

## The Broadcast Open Development Exchange Initiative

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### Abstract

With the advent of digital broadcast facilities, typical broadcast operations emulate more and more an Information Systems (IS) facility. Taking advantage of this paradigm shift, Radio Free Asia<sup>1</sup> is working on leveraging IS and computer industry solutions to simplify and enhance tasks such as audio transfer, program automation, and documentation. Use of the World Wide Web serves the IS industry as a platform to share solutions, systems development and information. Following this model Radio Free Asia's Open Development Exchange Initiative Web site is located at the following URL: <http://www.techweb.rfa.org>. The site was launched on April 1, 2000 to serve as an open platform to freely exchange information and technical development in the professional broadcast community.

### Open Development Exchange Initiative

Radio Free Asia's Open Development Exchange Web site was launched with two inaugural projects:

- 1- The Radio-Broadcast Open Source System or R-BOSS. The R-BOSS is a suite of digital broadcast applications currently

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<sup>1</sup> **Radio Free Asia** is a private, non-profit corporation broadcasting news and information in 9 languages to listeners in Asia who do not have access to full and free news media. The purpose of RFA is to deliver accurate and timely news, information and commentary and to provide a forum for a variety of opinions and voices from within Asian countries. RFA focuses on events occurring in those countries. RFA seeks to promote the rights of freedom of opinion and expression including the freedom to seek, receive and impart information and ideas through any medium regardless of frontiers.

being developed under the Open Source Software Guidelines<sup>2</sup>. The goal of the R-BOSS project is to provide a reliable, robust, self-perpetuating software solution for today's digital broadcaster.

- 2- The Broadcast 3D Project. A free distribution and standardization of broadcast specific 3D drawings, material and texture bitmap files. The Broadcast 3D project exists as a free resource to assist broadcast engineers in the migration from 2D to 3D facility and technical documentation.

### The R-BOSS Project

The R-BOSS is a suite of digital broadcast applications currently being developed under the Open Source Software Guidelines. The R-BOSS project at present consists of three main applications: News-X, Audio-X and Track-X. News-X and Audio-X are available for use as freely distributed software and can be downloaded at the Open Development Exchange Initiative Web site.

Track-X will be available for download in the summer of 2000. While at present the News-X and Audio-X operate as standalone applications, with the release of Track-X they will begin to share data and function as an integrated system.

### R-BOSS Overview

With the myriad of digital systems available, there are few universal standards - even common elements such as AES/EBU and MPEG come in multiple versions. The technical manager must search out systems that are compatible - that share at least one common compatible interface or allow proper conversion. Buying a single-vendor solution is seldom an option.

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<sup>2</sup> The Open Source Initiative, [www.opensource.org](http://www.opensource.org)

The challenge is to focus on the facility's needs, avoiding the non-essential and what's currently impossible to achieve, and plan the best system you can within budgetary limitations.

Digital multimedia applications are by nature resource intensive. In the past to make such functions as digital audio editing a reality, hardware platform limitations were kludged with special hardware workarounds such as digital signal processor cards. With the advent of the higher performance PC platforms (with more powerful CPUs, larger faster disk drives, faster less expensive RAM, etc.) multimedia applications can now be written to take advantage of this new level of performance and obviate the need for additional hardware.

In a modern digital broadcasting facility, a great deal of scheduling, file conversions, network transfers and other computer operations provide new flexibility and convenience. In a world where audio becomes just another kind of data file and multi-track editors are just another application many tricks of the Information Systems (IS) world can be employed to provide better support than was available in the analog domain.

With the key to the evolution of digital broadcast now pushing towards an entire broadcast software solution the need for a dynamic development model becomes apparent. These realities are what have given birth to the R-BOSS Open Source Project.

### Open Source Software

Open Source Software is software that comes with permission for anyone to use, copy, and distribute, either verbatim or with modifications, either gratis or for a fee. Open Source is a method of software distribution that includes the source code with the application. Open Source Software allows the user to modify source code to suit specific application needs. More precisely, Open Source Software refers to four kinds of freedom for the users of the software:

- The freedom to run the program, for any purpose.
- The freedom to study how the program works, and adapt it to your needs.
- The freedom to redistribute copies so you can help other users.

- The freedom to improve the program, and release your improvements to the public, so that the whole community benefits.

The Open Source Initiative is a non-profit organization dedicated to managing and promoting the Open Source Definition for the good of the community, specifically through the OSI Certified Open Software certification mark and program.

There are several examples of open source software in the IS world. To name only a few, on the operating system side there is Linux, for a graphical user interface (GUI) there is X- Windows and Gnome, for programming languages there is Perl and Python, for office applications there is Abiword and for Web based applications there is Apache.

With a growing list of applications, open source software is proving to be adaptable, robust and reliable. A large portion of the software user community has become involved in working together to fix problems and upgrade the applications. Users not only report bugs; they fix bugs and share the fixes. The users work together as a community to improve the software. Rather than a proprietary asset, the software becomes a shared resource.

### News-X

News-X is a news source application, for the storage, searching and editing of incoming text-based news information. This application is currently in use at Radio Free Asia. It is an open platform system in which the user interface runs under any WEB browser. It is multi-feed, multi-lingual capable and also capable of processing News Server (e-mail) input.

All executable programs and source code for News-X are located at <http://www.techweb.rfa.org> with full documentation for free downloading and use. The applications are open to the software developer community to improve. Radio Free Asia will manage all new modules and updates written by the software developer community. All new modules and upgrades will then in turn, after testing, be placed back on the WEB for distribution.

As with any Open Source initiative, developers are welcome to branch off new projects or

approaches if the existing structure proves inadequate. However, having more active developers pooling their talent on a single project usually decreases development time and improves feature content.

The principal approach to date for the News-X program development has been to leverage improved machine performance to allow relatively high results from simple standards and non-flashy programming (basic HTML, high-level scripting languages, generic SQL database calls). While this “slacker” approach may not suffice for all uses, it was partially chosen to offset the myth that high-power, expensive machines are needed to handle a normal news feed search and to manage an archive system.

Programming simplicity also means even the non-expert programmer can make changes to tailor the News-X program to his/her facility. These changes can include the addition of new feeds or types of input, the use of faster or more robust search algorithms, adding new natural languages, changing computer platforms or providing additional features.

Today’s diverse methods in which news stories are provided (serial feed/modems, e-mail, WWW, etc) also add to the programming challenge. How to standardize format, specify minimum requirements for tags (i.e. Subject or Date) and even to weight sources by figures of merit (say the New York Times vs. a local newspaper) for all these various sources? While this may require continual fine-tuning the existing News-X framework was developed to minimize the pain of adding new sources and to keep the overall news site maintenance effort low.

The News-X system itself has been written with Python scripts on a Linux server and using a Web interface for the clients. With some care, incompatibilities between Web browsers are avoided and a simple cross-platform tool is invoked with little effort.

Other integrated desktop facilities such as e-mail and text editing are tied into the system using MIME extensions to specify the “type” of application needed for a function, rather than naming the application itself. This lets each user use a favorite word processor with no inconsistencies.

Porting the News-X system to a Microsoft Windows server only requires the use of a different serial port program module for Python. Python is an interpreted, interactive, object-oriented programming language and is portable. Python runs on most brands of UNIX, on the Mac, and on PCs under MS-DOS, Windows, Windows NT, BeOS and OS/2, and has hooks into various databases and graphics systems. It is also extensible to C/C++ for use when faster performance is required.

### Audio-X

Audio-X was conceived as a networked MPEG digital audio broadcast system. Beta testing began at Radio Free Asia in March of 2000. This system is an open source MPEG recorder/player. Future development initiatives include networked database file storage, access and management.

The eventual goal of the Audio-X is to provide a digital audio system that will integrate the many ways audio data is accessed and disseminated in a modern broadcast facility. This includes the acquisition (recording/data file transfer) and manipulation (editing) of audio data files for broadcasting, archiving and Web-casting.

Included in the development consideration process is also the conversion between various audio formats (PCM, MPEG Layers 2 & 3, WAV), organizing audio with related textual and time-based information, and allowing for automation with interoperability between various types of broadcast gear / computer equipment. Providing a system that works seamlessly across the different common desktop systems (Unix, Windows, Mac, BeOS) and their unique graphical user interfaces (GUIs) is demanding, as are time constraints when dealing with networks or scheduling for distribution.

Maintaining appropriate sound fidelity is also a challenge when trying to avoid unnecessary rate conversions while ensuring high enough bit rates and working within constraints for both storage space and available transmission paths.

It is hoped by maintaining an Object Oriented modular programming approach this additional functionality can be provided.

While the Web based approach works fine for a News browser (as well as Web audio listening),

its responsiveness and quality of service (QoS) are suspect for an interactive audio suite. Instead, a more traditional applications GUI is required, but still using a client/server approach to access both database and audio services across the network or using the suite as a stand-alone system.

As of this writing for Audio-X development we have chosen the wxWindows GUI using Python and C++ underneath, but this can change if more appropriate tools become obvious. The nature of Open Source development allows more choice and flexibility of this sort, though at some point, choices need to be finalized even if less than optimum.

The encoding and decoding of various audio formats are handled in multiple Open Source packages around the net, allowing modules to fit in for MPEG Layers 2 and 3, WAVE and PCM, as well as the various converters needed to move between formats. Differences in the audio systems for the different platforms have to be accounted for, while the vagaries of which soundcards to support is mostly avoided through accessing more abstracted system audio calls. Handled in this way, a multi-card server compression system can function alongside a distributed workstation-based system using main CPUs for processing.

This approach assumes the use of reasonably high-powered computers with enough memory (RAM). Shared inventory is handled through standard network file sharing choices between types of machines – each type has its advocates, and are mostly interchangeable.

As with News-X all executable programs and source code for Audio-X can be found at <http://www.techweb.rfa.org> with full documentation for free downloading and use.

### Track-X

While Track-X began as a simple tool to carry a short description of what programs aired during the day, it is seen as the eventual glue that binds all of the R-BOSS applications together. Due to its database role in providing the basic program tagging and description it is the obvious place to specify and coordinate different categories of material. These categories include time accounting, piecing together play-lists, on-air scheduling, and programming summaries.

While some relevant information of this sort will be contained within the audio cuts themselves (internal MPEG data fields as well as the proposed Cart Chunk standard described below), there is a need for a unified control system to manage all the pieces.

Past experience has shown that just as people are interested in using audio any way possible, they are just as interested in receiving records about how and where music and text were used. This includes searchable audio and text archives with rapid access to old material. This does not mean that the average user enjoys entering this information. Therefore methods have to be developed to streamline data-entry as well as ensure it is done regularly and correctly. Also involved is some thought to security, both to prevent external hacks into the system, but also to prevent one user from inadvertently erasing material of another.

While this sounds greatly complex it is nothing new: there are many similar Open Source projects providing the capability of doing large amounts of recording MPEG to-and-from CD (“ripping”) with database back-ends providing the jukebox function of keeping it all organized. Ironically, it appears there are more hackers writing complex programs for personal CD collections than there are broadcast engineers writing integrated broadcast systems.

Again, as with News-X and Audio-X, all executable programs and source code for Track-X will be placed on the <http://www.techweb.rfa.org> WEB Site with full documentation for free downloading and use. Track-X is scheduled for release in the late spring of 2000.

### **The Cart Chunk Standard / R-BOSS**

#### **Applications Consolidation**

The Cart Chunk<sup>3</sup> is a new proposed RIFF WAVE data type specifically for use as an

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<sup>3</sup> **Specification for CART/Audio Delivery Extension to the EBU Broadcast WAVE Format (proposed)**

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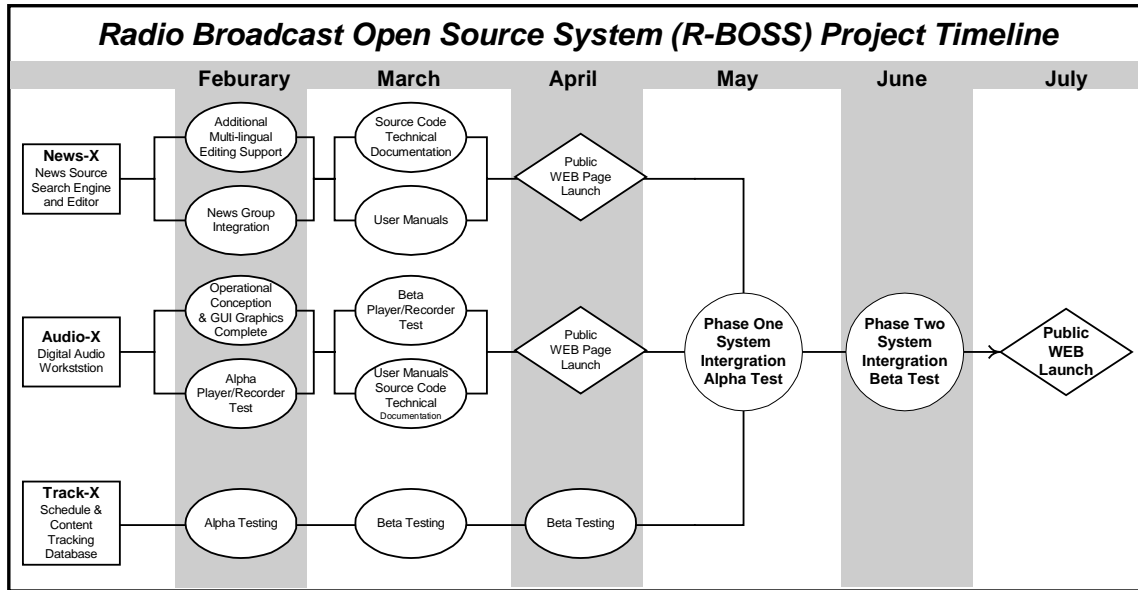
Revision 0.9 December 01, 1999

*interchange* medium by audio production and on-air delivery systems. The Cart Chunk standard allows for the exchange of audio data in the form of WAVE files, along with basic scheduling, traffic or continuity information. The Cart Chunk is in essence a digital label embedded in a common audio file.

The Cart Chunk provides a translation format, enabling better integration between on-air delivery and production systems. The Cart Chunk was proposed to serve as a common language for different broadcast systems and

applications to speak when they need to communicate with each other.

The R-BOSS will utilize the Cart Chunk standard to store and manage digital audio file information. The Cart Chunk standard will be the vehicle of information exchange between the various applications in the R-BOSS project. It is hoped that as the Cart Chunk standard becomes more widely accepted in the broadcast industry, the R-BOSS system created digital audio files can be readily interchanged with files from other systems.



**Overall Project Time Table**

The News-X is a system that has been in operation for over a year at Radio Free Asia. Audio-X has been in development since January of 2000. Audio-X first beta testing begins in March of 2000 at Radio Free Asia. The public launch on the Internet for both the News-X and Audio-X programs as open source software is April 1, 2000.

Track-X has been in beta testing at Radio Free Asia under the initial project name Radio Log since December of 1999. Its initial incarnation was as a program content tracking program. The

Radio Log will be renamed Track-X with the incorporation of a program scheduler and interoperability of text files from the News-X system and audio files from the Audio-X system. The Track-X open source web launch is scheduled for July 2000.

### 3-D Documentation Project

With the increased penetration of WWW, 3D is becoming the standard way to present graphical information. Business presentations, proposals and designs are no longer judged alone by their technical merits but also on their visual impact. Technical information today is becoming more interactive as the requirement to conceptualize factual 2D information is replaced by easy to manipulate fully dynamic virtual presentations.

3-D CAD drawings allow for the ergonomic study and virtual walkthroughs of broadcast facility design. While this may seem extravagantly excessive on the surface, there is a growing community that has a very hard time making a spatial correlation from a 2-D drawing to reality. The closer to life your documentation can be, the larger audience you can share the facility vision with.

Three years ago Radio Free Asia switched to a 3-D documentation platform. This not only allowed for virtual ergonomic planning in all studio facility designs, but also made system designs and plans more understandable to the general non-technical user community.

While the 3D drawing process initially takes more time, you will realize more accurate and flexible drawings that can be displayed in multiple modes. The ability to draw an object once in 3D and reuse it in multiple design drawings in the long run becomes a time saving tool.

To draw a studio table in 2-D, every view has to be drawn as a separate drawing including isometric views. In 3-D the studio table, as an object, has to be drawn only once in real life scale. The 3D-studio table drawing can then be viewed and printed in any and all angles and inserted into other relevant drawings. The 3D drawing can also be assigned true-to-life materials and rendered as a "photo realistic" picture.

The most time-consuming task in migrating documentation to a 3-D platform is creating the numerous drawings for objects that make up a facility or flow drawing. These drawings are the individual objects (i.e. various broadcast equipment, furnishings, etc.) that are inserted into multiple final drawings. The availability of pre-existing 3D object drawings will save

broadcast engineers an inordinate amount of time when migrating to a 3D platform.

The 3-D Documentation Project serves as a free exchange clearinghouse for 3-D tutorials, 3-D object drawings and material/texture bitmaps at <http://www.techweb.rfa.org>. The Web site will also include detailed information for file type, and the file/layer naming conventions.

#### Standardization

The potential of Computer Aided Design (CAD) relies on the ability to share and reuse information. The key to realizing this potential is using common organizing principles.

In the past, the selection of CAD options was limited. What was available was both platform limited and very expensive. This situation has changed. There are now dozens of CAD programs on the market, available for all platforms and in all price ranges. There are even Open Source CAD solutions available such as IntelliCAD which is being distributed by the IntelliCAD Technology Consortium<sup>4</sup> (ITC).

AutoCAD<sup>5</sup> has had the longest tenure in the CAD software market. Most CAD programs can either convert or import directly AutoCAD format drawings. For this reason CAD drawings available through the 3D Project will initially be standardized to the AutoCAD file format (DWG & DXF).

The file and layer naming standards used by the 3-D Documentation Project adhere as closely as possible to the CAD Layer Guidelines<sup>6</sup>. This standard was selected to allow broadcast facility CAD designs and details to integrate easily with construction industry CAD design standards.

All files distributed by the 3-D Documentation Project are formatted to USA measurement standards in inches and feet- for better integration into construction industry drawings.

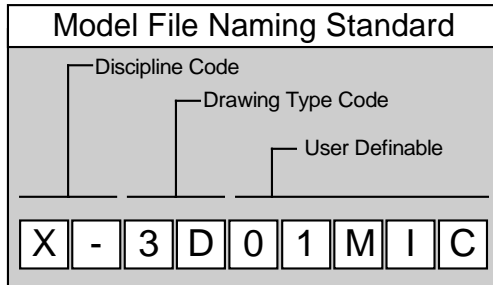
<sup>4</sup> "Visio Open Sources IntelliCAD" CADENCE Magazine, September 1999.

<sup>5</sup> AutoCAD is a registered trademark of Autodesk, Inc.

<sup>6</sup> CAD Layer Guidelines Computer Aided Design Management Techniques for Architecture, Engineering and Facility Management, Second Edition, *The American Institute of Architects*

### File Naming Convention and Type

All files distributed by the 3-D Documentation Project are 3D CAD model drawings. This is a complete single object drawing that can be inserted, by various methods, into other drawings. The file naming convention used is nine characters in length and divided into three informational fields. This nine-character string is followed by a three-character file extension.



The first field of the file name serves as the discipline code. The discipline code is two characters in length with "-" being used for the second character as a separator. The discipline code represents the profession of the originator of the drawing. For example: A= Architectural, C= Civil, E= Electrical, M= Mechanical, etc. Most drawings distributed by the 3-D Documentation Project use "X" as a discipline code. Under the CAD Layer Guidelines there is no designation for Broadcast Engineer. X represents "Other Disciplines."

The second data field of the file name serves to represent drawing type. This field is also two characters in length. All drawings distributed by the 3-D Documentation Project are 3D drawings and therefore use "3D" for the drawing type code.

The third, and last, field in the file name is a user definable information field. The 3-D Documentation Project has chosen to use this field as a five-character field. The first two characters represent the drawing number of that particular type of object. The last three characters serve as an abbreviated description of the object type. For example "01MIC" designates the first microphone drawing, "02MIC" the second microphone drawing and so on.

All other drawing file information and details can be found in the Windows file "properties" box. This includes author, creation date, object description, and all other pertinent drawing information.

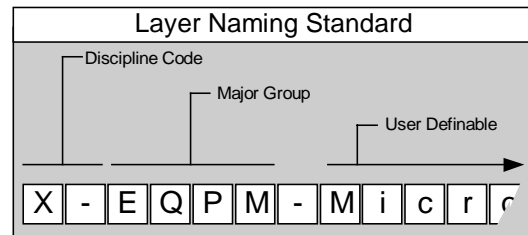
File extensions for drawings distributed by the 3-D Documentation Project will be both .DWG for AutoCAD format drawings and .DXF for AutoCAD Drawing Exchange Format drawings.

Drawings at the site are available in a total of three file formats: DWG for AutoCAD release 13/Lite95, .DWG for AutoCAD 2000/Lite2000 and .DXF AutoCAD release 13.

### Layer Naming Convention

Most CAD programs utilize layers. Layers, in CAD drawings, are a management tool used to organize data. All CAD files available from the 3D Document Project have one active layer.

The layer naming convention has similarities with the file naming convention. A minimal twelve-character length string is used in the layer name. The first character designates the discipline code, the same as in the file name.



The second field is the Major Group Field. The major group field is four characters in length and is used to represent the "building" system. Once again since most broadcast equipment has not been categorized in the CAD Layer Guidelines the Major Group designation EQPM is used most commonly for files available at the Web site. EQPM is used to designate "equipment".

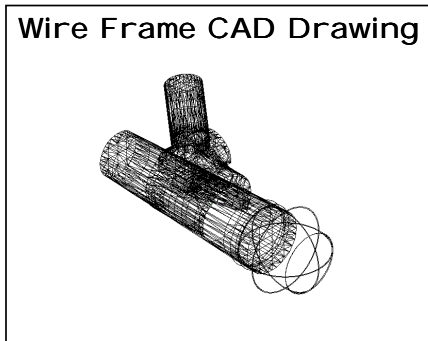
After the second layer information field a single character "-" is used as a separator. Following this separator is the user-defined field. This is a variable length field and is used to describe the drawing object. All drawing objects of the same type will have the same description, regardless of their model differences.

This naming convention was chosen to better manage drawings with multiple "object file" inserts. For example: all types of microphones would be on layer "X-EQPM-Microphone". In this manner all microphones in the drawing can be accessed easily as they reside on the same isolated drawing layer. A more detailed tutorial on drawing management is available on the Web site.

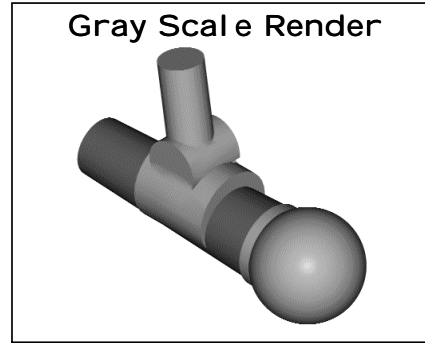
### **Material & Texture Bitmaps**

Materials are assigned to elements of the drawing object for rendering purposes. The materials are real-to-life assignments of what the various parts of the object are made of in real life. The rendering process is what changes a 3D-wire frame drawing into a real life representation. The rendering process can yield photo-like bitmap files, spherical active panoramic files or walkthrough animations.

All files have material assignments that exist in both the native AutoCAD material library and in Accurender<sup>3</sup>.



Accurender3 is the rendering program in use at Radio Free Asia. Materials are assigned in the drawings by object elements.



Broadcast related material and texture bitmap files are also available on the Web site along with tutorials on the rendering process. These bitmap files will be available in both high (1024x768) and low (320x240) resolution. These bitmaps files are named in a descriptive way to match their content.

### **Conclusion**

It is hoped that Radio Free Asia's Open Development Exchange Initiative Web site can serve as an open form where broadcast technicians can collectively work to further advance their knowledge. While conceived and maintained by Radio Free Asia, the project will not be a success without the contributions, use and feedback from the broadcast engineering and IS programming community. Suggestions, comments and feedback are more than welcome; contact information is located on the site.

<sup>7</sup> **Accurender3** is a registered trademark of Robert McNeel and Associates

