Aim : Case Study on failure of Project Stretch

Name : Ansari M.Saeem M.Saleem

Uid : 2019430001

Subject : PM - ISE

Part-1 :

About IBM -7010 (Project Stretch) :

This was developed by the International Business Machines (IBM) Corporation at Poughkeepsie, N.Y. started toward the end of 1954.the project was directed more specifically toward achieving, on very large mathematical computing problems, the highest performance possible within certain limits of time and resources. If mostly on-the-shelf components were used, a factor-of-l0 improvement over the IBM 704, the fastest computer then in production, appeared feasible. Although this leve1 of improvement would have been a respectable achievement, it was rejected as not being a large enough step. Instead, an over-al1 performance of 100 times that of the 704 was set as the target.

The project was originally designed to meet a requirement formulated by Edward Teller at Lawrence Livemore , the first example was delivered to Los Almos National Laboratory in 1961, and a second customized version, the IBM 7950 Harvest , to the National Security Agency in 1962. The Stretch at the Atomic Weapons Research Establishment at Aldermaston, England was heavily used by researchers there and at AERE Harwell, but only after the development of the S2 Fortan Compiler which was the first to add dynamic arrays, and which was later ported to the Ferranti Atlas of Altas Computer Laboratory at Chilton.

The purpose of setting so ambitious a, goal was to stimulate innovation in all aspects of computer design. The technology available in 1955 was clearly not adequate for the task. New transistors, new cores, new logical features, and new manufacturing techniques were needed, which, although they did not yet exist, were known to least physically possible. Even though the goal might not be reached in all respects, the resultant machine would set a new standard of performance and make available the best technology that could be achieved by straining the technical resources of the laboratory. Hence the name Project Stretch.

The need for a computer of the power envisioned was clear. A number of organizations in the world had many important computing problems for which the fastest existing computers were completely inadequate, and some had other problems for which even the projected computer of 100 times the speed of the existing ones would not be enough.

Objectives of Project Stretch :

The early design objectives were described in 1956' in terms of certain technological and organizational goals:

1. **Performance** : An overall performance leve1 of 100 times that of the fastest machines then in existence was the genera1 objective. (It has since become evident that speed comparisons of widely different machines are very difficult to make, so that it is hard to ascertain how well this target has been achieved. Taking the IBM 704 as the reference point, and assuming problems that can easily be fitted to the shorter word size, the smaller memory, and the more limited repertoire of the 704, the speed ratio for the computer actually built falls below the target of 100. On the other hand, for large problems which strain the facilities of the 704 in one or more ways, the ratio may exceed 100.)

2. **Reliability** : Solid-state components promised the much higher reliability needed for satisfactory operation of a necessarily complex machine.

3. **Checking Errors**: Extensive automatic checking facilities were intended to detect any errors that occurred and to locate faults within narrow limits. Storage devices were also to be equipped with error-correction facilities to ensure that data could be recovered in spite of an occasiona1 error.

4. **High-speed Arithmetic** : A high-speed parallel arithmetic unit was to execute floating-point additions in 0.8 microsecond and multiplications in 1.4 microseconds. (The actual speeds are not as high, see Chap. 14.) This unit would not be responsible for instruction preparation, indexing, and operand fetching, which were to be carried out by other sections of the system whose operation would overlap the arithmetic.

5. **Editing** : A separate seria1 computer unit with independent instruction sequencing was visualized to edit input and output data of variable length in a highly flexible manner. (It was later found desirable to combine the seria1 and parallel units to a greater degree, so that they are no longer independent, but the functional capability of both units was retained.)

6. **Memory** : The main memory was to have a cycle time of only 2 microseconds. (Al1 but the early production memories will indeed be capable of working a t 2.0 per sec, but computer timing dictates a slightly longer cycle of 2.1 per sec.) The capacity was to be 8,192 (later raised to 16,384) words per unit.

7. **Input-Output Exchange** : A unit resembling somewhat a telephone exchange was to provide simu1taneous operation of all kinds of input-output, storage, and data transmission devices.

8. Data formats

- Fixed Point numbers : are variable in length, stored in either binary (1 to 64 bits) or decimal (1 to 16 digits) and either unsigned format or sign/magnitude format. In decimal format, digits are variable length bytes (4 to 8 bits).
- Floating point numbers have a 1-bit exponent flag, a 10-bit exponent, a 1-bit exponent sign, a 48-bit magnitude, and a 4-bit sign byte in sign/magnitude format.
- Alphanumeric characters are variable length and can use any character code of 8 bits or less.
- Bytes are variable length (1 to 8 bits).

Reason for failure :

Following are the issues that cause failure to project Stretch:

- Goal was not realistic, because at that time technology was not as advance as its should to make a supercomputer.
- The team lacks the Subject Matter Expertise needed to complete the project successfully because at that time filed was totally new.
- Project goal was to achieve a supercomputer that would be 100 time faster than the existing one but it failed to achieve its primary goals.
- There were not enough resources to fulfill the requirement.
- The fundamental transistor circuit and memory registers are slower.
- Serial Arithmetic computing

Actions to mitigate the failure:

Following are the solutions to issues that cause failure to project Stretch:

- First of all target goal was so high to achieve at that time so if they set some low target project might be successful. Suppose the achieving target was 50 times more faster than IBM-704 so that would be achieve at that time and cost would be less then more people would like to buy. In this way company would not need to shutdown the project.
- At that time computer design was not that advance to achieve the goal, so before start building IBM-7030 company should invent some advance techniques in computer design like parallel computing, Caching, Concurrency control systems.
- During that period computer design was a recently discovered and emerging field with very few experts, my point here is IBM should had consult with some experts.
- Instead of using transistor circuit, Integrated circuit(IC) are more smaller, faster and cheaper so choosing transistor circuit over integrated circuit was a mistake.
- For Arithmetic computation serial arithmetic is used but if parallel arithmetic was used that could decrease the overall time required for arithmetic operations.

Part-2 :

Technical Specifications:

Memory Units : The main magnetic core memory units have a read-write cycle time of 2.1 microseconds. A memory word consists of 64 information bits and 8 check bits for automatic single-error correction and double-error detection.

Index Memory : A separate fast magnetic core memory is used for index registers. Since index words are normally read out much more often than they area altered, this memory has a short, nondestructive read cycle of 0.6 per sec.

Special Registers : Many of the registers of the machine are directly addressable. Some of these are composed of transistor flip-flop.

Central Processing Unit : The central processing unit performs arithmetical and logical operations upon operands taken from memory. The results are generally registers to be further operated on or to be stored in registers.

Arithmetic Unit : The arithmetic unit consists of a parallel and a serial section. The parallel section essentially performs floating-point arithmetic at high speed, and the serial section performs fixed-point arithmetic and logical operations on fields of variable length.

Radix Conversion Operations : A group of radix conversion operations is provided to convert integers between decima1 and binary form in either direction.

Transmission Operations : The operation TRANSMIT provides the facilities to move a block of data from one memory area to another.

Input Output Operations : There are basically two operations for controlling input-output and external storage units: READ and WRITE. Each instruction specifies the unit desired and a memory area for the data to be read or written.

Clocks : An interval timer is built in to measure elapsed time over relatively short intervals. It can be set to any value a t any time, and an indicator shows when the time period has ended. This indicator will cause automatic program interruption.

	Component	Make/ Buy/ Outsource	Justification
1	Magnetic Disk Storage	Buy	It’s required a plant to make make magnetic disk storage, so buying it is cost effective.
2	Oil heated/Cooled stabilizer for Memory	Make	Magnetic Disk is highly temperature sensitive, it has to be operate in an appropriate temperature to operate.
3	Transistors and circuit components	Buy	A huge amount (169,100) of transistors is required. It will be time effective to buy it.
4	Peripheral Devices	Make	IBM already have plant to make peripheral devices,so why to waste money when you can make on your own.
5	Operating System (MCP)	Make	Performance of any computer is depend on its OS like how its Resource, Process, Memory, management algorithms are implemented and how system calls are implemented. so in order to achieve primary goal OS should be made by IBM
6	Softwares (COLASL, IVY and , Fortran programming languages)	Outsource	For user level programming mentioned programming languages are already existing so just outsource.
7	New Computer Design Concepts(Instruction prefetch, Branch prediction)	Make	The mentioned concept either not exits or are in very initial steps but they are very much important to achieve the primary goal to invent them.

Conclusion:

After deeply studying the failure of project stretch we can conclude not every fail project fails totally. Although IBM-7030 was a huge failure that in upcoming time word fail meas IBM-7030 for IBM but this project give some advance concept like magnetic disc,Automated Programming, Branching, Memory bus unit, Indexing that used in modern computers .