iPass SmartConnect: a mobile technical decision maker's guide

iPass

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Executive summary

Adding Wi-Fi connectivity into a mobile operator's offering is potentially an attractive way to extend coverage and enhance customer satisfaction at low cost. However, doing this at scale may present significant integration challenges, requiring substantial investment.

To get around this, iPass, a software and technology company that provides mobile connectivity to the world's biggest Wi-Fi network, has developed a data-driven platform called iPass SmartConnect that not only overcomes major integration challenges but also delivers significant additional intelligence. iPass SmartConnect can be integrated into a mobile network relatively easily thanks to a simple yet powerful software development kit (SDK).

This document outlines the main technical characteristics of the platform and illustrates some of the main use cases that could be of benefit to mobile operators.
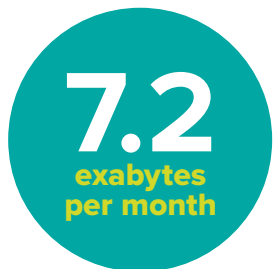
7.2
exabytes
per month

Mobile traffic reached 7.2 exabytes per month at the end of 2016, having grown 63 percent over the course of the year.[1]

Introduction: market dynamics

We are witnessing unprecedented growth in mobile data traffic. According to Cisco's Visual Networking Index, mobile traffic reached 7.2 exabytes per month at the end of 2016, having grown 63 percent over the course of the year.[1] Consumers have shown a voracious appetite for data and demand that they receive faster network speeds and unlimited data plans at cheaper prices. That means that the (finite, comparatively more expensive) cellular capacity that's being added to meet this demand is being consumed almost immediately. Those economics aren't great for mobile operators.

Against this backdrop, it is becoming increasingly difficult for mobile operators to maintain profitable margins and average revenue per user (ARPU). This is creating problems for the industry. Some industry sources, for example, believe that no more than 35 percent of MVNOs will remain profitable in the long term.[2] While the obvious answer is to build out additional mobile network capacity, this requires capital that is hard to come by and is not an option for MVNOs.

Hence operators must maximize their use of all and any available networks. But here again there are challenges. Sub-4G networks may only have limited capacity to carry data at the speeds now demanded by customers, for example.

However, Integrating Wi-Fi into a heterogeneous mobile network has not always been easy. In 2002 iPass helped publish a specification for web-based login and seamless client integration revered to as the WISPr (Wireless ISP roaming) specification, there has been little consistency in its implementation by Wi-Fi Access Gateway providers over the years. As a result, delivering a seamless Wi-Fi connection management experience has required significant collaboration with Wireless ISPs and an investment in dedicated in-house expertise to diagnose each provider's WISPr implementation. What the industry has lacked

until now is a technology interface that would allow MNOs and MVNOs to incorporate Wi-Fi into their networks in a plug-and-play fashion, without having to deal with underlying technical details while still maintaining carrier-grade quality and security.
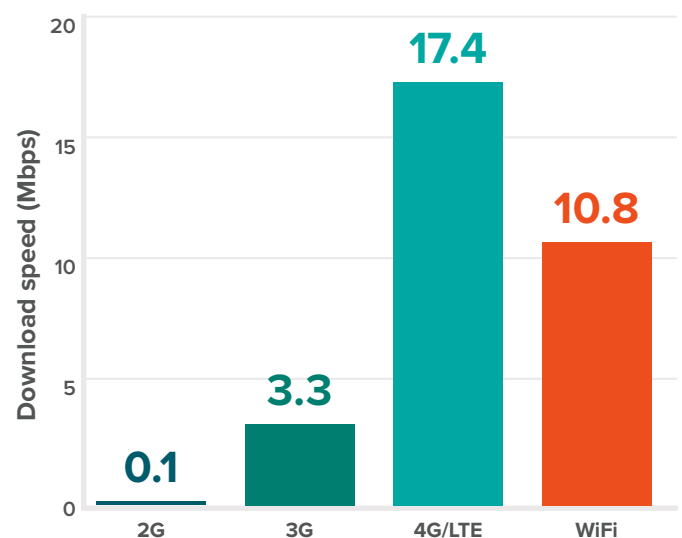
iPass SmartConnect™ has been designed to address this issue, opening a new horizon of competitive opportunity for the mobile industry.

The benefits of having iPass SmartConnect in the mix

iPass brings Wi-Fi connectivity to mobile users whenever and wherever they need it. As the world's largest aggregator of Wi-Fi networks, iPass provides global connectivity as a hosted cloud service to a diverse customer base, from the airline industry to oil and gas services. As part of its vision to make the service invisible to end users, in late 2015 iPass announced iPass SmartConnect, a service that automatically chooses the best hotspot based on a user's needs, enabling iPass users to roam Wi-Fi networks much like they currently roam mobile networks.

iPass SmartConnect not only 'curates' new hotspots into its network, but also gives iPass unprecedented visibility into the global Wi-Fi map as well as extensive insight into user behavior and needs. In effect, every user adds to a constantly growing knowledge base of global hotspot performance, so that iPass SmartConnect can make continuously more informed connection choices. In essence, by collecting data on Wi-Fi and cellular networks, Smart-Connect delivers an always-best-connected experience to users.
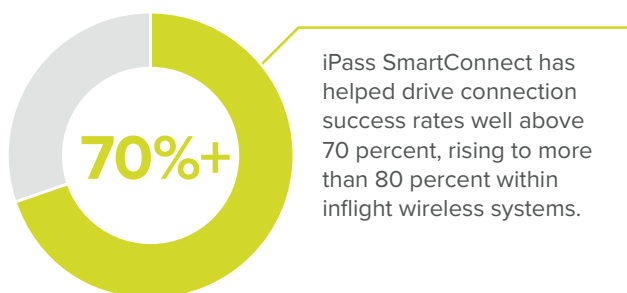
This allows operators using iPass SmartConnect to offer a superior global Wi-Fi experience than they could ever hope to achieve through any other provider, or indeed using in-house resources. Intelligence within the iPass SmartConnect platform also allows for more educated decisions about the best handoff points between cellular and Wi-Fi networks, which translates into a smoother, more gratifying customer experience.

iPass SmartConnect has helped drive connection success rates well above 70 percent, rising to more than 80 percent within inflight wireless systems. In a similar vein, iPass SmartConnect can improve the user experience by providing information about specific network availability, for example when users board a plane with inflight Wi-Fi.

These features allow MNOs and MVNOs to enjoy higher customer satisfaction and reduced churn without having to commit to significant investments.

In addition, iPass meets stringent security standards for government agencies, finance organizations, and countries with strict data privacy laws. The iPass Cloud platform authorizes and authenticates the user and then activates the user's device with unique, secure, device-based credentials. Users no longer need to enter usernames and passwords or sensitive credit card information to gain access to Wi-Fi hotspots worldwide. Once users have gone through the initial activation process, iPass authorizes the user's device each time they connect.

70%+

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How the iPass SmartConnect platform works

Based on iPass' patented Service Quality Management technology, iPass SmartConnect significantly improves the Wi-Fi user experience. An overview of the system function is as follows:

- As iPass users roam, their devices aggregate anonymous usage data to determine the location, signal strength, and speed of iPass hotspots.

- location accuracy using GPS, signal strength, and machine learning to continually analyze access point centroid.

- Aggregate data creates a real-time access map of iPass' global network of Wi-Fi hotspots.

- As a user comes into range of iPass hotspots, iPass SmartConnect uses predictive analysis to connect the user to the best hotspot for their needs.

- In addition to mapping iPass hotspots, iPass SmartConnect also aggregates anonymous usage data on hotspots not yet part of the iPass network.

- As iPass better understands user behavior patterns, it can add new access points into the network based on where users need them.

- iPass SmartConnect also enhances user security with last-mile, virtual private network (VPN) functionality.

iPass SmartConnect SDK

iPass SmartConnect, and its associated SDK, helps third party developers take advantage of the knowledge and experience that iPass has in providing connectivity to Wi-Fi networks. The iPass SmartConnect SDK is a set of tools to help developers build and manage Wi-Fi connectivity within their applications. It is lean and simple, yet provides great control. Its main elements are as follows:
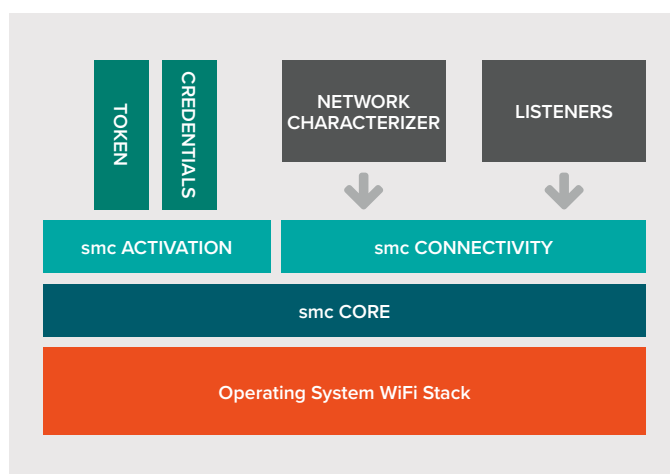
The SDK enables operators to embed iPass-patented mobile connectivity technologies and services into their applications. Developers will need to be signed in to the iPass developer program to access the SDK and accompanying documentation. The SDK is broken out into platform-based repositories, to make it easy for developers to find the assets they need.

At a high level, the SDK sits on top of the Wi-Fi stack and provides convenient methods to manage Wi-Fi connections. It also enables access to the iPass footprint by authorizing the user based on credentials or tokens. It comes with a default network ranking algorithm, which can also be overridden based on required rules.

The current version of the iPass SmartConnect SDK supports activation, connectivity services, authentication, a SmartConnect Connection Manager, Devicescape networks, and VPN functionality. Included in the SDK package is an iPass SmartConnect framework, documentation, a how-to developer guide, a sample reference app and source code, and an iPass hotspot-in-a-box router to test application connections.

TOKEN | CREDENTIALS | NETWORK CHARACTERIZER | LISTENERS

smc ACTIVATION | smc CONNECTIVITY

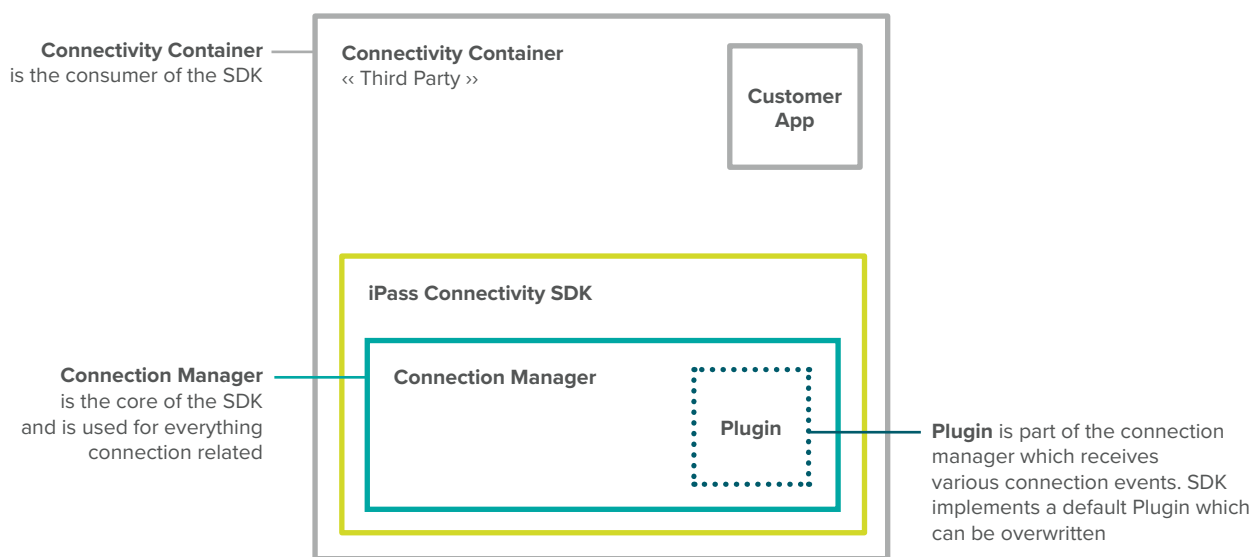smc CORE

Operating System WiFi Stack

Activation

For an operator's app to gain access to the iPass global footprint, the app needs to be activated via one of two simple-to-use activation methods. The first is via user credentials, whereby an iPass activation server validates customer-specified credentials and, if authorized, activates the app.

The second is via a token: if enabled, the iPass provisioning application programming interface (API) can use tokens to activate devices via an iPass activation server.

The connectivity container

The container app is the consumer of the iPass SDK. It uses the connection manager to trigger various connectivity functions and receive connection-related information through various events. The connectivity container's connection manager is the core of the SDK. It provides APIs for initiating or tearing down connections and listens for connection attempts, reachability status, and so on.

Connectivity Container
is the consumer of the SDK

Connectivity Container
‹‹ Third Party ››

Customer App

iPass Connectivity SDK

Connection Manager
is the core of the SDK
and is used for everything
connection related

Connection Manager

Plugin

Plugin is part of the connection manager which receives various connection events. SDK implements a default Plugin which can be overwritten

The iPass portal

Developers get access to a centralized, self-service administration portal designed to manage users, profiles, and iPass related-configurations required for the application that is using the SDK. Users can be provisioned as individuals, in bulk, or via a provisioning API.

Developer considerations

The iPass SmartConnect SDK is compatible with iOS and Android device operating systems. A Windows SDK is currently under development. The operating system requirements for iOS and Android are as follows:

iOS

The SDK is supported only on iOS 9 and higher devices and XCode 7 or higher developer toolsets. Developers must have a developer account with Apple and knowledge of Objective C/Swift, Frameworks, and the Apple developer portal. Developers must also have Network Extension entitlements with Apple before the host app can run on a device. Entitlements are granted by contacting networkextension@apple.com.

Android

The SDK is supported only on devices running 4.x or higher and an integrated development environment (IDE) running Android Studio 1.5.1 or higher. Developers need an account with Google and knowledge of the Android API and Java.

Use cases in detail

iPass SmartConnect carries a level of in-built intelligence that can add significant benefits to mobile network operations. An outline of some of the main use cases that can be enabled through iPass SmartConnect is given below. For more details on these and other potential use cases, please contact us.

Maintaining connection for critical applications

Losing connection during a handover from the mobile network to Wi-Fi, or vice versa, is a potentially major source of customer frustration, particularly when the user is relying on a connection-sensitive application such as a voice call or video. This problem potentially limits the usefulness of Wi-Fi in a mobile setting, since most networks lack the intelligence to identify when a handover is permissible.

Furthermore, traditional systems may lack the analytical capabilities to tell whether the handover is worthwhile in the first place, for example when a Wi-Fi signal will only be tolerable across a short distance. The intelligence inherent in iPass SmartConnect, however, addresses both problems.

Drawing on its continuously updated database of hotspot signal strengths, and integrating this with information on the speed and direction of travel of a mobile device, iPass SmartConnect can establish the exact point at which it makes sense to switch between networks. It can also monitor application use on the mobile device and hold off switching networks if there is danger of disconnecting a critical application.

This functionality can distinguish between, say, a music application with enough buffering to ride over a handover-sensitive and data-intensive app such as Skype for Business, which would be adversely affected by a drop in the connection.

Connectivity improvement

Because the iPass SmartConnect platform is continuously monitoring the signal quality received by all its users, it can assess which access points and hotspots offer the best connectivity at any point in time, and connect to them accordingly. This monitoring capability extends to access points that are outside the iPass network. This allows iPass to continuously identify new hotspots and select the highest-quality ones to add to its network.

The network is already the largest in the world, with more than 62 million hotspots, and has increased by more than 2000% since 2014.

It is important to note that, in addition to allowing iPass to add more hotspots, the data analysis enables iPass to discard and replace those lacking in quality, for example because of older wireless standards. Hence the iPass network improves as it grows. Mobile operators can take advantage of this to deliver connectivity improvements to their customers, for example by specifying an automatic handover from the cellular network to Wi-Fi in areas where the latter offers better performance.

The operator can set parameters to suit their needs, such as only joining access points that have a connection success rate above a given threshold. Another useful feature is that iPass SmartConnect can learn from past behaviors relating to a single user. Thus, for example, if a user consistently logs onto a given hotspot, say at work or at home, iPass SmartConnect can learn to ignore other hotspots in the vicinity, thus reducing the likelihood of unnecessary handovers.

Site-level Wi-Fi availability

The iPass SmartConnect platform curates hotspots by analyzing access point performance across several variables, including signal strength, wireless standard, and connection success rate. Access points with four connection failures in a row are earmarked for removal from the network. This ensures robust performance at the access point level, but iPass SmartConnect goes further by also analyzing performance at the hotspot and building level.

The purpose of this analysis is to make sure users do not suffer poor performance arising from multiple connection failures involving different access points across a site such as an airport or train station. Having site-level visibility of Wi-Fi quality allows mobile operators to create traffic and connection policies that can improve user experience in highly transited areas.

Supplementing and replacing cellular networks

Conversely, having detailed, granular knowledge of hotspot quality makes it easier for mobile operators to rely on Wi-Fi in areas where cellular coverage is lacking. Operating a hybrid cellular and Wi-Fi network makes it possible to provide much wider coverage, with vastly improved customer experience in hard-to-reach locations such as the interior of buildings, at no capital cost.

Furthermore, with iPass SmartConnect the operator can set parameters to ensure the customers' experience with Wi-Fi is as good as or better than that which the user gets

through the cellular network. Complementing traditional mobile network services with strong Wi-Fi connectivity can enhance in-building performance and allow MNOs and MVNOs to better serve important niche markets, such as the enterprise.

Many enterprises are already embarking on major employee mobility initiatives, in which the potential for integrated Wi-Fi and mobile communications is highly valued.

Inflight connectivity

Inflight connectivity is a potentially massive driver of mobile customer satisfaction, and one that can only be captured through Wi-Fi. Until recently, inflight Wi-Fi has been a predominantly US phenomenon, but with Inmarsat and Deutsche Telekom's European Aviation Network entering commercial service in 2017, the availability of aircraft-based connectivity looks set to soar.

As of January 2017, passengers could enjoy Wi-Fi for free on at least eight airlines, including Emirates, JetBlue, and Air China.[3] Inmarsat says the inflight Wi-Fi market will be worth $1 billion by 2020.[4] And already, inflight connectivity is among the top five use cases seen by iPass, in part because of the large number of people in the air at any given time and in part because of the lack of other connection and entertainment options.

All this, despite only a tiny number of access points. Using iPass SmartConnect, mobile operators can incorporate inflight connectivity seamlessly into their current offerings, helping to improve customer satisfaction and loyalty. The analytics in iPass SmartConnect deliver a connection success rate greater than 80 percent for inflight Wi-Fi. And iPass SmartConnect can guide users to download connectivity apps before takeoff, further improving the customer experience.

Cost reduction

With mobile operators facing increasing pressure to contain costs, offloading as much traffic as possible onto public Wi-Fi networks makes a lot of sense, particularly if users can be assured of levels of service akin to those they get with the mobile network. This is often the case. Even though mobile networks are being continuously upgraded, in many places Wi-Fi now offers superior connectivity and performance. And most importantly, Wi-Fi is not a space that is being crowded out by competitor MNOs and MVNOs, at least not yet.

Wi-Fi analytics

Having a clear view of the health of the network is of paramount importance to any mobile operator. In this respect, the analytics offered by iPass SmartConnect offer three potential benefit streams to operators.

- First and foremost, operators benefit from in-depth analytics around the hotspots being used by their customers.

- Second, the behavior of iPass SmartConnect can also reveal trends and shortcomings in the cellular network. An unusual number of handovers to a Wi-Fi network, for example, might indicate a problem with cellular coverage in the area.

- Finally, an increasing number of mobile operators also operate Wi-Fi hotspots of their own, frequently with legacy equipment. The scanning capabilities of iPass SmartConnect make it possible to easily check on the health and status of these infrastructures.

Aside from these network-level capabilities, iPass SmartConnect also offers operators the opportunity to carry out deep analyses of customer behavior, such as application usage or location. This information can be valuable for activities such as marketing and new product development.

"MVNOs have a tremendous opportunity to differentiate their services by offering global unlimited Wi-Fi services to their subscribers."

Traffic control and load balancing

If mobile traffic is like water flowing through a pipe, then for many MNOs and MVNOs it is becoming clear there is a real threat of overflow. Adding Wi-Fi to the mix gives operators an extra set of pipes to play with. And with iPass SmartConnect it is possible to balance traffic across the cellular and Wi-Fi networks intelligently, to maintain maximum flow while safeguarding customer experience.

Beyond managing current traffic flows, the rapidly expanding nature of the iPass SmartConnect network means it could help operators defer the need for capital investment in cellular networks, freeing up cash for other uses.

The customer perspective

"MVNOs have a tremendous opportunity to differentiate their services by offering global unlimited Wi-Fi services to their subscribers. In such a competitive market, in which MVNOs often have limited resources to develop their own applications and services, Mobilise can provide a completely managed solution with a customized user experience.

"Wi-Fi first is a high priority initiative for many MVNOs in today's market, and unlimited, global Wi-Fi access via Mobilise Hotspot and iPass represents a unique value proposition for MVNOs, so we are delighted to be working with iPass to make this possible."

—Hamish White, Mobilise founder and CEO.

Conclusion

The pressure facing MNOs and MVNOs on price is unlikely to go away. Increasing competition, along with regulatory action in regions such as Europe, continues to impact on profitability. In fact, while just about every key metric tracked by the GSMA, from mobile connections to revenue per year, is trending upwards, global ARPU fell 2.78 percent, to $10.25, in the last financial year for which there is data.[5]

This makes it imperative for MNOs and MVNOs to extend their options with low-cost, high-quality connectivity. Only Wi-Fi can fit the bill, but trying to integrate hotspots directly into the mobile network is an onerous affair. Using iPass SmartConnect, however, MNOs and MVNOs can circumvent integration issues and instead plug directly into a secure, scalable platform that delivers powerful analytics and high levels of intelligence to smooth the customer journey between cellular and Wi-Fi worlds.

Glossary

3G: third-generation wireless mobile telecommunications technology.[6]

4G: fourth generation of mobile telecommunications technology, succeeding 3G

Android: mobile operating system developed by Google, based on a Linux kernel and designed for touchscreen mobile devices such as smartphones and tablets.

Application programming interface (API): set of subroutine definitions, protocols, and tools for building application software.

Average revenue per user (ARPU): total revenue divided by the number of subscribers.

GSMA: GSM Association, a trade body that represents mobile operators worldwide.

iOS: mobile operating system by Apple exclusively for the company's mobile devices.

LTE (Long-Term Evolution): standard for high-speed wireless communication for mobile phones and data terminals.

Mbps: Megabit per second.

Point-to-Point Protocol (PPP): layer 2 protocol used to establish a direct connection between two nodes.

Software development kit (SDK): set of software development tools that allows the creation of applications for a certain software package.

Virtual private network (VPN): a channel that extends a private network across a public network.

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1. Cisco, March 20, 2017. Cisco Visual Networking Index: Global Mobile Data Traffic Forecast, 2016-2021. Available at **http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.pdf**.

2. Joanne Carew, IT Web, September 14, 2016: The modern MVNO. Available at **http://www.itweb.co.za/index.php?option=com_content&view=article&id=155803**.

3. Hazel Plush, The Telegraph, January 30, 2017: How does Wi-Fi work at 35,000 feet and why don't all airlines offer it? Available at **http://www.telegraph.co.uk/travel/travel-truths/how-does-inflight-wi-fi-work/**.

4. Inmarsat, European Aviation Network. Available at **http://www.inmarsat.com/aviation/aviation-connectivity-services/european-aviation-network/**.

5. GSMA, Global Data. Available at **https://www.gsmaintelligence.com**.

6. All definitions adapted from Wikipedia under Creative Commons license, available at **https://creativecommons.org/licenses/by-sa/3.0/**.

About iPass

iPass (NASDAQ: IPAS) is a leading provider of global mobile connectivity, offering simple, secure, always-on Wi-Fi access on any mobile device. Built on a software-as-a-service (SaaS) platform, the iPass cloud-based service keeps its customers connected by providing unlimited Wi-Fi connectivity on unlimited devices. iPass is the world's largest Wi-Fi network, with more than 62 million hotspots in more than 180 countries and territories where iPass customers have connected successfully at airports, hotels, train stations, convention centers, outdoor venues, inflight, and more. Using patented technology, the iPass SmartConnect™ platform takes the guesswork out of Wi-Fi, automatically connecting customers to the best hotspot for their needs. Customers simply download the iPass Smart-Connect app to experience unlimited, everywhere, and invisible Wi-Fi.

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