

## Rich Media Development & Deployment

### *Best Practice for the Mobile Internet*

The two tenets of success in content creation and delivery on handsets are clear:

- A compelling and intuitive end-user experience on handhelds.
- The fast and cost-effective development of rich media applications able to sustain the continued interest of users.

According to Informa Telecoms & Media, the market for content and services on cell phones is expected to grow to \$150 billion by 2011. All the bets are placed, yet end users are ultimately the ones who hold the cards. In 2007, the iPhone jolted the industry just as Macintosh, and later Windows, shook the PC world over twenty years ago, and for a similar reason: by again emphasizing that user experience is a decisive factor to generate enthusiasm and build Web 2.0 fan clubs. It is clearer than ever that success will be predicated both on the nature of the services offered and upon the ease with which users are able to discover and access services, as well as interact with these services and with fellow users.

The Streamazzo Universal Rich Media Platform is a Rich Media Service-Oriented Architecture™ specifically designed to deliver on the mobile Internet promise. Offering a compelling user experience entails the ability to design not only good-looking, but also smart and easy to navigate interfaces, which itself calls for the ability to build intelligent applications that transparently work together and interoperate. This in turn requires an exceptionally powerful and flexible environment that is device, network, and OS agnostic. Streamazzo fulfills this threefold mandate and provides a proven technology with a proven record of accomplishments.

We bring the future closer — more specifically we make it a reality for you today, wherever you operate in the value chain, as you define your strategy to leverage the phenomenal potential of services on mobile devices. Don't take our word for it! Here below is an example: A Samsung P930 and an iPhone are unquestionably dissimilar. Yet today, Streamazzo enables this lower cost Samsung handset to perform functions that an iPhone cannot.

*Figure 1: When a Samsung P930 can be as great as an iPhone... or greater!*



The service shown on the left broadcasts live TV over a broadcast network, such as, DVB-H, and allows users to customize the look and feel, and get live updates on topics of their choice.

Is this science fiction? No, it is not. Look at it this way: The simple fact that Streamazzo can offer this today means that everything with which you are currently struggling, as you try to design, scale, maintain or upgrade your Mobile Internet offering on multiple handsets is much simpler if you start with a scalable platform.

Streamazzo is your service development environment of choice: It was designed for the mobile world from day one and is not a stripped-down tool originated from the desktop (and for which the complexity and fragmentation of the mobile industry came as a surprise and an afterthought).

This document is composed of three sections and explains why and how the Streamazzo Universal Rich Media Platform™ allows services developers to engineer magic on handsets.

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## I- ONE BILLION PHONES READY FOR GREAT SERVICES

While it is widely acknowledged that services on handsets are key to non-SMS data ARPU growth, analysts tend to lower expectations as the users' uptake is not as rapid as anticipated. The relatively slow pace of the industry is usually attributed to multiple causes, ranging from the low number of high-end devices to the fact that the industry fragmentation renders application development nightmarish and extremely costly. Streamazzo looks at the situation from a different angle:

- 1) High-end handsets or smart phones account for a small percentage of the existing devices. Even if the number of smart phones grows constantly, expecting that they will represent one hundred percent of the market is unrealistic. This is why the Streamazzo platform allows the development of innovative applications and services that can be deployed on both mid-range and high-end devices.
- 2) The mobile industry is extremely fragmented and will not defragment anytime soon. Fragmentation is not all that negative: it also allows device manufacturers and service providers to differentiate, which also enables innovation. Hence, why don't we adopt fragmentation?

The mobile ecosystem is not going to change in the near future. Therefore, the industry needs development platforms designed to address the characteristics of the mobile ecosystem in both its current and future state. Currently, very few tools are architected to address the diversity of mobile platforms and keep development costs lower. The distinctive trait of the Streamazzo Rich Media platform is that it was conceived in the telephony world for mobiles from day one. The rich media development on mobile was incubated in the R&D Labs of France Télécom in 1999, when "high-end" corresponded to our present "low-end". In 2004, Streamazzo was created as a spin-off. Since then, the company has dedicated tremendous efforts to enriching and expanding on the features and performance of its technology and developed its customer base throughout the world. As a result of its exceptional expertise in rich media for mobile, Streamazzo holds a large number of patents on various technologies and processes.

### 1- Streamazzo: Rich Media made for Mobile™

The notion of multimedia appeared in the 1980's. In the late 90's, with the advent of interactive applications, the expression "interactive multimedia" started to become popular and today, it is more customary to speak of "rich media." Despite common use of the expression, actual implementations are not as widely spread as may be believed, and this for a simple reason: combining text, audio, still images, animation, video, and interactivity while delivering satisfactory performance requires a lot of processing power, whatever the device. The challenge is all the greater on handsets, notorious for their limited resources, no matter how "smart" they may be.

Streamazzo has successfully overcome this daunting task and designed a platform specifically thought-out for the design and implementation of high performance rich media services and applications on constrained and heterogeneous environments. Creating rich media services and applications for handsets calls for a new breed of authoring tools with novel technologies and methodologies, as well as a global architectural framework that drives speed of execution and offers to users a smooth, no-latency experience.

*Figure 2: Rich Media even on lower end handsets*

Today, Streamazzo can serve any handset that has a score as low as Jbench1 2500, such as, for example, the Symbian series 40, or any equivalent on other platforms. Consequently, an approximate one billion users are entitled to enjoy Streamazzo-based rich media services today, albeit not quite to the same extent.

While users of smart phones can enjoy live TV, users with a simple phone feel quite gratified to be able to browse through news and check on weather widgets, which is often far more than what they expected when they acquired their device.

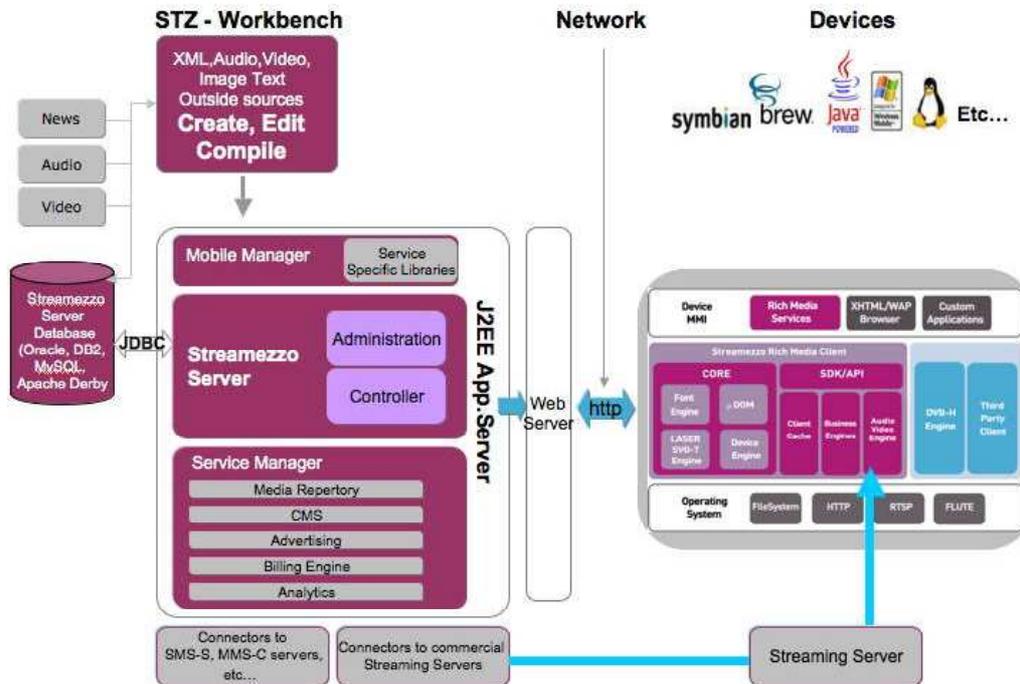
The example on the right presents a Music Store service on a low end Sony Ericsson W660: Users can visualize albums, listen to music while browsing the catalog, etc.



### a) The Streameezo architecture

Streameezo is an open, standards-based, distributed architecture capable of orchestrating the various aspects of rich media development and deployment for mobile devices.

Figure 3: The Streameezo open, standards-based, service oriented distributed architecture



The following sections detail why it is critical to use an open, standards-based, service oriented distributed J2EE architecture and provide a summary of some of the key features and benefits of the Streameezo's platform, with respect to development and deployment.

### b) An open, standards-based J2EE framework

Streameezo's architecture is an open, standards-based framework, which is scalable and extensible. This aspect is important just by itself. The mobile industry is fragmented for legacy, cost, and competitive reasons. If, on top of this, development environments for mobile platforms are proprietary or closed, the global market for mobile applications and services will indefinitely lag or turn into a collection of smaller proprietary ecosystems or niche markets. In other words, the software model that still prevails in the PC industry is not applicable to the mobile industry. In the PC world, we have standard I/Os, such as keyboard, mouse, displays, and standards-based north and south bridge chip implementations, as well as scalable screen sizes and resolutions. Mobile devices on the other hand, have at least a half dozen OSes and numerous variations in hardware implementations and capabilities, such as memory and processing power.

Relying on an open standards-based J2EE framework also facilitates the ability to connect multiple external systems, using connectors available within J2EE. A few examples of connectors employed for external feeds are XML, RSS feeds, html, SMS/IMS gateways, billing servers and web services. In addition, the source for streaming audio and video can be connected through the audio/video player using the RTP or RTSP transport layers. Commercially available audio/video streaming servers deliver content directly to the device using RTSP/RTP protocol. Our architecture has been tested with several streaming servers such as Packet Video, Real, Vidiator, and Darwin. In addition, we support connection to SMS-S and MMS-C servers to pass the SMS and MMS generated by the client.

This architecture allows operators and service providers to push new services, update and tune these services. It is robust and ready for integration with telecom networks, has built-in reliability, availability and scalability (RAS), and is easy to install, manage and maintain.

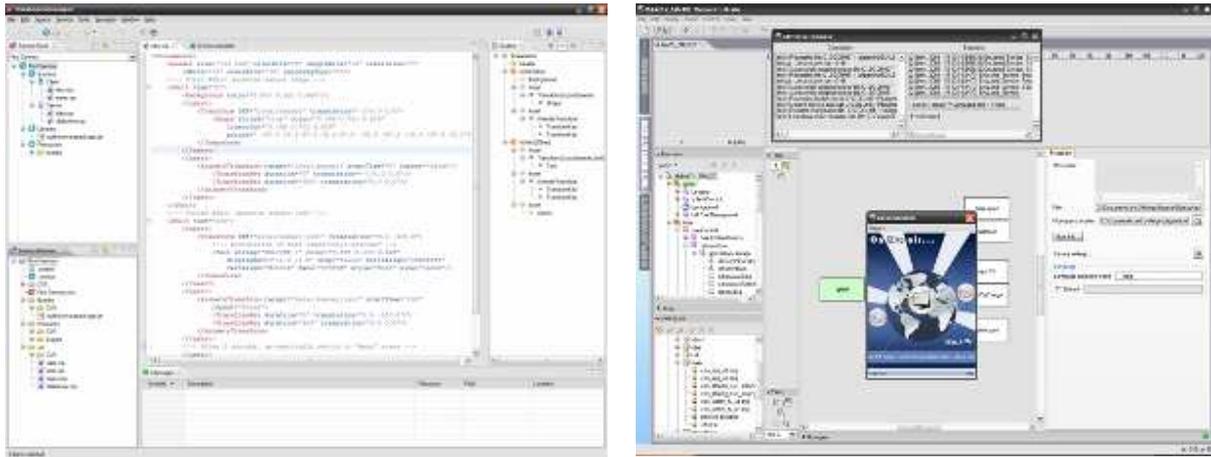
### c) Rich Media Packaging: Making content readily available and interactive

The Streameezo Workbench is an easy-to-use, open, and standards-based development environment where

you create scenes or a set of scenes and exploit current assets such as, text, audio, video, XML tags, graphics images or photos. Images and photos can come from Adobe Photoshop, .jpeg files or any other photo/graphics/video formats. The Workbench is developed using the Eclipse framework, which enables the developer community to take advantage of their own plug-ins. Developers can also include placeholders during service development to incorporate external sources of content such as news, videos, or audio files.

The Workbench consists of two set of tools, the Studio, which assists designers to create prototypes on a PC screen, and the Editor, where developers code the scenes and logic using a language which is Java-like and a subset of XML.

Figure 4: Views of the Streamezzo Workbench editor (left) and of the Streamezzo Workbench Studio (right)



The developer creates a storyboard, which includes the flow of the different events, user interface, and interactions. Once the developer is satisfied with the user experience offered by the scenes and the storyboard, they are compiled into Rich Media Server Pages in a binary format that reduces network bandwidth, guarantees performance while saving battery power, and ensures a small memory footprint. Essentially, the compilation encodes, compresses, and multiplexes assets and associated user interactivity. The binary format also ensures accurate and real-time synchronization at the frame level.

The Workbench is more than an authoring tool to produce elaborate rich media simulations and express one's creativity. It is also the environment where Streamezzo, because of its patented compilation technology, transforms data into a *Rich Media Packages*. This data can be atomic (text, audio, video, still images, etc) or complex (contents with multiple components). These *Rich Media Packages* are intrinsically relational and interact with each other.

As a result, one of the remarkable advantages of the Streamezzo Rich Media technology is not needing the mediation of a browser on any handset to present data at any time. Rich Media Packages are self-presenting interacting sets of information, offering to users a disintermediated access to information, and consequently much better performance as they navigate through that information, even on lower end devices. In other words, for Streamezzo, further adapting existing mobile browsers or creating even more browsers for mobiles is superfluous. Rich Media browsing does not require the use of a browser. However, in the event that a browser is already implemented, Streamezzo can subsume the content presented by the browser or can also be used as a plug-in, and most of the significant benefits of the architecture can be still achieved.

Once created, these *Rich Media Packages* are to be implemented on devices. The purpose is to ensure that they operate on the largest possible number of handsets. To do so, Streamezzo offers an exemplary service-oriented approach that decouples the nature of services from their delivery vehicles and physical incarnations, and thus elegantly solves the fragmentation challenges the mobile industry is facing.

**d) Device agnostic services**

Mobile devices have non-standard I/O, which includes different screen sizes and resolutions, with portrait and/or landscape modes, different keyboards with a large variety in the placement and the function of the soft keys and touch screens. Esthetic diversity is an important component of the manufacturers' branding efforts and part of the appeal of handsets to customers. For service developers, however, such disparity can be challenging as going from one screen to another entails significant repurposing work. This is the issue that the Streamezzo Mobile Manager addresses.

Once the service is created, the Mobile Manager characterizes the handset (brand, type, screen size and number of colors it can support), as well as the information specific to the handset capabilities, such as audio/video codecs, resolution, etc. Today Streamezzo already supports hundreds of handsets and qualifies about 100 devices per year, which corresponds to the average number of new devices introduced every year.

The Mobile Manager incorporates any device specific information, which includes device support for audio and video. Similarly, the Streamezzo server can transcode images in real-time to the image formats supported by the various handsets. Streamezzo also leverages the idiosyncrasies of each device and embeds the supplemental power that the Streamezzo Rich Media architecture confers to handsets. One of the unique strengths of Streamezzo is to optimize the device's internal resources as well as enable rich media services to seamlessly interact with the device's built-in features. In other words, whereas conventional porting kits tend to define a minimum common denominator between applications and only morph the code of siloed applications into the constraints of devices, the Streamezzo Mobile Manager leverages all the capabilities of any given device, and it is able to manage the applicative contexts as well as any inter-applications associated processes.

*Figure 5: Seamless interoperability between Rich Media services and devices' built-in capabilities*

As the Mobile Manager enables the seamless view of services across a large variety of devices, it also factors in the interoperability between applications permitted Streamezzo.

In this example, users want to check their availability. Instead of expecting them to open and browse their phone calendar, which is often cumbersome on a handset, they can select the date directly from the booking page.



Once services are handset-ready, the Rich Media pages are published on the server as *Mobile Packages* that are transported over the network to be used by the devices.

**e) Network agnostic environment: Enabling convergence – Broadcast/Unicast; Fixed/Mobile**

Streamezzo uses existing transport layers, http, https, and RTP, and thus it is network agnostic. Today the networks transparently supported include GPRS, EDGE, UMTS, 3G HSDPA, and CDMA for unicast. Streamezzo is also 4G ready and is capable of supporting LTE and WiMAX when they become commercially available.

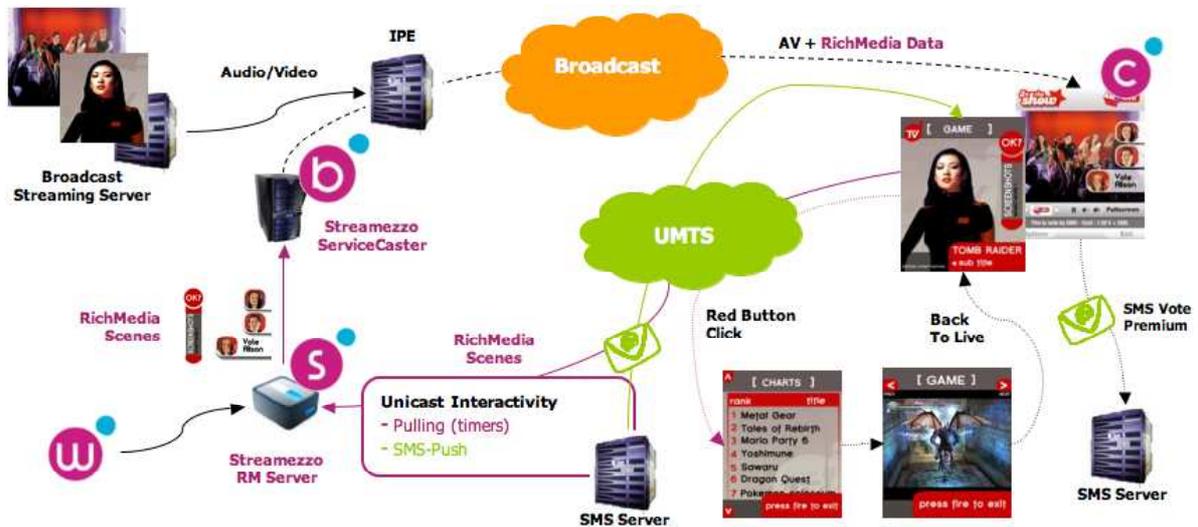
The Streamezzo platform addresses devices and OSes, and also different networks. The company holds several patents on the transparent convergence between broadcast and unicast infrastructures. Streamezzo supports DVB-H, DVB-SH, as well as T-DMB and Media FLO.

Transparent to the end-user through its unified rich media interface and its innovative rendering technology at the device level, the Streamezzo solution has already deployed services with major mobile operators, broadcasters, and content providers to launch innovative services on 2.5 and 3G networks, as well as sophisticated trials for DVB-H networks.

As noted in the section related to the Workbench describing the Streamezzo Rich Media Packaging

technology, one of the major strengths of Streamezzo is to disintermediate access to information. This is also true at the network level, where Streamezzo is able to directly attach the streaming server to the device using RTP and RTSP.

Figure 6: The Broadcast-Unicast convergence



### f) OS independence

The Streamezzo mobile packages are OS independent and designed to operate on a wide array of operating systems, including: BREW, JWM (all the versions of Java and particular Java implementations, ranging from Midp1 and Midp2, DoJa, Android, J2ME etc.), Linux, Windows (XP, Mobile 5, Mobile 6), WIPI, Samsung SHP proprietary OS, and Symbian (6.1 and above platforms). Streamezzo also supports additional closed OS (including Nucleus, Rex, MacOS, WIP and others) as well as custom versions of common OSes, such as Symbian 6.1 and above as well as sub-environments (S60, S40, UIQ).

The example below shows the same application on three different devices supported by three different OSes.

Figure 7: One service on three devices with three different OSes



**g) Augmenting the intelligence of constrained devices**

The Streamazzo platform implements rich media services for handsets in spite of their limitations with respect to processing power and memory. Therefore, optimizing these precious resources and ensuring the ability for the device to implement services with minimal latency and optimal performance is a critical aspect of service design, which is generally overlooked, whether rich media or not.

Here again the Streamazzo technology provides most innovative and constructive solutions:

- **Balancing intelligence between the server and the client:**

Streamazzo services are designed to permit the coexistence of a large number of applications on a handset, which requires the intelligent management of the handset's resources. This approach radically differs from a silo approach where one application or a small number of applications can literally drain these resources.

With Streamazzo, a service is structured as a set of intelligent stubs that enable *Real-Time Dynamic Download Over The Air* from appropriate content sources on the server (or orchestrated by the server). This dynamic download is a major advantage of the Streamazzo platform as it enables content providers to seamlessly and dynamically add/upgrade/update services on devices over the air.

The Streamazzo server "sees" devices as thin clients and communicates with them in a distributed client-server architecture. Each mobile application is a J2EE web application hosted on the Rich Media Server and managed by a control module, which arbitrates access to content and services. In order to enhance the user experience, we support two levels of caching on the server. The first level caches scenes and the second level caches objects from external databases or resources.

This server architecture is able to support very large numbers of users and is clustered to add more users. We support both horizontal, i.e., adding more server modules on the same machine, and vertical clustering where we add server modules on different machines.

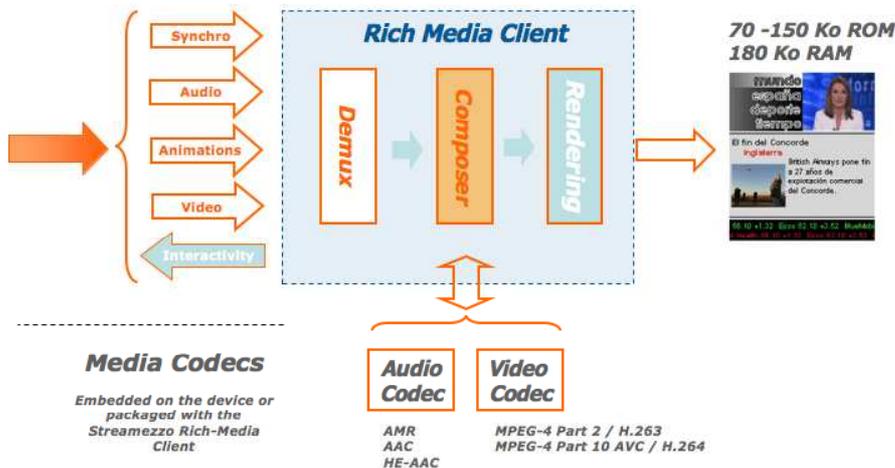
One of the main benefits of this architecture is that operators, manufacturers and content providers can dynamically configure their business models, considerably increase their offering to attract more users, and get them interested in a much larger number of applications.

- **The smallest footprint with the highest performance: Rich media user experience on lower range handset**

The Streamazzo thin client architecture allows for the smallest footprint in the industry (70 -150 KB ROM; 180 KB RAM). Streamazzo's clients are three to ten times lighter than equivalent clients for similar applications.

To give a summary view, the Streamazzo rich media client consists of a demultiplexer, a composer and a renderer.

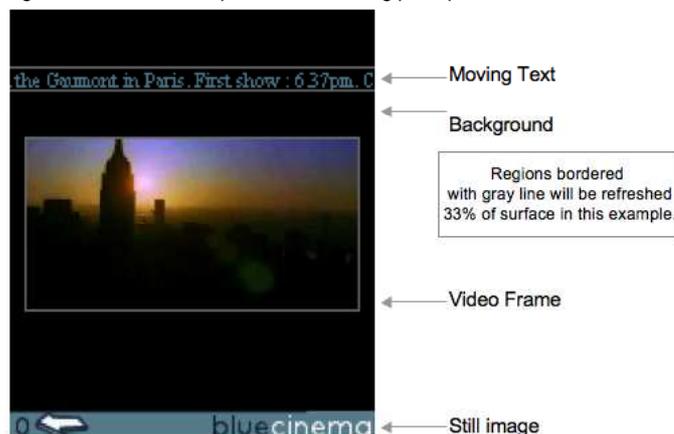
Figure 8: High level view of the Rich Media client



The demultiplexer demultiplexes and decompresses the binary information from the server. The composer takes this decompressed information, uses synchronization to compose a scene, and leverages the resources on the handset to decode images, video, or audio contents. Streamazzo also provides an optional audio/video player that supports high definition audio and video formats in addition to video graphics composition. This optional audio/video player is helpful when handsets support either video graphics composition or certain audio/video formats. The audio/video player has automatic video quality hinting that automatically renders a lower resolution video to higher one, for example QCIF to QVGA. A scaling algorithm ensures optimal video quality.

The core of the rich media client includes a font engine that supports different types of fonts and languages. For better user experience, the rich media client supports intelligent caching with programmable caching policies. An application reserves a certain amount of memory for caching scenes or parts of scenes. This cache can be updated using either least recently used or most recently used algorithms. An application is also capable of loading cache in the background when connection is available by queuing requests. An application developer can also optimize CPU utilization and power consumption by setting frame rates for each scene, and, internally, the software relies on a powerful patented render graphing technique to reduce refreshing of areas. In addition, Streamazzo supports progressive downloads, where a client can generate multiple http requests while it is rendering scenes, and incremental updates. Streamazzo does not need to download a complete page, but only the components of the page that have changed.

Figure 9: Streamazzo optimized rendering principles



## 2) The future is today: Discover, enable and experience with Rich Media

Although industry fragmentation diversely impacts carriers and devices manufacturers, it still affects them all equally as content providers and services developers are deterred from venturing into mobile marketing for fear of being stuck with one specific brand or OS, or of spending inordinate amounts of money to port applications from one platform to another. In order to succeed, one has to be able to address the mass market and hence target all platforms – and in order to do so at reasonable cost, invert the current metrics in the mobile Internet where 80% of the expenditures go to the technology and 20% to marketing efforts, while the opposite is true for most Internet businesses.

Streamazzo solves all the problems that slow down the expansion of the Mobile Internet and enables the players in the mobile value chain to propose rich media for a large number of devices:

- Carriers can expand their offering to their subscribers on a wide range of handsets while making no compromise on their Mobile Internet and mobile data strategy.
- Devices manufacturers can continue to offer a wide range of handsets to the largest possible number of customers with different needs and different spending capabilities, and in parallel pursue a productive services strategy.
- Content providers and services developers can roll out their services on many handsets and address mass markets cost-effectively.

**a) Rich Media services across the board**

Not all phones can support broadcast today, but a large number of them already support Rich Media browsing. Here below are typical applications by type of devices.

*Figure 10: Rich Media browsing on three low-end devices*

Rich Media Browsing offers an optimized presentation of the content, a user-friendly interface and offline browsing. Typical services that a user enjoys include accessing news, stock, weather, sports, mobile downloads, yellow pages, etc.



*Figure 11: Rich Media applications on three mid-range devices*

Rich Media Applications offers a complete interaction with the phone's built-in features such as camera and take advantage of the file system, audio and video and local logic. Typical services that a user enjoys include video sharing, branded agenda, community chat, mobile quiz, access to artists' minisites, etc.



*Figure 12: Full TV applications on three mid-range to high-range devices*

Typical services that a user enjoys include mobile TV and access to VoD catalogs.



Figure 13: Broadcast on high-range devices



### b) Benefits of adopting Streamezzo today

In 2008, the Mobile Internet may be, in some respects, where the Internet was ten to twelve years ago, i.e., in a sort of advanced infancy, with a lot of trials and errors and, more often than not, somewhat sketchy strategies. Yet, Mobile Internet is most likely to blossom overnight, just as the Internet did, and in considerably higher proportions: there are over 2 billion phones in the hands of consumers today, making it the most pervasive and targeted media market one could imagine! Getting ready for that moment is primarily a matter of using the right platform today.

- **Coordinating services development to reduce development and maintenance costs**

Most players in the mobile chain develop services today, but in a somewhat uncoordinated fashion. Most wonder about what tools to adopt, try various more or less mature softwares, or look at recruiting an army of developers. All of this results in high development costs, unmaintainable applications, and ultimately, an increase in the discrepancy between investments and actual achievements. Streamezzo enables operators, devices manufacturers, as well as content and media providers to adopt a coherent strategy. Internal developers can all use the same technology, which reduces training and maintenance costs. As the same platform can be used across the board, for both lower and higher end handsets, existing applications can be reused or transparently upgraded thanks to the Streamezzo Real-Time Dynamic OTA.<sup>1</sup>

- **Rapid development**

Streamezzo is a rapid development environment for Rich Media applications, and today, the only one with this level of features and architectural power. As was the case when the first encompassing RDBMS with programming languages appeared, some may be tempted to say that similar applications can be created as Java applets. It is correct that they can be beautiful products. Yet, Java applets are inevitably siloed applications with none of the built-in interoperability capabilities offered by Streamezzo. Also, and in order to achieve scalability across devices and OSes, developers have to create features that are built-in in the Streamezzo platform! Given that services on handsets are consumers' goods, and that many of them have a relatively short life cycle, reducing development cycles and offering automatic updates are clearly a shorter path to success.

- **Modularity and scalability**

The same service can be made available with variable options depending on the power of the device as well as the subscriber's data plan. In addition and given the pace at which handsets are renewed, a large number of users that belong to the low or mid-range categories today are likely to move to a higher group within the next two years. For operators and manufacturers, adopting a rich media strategy today is a powerful incentive tool for users to upgrade their equipments and/or expand their data plans. The consumption of Mobile Internet follows all the rules of consumers' markets: You buy better cars with more optional components only if you know that they exist in the first place!

<sup>1</sup> While today, Over the Air Provisioning (OTA) is simply a cumbersome and basic download, the Real-Time Streamezzo OTA allows the seamless and dynamic upgrade/update of services on the devices. This major capability of Streamezzo is further explained in Section II.

- **Service continuity**

By enabling operators, manufacturers and content providers to propose a consistent offering across the board, deliver interoperating services, and perform Real-Time Dynamic OTA of both the application and the service, Streamezzo also enables them to ensure a continuity of services that can be crucial for high-end users who like to acquire the latest, coolest devices as soon as they appear on the market, but still want to use the same application. The fact that Streamezzo's services are device and OS agnostic allows for an uninterrupted usage of favorite services and strengthens their loyalty.

- **Agility: Real-time analysis of trends for an adjusted offering**

Today services providers have virtually no information on their users' experience (navigation, previews, etc.), which makes it extremely difficult for them to understand what users are doing with these applications and what they would be more interested in. Such reports are complex to obtain from WAP browsers, and aggregating data from siloed and scattered Java applets is a daunting task. Because the Streamezzo server constantly interacts with the device, all relevant data can be captured in the Analytics module of the Service Manager. Therefore, instead of creating or modifying services out of the blue, services providers are able to design a granular offering capable of addressing a diverse audience, and know what is of interest to their various customer segments. Given that for some segments, especially young mobile consumers, services can be extremely fashion sensitive, it is critical to have a constant visibility on how services are received, as well as identify new trends and new opportunities extremely quickly. Streamezzo not only addresses the latter as a fast development platform, but also provides for real-time analytics to monitor successes and failures and trigger strategy adjustments if/when needed.

Figure 14: Analytics module: Know your customers!



Get a first-hand knowledge of what users are interested in and build sound marketing programs based on real data from your users' population.

The Streamezzo environment comes with an analytics platform that allows for focused and targeted marketing efforts