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BIG-DATA PLATFORMS & TOOLS

The Starship Enterprise Always Had Big Data!



Robert Plant, Associate Professor, School of Business Administration, University of Miami
 2/20/2013
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Spock and Mr. Data on the Starship Enterprise were always armed with great technology. They had natural language voice activated computers, to which they issued commands such as "computer plot a course to the delta quadrant." they had Communicators, Tricorders, Phasers, Replicators, and other cool devices from the future. They had even big data.

The technology is well on its way

Well, it seems 40 years after Captain Kirk went boldly forth with his crew, many of those devices are with us today. The team, led by former Microsoft CTO Nathan Myhrvold at [Intellectual Ventures](#), use lasers to zap mosquitos, just like Kirk would evil aliens; you can use a 3D printer to create almost anything, and we all carry around our own tricorder-communicator in the form of a smartphone, which through Siri's natural language interface does our bidding.

Now all we need is the ability to carry around all that big data without being attached to the mothership through the cloud. The technology is on its way, it's just taking awhile longer, but this was in many ways predictable. In 1969, three years after the original star trek aired, two giant leaps for mankind occurred: Neil Armstrong set foot on the moon, and Intel released the 1K RAM chip. The journey to the moon was in essence the end of the cold war space race, but for memory chip companies the 1K RAM chip signified the data storage race had just begun. From then on, Moore's law would take over and the doubling of transistors on an integrated circuit would continue approximately every two years. However, an industry group that produces the "International Technology Roadmap for Semiconductors" has indicated that growth will slow, doubling only every three years after 2013 using existing silicon technology. This indicates that a paradigm shift is about to occur, as it did when data storage moved from valves, to wire cores, to silicon. This time the shift will be closer to several technologies Spock would recognize.

DNA memory

A team at the Wyss Institute at Harvard has been pioneering the research into the use of DNA techniques to store data and published their work in the journal [Science](#). The team, led by Professor George Church, used the notation of DNA sequences (As, Cs, Gs, and Ts) and embedded digital barcodes in the DNA -- the data being converted to and from a digital format, via a computer and a DNA sequencer. Church and his team recently stored 70 billion copies of a book in a DNA binary code storage system, using 5.5 petabytes of memory. The power of the media, as Professor Church states, is from its density "1 bit per base, 1 base per cubic nanometer" or a zettabyte in a gram or milliliter of volume. While this is hard for mortals to get their mind around, Dr. Sririm Kosuri, a team member at Wyss, helps by explaining that this approach would "allow all the worlds' current information, 1.8 zettabytes to be captured in about 4 grams of DNA." The advantages are clear: low-volume, high-density storage that can be recovered thousands of years later, and stored in a form that even if the physical material such as glass is broken the shards can be re-sequenced and the memory put back together.

Holograms

While DNA memory may not be available for awhile, other technologies, such as quantum holographic storage, are also being developed. Researchers at Stanford have been studying how data can be stored in the quantum space around a single electron. As the team reported in their 2008 Nature article, it is possible to [encode 35 bits of data in the quantum space](#) of an electron through the use of a hologram. This takes the form of CO gas molecules being bonded to the face of a copper crystal. The potential for this technology is staggering. The team estimates that for 80 molecules, there are approximately 3,500 sites for bits, which equals 10 to the 167 states. The data itself is read by a scanning tunneling microscope capable of precise measurements of the electron "wave functions," which store the actual "pages" of information.

Copolymers

Hard drives have been the staple of computer memory for several decades, however, their replacement with in-memory solid state databases may be a bit premature. Research from UT Austin has built upon a process known as Self-Directed Assembly (DSA), pioneered at MIT and reported in Science. This is a technique where by the magnetic memory dots (the area where the ones or zeros are written) on a hard drive are isolated from one another. Usually the disk is completely magnetic, and when the dots are pushed together they can, if squeezed too close, spontaneously change state from zero to a one. However, this does not occur if they are completely isolated from each other with no magnetic area between them. This technique allows for higher capacity storage in the same space, with higher reliability.

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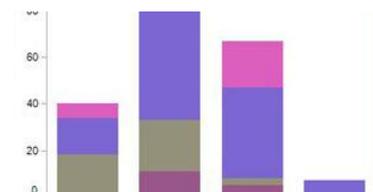
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While these technologies are some way away; perhaps between five to 20 years for DNA and hologram, less for the Copolymers, if someone had told the Star Trek audience of 1966 that they would soon have a Communicator and voice activated computer to carry around, they would have been thrilled. So, while DNA and hologram data storage seems sci-fi, it should be remembered that the folks in engineering research typically love Star Trek and love making the Sci-Fi future a reality as quickly as possible, so perhaps these technologies will be here sooner than we think. Personally, I'm waiting for the transporter to be invented so I can beam from place to place...

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— Robert Plant, Associate Professor, School of Business Administration, University of Miami

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Edwin Willems, User Rank: Exabyte Executive
2/27/2013 | 7:43:19 PM

Re: The Starship Enterprise Always Had Big Data!

good article. We always tend to think about big data as traditional structured data, or in case of unstructured, the more conventional types of data. With the volumes we see today, should we talk about Big Data looking at what can be REALLY big such as the examples you gave robert?

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Keith Grinstead, User Rank: Petabyte Pathfinder
2/27/2013 | 5:10:24 PM

Re: Another future

@Saul in the UK we are a nation of hoarders and I'd guess the US is probably the same?

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So the more capacity you give us to store then the more we will store - just in case!

And our software doesn't help - you have a file on your PC and you want to email it to someone - hey ho - now you have two copies of that file taking up twice as much space. Then the recipient saves it their hard drive and they have three copies!! One in their email programme, one in downloads, and one in the place they have saved it.

Yes, we will gobble up whatever storage you give us.

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Keith Grinstead, User Rank: Petabyte Pathfinder
2/27/2013 | 4:42:48 PM

Reality check.....

@Saul whoa there!! ... I could go to my national stadium (Wembley), sit down and see the game that was taking place in Japan as if it was happening right in front of my eyes....'

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I seem to recall only recently a great game of football was halted for some time because of a partial power outage in the stadium!!!

There's some great 'blue sky' thinking here, but in reality.....well!

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Saul Sherry, User Rank: Blogger
2/22/2013 | 5:29:51 AM

Re: Another future

Is it possible that we are going to keep up with this in terms of data produced @robert? If storage capacity is going to sprint ahead like this (and shrink so much in terms of a physical footprint) are we going to do our usual human thing and bloat our usage to the point where we have to keep looking for new storage solutions? Or would this level of tech mean worrying about space becomes a relic of the 21st century?

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Saul Sherry, User Rank: Blogger
2/22/2013 | 5:26:06 AM

Re: Another future

With data storage, sure. But @Daniel, had the Japanese bid to host the world cup won, we could have be treated to the following (from [Geek Tech](#)):

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"The Japanese have proposed to capture all 360 degrees of World Cup matches using up-to 200 HD cameras, the footage from which would then be used to project life like full 3D images onto genuine football fields the world over. What does this mean? It means that potentially I could go to my national stadium (Wembley), sit down and see the game that was taking place in Japan as if it was happening right in front of my eyes - With holographic players moving around the pitch."

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mharden, User Rank: Exabyte Executive
2/21/2013 | 11:06:29 PM

Re: Another future

Interesting. A device the size of your thumb could store as much information as the whole Internet. I can't wait to see how Apple and Microsoft could use this data storage for documents, music and jpeg files that easily consume my laptop's space today.

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Robert Plant, User Rank: Blogger
2/21/2013 | 5:46:03 PM

Re: Another future

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Hes its kind of hard to imagine all the worlds data in a thimble. The DNA folks are going to change the game in a way that the silcon chip did that reduced ENIAC from 30 tons to a Smartphones weight. Then what? implantable DNA data storage. Not sure I want to be a Borg, Kaptain Kirk mabe but Im not ready to be assimilated.

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Robert Plant, User Rank: Blogger
2/21/2013 | 5:43:41 PM

Re: Another future

Yes, interesting in deed, of course shoppers are using imaging techniques to visualize themselves in clothes at stores and virtual reality is making a comeback, so convergence is the active dimesion that big data participants will have to deal with next.

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Daniel Gutierrez, User Rank: Blogger
2/21/2013 | 1:35:11 PM

Re: Another future

Speaking of holograms, my favorite technology from Star Trek was the holodeck, first used in the Star Trek Next Generation series. Talk about big data, imagine the data resources required to produce real-life simulations like that and have the ability to interact with the virtual reality in real-time. I always thought what I could do with a toy like that! Our current-day big data technology has a ways to go.

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Saul Sherry, User Rank: Blogger
2/21/2013 | 7:06:30 AM

Another future

Gosh @Robert, it often feels like we are arriving at the future with all the current big data technologies, and then you throw this at us. Hologrammatic data storage? I wonder how long before IT teams are building that into their spending budgets...

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