TITLE: "LOGICAL VS. PHYSICAL DESIGN: DO YOU KNOW THE DIFFERENCE?"

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"Whereas logical information resources will remain relatively static, the physical resources will change dynamically."
- Bryce's Law

The physical aspects of our information resources are well understood by developers; e.g., computer hardware/software, DBMS files, manual files, screens, reports, forms, etc. The logical side of our resources is a bit more nebulous, yet just as important, if not more so, than their physical counterparts. Think about it. In its simplest form, logical information resources include data and process components. The physical components describe "how" it will be implemented. For example, companies have been implementing payroll systems for many years prior to the advent of the computer. We have seen payroll implemented manually, then with time clocks and punch cards, followed by automation on mainframes, minis and PC's. We have also seen such innovations as "direct deposit" to expedite paying employees, and electronic government reporting. All of these devices are simply a physical variation of a theme. Its a lot like music; the composition represents the logical and the orchestration represents the physical. For example, Paul McCartney of the Beatles wrote one "Yesterday," yet hundreds of renditions of it have been recorded by different artists over the years.

The physical implementation is ultimately based on available technology and, as such, changes dynamically. In contrast, the logical side represents the inherent nature of a business and only changes if the business changes, which is considerably less volatile than the physical.

It is important to understand that logical design is a precursor to physical design. In other words, the physical implementation must serve the business, not the other way around. Too often this is a false assumption and developers spend an inordinate amount of time and money devising a technical solution without fully understanding the logical design. This is commonly referred to as "the cart before the horse" phenomenon. The logical design of information resources always precedes physical design. Failure to do so is an exercise in futility.

RE-ENGINEER?

I now hear pundits in the industry saying companies have to re-engineer their systems in order to implement SOA (Service Oriented Architecture). Are we really re-engineering or are we simply introducing a new physical implementation? Frankly, it is the latter. In an earlier bulletin, I described this logical/physical phenomenon as implemented by a large Fortune 500 conglomerate; see:

No. 8 - *"Is Software Hard?"* - Jan 24, 2005
http://www.phmainstreet.com/mba/ss050124.pdf

Basically, the company devised a standard Payroll System to be implemented by all of their divisions on a worldwide basis. They first produced a complete logical design of the system, followed by a single physical implementation (the recommended standard to be used). Recognizing some of their divisions might need to use other computer equipment, they provided the logical design for these divisions to implement. This resulted in multiple physical implementations of the same logical payroll system, all working harmoniously together. This included implementations using IBM MVS, VM, Honeywell GCOS, UNIVAC Exec, HP MPE, and DEC VAX/VMS, What this illustrates is that a logical design can be implemented many different ways, not just one. The conglomerate didn't have multiple systems; only one, with multiple physical implementations.

The reason developers are more imbued in physical design as opposed to logical design is rather obvious; the physical components are much more tangible than the logical components. Because people can "touch and feel" something, they are more likely to relate to it. As a small example, there are those people who can read a set of blueprints and comprehend what a house or building will look like. But in contrast, there are those who need to walk through a physical model in order to assimilate what the structure will look like.

It is because of our natural inclination to assimilate the physical design, and not the logical, that people find it easier to describe screen or report layouts as opposed to business requirements.

(continued on page 2)

(continued from page 1)

TYPES OF INFORMATION RESOURCES

As I have described many times in the past, there are three types of information resources: Business components (the consumers of the information), Systems components (representing processing), and Data components (the facts and events of the business). There are logical and physical dimensions to all three:

BUSINESS COMPONENTS

Logical: Functions - a prescribed scope of duties and responsibilities.

Physical: Jobs/Positions (one job may implement multiple functions, and one function may be implemented by multiple jobs), and Human/Machine Resources.

SYSTEM COMPONENTS

Logical: Systems, and Sub-Systems (representing a business process).

Physical: Procedures (both manual and automated), Steps (tasks), Programs, Modules/Subroutines

DATA COMPONENTS

Logical: Data Bases (logical), Objects (logical files), Views (logical records), Data Elements, Inputs and Outputs.

Physical: Data Bases (physical), Files (manual and computer), Records, Data Elements, Inputs and Outputs.

You'll notice that Data Elements, Inputs, and Outputs are listed as both Logical and Physical. Logically, Data Elements have a single definition (representing a single fact or event) but can be implemented physically many different ways. For example, "Ship Date" has one logical definition but can be expressed many different ways;

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Inputs represent how data is collected and Outputs represent how information is conveyed. As in the Payroll System example mentioned above, Inputs and Outputs were defined logically first, then implemented physically to suit a particular physical environment. Inputs and Outputs are designed logically for Sub-Systems, and physically for Procedures, Steps, Programs, etc.

As the various logical components are defined, they are then linked to the physical components implementing them, thereby demonstrating how the physical solution satisfies the logical problem. To do so, a Repository is needed to map such relationships.

THE LOGICAL BUSINESS

This differentiation between logical and physical is vital for successful design. To illustrate:

- By having a logical model of the business (functions), we can determine a suitable physical implementation of jobs, and human/machine resources.

- By having a logical model of a system (sub-systems with logical inputs, outputs, and files) we can determine a suitable physical implementation.

- By having a logical model of a data base (objects), we can determine a suitable physical design of the data base.

It is the failure to prepare such logical designs that inevitably leads to problems in physical design later on, particularly when it is necessary to prove that a physical solution solves a logical design (aka, "Design Correctness"). Before we embark on a costly re-engineering project (whether it be to implement SOA or whatever the next technological innovation will be), perhaps it would be wise to first take stock of our logical components so we know what we are ultimately implementing.

But let's take it a step further; if we can logically model a type of business (such as a bank, insurance company, etc.), then it shouldn't be too difficult to develop standard templates for implementing businesses physically. This was the point of a past article:

No. 23-*"Using Logical Models as Templates"*-May 9, 2005
http://www.phmainstreet.com/mba/ss050509.pdf

This suggests corporate success is greatly influenced by who has the best physical implementation of the logical model.

CONCLUSION

The logical model is stable; it will only change if the business changes (due to mergers, acquisitions, diversifica-

(continued on page 3)

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tion, new products/services, etc.). The physical model is much more dynamic, and is ultimately driven by changes in technology. The physical model is certainly not irrelevant, but I believe we have become too bound to it. A logical model represents independence of our physical environment, thus permitting mobility and portability to new physical environments. If done properly, new physical models can be implemented less painfully than they are today. In fact, a good logical model expedites the implementation of the physical model.

Logical design has been an inherent part of the "PRIDE" Methodologies for IRM for a long time. In "PRIDE"-EEM (Enterprise Engineering Methodology), Phase 2 is used to define the logical model of the business (functions). In "PRIDE"-ISEM (Information Systems Engineering Methodology), Phase 2 is used to define the logical model of a system (sub-systems). In "PRIDE"-DBEM (Data Base Engineering Methodology), Phase 2 is used to define the logical data base model for a system; Phase 3 is used to define the logical data base model for the enterprise. Of course, phases for physical design are also included.

Some see logical design as a pipe dream. I see it as a practical reality. The problem though is thinking in terms of logical models. Most developers today think only in terms of the physical aspects of our information resources. Devising a logical model requires someone more in tune with the business as opposed to technology. This used to be the forte of the Systems Analyst which, regrettably, is an obsolete job description. Instead, it defaults to Enterprise Architects who should be more adept at seeing the bigger picture.

END

About the Author

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