MAINFRAME SKILLS REPORT

Sources of Mainframe Skill Training

Because of our heavy coverage of mainframe technology — and our active coverage of mainframe skills development — CA Technologies asked us (*Clabby Analytics*) to examine the sources of mainframe skills development around the world. What we find is that there are numerous sources of mainframe skills training ranging from colleges and universities, through vendors, to independent training organizations and consortia.
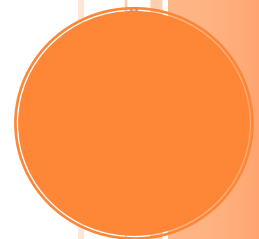
In this report, we examine each of these approaches and describe the length of time involved to learn skills, types of training, related costs, and certifications issues at the end of a given course of study. We also describe why one course of study should be taken over another course — depending on enterprise and individual needs.

We do call attention to two CA Technology offerings in this report: CA's Mainframe Academy and the company's CA Mainframe Chorus product offering. But we also describe competing products and services available from IBM and other sources and describe the differences between CA's offerings and those of other sources of mainframe training.

In the end, we want you to know that there are hundreds of sources for mainframe training — and that the next generation of mainframe managers are using all of these sources to build the skills you need to manage the mainframe now — and well into the future.

Presented by Clabby Analytics

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Mainframe Skills Report

Introduction

Clabby Analytics has been following the mainframe marketplace very closely for the past six years. And during this time period we talked to dozens of "mainframes" within enterprises, at user groups, within the vendor community, and at colleges and universities. In conversations with practitioners and educators we almost always ask: "how are you preparing to educate the next generation of mainframe managers?" And what we've found is pretty interesting…

When talking to enterprise information technology (IT) managers, we have found that many enterprises have developed their own internal training curriculum using a variety of techniques including role-based training and mentoring. Others are hiring newly graduated mainframe talent from colleges and universities. And still others are sending their existing distributed systems IT managers to external training courses where they can develop and and/or expand mainframe skills. In other words, we have found that enterprises are taking advantage of many different sources of mainframe education.

In this report we examine the various training programs available for mainframe computers users. And, in general, this is what we have found:

- Hundreds of colleges and universities offer full bachelor-of-science degrees that include a mainframe specialty — while others offer a only a few mainframe management courses.
- Two vendors (IBM and CA) dominate the vendor-provided mainframe skills market. IBM tends to offer point products (general courses designed to introduce mainframe concepts, as well as specific courses to hone skills [such as database administrator courses]) — while CA offers a comprehensive, immersive mainframe skills training program.
- Hundreds of third party vendors and individual subject matter experts offer point product mainframe skills training (for instance, COBOL programming, WebSphere deployment and management, DB2 deployment and management, and so on);
- Training can also be found at user group meetings (such as mainframe-oriented SHARE user group meetings); and finally,
- Some end users conduct their own internal training — frequently promoting their best-and-brightest distributed systems managers into mainframe management positions.

The remainder of this report takes a closer look the types of skills being developed and at these various training approaches.

Which Skills Are Being Developed?

Between 2006 and 2009, IBM, under the auspices of its Academic Initiative program, conducted several mainframe skills surveys with its customers and business partners. These surveys showed IBM where to focus its mainframe skill training efforts. IBM shared this data with the entire mainframe ecosystem of partners, customers, and educators — providing guidance for fellow mainframe educators across the globe.

What IBM found is mainframe skills training is needed most in the following areas:

Skills Area	Strongly Required	Required	Not Required
Application Development	33.33%	52.33%	16.33%
Architecture	33.33%	62.33%	4.34%
Assembler	18.43%	46.37%	35.20%
Capacity Planning	38.00%	39.67%	22.33%
CICS	40.96%	43.67%	15.37%
COBOL	34.14%	38.35%	27.51%
DB2	36.60%	44.50%	18.90%
Disaster Recovery	6.67%	53.33%	40.00%
IMS	11.60%	28.40%	60.00%
Linux	24.33%	42.73%	32.94%
Message Queuing	27.00%	68.33%	4.67%
Networking	37.33%	43.07%	19.60%
Performance Management	26.33%	52.33%	21.33%
Security	36.03%	46.67%	17.30%
Storage	38.00%	57.33%	4.67%
SOA	26.33%	58.00%	15.67%
System Administration	32.00%	41.67%	26.33%
VSAM	16.67%	57.00%	26.33%
WebSphere / Web Development	16.33%	59.00%	24.67%
z/OS (ISPF, TSO, JCL)	69.54%	24.23%	6.23%
z/VM	18.63%	33.17%	48.20%
z/VSE	4.67%	44.00%	51.33%

Source: Consolidated_RoundtableSurveysResults.pdf , IBM Academic Initiative, System z Program, Enterprise Skills Survey Results, Roundtable Events 2006 through 2009, feedback from approximately 130 customers and partners

Note that this information is based upon survey work done in 2006-2009. But conversations with mainframe executives lead us to believe that these requirements are still valid today.

Based upon these surveys, it is clear that customers and business partners place high priority on the development of z/OS skills (69.54 ranked this skill as "strongly required") — with CICS (a transaction engine) skills also strongly required (40.96 percent of the audience responded that this skill set is strongly required). Capacity planning and storage management tied with 38 percent of respondents stating that skill in these areas are strongly required. These are skills that are key to operating a mainframe and keeping it busy.

What is particularly noteworthy in the survey skill demands are strong demands for DB2 administration, for security, for CICS (transaction expertise), and for Storage managers. With the advance of Big Data and business analytics within the enterprise, we believe that DB2 and storage management expertise demand will actually increase as enterprises learn that mainframes are excellent business analytics engines (see this report).

Surprising due to a weak showing is a light requirement for zVM skills — a virtualization management operating environment. This weak showing could be because the mainframe has been virtualized for over 40 years, so these skills are readily available. It should be noted that IBM is reporting that 36% of its mainframe base has installed IFLs (integrated facility for Linux processors), System z chips with modified microcode that enable thousands of Linux instances to be launched and managed within a system z environment. IFL growth is important to the mainframe's future because it enables today's modern Java-based applications to run on the mainframe — and because it enables the mainframe to be positioned as a very large, very efficient Linux consolidation server. These Linux consolidation servers run under the z/VM operating environment. The lack of demand for zVM is, therefore, puzzling — but this lack of demand could also be due to zVM itself — it is very straightforward to learn to use.

How This Report Is Organized

Bearing all of these requirements in mind, the remainder of this report considers the curricula and methodologies used by educational institutions, 3rd parties and vendors to deliver skills in these areas.

We start with a discussion of colleges and universities; we then move to internal training. After examining these approaches, we turn our attention to vendor training. And we conclude with "3rd party" training (training available from consortia, from user groups, from 3rd party institutions, and from independents that tend to focus on specialty training).

We conclude this report with a matrix that maps-out how all of these training sources compare with one another.

EDUCATIONAL INSTITUTIONS

As stated at the outset of this report, educational institutions (colleges and universities) offer varying levels of mainframe training. Some institutions offer rich, deep bachelor of science programs in computer science that include exposure to distributed systems as well as mainframes (including exposure to multiple operating environments, middleware, databases, and more) — while others may offer a few "point" (specific, focused) mainframe courses on topics such as DB2 Database Administration, service-oriented architecture, and the like.

What is important to understand about mainframe training at these institutions is that mainframe education is experiencing a renaissance. In the late 1980s and through the 1990s, colleges and universities tended to focus on distributed systems training — and on Windows, Unix, and Linux training in specific. But, in 2005, IBM started and funded a mainframe education initiative (its "IBM academic initiative for System z") and has greatly grown the number of colleges and universities that now teach a mainframe computing curriculum.

The following is a selection of schools that IBM describes as "the most active" in System z education in North America (schools in bold/italics were personally interviewed by us about their programs). Note: there are more than 800 schools worldwide teaching mainframe courses.

DeVry University
University of Alabama - Birmingham
Estrella Mountain Community College
NorthWest Arkansas Community College
University of Arkansas
University of Arkansas Fort Smith
California State University, Dominguez Hills
San Francisco State University
San Jose State University
Regis University
University of Denver
University of South Florida
GeorgiaColumbus State University
Southern Polytechnic State University
Brigham Young University - Idaho
Eastern Illinois University
Illinois Central College
Illinois State University
Northeastern Illinois University
Northern Illinois University
Ball State University
Indiana State University
Indian Hills Community College
Loras College
Northwestern State University
Southern University
Frederick Community College
Loyola College
Prince George's Community College
University of Maryland Eastern Shore
University of Massachusetts (Lowell)
Mesabi Range Community and Technical College

Lincoln University
Park University
State Fair Community College
Southeast Community College
Fairleigh Dickinson University
Stevens Institute of Technology
Baruch College - City University of New York
Binghamton University
Clarkson University
Columbia University
Dutchess County Community College
Lehman College - City University of New York
Long Island University
Marist College
Monroe College
NYC College of Technology - City University of New York
Orange County Community College
Pace University
Rochester Institute of Technology
State University of New York at New Paltz
State University of New York Institute of Technology, Utica
Syracuse University
Gardner-Webb University
A&T State University
North Carolina Central University
North Carolina State University
University of North Carolina at Pembroke
Columbus State Community College
Lakeland Community College
Malone College
Tri-C (Cuyahoga Community College)
University of Toledo
Indiana University of Pennsylvania
Widener University
University of South Carolina
Dakota State University
South Dakota State University
TexasCollin County Community College
Eastfield College
Houston Community College
Huston-Tillotson University
University of North Texas
West Texas A&M University
UtahWeber State University
West VirginiaWest Virginia University at Parkersburg
WisconsinFox Valley Technical College
University of Wisconsin-Stout
Ontario, CanadaGeorgian College
Humber College
Mohawk College
Hamilton, ON
Ryerson University
Seneca College

St. Lawrence College
Quebec, CanadaCegep de Rimouski
Cegep de Thetford
Universite du Quebec en Outaouais
Universite Laval

Some international schools that teach a mainframe curriculum include:

AustraliaCanberra University
ChinaDalian Jiaotong University
Dalian University of Technology
Huazhong University of Science and Technology
Peking University
Sichuan University
South China University of Technology
Tongji University
University of Electronic Science and Technology
Anna University
Estacao Business School, Brazil
University of Stuttgart, Germany
Leipzig University, Germany
University of Palermo, Italy
Madurai Kamraj University
RCC Institute of Information Technology
MalaysiaKBU International College
Universiti Malaysia Pahang
PhilippinesUniversity of the Philippines Diliman
SingaporeRepublic Polytechnic
TaiwanNational Taiwan University of Science and Technology
ThailandKing Mongkut's University of Technology Thonburi

There are also short profiles of many of these schools that can be found here:
http://www.scribd.com/doc/36855308/Ibm-Magazine

Marist College typifies the type of four year institution that we visited. This school is offers a BS degree in computer science degree as well as a BS degree in Information Technology and Systems (that bridges computer science with business). This is a four year program and costs about $35,000 per year (room/board/tuition). Being based in the New York City area, students frequently find placement with the city's many banking and financial institutions.

> *Attending a college or university to study mainframes is a good idea for younger people who also wish to get exposure to non-technology topics such as social sciences, hard sciences, and the like. Students graduate with a certification — and with some level of proficiency in mainframe environments (some of this proficiency is the result of internships that a student may have experienced during his or her course of study). It should be noted that employers frequently have tight relationships with colleges and universities — and graduates usually often find ready employment (as exemplified at Syracuse University where close to 100% of its computer science/information systems graduates are hired immediately after graduation. The downside of attending a college or university is that this approach to learning technology is lengthy (2-4 years) — and costly (often over $100,000 in the US).*

VENDORS

When we looked for vendor-led System z training, we came up with only two companies that teach a broad mainframe curriculum: IBM and CA Technologies. IBM is the maker of the System z — so it was logical that the company would be actively involved in System z training. And CA Technologies sells a lot of software products on System z — and accordingly has a vested interest in ensuring that a next generation of mainframe operators is trained.

Dozens of other vendors do provide training for their specific products on System z (BMC, for instance, provides training on its middleware products; SAP on its application products [including deployment and tuning recommendations], and so on). But we do not cover these vendors in this section because what these vendors offer is what we call a "point" solution — not broad, system-wide System z training.

IBM and CA offer point product training too (for individual products that they offer). But they also offer introduction to mainframe courses, operating specific courses, database administration, security, infrastructure — and other courses that cross the whole spectrum of the mainframe (not just a particular point application area).

IBM's Academic Initiative for System z

IBM's System z training is organized around four "tracks":

1. Systems Administration and End User;
2. Systems Management;
3. Performance; and,
4. Programming.

Each one of these tracks has a variety of courses from which to choose. For instance, the systems administration track includes an "Introduction to the z/OS Environment" course as a 2 day, classroom experience that costs $1075 to attend. And it progresses across 19 other courses such as "Parallel Sysplex Operations and Recovery" that can cost up to $4450 to attend.

More information on these tracks and related pricing can be found at:
http://www-03.ibm.com/systems/services/training/systemz/index.html

> *What IBM offers through its mainframe training courses is an opportunity to pick and choose the topics of interest to the student (an ala carte menu). For students with mainframe familiarity, some of these courses can be skipped. For students with little mainframe experience, some of these courses are an absolute "must do" before moving on to more advanced courses. IBM's approach enables enterprises to tailor training to specific areas of focus. And this works well for enterprises whose employees need to learn new skills or who want additional information in areas in which they already have some competence. Plus many enterprises like this approach because they don't need to send their employees away for several weeks or months — making this approach more palatable to organizations with skills shortages.*

CA's Mainframe Academy

CA's approach is markedly different than IBM's approach in that it is "immersive" in nature. CA Technologies' Mainframe Academy offers a mainframe overview/specialty course that

includes over 220 hours of training, 26 mastery tests, and 3 certification exams. The course focuses on a targeted spectrum of mainframe processing, programming concepts and Applications — and is designed to rapidly grow students from almost no knowledge of mainframes to certified specialists in a short period of time. The content is delivered with a unique, flexible blend of instructor-led,Web-based, and self-paced learning.

What we especially liked about CA's Mainframe Academy is its focus on helping to rapidly build mainframe skills. The immersive course load starts by introducing students to mainframe basics and terminology such that students can become familiar with mainframe hardware, infrastructure, operating environments, transaction managers, and the like. It then introduces students to real mainframe practitioners — people who have in depth operational knowledge of the mainframe and who can act as a valuable knowledge resource to students. Course work then focuses on labs, self-learning, and testing (to ensure that students truly understand the subject matter).

At the completion of the course, students will have learned how to:
- Perform basic programming and application development in z/OS;
- Issue Job-level commands for z/OS job output;
- Partition z/OS in a real and virtual environment;
- Perform basic troubleshooting;
- Issue JES commands for batch jobs, monitor those jobs, and analyze problems;
- Create, copy, delete and change datasets;
- Use TSO/ISPF to allocate and delete datasets;
- Navigate the ISPF menu structure;
- Use Job Control Language statement syntax and format;
- Create and use JCL procedures;
- Issue SDSF system-level commands;
- Use basic REXX keyword commands; and,
- Identify REXX functions and their usage.

> *As for who take this course, we have met recent college graduates who may have had little exposure to mainframes who have taken this course and ramped up quickly in mainframe management and mainframe software programming. Businesses frequently send their best-and-brightest distributed systems managers to this course in order to build skills from within their own organization (a good idea, because many of the students already have a familiarity with the goals and objectives of the business, so they can focus on building skills that can support the business while training). But students with very little IT experience should also consider taking this course as a way to rapidly build mainframe skills in a much more succinct time frame than attending a college program — 220 hours versus 4 years of college education.*

Specific details on the type of training that CA Technologies offers can be found on its Mainframe Academy Website at: http://www.ca.com/us/mainframe-academy.aspx.

A Mainframe Academy course catalogue can be found here: https://www.ca.com/us/register/activity.aspx?cid=113914.

INTERNAL TRAINING WITHIN ENTERPRISES

Internal training efforts typically focus on selecting distributed systems managers and enticing those managers into mainframe management. These enticements are usually threefold:

1. Mainframe managers get paid more to manage their environment than distributed systems managers;
2. Distributed systems managers are given the opportunity to get involved with a more technologically advanced systems environment (this appeals technology geeks — individuals who like to push the technology envelope); and,
3. A move into mainframe computing offers candidates a chance to get more involved with advanced business processes and real run-the-business mission-critical computing.

We expect enterprises to continue to build their own internal mainframe skills training programs (and we include several examples of enterprises that do just that today in this chapter). But we also expect that enterprises will also be able to exploit a new generation of mainframe tools that make it possible to learn while doing (role-based tools that include a knowledge database and a simplified user interface).

As for training approaches, the mainframe training approaches used by enterprises — and the curriculum — vary widely. For examples, consider the following approaches used by Al Rajhi Bank, El Banco del Credito de Peru; and Corner Banca. All of these companies use different methods and emphasize different areas of mainframe management.

Al Rajhi Bank

Ahmed Mohammed Anwar, Head of the IT Production Department at Al Rajhi bank in Riyadh, Saudi Arabi, describes his internal mainframe training effort as a series of formal courses, plus mentoring from experienced mainframers. He emphasizes that the bank has certain custom requirements, and his classes teach the bank's future mainframers how to perform activities in the manner the bank wants them performed. He also notes that the bank has formed its own "Error Knowledge Database" where issues are described in a common repository that can be used by IT managers to quickly identify an issue and rapidly find a solution.

"In the mainframe world" says Mr. Anwar, "the machine interface is different [he was referring to mainframe command line interfaces] — and the terms are different. But computers fundamentally operate in similar manners [he was referring to computers accessing and processing data, putting data in memory for faster processing, input/output systems, and the like). So what we do is take our own people and teach them what mainframe terms like DASD and CICS mean — and they can easily relate to those terms. We then teach them what a command line does and how to use it. So, we are training mainframe managers internally".

A closer look at Al Rahji Bank's curriculum shows that the bank has designed its own courses based upon the bank's best practices and specific requirements. It teaches students about the basics in mainframe operating systems (foundations of operating systems); systems design (how systems are connected together); DB2; JCL, CICS; storage administration, and so on. By growing resources using this organic approach, the bank believes it will be able to deal with any future mainframe skills shortages.

Cornèr Banca

When we last talked to Mr. Charles Inches of Cornèr Banca in Lugano, Switzerland, we asked if finding mainframe talent is a problem in the Lugano area, Cornèr Banca's response was "not at all". As Mr. Inches pointed out: "COBOL programmers do not need to be grown in a university — anyone with a logical mind can write COBOL programs". And, as Mr. Inches proudly pointed out: "there is no shortage of people with logical minds in Lugano…" He also told us about how the bank had hired a philosophy student to manage a mainframe.

When Cornèr Banca does need skilled professional assistance that is outside of its range of expertise, Cornèr Banca can turn to professional service providers for additional help. But Cornèr Banca has other options, including finding individual contractors or making use of the expertise provided by Primeur — an Italian systems integrator that has deep expertise in middleware for SOA, enterprise systems busses — and, best of all, deep mainframe expertise.

El Banco de Credito del Peru

When we talked with Jorge Torres, the manager of continuity and infrastructure planning at Lima, Peru's El Banco de Credito del Peru, we asked "do you have trouble finding mainframe management resources?" Mr. Torres indicated that BCP grows mainframe skill sets organically — taking the best managers from their own Windows and Unix worlds and teaching them how to manage mainframe environments. "Our older people are happy to introduce our younger people to mainframe technology. And we provide our younger people with better salaries for managing the mainframe. But, even though we pay them a bit more, we still come out ahead because it takes far fewer people to manage a mainframe environment than it does to manage distributed environments".

Citigroup

Martin Kennedy, managing director at CitiGroup in New York City, is using internal candidates as well as college students to grow his mainframe skills base. At Citi, fifteen prospective mainframe managers go through a rigorous 6.5 month training program where they learn about all aspects of a mainframe. An in-house curriculum has been developed by Citi — this curriculum goes through how CitiGroup operates its mainframes as well as CitiGroup practices in change management, problem management, and the like. Mentors are also available to help explain how mainframes operate. Following this core course, trainees are then put into 3 month courses in a variety of disciplines (specialties) — and Citi and the trainees then determine where the best placement for that particular trainee should be.

Satyam and Tata

Two years ago we had some in-depth discussions with outsources Satyam and Tata, both located in India. And what we found is that both organizations run large mainframe outsourcing operations and have a constant need to grow their mainframe expertise base (both companies have over ten thousand mainframe programmers/systems managers — and this number is constantly growing due to the low cost of technical labor in India that makes it less costly to operate mainframes within India as compared with North America and Western Europe.

Almost all of the mainframe training within these organizations is organic — grown from within. Each company offers internal training. But, India also has a wealth of 3rd party training organizations that offer mainframe curricula — and both outsources also hire from this resource pool.

Clabby Analytics has discussed mainframe skills building with dozens of enterprise mainframe managers. Some of this course work can be very general in nature (such as that provided by Al Rajhi Bank) while other course work can be very specific (such as the COBOL development at Corner Banca).

It is also interesting to observe the profiles of the students taking these courses. Some are college graduates with previous mainframe training who are being taught how to apply that expertise to a specific need within a given enterprise (Citi); while others have practically no IT experience (Corner Banca). And many have distributed systems skills and a knowledge of the enterprises IT goals and objectives — and simply need to apply that knowledge toward operating a different type of computer (a mainframe).

THIRD PARTY INSTITUTIONS, INDEPENDENTS, AND CONSORTIA

To us it is astonishing to find such a large, vibrant community of third party educators selling mainframe training. These institutions include:

- A large number of technical schools (not full blown colleges and universities but rather institutions that focus on training students in particular technologies);
- University-like training organizations (shorter programs [typically 2 years], not necessarily accredited, with deep/focused expertise);
- Independents (subject matter experts who offer courses — frequently on an ad hoc basis); and,
- Consortia (such as the training available from the IBM mainframe user group known as SHARE).

Technical Schools

The list of technical schools that teach a mainframe curriculum is lengthy. A simple search for mainframe training in India found the following (see Figure 1):

Figure 1: A Small Sample of Mainframe Training Institutions in India

Legend:
- ■■■■ Excellent
- ■■■□ Very Good
- ■■□□ Good
- ■□□□ Fair
- □□□□ Poor

	IBMMAINFRAMES	ER & DCI	PENTASOFT	SISI	DSRC	GLOBAL	HTMT	MAPLES	MAINTEC	TEXSAS
Rank	GOLD	SILVER	BRONZE	4	5	6	7	8	9	10
Overall Rating	■■■■	■■■■	■■■□	■■■□	■■■□	■■□□	■■□□	■■□□	■□□□	■□□□
Ratings										
Syllabus	■■■■	■■■■	■■■□	■■□□	■■■□	■■■□	■■■□	■■□□	■□□□	■□□□
Access	■■■■	■■■■	■■■■	■■■■	■■■□	■■■■	■■■□	■■□□	■■□□	■■□□
Materials	■■■■	■■■□	■■■■	■■■□	■■■□	■■□□	■■□□	■■□□	■■□□	■□□□
Support	■■■■	■■■■	■■■■	■■□□	■□□□	■■□□	■□□□	□□□□	■□□□	■□□□
Facilities	■■□□	■■■■	■■□□	■■■■	■■■□	■■■■	■■■■	■■■■	■■□□	■■□□
Placement	■■■□	■■■□	■■□□	■■□□	■■■□	■■□□	■■□□	■■■□	■□□□	■□□□
Value for Money	■■■■	■■■□	■■■■	■■■□	■■□□	■□□□	■■□□	■□□□	■■□□	■■□□
Costs (in Indian Rupees)										
Training Fee	0	20,000	20,000	10,000	20,000	15,000	20,000	15,000	20,000	10,000
Lab Fee	10,000	20,000	20,000	12,000	20,000	20,000	20,000	20,000	20,000	10,000
Placement Fee	0	0	0	0	0	0	0	0	0	15,000
Materials Fee	0	5000	5000	0	0	3,000	0	3000	0	0
Other Fee	0	0	0	500	0	0	500	0	500	2000
Total Fee	10,000	45,000	45,000	22,500	40,000	38,000	40,500	38,000	40,500	37,000

Source: ibmmainframetraining.com (2009 data)

Note that all of these institutions offer training and lab instruction. Also note the cost of this training (**1.00 Indian Rupee = 0.0219 U.S. Dollar).** These fees are for courses that run 1-2 hours per day and 1-2 hours of labs — and courses are delivered in 40-100 days.

As for the curricula offered, these institutions mix a combination of the following topics:

- Mainframe concepts;
- VS COBOL II;
  IBM COBOL;
- JCL;
- VSAM;
- MVS;
- CICS;
- DB2;
- QMF;
- IMS;
- REXX;
- PL/1;
- Assembler; and,
- Synchsort.

Similar technical training can be found in dozens of other countries all around the world. Our general assessment of these institutions is that they provide high-level mainframe training and a certification of proficiency in mainframes — and the level of depth given 80-100 hours of training may be sufficient to introduce a student to mainframes — but is probably not deep enough to enable a student to manage a mainframe or develop code for a mainframe without additional hands-on training.

University -like Training Programs

We have added this class of training organization to this report because we have found several organizations that offer comprehensive mainframe training on a wide variety of topics (including mainframe basics, operating environments, databases, etc.) using self-study programs combined with virtual and physical classroom learning.

One of the best examples of this class of training program is "the European Mainframe Academy" — a group that consists of a few training groups as well as individual teachers (almost like a loosely-connected consortium of mainframe experts). Some of the members of the European Mainframe academy include Professor Wilhelm G. Spruth (a well respected educator with college/university teaching experience); Wolfram Gries, a partner of the tps Data AG in Zurich, the bbw group (an educational organization — part of the Bavarian employers association), and Volker Falch (who serves as managing director of the European Mainframe Academy).

What is interesting about this organization is that it closely resembles CA Technologies' Mainframe Academy from an approach perspective. It offers:

o   800 hrs Self-Study-Material (Online-Tutorials, Textbooks, Self-Exams)

o   3-day-Kick-Off-Meeting

o   20 days of classroom training

o   20 Virtual-Classroom-Meetings

o   Online-Tutoring/Coaching (24 months)

But, the primary differences are that CA Technologies' program is backed by a $5 billion company (CA Technologies' annual revenue); and CA's program can be completed more quickly. The cost for this program ranges from $39,795 to $49,400 as compared with CA Technologies Mainframe Academy charge of $20,000.

Independents

Independents, or bands of independents, frequently put together specialized training and then hit-the-road with their training offerings and insights (and sometimes additional consulting). One case in point is a company known as Enterprise Performance Strategies, a company with deep expertise in parallel sysplex (a particular mainframe configuration) and z/OS performance tuning, WLM tuning, and capacity planning and performance analysis.

> *As we look at Enterprise Performance Strategies, we note that this company tends to offer is deep expertise in certain fields, as well as geographic flexibility (schools obviously teach on premises — independents can come to locations close to their students). The price for this kind of training starts at @$3,250 per course (pre-discount).*

Consortia/User Groups

Training is also conducted at consortia meeting and within user group meetings. At Clabby Analytics, we occasionally attend two of these types of events: the Computer Measurement Group and the IBM mainframe user group known as "SHARE".

At the Computer Measurement Group consortium, attendees can learn all about performance tuning and application management in mainframe as well as distributed computing environments. Lectures range from introductory to very in-depth — and the cost to attend can be a few hundred to a few thousand dollars — depending on the activities an attendee chooses to engage in.

IBM's SHARE is also rich with training opportunities. Seminars on topics such as performance, security, software distribution, systems management and the like are offered — and vendors sponsor a demo hall where hardware, software, and service solutions (including training solutions) can be viewed and discussed. Like the Computer Measurement Group, SHARE can cost a few hundred to a few thousand dollars depending on the activities an attendee engages in.

> *The beauty of this type of training is that it is varied, fast, and comparatively inexpensive. Speakers usually have deep insights into the products being discussed. But, to maximize the benefits of attending these types of events, a thorough knowledge of a mainframe environment is almost a prerequisite.*

Tools to Assist Internal Development Efforts

As described earlier, there is a new generation of tools and utilities that is coming to market to simplify the management of mainframes. These tools and utilities do two important things:

1. They simplify the interface to mainframe resources by using a friendly graphical user interface that shows activities in dashboard fashion; and,
2. They greatly streamline the amount of time it takes to execute certain actions.

IBM offers products like this included in its Tivoli management software environment as well as in its System Director product line. In fact, IBM has dozens of such graphically driven, dashboard products offered as part of its integrated systems management initiative.

CA, on the other hand, offers dozens of its own integrated service management products as part of its Wily product set — and it offers a unique mainframe management environment as part of its evolving CA Mainframe Chorus product line. We especially like this product offering because its interface is simple/straightforward to use; because it is organized around tasks (the tools needed for a database administrator, for instance, can all be launched and operated from within Chorus); and because of its knowledge management feature. This knowledge management feature enables experienced IT managers to leave behind "how to do it" notes and other pieces of valuable data that can help novice mainframe managers solve problems. And, this knowledge management library can be linked to other documents and sources of information to further simplify troubleshooting while making novice managers more effective.

> *For enterprises that are looking to conduct internal training, the new generation of integrated service management tools from IBM — and CA Technologies' unique CA Mainframe Chorus — represent a way to rapidly build mainframe skills internally. Distributed systems managers and administrators with good distributed systems management skills can quickly learn to manage mainframe databases today. And, in the future, Chorus will be expanded to allow for security, storage, workload, performance systems, datacom database, IDMS database, and IMS database management — as well as expand to manage a wide number of "common services" within a mainframe environment. And these kinds of tools will not only make training on the mainframe easier to accomplish — they will streamline mainframe operations and help lower mainframe management costs.*

Finally, it should be noted that applications are also becoming "more intelligent", capable of providing management details to application monitor and control systems. These, too, will help the next generation of mainframers become more efficient when managing mainframe applications and databases.

SUMMARY OBSERVATIONS

This report considered several different types of mainframe education, including:

- Colleges and universities;
- Vendor-based training;
- Internal training (within enterprises);
- 3rd Party training (including technical schools, independents, and consortia).

When comparing these training approaches, clear differentiators arose. For instance, colleges and universities can provide excellent mainframe training — but it often takes 2-4 years to complete a college course of study and receive a bachelor-of-science degree. By contrast, a technical institution in India offers 40 days of mainframe training (at 2 hours per day) — and then issues its certification. Meanwhile, consortia offer various levels of mainframe training (in tremendous depth) over a few days or a week — but no certification is issued after attending these types of training offerings.

Cost is also a major differentiator with colleges and universities providing a lot of training over a four year period at tens-of-thousands of dollars per year. Meanwhile, 45 days of technical training at an institution in India could cost only $810.

The kind of training offered by institutions, vendors, consortia, and individuals also varies widely. For instance, vendors and technical institutes tend to focus on product training — college and universities often focus on the relation of the technology being studies to a given business. Consortia and user groups generally focus on providing deep drill-downs into specific products (attendees use these meeting to gain new insights or to refine practices — as well as to network with other professionals and pick-up tips on how to perform their jobs more effectively).

Given this variety, we have concluded that the best way to sort out the differences between these various offerings is to produce a matrix (see Figure 3). Using this matrix, enterprises should better understand which types of training should be used for their IT workers — and students can better understand the different training options and costs.

Educational Organization	Duration	Curriculum	Methods	Cost ($)	Certification
Colleges and Universities					
Currently 640 Institutions					
*offering mainframe training**					
Stevens Institute of Technology	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	52965/year	Bachelor of Science
Loyola College	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	49950/year	Bachelor of Science
Syracuse University	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	49150/year	Bachelor of Science
Marist College	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	39420/year	Bachelor of Science
Widener University	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	44990/year	Bachelor of Science
Eastern Illinois University	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	18800-44100/yr	Bachelor of Science
North Carolina State	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	14600-27000/yr	Bachelor of Science
University of Arkansas	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	14700-27200/yr	Bachelor of Science
Pace	4 years	Mainframes, Dist. Systems, Business Linkage	Lectures, Labs, Internships	47600/year	Bachelor of Science
***Clabby Analytics talked with**					
or attended briefings with					
professors from these institutions					
Vendor Training					
IBM University	varies from hours to days	Wide course variety; intro courses, skills building; not unified curriculum like a college	Self-study, class room &/or virtual classroom training	1075-4495/course	Certificate of Attendance & Competency Certification
CA Mainframe Academy	220 hours	Unified curriculum (intro, basics, then depth)	Self-study, class, virtual class — a 26 mastery tests; 3 cert. exams	$20,000	Certificate of Attendance & Competency Certification
3rd Party Training Organizations (includes technical schools, individual contributors, consortia)					
Technical Schools					
IBMMAINFRAMES	60 days	Overview, specific skills training	Lectures, Labs	219	Skills Completion
ER&DCI	45 days	Overview, specific skills training	Lectures, Labs	985	Skills Completion
Pentasoft	50 days	Overview, specific skills training	Lectures, Labs	985	Skills Completion
SISI	100 days	Overview, specific skills training	Lectures, Labs	492	Skills Completion
DSRC	45 days	Overview, specific skills training	Lectures, Labs	876	Skills Completion
Global	45 days	Overview, specific skills training	Lectures, Labs	832	Skills Completion
HTMT	40 days	Overview, specific skills training	Lectures, Labs	886	Skills Completion
Maples	45 days	Overview, specific skills training	Lectures, Labs	832	Skills Completion
Maintech	40 days	Overview, specific skills training	Lectures, Labs	886	Skills Completion
Texsas	50 days	Overview, specific skills training	Lectures, Labs	810	Skills Completion
Independent(s)					
Enterprise Performance Strategies	1 day	Highly specialized	Lecture, results analysis	3250	None
University-like Training					
The European Mainframe Academy	2 years	Overview; general and specific training	Self-study, class, virtual class	39795-49400	Certificate of Attendance
Consortia					
SHARE	1-5 days	Highly specialized, some basic training	Lecture	490 to 1650	None
Computer Measurement Group	1-5 days	Highly specialized	Lecture	340 to 2185	None
End User Internal Training Courses					
Curriculum completely vairiable; internal cost measurement completely variable; duration variable, no certification					