devicescape

Cellular Data Offload

And Extending Wi-Fi Coverage

With Devicescape Easy WiFi

Case Study

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List of Acronyms

3G	Third Generation
4G	Fourth Generation
API	Application Programming Interface
AP	Access Point
BSSID	Basic Service Set Identifier
EAP	Extensible Authentication Protocol
EVDO	Evolution Data Optimized
EWFN	Easy WiFi Network
GUI	Graphical User Interface
IP	Internet Protocol
LTE	Long Term Evolution
OEM	Original Equipment Manufacturer
OS	Operating System
SDK	Software Development Kit
SSID	Service Set Identifier
STA	Station
UAM	Universal Access Method
UI	User Interface
UUID	Universally Unique Identifier
VoIP	Voice over IP
WBA	Wireless Broadband Alliance
WFA	Wi-Fi Alliance
Wi-Fi	Wireless Fidelity, aka 802.11
WISPr	Wireless Internet Service Provider Roaming
WLAN	Wireless LAN
WPA	Wi-Fi Protected Access

Introduction

There is an unstoppable upwards trend in mobile data usage today. While cellular data revenues remain relatively flat, increased data demand requires more infrastructure investment with a corresponding decrease in ROI. Moreover, the licensed frequencies required to carry the data will eventually reach capacity, or already have done so in some geographic regions.

Cellular data offloading to Wi-Fi has now become an urgent requirement.

Unfortunately, many customers are unaware of what Wi-Fi does or how to configure it on their smartphone. They may not know or care about the difference between a Wi-Fi connection and a cellular data connection – they just want to connect to the internet. In order for cellular data offloading to be successful, a Wi-Fi enabled smartphone must automatically connect to Wi-Fi hotspots with NO user configuration or intervention. Furthermore, the smartphone must have access to a very large number of Wi-Fi hotspots.

This Case Study describes how a wireless operator is able to leverage Wi-Fi using Easy WiFi to implement a cellular data offloading solution with a maximized Wi-Fi footprint.

About Easy WiFi

Devicescape **Easy WiFi** enables wireless devices to automatically connect to public Wi-Fi hotspots, personal home Wi-Fi networks and office Wi-Fi networks. Whenever a device comes within range of a Wi-Fi network to which it has access rights, Easy WiFi will automatically connect the device to that network without user interaction. The experience is much like obtaining a cellular network with a mobile phone.

With Easy WiFi, users avoid the hassles of Wi-Fi technology. There's no need to configure wireless or security settings, select an SSID, start-up a browser just to login and tediously enter usernames/passwords with a keypad, stylus or scroll wheel. Users experience simple and fast wireless connectivity wherever they go.

Devicescape also provides a virtual public hotspot network which can be used in conjunction with Easy WiFi. The **Easy WiFi Network** aggregates public hotspots which have been set up to provide free network connectivity as an amenity for citizens and customers. By providing simple, automated access to these *unmanaged* hotspots, and through monitoring of their capabilities, the Easy WiFi Network can present a huge, global footprint of hotspots as if it were a seamless, single network.

For manufacturers of Wi-Fi devices, Easy WiFi enables the creation of products with out-of-the-box, global connectivity, which can be extended, as required, with *premium* hotspot access. With effortless connectivity, customer satisfaction goes up, support calls and returns go down, and a manufacturer's overall brand is enhanced. Device vendors gain increased flexibility to partner and co-market with wireless service providers. The Easy WiFi Network can provide basic Wi-Fi connectivity, and service provider partnerships can be established as demand grows or end-user needs are better understood. Since Easy WiFi already works seamlessly with commercial networks, there is no need for additional development when new providers are selected, nor is there a need to update the firmware of deployed devices.

For wireless service providers, Easy WiFi compliments the provider's existing Wi-Fi hotspot coverage with automatic support for roaming partners, and hundreds of thousands of hotspot locations in the Easy WiFi Network. Mobile operators can utilize Wi-Fi to deliver rich media services while offloading traffic from their cellular data network. Service providers can expand their services beyond laptops to the burgeoning wave of Wi-Fi phones, game systems, media players, cameras and other devices. Service providers can craft new types of service plans that segment their markets on the basis of device type and application. Providers additionally gain the flexibility to support devices from many vendors on their networks without having to craft complicated integration deals with each manufacturer. And, Easy WiFi will improve the experience of their subscribers and lower the cost of support.

Case Study: Cellular Network Operator

A large cellular network operator would like to offload user data traffic onto Wi-Fi whenever possible. This is desired for the following reasons:

1. Reduce cellular data bandwidth congestion. This allows the network operator to provide data connectivity in dense urban environments where customer data usage is already at capacity and no additional cellular licensed frequencies are available. It also allows the network operator to reduce or defer the cost of deploying future high-capacity data infrastructure, such as LTE or 4G.

2. Reduce data delivery costs. In dense urban environments, providing data connectivity over a network of Wi-Fi hotspots is less expensive than a cellular data connection. Wi-Fi hardware is far less expensive than cellular data infrastructure with the associated costs of licensed frequencies and roaming agreements with other carriers.

3. Reduce support costs. Many customers with a hotspot subscription have issues with configuring their Wi-Fi connection and authenticating with the hotspot service. With an automated Wi-Fi connection, the number of customer support calls will decrease.

4. Increase customer satisfaction. When the customer's device is connected to Wi-Fi, the customer enjoys a higher data throughput, increased battery life and less cellular data plan usage.

Every mid-tier and high-end smartphone offered by the cellular network operator now has Wi-Fi capability due to the proliferation of the Wi-Fi feature. The network operator is now in a unique position to leverage Wi-Fi functionality across their user base to reduce costs while increasing data coverage and customer satisfaction.

To achieve the above objectives, the smartphone must automatically detect and connect to Wi-Fi hotspots. Although the cellular network operator may already have a network of commercial hotspots with roaming relationships with other hotspot providers, the smartphone has no way of automating the Wi-Fi connection with the native hotspot provider or roaming partners. Furthermore, commercial hotspot coverage is increasingly limited to a select number of premium venues such as airports and hotels. A larger Wi-Fi hotspot footprint with universal coverage is required for a successful implementation.

Using Easy WiFi

Devicescape Easy WiFi meets the cellular network provider's requirements for cellular data offloading with the following value proposition:

- Automatic Easy WiFi client registration
- Automatic Wi-Fi user subscription provisioning (with a connection to cellular network provider backend)
- Automatic Easy WiFi Network provisioning
- Automatic detection and connection of native hotspots, roaming partner hotspots, and Easy WiFi Network hotspots

- Access to 500k+ hotspots in the Easy WiFi Network, in addition to native and roaming partner hotspots
- Decrease in customer support issues and lower customer churn by making the Wi-Fi connection completely automatic
- Lower operating costs and CAPEX requirements, as Easy WiFi is able to automatically offload cellular data at 500k+ hotspot locations worldwide
- A highly available, reliable and secure implementation

Offloading Cellular Data with Easy WiFi

Easy Wi-Fi automates **both** the hotspot SSID detection and hotspot web portal login, so the customer does not have to do anything to get connected to a Wi-Fi hotspot. The customer simply moves in range of a known hotspot and Easy WiFi takes care of selecting the appropriate SSID and performing the necessary login authentication steps, as shown below.

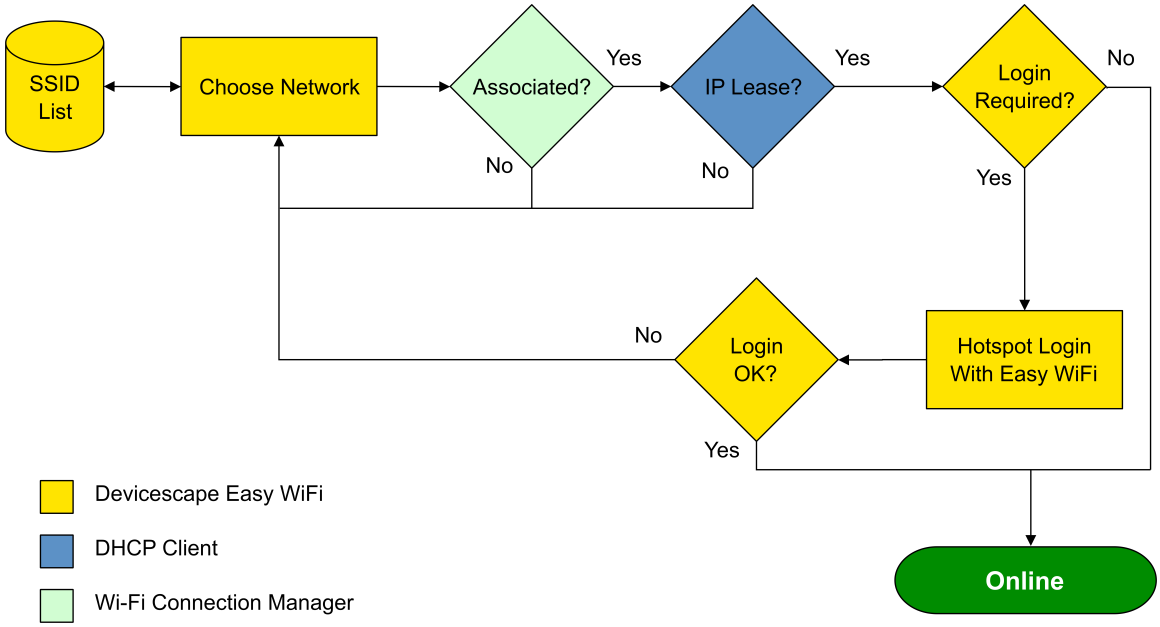

Figure 1: Easy WiFi Login Process

In addition to detecting hotspots provided by the cellular network operator (i.e. native hotspots), Easy WiFi is able to detect and connect to hotspot roaming partners as well. The Devicescape Service maintains roaming relationships and understands which networks to associate with and how to perform roaming authentication. Because the roaming relationships are maintained in a central location on the Devicescape servers, updates are immediately available to all users. This allows quick and seamless access to any roaming network for which the user's accounts are valid, even as roaming relationships evolve.

Extending the Wi-Fi Footprint with the Easy WiFi Network

Devicescape Easy WiFi can seamlessly extend the commercial hotspot coverage of the cellular network operator using the Easy WiFi Network, as illustrated below:

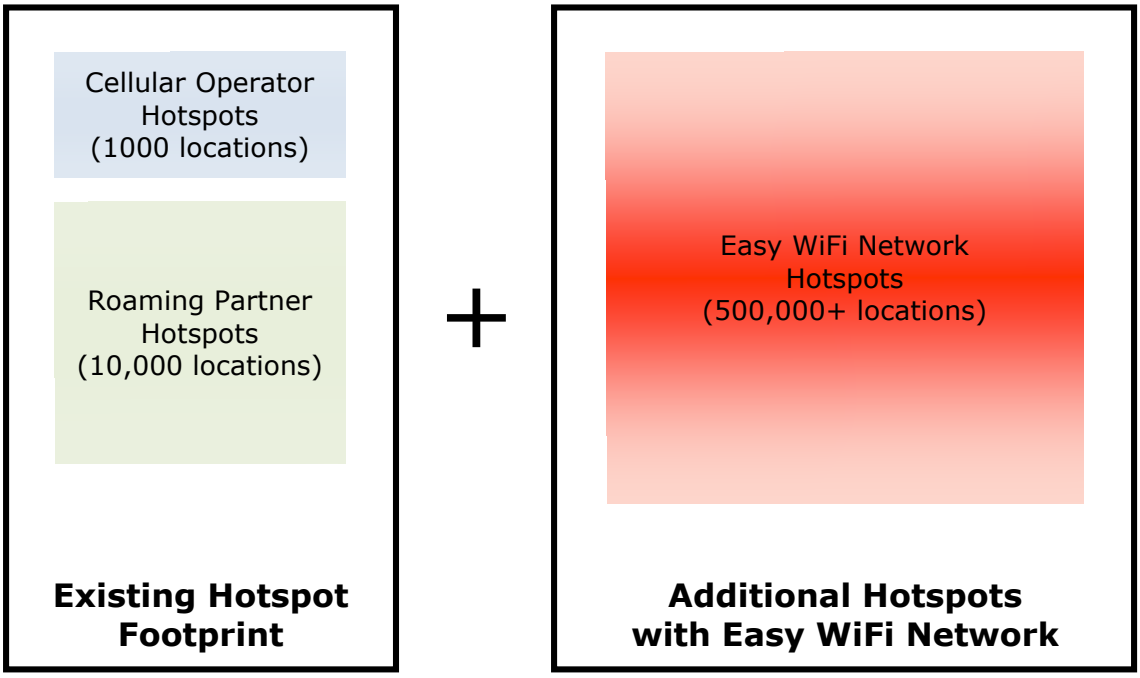

Figure 2: User Wi-Fi footprint with Easy WiFi

Each of the Easy WiFi Network hotspots has been verified for internet connectivity. One can think of the Easy WiFi Network as a free, default hotspot network. The Easy WiFi Network has a very large global access footprint of over 500k+ locations and is growing every day.

Assembling the Easy WiFi Network is not a trivial task. There are millions of open and free hotspots all around the world, in businesses, homes, and public spaces. They're everywhere, but completely chaotic. Their location, capabilities, quality, legal status, and ownership are all unknown and uncontained, making it difficult for them to be usable separately as a service. Devicescape has the capability to sort through these uncoordinated networks to construct and maintain a virtual public network. Using hotspot data collected from Devicescape clients, Devicescape is able to produce a map of access locations which is accurate and up to date. If a location moves or switches off, Devicescape is able to detect that and make updates accordingly.

Growing the Hotspot Network

The Easy WiFi client can automatically capture information about new hotspot locations that are not already supported by Devicescape. In most cases these new

networks can be added quickly. Once added, the new provider is available for any Easy WiFi user.

This powerful capability allows a virtually unlimited number of networks to be supported, and for users to receive automated access in locations that are personally relevant. All the network provider information is stored on Devicescape servers, avoiding the need to update a potentially extremely large device population, and allowing low-cost devices with no local storage to be configured to access many different networks.

Using Meta Data with Hotspots

In addition to providing geolocation information for hotspot locations, the Devicescape Servers can provide location-specific or network-specific information to the Easy WiFi client. This information can be added by Devicescape, network providers or Easy WiFi users.

For example, if a particular SSID is associated with a chain of coffee shops, the coffee shop name can be used to identify the hotspot network instead of the SSID when searching for hotspot access using the Easy WiFi hotspot mapping feature.

Another example would allow a specific hotspot location (BSSID) to include the hotspot location and floor within a building to make it easier to find the physical location of the hotspot. This can be extended to allow user ratings of the hotspot location including bandwidth and reliability.

Mapping Service Plans to Devices

Devicescape Easy WiFi enables service providers to define new types of service plans, and to better regulate how those plans are used. Today, most service providers cannot determine the type of device that is logging onto their network – it may be a laptop, a PDA, a smart phone, or some other type of device. Easy WiFi, however, knows exactly what kind of device is gaining access and is thus able to ensure that a particular access plan is applied to a specific type of device.

Service providers can use this capability to segment plans for specific types of devices, such as converged phones or media players. Each plan can have its own terms of service, pricing, and quality of service. By designing service plans that are tailored to the needs of different devices, service providers will be better able to segment their markets and optimize their revenue streams. In addition, the Easy WiFi architecture allows a service provider to enforce its terms of service with respect to different service plans. For example, a service provider with a $7.95 per month voice-over-Wi-Fi plan will be able to block laptop users from using this same plan, and drive these users to a more lucrative $29.95 per month laptop subscription.

Ensuring Security

The contents of all messages sent between the Easy WiFi client and the Devicescape web service are encrypted in order to ensure the security and integrity of the system

and the users' personal information. A device's UUID is communicated in such a fashion that it can be verified by the Devicescape web service, and not sniffed over the air or while in transit across the Internet. Communications are also protected against man-in-the-middle attacks with industry-standard mutual authentication protocols.

In addition, the Easy WiFi client verifies the authenticity of public Wi-Fi network access points by means of client-side certificate validation prior to logging into the network. This ensures that the device is not accessing an "evil twin" access point that is masquerading as a legitimate access point in an attempt to collect usernames and passwords. This makes many devices running the Easy WiFi client more secure than those not running it.

Summary

Mobile network operators are taking a serious look at Wi-Fi to offload data from their cellular data network. However, the offloading solution must provide a large footprint of Wi-Fi hotspots and an automatic method of recognizing and connecting to these Wi-Fi hotspots in order to be successful.

Easy WiFi provides a large Wi-Fi hotspot footprint which can be seamlessly integrated into a network operator's existing commercial hotspot footprint. Easy WiFi also contains the necessary technology required to automatically detect and connect to hotspots.

With Easy WiFi, cellular network operators will see enhanced customer satisfaction and lower support costs as users enjoy hassle-free wireless connectivity.

Evaluation versions of Easy WiFi are available at www.easywifi.com.

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