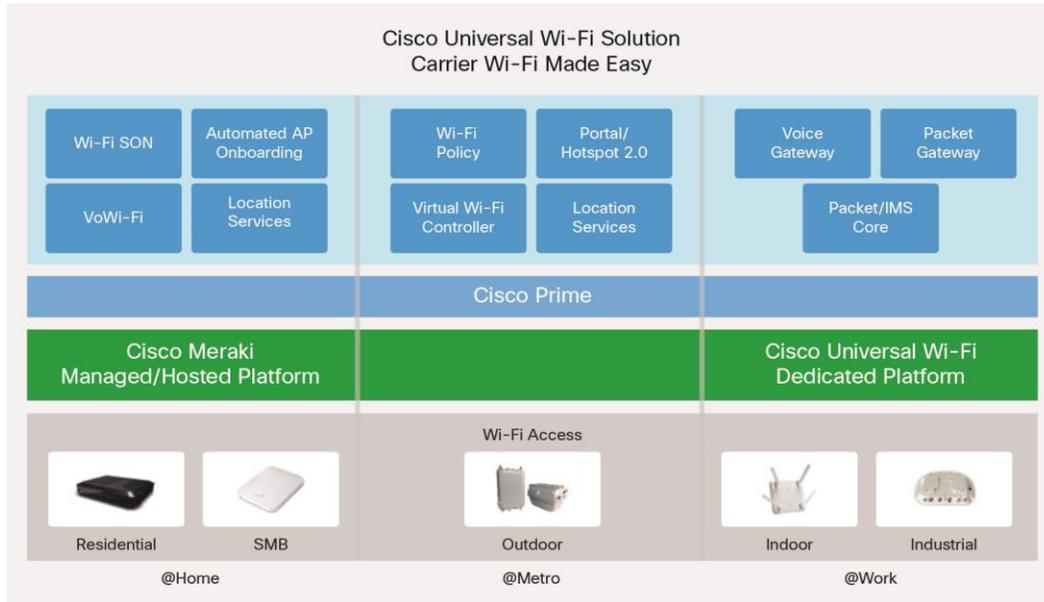# Cisco Universal Wi-Fi Solution 6.0

Cisco® Universal Wi-Fi 6.0 is a carrier-grade solution providing operators with a tested architecture for business and service innovation. A primary feature of the Release 6.0 architecture provides VoWi-Fi support for trusted and untrusted access models. Release 6.0 also offers a variety of tunneling models to support both residential and metro Wi-Fi access networks. Virtual infrastructure components and client onboarding integration open new vertical markets such as hospitality and retail. These features enhance the complete Cisco Universal Wi-Fi solution, offering a portfolio of intelligent 802.11ac access points, an intelligent services platform, and an award-winning mobile packet core.

The Cisco Universal Wi-Fi solution (Figure 1) includes the following elements:

- A complete portfolio of intelligent 802.11ac access points includes the Cisco Aironet® 1530,1550, and 1570 Series for outdoors and the Cisco Aironet 700, 1700, 1800, 2700, 2800, 3700, and 3800 Series for indoors. Silicon-level integration supports crucial network functions, including interference mitigation, resource management, beamforming, band selection, and video optimization.

- Secure network intelligence and management with carrier-grade network analytics, subscriber management, and policy control provided from the Cisco Wireless Controller, the Cisco Mobility Services Engine (MSE), the Cisco Wireless Access Gateways (WAG), and the Cisco Policy Suite. Cisco WAG configuration options include LMA, iWAG, eWAG, and SAMOG-GW. These solution elements give you the flexibility needed to deploy, operate, and manage networks with hundreds of thousands of access points and let you turn on different services by simply pointing and clicking. Real-time analytics and reports are a primary feature of Cisco Universal Wi-Fi, providing operators with a tool for offering location-based services. These robust service features help to reduce operating costs through zero-touch provisioning and centralized interference mitigation and troubleshooting for easier network maintenance.

- Cisco Policy Suite provides a next-generation policy management solution that helps customers scale, control, monetize, and personalize services through a flexible and interactive architecture that supports application-centric policy capabilities. Cisco Policy Suite is a flexible, scalable policy control platform that can be deployed across all access networks.

- The mobile packet core, with the award-winning Cisco ASR 5500 Series, provides standards-based capabilities that allow operators to transparently and securely integrate Wi-Fi, small cell, and macrocell radio networks through the Cisco ASR 5500 Small Cell Gateway. The Cisco ASR 5500 Series includes common subscriber management, policy, and authentication functions, delivering transparent service integration to Wi-Fi and licensed small cell users. The Cisco ASR 5500 Series Small Cell Gateway is widely deployed today, providing multivendor interoperability.

- Across the Universal Wi-Fi solution, Cisco Prime™ Infrastructure is a unified network management platform that supports an intuitive user experience as it integrates operations across Cisco products, technologies, and networks.

Figure 1.   Cisco Universal Wi-Fi

Architecture Models and Use Cases

In this sixth-generation release, Cisco Universal Wi-Fi adds support for VoWi-Fi, EoGRE tunneling, virtual infrastructure, and client onboarding using the webauth model. Selected use cases from Release 5.0 have also been revalidated with newer hardware and software releases.

VoWi-Fi

VoWi-Fi is a market disruptor and has already been deployed by some aggressive MNOs such as T-Mobile. The ability to provide LTE voice quality over Wi-Fi networks is attractive to operators that struggle with coverage and will become important even to those operators with spectrum to provide coverage in building and to reduce roaming costs.

There are several architectural models that operators can employ (Figure 2). The model that operators choose will depend on several factors:

- Do they own spectrum and hence their client's phones utilize SIM cards for access control?
- Do they own or plan to own Wi-Fi access networks?
- Do they plan to provide VoWi-Fi access on devices other than smartphones?

Some operators might choose to provide access using a SIP client on the smartphone or tablet over a trusted Wi-Fi network. In this model, only clients of the operator can connect using proprietary client software, and the operator has control of the Wi-Fi access network.

Operators such as T-Mobile are utilizing the untrusted model. In this case, clients are utilizing native dialers through their IPhone or Android device and connect over any Wi-Fi network to the operator's ePDG (which terminates the secure call from the client's device). The operator has no control over the access control or quality of the Wi-Fi network.

Operators that want to control the user experience for VoWi-Fi while utilizing native VoWi-Fi clients may implement a hybrid model. In this model, the clients are authenticated on the operator's network with their SIM credentials and then connected to the operator's ePDG using a gateway. In this model, the operator controls the Wi-Fi network and, with the use of a policy server, may also influence the flow of voice traffic over the cellular or Wi-Fi network. This model will be tested in a future release.

Figure 2.   VoWi-Fi Architectures
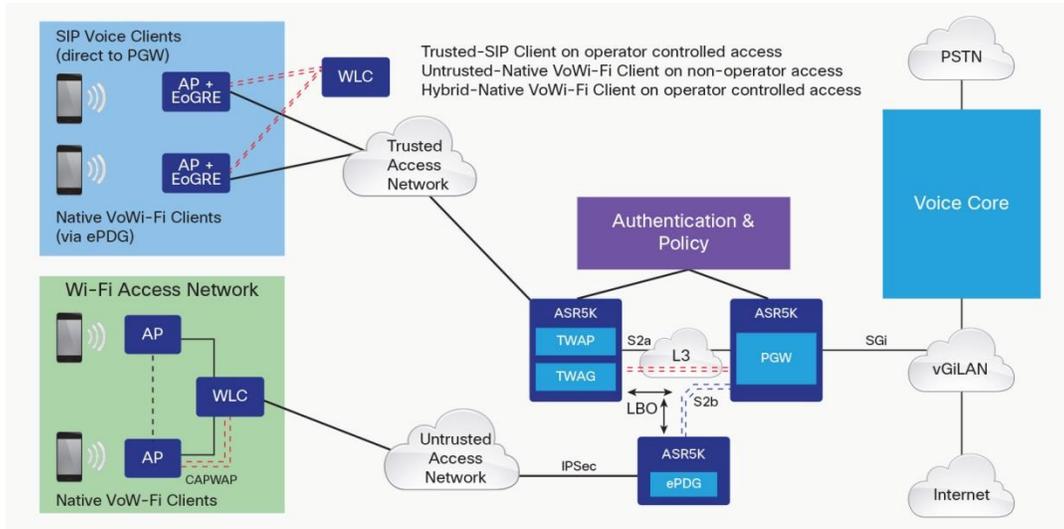
EoGRE Tunneling

EoGRE is a tunneling protocol that is often used by cable operators that want to provide policy controls and features on their connected client networks. All data from the client devices is tunneled back to a gateway, where policy can be implemented. There are two architectural models (converged and split) that can be used to implement this tunneling protocol. The converged model transports both control and client data from the access point back to the wireless LAN controller (WLC) utilizing the CAPWAP protocol and then tunnels the client data to the gateway utilizing the EoGRE protocol. The split model separates the control and client data at the access point, with the control data going to the WLC using CAPWAP and the client data being tunneled back to the gateway using the EoGRE protocol. Figure 3 shows the converged architectural model.

**Figure 3.**   Converged EoGRE Tunneling Architecture
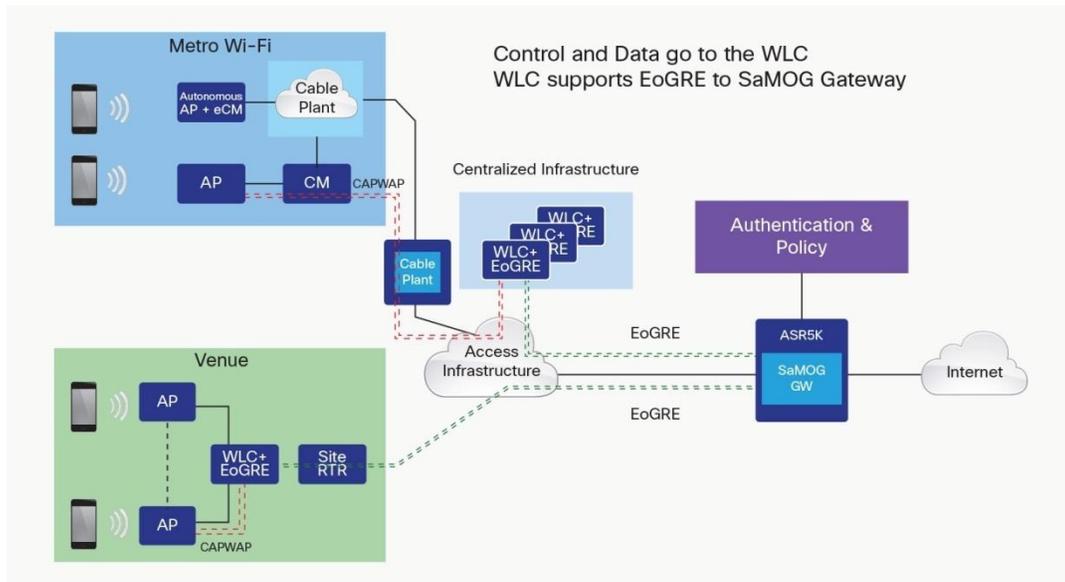
User Onboarding

This feature is typically used in a hospitality application, but is applicable whenever there is a requirement to authenticate users prior to letting them have access to the network. There are two main features in this configuration. The first allows the user to easily access the network. If the user's device's MAC address is already stored in the AAA server, then the user is automatically connected as an authenticated session (MAC TAL). If the user device is not in the AAA server, then the user is redirected to a web portal (based on the location of the access point to which the user is connected) and queried for their user name and password. Upon successful authentication, the user is then allowed access to the network. We've tested two partner solutions in Release 6.0: Single Digits and Global Reach. In the case of Single Digits, the user can access selected pages/sites based on configuration prior to authentication. This feature enables limited access if the user decides not to authenticate.

Both the Single Digits and Global Reach portals have been deployed using the virtual WLC and the virtual ASR1K. These applications reside on a virtual machine located onsite with the access points. In the case of Single Digits, their BAP and white listing module can also be colocated with these virtual components. Figure 4 shows the architectures of a Single Digits and a Global Reach deployment.

Figure 4.   Portal-Based User Onboarding
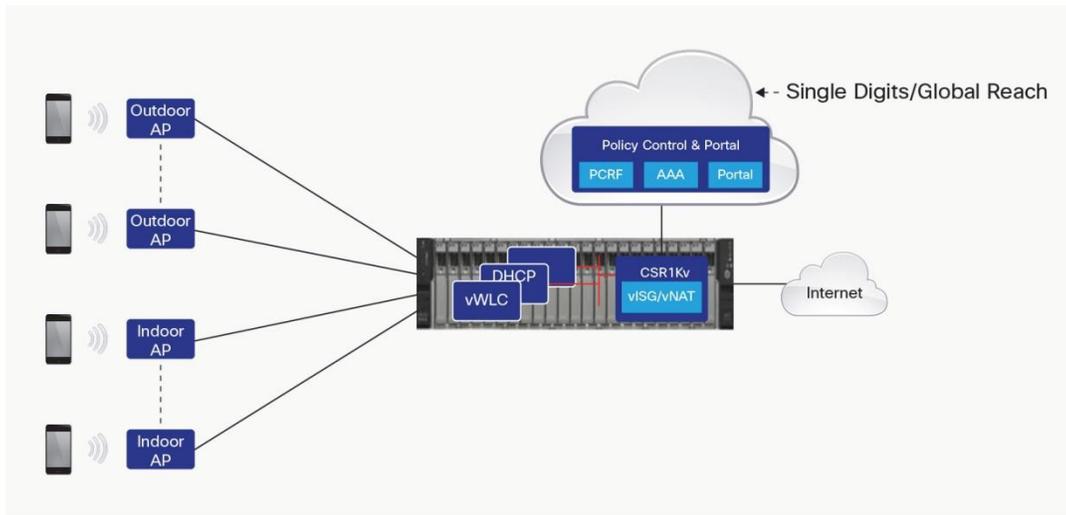
Cisco Prime

Cisco Prime provides a suite of carrier-grade tools to address the challenge in operating and managing complex network infrastructure by providing visibility into network element resources. Cisco Prime consists of the following main tools:

**Cisco Prime Infrastructure:** For management of the Universal Wi-Fi Infrastructure and clients.

Cisco Prime Central: Increases efficiencies in network and service lifecycle management tasks through centralized access to integrated operator workflows.

Cisco Prime Performance Manager: Improves quality of service (QoS) by gathering actionable performance statistics across the entire network.

Cisco Prime Network: Provides comprehensive device operation, administration, and fault management for carrier networks and services, supporting multivendor environments.

Figure 5 shows the framework topology for Cisco Prime.

Figure 5. Cisco Prime Framework Topology
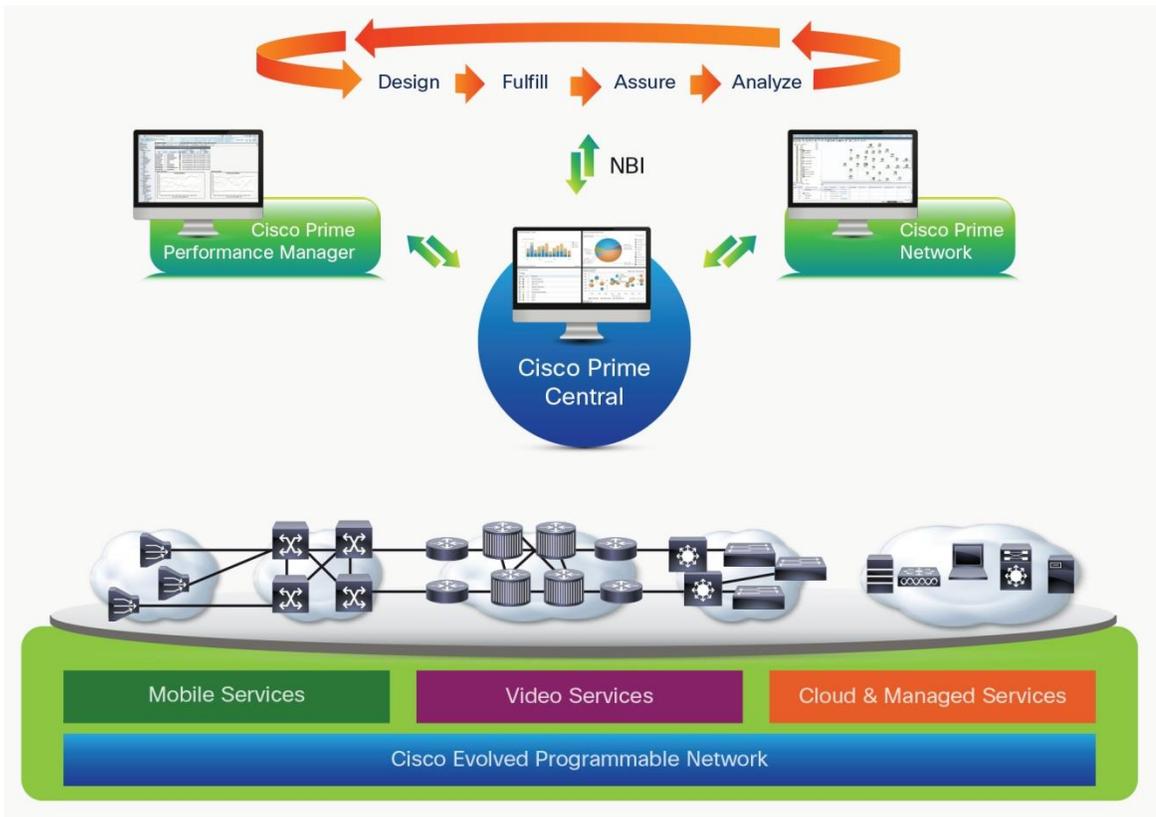
The main use cases and features for the Cisco Universal Wi-Fi Solution 6.0 are shown in Table 1. The main use cases and features for the Cisco Universal Wi-Fi Solution 5.0 are shown for completeness in Table 2.

Table 1. Cisco Universal Wi-Fi Solution Use Case Details Release 6.0

Architecture Models	Use Case Details
VoWi-Fi	**SAMOG-GW Based** • SaMOG PMIPv6-based converged CP-DP on Wi-Fi access network • SaMOG PMIPv6-based split CP-DP on Wi-Fi access network • SaMOG EoGRE-based converged CP-DP on Wi-Fi access network • SaMOG EoGRE-based split CP-DP on Wi-Fi access network
EoGRE tunneling	• Location-specific web authorization using LMA on ASR5500 • Tier 2/Tier 3 • ASR1K base EoGRE deployment model • Cisco Prime Carrier Management
Portals	• Single Digits • Global Reach • vWLC and CSR1Kv support for authentication and MiQ

Table 2.   Existing Cisco Universal Wi-Fi Solution Use Cases (Release 5.0)

Packet core integration	**SAMOG-GW Based** • SaMOG 4G/EPC integration with EAP-SIM authentication[*] • SaMOG 4G/EPC integration with EAP-AKA authentication • SaMOG PMIPv6-based split CP-DP on Wi-Fi access network • SaMOG-based EoGRE deployment model • SaMOG 3G integration model **iWAG Based** • EAP-SIM authentication • EAP-SIM authentication with online charging (Gy interface-based) • EAP-PEAP (not revalidated in Release 6.0) • EAP-TTLS (not revalidated in Release 6.0) • Inter-MAG mobility for PMIPv6 • Intra-MAG mobility • PMIPv6-MAG, GTPv1, GTPv2, and Cisco ISG coexistence (only PMIPV6 validated in Release 6.0) **eWAG Based** (not revalidated in Release 6.0) • RADIUS/DHCP proxy • Unclassified MAC or MAC-TAL • DeWAG on with EAP-SIM authentication - DHCP mode of eWAG (DeWAG)
Internet access	**PMIPv6-MAG on Wireless Controller** • EAP-SIM authentication[*] • Gx-based, web-based authentication from the LMA user device capability • Location-specific web authorization using LMA on ASR5500[*] • Tier 2/Tier 3 • ASR1K base EoGRE deployment model • Cisco Prime Carrier Management (Prime Infrastructure only) • Tested with Release 6.0 elements

Platforms and Software Releases

Table 3 summarizes Cisco Universal Wi-Fi 6.0 platforms and software releases and provides links to product information.

Table 3.   Cisco Universal Wi-Fi Solution 6.0 Platforms and Software Releases

Equipment	Software Release	Product Information
Cisco Aironet Indoor Access Points 1700, 2700, and 3700 for 802.11ac Wave 1 **Cisco Aironet Indoor Access Points 1850, 2800 and 3800 for 802.11ac Wave 2**	8.1MR3	Cisco Aironet 1700 Series Access Point data sheet Cisco Aironet 2700 Series Access Point data sheet Cisco Aironet 3700 Series Access Point data sheet Cisco Aironet 1850 Series Access Point data sheet Cisco Aironet 2800 Series Access Point data sheet Cisco Aironet 3800 Series Access Point data sheet
Cisco Aironet Outdoor Access Points 1550, 1530 for 802.11n **Outdoor Access Points 1570 for 802.11ac**	8.1MR3	Cisco Aironet 1530 Series Access Point data sheet Cisco Aironet 1550 Series Access Point data sheet Cisco Aironet 1570 Series Access Point data sheet
Cisco 5508 Wireless Controller	8.1MR3	Cisco 5508 data sheet
Cisco 8510 Wireless Controller	8.1MR3	Cisco 8510 data sheet
Cisco Virtual LAN Controller	8.1MR3	Cisco vWLC data sheet
Cisco Mobility Services Engine	10.2.0	Cisco Mobility Service Engine data sheet
Cisco ASR 1000 Series (including CSR 1000v)	3.15/16	Cisco ASR 1000 data sheet
Cisco ASR 5000 Series	StarOS 18.2	Cisco ASR 5000 data sheet
Cisco Prime Infrastructure (CPI)	2.2, 3.0	Cisco Prime Infrastructure data sheet

Equipment	Software Release	Product Information
Cisco Policy Suite	Cisco Policy Suite 7.5 MR1	Cisco Policy Suite data sheet for Wi-Fi
Cisco Prime Access Registrar (CPAR)	6.1.2.5	Cisco Prime Access Registrar data sheet
Cisco Prime Network Registrar (CPNR)	8.3.1	Cisco Prime Network Registrar data sheet
Single Digits Portal	4.4.0.1870	
Global Reach Portal	2.19.1	

Cisco Universal Wi-Fi Services Overview

Our Universal Wi-Fi Services portfolio is a comprehensive set of services representing a holistic approach to the total lifecycle of service provider Wi-Fi engagements. Starting with a proof of concept, it covers the end-to-end spectrum of planning, building, optimization, and operation services, each assured by Cisco service level agreements (SLAs). These services are flexible and can be customized.

Cisco Universal Wi-Fi Proof of Concept Service:

- From a cloud-based architecture hosted in a Cisco data center, demonstration of a centralized management system, with zero-touch service fulfillment for rapid deployments of meshed access points

Cisco Universal Wi-Fi RF Plan and Build Service:

- Professional services from Cisco and Cisco's Wi-Fi specialized partners
- Help in planning and deploying the RF components of the Cisco Universal Wi-Fi solution
- Analysis of architectural readiness, with guidance for selecting and prioritizing locations for Wi-Fi
- RF expertise to obtain the most from your wireless access points
- Coverage and capacity planning
- Post-deployment RF analysis help to ensure deployment success

Cisco Universal Wi-Fi Core Plan and Build Service:

- Professional services from Cisco and Cisco's Wi-Fi specialized partners
- Help to plan and deploy the core components of the Cisco Universal Wi-Fi solution
- Analysis of architectural readiness and assistance with the service provider Wi-Fi deployment design
- Start-to-finish deployment assistance, including mobile subscriber policy enforcement system
- Pre-deployment validation to help ensure deployment success
- Post-deployment knowledge transfers to help ensure your understanding of the solution

Cisco Universal Wi-Fi Solution Support Service (reactive):

- Expert assistance to streamline operation of the Wi-Fi architecture
- Quick isolation and remediation of unplanned service disruptions by specialists
- Tracking and identifying the root cause of disruptive incidents, providing valuable information for design changes and scaling with your mobile subscriber growth

Cisco Universal Wi-Fi Optimization Services (proactive):

- Expert analysis and recommendations for transforming your Wi-Fi architecture into a high-performing, efficient environment
- Help to create a strategy for managing all the critical components of the Cisco Universal Wi-Fi architecture using a suite of Cisco hosted network management applications
- Availability and performance optimization expertise to validate planned design changes
- Collaboration to develop a strategy for managing software releases and changes
- Continuous learning activities that help your IT staff become more self-sufficient

Cisco Universal Wi-Fi Assurance Service (preemptive):

- Extension of the measurement and analytical capabilities of your Cisco Universal Wi-Fi architecture
- Real-time monitoring of a variety of key performance indicators from Cisco network operations center
- Comprehensive analytics using fault, capacity, availability, and performance information to help ensure reliable operations

Cisco Universal Wi-Fi Operate Service (end-to-end platform management):

- Monitoring the managed devices in the your environment to help ensure access points and controllers are properly activated and provisioned
- Managing incident and problem resolution
- Identifying operational trends to continually improve performance

Cisco Capital

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Cisco Capital can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce CapEx. Accelerate your growth. Optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital is available in more than 100 countries. Learn more.

For More Information

For more information about the end-to-end Universal Wi-Fi architecture, services, and product details, visit cisco.com/go/spwifi.

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