Management of Information Model of the Telecommunications Network Under Cyclic Life Cycle

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***Abstract*—The functioning process of telecom companies is cyclical. Each cycle may vary in the composition and structure of the network. When there is a change, it is not enough to have just historical information. It is important to understand which elements of the old network structure form a new structure. In this paper we propose to store information about the assets of the telecommunication network in temporal multidimensional data warehouse.**

I. INTRODUCTION

The process of functioning of the telecommunications network is cyclical. Stages of designing alternate phases of the project. Then comes the stage of modification, which also requires the design and implementation. At all stages of the life cycle a network information model is modified. In terms of constructing cycling network, specific mechanisms to keep information model up to date are applied.

II. PROBLEM DEFINITION

At present, the work on the implementation of the production assets management standards is being actively carried out in industry and related systems that automate the processes described in these standards - EAM (EnterpriseAssetManagement) system.

Currently EAM system is a fully integrated software solution designed to monitor the daily operational activities of the capital-intensive businesses and support its core assets and funds of the life cycle. The introduction of EAM enterprise usually pays off within the first year of operation.

Concurrently with the development of EAM systems in industry, methodology of information modeling in the design and construction was being developed. Information objects modeling is a process in which the object is formed by the information model of production - AIM (Asset Informational Model).

AIM-model starts developing at the time of the decision to initiate the design, continues to be formed in the process of project preparation and construction.

Fig. 1 shows the filling cycle of BIM (Building Information Model) information.

The cycle begins in the upper right corner of the circuit and passes the stage of pre-project analysis, design, commissioning, operation, and then the results of assessments of the status of decommissioning or upgrading [1].

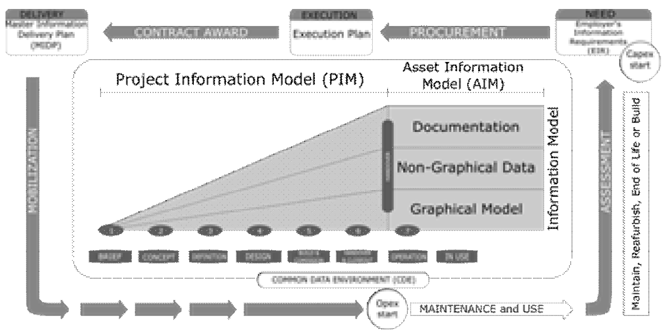

Fig. 1. AIM filling cycling

Thus, at each stage of the BIM process, we have some information model, which reflects the amount of processed information about the construction site.

Furthermore, complete information model object does not exist at all, for we can always supplement the model with new information available at some point in time. The process of information modeling, carried out as any human process, solves some sets of problems at each stage before completing the task. The information model of the object each time is the result of solving these problems[2].

AIM-model is currently widely used in the design phase, so the basic amount of the information collected is for the design and construction, and ceases to accumulate, or accumulates in much smaller amounts, after putting the object into operation.

Lack of accurate business processes and information systems that keep the AIM-model up to date during operation causes the loss of the relevance of the model almost immediately at the beginning of the operation.

As a consequence, during the evaluation of the object status and the decision to modernize the company that owns the object may face the necessity to update the whole information model. However, this scheme of information model replenishment is applicable only for the cascade model of construction projects [3].

II. Temporal information model concept

The telecommunications industry is dominated by cyclical development model objects.

Objects are built, developed and then modified. Thus the accumulation of information never ends. It is possible to keep the information up to date at the current moment and update it at certain stages of the project modifications [4].

However, this approach limits the possibility of analyzing the development of the information model. We propose to use a fundamentally new approach - temporal information model objects.[5], [6]

To save not only up to date information about the object, but also all modifications and modernization processes in the model, as well as changes in the topology it is necessary to keep all accounts of the historical data. But as a data model may vary not only in composition but also in structure, not just an information model of the object, but the temporal information model of the object is needed. The temporal information model of the object is not just the accumulation of information about the object, but also metadata about the structure of the model itself [7].

During the operation of the spatial data warehouse in the elements and measurement structure over time the following changes may occur: adding, changing, disappearance, splitting and combining of the elements of measurement; adding and deleting measurements; changes in the hierarchical relationships measuring elements - in the case of hierarchical dimensions. All these changes should be taken into account, since the analysis can be involved in how the data relevant to the change in time of measurement, and data in the time expired after the measurement, change. Although modifications to the structure and elements of dimensions, information about previous measurement conditions must remain in the system and participate in the assay.

There is a generally accepted tracking technology developed by R. Kimball [8] to track changes in elements, if the changes in dimensions occur much less frequently than the addition of the data in the fact table. However, in the case of multiple changes, as well as the changes in the hierarchical dimensions of the classic techniques do not allow to solve the problem of data integrity, - storing information about the measurement structure to change. Certain results in solving the problems described manages to achieve a modification of the multi-dimensional data model representations in the temporal multidimensional model and the use of temporal data warehouse [7].

III. Conclusion

With this model, we can get the up-to-date model at any given time. The possibility of obtaining target information model is of a particular importance. If it is temporal, we can trace the proposed solutions to optimize, analyze and correct them in detail. The use of temporal information model of the object will produce tracking of all phases of telecommunication infrastructure object life cycle and decide on a strategy for its further use.

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References

[1] The British Standards Institution, *Specification for information management for the capital/delivery phase of construction projects using building information modeling,* BSI Standards Limited, 2013, pp. 105-135.

[2] National Institute of Building Sciences, *National Building Information Modelling*, BuldingSMARTalliance. 2007, pp. 182-214.

[3] B.Succar, "Building Information Modeling Framework: A Research and Delivery Foundation for Industry Stakeholders", *Automation in Construction.*, vol. 18(3), 2009, pp. 357–375.

[4] D.V. Spanderashvili, "Mechanisms for tracking changes in multidimensional data structures", *Info communication technologies in science, manufacturing and education:Second international Scientific and Technical conference.*, 2006, pp. 160-162.

[5] D.V. Spanderashvili, "Example algorithm cube data transformation using the transformation matrix", *Caspian magazine: Management and high technology. Scientific and Technical Journal.*, №3 (15), 2011. pp. 30-38.

[6] J. Eder, C. Koncilia, "Changes of Dimension Data in Temporal Data Warehouses", *Data Warehousing and Knowledge Discovery, Third International Conference*, 2001, pp.284-293.

[7] J. Eder, C. Koncilia, D. Mitsche, "Analysing Slices of Data Warehouses to Detect Structural Modifications", *Advanced Information Systems Engineering, 16th International Conference*, 2004, pp.492-505.

[8] R. Kimball. "Slowly changing dimensions", *DBMS and Internet Systems*, vol.1, no.4, 1996, pp.80-84