

OpenWeb & enabling the Mobile Internet

Advantages through adaptation for Mobile Browsing

About Openwave

Openwave Systems Inc. (Nasdaq: OPWV) is the leading independent provider of software solutions that ignite mobility for the communications and media industries. Openwave empowers its customers to rapidly transform their business by reducing operational costs, maximizing new market opportunities, building loyal subscriber communities and sparking new revenue streams. Openwave's broad range of IP-based handset-to-network solutions enable the rapid launch of information, communication and entertainment services across networks and devices and include handset software, content delivery, adaptive messaging, location, music and video services. Openwave is a global company headquartered in Redwood City, California.

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Executive Summary

“Approximately 1.8 Million customers a month go off of our Deck ... the experience is often poor”

US Carrier Executive on Mobile Browsing

“In the **November 2007** survey we received responses from **149,784,002** sites. This is an increase of 7.0M sites since last month, and represents growth of over 40 million sites since the start of the year.”

Netcraft (www.netcraft.com)

The problem

The Internet marches on; web sites continue to appear in staggering numbers and usage continues to climb. Is this growth reflected in the Mobile Internet? Unfortunately not.

Most web sites continue to be unavailable for use from mobile handsets. Despite the ubiquity of web browsers and data access on modern handsets there is a disconnect between this capability and the content; suitability. Almost all web sites are written for personal computer access and the complexity of these pages and leniency of standards adoption means that most pages fail when used from a mobile phone.

What can be done about this?

Many techniques have been used to increase mobile web uptake; newer data carriers such as 3G and Edge, traffic optimisation and new standards bodies among them. But the fundamental problem still exists which is a cycle of content development that excludes mobile usage and so discourages it.

The solution? Adaptation

Content Adaptation. Platforms are now available that can take the PC web sites and re-purpose to suit mobile browsers. This immediately breaks the cycle and starts encourage web browsing uptake. Sites that did not function now do so, encouraging results leads to more browsing and a positive cycle kicks in accelerating usage and customer satisfaction. This in turn leads to new business models and revenue based on the premise that the Internet is now here.

Openwave OpenWeb

OpenWeb is the class leading adaptation platform from Openwave, the global leader in Mobile Internet solutions. The technology takes pages and adapts to mobile industry standards, with optimisation and browser profiling included. OpenWeb is deployed as a network proxy that works with all browsers in use today, allowing a speedy and robust deployment to Telco networks.

The results

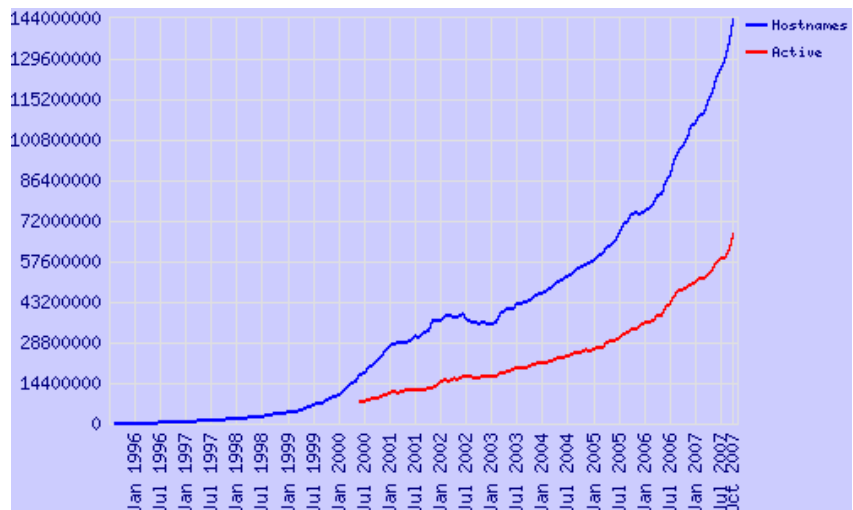
On introduction of OpenWeb customers have seen browsing levels more than double, both in terms of traffic and revenue generated. Could we do this for you?

The Internet marches on

In the years since the Mobile Internet became a reality with WAP handsets and GPRS data networks the Internet as a whole has continued to advance at a breathtaking speed. All statistics from the level of content available, network capacity, users online have increased dramatically with a matching increase in technical sophistication of features and services available.

Access to the Internet has gone in this time from being a plaything of the few to a universal requirement. The health of countries can be measured by their capability to connect to it and levels of usage.

Figure 1: Web site growth (Netcraft)



The Internet has also become a key tool of

industry to function, for people to not only keep in touch but also to find like-minded friends and for every to get access to information, goods and services. This revolution has moved a long way but has much further to go still. Most of the world is still not connected and being in third world countries or far from urban centres the Mobile Internet has a key part to play in enabling access.

Improvements to the Mobile Internet

The Mobile Internet has been a part of Internet growth and in many ways has impressed with even greater sophistication and change than in the wired Internet.

Technical

Mobile data networks continue to be enhanced at a rapid rate. Five years ago 2nd generation networks based on GPRS, iDen and CDMA were common providing usable but limited data bandwidth. Today 3G networks such as 3GPP, CDMA2000 and EVDO are driving much higher throughput. Browsers technology is moving from WAP 1.0 standards to WAP 2.0 and devices are coming equipped with larger, colour screens and improved processing power.

Operational improvements

Mirroring these technical advances are operational ones. Mobile operators can now universally offer access to data networks for their subscriber base, be this on post-pay or pre-pay billing. Access has been provided to data packages and to event based content payments without requiring new contracts or payment plans.

New Services

Not only is faster and affordable but new services have also been deployed to make the Internet more useful. These include portals with quick access to new content, Search, email and Instant Messaging.

These measures combined with the continuing roll out across new territories should make the Mobile Internet a leading force enabling Internet access, however problems still exist that are hampering take up.

Concerns for the Mobile Internet

While Mobile Internet technology has been increasing in capability the Wired Internet has been moving just as fast. Data speeds have been increasing to the point where in some countries 100Mb/s to the home is common. Processing power and screen resolutions on Personal Computer (PC) technology has also moved on and content owners have been swift to take advantage.

While the Mobile Internet has advantages in terms of flexibility of deployment and ease of movement it will continue to suffer being a subset of Internet capability. There is the potential that services will continue to be aimed at PCs as the target

"Mobile data will take up rapidly in the next few years, fuelled by an increasing adoption of open approach to the mobile Internet, flat-rate data pricing and ongoing deployment"

Dr Yanii Suo-Saunders

Analysys: *"Western European mobile market: Trends and forecasts 2007 - 2012"*, September 2007

devices and therefore will overwhelm the capabilities of even the most advanced mobile handset

Openwave sees the issues and prepares businesses to meet them.

Challenges for Network Operators

Network operators have a great opportunity and justifiable concerns with the new Internet economy and how this will apply to mobile. Behaviour on one network world is influencing user behaviour and to understand and harness this is the challenge.

Customer Power leads the way

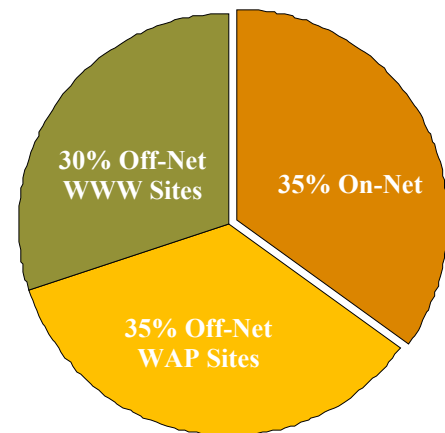
The customer no longer sees a difference between the Internet and Mobile Internet. Internet usage is building brand awareness and use of content services that are potentially outside the control of a network operator. People know where they want to go and what they want to do and try these irrespective of the current results.

What's more, people are not differentiating between mobile only content sites and PC focused sites. In some cases the actual content format is unknown before browsing is even begun!

Opening Access

A direct result of this change in user expectations is the opening of the walled garden. The operator portal and packaged services are no longer considered compelling enough, or to provide enough choice.

The removal of walled gardens should require a rethink of service provision; what do people want and have can I help them find it? Where will my data



Walled gardens come tumbling down

Web 2.0 forces Telco's to rethink strategy. By Ken Wieland
Telecommunications Online: Tues, August 21, 2007

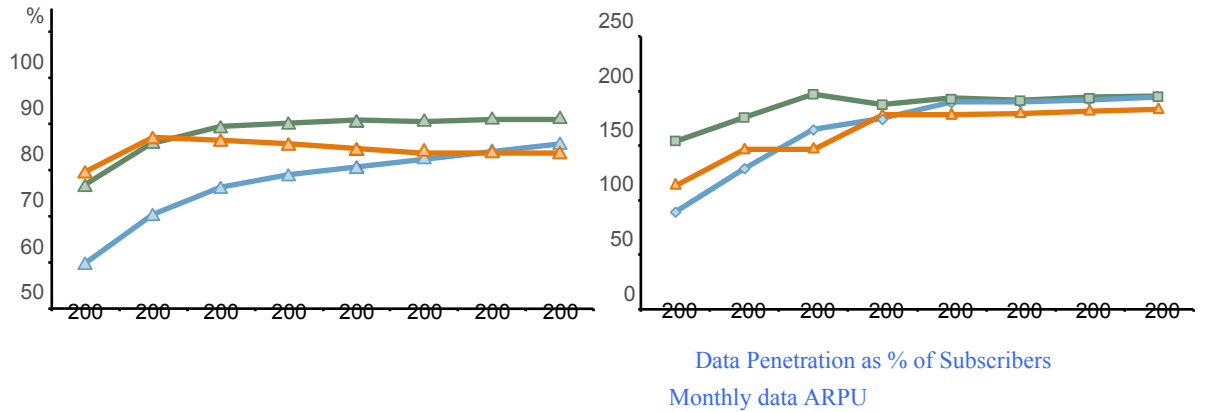
It has already happened in Japan and is starting to happen in Europe: the collapse of mobile operators' walled gardens. The increasing popularity of so-called Web 2.0 social networking Web sites such as MySpace, YouTube and Facebook, along with a growing demand among mobile users to access the "real" Internet, means the days of the traditional walled garden are numbered.

revenues come from? What safeguards must I put in place to make the experience acceptable and safe? How must cost structures differ?

Handled correctly this change will be a spur to revenues and customer satisfaction, but it must be well thought through to achieve the desired results.

Data Revenues

A clear sign of problems in the data market has been the stagnating of data uptake by subscribers on mobile networks, both in terms of users accessing data services and the amount of revenue generated.



Taken together the evidence points to the creation of a new service; enabling users to access the full web, for all content and as easily as possible. Access to the 'Open Web' is the goal, how can this best be achieved?

Solutions and Shortcomings for the Open Internet

Many systems have been developed to improve web browsing from mobile browsers; the challenge is to achieve the ultimate goal:

- Any browser to any web content
- Increase speed to near broadband levels
- Improve usability to compensate for the more limited device
- Enable in co-operation with an operators own mobile content strategy.

Several of these approaches are worth considering in more detail.

Optimisation

Optimisation generally refers to improving the throughput of pages, by reducing the amount of data to be spent and accelerating the flow of data on the radio network.

The approach has benefits in terms of speeding up the browsing experience but for most cases does not solve the main problem; which is that most content is not suitable in its native form for use from a standard phone browser.

Secondary Browsers

Deploying a second browser (perhaps with a server component) is an approach to solving this incompatibility. It usually involves loading a secondary and more capable browser on the handset and using this for web browsing. As the client can handle more content it can enhance access to web sites.

The primary limitation with this approach is in user education and support. General consumers do not understand the concept of two browsers; one for mobile and another for web. What is the difference? What if a browsing session involves both types? It is also usually difficult to install and upgrade a second browser and it may difficult to find under a Games menu.

Next Generation Networks

3G and WiMax networks focus on the browsing speed. Richer pages can be delivered more quickly, but they do not address the compatibility issue. The speed enhancement is very useful but another technique is required to solve the nagging issue of making content more appropriate.

.Mobi domains

The .mobi domain is an industry supported effort to encourage content owners to develop mobile friendly content and to simplify the ability of consumers to find that content. Mobile compliant sites are developed with a <name>.mobi DNS address, so it can be identified clearly while at the same time following industry standard guidelines for compatibility.

.mobi does help encourage content owner adoption of mobile friendly sites but does not address either the existing content base, those owners who still do not intend to invest in mobile development or where a site owner wishes to promote a single web address in marketing materials. It also confuses a key issue in the future; not all mobile phones or browsers are equal, some may even begin to resemble PC browsers in terms of functionality. If you have .com sites aimed at PC style browsers and .mobi addressing mobile phones where should these smartphones browse to?

Content Adaptation

A final option and the best solution is deployment of a content adaptation network proxy. In this case web page requests from a mobile browser are collected by the proxy and turned into pseudo-PC requests instead. When a standard page is returned it is adapted in real time to a mobile standard and optimised for the handset being used.

Several vendors have attempted to provide such a proxy but most are unable to render a suitable experience because of the complexity of the task. Examples of this are as follows:

- JavaScript needs to be executed. Mobile pages do not currently contain JavaScript while PC targeted sites use it extensively for page layout, menus, form verification and transaction management. It is necessary to handle JavaScript calls throughout a page and session, converting where required in to a mobile equivalent function.
- A solution should manage multiple markup types; HTML, XHTML, XHTML/MP and legacy WML.
- You must convert all Character Sets found through the world; including handling Windows specific sets and conversion to a character set supported by the handset and for POSTs converting back to the expected character set expected by the originating server.
- It is vital to maintain transaction state; including support for SSL and session cookies that control transaction flow. An adaptation solution should be principally designed to *enable* web tasks to be carried out, not just to represent static information from a page.
- It is necessary to adapt all web sites generically and automatically, with no manual layout intervention. It is not feasible given the size and complexity of the web, with fast changing designs and new sites being added, to rely on tools to layout the expected page.
- The service must work with the browser already installed in the handset. Despite the complexity of supporting multiple browsers from multiple vendors, all with different speed and memory constraints, this is the only way to manage a general deployment.

So in summary the ideal solution for Open Internet access is a combination of these solutions; a content adaptation server with optimised transport to speed data flows to the standard browser plus support for identifying mobile friendly web sites and conformance to open standards. In addition to this is the key requirement that the supplier must be experienced in scalable mobile network deployments; such a solution will form a critical and complex element of a mobile data infrastructure and therefore the supplier should have the skills and track record in similar deployments.

Fortunately such a solutions exists; OpenWeb from Openwave.

The Ideal Solution – Openwave OpenWeb

OpenWeb is the class leading adaptation solution from Openwave, designed for operators and portal owners to bring as much of the mainstream web to the mobile web.

Benefits of OpenWeb

OpenWeb has been designed to address all aspects of the content adaptation and to drive the maximum amount of traffic through your network. Measures include:

- Richest capability to handle complex web sites: native support for JavaScript, CSS, complex markup and image management. More features of more web sites work with OpenWeb than other adaptation solutions.
- Globally ready; works with all characters sets and languages.
- Designed to optimise the user experience; to accelerate content download and minimise data used. Page navigation and session control options automatically allow users to customise the experience to their own requirements.
- Best able to handle mobile web and PC web sites. A single set of management rules can automatically decide how best a site be served to customers, no manual adaptation required.
- Works with the handset integrated browser, with no need to deploy a new client we allow a rapid deployment to a pre-existing user base.
- Live running deployments across many years give OpenWeb the experience and scalability to be deployed with confidence to even the largest of operator infrastructures.

OpenWeb was designed as a network based adaptation server that is able to handle transactional web sites and complex site functions. More than this though it was designed as an ‘Experience Enhancer’. Not only will we adapt sites to be mobile friendly but the aim is to make the overall experience a rewarding one; so speed of delivery and richness of the experience is also important, as is flexibility of deployment.

OpenWeb is designed to be used in many different ways depending on operator requirements. It can be deployed as part of a network infrastructure handling all Internet web traffic, or alternatively as a service provided only from an operator portal. Other uses include automating third party applications such as RSS readers and enabling mobile search.

Physical and logical deployments are also flexible. OpenWeb can be easily configured within an operator network or just as simply deployed as a managed service from an independent data centre.

Such flexibility and feature richness makes OpenWeb an ideal platform for content adaptation. Openwave Systems matches that with unparalleled experience in Mobile Internet services.

Benefits of Openwave

Openwave (Nasdaq: OPWV) is one of the world's leading innovators of software applications and infrastructure designed to enable revenue-generating, personalized services, including merchandising and advertising, which converge the mobile and broadband experience across devices. Introducing our first software products in 1994, today Openwave enables the delivery of innovative data services for leading operators worldwide across Internet Service Management, messaging systems, Location Services and Client Applications.

Openwave is the *only* major vendor of mobile gateway infrastructure to develop the own content adaptation technology and platforms, making us the ideal partner for driving new value in these leading edge Internet services. Not only can Openwave deliver the platforms, but also to work actively with customers to drive new business opportunities from the Mobile Internet.

Driving new business opportunities

Technology is only as good as the business opportunity it enables. OpenWeb is a key service enabler as Mobile Operators move in to the Internet age.

OpenWeb opens up for the first time the full range of available web sites for use from Mobile Browsing. This allows a true Mobile Internet service offering, enabling operators to promote Web Access as a real possibility to the general public and not from just a few high-cost handsets. Benefits include:

- Most active mobile browsers are the young who predominantly have simpler handsets. OpenWeb opens up these devices to true web browsing, so matching for the first time the keenest users with the most content.
- Most current web sites are not designed with mobile phones in mind and many do not render at all while OpenWeb always provides an improved user experience. This has the effect of increasing confidence of users to try new sites; which increases usage and data traffic. The final goal is to convert non-users in to user, occasional users to frequent users and frequent users to unlimited. Increasing traffic levels then allows new business models to become possible.
- A large group of active web browsers allows advertising to become a possibility as you can target advertising accurately base don customer knowledge of behaviour. This is a new revenue stream and a first not coming from users themselves.
- Web Search now also becomes possible; without adaptation you cannot run a comprehensive search service as most sites are not mobile friendly. This is not only a good service to encourage usage but again an indirect and new revenue source.

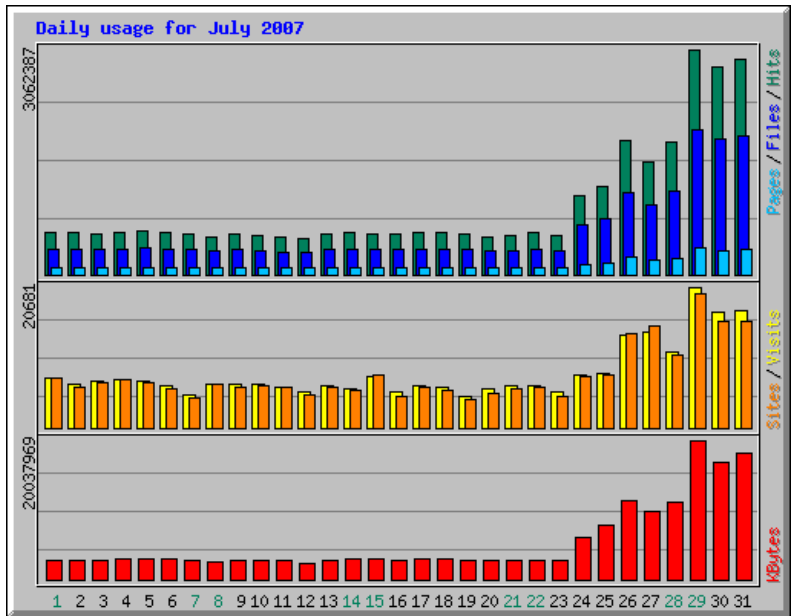
Content Adaptation can deliver a real step change in user activity and Mobile Internet acceptance. Powered by OpenWeb you get the best experience possible.

Example Case Study

A European operator took the decision to offer a full, Open Internet service with content adaptation to open up non-suitable web sites. Also included were web search and simplified tariffs. OpenWeb was selected to provide adaptation and content optimisation, integrated to the network and the operator’s portal.

The new service was initially launched without advertising and with limited capacity. Take up of the service was immediate and continued to increase based solely on self-discovery and word of mouth. Users instinctively understood how to use the service and discovered their own destinations of interest. Extra capacity was then added and a formal marketing campaign launched, the effect of which on traffic levels is shown below.

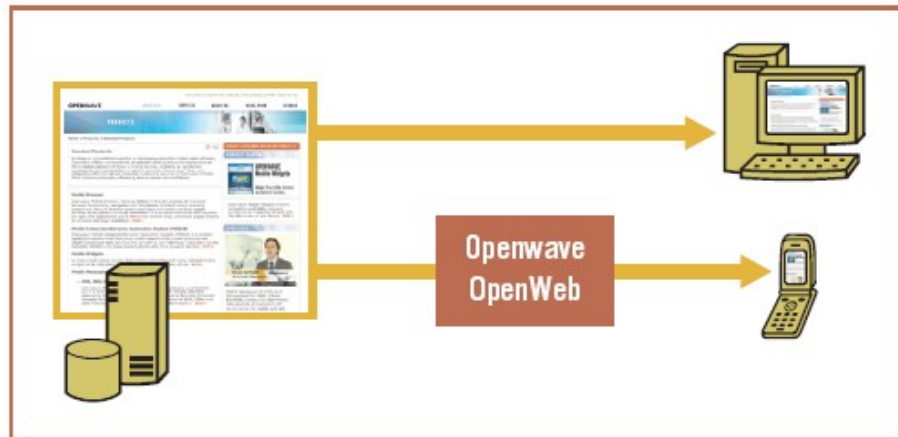
Both revenue and traffic levels have continued at the increased rate showing that once tried people do keep coming back to the service again and again. Also of interest – and available due to OpenWeb’s advanced analytic is detailed information on where people are going and with what handsets. Literally millions of different destinations are seen across more than two hundred handset types. This shows that usage is across the board and web access is not only the preserve of smartphones.



The operator is question has continued to invest in new services based on web access to increase revenue, all powered by OpenWeb.

OpenWeb Product Description

Openwave OpenWeb takes the vast majority of sites and on the fly throughout a user session converts the content to XHTML/MP compliant pages. It achieves this through the use of Proxy Execution, carrying out complex page actions at OpenWeb and then passing on simplified and transcoded pages to the client.



Web Complexity

OpenWeb was designed from day one to address adaptation from the most complex web sites and to deliver the most functionality possible. Sophisticated JavaScript support and stateful DOM management allows support for transactions with full security support.

A key area in content adaptation is to ensure that as much of an original web site continues to function as is feasibly possible. It is not enough to simply present the simplest elements of a page that can be handled, but to make function the aspects of a site that are of principal use to a person. Such functions include logins, purchases, searches and form completion. Working with a broad range of browsers as OpenWeb does also means we may present these functions in different ways depending on the browser in use, for example splitting pages in to smaller sections and importantly handling correctly any forms that need to be split.

Deployment

OpenWeb is designed to be very flexible with many deployment options supported. In terms of network architecture OpenWeb can deploy as a proxy or as a portal based service accessed from a service page.

Operationally; OpenWeb can be deployed as a fully managed service from an external Openwave data centre, a managed service in-network but controlled by Openwave Professional Services or as an in-network deployment by a customer.

OpenWeb runs under Linux or Solaris operating systems for full Telco grade reliability and robustness.

Feature Matrix

OpenWeb Features	
HTML to XHTML/MP transcoding	✓
JavaScript Execution	✓
JavaScript Event Management	✓
SSL Connection Management	✓
Session Management	✓
Device Profiling	✓
Advert & Analytics Management	✓
DOM Management	✓
Pop-Up & Pop-Under Control	✓
Page Splitting & Sub-Page Navigation	✓
Usability Defaults	✓
Alert & Warning Message Insertion	✓
Hosted Service Page	✓
Integrated Search Linking	✓
Transaction Support	✓
FrameSet Merging & Tracking	✓
Sub-Page Form Split Management	✓
Downstream Cache Management	✓
Image Resizing & Conversion	✓
Image Quality Management	✓
Object Linking and Control	✓
Table Management	✓
CSS to CSS/MP transcoding	✓
Header Management	✓
Auto-Redirect Following	✓
URL Hashing for page reduction	✓
Remove hidden HTML	✓
Usage Log Generation	✓
WML/Mobile Site Pass-thru	✓
HTTP 1.1 Support	✓
Universal Characters Set Conversion	✓
Proxy Mode Support	✓
In-Page Header & Footer Branding & Insertion	✓
Host Profiling	✓
User Preferences	✓

Openwave Product Family for Mobile Internet access

OpenWeb is a member of Openwave's Service Management product family.

To deliver on the promise of the internet anywhere anytime on any device, operators must expand their services to allow greater individual customization; they must protect subscribers from security threats; and they must accelerate the delivery of rich content.

Openwave's market-leading Service Management products sit at the edge and core of operator networks to enable the delivery of voice and video communication, messaging, location, and content services to mobile handsets and personal computers. These products help transform the mobile internet experience from mere data connectivity, to rich, personalized content across multiple devices.

Services include:

- **Integra** Next generation management proxy
- **Guardian** Guards against multiple threats aimed at mobile messaging, browsing and downloads.
- **Mobile Advertising Solution** Profiling and placement of banner advertising within Mobile Internet pages.
- **OpenStream** Management of adaptation for streaming rich media files.
- **Client-Server Optimisation** Enhancing the data transport layer for client/server applications.

Conclusion

Open Internet browsing is a wonderful opportunity to generate new revenue sources of revenue and increase customer satisfaction with data services. With a focus on delivering real value to all customers immediately OpenWeb makes this a reality.

OpenWeb continues to mature, to meet rising expectations while delivering advanced solutions for operators in terms of data control and revenue enhancement. As web complexity increases and phone browsing capabilities stretch OpenWeb will be there to assist and to drive this future. Openwave are committed to making the future a good place to be.

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Author

Ed Moore
OpenWeb Product Manager
Openwave Systems Inc.
ed.moore@openwave.com

Feedback

marcom@openwave.com

OPENWAVE®

Openwave Systems Inc.
2100 Seaport Boulevard
Redwood City
California 94063
U.S.A.
Corporate +1 650 480 8000
Europe +44 2890 416 200
Japan +81 3 5909 6100
<http://www.openwave.com>