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Time and Energy Optimizing Signature Indexing Technique Perform and Implementation by VHDL

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Abstract - The periodic broadcasting of frequently requested data can The periodic broadcasting of frequently requested data can reduce the workload of uplink channels and improve data access for users in a wireless network. Since portable devices have limited energy capacities associated with their relies on battery power, it is important to minimize the time and energy spent on accessing the required data from the broadcasted data. The indexing in the broadcast data plays an important role in this problem. This research intends to study the indexing technique that is used to save the power and to minimize the access time. The simple signature technique to index data is one of the simplest ways to optimize these factors. The VHDL implementation of simple signature model presented here is real time.

Key Words: Mobile computing, mobile client, broadcast, signature indexing.

I. INTRODUCTION

In the mobile computing environment the efficient utilization of wireless bandwidth and battery power are two of the most important problems that are faced by software designers. Literature review suggests broadcasting (one-way communication) as an effective way to disseminate the public data to portable devices called (MC). Data disseminated through broadcast channels can be accessed simultaneously by any number of mobile users, thus increasing the efficiency of bandwidth usage. The hardware and architecture of the mobile units offer different operational modes that consume different energy levels. Along with these enhancements, techniques such as indexing, broadcasting along parallel channels, and efficient allocation and retrieval protocols can be used to minimize power consumption. In addition, portable devices consume less battery power on monitoring broadcast channels to receive data than accessing data through point-to-point communications. To estimate the efficiency of the broadcast channels, two criteria are frequently used.

Access time: The time elapsed between the moment when a request is issued and the moment when it is satisfied,. which are related to the access efficiency Tuning time: The time a mobile user stays active to receive the requested data items, which is related to the power conservation.

The behavior of the broadcast-based information system is unidirectional which means the server disseminates a set of data periodically to a multiple number of users. With this mechanism, the requests from the clients are not known a priori.

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Data dissemination strategy refers to periodically broadcast database items to clients through one or more broadcast channels and mobile clients filter their desired data on the air . With this strategy, the number of users, their frequency and arrival rate of request do not affect the query access time. Thus, it is regarded as a scalable paradigm. But, the number of broadcast data affects the query performance. It is becoming very challenging to maintain the query access time low while obtaining information from the channel.

II. SIGNATURE TECHNIQUES

There are two fundamental information delivery approaches for wireless data services viz. on demand and broadcast. When number of mobile client accessing the information are large then later approach over perform the former one. It increases the scalability with rationalized use of available bandwidth. Moreover, the real time wireless broadcast system is asymmetric and heterogeneous. Signature is basically an abstraction of the information stored in the record. By examining it we can estimate whether the record contains the desired information. This technique is very suitable for filtering information frames in a wireless broadcasting environment and also used extensively for text retrieval; image database, multimedia database and other conventional database systems. Signatures are constructed from the information frames and broadcasted together with the information frames. The signature may be broadcasted as a group before the information frames. Figure 1, represent the broadcast cycle with position of simple signature.

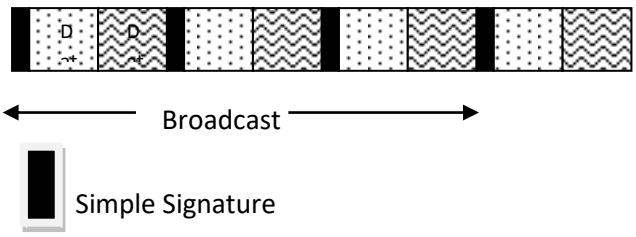

Fig -1: Broadcast Cycle

In wireless environment the signature technique offers the various advantages for information filtering like precise filtering conditions, easy to generate and linearise, less memory requirement and flexibility to use on various type of media. The most intuitive approach for interleaving signature with information frame is to construct a fame signature for each information frame. The signature frame is broadcasted before the corresponding information frame. When a mobile user want to retrieve the information from the broadcast channel it specifies query on the MCs .

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A query signature Sq generated based on the specified query.

Then the MCs tune into the channel and compare Sq with the frame signature received. When a match is found the corresponding information frame is received by the MCs for further checking in order to eliminate false drop. If the frame is not a false drop it will be retained in their result set. When a received frame signature does not match with the query signature, the MCs will switch into doze mode until the next signature frame arrives. If most of the frame signature does not match with the query signature, the MCs will stay in doze mode for the most of time, saving a lot of energy. Initial probe time is the period of time from the moment a user tune to chanel until the first signature is received. During the initial probe time, the user may choose to switch to doze mode until a signature is encountered or to remain in active mode to scan for qualified information frame without the help of signature. In this scheme the average initial probe time is half of the average of an information frame and its signature frames. The access time and tune in time however are dependent on the position of the initial probe.

A. Signature Generation

Signature of a record is formed by hashing technique each value in the record in the random bit string and then superimposing it with the data. Query signature is constructed in the same way as the record and then compared to record signature.

Three possible outcomes of comparisons are (i) true drop i.e. simple signature as well as data following it match with query signature (ii) false drop i.e. only the initial part of signature match but letter part does not qualify to be downloaded and (iii) unmatched i.e. nothing is matched. For instance, if we have to download the information of particular company, we proceed as follows: as the information frame first few bits consist of company's identification and the other bits as data, Simple signature are formed by performing the OR operation on the both the company's identification and data bits. Let we denote this signature as Si. If the information frame is "001000110010000010101001". Then the first 12 bits consist of the company's identification i.e "001000110010" and the next 12 bits represent the data "000010101001".Record signature is formed by performing OR operation of both

- Airtel = 001000110010
- Data = 001000110010
- Record signature (Si) = 001010111011

Airtel	Data

Fig 2: Record signature for the information of Airtel data

B. Comparison with query signature

The AND operation of record signature (Si) and the query signature (Sq) is performed. Then this Si is compared with Sq and it results two outcomes:

- If Si matches with Sq it means that a match has occurred and the information frame contains the desired information result the MCs in active mode.
- If Si does not match with Sq it means there is no match and the information frame does not contain the desired information, resulting the MCs in doze mode. No further matching is required.

C. Comparisons in active mode

When the PCS is in active mode then further comparison is done, now the comparison is done between the Query signature and Data. The comparison results two outcomes as either there is a match then it is true drop or it does not match then it is false drop.

III. INFORMATION BROADCASTING

In broadcasting, the base station sends out the series of information frames. Since the information frames are broadcast periodically, a complete broadcast of the information frames is called broadcast cycle. From the user's point of view, the broadcast information is perceived as a stream of frames flowing along the time axis. Logically there is no specific start and end frames for a broadcast cycle. In broadcast cycle some important information frames may be replicated. Information frames may be inserted, deleted and modified. The updates will be reflected in the subsequent broadcast cycle. Access method can be developed so that MCs can be turned off when the frame being broadcasting is not qualified. By switching between active mode and doze mode power consumption is reduced. In order to tell which frames would qualify ahead of time, auxiliary information about the contents of the frames must be added. Due to the limited number of broadcast channel available we assume that only one channel is used for both primary and auxiliary information. With only one channel, the auxiliary information will increase the length of the broadcast cycle and thus increase access time. However, it will reduce tune in time, because it allows the MCs to avoid tuning into unwanted information frames. Thus, we must trade off between access time and tune in time. Simplicity of the signature file makes it highly suitable for real time information filtering under stringent processor and memory size.

IV. PERFORMANCE ANALYSIS

The data filtering process can be affected by various factors like number and size of signature, filtering capacity, false drop probability and initial probe time etc. now we will evaluate the performance of our model based on these factors to find access and tune time.

Symbols:

Si	Record Simple Signature
m	Length of a signature in bits
p	Numbers of bits in a packet
r	Number of packet in a simple signature
A	Number of information frame in a broadcast cycle
Af	Number of information frame received due to false drops
At	Number of information frame received due to true drops
Pf	Probability of false drop of data
Pfs	Probability of false drop in signature

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The total numbers of packets for the simple signature in a cycle is :

SIGs = (m/p)*A = A.r

CYCLEs denotes the length of the complete cycle for the simple signature scheme.

CYCLEs = SIGs + DATA

The average initial probe time is

PROBEs = (r + n)/q

After the initial probe period the filtering process will last for a complete broadcast cycle. Therefore the average access time is the sum of initial probe time and the broadcast cycle.

ACCESSs = PROBEs + CYCLEs= (A + 0.5) (r + n)

PTs denote the period in which the MCs is active during the initial probe time.

$$PTs = \frac{r .1/2. r + n .1/2.n}{r+n}$$

To estimate the tune in time we have to first estimate the number of true drops.

Ps denote the selectivity of a query, the number of true drops is

At = A.Ps

In the filtering process the MCs has to tune in for all of the signature frames. In addition it has to tune in for the true drop and false drop information as well. Therefore, the tune in time is

TUNES:-

= PTs + SIGs + At . n + Af . n

=PTs + SIGs + At. n + Pfs. A. n – Pfs . At. N

=PTs + SIGs + A . n . Ps + A .n . Pfs – A .n. . Ps .Pfs

= PTs + SIGs + DATA. Ps + DATA. Pfs – DATA. Ps .Pfs

V. VHDL IMPLEMENTATION

As the signature is basically the abstraction of the information stored in a record. During filtering, a query signature is constructed in the same way & then compared to the record signatures. The VHDL protocol for comparison should be followed while implementing on real time system.

- The record matches the query that is for every bit set in the query signature, the corresponding bit in the record signature is also set (i.e. the bit string Sq ^ Si = Sq). It is true match. The Sq is again match to data if Sq =Data client remain in active mode and frame will be down loaded.
- The record does not match the query (Sq ^ Si ≠ Sq) it is unmatched client and client goes to doze mode.
- The signature comparison indicates a match but the record infect does not match the search criteria. It is false drop (Sq ^ Si = Sq but Sq ≠ Data).

The last case is called the false drop. To eliminate false drop the record must be compared directly with the query after the record signature signifies the match. A signature failing to match the query signature guarantees that the corresponding record can be ignored. The signature technique is good at screening out unqualified records. Table 1 shows Record (Simple Signature) and Information Frame

Table -1: Record (Simple Signature) and Information Frame

Record (Simple Signature)	Information Frame
0010101110	001000110010000010101001

There are three queries for three companies Airtel, Idea and BSNL respectively are (in the form of signature)

Sq1 = Sq (Airtel) = 000010101001

Sq2 = Sq (Idea) = 010001000011

Sq3 = Sq (BSNL) = 001000111000

Data="000010101001"

Sq1="000010101001"

(Si) RS="001010111011" (AND operation)

G1="000010101001"

G1= Sq1 ^ Si = Sq1. G1 is compared to data.

G1 = Data So it is true match.

G2="000000000011"

G2= Sq2 ^ Si ≠ Sq2. So it is unmatched.

G3="001000111011"

G3= Sq3 ^ Si = Sq3. G3 is compared to data. G3 ≠ Data. So it is false drop.

The comparison result can be summarized as followings(Table-2):

Table -2: comparison result of Airtel,Idea,Cellone

Queries	(SQ) Query Signature	Results
Airtel	000010101001	Match
Idea	010001000011	No match
Cellone	001000111000	False drop

A. Simulation Results

The Simulation results of various outcomes are shown in figure 3, 4, 5.

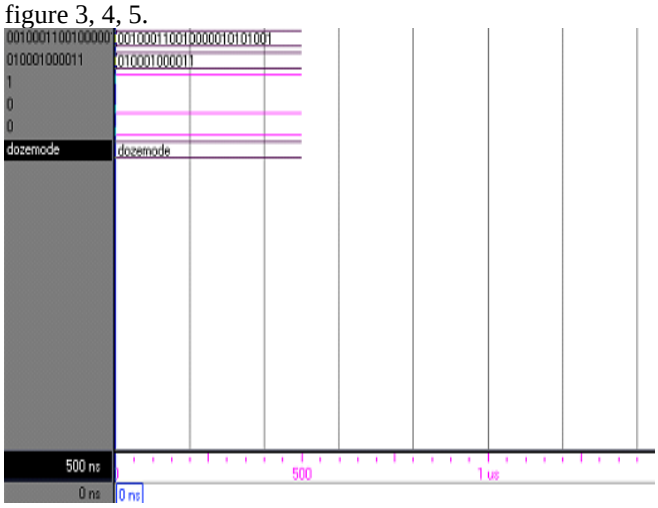

Fig -3: Doze mode

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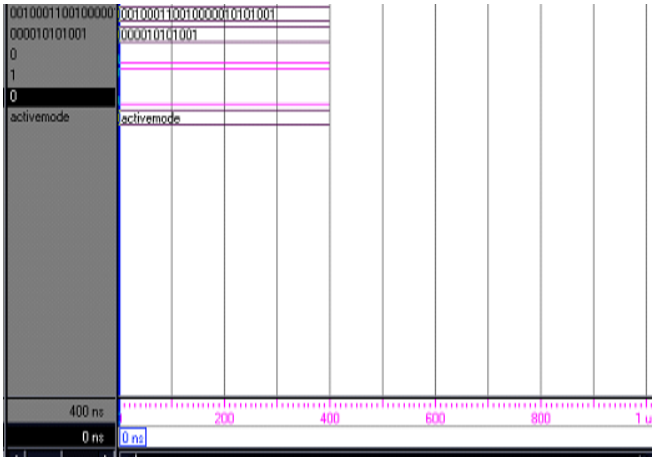

Fig -4: False drop

When Si ^ Sq ≠ Si then client goes to doze mode as in figure 3 to the save power. If Si ^ Sq = Si and Sq = Data then client remain in active mode to down load the required data as in figure 4 and if Si ^ Sq =Si but Sq ≠ Data then it is false drop and client goes into doze mode to save power as in fig 5.

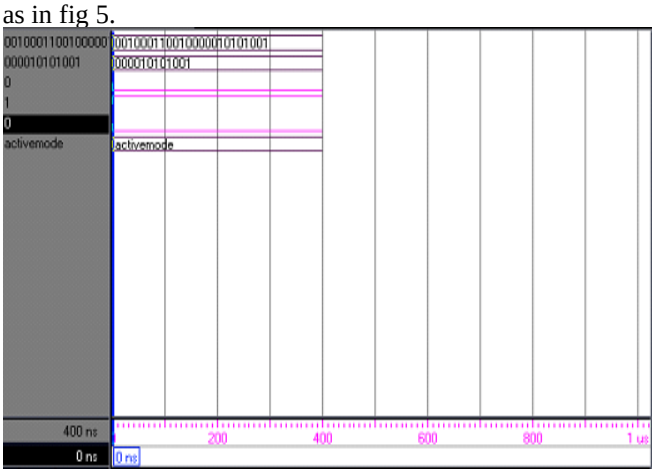

Fig -5: True drop

VI. CONLUSION

For broadcast channels, the base station sends out the information frames along with the signature. After retrieve the frames off the air, users specify queries on the frames (e.g., by specifying a text pattern on a text field). The portable devices will monitor the broadcast channels and gives to the user frames to matching the queries.

In this paper, we assume that all information to the clients, including data and auxiliary index information, is sent on a broadcast channel. We assume only one channel for broadcasting, because a channel with large bandwidth is logically the same as multiple channels with combined bandwidth of the same capacity. The outcome of the VHDL implementation of simple signature is presented in simulation result. It gives a quick way to compare the signature and send the client quickly to doze mode if no need of further match. The chip of this model will be multi usage. This gives implementation gives real time implementation of simple signature. The results obtained from VHDL implementation of simple signature are much easy to obtain and multi usage then other simulations. So VHDL implementation of simple signature strategy to manage data broadcast.

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