Ironically, this is the second version of this article I have written, and the events leading up to this rewrite substantiated the point I was trying to make in the first version. My intended theme was how preservation of digital data has evolved through the years, and how difficult it has been to achieve. I was working on this article on different computers and carrying it around on a USB (Universal Service Bus) drive until it was ready for final editing and printing. One morning when I was close to finishing, I plugged the USB drive into the computer, and a dire warning message appeared on the screen. I don’t know how it happened, but the data was irretrievable, and there was nothing to do but start over. So to the best of my memory, and with reinforced conviction as to the conclusion, the reconstituted article is presented below. The title of the article was to be “Data Fugit”, a reference to the Latin phrase “Tempus Fugit”, which means “Time Flies”. This ancient phrase was a reminder to take advantage of the present because time swiftly passes us by. As detailed in the article below, all means of electronic data storage pass with time, and it is a continuing struggle to preserve information in a readable form. In the end, we shall see that the oldest forms of recordation are sometimes the most durable.

As a preface, here is some terminology of computer storage capacity that will appear throughout the article:

- Kilobytes = thousands of pieces of information
- Megabytes = millions of pieces of information
- Gigabytes = billions of pieces of information
- Terabytes = trillions of pieces of information

While cleaning out an office recently, I came across the equivalent of an electronic archaeological dig. It contained virtually every form of portable data storage media that have been used since desktop computers came into widespread use. Before reviewing examples of the rapid development of technology that turned up in this office cleanup, for historical perspective let’s go back to the beginning of computer usage in the engineering profession. Our company was an early adopter of electronic computing and began using mainframe computers in its practice in the 1950’s. We were one of the first private firms in the area to have a mainframe, and even gave demonstrations of its capabilities to some government agencies who did not have them at the time. The programming of the early computers was done via paper cards with holes punched in them. These were a descendant of the cards used to define the patterns for large industrial looms. They had the advantage of not being subject to magnetic or electrical disturbance, but they were subject to moisture damage, and it was a catastrophe to drop the whole deck and have it fall out of order. The internal electronic memory capacity of these early machines seems laughable to current computer users, whose cellphones easily surpass the capacity of those giant machines. But we did some remarkable design work on them using ingenuity in writing our programs within the limited memory constraints, including the design of some of the earliest offshore platforms in the Gulf of Mexico. I remember the excitement when we purchased an add-on unit the size of a small
refrigerator that increased the inter-

nal memory capacity of our main-
frame from 16 kilobytes to 32 kilo-
bytes. The computer had a removable
magnetic disc about one foot in di-
ameter with extra read/write storage
 capacity, but the calculating heart
of the machine was originally doing its
work with 16 kilobytes of memory!
For comparison, a single photograph
 taken with a “smart phone” these days
uses several megabytes of memory.

cединфrame computers larger than
the one we used had magnetic tape
drives to store large volumes of data.
They also used larger assemblies of mag-
netically coated discs like the single
disc we had in our relatively small main
frame. In the 1970’s I saw a large
mainframe in a university that used a
rotating ceramic cylinder about a foot
in diameter and four feet long which
was covered with a magnetic coating
and ran on a high speed. A room
dead-head traveled back and forth along
the length of the cylinder, and the high
rotational speed of the cylinder gave
very fast access to a large area of stor-
age space.

The hardware we use to do com-
puter calculations and store the data
has been ingeniously innovated
through many generations in just a
decade or two. The computer calcula-
tions for an offshore platform compo-
nent that we had designed using a
commercially available structural
analysis program. Although only a bit
over a decade past the design, we
found that the magnetic tapes the data
was stored on had been damaged.
However, more intense users of memory,
the industry developed “zip drives”,
which were smaller and faster but
were thicker and had what at the
time seemed an astounding capacity
of 100 megabytes. These were
described as “thumb drives”,
“jump drives”, or “flash drives”.
Several of these were found in
the office, but for all intents and
purposes the reign of the zip
drive was also short lived. All of these
magnetic storage media could be erased
either intentionally or inadvertently,
so in addition to the obsoles-
cence of the hardware that read them,
there was always a risk of being
erased. Even if one kept the old hard-
ware and software running to read
them, the plastic itself was eventually
subject to physical deterioration with
in a relatively short span of years. All
three forms of the above described
storage media consisted of thin plastic
discs which were replaced in our
computer whenever we were used
due to “operator error” or just mass
manufacturing bad luck, but it meant
the loss of hours of writing, and could
have been more consequential if it
had been storing commercially valu-
able information. The last form of
portable storage media was stored on
to external hard drives. These devices
were plugged into a USB port and
rapidly developed from megabytes to giga-

bytes to terabytes of capacity.

Finally, however, these remained
at risk of physical deterioration and
obsolescence of the hardware and
software needed to read them.

The next form of portable storage
media encountered were solid state
electronic devices that plugged into a
universal service buss port, or USB
port on the computer. These were var-
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One of these I bought was
on sale because it was rapidly becom-

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dropped to the point that vendors
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UNO 2018 Crawfish Mambo

Winning Best Decorated Booth was
team “Welcome To The Jungle”
Team members were Martin
Patterson (Captain), Juan Van Tran,
Casey & Leanne Gehorgan, Rachel
Dolatt, Anthony Beard, Bill Stone,
and Nathan Linhardt. Ken Nelson,
center, stopped by to congratulate
the team.

The Sporting Clays Tournament is a
game that provides a setting for vari-
ous games and activities. Participants from
the Houston area office were, to r. l:
Robert Griffin, client Jack Lamlein,
Marcel Danos, and clients Jason Zamaitis
and Michael Dubravec.
refrigerator that increased the internal memory capacity of our mainframe from 16 kilobytes to 32 kilobytes. The computer had a removable magnetic disc about one foot in diameter with extra read/write storage capacity, but the calculating heart of the machine was originally doing its work with 16 kilobytes of memory! For comparison, a single photograph taken with a "smart phone" these days utilizes several megabytes of memory. Early computer designers used the one we had used magnetic tape drives to store large volumes of data. They also used larger assemblies of magnetically coated discs like the single disc we had in our relatively small mainframe. In the 1970's I saw a large mainframe in a university that used a rotating ceramic cylinder about a foot in diameter and four feet long which was covered with a magnetic coating and ran on a high power supply. A solid head traveled back and forth along the length of the cylinder, and the high rotational speed of the cylinder gave very fast access to a large area of storage space.

The hardware we use to do computer calculations and store the data has been ingeniously innovated through many generations in just a few decades, but equally important and fugitive are the software programs designed to handle the data. These programs are constantly being updated, and some go completely out of use. We were once asked to do a data archiving program for a software company for an off-shore platform component that we had designed using a commercially available structured analysis program. Although only a bit over a decade past the design, we found that the magnetic tapes the data was stored on had become unreadable through physical deterioration, and the structural analysis program had become obsolete and was no longer supported by the publisher. Any user of a "smart phone" or desktop computer knows how frequently they get messages popping up to install the latest updates in programming, and the world of design and drafting programs is no different. Remarkable tools are available to aid the design process, but they are in a constant state of flux and their half-life seems to be ever shortening. It is a constant struggle to keep adjusting to the changing electronic landscape.

So, let's look at the many generations of storage media artifacts uncovered in the recent cleanup of just one office. The first form encountered was 5 ¼ " "floppy discs" having storage capacity of 100 kilobytes for the earliest versions, scaling up to 1.2 megabytes for later versions. These were thin plastic discs with a magnetic coating in a flexible plastic sleeve. The computer spun them at high speed to provide rapid access to any part of the surface where information was stored. They were useful for a short while until the size of files became so large that a single computation or a slide presentation drawing could not fit onto the disc. The next find was 3 ½ " "hard discs", which were also thin plastic discs with a magnetic coating, but were in a hard plastic protective sleeve and had capacities from 720 kilobytes up to 2.88 megabytes.

In addition to the increased capacity, they had the physical robustness to allow them to be tossed in a briefcase and carried around with some confidence that they would not be damaged. As programs became more intensive users of memory, the industry developed "zip drives", which were directly based on these but were thicker and had what at the time seemed an astounding capacity of 100 megabytes to 200 megabytes. Several of these were found in the office, but the reconfiguration of the zip drive was also short lived. All of these magnetic storage media could be erased either intentionally or inadvertently, so in addition to the obsolescence of the hardware that read them, they had a capacity at risk of being erased. Even if one kept the old hardware and software running to read them, the plastic itself was eventually subject to physical deterioration with a relatively short span of years. All three forms of the above described storage media had spinning plastic discs which were often used by us in our digging through the office had a prime useful life of only a decade or even less.

The next storage media encountered in our archaeological dig were compact discs, or "CD's", which were hard clear plastic discs that could be etched by a laser in the computer to make permanent records and typically had a capacity of about 650 megabytes. These could only be etched once, so their main use was for archival purposes. Eventually digital video discs, or "DVD"'s, with even larger disc storage useage and brought the capacity of a single disc up to about 4.7 gigabytes. The DVD also offered the ability to use the etched media and mainly useful for archival purposes. Computer manufacturers saw a need and market for the ability to use the CD and DVD's in a manner similar to the old magnetic media, so they developed readable-writable discs, or "CD-RW" and "DVD-RW", which could be used multiple times and allowed editing of files. Ultimately however, these remained at risk of physical deterioration and obsolescence of the hardware and software needed to read them.

The next form of portable storage media encountered were solid state electronic devices that plugged into a universal service buss port, or USB port on the computer. These were variable forms described as "thumb drives", "jump drives", or "flash drives". The first one of these I bought was on sale because it was rapidly becoming obsolete at its modest capacity of 128 megabytes. I still have it many years later, and this article briefly resided on it before being transferred to other media. These USB devices rapidly evolved to have gigabytes of memory capacity, and the price declined to the point that vendors handed them out as promotional trinkets at trade shows. In fact, one of these trinkets was the drive that failed and led to the rewrite of this article. The drives were often used due to "operator error" or just mass manufacturing bad luck, but it meant the loss of hours of writing, and could have been more consequential if it had been storing commercially valuable information. The last form of portable storage media we encountered were external hard drives. These devices plugged into a USB port and rapidly developed from megabytes to gigabytes to terabytes of capacity. There seemed to be a constant drive to sell them off before the next generation came onto the market with more capacity at a lower price.

As the forms of storage media developed at breakneck speed, the cost came down in equally fast increments. File storage servers with many terabytes of memory became commonplace, and ultimately subscription storage services developed that data centers would store your data in large offsite facilities and let you access it over the internet. This type of service is called "cloud storage" and has the advantage of being professionally maintained with robust backup systems, although I have heard one user lament that something went wrong with their's and the "cloud" became the "fog" for some period of time. There was also a famous case in which a major corporation lost all its data due a cloud failure, so nothing is foolproof.

It is ironic, but the most stable form of data storage we have seen are the humble markings of graphite pencil or drafting ink on a sheet of good quality paper. In the late 1940's, a cache of scrolls written on parchment paper was discovered in the Middle East. They became known as the Dead Sea Scrolls, and have been estimated to date from about two thousand years ago. Clay tablets inscribed with early forms of writing have survived from millennia ago, and the hieroglyphics carved in the Egyptian pyramids date to approximately four or five thousand years ago. Humankind has attempted to pass down its history by writing on every available surface, but the important lesson to take away is that regardless of the means of recordation, the window of time to teach about the transfer of information is only one generation. We must constantly work to instruct the generation coming after us on the importance of preserving our hard won body of knowledge, its fragility, and along with it the fragility of civilization.
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