

## PDF Forms and Database Connectivity Solutions

By

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September 26, 2005

### Introduction

Every company and organization uses business forms, and now most have PC's with access to the Internet. With great software like *Amgraf OneForm Designer Plus (OFDP)* and *Adobe Acrobat*, paper forms can be converted to Internet forms (I-forms) thereby saving significant costs in printing and storage. With additional effort, I-forms can be extended into fillable, submittable containers for data capture, retrieval, presentation, and processing.

The benefits of database-connected I-forms solutions include improvements in productivity, transaction accuracy, and user satisfaction. *So where's the problem?*

Forms layout and design, and even the steps to insert fill fields, are usually graphic designer tasks. A non-connected PDF form is a self-contained file with everything packaged within the visual image. To make an I-form submittable, the originator must go beyond the form image and interact with *software* for field data extraction, data communication with acknowledgement, and navigational methods to start and end the form filling session. These functions have traditionally been performed by computer programmers, and are worrisome tasks for graphic designers. Adding database connectivity also introduces another layer of complexity onto I-forms.

This white paper is intended to clarify the technical issues involved in implementing an I-forms data collection and retrieval system.

### Basic Internet Forms Functionality

Internet forms can be used for many online transaction functions. The starting point is where the image of a form is converted so that it can be displayed on a computer screen and output to a local printer. Most *Acrobat Distiller* users have mastered this conversion step, and many web sites now have links to PDF forms for user access. Upon clicking a link, the free Adobe Reader opens within the browser window and a PDF form is displayed. The form can then be locally saved and/or printed.

With the Amgraf OFDP and Adobe Acrobat software, the form owner or originator can add many other functions to make PDF forms:

- fillable
- pre-populated
- submittable
- dynamic database views
- field flattened

*Fillable* forms have fill-fields overlaid on the form background so that field information can be keyed. Fields can be coded so that input validation occurs immediately, helping to reduce errors. With a little extra effort, fields can be programmed so that standard answers are chosen from drop-down lists, numerical amounts are immediately calculated, and other input values are automatically tested for correctness.

*Pre-populated* forms open at the client PC with many fields already filled in. Field data can be transmitted along with the PDF file as Forms Data Format (FDF) instructions, or merged with the PDF form before it is served to the client. By pre-populating fields, the client is relieved of the burden of re-keying information already on file, and assured that the central system knows who is on the other end of the transaction.

*Submittable* forms move field data in the other direction, from the client to the server. When a form is filled out, the information can be transmitted to the server so that it can be saved and/or processed immediately, without the need to rekey or scan in keystrokes from a paper document image. The benefit is that the costs associated with handling forms can be greatly reduced.

*Dynamic database views* modeled as Internet forms are the highest level of I-forms technology being deployed today. With this functionality, each input fill-field can potentially interact with the server database to immediately change the choices presented to the client, and/or the data displayed within fill-fields.

*Field-flattened* I-forms are similar to pre-populated forms, but usually produced at the end of a forms filling workflow. To flatten the I-form, the fill fields are removed, and the fill data is merged into the form background. This helps prevent inadvertent or fraudulent changes to an I-form, and the flattened I-form becomes a reference document similar to a paper photocopy.

Next we will examine the technical details involved in interfacing I-forms to databases.

## Database Connectivity Methods

There are two fundamental methods to link databases to fillable PDF forms. The first method is best suited for individuals who have personal databases on dedicated PC's. This method is typically handled by using the following technologies:

- Full Adobe Acrobat Software
- Acrobat Database Connectivity (ADBC)
- Microsoft Data Source Name (DSN) with Open Database Connectivity (ODBC)
- Microsoft Access Database Software

Examples of building a database-connected PDF form for personal use are readily available from Adobe's web site and from numerous PDF reference publications.

The second method is best suited for centralized forms and database management on a larger scale, using the Internet as the communication medium. This method is typically handled by utilizing the following technologies:

- Server-side Relational Database Management System (RDBMS)
- Web Server to Collect and Retrieve Form Field Data
- Internet Forms Repository
- Windows PC's with the Microsoft Internet Explorer (or compatible) Browser
- Free Adobe Reader

This presentation will focus primarily on the second database connectivity method, and review the technical issues involved in developing and implementing fillable database-connected Internet forms on a large scale with deployment through a web site.

## The Components of an Online I-forms System

An online I-forms system has essentially the same architecture as an e-commerce system, without the shopping cart and payment processing modules. Instead, the I-forms system may include expanded workflows for digital signatures, form approvals, and tracking.

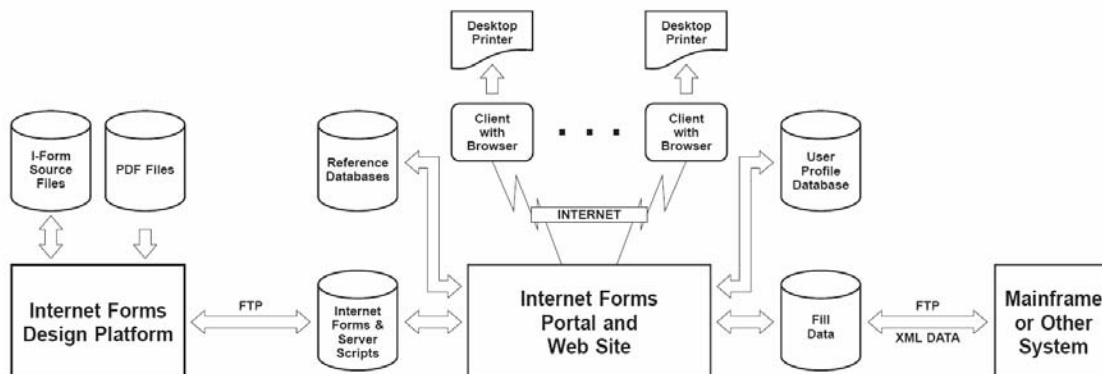


Fig. 1 – Diagram of a Typical Online Internet Forms System

The required software components are:

- Relational Database Management System (RDBMS)
  - Oracle
  - SQL Server 2000
  - MySQL
  - DB2
  
- Forms Repository
  - Save by Classification and Category
  - Save by Data Format (HTML, PDF, Word, etc.)
  - Maintain Form Versions
  
- Web Server
  - IIS
  - Apache
  
- Server Scripts
  - *Forms Handler Scripts*
    - Open new unfilled form
    - Open filled form
    - Open flattened form
    - Query and retrieve data from tables
    - Save submitted form data
  
  - *Client Support Scripts*
    - Search for records
    - List records
    - E-mail records
  
  - *Administrator Support Scripts*
    - Create/Drop data tables
    - Examine data tables
    - Delete records
    - Export record data as XML
    - Import record data as XML
  
- User Access Control
  - Manage Login Password/ID
  - User Profiles
  - Administrative (Who has access to Which forms)

- Workflow Processing
  - Approvals
  - Tracking
  - Reporting
  - Connectivity to other Business Systems

A *script* is a list of commands that is executed by an Internet web server to direct the page management processes. The *forms handler scripts* provide the critical link between submittable forms and the database management system.

- For pre-populated forms, the *open filled form* script retrieves the appropriate data record and fills the necessary form fields before serving the form to the client.
- For submittable forms, the *save submitted form data* script stores the field data into a table record.
- For dynamic database view forms, the *query and retrieve field data* sends a query when the client keys in a data value (i.e. account number) and returns data values to repopulate multiple form fields. This script can also retrieve a collection of values to populate a drop-down list.
- For field-flattened forms, the *open flattened form* script retrieves the appropriate data record and replaces fill fields with inline text before serving the form to the client.

Amgraf's OFDP software automatically generates the server scripts when the fillable I-form is created, including those for the database connectivity functions.

### **Creating a Database-Connected I-form**

After creating the I-form and overlaying the fill fields, there are several steps necessary to make database connections. For OFDP users, these steps are simplified through menu functions and dialog panels that help the form designer to:

- Insert a Submit button
- Insert necessary hidden fields
- Link data tables
  - Input tables (Read Only)
  - Output tables (Allow Write)
- Link form fields to data table columns
- Identify input Trigger fields

The first step is to make the I-form submittable by inserting a *Submit* button. Note that the OFDP Submit button uses the "HTML Post" method for transmitting the field name/value pair data to a server script URL.

Several hidden fields must also be inserted onto the I-form so that when the I-form is served to the client, navigational information and transaction status are preserved. This insures that the correct next page will be presented to the client when a form is submitted.

Before making database connections, it is important to identify the data tables that are going to be used with the I-form. Typically there is an *Output* table where form fill data is stored. Sometimes there are one or more *Input* tables used to populate fields on the I-form. Oftentimes, an Output table for an I-form is later used as an Input table for a subsequent I-form.

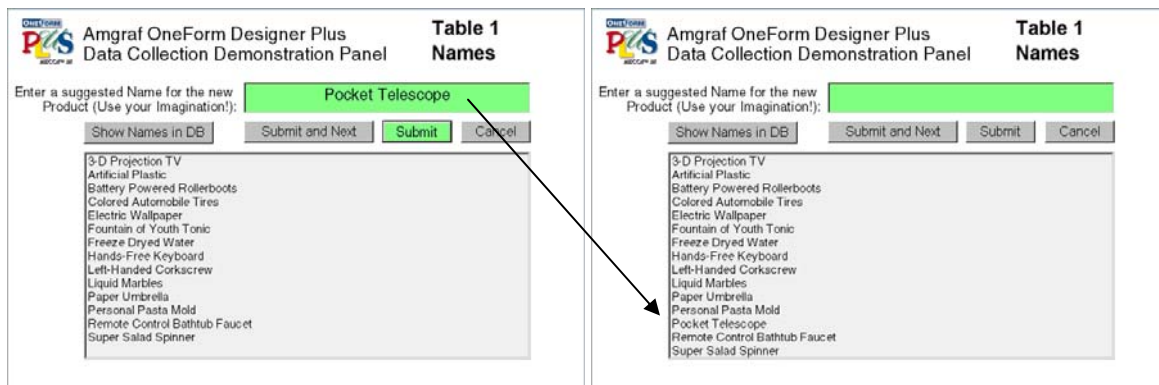
Next, each I-form fill field is linked to a Output data table column name. Some fields may have links to both Input and Output tables. In many cases, the I-form field list is used to create a new Output table where each I-form field name is mirrored as a table column name.

Finally, for each input table, there must be a “trigger” event to force a data table record to be retrieved and I-form fill fields to be populated. Typically a fill field is designated as a trigger field, and an event occurs when the client keys a value (i.e. account number) into the field and presses the tab key. This causes other fields (i.e. name and address) to be populated.

#### Demonstration of I-forms Database Connectivity

There are several I-form demonstrations located on Amgraf’s web site at [www.amgraf.com](http://www.amgraf.com). One of the examples is illustrated below.

In this simple demonstration, there are five consecutive I-forms used to capture and configure product information. Each I-form saves the information into a separate Output table. The tables are called “Names”, “Colors”, “Cities”, “Price”, and “Products”.



**Fig. 2 - A list box on the I-form instantly shows the contents of the table as new information is submitted.**

The “Show Names in DB” button displays a current list of the data values in the Output table. New fill data is stored into the Output table when the user clicks the “Submit” button.

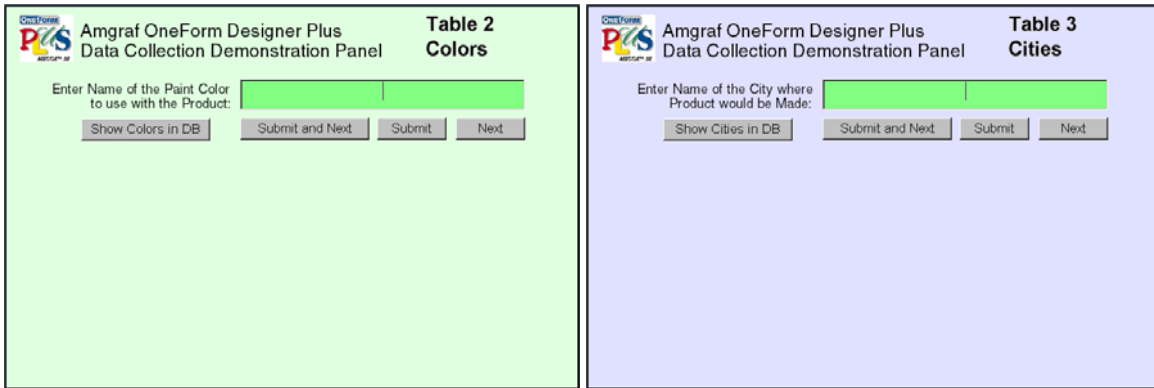


Fig. 3 - I-forms to Capture a Color and City Location Name.

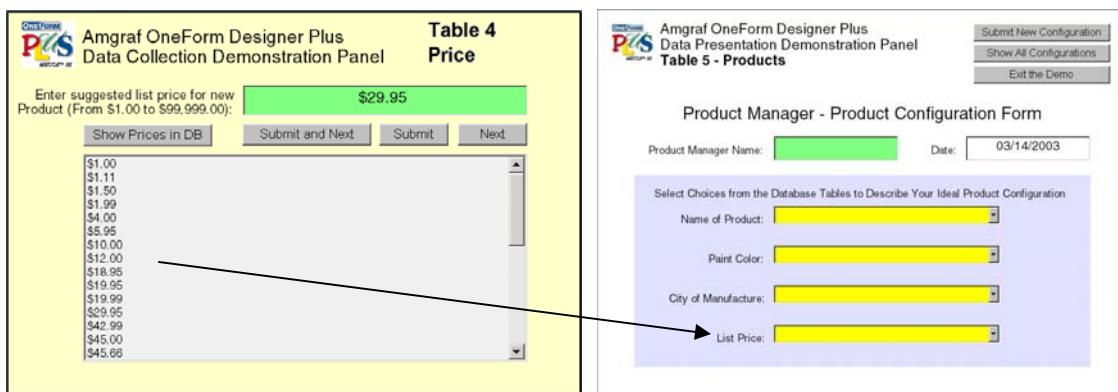


Fig. 4 – I-form to Capture Product Prices that will Populate Dropdown List on the Products I-form.

The Output tables from the first four I-forms are now used as Input tables for the Products I-form. The dropdown list fields are populated with data captured in the first four I-forms.

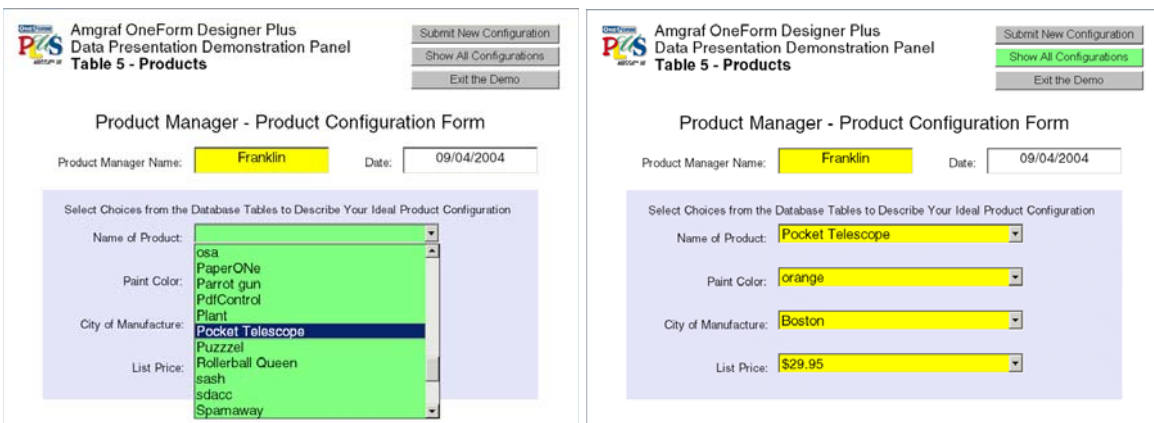


Fig. 5 – The Dropdown List Fields on the Configuration I-form contains data from the Input Tables.

The user can select from the drop-down lists and then click the “Submit Configuration” to save the choices. Clicking the “Show All Configurations” button produces a report that shows the 20 most recent user choices.

 Amgraf OneForm Designer Plus Database Presentation and Reporting					
<a href="#">Close Window</a>					
The 20 Most Recent Product Configurations					
Manager	Product	Color	City	Price	Date
Franklin	Pocket Telescope	orange	Boston	\$29.95	9/4/2004
Richard Noggin	Liquid Ice	Chartruse	Wolfspit Kansas	\$309.77	9/1/2004
Joe Schmoie	Goat Glue	Jerked Chicken Brown	DuckSquat Texas	\$5.95	8/31/2004
Steve	Dr. Zogg's Secret Formula Coug	Green	sacramento	\$700.00	8/30/2004
Robert	PaperONe	Blue	Jakarta	\$19.95	8/26/2004
Diana	Brand-New-Product	perrywinkle	sacramento	\$700.00	8/24/2004
Joe	BOSCAD	Bilious Blue	jamestown	\$10.00	8/20/2004
blah	a	blue	baltimore	\$18.95	8/18/2004
Podna	Puzzzel	pizza	paloma	\$123.00	8/15/2004
Eric E	NEO	Blue	Gloucester	\$10,000.00	8/9/2004
Joe Smoe	new product 4	purple people	Taipai	\$1.11	7/23/2004
Fred	Brand-New-Product	65464645	baltimore	\$29.95	7/16/2004
tim	Goat Glue	red	sacto	\$19.95	7/12/2004
Dennis	tester321	purple	Ottawa	\$99.99	7/6/2004
svn	Spamaway	Red and Blue	Adipur	\$999.00	6/26/2004
gILLES	Aculert	65464645	Boston	\$5.95	6/14/2004
Kahuna	Open Ocean Surfboards	Red and Blue	Sidney	\$2,000.00	6/1/2004
asdas	Brand-New-Product	Magenta	New Orleans	\$5,000.00	5/27/2004
Romulus	Spamaway	Bilious Blue	mississauga	\$29.95	5/24/2004
Romulus	Rollerball Queen	Jerked Chicken Brown	DuckSquat Texas	\$29.95	5/24/2004

Fig. 6 – Product Configuration Report that contains Data Captured with I-forms

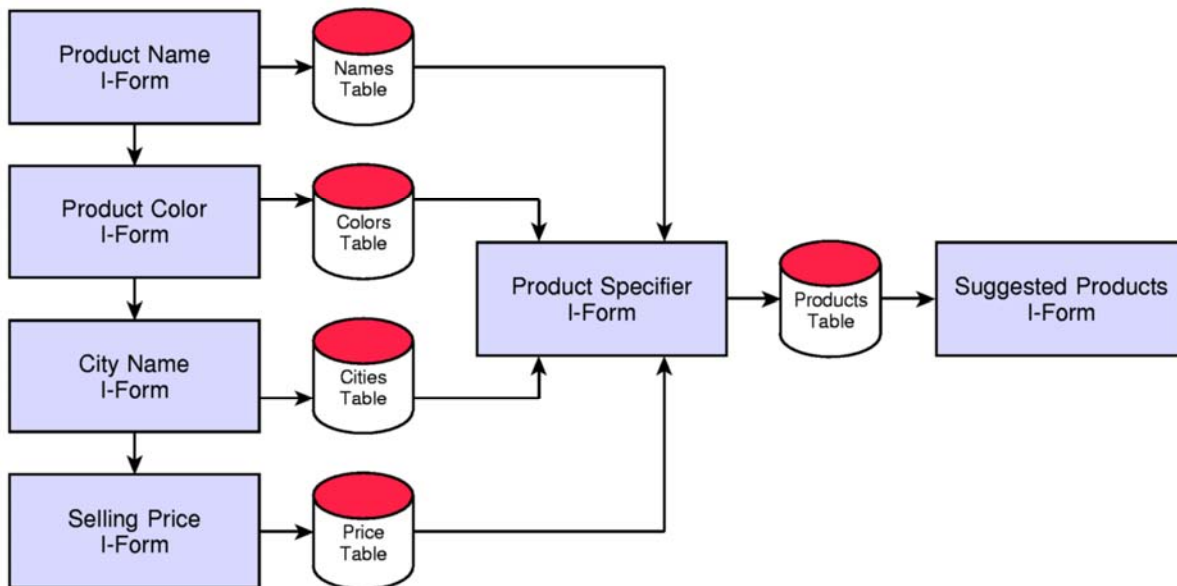


Fig. 7 - I-forms Database Connectivity Diagram for the Online Demonstration.

## Using HTML and PDF Internet Forms

Amgraf's OFDP software can produce PDF forms with database connectivity as described in this presentation. OFDP can also generate HTML versions of PDF forms that look and act the same without the need to start the Adobe Reader. Amgraf's server scripts work equally well with both HTML and PDF forms. From our experience in helping to implement large-scale I-forms solutions, we have found that there are often advantages to using HTML forms along with PDF forms. We believe that HTML forms are best suited for:

- Online data collection
- Dynamic database views
- Use with external JavaScript functions

We recommend PDF forms for:

- Printing
- Field-flattened I-forms
- E-mail attachments
- Archival purposes

As the screen shots shown below illustrate, there are many similarities between the HTML and PDF I-forms produced by Amgraf's OFDP software.

The image displays two side-by-side screenshots of a "TRAVEL EXPENSE REPORT" form. The left screenshot shows the HTML version, and the right screenshot shows the PDF version. Both forms are identical in layout and content, featuring a header section with employee information, a "PART I EXPENSES" section with a "TRANSPORTATION" table, and a "LOGGING & MEALS" section. The "TRANSPORTATION" table has columns for MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, SATURDAY, SUNDAY, and TOTALS. The "LOGGING & MEALS" section has a similar table structure. The total trip amount is shown as 2,030.00.

Fig. 8 – This Database-Connected HTML I-form (Left) looks like a PDF I-form.

You can try out the example forms shown here by going to Amgraf's web site demonstration page at [www.amgraf.com/pages/iforms.html](http://www.amgraf.com/pages/iforms.html).

## Summary

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### About the Author.

Franklin J. Garner, III is President and CEO of Amgraf, Inc., a Kansas City company specializing in forms software technology for print manufacturing, industry and government. Amgraf's products are widely used for business forms pre-press automation, and electronic and Internet forms systems.

Garner serves on the Board of Directors of the North American Security Products Organization (NASPO), and serves on the Board of Trustees for the Print Education and Research Foundation (PERF). He is also an instructor of Forms Automation Technology for the Document Management Industries Association (DMIA), and has written and co-authored several research papers and articles for various business documents industry trade magazines and journals.

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