b) Waiver recipient partners with 3rd party long-term

- Next slides discuss these in more detail

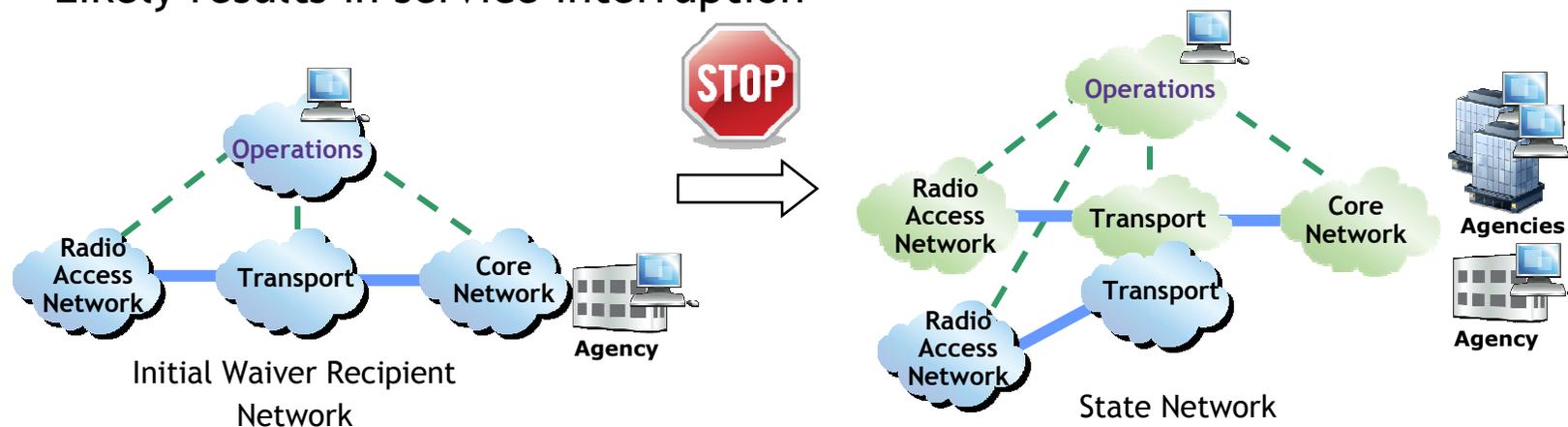
Initial Waiver Recipient Maintains Own Core Long-Term

- Requires initial waiver recipient to reach agreement with the State to maintain its own core network and PLMN id in the long-term
 - Example: New York City and State of New York
 - Networks are complementary
 - E.g. New York State users roaming into New York City would roam onto New York City's network (but can still get services from their home network through a home-routed APN)
 - Requires S10 interface between MME from initial waiver recipient and MME in state network to support handovers
- Should be exception case to minimize total number of networks



Initial Waiver Moves From Own Core To State Core

- The initial waiver recipient can move from their initial core to the statewide core
 - Significant migration effort:
 - All subscriber data has to change to reflect new PLMN, including UE data
 - eNBs have to be migrated
 - EPC elements from initial waiver recipient can be reused with significant effort:
 - Significant reconfiguration to account for new network, PLMN, ...
 - Have to either migrate HSS data or introduce SLF (see next slide)
 - May require significant inter-vendor testing if not same equipment vendor
 - Likely results in service interruption



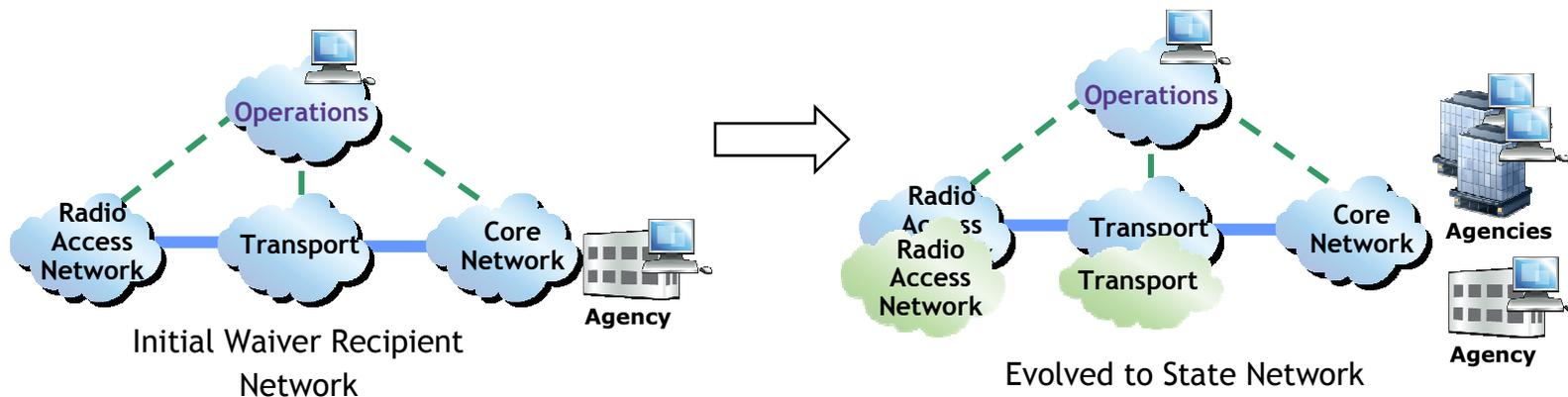
Single versus Multiple HSSes

- Alcatel-Lucent recommends a single, geographically redundant HSS for the state with partitioned access for each jurisdiction. This HSS should include policy data (SPR) as well with partitioned access for each jurisdiction.
 - Jurisdictions can manage their own subscribers/policies
 - Jurisdictions can not see subscriber data from other jurisdictions

- Why not multiple HSSes?
 - 3GPP standards define the use of Subscriber Location Function (SLF) as the only way to determine the correct HSS if multiple HSSes are used in the same PLMN
 - Only method that guarantees interoperability in a multi-vendor environment
 - SLF becomes an additional entity to manage and maintain in the network
 - In addition multiple HSSes result in added CAPEX and cost to maintain them
 - No additional functionality provided by the multiple HSSes

Initial Waiver Recipient's Core Evolves to State Core

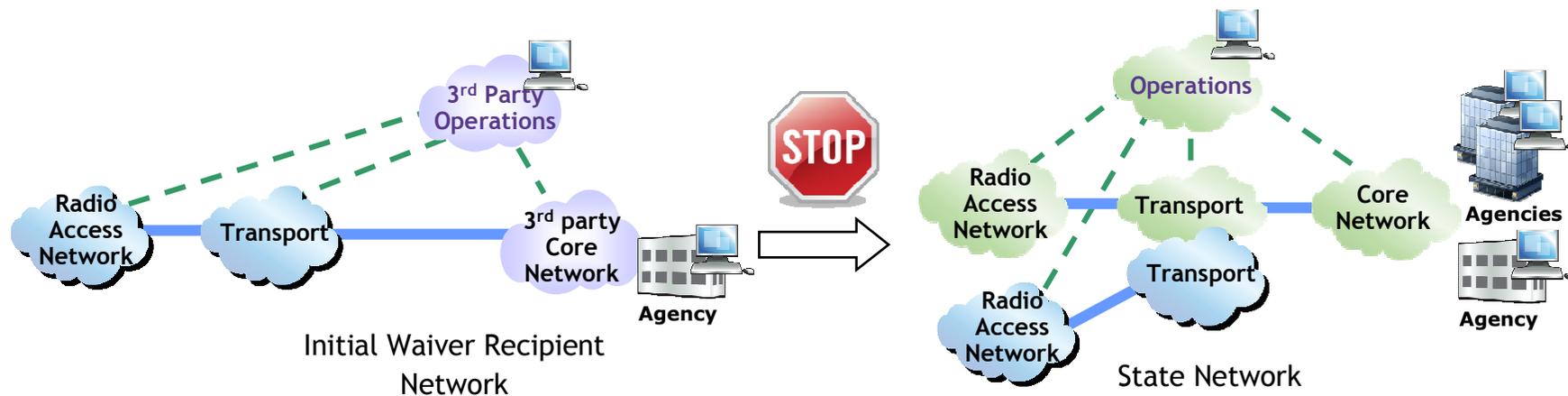
- The initial waiver recipient can reach agreement with the State that their initial core deployment will evolve to become the statewide core, with the initial PLMN id
 - No disruption
 - Grows additional radio access networks and transport infrastructure onto initial core
 - Managed long-term by initial waiver recipient, or management can transition to state
 - All users share common HSS/PCRF, but with partitioned access for each jurisdiction to manage their own subscribers and priorities
 - Jurisdictions may optionally have own SGW and PGW



Initial Waiver Recipient Partners With 3rd Party For Core

4a - Waiver Recipient Evolves from Hosted Core to State Core

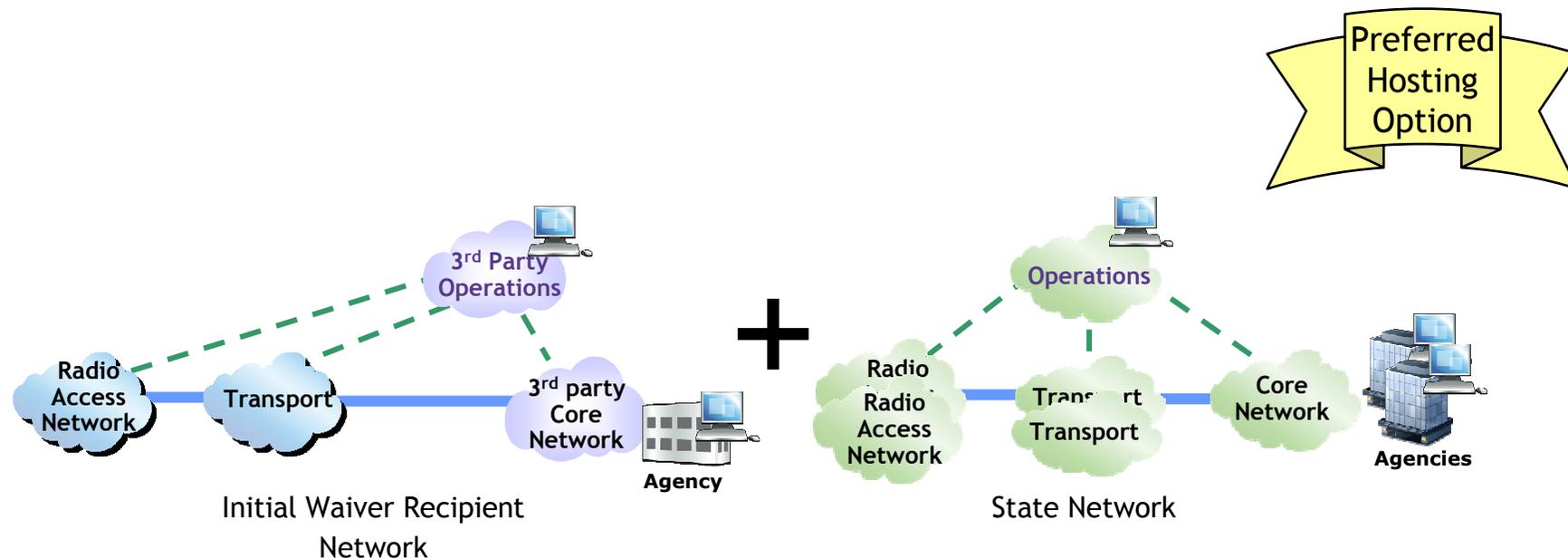
- Minimizes initial CAPEX required to introduce LTE network
- Requires significant migration effort:
 - All subscriber data has to change to reflect new PLMN and network owner
 - Users have to be newly added to state HSS
 - All SPR/policy data has to be added to the state PCRF
 - UE data needs to be updated
 - eNBs and possibly SGW/PGWs have to be migrated/reconfigured
 - Backhaul may have to be modified
 - Process will likely result in significant service disruption



Initial Waiver Recipient Partners With 3rd Party For Core

4b - Waiver Recipient Partners with 3rd Party Long-term

- Minimizes initial CAPEX required to introduce LTE network
- Networks are complementary
 - If state user roams into initial waiver territory they will roam onto 3rd party network
 - Requires S10 interface between MME from 3rd party and MME in state network to support handovers



Key Takeaways

- Alcatel-Lucent continues to support assigning PLMN ids at the state level
- We continue to recommend the use of an umbrella PS PLMN id to ease roaming across networks
- Evolve initial waiver recipient's core network to become statewide LTE core network wherever possible
- Initial waiver recipients that use a 3rd party LTE core should continue to use this core long-term
- FCC should consider allocating a very small number of PLMNs to 3rd party hosted core operators for public safety in order to facilitate early build-outs by small waiver recipients that may have funds available to them