Paper reading Sammerize

Goal

1. Design algorithm that minimize the overall effort for both Location Update & Paging
2. Suggest a generic analytical simulation platform for both location update and paging schemes with following modules in this platform
    a. A realistic / parameterized model for user mobility model
    b. A realistic geographic context (SUMO & Openstreet Maps)
    c. A realistic / parameterized model for call behaviors(call patterns)

State of Art

1. Various location update and paging schemes have been proposed in the literature
2. Due to different models and assumptions during performance evaluation, so relative performance of all these schemes was not yet clear (not comparable)

Steps to take

1. Design a simulation/performance analysis platform for both location update and paging
2. Using the simulation platform so designed, determine a series of scenarios, which will help finding out under which circumstances each of the location management schemes performs best
3. Present and discuss simulation performance evaluation results for a representative sample of location management schemes

Focus

- Location Management Schemes
- User Mobility Model
- Call patterns

Location Management Schemes

1. **Paging Schemes**
    a. Cost
        i. Proportional to number of polling cycles & number of cells in each cycle
    b. Types
        i. Blanket polling: all cells within the location area are polled simultaneously
        ii. Sequential Paging: the current location of the mobile is predicted based on its location probability distribution
2. **Location Update schemes:**
    a. Standard TA schemes:
        i. Cells are grouped into mutually disjoint sets, each being a TA, a cell belongs to exactly one TA, and each UE is registered to only one TA
        ii. While network conditions change, this approach is not effective, in other words, it does not meet the diverse traffic and mobility characteristics of different UEs.

iii. No matter how the TAs are designed, the Ping-Pong effect exists between two neighbor TAs, and sometimes even between three neighbor TAs of a corner.
iv. Standard TA could not solve the problem of high traffic due to simultaneous Updates of a large number of UEs crossing a TA boundary.

b. TAL
   i. Reconfiguration of static TA results service interruption, however thanks self-organizing network (SON) capability of LTE, there is a possibility to change the TAL assigned to each cell in short time intervals without any cost of service interruption
   ii. TAL could solve the most significant problems, which faces standard static TA schemes
   iii. TAL scheme design:
      1. Design TA for UEs (user specific) : the network assigns each UE with a TAL proper to that UE's mobility behavior
      2. Design for cells (cell specific): based on the aggregated movement patterns and call arrival rates of the UEs
   iv. Several optional "user-specific schemes" could be taken into account:
      1. Location-area based schemes
      2. Distance-based schemes
      3. Movement-based schemes
      4. Direction based schemes
   v. Consideration during TAL scheme selection:
      1. Which one results in the lowest signaling overhead (TAU + Paging) ?
      2. Which one is more practical one to be applied in a large-scale network?

c. TAU conditions:
   i. In active mode: cell handover
   ii. In idle mode:
      1. Cell reselection with TAU
      2. Periodic TAU

User Mobility Model

- Users classification :
  - Local users : local residents of the current region, they often follow an ordered pattern to haunt several fixed sites, so that their mobility exhibits strong regularity
  - Global UEs : not local residents of the current region with weak regularity
- Important aspects to consider by modeling:
  - Individual movement behavior based mobility model : Gaussian, Markov, Random Walk & activity based …
  - aggregate movement behavior of users: aggregate traffic congestion, velocity profiles …
  - speed, direction recording of history movement
- Elements included in the model , here I take an example for an individual movement based mobility model – Activity based model

    - Number of activities of interest for a user, which generally take place at different spatial locations
    - Time zone for each activity (for example, movement towards work places)
    - Time periods where certain population resides at certain attractions (working places, shopping hours)
    - Activity duration profile : survey or set by analyst
    - Activity sequential profile
    - Geographic location of activities : location can either be estimated using the geographic distribution of the different movement attraction points (MAPs) or randomly distributed one
    - Optional : recording of movement history
- Classification of Uses: people, people in the any kind of cars/trains

Call patterns model

- Assume the call arrival to the UE follow a Poisson distribution
    - Fix the number of calls
        - Could maybe copy the daily call traffic profiles as observed in published data from telephone network
    - Distribute them over a specific time interval
    - During the day generally higher than in the night
    - Alternative uniform distribution is used to compare

Questions

- Question 1: Considering dynamic TAL schemes: each optimal scheme is obtained periodically using specific algorithm, which is generally based on measured UE mobility and traffic characteristics of Users during the last time interval, and then it would be adopted for next time interval.
    - The Question is, would it be still effective for the next time interval? If not, do we need to design a new algorithms based on statistical data processing?
- Question 2: in our case, do we still to consider our user mobility model presented above?
- Question 3: is there some other aspects that I have not mentioned in this summary?