

Crisis with COBOL

Where Industry and IT Departments Stand

Gary McGirr

Rick Barker

Jack Decker

Gary Schmidt

**Computer Information Sciences Department
Washburn University**

gary.mcgirr@washburn.edu
rick.barker@washburn.edu
jack.decker@washburn.edu
gary.schmidt@washburn.edu

Abstract:

Many IT specialists whose primary task is to maintain existing and/or write new COBOL applications are Baby Boomers approaching retirement. A resulting hypothesis is that by 2010, IT may have a crisis with respect to COBOL and mainframe installations. The study was designed in three parts: first, a formal survey document to determine current and future COBOL requirements was administered to selected large state agencies and businesses across the United States. Second, this formal survey was followed with phone interviews with the IT managers from these mainframe shops concerning staff make-up, maintenance responsibilities, and future IT developmental requirements. The third part of the study was the administering of a survey to IT departments of Midwestern colleges and universities concerning the current and future status of COBOL within their curriculum. This paper provides analysis of the survey results and the expected interaction of the two environments, business and higher education.

Introduction:

Since 1960 when Dr. Grace Hopper and her colleagues created COBOL, the installed base of the language has grown to an estimated 150 to 250 billion lines of application code (4) with 8 to 9 million new lines being written each year (2). In fact it might be as high as 5 billion lines of new code each year (4). It was and can still be considered the language of choice for the mainframe environment. However, with the development of other languages, COBOL has been labeled 'out-of-date', 'dying', and 'no longer the language of choice'. Each year since the early 1970's, COBOL's demise has been considered imminent, but COBOL could respond much as Mark Twain did when he cabled the Associated Press "The reports of my death are greatly exaggerated".

If an organization has a mainframe, the chances are very likely most, if not all, of those applications are written in COBOL. If one chose to enter the technology field as a programmer during the 70's and 80's one would very likely have been a COBOL programmer. Even in midrange and micro-computer environments, it is not unheard of to see applications written in COBOL.

It is quite clear that the age distribution for mainframe workers is quite different than the distribution for workers in UNIX and Windows environments. According to studies done by the Meta Group, 60% of the people in mainframe environments are 50 and older compared to only 8% for UNIX and Windows employees (2). At the other end of the age spectrum, 22% of Unix/Windows trained IT workers are under 30 compared to only 5% for mainframe workers (2). It is clear that many mainframe professionals will soon consider retirement and that little new blood is coming in.

In the past, many university educated IT professionals entered the profession through programming. Consequently, most institutions had COBOL courses and delivered other courses based in the mainframe environment. With the advent of new languages and programming paradigms, educational institutions began to de-emphasize COBOL and mainframe related courses and students migrated to apparently "more modern" and perhaps "more sexy" technologies.

Other factors as well were at work in reducing the number of new people entering the mainframe environment. In order to deal with Y2K issues, staffing levels were artificially elevated at the turn of the century. Hiring has been restricted while levels are returning to more sustainable levels. This, plus the downturn in the technology sector in general and the movement of programming off-shore, all have led to fewer job opportunities for recent graduates. With the perception of the mainframe environment being outdated and with few job opportunities, it is no wonder that universities and students have been quick to jump off the mainframe bandwagon.

Background:

Washburn University is a 7000 student educational institution located in the state capital city, a metropolitan area with a number of small to medium size mainframe shops that support various COBOL environments. This university has a Computer Information Sciences Department with 100 majors, evenly divided between computer science (CS) and computer information systems (CIS). The department offers both day and evening classes taught by fulltime faculty as well as adjunct faculty who are employed by many of the local mainframe shops. Several of these adjunct faculty are contemplating retirement and since they play major roles for their organizations within the mainframe environment, they are concerned about finding adequate replacements. Being in the state capital, a number of these professionals work for state agencies. In the current budget crisis in Kansas (as with many other states) it is apparent the state will struggle to hire equally trained professionals and there will be few funds expended to replace current COBOL systems for the foreseeable future.

Concerns were further elevated with the cancellation of the university's COBOL classes due to low enrollments. While COBOL is not a required language for computer majors, in the past a number of students chose to consider at least one semester of COBOL as an elective with some taking two semesters to enhance their employment chances. However, for the reasons stated above, job opportunities have been mostly nonexistent in the mainframe environment. This has caused students to enroll in electives that teach non-programming topics or other specialties to improve their marketability. As a result elective procedural language courses, in particular COBOL, have experienced dwindling enrollments.

An additional concern deals with the loss of CIS and CS majors. Over the past four years, this institution has experienced nearly a 50% decline in computing majors (107 for 2004 versus 198 for 2000). And looking at enrollment applications for incoming students for 2004 suggests even fewer CS and CIS majors in the near future.

Based on the issues raised above, the following questions emerged:

- What is the immediate (next 5 years) future of COBOL?
- What type of professionals will support the COBOL environment?
- Where will one go to get the training for the COBOL environment?

Research Method:

Business:

In order to answer the above questions, a survey was created to ask IT managers questions about their current staff, their anticipated future staffing needs and retirements, and their current and future reliance on the COBOL programming language. (See

questionnaire in Appendix A). Specific questions were developed about the size and make-up of the current staff, how many actually work on COBOL applications and of those who do, whether in maintenance or new code development. Questions were developed concerning the amount of COBOL code currently present and what the expected future percentage might be in 3-5 yrs. For shops with significant decreases in COBOL as percentage of total code, additional data was collected: replacement language, conversion budget, and whether that conversion budget was approved. Lastly, a set of questions were developed to determine future staff make-up. These questions dealt with projected retirements and the desired background of replacement personnel, in particular the specific programming skills needed.

The survey document was field tested with several local state agencies to verify that the wording of the document correctly addressed the concerns of the authors. Criticisms and suggestions were reflected in subsequent revised documents. To ensure an adequate number of responses, it was determined to conduct the survey by phone with one of the authors conducting all of the phone calls to maintain consistency. Twenty-five mainframe shops and state agencies were selected nationwide to be surveyed. The surveyor determined the appropriate IT managers and conducted the phone interviews.

Of the twenty-five mainframe and state agencies selected, twenty-two were successfully contacted. The survey ranged from shops having 1 COBOL programmer to a company having approximately 250 COBOL programmers. Two of the shops no longer supported COBOL, while another anticipated being completely out of COBOL within three years, but with a qualification that the state had not yet allocated any resources to accomplish this rollover. (See Companies sorted by COBOL Hiring Requirements Appendix B) The data in appendix B shows that the current level of COBOL code ranges from 0% for the two shops with no COBOL code to 100% for two shops having very small support staffs. Most of the shops have at least 50 percent of their code written in COBOL and more that 80% have at least 70 % of their current applications in COBOL. However no shop expects to increase the percentage of their COBOL code within five years. On the other hand, the amount of code written in COBOL will not significantly decrease in most shops either. COBOL will still be the language of choice for most shops for the next 3-5 years.

A very striking statistic does present itself. Of the nearly 1000 programmers who actively support COBOL environments, approximately 18% will retire within the next 3-5 years. (178 of 991). The retirement issue is not isolated in any COBOL hiring preference grouping (see Appendix B).

The above statistics closely match work done and reported by Carr and Kizior in a paper presented at the ISECON 2003 conference. A particular finding indicated "...increased concern about the present need to maintain the large inventory of 'legacy' code while at the same time developing new e-commerce oriented systems" (1). Additional similar findings were reported by Reggie, Comer, and Brauda in a paper "COBOL in Crisis", (3) and Garvey's "Mainframe Talent: An Endangered Species". (2).

Educational Entities:

In order to answer where colleges and universities stand with respect to the current support of COBOL, a questionnaire was created to be administered to small and medium sized educational institutions in the Midwest. (See Questionnaire in Appendix C) The survey collected information regarding the size of the institution, the number of CS and CIS majors, whether COBOL was offered and how frequently. The number of students enrolled in OOP classes was requested for comparison purposes.

The survey (See survey in Appendix D) was administered to 21 educational institutions ranging from enrollments of 500 to schools with enrollments over 15,000 students. The computing departments had from 4 to over 500 CS and CIS majors. Slightly more than 50% of the responding schools offer COBOL either on demand or somewhat regularly. Nine schools, slightly less than 50%, never offer COBOL. These nine schools range from large to small both in overall enrollment and in the size of the computing departments.

Results:

It is clear from the IT shops surveyed that COBOL will represent the dominant language of most mainframe shops for the next five years, particularly in state agencies. While the percent is dwindling, COBOL is not in any major sense becoming obsolete. For those shops hiring IT professionals, 55% indicate COBOL knowledge will be a *requirement* for anyone being hired in the next 3-5 years and an additional 32% indicate it would either be nice or desirable for applicants to have some COBOL background. (See Appendix B)

It is also clear from the IT shops surveyed and other supporting data that current professionals providing COBOL support are rapidly approaching retirement age. Almost 18% of them plan on retiring in the next 3-5 years.

When looking at who might educate potential replacements, educational institutions seemingly do not anticipate the need for additional COBOL classes. Furthermore, slightly less than 50% do not anticipate offering COBOL at all. This group has written off COBOL as a viable language to teach to computing students, even though significant work in COBOL will continue for many years. This statistic crosses all size boundaries from the smallest to the largest of schools. COBOL appears to be a language that is being phased out of the normal language offerings. These findings again are supported by others doing similar research. The Reggie, Comer, and Brauda report found similar results as did the Garvey report. COBOL is being phased out in colleges and universities.

Limitations of the study:

When this study was undertaken, this research group was interested in answers to several basic questions: “What is happening to COBOL? What is happening to the IT professional supporting COBOL? What are colleges and universities doing to educate students in COBOL?” However, as this study progressed many other questions developed. Questions such as: “Is the amount of COBOL code dwindling? What language(s) are being used to replace COBOL?” Are IT shops aware of the new enhancements to COBOL such as OO-COBOL and web based COBOL? Would this knowledge have changed the decisions made by either the organizations using COBOL or by the universities offering programming courses? While it seems clear that educational institutions are forced to offer a wider range of courses than 10 years ago, this study did not address whether younger faculty would be willing to learn and teach COBOL, or how successful older faculty have been in moving from procedural to object-oriented environments.

This study also did not address the number of professionals that might retire 5-10 years from now and what might happen in the IT shops that far into the future. Neither did it address the coming retirement of faculty with COBOL knowledge. This study did not address the re-hosting and the rewriting issue that currently hampers mainframe development.

Lastly this study did not address what effect, if any, outsourcing and off-shoring will have with respect to supporting or rewriting of the COBOL systems. All of these questions are topics for future study.

Discussion and Conclusion:

For one to argue ‘legacy’ systems will soon be rewritten to newer more current languages would seem to also say, money and time are not relevant factors in IT decision making. It is clear most current mainframe ‘COBOL’ shops do not have staff or funding to rewrite or convert systems; otherwise the task would have already been completed. Y2K provided ample justification for funding system conversions through a unique convergence of funding, upper management support, and allocation of resources and time. But in most cases, the COBOL systems were tweaked, not converted to other languages. Something in the environment more drastic than Y2K will need to occur for this situation to change.

It would also appear there is a need for educational institutions to re-address the COBOL issue. While curriculums will not return to being COBOL based (or any other specific language, for that matter), having a background in COBOL is not bad either. The educational benefits of giving students the opportunity to take another object oriented language are real, especially if OO-COBOL was an option. And if such a course increases the employment prospects of the student, so much the better. While front-end

processing will most likely continue to change and evolve, backend processing may not change significantly. Students need to know there is a place in the workplace for professionals willing to support COBOL. In fact, with the aging mainframe workforce, many students may find the mainframe environment full of opportunities not only for initial employment but also for advancement.

References

1. Carr, D. & Kizior, R. (2003). "Continued Relevance of COBOL in Business and Academia: Current Situation and Comparison to the Year 2000 Study", (November 2003). Proceedings ISECON 2003.
2. Garvey, M (2002). "Mainframe Talent: An Endangered Species", (March 4, 2002). Information Week
3. Roggio, R., Comer, J., & Brauda, P. (2003). "IS Programs become Accredited: COBOL in Crisis", (November 2003). Proceedings ISECON 2003.
4. Stern, N & Stern, R, 2002; Structured COBOL Programming, 9th Edition; John Wiley & Sons; New York; pg13.

Appendix A

IT Business Questionnaire

1. What is the size of the IT staff at your facility (i.e programmers, DBAs, project managers, support staff, etc.)?
2. How many staff code in COBOL?
3. In a year, what percent of IT staff effort is allocated to COBOL maintenance/development?
4. How many of your COBOL staff can retire in the next 3 – 5 years?
5. What percentage of your code is written in COBOL?
6. In 5 years what is your expected percentage of code in COBOL?

IF the percentage mentioned in question 5 is significant and the percentage from question 6 is very low ask questions 6a - 6d.
 - 6a. What Language do you plan to replace COBOL with?
 - 6b. What is the amount of your budget to Re-write the systems?
 - 6c. Has the budget been approved?
7. How important is COBOL knowledge in hiring new IT staff?
 - 7a. List the top two language skills that are important in hiring new staff.
 - 7b. Any other skills?

Appendix B

Companies sorted by Cobol Hiring Requirement

CobolRequired For Hiring?	% Current Code written in COBOL	Expected % of COBOL in 5 years	IT Staff size	Cobol Staff Size	% IT Staff effort w/ COBOL	COBOL Staff retirement within 3-5 yrs	Coverion Budget Approved
Required	100	100	1	1	100	1	
Required	100	10	17	8	80	2	
Required	98	95	98	23	82	1	
Required	95	95	60	50	85	15	
Required	90	90	200	150	80	15	
Required	90	80	22	6	85	0	
Required	80	75	100	95	95	14	
Required	80	25	115	50	75	5	yes
Required	75	70	1000	250	25	38	
Required	70	60	74	26	50	0	
Required	50	25	20	10	10	0	
Required	35	35	18	6	35	2	
<u>COBOL Required</u>	12	<u>Group Staff Totals</u>	<u>1725</u>	<u>675</u>	<u>Group total retiring</u>	<u>93</u>	
Desirable	90	75	110	40	95	1	
Desirable	90	30	180	34	90	20	yes
<u>COBOL Desirable</u>	2	<u>Group Staff Totals</u>	<u>290</u>	<u>74</u>	<u>Group total retiring</u>	<u>21</u>	
Nice	95	5	45	34	50	7	yes
Nice	75	45	800	85	40	13	yes
Nice	70	50	200	30	15	1	
Nice	25	10	60	10	10	3	
Nice	10	10	40	3	20	0	
<u>COBOL Nice</u>	5	<u>Group Staff Totals</u>	<u>1145</u>	<u>162</u>	<u>Group total retiring</u>	<u>24</u>	
None	70	0	400	80	40	40	yes
None	0	0	35	0	0	0	yes
None	0	0	34	0	0	0	
<u>COBOL None</u>	3	<u>Group Staff Totals</u>	<u>469</u>	<u>80</u>	<u>Group total retiring</u>	<u>40</u>	
22 Companies		<u>Report Staff Totals</u>	<u>3629</u>	<u>991</u>	<u>Staff Retire Totals</u>	<u>178</u>	

Appendix C

College/University Questionnaire

Name of Institution _____

Size of Institution _____

Individual responding _____

Title _____

Number of majors in Computer Info Systems _____

Computer Science _____

What degrees(AA,BA,BS) are offered at your institution
in Computer Info Systems?

in Computer Science?

Please estimate the number of annual graduates with a computing degree pursuing a
career in application development.

Does your department offer a course in COBOL? _____

If so, how frequently? _____

If so, what is the usual enrollment? _____

Any other Procedural Languages
(please list language frequency and usual enrollment)?

Is COBOL a requirement for any of your majors?

Is COBOL an accepted elective for any of your majors?

How frequently does your department offer an Object-Oriented course? _____
(Java, C++)

What is the usual enrollment? _____

Appendix D

School Report

<i>COBOL class frequency</i>	<i>Annual Computing Graduates</i>	<i>School Size</i>	<i>COBOL enrollment</i>	<i>Number of CIS Majors</i>	<i>Number of CompSci Majors</i>	<i>OOP class Frequency</i>	<i>OOP enrollment</i>
<i>sem</i>							
	70	11500	60	550	110	sem	275
	40	6000	30	150	50	none	0
	25	6500	15	50	50	sem	75
	20	3000	20	70	0	sem	25
	<u>sem Totals</u> 155		<u>Schools within Group</u>		<u>4</u>		
<i>yearly</i>							
	40	1500	20	30	30	sem	15
	30	5000	30	200	200	sem	100
	<u>yearly Totals</u> 70		<u>Schools within Group</u>		<u>2</u>		
<i>Alt Years</i>							
	50	1000	7	3	60	yearly	20
	30	5500	30	45	47	sem	60
	6	2300	7	20	20	yearly	20
	5	500	10	5	5	Alt Years	5
	<u>Alt Years Totals</u> 91		<u>Schools within Group</u>		<u>4</u>		
<i>onDemand</i>							
	12	1500	15	45	25	sem	30
	0	1000	9	20	15	sem	13
	<u>onDemand Totals</u> 12		<u>Schools within Group</u>		<u>2</u>		
<i>Never</i>							
	30	1850	0	0	185	sem	40
	25	7000	0	286	0	sem	40
	20	5500	0	30	45	sem	75
	6	5300	0	35	11	sem	60
	4	1500	0	2	2	sem	6
	3	1100	0	0	30	sem	17
	2	500	0	0	15	sem	8
	0	500	0	0	10	sem	8
	0	15000	0	250	200	sem	80
	<u>Never Totals</u> 90		<u>Schools within Group</u>		<u>9</u>		
<u>Report Totals</u> 418		<u>Total number of schools</u>		<u>21</u>			