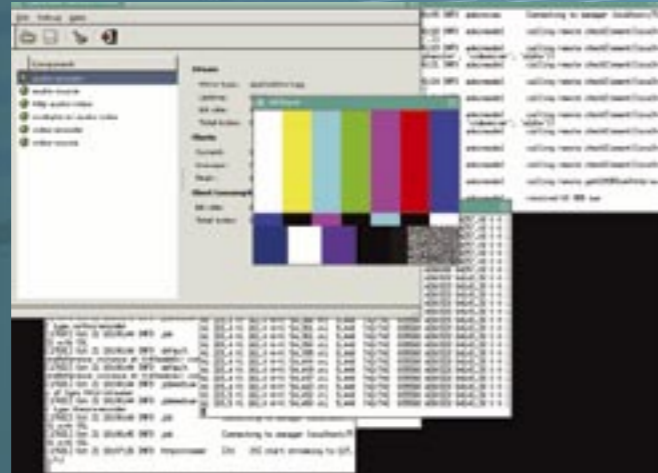


Open and unencumbered media streaming solutions have finally come of age. Martin Howse checks out the best of breed components for a burgeoning, increasingly mobile, streaming scene



DarkSnow presents a simple, yet powerful GUI for the versatile DarkIce streaming client which is used to stream live audio to Icecast2 under both MP3 and Ogg Vorbis codecs

Ogg Theora really is shaking the media streaming scene, and the Flumotion server, from Fluendo, provides a taste of things to come under this new codec

As GNU/Linux has become dominant in industrial if not home multimedia production, distribution is the next big nut to crack - and success is just around the corner, with quality, highly flexible, and unencumbered solutions emerging rapidly as developers rise to the challenge. Contemporary peer to peer solutions (see LinuxUser & Developer 45) present one side of the distribution coin, enabling rapid, widescale dissemination of all manner of static, pre-recorded content - but for live or dynamically generated material, media streaming is where the action really happens.

Providing access to events, news, or documentary material, media streaming allows for the formation of alternative broadcast networks. Indeed, media streaming can also be referred to as webcasting, livecasting, or in the instance of audio, (net radio, perhaps), mixing content provided by viewers worldwide and providing a valuable resource for activists that enables content to emerge from problematic regions or heavily censored situations. Media

streaming can readily mimic the passive one-to-many model of traditional broadcasting, and many businesses take advantage of this low budget strategy for marketing. But as the blogging phenomenon really takes off, and open technologies, such as RDF, help to realise a more shared, Semantic Web, streaming becomes more compelling the closer it approaches a peer to peer phenomenon, with multiple producers and consumers creating, accessing and sharing content. The sheer ubiquity of wireless networks makes mobile webcasting a real and powerful option.

From both a political and practical perspective, the GNU/Linux platform and, more importantly, open unencumbered formats or codecs, such as Ogg Vorbis and Ogg Theora, present the only way forward for quality media streaming freely available to large audiences. No business or organisation wants to be held to ransom or locked in to a closed format, risking loss of audience as formats cease to be supported. The advantages of unencumbered solutions are clear, but it's surely worth spelling

these out for those who might imagine, given the sheer ubiquity and free exchange of patented MP3 as a streaming format, that it thus presents an adequate solution. Tacitly accepting a license, as one does in this case, is never a good thing, and though Fraunhofer currently doesn't enforce licensing fees, it is able to change license terms at will. Further along the line, codecs such as RealAudio, (despite the availability of the source code through the Helix community project), demand commercial licenses in most instances - and some codecs, such as WMA, are totally closed.

Open code leads to proliferation, and, in the case of new broadcast networks and growing audiences and producers, that is surely a good thing. Versatility and integration are the buzzwords in this instance, particularly as streaming solutions are rarely presented as standalone apps - rather as pluggable components which suit a good range of streaming needs. Icecast is a classic case in point here. In combination with open codecs, the advantages of a dedicated platform with little

Going with the flow

OS overhead are quite plain, and GNU/Linux is a natural fit for a custom built media-streaming solution, offering both solidity and, as we shall see, a good choice of best of breed production and server components for streaming under a range of codecs. Yet, within an arena which is all about audience, there's certainly little point having open solutions tied down to one platform, and streaming media servers and client players proliferate on all manner of OS. Solid solutions implemented on a free software platform can always be described as technologies which enable, and none more so than open media streaming.

BROADCASTING TO THE WORLD

Given the sheer range of codecs, streaming solutions and methodologies, and the proliferation of misused technical terms, media-streaming is a jungle that is often difficult for even the more experienced implementers to navigate their way around. Clearly identifying components which match specific needs is essential, and in many instances true streaming is complete overkill. It's important to distinguish progressive download, implemented by a regular web server, from true streaming, though in some cases, the results are identical, with client players showing content moments after clicking on a link. However, even in the case of static files (programmed within a playlist or archive), true streaming, as served up by the apps we'll investigate, provides for good levels of flexibility and versatility which can be used to generate interesting applications (see The Global Remix) and enable lively communities. That said, as both bandwidth and free wireless nodes proliferate, live streaming presents an equally compelling, non exclusive option.

The sheer ubiquity of wireless networks makes mobile webcasting a real and powerful option

And though, in a bandwidth rich environment, Multicast is less often heard, it's worth checking out the differences between more common Unicast streaming and both broadcast and Multicast scenarios. The traditional broadcast model lies at one end of the spectrum, with one signal received by all consumers. At the opposite end of is Unicast, under which a separate copy of the data is sent from the server to each client. This is how much traffic on the Net is generated, with TCP/IP as

classic Unicast protocol. In this instance, Multicast lies closer to the broadcast end of things, with one stream simultaneously broadcast to numerous clients as routers copy data across. Of course, routers must be Multicast enabled and portions of the Net that support Multicast make up the Internet Multicast Backbone or Mbone. Traffic is tunneled by Unicast between such islands. Open standard protocols such as RTP/RTCP (Real-Time Transport Protocol), RTSP (Real-Time Streaming Protocol), and SIP are used for Multicast multimedia streaming and apps such as FFserver provide streaming solutions for video, supporting less than open codecs on the whole, and currently without Ogg Theora support. The venerable Icecast media streaming server can relay to LIVE.COM's liveCaster app for Multicast use, and their LGPLed libraries can also be used to both add RTSP streaming client support to MPlayer, or build Multicast apps. And if you really need Multicast and want to stick with unencumbered codecs, Fluendo, serious streaming Ogg Theora players, have just announced that they'll be funding development of a reference implementation for RTP streaming of Theora and Ogg Vorbis.

IT'S A WRAP

Unicast HTTP streaming is more or less the norm these days, and a rich toolset is in place on a range of platforms to implement streaming of unencumbered codecs. Ogg Vorbis, for audio, and Ogg Theora, for video, are the most popular open codecs, with support spanning a huge number of cross-platform players. Audio players under GNU/Linux include XMMS, FreeAmp and ogg123. Theora is supported by MPlayer, Xine and a Java player implementation. Although best of breed media streaming servers such as Icecast can be coaxed into streaming all manner of other codecs, Theora and Vorbis are most definitely worth throwing one's weight behind in the pursuit of free, open standards-based media streaming. Xiph.org, creators of the Ogg project, really do stress that all Internet standards belong in the public domain, away from the controlling interests of big business and groups such as the RIAA. Xiph.org make a passionate case in writing for open codecs and solutions, but their software projects, including the less well known FLAC (Free Lossless Audio Codec) and Speex projects, really speak for themselves in making a serious difference.

When it comes down to Ogg it's worth clearing up some of the confusion surrounding the .ogg and .ogm formats and Vorbis and Theora codecs. Strictly speaking Ogg just refers to the container or transport format which



Cornerstone of the highly usable dyne:bolic multimedia LiveCD, MuSE provides for streaming to a range of servers, with support for file, net and live inputs and decent mixing capabilities

wraps up audio, video or any form of data such as metadata. So streaming with Ogg is not tied down to the Vorbis format which refers to the specific audio compression scheme. Ogg streams provide a way of multiplexing and framing raw packets such as providing a time base. This gives Ogg a good deal of flexibility, and developers seeking to use Ogg as transport within their own projects can find a good deal of detail regarding the spec in the famous Internet RFC (Request For Comments) 3533. Here you can dig deep into issues surrounding Ogg's flexibility as transport, with Ogg encapsulation broken down into physical and logical bitstreams. The .ogm file extension further clouds some of the issues surrounding the Ogg project, with .ogm lazily identified by some as video format and .ogg as audio. Indeed, there is no such distinction within the Ogg project, with .ogm simply providing a way of wrapping AVI stream headers in an Ogg stream. Ogm was adopted by the community but unsupported by Xiph.org, quite rightly given that it encases a closed codec. As Ogg Theora hits the streaming streets, however, a separate video only extension would make sense.

Just as we can simply and usefully break down Ogg Vorbis into codec and transport, so quite often a streaming media solution will consist of two separate apps, a producer/encoder and streaming server possibly running on different machines, or relaying to further streaming servers to meet demand. Streaming servers such as Icecast and GINI operate in such a manner, with a feeder or source client streaming into the server. When assessing implementation needs, it helps also to break down the task into production, encoding and serving, with content produced either live, or via playlists, and possibly utilising further scheduling and management software. On the receiving end, a playlist can also be used as an

intermediary text file which links streams within a browser. M3u and pls are common formats, with pls as proprietary Winamp format. Without a playlist, most browsers will attempt to download the stream straight to the desktop.

ICED OUT

Multiple bitrate encoding further rounds out the core concepts of media streaming. Rather than choosing a one size fits all approach, which may leave those hanging off a 56k modem starved of content, or xDSL users forced to endure seriously blocky compression, multiple bitrate encoding tailors the stream to suit the players' needs. Multiple bitrate encoding is supported by IceS2, the source client for Icecast2, a totally Ogg affair now with Theora support even working within the kh development branch. Icecast has a long history, and really can be considered as the grandfather of free software streaming media solutions, providing solid, consistent configuration and streaming capabilities. The latest 2.1 iteration of Icecast throws in updates to the Web-based admin interface and listener authentication amongst other new features. Icecast2 is a powerful package, but configuration, through both the

XML based configuration file, and via the administration interface, is complex and does demand some knowledge of core Icecast concepts such as mountpoints, which refer to specific broadcasts or bitrates. Documentation is available online and as part of the package but little background is provided and plentiful sample configuration files within the community

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are perhaps more helpful.

Icecast2 supports a range of source clients which throw it encoded streams. Oggfwd is a tiny app which makes full use of the Libshout2 library, which can easily be used to write further Icecast2 source clients, to quite simply read from stdin and stream this content to the server. In common with other such pluggable Unix style apps this makes for good flexibility. Using the kh development branch of Icecast2 and ffmpeg2theora tool, Icecast2 can quite happily

broadcast live Theora streams. As well as functioning as a highly usable app, Oggfwd source code readily demonstrates Libshout2's simple API, further proof of the flexibility of open source solutions enabling organisations to tailor streaming solutions to suit complex needs. Libshout bindings are also available for languages such as Perl or Java, and Python

bindings make for an even easier ride when building custom apps. IceS2 itself makes use of the powerful Libshout2 library, which must be installed before we can throw audio at IceS2 and thence to Icecast2.

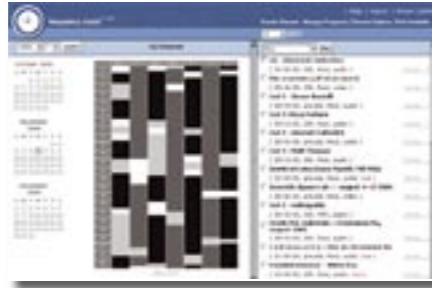
IceS2, which is commonly situated away from the Icecast2 machine and can even encode for other streaming servers, supports a range of input methodologies before processing and encoding to produce a suitable Ogg stream. Supported inputs include audio grabbed from

the soundcard under both OSS and ALSA, stdin for good pluggability, and playlists can also be used to read in audio files. In common with Icecast2, IceS is configured by way of an XML-based file which can take some getting used to, though less options are presented here and sample configurations are readily available. IceS

All Internet standards belong in the public domain, away from the controlling interests of big business and groups such as the RIAA

deals purely with Ogg encoding now, even though Icecast can also handle MP3. If you still choose to stick with this encumbered format, a different source client such as LiveIce or DarkIce can readily be used. LiveIce is yet another command line app, and can be used with both the original Icecast and the latest iteration to stream in MP3. For those seeking an even simpler streaming solution, LiveIce XMMS also functions as a simple source client for Icecast,

plugging straight into the XMMS player which itself provides a simple, easy to use GUI. Both the OggCaster and Oddcast plugins for XMMS provide the same simple setup under Ogg Vorbis. And in instances where you need to provide for both MP3 and Ogg oriented audiences, DarkIce makes for a decent



Open media streaming isn't always about relaying live action. A good range of tools such as Frequency Clock provide for community-led scheduling and re-working of pre-recorded content

alternative solely for live audio streaming with a good range of encoding and re-sampling options. DarkIce also caters for the SHOUTcast streaming server, which, though available for

the GNU/Linux platform is a non-free MP3 solution which has found little favour within the community. The DarkSnow GUI, a separate project which provides for easy administration of DarkIce, presents a decent option for those less enamored of the command-line approach which most of the media streaming apps favour.



August Black's, Pd-based Userradio app pushes the global remix envelop with unlimited numbers of performers sharing and mixing material for final FM broadcast

GETTING GUI

MuSE, from dyne, presents a valuable exception to this rule with a well-designed GUI fronting a powerful feature set to encode and stream audio to a number of different streaming servers. MuSE allows for mixing a good range of audio sources, from network, filesystem or soundcard, and different bitrates and other options can be easily configured. With a well set up server in place, it's probably one of the simplest streaming options for both Ogg Vorbis and MP3, and plenty of thorough documentation can easily be accessed via dyne.org's site. Icecast is well catered for, and SHOUTcast also, but MuSE also throws in support for Litestream, a lightweight MP3 streamer and Darwin Streaming Server (DSS) under OS X. Indeed, Darwin Streaming Server is a decent option released under the Apple Public Source License, with RTP and RTSP support for streaming QuickTime and MPEG-4 encoded content. Along with MuSE and a host of other highly usable media tools, DSS makes up part of the essential dyne:bolic LiveCD distro which is a sensible choice for those thinking of checking out best of breed streaming solutions.

Indeed MuSE, bundled with Icecast2 presents a solid, proven solution for flexible audio streaming of the unencumbered Vorbis codec. Installation of both apps should present few difficulties, with meagre dependencies in both instances. And, as with other such well established suites, pre-packaged versions can be found for most distros. However, it's worth mentioning that free media streaming is no stranger to diversity, and a trawl

through Sourceforge should uncover a good range of projects best suited to specific needs. GINI is well worth mentioning here, with support for video under closed codecs such as RIFF AVI, and with Ogg Theora support in the offering. Slimmed down servers include Ample, a simple, rather static MP3 streamer, and GNUMP3d, a small Perl-based alternative to MP3, Ogg Vorbis and other file formats.

A LITTLE THEORA

Though the relaying capabilities inherent in apps such as Icecast and other split encoder/server software do allow for some freedom from a bandwidth restricted and passive one to many broadcast model, few applications push media streaming beyond this model towards more peer to peer oriented realms. JRoar, a Java coded streaming server for Ogg from JCraft, serious Java experts, is the exception here and perhaps represents a new breed of streaming solution. JRoar is all about sharing streams, and itself solely acts as a proxy for live Ogg streams. The developers maintain that JRoar was coded not as a competitor to other solutions such as Icecast, but rather as enabling the construction of Ogg stream networks in a peer to peer manner. JRoar's Java only approach makes for easy customisation, but may upset some in the community who are far from fans of such a language. Nevertheless, the philosophy and design approach is a good one. And, JRoar does seem to have beaten many streaming servers to the Theora finishing line, with Ogg Theora streaming now supported.

For those who have yet to check it out, Ogg Theora presents a massive step forward for open media streaming, promising video streams of unsurpassed quality delivered by a patent free codec, and wrapped within the versatile Ogg container format. Theora is both a developer's

Free media streaming is no stranger to diversity, and a trawl through Sourceforge should uncover a good range of projects best suited to specific needs

dream and powerful argument for open streaming, preferably on free platforms. And the latest alpha release of Theora certainly delivers the goods. If you've previously discarded streaming as client or as producer on the basis of a rather unenlightened encounter with small, blocky,

artifact ridden video, then Theora is well worth a look. Given adequate bandwidth server side, Theora based solutions such as Flumotion from Fluendo (see review issue 44) deliver streams of surprising quality at average bitrates. And, with Theora's naturally frantic adoption by the community, Theora streams can easily be judged, with live video feeds from open source conferences and meetings proliferating. And if, as producer, you're worried about diminished audiences due to player incompatibilities, rest assured that all major players on all the main platforms are currently supported with simple to install plugins for MPlayer and RealPlayer. This is quite simply a poor argument against adoption of a new technology which offers radical benefits and paves the way for free media streaming.

With GUI wizards, Flumotion presents a seriously simple solution for live webcasting, but only for those brave souls who manage to make it past the install stage. Flumotion breaks the golden rule for successful free software projects, with multiple, hard to satisfy dependencies and an poorly integrated component based architecture. The kh development branch of Icecast2, backed up by oggfvw, may present a more flexible solution, but it's still early days, and streaming Theora remains a bleeding edge activity. Yet it does seem that a good many developers are rising to the challenge and a slimmed down, solid Theora solution should be with us in early 2005.

Theora streaming is already supported by an experimental version of PiDiP, an extension library for the all powerful Pd (Pure Data) multimedia suite, and with this in place, Pd does seem set to become the streaming solution for those who demand flexibility. Pd, via a range of externals, already supports MP3, Vorbis and the raft of less than free codecs supported by FFserver, part of the powerful FFmpeg project. Indeed, FFserver, though currently not so popular under the wholesale move to Theora, still presents a powerful command line option for streaming video. If you're happy to contend with complex licensing demands, the Helix DNA platform, produced by the Helix community founded by Real, is well worth a look, with code available for client, producer and server apps. Theora is definitely the only way to go for future use, and those worried about committing to such an unknown, fresh codec can easily be pointed to Ogg Vorbis as popular, now standard audio codec. It's now totally clear that free, open standards and solutions are the way to go for networked media, and few unprejudiced parties could argue with this. And as more consumers and producers join the Ogg fold, sticking with less powerful encumbered technologies makes less and less sense.

key links

Ogg
www.xiph.org

Theora
www.theora.org

radioqualia
www.radioqualia.net

Icecast and IceS
www.icecast.org

liveCaster
www.live.com/liveCaster

Fluendo
www.fluendo.com

LiveIce
star.arm.ac.uk/~spm/software/liveice.html

DarkIce
darkice.sourceforge.net

MuSE
muse.dyne.org

Darwin Streaming Server
developer.apple.com/darwin/projects/streaming

GINI
gini.sourceforge.net

Ample
ample.sourceforge.net

GNUMP3
www.gnu.org/software/gnump3d

JRoar
www.jcraft.com/jroar

Helix Community
helixcommunity.org

Gollum
gollum.artefacte.org

Userradio
aug.ment.org/userradio

Campware
www.campware.org



The Global Remix

Though live streaming from, say events such as concerts and conferences or of newsworthy items, is one common use for the best of breed streaming apps under consideration, the sheer flexibility and pluggability of such suites makes for more interesting possibilities which break down both the static nature of much of the Web and the restrictions of a broadcast model. Radioqualia, a web-based one-stop shop for open media streaming tools and Howtos, are committed to pushing forward new models of collaboration and production using open source, enabling technologies. One of the founders, Adam Hyde, as well as holding workshops worldwide in such streaming technologies, has produced a definitive online streaming guide for those new to audio, streaming and the GNU/Linux platform. Radioqualia also develop and produce the Frequency Clock Free Media System, which provide a valuable, shared resource for streaming and conventional broadcast. The software, accessible through a somewhat clunky web-based GUI, features a program database which is used to timetable live or pre-recorded audio or video streams. A cross platform player rounds out the suite which enables remote collaboration and the creation of multiple customisable channels.

Gollum, built on a flexible Pd base, provides for similar collaborative functionality, but throws in mixing, chat and a map-based interface for the ultimate in web-based community building. Userradio, developed by August Black is also worthy of mention, despite being a Flash-based app. Under Userradio unlimited numbers of folk can share and mix audio streams, the main intention being distributed FM transmission from machines connected to the Net. Old fashioned broadcast meets new collaborative production models, and this further option for re-distribution of content presents some intriguing possibilities. Indeed, traditional broadcast remains an open option, and Campware, a free software initiative working for a free press, aim to create an open source radio management solution which can rival commercial packages. This project, dubbed LiveSupport, will provide for unencumbered web streaming, full remote Net-based control of a station and support for open meta-data and combined local broadcasts. LiveSupport builds on Campware's contemporary LOWLIVE release which currently allows for on-air FM transmitters to broadcast completely autonomously from a Web-based stream. Media streaming comes full circle, presenting real, localised broadcast.