Preface

The use of traditional sound archives based on individual sound carriers is very personnel intensive and time-consuming, compared with the currently emerging forms of programme. Over and above that, continuous quality control in this context would not make any financial sense, necessary though it is for the back-up of the stored material. The only remedy is the "final break with the past", that is, the transition from the individual sound carrier to the "perpetual" data set, the sound file. The sound files are stored in mass storage systems (predominantly tape cassettes) in automated archives, which allow both automatic back-up and intensive use of the sound archive through their integration in the broadcasting company's digital network.

The sound archive is thus undergoing a change, away from its dusty shelves with their time-consuming "sneaker net" (by courier) to the production and transmission operations, towards the Information Centre of the future. The latter's content, whether sounds or accompanying metadata, is extracted by "robot access" from mass storage, and is immediately available at the respective PC workplace via fast networks such as ATM or FDDI.

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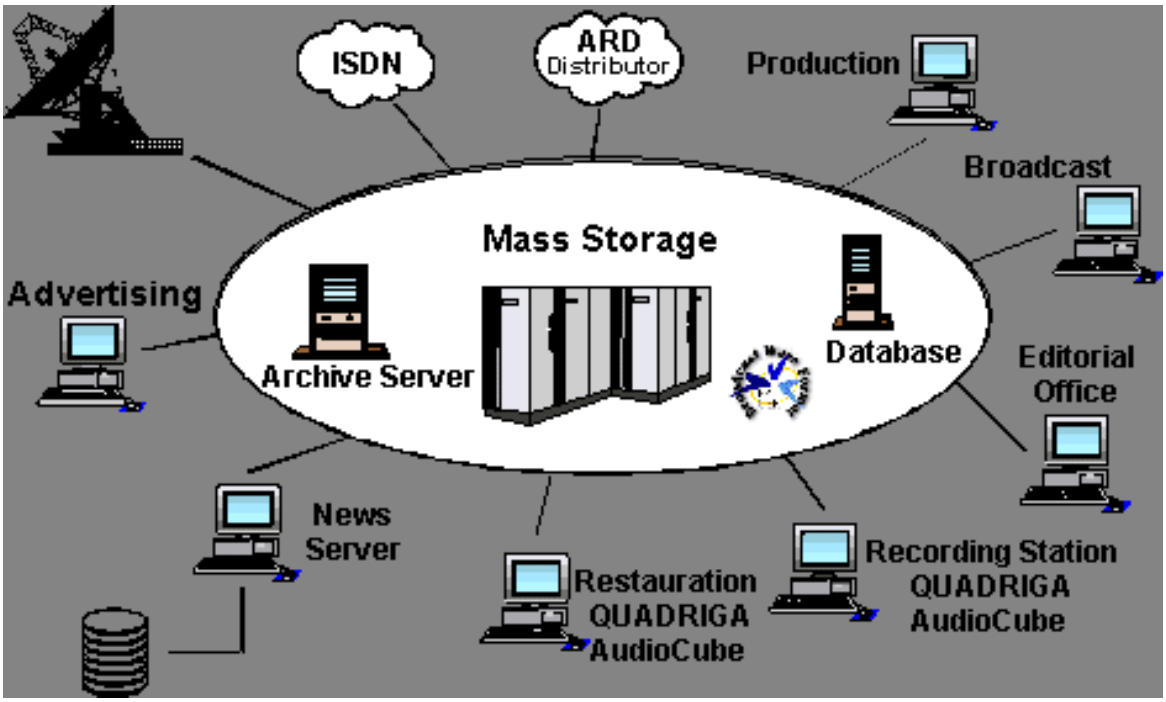

Figure 1: Digital On-line Sound Archive - Information Centre in the Broadcasting Company Network

However, a tremendous transfer effort to the digital level is required before the "buried" treasures of the archives (in all, about 20-30 years of sound) can be utilised this way. This is where QUADRIGA(tm) comes into play. In the classical era, the quadriga was a powerful team of four horses, driven from a war, racing or triumphal chariot. 2000 years later, the QUADRIGA(tm) AudioCube Workstation (high-performance, audio-signal oriented PC) is a powerful tool that transforms individual sound carriers such as tapes and gramophone records into the "immortal Phoenix", the Broadcast-Wave-Format file (BWF standard of the EBU). As required, the four in hand are an analogue tape machine, a record deck, DAT and CD player (Figure 2).
QUADRIGA(tm) was developed in the Institute of Radio Technology (IRT), in close co-operation with the radio operators, and is a registered trade mark of the IRT. The acronym, derived from "QUality from Analogue to Digital RIGorously Analysed", alludes to the quality control implemented in it during the digitalisation process.

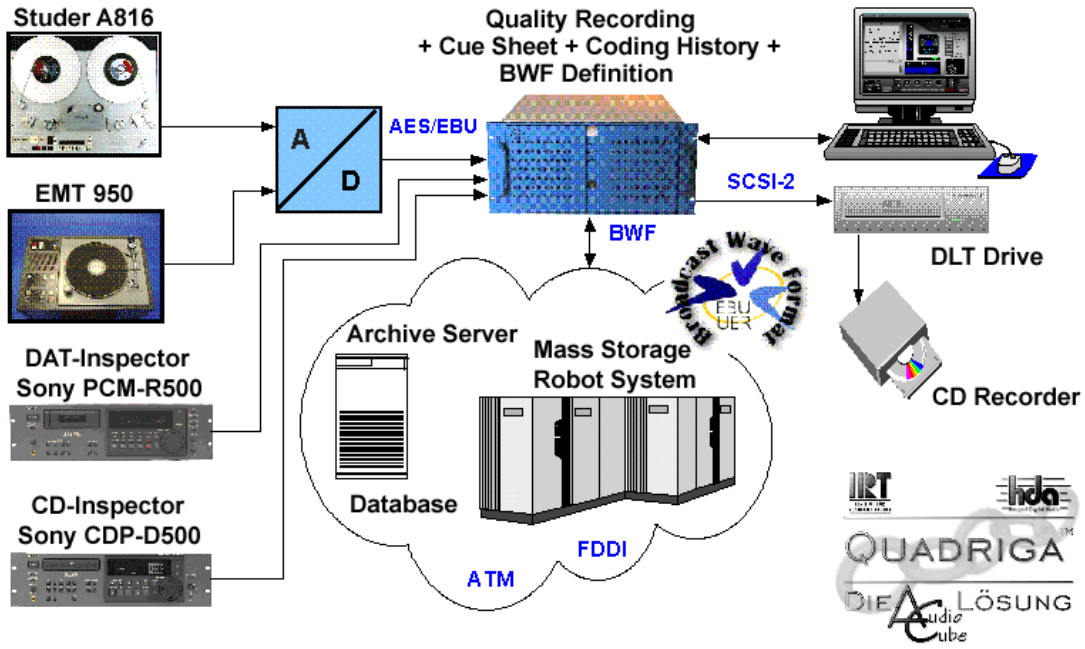

Figure 2: QUADRIGA(tm) Input Station

The QUADRIGA(tm) team derives its real pulling power from the AudioCube and its powerful audio signal processing, which the Houpert Digital Audio (HDA) company brought with it on entering into co-operation in September 1998. The operating personnel have everything at their fingertips in the single-screen cockpit, and can, for example, control the entire re-recording efficiently by mouse-click, with the system working automatically to a great extent (Figure 3). During dubbing, QUADRIGA(tm) registers the quality of the sound information and of the re-recording process, and documents any loss of quality, independent of the operator. The operator, on the other hand, is supported through monitoring by the system, in order to eliminate human error during this often "dull" job, and thus to assure the quality of the transmitted programs.

When re-recording, the sound signal is stored in the BWF file in linear PCM quality (sampling rate 48 kHz, resolution 16...24 bit) after analogue/digital conversion. The sound information thus stored as an "immortal Phoenix" in the form of numeric values must not be altered again. This is the only way to preserve the original sound quality down the centuries. In the future, when the storage media in the automated archive decay, "horses must be changed", that is, migration to new data carriers must take place automatically and in good time. For this reason, any form of data reduction in the archive shall be out of place. With each subsequent iteration of the process, it would lead to a continuous deterioration of the sound signal through a cascade effect, only a few levels of which would render the sound information useless, setting at nought one of the main advantages of digital technology.

The "CodingHistory" of the BWF file (complementary metadata) documents the source material, the re-recording equipment and the operator. QUADRIGA(tm) also provides further statistical information, because the integrated quality analysis checks the sound signal and indicates tolerance exceptions and errors. The standardised "indicator instruments" on the screen of the QUADRIGA(tm) cockpit make visual monitoring possible without additional monitor screens, and if the operator notices errors, these can be documented with a mouse-click. A transmission quality factor is calculated that makes it much easier to gauge the material's suitability for broadcasting and to locate errors, should any problems occur.

And not only the quality can be registered at the click of a mouse. Other descriptive metadata (CueSheet) can be registered in real time, for example, the beginning of an aria or the start of key sentences (like John F. Kennedy's "Ich bin ein Berliner!"). This additional information is passed to the data base (e.g. MUSAD, WOSAD) in the BWF file. The future user of the sound archive, perhaps an editor, is thus given the opportunity to search the data base for these elements directly with the "browser" from his PC workplace, listen to a short sample, and liven up and round off his program with original sounds.

Figure 3: the QUADRIGA(tm) Cockpit

However, QUADRIGA(tm) is more than just a re-recording station. Together with proven "restoration tools", which are continually being enhanced to conform to the state of technology, it forms a purpose-built, extendable workstation that covers the entire spectrum of sound-archive preservation and digitisation from simple re-recording to comprehensive sound restoration, depending on how it is set up. The clear quality log and the user-friendly tools make child's play of efficient, time and money-saving restoration of sound-signals.
QUADRIGA(tm) is suitable both for re-recording the contents of old, analogue archives and interim, digital archives in the radio sector, and

for the creation of interim archives in a transition phase. Used by vendors who undertake the re-recording under contract, QUADRIGA(tm) with its integrated quality control, ensures the future usability of the archived material for broadcasting.

As the QUADRIGA(tm) project leader (IRT), I would like to extend my sincere thanks to all my colleagues in the broadcasting companies and at IRT, to the people at HDA who have participated in the development of QUADRIGA(tm), and to the Studer company. My particular thanks go to Dipl.-Ing. (FH) Frank Lott, whose degree thesis it was that laid the foundation stone, and who developed QUADRIGA(tm) up to the QUADRIGA(tm) prototype Version 1.0 for the test in the sound archives of Bayerischer Rundfunk (BR). In this, we received active support from Christof Ihn, Birgit von Porembski (both at the sound archives) and Guenter Marschall (Technical Planning).
Project member Dipl.-Ing. Wolfgang Krafft contributed to the groundwork of the project, especially through his QUADRIGA(tm) tests and presentations at trade-fairs. The manager of our business area "Sound", Dr. Achim Fasbender (IRT), Dr. Andreas Matzke (SWR), Albrecht Haefner (SWR), Horst Mueller (WDR), Manfred Grape and Martin Woehr (both BR) also contributed to the success of the project in the role of "promoters". All of us have made QUADRIGA(tm) a powerful team, which is now starting to establish itself in archives world wide. But Joerg Houpert and his crew deserve special mention for their courage in mounting this "war chariot"; not forgetting Hofrat Dr. Dietrich Schueller (Phonogram Archive, Vienna), who gave the initial impetus for IRT-HDA co-operation at the AES Convention in Amsterdam in 1998.
For future "charioteers", the School of Radio Technology (SRT) offers "QUADRIGA(tm) driving licence" courses.

I am sure we are all very happy to be able to contribute, with QUADRIGA(tm) to the preservation of the world's cultural heritage in "100 years of sound recording", and will follow with interest what treasures the QUADRIGA(tm) workstations will bring to light.

Good luck!

Munich, 15th January 2000
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