



Sanctum* Builds Scalable Wi-Fi Networks Using SDN-based JustiFi*

Enterprise Wi-Fi environments are more complex as device diversity increases and network usage grows. JustiFi provides an automated, policy-controlled network that provides adaptive coverage and capacity.



In 2019—the 20th anniversary of Wi-Fi—the industry hit a milestone of 30 billion Wi-Fi devices shipped, according to the Wi-Fi Alliance.^{1*} In a sign of how fast Wi-Fi is growing in today's always connected world, the Alliance reports that a full third of the Wi-Fi device installed base has shipped since 2017.

This extraordinary growth has been partly driven by an expanding diversity of Wi-Fi-enabled devices and applications, ranging from laptops to smartphones and mobile tablets to building automation and internet of things (IoT) devices. This diversity has an impact on Wi-Fi infrastructure as the performance of decades-old wireless LAN (WLAN) controller-based architectures is impacted due to complex management, high maintenance overhead, vendor-locked hardware, single point of failure design, limited scalability, and high capital outlays.

The Wi-Fi architecture for large enterprise and public space Wi-Fi deployments can overcome these issues using software-defined networking (SDN) technologies that manage the network using a central, cloud-based SDN controller delivering network simplification, dynamic policy control, intelligent traffic management, and location services.

Large Wi-Fi installations need to be designed for both coverage and capacity. Capacity planning experts for large networks must optimize as co-channel interference, band steering, spectral capacity, collocated access points and load balancing. The information in a central SDN controller can optimize both coverage and capacity, minimizing the need for highly skilled technical experts.

Sanctum Networks,* an Intel® Network Builders ecosystem partner, has developed JustiFi,* an SDN-based Wi-Fi controller architecture that utilizes SDN to help improve Wi-Fi network performance in large enterprise and public space deployments.

JustiFi Solution

Sanctum has developed JustiFi as a policy-based Wi-Fi network solution that offers secure, scalable, cost-effective wireless LANs for business critical mobility. As seen in Figure 1, the core components of the JustiFi solution are the following:

1. CPE Agent that is deployed on network elements (router, access point) with a connection back to the WLAN controller. The CPE Agent collects statistics, monitors the network, and provides orchestration services.
2. WLAN Controller that delivers the security, mobility, coverage, and bandwidth management. The controller includes APIs that allow clients and access points to send customized information for Wi-Fi management back to the controller so it can process this information to form a global view of the network. The controller can be deployed in the cloud or on premises, and it serves as the demarcation point on an enterprise network for security and management purposes.

3. Orchestration Software resides on the central controller and communicates with the CPE Agents providing resource management, authentication, and policy enforcement. The Orchestrator is automated and manages policies, users, and routes through the network using information collected by the agents.
4. Self-Service Portals are customizable web interfaces that enable self-service user log in and service requests.

CPE AGENT	<ul style="list-style-type: none"> • Resides on any physical network element or device • Lightweight & extensible on-demand programmable module • Monitoring & statistic collections • Orchestration agent for Wi-Fi, captive portal login, visibility, quality of service (QoS), access control
ORCHESTRATION	<ul style="list-style-type: none"> • End-to-end orchestration integrating with the Agent • Integrates to existing & new systems and tools • Resource management, authentication, and policy • Collates and provides analytics to operations & visibility • Branches, tunnels, routers, vouchers, policies, users—all managed under one user-friendly portal/app • Automation
WIRELESS LAN CONTROLLER	<ul style="list-style-type: none"> • On-premises and on-cloud models to choose from • Demarcation for various operational zones • Branch office connectivity and orchestration • Enables public Wi-Fi and private managed Wi-Fi deployments • Security, mobility, coverage, bandwidth management
SELF-SERVICE PORTALS	<ul style="list-style-type: none"> • Customer cloud portal for residential Wi-Fi management • Self-service, FUP, QoS, billing, app store • Simple consumption control: who, what, when, and how

Figure 1. Software components of the JustiFi Wi-Fi SDN controller solution.

Bringing SDN and Wi-Fi Together

To insert its SDN and machine learning technology into an enterprise network without requiring a completely new infrastructure, JustiFi’s controller features Sanctum-developed abstractions that add SDN to the IEEE* 802.11 protocol stack. The company then adapted this stack so it can be used with a wide range of off-the-shelf access point hardware.

The controller provides a global view of the network that is combined with historical information about spatial and temporal usage patterns. JustiFi provides a Python-programming language-based scripting API that allows the central controller’s policies to be extended for site-specific customizations and new optimizations that leverage historical knowledge. This dataset allows the central controller to enact policies to control the network’s behavior.

Resolving Capacity Mismatches to Conserve Channels

Evolving 802.11 standards have increased capacity and speeds by allowing the use of wider channels through channel bonding of two or more channels together. The

802.11n standard, for example, can use 2x 20 MHz channels to create a 40 MHz super channel. The 802.11ac standard improved on this with the ability to create 80 MHz (4x 20 MHz) and 160 MHz (8x 20 MHz) super channels.

When 40 MHz or 80 MHz super channels are chosen, access points (APs) require two or four channels for every interface. If the network does not have enough channels to keep the access points isolated in frequency, the APs suffer from self-interference.

Even more problematic, 802.11n supports 40 MHz-wide channels and 802.11ac supports 160 MHz; creating an 80 MHz or 160 MHz super channel is largely wasted if the clients only support 802.11n since they can only use 40 MHz of that channel.

To ensure an efficient allocation of bandwidth, JustiFi adds an algorithm to the routers to track the client type, as well as real-time media use (voice, video, etc.) for each radio, and automatically assigns the right bandwidth for the cell, based on the requirements of the clients. This allows the channels to be created as needed and preserves critical channel spacing to maintain cell separation and avoid interference.

The system can also detect and correct RF interference that comes from rogue APs, such as when a user or guest turns their mobile device into a portable hotspot. Currently, dealing with such environments requires IT technicians to be sent throughout the enterprise to run RF tests and perform signal/spectrum analysis at each AP to diagnose and fix the Wi-Fi performance issues.

Responding to Changing Usage Patterns

Network usage patterns change constantly, and the router parameters must dynamically adapt to those changes to ensure proper bandwidth is deployed where it is needed. With JustiFi's intelligent monitoring and algorithms that can crunch large quantities of data from usage patterns and parameters collected over time, it's very easy for companies to manage connectivity and user quality of experience expectations.

Benefits of JustiFi SDN-based Controller

- End-to-end network visibility
- Application, user, and device awareness
- Per-tenant policy enforcement and visualization
- Auto-provisioning of cloud services
- Auto-detection of multi WAN links
- Customer engagement services
- Community and public Wi-Fi services
- Correlated data analytics
- Simplified network administration
- Works with wide range of routers/access points
- Multivendor Wi-Fi management software

JustiFi Taps Intel® Processors for Performance

Sanctum developed the JustiFi controller on servers utilizing the Intel Atom® C3000 processor, Intel's third generation system-on-a-chip (SoC)-based CPU. Intel Atom SoCs are

designed for light scaled-out workloads that require very low power, high density, and high I/O integration. Intel® QuickAssist Technology (Intel® QAT) functionality is built into the Intel Atom C3000 SoCs for accelerating encryption of customer data, freeing up valuable CPU processor cycles for other critical needs such as data path processing.

Conclusion

Today's enterprise Wi-Fi environments are complex with a need to support an increase in connected devices and in the diversity of the types of connected devices. Users need capacity for both real-time and high bandwidth applications, and coverage to reliably use the network throughout an enterprise. Sanctum Networks' JustiFi delivers an adaptive Wi-Fi infrastructure using SDN and learning algorithms to automatically shift resources to meet end user demand. Utilizing Intel technologies for performance, JustiFi works with all Wi-Fi technologies to allow IT organizations to give users an exceptional wireless experience.

About Sanctum

Sanctum Networks is a pioneer in delivering fully programmable control plane solutions for software-defined access and on premise networks. Its flagship product, Jupiter, is a semantically designed SDN-based distributed service innovation platform, built specifically to dynamically understand the affinities between services and user networks and auto-orchestrate the network to meet ultimate digital satisfaction. Sanctum Networks is currently headquartered in Bangalore, India, with its main engineering and R&D operations there as well. More information is at <http://www.sanctumnetworks.com>.

About Intel® Network Builders

Intel Network Builders is an ecosystem of infrastructure, software, and technology vendors coming together with communications service providers and end users to accelerate the adoption of solutions based on network functions virtualization (NFV) and software defined networking (SDN) in telecommunications and data center networks. The program offers technical support, matchmaking, and co-marketing opportunities to help facilitate joint collaboration through to the trial and deployment of NFV and SDN solutions. Learn more at <http://networkbuilders.intel.com>.



¹ https://www.wi-fi.org/sites/default/files/public/Infographic_20_years_of_Wi-Fi.pdf

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