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Improving the Mean Time in a Wireless Systems Using Automaton Technique

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ABSTRACT: In wireless telecommunication, the network consists of a broadcast server with a set of clients. It sends a group of information to the clients in a desired closed loop path. According to the information send by the broadcasting server the clients access should happen in a cyclic path. In olden days we use fixed directional antennas for transmitting the signal from one place to another. Due to some drawback over the existing one we use multiple directional antennas at the Broadcast Server has been shown to increase performance. In many cases however, such broadcasting systems fail to exploit the full potential of the multiple antennas as they do not take into account the geographical distribution of clients within the coverage area of the system. An adaptive array antenna based wireless push system is designed where the beam width of each smart antenna is altered based on the current placement of clients within the system area. Coupled with a modification of the broadcast schedule, the proposed approach significantly increases the performance observed by the system clients.

KEYWORDS: Data broadcasting, smart antennas, locality of demand.

I. INTRODUCTION

Wireless telecommunications refers to the transfer of information between two or more points that are not physically connected. Distances can be short, such as a few meters for television remote control, or as far as thousands or even millions of kilometers for deep-space radio communications. It encompasses various types of fixed, mobile, and portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Telecommunication is the science and practice of transmitting information by electromagnetic means.

Communication is talking to someone or thing not necessarily through technological means. Telecommunication, however, is talking through technology meaning phones, Internet, radio etc...

In earlier times, telecommunications involved the use of visual signals, such as beacons, smoke signals, semaphore telegraphs, signal flags, and optical heliographs, else the audio messages such as coded drumbeats, lung-blown horns, and loud whistles.

In modern times, telecommunications involves the use of electrical devices such as the telegraph, telephone, and tele-printer, as well as the use of radio and microwave communications, as well as fiber optics and their associated electronics, plus the use of the orbiting satellites and the Internet.

Data broadcasting is the broadcasting of data over a wide area via radio waves. It most often refers to supplemental information sent by television stations along with digital television, but May also be applied to digital signals on analog TV or radio. It generally does not apply to data which is inherent to the medium, such as PSIP data which defines virtual channels for DTV or direct broadcast satellite systems; or to things like cable modem or satellite modem, which use a completely separate channel for data. Data broadcasting, which has emerged as an efficient way of information dissemination in wireless networks, can be characterized by locality of client demands.

An example is the case of a traffic information system. Such an application is characterized by locality of demand, as a driver is obviously more interested in information regarding her neighboring streets than for information regarding streets further away. In environments with locality of client demands, the use of multiple directional antennas at the Broadcast Server (BS) splits the client population to groups of clients that exhibit higher demand skewness and has

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been shown to increase performance . In such a system, each antenna is equipped with a Learning Automaton (LA) whose probability distribution vector determines the popularity of each information item among the clients in the service area of the antenna.

However, depending on the actual placement of clients within the coverage area of the system, there can exist cases where the use of directional antennas of fixed beamwidth limits the amount of performance improvement over single antenna systems. This is because the coverage area of each such antenna is fixed and does not follow the geographical distribution of clients within the coverage area of the system. When this distribution is not uniform, but rather there exist areas with higher density of client groups, there can exist cases where one or more antennas serve a very small, possibly even zero, number of clients, a fact that leads to underutilization of these antennas and consequently to their small contribution to performance improvement. To combat the above problem, this paper proposes to use smart antennas at the BS. The ability of smart antennas to alter their beamwidth is exploited so that the coverage of each antenna is adapted according to the current placement of clients within the system. Thus performance will be improved even more compared to the use directional antennas of fixed beamwidth in cases of non-uniform distribution of the clients within the coverage area of the system. This is due to the fact that each antenna will now have a similar number of clients under its coverage. Moreover, locality of client demands is exploited and thus the broadcast schedule at each antenna is altered, so that it excludes items that are never demanded from clients under its coverage. Simulation results reveal that the proposed approach significantly increases the performance observed by the system clients.

II. SYSTEM DESCRIPTOR

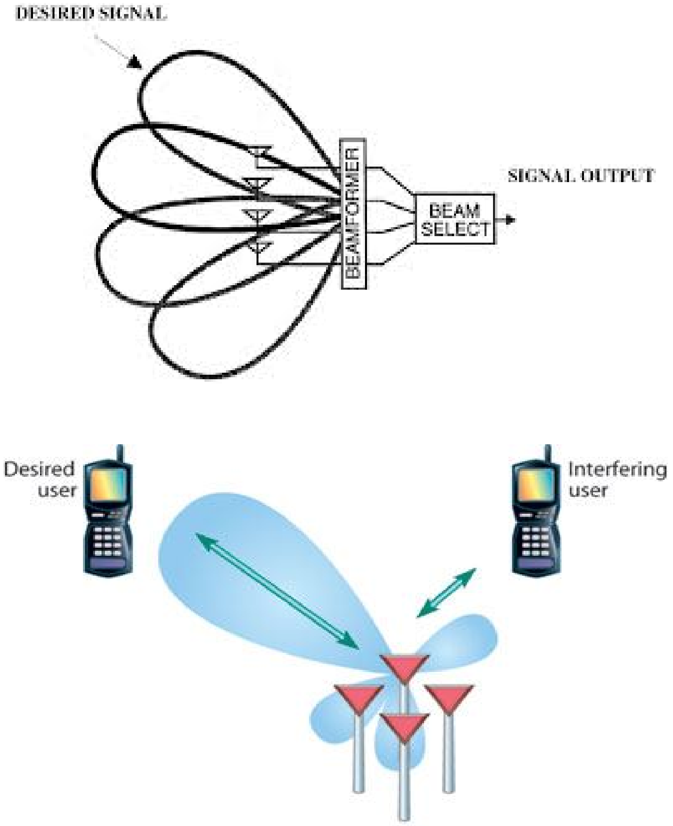

Fig. 1. & 2. Smart Antenna Adaptive Wireless Push System

Due to some disadvantages over the existing system another technique called smart antennas with rescheduling application is used in the proposed system. The use of multiple directional antennas at the Broadcast Server has been shown to increase performance. In many cases however, such broadcasting systems fail to exploit the full potential of the multiple antennas as they do not take into account the geographical distribution of clients within the coverage area of the system.

This proposes an adaptive smart antenna based wireless push system where the beam width of each smart antenna is altered based on the current placement of clients within the system area. Coupled with a modification of the broadcast schedule, this should be done by using learning automaton tool on the broadcasting server side.

The proposed approach significantly increases the performance observed by the system clients. Space Division Multiple Access (SDMA), a technique that requires from smart antennas to form a transmission beam able to follow the movement of a specific client. Satellite communication system also uses the smart antennas for the communication purpose. By using this technique the gain of the signal should be gradually increase to the desired range. In the satellite communication the smart antennas are mainly used to monitor their coverage area. It is also used to preset the beam width according to the location of the subscriber.

A. Systems Characteristics

The topology of the proposed wireless push system, an example of which is shown in Figure 1, consists of a large number of clients and a BS equipped with a number of smart antennas. The fact that the system is of a push nature means that the system clients do not possess the ability to explicitly submit requests for data items, thus each client will wait for the item it demands to appear in the broadcast program c system. This can be achieved by transmit beamforming , which allows a smart antenna to focus its transmit main beam constructed by the broadcast server.

In the proposed system, the ability of smart antennas to change their beamwidth is exploited so that the coverage area of each antenna is changed according to the current placement of clients within the the direction where the desired client receivers reside and steer nulls in the other directions, so that clients residing in areas other than the desired one do not receive any transmission from this antenna.

It has to be noted that such a requirement is nowadays easy to implement by already proposed smart antenna technology, which has gone even further by supporting Space Division Multiple Access (SDMA), a technique that requires from the smart antenna to form a transmission beam able to follow the movement of a specific mobile. The proposed system can thus work with any kind of smart antennas that offer the property of alterable beamwidth, thus with both switched beam smart antennas and adaptive array ones. Switched beam systems employ a number of fixed beam patterns and based on the application requirement determine which beam to access at a given point in time. Adaptive arrays systems are able to steer the antenna beam to any direction of interest while at the same time nulling interfering signals. Each smart antenna is equipped with a Learning Automaton for the estimation of the demand probability of the information items that are broadcast to the clients under its coverage. A LA is an automaton that improves its performance by interacting with the random environment in which it operates. LA have been applied to several problems in the area of wireless networks , including wireless data broadcasting, adaptive mobile ad-hoc networks.

The client population exhibits locality of demand. This means that clients are grouped into groups each one located at a different place with members of each group having similar demands, different from those of clients at other groups. The clients are considered equipped with GPS receivers, a requirement that is common nowadays. Each client acknowledges reception of the item it is waiting for via Code Division Multiple Access (CDMA). The major advantages of this system are Antenna beam width is not fixed. So,the beam width of adaptive array antenna can be adjusted according to the clients. Using of Adaptive array antenna increases the system performance is significantly. Multi- directional signal accessing is possible which enables better performance.

B. The Broadcasting Algorithm and the Probability Updating Scheme

In this module designing the basic system that consists of one broadcasting server and N number of clients are done. According to the population the clients are divided into several numbers of groups. Broadcasting server uses multiple antennas for transmitting the signals to the clients. According to the number of clients the antennas used on the broadcasting server should be changed.Basic system consists of a broadcasting server and a group of clients. According to the number of clients antennas used at the broadcasting server should be changed. In this system we have to use smart antenna for the transmission of information to the clients. The main use of these kinds of antennas is they accept

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signal from all direction and also they adjust their beamwidth according to the client's location. It should be more advantage over the existing system.

An another technique called Learning Automaton tool is used. This tool is mainly used to find the client requirement. Because the system used here is push in nature. So the clients want to demand their requirement to the broadcasting server. This should be carried out by using these types of tools at the BS. The server estimates the next transmission by using the cost function present in this system. The cost function mainly used to find the next transmission, by comparing the current transmission with the previous transmission.

After the information sent by the broadcasting server it should be accessed by the group of clients, according to their response the broadcasting schedule should be arranged by using the learning automaton tool present in this system.

$$G(i) = (T-R(i))^2 \, p_{i/□□} \, ((1+E(□_□)/1-E(□_□)) \quad (1)$$

In this cost function, □ is the current time, □(□) the time when item □ was last broadcast, $□_□$ is the length of item □ and □($□_□$) is the probability that an item of length $□_□$ is erroneously received. For items that haven't been previously broadcast, □ is initialized to -1. If the maximum value of (□) is shared by more than one item, the algorithm selects one of them arbitrarily. Upon the broadcast of item □ at time □,(□) is changed so that □(□)=□.

So we have to find the number of cycles that the program has to be executed and is given in equation

$$N=\sum_{i=1}^{N} f_i l_i \quad (2)$$

The spacing between the information arranged in the broadcasting schedule should be calculating by using the above equation .

C. Using smart antennas for performance increase

The multiple directional antenna system does not fully exploit the potential of the available directional antennas at the BS. This is attributed to the fixed way that these serve the coverage area due to their lack of ability for beamwidth alteration. Therefore a significant room for improvement exists in cases where some of the antennas cover areas with a high density of groups (thus they serve the majority of clients) while the other antennas cover areas with few or no groups.

To this end, the proposed system is equipped with smart antennas instead of directional ones. Based on their capability of altering their beamwidth, the use of smart antennas aims at allocating a similar number of clients to each antenna and thus to achieve a more efficient coverage of the broadcast area in cases where the distribution of clients within the system area is not uniform.

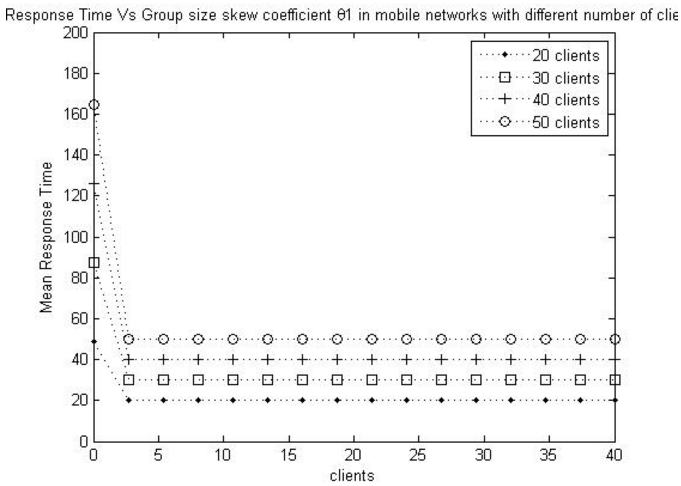

Fig. 2.The mean response time versus group size skew coefficient θ1 in mobile networks with different number of clients.

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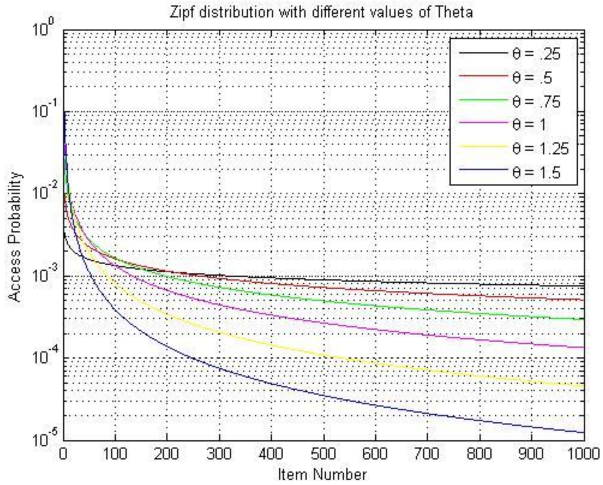

Fig. 3.Zip distribution with different values of theta

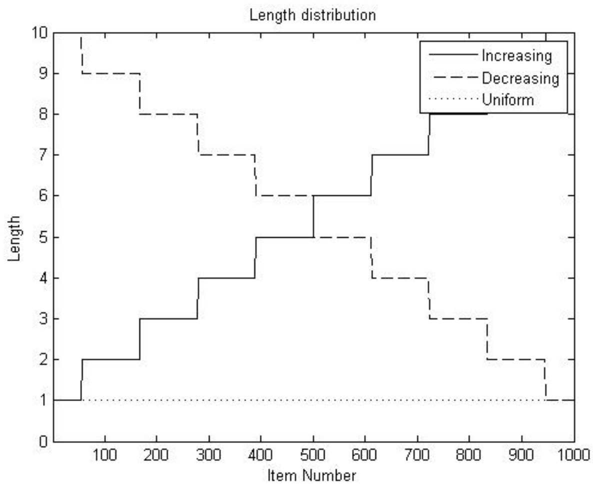

Fig.4. Length distribution with respect to item number

Thus, Figure 2 shows the mean response time versus group size skew co- efficient θ1 when employing the probability distributions for producing the client item demands in network. It can be observed that the performance superiority of the proposed system is again confirmed.

To study the effect on system performance of clients that are moving around at high speeds, Figure 4 compares the proposed approach to that of under the assumption that 10% of the population of each group of clients migrates to a new position every 100 item broadcasts in networks. Fig 3 determines the zip distribution with different values of theta.

III. PERFORMANCE EVALUATION

Consider SA antennas having replicas of the same database of equally-sized items. The antennas are initially unaware of the demand for each item, so initially every item has the same probability estimate. Client demands are a-priori unknown to the server and location dependent. Mean response time is the mean amount of time units that a client has to wait until it receives a desired information item.

Figure 2 shows that the mean response time of the proposed smart antenna-based system with different number of clients. This is due to the fact that the proposed system adjusts its beamwidth so as to efficiently assign the client groups to its antennas. It is worth mentioning the performance difference is increased in networks where the clients are located in fewer quadrants, as in such cases antennas in the system remain unused.

It is also noticeable that while the performance of the system is affected by the geographic distribution of the groups , the proposed scheme has the same performance, despite differences in client placement. This is due to the fact that the ability for beamwidth alteration of the antennas enables the proposed system to assign a similar number of clients to each antenna and thus yield the same performance despite differences in client placement.

IV. CONCLUSION

In this paper,the mean response time versus group size skew coefficient θ1 in mobile networks with different number of clients are analysed which ressults in proving the efficiency of using adaptive array antenna.This paper proposed an adaptive smart antenna-based wireless push system where the beamwidth of each smart antenna is altered based on the current placement of clients within the system. After the antenna assignment procedure, each antenna excludes from its broadcast schedule the information items that refer to geographic areas that are out of its coverage. Simulation results reveal that the above-mentioned properties of the proposed system provide a significant performance increase over the system of that utilizes multiple antennas of fixed beam width.

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