Neighbor List Update in SON

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

    IEEE C802.16m-08/1382

Date Submitted:

    2008-10-31

Source:

Roberto Albanese, Zexian Li	E-mail:	roberto.albanese@nokia.com
Nokia		
Shashikant Maheshwari	E-mail:	shashi.maheshwari@nsn.com
Nokia Siemens Networks		

Venue:

    Re: SON; in response to the TGm Call for Contributions and Comments 802.16m-08/040 for Session 58

Base Contribution:

    This is the base contribution.

Purpose:

    To be discussed and adopted by TGm for the 802.16m SDD

Notice:

Release:

Patent Policy:

Background

- IEEE 802.16m system will support self organizing mechanisms including:
  - self configuration;
  - self optimization.

- Measurement and reporting play key roles in self organized network. And from SRD (Section 6.4.1 Reporting)
  - IEEE 802.16m shall enable advanced RRM by enabling the collection of reliable statistics over different timescales, including system (e.g. dropped call statistics, BS loading condition, channel occupancy), user (e.g. terminal capabilities, mobility statistics, and battery life), flow, packet, etc.

Neighbor Lists

- Dynamic changing of neighbor BSs is a key feature of SON. Neighbor Lists need to be dynamically updated (which neighbor BS shall be inserted or deleted in the list).

- Typically the MS determines which cells are in adjacent area based on the Neighbor List sent by BS.

- There's a trade-off in the size of the Neighbor Lists
  - too many neighbors in the list: unnecessary measurements/reports → Increased overhead
  - too few neighbors in the list: cells that are good candidates for handovers may be missed → Degraded performance

Motivation for network centric approach in SON

- Self-configuration and self-optimization of Neighbor Lists update in SON can be complex and resource consuming.

- Allowing MS to do continuous or "blind" search for potential Neighbors, can
  - consume too much MS power;
  - degrade the performance of measurements for cells already belonging to the Neighbor Lists, since resources are wasted for unnecessary measurements.

- Is there an efficient way to have Neighbor Lists dynamically updated?
- Is there a way to minimize the unnecessary measurement reports for MS?

Network-centric Neighbor List update

- BS coordinates MSs to generate reports when and where the network has not yet been configured or optimized properly. Different ways of requesting MS to start measurement and reporting, e.g.
  - allowing periodic measurements by MSs;
  - sending broadcast request for measurements, when BS has insufficient data for a certain region;
  - sending requests in a fair way among MSs;
  - limiting the amount of MS measurements based on MS's status.

- Requests from BS include a flag indication in order to distinguish between low and high priority measurements.

- BS will send different requests according to MS traffic conditions. BS will request:
  - serving frequency measurements during MS's high traffic rate periods;
  - non-serving frequency measurements during MS's low traffic rate periods (e.g. inter-RAT neighbor cell measurements).

- MS can decide to delay or even decline sending unnecessary reports to BS especially in critical situations (e.g. low battery level, no changes with respect to previous measurement requests, etc.)
  - MS notifies BS in case the requested measurements will be delayed or can not be completed in a predefined interval, so that BS may decide to reallocate the request to another MS.

Measurement/report optimization

- Example parameters in MS measurement reports are signal quality of a given neighbor cell, BSID on a given frequency, position of MS if GPS or other positioning functionality is supported, etc.

- In addition to signal quality, BSID, MS position, BS also collects information such as
  - MS battery status;
  - report history of a particular MS.

- BS exploits such information in order to decide the subset of MSs that needs to perform measurements and produce reports.

- Based on the information available at BS, BS can
  - reduce the frequency of measurements to MSs with low battery or high power consumption;
  - fairly distribute among MSs the measurement requests;
  - increase the interval between two consecutive measurement requests for those MSs that did not change their position.

- The detailed algorithm is left for implementation.

Proposed SDD text

18 Support for Self Organization

18.x Network-centric Neighbor Scanning

SON can provide network-centric mechanisms for Neighbor List update and MS measurement optimization.

BS can coordinate MSs to generate reports, especially when and where the network has not yet been configured or optimized properly. BS can requests for serving frequency measurements and/or non-serving frequency measurements (e.g. inter-RAT neighbor cell measurements) based on MS traffic conditions. Moreover, BS can request low and high priority measurements.

MS can decide to delay or even decline sending unnecessary reports to BS. In this case MS notifies BS that the report can not be completed in a predefined interval.

Reports to BS may carry information on signal strength, BSID and some additional information, e. g. MS position, battery status and report history for a certain MS. BS can exploit such information in order to select a subset of MSs to perform measurements and produce reports.