2005－EIP－27（5）
2005／3／19

A Proposal on Advertisement Distribution Model and Discussion on Its Experiment

Pao Sriprasertsuk† Akiko Seki† Wataru Kameyama† Nobuyuki Kinoshita†† Tatsuo Inoue†† Yasuhiro Nakanishi††
†Global Information and Telecommunication Studies, Waseda University
1011 Okuboyama Nishi-Tomida Honjo-shi Saitama 367-0035 Japan
††Melodies & Memories Global Limited
9Floor, Kitsune Bldg. 2-12-8、Tsukiji, Chuo-ku, Tokyo 104-0045 Japan
Email: †pao@akane.waseda.jp, †akiko@aoni.waseda.jp,†wataru@waseda.jp,
††kinoshita@m-m-g.net, ††inoue@m-m-g.net ††nakanishi@m-m-g.net

Abstract Almost traditional advertisement distribution methods have concerned only primary information distribution. However, according to the rapid growth of the Internet and interactive media, we can not disregard the power and efficiency of secondary information distribution by information consumers. Unfortunately, the advertisement distribution model which can be used to analyze and measure the effectiveness of such a secondary distribution has not been ever discussed. Thus, in this paper, we propose an advertisement distribution model and how to use the model to analyze advertisement distribution including primary and secondary information distributions. Subsequently, our future works are discussed in the last section.

1. INTRODUCTION

Traditionally, almost the secondary distributions of advertisements, distribution by consumers to consumers, have been done by "power of mouth". However, according to the rapid growth of the Internet and interactive media, the secondary information distribution can be performed effectively by various ways such as e-mail and etc. Consequently, we can not disregard the power of this distribution anymore. Nevertheless, until now the measurement methods of the effectiveness of advertisement distribution are only audience rating survey and questionnaire, and these methods can measure only the effectiveness of primary information distribution, distribution by providers or broadcasters to consumers. In order to analyze efficiently the next generation of advertisement distribution, not only measurement and analysis of primary distribution but also the secondary distribution are undeniably required. Unfortunately, the advertisement distribution model which can be used to analyze and measure the effectiveness of secondary distribution has not been ever conducted. Hence, we propose the advertisement distribution model which can be used to analyze and measure the entire circulation including primary and secondary information distribution.

2. THE PROPOSED MODEL

We proposed the advertisement model and analyzed characteristics of advertisement distribution[1][2]. In our consideration, advertisement can be consciously and unconsciously distributed by consumers and its distribution can occur repeatedly including push and pull model. Thus, to find and analyze the factors for realizing such distribution, in this paper we propose advertisement distribution model as shown in *Figure 1*. This model is composed of 6 states and 11 operations.

The definition of each state is clarified as follows:

1. Ready for Primary Distribution
   In this state, advertisers or sponsors are ready to inject their advertisements to networks including push and pull model of distribution.
2. Primary Pushed
   In this state, the distributed advertisement is already arrived to consumers from advertisers but the consumers are not consumed it yet. For instance, newspaper and magazines are shown in a store, CM is broadcasted from a broadcaster, and email is transmitted and reached to a received messages box.
3. Consumed
   Users consumed consciously or unconsciously advertisements in this state. All of consumption methods such as watched, listened and read are considered as a same method.
4. Ready for Secondary Distribution
   For this state, consumers are ready to redistribute consumed advertisements to the third person by push or pull model. For example, they can forward them by email, or consumers put the advertisements in their own servers to be able to be accessed from anyone.
5. Secondary Pushed
   The redistributed advertisement is already arrived to the third person from a consumer but the third person is not consumed yet. In the other words, this state is similar to "Primary Pushed" state but it is done by consumers not advertisers or sponsors.
6. Discarded
   In this state, the distribution of advertisement is terminated and it will not occur or anyone can not consume it again.

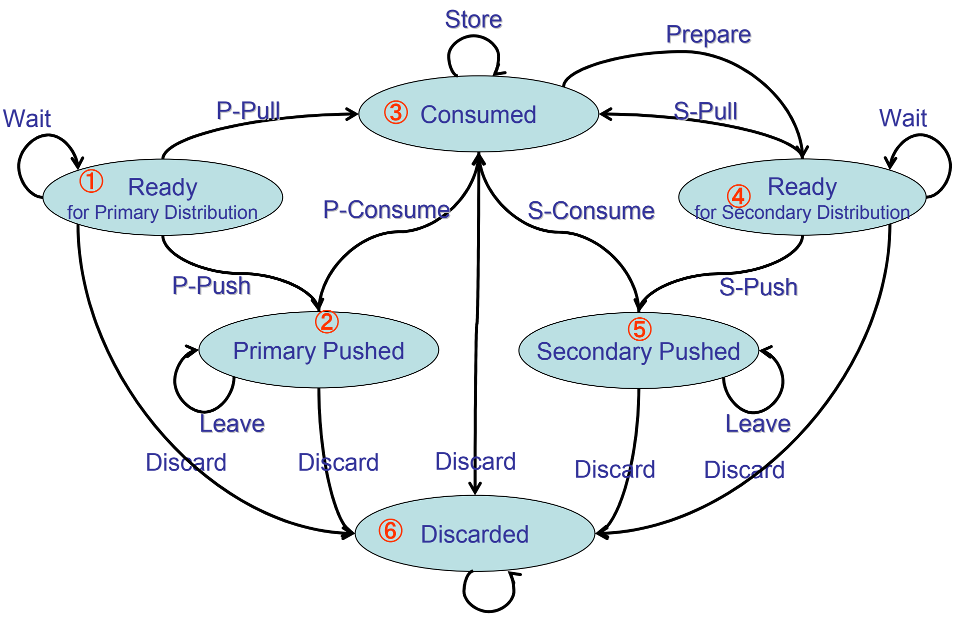

Figure 1: The Proposed Advertisement Distribution Model

The definition of each operation is clarified as follows:

1. Primary Push (P-Push)
   Advertisers or sponsors distribute advertisements to consumers by push model.
2. Primary Pull (P-Pull)
   Consumers access to advertisers or sponsors to acquire advertisements such as accessing to web advertisements
3. Secondary Push (S-Push)
   Consumers redistribute consumed

advertisement to the third person by push model.

4. Secondary Pull (S-Pull)
   The third person accesses to consumers to acquire the advertisements prepared by consumers.
5. Primary Consume (P-Consume)
   Consumers consume advertisements distributed by advertisers or sponsors.
6. Secondary Consume (S-Consume)
   Consumers consume advertisements redistributed by other consumers.
7. Discard
   Consumers or advertisers terminate advertisements
8. Wait
   Advertisers or consumers are waiting for distributing advertisements including push and pull model. During the waiting, they have also potential for distribution.
9. Leave
   Consumers keep arrived advertisements to consume later.
10. Store
   After consumed, consumers record or store the advertisements on them.
11. Prepare
   Consumers make the secondary information distribution be possible. For example, copy, edit, transform and etc.

3. THE ANALYSIS METHOD

As illustrated in *Figure 2*, we define "Ready for Primary Distribution", "Primary Pushed", "Consumed", "Secondary Distribution", "Secondary Pushed" and "Discarded" as S_1, S_2, S_3, S_4, S_5 and S_6 respectively and these states can be described as S_k $(1 \leqq k \leqq 6)$. Furthermore, we also describe transition probability from S_i $(1 \leqq i \leqq 6)$ to S_j $(1 \leqq j \leqq 6)$ as a_{ij}. Thus, the state transition probability matrix of our proposed model can be shown in *Figure 3.*

According to *Figure 2*, the proposed model can be considered as Markov Chain Model. Consequently, the matrix model shown in *Figure 3* can be analyzed by the Markov Chain theory. The principle process for practical analysis of advertisement distribution in this model is how to establish or use values or functions of a_{ij}. Furthermore, a_{ij} can be estimated to predict the distribution result in the proposed model.

We have been expecting that according to the analysis, a set of the transition probabilities which can increase effectiveness or prevent degradation of advertisement distribution will be discovered. Consequently, the main factors which can realize such probabilities will be applied to practical advertisement distribution to enhance their potential and effectiveness.

In order to prove that the Markov Chain can be used to analyze our model as discussed above, we are investigating comprehensively the analysis method and making practical experiments.

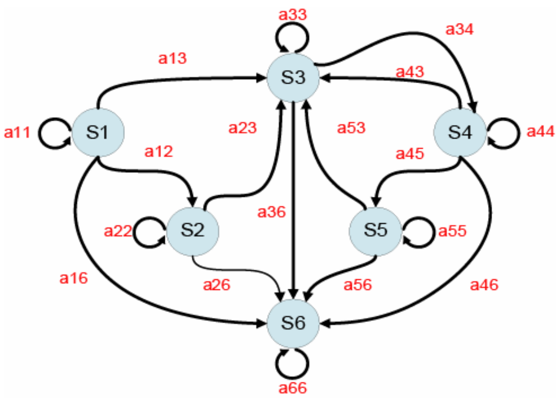

Figure 2: The Proposed Advertisement Distribution Model

From \ To	S1	S2	S3	S4	S5	S6
S1	$a11$	$a12$	$a13$	0	0	$a16$
S2	0	$a22$	$a23$	0	0	$a26$
S3	0	0	$a33$	$a34$	0	$a36$
S4	0	0	$a43$	$a44$	$a45$	$a46$
S5	0	0	$a53$	0	$a55$	$a56$
S6	0	0	0	0	0	$a66$

Figure 3 :The State Transition Probability Matrix

4. EXAMPLES OF USING THE PROPSOED MODEL

4.1 Example 1: Handbills and Emails

To clarify using our proposed model, an example of using handbills and emails as primary and secondary information distribution respectively is shown in *Figure 4*. In other words, in this example, firstly handbills are distributed by advertisers to consumers. After consumers consume distributed handbills, some consumers use e-mail to redistribute information of handbills to the third person. As discussed in section 3, the mapping of each state is described as following:

1. S_1 = Waiting for distribution
   Advertisers are waiting for opportunity to distribute handbills.
2. S_2 = Distributing
   Advertisers or providers are distributing handbills to consumers.
3. S_3 = Receiving handbills or emails
   Consumers received handbills or forwarded e-mails
4. S_4 = Waiting for transmitting email
   Consumers created e-mails and be waiting for transmitting the emails.
5. S_5 = Transmitting
   The e-mails are transmitted
6. S_6 = Discarded
   The distribution is terminated. For instance, the handbills are discarded or e-mails, are deleted.

As discussed in section 3, the transition probability (a_{ij}) have the properties shown in below.

$$a_{ij} \geq 0,\ all\ i, j$$
$$\sum_{all\ j} a_{ij} = 1,\ all\ i \qquad (4.1)$$

The mapping of each a_{ij} is also clarified as follows:

1. a_{11} = Transition from S_1 to S_1
   According to the equation 4.1 and a_{13}=0, a_{11}=1- a_{12}
2. a_{12} = Transition from S_1 to S_2
   a_{12} is considered as probability of primary handbills distribution. The probability can be calculated by dividing *"Number of expected distributed handbills"* by *"Number of published handbills"*.
3. a_{13} = Transition from S_1 to S_3
   Since, there is no pull model of information distribution in this mapping model, this transition probability is always "0".
4. a_{16} = Transition from S_1 to S_6
   a_{16} is considered as probability of remainder at the end. The probability value can be shown as below, where $t = time$.

$$a_{16} = \begin{Bmatrix} = 0(t \neq end) \\ = 1(t = end) \end{Bmatrix}$$

   a_{16} is always equal "0" during the distribution of handbills and "1" when the distribution is finished.
5. a_{22} = Transition from S_2 to S_2
   According to the equation 4.1, a_{22} = 1-($a_{23}+a_{26}$)
6. a_{23} = Transition from S_2 to S_3
   a_{23} is considered as probability of practical distribution. The probability can be calculated by dividing *"Number of real distributed handbills"* by *"Number of expected distributed handbills"*.
7. a_{26} = Transition from S_2 to S_6
   a_{26} is considered as probability of discard at the end. The probability value can be shown as below, where $t = time$.

$$a_{26} = \begin{Bmatrix} = 0(t \neq end) \\ = 1(t = end) \end{Bmatrix}$$

   a_{26} is always equal "0" during the distribution of handbills and "1" when the distribution is finished.
8. a_{33} = Transition from S_3 to S_3
   a_{33} is considered as probability of storing handbills and emails. This operation means that consumers only stored handbills or emails on them without any actions such as redistribute or discard. The probability can be calculated by dividing *"Number of stored handbills and*

emails" by *"Number of real distributed handbills and successful transmitted emails"*

9. a_{34} = Transition from S_3 to S_4

   a_{34} is considered as probability of creating e-mail to forward. This transition means that after consumers consumed the handbills advertisement or forwarded emails, if they create an email to forward the advertisement information to someone, the state S_3 will transit to S_4. The probability can be calculated by dividing *"Number of people who created email to forward"* by *"Number of people who received handbills and forwarded emails"*

10. a_{36} = Transition from S_3 to S_6

    a_{36} is considered as probability of discard. According to the equation 4.1, $a_{36} = 1-(a_{33}+a_{34})$

11. a_{43} = Transition from S_4 to S_3

    Since, there is no pull model of information distribution in this mapping model, this transition probability is always "0".

12. a_{44} = Transition from S_4 to S_4

    In the case of email, probability of this transition is always "0".

13. a_{45} = Transition from S_4 to S_5

    a_{45} is considered as probability of transition. According to the equation 4.1 and $a_{44}=0$ and $a_{46}=0$, $a_{45}=1$.

14. a_{46} = Transition from S_4 to S_6

    In the case of email, probability of this transition is always "0".

15. a_{53} = Transition from S_5 to S_3

    a_{53} is considered as probability of successful transmitted email. The probability can be calculated by dividing "Number of successful transmitted email" by "Number of transmitted email".

16. a_{55} = Transition from S_5 to S_5

    In the case of email, probability of this transition is always "0".

17. a_{56} = Transition from S_5 to S_6

    a_{56} is considered as probability of transmission error. According to the equation 4.1 and $a_{55}=0$, $a_{56}=1-a_{53}$

18. a_{66} = Transition from S_6 to S_6

    This transition is always "1".

4.2 Example 2: Radio and "Word-of-Mouth"

Another example is shown using radio broadcast and "word-of-mouth" as primary and secondary information distributions, respectively. In this example, firstly radio advertisement is broadcasted from a broadcaster. Subsequently, some consumers redistribute broadcasted advertisement information by using "word of mouth" to the third person. After mapped this example to our model, the model is illustrated as shown in *Figure 5*.
The mapping of each state is described as follows:

1. S_1 =Waiting for distribution

   Advertisers are waiting for opportunity to broadcast radio

2. S_2 =Distributing

   Broadcasters are broadcasting radio to consumers.

3. S_3 =Listening CM from broadcasters or CM information from other consumers

   Consumers listened CM from broadcasted radio or broadcasted information from other consumers by "word-of-mouth"

4. S_4 =Thinking to inform listened CM information to the third person

   Consumers are thinking to inform broadcasted CM information to the third person.

5. S_5 =Informing

   Consumers are informing the information to the third person by using word-of-mouth

6. S_6 =Discarded

   The distribution is terminated. For example, consumers forget CM information or they turn-off the radio channel.

The mapping of each transition probability is also clarified as follows:

1. a_{11} = Transition from S_1 to S_1

   According to the equation 4.1 and $a_{13}=0$, $a_{11}=1-a_{12}$

2. a_{12} = Transition from S_1 to S_2

a_{12} is considered as probability of CM broadcast. The probability can be calculated by dividing *"Time for CM broadcast"* by *"Time for total broadcast"*

3. a_{13} = Transition from S_1 to S_3

Since, there is no pull model of information distribution in this mapping model, this transition probability is always "0".

4. a_{16} = Transition from S_1 to S_6

a_{16} is considered as probability of remainder at the end. The probability value can be shown as below, where $t = time$.

$$a_{16} = \begin{Bmatrix} = 0(t \neq end) \\ = 1(t = end) \end{Bmatrix}$$

a_{16} is always equal "0" during the broadcasting radio and "1" when the broadcast is finished.

5. a_{22} = Transition from S_2 to S_2

Since, radio broadcast is a kind of real time communication, probability of this transition is always "0".

6. a_{23} = Transition from S_2 to S_3

a_{23} is considered as probability that consumers turn the channel on. The probability can be calculated by dividing *"Number of people who turn on the channel"* by *"Number of people who have receivers".*

7. a_{26} = Transition from S_2 to S_6

a_{26} is considered as probability that consumers turn the channel off. According to the equation 4.1 and a_{22} =0, a_{26} = 1-a23

8. a_{33} = Transition from S_3 to S_3

a_{33} is considered as probability that consumers only listened CM from broadcasters or broadcasted information from other consumers without other actions such as informing to the third person. The probability can be calculated by dividing *"Number of people who only listened CM information"* by *"Number of people who listened CM" information".*

9. a_{34} = Transition from S_3 to S_4

a_{34} is considered as probability that consumers think to inform CM information to third person. This probability can be calculated by dividing *"Number of people who think to inform the CM information to the third person"* by *"Number of people who listened to the CM information from broadcasters or other consumers"*

10. a_{36} = Transition from S_3 to S_6

a_{36} is considered as probability that consumers listened CM information but after that they forget the information. According to the equation 4.1, a_{36}=1-($a_{33}+a_{34}$)

11. a_{43} = Transition from S_4 to S_3

Since, there is no pull model of information distribution in this mapping model, this transition probability is always "0".

12. a_{44} = Transition from S_4 to S_4

In the case of word-of-mouth, probability of this transition is always "0".

13. a_{45} = Transition from S_4 to S_5

a_{45} is considered as probability of transition. According to the equation 4.1 and a_{44}=0 and a_{46}=0, a_{45}=1.

14. a_{46} = Transition from S_4 to S_6

In the case of word-of-mouth, probability of this transition is always "0"

15. a_{53} = Transition from S_5 to S_3

a_{53} is considered as probability of successful informers. This transition means that a consumer is successful to inform the CM information by using word-of-mouth. The probability can be calculated by dividing *"Number of successful informers"* by *"Number of people who informed the third person".*

16. a_{55} = Transition from S_5 to S_5

In the case of word-of-mouth, probability of this transition is always "0"

17. a_{56} = Transition from S_5 to S_6

a_{56} is considered as probability of unsuccessful informers. According to the equation 4.1 and a_{55}=0, a_{56}=1-a_{53}

18. a_{66} = Transition from S_6 to S_6

This transition is always "1".

5. CONCLUSION AND FUTURE WORKS

We propose an innovative advertisement distribution model which can be used to measure the effectiveness both of primary and secondary distribution. Subsequently, the model will be analyzed by using the Markov Chain and utilized to find what are the key factors for realizing super distribution advertisement, respectively.

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[2] S.Pao, Akiko Seki, Wataru Kameyama, Nobuyuki Kinoshita, Tatsuo Inoue, Yasuhiro Nakanishi, "A Proposal on an Advertisement Model and Next Generation of Advertisement Distribution", Proc. 67th National Convention of Information Processing Society, March 2005 (Scheduled)

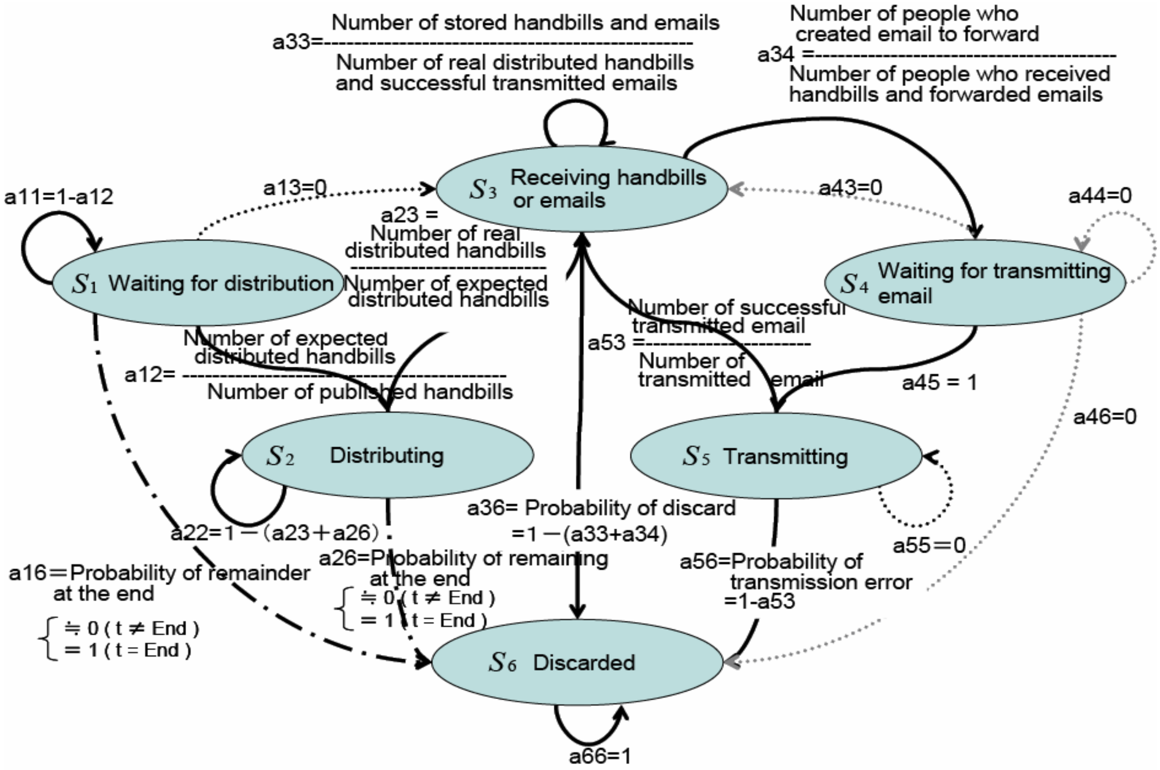

Figure 4: An Example of Using The Proposed Model
(Handbills and Emails)

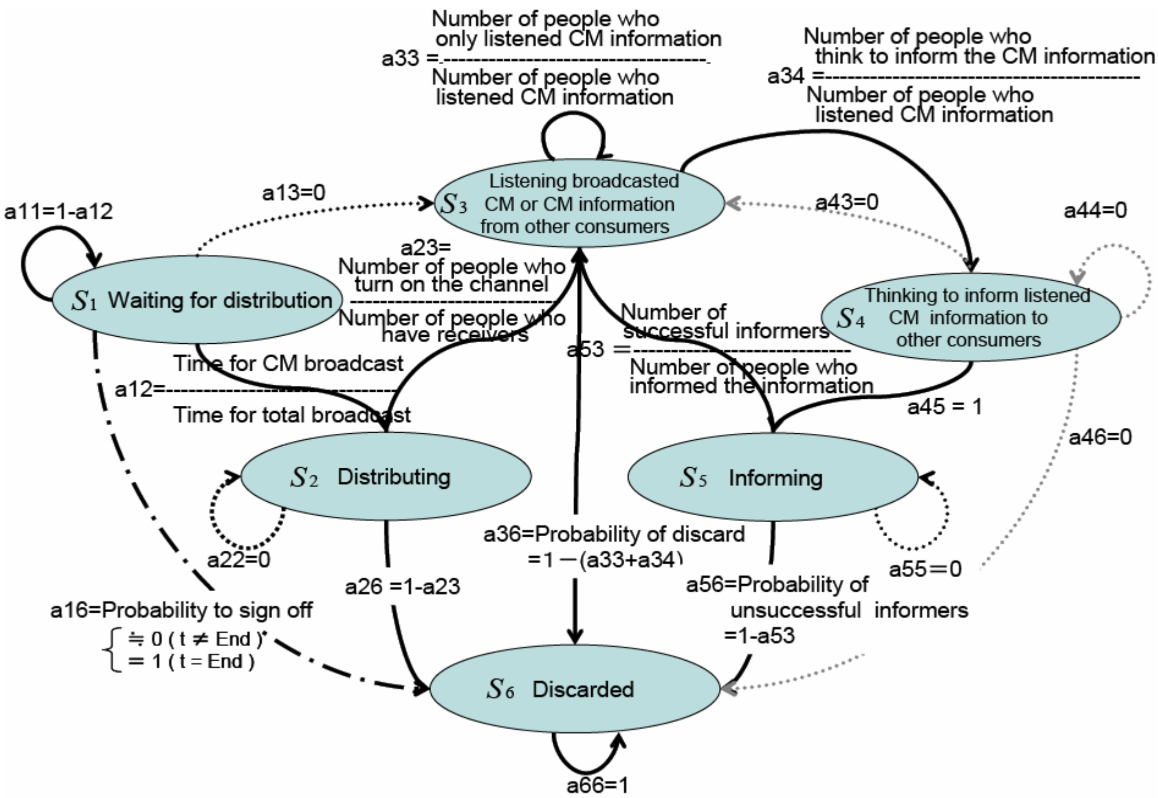

Figure 5: An Example of Using The Proposed Model
(Radio Broadcast and "Word-of-Mouth")