

HomeNet Communications i-Serve product family

Technologies for enabling distributed media streaming in limited bandwidth environments

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Defining the problem

The ability for a carrier to handle multimedia content has now become an imperative due to competitive marketing pressures, and the ongoing need to generate additional revenues from their network. Making multimedia available for access from fixed and wireless devices involves preparing, managing and delivering the content in a usable and appropriate format.

The content preparation activity, termed encoding, is a processor intensive and specialist software activity that produces content which is compressed and ready for streaming across a network to mobile devices. The content is typically encoded to a standard format, which may be streamed to a variety of end user devices. It is then played typically using software on the mobile device.

Standards bodies have emerged in the multimedia space, defining standards such as MPEG4, to ensure interoperability between hardware and software systems developed by the variety of vendors operating in the space. MPEG4 is the video streaming standard being adopted by the Internet and mobile operator community including the 3G Partnership Program (3GPP) for multimedia streaming.

Video can be streamed from either a live content source, such as a CCTV camera, or from a stored file such as the edited highlights of a football match. Irrespective of the source, the streaming of multimedia stresses carrier network infrastructures and presents a number of challenges for the carrier. At the same time, enabling multimedia is widely regarded as the next key revenue opportunity in the mobile computing revolution.

***i-Serve* from HomeNet Communications**

HomeNet Communications "HNC" has developed key enabling technologies for distributed multimedia streaming solutions in limited bandwidth environments. In particular, HNC is enabling the management of multimedia content in a distributed fashion. This is most appropriate where the content is relevant to a particular location, business activity or community. The Company

has released its first product, *i-Serve*, an embedded distributed rich media streaming server (DMSS).

Carrier network challenge

To supply multimedia streaming to their customers, carriers have adopted the traditional Internet model of large clusters of servers co-located with archived media, where the necessary network bandwidth is available as indicated by Figure 1 below. This approach only partially reflects the structure of today's mobile communication networks, where the Base Transceiver Station and Base Station Controller's location are determined by a combination of user group size, and geographical conditions as indicated by Figure 2.

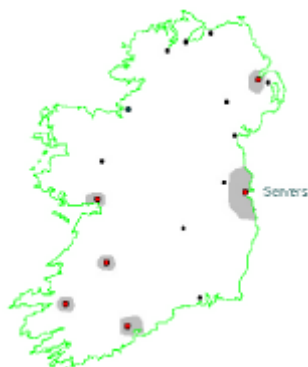


Figure 1 Centralised Server Model

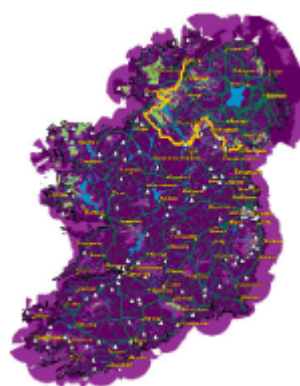


Figure 2 Typical Cellular Network

Because of the structure of these networks the value of content to the customer is determined more by geographical conditions than by the availability of network bandwidth.

Location oriented content

Often location-oriented content may be required close to its source, such as local traffic information and community, or corporate specific content. Alternatively, the content may be located close to the customer base in the case of local event news, such as sporting highlights, or breaking news headlines.

The HNC approach is to use specialist, easy to use “plug and go” devices, and locate these at the source of the content as in customer premises equipment or on the networks where they are most effective, and where they can serve the specific needs of the customer or community. Embedded distributed media streaming servers such as *i-Serve* may therefore be used to provide the best available quality of service.



Distributed multimedia serving

For real-time source based content the DMSS provides audio and video encoding, transcoding and transrating capabilities so that the content may be delivered to the end users with the minimum of cost and delay at an appropriate level of quality.

For global event news the content (usually file based) needs to be placed onto the device caching storage area easily and reliably. The DMSS must provide adequate file storage capability, so that several hours of global event news content will be available to the customer. For location oriented content, such as local community news and events, the DMSS must provide adequate storage and permission control access for local update.

While streaming media will become the dominant mode for moving media over networks the DMSS should also incorporate an FTP server for moving content onto the device and administrating content on the device. An FTP server will also be required to support applications where streaming of media is not practicable, as in where terminals do not support real time streaming protocols, or due to the inadequacy of the network infrastructures to support streaming. *i-Serve* handles these issues though its FTP serving and local storage features.

Multimedia content must also be easily accessed by the customer, so a web server is a requirement. For the carrier the DMSS must be easily manageable across the network so network management protocols such as SNMP are desirable. *i-Serve* includes its own web serving and supports a range of network management protocols.

Quality of service

The quality of service level is determined by the usable quality of video required to deliver that service. For accessing real time content the DMSS should be able to support broadcast or multicast streaming. To support a diverse user group accessing diverse media file content a media streaming server is a key requirement. *i-Serve* includes its own real-time media streaming server with its unique patent pending Adaptive Dynamic Quality of Service (ADQoS) control.

As diverse as the media content stored on the DMSS is, so too is the range of terminals that access the content. The terminals may be mobile, as in PDA and 2.5G+ handsets, or laptop PC's with high-speed 802.11 or 2.5G+ wireless connections. The media server requires an adaptive capability so that the streamed media will be adapted to the terminal accessing the media.

In a mobile environment the bandwidth available to stream media will fluctuate rapidly over time so the DMSS must have a dynamic capability, where the bit rate and the frame rate for streaming media can be varied in response to the



available bandwidth. The DMSS should control the number of user sessions and also control the bandwidth available per session. *i-serve* ADQoS deals with all these issues.

Interoperability

This is a key requirement for any technology designed to support multimedia streaming. The key objective of standards development is to provide interoperability with source content, pre-encoded files and the delivery environment (media players).

i-serve has been developed with interoperability in mind. Its encoding conforms to the MPEG4 standard ensuring that any MPEG4 compliant player will successfully play *i-serve* streamed content.

Carrier opportunities

For the cellular operators to generate revenue quickly they need to start to provide innovative services to all customers. One could expect that most of the revenue generated from media content in diverse cellular networks would be relative to the location as indicated by Figure 3.

Traffic information is one of the most requested services from next generation handsets. Traffic information is one of those services that may be introduced at an early stage, as the usable quality of video required to convey the necessary information is not as stringent as the usable quality of video required for video on demand services. Traffic information is location oriented, and while large urban centres could benefit from the centralised server farm model, an embedded DMSS is more suited to the application. The DMSS needs to be located close to the source, which would be the traffic-monitoring centres. As there will be many traffic cameras feeds coming into a centre, the product needs to have a small physical footprint, operate from small power sources and be scalable to support small or large quantities of camera sources.

As indicated by Figure 2 cellular network infrastructures are large and diverse in nature, and the ability of the operators to provide services throughout their network rapidly will result in quicker revenue flows. One of the most serious challenges facing the operators is the ability to provide an adequate quality of service to their customer, and to provide a service that will allow the customer to avail of the full functionality of their terminals. Network DMSS offer an opportunity for the cellular operators to introduce targeted media streaming services, where the opportunity for early revenue is high, and gradually to extend the service throughout the network.

The cellular operator can locate the DMSS very close to the content and in the same context close to the customer base. By providing short haul backbone access to the DMSS units and localising the traffic the customers will be

provided with the best possible quality of service. It is not necessary for the carrier to provide long haul services or have major network upgrades as the product may be configured for CPE operation and the carrier can concentrate on the network connectivity in a localised area.

The consumer or the content owner in the case of a corporate ultimately determines content value. Where low cost, interoperable, “plug and go” media streaming servers are available, the need for the carrier operator to provide content to generate revenues will be reduced. By employing low cost, interoperable, “plug and go” media streaming servers, the content available on networks will become more pervasive and diverse which will lead to more revenues for the operators and more content for the customer base. Most of this content will be location oriented, and the need for the network operators to provide large bandwidth pipes between remote locations will not become a necessity prior to launching media streaming services.

By using devices that are software upgradeable in the field the investment by the owners of the content, and the operators who distribute the media, is future proof, as the ability of the devices to adapt to new or enhanced encoding streaming standards is secured.

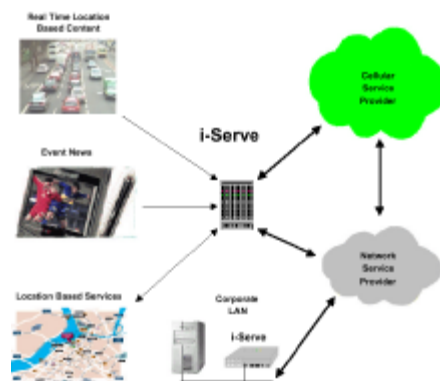


Figure 3 Early Revenue Sources

Conclusion

The *i-Serve* product developed by HomeNet Communications Ltd is an embedded, Internet Protocol (IP) based, distributed media streaming server (DMSS) which combines content generation, content distribution and content access features with Adaptive Dynamic Quality of Service (ADQoS) control.

i-Serve will enable the early low cost delivery of rich media streaming, without the expensive network upgrades required when attempting to deliver archived material and video on demand services. The product family is designed to enable the carriers to start to earn early revenues, by delivering usable quality



of video services that are location oriented, and are of a high value to their customers.

i-Serve is designed to be located where the source of the content originates, as in enterprise LANs or traffic camera networks, or where the content needs to be delivered with a minimum required quality of service level as from Base Station Controllers.

Which solution the carriers choose to implement will depend on the type of application or the type of content. Streaming live broadcast to a large user population requires a lot of bandwidth, and a large streaming server or cluster of servers. *i-Serve* can be the perfect complimentary offering for localised content, and can compliment the centralised model for many niched or smaller applications. The opportunity for carriers is to combine the best of centralised and distributed technologies.

Glossary of Terms

2.5G – Data Enabled Second Generation Mobile Carrier Networks

3GPP – Third Generation Partnership Program

802.11 – IEEE Wireless Local Area Network Standard

ADQoS – Adaptive Dynamic Quality of Service

CCTV – Closed Circuit Television

DMSS – Distributed Media Streaming Server

FTP – File Transfer Protocol

HNC – HomeNet Communications

IP – Internet Protocol

LAN – Local Area Network

MPEG4 - Motion Picture Expert Group

PLMN - Public Land Mobile Network

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