
Case Management: HR Application of

Finite State Processing

Naomi Lee Bloom

Does your company manage a large number of applicants through a well-defined series of applicant evaluation steps? Do you have well-defined procedures to follow when an employee files a grievance or complaint? Do you have a broadly-based suggestion program in which each suggestion is evaluated in a predefined manner? These and many other types of human resource "case management" activities are excellent candidates for automation using an analytical technique borrowed from the physical sciences. Rather than build a separate "tracking" system for each such "case management" activity -- i.e. applicant tracking, grievance tracking, or suggestion tracking -- we can use the methods of finite state processing to create a generic "tracking" or case management system to support all of these and many other similar activities.

Situations Covered

Finite state processing is a modeling technique that is extremely useful both to describe, and to develop software to support, business situations with the following characteristics:*

- The cases (i.e. applicant/position seeker, grievance, suggestion) of interest may potentially occupy a finite number of states (i.e. conditions of existence). These states must be distinct and well-defined. In practice, the total number of states must be small enough to be workable; e.g. depending on the application and on the complexity of the transition rules, 10 or 20 states may represent an upper limit. Certainly, 100 states would be an unreasonable number for most applications;
- At any given time, a specific case is in exactly *one* of these states (i.e. it can not be in two states, or in any state that is not predefined);
- In any state, one of several actions may occur. Actions must be mutually exclusive and collectively exhaustive (i.e. there must be no more than one action, and that action must be one which has been predefined);
- When a case is in a given state and a particular action occurs, the result must be that the case moves (transits or makes a transition) to a defined state (which could be the same as the initial state); and
- All the rules governing the transition of the case from state to state must be known and predefined. Transitions cannot be random or ambiguous. The actions may be random (i.e. it is not known in advance exactly which action will occur), but the effect of each known action must be definite and predictable.

Many human resource management cases exhibit this set of characteristics, i.e. conform to a finite state processing model, and can be managed using finite state processing techniques. A very good example of such a case is the formal grievance or complaint

*The focus of this article is on the business of human resource management. The technique of finite state processing is applicable not only to business situations, but to any situation exhibiting the proper characteristics. The technique was originally developed to represent situations in engineering and the physical sciences, where the existence of finite state phenomena is more intuitively obvious than it is in a business setting.

Figure 1: Discrimination Complaint States

Logical Key	Non-Key Data Field
Discrimination Complaint State Code	Discrimination Complaint State Name
01	Awaiting precomplaint counseling
02	Formal complaint awaiting company disposition
03	Formal complaint accepted by company
04	Formal complaint rejected by company
05	Formal complaint awaiting GMRC investigation
06	Formal complaint undergoing GMRC investigation
07	Resolved complaint

whose resolution process is well-defined in company policy or in a union contract. To fit this case management model, a formal grievance process must have two important characteristics:

- All grievance cases (to be served by the model) must progress through well-defined states (which may vary for differing types of grievances) as a result of specific actions taken by the company, the employee, and/or other parties; and
- The processing of all covered grievance cases is governed by applicable laws, regulations, policies, procedures, and collective bargaining agreements (i.e. transition rules).

To demonstrate how case management works, the following example uses a particular type of grievance case, a complaint of discrimination, with greatly simplified states, actions, and transition rules. This example is intended to show how finite state processing concepts can be implemented in software, using system reference tables. This same approach to case management software could be applied to other types of grievances as well as to many other HR "cases".

Complaint Case

A simplified set of possible states for a complaint of discrimination could include:

- Awaiting precomplaint counseling;
- Formal complaint awaiting company disposition;

- Formal complaint accepted by company;
- Formal complaint rejected by company;
- Formal complaint awaiting investigation by the company's grievance management review committee (GMRC);
- Formal complaint undergoing GMRC investigation; and
- Resolved complaint.

Assuming for this discussion that this list of possible states is complete, a system reference table of Discrimination Complaint States could be constructed, as shown in Figure 1, on the following page.

In a finite state approach to the processing of discrimination complaints using system reference tables, a second and closely related reference table would be the Discrimination Complaint State Transition Table, as shown in Figure 2. Again, the entries are simplified for the purpose of this discussion. Figure 2 shows that from State 01, the discrimination complaint may move to State 02 or to State 07, but to no other state. Implicitly, if none of the actions A1 through A4 occurs, the complaint remains in State 01. If there is a time limit (e.g. the precomplaint lapses and is considered resolved), the lapsing of the time limit is another action to be included in the table. If Lapsed Complaint is different from Resolved Complaint for the

Consistency Checker

The concept of consistency checking is critical to this finite state processing application of system reference tables. A consistency checker is that part of the reference table maintenance capability which ensures that all related reference tables are updated in such a way that their mandatory relationships are validated. Unless the State Table and the State Transition Table are properly defined, and unless all updates are checked for consistency across applicable tables, complex errors can occur in automated case processing logic.

The finite state framework can be used to define not only the transitions, but also a set of specific tasks to be performed (either manually or by an automated system) when the Initial State is *x* and Action *y* occurs: For example, when routing the case to a particular organizational unit or individual, issuing notifications, letters, and warnings of impending deadlines. Implicit in any automated case routing support is the ability to verify the correct actions for each case. Thus, instead of Comments in the last column of Figure 2, this table could contain either a list of coded tasks, a reference to another table--which in turn would list the coded tasks--or a reference to a particular application program, which would be called to perform the required tasks.

In addition to the State Table and the State Transition Table for a given type of case, one other construct, the **State Processor** is required. The State Processor is the program or set of programs that applies the logic of the State Transition table and tracks the current status of the cases. Defining the transition rules in a system reference table (as opposed to hard-coding them in an application program) gives a company tremendous flexibility to adapt the case management system to reflect changes in policies, or in statutory and regulatory requirements. The State Processor uses these tables to ensure that each case is properly handled.

Single Software

Using a finite state approach in conjunction with these system reference tables, a human resource management system could provide generic automated support for processing many types of cases. Lapsing deadlines could

Figure 2: Discrimination Complaint State Transition

Initial State	Action Code	Action Name	Resulting State	Comments
01	A1	Employee withdraws complaint	07	
01	A2	Company grants employee request	07	
01	A3	Company and employee reach compromise	07	
01	A4	Employee files formal complaint	02	
02	A5	Company accepts formal complaint	03	

be represented as actions, and tracked effectively. Planned followups on grievances, applicants, suggestions, etc., could be automated and their completions noted and tracked. With a generic approach to case management, a single set of software (with resulting low maintenance costs, etc.) could be used wherever HR business activities warrant this type of support.

Before adopting the finite state processing approach for any particular type of case, it is essential to identify and analyze all the possible states, actions, and transition rules for that type of case. While not an easy task, such rigorous analysis is an excellent mechanism for uncovering ambiguities and inconsistencies in our manual or partially automated handling of such cases. Simply trying to define the table values goes a long way toward developing clear user procedures for how to process these cases, with or without automated support.

Finite state processing is an elegant concept upon which to build a generic HR case management software package. There are generic spreadsheet packages and generic data base management systems, but, to my knowledge, no truly generic HR case management software exists. At one company, finite State processing concepts have been applied to credit card

collections and to related financial "case management" activities. Hopefully, this article will increase the demand for and, perhaps, encourage suppliers of finite state processing software geared toward HR case management applications.

About the Author

Naomi Bloom, managing partner of Bloom & Wallace, a Fairfax, Virginia based systems consulting firm, has more than 20 years of experience doing strategic planning for and the design, development, implementation, audit and support of financial, data analysis, administrative and especially, human resource management systems.

In addition to a number of published papers and lectures on software development and administrative systems implementation, Ms. Bloom, who holds an MBA in finance and accounting systems from Boston University, can be seen nationally on the PBS television course, "The New Literacy: An Introduction to Computers" and read quarterly in Auerbach's Computers in Personnel. Prior to forming Bloom & Wallace, Ms. Bloom was a senior principal and spent nine years with American Management Systems, Inc.