HTTP IN-BROWSER NOTIFICATION

THE ALCATEL-LUCENT SUBSCRIBER MESSAGING SERVICE FOR WEB-BASED APPLICATIONS

APPLICATION NOTE

Alcatel·Lucent

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INTRODUCTION

Network operators are looking for efficient and reliable methods for communicating directly with subscribers on any device. E-mail notifications are ineffective because subscribers may not regularly track their operator-provided e-mail accounts, or messages might be re-routed to Junk folders, ignored or misfiled. Meanwhile the provider has no confirmation whether the message was received and understood by the intended target party.

HTTP redirect messages to a messaging landing page provide a secure, verifiable means to message to web browser users, as used for messaging to non-authenticated subscribers. However this approach is too disruptive to the end-user experience to be used as a means for regular communications. Authentication style HTTP redirect is typically not application aware (will interrupt all web apps including streaming video) and replaces the intended destination content with service provider messages, which is not always going to be satisfactory to the user.

Mobile operators use SMS to mobile devices for greeting and notification messages, across a range of use cases. However, not all web devices have mobile calling / SMS capabilities (desktop and laptop computers, TVs, gaming consoles, or any Wi-Fi-only connected mobile devices). Further, even for mobile phones, the operator of a Wi-Fi or residential internet service may not have access to the user device phone number.

For residential or mobile services, the last resort for secure, verifiable communication is for the network operator to call the end user on their phone number associated with the account. However, that is costly and obtrusive and is suitable only for a small set of notification cases.

Hence there is a need for an ISP mechanism to message directly to users of web clients on any device in a unobtrusive, cost effective and context aware manner.

Using the Alcatel-Lucent 7750 Service Router (SR) In-Browser Notification (IBN) system, combined with the Motive AAA server and the Motive Messaging Server, subscribers that are connected to an operator-owned network can be sent fully customizable, on-screen messages that can be displayed to customers in a non-disruptive and cost-effective manner.

This Application Note provides details of several real-world applications of the In-Browser Notification system, as well as details of the functionality of the component parts of the solution.

USE CASES

Wi-Fi Connection Notifications

Many network operators around the world are looking to rapidly extend their traditional footprint with the deployment of public Wi-Fi networks. Operators without wireless assets, for example, can offer Wi-Fi access to owners of smart phones and tablets, allowing those customers to minimize the use of their mobile data plans.

In some cases, this Wi-Fi access is offered for free to everyone — whether they are existing customers or not. In these cases, it is important for the operator to be able to gain some brand recognition in exchange for this free access. From an end-user perspective, having a free Wi-Fi network available to them is a huge benefit that can have a strong, positive impact on that network operator's brand.

Using the 7750 SR In-Browser Notification system, combined with the Motive AAA server and the Motive Messaging Server, subscribers that are connected to an operator-owned Wi-Fi network can be sent an on-screen message, informing them that their access is being provided by their friendly neighborhood operator. In cases where subscribers are already customers, this provides strong reinforcement of the brand. This is equally powerful when subscribers are not existing customers, as it provides an opportunity for customer engagement.

This "welcome message" can be displayed in many different ways; most often as a watermark on the web page, so that the subscriber's online experience is not interrupted.

**Figure 1. Standard web browser with a sample overlay notification message.**
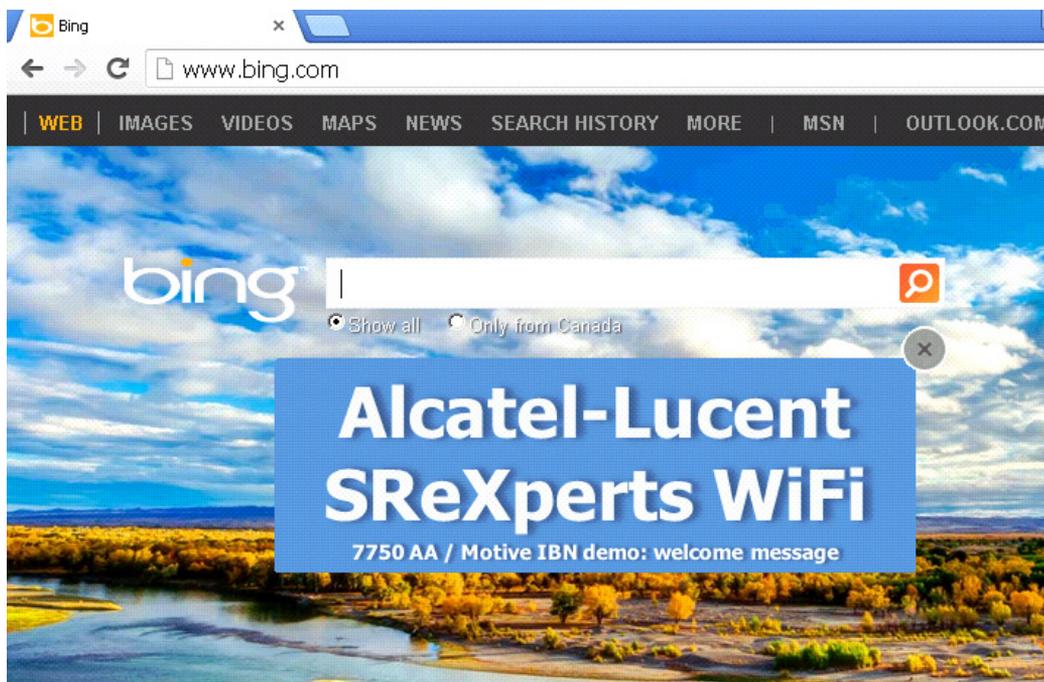
Periodic Wi-Fi Notifications

Wi-Fi Connection Notifications can be displayed for any length of time desired and can appear just once (upon initial connection) or on a regular basis (e.g., every five or ten minutes), reminding the subscriber of the benefit of doing business with that operator.

The In-Browser Notification system also has the intelligence to know whether or not that subscriber is a customer and targeted offers can be served up. Regardless of the nature of the relationship with that subscriber, an additional message can be displayed, informing them of special promotions, such as free movies (to attract new customers away from a competitor that offers wireless services only and not a TV or video service).

Figure 2. Sample overlay notification message on an Android smart phone. **>>**
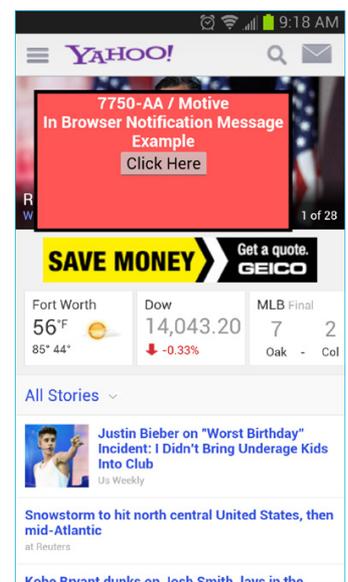
Over Quota Notifications

With the introduction of usage-based billing — which involves assigning maximum quantities of traffic usage that can be consumed during a given period, usually a month — many operators are looking for an effective, non-intrusive way to inform subscribers when they are approaching, or have exceeded, their monthly bandwidth allowance that might involve additional charges.

Many solutions on the market today use web redirects. Redirects are extremely disruptive and, except in rare cases, often unnecessary. An on-screen notification, displayed as an overlay to the original content within the existing browser session, is an effective way to notify subscribers of the status of their usage and to have them acknowledge the receipt of that message.

The In-Browser Notification system has the intelligence to know what kind of service is being consumed (e.g., text web pages, video streaming, Netflix, iTunes, etc.) and offers different kinds of messaging options, including banners, overlays and HTTP redirects. An IBN redirect is better than a normal authentication redirect that affects all HTTP services, creating a very disruptive experience. For online experiences like video streaming, you don't want to issue a full HTTP acknowledge redirect that impacts all traffic including the video service to notify a subscriber that they have consumed 75% of their usage allowance. An IBN message, on the other hand, keeps the user session live and will not affect other non-browser HTTP traffic.

Billing Notifications

Having an efficient and reliable method to notify subscribers about the status of past due accounts is an important way for network operators to reduce the costs associated with customer dissatisfaction and churn, customer non-payment, and customer disconnection and re-connection. Often, subscribers may have a past due account, but are not aware of it. This could be because a notification came to them in the mail, which they didn't read because they thought it was junk mail. Or they may have received a notification to an e-mail account that they rarely use, or one that filtered the notification to a junk mail box. When this happens, subscribers can get behind on their bill, run up a big past due account that they may not be aware of, and ultimately have their service disconnected.

Using the 7750 SR In-Browser Notification system, combined with the Motive Messaging Server, subscribers who are past due on their bill can be sent an on-screen message, informing them of their account status, and providing them with a link to pay their bill online. The messages can be delivered in phases; the more delinquent the payment the more serious the message. Until the point where the service is disconnected, the customers are allowed to utilize services with a relatively non-invasive mechanism that notifies them of the past due status.

This "past due notice" can be displayed in many different ways; most often inserted into a subscriber's browser home page, with an "ok – thanks for the reminder" link. This way, the subscriber can acknowledge being made aware of the issue, but continue using the Internet as normal, until their account has a more severe delinquent status.

Monetizing In-Browser Notification

Having the ability to communicate directly with the end-user in real time provides a range of opportunities to monetize the user session. Advertisements and promotional messages can be provided (subject to normal user opt-in/out configuration) that can be to the benefit of the end user, such as service discounts, coupons for retail or online services, etc. One example would be to use location-based information on a Wi-Fi service to promote free or discounted services at retail shops in the vicinity of the nomadic user.

Multi-service operators may choose to promote across services, for instance, to promote video service discounts (e.g., "watch free VoD tonight") to users of a residential or Wi-Fi internet access service. Another model may be an ad-funded Wi-Fi service; in exchange for ads on a periodic basis, the user gets access to free or cost-reduced Wi-Fi services. There are many options possible that can now be unlocked by the ISP marketing teams, according to the service objectives and needs of each network operator.

Copyright Infringement Notification

Illegal copying and distribution of copyrighted content, including music and videos, is often accomplished using peer-to-peer (P2P) software or file hosting services. In some jurisdictions, businesses and network operators have a legal responsibility to warn subscribers and instruct them not to engage in this activity. Today, this is often accomplished by identifying transgressors offline and sending e-mails educating them how to acquire content legally, and instructing them to delete all content that violates copyright law.

As with previous examples, getting confirmation that notice has been served is difficult. E-mails are often lost or misfiled by subscribers, the subscriber's IP addresses may have changed, or an IP address may be shared by many users in a single office or residence, making it difficult to reach the individual engaged in the copyright infringement. In-Browser Notification allows network operators to reach subscribers in real time (possibly while they are engaging in the copyright infringement activity) and to provide customized warning messages that outline next steps (e.g., click on link to confirm receipt, or that confirm that unlawfully obtained content has been deleted, to continue with service).

Outage or Device Upgrade Notification

An increasing amount of network operator revenue is being derived from premium, usage-based services that are offered in addition to internet access (e.g., payTV, gaming or video conferencing). Revenue is immediately impacted when these services go down, and subscribers immediately start looking at competitive providers of the same service, or for other forms of entertainment to spend their leisure time. In-Browser Notification allows network operators to minimize revenue shortfall and improve customer satisfaction by allowing them to send customized messages to relevant subscribers as soon as service access has been restored.

Similarly, upgrades or changes to in-home devices such as modems, set-top boxes or PVRs can use IBN as a cost effective and reliable means of communicating with the end user for issues across a range of services.

7750 SR HTTP IN-BROWSER NOTIFICATION FUNCTIONALITY

Network Topology Benefits

The 7750 SR IBN software is a patent pending use case implementation of the Application Assurance (AA) software package running on the Multi-Service Integrated Services Adapter (MS-ISA).

Unlike external HTTP redirection solutions that move subscribers away from the content or applications they have requested, the AA IBN capability sits inside a 7750 SR network to deliver notifications to a subscriber overlaid or above a web page that is currently being viewed.

When instructed by RADIUS policy for a given user, AA IBN selects eligible HTTP traffic for the targeted subscriber and inserts a new HTML pointer in the HTTP session that causes the browser to contact the Motive Messaging Server, which then provides notification in the form ofJavaScript code for the browser. By intercepting existing HTTP streams in the network, the AA IBN capability allows notifications to be rendered in addition to the web page content being accessed.

The AA IBN functionality has been designed with the following options to support a wide range of use cases:

- All AA IBN capabilities are activated and controlled through notification scripts defined and executed in open, standards-based RADIUS servers.
- Notification to subscribers can be one-time, for instance, when a user connects to a network; or periodic to a configured interval, for instance, to keep notifying users they have exceeded their monthly data quota until they acknowledge.
- Multiple RADIUS Vendor Specific Attributes (VSAs) can be defined so that a customized notification can be sent depending on one or more attributes. For example, a network operator may want to customize the notification sent to users that have just joined a network based on their location, partner provider, or subscriber plan.
- HTTP flow selection is constrained so that only text-based HTTP flows originating from a web browser are targeted. This ensures HTTP(S) flows used for transport protocols or encrypted communications are not impacted.
- When required, the AA IBN function can be used to implement a traditional HTTP redirection mode, ensuring browsers are redirected to appropriate redirect landing pages.

The network-integrated, inline approach of the AA IBN solution eliminates the operational complexity, cost and customer dissatisfaction that can be associated with offline, appliance/server-based IBN solutions. Other benefits include:

- Only one, per-subscriber policy context within RADIUS is required for interworking between the 7750 SR (including AA) and the Motive Messaging Server. With traditional IBN solutions, network operators may need to synchronize multiple subscriber databases and policy points, significantly increasing their operational complexity and costs.
- An integrated Alcatel-Lucent IBN solution eliminates the need for an appliance stack and associated network connectivity that can impact reliability and increase operational costs.

- AA IBN intercepts packets from web servers and forces the browser to communicate with a message server in addition to the original web server destination. By contrast, offline solutions create a new HTTP redirect packet to force the session through a message server, and this redirect competes with the original packet sent from the web server. If the original packet reaches the user first, this can result in broken web pages and dissatisfied users.
- The architecture of the AA IBN capability does not require creation or manipulation of i-frame HTTP content, which often creates compatibility issues for some web domains and raises data privacy and content control concerns. The Alcatel-Lucent IBN solution does not reformat or modify the content of web pages as provided by the contacted web server.
- By being inline, AA has the benefit of being able to inspect the content response from the contacted web server, to be able to perform various rules checks (such as, but not limited to: http 200 ok, content-type is text/html) to ensure that notification attempts are only provided with high certainty of correct solution behavior and browser compatibility. Offline IBN solutions select a flow for notification based on an HTTP request, thus will sometimes interfere with proper web page rendering and behavior. For instance, an HTTP request whose response should be a 302 redirect can be messaged by an offline system, thus interfering with the web page rendering (possible side effect is seeing a blank web page).

Notification Flow Selection and Manipulation

The Alcatel-Lucent IBN solution initiates with the 7750 SR AA implementing a policy enforcement action (notify) against an AA subscriber, according to dynamic or static policy rules. AA will then select an HTTP session that meets a range of criteria to be deemed eligible for notification, including application type and http request and response header information such as content type. When these checks are satisfied, AA modifies the HTTP server response and inserts a new pointer that will cause the user's browser to contact the Messaging Server to retrieve the appropriate message Javascript. In addition to the providing the messaging server URL pointer, the browser's HTTP request to the server also includes user-specific parameters such as subscriber ID and custom messaging subscriber attributes.

Messaging Server Role

The Messaging Server provides an appropriate messaging Javascript to the browser, while the browser continues to communicate directly with the initial server for the original web content. In this way, the web server content is not modified. The Javascript message that is provided supports a range of format/display options that are easily customized by each network operator, based on their requirements; the same technique is used regardless of the format of the message display (e.g., banner, overlay or redirect). The messaging server is explained in more detail in section 4.

Customized RADIUS URL Parameters

Some notification messages may require dynamic parameters to be provided, relating to the subscriber's policy, such as quota amount, message type, or user location. Any such parameters can be passed from the Policy Server managing the IBN subscribers using an ALU RADIUS VSA to allow a service provider to dynamically customize the subscriber notification. The 7750 SR append the fields from this parameter as arguments in the URL provided to the device client to contact the messaging server, which allows this content to be used in the formation of the dynamic message.

A typical usage for this RADIUS parameter is location-based HTTP Notification in a Wi-Fi Metro network where the subscriber location and retail VPN are dynamically returned by RADIUS at subscriber authentication time.

THE MOTIVE MESSAGING SERVER

Subscriber Messaging Solution

The Motive Messaging Server is a Java-based application server that complements the AA HTTP packet manipulation feature of the 7750 SR and serves the notification script and message to the subscriber's device.

It enables the network operator to have full control over the message display pattern (i.e., message templates) and the message lifecycle to provide a consistent user experience across all web-based subscriber devices.

The Motive Messaging Server supports different IBN display patterns that are implemented as message templates, including:
- Overlay Message
- Banner message
- Splash page
- Captive portal

The server comes with pre-defined message templates that are fully customizable and extendable. The message lifecycle is managed through the following web interfaces:
- The Message Creation console gives control over the notification message content, format, resolution, language, and other parameters.
- The Campaign Creation console allows for the right message pattern/template to be assigned to the right message. It also allows for customization of the on-screen message position and the message display behavior (e.g., display time, fade in/out behavior, click through behavior, etc.). A What You See Is What You Get (WYSIWYG) query builder tool is provided to associate a unique 'messaging rule' to a message that defines when this message needs to be shown to which subscriber and device.

The Motive Messaging Server supports N + 1 clustering, high availability and bare metal or cloud-based deployments. Optionally, it can also be deployed in concert with a Content Distribution Network for static message content.

Extensive reporting capabilities are provided, both real-time and non-real-time. These reports are built from transaction monitoring data that track the number of failed and successful stages of the load and rendering process of the message in the browser.

The reports provide detailed per campaign efficiency and trending analytics, including:
- Subscriber aggregate data and trending per device type, browser type and URL
- User actions per device type, browser type and per URL
  - ¬ Page impressions and click-throughs
  - ¬ Closure/opt-out behavior
  - ¬ Display and fade-out time
  - ¬ Detailed Javascript failure reporting available for post processing and root cause analysis of a messaging transaction

Overlay Template

The In-Browser Notification Overlay Template is one of the display patterns of the Motive Messaging Server. This template allows for an image to overlay an existing web page, resulting in a non-disruptive end-user experience, while still ensuring that the user will notice it. Overlay messages may:

- automatically diffuse after a configurable display period
- be removed when the user clicks or moves over a portion of the message
- a combination of both above options to allow immediate user removal prior to the full display period
- include links that will open new browser click-through sessions

This template relies on the 7750 SR AA module to inject an existing HTTP response and a Motive Messaging Server IBN request with the right attributes. When this request is executed by the browser, the Motive Messaging Server will respond with the correct notification message and the necessary Javascript code to overlay the image on the original URL.

Banner Template

Banner templates are messages that can be displayed above (most common), below or beside the original web page content. They have the benefit of not obscuring page content even temporarily, but may sometimes not be noticed. Use cases and Javascript design preferences will dictate when this format is preferred.

All display time and content options of the overlay template can also be used with banners, but in general banners tend to be left displayed until the page is refreshed, as they are non obtrusive.

Splash Page Template

A splash page is a message that temporarily occupies the full page display of the web browser, then self diffuses after a configurable time after which the original page content is displayed. As with Overlay and Banner, the splash page can include options to remove before timeout based on user response, and can include click-though links.

Captive Portal Template

The Captive Portal template implements standard captive portal behavior where the user remains on that page until suitable steps are taken, typically in the form of user input or click-though. The messaging server captive portal functionality may be called on either by an IBN implementation for messaging purposes, or can be invoked by standard HTTP redirect as the landing page.

Leveraging the 7750 SR AA Module

The 7750 SR AA module injects a message request in the HTTP response of a subscriber device browser. This message request is appended with the subscriber identifier and vendor-specific AAA attributes that can be used as input for message campaign selection. Subsequently, the Motive Messaging Server is capable of using browser information to select the right message and messaging template, such as:

- User agent
- IP address
- Browser locale

The vendor-specific AAA attributes are parameter-value operator configurable data that provide additional information from the network to the messaging server about the subscriber and his devices, for example:

- line of business this subscriber belongs to
- subscriber profile
- subscriber location
- hotspot location type
- UBB usage to date, percent of total, and total

CONCLUSION

When looking for efficient and reliable methods for communicating with subscribers, the Alcatel-Lucent 7750 Service Router (SR) In-Browser Notification (IBN) system, combined with the Motive AAA server and the Motive Messaging Server, allows network operators to send fully customizable, on-screen messages that are complementary to alternative methods of subscriber communication:

- more effective than e-mail notifications
- less disruptive than full HTTP redirects
- more cost effective and less disruptive than phone calls
- positively acknowledged when necessary
- available on any browser, any device, any data service

The network-integrated, inline approach of the In-Browser Notification system eliminates the operational complexity that can be associated with offline, appliance/server-based solutions — which can also impact reliability and increase operational costs. It is also more effective and less intrusive than offline solutions, which can result in broken web pages and dissatisfied users.

ACRONYMS

7750 SR	Alcatel-Lucent 7750 Service Router
AA	Application Assurance
AAA	Authentication, Authorization and Accounting
AP	Access Point
HTTP	Hypertext Transfer Protocol
ISP	Internet Service Provider
IP	Internet Protocol
MS-ISA	Multi-Service Integrated Services Adapter
P2P	Peer-to-peer
QoE	Quality of Experience
QoS	Quality of Service
RADIUS	Remote Authentication Dial-In User Service
UBB	Usage Based Billing
URL	Uniform Resource Locator
VPN	Virtual Private Network
VSA	Vendor Specific Attribute
WYSIWYG	What You See Is What You Get