PRINCIPLES, RULES AND APPLICATION FUNCTION MODELING (IDEF0)

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Abstract:

This contribution describes the IDEF0 modeling language (semantics and syntax), and associated rules and techniques, for developing structured graphical representations of a system or enterprise. Use of this standard permits the construction of models comprising system functions (activities, actions, processes, operations), functional relationships, and data (information or objects) that support systems integration. Second part describes process of application function modeling.

Keywords: IDEF0, modeling,boxes, arrows, team

1. FUNCTION MODELING

The U.S. Air Force Program for Integrated Computer Aided Manufacturing (ICAM) sought to increase manufacturing productivity through systematic application of computer technology. The ICAM program identified the need for better analysis and communication techniques for people involved in improving manufacturing productivity.

As a result, the ICAM program developed a series of techniques known as the IDEF (ICAM Definition) techniques which included the following:

- IDEF0 –Function Modeling
- IDEF1 – Information Modeling
- IDEF1X – Data Modeling
- IDEF2 - Simulation Model Design
- IDEF3 - Process Description Capture
- IDEF4 - Object – Oriented Design
- IDEF5 - Ontology Description Capture.

Others eight methods (IDEF6 – IDEF14) are under development.Each of these methods is the group of tools dedicated to modeling.

The use of IDEF0 is strongly recommended for projects that require a modeling technique for the analysis, development, re-engineering, integration, or acquisition of information systems and. The main object is to provide a means for completely and consistently modeling the functions (activities, actions, processes, operations) required by a system or enterprise, and the functional relationships and data (information or objects) that support the integration of those functions.

IDEF0 (Integration DEFinition language 0) is based on SADT™ (Structured Analysis and Design Technique™), developed by Douglas T. Ross and SofTech, Inc. In its original form, IDEF0 includes both a definition of a graphical modeling language (syntax and semantics) and a description of a comprehensive methodology for developing models.

1.1 IDEF0 – Principles and Rules

In this part I would like to describe shortly the basic elements of the IDEF0 modeling technique, identifies the basic components of syntax (graphical component) and semantics (meaning), specifies the rules that govern the use of the IDEF0 technique, and describes the types of diagrams used.

A model is a representation of a set of components of a system or subject area. The model is developed for understanding, analysis, improvement or replacement of the system. Systems are composed of interfacing or interdependent parts that work together to perform a useful function. System parts can be any combination of things, including people, information, software, processes, equipment, products, or raw materials. The model describes what a system does, what controls it, what things it works on, what means it uses to perform its functions, and what it produces.

IDEF0 is a modeling technique based on combined graphics and text that are presented in an organized and systematic way to gain understanding, support analysis, provide logic for potential changes, specify requirements, or support systems level design and integration activities. This model is composed of a hierarchical series of diagrams that gradually display increasing levels of detail describing functions and their interfaces within the context of a system. There are three types of diagrams: graphic, text, and glossary. The graphic diagrams define functions and functional relationships via box and arrow syntax and semantics. The text and glossary diagrams provide additional information in support of graphic diagrams.

1.1.1 Syntax and Semantics

The structural components and features of a language and the rules that define relationships among them are referred to as the language's syntax. The components of the IDEF0 syntax are boxes and arrows, rules, and diagrams. Boxes represent functions, defined as activities, processes or transformations. Arrows represent data or objects related to functions. Rules define how the components are used, and the diagrams provide a format for depicting models both verbally and graphically. The format also provides the basis for model configuration management.

A box provides a description of what happens in a designated function. A typical box is shown in Figure 1. Each box shall have a name and number inside the box boundaries. The name shall be an active verb or verb phrase that describes the function. Each box on the diagram shall contain a box number inside the lower right corner. Box numbers are used to identify the subject box in the associated text.

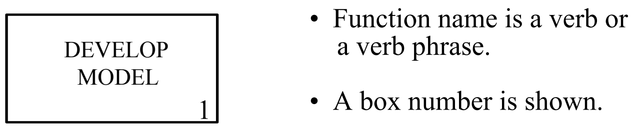

***Figure 1** Box Syntax [1]*

An arrow is composed of one or more line segments, with a terminal arrowhead at one end. Arrows convey data or objects related to functions to be performed. The functions receiving data or objects are constrained by the data or objects made available.

Box and Arrow Semantics

Function – what is needed to realize
Inputs – are transformed or consumed by the function to produce the outputs
Outputs – are datas or objects produced by the function
Controls – specify the conditions required for the function to produce correct outputs
Mechanism – sources support to perform funktions
Call – call arrows enable the sharingof detail between models or between portions of the same model

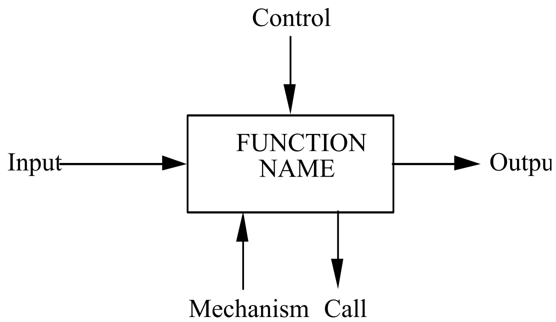

Figure 2 *Arrow Positions and Roles [1]*

Labels and Names

Boxes represent functions that show what must be accomplished. A function name shall be an active verb or verb phrase

The arrows identify data or objects needed or produced by the function. Each arrow shall be labeled with a noun or noun phrase.

An example depicting the placement of arrow labels and box names is shown in Figure 3.

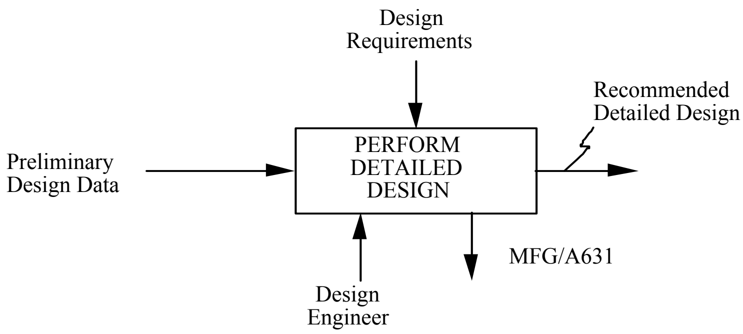

Figure 3 *Label and Name Semantics [1]*

1.2 IDEF0 Diagrams

IDEF0 models are composed of three types of information: graphic diagrams, text, and glossary. These diagram types are cross-referenced to each other. The graphic diagram is the major component of an IDEF0 model, containing boxes, arrows, box/arrow interconnections and associated relationships. Boxes represent each major function of a subject. These functions are broken down or decomposed into more detailed diagrams, until the subject is described at a level necessary to support the goals of a particular project. The top-level diagram in the model provides the most general or abstract description of the subject represented by the model. This diagram is followed by a series of child diagrams providing more detail about the subject.

Each model shall have a top-level context diagram, on which the subject of the model is represented by a single box with its bounding arrows. This is called the A-0 diagram (pronounced A minus zero). The arrows on this diagram interface with functions outside the subject area to establish model focus. Since a single box represents the whole subject, the descriptive name written in the box is general. The same is true of the interface arrows since they also represent the complete set of external interfaces to the subject. The A-0 diagram also sets the model scope or boundary and orientation.

The A-0 context diagram also shall present brief statements specifying the model's viewpoint and purpose, which help to guide and constrain the creation of the model. The viewpoint determines what can be "seen" within the model context, and from what perspective or "slant". Depending on the audience, different statements of viewpoint may be adopted that emphasize different aspects of the subject. Things that are important in one viewpoint may not even appear in a model presented from another viewpoint of the same subject.

The single function represented on the top-level context diagram may be decomposed into its major sub-functions by creating its child diagram. In turn, each of these sub-functions may be decomposed, each creating another, lower-level child diagram. On a given diagram, some of the functions, none of the functions or all of the functions may be decomposed. Each child diagram contains the child boxes and arrows that provide additional detail about the parent box.

The child diagram that results from the decomposition of a function covers the same scope as the parent box it details. Thus, a child diagram may be thought of as being the "inside" of its the functions, none of the functions or all of the functions may be decomposed. Each child diagram contains the child boxes and arrows that provide additional detail about the parent box.

The child diagram that results from the decomposition of a function covers the same scope as the parent box it details. Thus, a child diagram may be thought of as being the "inside" of its parent box. This structure is illustrated in Figure 4.

A parent diagram is one that contains one or more parent boxes. Every ordinary (non-context) diagram is also a child diagram, since by definition it details a parent box. Thus a diagram may be both a parent diagram (containing parent boxes) and a child diagram (detailing its own parent box). Likewise, a box may be both a parent box (detailed by a child diagram) and a child box (appearing on a child diagram). The primary hierarchical relationship is between a parent box and the child diagram that details it.

Text and Glossary

A diagram may have associated structured text, which is used to provide a concise overview of the diagram. Text shall be used to highlight features, flows, and inter-box

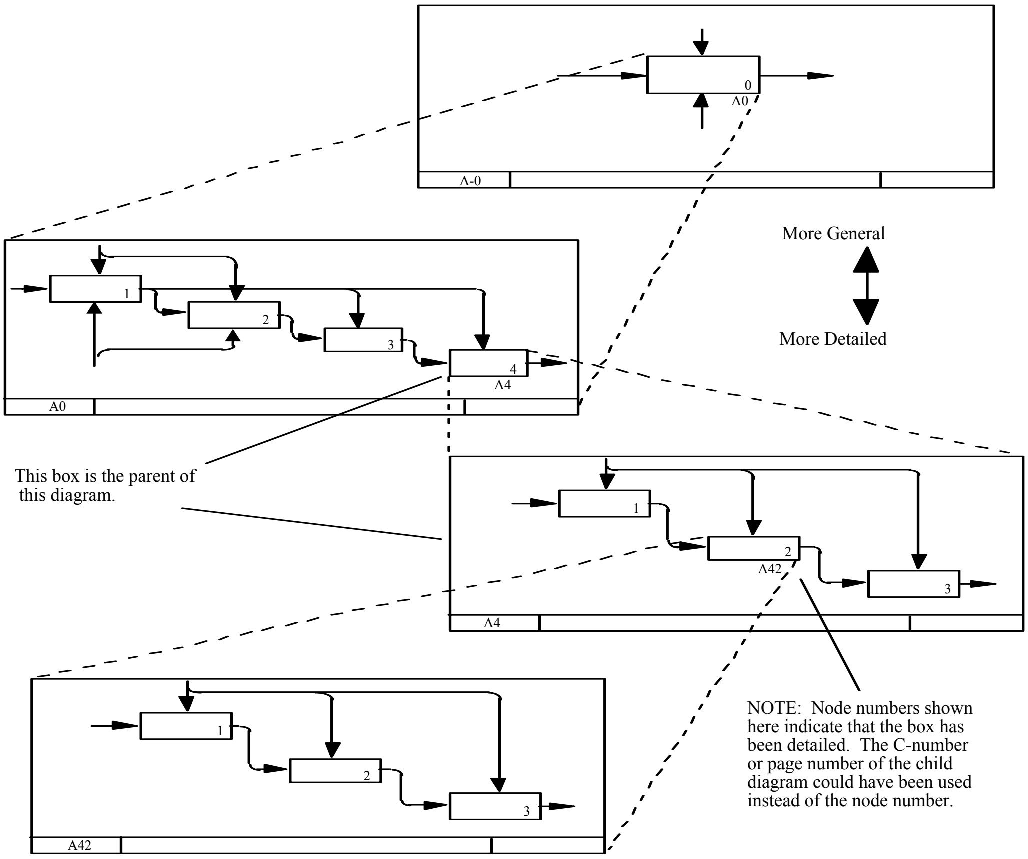

Figure 4 *Decomposition Structure [1]*

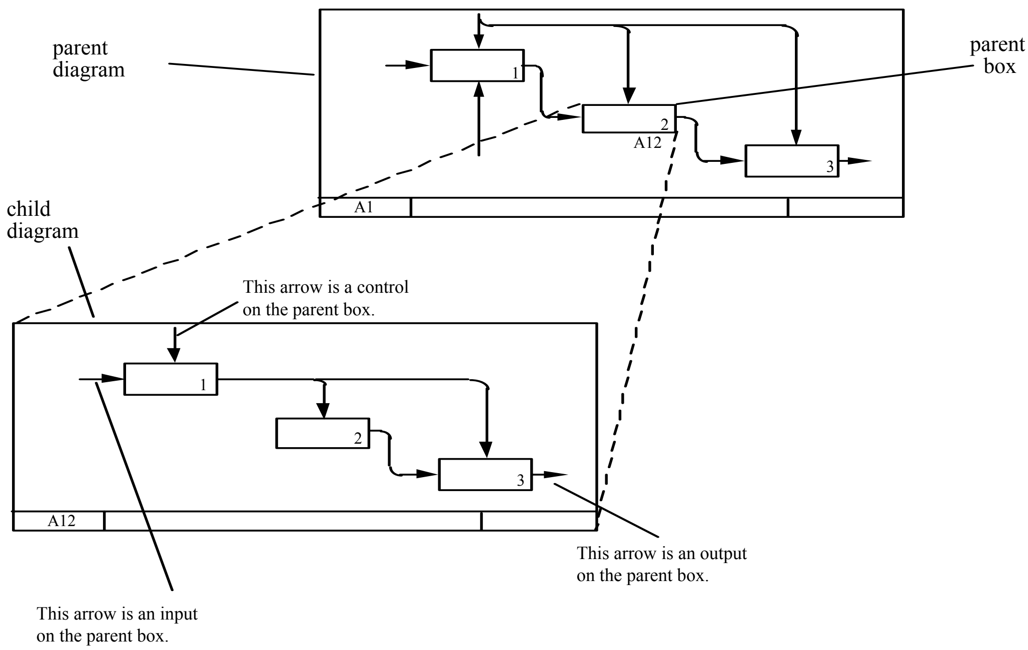

Figure 5 *Boundary Arrow Correspondence [1]*

2. PROCESS OF IDEF0 APPLICATION

The IDEF0 methodology may be used to model a wide variety of automated and non-automated “systems” or subject areas, including any combination of hardware, software, machines, processes or people. For new systems IDEF0 may be used first to define the requirements and specify the functions, and then to design an implementation that meets the requirements and performs the functions. For existing systems, IDEF0 can be used to analyze the functions the system performs and to record the mechanisms (means) by which these are done.The development of IDEF0 model is a dynamic process which requires the participation of more than one person. Throughout a project, the draft portions of a model are created by authors and distributed to others (project members, experts in the subject matter, management, etc.) for review and comment. It requires brief training and modest experience to correctly read and understand IDEF0 models. Such knowledgeable understanding is essential if the team-supplied quality assurance of IDEF0 modeling is to be realized therefore at the beginning of the project must be defined IDEF0 team which should be compound of following members:

Authors – they are prepareing IDEF0 model, getting information by interview *Experts* – they have knowledge about object, which is describing. *Readers* – experts or whoever on reader´s list, they are doing review, but their task is not do formally moving papers	TEAM 1
Opponents – experts or other authors - they are trained in IDEF0 technigues, their task is moving papers of changes *Archivist* – keep the documentation, create,record anddistribute copies of documents and complete file	TEAM 2

Figure 6 *IDEF0 Team*

2.1 Guide for function modeling

In this part I will try to describe several steps, which are used for function modeling. The steps are following:

a) determination of purpose a viewpoint
Before beginning any model, it is important to determine the model’s orientation. This includes the context, viewpoint and purpose. The viewpoint determines what can be “seen” within the context, and from what “slant” or perspective. Depending on the purpose, different viewpoints may be adopted that emphasize different aspects of the subject. There is only one viewpoint per model.

The purpose establishes the intent of the model or the goal of communication that it serves. Purpose embodies the reason why the model is created (functional specification, implementation design, customer operations, etc.).

b) creation list of datas and activities

List of datas includes for example price, quality, orders, deliveries, payments, advertising...

List of activities includes suppliers assesment, product improvement, opening new plants...

c) configuration of actions and datas.

By configuration is recommended mostly six actions and is needed take in consideration affinity of the functions, flexibility, complexity and datas align in compliance with purpose.

d) Proposal and structure of boxes.

This step contains following activities: configuration boxes by grades
composition boxes in consideration of significance
name a box

e) arrows addition

By this step is important to check list of arrows that we are sure we used all datas.

f) variant´s checking rests in checking all possibilities and all actions have to have regulations and outputs.

g) Readers/authors cycle.

As the first readers is needed to choose another author, which is disabused that he corrected the mistakes and provided knowing comments to describing. For second and last round is recommended to involve management and staff which process concerning.

In addition to definition of the IDEF0 language, the IDEF0 methodology also prescribes procedures and techniques for developing and interpreting models, including ones for data gathering, diagram construction, review cycles and documentation.

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