# POWERING A CONNECTED WORLD. NETWORKS OF THE FUTURE

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## A CONNECTED WORLD

There is no doubt that the **Internet of Things (IoT)** is here. Consumer and business demand for **more connected devices** and greater bandwidth is driving an explosion in the networked world. It's not just new 'things' that are being connected, but existing devices that are being combined and re-combined in multiple ways.

Juniper Research estimates that 38.5 billion units will be hooked up to the Internet of Things (IoT) by 2020 as the number of connected devices across the world triples over the next few year[1]. However, the connected world will not truly arrive until the infrastructure and networks supporting it are proven. Between now and 2020, the industry needs to determine which emerging and new network technologies will take centre stage in the IoT.

## SUPPLY AND DEMAND

Networks are evolving to keep pace with the growth in connected devices and, as more devices connect to each, the mounting number of device clusters sending data back to the network is creating a heavy burden. With end-user demand for mobile at an all-time high and wired communications now showing their limitations, **there is a real and urgent need for new distribution and receptor technologies**.

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1 http://www.techweekeurope.co.uk/networks/m2m/juniper-internet-of-things-devices-173468#FjPk1W2LhP5hDuHy.99
TechWeek Europe "Internet Of Things Devices To 'Triple' By 2020" by Michael Moore, July 28, 2015

in the street, in their cars, on transportation and underground. We expect these connections to be fast and as networks deliver this speed, we want it faster still. Once again, **technology is struggling to meet demand**.

This insatiable, end-user hunger for network availability and speed means that they are key differentiators in a **digital journey**. There is a real financial value to this speed - even back in 2009, Amazon found that every second of latency on its site would cost them approximately 10% of revenue [2]. More recent estimates from Akamai show that just a one second delay in page response can result in a 7% reduction in conversions [3].

All the big internet players are also increasing pressure to **get more smart objects into consumer hands**. Apple started with their iBeacon protocol in 2014, and Google, Facebook and Amazon are following the trend with IoT platforms like Brillo and Parse and devices like the Dash Button.

## DEVICES AND NETWORKS

**Network technologies** will ultimately deliver the IoT. How do the current networks measure up? The wired internet, which works fine when you're in a static location; Wi-Fi communications that connect us to a LAN network; and mobile networks, such as 3G and 4G, which depend entirely on coverage quality; are the most used networks. However, one of the challenges with devices, such as PCs and mobile, is that the connection to these networks tends to be on a binary mode and connected to one type of network or another. What users want is to be able to move from different networks to ensure a seamless connection.

What we will start seeing is a demand for network bridges and switches in micro-form or a software form that will allow devices to connect to multiple networks. **Next generation networks (NGN)** and **software defined networks (SDN)** will evolve and deliver this multicarrier ability to send and receive packets across numerous networks and then combine them to form a whole service. This will give end-users the greater speed they need, greatly improving the digital experience.

## EMERGING AND NEW NETWORK TECHNOLOGIES

As well as making the best of current network technologies, we will start to see the emergence of new types of connections. Today's networks, such as broadband or mobile, rely on heavy physical infrastructure. The cable for fibre requires space, as do masts,

2 http://docs.presscustomizr.com/article/176-how-to-improve-the-page-load-performances-with-the-customizr-theme
Source: Press Customizer, November 2015
3 https://blog.kissmetrics.com/loading-time/

repeaters and boosters for mobile networks. This requirement for space and construction makes these networks burdensome and clunky. This has driven a demand for new network paradigms that necessitate much lower physical footprints, such as Li-Fi and laser networks. These emerging networks offer exciting possibilities and could change industries and consumer buying power alike.

**Laser networks**

By 2020, we will see more laser technologies, with laser distribution placed between buildings to transmit through the network. The beauty of laser networks is that it avoids having to lay physical cable in a road, but instead creates a laser bridge in the air to transmit data. In fact, multiple laser bridges could be used to create huge capacity if required.

A laser network is used to link the New York Stock Exchange with the Nasdaq Stock Market in the first phase of a planned grid to link nearly all of the U.S. stock exchanges. This laser network has become crucial in speeding up trades in an environment where nanoseconds can make a huge difference between success and failure. Laser networks can literally travel near light speed.

**Firechat**

An emerging network is Firechat, essentially where the connection between a number of mobile phones creates a self-fulfilling network. Each phone has the ability to be a network booster, via an app, and this cluster of them creates a mini network with increased bandwidth capabilities.

**Li-Fi**

Li-Fi is a network that distributes bandwidth through LED lights, rather than the Wi-Fi method, which is based on waves. The pulse in LEDS transmits the data and because light waves are closer together the network delivers much higher frequencies, making it fast. Which, as we know, will drive uptake. Unlike Wi-Fi, which suffers from interference, Li-Fi doesn't experience interference in the direct line of sight. This could make Li-Fi a ubiquitous network that could be available anywhere where there is LED light, but where traditional networks don't work well, such as on planes, ships and underground. Because Li-Fi uses the current infrastructure, there is no need for a new, heavy footprint.

**Existing resources**

We will see a focus on using existing infrastructure for new networks to minimise costs and disruption. For example, there is a lot of redundant network capacity in power lines. We may well see a time were local street lights, connected to power through copper electricity cables, are used to create bandwidth for networks. The final network service could then be distributed using LED lights.

It's realistic to assume that not one of these networks will win out, but the availability of a range of networks will help fuel the progression of the IoT. Devices will no longer be binary, but will instead have the ability to connect to multiple networks, whether that's fixed-line, Wi-Fi, Li-Fi or 4G. Devices would then send packets across these data networks to increase the capacity available.

## THE FUTURE WORLD

With these network capabilities, it's safe to say that **the future includes connected vehicles, connected homes and beyond**.

Li-Fi, for example, could change the way we live and work. There could be a time when Li-Fi's are used in cars by utilising the taillights as transmitters to sense the environment around it and to receive information from and to the road. There are endless possibilities and implications for safety and traffic information. Perhaps we may see a time when all light bulbs have a built-in facility to be a network receiver.

Similarly, smart grids could change the face of the utilities industry and suppliers' ability to meet user demand. By connecting the whole electricity chain together, from power stations to homes, consumers could enjoy a more reliable and energy efficient power supply. It's the network capabilities of a smart grid that enables better transmission and distribution of power, through the automated, bidirectional flow of information. This shows how the **IoT can disrupt entire industries** by delivering never-before-seen insight throughout existing processes.

## SENSORY AND ASSERTIVE CONTENT

Whilst industries shift, so too will consumer behaviour and expectation. The content we receive and the way we view it is very much a product of the network frameworks available. Many ecommerce sites are the same, with tiled images and text below each. As a result, consumers have 'scroll blindness' – a hypnotic state caused by scrolling through content that looks the same as any other.

Consumers begin to struggle to differentiate between ecommerce sites because the brain goes into a trance-like state. With additional bandwidth and multi-network capability, brands can interrupt the search patterns with different types of content and media, such as audio, video and even vibration. This would mean that content would no longer be passive and bland, but more active to better engage consumers.

This active and assertive content will allow users to experience the internet in a completely different way, with brands making better use of the available senses.

## WHAT DOES 2020 LOOK LIKE?

The future is all about the network and the devices that connect us to these networks. It will change content, data and human behaviour. Increased network capabilities open up a new world that will benefit both business and consumers.

The demand for connected devices is there, but we won't get there without the right networks. The 2015 budget included a number of initiatives to support networking technologies, including the IoT and 5G mobile networks. These are interesting times as a few networking technologies come to the fore of the IoT space. Applications and lesser-known protocols may well be swallowed up by a not-yet identified big IoT player.

User demand for new connections and data possibilities have put networks in the spotlight. **The connected world has never looked more exciting**.