Use Case 2

Dynamic Coverage of Existing Network, Intermittent Backhaul

This represents a scenario where a network such as the highly mobile deployed network described above in use case 1 (UC1) is moving in and out of the coverage area of the existing, nationwide public safety broadband network (PSBN). Additionally, during this movement, backhaul connectivity may be available, but its connection specifics such as throughput, availability, latency, loss, etc. all vary greatly from situation to situation.

For this use case, consider a response team with a highly mobile deployed network operating in an area which is at the edge of coverage of the PSBN or in an urban environment where the PSBN connectivity is intermittent. Naturally, it is most desirable for the users to be able to use the nationwide PSBN core at all times, as this would alleviate the mobility and access issues described in UC1, but it is perceivable that there are times when the PSBN is available and times when it is not. The deployable network needs to be able to determine when users should be utilizing the deployed core, when the users could be using the radio access network (RAN) portion of the deployed network and the nationwide core, or when the users should be completely handed over to the RAN and the nationwide core of the PSBN. It should also know when to take the users back following either of the last two scenarios. During this time, there must be no loss of access to applications or databases regardless of which core the system is connected to.

Additionally, when the deployed network is connected to the nationwide core, it is perceivable that there will be a stable enough backhaul connection to begin updating its local (or edge) based databases and application services. For example, if there is a backhaul connection, then the system may be able to use that connection to update an imagery server locally, so that when the backhaul drops, the latest imagery is available. This would apply to any application or database where timeliness of information is key. The system should also be intelligent enough to determine how to use its backhaul connection efficiently so as to prioritize real-time information sharing (i.e., active data calls) over priority database replication which would be prioritized over non-critical replication. There should also be a control to determine the need for an update. For example, if an image stored locally hasn't changed significantly, then there would be no need to use bandwidth to update the local store.

In addition to the technology needs derived from UC1, this use case also needs the following technologies:

- A mechanism to determine what configuration the LTE system should operate in. Consider three cases for the deployable network as follows:
  - Case 1 – No nationwide core services available, all RAN and core functionality is happening from the deployable platform

- Case 2 – Backhaul to the core is available, but fixed RAN coverage is not, so the deployable RAN is being used but connecting via the S1 interface to the nationwide core
- Case 3 – Fixed RAN coverage is available as is the nationwide core, so all devices are connecting to the existing PSBN.

It is conceivable that, as the incident area is dynamic, a single user or group of users could experience all three conditions in a short amount of time. The deployable system should be able to determine how to configure itself, and send messages as appropriate. It should also be identified whether each case is viable. It is possible that only case 1 and case 3 are implemented.

- The security solution or ICAM should be able to switch to online (connected to a centralized ICAM server) and offline (utilizing the edge-based ICAM service) as the network switches from the deployed state (Case 1 above) and the fixed state (Case 3 above). As this switch occurs, the operator who is currently authenticated at a given level should not lose or gain additional access. Additionally, if there are any updates needed to the offline ICAM service, it should be updated at this time.
- As the deployed network establishes a backhaul connection or a connection to the fixed PSBN, there should be a mechanism to assess the reliability and stability of that connection. This may rely on machine learning techniques or potentially simply OSPF-type link costing. The idea is that the system should know what kind of backhaul it has, if it is reliable or not, and how much bandwidth could be available to the deployed network. This will drive decisions in handing over to the nationwide core, synchronization of databases, how user traffic is routed, etc. For example, if the system knows that, while it may have a backhaul connection, the particular backhaul connection is prone to loss or disruption, it would be desirable to maintain all edge services rather than pushing services to the PSBN core.
- As backhaul connections are dynamic, the system should understand which application databases need updating, the resource cost of those updates, and the benefits to those updates. This again could implement machine learning techniques to determine which data sets are being utilized to prioritize the updates. It should additionally be able to determine which datasets need updating. For example, it would be inefficient to expend resources updating an imagery database if there are no significant changes from what is currently available at the edge.