An Overview of MAMS (Multiple Access Management Services)

draft-kanugovi-intarea-mams-protocol-01

Satish Kanugovi (satish.k@nokia.com)

Subramanian (Vasu) Vasudevan (vasu.vasudevan@nokia.com)

Florin Baboescu (florin.Baboescu@Broadcom.com)

Jing Zhu (jing.z.zhu@intel.com)

Motivation

- Devices are capable of Multiconnectivity – Applications have ability to leverage multiple networks
- Application QoE (quality of experience) varies with choice of network paths
  - Performance varies dynamically based on network conditions, e.g. radio conditions, user population, actual network utilization
    - e.g. 1, Wi-Fi offers good capacity with small number of users which quickly degrades, low throughputs and large unpredictable delays due to uplink contention with larger user population.
    - e.g. 2, LTE capacity is limited by available licensed spectrum but offers predictable performance even with increasing number of users
- Deployment configurations determine certain network path choices for applications
  - e.g. Enterprise apps available only via Wi-Fi IP gateway, Cellular operator hosted Cloud only available via cellular IP gateway, VPNs
- Selecting best combination of network paths is essential for consistent and high QoE
  - Dynamically adapt to changing network conditions
  - e.g. Improve enterprise conferencing service (e.g. Skype) by choosing Wi-Fi access in uncongested conditions, Switch only uplink to LTE access as Wi-Fi radio link condition degrades or congestion increases

MAMS - Introduction

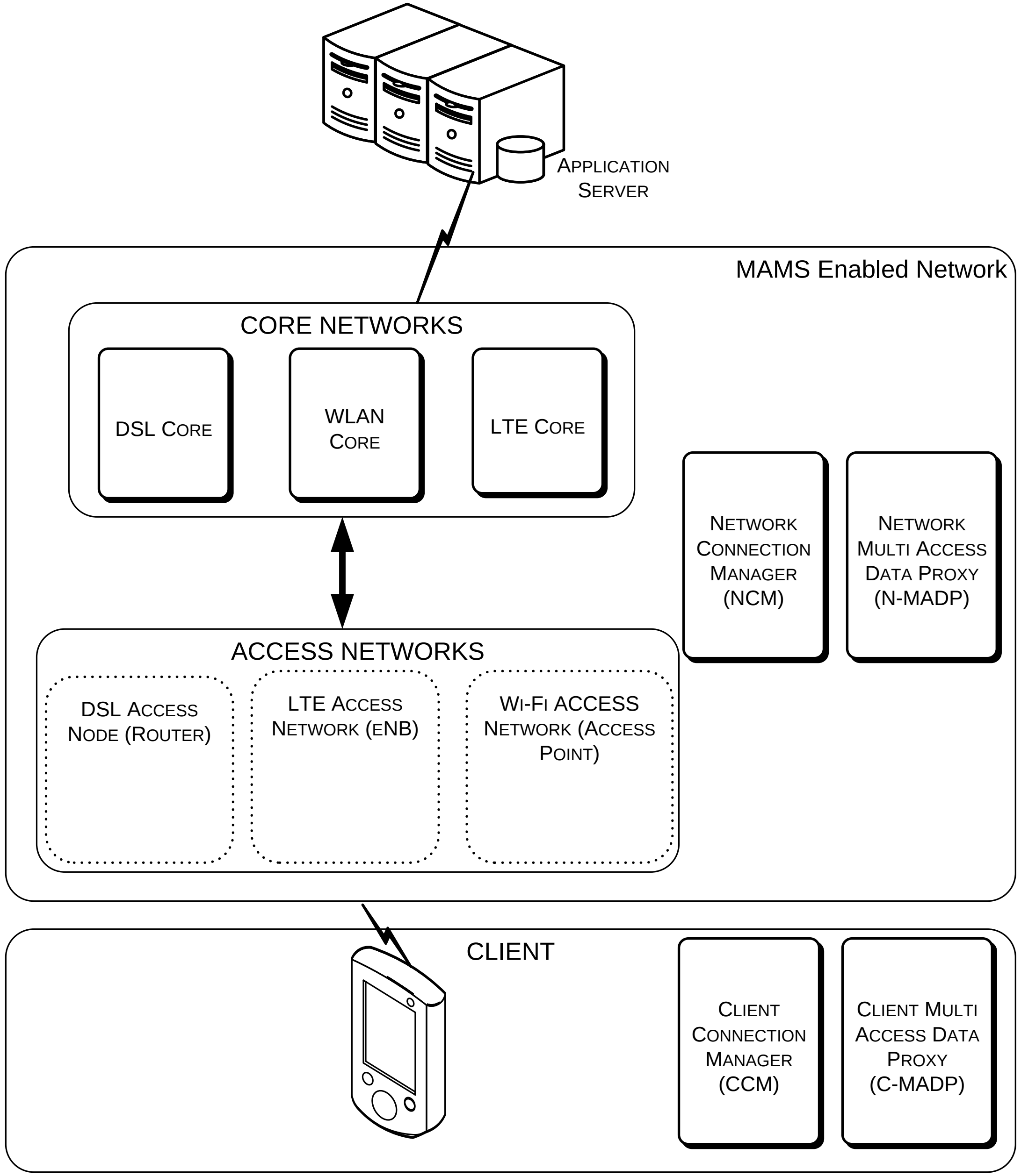
- MAMS is a framework for
  - Integrating networks based on IP layer interworking,
  - with ability to select access and core network paths independently
  - that can dynamically adapt to changing network conditions
  - based on negotiation between client and network

MAMS - Requirements

- Simplify multi-operator/vendor integration
- Independent UL and DL accesses selection and aggregation
- Network connectivity technology and architecture agnostic integration
  - Enabled by Loose IP layer Interworking and Programmable Network APIs
- Flexible anchoring (Any core/IP gateway + Any access)
  - Flexibly pick network anchor point(s)/IP gateway(s) based on application deployment configurations
- Adaptive path selection for maintaining quality of experience
  - Network analytics based on client reports/network status monitoring
- Support multiple deployment options
  - Network function elements can be flexibly located at different locations

Architectural Framework

- MAMS functional elements
  - Network Connection Manager (NCM)
    - Intelligence in the network to configure network paths based on negotiation with the client
  - Multiple Access Data Proxy (MADP)
    - Handles user plane distribution across configured network paths.
    - Can support any user plane protocols including existing IETF protocols like TCP, UDP, MPTCP, SCTP, QUIC, GRE, …
    - C-MADP handles MAMS related user plane functions at the client and N-MADP at network.
  - Client Connection Manager (CCM)
    - Negotiates client's capabilities and needs with the NCM and configures network path usage
  - NCM – CCM message exchange enables
    - Dynamic selection of best network paths
    - Flexible configuration of MADP protocols and parameters



Relation to other IETF work

- MAMS is a framework for negotiation, configuration and delivery of network paths in a multi-network scenario.
  - Control layer for flexible combination of access and core network paths
  - Efficient delivery of user plane over multiple paths with no impact to existing network/transport protocols
  - Dynamic best path selection based on real-time network conditions and utilization.
  - Minimal impact to actual underlying network technology and architecture
- IETF groups are engaged in development of multipath user plane protocols
- MAMS is not bound to any specific user plane protocol, e.g. TCP, UDP, MPTCP, GRE but provides mechanism to negotiate use and configuration of the protocols.
- Network state information from MAMS framework can be used to optimize user plane operation.
  - e.g. CCM-NCM can exchange policy [1] or optimal path information [2] to complement MPTCP operation
- MAMS framework is complementary to such IETF work

References

[1] Lance Hartung and Milind M. Buddhikot, "Policy Driven Multi-band Spectrum Aggregation for Ultra-broadband Wireless Networks", 7th IEEE Dynamic Spectrum Access Networks (DySPAN) 2015. Stockholm, Sweden.

[2] S. Borst, A. O. Kaya, D. Calin, H. Viswanathan, "Optimal Path Selection in Multi-RAT Wireless Networks", in Proc. of IEEE INFOCOM 2016 Wkshp on 5G & Beyond – Enabling Technologies and Applications, April 2016, SF, CA