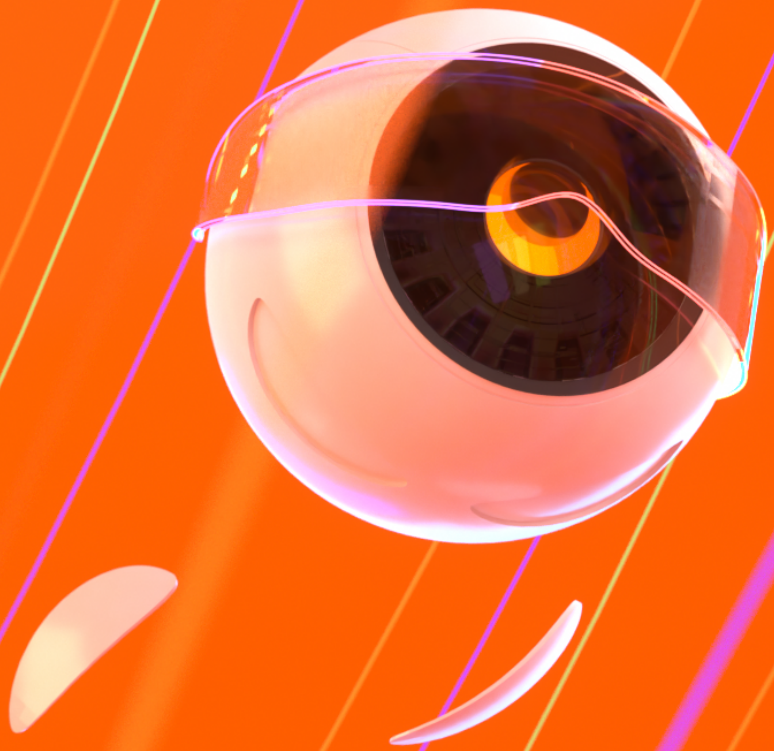
Investment Recipes

by AtonRā Partners



21 OCTOBER 2020

21 OCTOBER 2020

AtonRâ Partners

AtonRâ Partners SA
www.atonra.ch

research@atonra.ch
+41 22 906 16 16

7, rue de la Croix d'Or
1204 Geneva | Switzerland

On the Menu

DATACENTER SILICON CONTEST, A NEW ROUND

Datacenters Offer Huge Opportunities For Chips

Warehouse-scale computing machines have become ubiquitous

Hyperconverged infrastructures and warehouse-scale datacenters enabled the everything-cloud tsunami that transformed the IT world. They are based on virtual blocks of pre-configured servers with full hardware and software stacks in standardized form-factors (racks of servers).

- The main beneficiary of this trend has been Intel, which has captured disproportionate value - operating margins around 50%, with more than 95% of the server processor market.

Composable disaggregated infrastructures change the rules

The status quo is challenged by the emergence of new use-cases and novel accelerated computing chips, driving the next wave for the datacenter – where computing resources are allocated dynamically to built-on-demand virtual servers.

- Such architecture offers much lower operating expenditures, thanks to an almost optimal power efficiency (0.5x the power of current datacenter) and lower maintenance costs (technician time divide by 5).

Opportunities for new chip architectures and silicon players

With the enablement of new chip architectures and an evolving role for microprocessors, disaggregated infrastructure opens opportunities for current and emerging chip players to capture large returns.

- Nvidia, Marvell and Broadcom could be the most likely beneficiaries.
- AMD's strong dynamic to continue thanks to chiplet and potential Xilinx deal.

SOURCE:
Mayasimulation / CC BY-SA

The Divergence Of Convergence

A digital world, from edge to core

The global datasphere is expected to grow to 175 zettabytes in 2025, with more data being created and consumed, both at the edge (IoT) and at the core (Cloud).

- Public clouds will process, store and deliver 25% of this data deluge.
- By 2025, more than a quarter of data created in the global datasphere will be real time in nature, with >95% of it being IoT data.

Datacenters for massive and diverging needs

Composable infrastructure is a way to increase resource utilization and performance by assigning resources to an application from disaggregated pools of compute, storage, and networking resources. More sophisticated offerings deliver GPU, FPGA, network and storage memory accelerators that can also be provisioned as needed.

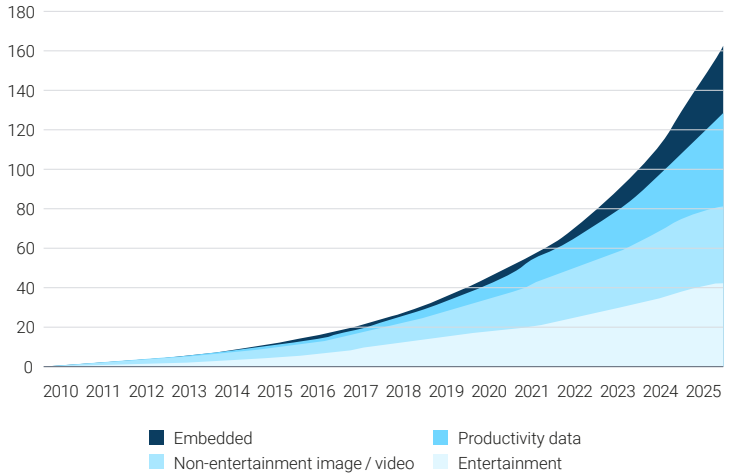
- IDC estimates that the composable data center will grow at a 58% CAGR, reaching $4.7bn in 2023.

Disaggregated servers drive datacenter efficiency and profitability

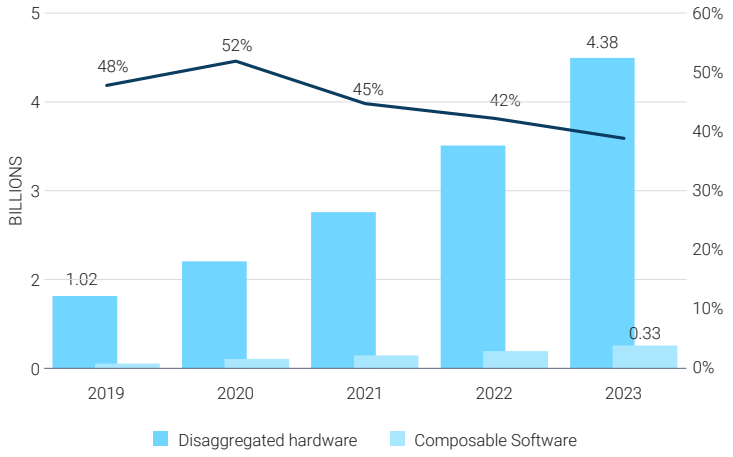
To meet service level agreement (SLA) requirements, enterprise infrastructure is typically overprovisioned, underutilized, non-compliant and lacking agility, allowing for configuration optimization and liberation of unused resources, increased reliability and lower maintenance costs.

- Intel's disaggregated servers feature the world's lowest power usage effectiveness (using less than half the power of typical US datacenters).
- Intel cut refresh costs by >44% and technician time by 77%.

GLOBAL DATA CREATION BY TYPE

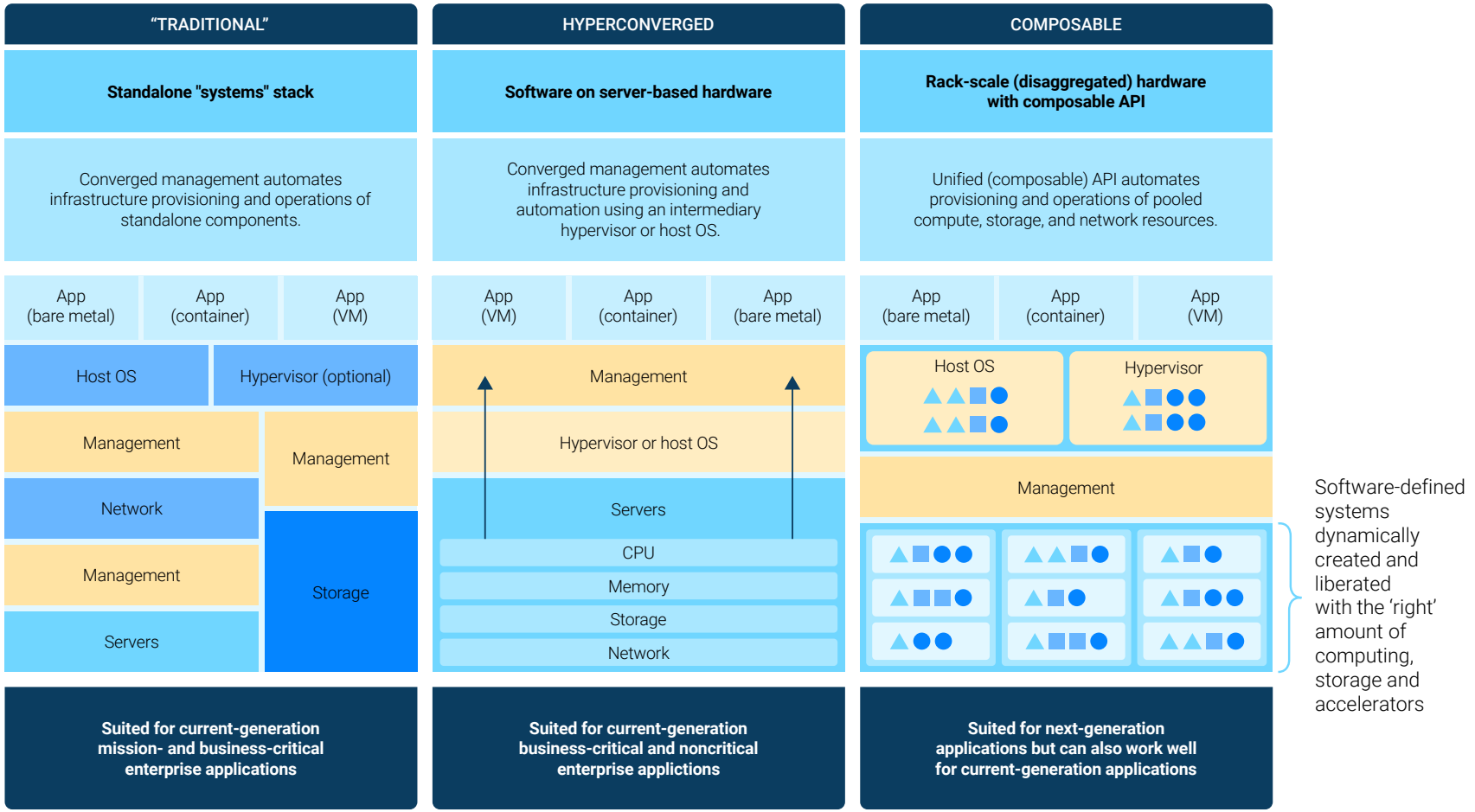


WORLDWIDE COMPOSABLE/DISAGGREGATED INFRASTRUCTURE REVENUE



SOURCE:
IDC - Worldwide Composable/Disaggregated Infrastructure Forecast, 2018–2023
IDC - Data Age 2025 & "Power Issues in the Datacenter: IDC Survey Results"

Traditional, Hyperconverged, and Composable / Disaggregated Infrastructure



SOURCE:
IDC - Worldwide Composable/Disaggregated Infrastructure Forecast, 2018–2023

An Alphabet Of Processing Units

GPU – pioneering the accelerated datacenter era

The GPU (Graphics Processing Unit) has transformed artificial intelligence by enabling deep learning (see our previous Investment Recipes) and has seen massive demand for cloud instances over the last 10 years.

- According to Gartner, the server GPU market continues to expand at more than 20% CAGR, driven by data science, analytics and graphics.

Field Programmable Gate Arrays (FPGAs) - a force to reckon with

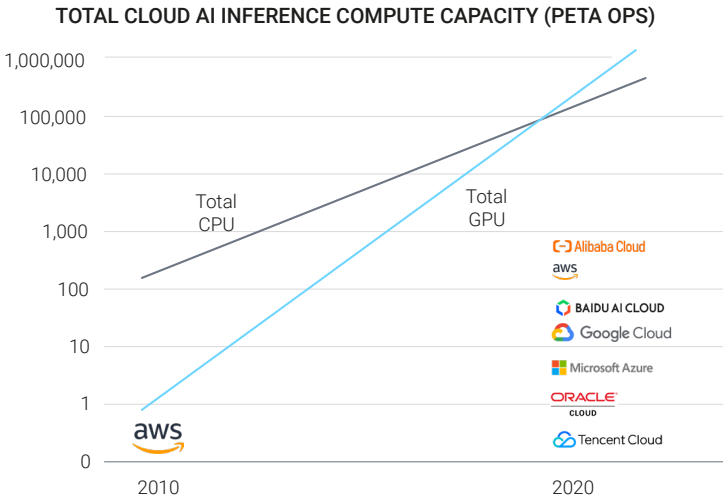
As the CPU is continuously replaced by GPU for artificial intelligence workloads, the FPGA has proven to be a formidable competing approach and has demonstrated the flexibility and performance to accelerate a wide range of workloads.

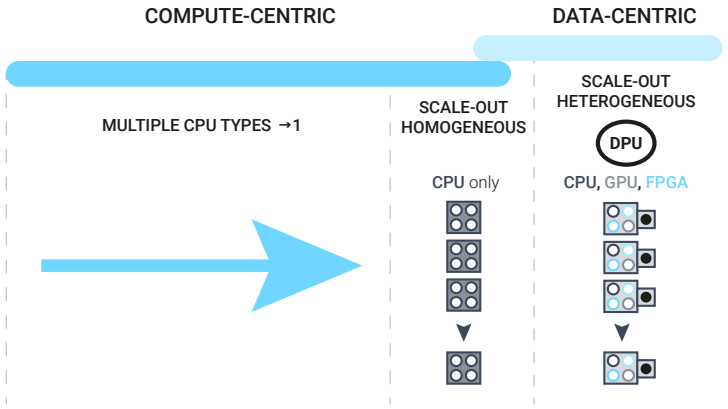
- Genome pipeline algorithms leveraging AWS' FPGA instances replaced up to 80 traditional compute instances and associated costs with just one EC2 F1 instance.
- Alibaba e-commerce platform achieved ~50% reduction in query times using FPGA.

DPU (Data Processing Unit) revolutionizing the data center

The last decade has seen an explosion in the amount of data moved, stored, retrieved and microprocessors are not the best architecture to orchestrate such workloads, hence we believe that DPUs will transform the datacenter world.

- As per Fungible, DPUs perform data-centric computations 10x more efficiently than general-purpose CPUs, improving 2x the server performance per unit power.
- Nvidia claims that a single BlueField-2 DPU can deliver the same data center services as 125 CPU cores – and presented an aggressive roadmap in October.





SOURCE:
Nvidia - GTC October 2020
Fungible DPU / Nextplatform - Staking The Claim For The Real DPU

A New Breed Of Server Microprocessors

How many cores can you cram into a CPU ?

As the datacenter infrastructure becomes disaggregated, the CPU has a less central role and can leverage multiple accelerated computing cores (following the trends of GPUs and artificial intelligence accelerators).

- AMD introduced the concept of 'chiplet' to deliver the Epyc server chips with 64 cores, moving its server market share from 1% to 10% in less then 3years.
- ARM just presented the N2 cores, opening the way for 128 cores server CPU.

Raw computing performance for everyone

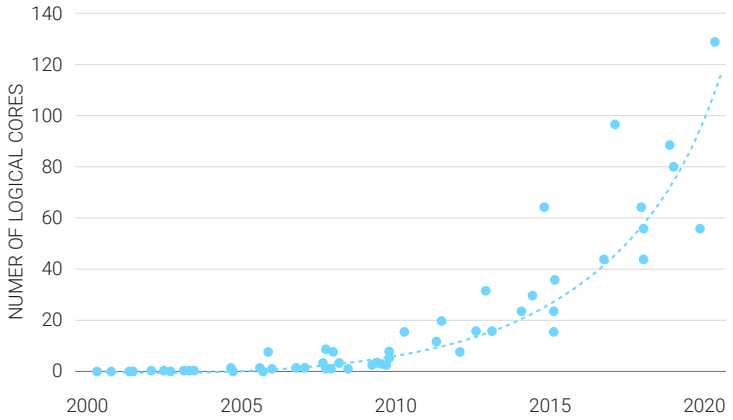
Cloud service providers and infrastructure companies have new opportunities to mix and match microprocessors and computing architectures.

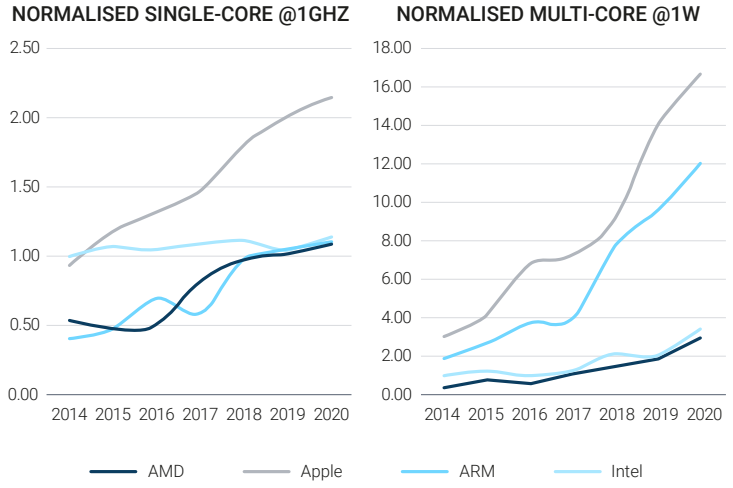
- AMD and ARM have caught up in the last 3 years on Intel's raw computational performance (see single-core performance @ 1Ghz).
- Forthcoming ARM server roadmap will provide an additional +50% performance increase at constant power, enabling new players (Marvell, Nvidia).

Power efficiency at the forefront

As the power envelope of servers and datacenters remain constrained new microprocessor architectures will emerge to offer increased efficiency.

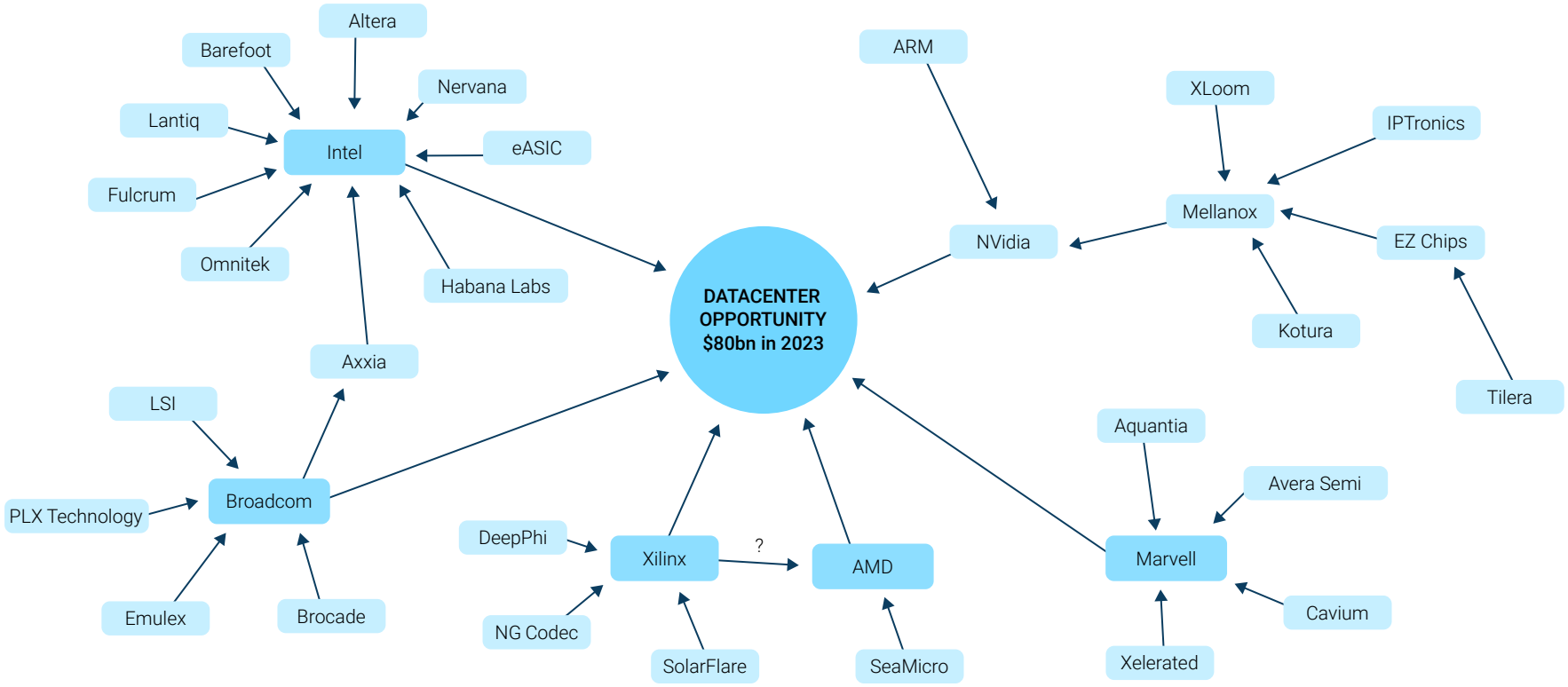
- Nuvia Inc. presented the Phoenix computing cores which could cut the server core power by a factor of 10 (such gains being already demonstrated by Apple).
- Amazon Graviton2 and Ampere Altra server chips (ARM-based) demonstrated 40% gain in the cost of computing when compared to incumbent AMD and Intel server chips.





SOURCE:
AtonRâ Partners, K. Rupp, GeekBench, Companies

Datacenter Bonanza Drives Semiconductor Players Consolidation



FURTHER READINGS:
AMD and Xilinx merging to create a formidable datacenter player / Nvidia buying ARM to create the dominant ecosystem for distributed Artificial Intelligence

SOURCE:
Datacenter Market: NVIDIA estimates, Arm estimates, incorporating data from Counterpoint, Dell'Oro, Gartner, IDC, IHS, and Strategy Analytics

Catalysts

- **Composable infrastructure.** Datacenter has proven to be both a growing and profitable market for semiconductor companies. A new architecture is emerging and growing very fast (expected above 50% YoY in 2020).
- **Merger and acquisitions.** Intel has created a superb datacenter business with a relentless acquisition strategy to become the datacenter one-stop shop. Nvidia acquisition of Mellanox and ARM transforms this landscape.
- **ARM-based server processors.** ARM is finally ready for primetime in the server space as demonstrated by Nvidia acquisition, the announcement of the V1/N2 Neoverse roadmap and multiple industrial validation (Amazon, Ampere, Marvell).

Risks

- **Datacenter industry inertia.** Despite the explosive growth of cloud data and computation needs, the global server market is expected to grow single digit with legacy infrastructure remaining dominant.
- **Intel ecosystem strength.** Although incumbents demonstrated return-on-investment for their customers, Intel is still offering solutions than can hardly be matched and will react to threats on its margins.
- **US-China trade tensions.** The datacenter business is currently dominated by US players. Yet, Chinese giants (Baidu, Alibaba, Huawei, Lenovo) have made significant inroads and are looking to leverage local production, whose strategic value increases with geopolitical tensions.

Bottom Line

- Composable disaggregated infrastructure is growing fast and redistributing the cards between chip players and architectures in datacenters. We see Nvidia as best positioned to leverage this trend, with Marvell as a wildcard. AMD acquisition of Xilinx would create a leader in the global and composable infrastructure market. Amazon (AWS) is winning on both sides with proprietary silicon and improved price/performance ratios.
- Semiconductors players can dent into Intel's datacenter server processor monopoly (more than 95% of the server market, operating margin around 50%). Yet, Intel breadth of intellectual property is still unmatched in the industry, so we expect additional mergers and acquisitions to be necessary in reshaping the competitive landscape. We are looking to increase our exposure to the sector across our portfolios.

Companies mentioned in this article:

Amazon (AMZN US), AMD (AMD US), Apple (AAPL US), Broadcom (AVGO US), Intel (INTC US), Marvell (MRVL US), NVidia (NVDA US), Xilinx (XLNX US)

IS VIRTUAL REALITY DEAD?

VR At An Inflection Point And Very Much Alive

Virtual reality will not repeat the lifecycle of 3D

As we already wrote in a previous issue, the augmented and Virtual reality (AR/VR) industry is likely to have a significant impact, especially in the education and retail sectors. Today we revisit some of those trends and remain convinced that VR will not flatline like 3D, because we see this technology as having a lot of potential.

- Currently consumer interest towards AR/VR is so thin, that a single VR game release is enough to create a considerable spike in the interest for the overall sector.
- However, the true interest and demand come behind the scenes from the well-established companies that are fully embracing the technology in day to day life.

New trends are emerging and are there to stay

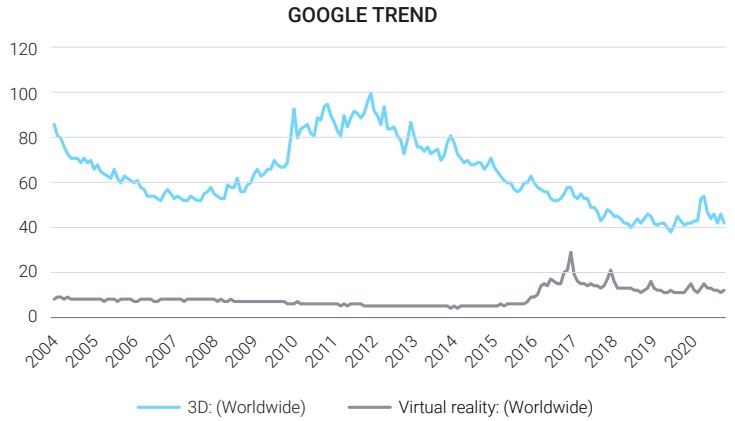
AR/VR is years away from being widely used, but technological innovations and new use cases accelerate the market growth and investments in the space.

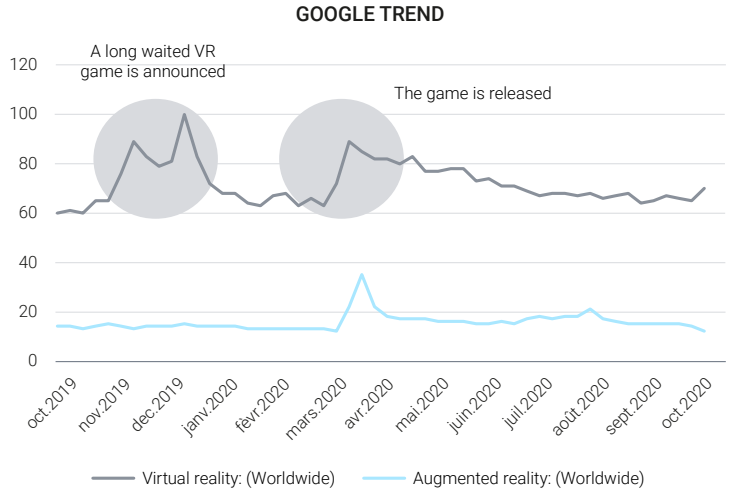
- Car manufacturers are more heavily using Artificial Intelligence and AR (e.g. through head-up displays) to display critical information in an easily digestible manner.
- Healthcare and Biotechnology, followed by Engineering and Manufacturing are also starting to adopt the technology.

VR industry is on a reasoned path to growth

After erroneously expecting that over a third of the population will be using VR by 2020, everyone is starting to realize that the true industry potential lies beyond initial hyped applications such as VR gaming, VR shopping, or VR real-estate walkthroughs.

- Walmart and Tyson rely on AR training to teach workers compliance by making them identify safety issues in augmented-reality environments.
- According to ABI Research, AR-based training is a $6bn market opportunity for 2022.





SOURCE:
AtonRâ Partners, Google trends, ABI Research

AR/VR Will Not Repeat The Lifecycle Of 3D

AR/VR market to gain momentum

The main source of interest for AR/VR is content creation and photo-realism. Specifically, the AR market is boosted by better camera sensors and hardware acceleration which overlays higher quality digital content on real-world images.

- The global AR/VR market has grown 141x in the past 5 years and is expected to additionally increase 10x over the next 5.
- About 22.8mn AR headsets are projected to be used by 2021. The user base for AR is also expected to grow beyond 1bn by 2021, with 8.5% coming from the US.

Smartphone compatibility is the main source of growth for AR

The easiest and most affordable way of using AR for consumers is through any smartphone equipped with a camera. No additional equipment is required to allow customers to experience AR and companies to acquire clients at reduced cost.

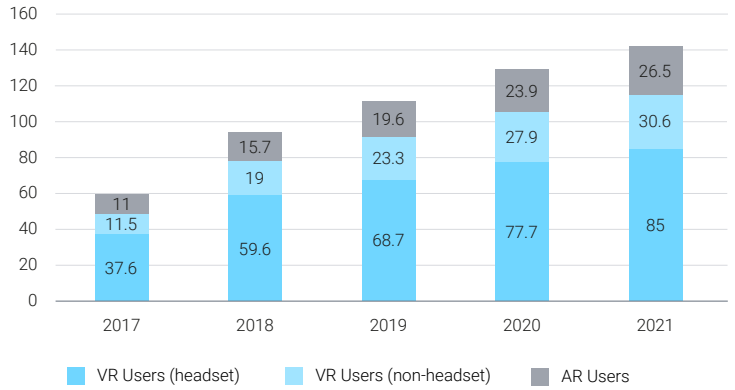
- Following Apple's example, new smartphones are supplied with graphical processing units and neural chips for dedicated AR support.
- Everyone is working towards higher resolution cameras with sensors to precisely estimate 3D space to allow for better quality content and AR execution.

Gaming is still a growth market

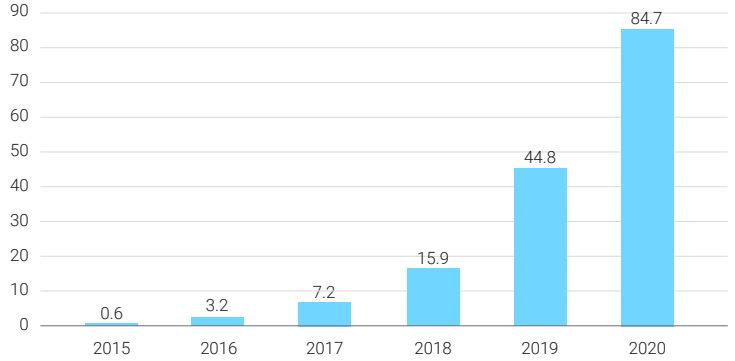
Consumer acceptance of AR/VR games is inversely proportional to the headset pricing. Economies of scale made most headsets affordable for an average consumer to benefit from the latest technology.

- According to Ericsson, two thirds of gamers would like to try immersive AR gaming.

US VIRTUAL REALITY AND AUGMENTED REALITY USERS



AR/VR HEADSET SALES REVENUE $BN



SOURCE:
AtonRâ Partners,
Augmented Reality Market Size - Growth, Trends, and Forecasts (2020 - 2025),
9 Augmented Reality Trends to Watch in 2020,
Augmented, virtual and mixed reality headset sales revenue worldwide from 2015 to 2020

New Hot Trends In The AR/VR Space

Catering to the elderly and the disabled

Artificial intelligence and VR alter the way disabled and old people navigate and experience the world. Anyone may now feel sensations they could not feel before.

- Virtual Reality Exposure Therapy may be used to treat conditions such as depression, post-traumatic stress disorder, panic disorder, phobias, and anxiety.
- For people with Intellectual Disability VR helps teach living skills, while functional disabilities may be stimulated with VR controllers, e.g. Xbox Kinect.

Virtual freedom after physical lockdown

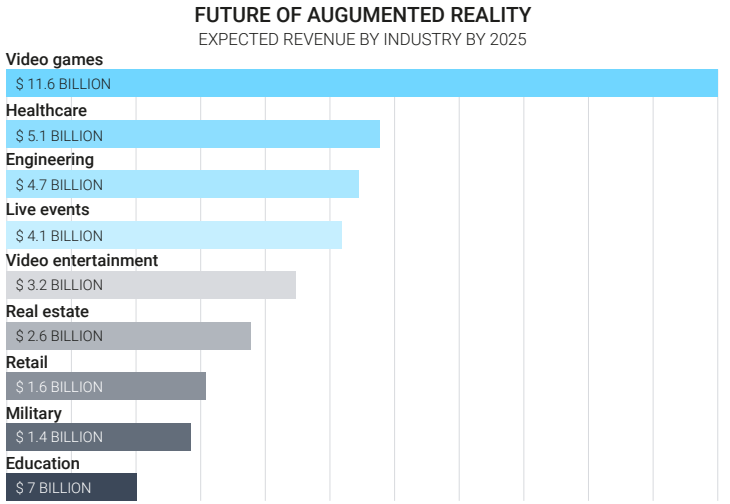
Firms worldwide are trying to find ways how to help their teams communicate both within the organization and with their clients. COVID-19 has been an important catalyst to accelerate AR/VR adoption.

- In June 2019, Seiko Epson introduced Moverio Assist Tool that utilizes smart glasses to deploy AR remote assistance for small teams and end consumers.
- In March 2020, RealWear enhanced their HMT-1 smart glasses by integrating Microsoft Teams, so industrial workers can use both hands while collaborating.

Interacting with your future home

Designers, architects, and civil engineers may finally “touch” and confirm their models and designs before signing their project off for production. Previously, slight mismatches in fit or form would require tedious and expensive readjustments.

- Solidworks can currently use AR technology to display 3D models in real-world settings. This helps designers get a feel of their models in the actual environment.



SOURCE:
AtonRâ Partners,
Does Virtual Reality Have a Future in Engineering?,
How Artificial Intelligence and Virtual Reality Benefit the Elderly and Individuals with Disabilities
Image: Usage of AR and VR within heavy industry

On A Clear Path To Growth

Indoor navigation

The hottest trend and use case for AR is indoor navigation, e.g. finding a classroom on campus, or a specific product in a shop. The headwind that needs to be overcome is battery life. The load from the camera module and hardware processing by neural chips allows for a very limited operational time.

- Current indoor tracking systems such as Apple Indoor Maps or Bluetooth beacons are in 2D space, have an accuracy of 3-8m and are hard to set-up, but are cheap.
- New Visual recognition and 3D/AR fusion spacing technology operates in 3D with an accuracy of 10-30cm, is highly usable, but is also extremely expensive.

Market is gaining competitiveness

Many companies, comfortable with their designs and AR/VR products, are starting to secure new contracts and target new markets. It is early for a full-scale consolidation and M&A cycle, thus partnerships remain the main source for scaling sales growth.

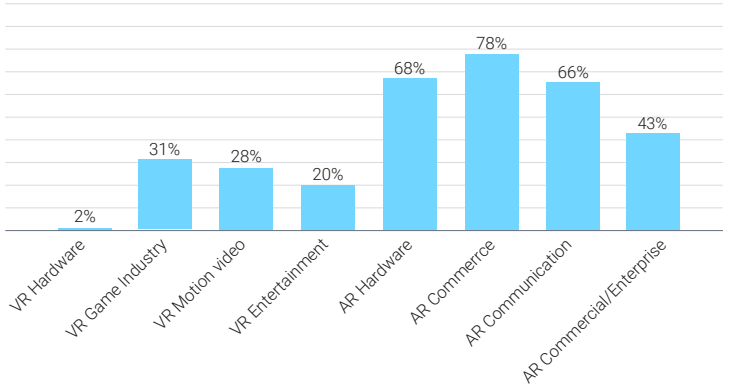
- Companies like Meta, Vuzix, RealWear, are partnering with large established firms such as Porsche, SAP, Caterpillar, Google, Epson, and Toshiba to boost their sales.

Long-term outlook is very optimistic and promising

The AR/VR technology did not meet initially inflated expectations of large adoption by consumers due to various reasons such as pricing, quality, comfort, etc. The COVID-19 pandemic further slowed growth, but the industry has regained momentum.

- The number of job posts for AR/VR engineers has jumped 1400% in 2019.
- Most software engineers predict the enterprise sector will reap the benefits of AR/VR in the next 5 years, and half of them will learn this skill in 2020.
- Slowed by COVID-19, the AR/VR market is back on track to grow at 56% 5Y CAGR.

GROWTH OF VARIOUS AR/VR APPLICATIONS (%), GLOBAL (2020-2025)



SOURCE:
AtonRâ Partners,
Pandemic Tempers Growth in AR/VR Spending, but the Long-Term Outlook is Positive, says IDC
Image: Why Augmented Reality-based Indoor Navigation Is a New Trend in AR Development

Catalysts

- **Affordability.** Cheaper AR/VR technology will drive increased adoption in existing sectors and open doors for AR/VR adoption in less obvious sectors such as engineering or real-estate.
- **Proven track record of use-cases.** Enlarging currently limited use cases will boost interest towards AR/VR.
- **Full "embodiment".** A concept introduced years ago is still set to see the light. Embodying a virtual avatar which will be able to shop, interact, and legally represent a human being in virtual space will make VR a necessity.

Risks

- **Shortage of content.** Lack of studios and firms producing valuable and useful content will kill all the remaining demand and hype for the technology, e.g. lack of VR games, movies, educational apps.
- **Premium pricing.** AR/VR devices still fail to capture mass audience like 10 years ago. For the same money consumers, who can afford VR, are getting only more comfortable headsets with marginally better-quality screens.
- **Low-quality content.** Given that "realism" is the keyword for the technology to get any traction, unrealistic and low-quality content due to subpar technical implementation would make VR useless.

Bottom Line

- AR/VR industry has faced a lot of headwinds on its way to where it is now. Slowed investments due to COVID-19 did not help, but as the market enters the plateau of disillusionment both users and investors start to see the full potential of this innovative technology. The market is expected to beat the forecasts and grow 10-fold by 2025 growing at a 5Y CAGR of 56%.
- New hot trends such as indoor navigation, AR-training, and VR-meetings are gaining traction and providing the whole industry with much needed momentum. To capture the ensuing growth we already have some exposure to AR/VR players in our AI & Robotics portfolio, and we are constantly monitoring for newly listed and promising entrants to add exposure to the sector.

Companies mentioned in this article:

Alan (not listed), Apple (AAPL US), Caterpillar (CAT US), Google (GOOG US), Meta (not listed), Microsoft (MSFT US), Porsche (PAH3 GR), RealWear (not listed), SAP (SAP GR), Seiko Epson (6724 JP), Solidworks (not listed), Toshiba (6502 JP), Tyson (not listed), Vuzix (VUZI US), and Walmart (WMT US)

BRAIN-MACHINE INTERFACES

A Clinical Revolution In The Making?

A technological breakthrough

Brain-machine interfaces (BMI), or brain-computer interfaces (BCI), are the outcome of multidisciplinary innovations, ranging from semiconductors to neuroscience through artificial intelligence (AI).

- BMIs use sensors to read brain activity and transform the signal into specific commands sent to an effector device (e.g. a robotic arm).
- BMIs are still at an early-stage, but developers aim for long-term recordings and use in real-life environments.

The future treatment of brain-related diseases?

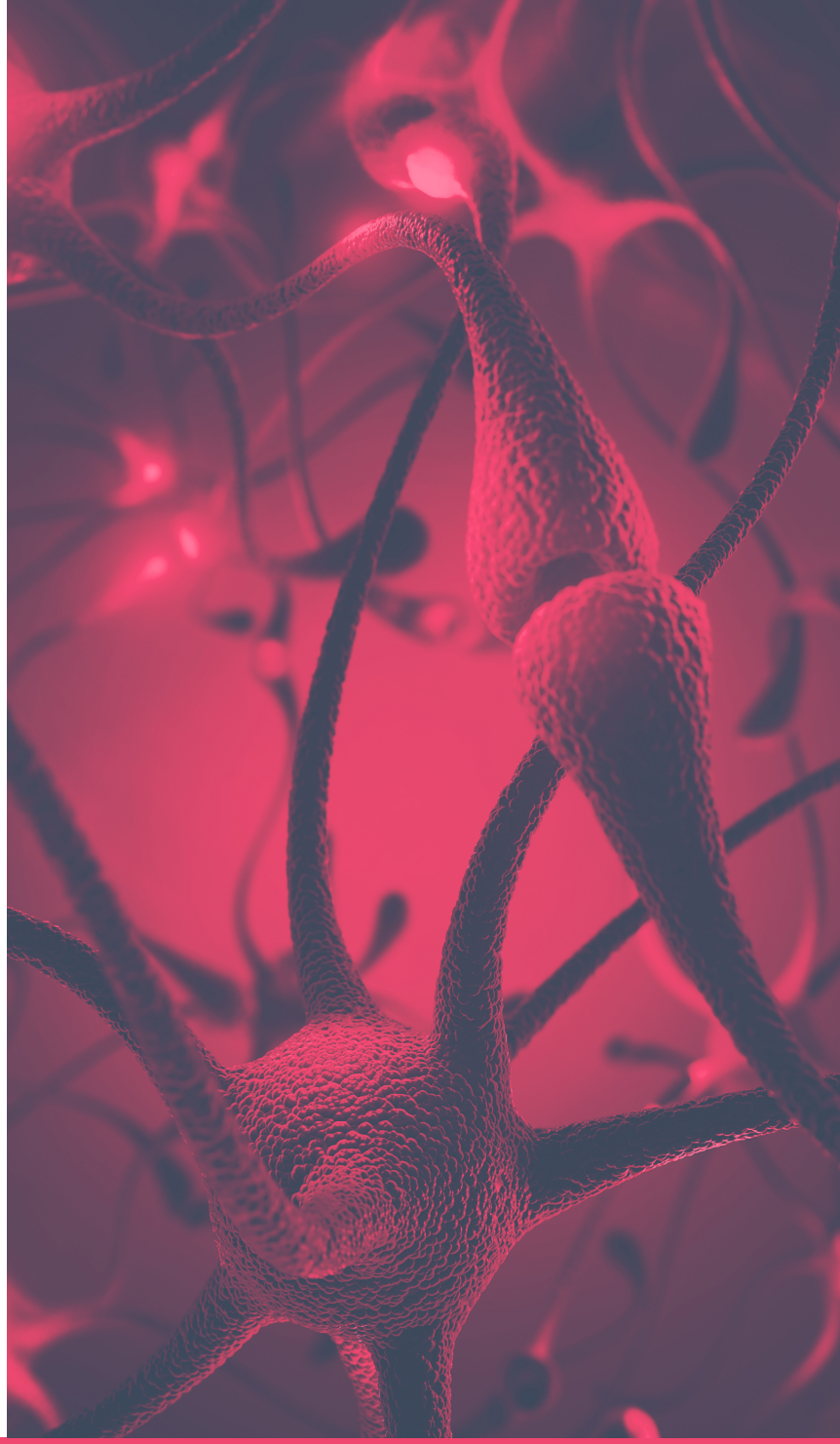
BMIs are expected to have an important impact in the understanding of the human brain and the treatment of its diseases in the coming decades.

- Technological improvement in reading (and eventually writing) the brain will increase our understanding of brain functions.
- BMIs could enable paralyzed people to move again and control objects with their mind. They will also play a major role in the early detection of brain disorders.

BMIs development should be a marathon not a sprint

BMIs result from the integration of multiple technologies that are at different stages of maturity, challenging standardization and compliance. Manipulating the brain is rising ethical, legal and social questions.

- Standards and regulations may slow down development, but they are unavoidable in order to bring BMIs to the market.
- Neurosensors should be as safe as possible and therefore minimally invasive.



The Brain

The Nervous System

The Nervous System (NS) represents the body electrical wiring and is divided into two main parts: the Central Nervous System (CNS) which includes the brain and the spinal cord, and the Peripheral Nervous System (PNS) consisting of the nerves spreading along the entire body.

- The brain controls most of the activities of the body, processes the information received from the environment and acts on decisions through instructions it sends to the rest of the body.

The brain: the most complex organ

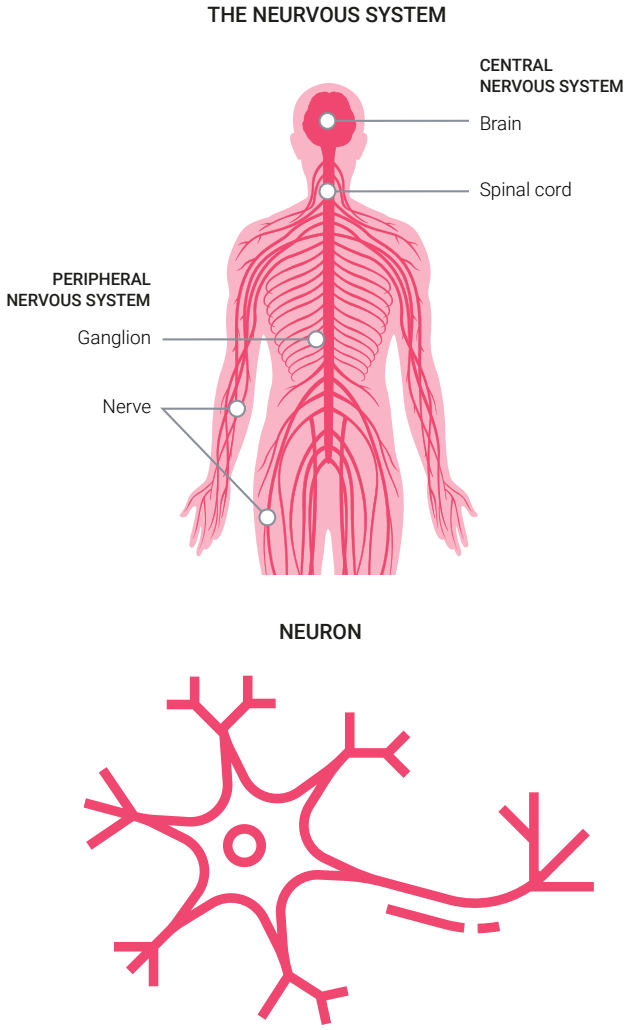
The brain is the most complex organ of the human body and is composed of billions of interconnected neurons. Centuries of study have provided an increased understanding about how the human brain works. However, most of its mechanisms remain yet unknown.

- Scientists are currently mapping the neural circuitry, to get a dynamic picture of the brain in action.

Neurons, the functional units of the brain

Brain signals are, at a microscopic scale, the electrical and biochemical activity of neurons firing to communicate between them in order to produce our thoughts, movements or consciousness.

- Neural activity can be measured through different techniques.
- Brain-machine interfaces set a direct communication link between the brain and an external device.



The Technology

Neural signal acquisition

Most BMI systems rely on EEG* or intracortical electrode arrays to record electrical activity of neurons at work. Other neurosensors like fMRI** give a better signal than EEG but are bulky and very expensive.

- There is an increasing interest to develop neurosensors allowing long-term recordings and usability in real-life environments.
- Emerging technologies like fNIRS***, neural dust (iota Biosciences) or stentrodes (Synchron) are strong candidates for the development of future BMI sensors due to their low-cost, wearability and low invasiveness.

Brain signal processing

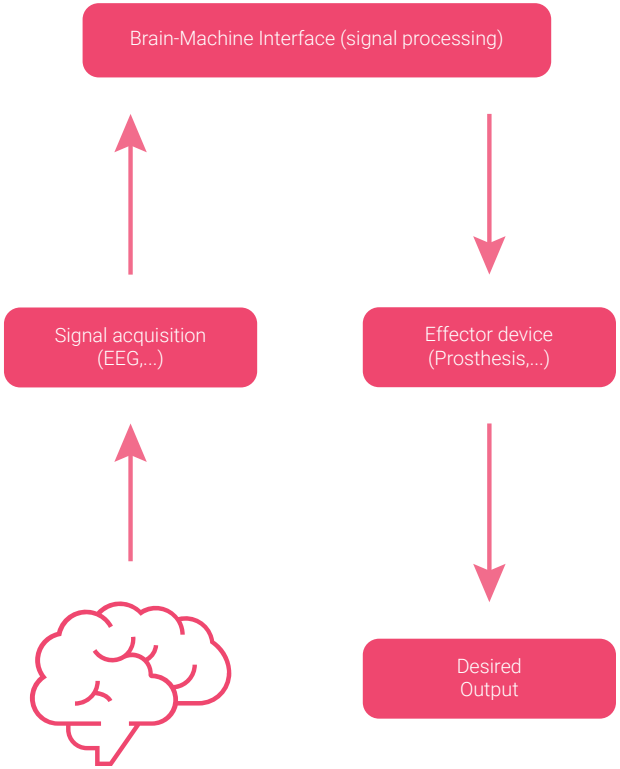
Raw recorded brain signal is generally noisy and hard to interpret. BMIs are using artificial intelligence (AI) and machine learning algorithms to remove the noise and translate signals into actionable ones.

- Improvement in AI and semi-conductors allow for a fast and real-time signal processing as well as a wireless signal transmission.

Effector devices

Our thoughts can be used to control different devices like computers, prosthetics or to modulate the internal brain environment. The technology will have huge implications in the medical field enabling paralyzed people to perform everyday tasks or as a diagnosis tool for brain dysfunctions.

- BMIs, such as developed by BrainGate, allow the use of brain activity to control objects in a user's environment and communicate via a computer.



* Electroencephalography
** Functional Magnetic Resonance Imaging
*** Function Near-Infrared Spectroscopy

The Technology

NON-INVASIVE TECHNOLOGIES

Recording technologies
Stimulating technologies
Recording and stimualting technologies

EEG
Electroenceph-alography

MEG
Magnetoen-cephalography

fMEG
Functional magnetic resonance imaging

fNIRS
Functional near-infrared spectroscopy

MMG
Mechanomy-ography

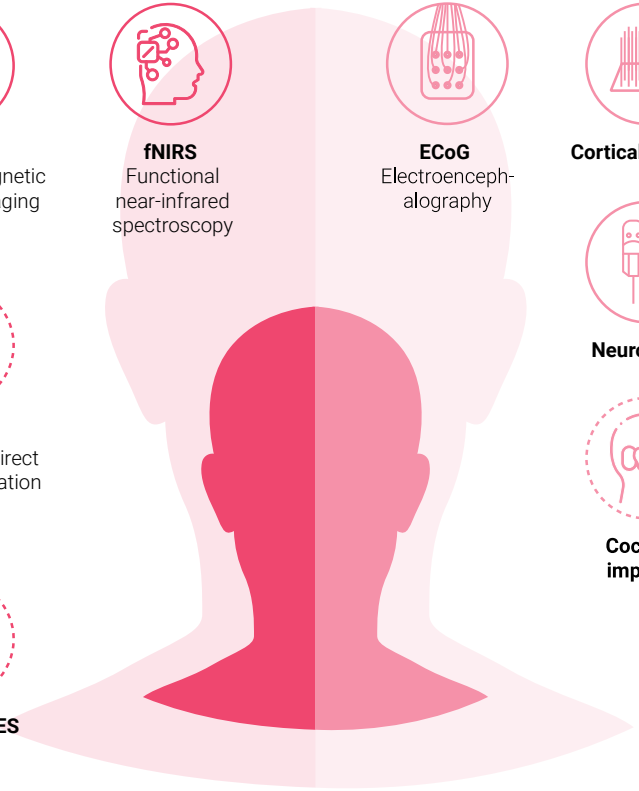
FES
Functional electrical stimulation

tDCS
Transcranial direct current stimulation

TENS
Transcutaneous electrical nerve stimulation

TMS
Transcranial magnetic stimulation

EEG with FES



INVASIVE TECHNOLOGIES

Recording technologies
Stimulating technologies

ECoG
Electroenceph-alography

Cortical implant

Neural dust

Neural lace

Neuropixels

Stentrodes

Optogenetics

Cochlear implants

DBS
Deep brain stimulation

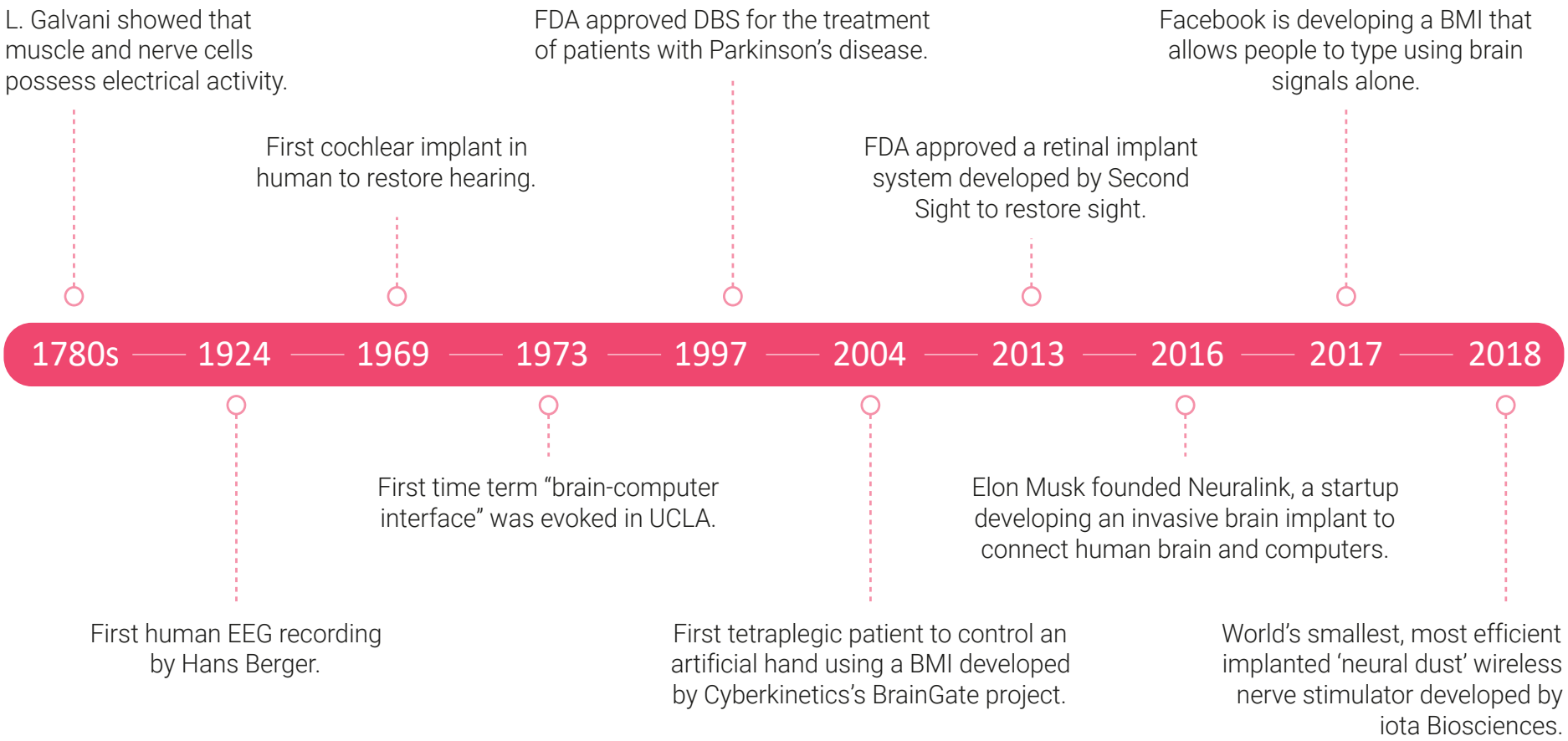
VNS
Vagus nerve stimulation

Retinal implants

Vestibular implants

SOURCE:
iHumanBlurring lines between mind and machine

Timeline


L. Galvani showed that muscle and nerve cells possess electrical activity.
First cochlear implant in human to restore hearing.
FDA approved DBS for the treatment of patients with Parkinson's disease.
FDA approved a retinal implant system developed by Second Sight to restore sight.
Facebook is developing a BMI that allows people to type using brain signals alone.
1780s
1924
1969
1973
1997
2004
2013
2016
2017
2018
First human EEG recording by Hans Berger.
First time term "brain-computer interface" was evoked in UCLA.
First tetraplegic patient to control an artificial hand using a BMI developed by Cyberkinetics's BrainGate project.
Elon Musk founded Neuralink, a startup developing an invasive brain implant to connect human brain and computers.
World's smallest, most efficient implanted 'neural dust' wireless nerve stimulator developed by iota Biosciences.

Applications

Understanding brain functions

BMIs are used to understand what neural networks are doing in real-time. Researchers are using BMI to record or manipulate brain activity in order to bring to light neural mechanisms of specific behavior or cognitive functions.

- Understanding precisely the mechanisms underlying brain disorders will be an important step in their future treatment.
- The development of smaller, more flexible and biocompatible BMI devices allows a better signal quality for long-term recordings in real-life environment.

A clinical revolution

The global burden of brain-related disorders is huge and is increasing due to the aging population. BMIs will have a particular impact in rehabilitation and in early diagnosis.

- People with motor disabilities can use their thoughts to control a prosthetic limb or a computer using a BMI to restore motricity and communication.
- Early-diagnosis of neurodegenerative condition like Alzheimer's or Parkinson's disease allows for rapid patient care and prevention of further symptoms affecting quality of life.

Beyond medical applications

The development of BMIs for commercial use are expected to also have an impact in non-medical applications.

- Non-invasive devices can be used for human well-being (e.g. improve sleep quality) or for entertainment like video games.
- Enhancing human cognition is the long-term goal of Neuralink's implant developed by Elon Musk and detailed in our recent article.

Source

Challenges

Regulation

BMIs give rise to ethical, legal and social questions. There is a need for regulation and standardization for responsible innovation in order to mitigate some potential risks these technologies may bring. Safety, security and privacy appear as top priorities for successful standardization.

- An important milestone was the release of the Food and Drug Administration (FDA) draft guideline on implanted brain-computer interfaces in February 2019.

Privacy

The brain is defining who we are and manipulating it or using neural data with malicious intents might have disastrous social consequences.

- Taking control of a BMI device and steal personal information like thoughts and memories, or even manipulate the brain and thus behavior represents a huge risk.

Improving non-invasive BMIs

Non-invasive sensing technologies like EEG have a high signal-to-noise ratio and a low spatial resolution.

- Increasing invasiveness allows a much better quality of signal but requires surgery which could be a barrier for non-medical applications.
- The development of dry electrodes, new non-invasive technologies (e.g. fNIRS) and improvement in artificial intelligence (AI) should improve brain signal detection without needing to open the skull.

Catalysts

- **Increased interest.** BMIs are attracting growing interest, investments and research efforts. Interest for BMIs from large tech companies (e.g. Neuralink or Facebook) are also rising people and investors awareness.
- **The right timing.** Past few years have seen an explosion of work and innovation in every aspect of neurotechnology, from neuroscience to semi-conductors and AI. These major advances will continue to improve BMI capabilities.
- **A medical need.** The economic and societal burden caused by brain-related disorders is constantly increasing due to aging population. There is a real need to develop BMIs in order to treat and prevent such disorders.

Risks

- **Lack of brain mechanisms understanding.** The brain is very complex and unveiling neural mechanisms underlying mental health or neurological disorders will take time and is limiting BMIs applications for the moment.
- **Medical reimbursements.** BMIs are expected to be expensive at the beginning and if the devices are not reimbursed to patients it would be a huge barrier for BMIs to enter the marker.
- **Ethical issues.** The development of invasive BMIs for medical usage should be carefully regulated. These standards and regulatory processes, like FDA approvals, may delay market opportunities.

Bottom Line

- Brain-machine interfaces have the potential to change our lives and open new perspective in the way we treat brain-related diseases. With the unprecedented medical need and the increasing investments to develop such devices, there is no doubt that BMIs will have a huge impact in medical applications in the coming years.
- It is already long time that at AtonRâ we are closely studying the brain field and its investment implications. Thanks to our close collaboration with the Hebrew University Of Jerusalem, last year we had the pleasure to welcome Prof. Idan Segev, head of the Neurobiology's Department, for a very interesting conference. We continue to closely monitoring this exciting industry and our Bionics portfolio is already exposed to companies involved in neuromodulation devices related to pain relief, Parkinson's disease and sleep apnea.

Companies mentioned in this article:

Neuralink (not listed), Neurable (not listed), Synchron (not listed), BrainGate (not listed), iota Biosciences (not listed), SecondSight (EYES US), Facebook (FB US)

U.S. ELECTIONS: AN OPPORTUNITY AHEAD?

Healthcare: Politics Vs. Fundamentals

Both parties agree on lowering healthcare costs

As we wrote in our 9 October 2019 Investment Recipes, healthcare spending in the U.S. is the subject of ongoing debates and both Democrats and Republicans have vowed to reduce drug prices.

- The healthcare spending is expected to rise from $3.8bn in 2019 to $4bn in 2020, representing ~18% of U.S. GDP.
- Americans pay the highest drug prices in the world, but prescription drugs account for only 10% of total healthcare spending.

A turbulent period followed by better days

History shows that before a U.S. elections, biotech stocks tend to underperform. But the bounce back can be as powerful.

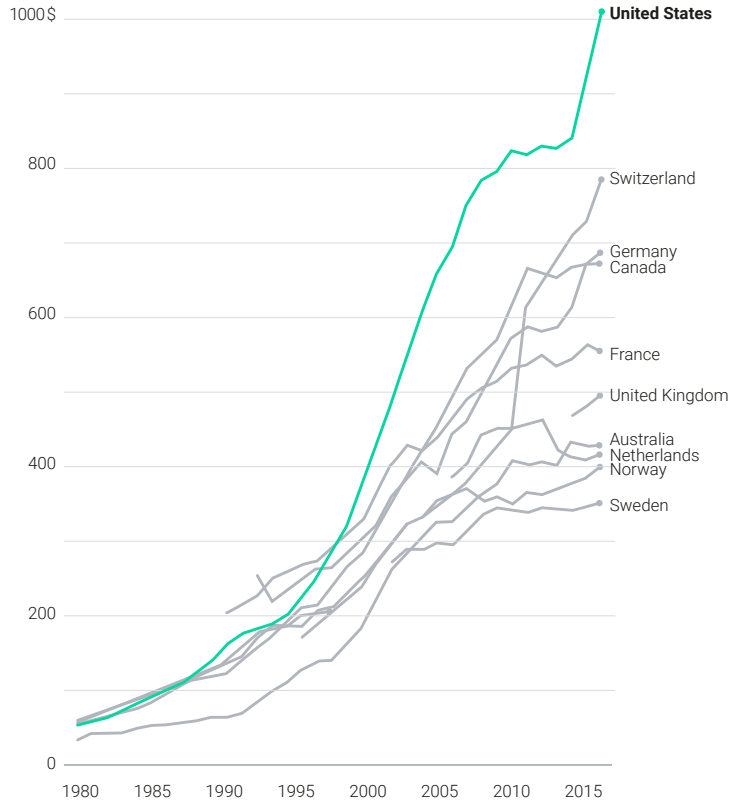
- Healthcare is a heated fighting ground for candidates, bringing a lot of near-term uncertainty to investors.
- Once uncertainty is lifted, the industry gets once again driven by its fundamentals.

Strong and healthy fundamentals

The long-term fundamentals of the healthcare industry remain strong, providing momentum beyond any eventual short-term sell-off.

- Innovation continues to pave the way for new drugs and COVID-19 has highlighted the biopharma industry's importance.
- Access to capital has never been easier, IPOs and M&A activities have rebounded strongly.

ANNUAL RETAIL PRESCRIPTION DRUG SPENDING PER PERSON



SOURCE:
CMS: US health care spending will reach $4T in 2020
Something Happened to U.S. Drug Spending in the 1990s

Fighting About How To Cut Costs

The government does not control prices

As we explained in detail, drug prices are set "behind the scene" through a complicated supply chain that involves three crucial players: drug manufacturers, pharmacy benefit managers (PBMs), and payers (insurers).

- After PBMs act as middlemen, working on behalf of payers to negotiate with the drug-makers discounts on the list prices of drugs, called rebates. PBMs generally give preferential status to drugs offering higher discounts.
- If the government decides to change the rules, volatility in the stock market will be inevitable.

Telemedicine: the big winner during Trump's term

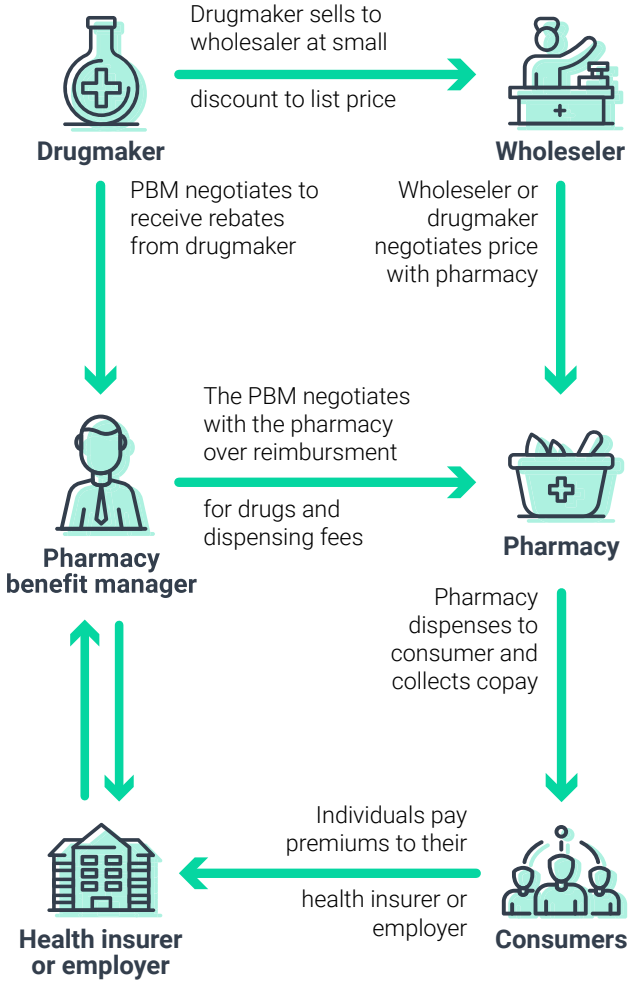
Given the great success of telemedicine during the COVID pandemic, Trump supported making permanent the temporary changes to telehealth rules.

- After the election, we believe that digital health will continue to be supported, whether Democrats or Republicans win.
- As we wrote, Telemedicine has a direct impact in reducing overall healthcare costs.

Little impact on innovative drugs

Main proposals by both candidates do not impact the most innovative drugs, to which we are exposed in our portfolios. They command high prices even in Europe, given their efficacy in otherwise often incurable diseases.

- Specific therapeutic classes (such as cancer) remain protected by state legislation, and orphan drugs are protected by moral suasion.
- In Europe, Novartis' gene therapy has been priced at €1.9mn, on par with U.S. levels.



SOURCE:
Wall Street Journal
Who Are Pharmacy Benefit Managers (PBMs) and How Do They Influence Drug Pricing?

Uncertainty Polarizing Investors' Attention

Uncertainty is worse than any victory

Healthcare reforms remain a heated battle ground, as many healthcare issues are contentious. In recent years, both political camps have made several proposals, but no significant change ever materialized.

- Biden and Trump are against high drug prices but do not share the same approach on how to curb them.
- The two candidates are mainly opposed on Medicaid/Medicare changes and on the Affordable Care Act (ACA), also known as the "Obamacare".

Expanding public care not an evil for the industry

The Democrat nominee Joe Biden supports the ACA's expansion in several ways, in the end providing insurance to more Americans. Ultimately, this will benefit the industry because it is easier to sell drugs to insured patients.

- The Democrat candidate vowed to restore some of the directives repealed during Trump's term and expand eligibility for subsidies to afford insurance.
- Biden calls for a "public option" as an alternative to private insurance, offering cheaper coverage by negotiating lower prices with providers.

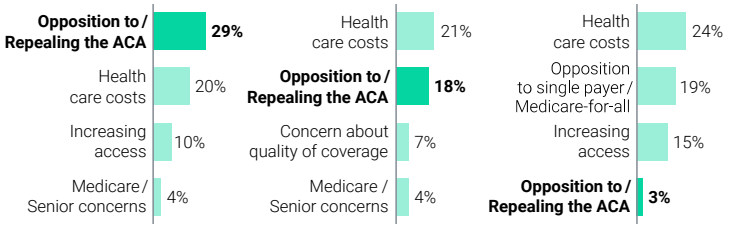
Beyond the presidential election, Congress control is key

Biden's win would create short-term volatility; however, the Democrats would have to regain the full control of Congress to be able to succeed in bringing about any significant reform.

- Under a split Congress scenario, the most aggressive bills such as Medicare direct negotiation on drug prices would be extremely unlikely to succeed.
- A split Congress will likely lead to a dead-end for most reforms, given the power of lobbying groups.

Obamacare main directives
Prohibits insurance companies from denying a person coverage or charging more for a plan if that person has a pre-existing condition.
Federal tax penalty for individuals for not having a health insurance – Trump signed a bill that repeals this tax penalty from 2019.
Plans required to offer benefits such as preventative care
Subsidies to help low income individuals afford insurance
Adult children can remain on parent's plan until age 26
Large employers required to offer coverage

AMONG REPUBLICAN VOTERS:
Percent who mention each of the following as the top health care issue in



NOTE: Percentages reported based on total registered voters. Open-ended responses, top four shown.

SOURCE: KFF Health Tracking Poll (conducted March 7–14, 2016, September 19–October 2, 2018 and February 13–18, 2020). See toplines for full question wording.

Fundamentals Are Here To Stay

Innovation leading to lower costs

The number of innovative drugs in the pipelines has increased, resulting in a spate of FDA approvals that could ultimately lead to cost savings for the general healthcare system.

- Better diagnosis will reduce treatment costs. AI and digital health have the potential to accelerate patients screening and disease detection.
- New gene- and cell-therapies are likely to be cheaper despite steep upfront costs when compared to recurring expenses of standard treatments.

Plenty of cash available

Biotech and digital health will continue to be hotspots as major pharma and MedTech companies seek to boost their pipeline with innovative products, and investor continue to pour (cheap) money in the sector.

- Fund raising has been all the rage this year, with many companies easily tapping the markets, both for equities and corporate bonds.
- M&A activity already exceeded FY19 levels, as large cash reserves are being deployed by big Pharmas and MedTechs to access promising drugs.

COVID-19 impact

Pharmaceutical companies have shown their importance in the fight against the COVID-19, making it politically sensitive to penalize the industry.

- Biotech companies (e.g. Moderna) received many incentives from the U.S. government to help in the development of COVID-19 treatments.

MAIN HEALTHCARE M&A DEALS IN 2H 2020

Acquirer	Target	Deal value	Date
Bristol Myers	Myokardia	$13bn	05-Oct
Gilead	Immunomedics	$21bn	14 Septembre
Teladoc	Livongo	$18.3bn	05-Aug
Sanofi	Principia Biosciences	$3.4bn	17-Aug

GLOBAL: M&A TRANSACTIONS IN THE HEALTHCARE SECTOR (USD BILLION)

SOURCE:
Fundamental strengths to drive recovery from a short-term slowdown

Catalysts

- **COVID-19 vaccine approval.** Approval by the end of the year will make the pharma and biotech industry the great savior of the pandemic.
- **A split Congress in case of Democrats victory.** Any important changes require the alignment of the president, the House and the Senate. Finally, even under a new Democrat administration, the government will still have little power to regulate drug's pricing.
- **Continued M&A deals.** There is ample space for consolidation, especially in the most promising biotech therapeutic areas we follow, that would reassure investors about the health of the sector's fundamentals.

Risks

- **A COVID-19 fiasco.** Public interest is so polarized by the race to beat COVID, that any major clinical safety setbacks could backfire across the sector as a whole.
- **Worse than expected policies.** Most policies are largely priced-in by the market. Under a Democratic administration, policies are moderate. However, any sudden change could lead to volatility.
- **The FDA playing the politics game.** As we wrote in a recent note, political pressure on drug prices could interfere with FDA decisions to avoid approving drugs that appear too expensive.

Bottom Line

- The discussion around healthcare in the U.S. has always brought a lot of volatility ahead of the elections. A Trump victory would probably be better viewed by the industry since most of his proposals have been more threats than actual action. A Biden victory could actually offer a nice short-term opportunity, as proposed measures such as expanding health coverage would ultimately be beneficial for the industry.
- The uncertainty is likely to affect mostly the mainstream big pharmas exposed to prescription drugs. In our portfolio we focus on the most innovative drugs, which command strong pricing power and offer relative shelter to the ebbs and flows of politics.

Companies mentioned in this article:

Brystol Myers (BMY US), Gilead (GILD US), Moderna (MRNA US), Novartis (NOVN SW), Sanofi (SAN FP), Teladoc (TDOC US)

EV CHARGING ON THE RISE

Infrastructure Rollout Accelerates

EV charging market overview

As electric vehicle (EV) market keeps on expanding, the deployment of required charging stations draws a lot of attention. Both public & private charging points are ramping up worldwide and different business models are emerging.

- Today's global EV charger stock is estimated at 7.3mn with roughly 90% being privately-owned chargers (at home or work).
- To keep pace with EV demand growth, some 290mn charging points will be required by 2040, representing a 20.2% CAGR over the 20-years period.

Solving the chicken-and-egg dilemma

"Drivers need charging infrastructure to buy EVs, but infrastructure investments won't happen if there's not enough users." This chicken-and-egg dilemma might already be history, as both EVs' fleets and chargers' networks show strong growth.

- The EU Commission had set a norm of 1 public charging point for every 10 EVs but current ratio is already at 5-to-1 in Europe.
- Many governments are now including EV charging infrastructures as part of their post-COVID stimulus packages.

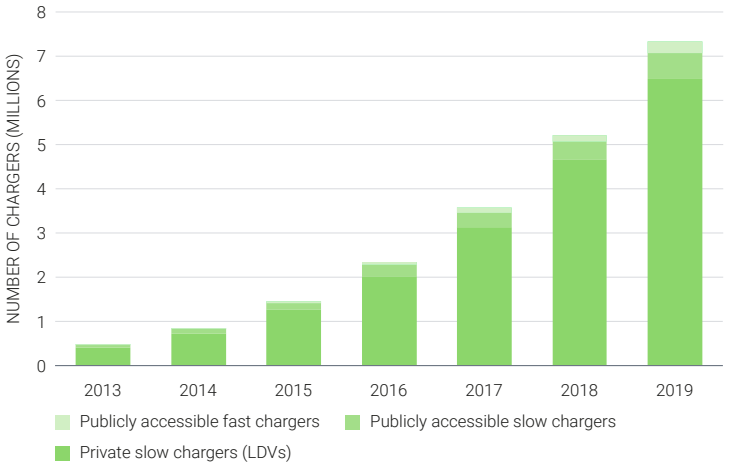
A complex ecosystem with multiple stakeholders

The appealing market potential is fueling interest among a variety of players, and each region seems to be developing its own ecosystem. The global market comprises pure-play EV charger makers, EV manufacturers, utilities and oil companies.

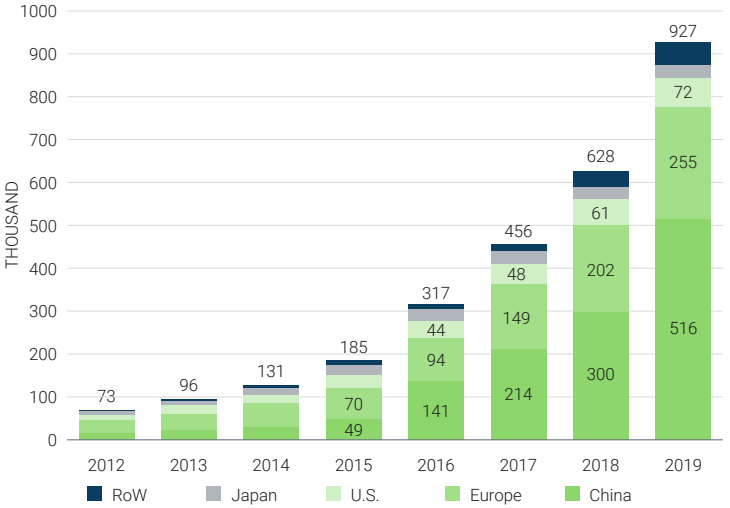
- 80% of Europe's public charging infrastructure is operated by utilities and oil companies.
- U.S. charging market is dominated by pure-play EV operators.

SOURCE:
Global EV Outlook 2020, IEA

GLOBAL STOCK OF ELECTRIC LDV CHARGERS, 2013–2019



CUMULATIVE PUBLIC CHARGING CONNECTORS



Source: BloombergNEF. Note: Includes Tesla destination and supercharger networks even though these are semi-private.

Overview Of The Market Situation

Different types of chargers

Charging infrastructure can be classified into 3 main types based on their voltage and rate of charge: AC chargers (level 1 and 2) and DC fast chargers (level 3).

- Level 1 chargers simply using household outlets and a plug to connect to the car's on-board charger and roughly charge 10km/h at 2.4kW.
- Level 2 chargers require the installation of dedicated EV charger and can provide up to 100km/h of charging at 22kW.
- Level 3 DC fast chargers provide up to 350kW and typically reach 80% charge in 30-60minutes.

Different mobility use-cases and charging habits

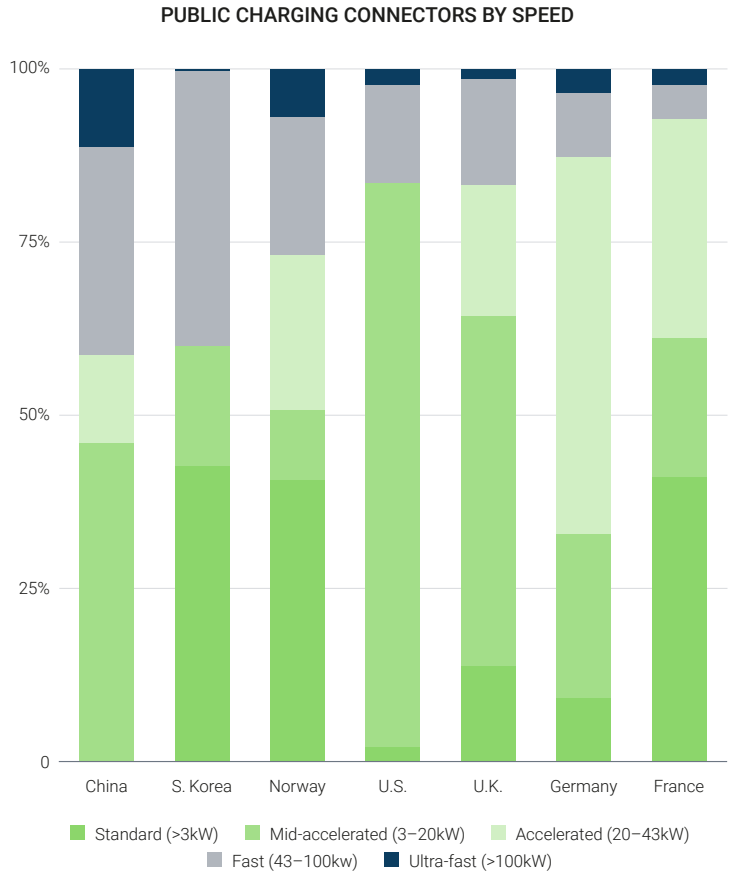
The market potential of each EV charger type is very specific to use-cases and locations. Overnight slow charge fits well with private house chargers, while public charging should favor fast charge for punctual use.

- Market can be segmented into four charging options: individual charge owners (individual house) , shared charge users (collective building), corporate users (corporate) and public charger users (public).

A major infrastructure build-out in the making

While regions with high level of individual home ownership will have most of the charging done at home, dense urban areas will likely see a strong uptake in public charging infrastructure.

- By 2040,expanding the public charging base from 1mn to the required12mn requires >$110bn. Including private chargers, investments are in the USD trillions.
- Public chargers are more likely to adopt level 3 fast charging technology as drivers wants to minimize charging time when not at home or work.



SOURCE:
Electric Car Charging Stations Are Finally About to Take Off

Market Segmentation Based On Customer's Charging Locations And Habits

	Individual charger owners	Shared charger users	Corporate users	Public charger users
Charging locations	Individual house	Collective building	Corporate	Public
Parking lots	Private	Shared or public	Shared	Public
Customer charging habits	Overnight slow charge	Overnight slow charge	Slow charge during the day Overnight slow charge Fast charge for puncutal use	Slow charge during the day Overnight slow charge Fast charge for puncutal use
Mobility use-cases	Professional use of car for - & short - distance trips Commuting to work Leisure mobility, holidays shopping / groceries, ...	Professional use of car for long-distance trips Commuting to work Leisure mobility, holidays purchase	Use of car for sales trips Use of car for delivery	Leisure mobility for holidays (short & long trips) Professional use of car for long-distance trips Functional use, puncutal trips

SOURCE:
Key Factors Defining The E-Mobility Of Tomorrow

Becoming A Profitable Business

Charging infrastructure and EVs will grow together in a virtuous circle

There were no gas stations when Henry Ford started developing its model T car. A similar scenario is already happening, as more public charging stations help offset "range anxiety" concerns and foster EV adoption.

- Range anxiety, which was once a primary barrier to EV adoption, is becoming less of an obstacle thanks to the development of longer-range batteries and the deployment of public charging infrastructure.

Infrastructure is part of many government stimulus

Several governments have recently included charging infrastructure as part of their post-covid stimulus packages. A way for them to stimulate EV demand and help them achieve their climate targets.

- Germany recently included EV chargers as part of a €2.5bn stimulus plan.
- China is to invest $2.1bn for EV infrastructure.
- The EU set a goal of 1mn public chargers by 2030 (from 200k today).

Finding the best business model

Given the initial low utilization rate of public chargers, offsetting initial capital cost by finding new revenue streams becomes crucial. As detailed in a previous Investment Recipes issues, "smart charging" has the potential to unlock new revenues along with providing greater flexibility to the power grid.

- New revenue streams could also come through the development of innovative subscriptions models (e.g. Charging-as-a-service) or by providing add-on services (fleet management & dispatch software, telematics services, etc.).

SOURCE:
Germany to require all petrol stations to provide EV charging

Multiple Players Entering The Game

A complex value chain

The EV charging value chain can be broken down in three segments: from energy supply (incl. energy production, distribution & retail), charging infrastructure (charging station production, sales, installation and O&M), and add-on services (billing, geo-services, roaming, battery management, etc.).

- Today, energy supply is logically being provided by traditional utilities, power companies and energy services companies (ESCO)
- The charging infrastructure segment is rather nascent and thus split between pure players, automakers, and auto-parts manufacturers.

Utilities and Oil & Gas players entering the EV charging space

Utilities and Oil&Gas companies are reshaping their business models to get ready for the upcoming challenges and opportunities created by EV's massive takeoff.

- Utilities aim to become fully integrated energy providers and leverage their know-how to overcome future load-balancing challenges.
- Oil&Gas players see EV charging as a way to transition away from oil, retain the car refueling/recharging business, and capture new revenue streams.

IPOs, M&As, and new partnerships are sprouting up

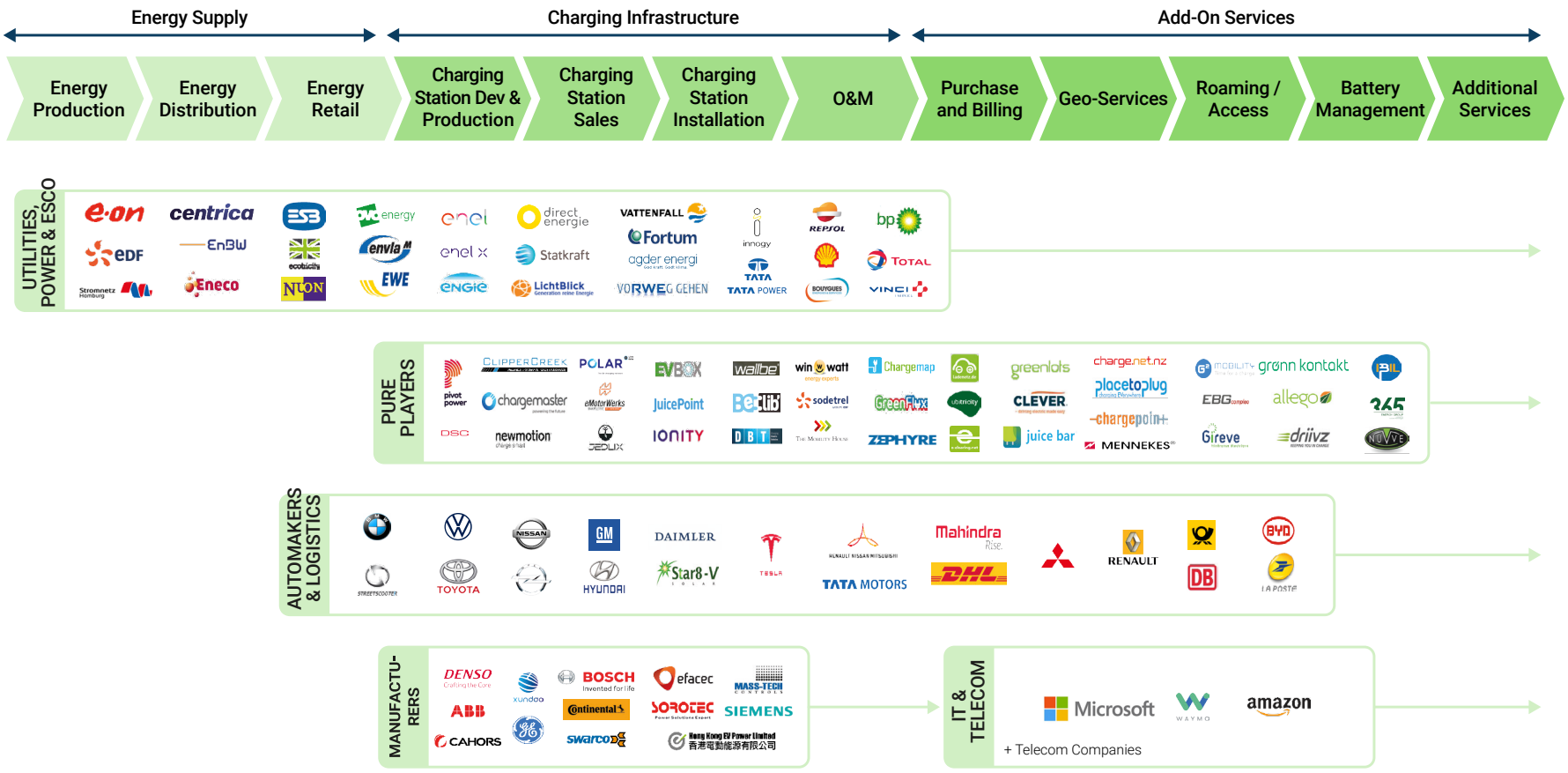
Lately, many EV charging players have made headlines, either through acquisitions, new partnerships or by going public.

- Shell acquired NewMotion and Greenlots; BP bought Chargemaster.
- Chargepoint, the largest network of EV charging stations in North America and Europe, is to go public later this year through a reverse merge with a SPAC.

EV ECOSYSTEM M&A ACTIVITIES AND PARTNERSHIPS

SOURCE:
Key Factors Defining The E-Mobility Of Tomorrow

The EV-charging Value Chain



SOURCE:
Key Factors Defining The E-Mobility Of Tomorrow

Catalysts

- **Government' support.** New regulations such as California's 2035 gas engine ban or supportive stimulus packages could foster EV adoption and chargers' deployment.
- **Heavy vehicle electrification.** Electrification of large and heavy vehicles (e.g. buses or trucks) is to accelerate the charging infrastructure rollout, as such vehicles feature bigger batteries and thus larger & faster charging needs.
- **New revenue streams.** As EVs become mainstream, new sources of revenues are to be captured while exploiting these "batteries-on-wheel".

Risks

- **Disrupting technologies.** Alternative technologies, such as wireless charging or battery swap (e.g. as developed by Nio) might hamper the growth of EVs' public charging points.
- **EV slowdown.** Slower-than-expected adoption of EV could negatively affect charging infrastructure expansion and challenge charging economics.
- **Lack of standardization.** EV makers requiring brand-specific charging technologies could add uncertainty on future technology and make charging infrastructure investments less attractive for private owners.

Bottom Line

- EV charging infrastructure is at its nascent development stage, with several competing charging technologies and business models. While we remain confident that EVs and public charging stations will both expand simultaneously, the form in which the future charging ecosystem will develop remains still uncertain.
- Utilities, Oil & Gas companies, automakers and EV-charger pure players are all entering this market, and we keep monitoring any potential investment opportunities in the sector.

Companies mentioned in this article:

BP (BP LN), Chargemaster(not listed), ChargePoint (not listed), Greenlots (not listed), Shell (RDSA NA)

CHARTS FOR THOUGHTS

Go With The Flows?

Long run fund flows influence the trends

Cumulative flows into equity funds by sector can help investors better understand market trends. Significant in- or out-flows usually influence a sector's performance.

- Since 2016, we observe a significant flow towards IT and more importantly right after the COVID-19 crash of March 2020.
- Healthcare, which is more cyclical, saw a sharp increase from 2012 to 2016, then a decrease until COVID-19 pandemic revivified the industry.

Shorter term flows indicate sentiment

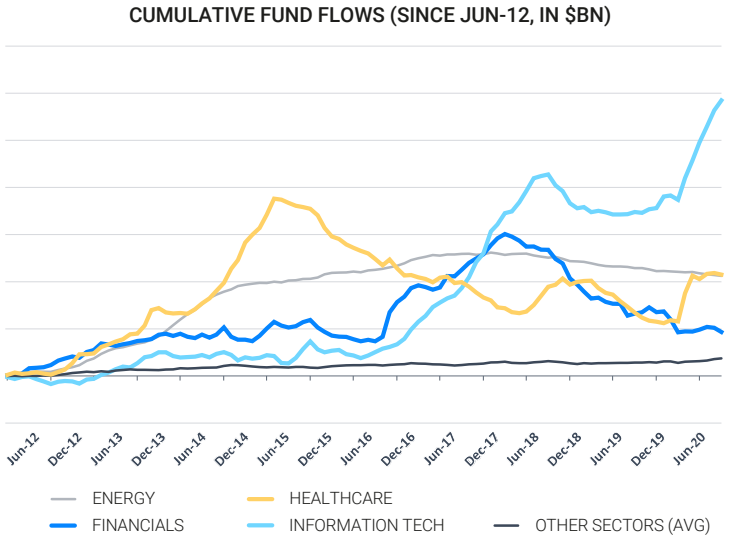
Short term flows are more reflexive of market sentiments. Looking at rolling data, helps identify change of speed in fund flows.

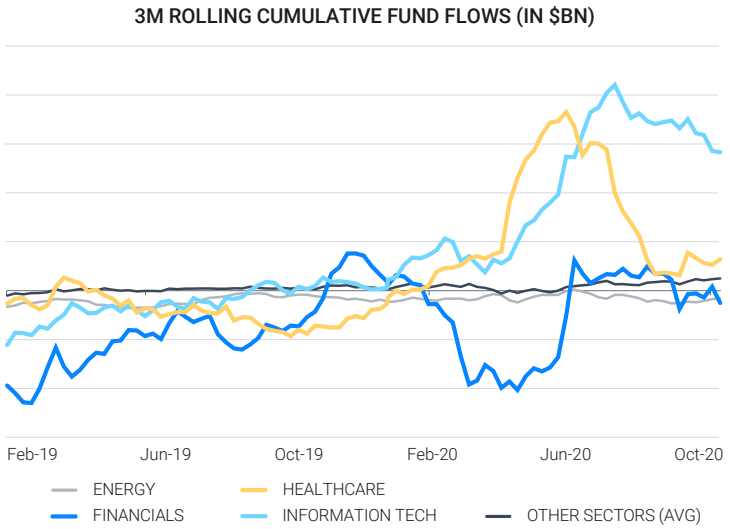
- The COVID-19 crisis outbreak brought accelerating inflows to the IT and Healthcare sectors, while financials suffered from outflows.
- Since the end of spring, flows tended to revert to neutral, but remained positive (albeit at a slower rate) for Healthcare & IT, and negative for financials.

But are the flows all that important?

While inflows are a tailwind and thus usually a source of outperformance, we observe that lately the Healthcare and IT sectors' performances were not entirely driven by the flows. Are fundamentals back in the driving seat?

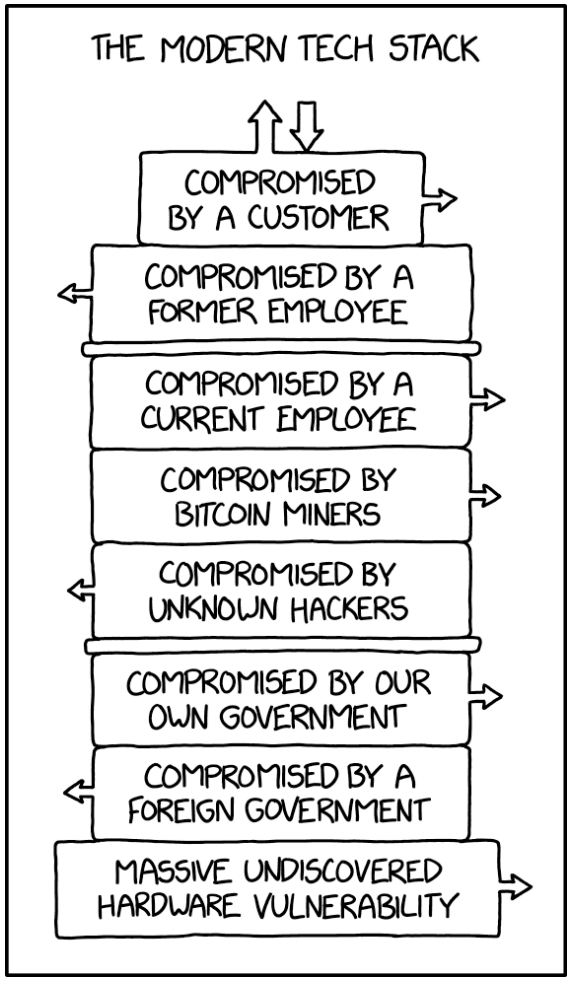
- A marked slowdown in inflows (notably for healthcare) has not led to any noticeable underperformance.





SOURCE:
Reuters, AtonRâ

CASUAL FRIDAY



SOURCE:
https://xkcd.com/2166/

Invest Beyond The Ordinary

Explore our investment themes:
www.atonra.ch/investment-themes/

HEALTHCARE M&A | SUSTAINABLE FUTURE | BIOTECHNOLOGY | AI AND ROBOTICS | FINTECH | SECURITY AND SPACE | MOBILE PAYMENTS | BIONICS

About AtonRâ Partners

AtonRâ Partners is an asset management company, founded in 2004 with head office in Geneva, incorporated under Swiss law, duly approved by the Swiss Financial Market Supervisory Authority (FINMA) under the Swiss Collective Investment Schemes Act.

AtonRâ Partners is a conviction-driven asset manager combining industrial and scientific research with financial analysis. AtonRâ Partners focuses on long-term trends powerful enough to be turned into thematic equity portfolios.

Disclaimer

This report has been produced by the organizational unit responsible for investment research (Research unit) of AtonRâ Partners and sent to you by the company sales representatives.

As an internationally active company, AtonRâ Partners SA may be subject to a number of provisions in drawing up and distributing its investment research documents. These regulations include the Directives on the Independence of Financial Research issued by the Swiss Bankers Association.

Although AtonRâ Partners SA believes that the information provided in this document is based on reliable sources, it cannot assume responsibility for the quality, correctness, timeliness or completeness of the information contained in this report.

The information contained in these publications is exclusively intended for a client base consisting of professionals or qualified investors. It is sent to you by way of information and cannot be divulged to a third party without the prior consent of AtonRâ Partners. While all reasonable effort has been made to ensure that the information contained is not untrue or misleading at the time of publication, no representation is made as to its accuracy or completeness and it should not be relied upon as such.

Past performance is not indicative or a guarantee of future results. Investment losses may occur, and investors could lose some or all of their investment. Any indices cited herein are provided only as examples of general market performance and no index is directly comparable to the past or future performance of the Certificate.

It should not be assumed that the Certificate will invest in any specific securities that comprise any index, nor should it be understood to mean that there is a correlation between the Certificate's returns and any index returns.

Any material provided to you is intended only for discussion purposes and is not intended as an offer or solicitation with respect to the purchase or sale of any security and should not be relied upon by you in evaluating the merits of investing in any securities.