Mainframe Computer Systems

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The General Electric Corporation

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Finally, this book is also dedicated to my granddaughter, Isobel Freya Williams, who was born during its preparation.

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GENERAL ELECTRIC CO. COMPUTERS

General Electric (GE) began its life as the Edison Electric Light Company founded by Thomas Alva Edison in 1878. Through the late 1800s, Edison invented many products based around electricity – the incandescent bulb, the stock ticker, the electric dynamo, and the electric streetcar. It was renamed the Edison General Electric Co., which merged with Thomson-Houston Electric Company in 1892 to become the General Electric Company (Gandy and Edwards 2014).

In 1896, the Dow-Jones Industrial Average (DJIA) was created to track the financial ups and downs of the nascent New York Stock Exchange. General Electric was one of the 12 stocks that comprised the DJIA. It was the only one of the original stocks still a component of the DJIA today. Recently (2018), General Electric was removed from the DJIA and replaced by WalMart. Its removal was a clear sign that GE's day as a manufacturer was waning and its stock price took a significant hit as it lost revenues. The inclusion of WalMart reflected the rise of the low-cost big box retailer as a major influence in American life.

In 1919, GE and American Telephone & Telegraph (AT&T) formed the Radio Corporation of America (RCA) to commercialize radio technology, which had been demonstrated during World War I by, among others, E. Marconi. Each contributed technology to the new corporation to productize and commercialize it. In the 1930s, GE spun off RCA as a separate company.

In 1955, Bank of America solicited bids for a system to design and build a new computer system for its operations – the ERMA (Electronic Recording Method of Accounting) system. GE management was convinced that International Business Machines (IBM) would win and were unduly surprised when they received the contract in the amount of $32 million. ERMA introduced the MICR – Magnetic Ink Character Recognition system for encoding checks. In 1957, it received a contract from National Cash Register to develop special equipment for the banking industry.

GE established its Computer Department in 1956 with its headquarters in Phoenix, Arizona. H.R. (Barney) Oldfield was its first general manager. In 1960, GE expanded its computer business from a custom single-product shop to a wider customer base. The GE-225 system was designed to appeal to a broader array of customers. Throughout the 1960s its business expanded and it developed new and enhanced models of its machines, ending with the

GE 6xx series which ran the GECOS operating system, a batch-oriented system. When MIT sought a computer for Project MACs Multics, GE bid a modified version of its mainframe, the GE-645, and won the contract.

GE's Information Services developed from its early support for John Kemeny's BASIC and DTSS projects at Dartmouth. An interview with Warner Sinback (Johnson 2004) documents the early days of developing time sharing within GE (Johnson 2004). Additional information about DTSS and BASIC can be found in the Dartmouth Timeshare System, a transcript of the 1974 National Computer Conference Pioneer Day session (Kurtz 1974).

As Gandy and Edwards (2014) noted, GE's Computer Department's ultimate goal, as a reflecting of its strategic thinking, was to enter the general-purpose computing market and become a rival to IBM. GE's Chief Executive Officer (CEO) was reluctant to do so, but the Computer Department, supported by other GE departments that had interest in computing, carried the day. GE's strategy was based on its deep understanding of industrial processes, such as oil transport, electricity generation and engine development. GE's strategy focused on not just delivering a manufactured product, but a package which included software, servicing and training, as well as hardware.

When IBM announced the System/360 family in 1964, GE noted that IBM had introduced a family with no performance gaps that was upward compatible and included both batch and direct access capabilities. It also lowered the price/performance level, which competitors had used in the past and eliminated opportunities for product specialization, which could yield better performance with a higher price (GE 1964u).

The Computer Department manufactured mainframe computers until 1970. At that time, G realizing it could not compete with IBM, retired from the computer industry. It sold its entire computer division – lock, stock, and barrel – to Honeywell Corporation and exited the computer industry quickly and efficiently.

In 1986, GE re-acquired RCA, primarily for the National Broadcasting Company (NBC) television network. The rest of RCA was split up and sold to various companies.

During its heyday, GE manufactured the following computing machines:

Model	**First Delivery**
GE 100 Series	1956
GE 200 Series	1961
GE-400 Series	1963

GE 615/625/635	1965
GE 645	1966

CHAPTER ONE

GE-100 COMPUTER SYSTEM

Source: GE 1955o

In 1957, GE obtained a $32,000,000 contract with the Bank of America to develop an accounting system for automated demand deposits. The GE-100 computer system, under development since 1955, was developed for the ERMA (Electronic Recording Method of Accounting) project. It was a fixed-word machine with an unusual instruction set. Figure 1-1 depicts the GE-115 model.

Figure 1-1. GE-115 Computer System
Source: GE 1955o
Courtesy of General Electric Co.

Table 1-1 describes the characteristics of the GE-100 series of machines.

Table 1-1. GE-100 – Basic Characteristics (GE 1955o)

Characteristic	Value/Explanation
Internal Representation	Fixed Point Binary
# Bits/Word	28 (six characters using 24 bits and 4 bits for sign)
# Instructions/Word	1
# Instructions	25
# Bits/Instruction	28
Instruction Type	One-Address
CPU Technology	Transistors: 32 microsecond cycle time
CPU Registers	See Table 1-2
Main Memory	Magnetic Core: 4K – 8K characters; cycle time: 32 microseconds
Add Time	Fixed Point: 8 microseconds
Multiply Time	Software-based
Divide Time	Software-based

1.1 The ERMA Project

By the early 1950s, the increased use of bank checks as a form of payment had pushed many banks to the brink of a crisis. They could not keep up with the level of manual processing required to record and reconcile checks. The Electronic Recording Machine Accounting (ERMA) project was intended by the Bank of America (BoA) to modernize and computerize some of its critical banking operations. BoA teamed with Stanford Research International (SRI) to design a new banking system called ERMA (Fisher and McKenney 1993, McKenney and Fisher 1993).

1.1.1 In the Beginning

In 1950, SRI began the conceptual study of the system. Since BoA felt that the check was important to the customer, few changes would be made to the checks themselves. BoA and SRI had determined that the system would perform five basic bookkeeping functions:

- Account credit and debit
- Record all transactions
- Record customer balances and print them as needed
- Handle stop-payment and hold orders on checks
- Notify the operator of possible overdrafts on accounts by checks