



Insight

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# The Top 10 Technology Trends of 2016



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Principal

# Introduction

Peter Diamandis of Singularity University wrote the following email about the top ten tech trends in 2016 that positively transformed the world. It is an amazing story. Enjoy and ponder the implications for your boards.

2016 was an incredible year for technology, and for humanity.

Despite all the negative political-related news, there were 10 tech trends this year that positively transformed humanity.

## 1. We are Hyper-Connecting the World

In 2010, 1.8 billion people were connected. Today, that number is about 3 billion, and by 2022 – 2025, that number will expand to include every human on the planet, approaching 8 billion humans.

Unlike when I was connected 20 years ago at 9,600 baud via, the world today is coming online at 1 megabit per second or greater, with access to the world's information on Google, access to the world's products on Amazon, access to massive computing power on AWS and artificial intelligence with Watson... not to mention crowdfunding for capital and crowdsourcing for expertise.

Looking back at 2016, you can feel the acceleration. Here are seven stories that highlight the major advances in our race for global connectivity:

### **Free Internet for 1 billion in India:**

- India's richest man, Mukesh Ambani, announced his plans to roll out a \$20 billion mobile network that will bring lightning-fast Internet to hundreds of millions of people FOR FREE. It's called Jio – and it's a 4G network that will reach more than 80% of the country. By 2018, 100% of India will be covered by this infrastructure

### **Google Loon Finally Implemented:**

- Project Loon is an initiative out of Google's X (their moonshot factory) that aims to provide high-speed Internet access to rural areas via balloons. After years of testing, and many failures, Loon will finally be launched in Indonesia this year. The team, led by Astro Teller, settled on a balloon that managed to travel around the world 19 times in 187 days.

### **Google's 5G Solar Drones Internet Service:**

- Project Skybender is Google's secretive 5G Internet drone initiative. News broke this year that they have been testing these solar-powered drones at Spaceport America in New Mexico to explore ways to deliver high-speed Internet from the air. Their purported millimeter wave technology could deliver data from drones up to 40 times faster than 4G.

#### **Facebook's Solar Drone Internet Service:**

- Even before Google, Facebook has been experimenting with a solar-powered drone, also for the express purpose of providing Internet to billions. The drone has the wingspan of an airliner and flies with roughly the power of three blowdryers.

#### **ViaSat Plans 1 Terabit Internet Service:**

- ViaSat, a U.S.-based satellite company, has teamed up with Boeing to launch three satellites to provide 1 terabit-per-second Internet connections to remote areas, aircraft and maritime vehicles. ViaSat is scheduled to launch its satellite ViaSat2 in early 2017.

#### **OneWeb Raises \$1.2B for 900 Satellite Constellation:**

- An ambitious low-Earth Orbit satellite system proposed by Greg Wyler, Paul Jacobs and Richard Branson just closed \$1.2 billion in financing. This 900-satellite system will offer global Internet services as soon as 2019.

#### **Musk Announces 4,425 Internet Satellite System:**

- Perhaps the most ambitious plan for global Internet domination was proposed this year by SpaceX founder Elon Musk, with plans for SpaceX to deploy a 4,425 low-Earth orbit satellite system to blanket the entire planet in broadband.

## **2. Solar/Renewables Cheaper than Coal**

We've just exceeded a historic inflection point. 2016 was the year solar and renewable energy became cheaper than coal.

In December, the World Economic Forum reported that solar and wind energy is now the same price or cheaper than new fossil fuel capacity in more than 30 countries.

"As prices for solar and wind power continue their precipitous fall, two-thirds of all nations will reach the point known as "grid parity" within a few years, even without subsidies," they added.

This is one of the most important developments in the history of humanity, and this year marked a number of major milestones for renewable energy. Here are 10 data points (stories) to hammer home the historic nature of this 2016 achievement.

#### **25% of the World's Power Comes From Renewables:**

- REN21, a global renewable energy policy network, published a report showing that a quarter of the world's power now comes from renewable energy. International investment in renewable energy reached \$286 billion last year (with solar accounting for over \$160b of this), and it's accelerating.

#### **In India, Solar is Now Cheaper Than Coal:**

- An amazing milestone indeed, and India is now on track to deploy >100 gigawatts of solar power by 2022.

#### **The UK is Generating More Energy From Solar Than Coal:**

- For the first time in history, this year the U.K. has produced an estimated 6,964 GWh of electricity from solar cells, 10% higher than the 6,342 GWh generated by coal.

#### **Coal Plants Being Replaced by Solar Farms:**

- The Nanticoke Generating Station in Ontario, once North America's largest coal plant, will be turned into a solar farm.

#### **Coal Will Never Recover:**

- The coal industry, once the backbone of U.S. energy, is fading fast on account of renewables like solar and wind. Official and expert reports now state that it will never recover (e.g. coal power generation in Texas is down from 39% in early 2015 to 24.8% in May 2016).

#### **Scotland Generated 106% Energy from Wind:**

- This year, high winds boosted renewable energy output to provide 106% of Scotland's electricity needs for a day.

#### **Costa Rica Ran on Renewables for 2+ Months:**

- The country ran on 100% renewable energy for 76 days.

#### **Google to Run 100% on Renewable Energy:**

- Google has announced its entire global business will be powered by renewable energy in 2017.

#### **Las Vegas Meets Goal of 100% Power by Renewables:**

- Las Vegas is now the largest city in the country to run entirely on renewable energy.

#### **Tesla's Gigafactory:**

- Tesla's \$5 billion structure in Nevada will produce 500,000 lithium ion batteries annually and Tesla's Model III vehicle. It is now over 30 percent complete... the 10 million square foot structure is set to be done by 2020. Musk projected that a total of 100 Gigafactories could provide enough storage capacity to run the entire planet on renewables.

## **3. Glimpsing the End of Cancer & Disease**

Though it may seem hard to believe, the end of cancer and disease is near.

Scientists and researchers have been working diligently to find novel approaches to combating these diseases, and 2016 saw some extraordinary progress in this regard.

Here are the top 10 picks that provide great faith about our abilities to cure cancer and most diseases:

#### **Cancer Immunotherapy Makes Strides (Extraordinary Results):**

- Immunotherapy involves using a patient's own immune system (in this case, T cells) to fight cancer. Doctors remove immune cells from patients, tag them with "receptor" molecules that target the specific cancer, and then infuse the cells back in the body. During the study, 94% of patients with acute lymphoblastic leukemia (ALL) saw symptoms vanish completely. Patients with other blood cancers had response rates greater than 80%, and more than half experienced complete remission.

#### **In China, CRISPR/Cas9 used in First Human Trial:**

- A team of scientists in China (Sichuan University) became the first to treat a human patient with an aggressive form of lung cancer with the ground-breaking CRISPR-Cas9 gene-editing technique.

#### **NIH Approves Human Trials Using CRISPR:**

- A team of physicians at the University of Pennsylvania's School of Medicine had their project of modifying the immune cells of 18 different cancer patients with the CRISPR-Cas9 system approved by the National Institute of Health. Results are TBD.

#### **Giant Leap in Treatment of Diabetes from Harvard:**

- For the first time, Harvard stem cell researchers created “insulin-producing” islet cells to cure diabetes in mice. This offers a promising cure in humans as well.

#### **HIV Genes Cut Out of Live Animals Using CRISPR:**

- Scientists at the Comprehensive NeuroAIDS Center at Temple University were able to cut out successfully the HIV genes from live animals, and they had over a 50% success rate.

#### **New Treatment Causes HIV Infected Cells to Vanish:**

- A team of scientists in the U.K. discovered a new treatment for HIV. The patient was treated with vaccines that helped the body recognize the HIV-infected cells. Then, the drug Vorinostat was administered to activate the dormant cells so they could be spotted by the immune system.

#### **CRISPR Cures Mice of Sickle Cell Disease:**

- CRISPR was used to completely cure sickle cell by editing the errant DNA sequence in mice. The treatment may soon be used to cure this disease, which affects about 100,000 Americans.

#### **Eradicating Measles (in the U.S.):**

- The World Health Organization (WHO) announced that after 50 years, they have successfully eradicated measles in the U.S. This is one of the most contagious diseases around the world.

#### **New Ebola Vaccine Proved to be 100% Effective:**

- None of the nearly 6,000 individuals vaccinated with rVSV-ZEBOV in Guinea, a country with more than 3,000 confirmed cases of Ebola, showed any signs of contracting the disease.

#### **Eradicating Polio:**

- The World Health Organization has announced that it expects to fully eradicate polio worldwide by Early 2017.

## 4. Progress on Extending Human Life

We are on the verge of significantly impacting human longevity. At a minimum, making “100 years old the new 60.”

This year, hundreds of millions of dollars were poured into research initiatives and companies focused on extending life.

Here are five of the top stories from 2016 in longevity research:

### **500-Year-Old Shark Discovered:**

- A Greenland shark that could have been over 500 years old was discovered this year, making the species the longest-lived vertebrate in the world.

### **Genetically Reversing Aging:**

- With an experiment that replicated stem cell-like conditions, Salk Institute researchers made human skin cells in a dish look and behave young again, and mice with premature aging disease were rejuvenated with a 30% increase in lifespan. The Salk Institute expects to see this work in human trials in less than 10 years.

### **25% Life Extension Based on Removal of Senescent Cells:**

- Published in the medical journal Nature, cell biologists Darren Baker and Jan van Deursen have found that systematically removing a category of living, stagnant cells can extend the life of mice by 25 percent.

### **Funding for Anti-Aging Startups:**

- Jeff Bezos and the Mayo Clinic-backed Anti-Aging Startup Unity Biotechnology with \$116 million. The company will focus on medicines to slow the effects of age-related diseases by removing senescent cells (as mentioned in the article above).

### **Young Blood Experiments Show Promising Results for Longevity:**

- Sakura Minami and her colleagues at Alkahest, a company specializing in blood-derived therapies for neurodegenerative diseases, have found that simply injecting older mice with the plasma of young humans twice a week improved the mice’s cognitive functions as well as their physical performance. This practice has seen a 30% increase in lifespan, and increase in muscle tissue and cognitive function.

## 5. Amazing Successes with Stem Cells

Stem cells, the regenerative engine of the body, help cure disease and extend the healthy human lifespan.

The top three stories demonstrating the incredible research and implications for stem cells in 2016:

### **Stem Cells Able to Grow New Human Eyes:**

- Biologists led by Kohji Nishida at Osaka University in Japan have discovered a new way to nurture and grow the tissues that make up the human eyeball. The scientists are able to grow retinas, corneas, the eye's lens, and more using only a small sample of adult skin.

### **Stem Cell Injections Help Stroke Victims Walk Again:**

- In a study out of Stanford, of 18 stroke victims who agreed to stem cells treatments, seven of them showed remarkable motor function improvements. This treatment could work for other neurodegenerative conditions such as Alzheimer's disease, Parkinson's and Lou Gehrig's disease.

### **Stem Cells Help Paralyzed Victim Gain Use of Arms:**

- Doctors from the USC Neurorestoration Center and Keck Medicine of USC injected stem cells into the damaged cervical spine of a recently paralyzed 21-year-old man. Three months later, he showed dramatic improvement in sensation and movement of both arms.

## 6. The Year of Autonomous Vehicles

2016 was definitely "the year of the autonomous vehicle."

As Google, Tesla and Uber lead the charge, almost every major car company is investing heavily in autonomy.

This will be one of the defining technology developments of the decade -- soon we may well look back in shock that we ever let humans drive cars on their own...

In looking back at the last 12 months, here are the top nine developments in self-driving cars:

### **Autonomous Uber Operational in Pittsburgh:**



- Uber's self-driving autonomous cars began picking up passengers in Pittsburgh this year. They also attempted a rollout in San Francisco.

#### **Uber's Self-Driving Trucks Made a Delivery of 50,000 Beers:**

- This year, Uber acquired autonomous truck company Otto, and the retrofitted 18-wheeler made its first delivery... 50,000 cans of Budweiser

#### **Every Tesla Will Be Fully Autonomous in 2017:**

- Elon Musk announced that all new Tesla cars will have Level 5 autonomy. This means that by 2017, Tesla cars will be fully capable of driving themselves with zero interaction from a human driver.

#### **Ford Targets 2021 for Autonomous Vehicle Release:**

- Ford announces intention to deliver high-volume, fully autonomous vehicle for ridesharing in 2021.

#### **GM's First Fully Autonomous Car:**

- The company plans to bring its fully electric self-driving cars to the masses by launching its first driverless cars on Lyft.

#### **Google Creates Waymo to Support Self-Driving Car Technology:**

- Google spun out its self-driving car unit as its own separate entity called Waymo.

#### **Google Plans Ride-Sharing Service with Chrysler:**

- Google will deploy a semi-autonomous version of the Chrysler Pacifica minivan by as soon as the end of 2017.

#### **Autonomy Will Kill Car Ownership:**

- A former Tesla and BMW exec said that self-driving cars would start to kill car ownership in just five years. John Zimmer, the co-founder and president of Lyft, said in September that car ownership would "all but end" in cities by 2025.

#### **Self-Driving Tractors Hit Farms:**

- The self-driving tractors can deliver faster, more precise results than their human-controlled counterparts.

## 7. Here Come Drones & Flying Cars

Quadcopters and multicopters big and small made huge strides in 2016.

We are headed towards a world where autonomous drones will image the world at millimeter resolution, deliver products and packages, and transport humans to remote areas that were previously inaccessible by roads.

Here were the top six drone and “flying car” developments this year:

### **Amazon Prime Air Made Its First Delivery:**

- Amazon’s drone delivery program “Prime Air” made its first delivery in the U.K. this year. Expect a much bigger rollout in 2017.

### **The 7-11 Convenience Store Leads:**

- Convenience store 7-11 made 77 drone deliveries this year, beating Amazon by a long shot.

### **Mercedes Commits \$500M to Drone Delivery:**

- Mercedes-Benz vans and drone tech startup Matternet have created a concept car called a Vision Van. The van’s rooftop serves as a launch and landing pad for Matternet’s new M2 drones

### **Larry Page Funding Flying Cars:**

- Reports this year suggest Google cofounder Larry Page has been personally funding a pair of startups devoted to creating flying cars. He has purportedly put over \$100 million into the ventures.

### **1,000 Organ Transplant Deliveries from Drone Ordered:**

- Last year we saw Chinese company eHang announce the first human-carrying drone. Recently, United Therapeutics CEO Martine Rothblatt announced a deal to fund 1,000 retrofitted eHang drones to provide organ deliveries to transplant patients, as part of Rothblatt’s Manufactured Organ Transport Helicopter (MOTH) system.

### **Uber Launched Its Elevate Program:**

- Global transportation giant Uber announced its plans to enter the “flying car” service arena by publishing a massive whitepaper this year detailing its plan to launch an “on demand aviation” service called Uber Elevate.

## **8. The March of Artificial Intelligence**

Artificial Intelligence (AI) is the most important technology humanity will ever develop. AI is a massive opportunity for humanity, not a threat.

Broadly, AI is the ability of a computer to understand your question, to search its vast memory banks, and to give you the best, most accurate answer.

AI will also help humanity fundamentally solve its grandest challenges.

You may think of early versions of AI as Siri on your iPhone, or IBM’s Watson supercomputer, but what is coming is truly awesome.

Here are 10 of the most important stories for the past year:

### **NVIDIA Revealed a Deep-Learning Computer Chipset:**

- The Tesla P100, Nvidia’s newly announced 15-billion-transistor chip, is designed specifically for deep- learning A.I. technology. Hardware advances like this are rapidly accelerating AI developments.

### **\$5M IBM Watson AI XPRIZE:**

- The XPRIZE Foundation and IBM Watson, in partnership with TED, announced a \$5M purse for the team able to develop an AI that can collaborate with humans to solve grand challenges. The top three teams will compete on the TED stage in the spring of 2020.

### **AI’s Can Read your Lips:**

- A new AI lip reader out of Oxford called LipNet was built to process whole sentences at a time. LipNet was 1.78 times more accurate than human lip readers in translating the same sentences.

### **AI’s Predict Election Better Than Humans:**

- MogIA, an AI system developed by an Indian startup, correctly predicted the outcome of this year's elections. It based its analysis on 20 million data points from platforms such as Google, Twitter and YouTube

#### **AI System Beats 500-to-1 Odds, Predicts the Kentucky Derby Trifecta:**

- A startup called Unanimous AI built a swarm system in which individuals within a group influence each other's decision making. The swarm correctly predicted the top four finishers – known as a superfecta – beating 540 to 1 odds.

#### **Microsoft Speech Recognition Tech Scores Better Than Humans:**

- Microsoft's new speech recognition technology is able to transcribe conversational speech as well as (or even better than) humans. The technology scored a word error rate (WER) of 5.9%.

#### **AI-Written Novel Passes 1st Round of Literary Award:**

- Titled 'The Day A Computer Writes A Novel,' the short story was a team effort between human authors, led by Hitoshi Matsubara from the Future University Hakodate, and, well, a computer.

#### **AI Saves Woman's Life:**

- Reports assert that Japanese doctors have, for the first time in history, used artificial intelligence from IBM's Watson system to detect a rare type of leukemia, helping to save a patient's life.

#### **AI's Beat Human Pilot in Air Combat:**

- Retired United States Air Force Colonel Gene Lee recently went up against ALPHA, an artificial intelligence developed by a University of Cincinnati doctoral graduate in a high-fidelity air combat simulator. The Colonel lost to the AI.

#### **Deep Mind Beats World's GO Champion:**

- The Go-playing AI "AlphaGo" from Google's DeepMind beat the reigning Go world champion, winning the five-game series 4-1 overall. This is a major achievement in the field of AI and deep learning.



## 9. Physics & Exploration

This year saw a number of fundamental achievements in physics, as well as a number of notable discoveries in our quest to explore the cosmos.

Here are the top three stories for your consideration:

### **Gravitational Waves Confirmed:**

- After decades of searching, scientists have succeeded in detecting gravitational waves from the violent merger of two massive black holes.

### **Evidence Found for Planet Nine:**

- This year, more evidence arose suggesting there is, in fact, another giant, icy planet circling at the edges of our solar system.

### **Earth-Size Planet Around Proxima Centauri:**

- A new planet that bears striking similarities to our own planet prompts remarkable inroads into the study of space. This also brings a new area to search for the possibility of extraterrestrial life.

## 10. Conquest of Commercial Space

We are living during the birth of the commercial space era, driven by passionate billionaire backers.

Companies like SpaceX, Blue Origin, Planetary Resources and various teams competing for the Google Lunar XPRIZE are building commercial rockets and spacecraft to explore the cosmos.

It is an incredibly exciting time for commercial space – here are the top four developments from the past 12 months.

### **Bezos Announced ‘New Glenn’:**

- Jeff Bezos announced a massive new reusable rocket family in development for his private spaceflight company Blue Origin. The rocket, called New Glenn, will be used to launch satellites and people into space, according to Bezos.

### **Four Companies Sign Private Contracts To Fly To Moon In 2017:**



- The teams are competing to win the \$20 million Google Lunar XPRIZE to become to the first private team to land a spacecraft on the moon. The companies are: Moon Express, Spacell, Synergy Moon and Team-Indus.

#### **Musk Announces Mars Plans:**

- SpaceX founder Elon Musk said he will put a person on Mars by 2025. There are four key things we will need to get there: full reusability, refueling in orbit, propellant production on Mars, and a propellant that works.

#### **Breakthrough Starshot Project Targets Interstellar Travel:**

- Theoretical physicist Stephen Hawking and Russian billionaire Yuri Milner announced their collaborative venture “Breakthrough Starshot” – a \$100 million attempt to make an interstellar starship.

## Conclusion

What a past 12 months!

Thanks to Peter Diamandis of Singularity University for this great summary of significant technological events during 2016.

Boards all over the world have a lot to think about.

# Thanks for reading

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