SHARE Sixtieth Anniversary: Technology in the Next Sixty Years v2

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The Future

Future, *noun*

That period of time in which our affairs prosper, our friends are true and our happiness is assured

-- Ambrose Bierce in *The Devil's Dictionary*

The Future, Conan?

- "Perhaps the best thing about the future is that it only comes one day at a time." - Dean Acheson
- "We are confronted with insurmountable opportunities." - Pogo (Walt Kelley)
- "Future shock [is] the shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time." - Alvin Toffler

"Predicting the future ain't what it used to be." – Yogi Berra

- Predicting the future is not only not easy, it is essentially impossible
- Because of, among other things, the "butterfly effect"
- Humans tend to predict via linear extrapolations
- No one guesses the paradigm shifts, much less the impacts
- Ergo, I am as well-qualified as anyone
- Besides, I am now retired
- "Futurology is not, and predictably will never become, one of the exact sciences." – David Pearce, *The Hedonistic Imperative*

The History of Prediction is Littered with Absurdities

- "This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us." - Western Union internal memo, 1876

- "The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?" - David Sarnoff's associates in response to his urgings for investment in the radio in the 1920s

A Confession

I confess that in 1901, I said to my brother Orville that man would not fly for fifty years .... Ever since, I have distrusted myself and avoided all predictions".

- Wilbur Wright, US aviation pioneer, 1908

We Don’t Need No Stinking Telephones

"What use could this company make of an electrical toy?"

- Western Union president William Orton, rejecting Alexander Graham Bell's offer to sell his struggling telephone company to Western Union for $100,000

Ma Bell Forecast

- "By 1936, at the current rate of telephone industry growth, every high school graduate will need to be a telephone operator"

  - ATT's forecast in the 1920s

- But, it came true! (via the invention of the dial telephone, a paradigm shift if there ever was one)

The Vast Wasteland

- “[Television] won't be able to hold on to any market it captures after the first six months. People will soon get tired of staring at a plywood box every night". - Darryl F Zanuck, head of 20th Century-Fox, 1946
- "Although television is theoretically feasible , it's a waste of time both Commercially and financially ...." - RCA, 1926

The World Market

- "I think there is a world market for maybe five computers." -Thomas Watson, chairman of IBM, 1943
- "The world potential market for copying machines is 5000 at most." - IBM to the founders of Xerox, 1959

Computers

- "Computers in the future may ... perhaps only weigh 1.5 tons". - Popular Mechanics, forecasting the development of computer technology, 1949
- In 1956, the “main frame” computer running the space ship in *The Forbidden Planet* could only be accessed with a card reader for input and a printer for output!

Data Processing

- "I have travelled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year." - The editor in charge of business books for Prentice Hall, 1957

Popular Mechanics 1954

(outtake)

"Scientists from the RAND Corporation have created this model to illustrate how a 'home computer' could look like in the year 2004. However, the needed technology will not be economically feasible for the average home. Also the scientists readily admit that the computer will require not yet invented technology to actually work, but 50 years from now scientific progress is expected to solve these problems. With teletype interface and the FORTRAN language, the computer will be easy to use."

(picture is actually taken from an original photo of a submarine maneuvering room console)

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Microchips

- **"But what ... is it good for?"**

  - Engineer at the Advanced Computing Systems Division of IBM, 1968, on the microchip

Home Computers aka the PC

- **"There is no reason for any individual to have a computer in their home".** - Kenneth Olsen, president and founder of Digital Equipment Corp., 1977

- **"So we went to Atari and said, 'Hey, we've got this amazing thing, even built with some of your parts, and what do you think about funding us? Or we'll give it to you. We just want to do it. Pay our salary, we'll come work for you.' And they said, 'No.' So then we went to Hewlett-Packard, and they said, 'Hey, we don't need you. You haven't got through college yet.'"** - Apple Computer Inc. founder Steve Jobs on attempts to get Atari and H-P interested in his and Steve Wozniak's personal computer.

The Butterfly Effect

- If Gary Kildall of Digital Research Inc. had answered IBM's phone call on Christmas Eve 1980, IBM would have chosen CP-M instead of DOS as the operating system for the new IBM Personal Computer
- And none of us would have ever heard of Bill Gates
- An unintended paradigm shift perhaps

The Wisdom of Bill Gates

- "640K ought to be enough for anybody."
  - Bill Gates, 1981

- "Internet? What Internet?"
  – paraphrase of Bill Gates, c. 1992

The SILT Report

A serious attempt to get ready for the future

- SHARE/IBM Liaison Team
- Data Processing in 1980-1985: A Study of Potential Limitations to Progress
- By Ted Dolotta, Mort Bernstein, Roy Dickson, Noel France, Bruce Rosenblatt, Dave Smith, and Tom Steel
- An intensive and prodigious attempt to look at future problems
- Published in 1974

SILT Predictions: B-minus

- Programmer crisis
- Productivity and quality (presaged SEI*)
- Presaged the lights out glass house
- Presaged SCP commoditisation and the rise of UNIX and LINUX
- Missed the impact of the PC
- Missed the Internet
- * Software Engineering Institute

Dr James Martin – A-plus

The Wired Society: A Challenge for Tomorrow (1977) Predicted:

- Personal Computers
- Cell Phones
- The Internet and World Wide Web
- Ubiquity of email
- Missed the ubiquity of Facebook

Limits to Progress

- "We have to conquer complexity if we are going to make real progress"
- "In all really big systems involving technology and/or people, over 50% of the resources are devoted to looking after the remainder!"
- “Culture has inertia and momentum”

- Peter Cochrane

Complexity Not Vanquished

- “A mobile phone needs a manual in the way that a teacup doesn't” - Douglas Adams
- "We are drowning in information but starved for knowledge", - John Naisbitt
- Legacy systems are still with us => encapsulation
- Elegance is still (negatively) driven by (short-term) economics

This is the negative inertia which may hold us back

Trends

- **"The IT and Security Departments of all the big companies are going to go the same way as the Typing Pool for exactly the same reasons"**

- **"Large organisations employ large numbers of really smart people to do really dumb things."**

- Peter Cochrane

Television: Near term trends

- **Increasing narrow-casting**
- **Decreasing substance**
- **The “vast wasteland” grows a lot vaster**
- **The Future Television Will Be Paper Thin and Rollable, LG Says by 2017**
- **Streamers vs. the traditional networks**

LG Shapes Up With Curvy, Self-Healing G Flex Smartphone

IT Near Term Trends (2005)

- Processor coalescence
- OS coalescence (z/OS, i/OS, AIX, Linux, and Windows all run on son of IBM Power chips)
- Intel making a comeback
- Grid computing is driving SOA concept
- SOA concept is foundation for the Cloud
- Future may well be object oriented integration

IT Industry Near Term Trends: IBM (1)

- IBM is moving away from the successful past
- IBM's chip manufacturing sold to GlobalFoundries (July 2015)
- GlobalFoundries owned by the Emirate of Abu Dhabi
- Extreme Ultraviolet is etching 7 nanometre chips
- 7 nanometre chips will appear in the 2018 time frame
- Silicon/Germanium replaces pure Silicon
- IBM sold its x84 Server business to Lenovo in 2014
- Rumours persist that Apple may acquire IBM

IT Industry Near Term Trends: IBM (2)

- But IBM will continue to make and sell mainframes (Z) and AS/400s (I)
- Why? Because they are bloody good at it, and
- Because they still have enormous margins:
- Z ~ 90% and I ~ 40 to 50 %!
- And nobody else comes close in execution
- But I worry about the changes eroding core strengths in IBM Research

AI Near Term Trends

- Robots in wonderland
- The need to socialise bots is recognised to achieve more human like thinking
- Specialised processors with AI-oriented instruction sets spurs progress
- Strong AI still eludes researchers (Thank you very much)

Energy Near Term Trends

- Since 2005 Oil price climbed to over $100/barrel
- And then it fell again as the market reacted and
- Spurred development of Shale and Tar Sands
- Frack you and NIMBY collide (not in my water table)
- Battle between oil and coal companies and advocates of greener energy heats up dramatically
- The future is Solar and safer Nuclear Power
- Electric automobiles (think Tesla)
- Hydrogen – not so much

Environment Near Term Trends

- Politicians continue to fumble the ball
- Global warming is running rampant
- Major effects will be felt in next ten years
- Some effects are very apparent now
- But other effects continue to come incrementally
- Dust bowl returns to American Plains and California
- Similarly in S Europe, Africa, India, China
- Long term drought in western US vs. El Niño

Environment Near Term Trends 2

- Glacial and Ice Cap Melting continues:
- Now irreversible in Western Antarctica and Greenland
- Atlantic Conveyer becomes more fragile
- Sea level rises begin to overrun island nations
- Coastal areas flooded (Bangla Desh and Florida)
- Cape Cod erosion worsens dramatically
- Air pollution worsens globally
- Economic impact mounts

Geopolitical Near Term Trends

- Increasing awareness of impending crises
- Twin problems: oil dearth and global warming
- Economic development curtailed by the crises
- Progress in limiting war? (perhaps too hopeful)
- Anything labelled “War on xxx” has already failed
- Awareness of the futility of the “War on …” rhetoric could lead to attack on underlying issues

Intermission

Here endeth the first part.

2075: Existential Questions

- If we do not forsake fossil fuels long before 2075, our existence *may* be moot
- Capitalism as we know it ("only growth matters") may well kill us
- Organization and cooperation are absolutely necessary; you know how well we do this
- Politics will likely fail utterly (again)

The World 2075: Europe

- Wither the European Union?
- European Union driven by the need to compete economically with North America, Japan, Korea, China, India
- But Europe needs to fix the management of the Euro
- Turkey in the European Union? maybe never
- The rest the former Yugoslavia and Albania?

- Russia may implode again as a result of Putin's ego

Questions

- Islamic self destruction?
- Reaction against terrorism creates more problems
- Exacerbated by Climate Change
- Rise of Asia as the new economic super power
- Dumbing down of America
- Moving away from hard sciences, engineering
- Will innovation continue to come from the west?

The World 2075

- Korean reunification? Maybe if the north collapses
- Israel and Palestine raproachment? Only if Israel wakes up
- Theocracy replaced with real democracy in Iran (or not)
- India passes China as world's largest economy (maybe) but certainly will have the most population
- Some progress is made against poverty and disease in Africa (finally)
- Wars no longer fought over religion or economics (but still fought over water rights and the rising oceans)
- US population grows to a half a billion

Science in 2075

- Superstring Theory confirmed as valid Theory of Everything as effects from the other six dimensions and supersymmetric particles are detected or not
- Dark matter is not simple; Dark Energy only words
- Genetic code is seen to be even more complex than first thought; junk DNA found to have real if subtle function ; many indirect effects: not fully understood yet even in 2075
- Crispr: automatic DNA editing: what could possibly go wrong?

Engineering and Technology

- Flying cars NEVER become a paradigm
- Ultra-safe and green electric automobiles do
- Fusion power still is “25 years away “
- Ultra-engineered (for safety) nuclear power plants provide most of the world’s power
- Global warming now accepted as fact even by some Republicans but it is too late
- Nuclear Power + Desalinisation Plants solve the California perpetual drought

Computers and IT (1)

- "Moore's wall will see the end of our present strain of silicon technology before 2020. But on the other side there are even more options and technologies available to us than ever before."
- "I see absolutely no evidence of convergence in IT! "

- Peter Cochrane

Computers and IT (2)

- AI will NOT produce a program that can pass the Turing Test – human intelligence still cannot be modelled (yet) on a digital computer (no “strong AI” yet)
- Quantum Computers will still be even further away than fusion power

Computers and IT (3)

- Supercomputers, cognitive computing
- Special instruction set computing (SISC)
- AI advances in modelling voice, vision, and animal movements => AL*
- Bio and language recognition systems continue advance further and faster
- Direct interfaces – limbs, eyes, brain
- Power supply is the limiting dimension

* Artificial Life

Computers and IT (4)

- Real plug and play arrives in the near term ~ 2020s
- AI increasingly used to facilitate plug and play
- Major complex systems can be configured and optimised through a combination of advanced Object-Oriented methods and AI; Grid computing and SOA also help converge architectures
- Legacy systems delay the full advantage
- And systems still crash and still have bugs

And now, an Opposing View

According to Ian Pearson (BT Futurologist) in 2005:

2015: Computers catch up with humans (didn't happen, did it?)

2020: Machine knowledge will greatly exceed human knowledge

2030: Computers direct connect to human brain

2048: Computers approach physics limits – over a billion times more powerful than a human brain

Whither Strong AI?

My view

- Strong AI is possible but unlikely (hopefully)
- Artificial Life (AL) systems (modelling of animal movements and decision making) need to create artificial animals which evolve via socialisation
- Leading to artificial *homo erectus* who likewise need to evolve and socialise
- This will not happen on this planet anytime soon

  – Mark Humphrys computing.dcu.ie/~humphrys

Whither Strong AI?

Opposing view

- Robots with human intelligence by late 2020s (?)
- Reverse engineering of the human brain:
- Get the software algorithms, secrets and principles of operations of the human brain
- Understand “emotional intelligence”
- Correction of neurological diseases
- Expand human intelligence
  - Ray Kurzweil kurzweilAI.net

Be Careful What You Wish For

Consider what would happen if strong AI is achieved:

- By 2075, computers are everywhere, embedded in everything and combined with nanotechnology
- Most are interconnected, still subject to viruses and worms
- Real thinking AI can easily be subverted into illiberal ends especially if networked ubiquitously
- There is a real danger that strong AI controlled computers could destroy our civilisation
- Cf. how we cannot even control SPAM or hacking today

Be Careful What You Wish For (2)

Consider:

- "Data" versus "Lore" in Star trek Next Generation
- Lore is a good model for strong AI gone bad
- Lore could be in control of every interconnected and infected machine
- It is the end of civilisation as we know it
- It is likely the will to control strong AI will only arise when it is too late

Be Careful What You Wish For (3)

"Once the first powerful machine, with an intelligence similar to that of a human, is switched on, we will most likely not get the opportunity to switch it back off again."

-Kevin Warwick in *March of the Machines*

Be Careful What You Wish For

Headline in The Washington Post 1 July 2015:

Volkswagen worker grabbed and killed by robot in German plant

Compute Power

- Huge amounts of new compute power consumed by self-defining active object-oriented architectures and the AI needed to bring self-configuring => real Plug and Play
- Nevertheless, the availability of prodigious amounts of more cost-effective compute power allows automation of ever more full motion-video-graphic-multi-media-3D-surround-sound-etc. and many other things you don't need
- This will, in an of itself, lead to major paradigm shifts
- Supercomputers will be limited by raw power usage and the expanding internal distances

IT Industry

- Not all big players survive intact or at all (cf. DEC)
- But Apple will survive and thrive
- IBM may or may not be one of the survivors
- Lenovo will be there as a work station and server provider
- The top IT software companies will probably be from India (TCS, Wipro)
- Major battle between the Open-Source movement and entrenched proprietary interests will be over
- The result will be that the control freaks will lose

IBM Survival

- Depends on how well the new strategy works
- IBM still rules the big server business big time
- But large server and super-computer sales alone are not enough
- How big can the Cloud be in terms of net income?
- A putative Apple/IBM merger is a master class in clashing control freak styles

Users

- The “Gap” between IT and business largely closes
- Business leaders will have to be IT concept literate
- The well-architected future threatened by the garbage (inertia) in gargantuan legacy portfolios
- User group focus will be in things like portal-ware, enterprise wide applications, the middle-ware evolution, (especially) vertical industry applications and, of course, Open Source
- Some companies are in a race to eliminate legacy inertia before it eliminates the company

Legacy IT Killing Businesses

- **A banking T-Rex (RBS) is dying and nimble competitors will pick at its carcass. Is it too late for the retail bank giants to overhaul their IT and survive? -** *Computer Weekly* January 2014
- **There are other examples**

IT People and Functions (1)

- IT Departments disappear as major functions
- Replaced with Information Management:
- CIO role largely subsumed into IT-savvy CEOs and COOs
- “Enterprise Information Architects”
- “Function Architects”
- Expediters (What we now call tech support and performance/capacity management)
- The last two will often be outsourced
- But there will still be plenty of things to fix but
- How does that happen in the cloud?

IT People and Functions (2)

- Migrant IT workers
- Geographically dispersed virtual teams
- Sourcing strategies enabled by clean and standardised architectures => turn-on-a-dime flexibility
- All users are knowledge workers
- All knowledge workers do the “programming”
- There is a growing shortage of coders today

(cf. The 1920s ATT prediction about telephone operators)

Nano-Technology

- "Nanotechnology will be dominant in 100 years time"
- "Factories may only be 1 - 2m tall"
- Interplay of computing and non-technology will be a big deal, maybe lethal to the human race

=> Major Paradigm shift

Our Molecular Future

"Nanotechnology, robotics, genetics, and artificial intelligence will transform our world"
- Douglas Mulhall

- Active Skin, antibiotic nanobots
- Stupendous advances in medicine
- Big opportunity for information architects

⇒Paradigm shift

⇒Disease, hunger could be eliminated (but instead the rich will get richer)

Better Living Through Chemistry

- "Secularism and individualism will triumph over resurgent Islamic and Christian fundamentalism. An entitlement to lifelong well-being in this world, rather than the next, will take on the status of a basic human right." - David Pearce (I hope so)
- "The war on (some) drugs will finally collapse under the weight of its own contradictions." - David Pearce
- Genetic and pharmacological work will continue to be funded to improve mood, intelligence, etc. Can we become innately happier and selfless?
- Pharmacology economics win out, but

"Happiness is an illusion; only suffering is real."
-Voltaire

People and Jobs

- Most jobs now require knowledge workers
- Much more is automated and the current trend toward 80-hour weeks may reverse
- Reduced hours will mean reduced pay
- “The end of Work” (except for coders)
- Major societal and economic changes will need careful and enlightened management, a challenge to which politicians may not rise

The Final Frontier

- Life may well be confirmed to have existed on Mars (and Europa and Enceladus) and found on comets giving a boost to Panspermia theories
- No contact with others from SETI (because there is no one nearby; cf. *Rare Earth* hypothesis)
- No manned travel to planets (too expensive to shield against radiation and there is no business case)
- Moon base depends on business case but the business case depends on more exploration
- Solar System LAN has long latencies! No amount of compute power can fix this (ever)

The Final Frontier finally…

- No worm hole travel short cuts and no black-hole computers (torn apart by tidal forces)
- The Universe is not a computer any more than a person is
- It turns out the laws of Physics do not permit time travel
- Teleportation not possible (2nd Law Thermodynamics)
- Interstellar speed limit = .2*c (that's 2/10s of light speed)*
- (Anti-matter drive could reach this speed if we could figure out how to make anti-matter in quantity)
- Economics rule out space travel in the next 60 years or more or until we all win the lottery (assuming climate change even permits such investments)

Collapse of Civilization?

- Irrational religion-inspired terrorism increases dramatically and may end civilization
- Climate Change=>massive sea level rise
- Automation kills most jobs=>End of work! => collapse of civilization?
- Strong AI could end human civilization
- More than one of these are very likely

What to Worry About

- Reason does not reconquer irrationality and oppressive theocracies replace liberal democracies
- Global warming and environmental catastrophes; overpopulation already here
- Strong AI would lead to computers taking over
- The rich get richer; inequity leads to bloodbath
- Death spiral in poor and low-lying countries
- Politicians do not rise to the occasion again

Summary

- IT Department disappears
- CIO means Career Is Over
- Migrant IT workers; social upheaval & coder shortage
- Architectural coherence: AI and O-O assisted plug and play and grid architectures (but who cares?)
- Legacy applications kill many enterprises
- Shakeout of IT vendors
- India and China dominate
- No strong AI, no quantum computers
- No manned planetary space flights

Epilogue

- Never confuse movement with action. –Ernest Hemingway

- For every action there is an equal and opposite government program. –Bob Wells
- You cannot shake hands with a clenched fist. –Indira Gandhi
- Whenever people agree with me I always feel I must be wrong. – Oscar Wilde

Finis

Here endeth the second part.

Questions and Comments

- Google the authors noted in the slides
- Contact me: jph@jph.co.uk
- SHARE Futures Forum?