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# Royalty Rate of Business Method Patents for Large Scale Software Applications

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**Abstract:**
The royalty rate for Japanese patents is usually 2%-3% in the computer domain. This rate is based on the royalty rate values described in the "Royalty Rate" (published by Japan Institute of Invention and Innovation) and those used by Japanese national holding patents. This paper demonstrates that this conventional royalty is inadequate for large-scale software application systems and large-scale integrations (LSIs), especially the AP system using business method patents. The reason is that the contribution of the invention is very small for these large-scale systems. Moreover, this paper proposes a new method to calculate the royalty rate for large-scale applications in order to resolve these problems. Experimental case analyses show that the proposed method can derive adequate royalty rates, that pioneer patents have high royalty rates and that bubble patents have low royalty rates.

**Keywords:** Royalty Rate, Business Method Patents, Software Patent, System

**JEL codes:** O34, O31, L63, L86

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**Royalty Rate of Business Method Patents for Large Scale Software Applications**

Shigeo Kaneda / Takuya Senbo

## 1 Introduction

Royalty is the money paid to patent holders. The royalty rate for Japanese patents is usually 2%-3% in the computer domain. This rate is based on the royalty rate described in the "Royalty Rate [1]" and those used by Japanese national holding patents. The same rate is often applied into large-scale application systems such as "Business Method Patents (*BM Patents*)."

For instance, International Scientific Co., Ltd. (*IS Co.*[1]) sent an exacting warning E-mail concerning patent[2] infringement to many Japanese Internet providers. IS Co. demanded 3% of each provider's total sales as the royalty. This royalty is severe, because the royalty is nearly equal to the net profit of each provider business. This means that the conventional royalty is inadequate for large-scale application systems (*AP*).

This paper proposes a new method using a "verb" to calculate the royalty rate for large-scale applications in order to resolve these problems. Focusing on the verb is popular in software design or the "ontology" approach of the artificial intelligence domain. Experimental case analyses show that the proposed method can derive adequate royalty rates, that pioneer patents have high royalty rates and that bubble patents have low rates.

In the following section, problems of conventional royalty rates are discussed. Section 3 analyses BM patent cases. A new approach to calculate royalty rates for large-scale applications is proposed in Section 4. Finally, Section 5 concludes this paper.

## 2 Royalty Rate for Large Scale Systems

### 2.1 Statistical Bases for Royalty Rate

Royalty rates are expected to be decided under the principle of free contract between the patent assignee and the user. There is, however, a standard royalty rate for each domain. The value is usually 2%-3% in the computer domain. This rate is based on the royalty rate values described in the "Royalty Rate [1]."

Figure 1 shows the royalty rate distribution for the computer hardware domain in the literature [1]. The mean value is about 3% and the distribution has a peak at 3%. Figure 1 shows that the conventional standard 2%-3% has statistical and empirical bases. On the other hand, Fig. 2 is the royalty rate distribution for computer software in the same literature. This royalty rate is very high at more than 50%. The literature also reports many cases at less than 8%. The distribution profile is not a "normal distribution." Thus,

the values of 2%-3% have neither a statistical nor empirical basis for the software program domain.

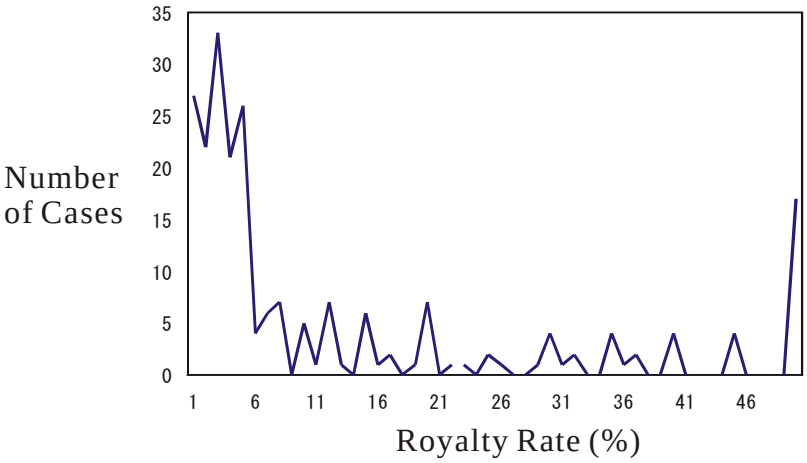


**Fig. 1 Royalty Rate for Computer Hardware**

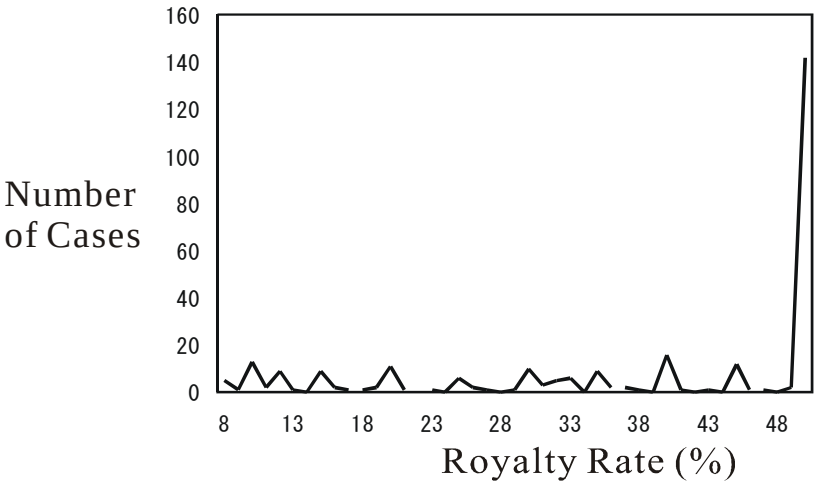


**Fig. 2 Royalty Rate for Computer Software [1]**

### 2.2 Inadequate Royalty Rate for Large-scale Applications

Next, we focus on the lack of balance between the royalty rate for small hardware parts and that for large-scale application systems. Figure 3 is a system configuration of a Web application. This system has a server computer and the server has dynamic random-access memories (DRAMs). If the DRAMs use a patent, the DRAM manufacturer should pay a royalty to the patent assignee. Let us assume that the royalty is 3% of a DRAM. A DRAM is not expensive, thus this royalty is very cheap.

On the other hand, Fig. 4 shows another type of patent royalty. Let us assume that the patent assignee demands 3% of the Web application total sales. If the total sale is 1,000,000 U.S. dollars, the royalty is 30,000 U.S. dollars. There is thus a big difference between these two royalty values. This difference is caused by the "spending patent right." The DRAM patent royalty is included in the price of DRAM chips. DRAM users are free from the DRAM patent royalty. On the other hand, the BM patent is a user function. Thus, the royalty is calculated from the total sales of the system. The same 3% royalty should not be applied.

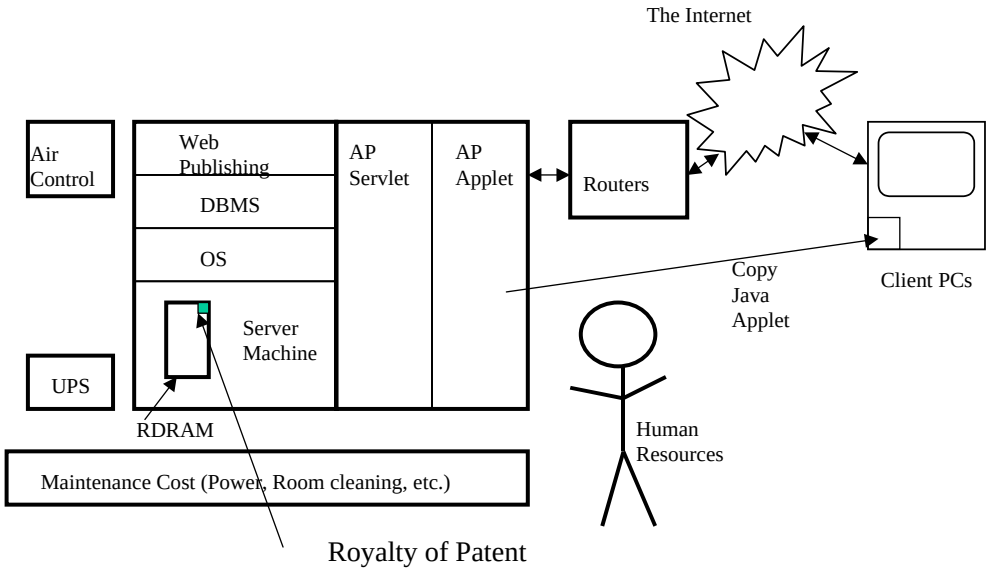


**Fig. 3 Royalty for Hardware Patent**

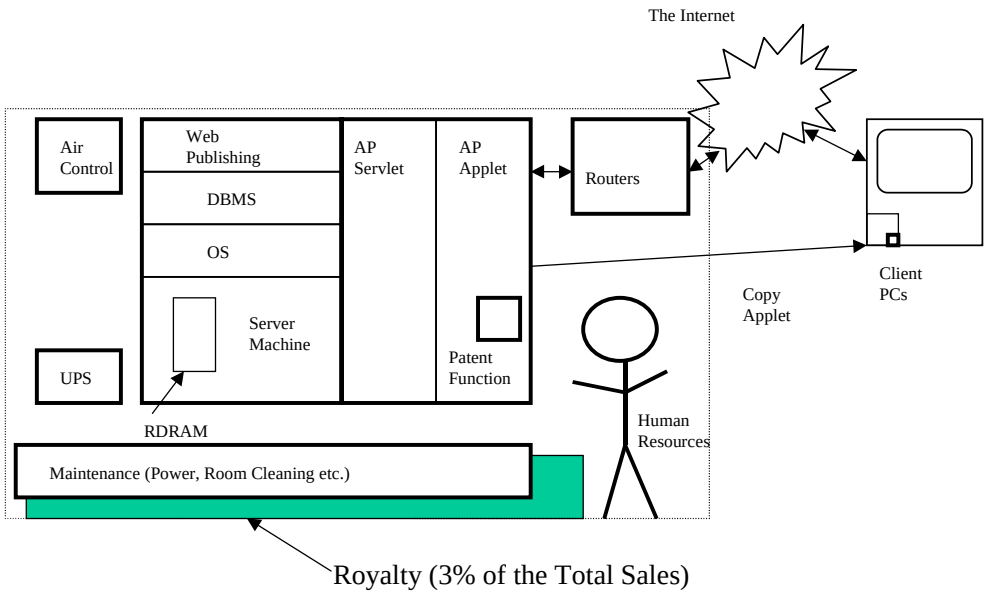


**Fig. 4 Royalty for BM Patent**

## 3 Coverage of Patent

A conventional method to calculate the royalty rate so as to resolve the above un-balance is already known. The basic idea is

- The large system is divided into some "modules."
- Patent coverage is calculated for each module.
- The overall coverage rate is calculated by the following equation:

  Σ (Price-of-Module x Patent-Coverage-for-the-Module) / Σ (Price-of-Module).

  Here, Σ is the sum for all modules.

### 3.1 Analysis of International Scientific Patent

Let us demonstrate the conventional method for the IS Co.'s BM patent[3] mentioned before. By using this patent system, the customer can access the Internet until the authentication database falls below zero. Generally speaking, a provider has many facilities to accomplish the service functions, as follows:

(1) Lines to accept ISDN(integrated services digital network)/xDSL access from the customer,

(2) ISDN/xDSL routers,

(3) High-speed backbone network for Internet access,

(4) High-speed router for Internet backbone access,

(5) Firewall server,

(6) Web publishing server,

(7) Mail server,

(8) User authentication server,

(9) Virus checking server or software, and

(10) Account server to maintain customer data and generate bills.

The first element of patent claim 1 says "a terminal server to provide Internet access to clients." Thus, modules (1), (2), (3) and (4) are related to the "terminal server." Finally, modules (1), (2), (3), (4), (8) and (10) are included in the patents. Let us assume that 1) the cost of all modules is the same and 2) patent coverage for each module is 100%. Thus, the overall coverage is 6/10 = 0.6, and the resultant royalty rate is, for example, 3% x 0.6 = 1.8%.

Of course, the above analysis is very rough. For example, the module "high speed router for Internet backbone access," is not an exclusive element of the patent. The purpose of the patent is user authentication. The above overall coverage is a little strange from a technical viewpoint. We can employ a more detailed analysis. However, even if we employed a detailed cost evaluation, this approach has a major problem. The main module of this patent is the authentication server. The cost of this server does not depend upon the number of users. On the other hand, the cost of the routers and network facilities depends upon the number of users. This means that the royalty rate depends upon the size of the provider. Notably, a huge provider has a very cheap royalty rate and a small provider must pay a high royalty.

### 3.2 Analysis of the Rambus Patent

Next, we consider another example: the well-known Rambus patents[4]. These patents say that the read access time of DRAM chips can be programmable by using a programmable register to store a number of access time clocks. These patents cover DDR-SDRAM (synchronous dynamic RAM). Hitachi Ltd. payed 5% of the DDR-SDRAM total sales. This is a huge amount, because this 5% cancels Hitachi's net profit for the DDR-SDRAM sales.

If the above conventional approach is employed to the Rambus patents, the result is very strange. Let us assume that the capacity of the DDR-SDRAM is 256 Mbits. The number of transistors of memory cell is 268,435,456. The DDR-SDRAM has sense amplifiers, row address decoders and column address decoders. These circuitries require many transistors. On the other hand, just a few hundred transistors can implement the patent. Let us assume that 1) the number of manufactured DDR-SDRAM chips is 1,000,000, 2) the chip price is 20 U.S. dollars, 3) the cost of circuitry is proportional to the number of transistors and 4) the *original royalty rate*[5] is 3%. The number of transistors for column address signal (CAS) access time control is very small. If the number is 200, the royalty is 20 x 1,000,000 x 0.03 x 200 / 268,435,456 = 0.447 U.S. dollars. This 0.44 U.S. dollar royalty for 1,000,000 chips is an unfeasible value. In addition, the royalty is decreased if the capacity of the DRAM is increased. The conventional overall coverage approach is not suitable for large-scale applications and large scale LSIs.

## 4 News Approach using “Verb”

### 4.1 Details of the Verb Approach

We have to calculate the cost of each module in the above conventional approach. The price calculation for the software module, however, is difficult. The reasons are as follows:

- Customers do not evaluate the “system value” by coding steps or module functions. Customers can only observe the user function of the system. Module cost evaluation has no meaning in this situation.
- It is very difficult to evaluate the cost of the software module. If the programmer employs a middle software tool, the cost is decreased. The module function, however, does not vary and the value for the customer never changes.

Let us consider the royalty of the IS Co.'s patent again. Even if the number of customers is doubled, the provider need not change the authentication server, but should reinforce the high-speed/ISDN/xDSL routers or network lines. By using the conventional approach, the royalty rate will be decreased. This phenomenon is strange, as mentioned before, because the patent provides the same function to the customers.

Based on the above analysis, the authors propose a new approach to calculate the royalty rate of large-scale application systems. The authors focus on a natural language description of the application system specification from the customer's viewpoint. The method is as follows:

- **STEP1:** *Extract System Function in Natural Language:* Convert system function into verb and nouns. The specification should be examined from the customer service viewpoints. In addition, the “verb” is extracted from these descriptions. The verb is very important in software design, especially in the early phase of system design.
- **STEP2:** *Check the coverage for each verb:* “Coverage” means the probability of use for each customer access. Let us assume that a user accessed a Web application or large-scale application software. The web application or application software has “workflow” in the system. The workflow has many branches, loops or quits. The verb is not always activated. The probability of activation for one user access is the coverage for the verb.
- **STEP3:** *Calculation of Overall Coverage Probability:* For a verb Vi and i = 1, 2, 3,…,$n^6$, let P(i) be the probability of activation defined in STEP2. Let $\rho(i)$

be, also, a probability that the verb function is included in the patent[7]. The overall coverage is

Overall-Coverage = $\Sigma$ P(i) $\rho$(i)/ $\Sigma$ P(i) ,

where $\Sigma$ is the sum of all elements.

This is the expected patent coverage value for one verb. Finally, the royalty rate = the Original Royalty Rate x Overall-Coverage.

### 4.2 Example I: Amazon.com "One Action" Patent

The "One Action" patent of Amazon.com is quite famous[8]. The coverage will be examined in this subsection. In this case, the Web shopping site has the following customer workflow.

1. The customer browses through the site. The site has many pages and graphics.
2. The customer selects one item to purchase.
3. The customer orders the item by "One Action."

In the above case, the verbs are "browse," "select" and "order." If all the customers go to the "order" phase, the probabilities for these three verbs, P(1), P(2) and P(3) are equal to the same value: 1.00. Usually, customers on the Internet buy nothing. If we assume that only two customers buys the goods within 100 customers who access the URL, then P(1) = 1, P(2) = 0.02, P(3) = 0.02, $\rho$(1) = 0.02, $\rho$(2) = 1 and $\rho$(3) = 1.

Thus, if the typical original royalty rate is 3%, the royalty rate of this patent is: 3% x 0.06 / 1.04 = 0.18%. If the total sales of the Web site is 1,000,000 U. S. dollars, the royalty is 0.0018 x 1,000,000 = 1,800 U.S. dollars. This means that the Amazon.com patent is a user interface patent and does not contribute to the overall user function of the site. The value 0.02 is not affected by the size or total sales of the Web site. This property is desirable for royalty rate calculation.

### 4.3 Example II: Rambus Patents

The Rambus patents mentioned before are examined again. Using the proposed approach, the DRAM specification should be described by verbs as follows.

(1) Latches column address.

(2) Latches row address.

(3) Receives Read/Write command.

(4) Receives write data from central processing unit (CPU).

(5) Sends read data to CPU.

(6) Receives refresh command.

(7) Memorizes data.

(8) Receives write data from CPU in page mode.[9]

(9) Sends read data to CPU in page mode.

Probabilities P(i)s for the verbs are not the same. The read/write operation is dominant, but refresh is not dominant. It is assumed that 1) the write and read operations have the same probability and 2) all write/read operations are in the page mode. The probabilities P(i)s are P(1) = 1, P(2) = 1, P(3) = 1, P(4) = 0.5, P(5) = 0.5, P(6) = 0, P(7) = 0.5, P(8) = 0.5 and P(9) = 0.5. Roughly speaking, the Rambus 5,953,263 patent covers P(5) and P(9). Further, let us assume that $\rho(5) = 1$, and $\rho(9) = 1$[10].

Overall Coverage = (0.5+0.5) / (1+1+1+0.5+0.5+0.5+0.5+0.5) = 1/5.5.

Thus, the royalty rate of this patent is 3% x 1 / 5.5 = 0.545%. When the chip price is 20 U. S. dollars and the number of chips is 1,000,000, the royalty is 10,900 U.S. dollars. This royalty rate is independent of the memory chip capacity.

### 4.4 Royalty Rate for Pioneer and Non-pioneer Inventions

Pioneer inventions should be encouraged from an economical and industrial development view. Thus, royalty rate calculation methods should provide a high rate for pioneer patents and a low rate for non-pioneer "Bubble" ones. In this section, using two famous BM patent claims, the proposed method is investigated from this point of view. As mentioned before, the royalty rate of Amazon.com's one-action patent is not high. The patent is effective only when the customer purchases something. Thus, this result is reasonable.

Let us examine Priceline's "reverse-auction" patent (U.S. Patent 5,794,207) for the buyer-driven e-commerce system[11]. Consumers can go to the Web site to offer their price for goods or services, and sellers electronically decide whether to accept the customer's price. The claim (claim 1) of the patent is shown in the footnote 12[12]. When the customer accesses this web site, each customer is required to buy a ticket. Thus, the probability of using the patent is rather high. This means that this BM patent is a pioneer patent.

## 5 Conclusions

This paper demonstrates a new approach to calculate the royalty rate of patents for large-scale software applications. The key idea is to use a verb to express the function of the system from the customer's viewpoint. This is a new approach to employ an ontology approach of the artificial intelligence field into the field of the science of law.

Some BM (business model) patent cases were analysed and the experiment resulted in a reasonable royalty rate. It was also shown that pioneer patents have a high royalty rate and non-pioneer patents have a low one.However, only a few cases were used in this analysis. Thus, further research is required to confirm the evaluation capability for pioneer property.

By using the proposed method, the royalty rate is decreased. A decrease in the royalty rate is not the purpose of this paper. The original royalty rate, 2%-3%, is rather too low for engineers. The 3% rate shown in this paper is just an example. If the proposed method is employed, a large original rate should be used.

**Notes:**

[1] http://www.iswebnet.com/ (In Japanese)

[2] This is a famous BM patent in Japan entitled "Timer-based fee-charging system for internet." U. S. Patent 5,956,697, Japanese Patent 2,939,723. The claim will be shown later.

[3] U. S. Patent 5,956,697. Claim 1 of the U.S. Patent is as follows.

(Claim 1) A timer-based fee-charging system for Internet services comprising: a terminal server to provide Internet access to clients;

an authentication server to confirm whether or not a client is gaining access based on specific information input by the client upon instruction from said terminal server;

an extended authentication database, linked to the authentication server, which controls authentication data comprising specific information of, and the access status rate that indicates a predetermined available time range for access for, each client;

a fee-charging server, linked with the extended authentication database, which constantly renews the access status rate by calculating access charges according to the amount of access time each client used;

the timer-based fee-charging system features the capability to provide Internet access services to a client until the access status rate of the client controlled by the extended authentication database falls below 0, featuring an http server linked with the extended authentication server;

operates a program that enables a client who accesses the server freely to add up the access status rate into a total when the client owns several information units.

[4] U. S. Patents 5,915105, 5,953,263, 5,954,804, and 5,995,443. In particular, NO. 5,953,263 has the following claim (claim 1):

A synchronous semiconductor memory device having at least one memory section which includes a plurality of memory cells, the memory device comprises:

a programmable register to store a value which is representative of a delay time after which the memory device responds to a read request.

[5] Original rate is a maximum rate when all modules are exhaustively used for the patent.

[6] This n is the number of verbs.

[7] If the verb is an exclusive function for the patent, (i) = 1. On the other hand, if the patent does not refer to the function, (i) = 0.

[8] U. S. Patent 5,960,411. In a patent infringement suit brought by Amazon.com, Inc. ("Amazon") against Barnesandnoble.com, inc., and Barnesandnoble.com llc (together "BN"), CAFC (United States Court of Appeals for the Federal Circuit) concluded "It is

true that BN has raised substantial questions as to the validity of this '411 patent." (39 F.3d 1343; 2001 U.S. App. LEXIS 2163; 57 U.S.P.Q.2D (BNA)1747).

Claim 1 of the patent is as follows.

(Claim 1) A method of placing an order for an item comprising:

under control of a client system, displaying information identifying the item; and

in response to only a single action being performed, sending a request to order the item along with an identifier of a purchaser of the item to a server system;

under control of a single-action ordering component of the server system, receiving the request; retrieving additional information previously stored for the purchaser identified by the identifier in the received request; and generating an order to purchase the requested item for the purchaser identified by the identifier in the received request using the retrieved additional information; and

fulfilling the generated order to complete purchase of the item whereby the item is ordered without using a shopping cart ordering model.

[9] Multiple data in the same row address are written continuously without the reading row address. Thedata transfer rate is high in this page mode.

[10] This discussion is too rough. A more detailed discussion will be required to calculate the exact rate.

[11] http://www.priceline.com/

[12] (Claim 1) A method for using a computer to facilitate a transaction between a buyer and at least one of sellers, comprising:

inputting into the computer a conditional purchase offer which includes an offer price;

inputting into the computer a payment identifier specifying a credit card account, the payment identifier being associated with the conditional purchase offer;

outputting the conditional purchase offer to the plurality of sellers after receiving the payment identifier;

inputting into the computer an acceptance from a seller, the acceptance being responsive to the conditional purchase offer; and

providing a payment to the seller by using the pay Multiple data in the same row address are written continuously without reading row address. The data transfer rate is high in this page mode.

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