



PRESS RELEASE

Shrinking the size of sound:

Lars Liljeryd named European Inventor Award 2017 finalist

- **Swedish inventor Lars Liljeryd nominated for EPO prize for unique audio compression technique: spectral band replication (SBR)**
- **Unlike previous methods it preserves audio quality**
- **Employed in an estimated six billion devices, SBR cuts the size of compressed audio files by about half, improving the efficiency and quality of recorded, broadcast and streamed audio**
- **EPO President Battistelli: "Liljeryd's innovative sound compression technology enhanced the possibilities of digital audio while preserving sound quality."**

Munich, 26 April 2017 – Few rock 'n roll drummers can lay claim to having transformed an entire industry, but Swedish inventor, audio engineer and music aficionado Lars Liljeryd is an exception to that. Blending his lifelong love of music with his knowledge of electronics, Liljeryd invented a revolutionary sound compression technology that reduces audio file size roughly by half while keeping audio quality intact. Known as spectral band replication (SBR) for the way it replicates higher-register elements by using lower frequencies as a guide, SBR is applied in the world's most commonly used methods to stream, store and play audio files. It allows people around the world to listen to music, radio broadcasts and podcasts in high fidelity.

For this achievement, Lars Liljeryd has been nominated for the European Inventor Award 2017 as one of three finalists in the category "Industry". The winners of the 12th edition of the European Patent Office (EPO)'s annual innovation prize will be announced at a ceremony in Venice on 15 June.

Liljeryd's innovative sound compression technology has enhanced the possibilities of digital audio while preserving sound quality," said EPO President Benoît Battistelli announcing the European Inventor Award 2017 finalists. "He has made it possible for us to enjoy higher-quality sound conveniently and affordably on digital devices. "Looking at the field from a fresh

angle and with the help of patents, he has managed to establish himself in a competitive sector otherwise dominated by larger players."

The outside angle on audio compression

An iconoclast, an autodidact or a "crazy outsider" as Liljeryd likes to call himself – it is difficult to pigeonhole a man who radiates intellectual curiosity and who has pursued enough careers to fill two lifetimes: Liljeryd was drummer in two bands that broke into the Swedish pop charts, a sound engineer, a Hammond organ 'overhauler' and repairman, a laser lightshow artist, the owner of a biotech company, an entrepreneur and the creative mind behind a collection of innovations. But if there are some constants in Liljeryd's life, they are music, his self-taught command of electronics and a desire to shake things up. All of these elements came together in his invention of spectral band replication (SBR), which created a new way to slim down audio files without sacrificing audio quality.

"The science behind sound encoding is characterised as being very traditional. I had a different angle on the problem," says Liljeryd. "That led to me being regarded as someone who wanted to introduce a disruptive technology into traditional thinking."

Liljeryd's SBR was a clean break from previous compression technologies, called codecs, that consisted in cutting out parts of the audio file – usually the high and low frequencies – to reduce it down to a manageable size. Most codecs worked fine for saving memory and bandwidth, but the technique reached a limit with Advanced Audio Coding (AAC), the successor to MP3. It offered a 90% compression rate, delivering a file 10% the size of the original. Any further compression produced a noticeable reduction in audio quality.

The SBR 'turbocharger'

Rather than looking at the parts of the audio file that could be removed, Liljeryd concentrated on the parts of music that are naturally duplicated. His invention is based on an acoustic phenomenon known as "spectral redundancy", and the fact that harmonics are often quite similar in both low and high frequencies. Liljeryd realised that it was not necessary to transmit *all* of the parts of a file to maintain the original sound. It was enough to transmit only the lower frequencies and use these as a guide to reconstruct the higher-frequency parts in the receiver. Sounds could be encoded, some parts of it sent with instructions for the rest, and then the whole sound could be recreated at the receiving end.

Liljeryd likens the process to a turbo-charged engine in a high-performance sports car: "The turbo vastly increases the power and efficiency of the engine. So my

original thought was a technology that would be a kind of turbo, which could be added to existing encoders such as MP3 or AAC to improve their performance," says Liljeryd. "The business model was to sell these 'turbo units' to sound code manufacturers."

However, when developing his idea, Liljeryd found that SBR could not function as a "snap-on" device but had to be integrated directly into specific decoding software. This led him to enlist the help of a team of engineers that included Kristofer Kjörling, Per Ekstrand and Fredrik Henn – and establish a small start-up. With the growing complexity of the work, Liljeryd reached out to the Fraunhofer Institute in Erlangen, Germany, which had developed both MP3 and AAC. With some additional investment capital, Liljeryd formed Coding Technologies AB in Sweden and – together with the Fraunhofer Institute – its German subsidiary Coding Technologies GmbH, and hired Fraunhofer's MP3 specialist Martin Dietz to head both companies. In 2002, SBR was technically fully integrated into AAC – enabling the reduction of audio file sizes by up to 50%. Marketed under the name HE-AAC, it is one of the world's most popular MPEG-standardised audio codecs today.

For internet service providers with growing customer bases that use an ever-increasing amount of data, the benefits of such a staggering boost in efficiency are clear. If music and podcasts can be streamed, rather than downloaded, there is less need for bigger hard drives, saving on hardware costs. In addition, lower bit rates translate into lower transmission costs. This has contributed to the technology's popularity.

Going mass market

SBR, through its incorporation into the HE-AAC standard and its subsequent upgrades, is used in an audio codec market which was valued at about EUR 5 billion in 2015 and is expected to reach nearly EUR 7 billion by 2022, according to industry analysts. Giving the technology a stronger foothold in the mass market, Dolby Laboratories acquired Coding Technologies in 2007, along with its key SBR patents, for approximately EUR 170 million (at 2007 rates).

Now a standard on about six billion devices around the globe, ranging from video cameras to smart phones and PCs, SBR is used in popular music players, most notably Apple's iTunes, by satellite radio services, including the Digital Radio Mondiale broadcasting network, and for audio compression of digital TV broadcasting signals in many countries.

After Coding Technologies' takeover, Liljeryd continued to work with Dolby Laboratories as a senior technical advisor until "retiring" in 2016. In addition to pursuing multiple hobbies, he

continues to support the Swedish med-tech start-up Diabetes Tools AB, which he founded in 2000. "Here, I am hoping for success with my old and new inventions in improving health and treatments for diabetes patients," says Liljeryd.

For his work in developing spectral band replication, Liljeryd, who is listed as the inventor or co-inventor in nine different patent families, including patents and pending patent applications in several countries, has been honoured with the Royal Swedish Academy of Engineering Sciences' Grand Technology Prize (2006, along with Kjörling, Ekstrand and Henn), the IEEE Masaru Ibuka Consumer Electronics Award (2013, shared with Dietz and Kjörling) and named Sweden's eighth most influential thinker by two Swedish newspapers (2005, *Ny Teknik* and *Dagens Industri*).

Additional resources

[Video and photo material](#)

[Read more about the inventor](#)

View the patents: [EP0940015](#)

A rich field for European innovation

European audio and video coding inventors have done well at the European Inventor Award over the years. Liljeryd joins the ranks of [Karlheinz Brandenburg](#) (2006; Lifetime achievement – finalist) regarded by many as the father of digital audio compression and one of the main forces at the Fraunhofer Institute behind MP3, as well as [Leonardo Chiariglione](#) (2008; Lifetime achievement – finalist) who both established the MPEG codec and pushed for video standards that led to HDTV. In a similar vein, [Kornelis A. Schouhamer Immink](#) (2015; Lifetime achievement – finalist) was instrumental in the development of EFM, the data coding behind CDs, DVDs and minidisks.

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