GENERALIZED SURVEY PROCESSING SYSTEMS AND GENERALIZED MODULES —THE WAY OF THE FUTURE?
A Discussion of Research Triangle Institute's Integrated Field Management System

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Overview

During the last 10 to 15 years, survey processes have become increasingly dependent on computerized systems. Advances in information technology have resulted in smaller, more powerful computing devices available for use in survey activities. The Internet has provided a ubiquitous platform upon which project sponsors, survey managers, and even study participants can exchange information and access study databases. As technologies have continued to evolve, so too have survey processes and associated systems. Research Triangle Institute's (RTI) ongoing goal is to develop standardized, reusable tools for conducting surveys that are generalized enough to service multiple projects, but are robust enough to keep up with advancing technology. The goal of building standardized systems is especially challenging for an organization like RTI, which specializes in complex nonstandard survey projects.

In late 1996, RTI programmers began working on a general system that has become known as the Integrated Field Management System (IFMS). The initial version of the IFMS took approximately 8 months to build, test, and deploy. This system is a collection of integrated software modules used in conducting and managing field surveys or clinic-based data collection activities. The IFMS consists of both central-office and interviewer/supervisor modules that mirror RTI survey processes. Survey processes supported by the IFMS include:

- recruiting, hiring, and managing field staff, including ordering and approving recruitment ads;
- field survey case management (assignment of cases to interviewers and supervisors, and transfer of cases between interviewers and supervisors);
- assignment and tracking of case-level status and event codes;
- startup and execution of computer-assisted interviewing (CAI) modules;
- collection and management of interviewer time and expense data;
- survey status reporting and project management support; and
- central-office and field staff communications, including e-mail, data transmission, and software updates.

Integrated Field Management System In Use

The majority of the IFMS modules reside on interviewer and field supervisor laptop computers and can be thought of as the front end for a laptop-based data collection system. However, the IFMS is separate and distinct from the computerized survey questionnaire, which at RTI is typically programmed using an off-the-shelf survey software package such as Computer-Assisted Survey Execution System (CASES) or Blaise. The IFMS facilitates the collection of survey data, but it is not a data editing or processing system, nor is it a comprehensive survey control system. It is, however, an integral component of nearly all field surveys conducted by RTI.

The IFMS was initially conceived of as a fully generalized software tool that could be easily "attached" to any Computer Assisted Personal Interviewing (CAPI) application to provide an off-the-shelf case management component. However, the majority of studies requiring such a component also require some degree of customization to match the design of the study. For example, a study design may include both a household screening and individual interviews. It may be necessary to launch new household cases based on the results of the screening or there may be multiple questionnaires to administer to each sample member. For the IFMS to be effective, it requires tailoring for each project.

The IFMS's "generalized but customizable" design allows ample flexibility in the system. It has been incorporated for use with several different CAI software platforms, including CASES and Blaise. It has been used for studies requiring very little support, such as e-mail capability for field supervisors, to studies in which interviewers were managing a sample of elementary/secondary schools, within each of which existed multiple respondents and questionnaires. The system's modular design allows the addition of new capabilities, such as the ability to account for multiple questionnaires from the same respondent, without

disrupting other components such as time and expense data management and data transmission.

Figure 1 displays an example of one of the most flexible features of the system. This screen comes from the case management module of the IFMS and is used to set case status and event codes. The underlying database is table-driven, and the visible columns can be easily turned on or off based on project needs. A database table containing valid case event codes can be customized for each project, allowing each study to augment RTI's standard set of status and event codes with project-specific codes and related logic.

Notice in Figure 1 that the IFMS allows interviewers to toggle between training and real cases. Inclusion of a training environment has proven especially useful for projects using the system, both as an in-class training tool and as a practice tool for interviewers when they have completed training. The upper right button, "Go to Real Cases," indicates the user is in training mode, as does the parenthetical "Training" in the screen title. These values toggle to "Go To Training Cases" and "Production," respectively, when the user leaves the training environment and enters the production environment.

To date, the IFMS has been or is being used on at least 17 studies that range in size from 5 to 450 remote PCs. An additional eight studies, ranging from 4 to 1,200 PCs, have used the data transmission component only.

Integrated Field Management System Development and Implementation

The IFMS began as a development effort for a specific project, with the goal being to generalize as many features as possible for use in subsequent projects. Although hard data regarding IFMS-related level of effort for that study are not available, it is estimated that 1,800 to 2,000 programmer hours were required for the design, coding, and testing of the initial version. Costs for the first version, including software and hardware, are estimated at $100,000. Each additional project for which the IFMS has been adapted has expended from as little as 40 to as many as 1,000 programmer hours to support the system's continued evolution.

In 1998 a team of four software developers was

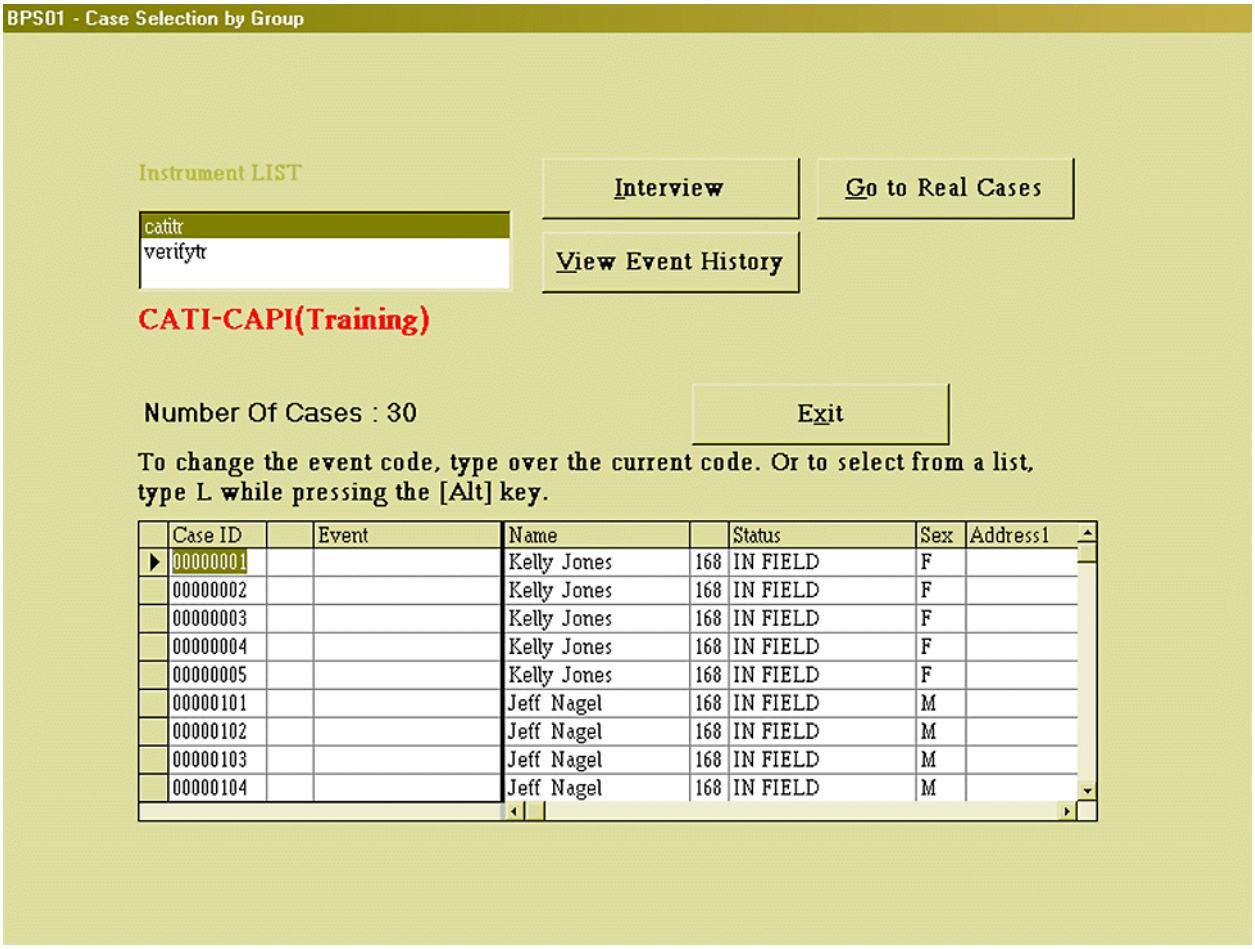

Figure 1. Example case management screen from the Integrated Field Management System

assembled who were most involved in the IFMS-related activities. This team, known as the Field Systems Group (FSG), is co-led by a senior developer and a team manager (both co-authors of this paper). For the last three years, the FSG has been responsible for the development, maintenance, and support of the IFMS and has maintained enough separation from the project team to allow a continued emphasis on generalizing the development of any new project-specific features. During periods of heavy workload, adjunct team members have been assigned to the FSG on a temporary basis.

As new projects begin at RTI, the FSG team manager meets with the survey manager to assess the project's needs. If there are special requirements (e.g., additional reports or new event codes) they are considered in relation to the project budget and timeline. Project-specific decision points, such as column display on screens and reports or the desirability of e-mail-enabling field interviewers, are considered as early as possible. The FSG team manager typically negotiates a scope of work, budget, and development schedule with the project team. If the project-specific feature is viewed as a longer-term enhancement to the generalized IFMS, RTI will often cost-share in its development. This approach has resulted in lower costs for subsequent studies, although no hard data are available to provide an accurate measure of total savings.

The IFMS component that has evolved the most from its initial design is the "Assignment Transfer System" (ATS). This mechanism assigns individual sample cases to field supervisors and interviewers. The initial IFMS design assumed a staffing model for field staff based on a tree structure; a single field supervisor would manage one or more field interviewers, and each field interviewer would report to one field supervisor. Underlying database tables and linkage relationships were developed based on this assumption. This module required significant redesign for a study that utilized traveling interviewers who received assignments from multiple field supervisors.

The ATS also has been the module most conducive to a web-based design. The initial IFMS required supervisors to issue case transfer orders (moving a sample case from one interviewer to another) on their laptop computer, then transmit those orders to RTI for processing. This required a daily refreshing of the up-to-date case assignment database on each supervisor's laptop. Part of the redesign and redevelopment of the ATS mentioned above included a web-based design utilizing a central-office database. The master case assignment database now resides on an RTI server, and supervisors initiate case transfer orders via a web-based application. This significantly reduces the amount of in-house-to-field data transmissions. Figure 2 displays a training screen from the current version of the Assignment Transfer System.

Integrated Field Management System Technology Platform

The IFMS is a Microsoft Windows application, developed primarily using Microsoft products. The in-house database systems were developed in Microsoft SQL Server (currently using version 7.0). The laptop-based databases are in Microsoft Access. The in-house operating system is Windows 2000, and laptop operating systems are Windows 95/98. User interface components were developed using Microsoft Visual Basic, with web-based components developed using Allaire Cold Fusion. The development team used Microsoft Visual Source Safe and Microsoft Project to assist with software version control and the management of development activities.

The in-house IFMS data are maintained in multi-project database tables; data are moved to archive files as projects end. The IFMS is the conduit for survey interview data arriving at RTI and hence is not the final repository of the survey data. Rather, as data arrive they are immediately transmitted to project-specific databases for further processing (cleaning, editing, analysis, and delivery to study sponsors). Control and audit data related to IFMS processes are archived to CD through Data Transformation Services software that is further enhanced with RTI-developed scripts and some manual processes.

Lessons Learned—Future Direction

The IFMS grew out of a need to address project-specific requirements in a generalized manner. A fully-generalized system was not intended. Experience has shown that development of truly general-purpose systems often fails if it is not directly tied to user needs. Using project-based needs to drive the development agenda for the IFMS has helped ensure its viability and keeps the system current with changing user requirements.

Ideally, user requirements should drive the system design, not the other way around. With certain features of the IFMS, the "logical" design based on programmer perspective has not always been consistent with user requirements. Regular focus group discussions are conducted with interviewers, supervisors, and survey managers regarding usability and functionality issues.

Rapid advances in technology often drive the development agenda. For example, several IFMS modules have required revision as new versions of SQL Server, Access, and Visual Basic have been

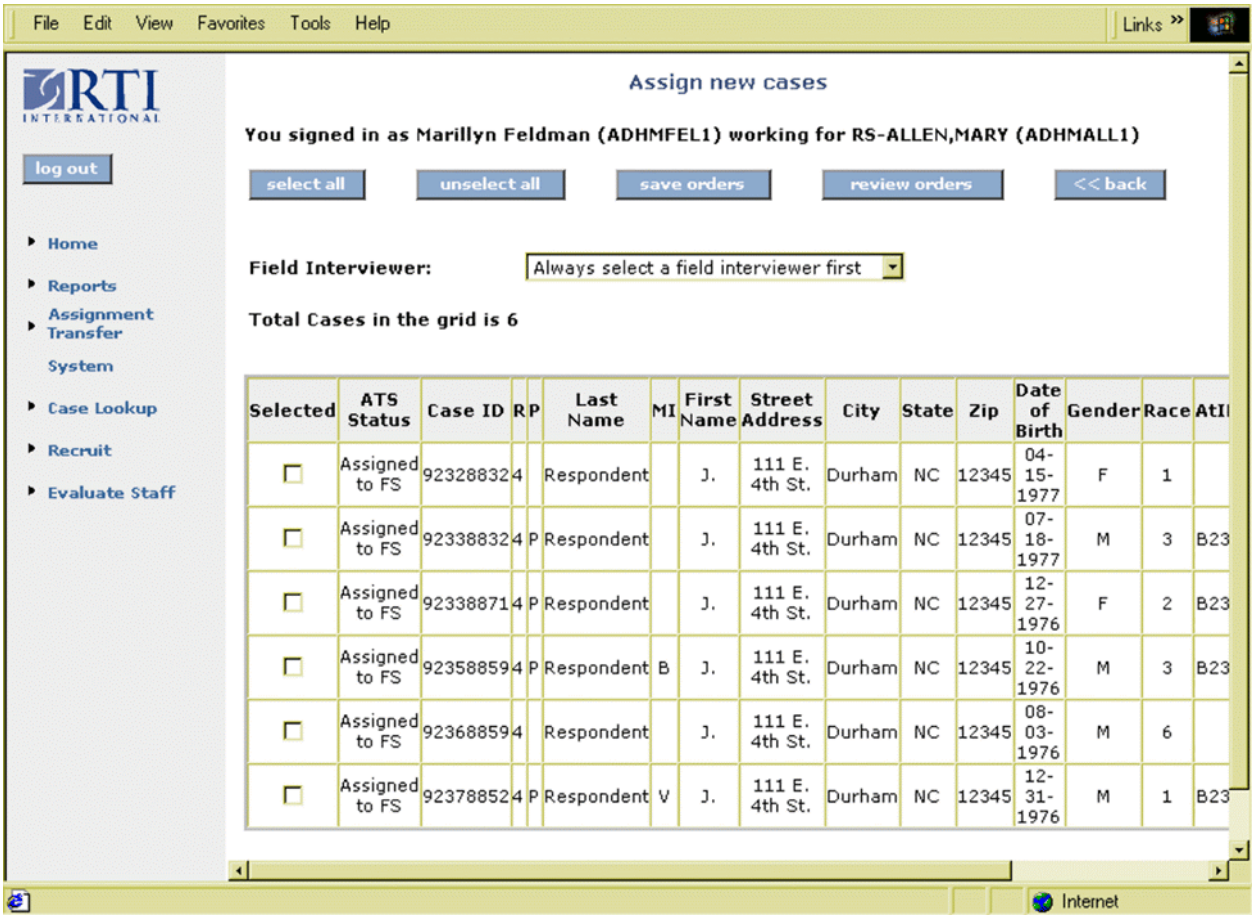

Figure 2. Case assignment screen from the Integrated Field Management System Assignment Transfer System

released. The issue has not been that IFMS modules were not functional; rather, as new laptops have been purchased with newer operating systems and software components, some IFMS modules have required adjustments to make them upward compatible.

Expectations about IFMS functions and features should be managed and documented. This is the area where results have been less than optimal; components and features of the IFMS have not been adequately documented. The development team and experienced survey managers know the system very well; however, it has been difficult to orient new survey managers to what the system will (and will not) do. There have been expectations that IFMS will generate unlimited reports, or that some new project-specific feature has been developed previously. Preparing documentation has generally received too little attention for the IFMS.

System programming is only about 25% of the IFMS-related level of effort. Discussions with project teams regarding new features, troubleshooting in-field anomalies, and providing system support during deployment all consume labor hours from the development team. Because of the lack of documentation, a member of the development team often attends portions of interviewer training sessions in order to assist in communicating the system's capabilities to the end users.

Overall, we believe the IFMS's "generalized but customizable" approach has resulted in an effective approach for conducting field surveys at RTI.