

How Should We Implement Business Process?

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How Should We Implement Business Process?

Introduction

MetaPower has been working with business processes since the late 1970's. Along the way we have learned a lot about these processes and how to effectively design, construct and deploy computer applications that automate them. The key driving principle over all the years has been the belief that much like the natural world, business processes have a fundamental structure and behave in fundamentally consistent patterns. If we can identify and understand this structure and these patterns, then technologies and tools can be developed to deliver significant improvement in business processes performance. It can fundamentally change the way they are developed and used. Much as understanding the structure of the atom offered the promise of boundless energy, understanding the nature of business processes and how they fundamentally implement commerce can open the door to a quantum improvement in the cost and efficiency of that commerce.

The following discussion describes a work that is still in progress. We have developed and deployed a "Business Process Work Station" that implements virtually any business process. The work station is based on the structures and patterns inherent in business process and discussed here. Our challenge is developing and selling the business process application(s) that the exploit the technology.

The first section, "Have Things Really Changed?", alludes to the patterns we recognized early in our career and describes the basic concepts that must be addressed to successfully develop and implement an automated business process.

The second section, "What is the Process Control Standard?", describes the process control features and functions that are deployed in the business process technology (Business Process Work Station). The Business Process Work Station is designed to host virtually any/all business process(s) and this section describes the suite of functions and features required to make that possible.

The third section, "What is a Process-Centric Data Architecture?", describes the underlying architecture that is required to make the business process technology viable. We have identified nine generic archetypes that make up all processes. This section describes these archetypes. As noted in the following discussion and in the Bibliography, MetaPower currently holds 4 patents on the Process-Centric Data Architecture.

The fourth section, "What Happened to Application Programming?", describes the new approach to designing and building automated business processes. It uses the "Tinker Toy" metaphor to illustrate that the Business Process Work Station has all the functionality needed to implement any business process step. All we need is to activate the appropriate features, provide the asset data and direct the routing between process steps. Building automated business process will be like children playing with "Tinker Toys".

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Have Things Really Changed?

Solomon wrote “History merely repeats itself. It has all been done before. Nothing under the sun is truly new” (Ecclesiastes 1:9). Process analysis has occurred since the early 1930’s, even before computers were invented (Wikipedia, Petri Net, 2014). And yet we still struggle to implement business designs that are specific to our companies. We design the business process and then we 1) re-define the business process based on the software that comes closest to what we really want to do, or 2) take the time (and expense) to create custom software to implement the business process. What if there was a way to “have your cake and eat it too”?

Having done Business Analysis since 1978, we have come to realize that we are basically doing the same thing over and over and over. We change the names and the business rules, but business work has a pattern. What if we used that pattern and built an application that would do ANY business process? All we would have to do is define the data and the business rules so that the application would do the rest. This would eliminate major time and cost factors when implementing the business designs that we so carefully develop and promise to the end-users.

For each step of a business process, there are 7 basic concepts in defining the work to be performed.

1. Clearly-defined Responsibilities
2. Communication
3. Process Flow
4. Data
5. Business Rules
6. Authority
7. Timeliness

Let’s take a closer look at them:

- Clearly-defined Responsibilities

Each step of a business process needs to have clearly defined responsibilities. This includes a defined group of people who can perform the work, a defined person who is responsible to see that the work is performed (the “Owner”), and the person who was responsible in doing the work. The rules for who can perform the work and who owns the work can vary from step to step and can be simple (the safety officers and their supervisor) or complicated (the planners for the specified skill and plant and their lead planner).

Although many people may participate in performing a step of a process (e.g. planning the solution for a corrective action), one person needs to be responsible for the decisions of the group and to complete the task. That does not mean that they did all the work. Collaboration still needs to take place in a business process step.

- Communication

Communication begins with the notification that work is to be performed. Unless someone knows that they are responsible to do something, it will never get done. For a person’s primary job function, just providing an “in basket” that they check throughout the day may be sufficient notification. If a

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business process responsibility is a secondary or tertiary job function, a more direct communication is required. Today email has become a standard means of notification, even in the workforce. Thus a business process step needs the ability to send email notifications to the appropriate parties when work has reached a particular step. This can be to the responsible parties, the initiator or third parties with oversight responsibilities (e.g. notifying the safety officer that a safety-related action has been identified).

Communication also includes expected completion of the step of a process. Each step of the process needs to be able to determine when the step should be completed. This can be a standard duration (e.g. all approvals are to be completed within 3 business days) or it can be scope related where the process determines a reasonable duration (e.g. milestone dates). These dates not only need to be determined, but also communicated to the responsible persons in a clear and predictable fashion.

Not only does communication need to be able to occur at the beginning of the work, but it also at the completion of the work. Notification that the work has been completed may be as important as that the work has been started. Again who gets it and what is communicated depends on the nature of the step of the process. Email notifications should be available when a step is completed.

- Process Flow

Obviously every business process has a flow. Each step of the process needs to know where it is in the flow. The step must know what the next step(s) are and under what conditions can the work flow to which steps. This includes both going forward and going backward.

Work can route forward from the step only when it has complied with 1) all the “exit” business rules of that step (without violating any of the rules of the previous steps); 2) the “entrance” business rules of next step; and 3) any routing rules that may be in place. Exit Rules determine the data that this step needs to provide in order to finish. Entrance Rules determines the data that this step needs to have provided in order to start. Route Rules determine the data/conditions that must be met to go to a particular step.

Work can route backward from the step when a mistake has been made and work needs to be corrected and possibly re-routed. Rules need to be established so that work does not back route too far. For example, of the “Schedule Work” step has a problem with the plan, the work should not be routed back to the initiator; it should be routed back to the planner. If the planner has an issue, they can back route to the initiator for clarification.

- Data

Each step of the process should have access to all the data needed to perform that step. Conversely, it should not show data that is not needed to perform that step. The data can be display-only or it can be edited or created within that step. The data may also come from reports associated with that step when the data is only rarely needed or when research is needed to make decisions (e.g. Equipment repair history).

It is also valuable to understand the data that has changed from step to step and to understand if other processes are attempting to change the same data (to avoid “data collisions”).

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Access to the history of the data is critical to understand why the data is the way it is today, especially a history that can coordinate different business process changes to the same data.

- Business Rules

When a process step is defined, there are expectations as to what is to occur in that step. These “rules of the business” are both rules for data and rules for action. The obvious data rules were discussed above. The less obvious rules are the actions that are to be performed within the step. Without a consensus of what is to be done, the output of a process step will be inconsistent and the process will break down. Typically implemented as procedures, the business process step needs to define the actions that the responsible persons will perform, both manually and through the automation.

- Authority

A business process is the authority to change a business asset. Too many times we build applications that short-change the authorization process and only provide Insert, Update and Delete capabilities for a business object (an asset). How many applications have a Change Employee or Change Equipment transaction that everyone uses to make their changes to these business objects? Typically there are many processes that maintain some or all of the data of these business objects. A business object should only be changed as the end-result of a business process that documents and justifies the changes being made.

- Timeliness

As business happens, data changes. Understanding the order in which the data was changed is important to understanding what happened. Keeping the “official” record is important, but keeping it over time is even more important. Being able to answer questions about how things were at the time a certain event occurred is sometimes even more important. For example, did the person who performed the repair have the required certifications AT THE TIME that the work was performed? Data needs to be kept so that the official records are preserved over time.

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What is the Business Process Control Standard

How many times have you been on a Process Design project where you have worked with the end-users to establish the best practices for their business area? You complete the process design and then the end-users start looking for a way to automate the design. They come back saying that there is no software to implement the design. They are now faced with the choice of either developing a custom application, which usually takes 9 to 18 months, or using off-the-shelf software and giving up on the innovations that were designed into the process to provide efficiencies and/or a competitive advantage.

What is needed is an application that can fully implement any business process AS DESIGNED. In order to do this, the application needs to implement, as the basic functionality, the process concepts identified in the previous section. We call this basic functionality the “Business Process Control Standard.” These standards apply to each “Unit of Work¹” performed by a business process.

The Business Process Control Standard includes the concepts in Table 1:

Responsibility / Assignment Concepts	Process Flow Concepts
<ul style="list-style-type: none">• Responsible Users• Ownership• Blank Forms• In Basket• Out Basket• On My Desk• My Team’s Work• Work Selection Data• Natural Security• Reports	<ul style="list-style-type: none">• Process Step• Process Step Data• Process Routing• Back Routing• Route Maps
	Communication Concepts
	<ul style="list-style-type: none">• Notifications• Notes• Help

Table 1 – Business Process Control Standard Concepts

Responsible Users

The Responsible User concept establishes personal responsibility for all Unit(s) of Work in the business process. For each Unit of Work, there is a defined workgroup who can perform the work. The workgroup can be based on organization (e.g. Maintenance Planning) or on assigned roles (e.g. Safety Officer).

It is best, though not always achievable, to define the responsible users for each step of the business process to include more than one person. If only one person can perform a step of a process and that person is not available, the process can get stuck. To help alleviate this problem, delegating responsibilities to other is very important. Done “properly”, this will allow for both planned and unplanned absences.

¹“Unit of Work” refers to a business process instance. For example, you have a Time Reporting process. Every Timesheet that is processed in the Time Reporting process is a “Unit of Work” that must be completed in accordance with the rules of the process design. Each Timesheet (Unit of Work) may go through many steps before it is completed, each one possibly performed by a different person.

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Delegation of responsibilities requires that when work is completed by the delegate², that the history of the Unit of Work knows both who actually did the work (the delegate) and for whom they were doing it (the delegator).

Ownership

The Ownership concept establishes corporate responsibility for all Unit(s) of Work in the business process. For each Unit of Work, there is one person who is responsible to make sure that the work for that step of the process gets done. The rules of ownership can be very simple (e.g. “Shift Supervisor”) or complicated (e.g. “Planning Supervisor for the plant and lead work discipline of the work order”). The owner can assign individual responsibility of each Unit of Work to a Responsible User or they can choose to do the work themselves.

Like with Responsible Users, Ownership should also be able to be delegated to others.

Blank Forms

Forms have been the basis for doing business for centuries. The Business Process Work Station should likewise be based on forms. Those users who can initiate a business process (e.g. Report Time) should have access to the form that initiates the business process (e.g. Time Sheet). Access to the forms should be based on security settings for the roles that each user has been assigned (see “Natural Security”, on page 10).

The Blank Forms concept establishes the mechanism for initiating a new Unit of Work in the first step of the appropriate business process.

In Basket

The In Basket concept is based on the office in basket. The In Basket contains all the Unit(s) of Work that a user of the Business Process Work Station is authorized to work on. This includes all Unit(s) of Work for which they can be a Responsible User (see “Responsible Users”, on page 7). This is the biggest distinction between an application and a process work station. The goal of the user isn’t to run the right application at the right time, but to take care of the forms that are their responsibility and to send the forms on to the next step of the process. At any one time a user can be involved in many processes. They need a way to keep track of all of these. Having a dozen different applications on your desktop doesn’t help you keep track of things. Having a single “In Basket”, where all work comes into, is an efficient way to do things.

Unlike the basket that physically sits on your desk where a form (a Unit of Work) can only be in one person’s basket at a time, the electronic In Basket allows the form to be in multiple In Baskets at the same time. Thus, the people who are authorized to complete a Unit of Work can see that it is ready to be worked on. The first person to claim the Unit of Work removes it from the In Basket and puts it on to their electronic “desk” (see “On My Desk”, on page 9). At that point, the Unit of Work is no longer available in anyone else’s In Basket and is now the responsibility of the person who “pulled” the Unit of Work.

Work groups can choose to use the above “Pull” concept for assigning work (each person in the work group pulls the Unit(s) of Work out of the In Basket). They can also use a “Push” concept where the Owner (see “Ownership”, above) assigns each Unit of Work to a designated person in the work group. Using the “Push”

² the person designated as “responsible” for the work of the delegator,

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approach, people only need to look “on their desk” to see what work they need to take care of. As with real desks, the Business Process Work Station can get too many forms piled on to a desk, making it difficult for the user to set good priorities. A balance of “Push” and “Pull” needs to be maintained so as to not overwhelm those doing the work.

Out Basket

The Out Basket concept contains all the Unit(s) of Work that one has completed. Unlike the Out Basket that physically sits on your desk where the form sits until someone picks it up and delivers it to the next person, the electronic Out Basket allows one to see ALL the items that they have completed and sent on to others, regardless of how long it has been. We have found that many times people are asked, “What happened to my form that I approved?” The Out Basket answers that question.

On My Desk

When a Unit of Work is assigned to a person, it is on that person’s electronic “desk.” Only the Responsible User (through “On My Desk”) and the Owner (through “My Team’s Work” (see below)) can access the Unit of Work. The On My Desk concept prevents confusion as to who is doing what. Work on your electronic “desk” can either be:

- Worked on (and retained on your desk)
- Completed and sent on to the next step (via the Out Basket)
- Stopped (putting the Unit of Work back in the In Basket so that others can work on it)
- Assigned to another desk (making someone else responsible for it).

Once again, getting too many things on your desk at the same time can create confusion and should be managed wisely.

My Team’s Work

The My Team’s Work concept gives the Owner(s)³ of process steps the ability to see all the work that they own. This allows the Owner to oversee which work is being worked on (on someone’s desk – see “On My Desk”, above) and which work is waiting to be worked on (still in the “In Basket”, on page 8). Overseeing the Unit(s) of Work gives the Owner flexibility to:

1. *Assign Unit(s) of Work to Responsible Users (on page 7), by using the “Push” approach to task management.*
2. *Reassign work to other Responsible Users to balance the work load of the work group or to address absences (due to vacation, sickness or other causes). This moves Unit(s) of Work from one person’s electronic “desk” to another’s electronic “desk”, or in the case of un-assigning work, back to the In Basket).*
3. *“Pull” Unit(s) of Work to their own electronic “desk”, becoming the Responsible User.*

³ Although a Unit of Work has only one Owner, there can be different Owners for the same step if Business Rules establish which Unit(s) of Work belong to which Owners.

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Work Selection Data

When selecting Unit(s) of Work to select, work or reassign, it is important to understand the priority of the work. Most times, there is more work to be done than can be done at one time. In those cases the data on the form can give an indication of what is most important. For example, the Work Type and Priority of a Work Order will determine which one is more important. The concept of Work Selection Data is that for each step of the process, the data that can determine priority of the Unit(s) of Work is specified. When the User is deciding which Unit(s) of Work to give their attention to first, the Work Selection Data is displayed (in the In Basket, On My Desk, or My Team's Work) to help the user make that decision.

Natural Security

Determining who can do what is an issue of security. When at all possible, security should be based on the actual data of the organization. For example, those employees in the Planning organization are authorized to do planning steps of a Work Order business process. The more the security can be based on "natural data" the easier it is to maintain. If the security rules require special authorizations, there is then a need to create a Security Administrator function that will become a bottle neck in managing the business process.

We have found that assigning Business Roles (capabilities) to the organization structure is the best way to implement security rules in a Business Process context. Each step of the business process defines the Business Role that identifies the Responsible Users (on page 7) and the Ownership (on page 8).

Reports

Any Business Process has the need to generate reports. Reports are of two varieties: stand-alone reports and step reports.

Stand-alone reports are accessed outside of any particular business process. Security for stand-alone reports must be specifically granted. The criteria for these reports are supplied by the person running the report.

Step reports are accessed inside a specific step of a business process. Security is automatically granted by being authorized to perform the step as Responsible Users (on page 7). The criteria for these reports can come from the step's screen, so the report is tailored to the specific step's data.

Process Step

For the Business Process Work Station, the definition of a process step is:

All the work that is to be done by a Responsible user until:

- 1. Someone else needs to be responsible to continue the work, or*
- 2. Someone in the company needs to know that the work up to that point has been completed.*

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The most basic demarcation between process steps is the change of ownership and responsibility. Because only one person can be responsible for a Unit of Work at a time, another process step is required if another person needs to perform certain tasks of the process⁴.

A more subtle distinction of a process step occurs around corporate milestones that occur within the performance of one step of the process. When this occurs, the step needs to be divided into two steps. For example, a planner may be responsible for performing a root cause analysis AND for preparing the plan to address the root cause. Management may want to know what Unit(s) of Work have completed the root cause analysis and which ones are being planned. This milestone requirement will require that the step performed by one person be divided into two steps.

For the purposes of Process Step determination, the change of responsibility also includes the change of ownership.

Process Step Data

A key Business Process Work Station concept is that each process step must provide access to all the necessary information for performing the work of the process step. The responsible user should not have to access multiple tools (applications) in order to do their work (one-stop shopping). This means that each step should have its own screen showing only the data that pertains to the step being performed. This also makes sure that only the data editable in that step is editable.

Thus the maintain screens (like “Maintain Item Master”) no longer exist. This traditional mode of application design has created a complicated programming problem as it requires all the business rules of all the processes that can change the Item Master record to be integrated into a single program. Making a change to its rules requires re-integrating all the needs of all the processes that use the maintain screen before the change can be implemented. The “unique screen for each step of the process” concept allows the rules to be separate and independently maintained, reducing programming time and providing a clear presentation of the information needed to do the work.

Process Step data needs to be maintained so as to provide a complete history of what happened in each step of the process. The Business Process Work Station should provide easy access to the history so that IT can see who did what (the traditional view of Audit Trails) and so that the Responsible User can see what has happened in the past. The history should easily show what data was changed at each step of the business process, who changed it and when it was changed. At this time we do not see a need to track changes below the step boundary⁵.

⁴ Note that the premise that one person at a time is responsible for a Unit of Work requires that if parallel processing is required, a second Unit of Work is required for the work that is to be done in parallel to the first Unit of Work.

⁵ In other words, when, during the completion of a step, the data was changed is not important.

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Process Routing

Business Processes define a flow of information between steps. The flow can be simple (each step flows to the next step, with no branches – see Figure 1).



Figure 1 - Simple Process Flow

The flow can be complex (a step can be followed by more than one step – “fan out” - and a step can be preceded by more than one step – “fan in” – see Figure 2).

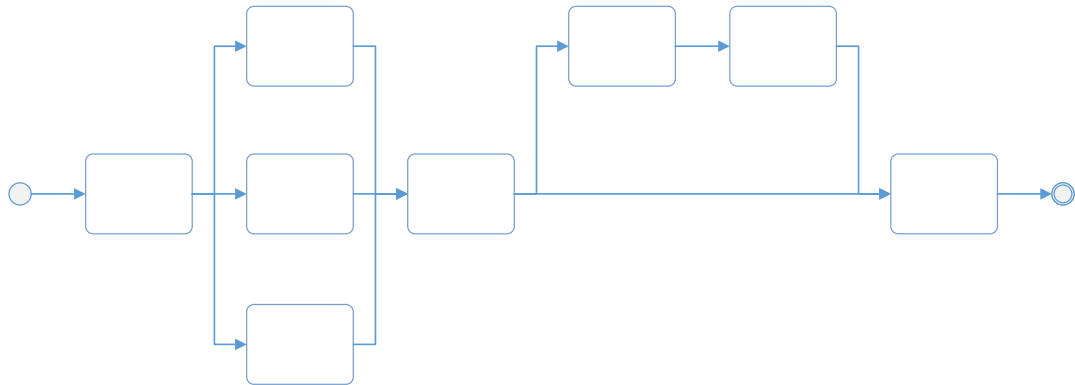


Figure 2 - Complex Process Flow

Before a Unit of Work can proceed from one step to the next, it must pass three tests. These rules are based on the step the work is currently in as well as the step the work is attempting to be sent to. These tests are:

1. All the “Exit” business rules of the current step (regardless of the next step).
2. All the “Entrance” business rules of the next step (regardless of the current step).
3. Any criteria for routing between the current step and the next step.

Unless all three sets of rules are passed, the process cannot proceed to the next step. This enforces compliance to the design of the process flow. A Business Process Work Station should understand these rules and select the step that is appropriate based on the rules and the data. Only when there is more than one acceptable destination will the Responsible User be required to select the next step of the process flow.

Business Rules (entrance or exit) can be applied to each step of the business process. A Unit of Work must abide by all business rules of the process steps that the Unit of Work has completed or is trying to complete. Once a Unit of Work is required to comply with a rule, it must do so for the rest of the life of that Unit of Work. Business Rules that belong to steps that the Unit of Work has not yet gotten to or that it skipped (if the process flow allows for steps to be skipped) do not apply to that specific Unit of Work.

Back Routing

In general, going backwards is always allowed. Business rules do not apply when going backwards, as going backwards in a process flow is used to re-do a step that was done improperly. Improper work is not due to a

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failure to comply with rules, but due to making a decision that someone else disagrees with. For example, the first step may have determined the Work Priority a job is to have (a required field), but someone further in the process may disagree with the determination and request that the Work Priority be reconsidered. If the current step does not have the authority to change the Work Priority⁶ the work must be sent back to a step where it change be changed.

When a Unit of Work has been back-routed, it must go forward through all the steps in order of the process flow (even though it has done so before). The data will still be available from those steps, but they will need to be revalidated. It is possible that decisions made the first time through the process flow will be changed the second time based on the changed data values.

The Business Process Work Station needs to allow for limits on route back. The need for this is to address accountability that has been assumed. Consider the process flow of Figure 3.

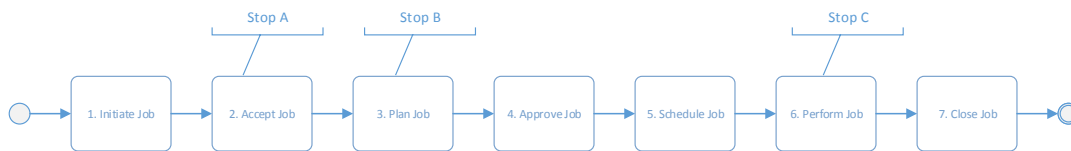


Figure 3 - Back Routing Limits

Table 2 contains the steps to which a Unit of Work can back route, given the “stops” indicated in Figure 3:

When in step...	Back route to...	Typical Reason
1. Initiate Job	n/a	
2. Accept Job	1. Initiate Job	To clarify Job requested
3. Plan Job	2. Accept Job	Job, as accepted is not clear
4. Approve Job	3. Plan Job	Job Plan is not acceptable
5. Schedule Job	3. Plan Job	Job Plan is not feasible
	4. Approve Job	No reason
6. Perform Job	3. Plan Job	Job Plan is not feasible
	4. Approve Job	No reason
	5. Schedule Job	Job needs to be rescheduled
7. Close Job	6. Perform Job	Job was not completed properly

Table 2 - Back Routing Destinations

Note, in this example, that back-routing from “7. Close Job” to “1. Initiate Job” requires the Unit of Work to be back-routed first to “6. Perform Job”, then to “3. Plan Job”, then to “2. Accept Job”, and finally to “1. Initiate Job.” This allows the person who performed the work, the person who planned the work and the person who accepted the work to weigh in on the reason for back routing before going back to the initiator. This avoids sending issues that are beyond the knowledge of the initiator directly back to the initiator of the process.

Back routing issues are best communicated through the Business Process Work Station’s Notes capability (see “Notes”, on page 15).

⁶ Either because the current Responsible User is not authorized to make the change or because other processing is required if the value is changed.

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Route Maps

A Route Map is a picture of the process flow (similar to Figure 1 and Figure 2) that identifies the route of the Unit of Work through the business process. It shows 5 things:

1. *The current location (step).*
2. *The next possible steps (and any criteria for going to the step).*
3. *The selected next step.*
4. *The step(s) that the Unit of Work has successfully completed⁷.*
5. *The steps that are currently not available to the Unit of Work.*

The Route Map is needed for three reasons:

1. *Understand the flow of the process.*
2. *To choose the next step when there are multiple valid options.*
3. *To back-route to a previously completed step.*

Choosing a new step will alter the rules that the Unit of Work must comply with and where the Unit of Work will next appear in the process flow (see “Process Step”, on page 10). The form should be re-validated when a new destination is selected.

Notifications

As a Unit of Work progresses through the process flow it is helpful to send notifications to those involved. E-mail is the primary communication method that is supported throughout the business world. Other modes (Twitter, Facebook, etc.) would work, but currently are used in the private sector and do not have the support in the business world.

The Business Process needs to be able to send notifications when:

- a Unit of Work changes responsibility (assigning, re-assigning or un-assigning work)
- or when:
- a Unit of Work moves through the business process (either entering a step or exiting a step).

Notifications should be able to be sent to:

- The current Owner (it can change from step to step)
- All the prospective Responsible Users
- The current Responsible User
- The Initiator of the Unit of Work
- Other persons who need to know what is happening with the Unit of Work.

⁷ When a Unit of Work is back routed, the steps not completed and any steps skipped over and the step back routed to (the new current step) are not considered completed steps. The steps completed prior to the new current step remain completed.

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The need to send notifications to the Owner and Responsible User(s) depends on their involvement with the Business Process Work Station. If the business process is their primary (or even secondary) job, it can be assumed that they will be in the work station frequently, if not daily. If the business process is their tertiary job, it would be helpful to send them a notification when new work comes their way as they probably don't access the work station very frequently.

Notes

The Business Process Work Station needs to support communication and collaboration. Building a Notes capability into the work station can do this. Notes needs to have:

- Text
- Time Stamp
- Originator
- Read/Unread Status

To collaborate, anyone who accesses the Unit of Work can create a note for the Responsible User. This allows the Responsible User to receive input from others who have seen the work in progress.

When back-routing, the Responsible User can record the reason that they are back-routing the Unit of Work for the person who will address the issue at the receiving step. To support this, the business rules can require that an un-read note be created so that the recipient will know what the issue is for. When forward-routing, the business rules can require that all notes written by others first be read.

As the notes are part of the Unit of Work, the history of the notes become part of the history of process.

Help

On any given screen of the Business Process Work Station the user needs to be able to get help on how the screen is designed to work. For the business process steps, this help needs to start with the manual logic of the step. The help capability needs to also provide access to procedures and other resources needed to complete the step. Help should be able to support not only text, but also diagrams and even videos.

Putting the Work Station Together

The Business Process Work Station provides the basic work practices that are essential to control and manage any business process. With this capability, Process Design can focus on the essential aspects of the process that provide value to the enterprise.

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What is a Process-Centric Data Architecture?

The Process Control Standard does not address the data or timeliness aspects of the overall business process pattern that we first identified. In order to address these concepts, we discovered that we needed a new approach to how data is stored and maintained. Also, the implementation of the common functionality of the Process Control Standard is possible only if there is a standard data architecture to work with that functionality. MetaPower has identified a universal data architecture that allows an application to support all business processes. This architecture is identified in detail in our patents “A Method and Apparatus for Process Design” (USA Patent No. 6,768,984, 2001), (USA Patent No. 7,254,594, 2004), (USA Patent No. 7,756,914, 2007), (USA Patent No. 7,945,599, 2010).

Data Archetypes

This architecture identifies nine archetypes for data design that are needed to provide a database that can implement any and all business processes⁸.

1. *Base*
2. *Control*
3. *Intersection*
4. *Observation*
5. *Transaction*
6. *Accumulator*
7. *Template*
8. *Generator*
9. *Criterion*

There is a common thread to all of these archetypes. Each one has two facets:

1. *Architecture Data*
2. *Process Data*

The Architecture Data is the data that makes the archetype the archetype it is. In other words, the architecture data of a Process Control is the data that makes the table a Process Control and not a Base Data or Intersection. Each archetype has its own unique set of architecture data. The Business Process Work Station knows how to work with all of the architecture data and can change the architecture data based on the functionality of the work station.

The Process Data is the data in the archetype that makes the archetype distinct. In other words, the process data of one Process Control is going to be different than the process data of a different Process Control. The Business Process Work Station knows about all the process data, but it is not allowed to change it. Only the user and/or the configuration of the process (see “What Happened to Application Programming?”, on page 20) is allowed to change process data.

⁸ The details of each archetype is too much for this paper, but has been described in the patents identified in the Bibliography.

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In order for the Business Process Work Station to manage data throughout the business process life-cycle, the data is required to be kept “over time.” This adds a 4th dimension⁹ to the data that we normally don’t see in databases today, that of “Time.” Data Attributes have been added to the Architecture Data of all archetypes to support this 4th dimension. In order to keep track of data in the 4th dimension, records are classified as described in Table 3.

Revision Status	Represents...
History	“Historical data that used to be “Current” but has been replaced with an updated version of data. This data can be accessed when referring to the history of data (e.g. The employee’s data when they worked for an organization). A second attribute, Revision #, keeps the revisions in chronological order.
Current	“Official” data that has been fully validated and will be used when selecting the current information about an object (e.g. the employee’s current data today).
Future	“Work in Progress” data that has not been fully validated and therefore is not “Official” (e.g. the employee’s data that may become official unless the change is cancelled or someone changes the data before it becomes official).

Table 3 - Revision Status

Base

The Base archetype defines the assets of the business. These are “basis” of the company. Assets include all physical objects like equipment, vehicles, employees, documents, etc. The assets of the business also include virtual objects like organization, roles, positions, etc. These objects make up your specific business and are the subjects of all your business processes. The purpose of a business process is to authorize a change to a Base. For example, in order to make a new assignment for an employee, an Employee Organization Change Request would authorize the changes to the following “Bases”: organization, position and employee.

Control

The Control archetype defines the primary object in a Process-Centric Data Architecture; i.e. the “business process.”¹⁰ It “controls” the flow of work throughout the enterprise until the point/time at which the work is done. It defines all the data that is used by each step of the business process. A simple way to think about this is that the Control is the Form (see “Blank Forms”, on page 8) of the business process. For example, for the “Report Time” process, the Control is the “Time Sheet.” The Control is what shows up in the “In Basket” (on page 8) and what is sent to the next person/step. When the Control is complete, the Base(s) will be changed as authorizing by the Control.

⁹ The standard dimensions of Object, Instance and Attribute are fully utilized in the Process-Centric Data Architecture.

¹⁰ This concept is similar to research IBM recently published on data-centric dynamic systems. (Russo, Mecalla, Montali, & Patrizi, 2013) and (Damaggio, Deutsch, Hull, & Vianu, 2011)

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Intersection

The Intersection archetype defines the relationship between Base Data over time. This is where the 4th dimension of the Process-Centric Data Architecture really comes into play. In a 3-dimensional database we would have a data model like in Figure 4.

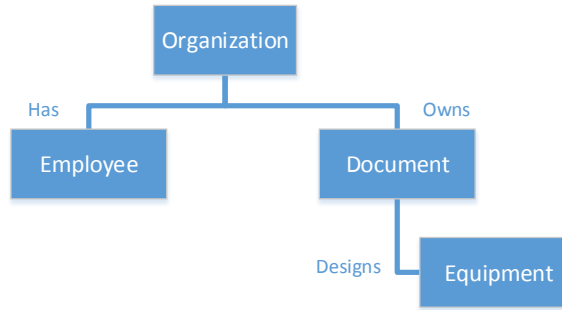


Figure 4 - 3-Dimensional DB Design

This works fine if there is only 1 official version of each record. But when you introduce the 4th Dimension (Time), things get messy very quickly. Because the relationships between the tables involve pointers to the related records, trying to keep a clear understanding of the relationships over time when one record changes would require updating every related record. For an enterprise-wide database, where virtually everything is related to everything else – directly or indirectly – this would result in updating the entire database.

The Intersection addresses this issue. It acts as a buffer between Bases so that only the records modified are modified and the relationships to other records are maintained over time (the 4th dimension). Figure 4 is the 4-dimensional version of Figure 5.

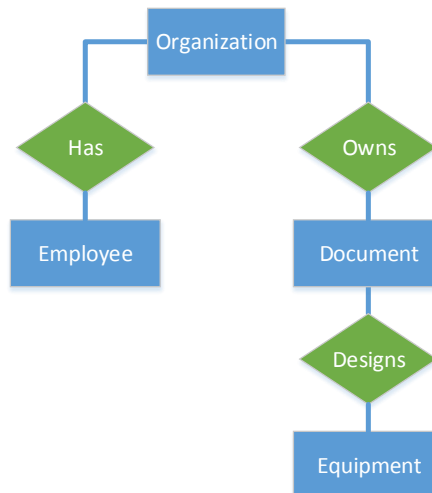


Figure 5 - 4-Dimensional DB Design

Observation

The Observations archetype defines the data observed about a Base. Unlike a Control that alters the Base (creating a new revision of the Base as per Table 3 - Revision Status), the Observation does NOT alter the

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Base. It only records information about it. The Observation is made by a Control about a Base. Observations are typically used for analysis about the Base. For example, observing the operating conditions of an equipment can allow analysis of the condition of the equipment that may foretell the failure of the equipment.

Transaction

The Transaction archetype defines the consumption or transfer of a resource. It provides both a “credit” and a “debit” as well as the “cost” of consumption / use. For example, an employee’s time worked is credited to the Employee and the organization is debited the cost of the time worked. Thus, the transaction is balanced. A second transaction will be done later between the organization and the checking account to actually pay the employee for the time. Another transaction example would include issuing inventory and receiving money in payment of an invoice. Like the Observation, the Transaction does not alter the Bases involved (credit or debit) and the transaction is made by a Control.

Accumulator

The Accumulator archetype is related to the Transaction as it totals the transactions for a Base. This allows organizations, projects, jobs, banking accounts (bases) to all accumulate the same transaction without duplicating the transaction for each need and without requiring the transaction to understand all the ways it is accumulated.

Template

The Template archetype is an “initial” Control that will be used by a Generator (see below) to create a Control based on criteria. This archetype is a Control “in waiting” and does not do anything on its own. Once activated, it IS a Control and works as a Control.

Generator

The Generator archetype contains the scheduling data needed to determine when it is time to create a Control from a Template on a repetitive basis. The scheduling data includes the conditions in which the Control is to be created. The conditions can be time based (e.g. Monthly) or usage based (Hours of Operations) and be based on the scheduled or actual completion of the previous generation of the Template.

Criterion

The Criterion archetype is used when a Generator is based on the usage of a Base as observed by an Observation. For example, if a Control is to be created every 10,000 miles of operation of a vehicle, the Generator will use an “miles of operation” Criterion on the vehicle’s odometer. The Criterion will keep track of the miles driven. If the vehicle has an accident and the odometer is replaced, the Criterion will account for the new odometer in the odometer Observations and report the correct number of miles driven since the last Generation of the Control.

Putting the Database together

All nine archetypes cover the database constructs needed to implement any business process in a way that the Business Process Work Station can make sure all the business rules are complied with. The archetypes

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also allow Business Process Design to focus on the process data and not have to address the underlying architecture data.

What Happened to Application Programming?

Wikipedia defines Computer Programming as follows:

Program design of small programs is relatively simple and involves the analysis of the problem, collection of inputs, using the programming constructs within languages, devising or using established procedures and algorithms, providing data for output devices and solutions to the problem as applicable. As problems become larger and more complex, features such as subprograms, modules, formal documentation, and new paradigms such as object-oriented programming are encountered. Large programs involving thousands of line of code and more require formal software methodologies. The task of developing large software systems presents a significant intellectual challenge. Producing software with an acceptably high reliability within a predictable schedule and budget has historically been difficult; the academic and professional discipline of software engineering concentrates specifically on this challenge. (Wikipedia, Computer, 2013)

Note that neither the Business Process Work Station nor the Process-Centric Data Architecture includes specific business process rules. They are what can be termed as “agnostic.” They are somewhat like a child’s “Tinker Toys.”



Figure 6 – Tinker toys®, by Hasbro®, Inc

Tinker Toys can be put together in infinite ways. The same is with Business Processes. With the functionality of the Business Process Work Station implemented using the Process-Centric Data Architecture, implementing a Business Process does not require thousands of lines of application code and months of development; it only requires specifying the business data and rules. This means that the Business Process Work Station can support any business process of the enterprise.

Note that the Tinker Toys wheels have 8 holes around the edge and 1 in the middle, but you don’t use all the holes every time you use a wheel. MetaPower has determined that, like the holes in the Tinker Toy wheel,

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each step of a business process has 12 components (see Table 4, below) which can be specified, depending on how the step is being used.

Process Step Components		
Basic Specification	Back Route Criteria	E-Mail Notifications
Entrance Rules	Route Actions	Help Topics
Exit Rules	On-Demand Actions	Step Reports
Route Criteria	Screen Layout	In Basket List Fields

Table 4 - Process Step Components

Given a Business Process Work Station that can deal with these 12 Process Step Components, there is no longer a need to write applications.

Process implementation begins with defining the process and its data. The data is specified in the database using the constructs of the Process-Centric Data Architecture. The definition of the process includes the name, the database tables involved in the process, the steps of the process and all valid navigation paths between the steps.

Then, for each step of the process, as many of the 12 Process Step Components necessary to complete the step are specified.

Basic Specification

The Basic Specification identifies basic data about the step. This includes the name and type of process step (start, middle or end).

Screen Layout

The Screen Layout identifies the presentation of the data needed by the step. This includes whether the data is editable or not. For a Web-based Business Process Work Station, the screen will need to be HTML based. Only data identified in the screen can be referenced within the configuration of the step.

Entrance Rules

The Entrance Rules are the business rules that all Unit(s) of Work must comply with before they can enter this step, regardless of the step from which they come (see “Process Routing”, on page 12). The business rules include the logic to detect violation of the rule, the message to be given to the user to explain the violation and the fields on the screen that contributed to the violation. For example, the logic would be “IF Job.WorkType is Missing, Then Error”, the message would be “This field is required.”, and the field is “Job.WorkType.”

Exit Rules

The Exit Rules are the business rules that all Unit(s) of Work must comply with before they can leave this step, regardless of the step to which they are going. The business rules are identical in form to the example used for Entrance Rules.

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Route Criteria

Route Criteria are the criteria that the Unit of Work must comply with in order to go to the specified step after it has met the Exit Rules for this step and the Entrance Rules for that step. The criteria also specifies the rule that will appear on the Route Map (see “Route Maps”, on page 14). Sometimes it is easier to specify the converse of the rule, resulting in what we call a “Deny” rule. The Unit of Work must not comply with the Deny Rule in order to go to the specified step. If no route criteria is specified, the Unit of Work can go to

Back Route Criteria

The Back Route Criteria are the criteria that prevents the Unit of Work from being back routed beyond the limits of the process design (see “Back Routing”, on page 12). The criteria also specifies the rule that will be displayed if the Unit of Work is not allowed to back route to or prior to the specified step.

Route Actions

The Route Actions are the actions that will be done automatically when the Unit of Work is routed to the next step. These actions can be performed upon: entering this step, exiting this step, entering the next step or re-entering this step (via a Back Route). Route Actions can do a variety of things. For example, they can be used for setting default values or for sending special notifications not covered by the E-Mail Notifications.

On-Demand Actions

The On-Demand Actions are similar to Route Actions, but happen while in the step and only when requested by the person performing the step (via pressing a button). An example of an On-Demand Action is one that initiates a Control (process) from within this process. By creating the Control from within the step, instead of using Blank Forms (on page 8), the relationship can be established between the two Unit(s) of Work (instead of being independent Unit(s) of Work).

E-Mail Notifications

The E-Mail Notifications define E-mails that can be sent out by the Business Process Work Station (see “Notifications”, on page 14). Each notification defines the following: when to send the notification (entering the step, exiting the step, changing responsibility); to whom to send the notification (initiator, Owner, current Responsible User, all Responsible Users); the message to be sent (Subject Line and Message Text); any conditions that must be met to send the notification.

Help Topics

The Help Topics identify the topics that need to be available to the Responsible User for this step (see “Help”, on page 15). Help topics are identified as “Primary”, “Supplemental”, and “Additional.” The actual Help Topics need to be developed based on the design of the Help Engine used by the Business Process Work Station. The Primary help topic needs to include the logic of the step from the Process Design.

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Step Reports

The Step Reports lists the reports that need to be available to the Responsible User for this step (see “Reports”, on page 10). The actual reports need to be developed based on the design of the Report Engine used by the Business Process Work Station. The criteria, when applicable, needs to identify the step data that will be used by the step report.

In Basket List Fields

The In Basket List Fields are used in the In Basket (on page 8) as well as On My Desk (on page 9), and in My Team’s Work (on page 9) when filtered by a single step. These fields are used to help find the important work to work on (see “Work Selection Data”, on page 10). The list identifies which fields are to be shown and their order to be displayed the Business Process Work Station.

Putting the Application together

Given an application that can deal with these 12 Process Step Components, there is no longer a need to write applications. Process Implementation is merely the loading of the process configuration into the application. This reduces implementation to weeks, not months or years.

Conclusion

As previously stated, we keep doing the same thing over and over. Isn’t it time to stop? By using the business process implementation patterns we have discovered for, a consistent, comprehensive solution for implementing business processes can be put applications in the hands of those who truly know what needs to happen.

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