

Ginga Middleware and Digital TV in Latin America

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In 2005, Brazil launched its digital TV (DTV) agenda having as main premise to reduce the digital divide present in the country, giving the lower social classes the right to access, to produce and to distribute information. As a natural consequence, a second premise stressed the generation of local IT jobs and companies to support the whole effort.

To bring the benefits of DTV to the masses, Brazil decided to devise the Japanese-Brazilian terrestrial DTV (ISDB-T – International Standard for Digital Broadcasting), taking the earlier ISDB Japanese standard as base with some video and audio coding updates, but mainly introducing the pronounced Brazilian innovation, the middleware system called Ginga.¹

Argentina adopted ISDB-T in 2009 with similar objectives to those of Brazil. Since then, Ginga has been adopted in 12 Latin-American countries. Several other countries in Central America and Africa are testing it as well.

Ginga Middleware

The middleware lies between the application code and runtime infrastructure to enable fast and easy development of TV applications. In 2007, the Brazilian terrestrial DTV standard² adopted the Nested Context Language³ as its declarative language. In the beginning of 2009, NCL and its user agent, Ginga-NCL, became part of ISDB-T standards and of the International Telecommunication Union (ITU-R) BT 1699 Recommendation. Also in 2009, NCL and Ginga-NCL became an ITU-T Recommendation for IPTV services.⁴ Ginga was the first free DTV middleware. Ginga-NCL and NCL specifications are open source and royalty free, independent of the distribution network used. NCL and Ginga-NCL was conceived at the TeleMidia Lab at Pontifical Catholic University of Rio de Janeiro (PUC-Rio)/Brazil and have been designed in a joint effort, including LIFIA Lab at National University of La Plata (UNLP)/Argentina.

Requirements

Aiming at social inclusion, a middleware must support applications such as T-learning, T-government and T-health. However, social inclusion is reached not only offering access to information, but also providing knowledge about how to generate information. Therefore, a DTV system should offer a user-friendly language for designing applications and services. This language should be simple enough to be understood and learned by non-experts. Moreover, it should be lightweight, because its interpreter must run in low-cost receivers with limited resources. However, it should also be powerful enough to support creativity.

This need for a simple, lightweight, and expressive language led to a declarative domain-specific language (DSL) for TV application design, in which the complex algorithmic steps to accomplish a task are left to the machine and are not under user responsibility. The focus on media synchronization in its general aspect (having interactivity as a particular case), on content and presentation adaptability, on support to multiple device exhibitions, and on support that would also allow for generating live DTV applications were the requirements that guided the NCL design.³

Architecture

Ginga was initially proposed for terrestrial DTV systems, but the same architecture and facilities were later applied to IPTV. Furthermore, the modular architecture of Ginga also allows for its use with other transport systems (such as satellite and cable TV), depending only on its Ginga Common Core (Ginga-CC) subsystem. Figure 1a depicts the Ginga components and how they relate with other components of a general DTV architecture.

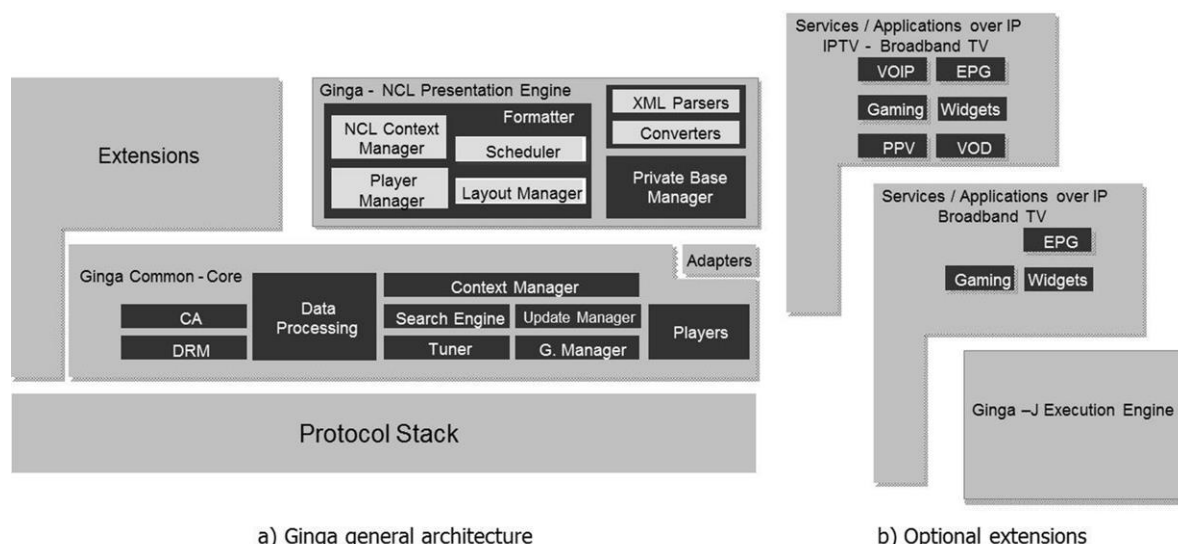


Figure 1. The Ginga architecture: (a) the general architecture and (b) optional extensions.

The Ginga-CC subsystem delivers applications to Ginga-NCL. The Ginga-NCL Presentation Engine is the logical subsystem responsible for running NCL applications. The Ginga architecture also offers optional extensions (see Figure 1b). For example, for terrestrial DTV systems, the Ginga-J execution engine (required for fixed receivers and optional for portable receivers in Brazil; and optional for all kind of receivers in Argentina) is responsible for running Java DTV applications. Connected or Broadband TV may also define some extensions to implement services, such as Electronic Program Guides, widgets, etc. IPTV specific services, such as Video on Demand, datacasting, etc. are examples of other possible extensions. Ginga offers NCL services to all extensions through a well-defined API.

Ginga-NCL has an open source GPL reference implementation (www.softwarepublico.gov.br) recognized by ITU-T. Some open source products have been derived from this implementation, including LIFIA middleware (ginga.ar) for set-top boxes (<http://tvd.lifia.info.unlp.edu.ar/ginga.ar>) and Nokia middleware for mobile phones (<http://store.oivi.com/content/48850?clickSource=search&pos=2>). There are also some other proprietary Ginga implementations. Although having many implementations, there is still a worry that a monopoly can be created for the market of Ginga, mainly resulting from its possible extensions. This should be strongly opposed.

Impact

Ginga has helped create many jobs and IT companies in Brazil—at least 13 small and medium-size software companies and 60 service providers. TV manufacturers has been merely assemblers of multinational companies in the country, but now they are obliged to establish local development sections to incorporate the technological innovations being created. As for Brazilian private (commercial) broadcasters, as expected, they are not committed to social inclusion. Of course this scenario brings some tensions that can only be overcome with a strong and responsible government policy and the strong technical support of the academy.

In Argentina, around a dozen companies have shown interest in developing applications or services based on Ginga, and some have developed products. In addition, some academic laboratories—mainly LIFIA and the University of 3 de Febrero, with the support of the Ministry of Federal Planning—have developed technological innovations and interactive applications based on Ginga. If Argentina can turn LIFIA's "ginga.ar" free implementation (based on the PUC-Rio's reference implementation) into a de facto product, then it can provide a platform on which IT companies could develop new products and services.

Content Distribution

The right to distribute content is an important component of social inclusion, yet private (commercial) broadcasters won't transmit social third party content for free. Perhaps state and federal governments could pay for some transmissions of large-scale interest, but independent producers, such as community TV programmers, can't afford to distribute their content. Public broadcasting could be a solution. Although the process of digitalization for public broadcasters in Brazil is behind schedule, the process has currently started and there is a comprehensive hope.

The Argentinian program is heavily based on public media, such as Public TV and other channels like "Encuentro" and "INCAA TV." Although several private broadcasters have joined the initiative, the production of content is being led by the federal government, promoting the production of content to strengthen and democratize communication.

Nevertheless, another alternative for democratizing content distribution comes from IP networks—in particular, the Internet (see www.iptv.br initiative). Ginga is an international standard not only for terrestrial DTV but also for IPTV services and thus for hybrid DTV.

Interoperability and Next Steps

Ginga-NCL can embed but also be embedded in other language players—for example, acting as a plug-in for HTML-5 browsers. An NCL application can be embedded in a HTML application and, at the same time, it can embed another HTML application. A work in this direction has just been finished for Firefox and Chrome; and has already been started for HBBTV (Hybrid Broadcast Broadband TV) and LIME/BML (Lightweight Interactive Multimedia Environment).

Several issues are under consideration for the next generation of the NCL language, such as high-level abstractions for defining relationships, better support for context aware applications, and support for multimodal interactions and 3D objects, besides novel issues for Ginga-CC, to keep Ginga as a competitive DTV middleware in the world market.

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//Digital Library abstract and keywords//

In 2005, Brazil launched its digital TV (DTV) agenda having as main premise to reduce the digital divide present in the country, giving the lower social classes the right to access, produce and distribute information. As a natural consequence, a second premise stressed the generation of local IT jobs and companies in support of this effort. It was under these requirements that Ginga, the ITU-T DTV middleware system, was conceived. This department presents Ginga and its role in the socioeconomic development of Latin-America.

Keywords: Ginga, open source middleware, digital TV, Brazil, Latin America, emerging economies