Remaking the Nokia 6110 and Psion Series 3 on 22nm

How much 1990s of a phone or PDA would anyone want today, if you never had to worry about a battery charge again?

IoT Mote
Nov 6

This post will be as speculative as possible, which can be apt for a retrospective, if not nostalgic review.

UI category	Series 30	Series 40	Series 60	Series 80
Key drivers	Cost-driven platform	Size-driven color platform	One-hand operated feature platform	Two-hand operated feature platform
Display image (images not to scale)				
Display resolution	96 x 65	128 x128	176 x 208	640 x 200
Supported application and content platforms	WAP/XHTML MIDP MMS	WAP/XHTML MIDP MMS	WAP/XHTML MIDP MMS Symbian OS	WEB browser MIDP, Personal Java MMS Symbian OS

Figure 34. Nokia's user interface categories

https://en.wikipedia.org/wiki/Nokia_6110

"The **Nokia 6110** was a GSM mobile phone from Nokia announced on 18 December 1997 and released in 1998. It is not to be confused with the newer Nokia 6110 Navigator. It was a hugely popular follower of the Nokia 2110, and the first of the many Nokia 6xxx series business-targeted phones. Main improvements over the 2110 were reduced size

and improved talk time. It was the first GSM phone to use an ARM processor,[1] as well as the first running on Nokia's Series 20 user interface.[2]”

http://www.nokia-tuning.net/index.php?s=series20

The Nokia 6110 may be remembered more for its Snake game than anything else, if only because its 450 hour standby battery life didn't require worrying about anything else. The phones worked, and even had tactile contours on the buttons so one didn't have to think so much about where to press on a touch screen (e.g. smartphones with capacitive touch)

The resolution was also not described in the same way. For example on the Nokia 3310, with the same chipset, it had "Resolution 4 x 13 characters". It also went by "5 Lines" on the 6110. The actual number of pixels was more than 4x13, obviously, but resolutions back then were probably advertised to indicate how how many rows of contacts one could view at a time.

https://en.wikipedia.org/wiki/Nokia_3310

The Nokia 6110 and 3310 used an ARM7TDMI which TI made in their MAD2WD1:

Processor	Texas Instruments MAD2WD1
Market (main)	Smartphone
ISA	ARMv3 (32-bit)
Microarchitecture	ARM7
Family	Texas Instruments
Part number(s), S-Spec	MAD2WD1
Release date	Q4 1994
Lithography	132 nm
Transistors	74,209
Cores	1
Threads	1
Frequency	13 MHz
Details	1x ARM7TDMI @ 13 MHz
Cache memory	8 KB
Max memory capacity	1 KB
Memory types	SDRAM
TDP	5 W
GPU integrated graphics	None
Socket	SoC

This was Nokia's first use of the ARM processor, which had a display for *applications*, like calendar, contacts, and snake. All on 13 MHz.

Psion PDA

Technische specificaties [bewerken | brontekst bewerken]

Jaar	Model	Processor	Beeldscherm	ROM	RAM	Connectiviteit	Specificaties
1991	Series 3	V30 (3,84 MHz)	240×80 pixels	384 kB	256 kB, 512 kB		- 165×85×22 mm - 265 gram - 3 volt
1993	Series 3a	V30H (7,68 MHz)	480×160 pixels	1 MB	256 kB, 512 kB, 1 MB, 2 MB	19,2 kbps RS-232C	
1996	Series 3c					56,4 kbps RS-232C, infraroodpoort	
1998	Series 3mx	V30MX (27,68 MHz)		2 MB	1 MB, 2 MB	115 kbps RS-232C	

https://nl.wikipedia.org/wiki/Psion_Series_3 (Dutch Wiki entry, with Megahertz chart)

https://en.wikipedia.org/wiki/Psion_Series_3 (English, no Mhz specs)

Pictured: The Series 3 (1991) with 3.84 Mhz and a 240x80 pixel screen.

“The **Psion Series 3** range of personal digital assistants were made by Psion PLC. The four main variants are the *Psion Series 3* (1991), the *Psion Series 3a* (1993), the *Psion Series 3c* (1996), and the *Psion Series 3mx* (1998), all sized 165 by 85 by 22 millimetres (6.50 in × 3.35 in × 0.87 in).”

https://en.wikipedia.org/wiki/EPOC_(operating_system)

“EPOC was developed at Psion, a software and mobile-device company founded in London in 1980. The company released its first pocket computer in 1984: an 8-bit device named the Psion Organiser. In 1986 they released a series of improved models under the Organiser II brand, but the 8-bit era was ending. Psion saw a need to develop a 16-bit operating system to drive their next generation of devices.[5] First, however, they needed to engineer a 16-bit single-board computer, something that was extremely difficult at the time. They codenamed the project *SIBO*, for "single-board organiser" or "sixteen-bit organiser". To develop the SIBO hardware and software, they needed samples of the 16-bit microprocessors they would be programming; but it took more than a year to secure the chips, which caused a significant delay.[5]

By 1987, development of EPOC was underway: It was a single-user, preemptive multitasking operating system designed to run in read-only memory (ROM). The operating system and its programms were written in Intel 8086 assembly language and C. When the operating system started, it opened the pre-installed programmes in advance so that the system could switch between them quickly. To enable users to write and run their own programmes, EPOC featured an updated version of the Open Programming Language (OPL), which was first published with the Psion Organiser. OPL was a simple interpreted language somewhat like BASIC.

In 1989, Psion released the first 16-bit computers to be equipped with the new operating system: the MC200 and MC400 notebooks. Each of these had an Intel 80C86 processor, but differed in some other specifications, such as memory capacity. Among the later SIBO devices were the Psion Series 3 (1991), 3A (1993), 3C (1996), Workabout series, and the Siena 512K model (1996). The final EPOC device was the Psion Series 3mx (1998).[6]

The user interface differed by device. The notebook computers had a *windows, icons, menus, pointer* (WIMP) graphical user interface (GUI). The handheld computers, which

had smaller screens and no pointing device, accept input from a keyboard or a stylus.[7]"

The Precedent

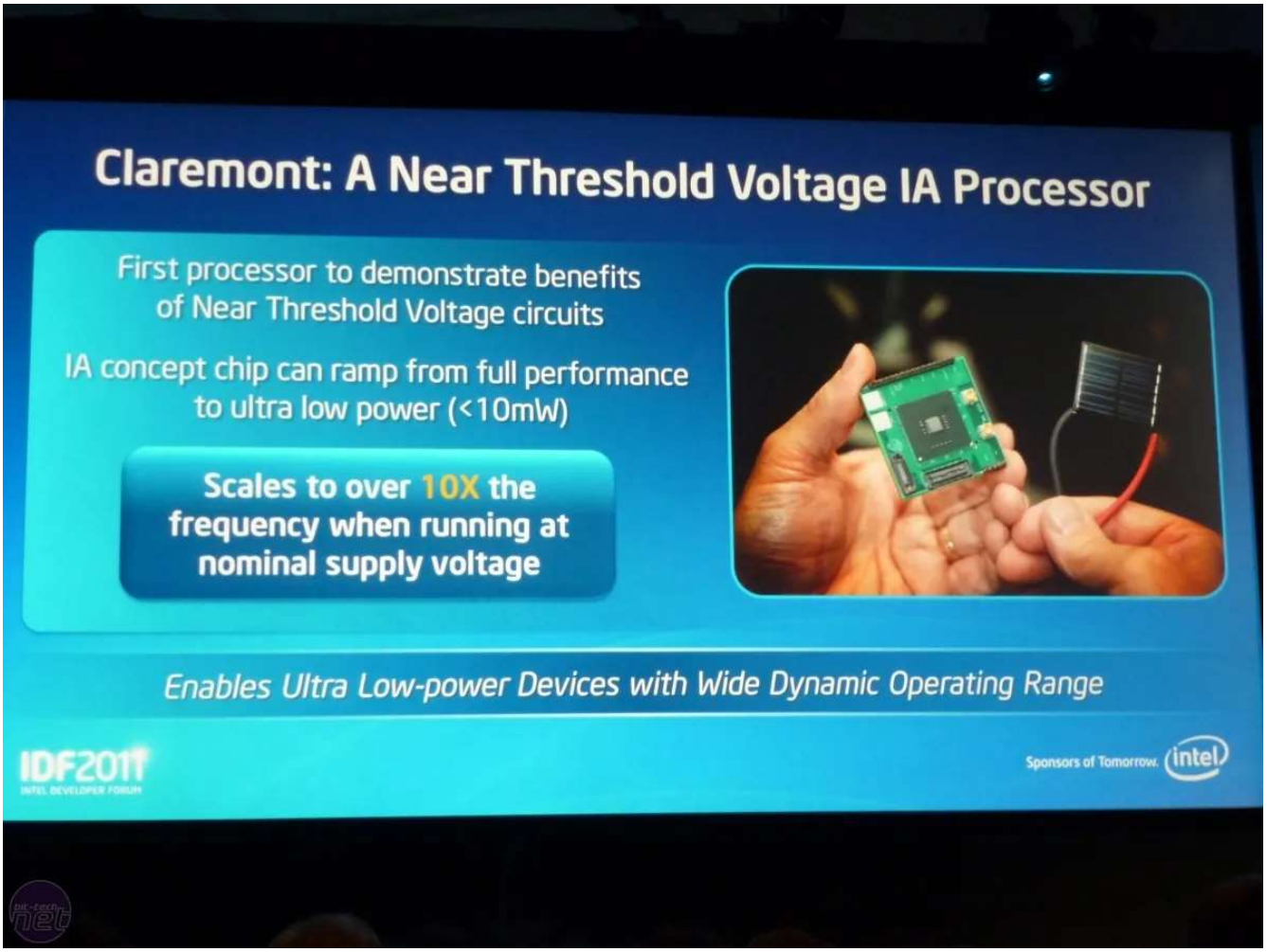
I eschew making predictions, because I do not want to be wrong when I don't have to, and I especially eschew making bets, but I'd be willing to bet $2000 (or a used 90s Honda Civic, if I had one) that the above two operating systems could be solar powered without a battery using 22nm technology or less.

The reasoning starts with the first front-facing, and fully solar powered calculator, in 1978, the Teal Photon.

The Photon, had no coin battery like other calculators at the time did. It also didn't require constant computation, which definitely made the task easier for the designer. But in the 40+ years since the 7-function, 25-key Teal Photon, Koomey's Law happened (*continued* to happen). Now, you might be wondering, why I didn't say Moore's Law, or even Dennard's scaling. And the reason is, because no one in the for-profit world listens

to an environmentalist. Moore is the normal paternalistic person that everyone needs first, like Maslow's hierarchy. I'm kidding of course, and no offense to any of the three. In fact, I was talking about myself, which no one really listens to.

So while Koomey was being ignored every time a new Intel i7 or AMD processor was released, sometime in 2011, Intel demonstrated what seemed like pure magic, but something a Koomeyist would have foreseen since knowing what the solar calculator could do in 1978. In Remaking the Pentium on 32nm, what a .8µm Pentium P54C did on 9W it could run on 2-10mW.



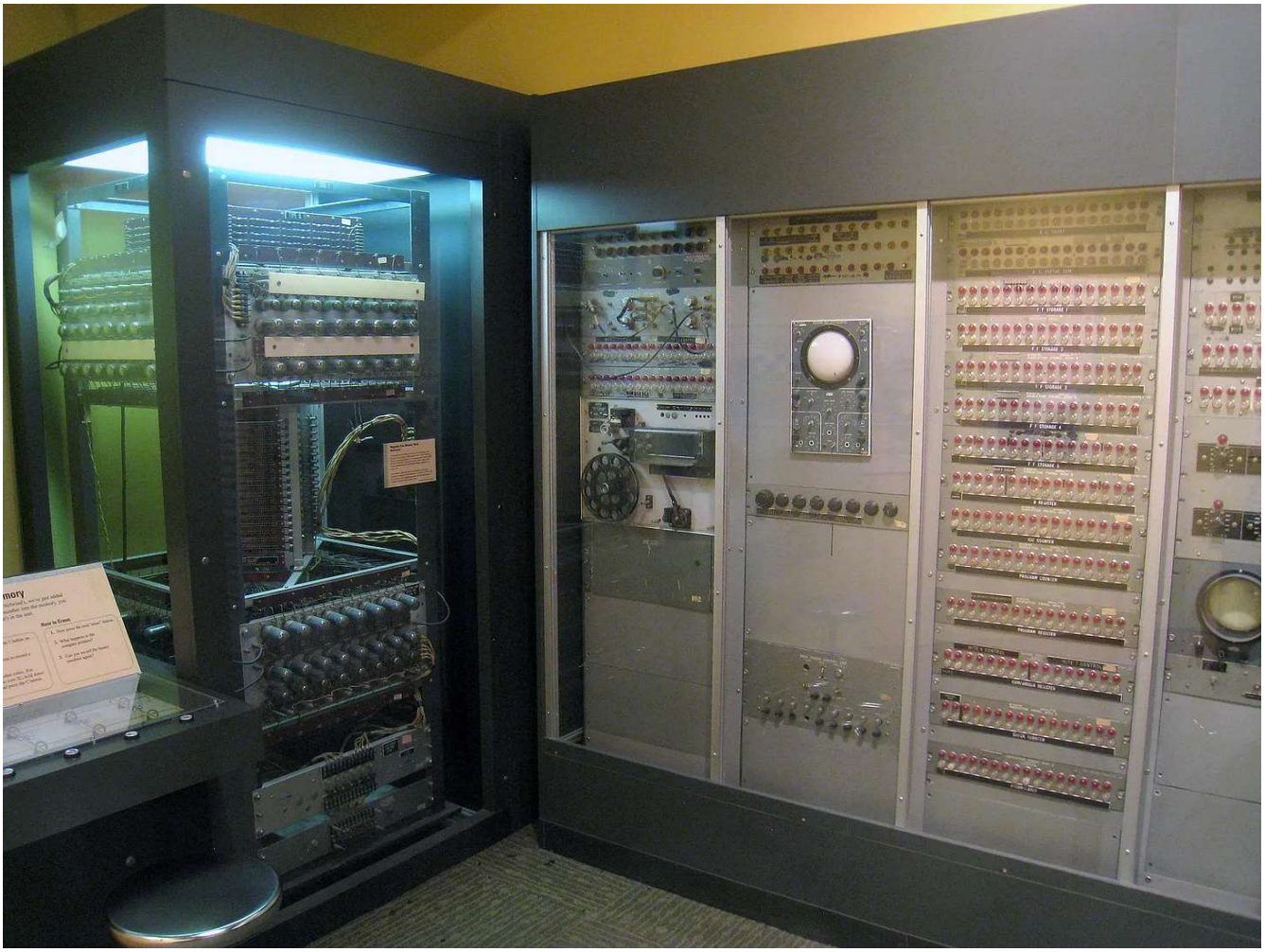
More notably, Intel resorted to dumpster diving (something I also did when I was at university in 2005, picking up an Optiplex PC with a 266mhz Pentium II, far faster than my 90s era hand-me-down Pentium 1 laptop, though the Optiplex was from a bio lab which could have been contaminated with biohazard waste or unstable radioisotopes):

“We were even told that Intel didn’t have any motherboards lying around to use, so it had to search eBay and scrounge from dumpsters to find the Asus P/I-P55TZP4 pictured.”

The Nokia 6110’s 13mHz ARM7TDMI with a 5W TDP, likewise, could be emulated at 5mW on an 48mhz Ambiq Apollo3, a 1000x fold reduction in power. The original Nintendo, which ran at 1.79mhz, was emulated flawlessly on the microcontroller having 24x the speed. The Psion 3, ran at 3.84mhz, suggesting a hypervisor could emulate the software, if it could not be ported. Similar emulators exist: https://100r.co/site/uxn.html Thus porting user applications to a solar powerable hardware could be less a matter of

rewriting all source code if an emulation layer can interpret the original code using a compatibility layer/ API.

To make the solar analogy more complete (though not Turing complete), one needs to go even further back in time, to when mechanical computers were feverishly getting built in the 1940s. If you were to walk into Bletchley Park or the MIT Servomechanisms Laboratory during the height of the of the War effort and claimed that the machines that they were working on would be powered by the sun in 32 years, you'd probably be thrown, head first, out. Not only would it be completely irrelevant to the immediate application, but solar power hadn't even been discovered yet (unless you count George Cove) and it would probably seem offensive and outlandish considering how heavy and large the machines were. The first electromechanical computers probably had a lot more functions than a 7 function calculator. But which machine could be most closely linked to the equivalent number of computations?



“Scientific calculators are used widely in situations that require quick access to certain mathematical functions, especially those that were once looked up in mathematical tables, such as trigonometric functions or logarithms. They are also used for calculations of very large or very small numbers, as in some aspects of astronomy, physics, and chemistry.

The first scientific calculator that included all of the basic ideas above was the programmable Hewlett-Packard HP-9100A,[2] released in 1968, though the Wang LOCI-2 and the Mathatronics Mathatron[3] had some features later identified with scientific calculator designs.”

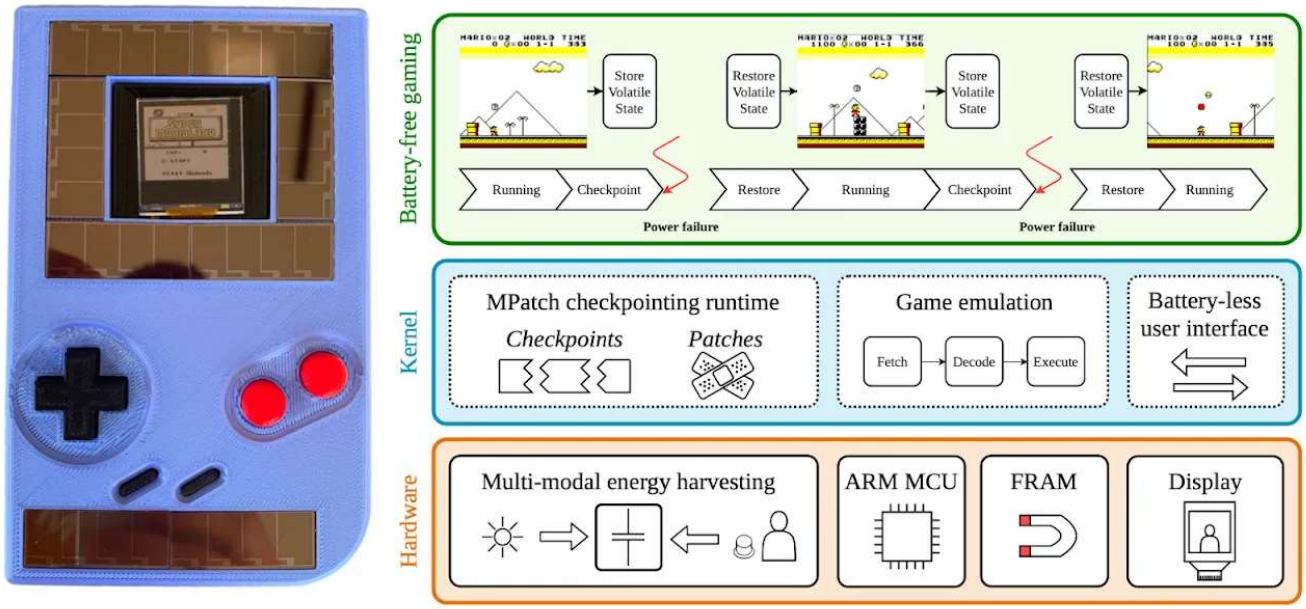
The HP-9100A, the first standard scientific calculator

Just 10 years before the Teal Photon was released, a machine was designed that virtually no one would imagine would be solar powered just a decade later (At least 4-7 of the functions). Granted, Moore's Law was progressing much faster than it was now. But if you told someone in 1968 if the HP-9100A would be one day be powered by solar, the idea would appear unintelligible, and quite far-fetched, though you probably wouldn't get tossed out of *every* bar. If you asked someone in Palo Alto or Murray Hill, they'd probably say "far out…" (Photovoltaics had been discovered at Bell Labs in 1954).

By the 1990s, solar calculators were inexpensive enough to be in every classroom, although they did not immediately lead to a new generation of microelectronics until over 30 years later when Industrial IoT devices using energy harvesting became identified as a cost-saving strategy (in both labor and occupational safety). As is usually the case, state of the art technologies usually get adopted first not by the mass market but by the academics, industrialists, and governments as can be seen with the first large computers being used for scientific, defense, accounting and insurance companies.

It's very likely that with increased sales of energy harvesting sensors to industry, that the technology will find its way into consumers for other purposes. There isn't an immediate need for energy scavenging cell phones to send SOS texts, unless one is in a high risk area:

“"As Hester explains in the video below, the technology behind the ENGAGE could be of use to people in space or high-risk environments who can't have their devices running out of juice. "No matter what, when the emergency happens, [the device] will still work," he says.”



The Solar Game Boy

from: https://github.com/TUDSSL/ENGAGE/blob/master/doc-images/system-engage.png

The New Normal

In October 2022, as much as 40% of Ukraine's power grid was seriously damaged or out of service. Ukraine is considered a first-world country, yet it is not a thought that someone in a first world country wants to think or should have to think- that their energy security should all of a sudden become unpredictable. But that's exactly what happened. Whether it is due to climate change, a natural disaster, or man-made, planning for resilient networks and infrastructure is common sense. The semi-conductor industry makes its highest margins on the leading node, the chips that go into the latest iPhone and Galaxy, but the revenue from this profit doesn't always get reinvested into new and groundbreaking technologies, either because it does not benefit the market leader-it would cannibalize the sales of Intel i3 to sell a slower Celeron- which is why Intel discontinued the entry level line. AMD discontinued their Geode processor for similar reasons- the same processor found in the OLPC.


OFF

In 2011, the solar powered Claremont x86 was demo'd to the world. Samsung released a solar powered netbook, I kid you not, called the NC215S which took 2 hours of bright sun to charge the battery life one hour, and used a 6.5Watt Intel Atom N455.

Perhaps to compete with the OLPC, and, once its AMD Geode threat was over, and the ripple effects of the 2008 economic crisis began to subside, much like the 1973 oil crisis, the big fabs went back to making non-solar laptops with no need to show any eco-consciousness in their products. While the slowest Atom processors weren't able to run more modern OSes like Window 7 and YouTube very well, there was still a lot of potential for them for older operating systems. It took a couple more years to reach good enough computing. By the time i3 processors were released and quad core Athlons, however, PCs could run many more apps and quite quickly with the advent of solid state drives, eliminating Disk I/O as a system bottleneck.

In 2012 I already hoped to start building a solar powered laptop. But at the time, the lowest powered application processors used over 5watts of power. If a company like Intel back then realized that they could use that Claremont processor to build a Psion 3 with 256K, or a Nokia 6110-monochrome, not 24 bit color and extremely bright LED backlit display, they'd be able to build a modest phone not just for the "third world", but

maybe one that could be used in Ukraine today to send text messages on wifi, Teletype Morse SDR, LoReA, or LoRA over long distances without power:

"Although the WiFi-standard was developed for short-distance data communication, its reach can be extended to cover distances of more than 100 kilometres."

If the above link isn't working, try this one https://www.lowtechmagazine.com/2015/10/how-to-build-a-low-tech-internet.html (the "over long distances" link is a website powered by solar panels)

"The Spanish network is the largest WiFi-based long distance network in the world with more than 50,000 kilometres of links, although a small part is based on optic fibre links. Most of it is located in the Catalan Pyrenees, one of the least populated areas in Spain. The network was initiated in 2004 and now has close to 30,000 nodes, up from 17,000 in 2012. 822"

"However, the low-tech networks that distribute internet access to a large user base in developing countries can have much more limited bandwidth per user. For example, a university campus in Kerala (India) uses a 750 kbps internet connection that is shared across 3,000 faculty members and students operating from 400 machines, where during peak hours nearly every machine is being used.

Therefore, the worst-case average bandwidth available per machine is approximately 1.9 kbps, which is slow even in comparison to a dial-up connection (56 kbps). And this can be considered a really good connectivity compared to typical rural settings in poor countries. 26 To make matters worse, such networks often have to deal with an intermittent power supply."

The article goes on to explain lots of local solutions to that so it is not all pessimistic (If you were already thinking at 750Kbps that it was slow, you were maybe born after 2000, or haven't seen what you can do with 1.9kbps, or both)

Let's say that instead of using a GSM network (Ukraine has 2G in many places), because there could be an event that caused it to be down (manmade or natural disaster), an ad-hoc wifi network as the one above is implemented. Then, local routers subdivide the signal further and are able to transmit some of the network (maybe not bidirectionally

everywhere but at least in a round-about manner). The solar phone isn't able to use SMS, but may be able to use bluetooth over internet and wifi, with solar powered relay beacons providing the network throughout a city. Even with a small data rate of 1.9kbps, you can have an XMPP protocol or IRC channel sending data in very small packets. The equivalent in text messages is 140 bytes:
"Text Message Bits and Bytes

SMS text messages use 7-bit characters and have a maximum length of 160 characters, making the maximum data size of each SMS 1120 bits, or 140 bytes."

If a router is used by 45 users (the maximum recommended, even if an off the shelf router can theoretically handle up to 250), and a 802.11g access point is only able to pick up a 85.5Kbps signal, those users would also have only a 1.9kbps signal. 1.9kbps is 237 bytes per second. That means that a 160 character text message could be sent every second (if you can type that fast), and if the headers and packet sizes are not large. MQTT uses a low-packet size. What kind of data could be sent? Your location, if you need help; request for food or water, and where one can go. Practically anything one would send in an emergency. Better something descriptive than a generic SOS signal, especially if many other signals are being sent co-localized and not much more sense can be made of that.

And if you have more bandwidth, you can run SIP phones on an MCU with less than 256KB of RAM.

Low power LTE modems such as Quectel's BC660K -GL or Nordic nRF9160 may be able to use less power in idle and work with solar phones:

https://www.mouser.com/datasheet/2/297/nRF9160_PS_v2_0-1954012.pdf

5.2.1.9 SPIM

Symbol	Description	Min.	Typ.	Max.	Units
I_{SPIM0}	SPIM transferring data @ 2 Mbps, Clock = HFINT		0.63		mA
I_{SPIM1}	SPIM transferring data @ 2 Mbps, Clock = HFXO		1.58		mA
I_{SPIM2}	SPIM transferring data @ 8 Mbps, Clock = HFINT		0.67		mA
I_{SPIM3}	SPIM transferring data @ 8 Mbps, Clock = HFXO		1.62		mA

5.2.1.10 SPIS

Symbol	Description	Min.	Typ.	Max.	Units
I_{SPIS_2M}	SPIS receiving data @ 2 Mbps, Clock=HFINT		0.63		mA
I_{SPIS_2MXO}	SPIS receiving data @ 2 Mbps, Clock=HFXO		1.58		mA
I_{SPIS_8M}	SPIS receiving data @ 8 Mbps, Clock=HFINT		0.67		mA
I_{SPIS_8MXO}	SPIS receiving data @ 8 Mbps, Clock=HFXO		1.62		mA

p.61 Can someone tell me what this means? If I read that right, it's using only 1.58mA to send and receive 2Mbps Or is that over the SPI (to MCU) (and not the cell tower)

Current consumption (23 dBm TX power, 3.7 V supply)	
PSM floor current	LTE-M: 2.7 uA NB-IoT: 2.7 uA
eDRX, 655 seconds	LTE-M: 6 uA NB-IoT: 9 uA

https://www.nordicsemi.com/-/media/Software-and-other-downloads/Product-Briefs/nRF9160-SiP-product-brief.pdf The above appears to use 9uA to to listen for new data incoming, but not transmit, which would be quite low!

https://www.quectel.com/product/lpwa-bc660k-gl-nb2 could also be used on conventional networks:
" Power Consumption (Typical) : 800 nA @ PSM 0.11 mA @ Idle (DRX = 2.56 s) 0.038 mA @ Idle (eDRX = 40.96 s, PTW = 10.24 s)"

"67 mA @ Connected Tx 0 dBm 330 mA @ Connected Tx 23 dBm "

Aha! they both use eDRX. I googled it. https://www.sierrawireless.com/iot-blog/edrx-lpwa/

“What is eDRX?

Developed by mobile network standardization body 3GPP and introduced in 3GPP Rel.13, eDRX enables application developers to set, and later change how long an edge device stays in low-power sleep mode before it wakes up to listen for any network indications for pending data.

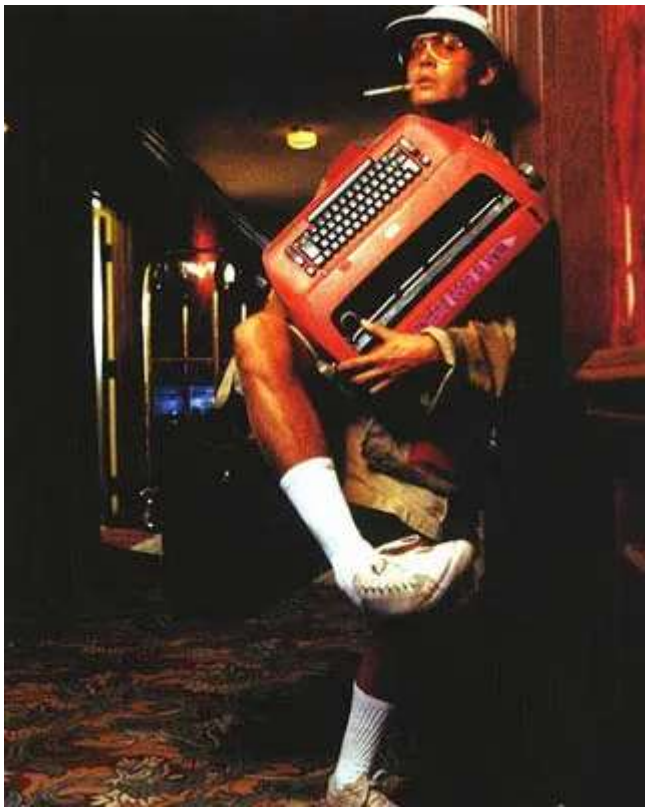
With eDRX, the device can listen for pending data indications without having to establish a full network connection. By just listening for a pending data indication, eDRX uses less power than if it made a full network connection, so this process helps preserve the device’s power. The time needed for this listening process is also much shorter than the time it takes to make a full network connection.

The maximum sleep time for eDRX devices range from up to 43 minutes for devices using LTE-M LPWA networks, to up to three hours for devices using NB-IoT LPWA networks. The minimum sleep time can be as short as 320 milliseconds (ms) for LTE-M and 10.24 seconds for NB-IoT.”

I’ll take it! Add it to my tab, waiter. So you can send a text messsage, let your phone sleep with one eye lid partially open for 43-180 minutes. eDRX, a technology you can trust.

Thus, the benefits of resilient communication networks using a decentralized network of routers and solar powered mobile devices are obvious. The issue is more of a will to develop these technologies, or maybe even a disbelief that it is even possible.

50 years ago, being a travelling writer could involve hauling a 48 lb IBM Selectric 1, and dealing with hotel neighbors who can’t stand the sound of Tennessee Williams typing next door.



There will always be a need for journalists writing stories- whether they are using voice-to-text speech recognition software or an 878 gram Fujitsu UH-X laptop, writing is indispensable. Likewise, solar powered phones that can easily scavenge for power will be essential in a world with unreliable energy security.

The solar powered calculator, like the transistor radio, got its start as a product demo:

“Meanwhile, advances in manufacturing had made solar panels—first developed at Bell Labs in the mid-1950s—cheap and efficient enough to be used on devices other than satellites. Putting them on calculators showed off how inexpensively the panels could be made and how little energy was needed for the processors to function.

This kind of display of technological achievement was fairly standard in consumer products at the time.

“When Texas Instruments wanted to push the then-new transistor, they chose the radio as first blockbuster application,” says Joerg Werner, who maintains the Datamath

Calculator Museum online.

Werner points out that the earliest computer chips followed a similar path, going from rockets to pockets and wrists (perhaps you had a cool solar LCD watch to go with your sun-powered calculator).

The first solar calculators had their disadvantages: The Sun Man's solar panels were on the back and the Teal Photon, which came two years later, needed bright light to operate. But by the early '80s, Sharp and Texas Instruments had developed solar panels that could run under low or artificial light. This pushed solar and the attached low-cost calculators, firmly and finally, into the mainstream.

One Texas Instruments promotion in 1984 gave free solar calculators to businesses that bought TI computers. A few years later, Chicago Public Schools paid $1.1 million for 167,000 solar TI calculators to use in classrooms. A 1989 trend-watching column declared solar calculators "in" and astrology "out" (the same column declared Morris the Cat in and Kitty Dukakis out).

Newsweek referenced solar calculators in 1990 to explain what solar panels were, while a column in the *St. Petersburg Times* predicted,"You'll be seeing a lot more new solar products on the shelves in the coming year," including devices for scaring away backyard moles and charging car batteries.

The technology that made tiny, efficient calculators possible also brought us mobile phones, personal computers, Game Boys, Tamagotchis, and Furbys in just a few years—minus the solar cells. Some of these devices needed small, constant streams of power to maintain their memories, and others just used a lot of juice, as anyone who tried to beat Link's Awakening on a long car trip surely knows.

And while solar calculators continue to outsell non-solar models for Texas Instruments, kids who stick with math class often move on to TI-89s and other graphing calculators. These are great for calculus and trigonometry, but they're too powerful to run on solar.

Instead, solar moved to less-visible places, like the lights and signs on highways. As they get more efficient, solar panels are increasingly showing up not just in large-scale

arrays, but on house rooftops and parking lot canopies. If Tesla CEO Elon Musk's plans work out, we'll all have batteries to store solar power for our homes.

But that doesn't mean children of the '80s, '90s, and today are all rushing to make their houses as green as their calculators. Solar calculators may have convinced a generation that the sun could power gadgets, but it's not the same as convincing them that the power in tiny calculators could stream from an outlet.

The problem, says professor and futurist Cindy Frewen, is that people don't necessarily think of rooftop panels the same way they might think of consumer electronics. "People adopt their gadgets, but they accept their energy," she says. "They take it for granted: 'This is what I have in my house.

That might change as utilities and clean energy companies offer more consumer-friendly options for solar panels and batteries to go with them like Tesla's Powerwall, a battery designed by and for technophiles.

The next generation may not even expect to plug their gadgets into a grid. Texas Instruments, the maker of all those school calculators, is working on circuits that will draw power from their users' movement. It's not likely to power a house, but as tablets make their way to classrooms, it's a great excuse for a long recess."

Those types of power generators, among the many types that are being developed by companies like TI and e-peas. ZF makes a mechanical energy harvester-kind like regenerative braking but used in the solar Gameboy.

Conclusion

Even if you disagree with the practicality of solar computers, there is one last reason I feel solar phones and PDAs should be developed. In 1977, The Voyager 1 spacecraft was launched to explore interstellar space. Included was a phonograph record, called the Voyager Golden Record containing "records contain sounds and images selected to portray the diversity of life and culture on Earth, and are intended for any intelligent extraterrestrial life form who may find them. The records are a time capsule."

If you were Carl Sagan and wanted to know if extraterrestrial life existed, a Golden Record would be a logical idea to send into space. He once, said, "The spacecraft will be encountered and the record played only if there are advanced spacefaring civilizations in interstellar space. But the launching of this bottle into the cosmic ocean says something very hopeful about life on this planet."

If you're not like Carl Sagan, you're probably not very hopeful. The Golden Record may seem symbolic, but isn't it practical? Even if there is no life found outside of Earth, the pursuit of science exists because some choose to believe that by testing a hypothesis, they no may no longer need to say, "I didn't try so I'll never know" What that means is, while there are some who want to believe just for the sake of believing, the scientist is neither a skeptic nor an optimist, but a realist by testing nature. A agnostic person can be hopeful for an outcome, but a bias cannot exist. Theodore von Kármán once said, "Scientists study the world as it is; engineers create the world that has never been." When one is not studying, they are creating.

That sounds all nice and dandy, but there's more. The "planets" metaphor is sometimes used with people. There is certainly the reality that some cultures want to be remain uncontacted. And others, for other reasons. Cultural diffusion includes technology. The uptake of technology is not always a top-down phenomena. Yet there is often a tendency for technology to be rejected regardless of it source. The technological change that engineering is focused on is less on direct-to-consumer, who may be non-technical and unaware of the direct applications of new technology, often used in arcane specialties with little to no observable immediate benefit. Thus out of each class of engineers, is one everyman, who is not from a long line of priestly families, who learns the ways of high priests, first out of curiosity, and then for the vernacular. When you're teaching a foreigner, or selling a product, aren't you trading in Golden Records?

"If I could explain it to the average person, I wouldn't have been worth

the Nobel Prize. -Richard Feynman"

Fortunately, some educators are aware of this gap between the Two Cultures:

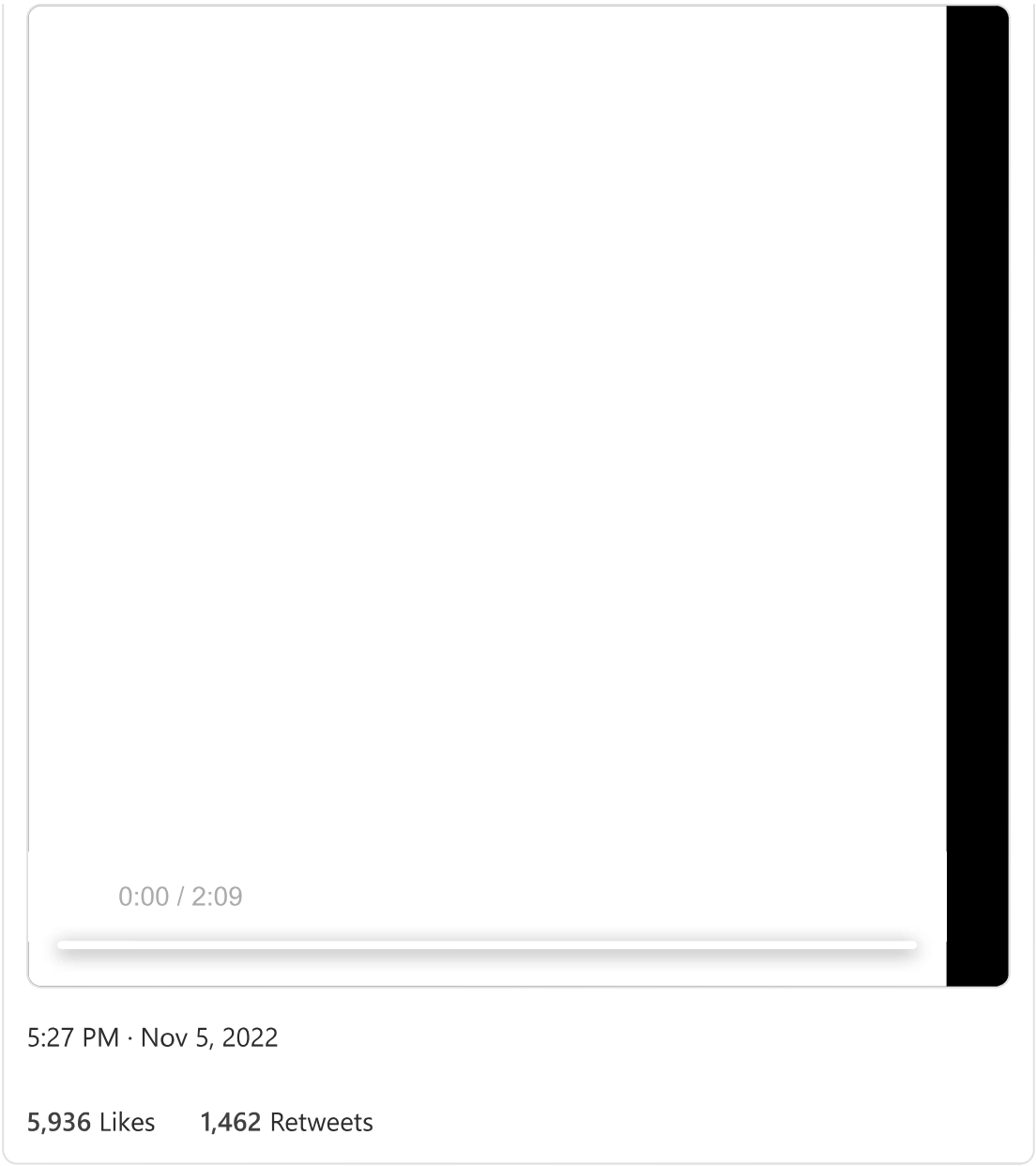
"Educators tend to describe engineering concepts in language and using examples that are unfamiliar to students starting out on their students. Research has shown that present[ing] engineering principles in a context that is familiar [to] students improves their understanding, helps recruitment and retention, and leads to higher ratings for professors."

Encore

David Bowie once described the Internet in 1999 as “an alien life form:”

Michael Warburton
@MichaelWarbur17

The always missed DAVID BOWIE predicting back in 1999 - with typical prescience - the impact of the Internet on all of us.

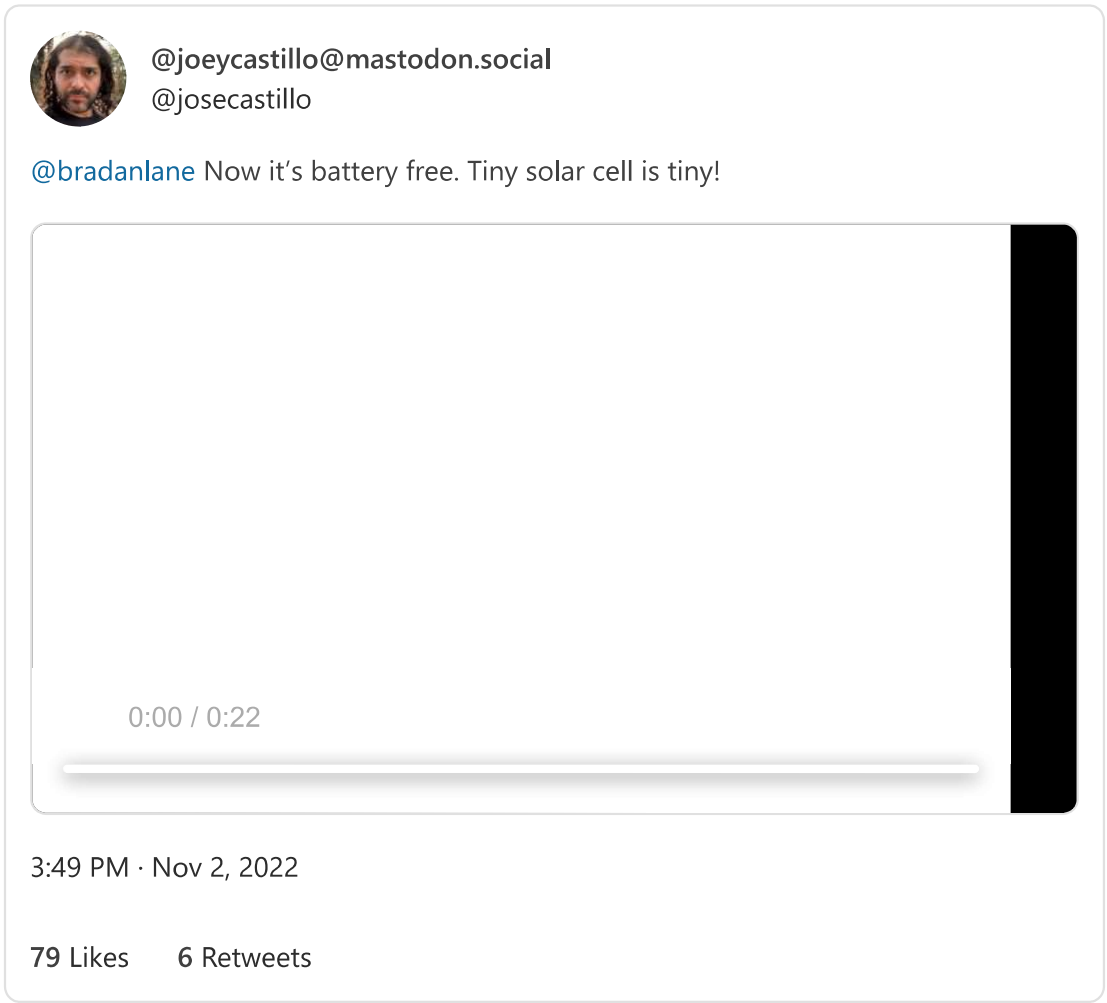


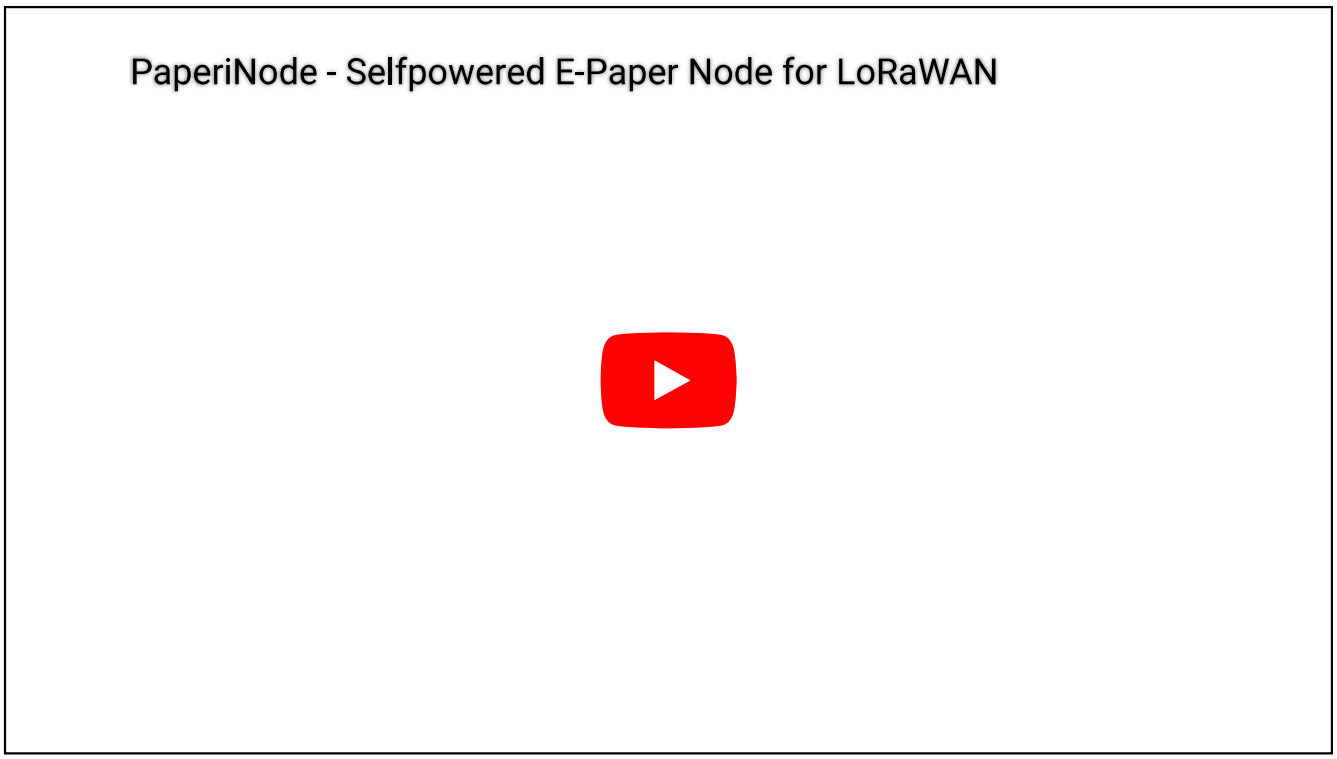
Bowie didn't invent the internet, yet his prediction that the internet would become much more integrated into the fabric of daily life was prescient. As Arthur Clarke once said, "Any sufficiently advanced technology is indistinguishable from magic." The internet isn't being compared directly to magic, but rather in that it was not immediately apparent in the early days of ARPAnet nor in 1999 to something so ubiquitous as as the IPv6 address system soon became needed.

In other words, the internet is like an alien life form, *by other means*. It is sufficiently weird, that the weird became the *pros*.

So, Bowie deserves some credit, which is why I will name a new semiconductor law to him, which I call Bowie's Law. I previously wrote a guideline here. It states that for every solar powered mobile computer (MC), there is an equally eerie extra-terrestrial energy efficient-equivalent, which can be written MC=E^5 (one E was not counted because equivalent is hyphenated, and somewhat redundant)

This energy efficiency of a mobile computer requires that the TDP (thermal design power limit) not exceed the extra-terrestrial energy source (namely the sun) in ambient conditions- e.g low to average lumen levels) that is able to reach that device. In other words, for a typical phone or laptop that uses an earth-based energy source, the power consumption usually exceeds what a small solar panel beside it would be able to generate, often by a large margin. By contrast, as in the solar gameboy and in recent hardware prototypes,





The design of the MCU and Display is intentionally chosen with a TDP not to exceed the instantaneous amount of power that the small solar panel is able to generate. Other than a hard reset or a cold boot from extremely low light conditions (like a room with no windows), a energy autarkic device such as the one above could certainly be scaled up to that of a solar laptop.

But First: Eat your vegetables!

In the 2014 movie “The Interview” with Seth Rogan and James Franco, where the character Dave Skylark is pressing his producer, Aaron Rapaport to be able to interview the head of state of the DPRK. This is after the producer realizes he is a mediocre head of a tabloid news program: “After Skylark and his crew celebrate producer Aaron Rapaport's 1,000th episode, Rapaport is upset by a producer peer who criticizes the show as not being a real news program. He voices his concern to Skylark, urging change.”

Skylark says, “This is like eating vegetables. Once you eat those, *then you get to eat the steak.*” That “steak” today is the full fat modern operating systems like Android and iOS. And the salad is the Nokia 6110. The 1990s phone is the lean payload of the 2022 equivalent, if only because feature development has become inextricably linked to platforms now deliberately ignorant of energy-autarkic design. Another, albeit confusing analogy would be- the voice and text feature is the main course meal, and the games/idle browsing is the dessert. Thus anyone who seriously wanted to develop a solar powered phone or PDA should set more modest software goals for the short term, while emphasizing the benefits of solar hardware in future releases.

I am the Cargo Cult

One does not get to become Steve Jobs by developing an Iphone. One became Steve Jobs by visiting Xerox PARC in 1979, seeing Douglas Englebart’s Mother of All demos, and realizing this is not just a Business 2 Business product, but an **intuitive** UI and product that average people, not mainframe users, could use. Like a magician, he asked people to believe that they could interact with the TV-like monitors. An lo and behold, people could walk over water! jk. But they intuitively understood what the WIMP was. They didn’t need a 700 page Unix technical manual to tell them how to develop/use software

after unboxing. So I present to you a new general purpose technology. The nametag sized solar panel. It intuitively works! By holding it up or placing it on a flat surface, it passively collects sunlight and the PMIC does all the power management. Make room on your PCB & chassis, please. Because there are many solar panel deniers. There are unbelievers. Maybe if ARPA-E could develop a vertically integrated (yet open, modular and interoperable hardware) mobile phone, tablet, and laptop with a solar panel, you might have have believers, in the hinterlands, who will not view Silicon Valley so much a place of coastal elitism if only they could get a piece of the technology. However, cultural adoption of solutions, such as vaccines, are not always met with open triceps. For all the other believers, they are already queuing at landing strips, chanting for the next cargo drop. Make The White House Solar again. Oh, wait they already put them back on in 2002. Well, we put a man on the moon before, so we can also put a solar panel back on a laptop… ;)

But in order for this to happen, I need to integrate a LOT of technologies- AEM10941 or TI BQ24074 with lithium ion capacitors that last more than 2.7 hrs (lithium just at the anodes) without a battery onto the phone, a small credit card sized panel, and an extremely low power display. Perhaps this idea of inverting the concept of devices that run on battery power to run on local generation is so radical, because no one ever thought of adding up the power consumption numbers of all the components, something only accountants do in other fields. I don't consider this idea that ***bold***. The idea to redesign an entire computer and promote innovative technologies is exactly what the CHIPS act is trying to promote, but I think it's not explicitly supporting the small startups. It's supporting those who can continue to make more powerful chips that use the same energy- Dennard's scaling. The amount of display selection is dominated by emissive, relatively high power consumption backlit screens. Reflective displays like Azumo somewhat innovative and niche, but attempt to limit the backlight and instead add a front light.

"The AEMLIC charges the capacitor up to 3.78V and the output is enabled down to 2.49V. If your application draws 30mA from the 3.3V output, then it will run for: 250F*(3.78V-2.49V)*90%/0.03A= 10750s = 2.7 hrs" A display that runs at less than 9mA and an MCU that runs at 1mA could thus last over 8 hrs (not counting inputs or wireless).

So what else is available? No, not OLED. Something like 2.7" SHARP Memory in Pixel, or 4.4" Japan Display (maybe one day we can get 17" screens that run on 5mW, I hear ya). Other displays like discontinued Epson TFD displays use 3mW for 1.9"- potentially good enough for a phone. The advantage of these displays is that they are not so slow of a refresh as e-paper but also provide clear and non-glared reflective surfaces in sunlight, like the Pixel Qi display (defunct). This is a desire to offer consumers more display types, not just *faster* refresh rates. 60Hz, 120Hz 240Hz appear to imitate some vague notion of progress*, but there can be also lower refresh rates do not depend on highly interactive information. That is, more displays should be designed to display static information, and use less power to display that. One of those ways is to use bistable displays, as seen in epaper and other screens. Maximalism has been identified in the humanities such as literature by Joyce's *Finnegan's Wake*, Delillo's *White Noise*, David Foster Wallace's *Infinite Jest*, which were satirical uses of Maximalism, rather than blind acceptance of it. The design of technology is not viewed with the same critical rigor. Features are packed into an omnibus of an operating system, and hardware is designed around it. However, the operating systems of today are actually built on an hardware with an expectation of abundant transistors. A modern computer has more transistors on a single chip than the the number of humans on earth. The awareness and reaction of this trend, is what is called "software-defined hardware." In the past (1970s-90s) hardware was the limiting factor, thus hardware defined the amount of software. When RAM prices decreased (though not immediately after Taiwan's 1999 Jiji earthquake), hardware ceased to be the limiting factor. But now that less expensive hardware no longer limits software, one previous component which was given secondary or tertiary priority, power, can now be used to return to constrained hardware that can fit exactly one or a handful of apps, due to the power reduction of each generation of transistor node process. In this way, it is software defined hardware, for the sake of allowing solar powered/autarkic devices, rather than the arbitrary or Houdini-like mysteriousness of creating challenges that make product ideas appear to be a spectacle, when they are rather, an efficient way of single-tasking user interfaces, for the sake of improving one's attention span.

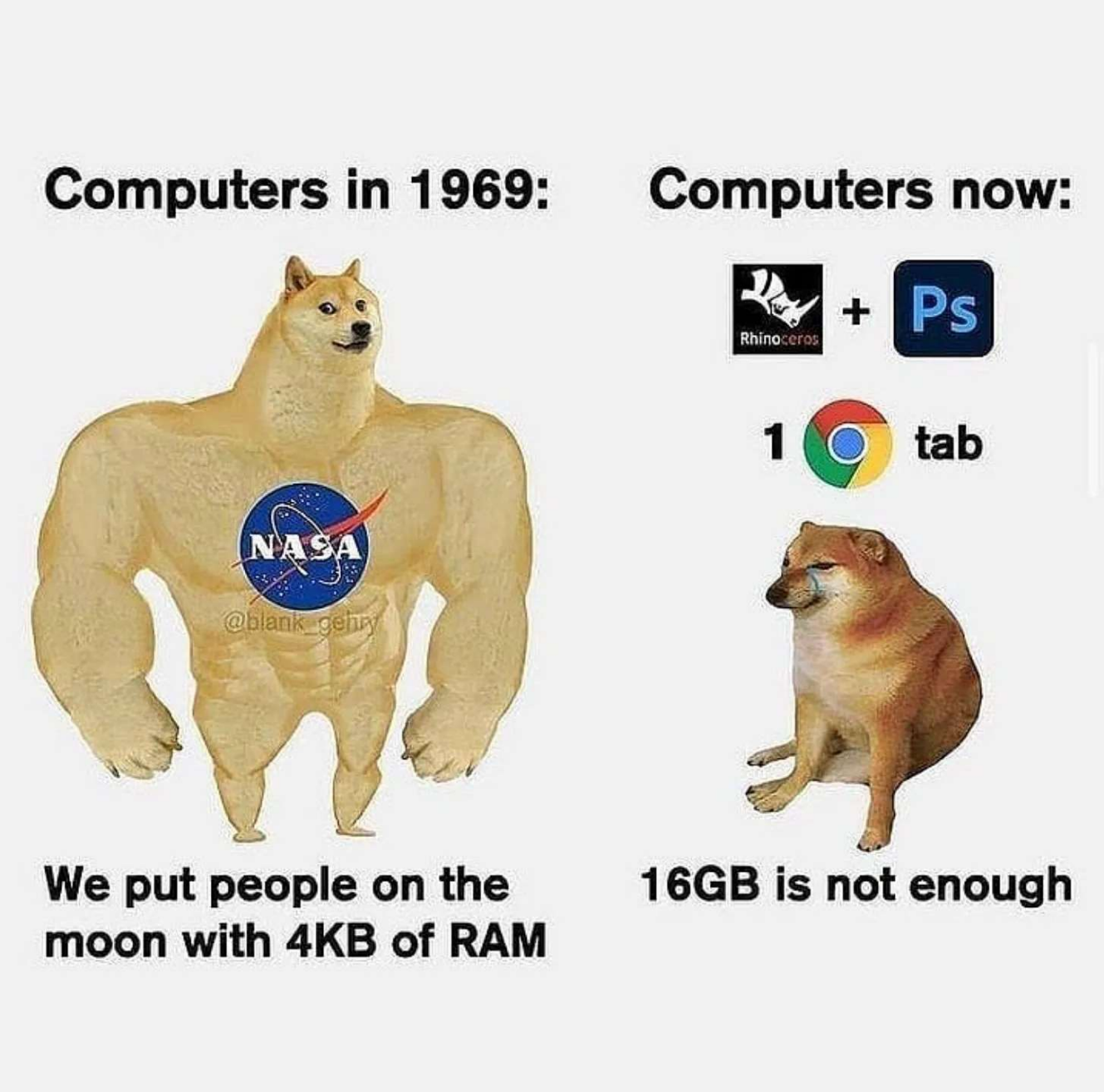
So, by instead designing every single part of the phone running even at 100% CPU utilization (with a maximum speed of perhaps 100MHz), it can use less power than the amount of power generated per second in ambient light. Isn't there a calculus term for that, like derivative or something? That's right- the differential at a point on a slope.

The rate of power consumption SHALL NOT exceed the rate of power generation. *Ideally*. Some amount of fuzzy logic has to have some kind of utility here, right? But sometimes the generation will create a harvest when idling, and that can be used for longer durations. And sometimes the consumption will exceed available light. No matter how hard one tried to stress test the power consumption, the system shall be designed to never use more than what could be generated by a window sill from 8am-4pm. Obviously if one lives in a windowless cell, they wouldn't have the ability to charge it, unless you count the lightbulb in the ceiling…

Those average people today are not just iphone or android users. They are The Other, which the mainstream repeatedly, and belatedly tends to identify. Engineers, please stop ignoring this market. If you build it, they will come:

Don't worry about what applications should be designed for it. Just build the barebone kernel. People can figure what they want to put on it. No systemd. The mentality where someone thinks everyone needs at least 16GB (and still not enough!) of RAM is false.

https://www.metroweekly.com/2014/07/to-the-moon-and-back-on-4kb-of-memory/



Something simple and sweet. If one is of the mentality that one needs 512MB or 1GB, they will never get a solar powered device because 512MB uses way too much power - in 2022. Memory also uses more wafer area, and I recall is around 28nm- I estimate it will take another 10 years before 5nm memory is low power enough to run 512MB or 1GB on portable solar power- it's not that I think it shouldn't be pursued, but to wait a decade and not allow users to creatively explore simple apps on 2MB SRAM stymies innovation.

Edit (12/12/22): See:

https://www.thediff.co/archive/a-solution-in-search-of-a-problem/

“The underlying characteristics of a new technology can determine potential, and in wide-ranging ways—there's a sense in which the ancestor to Twitter's, Instagram's, Snapchat's, and TikTok's voracious demand for constant attention from users who can access them from anywhere is all descended from the very trivial and definitely-a-toy Tamagotchi. Which, if nothing else, showed that people can be highly responsive to **low-bandwidth*** positive feedback from electronic devices, which they'll keep on their person at all times. But there's a feature of the outside world that also has a major impact: solutions-in-search-of-a-problem and toys-in-search-of-real-world-use are both less costly and more valuable in a world of lower real interest rates.”

“But this mostly means that the economy is asking technology to find some sort of money sink that can profitably absorb the vast amount of savings that a rich economy

can produce. General-purpose technologies tend to be big capital sinks because they create demand for so much associated infrastructure."

"One interesting trait of toys-turned-tools is that they seem more likely than average to become such general-purpose technologies. General-purpose technologies are fairly rare, and very important—many comprehensive lists of them will start with things like fire, writing, and the use of tools to improve other tools. A toy that finds another use case is more likely to be a general-purpose technology, in part because of the "Pirahã Are Off By One " phenomenon: most inventions are useless, some have an extremely specific use case, but if you discover that they have more than one use case, it's likely that this generalization will continue. And this is especially true from the standpoint of someone who hears about a new tool: it's going to be more viral if a) it spreads by being useful, and b) it spreads in as many different groups as possible, i.e. it has lots of use cases."

The Little Solar Power Plant that Could

Look Ma! No sky high Threadripper electricity bill anymore, I can game Diablo IV in your backyard Aptera!

Maybe it's wishful thinking I'm thinking of myself when I read that article, and reasoning that a solar panel is general purpose. I'm glad Aptera built a partially/fully solar powered electric car (depending on how many miles a day you drive). Perhaps one day they will adopt iron-air batteries with 10x the density, since lithium mining is unsustainable. I was talking about Aptera as an unaffiliated, volunteer brand ambassador in 2010, promoting rooftop charging of electric cars to anyone who would listen, and people on a forum were telling me it was impossible. People told me to go tell it on a rooftop, and so I did, and I met James Baldwin there. We chatted a bit. You know what? Don't you think it's ironic that we have a solar powered car now and not a solar powered laptop or phone? One that can charge several miles a day parked in a sunny parking lot from 8AM-4PM in a corporate parking lot. Discontinuous charging allows asynchronous use of power via a battery, rather than the mindset that solar should be

instantaneously capable of powering a motor. This mentality stems out of instant gratification, where patience should be a virtue.

So my scrutiny towards the semiconductor innovation/stagnation is much higher than the greener automotive industry, when there is a cognitive surplus for idle tweeting but not a utilization of passive mobile devices harvesting energy while someone is waiting at a bus stop. Sure there's Bell Labs and Intel Labs, but the Idea Factory is way past its heyday, although one would hope that Nokia is doing something revolutionary. I've wanted to apply, but I don't feel like I fit in anything. I feel like the open source "community" should tackle moon shot projects like this. They should be the ones building something bigger than any single company, and focus on a standard platform: https://semiengineering.com/is-ucie-really-universal/

That's the issue- a platform isn't really universal if you can't get to an agreement. If Raspberry Pi, OSI, and Free Software based Single Board Computers can agree on the dimensions of a board, including at least 4 of the same mounting holes (like miniITX, but smaller), and height, so it it can be used as a DUAL purpose laptop motherboard, then they can come back to talking about how virtuous they are with their universal chiplet.
I propose hiring U.S. ambassador and former labor union mediator Mason Skiles- this man's negotiating skills can bring any two parties together.

Until then, it's virtue signaling and ensuring the devices can only be used by the top 10% of a socio-economic class by creating small batches with awkwardly exposed hardware that sits on a benchtop. What am I talking about 10%? If open hardware built a standard laptop, and then someone dumpster dives and finds a chassis with no case, you have someone who can put together a new laptop, because some thoughtless person decided the plastic was worthless and yet when that chassis is not standardized, that dumpster diver can't install a SBC motherboard in their laptop and carry it around like a cool person. They have to make do with a bunch of hardware that doesn't fit, all because FSF and Open Source can't work towards a common cause- the environment. The person might be taking a train and has to stuff a Raspberry pi in their bag because their chassis is an empty heap of plastic (e.g. Pi Top v2). if Rpi makes a Rpi5 and some other SBC makes one, I am curious if they are going to still duke it out while our landfills pile up with plastic cases.

So back to what I was saying. Early linux 2.4 perhaps. Sure, there are lots of people who can use a command line interface. I have used sudo apt get install __ hundreds of times, but that doesn't make me a programmer. My point is, developing a GUI-based OS, for solar powered CPUS, will allow more people to use linux on a mobile device. They can learn command line later, if they choose. Not everyone gets into the world of programming by purchasing an expensive general purpose CPU, nor should they. This type of computer could be used in cafes without ample outlets for charging, on 8 hour bus rides in third world countries that don't yet have outlets like first world countries do. So you have a basic interactive typewriter that outputs information based on programming inputs. This is experiential based learning, and more productive than a text book-like e-reader. Thus if one had a quiz app, where a user is memorizing programming commands with rote exercises, or something like Thonny, they could learn programming without needing a high speed internet connection. This can be useful in areas where large exercises can be downloaded for offline use. And thus developers can be productive, even in the absence of a more RAM intensive IDE. Thonny uses 39MB, too much for a microcontroller, but perhaps not too much for a 64MB RAM SBC in a serial task-based OS (one that doesn't allow tabbed windows or apps, but the ability to save one's work if toggling between apps on microSD storage), which I believe would help with assisting users with attention span as well.

Revisiting OLPC

Just for a minute, let's suggest that phones are not computers. First, are phones a computer? I would say yes and no. A phone doesn't always need to be a computer, and it's best that they are a phone first.

In Ben Morris's "The Symbian OS Architecture Sourcebook," (2007) Chapter 1 "Why Phones are Different," a brief history of mobile phones and technological convergence, along with some key points why phones are different- it is their complexity:

"Mobile phones are different from other devices for many reasons and

most of those reasons make them more complex too.

• Mobile phones are multi-function devices.

•Mobile phone functionality is expanding at an exponential rate.

•Phone-related technologies are evolving at an exponential rate.

•Mobile phones are enmeshed in a complex and still evolving business model.

•Mobile phones are highly personal consumer devices (even when

someone else pays for them)

In a word, the mobile phone difference is 'complexity' and the trend

towards complexity appears to be growing at an exponential pace."

"Device convergence is not a hypothesis, it is the reality. As discussed

above, mobile phones have cannibalized the PDA market, appear to have

eroded the digital camera market, and threaten other markets including

the personal music-player market."

User Expectations

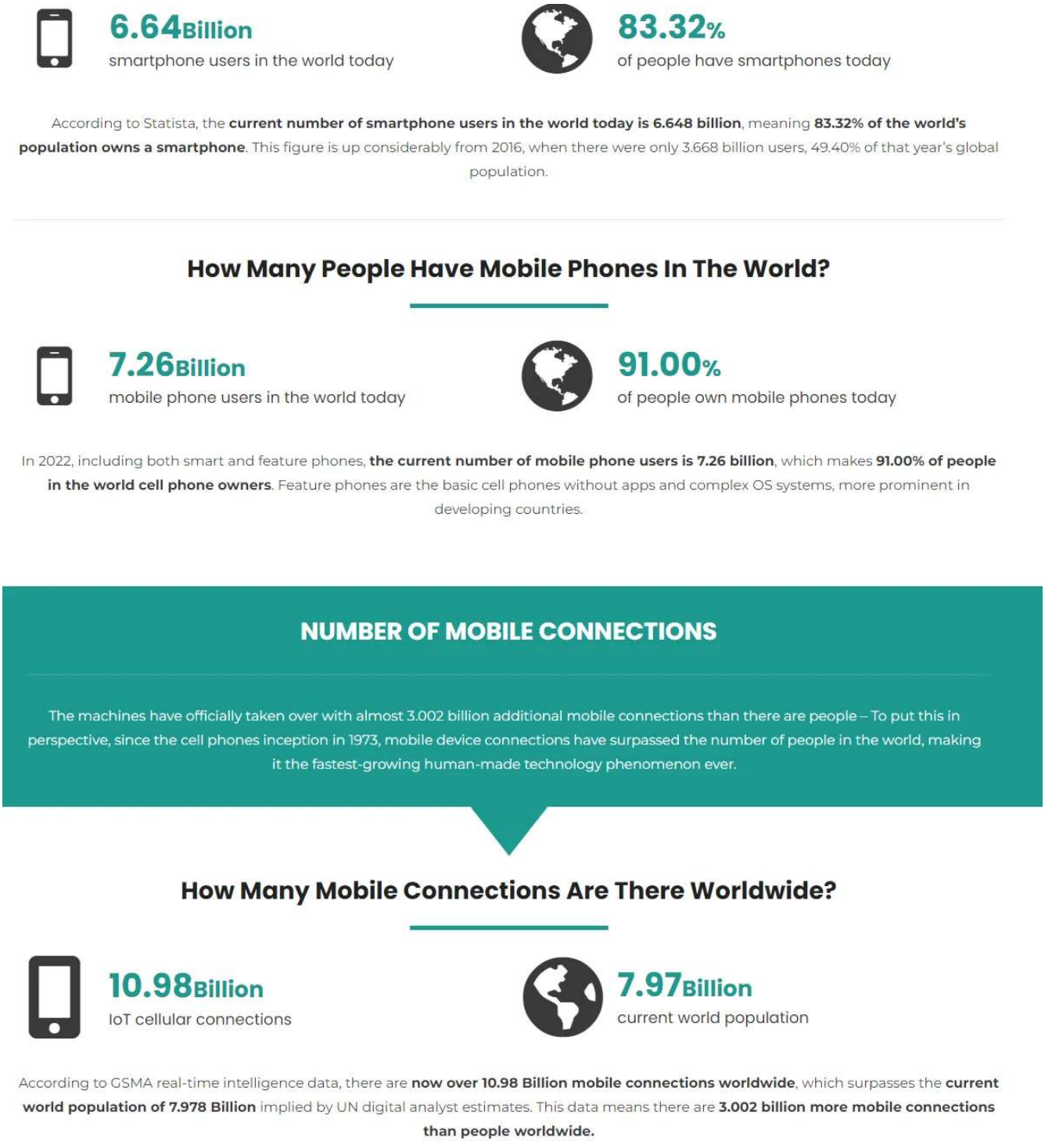
> Users expect and demand rock-solid stability and performance from their phones; desktop computer performance standards are not acceptable.
>
> At the same time, users are fickle, tending either to be infinitely happy or infinitely unhappy.[17] When they are infinitely unhappy, they return the phone. However, it is not always easy to understand precisely what triggers happiness or unhappiness (the trigger often seems removed from ordinary measures of good, bad and defective behavior). Desktop PC users seem more likely to be either *infinitesimally* happy (the machine has not crashed) or unhappy (it crashed but they did not lose much data).
>
> The conclusion is that phones really are different from other systems and they are complex.

"The conclusion is that phones really are different from other systems and they are complex."

Nicholas Negroponte may have had the wrong product in mind when he set out to develop the OLPC. The OLPC laptop was certainly influential, in that it inspired many developers to bridge access to technology, but it had some major flaws, as has already been covered in the press and in books like "The Charisma Machine," by Morgan Ames.

"Ames reveals that the laptops were not only frustrating to use, easy to break, and hard to repair, they were designed for "technically precocious boys"—idealized younger versions of the developers themselves—rather than the children who were actually using them."

Today, desktop PC and laptop usage is a minority of electronic communication devices. By comparison, a recent estimate places 91% of the world's population as an owner of a cell phone (this includes both smartphones and feature phones). If one only counted smartphones (devices with more than a handful of apps like Snake, Calender, Contacts, and a calculator), the number decreases to 83.32%.



Negroponte's words weren't the gentlest, either:

"And Negroponte was losing interest in hardware. After he outlined a dramatic (and ultimately metaphorical) plan to drop tablets out of helicopters, the OLPC Foundation distributed mass-market Motorola Xoom tablets in two Ethiopian villages as a new experiment. In 2012, it reported that children had learned the alphabet within two

weeks, and within five months, they had “hacked Android” — which referred to turning off software that disabled the camera. As Android phones and tablets became more sophisticated, Negroponte abandoned development of an OLPC solar-powered XO-3 tablet. He joined the newly founded Global Literacy XPrize soon after, effectively putting OLPC behind him.”

From PC Mag link above, quoting Negroponte after an Open Mobile Summit on November 2, 2011, he doubled down: “"We will literally take tablets and drop them out of helicopters," and return a year later to see if the effort was a success, Negroponte said. A new tablet design can withstand a 30-foot drop, and even be left out in the rain.

"When I say no people, I mean absolutely no people," he added, when asked if he was serious. "When I say I drop out of the helicopters, I mean it... it's like a Coke bottle falling out of the sky," he said, apparently referring to the 1982 movie, *The Gods Must Be Crazy*. In that movie, however, a bushman is convinced that the Coke bottle's embodiment of the concept of property is evil, and leaves his village to dispose of it.”

One of the points the narrator in the 1982 movie makes is that because there is only coke bottle, there is not enough to share, and it creates problems and conflict. But as mentioned above, 91% of the world owns a phone. Whether it is reliable is another issue, but one solar aims to address. The futurist or utopian belief of a post-scarcity economy, even in the face of an earth with dwindling resources, is a reaction to real or perceived artificial scarcity.

According to a quote from earlier that year, in June 2011 at the Social Innovation Summit, OLPC News, Wayan Vota says,

“And yet he is still talking about dropping XO laptops from the sky. Just listen to him at the United Nations Social Innovation Summit 2011 at around the 1 hour mark:

“So you've got a hundred and fifty to two hundred million kids [not going to first grade], and so here's the question: Can you, either literally or metaphorically, drop out of a helicopter, which is exactly what we plan to do, with tablets into village, where there is no school, but there's kids, at least eight to ten kids?

And then go back a year later - are they reading? And if the answer is yes, that would be transformational. Then people might pay more attention. And then it would apply to places where there are schools, so on and so forth."

Thus, Negroponte may have corrected himself before the emphasis was placed on the metaphorical in the 2018 Verge's article, but he was at least open to the idea at sometime before the November PC Mag stating only the literal.

In any case, dropping anything out of a plane is not a great idea. A one time Dumbo drop should not be an expensive design feature if there are less impersonal delivery methods, but leaves too much of an impression that the machines are designed for surviving impact, rather than surviving its users. But while I'm on the topic, anything dropped from a plane or helicopter should have a parachute, or fall out like a swarm of biomimetic bats so as not to injure someone below. What if The OLPC was instead a One-Phone Per Person project? That is, each individual could receive a solar powered phone?

I think of that phrase:

Like the old saying, "Give a person a fish, you'll feed him for a day. Teach a man to fish, and you'll feed him for a lifetime. "

Give a person a laptop, in a rural village with no running electricity, and he'll run out of battery in a day. Give a person a solar powered phone, he'll never need a USB or Lightning charger again.

"Negroponte, who delivered the very first TED talk in 1984 and co-founded the MIT Media Lab in 1985, envisioned a program that would bridge both the access and usage divides. In a 2006 TED talk, he shared a personal anecdote from a remote village in Cambodia:

"...a village that has no electricity, no water, no television, no telephone, but has broadband Internet now. And these kids, their first English word is "Google" and they only know Skype. They've never heard of telephony. They just use Skype. And they go home at night—they 've got a broadband connection in a hut that doesn't have

electricity. The parents love it, because when they open up the laptops, it's the brightest light source in the house."

This ideal can be contrasted with the costs of maintaining a solar network- ***in 2006****:*

"$5,000 - 15KVa electricity generator
$3,000 - VSAT dish
$50 - WiFi access points
$100 - electrical wiring of the classrooms
$600 - solar panels
$250 - gang charger
$9,000"

Pardon my M'waukeean accent, but that's fizzed up, like *soda*!

By contrast, Solar Low Tech Magazine, as linked above (but here again) describes that the means to build a solar network not rest on expensive solar charging equipment. Once mass production of solar-autarkic ASSPs can be developed, the infrastructure to maintain a decentralized WAN would be significantly reduced. Instead of all internet bandwidth travelling through large centralized towers, a backup network dedicated just for vital communications could be installed in parallel wherever infrastructure can support it. An option to limit bandwidth to "essential" texts and minimum data packages could guarantee some form of a social safety net, in terms of access to job bulletins, marketplace negotiations, and other kinds of communications that would not necessarily require expensive cell towers to relay. A village that doesn't need a large cell tower might be able to install a small 200-400 watt solar panel with a battery capable of running a community-shared, mutually distrustful, high throughput router capable of tens of thousand of SMS-like and SIP connections per day, using advanced QoS techniques that limits all non-essential internet use, and and costing less than $400 worth of equipment. A used 200watt solar panel can be had for less than $100, while a LiFePO4 battery capable of running a router at 10-20watts for 24 hrs at 100 % utilization may run over $100, while solar charge controllers and DC-based routers, or an inexpensive inverter should be the most basic unit of a wifi network. The goal here is low-tech: not low-tech in the Neanderthal sense (that would be an insult to Neanderthals), but high-tech in the relativistic emphasis on 2D GUIS with text-based

communication over graphically accelerated, multimedia-centric operating systems. Thus 90's era communication should be a goal post that remains stable until resilient, autarkic infrastructure can be delivered for worldwide access. Then, and only then, should the goal posts be moved towards 3D and more graphically demanding hardware- Most people would prefer to have a feature phone over nothing at all, but surely there are some that would snub at the idea. I do not view this concept as a charity, but rather an opt-in platform, since it's likely many will continue to prefer to use battery-or outlet dependent devices.

Can the 91% of the world with a phone be considered a globalized cohort? Does the fact that 91% of the world owns a phone signify that humanity has some shared acceptance that technology is not some anti-traditional disruptive innovation? I don't really concern myself with those questions very often. I view solar phones not as a one-time techno-solutionism, as some critics of a technological fix might suggest, but rather a de-emphasis on technologies that should have been transitioned away decades ago, but for various reasons- political, economic, or otherwise, were not.

"The technological fix is the idea that all problems can find solutions in better and new technologies. It now is used as a dismissive phrase to describe cheap, quick fixes by using inappropriate technologies; these fixes often create more problems than they solve, or give people a sense that they have solved the problem.[3]"

In the past, research funding for projects like the OLPC seemed to flow much more freely. Would a project like this be granted with much less skepticism, if MIT or some other organization had a 2nd chance? If the OLPC continued their development and licensed AMD's Geode on 32nm at reduced speed (200mhz, with a low-ram OS), would they still have all the issues with charging the devices on 100% solar in say 2015? Probably not. But they'd be a lot closer to arriving there had they stayed the course. Now it seems politically incorrect to renew interest in it. And I seek to find out to what extent.

Encoragain (portmanteau of Encore and Again)

There is a missing angle, or worse, a false dichotomy being presented in recent debates about AI, Effective Altruists, and "longtermism."

"**Longtermism** is an ethical stance which gives priority to improving the long-term future. It is an important concept in effective altruism and serves as a primary motivation for efforts to reduce existential risks to humanity.[1]"

For one, it's unclear what economic system proponents of long termism believe in, as it would reveal much about their approach to the long-term. Some academics have observed a preferential status for elite planners among Effective altruists, adhering to a "techno-utopian approach" to planning and development.

"2.1.2 Defining Existential Risk under the TUA Bostrom provides two general formulations of existential risk. He initially defined it as "where an adverse outcome would either annihilate Earth-originating intelligent life or permanently and drastically curtail its potential"13 . Later, he provided a more refined definition: "one that threatens the premature extinction of Earth-originating intelligent life or the permanent and drastic destruction of its potential for desirable future development"

"By leaving "value" and "potential" undefined, these latter definitions theoretically avoid the charge of existential risk as being a project of a niche philosophical view"

"First, in practice, value is still expressed in techno-utopian terms. For example, the last chapter of The Precipice expands on a vision of humanity's potential: transhumanist space expansion receives ample attention and adoration. Unrecoverable civilisational collapse (a state in which technological progress is not ensured) is described as an existential risk. Here, "civilisational collapse" refers to a permanent reversion back to non-agricultural ways of living. It is not explained why the presence of agriculture, or many of the commonly assumed trappings of "civilisation", such as urbanism, writing, and states (although these rarely came as a coherent package, see Graeber and Wengrow52) would increase the likelihood of reaching our potential. For a techno-utopian, it does. For others who value virtue, freedom, or equality, it is unclear why a long-term future without industrialisation is abhorrent: it all depends on one's notion of potential. The definition is seemingly agnostic in the abstract, but in practice there are numerous signals that it expresses the same commitment to total utilitarianism and transhumanism.

Secondly, we need to define what our potential is before we can identify threats to it. How else would we know which risks to address? This is an inherent tension within The Precipice since we are supposed to achieve existential security before undertaking the Long Reflection. It is difficult to know if we have achieved existential security if we haven't defined what an existential risk is, since we haven't undertaken the Long Reflection to define our potential. A reasonable counter could be that, in theory, there are certain futures that almost no one would like to live in (such as nuclear winter), and that there may be certain risks (for instance, an asteroid strike) that would take lots of plausibly good options off the table. Extinction may indeed be an outcome which we could assume most people would agree we should avoid. Beyond this point of convergence, there may be far more disagreement on what futures are worth protecting"

For one, the counterview to AI, and by extension, EA (since EA will use AI to their needs, unless it is open source and distributed (Stability AI), would be the concept of collective intelligence:

From Pierre Levy's 2015 Vice interview, "Collective intelligence is a research project about making people smarter with computers, and not making computers smarter than people."

"'"The machines are built by people, the software are programmed and designed by people, and so on. They are just the media of our will, our intentions, and so on. '"

I write more about collective intelligence here and in this short essay, "Do Ant Colonies Dream of Economic Systems?" (titled after "Do Androids Dream of Electric Sheep?")

So, what does this have to do with mobile phone development? Well, e-waste is an existential risk. One may be for EA's support of AI research, while cautioning against its applications. These involve the continued development of ever-increasing semi-conductors, which in turn can result in a competition for an edge in AGI. Remember Net-neutrality? And how there was all that discussion on fast lanes and slow internet lanes? Well, imagine foundry neutrality issues, where pure-play foundries giving preferential treatment to AI and other ML research, while small-time developers and consumer products from fabless startups can't get enough fundraising to get a seat at the leading edge node. AGI may not benefit individuals immediately as quickly as it can

benefit organizations. Though as mentioned in a previous post- time sharing of open source AI is likely and already available.

“"While these techniques may be led by one sector, interest is spreading. “The hyperscalers are motivated by one thing — power,” says Rob Knoth, product management director in Cadence’s Digital & Signoff Group. “The energy footprint of a data center is not something you can just hide. It is a very clear cost — the thermal impact, and carbon footprint. There’s a strong motivation. But if you look at something like an embedded system, especially with edge-based intelligence, there is a very different cost in terms of battery life. This trickle-down of technology, tools, and methodology means they are able to leverage those exact same things that the hyperscale customers are using, but they’re doing it in a much smaller footprint and much more fine-grain method and achieving their own benefits.” from this article.

Thus, hyperscalers want to leverage a foundries’ tech, using power as a design feature, but a designer might want to reserve all the tooling to create multicore chips- over 64 cores (which admittedly would be more power efficient than an earlier transistor). But if the foundry only has so much tooling to design wafers for a single customer using a very special instrument, then there could be potential scarcity and competition for a FinFET lithography technique for NTV, which could be repurposed for manufacturing single core chips- which could serve many customers instead of one data center.

The Chip Industry is Decadent and Depraved

Existential risk arises can arise out of unsustainable product cycles- you’ve heard of fast food, fast fashion, disposable cameras, disposable phones, and now fast furniture. What was once considered a permanent fixture in a homes has now transformed into into a completely wasteful way of planning for the future. While it is true that the cost of natural and solid woods has increased in price and scarcity, the cheaper particleboard and plastic substitutes for furniture should not be an excuse to wish a short life-cycle. The preservation of manufactured goods should last as long as its functional ability withstands. In lieu of merely repeating ideas about how social reform could be implemented, I would promote the use of a basic universal phone, similar to a guaranteed minimum income (or universal basic income, UBI). The difference, is that even though a guaranteed minimum income will not be able to cover even a majority of

one's rent, that money would undoubtedly be used one day to purchase a new phone. The phone itself may not have software updates after 3-4 years, placing it at risk of vulnerabilities. However, by reducing the attack surface in designing a feature phone, a phone could last 30-40 years, if not 50. This could also encourage users to maintain their devices for much longer, rewarding users for their preservation, rather than rewarding conspicuous disposal culture (the last stage of the cycle of conspicuous consumption).

Italian American actors such as Espera Oscar de Corti (1904-1999) care just as much about the environment as natives. My ancestors were bombed by both Allied and Axis Powers, so I cannot imagine their ineffable reaction and effable indifference to any nation state that says one thing and does another.

There should a separation between the basic necessity of a phone, and a mobile device that today is primarily used to run apps. Yes, it is not always the case that someone may need to send a text to anyone locally or to use the call function. Apps are just as important as SMS & calls. However, in a bread and butter kind of way, texts and calls are important at the *local level.* For being able to communicate nearby is integral to a resilient network that can load share and develop overengineered redundancy with decentralized systems The disruptive innovation of IRC & VOIP certainly reduced the cost of a long distance call to the cost of maintaining the infrastructure, because it can now be done with off-the shelf components, if one really needed to. Thus just as important as a UBI, and universal and affordable housing, is a universal basic phone.

But just as important as the software is the hardware, and prioritizing energy independence at the portable level could be a more effective way at assisting users who possess such a phone from no longer needing to crowd a Starbucks or a library to charge their phone. They can do it wherever they are, provided there is sunlight. A user could treat a phone like a credit card, storing it in their wallet due to how thin it could be made (Just don't sit on your wallet or pack it with too many free guitar lesson coupons). Developing a long-lasting phone isn't so much longtermism and building a resilient network, so much as it is building an anti-fragile one.

"**Ubiquitous computing** (or "**ubicomp**") is a concept in software engineering, hardware engineering and computer science where computing is made to appear anytime and everywhere. In contrast to desktop computing, ubiquitous computing can occur using any device, in any location, and in any format. "The underlying technologies to support ubiquitous computing include Internet, advanced middleware, operating system, mobile code, sensors, microprocessors, new I/O and user interfaces, computer networks, mobile protocols, location and positioning, and new materials.

This paradigm is also described as **pervasive computing**,[1] ambient intelligence,[2] or "everyware".[3] Each term emphasizes slightly different aspects. When primarily concerning the objects involved, it is also known as physical computing, the Internet of Things, haptic computing,[4] and "things that think".

Before I delve into ubiquitous computing, I should emphasize that userspace apps like phone calls and texts are just one instance of the potential of the emergence of ubiquitous computing. The solar autarkic capabilities of ultra-low power microcontrollers represents one of the first commercially available instances of enough processing power to run human user interfaces without a battery. Microcontrollers with less than a Cortex M3 are unlikely to have much capability for an HMI (Human machine interface) outside of sensor networks and PLCs, Hardware designers such as EmCraft, who previously built uClinux on Cortex M4s, have also confirmed this. Thus the Ambiq Micro Apollo4's Cortex M4, and other FOSS SoC designs using MIPS, and low power RISC-V represents a way for developers to design circuits for individuals, and not just machines to compute ubiquitously. Meeting all energy autarkic requirements of ubiquitous computing first requires designing just the minimum amount of architecture and software to run singular apps (or a series of apps), so that computing requires far

less stationary charging (USB/AC outlet) or connectivity (Ethernet/Wifi)- as opposed to long-range wireless- 4G/LoRA, etc than fully featured multi-core chips used to run very large modern kernels.

A New Era of Solar Convergence & Multimedia-Deconvergence

The development of advanced multimedia and memory intensive software (apps that require more than 4MB of RAM), should be placed on a lower/non-priority in the initial development towards an autarkic userspace kernel, such as Symbian's EKA2. The development of EKA2 consolidated signal stacks (telephony) and Personal Information Management PIM stacks using a single processor core (Sales, 2005), forming a pillar of energy efficient design.

1.3.2.4 Personality layer

> We designed the nanokernel to provide just enough functionality to run a GSM signaling stack. The idea behind this was to allow mobile phone manufacturers to run both their signaling stacks and their personal information management (PIM) software on a single processor, providing considerable cost savings over the usual two-processor solution.

The UniSOC T117 appears to be one of the only commercially available phone chips (used in the Nokia 225 4G) in 2022 that eschews the multi processor SoC found in favor of a single core processor core which appears to use a single RTOS, which suggests it follows in the tradition of the Symbian OS era, if not being a spiritual successor (although not in a very transparent SDK). Of course these processors all use anywhere from 16-64MB of RAM, which is far more than what an Ambiq Apollo4 uses. Thus one approach would be to recreate the early EKA1-era Nokia 7650, being the first Symbian OS 6.1 S60 phone from 2001 which used just 4MB of RAM. However, with the EKA2 being released in 2005, it is not clear if the 7650 was using a two processor chipset.

Using just 104Mhz, a fully native port to Ambiq Apollo4 would not be impossible (it runs between 96mhz and 192mhz).

And for the real conclusion. https://semiengineering.com/a-power-first-approach/ :

“Are there enough people who care about this planet to make that a priority? As engineers, are we in some way responsible for the energy consumption of the products we create? I do see more people who care about these things, but I also see many technological advances that are a total waste of power, where the sole motivation is profit.”

“Albee described the inspiration for the title:

> I was in there [a saloon in New York] having a beer one night, and I saw "Who's Afraid of Virginia Woolf?" scrawled in soap, I suppose, on this mirror. When I started to write the play it cropped up in my mind again. And of course, who's afraid of Virginia Woolf means who's afraid of the big *bad* wolf . . . who's afraid of living life without false illusions. And it did strike me as being a rather typical, university intellectual joke.[8]

Who’s afraid of asking, not just what we can do for our foundry (e.g. SkyWater PDK) but what our foundry can do for my bespoke near threshold voltage interests?

““We are all now talking about systems of systems,” said Gupta. “As we look to these companies, we’re seeing they have a system of systems mindset. They’re not just talking chips. They’re talking chips in a software stack, plus the end system.”

“While these techniques may be led by one sector, interest is spreading. “The hyperscalers are motivated by one thing — power,” says Rob Knoth, product management director in Cadence’s Digital & Signoff Group. “The energy footprint of a data center is not something you can just hide. It is a very clear cost — the thermal impact, and carbon footprint. There’s a strong motivation. But if you look at something like an embedded system, especially with edge-based intelligence, there is a very different cost in terms of battery life. This trickle-down of technology, tools, and methodology means they are able to leverage those exact same things that the hyperscale customers are using, but they’re doing it in a much smaller footprint and much more fine-grain method and achieving their own benefits.”

What I’m reading from that above paragraph, is that this is the chance of a generation of environmental computer engineers to organize and develop new “system of systems”,

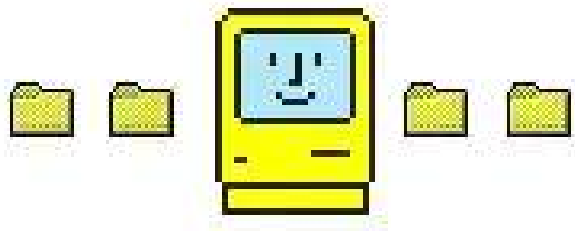
ones that integrate new energy sources, such as solar, low power displays, antennas, and an all-star team of low power PCB components instead of iterations of hyperscaling, which are more or less saving money for an establishment of datacenters and expensive chips, rather than lowering the barriers to entry and allowing this technology to trickle down into single or low-core chips consumer devices by those who ordinarily would need to charge their phones/laptops.

What's that you say? Oh, you didn't reach that same conclusion/product idea? Ah, yes, I know that, and I know why. The same was said about Gopher.

"The team, in 36-hour sessions fueled by beer, pizza, and speed metal, finished writing Gopher in about three weeks. They installed the first computer running a Gopher server — a Mac SE/30, a little droid of a computer with an iPad-size monitor built in — in a narrow hallway between their offices and the showroom, in a closet with metal shelves. It became known as the Mother Gopher.

The committee meeting where the team first presented the Gopher protocol was a disaster, "literally the worst meeting I've ever seen," says Alberti. "I still remember a woman in pumps jumping up and down and shouting, 'You can't do that!' "

Among the team's offenses: Gopher didn't use a mainframe computer and its server-client setup empowered anyone with a PC, not a central authority. While it did everything the U required and then some, to the committee it felt like a middle finger. "You're not supposed to have written this!" Alberti says of the group's reaction. "This is some lark, never do this again!" The Gopher team was forbidden from further work on the protocol."



Oh, I see, you didn't want that technology to end up in layman's devices. You wanted this big server, maybe because you're insecure? That's what I'm reading. I'm not

assuming, I'm psychic. Just kidding. A wise person once said, "there is a fine line between awkwardness and creepiness".

But I can say that Russell Brand is psychic. It takes one to know one: There was a video where a news anchor squeezed her water bottle; he noticed, and she freaked. Brand's lexicon suggests he is a modern day Chaucer or Shakespeare.

Another wise person once said, that it's not about desensitizing, but *re-sensitizing.* If a $75,000 education programmed you to ignore low signal to noise ratios, then desensitization is only going to have situational awareness of what's in the box. A good institution would teach you quite the opposite-consider *all* signals, however weak. The lack of detecting a signal depends on the sensitivity of the instrument, rather than the stimuli/particle. The above Lara Bingle "The Project" interview covers that- if you watch the whole interview. Some things can't be quantized. It requires intuitive instinct, and in some cases, a really good nose. There also isn't a huge job market for psychics and mystics; the elimination of the Romanov family in 1917 eliminated the position of Rasputin. Jim Joe Kelly's funding ran out quite quickly, at $500k/week.

Another thing I noticed about Brand's videos are, his appearances are entirely improvised. It takes wit to invent clever quips; which makes me wonder- how frequent

others choose to live a life according to notecard-prepared dialogue.

Earthbound for SNES was a rare example of eccentric mainstream success. Taming/Normalizing a hippie? The absurdity of the idea made it no less fun.

If you remember the 90s, you *were* there. Not everything fits in a box; This has been known for decades. Why then, is society pre-occupied with commercializing things that fit in a box? Outliers serve society no less than things that fit in a box.

Hacker philosophy can be found here. This is one of those cases where primary sources are really, really important.

“The whole GNU project is one big hack” at 1:21:00":

Revolution OS - 2001 - Multilingual (16 languages)

Skateboarders who do tricks, are also like hackers of other skater's tricks: https://www.ted.com/talks/rodney_mullen_pop_an_ollie_and_innovate

Rodney Mullen: Pop an ollie and innovate!

“First they ignore you, then they laugh at you, then they fight you, then you win.

Mahatma Gandhi”

Am I being ignored? I don’t know. Am I being laughed at? I don’t know. Does it matter? I don’t know.

Reconciling the cognitive dissonance of old and new:

https://github.com/readme/featured/vintage-computing “What we can learn from vintage computing” “Thanks to open source, no technology ever has to become obsolete, so long as a community remains to support it”

17 Equations That Changed the World
by Ian Stewart

1.	**Pythagoras's Theorem**	$a^2 + b^2 = c^2$	Pythagoras,530 BC
2.	**Logarithms**	$\log xy = \log x + \log y$	John Napier, 1610
3.	**Calculus**	$\frac{\mathrm{d}f}{\mathrm{d}t} = \lim_{h \to 0} = \frac{f(t+h) - f(t)}{h}$	Newton, 1668
4.	**Law of Gravity**	$F = G\frac{m_1 m_2}{r^2}$	Newton, 1687
5.	**The Square Root of Minus One**	$i^2 = -1$	Euler, 1750
6.	**Euler's Formula for Polyhedra**	$V - E + F = 2$	Euler, 1751
7.	**Normal Distribution**	$\Phi(x) = \frac{1}{\sqrt{2\pi\rho}} e^{\frac{(x-\mu)^2}{2\rho^2}}$	C.F. Gauss, 1810
8.	**Wave Equation**	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	J. d'Almbert, 1746
9.	**Fourier Transform**	$f(\omega) = \int_{\infty}^{\infty} f(x) e^{-2\pi i x \omega} \mathrm{d}\, x$	J. Fourier, 1822
10.	**Navier-Stokes Equation**	$\rho\left(\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla \mathbf{v}\right) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}$	C. Navier, G. Stokes, 1845
11.	**Maxwell's Equations**	$\nabla \cdot \mathbf{E} = 0$ $\quad \nabla \cdot \mathbf{H} = 0$ $\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}$ $\quad \nabla \times \mathbf{H} = \frac{1}{c}\frac{\partial E}{\partial t}$	J.C. Maxwell, 1865
12.	**Second Law of Thermodynamics**	$\mathrm{d}S \geq 0$	L. Boltzmann, 1874
13.	**Relativity**	$E = mc^2$	Einstein, 1905
14.	**Schrodinger's Equation**	$i\hbar\frac{\partial}{\partial t}\Psi = H\Psi$	E. Schrodinger, 1927
15.	**Information Theory**	$H = -\sum p(x) \log p(x)$	C. Shannon, 1949
16.	**Chaos Theory**	$x_{t+1} = k x_t (1 - x_t)$	Robert May, 1975
17.	**Black-Scholes Equation**	$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$	F. Black, M. Scholes, 1990

On a deeper level, both software,, programming languages, and microprocessors operate on instruction sets, which are algorithms. Is anything really old, if our machines depend on equations that are nearly 1500 years old? While it doesn't make marketing sense to advertise a product that Pythagoras' Theorem was used in a CAD file to produce a laptop chassis, consumers have no problem staring at a beer bottle that says "Since 1818" or "Since 1887," imagining they are in some all-wooden English tavern where everyone knows your name.

Fear and Loathing in Silicon Valley

A Savage Journey to the Heart of the American Foundries

If anything, bespoke silicon is revealing that FOSS and open silicon is a potentially true disruptive innovation, community efforts can make progress to bridge the Digital Divide faster than complicated IP packages with red tape can.

If you enjoyed this post, don't subscribe. Contact your Congressman or Congresswoman and ask them to support solar powered phones.

If I really was a “tankie”, which sounds like a term used by someone who grew up from late Millennial and Gen Z era, with anthropomorphized Transformer movies by Michael Bay may have indirectly suggested, you would have to listen to this speech in the hot Havana sun. Hope you brought a lawn chair, if the government stipend allows you to afford one. Plus this technology would make it harder to censor anyone or control their power supply, contradicting Tankie tracks of thought. One additional way to empower a community’s social media is to literally empower their devices and mobile servers. Every tangent that I liberally took in the post was taken to lead back to this point.

***Don Delillo warned against novelty intellectualism. A bit presumptuous that *homo sapiens* is physiologically adapted to accept the graft donation of high bandwidth 16-bit color+ through several generations of express speeds in less than a century of evolutionary adaptation to the ophthalmologic tolerance to artificial LED emissivity. Strunk and White was consulted for this obfuscatory footnote.**

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