

On-Demand Forensic Accounting and Analytics

Paul H. Harkins

Harkins & Associates, Inc.
www.harkinsaudit.com

Abstract

Forensic accounting, or financial forensics, currently lacks the ability to proactively record, access, examine, and analyze in real time all of the financial activity used in financial transactions and financial reporting.

The “black box” of opaque and inaccessible computing financial detail information has allowed and enabled numerous recent huge “Ponzi schemes,” including the Bernard Madoff and Allen Stanford cases, which cost investors billions of dollars while humiliating the responsible government regulators and causing the investing public to lose confidence in stock-market investing.

This paper describes a revolutionary and transformational patented forensic accounting and analytic capability that captures and records all executing program source statements and data, and puts a time stamp inside corporate computer programs as they produce financial reports. This makes ultimate drill-down to the source of financial information available—on-demand, instantly, and remotely—to authorized government regulators, auditors, and investors.

1. Introduction

Forensic accounting, or financial forensics [1], currently lacks the ability to proactively record, access, examine, and analyze in real time all of the financial activity used in financial transactions and financial reporting.

The “black box” of opaque and inaccessible computing financial detail information has allowed and enabled numerous recent huge “Ponzi schemes,” including the Bernard Madoff and Allen Stanford [2] cases, which cost investors billions of dollars while humiliating the responsible government regulators [3] and causing the investing public to lose confidence in stock market investing [4].

This paper describes a revolutionary and transformational patented forensic accounting and analytic computer software capability [5] that captures and records all executing program source statements and data, and puts a time stamp inside corporate computer programs as they produce financial reports. This makes ultimate drill-down to the source of financial information available—on-demand, instantly, and remotely—to authorized government regulators, auditors and investors.

The huge potential of forensic accounting was addressed by Dr. James Gordon Brown when he was Britain’s Chancellor of the Exchequer: “What the use of fingerprints was to the 19th century and DNA analysis was to the 20th, forensic accounting will be to the 21st century [6]. The above-described patented on-demand Forensic Accounting computer software, “Real-Time Program Audit”, or RTPA, enables the pervasive worldwide implementation of Dr. Brown’s vision and dramatically empowers forensic accountants. In short, RTPA creates a read-only permanent audit record of exactly what is happening in the computer program, in real-time, including executing source statements, data (the contents of variables) and a timestamp.

On-Demand Forensic Accounting and Analytics provides a video camera–like computer program recording and auditing capability of RTPA [6, 7, 8] software **on-demand via the Internet** to virtually any authorized computer worldwide. This on-demand computer forensic accounting capability enables and empowers government regulators, for the first time, to remotely forensically investigate the recorded actual computer program source statements and data produced in financial reporting.

2. On-Demand Forensic Accounting and Analytics Scenario

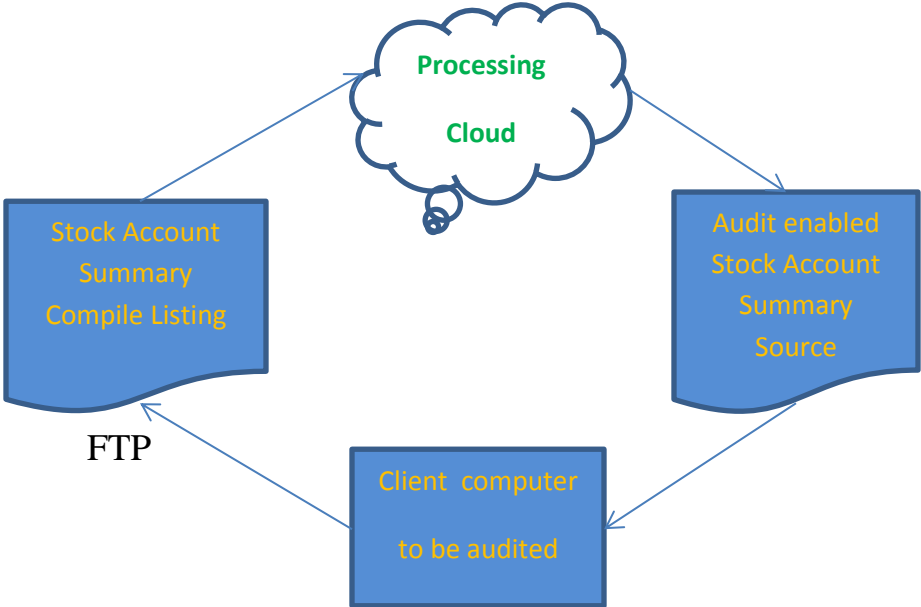


Figure 1: Stock Account Summary program compile listing for forensic accounting.

The government regulator or authorized forensic accountant requires financial reporting (for example, **Stock Account Summary Statements**) of a client to be audited, including source program statement execution and data and timestamp showing exactly how all program information is created (1)

- The client being audited transmits the financial source program listing to the secure government- authorized server or the Cloud for audit enablement via the Internet (2)
- The secure government server enhances the financial source program to enable source statement execution and data recording (3)
- The enabled, smarter and auditable source program source is transmitted back to the client via the Internet, and is compiled with the standard language compiler into a forensic accounting audit environment (4)
- The government regulator supervises processing of the audit enabled financial program at the client site in a secure separate auditing environment, and queries and analyzes the audit output files (5)

Scenario Notes:

- (1) The ultimate drill-down to the original program statement execution and data as it is actually created include all levels of summarization and eliminates the often used altering and corruption of summarized information at all levels of reporting.
- (2) The Internet or cloud normally uses secure FTP or File-Transfer-Protocol, and is nominally free.
- (3) The central secure government server or authorized Cloud server and FTP transmission is required only to enhance or make auditable the client source program, and is NOT required if the language vendor provides this enhanced auditing capability at the client SITE, or if the client has the enhanced auditing capability in-house [7].
- (4) The elapsed time to enable a typical client source program for forensic accountant auditing and analytics is less than 10 seconds.
- (5) Forensic accounting auditing is performed in a separate and secure environment at the client site.
- (6) No client data or client files are needed to audit-enable the client program remotely at the Government secure server or by the processing Cloud.
- (7) The audit-enabling process is completely automated and without human operator involvement.
- (8) The client production program and productions operating environment is unchanged, as a separate auditing environment is established.
- (9) The Forensic Accountant or Government regulator can examine, inspect, analyze, document, and record the audit output in real-time and remotely, including using mobile devices.

```

302     torder = 1500;
303     iorder = 78.543;
304     // value of iorder has now been computed
305     xorder = torder + 13.45 +
306     // this is a continuation free form statement preceded with +
307     26.2 + iorder;
308     sorder = torder + xorder + iorder + rorder + morder + norder;

```

Key Field Information

```

4  CUSTMAST
    CUSTREC1 is the RPG name of the external format CUSTREC.
      CUCUST          PACK      7,0 SIGNED
      CUSTOR          PACK      7,0 SIGNED

2  ORDERDE
    ODETREC
      ODORD#          PACK      7,0 SIGNED
      ODLINE          PACK      5,0 SIGNED

```

Global Field References:

```

IORDER      S(8,3)
TORDER      S(7,0)
XORDER      S(9,2)

```

(partial source program compile listing FTPed to Cloud for audit enablement)

Figure 2: Client Stock Account Summary program compile listing for forensic accounting.

```

0323.00     torder = 1500;
0324.00             Z$SRC# = 16 ;
0325.00             EXSR      Z$GENS;
0326.00             EXCEPT  Z$00016;
0327.00     iorder = 78.543;
0328.00             Z$SRC# = 17 ;
0329.00             EXSR      Z$GENS;
0330.00             EXCEPT  Z$00017;
0331.00     // value of iorder has now been computed
0332.00             Z$SRC# = 18 ;
0333.00             EXSR      Z$GENS;
0334.00     xorder = torder + 13.45 +
0335.00     // this is a continuation free form statement preceded with +
0336.00     26.2 + iorder;
0337.00             EXSR      Z$GETI;
0338.00             EXCEPT  ZF00001;
0339.00     sorder = torder + xorder + iorder + rorder + morder + norder;
0340.00             Z$SRC# = 19 ;
0341.00             EXSR      Z$GENS;
0342.00             EXCEPT  Z$00019;

```

(partial source program FTPed from Cloud audit enabled for forensic accounting)

Figure 3: Client Stock Account Summary source program audit enabled

2.1 Method

The FTPed Client Stock Account Statements Summary program compile listing (Figure 2) is received and processed by the processing Cloud server and the program source statements, and variable (data) information is stripped from the compile listing and is used as the input program source, files, and variables.

The inserted audit statements (Figure 3) in the audit enabled source program allow the enabled program to record all of the executing source statements, data (variables) and the timestamp as the compiled object program is later executed at the client site.

The audit enabled source program is FTPed back to the client, compiled into an executable object program, and run by the forensic accountant in a separate secure environment with normal client data and procedures to produce the ultimate recorded drill-down to all program statements actually executed and the data processed by each and every executed source program statement (Figure 4).

Note: If the client already has the source program audit enabling software installed at the client site, then no FTPing or processing Cloud is needed. For instance, this might be the case if government regulators installed that auditing capability during an audit of the client, or if the client already utilized the audit enabling software to enhance productivity.

Note: The program language providers of client financial applications, including IBM, Microsoft, SAP, Oracle, Hewlett Packard, and open source languages could easily provide this program audit enabling capability in their standard compilers.

```
302     torder = 1500;  
        1500  
303     iorder = 78.543;  
        78.543  
304     // value of iorder has now been computed  
305     xorder = torder + 13.45 +  
        1618.19     1500  
306     // this is a continuation free form statement preceded with +  
307         26.2 + iorder;  
        78.543  
308     sorder = torder + xorder + iorder + rorder + morder + norder;  
93330.496     1500  
        1618.19     78.543  
        32109.876  
        34567.098  
        23456.789  
  
(partial Client Stock Account Summary forensic accounting audit output)
```

Figure 4: Client Stock Account Summary forensic accounting audit output.

The right side of the audit output shows the source sequence number, change date and the timestamp of the **moment-in-time** when the statement was executed (Figure 5). These program statements were executed, recorded, and audited in the elapsed time of **one millisecond, and in a tiny fraction of a CPU second.**

```

00209 020623 23800           16.50.19.042 2012-09-19
                                16.50.19.042 2012-09-19
00210 020623 23900           16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
00211 061201 24000           16.50.19.043 2012-09-19
00212 020623 24100           16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
00213 061201 24200           16.50.19.043 2012-09-19
00214 020623 24300           16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
00215 070214 24400           16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19
                                16.50.19.043 2012-09-19

(partial Client Stock Account Summary forensic accounting audit timestamp

```

Figure 5: Client Stock Account Summary forensic accounting audit output **timestamp**.

2.2 Forensic Accounting and Analytics of the Audited Program Output

The forensic accountant now has the capability to remotely actually see from a mobile device and understand exactly is happening at the client’s computer inside the audit enabled program at the ultimate lowest level of information, which is the executing program code and data, and can utilize the full set of analytics tools including SQL to select and extract any desired information from the read-only audit output Relational Data Base (Figure 6).

The 64GB flash memory in mobile devices such as smartphones, tablets, laptops, and video camcorders enables the forensic accountant to **remotely access, inspect, analyze, and record** literally everything of interest processing inside the client’s computer program, in real time.

The forensic Accountant or Government regulator has the capability to Query the audit output for literally any variable data produced by the audit-enabled program. For instance, the auditor could query for **1618.19** and examine exactly where and how the variable xorder was computed. (figure 4).

```

305      xorder = torder + 13.45 +
          1618.19      1500
306      // this is a continuation free form statement preceded with +
307      26.2 + iorder;
          78.543

```

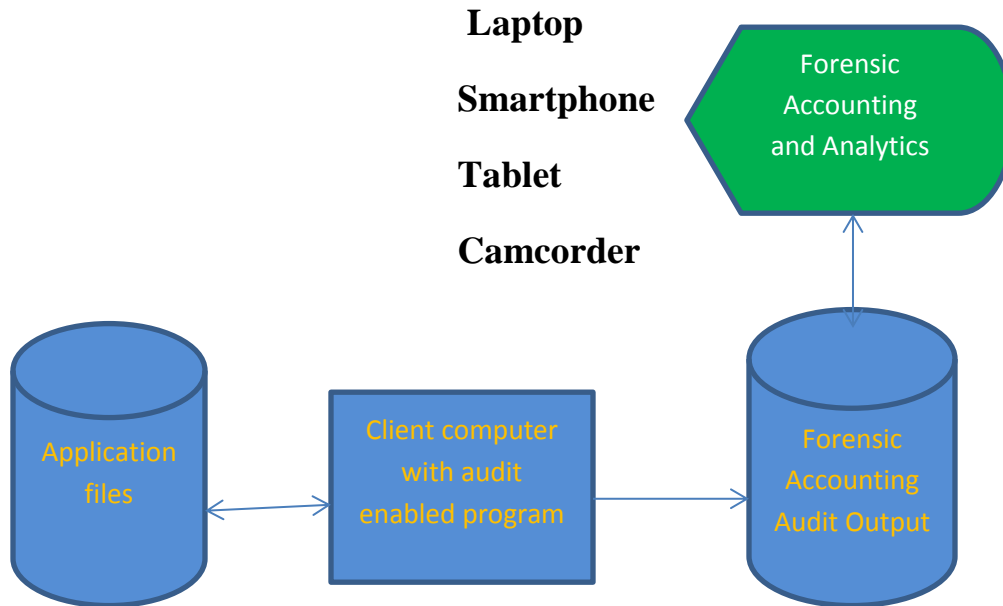


Figure 6: Forensic Accounting and Analytics (can be remote and mobile and real-time).

2.3 Additional Technical Details

The technical details of exactly how computer programs are enabled to audit and record the executing source program statements and all data (variables) processed is fully described on the patented Real-Time Program Audit (RTPA) software web site www.harkinsaudit.com and related documentation, including videos [7].

Detailed information and techniques about exactly how virtually any corporate programming language may be audit-enabled with video camera-like recording of the executing source statements and data are available in the “The Power of Traceability” paper [8].

Detailed information about the emerging and transformative field of Forensic Accounting, and particularly Computer Forensics, is widely available on the Internet, including the book *Computer Forensics: An Essential Guide for Accountants, Lawyers, and Managers* [9]

Computer program source statement and data audit-enabling provides, for the very first time, the capability for true **Autonomic Computing** [10], as all of the source program executing statements and all of the data (variables) are real-time recorded and available for autonomic computing, NOT just the program output written external to the program (normally to disk), or available by program probes. **Thus, a vast new world of critical self-healing capability is now available real-time at the most atomic level of all of the executing program statements and data.**

3. Related Work

The virtually unlimited computing power and data storage of the typical corporate computer is routinely multiplied every several years [10], and smartphones can have 64GB of flash memory [11], making computing power, computing speed, and data storage considerations and cost of little real concern, or no real concern, in implementing source program audit-enablement for forensic accounting.

A potential consideration relating to the speed and capability of creating and indexing forensic analysis audit databases is addressed in the paper “On-Demand View Materialization and Indexing for Network Forensic Analysis” [12]. This paper essentially concludes that commercially available relational database management systems (RDBMSs) and effective indexing techniques can provide sufficient real-time auditing capability and performance.

4 Possible Applications of This Transformational On-Demand Forensic Accounting Technique

The positive and immense benefits of real-time computer source program and data audit-enablement and recording include all corporate (client) computer program related functions, activities, and related personnel, from the programmer, analyst, IT manager, operations, to the compliance officer, auditor, and CFO.

Productivity gains, cost reductions, increased confidence, and large capability gains of each of these jobs, and in other jobs through the enterprise, even down to a packer in a warehouse, are actually enormous.

The immediate economics of audit-enabling forensic accounting, and general accounting, and auditing, may be illustrated in the huge current costs of belatedly discovering criminal fraud and in recovering and prosecuting that **preventable** fraud, sometimes hundreds of millions of dollars in a single case [13], rather than utilizing available forensic accounting tools and techniques proactively to look for fraud and to prevent or quickly discover those frauds.

The huge multi-billion dollar revenue generated annually by the **general accounting industry**, together with their relatively similar skills and capability in forensic accounting, would make a transformational capability commanded by one of them a powerful competitive and marketable revenue capability [14] (Figure 7).

Additionally, a huge new opportunity to educate and train and support forensic accounts, public accountants, government regulators and corporate personnel in new proactive techniques of fraud detection and dispute resolution would be available to early adopters of this technology.

Big Four (audit firms)

From Wikipedia, the free encyclopedia

The **Big Four** are the four largest international [professional services networks](#) in [accountancy](#) and [professional services](#), which handle the vast majority of [audits](#) for [publicly traded companies](#) as well as many [private companies](#), creating an [oligopoly](#) in auditing large companies. The Big Four firms are shown below, with their latest publicly available data:

Firm	Revenues	Employees	Fiscal Year	Headquarters	Source
Deloitte	\$31.1bn	193,000	2012	United States	^[1]
PwC	\$29.2bn	169,000	2011	United Kingdom	^[2]
Ernst & Young	\$22.9bn	152,000	2011	United Kingdom	^[3]
KPMG	\$22.7bn	145,000	2011	Netherlands	^[4]

(partial Client Stock Account Summary forensic accounting audit output)

Figure 7: Big Four Audit Firms annual revenues

Similarity, the huge **Investment Advisory industry** is very competitive and most firms have relatively similar skills and capability in forensic accounting, which would make a transformational capability, commanded by one of them a powerful competitive and marketable revenue capability.

Similarity, the huge **public and private college and university industry** is also very competitive and most schools have relatively similar skills and capability in forensic accounting, which would make a transformational capability, commanded by one of them a powerful competitive and marketable revenue capability.

Probably the most important possible use of computer audit audit-enabled forensic accounting is in the **U.S. Government and regulatory agencies**. Agencies such as the U.S. Securities & Exchange Commission (SEC) [15], the IRS, the FBI, the Securities Investment Protection Corporation (SIPC) [16], have tens of thousands of highly trained and highly-paid employees who would be able to do their jobs significantly more effectively with this computer program audit-enabling technique.

5 Conclusion

Forensic accounting is in its infancy, but it has already utilized some of the techniques illustrated in this paper to uncover and prosecute major criminal fraudulent activity, and has proven its immense potential and value to society.

Using the computer itself to provide a security camera–like recorded auditing capability at the most atomic level of the executing source program statement and data provides the basis for a revolutionary and transformational change in how auditing and information technology and forensic accounting are performed.

The importance of Dr. Gordon Brown’s quote “What the use of fingerprints was to the 19th century and DNA analysis was to the 20th, forensic accounting will be to the 21st century” is being proven true and on a scale unimaginable until now.

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