# UNITED STATES PROVISIONAL PATENT APPLICATION

For

# SWITCHED BROADCAST IMPLEMENTATION

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# SWITCHED BROADCAST IMPLEMENTATION

[0001]     Switched Broadcast (SwB) is a new concept accepted enthusiastically, especially by the cable television operators. Essentially, it offers broadcast programs on demand only. This way, precious bandwidth is saved. See, e.g., US patent application number: 09/841579, entitled METHOD AND SYSTEM FOR PROVIDING MULTIPLE SERVICES TO END-USERS, filed April 23, 2001, assigned to the assignee of the present invention and incorporated herein by reference.

[0002]     In order for this scheme to work, an SwB client is installed in the home viewer's set-top box (STB). Today's STBs have known channels and methods to communicate with the operators' head-ends. These communication lines are used to convey to the head-end information regarding the channel a viewer wants to watch, and to convey to the STB, technical parameters of the desired program (such as frequency, program number, etc.). These communication lines have limited bandwidth. Therefore there is a need to reduce the amount of traffic on them. Another problem is that viewers sometimes switch off their television sets but leave the STB on. This way, the head-end does not know that a viewer has stopped watching the desired program. The present invention provides methods to overcome these and other problems.

[0003]     In order to reduce communication between the multitude of STBs and the head-end, the head-end periodically send to the STB a list of currently available programs and their parameters. Occasionally, the head-end also sends update messages of this table. This way, if the program is available, the STB doesn't need to request it specifically from the head-end.

[0004]     Programs may sometimes move to a "regular" broadcast mode based on automatic policy based mechanisms. This can happen only on individual service groups. At different times, these programs can return to be switched broadcast programs.

[0005]     Viewer behavior is modeled constantly. This way, the system can decide that it is highly likely that a program being broadcast is actually not viewed by anyone. It can remove this program and free bandwidth for other programs. In order to eliminate mistakes, viewers who are watching these programs may receive a warning prior to the removal of the program. If none of them respond within a certain period, the program will be removed

[0006]     In order to reduce tuning times, more popular programs may be broadcast when there is available bandwidth even in nobody requested them. Eventually, if the popularity of these programs continues to increase, they may move out of the SwB pool and into the regular broadcast pool.

[0007]     It is very important to avoid cases where viewers can watch incorrect content (such as adult content). This can be avoided by the SwB system if it allocates to the different programs fixed and unique parameters such as program numbers and PIDs.

[0008]     Since most programs are encrypted, they cannot be RateShaped at the edge. However, there is no need to set to each program a fixed constant bit rate. There may be some pre-defined encoding levels used.

[0009]     A Dynamic Channel Map (DCM) is transmitted to all Switched Broadcast clients. It enables the following

- o   Switched Broadcast Clients can be aware of the programs being transmitted at any moment and can pre-tune to them in advance of receiving this tuning information from a Switched Broadcast Server. This reduces the overall channel change time and increases the performance of the system.

- o   The Switched Broadcast Server can mark a flag in the DCM that indicates that a channel is subject to be removed. This can prompt a Switched Broadcast client to take some action to allow this action to occur, prevent this action to occur, or notify the user of this impending action to prompt a user response. This optimizes the utilization of stream bandwidth.

- o   A popular Switched Broadcast channel can be flagged as "static". In this mode, the Switched Broadcast Client can rely on the DCM and need not send a channel request message to the Switched Broadcast Server. This allows out-of-band network traffic to be minimized/optimized.

[0010]     When a Switched Broadcast Channel Change message is sent, it includes diagnostic information from previous channel change transactions. This information is useful to transmit and log on the Switched Broadcast Server for gathering intelligence about the overall health of the service.

[0011]     A Switched Broadcast System can employ the use of pre-encrypted content. This eliminates any dependencies on the incumbent headend management system for overall system operation.

[0012]     The Switched Broadcast Client-Server protocol features two message types – an "init" message that is sent only once, and a channel change message that is sent whenever a channel is requested. By moving static information to the init message, the size of the channel change message is minimized and out of band network efficiency is thus optimized.

[0013]     Switched Broadcast clients periodically send a "keep alive" message to a Switched Broadcast Server. This allows the Switched Broadcast Server to affirm the functional state of the system. It also allows a backup Switched Broadcast Server to ascertain

the system state after one time cycle of keep-alive messages has propagated through the system.

[0014] A Switched Broadcast System shares streams with other subscribers watching the same program, though it is not necessary to do so. It is possible to construct a Switched Broadcast system where every client receives a private unicast stream, and the switching is performed on an individual basis at the hub. Such a system yields the following advantages:

- In a unicast Switched Broadcast system, the frequency, Program number, and PID values for a Switched Broadcast client can remain constant. This accelerates tuning times because the client does not need to change the tuning frequency or parse Program Map Tables to view a program.
- Tuning time can be further accelerated by adding intelligence at the headend. Multiple versions of a broadcast program can be created, staggered in time. When a Switched Broadcast program is selected, the staggered program that will produce the fastest decode time can be dynamically selected for downstream transmission.
- Tuning can also be facilitated if a stream is transmitted to a client only at an I frame. Alternatively, just before transmitting to a client, the headend transcodes a P frame into an I frame, transmits that new frame and continues transmitting the original stream immediately after the original P frame. To help enhance the seamless experience, B frames may be replaced by black frames around the switch point.