Load Balancing By Using Paging Technique for Cellular Network

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Abstract: *Practical load balancing framework that improves upon existing strategies. These techniques are portable to a broad range of prevalent architectures, including massively parallel machines as well as a task selection mechanism that can preserve or improve communication locality. To provide a multiple coverage area, the different tiers are associated with each cell. Each mobile terminal can be paged in any tier of a multi tier hierarchical cellular network. Paging requests are balanced in different waiting queues of different tiers, and the load balancing among them is achieved probabilistically among n tiers. In the process of paging schemes are the hierarchical pipeline paging scheme, the hierarchical sequential paging scheme, and the hierarchical blanket paging scheme can be apply to minimize the delay constraint and paging cost.*

Keywords– *Paging, cellular network, load balancing, HBP, HSP, HPP*

I. INTRODUCTION

Hierarchical cellular architecture, which can achieve increased network capacity while avoiding the pitfall of cell splitting, is a candidate solution to address mobile users' continuously surging demand with limited frequency resources. Location management, as a critical element in maintaining quality of service for mobile users, remains a challenging problem for hierarchical cellular networks due to increased complexity. This optimal load balancing of paging schemes for hierarchical cellular networks. Examples of multitier hierarchical cellular networks include macro cell-microcell two-tier networks, macro cell microcell- Pico cell three-tier networks, and macro cell-microcell- minicell-picocell four-tier networks.

load balance problem is defined as how to minimize the total paging cost using load balancing under the constraint that the average total delay including both queuing delay and paging delay

1.1 Cellular network

A cellular network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver known as a cell site or base station. When joined together these cells provide radio coverage over a wide geographic area. This enables a large number of portable transceivers (e.g., mobile phones, pagers, etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Cellular networks offer a number of advantages over alternative solutions:

- increased capacity
- reduced power use
- larger coverage area
- reduced interference from other signals

1.1.1 Cell signal encoding

To distinguish signals from several different transmitters, frequency division multiple access (FDMA) and code division multiple access (CDMA) were developed. With FDMA, the transmitting and receiving frequencies used in each cell are different from the frequencies used in each neighboring cell.

II. RELATED WORK

a) Reduction of paging cost

Reduction of paging cost [1] can be achieved by concurrent search scheme; the concurrent search approach is able to reduce the average paging cost by 25%. More importantly, this is achieved without an increase in the worst case paging delay or in the worst case paging cost. Depending on the total number of mobile users to be located, total number of cells in the network, and the probabilistic information about the

locations of mobile users, the reduction of the average paging cost due to the usage of the concurrent search approach.
Then the active location reporting scheme to improve the performance of location tracking.

b) Communication between users

The PoC (Push-to-talk over Cellular) application allows point-to-point, or point-to-multipoint voice communi cation [2] between mobile network users. The related work over PoC focuses on the performance analysis only and is completely ignorant about dimensioning PoC controller to optimize revenue for service providers. In this paper, we dimension a PoC controller with the assumption that the network grade of service is provided. The number of simultaneous session initiation by a PoC client is also a configurable parameter.

Each session is controlled by one controlling function. PoC server performs the following when it fulfills the controlling PoC function: a) Provides centralized PoC Session handling, b) Provides the centralized media distribution, c) Provides the centralized Talk Burst Control functionality including Talker Identification, d) Provides Session Initiation Protocol (SIP) Session handling, such as SIP Session origination, release, etc. e) Provides policy enforcement for participation in Group Sessions, f) Provides the Participants information, g) Provides for privacy of the PoC Addresses of Participants, h) Collects and provides centralized media quality information, i) Provides centralized charging reports, j) Supports User Plane adaptation procedures and k) Support Talk Burst Control Protocol negotiation.

c) Location update

Location update [3] involved in two main operation paging and registration. . There is a tradeoff between the paging and registration costs. If the MS registers its location within the cellular network more often, the paging costs are reduced, but the registration costs are higher.

The structure of jointly optimal paging and registration policies is investigated in this paper.

The conditional probability distribution of the states of an MS is viewed as a controlled Markov process, controlled by both the paging and registration polices at each time. The method of dynamic programming is applied, which in particular shows that the jointly optimal policies can be represented compactly by certain reduced complexity laws (RCLs). An iterative algorithm producing a pair of RCLs is proposed based on closing the loop.

d) Paging strategies for 3G mobile

One aspect of wireless networks where such resource consumption costs can be minimized is that of mobility management. The tether-less nature of wireless communications [4], which permits freedom of movement, also results in uncertainty regarding the location of users. When information is to be routed to a mobile unit, the network needs to determine its location. This is done by a three-part mechanism involving: i) the mobile providing *location updates* ii) the network sending *paging messages* within some location area, and iii) the mobile node *acknowledging* its current location in response to the paging message.

Optimal sub channel allocation scheme (OSAS) In OSAS we assign sub channels by solving the LP problem subject to constraint the algorithm is represented by following steps.
1) MS report: Let ***I***< SRFs and M modulation schemes are available. First, MS reports ***Rbi's*** to BS.
2) BS ***report:*** BS reports *Ri3* to a radio network controller that communicates with **BSs.**
3) Cell coordination by LP ***problem:*** After *RF's* **are** received, the solution to the problem, *NF,* is provided with the known values such as *RF,* ***Tbi*** and G.
4) Sub channel allocation to *BS* ***and*** *MS:* **A** radio. Network controller informs **ATP's** to cell ***b,*** which means ***CiNF*** subchannels of SRF k is allocated to cell 6. Then, *N f* subchannels are allocated to user ***i*** in cell ***b .***

III. EXISTING SYSTEM

Inter-cell interference is handled by the classical clustering technique for example, a reuse of 3. While this technique reduces interference for the cell-edge user terminals (UTs), it compromises system throughput due to resource partitioning. Such partitioning schemes may have been good enough for early networks focusing primarily voice service.

3.1 Drawbacks

- Frequency reuse problem in cell edge
- Flooding
- End to end delay

- interference

IV. PROPOSED SYSTEM

Interference management has been a key concept for designing future high data-rate wireless systems that are required to employ dense reuse of spectrum. Interference mitigation techniques are classified into three major categories such as interference cancellation through receiver processing, interference randomization by frequency hopping, and interference avoidance achieved by restrictions imposed in resource usage in terms of resource partitioning and power allocation.

The benefits of these techniques are mutually exclusive, and hence, a combination of these approaches is likely to be employed in the system. Our focus on interference avoidance where a dynamic *inter-cell interference coordination* (ICIC) scheme that makes use of inter-cell coordination is investigate in a multi-cell environment with aggressive frequency reuse. The fractional frequency reuse (FFR) scheme has attracted the attention of the researchers in different standardization bodies and forums. The motivation behind FFR lies in the fact that UTs in the central area of a cell are more robust against interference due to low path-loss and hence they can tolerate higher reuse compared to those at the cell border suffering from high interference as well as high path-losses. Therefore, it makes sense to use different degrees of reuse factor for UTs in the cell-centre and cell-edge areas.

4.1 Soft Frequency Reuse (SFR)

SFR, a variation of FFR, employs zone-based reuse factors in the cell-centre and the cell-edge areas. Restrictions are imposed in terms of allocation of frequency and power in the zones.

The term *soft reuse* comes from the fact that effective reuse of the scheme can be adjusted by the division of powers between the frequencies used in the centre and edge bands.

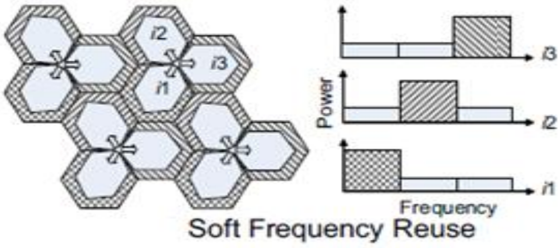

Fig 1: Soft frequency reuse

In order to provide enhanced services to disadvantaged UTs near the cell boundary, SFR was proposed in within 3GPP LTE framework.

4.2 Partial Frequency Reuse (PFR)

Contrary to SFR, the idea of the partial frequency reuse (PFR) is to restrict portion of the resources so that some frequencies are not used in some sectors at all. The effective reuse factor of this scheme depends on the fraction of unused frequency. The PFR and some of its variants are studied in the 3GPP and WINNER projects.

An example of PFR for sites with 3 sectors is shown in Fig.

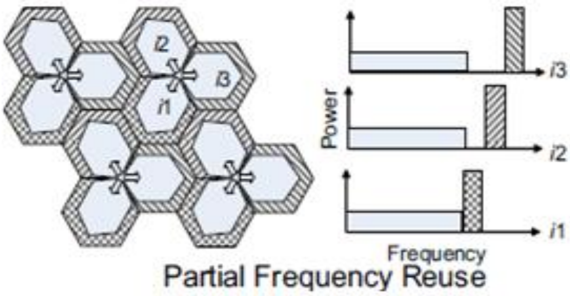

Fig 2: Partial frequency reuse

V. INTERFERENCE AVOIDANCE ALGORITHMS

We describe the sector-level and the central algorithms as follows. Sector-level algorithm prepares utility matrix and prepares chunk restriction requests for each of its first-tier interferers. The central algorithm resolves any conflicting restriction requests and prepares final restriction list for each sector.

5.1 Sector-level algorithm

Two major functions are associated with the sector-level algorithm– namely,

1) Preparation of a utility matrix
2) Preparation of restriction requests

Preparation of the utility matrix: In order to construct the utility matrix in sector i, the following steps are repeated for each UT m and each chunk n.

- Dominant interferers are sorted in descending order of interference powers into a dominant interferer set.
- The conditional SINRs of chunk n for UT m, i.e., $\gamma^{(i)}{}_{m,n}|\Psi=\{\ \}$, $\gamma^{(i)}{}_{m,n}|\Psi=\{\psi_1\}$, and $\gamma^{(i)}{}_{m,n}|\Psi=\{\psi_1,\psi_2\}$, which correspond to restrictions of none, one, and two most dominant interferers, respectively, are calculated from the SINR expression.
- The achievable rates for the above SINRs, i.e., $r^{(i)}{}_{m,n}|\Psi=\{\ \}$, $r^{(i)}{}_{m,n}|\Psi=\{\psi_1\}$, and $r^{(i)}{}_{m,n}|\Psi=\{\psi_1,\psi_2\}$ are determined.

- If $^{(i)}{}_{,}|\Psi=\{\psi_1\} \geq r^{(i)}{}_{m,n}|\Psi=\{\} + r^{TH}{}_{m}$, sector ψ_1 is marked to be restricted if chunk n is to be assigned to UT m.
- If $r^{(i)}{}_{m,n}|\Psi=\{\psi_1,\psi_2\} \geq r^{(i)}{}_{m,n}|\Psi=\{\psi_1\} + r^{TH}{}_{m}$, sector ψ_2 is also marked to be restricted for chunk n.

- After finding the inter-cell dominant interferer(s) to be restricted on each chunk and each UT, achievable rates $^{(i)}{}_{,}$ are calculated. Now, the utility of chunk n for UT m can be expressed as: $u^{(i)}{}_{m,n} = r^{(i)}{}_{m,n}\ d^{(i)}{}_{m}$
- Utility matrix, $^{(i)}{}_{\times N}$, is formed with $u^{(i)}{}_{m,n,}$ where each entry is associated with the corresponding interferer(s).

Applying Hungarian algorithm and finding restriction requests:

Chunks are tentatively allocated (as the central controller might override the restriction requests) in order to reserve chunks for each UT with the following steps.

1) Apply Hungarian algorithm to $^{(i)}{}_{\times N.}$ As $M<<N$, a maximum of M chunks that yield the maximum sum utility will be allocated to the corresponding M UTs.
2) If any of the M chosen entries has restriction marked, the corresponding chunk will be placed in the restriction list for the corresponding interferer.
3) The columns belonging to the chosen entries are deleted from $^{(i)}{}_{\times N}$. The Hungarian algorithm is applied to the updated matrix.
4) Steps 2 and 3 are repeated until all chunks are tentatively allocated to UTs.

5.2 Central-Level Algorithm

The central controller receives requests from a cluster of BSs and resolves conflicting requests in an optimal manner. For example, for a chunk of interest, sector B can tolerate interference from sector A, but the opposite is not true as there is a dashed arrow from sector A toward sector B. In this case, either sector A or B has to be restricted for this chunk.

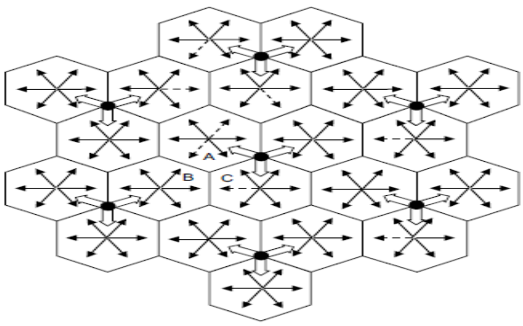

Fig 3: Central level algorithm

For any chunk n, the problem at the central controller can be formulated formally as follows:
Maximize
$Z = \Sigma u^{(i)}{}_{mi,n}(1-x_{i,n})+u^{(j)}{}_{mj,n}(1 - x_{j,n})$, $_{i,\in\Phi}$

Subject to

$x_{i,} + x_{j,} \leq 1,$

Where Φ is the set of sectors in which each sector either requests or is requested for restriction to use chunk n;

i.e., i has restriction request to sector j or vice versa or both have restriction requests to each other. UTs mi and mj are the candidates for chunk n in sector i and j, respectively. The variables $x_{i,}$ and $x_{j,}$ are binary which represent chunk restrictions. The value of $x_{i,}$ (or $x_{j,}$) is 1 if the chunk is restricted in sector i (or j), otherwise, it is zero

The central controller resolves request conflicts and sends refined restriction lists to all involved BSs.

VI. CONCLUSION

The performance of the proposed schemes is compared with that of a number of static coordination-based reference schemes. It is observed from the simulation results that the static coordination schemes achieve enhanced cell-edge throughput only with a significant loss in sector throughput. On the other hand, the proposed schemes achieve better cell-edge throughput without impacting the sector throughput.

The proposed system allow the mobile terminal to balance load in efficient manner, with a help of paging technique. Hierarchical paging is the search process to find out the mobile terminal.

REFERENCES

[1] Gau.R and Haas.Z.J, (2004) "Concurrent Search of Mobile Users in Cellular Networks," IEEE Trans. Networking, vol.12,no.1.pp.117130.

[2] Tsai .M.H and.Lin.Y.B, (2008) "Talk Burst Control for Push-to-Talk over Cellular,"IEEE Trans. Wireless Comm., vol.7,no.7,pp.2612-2618.

[3] Akyildiz,I.F, Ho.J.S.M and Lin.Y.B, (2006) "Movement - Based Location Update and Selective Paging for PCS Networks," IEEE/ACM Transaction. Networking, vol.4, no.4,pp.629-638.

[4] Lyberopoulos.G.LMarkoulidakis.J G Polymeros,D.V. Tsirkas.D.F,,(1995) "Intelligent Paging Strategies for Third Generation Mobile Tele communication Systems," IEEETrans. Vehicular Technology, vol.44,no.3,pp.543-553.

[5] Shan.W,Fan.P and Pan.Y,(2003) "Performance Evaluation Hierarchical Cellular System with Mobile Velocity-Based Bidirectional Call-Over flow Scheme," IEEE Trans.Parallel and Distributed Systems, vol.14,no.1,pp.72-83.

[6] Suand S.L, Chen.K.T ,(2002) "Two-Stage Ensemble Paging Strategy for Cellular Communication Systems," IEEEComm.Letters, vol.6, no.10, pp.425-427.