Assignment 2: Architecture Design and Analysis (12.5 marks)

Domain and Problem

Roaming allows mobile users to make and receive phone calls, send and receive data, and access other services via a network of another service provider when they are outside the coverage area of their home network. Network service providers, however, often encounter issues related to the mobiles' users on roaming networks, and do not always have visibility into the user activities on the other networks. A third-party clearinghouse is required for roaming payment reconciliation. Services provided by the clearinghouse are associated with costs.

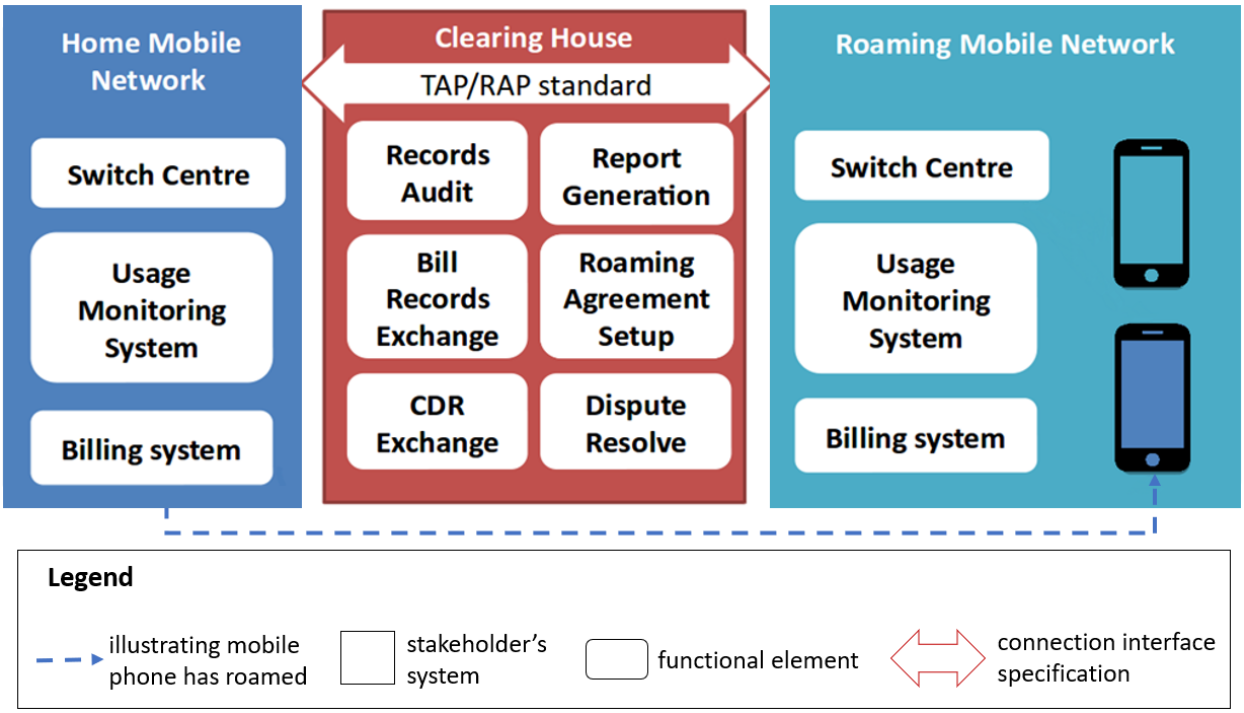

Figure 1. Illustrative abstract functional architecture of a conventional technology solution

A simplified architecture using a conventional technology solution is shown in Figure 1. If the network (Home Mobile Network in Figure 1) provided by a network service provider does not cover a particular city or country, then this network service provider makes a roaming agreement with another network service provider (Roaming Mobile Networks in Figure 1) having network in that city or country, who can provide all the available services to the roaming customer from the home network service provider. CDR (call-detail record) is generated based on the usage data from the network switch centre. A CDR contains the number of the caller and the number of the callee, the state and the end date and times. The roaming network service provider to see if the call is,

for example, an 800 number, a local call, an international call or a toll call, later examines CDR. Information such as the time of the call was placed and city code or country codes are used to calculate the rate for the call.

The rated CDRs are sent to the home network service provider of the roaming customer. The home network service provider charges the customer for all the roaming services provided based on their predefined service charges. Two roaming partners settle their financials on monthly basis by exchanging actual roaming CDRs and reports based on the CDRs.

A third-party clearinghouse is required as an interface between different roaming partners to help them exchanging CDRs, setting up roaming agreements and resolving any dispute. Clearinghouses receive billing records from one roaming partner for the inbound roamers and submit billing records to another roaming partner, which is the home network service provider of the roamers.

TAP (Transferred Account Procedure) is a GSM (Global System for Mobile Communications) standard that defines the format and validation rules for transferring roaming usage information between network service providers in different countries. RAP (Returned Accounts Procedure) is a GSM standard that defines the format for returning information on errors found within transferred TAP events and thereby rejecting financial liability for those events.

Architecturally-Significant Concerns/ NFPs for This System

1. Commercial confidentiality for telecommunication companies
   Networks don't reveal customer lists, total number of customers, nor total number of roaming customers to any other network.
2. Privacy for customers
   Customer data only shared to other networks that they roam to, and only minimal customer data shared sufficient to allow roaming.
3. Throughput for accounting reconciliation
   Sufficient throughput on an hourly basis for transactions supporting roaming reconciliation. You may make and state reasonable assumptions about load.
4. Integrity for accounting reconciliation
   Transactions for roaming only by authorized networks, and only for phones who have roaming agreements in place.

Tasks

1. Provide architecture diagrams for two plausible blockchain-based solutions that could replace or augment the “Clearing House”, one using a public blockchain, one using a private blockchain. The architecture diagrams describe which functions and data are allocated to which components, including blockchain components and non-blockchain components. Be clear which data is on-chain, which data is off-chain, and what data protection mechanisms are to be used (if any). A legend describing diagram elements must be included for all diagrams. Describe the role(s) that blockchain plays in the solution as an architectural element. [4 MARKS]

2. Provide two spreadsheets, each containing information for an ATAM Quality Attribute Utility Tree (each with 6 example scenarios across the 4 NFPs) [6 MARKS]

Provide short template info for each scenario:

- Name
- Description
- Attribute
- Environment
- Stimulus
- Response
- Reasoning why architecture deals with the risk

3. Provide a short discussion of which solution (using conventional technology, private blockchain, or public blockchain) would be better, and why [2 MARKS]

4. Submit on time [0.5 MARKS]