Consideration on Web Distribution Management System for Embedded System

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Abstract
Embedded system's modules　implemented in hardware system are distributed by WDMS(Web Distribution Management System) to users such as vendors or manufactures. This distribution is controlled by standards or procedures as formal knowledge [1], which is produced by experiences of engineers of vendors as well as manufactures. These standards or procedures are automatically arranged and processed by WDMS whose method is proposed in order to adjust the needs of a recipient of the distributed ESM&D (Embedded System's Modules and Documents). Under these circumstances, standards or procedures control　decomposition of Schema　(RDFs[2],or OWL[3],) as registration, reference, or receipt process. As a result of this proposed method, this WDMS brings forth versatility and rapid accommodation to the recipients' needs.

1.Introduction

A current technology to adjust recipient needs, An engineers must intervene between the recipients and PDMs [4][5]. When a designer registers the designed embedded system's modules and their documents, one must set destination like company name, department name, or section name etc.. data modules and documents have a security level to let data and document be distributed depending on security level as recipients' needs. Under these circumstances,　the proposed WDMS is preferable to be used for a managing control of embedded system's modules, a design drawing and specification form of a hardware or the like (hereinafter, collectively means a component).WDMS is able to accommodate users' needs as the component managing control system based on ISO9001:2000[6], which are capable of registering, receiving and referring a component easily, accurately and at a lower cost without any discrimination from embedded system to hardware.

2. Web Distribution Management System (WDMS)

2.1 . Background

WDMS regards that hardware and embedded system's modules are as same level as component organizing units. WDMS is a total management system applied to components (i.e., hardware drawings, embedded system's modules drawings, other documents, and source codes, and specifications are inevitable to manufacture units) and software programs.

Enterprise stands in need for a series of development process, design process, manufacturing process, inspection process, and shipment process. It also stands in need for many embedded system's modules (software products) in addition to design drawings, specifications and contracts. At this stage, hardware and embedded system's modules are separately managed. However, this conventional process should be revised. the both components are separately managed whereas ISO9001:2000[6] defines both hardware and software including embedded modules at the same level[7].

Conventional PDM	Proposed WDMS
Rule verification verifying a deliberation To deliver documents, PDM processes document numbering information.	2.4 (2) **Rule verification verifying a deliberation** result of a written rule, which is a source of the rule information, and registering rule information in response to the verification result in the rule information storage server.
Decomposition Conventional PDM can not change rules nor part of full rules automatically.	2.4 (3) **Decomposition** under the desired value, the decomposition means repeatedly recomposes the schema (RDFs or OWL) so that this evaluation value becomes max or min.
Agent At this stage, PDM has no agent.	2.4 (4) **Agent** the agent means deduces the rule information, so that the registration, reference or receipt of the component information is capable of being easily and accurately performed without manpower
Detection Rules or schemas are used , but no functions to deduce.	2.4 (5) **Detection** the agent deduces the rule information to evaluate the deduction result by a detection from 0 to 1

Fig. 1 Comparison between conventional PDM and proposed WDMS

However, because that both hardware and embedded system's modules are mounted on the same products' unit at the same time. Which makes lot of nascence trouble. For examples, the conventional process makes management mistakes, the degradation of management both efficiency and needed lot of time-consuming in the process from development of products to the shipment. Therefore, in order to solve the problems, new approach should be applied to this conventional process.

2.2. Conventional PDM environment

Fig.2 shows conventional development and manufacturing environment using PDM.

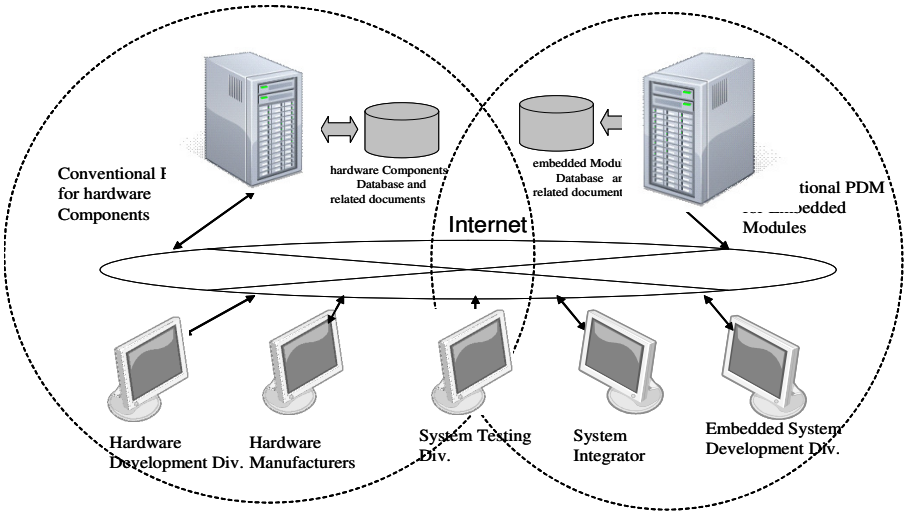

Fig. 2 Conventional PDM environment

Embedded system development division registers embedded system's modules, drawings and documents. But hardware drawings are stored in databases respectively as shown in Fig2.. For examples system testing engineers refer drawings and documents on both PDMs. Also manufactures and factories use embedded system's modules, drawing and document to produce products separately. As a consequence, it is complicated managements in the eyes of ISO9001 that deal concurrently with both hardware and software including embedded systems.

2.3. Conventional rule process

Fig. 3 is an explanatory view illustrating a conventional rule applicable activities with respect to designing and manufacturing of the products. The method for studying and improving the operation process and analyzing a workflow is illustrated. According to this method, all persons in charge of designing and manufacturing of the products interchange and supply the operation information to study and improve the operation process and analyze a workflow.

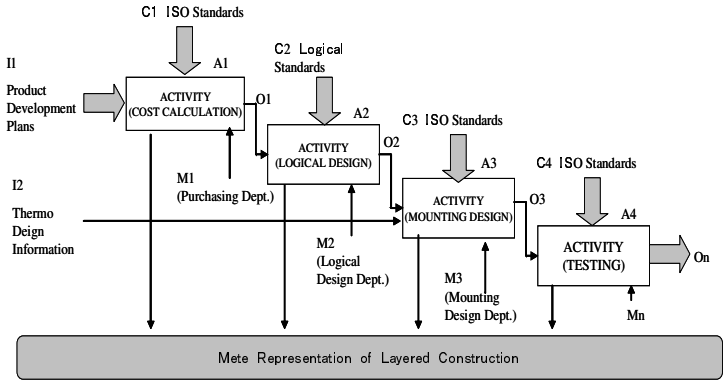

Fig. 3 Conventional rules' applicable activities

In Fig.3, a purchasing department M_1 applies control information C_1 (ISO standard) with respect to a product development plan I_1 to calculate the cost as an activity A_1 and make the cost account into an output O_1. Next, a logical design department M_2 receives the output O_1 on the basis of a control information C_2 (logical standard) to create a logical design as the activity A_1 and make a logical design drawing into an output O_2. Then, a mounting design department M_3 receives the output O_2 and thermal design information I_2 to perform a mounting design on the basis of a control information C_3 (ISO standard) and make the mounting designing form into an output O_3. Hereinafter, the source code and the object code or the like of the embedded system's modules get dumped.

2.4. Feature of proposed WDMS

WDMS consists of ESM&D server, predominant WDM(web distribution server and meta server, those of them are described as follows. An ESM&D system server stores a name of a component (hereinafter, referred to as a component name information), attributes of component information and a storage address of component information or the like in a storage device. The component name server is connected to the predominant WDM. A predominant WDM server stores meta information showing a layered construction between the component information (a cross relationship). The predominant WDM server is connected to the internet. The meta information is obtained by representing the layered construction of the component by the schema.

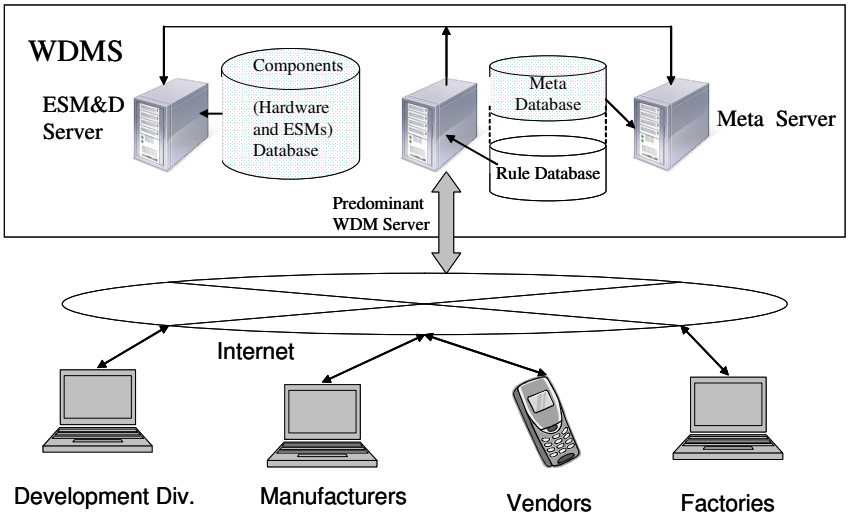

Fig. 4　Proposed WDMS environment

This schema is created broadly by three categories, namely, a category for registration, a category for making reference and a category for receiving. Further, for every category, the schema is created by respective departments, namely, a designing department, a manufacturing department, a purchasing department, a cost managing department, a maintenance department and a quality managing department.

A manufacturer server stored the component information itself in a storage device. In fact, a plurality of manufacturer servers is provided for distributed to respective departments and the enterprises exploiting the outsourcing or the like. In other words, component information is distributed to the manufacturer servers in the locations, where the information is created, and is stored therein. Then, the operation of the above-described embodiment is explained with reference to flow charts shown in Figs. 9 to 12. On the respective display of the registration client, the receipt client system and the reference client, a menu for selecting events (registration, reference, receipt and written deliberation) is displayed.

(1) Meta information

WDMS provides for the ESM&D server according to any one of the first aspect or the second aspect, which comprises a meta server, which is connected to the predominant WDM server, for storing a meta information having a layered construction of at least component information. The said registration client registers the meta

information in the meta server and registers the component information in the ESM&D server. According to this WDMS, at least a meta information having a layered construction of the component information is made to be stored in the meta server so that the user is capable of easily and accurately registering the component information without considering the complicated layered construction.

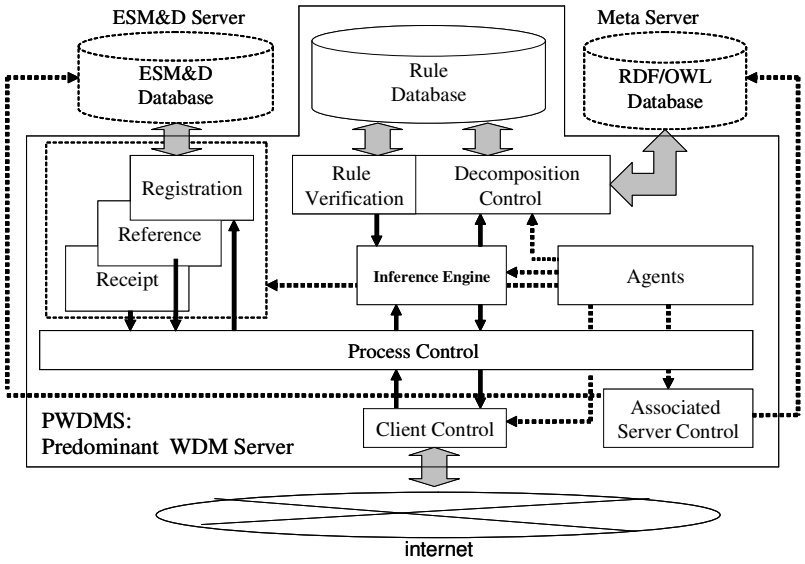

Fig. 5 Embodiment of proposed predominant WDM Server with associated servers

(2) Decomposition

WDMS provides the component managing control system, which comprises replacing means for repeatedly decomposed schema of the component information, which is described by the schema using a predetermined method so that the evaluation value in the agent means becomes maximum or minimum, when the evaluation value does not satisfy a target value. According to this WDMS, even if the evaluation value is under the desired value, the decomposition means repeatedly recomposes the schema. so that this evaluation value becomes maximum or minimum.　Therefore, the registration, reference or receipt of the component information is capable of being easily and accurately performed with detection closer to a man's detection.

(3) Rule verification

WDMS provides the component managing control system, which comprises rule verification means for verifying a deco positional result of a written rule, which is a source of the rule information, and registering rule information in response to the verification result in the rule database.

According to this WDMS, a decompositional result of a written rule as a source of the information rules is verified and the rule information in response to this verification result is made to be registered in the rule database server, so that the violation of the rule and the error or the like can be prevented compared with the case to register the information manually.

(4) Agent

WDMS provides the component managing control system according to any one of the aspect, which comprises agent means for deducing the rule information.

According to this WDMS, the agent means deduces the rule information, so that the registration, reference or receipt of the component information is capable of being easily and accurately performed without manpower. WDMS provides the component managing control system wherein the agent means evaluates the deduction result of the rule information by 0 / 1 detection. According to this WDMS, the agent means deduces the rule information to evaluate the deduction result by 0/1 detection [08], so that the registration, reference or receipt of the component information is capable of being easily and accurately performed without manpower.

(5) detection

WDMS provides the component managing control system, wherein the agent means evaluates the deduction result of the rule information by a　detection from 0 to 1.According to this WDMS, the agent means deduces the rule information to evaluate the deduction result by a detection from 0 to 1, so that the registration, reference or receipt of the component information is capable of being easily and accurately performed with a detection closer to a man's detection.

3. Mechanism of WDMS

An embodiment of the component managing control system according to the proposed WDMS will more fully be apparent from the following detailed description with accompanying drawings.

3.1. embodiments of components' structure

Components list　includes documents e_1 to e_n　The layered construction[9] shown in Fig. 6 corresponds to a managing information sk , managing information CK_1 to CK_n as the component lists , which are belonged to this managing information sk, respectively and documents D_{11} to D_{1n} through documents D_{n1} to D_{nn}, which link to these managing information CK_1 to CK_n, respectively. Hatched modules are embedded system as ESM21 and ESM22.

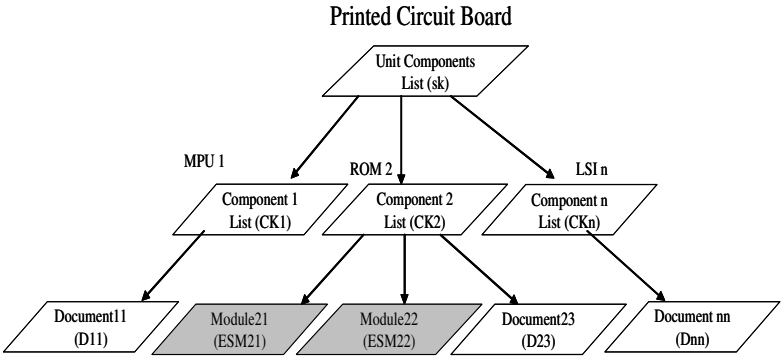

Fig.6 Components hierarchical structure

The following Figs. 7 is explanatory views illustrating a specific example of the layered construction of the identical embodiment. In this components lists control unit is given by the parts number QXY118, TX220-2 and 7800A (for example, a Embedded System's Components) are included. A parts constitution list showing "a parts

```
<owl:Class rdf:ID="printed_circuit_board">
  <rdfs:comment>
       control unit is performed by ESMs.
    </rdfs:comment>
    <rdfs:subClassOf rdf:resource="#component"/>
</owl:Class>
<owl:Class rdf:ID="QXY118">
 <rdfs:comment>
   QXY118 is subclass of printed_circuit_board and is an ESM.
 </rdfs:comment>
 <rdfs:subClassOf rdf:resource="# printed_circuit_board"/>
</owl:Class>
<owl:Class rdf:ID="TX220-2">
 <rdfs:comment>
  TX220-2 is subclass of printed_circuit_board and is an ESM.
 </rdfs:comment>
 <rdfs:subClassOf rdf:resource="# printed_circuit_board "/>
</owl:Class>
<owl:Class rdf:ID="7800A">
 <rdfs:comment>
  7800A is subclass of printed_circuit_board and is an ESM.
</rdfs:comment>
 <owl:intersectionOf rdf:parseType=" printed_circuit_board ">
  <owl:Class rdf:about="#7800A "/>
  <owl:Restriction>
   <owl:onProperty rdf:resource="# printed_circuit_board "/>
   <owl:hasValue rdf:datatype="&xsd;string">7800A </owl:hasValue>
  </owl:Restriction>
 </owl:intersectionOf>
</owl:Class>
```

Fig.7 Components construction

number", "a parts name", "a number of edition" and "a name of a manufacture" of these parts.　Further, in the

embodiment, this parts constitution list is used as a parts construction list.

As shown in Fig. 7, in the Components lists control unit, at least parts given by the parts number QXY118, TX220-2 and 7800A (for example, a embedded system's modules) are included. A components construction list showing "a parts number", "a parts name", "a number of edition" and "a name of a manufacture" of these parts in Fig. 7. Further, in the embodiment, this parts component list is used as a parts construction list, which is described in the RDF or OWL shown in Fig. 6. The items corresponding to the items in Fig. 7 are represented by the same reference numerals as those of Fig. 7. In this Figure, the items corresponding to the items are represented by the same reference numerals as those of Fig.8. Fig.8 shows proposed layered activities for ISO9001. This activities are processed by registration, reference and receipt process in accordance with decomposed schemas. And both hardware and embedded system modules with documents are registered, referred or received based on ISO9001:2000.

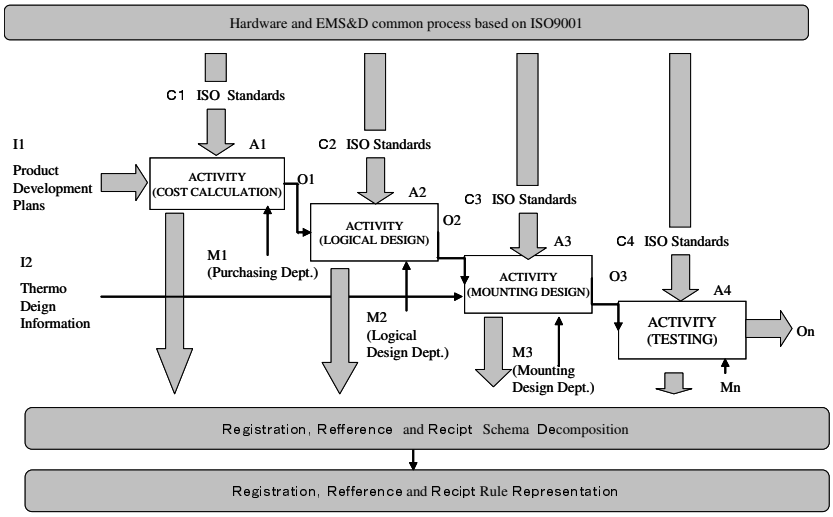

Fig.8　Proposed layered activities for ISO9001

3.2. Registration, reference, and receipt rules

The agent rule language comprises a language of converting the registration rule information, the receipt rule information and the reference rule information into the JAVA language. These registration rule information, the receipt rule information and the reference rule information are obtained by showing the information representing registration procedure of the component by a if/then format, respectively.　Examples of the registration rule, the reference rule and the receipt rule are shown below.

(1) Registration rule

A registration rule 1・・・・・・・・・・r11

If: a security segment of this component is in X class? Then: this component may be registered

A registration rule 2・・・・・・・・・・r12

If: this component has a correct title panel?

Then: this component may be registered

A registration rule n・・・・・・・・・・r1n

If: this component is related to hardware?

Then: a schema for the hardware may be registered

(2) A reference rule

A reference rule 1・・・・・・・・・・・r21

If: this component is permitted to be made reference to?

Then: this component may be made reference to

A reference rule 2・・・・・・・・・・・r22

If: a purchasing department makes reference to this component

Then: the Schema of the purchasing department may be employed.

A reference rule n・・・・・・・・・・・・r2n

If: a manufacturing department makes reference to this component

Then: the schema of the manufacturing department may be employed.

(3) A receipt rule

A receipt rule 1・・・・・・・・・・・・・r31

If: this component is permitted to be received?

Then: this component may be received

A receipt rule 2・・・・・・・・・・・・・r31

If: a purchasing department receives this component?

Then: the schema of the purchasing department may be employed.

A receipt rule n・・・・・・・・・・・・・r3n

If: a manufacturing department receives this component?

Then: the schema of the manufacturing department may be employed.

4. Embodiment of decompotional process

4.1 Registration process

In step RG1 shown in Fig. 9, the registration client derives the schema information for the designing department from the predominant WDM server. In step RG2, the registration client derives the definition/constitution/format information relating to the component from the predominant WDM server. In step RG3, the registration client derives the component name information from the ESM&D server. In step RG4, the registration client derives the registration rule information from the predominant WDM server. In the steps RG5 to RG7, the registration client makes a deduction of the registration rule information by using a deduction method of the if/then production rule or the like. For example, in he steps RG5 to RG7, the registration client performs the deduction processing on the basis of the previous registration rules 1 to n in 3.2 (1). Then, with reference to Fig.10, a deduction processing will be explained. In step RD1 shown in Fig. 10, the registration client derives a front part of the registration rule (if the steps RG5 to RG7, the registration client performs the deduction processing on the basis of the previous registration rules 1 to n in 3.2 (1). Then, with reference to Fig. 10, a deduction processing will be explained. In step RD1 shown

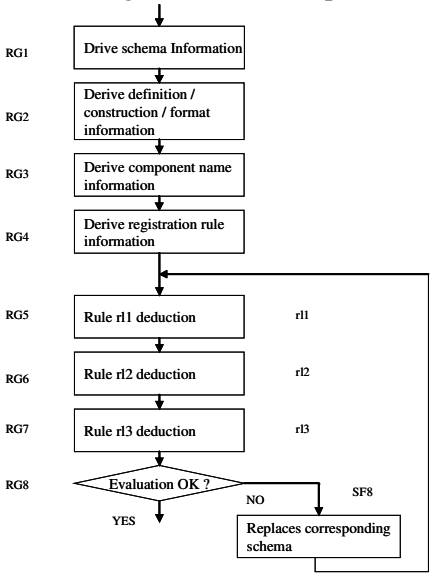

Fig.9 Registration process

in Fig.10, the registration client derives a front part of the registration rule (if part). In step RD2, the registration client derives a back part of the registration rule (then part). In step RD3, the registration client detects whether if part satisfies a first condition or not. If the detection result is "Yes", the registration client determines crisp value C (A) as 1. On the other hand, if the detection result of the step RD3 is "No", in step RD4, the registration client detects whether a membership function μ (A) satisfies a second condition or not. If the detection result is "Yes", in step RD5, the registration client determines the membership function μ (A) as a value at a midpoint in between 0 and 1. The registration system detects whether an evaluation result is ok or not on the basis of an evaluation processing shown in Fig.9.

The registration client detects whether the crisp value C (A) is 1 or not. If this detection result is "No", the registration client detects whether the membership function μ (A) is 0 or not. If this detection result is "No", the registration client detects whether the membership function μ (A) is 1 or not. If this detection result is "No", in step RD4, the registration client recomposes the schema. In Fig.10, in step RD8, the registration client detects whether the evaluation result is a ok target value is equal to the evaluation result or not, this detection result is "Yes", the current component is registered in the storage device of the manufacturer server. On the other hand, the detection result in the step RD8 is "No", after recomposing the schema so that the evaluation result takes the minimum value or the maximum value, the registration client repeats the processing after the step RD5.

4.2 Reference process

If "reference" is selected in the reference client, the reference client executes an electronic information relating to a drawing such as a

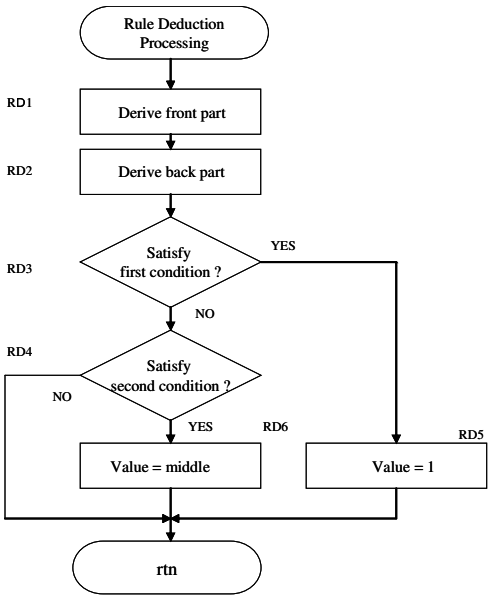

Fig.10　Deduction process

circuit diagram and a structural drawing or the like, an information relating to respective EC forms (new design notification, or design revision notification), an information relating to a program or a reference processing (agent processing) shown in electronic information relating to a drawing such as a circuit diagram and a structural drawing or the like, an information relating to respective EC forms (new design notification, or design revision notification), an information relating to a program or a reference processing (agent processing) shown in Fig. 10 for making reference to the component with the layered construction such as an electronic information relating to respective manuals. In other words, in step RF1 shown in Fig.11, the reference client derives the schema information for the designing department from the predominant server (PWDM). In step RF2, the reference client derives the

definition/constitution/format information relating to the component from the Predominant server(PWDM). In step RF3, the reference client derives the component name information from the ESM&D server. In step RF4, the reference client derives the reference rule information from the predominant WDM server.

In the steps RF5 to RF7, the reference client makes a deduction of the reference rule information by using a deduction method of the if/then production rule or the like. For example, in the steps RF5 to RF7, the reference client performs the deduction processing on the basis of the previous reference rules 1 to n in 3.2 (2).

Then, the reference client effects the deduction processing on the basis of the reference rules 1 to n with reference to following described Fig.11.

In step RF8, the reference client detects whether the evaluation result is ok or not on the basis of the evaluation result shown in Fig. 11 as it as in the RF8. If this detection result is "Yes", in step RF9, the reference client makes reference to the component by displaying the current component registered in the manufacturer server on the RDF or OWL browser. On the other hand, if the detection result of the step RF8 is "No", in step RF10, the reference client

Then, the reference client effects the deduction processing on the basis of the reference rules 1 to n with reference to above described Fig.10. In step RF8, the reference client detects whether the evaluation result is ok or not on the basis of the evaluation result shown in Fig. 8 as it as in the RF8. If this detection result is "Yes", in step RF9, the reference client makes reference to the component by displaying the current component registered in the manufacturer server on the RDF or OWL browser. On the other hand, if the detection result of the step RF8 is "No", in step RF10, the reference client detects whether the evaluation result tends to be improved compared with the former evaluation result or not. If this detection result is "Yes", in step RF11, after changing the schema information, the reference client repeats the processing after the step RF5.

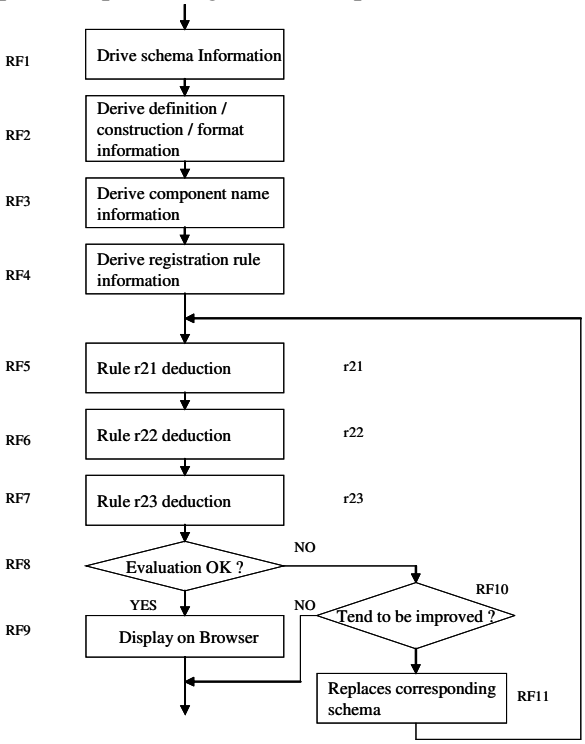

Fig.11　Reference process

In step RF8, the reference client detects whether the evaluation result is ok or not on the basis of the evaluation result shown in Fig. 11 as it as in the RF8. If this detection result is "Yes", in step RF9, the reference client makes reference to the component by displaying the current component registered in the manufacturer server on the RDF or OWL browser. On the other hand, if the detection result of the step RF8 is "No", in step RF10, the reference client.

Then, the reference client effects the deduction processing on the basis of the reference rules 1 to n with reference to above described Fig.11. In step RF8, the reference client detects whether the evaluation result is ok or not on the basis of the evaluation result shown in Fig. 11 as it as in the RF8. If this detection result is “Yes”, in step RF9, the reference client makes reference to the component by displaying the current component registered in the manufacturer server on the RDF or OWL browser. On the other hand, if the detection result of the step RF8 is “No”, in step RF10, the reference client detects whether the evaluation result tends to be improved compared with the former evaluation result or not. If this detection result is “Yes”, in step RF11, after changing the schema information, the reference client repeats the processing after the step RF5.

4.3 Receipt Process

If the receipt client is selected “receipt”, the receipt client determines the receipt process. On this account, the receipt client executes an electronic information relating to a drawing such as a circuit diagram and a structural drawing or the like, an information relating to a drawing such as a circuit diagram and a structural drawing or the like, an information relating to respective EC forms (new design notification, design revision notification), an information relating to a program or a receipt processing (agent processing) shown in Fig.12 for receiving the component with the layered construction such as an electronic information relating to respective manuals. In other words, in step RC1 shown in Fig.12, the receipt client derives from the Predominant server any one schema information from respective schema information for the designing department, the manufacturing department, the purchasing department, the cost managing department, the maintenance department, the quality assurance department or the like and further derives the definition/constitution/format information from this schema information. In step RC2, the receipt client derives the parts list information from the component name server. In step RC3, the receipt client derives the receipt rule information from the predominant. In step RC4, the receipt client performs the deduction processing shown in Fig. 12 by using the deduction method or the like of the if/then production rule to make deduction of the receipt rule information. For example, the receipt client performs the deduction processing on the basis of the previous receipt rules 1 to n in 3.2 (3).

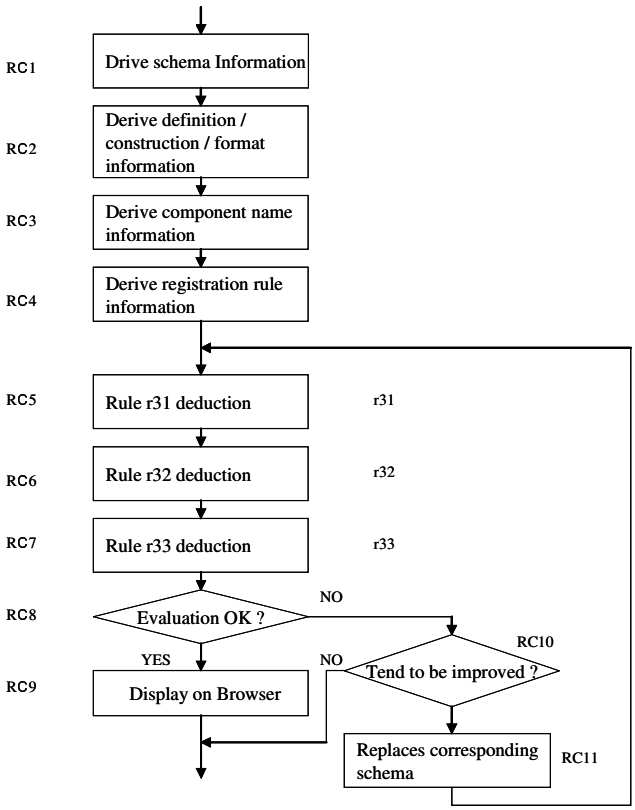

Fig. 12 Receipt process

Then, in step RC5 shown in Fig. 12, the receipt client detects whether the evaluation result is ok or not on the basis of the evaluation processing shown in Fig.12 as same as in the step RC8. If this detection result is "Yes", the receipt client receives the current component from the ESM&D server. On the other hand, if the detection result of the step RC5 is "No", in step RC6, the receipt client detects whether the evaluation result tends to be improved compared with the former evaluation result or not. If this detection result is "Yes", in step RC7, after recomposing the schema information, the receipt client repeats the processing after the step RC4.Further, the above described registration rules, the reference rules and the receipt rules (hereinafter, simply referred as to rules) are deliberated in writing by the persons in charge of respective department before being stored in the predominant.

5. Conclusion of proposed WDMS

(1) WDMS is proposed to distribute embedded system's modules and its relating documents in conjunction with hardware drawings and document. integrated distributions are very effective for both hardware and embedded system's modules. Double web management systems are rationalized. Human powers are also rationalized. Client systems are automatically able to receive drawings and their document. As a result, recipient's works are also reduced in cost by WDMS.

(2)WDMS is able to accommodate user's needs as the component managing control system, which are capable of registering, receiving and referring a component easily, accurately and at a lower cost.

(3) Even if the evaluation value is under the desired value, the decomposition performs repeatedly for the schema information so that this evaluation value becomes maximum or minimum.

(4) Therefore, the registration, reference or receipt of the component information is capable of being easily and accurately performed with detection closer to a man's detection.

(5) The agent deduces the rule information to evaluate the deduction result by a detection from 0 to 1, so that the registration, reference or receipt of the component information is capable of being easily and accurately performed with a detection closer to a man's detection.

(6) Since ISO9001 defines both hardware and embedded modules and documents management at the same level so that the proposed WDMS is able to accommodate to this necessity.

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