

Another Look at CGIDEV2

By Martin Cytrynbaum



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It has been an exciting summer for the CGIDEV2 web toolkit as its support and development has moved from IBM Italy to the iSeries Client Technology Center in Rochester. With this move came a new commitment from IBM in the CGIDEV2 product and other CGI solutions on the iSeries.

With IBM's backing and the growing popularity of the product in mind, I thought it was a good time for TUG to take a second look at this free IBM web toolkit and its role in creating interactive web pages using the RPG ILE programming language on the iSeries.

Part I: What is CGIDEV2?

At its core, CGIDEV2 is an iSeries based program development toolkit that facilitates the development of web-based interactive programs using RPG ILE or Cobol (using the older CGIDEV version) as the back-end CGI language. The functionality of this toolset is incorporated into an RPG ILE program by means of a service program that contains all of the procedures required to read input from a browser, generate and send the appropriate response back to the browser.

IBM ships a series of CGI APIs with every iSeries that permits a program to communicate with the iSeries HTTP Web server. You will likely find these APIs in a service program called QZHBCGI in library QHTTSPVR on your iSeries. Unfortunately, these APIs are not very programmer-friendly and require more time and patience to deploy than most application developers can afford. What

CGIDEV2 does best is to simplify these APIs by hiding their complexity and giving the programmer a generous palate of procedures that simplify communications with the Web Server.

CGIDEV2 was developed by **Mel Rothman** while he was with IBM Rochester. It was released to the public in 1999. The product was maintained and promoted by Mr. Rothman and **Dr. Giovanni B. Perotti** of IBM Italy, who has added enhancements, documentation and code samples to the package. Because the product is written in RPG ILE and comes with complete source, end users have also been able to contribute enhancements to the package and modify it for their specific requirements.

Recently, on the retirement of Dr. Perotti, there was an attempt by the Perotti and the user community to get IBM to declare an Open Source designation on the product. This attempt has failed for now; however the IBM Client Technology Center (CTC) in Rochester has taken back the CGIDEV2 product and is committed to continue to distribute and maintain it. The CTC also offers consulting and custom solutions using the CGIDEV2 product and have indicated that they may release the product as Open Source in the future. Jim Herring, IBM director of product management and business operations in the iSeries Division, was recently quoted as saying that once declared open source, IBM may even bundle it with the Apache Server or as part of the iSeries Operating System!

The actual usage of the product is hard to gauge because there is no annual licensing fee and upgrades are free. What we do know is that more than 14,000 individuals

have downloaded the software to date. This is likely a high number as only a small percentage of people who download a free product will end up actually using it. Recently, on Perotti's retirement, over 350 concerned users wrote letters or called IBM asking for CGIDEV2 to be designated as open source product. Another indicator is the CGIDEV2 registration-based message board which is typically getting over 200 messages a month and growing.

The web CGIDEV2 site, which Dr. Perotti has dubbed easy400, also includes educational resources (including resources on Web Security, HTML, CGI, JavaScript, TCP/IP, Mail Configuration, and the Apache Server) in addition to other production tools and utilities (including a Secured TCP servers utility, a Web Access Toolkit, a Library compression tool, and a MIME file creation and send utility).

Not Another Terminal Emulator

Many web solutions developed for the iSeries effectively wrap a web emulator around legacy 5250-based green screens. This permits instant or rapid deployment of existing green screens to the web. However there are many features of 5250 programs that are foreign to the web. For instance, have you ever been to a popular web page that asks you to hit an F24 key or a field exit key to continue? Not likely. Similarly, there are critical features of web pages that are foreign to a 5250 green screen program, such as hyperlinks, the back and reload buttons. Such emulation solutions may quickly bring your 5250 screens to the web,

CGIDEV2 Update

Recent reports suggest that the eServer iSeries system will no longer support CGIDEV2 code. This report was a miscommunication and IBM regrets the confusion it has caused. To address any issues customers may still have, IBM will direct customers to a different Web site: http://www-1.ibm.com/servers/eserver/services/assets/ebus_cgisrv.html, from which CGIDEV2 may be downloaded. All visitors to the current Easy400 site will be redirected to the new CGIDEV2 site. CGIDEV2 enables programmers to write code for the Internet, using COBOL or RPG as CGI language, which reinvigorates legacy applications. Additionally, IBM is investigating providing the code with an Open Source license at a later date.

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however they inevitably look and feel like a strange hybrid between web and 5250 standards. They may also demand a great deal of hardware resources and bandwidth to ensure good response time.

When you write your CGIDEV2 programs, you are writing RPG ILE optimized for the web. As a result, your programs look and behave like real interactive web pages with the functionality that users expect on a web page. The bad news is that with CGIDEV2 your 5250 screens will not be instantly converted to beautiful web pages. To bring your applications to the web with CGIDEV2, you have to roll up your sleeves and get busy. Luckily much of your RPG business logic can be used as is or cut and paste into your CGIDEV2 program. If your organization's existing code is well structured and modular with

many external CALLs for validation, screens and file updates tasks, then the task of moving to CGIDEV2 is greatly simplified. If your organization still loves large so-called "fast and efficient" monolith programs, then your task will be a bit greater.

Separation of Presentation and Business Logic

Another nice feature of CGIDEV2 is that it encourages the programmer to separate the program logic from the presentation of the web page. CGIDEV2 does this by allowing the programmer to keep the static portion of the web page in an HTML Skeleton file. This HTML skeleton file can be stored in a separate source physical file member or as text file on the iSeries's Integrated File System (IFS). This technique is not unlike the way iSeries programmers have been separat-

ing DDS display files from the logic of the program for years. This technique also permits an organization to separate much of the screen design tasks from programming tasks thus liberating the programmer from many on-going web maintenance "look and feel" tasks like changing static text, logos and fonts.

It is interesting to note that ability to separate the business logic from the presentation of the web page is missing or added as an afterthought, in other web languages like PHP, Perl and JSP.

Not Another SQL Solution

SQL (and the APIs that allow access to a database using SQL including JSBC and ODBC), have made web-based reporting using the iSeries database simple to implement. Most languages commonly used for web development use ODBC (PHP, Perl) or JDBC (Java, JSP) for data access. These solutions can work exceptionally well for simple queries. However, many organizations, for one reason or another, do not have an adequately normalized database to take full advantage of an SQL solution. Many organizations still have vestiges of hierarchical structure databases, or suffer from poor design or complex business relationships that cannot be expressed well using simple SQL statements. Such issues are hard to overcome using typical SQL solutions and may require complex SQL statements or temporary tables that can affect performance or require nightly data extractions that affect the timeliness of data.

Here is a typical example that illustrates a hierarchical database relationship and complex business logic that can complicate an SQL solution.

"I want a simple report of all transactions by fiscal month. All the data you need is in the Invoice Header, Invoice Detail, Customer Master and Bill-to Master." (So far so good.)

"However there are a few exceptional cases you should be aware of... A Customer may have Bill-to, so link to the Bill-to file to find the Bill-to entity. In a few cases the Bill-to entity has a higher master Bill-to entity, so you will have to link back to the Bill-to file several times, to get the top



Going mobile with CGIDEV2: One exciting use for CGIDEV2 is to take your iSeries applications on the road with a BlackBerry or Palm device equipped with a web browser! Great for field service agents, salespeople, drivers, operators and anyone who needs iSeries access on the road.

Billing entity. Also Debit notes that were migrated from the old Debit system in 2001 do not have detail records. So if you hit old Debit Notes with no details, use the total dollar value from the header file (converted back to Canadian dollars at the rate of the end of the month of sale if the customer is paying with another currency) and net out the taxes."

Because of RPG's close relationship to the iSeries database, non-normalized databases are not a big inconvenience for an RPG programmer. However, when working with an SQL solution, non-relational databases may require various techniques that may impact performance of the query, accuracy or timeliness of the data. CGIDEV2 allows you to use what is best for your application - SQL (with RPGSQLLE or OPNQRYF) or regular RPG data access (SETLL, READ, CHAIN). This can give CGIDEV2 a big advantage over other purely SQL solutions.

As CGIDEV2 is a native iSeries solution, you will not need to add additional PC servers. You can even integrate CGIDEV2 programs into your current production library list. Similarly, there is no need to replicate data from the DB/400 database to another database. This simplifies back up, recovery and other administrative tasks.

Fast and Free

One of the biggest selling points of CGIDEV2 is its cost. The package is available at no cost from the new IBM CGIDEV2 web site and the required HTTP sever comes installed with the OS/400 operating system. The CGIDEV2 installation kit comes with an automated installation process and many working examples, allowing you to get it up and running within an hour or so.

You will also need to be at OS/400 V4R5 or greater and have an RPG IV compiler at V4R3 or above. All development may be done directly on the iSeries using IBM source editor (SEU) for the Windows-phobic. However much better productivity can be achieved using an HTML editor and storing HTML source in the IFS. I use Websphere Development Studio for iSeries because it has a strong WYSIWYG HTML

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editor and tight integration with the iSeries for management of IFS files.

Because CGIDEV2 uses the lightweight iSeries HTTP Server (powered by Apache) you will probably not have to upgrade your hardware to deploy a CGIDEV2 project. In fact, moving users from interactive green screens to CGIDEV2 programs will likely reduce CPU usage and because CGIDEV2 programs are processed in batch. Because it is based on compiled RPG ILE code and not interpreted script, CGIDEV2 programs provide very good response time, especially on intensive data retrieval tasks.

Where CGIDEV2 Could Fit in Your Organization

I would not set out to re-write an ERP using CGIDEV2 right away. Many would argue that green screen applications still have a place in the workplace for heads-down dedicated data entry applications such as A/R, A/P, Order Entry and General Ledger. So who might benefit the most from this technology?

- Occasional or casual users who are more comfortable with a web interface than a 5250 interface.
- Remote or mobile users like salesmen, truck drivers or field service representatives who may have better access to a web browser than a 5250 emulator.
- Customers and suppliers who prefer to get their A/R, A/P or sales information from the web, rather than using a 5250 emulator.
- Applications that may benefit from web-friendly features like scrollable screens, file downloads, streaming audio or video media

Because CGIDEV2 allows you to seamlessly merge your iSeries data and business logic with a web interface, it opens up a whole world of web-based technologies that may add additional value to your applications.

Competitors

CGIDEV2 is not alone in its class. While IBM has been mostly promoting its Java/ Websphere solution, other companies have been targeting the same CGI/HTTP niche as CGIDEV2 with commercial solutions. These commercial products typically come with more evolved visual development environments and may add additional functionality like quick-start wizards and better state and session tracking. These products are also worth investigating for their additional features and support.

Leveraging Your Organization's Existing Skill Set

While other technologies such as Websphere/ Java and .net may offer additional functionality in building interactive web sites, the total cost of adopting and maintaining these technologies, including the difficulty of finding qualified people who also understand your business can make the decision to adopt these technologies very difficult. This is especially true for small and medium-sized organizations with limited resources. CGIDEV2 allows an iSeries shop to develop web applications in-house with existing staff without significant cost or learning curve.

A big strength of CGIDEV2 technology is its proximity to the skill set found in many iSeries development shops. While CGIDEV2's RPG back-end looks very familiar to RPG programmers, the end-

user deliverables appear very new and different from regular iSeries green screens. Your users are probably not accustomed to colourful web pages with pull-down menus, pictures and hyperlinks from your iSeries department. As an experienced RPGIV programmer with exposure to ILE techniques and a bit of HTML, you can ramp up on this technology in just a few days. For RPG programmers, it is a great tool to get started with web programming, as it does not require a large investment of time or money. It can also be a natural starting point to start learning additional web technologies such as CSS, Javascript, JSP and XML.

Some Considerations

There are also some additional considerations to take into account before adopting CGIDEV2. Firstly CGIDEV2 is iSeries specific. It will not migrate to Linux or Windows, so if you are in the process of migrating your ERP to Microsoft Access or a piece of Linux shareware, then this solution may not be right for your organization.

CGIDEV2 may be mastered quickly by experienced iSeries programmers. It builds on their experience with RPG, DDS, CL and the iSeries database. This is not a wizard type tool for an iSeries neophyte and is not a recommended starting pace for a new iSeries programmer.

Although it is now supported by IBM, and the CTC offers custom solutions based on this technology, as of today you cannot buy a service contract from IBM for CGIDEV2. The best place for support is one the CGIDEV2 message board which is monitored both by CTC staff and the two original developers of CGIDEV2.

For Further Information...

New IBM Web with CGIDEV2 download:
http://www-03.ibm.com/servers/eserver/services/assets/ebus_cgisrv.html

Giovanni's Easy400 site with CGIDEV2 installation instructions, tutorials and addition mail and security tools:
<http://www.easy400.net/en>

Easy400 Discussion Group:
<http://groups.yahoo.com/group/Easy400Group/>

Source code for this example and more on my CGIDEV2 site:
<http://as400.liberty-i.net/CgiDevExt/index.html>

Part II: Now Some Code

In order to get a feel for how CGIDEV2 works, this section features some pieces of code and corresponding output.

Figure 1 is an extract of a typical html skeleton file that is used in a CGIDEV2 program. This code is an example of an HTML table, with two notable exceptions.

```
<AS400>Top
Content-type: text/html

<HTML>
<BODY>
<AS400>Header1
  <H1>Sample Sales Report</H1>
<AS400>TopOfTable
  <table border =1 >
<AS400>TableDetail
  <tr><td>
    /%Region%/ </td><td > /%Sales%/
  </td></tr>
<AS400>BottomOfTable
  </table>
<AS400>Endhtml
</BODY>
</HTML>
```

Figure 1. salesReport1ifs.html

1. Note the use of Named Sections in this HTML skeleton code. In this example, named sections are introduced with the <AS400> tag. The contents of a named section begins on the line following the named section. A named section is similar conceptually to a DDS display file record. The contents of a named section will only print to the web browser when the RPG program tells it to print with the WriteSection() procedure. In this case we are likely to print the Top, Header1, TopOfTable and BottomOfTable sections only once. The TableDetail section will be repeated with each successful iteration of the RPG Read OpCode.

2. Also note the use of Substitution Variables. Here we have two such substitution variables: /%Region%/ and /%Sales%/. These substitution variables will be replaced by values coming from the RPG program. CGIDEV2 procedure updHTMLvar() is used to push a variable from the RPG program to the HTML skeleton program.

```
*****
C      WriteCalls  BEGSR
*****
C      callp      wrtsection('Top')
C      callp      wrtsection('Header1')
C      callp      wrtsection('TopOfTable')
C      *1ova1     Setll  SLSFILERC
C      read       SLSFILERC
C      dow        not %EOF
C      callp      updHTMLvar('Region' :REG07)
C      callp      updHTMLvar('Sales' :%char(SLS07))
C      callp      wrtsection('TableDetail')
C      read       SLSFILERC
C      enddo
C      callp      wrtsection('BottomOfTable')
C      callp      wrtSection('*fini')
C      endsr
*****
```

Figure 2. SLSRPT1

Figure 2 is a segment of RPG code that illustrates the process of setting up an HTML page that the user will ultimately see on his browser. The first thing that you may notice are some familiar RPG opcodes (setll, reade, dow, enddo) used to read the Salesman file (SLSFILE). You could as easily have used embedded SQL here if that is your preference.

Figure 3 is another extract of a CGIDEV2 RPG program. It shows the gethtmlifsmulti() procedure. This procedure acts as the link between the RPG program and the HTML skeleton code. This procedure tells the RPG program the location of the HTML skeleton code. In this case the HTML Skeleton code will be located in IFS library /myIFSlib and will be called salesReport1ifs.

```
*****
C      eval      IfsMultIndicators = gethtmlifsmulti(
C      '/myIFSlib/salesReport1ifs.html' :
C      '<AS400>')
*****
```

Figure 3. SLSRPT1

Next if you look carefully you will also see some CGIDEV2 procedures. The procedure updHTMLvar() serves to update the HTML substitute variables Region and Sales substitution variables in Figure 1 with the current contents of physical file fields REG07 and SLS07.


Region	Sales
01	1234.34
02	3455.34
03	4949.44
04	6262.64
05	2124.34

Figure 4.
Sample Sales Report

The procedure wrtsection() writes the named sections to a buffer that contains the web page that we are currently building. In Figure 2, we are writing these named sections: Top, Header1, TopOfTable, TableDetail and BottomOfTable. Wrtsection() is similar conceptually to the EXCEPT or WRITE opcodes in RPG. When the page is completed we will write the special section called *fini which will trigger the page to be pushed out to the user's browser.

html. It is also here that we establish the token <AS400> as the indicator for a new named section header.

Now if all goes well then the finished web page should look something like Figure 4. This is, of course, a trivial example, however it illustrates how the CGIDEV2 toolkit and a small

investment in time can help you bring your iSeries programs to the web. 

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