



WightFibre, Plume and OpenSync

A Different Kind of Broadband • Full-fibre • Ultrafast • Future-proof



Executive Summary

WightFibre has created one of the best broadband networks in the world providing domestic and business customers with future-proofed ultrafast, full-fibre, internet access.

With such fast broadband speeds, expanding WiFi coverage throughout the whole home or business premises has never been more critical. But more than that, the explosion of wireless portable devices, smart appliances, home automation and the "Internet of Things" (IoT) not only need to be connected but they also need to be looked after and monitored for reliability, safety and security.

Connectivity is essential to the modern home. But consumers want more than reliable WiFi. They expect high-quality network performance but also personalised, rich services.

As the smart home transforms and the home network becomes more intelligent - and more congested - Internet Service Providers (ISPs) need to be able to deliver new capabilities at scale, quickly and easily.

OpenSync, a cloud-hosted, open-source framework, enables rapid curation, delivery, scale, management and support of the services platform for the evolving smart home or business. OpenSync is an important building block in the WightFibre WiFi Ecosystem. Originated by WightFibre's partner Plume, OpenSync is a platform for Communication and Internet Service Providers, technology makers and chipset manufacturers enabling them to create a host of solutions with ease of management, reliability and security "baked in".

This whitepaper provides a comprehensive overview of OpenSync and its benefits for home and small business users.



Introduction: The Evolution of the Smart Home

The modern home is transforming. Just as businesses are adopting digital technology to modernize operations, consumers are embracing smart devices to make their home environments more convenient and enjoyable.

The market for smart home devices is booming, no longer a niche segment for early adopters. The growth continued throughout the pandemic at a time when consumers reduced spending on nonessential purchases. For example, sales of smart speakers reached record levels in 2020, with more than 150 million units sold globally, according to Strategy Analytics (March 2021).

Overall shipments of smart home devices are expected to rise from 801.5 million devices to 1.4 billion between 2020 and 2025, according to International Data Corporation (IDC).

Popular smart home devices are now available in the form of smart phones, smart TVs, smart speakers, smart assistants and so on. There are home and business automation systems for lighting and heating control. The new generation of top-end kitchen appliances from many manufacturers are even WiFi connected, including ovens, washing machines and tumble dryers.

In the business environment, there has been a proliferation in handheld devices such as order pads in hospitality settings and mobile stock pads and scanners in warehouses, and almost everywhere you go now customers expect reliable guest WiFi access, easily available, for free

Consumer habits are shifting to more online interaction and activities, making WiFi connectivity even more crucial. More people are turning to mesh networks for a high-quality connection, with improved coverage and better load balancing between the numerous connected devices. Customers using HomePass from WightFibre have on average more than 14.4 devices connected to their home network, and around 1% have more than 50 devices connected.

The desire for reliable connectivity is now only part of the picture. Consumers using their devices and services want the experience to be seamless and not constrained by the efforts of individual vendors. To be able to achieve these new demands by consumers, two things are needed:

- a more sophisticated centralised view and management tools for their network and WiFi.
- The ability to have the same view and management of the WiFi via different vendor equipment.

This is what OpenSync helps WightFibre to enable, with simplicity speed and scale. It is the fastest-growing opensource framework for the smart home and business and has been adopted by many industry players including chipset makers, Customer Premises equipment (CPE) manufacturers, Original Design Manufacturers and Communication Service Providers and ISPs.As the home and business environments continue to evolve, the market will move further away from disjointed hardware and services towards cloud-based platforms that enable the delivery of customer experiences and services. OpenSync will continue to enable WightFibre to evolve products and services for both home and small business consumers.



Overview of OpenSync

OpenSync is a secure cloud-based open-source software service platform. It has already been adopted by many global players for incorporation into their products and services and is backed by Comcast, and other big-name partners like Samsung Electronics, Bell Canada, and Liberty Global.

OpenSync is used for WiFi mesh networks, access control, cybersecurity, parental controls, automated IoT onboarding, and telemetry. And of course, it's used by Plume who originated the standard and is in Homepass, Workpass available with WightFibre's residential and small business consumer broadband subscriptions.

OpenSync connects in-home devices and hardware to the cloud providing telemetry and controls that enables customers to intelligently manage their home network.

Being open-source the OpenSync framework is being widely adopted enabling chipset suppliers, system integrators and operators like WightFibre rapidly develop and deploy new products and services for customers, often without even having to visit the customer home or premises

OpenSync operates across residential and business broadband routers, WiFi access points, extenders, set-top boxes, IoT hubs, smart speakers and other WiFi enabled equipment.

How Does OpenSync Work?

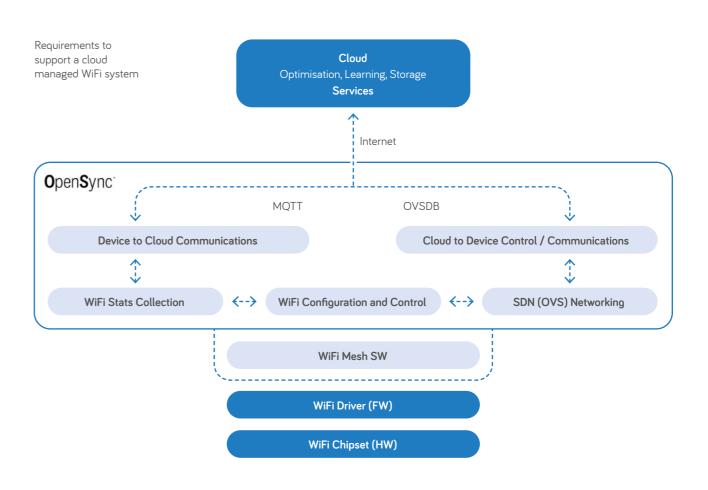
In a cloud services architecture, the bottom layers comprise the WiFi chipset (hardware and firmware), usually supplied by the chipset manufacturer. Platforms providers often control the top layer—the cloud.

OpenSync, the middle layer, is the software that connects the in-home hardware devices like Access points and customer Internet Routers and the cloud. This layer collects measurements and statistics from the consumer devices and the network management components in the WiFi network and moves the data to the cloud.

The platform also translates the cloud management commands to the hardware driver, providing the underlying layers with commands and configurations that modify the behaviour of a device.

These functions are beneficial in homes with a single WiFi Access Point (AP) or multiple APs configured into a mesh.

Additionally, OpenSync includes software-defined networking (SDN) capability, which helps gather information and statistics about the network traffic in the home and allows the cloud to take action by flexibly applying networking rules. SDN also enables the deployment of new services over time.



The Advantages of Open-Source

Open-Source software is software code that's freely available under a simple licence. In most instances the software can be freely incorporated in products and services as long as the original credits and copyright notices are acknowledged and its normal for bug fixes, improvements and new ideas to be fed back into the open-source community.

It's a different approach from standardisation, where interested parties try to get together in advance to form a consensus for how something will work and then agree it as a standard, but then often develop their own implementations

Developing a standard normally takes longer than open source, due to the amount of testing required before the adoption of the standard as each vendor tests their own implementation of the standard. Whereas open-source development essentially tests the same code across each vendor, and therefore reduces the amount of testing required.

Many high profile projects have been originated through open-source including the Linux operating system, the database MYSQL and the web server Apache.





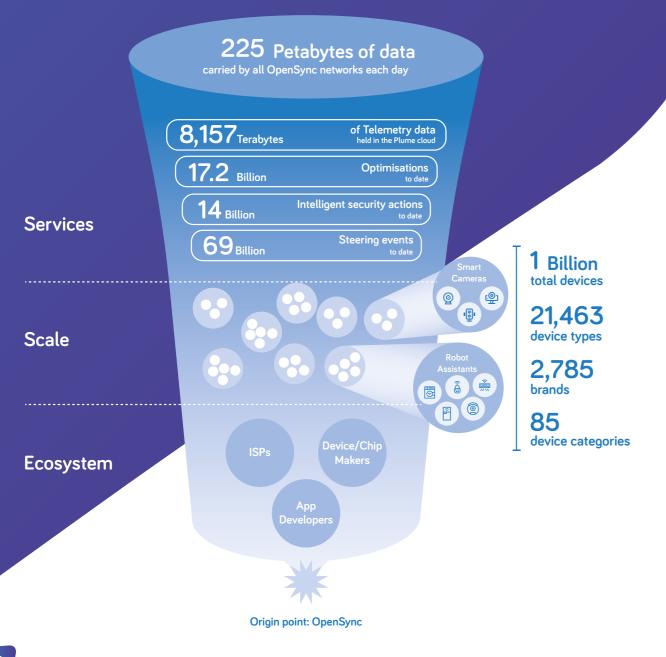
Framework Development and Adoption

Samsung, Comcast, Bell Canada, Liberty Global, and Plume began developing the OpenSync silicon-to-cloud framework in 2015. In 2018, OpenSync was open-sourced as a hardware-agnostic initiative to improve cloud interconnection to networking devices.

The software has evolved significantly over the years, receiving contributions from numerous industry players. There are no membership requirements for organizations to contribute to or adopt OpenSync.

Today, OpenSync is seeing explosive growth. The platform is present in over 30 million WiFi Access Points and devices and has had over 1 billion client devices connect to it. With the software ported onto so many different gateways and extended devices, OpenSync now provides a complete management and service-enabling solution for all network devices.

The rapidly expanding OpenSync universe





OpenSync in Use

Samsung

Samsung Electronics uses the OpenSync Framework for SmartThings WiFi, its tightly integrated mesh WiFi router and smart home hub the manages home security and smart home solutions. There is plug-and-play compatibility between Samsung's SmartThings WiFi and third-party IoT devices, OpenSync enables Samsung to offer customer's flexibility as well as the ability to upgrade services easily.

Telecom Infra Project

The Telecom Infra Project (TIP), a nonprofit foundation developing infrastructure for global telecommunications network, adopted OpenSync in February 2020 as a key componenet of the TIP OpenWiFi project.

Open WiFi seeks to create disaggregated solutions that reduce vendor lock-in and accelerate deployment of advance in WiFi. TIP adopted OpenSync as part of its Access Point (AP) WiFi software stack. This is because OpenSync:

- Provides consistent metrics across a wide variety of devices
- Unifies the cloud-toOdevice interface including configuration and control.
- Enables deployment of a wide variety range of services through a software defined . network (SDN) architecture.

Plume has pledge to support the community effort for creating a new class of AP software stack that will facilitate ubiquitous interoperability across devices, operation systems, software and services.

Opensync is adopted by:

- ODMs (Original Distribution Manufacturers) such as Samsung, Sagemcom
- Application Developers such as Symantec, Cognitive Systems
- CSPs such as Comcast, Vodafone
- Chipset makers such as Qualcomm, Broadcom and Quantenna
- Cloud Providers such as Plume, Tanaza and NetExperience





Core Technical Components

OpenSync is not a standalone piece of software; it's designed to work hand in hand with the underlying hardware and hardware drivers in devices to provide the required functionality. Chipset designers/manufacturers working with OpenSync will normally provide a Software Development Kit (SDK) which the creators of devices using those chipsets can use.

OpenSync has three core components:

Telemetry

- Collects measurements reported by the low-level drivers. .
- Compiles and pre-processes the measurements into statistics that are uniform across different devices.
- Presents the statistics using standardised formats.
- Prepares the formatted statistics for packet transfer to the cloud using serialisation. .
- Communicates the statistics to the cloud using standardised and efficient telemetry.

Control

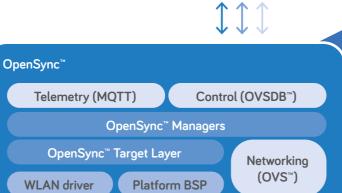
- Defines a standard interface for controlling messaging from the cloud.
- Provides operations necessary to manage the services, such as onboarding and provisioning.
- Provides rules-based networking configurations to block, filter, forward, and prioritise messages.
- Implements software to manage the device maintenance functions, including logging, firmware upgrades and • debugging.

Networking

- Monitors traffic-flow statistics and controls traffic to detect and block malware and viruses.
- Intercepts DNS queries to provide parental controls.
- Controls device traffic to enforce network access settings. .
- Enables software-defined networking (SDN). .
- Provides whole-home WiFi management.

Cloud - Big Data Advantages

- Network operaations & customer support
- Inventory & billing systems
- Data analytics & insights with scalable realtime
- Service onboarding & provisioning
- Device & firmware management
- Network performance





OpenSync Managers

Designed into OpenSync are a number of "Managers". These are special processes that perform a specific group of tasks. The four most important Managers are:

- Stats: gathering statistics and preparing them for transmission to the cloud.
- Wireless: SSID/AP config, associated client reporting, radio configuration.
- Network: IPv4/IPv6 addresses, DNS, firewall, Generic Routing Encapsulation tunnels (GRE), DHCP reservations.
- Connection: establishes backhaul connection and maintains connection with the cloud.

The main managers are supported by a number of ancillary managers:

- Diagnostics: spawns the rest of the OpenSync managers and monitors their operation.
- Steering: responsible for band steering and client steering of WiFi clients.
- Queue: responsible for sending messages to the cloud using Protobuf and MQTT.
- Log: collecting and uploading logs on demand for debugging and monitoring.
- OpenFlow: manages packet flow rules configured in Open vSwitch (OVS).
- Platform: naming and device typing, cloud managed device parental control/device freeze.

Telemetry, Measurements, and Statistics

The telemetry portion is based on Message Queuing Telemetry Transport (MQTT). Based on an OASIS standard messaging protocol, MQTT is a proven, efficient IoT framework that has been deployed successfully across the industry.

An extremely lightweight messaging transport, MQTT is designed to connect remote devices, for frequent reports, with minimal bandwidth and a small code footprint.

OpenSync also supports Protocol Buffers (Protobuf), a language- and platform-neutral data interchange format developed by Google. Protobuf is especially useful because of its flexible and simple format that can be easily parsed.

Control and Management

The control interface is based on Open vSwitch Database Management Protocol (OVSDB), a method that provides synchronised, distributed database semantics with callbacks on transactions. Robust, highly reliable, and industry-tested, OVSDB can be used uniformly in devices and in the cloud .

The OVSDB tables control the networking functions and all the parameters in a device, including WiFi functions. Editing entries in the OVSDB tables enables the cloud and OpenSync to exchange system information and instructions.

OVSDB has a number of properties that make it an effective control interface for a home networking system:

- It has both cloud-side and device-side open source implementations readily available.
- As a database, it naturally persists the state of a device. .
- It has built-in capabilities to maintain consistency between the state on the device and the state in the cloud. The database can be read and written from different sources, so there can be multiple points of control that are consistent within the cloud and device.

Networking

He networking element works jointly with OVSB and OpenFlow, and leverages Open Virtual Switch (OVS"). The flexibility that OVS provides allows the deployment of new services without having to update the firmware on customer devices. What would once have been a firmware update is now a reconfiguration of the parameters in the OVS system.

This capability is noteworthy because firmware updates are fraught with problems. While containers can help this challenge and are an option to consider, deploying new firmware onto devices in the field is generally avoided.

Many modern networking chipsets have built-in support for OVS. However, OVS can also be ported onto chipsets that don't explicitly support it. Additionally, OpenSync does not require a complete implementation of OVS, and also uses OVS in a way that allows only the first few packets of each new flow to require detailed processing.

One of the advantages of OVS is that it enables software-defined networking (SDN) capabilities. SDN helps gather information and statistics about the network traffic in the home, and allows the cloud to take action by flexibly applying networking rules.

Software - Defined Networking in the Home

Software-Defined Networking (SDN) has become a core component of many modern enterprises' data centres. In the home network, however, SDN applications are only just emerging.

For WightFibre, software-driven technology presents the opportunity to accelerate the launch of new services to our customer base and meet rapidly-changing customer demands.

The SDN's traffic control capabilities also help maintain service quality. By automatically identifying and measuring the traffic, SDN can not only detect and fix issues but also provide a better experience for highbandwidth, low-latency applications such as video streaming. Additionally, the ability to monitor and control traffic flows within the home enables WightFibre to offer value-added services such as cyber-security.



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OpenSync Capabilities

Using OpenSync, WightFibre connects all compatible networking devices via a secure cloud link to provide a variety of services.

Currently the main services OpenSync can provide are:

- Cloud-based Wi-Fi Management
- Cyber-Security
- Parental Controls (or Staff controls in a business environment) .
- Access Control .
- Wi-Fi motion detection .

Because OpenSync is an open-source platform it can easily be updated to include new features and applications as partner companies think of them and create them.

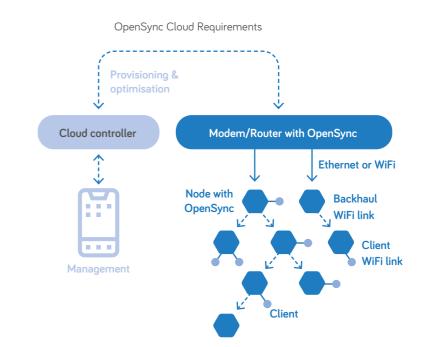
Cloud-based WiFi Management

OpenSync uses the scalability and computing power of the cloud to great effect: The computing power and memory available in the cloud allows for far more sophisticated algorithms and machine learning from a far bigger pool of data, all the better to optimise and manage your WiFi.

As the customer you get to control these services via an easy to use phone App or browser login using HomePass for domestic customer or BusinessPass for business customers, and a key benefit of the OpenSync solution is that you can see not just what your traditional devices like PC's laptops and mobile devices are doing but also your "Internet of Things" like Smart TV's, streaming devices and home automation.

WiFi management supported by OpenSync includes:

- Configuration of connections between multiple WiFi Access Points enabling easy and seamless . setup to get Wifi throughout your home or business premises.
- Connection Steering, improving the user experience as a device moves around within the area of coverage by making sure it is always getting the best signal from the Access Point best placed to serve it
- . Network and Traffic separation, enabling easy configuration of Private and Guest networks enhancing privacy and security
- WiFi 6 Support, enabling the benefits of this latest WiFi standard such as higher network . connection speeds and overall higher network capacity
- Traffic prioritisation, detecting a protecting data flows like streaming that require . low-latency and no interruption from lower priority data flows like web browsing



OpenSync's other capabilities can be grouped into three main categories

Network management

Device management

- Cloud connection for statistics and optimized control.
- Inherent elimination of conflicting controllers.
- Zero wait and multi-AP coordinated dynamic frequency selection.
- Rapid network optimization reconfiguration.

- WAN/broadband connection management.
- Cloud-controlled software agent upgrades.
- cloud coordination.

12 OpenSync Capabilities

Support for mixed private and public networks

• Device thermal management with

- Captive portal.
- Application and domain monitoring and blocking.
- Unique passwords per client device.
- Traffic isolation on WiFi and on Ethernet.



WiFi6: How OpenSync Delivers and Fully Optimised Experience

WiFi6 is the latest WiFi standard and is arguably the biggest step change in WiFi since the original 2.4GHz band was joined by the 5GHz band.

You may be wondering what happened to WiFi 1 to 5? WiFi 6 is the first standard really to be given its own customer-friendly name (in much the same way that mobile phone data has been called 2G, 3G, 4G and 5G). Previously the WiFi types have mainly be known by their technical standards and sub variants, so, in brief:

- WiFi 1: IEEE802.11 -2.4GHz, 1 to 2 Mbits
- WiFI 2 IEEE802.11b 2.4MHz, up to 11 Mbits
- WiFi 3: IEEE802.11g.. 2.4MHz, up to 54 Mbits
- WiFi 4: IEEE802.11n introduced the 5GHz band, 54 up to theoretical 600Mbits
- WiFi 5: IEEE802.11ac..400 Mbits becomes widely achievable with several Gbits in theory.

WiFi 6 by comparison will also add the 6GHz band (with WiFi 6E) to the pre-existing 2.4GHz and 5GHz WiFi bands and looks to rival many of todays wired network speeds. WiFi6 compatible devices should more easily achieve higher speeds, whilst compatibility is maintained for old devices, and cheap 2.4GHz IoT devices.

To unlock the full potential of the features of WiFi6, it is really important to be able to configure the network and Access Points to their optimum and in being able to do this automatically, OpenSync enables customers to get the very best out of their WiFi 6 Access Points and devices.

Some of the features of WiFi 6 that achieve the much higher speeds are quite technical. For example WiFi 6 uses orthogonal frequency-division multiple access (OFDMA), which allows a single transmission to be shared between multiple devices greatly improving efficiency and capacity. However getting the benefits of OFDMA requires OFDMA-aware client steering – so in some circumstances better performance may be achieved for an individual device by it being able to "hear" an OFDMA transmission, which may not necessarily be in the nearest Access Point (or the one with the highest raw signal strength). This is where OpenSync and its cloud-based machine learning and optimisation comes into its own, providing a centralised intelligent network controller that provides rigorous optimisation and maximises efficiency.

Cyber Security

Using OpenSync, Wightfibre enables the autonomous monitoring and control of the traffic flowing both into and out of your network. Not only can OpenSync spot rogue traffic created by malware and viruses, but it is also wise to the techniques now being used by cyber-criminals making it harder to detect, such as limiting network traffic; because OpenSync sees all the traffic it makes it easier to detect these threats. By using networking control, OpenSync can also detect and block denial of service (DOS) attacks. This is especially pertinent to IoT and other home automation devices which don't have readily available anti-virus software.

Parental Controls

One of the weaknesses of most parental control software packages and systems is that on one hand they are a bit of a blunt instrument in that in restricting a child's usage they can often restrict the usage of adults using the same device, whilst on the other hand leaving gaping holes if a device doesn't have such software available for it. Using Opensync, WightFibre enables you to configure parental controls at both a device and a person level.

Device Control

Being able to define the access of individual devices provides both additional security but also flexibility. For example, you can configure it so that some devices (such as a printer or a network storage devices and other computers) are off-limits to say a streaming device or home automation device, whilst still giving those devices access to the Internet but still being able to "see" those devices from your phone if they have an App that needs to be on the same network so you can control them.

WiFi Motion Detection

OpenSync is constantly monitoring the WiFi signals between devices and Access Points. One of the really clever side effects of this is that it can detect "disturbances in the force", effectively turning your WiFi network covering your home or business premises into a motion detector. OpenSync can not only detect the level of motion but also where it is occurring. This motion detection capability can be used for home security applications such as the system already available within HomePass and even for healthcare monitoring of the elderly.



Advantages for Stakeholders

Highly regarded Industry analyst Frost & Sullivan has forecast exponential growth in the smart home and IoT market with the global market expected to be worth nearly \$263 billion by 2025.

Consumers want not only wall-to-wall reliable WiFi but also more choice for personalised services with a seamless experience. They want greater control of their smart devices including the ability to mix and match devices and Access Points without worrying about being locked into one brand.

Consumers also don't want to be upgrading hardware all the time and fortunately the ability to introduce new features and functionality is inherent in devices using OpenSync.

This enables Communication and Internet Service providers like WightFibre to consistently be adapting to consumer needs and deliver next generation products and services to customers of its network.

One of the biggest benefits of OpenSync for Wightfibre is the cloud-based WiFi management. As home networks continue to become more complex and congested, they require more sophisticated control, coordination, and optimization. With the proliferation of consumer IoT devices in the home and the healthy pace of smart home adoption, WightFibre can harness the power of the cloud to offer new capabilities and maintain quality service.

For WightFibre, rolling out an array of services quickly and efficiently could be a challenge. If WightFibre were to build each service from scratch by itself, the total investment would be untenable. By adopting a cloud-services architecture, WightFibre can deploy these new services—as well as the future progression of additional services—rapidly and without disruption to the customer. In addition to the interoperability and the fast development and deployment of new services, the robust OpenSync system provides benefits such as:

- Efficient methods for telemetry and control.
- Support for a broad range of existing connectivity services.
- Scalability of services, often with only cloud software changes.

Many Chipset Manufacturers, Device designers and manufacturers and software developers take advantage of the OpenSync framework, including Samsung, Qualcomm, Sagemcom and Quantenna. This means that more and more Access Points, broadband routers and devices support OpenSync giving the customer the future choice and interoperability they will require.

How are OpenSync Access Points better than other WiFi systems?

Many customers will perhaps have tried to sort out WiFi in their home by using low cost extenders or maybe "mesh" devices. The main difference between even the latest mesh devices using the EasyMesh standard and OpenSync devices is the level of intelligence and this determines their performance not just in providing WiFi but also the additional service available.

OpenSync is fundamentally different from EasyMesh, another framework that provides interoperability. While the two technologies have some crossover in WiFi layer management, they solve completely different problems.

Compared to OpenSync, EasyMesh:

- Has more limited features for WiFi management.
- Lacks any other functionalities beyond the WiFi mesh layer, such as defining messaging, transport, or connection methods that enable CPEs to communicate with the cloud.

EasyMesh defines the way a local, in-home, multi-AP controller interacts with the software agents inside the APs and configures them to form a mesh network. The main objective of the standard is to give consumers, ODMs, and CSPs more flexibility and prevent vendor lock-in by enabling different vendors' AP products to work together and form one in-home network. However, these networks lack the cloud connection capability and added services provided by OpenSync.

The Wi-Fi Alliance, a nonprofit that sets standards and drives their adoption for the WiFi industry, created the EasyMesh standards and certifies products.

	OpenSync	EasyMesh
Framework	Open Source	Industry Standard
Main Purpose	 Cloud based, Silicon to Service platform which supports hardware from multiple manufacturers Enables the delivery, curation and management of a wide variety of services 	 Provide interoperability for WiFi mesh devices Local multi-Ap network controlled locally
Components	 WiFi configuration and control (with built-in WiFi mesh software) Cloud-device control and communications Software defined networking (SDN) 	• WiFi Mesh Software
Capabilities	 Configuration of connections between multiple APs Client steering controls WiFi 6 support Traffic prioritisation Network management (e.g. cloud connection for statistics and optimised control) Device management (e.g., WAN/broadband connection management) Security controls (e.g., application blocking, unique passwords per client) 	 Configuration of connections between multiple APs Client steering controls WiFi 6 support Traffic prioritisation
Supported Features	 WiFi management Cybersecurity Parental controls WiFi-based motion detection IoT device control 	• WiFi management





OpenSync in Action

OpenSync is a key component of the Plume Devices included in many WightFibre broadband packages. The cloud architecture enables WightFibre to rapidly deliver, scale and support smart home features. With OpenSync, Software Defined Networking (SDN) enables the quick rollout of new services, re-programming network behaviour in real time.

OpenSync is the foundation behind the cloud-based consumer experience management platform (CEM) used by WightFibre enabling features including IoT device management, parental controls, antivirus protection, WiFi motion detection and more.

The services for home customers are controlled via the easy-to-use HomePass mobile App, which includes easy network set up and configuration, access, control, security and more through its Adapt, Guard, Control and Sense modules. Similarly, businesses can operate enterprise grade features through the intuitive WorkPass mobile app.

In 2020 industry analysts Frost & Sullivan named Plume the Entrepreneurial Company of the year in the smart home as a service market. The cloud-based AI-driven CEM platform:

- Helps Wightfibre provide superior WiFi in their homes or businesses, maximising their use of WightFibre's ultrafast full-fibre broadband.
- Helps Wightfibre provide superior customer service and ability to respond to customer needs
- Helps Protect customers and their networks against viruses and malware
- Helps provide multiple value added services, future-proofing not just the broadband connection but the customers' whole WiFi and networking ecosystem

Wightfibre is in good company. More than 200 Communication and Internet Service providers around the world have adopted OpenSync and Plume bringing them to a customer base of more than 25 million, with on average a million new customers around the world each month.



The Future of Smart Home Service Delivery

The growing trend of the modern home as the hub for work, education, and entertainment puts more pressure on home networking capacity demands. It also creates exciting new possibilities in the evolution of the smart home. OpenSync is a proven model for innovating and delivering cutting-edge products and services that offer value to customers. The timing is especially relevant as the surge in WiFi 6 capable devices from laptops and PCs to phones and tablets makes it an ideal time to implement a new WiFi solution at home or in the workplace.

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01983 300 000 www.wightfibre.com