

# On the transport of NCL Applications over the Digital Radio Mondiale Broadcasting System for Ginga enabled receivers: Signaling and Definitions

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## Abstract

Ginga is the middleware defined in ISDB-T International to provide support for running NCL applications in Digital TV receivers. It is adopted by the majority of Latin America countries, and is already installed in most TV sets sold in recent years in the region. Just like in Digital TV, Digital Radio provides the means to carry applications. This report considers the importance of interactive applications for TV and Radio Broadcasting in the region and the importance of using the same language and middleware for both Digital TV and Radio. It is also considered that Brazil is carrying trials with Digital Radio Mondiale standard in order to evaluate the best system to be used as reference for the Brazilian Digital Radio System. This report establishes the signaling and definitions on how to transport NCL applications over a Digital Radio Mondiale transmission, and how the application should be executed in the receiver.

**Keywords.** interactive applications; digital radio; Digital Radio Mondiale; Multi-media Object Transfer; middleware; NCL.

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## 1 Introduction

Ginga is the middleware adopted by the Brazilian Terrestrial Digital TV System. The Brazilian DTV System, which is an evolution of the original Japanese ISDB-T, was rebranded as “ISDB-T International” and harmonized with the original ISDB-T. The main differences between the Japanese ISDB-T and ISDB-T International are the audio and video codecs, which were upgraded from MPEG 2 to MPEG 4, and the application middleware, which is a BML<sup>1</sup>-based technology, in case of the original ISDB-T, and Ginga, in case of ISDB-T International. A television set running Ginga is shown in Figure 1.



Figure 1: Standard TV running an application on Ginga middleware.

Ginga is defined in the ITU-T H.761 [10] and ABNT NBR 15606-2 [1] standards. By definition, Ginga is an IBB (Integrated Broadcast-Broadband) system, as specified in ITU-R BT.2267-5 [9]. This means that the middleware permits that applications received via broadcast channel, e.g., broadcast radio applications, use the Internet as a return channel, whenever such support is available in the receiver. Ginga applications are written in NCL (Nested Context Language), which is a declarative, domain-specific language for the description of interactive multimedia presentations.

Ginga is currently adopted by 14 countries. These Latin American countries are depicted in green in Figure 2.

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<sup>1</sup>BML: Broadcast Markup Language

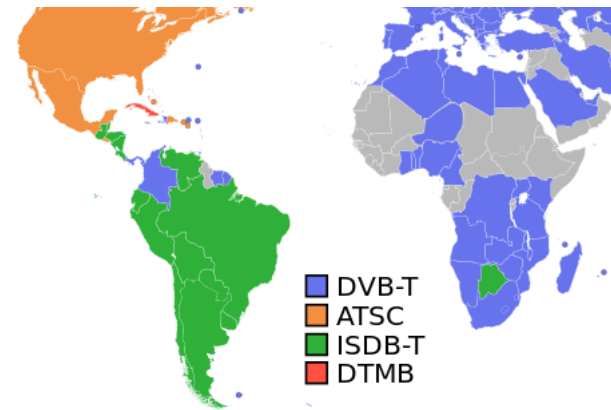


Figure 2: Countries painted in green are the ones where Ginga is used as DTV middleware.

This report describes the transport of NCL applications in the Digital Radio Mondiale <sup>2</sup> (DRM) system, i.e., it gives a set of definitions that allow for such transport. And it also discusses some adaptations to the middleware itself (Ginga) and its application language (NCL) that improve their support to digital radio-specific application requirements. These adaptations are defined as amendments to the 2014 ITU-T H.761 [10] text. The main purpose of this document is to serve as a reference for a possible standardization of the use of Ginga in the DRM system, and consequently to serve as a contribution to the Brazilian Digital Radio System specification <sup>3</sup>.

## 2 On the transport of NCL applications over DRM

The Digital Radio Mondiale (DRM) system specification [3] contains the modulation and channel coding, transmission structure, source coding and multiplex definitions.

The DRM multiplex definition establishes three channels: Main Service Channel (MSC), Fast Access Channel (FAC), and Service Description Channel (SDC). The MSC contains the streams, more precisely called MSC Streams, of the services. The FAC provides information on the channel width and related parameters, and it also provides service selection information to allow for fast scanning. Finally, the SDC gives information on how to decode the MSC and gives the attributes of the services within the multiplex.

From a service perspective, DRM defines two type of services: audio service and data service. An audio service must be associated with an audio stream and

<sup>2</sup>DRM is a digital radio broadcasting system standardised for all broadcasting frequencies

<sup>3</sup>Brazilian Digital Radio System specification, in Portuguese, Sistema Brasileiro de Rádio Digital, was established in March 30, 2010, but has no reference model defined until today. See: <http://www.mc.gov.br/portarias/25477-portaria-n-290-de-marco-de-2010>

optionally can be associated to Program Associated Data (PAD) streams. A data service must be associated with a Data stream.

In an interactive radio context, the application is transmitted via a data stream, and must be associated with an audio service, as PAD, or associated with a standalone data service. The mapping between services and streams is defined by Service Descriptor Channel (SDC) entities. Figure 3 shows an example of multiplex configuration with four services.

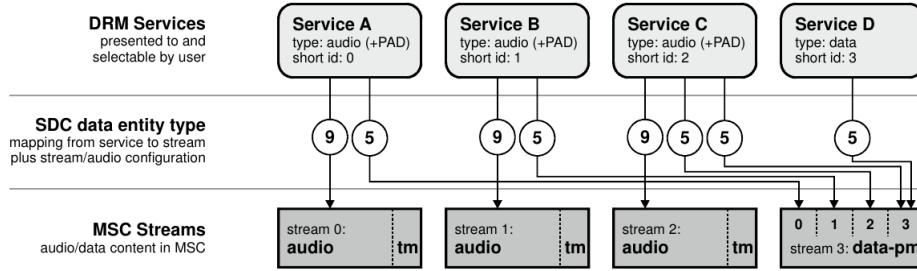


Figure 3: DRM multiplex configuration example with three services with Program Associated Data and one data service.

The DRM multiplex system provides a *Packet mode* for data streams, which defines a generalized way to deliver packetized data.

If an NCL application is broadcasted as standalone data service <sup>4</sup>, the proposed FAC parameter Application identifier is presented in Table 1. This value is the first available “reserved for future definition” in ETSI TS 101 968 [7], which is the standard that contains the identifiers of DRM applications.

Table 1: FAC Application identifier value for NCL application transmitted as standalone data service.

FAC Service Parameter	Value
Service Descriptor (Application identifier)	4

To carry an application composed of a set of files, which is normally the case of an NCL application, DRM uses the DAB MOT protocol [2]. MOT (Multimedia Object Transfer) is a protocol that allows for the transmission of one or more files in a cyclic way. It is already used in standardized digital radio applications such as SlideShow [5] and Broadcast Website [4].

The files of an NCL application may be carried as MOT objects. MOT objects are segmented in DAB MSC data groups, which are mapped directly to DRM data units, that are subsequently split in packets that are transported by the DRM Packet mode protocol, as detailed in Chapter 5.2 of ETSI TS 101 968 [7]. To reference an NCL application, the Application information parameters, which identify

<sup>4</sup>We assume that most applications will be transmitted as PAD of audio service, and not as standalone data service.

an application in the SDC and associates the application to a service, should be set to those presented in Table 2. The first two parameters, Packet mode indicator and data unit indicator, are requirements of the MOT protocol; an application domain with value 0 indicates a DRM application, and the user application domain with the proposed value 0x0001 indicates an NCL application. Note that 0x0001 the first available application identifier value for openly specified applications in ETSI TS 101 968 [7].

Table 2: SDC Application information parameter values for NCL applications.

Application information parameters	Value
Packet mode indicator	1
data unit indicator	1
application domain	0
user application identifier	0x0001

Since NCL assumes that the application files are organized in a directory tree, the MOT protocol’s Directory Mode must be used. The Directory Mode provides support for transmitting many files organized in a directory tree with the possibility of transmitting them in an interleaved way. The mandatory DirectoryExtension parameter is presented in Table 3. The DirectoryExtension parameter contains information that apply to the whole MOT transmission.

Table 3: Mandatory MOT DirectoryExtension parameter.

Parameter Id	Parameter
0x22 (100010)	DirectoryIndex

The syntax of DirectoryIndex parameter’s data field is shown in Table 4.

Table 4: Syntax of DirectoryIndex parameter’s data field.

Syntax	Size <sup>5</sup>
DirectoryIndex_parameter_data_field() {	
profile_id	8 bits
for (i=0;i<N;i++) {	
entry_point_byte	8bits
}	
}	

The DirectoryIndex parameter indicates to the Ginga middleware the application entry point for a given receiver profile, defined in the `profile_id` field. One may insert more than one DirectoryIndex parameter in order to signalize different entry points for distinct receiver profiles. The entry point is composed of `entry_point_byte` fields, which must be ISO/IEC 10646 [8] characters (using

UTF-8 transformation format), being the comma (‘,’) a reserved character. The entry point must follow one of the possible syntaxes expressed in Table 5. In the first syntax, one specifies the NCL file to be started, while in the second syntax, one specifies both the NCL file and a specific port to be started. Note that in the second syntax the file name and the port identifier must be separated by a comma (‘,’). Furthermore, in both syntaxes the file name must be a relative path, i.e., one not starting with character ‘/’, e.g., “code/main.ncl”.

Table 5: Entry point syntax.

Entry point syntax	Description
{application_filename}.ncl	The middleware should start the NCL file <i>application_filename.ncl</i> .
{application_filename}.ncl,{InterfaceId}	The middleware should start port <i>InterfaceId</i> of the NCL file <i>application_filename.ncl</i> .

Other optional DirectoryExtension parameters that must be supported by the Ginga middleware running in the receiver are SortedHeaderInformation, DefaultPermitOutdatedVersions, and DefaultExpiration. Their semantics is the same specified in the MOT standard [2].

The MOT protocol contains parameters which are related to the individual files transmitted by the MOT structures. All files transmitted over the MOT have, among other parameters, two mandatory parameters with file type information. These two mandatory parameters are the ContentType and ContentSubType, whose possible values specified in Table 17 of ETSI TS 101 756 [6]. The Ginga middleware must ignore these values, as they do not specify all supported file types supported by Ginga. The recommended values for these fields are shown in Table 6.

Table 6: Recommended values for ContentType and ContentSubType.

Field	Value
ContentType	0
ContentSubType	0

The MOT protocol defines optional parameters for each file. These parameters go in the Header extension part of the protocol header and their use is specified in Table 7.

Table 7: Header extension parameters.

Identifier	Parameter	Content
0x0C (001100)	ContentName	Contains the character set indicator, which must be set to ISO/IEC 10646 as specified in Table 19 of ETSI TS 101 756 [6] (value 1111b), and the file name of the content, which must use a relative path. This parameter is mandatory.
0x11 (010001)	CompressionType	Must be used when a file is transmitted compressed. The only allowed compression is GZip (value 0x01) as specified in Table 18 of ETSI TS 101 756 [6]. The middleware must support GZip decompression.

The ContentName parameter specifies a relative path for each file that composes an application (e.g., “media/pic.jpg”) and the CompressionType specifies compression algorithm used to compress the file, when this is transmitted compressed.

Other parameters can be optionally present in the Header extension. The optional parameters that must be correctly interpreted by the Ginga middleware are the following: PermitOutdatedVersions, Expiration, and TriggerTime. The semantics of these parameters is specified in the MOT standard [2].

## References

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